MITSUBISHI ELECTRIC

Programmable Controller

MELSEC iQ-F series

# MELSEC iQ-F
# FX5 User's Manual (Application)

- FX5S CPU module
- FX5UJ CPU module
- FX5U CPU module
- FX5UC CPU module
- High-speed pulse input/output module
- Analog adapter

# SAFETY PRECAUTIONS

(Read these precautions before use.)

Before using this product, please read this manual and the relevant manuals introduced in this manual carefully and pay full attention to safety in order to handle the product correctly.

This manual classifies the safety precautions into two categories: [⚠ WARNING] and [⚠ CAUTION].

| | |
|---|---|
| ⚠ **WARNING** | Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury. |
| ⚠ **CAUTION** | Indicates that incorrect handling may cause hazardous conditions, resulting in minor or moderate injury or property damage. |

Depending on the circumstances, procedures indicated by [⚠ CAUTION] may also cause severe injury.

It is important to follow all precautions for personal safety.

Store this manual in a safe place so that it can be read whenever necessary. Always forward it to the end user.

## [DESIGN PRECAUTIONS]

### ⚠ WARNING

- Make sure to set up the following safety circuits outside the programmable controller to ensure safe system operation even during external power supply problems or programmable controller failure. Otherwise, malfunctions may cause serious accidents.
  - Most importantly, set up the following: an emergency stop circuit, a protection circuit, an interlock circuit for opposite movements (such as normal vs. reverse rotation), and an interlock circuit (to prevent damage to the equipment at the upper and lower positioning limits).
  - Note that when the CPU module detects an error, such as a watchdog timer error, during self-diagnosis, all outputs are turned off. Also, when an error that cannot be detected by the CPU module occurs in an input/output control block, output control may be disabled. External circuits and mechanisms should be designed to ensure safe machinery operation in such a case.
  - Note that the output current of the 24 V DC service power supply varies depending on the model and the absence/presence of extension modules. If an overload occurs, the voltage automatically drops, inputs in the programmable controller are disabled, and all outputs are turned off. External circuits and mechanisms should be designed to ensure safe machinery operation in such a case.
  - Note that when an error occurs in a relay, triac or transistor of an output circuit, the output might stay on or off. For output signals that may lead to serious accidents, external circuits and mechanisms should be designed to ensure safe machinery operation in such a case.
- Construct an interlock circuit in the program so that the whole system always operates on the safe side before executing the control (for data change) of the programmable controller in operation. Read the manual thoroughly and ensure complete safety before executing other controls (for program change, parameter change, forcible output and operation status change) to the programmable controller in operation. Otherwise, the machine may be damaged and accidents may occur due to erroneous operations.
- In an output circuit, when a load current exceeding the current rating or an overcurrent caused by a load short-circuit flows for a long time, it may cause smoke and fire. To prevent this, configure an external safety circuit, such as a fuse.
- For the operating status of each station after a communication failure of the network, refer to relevant manuals for the network. Incorrect output or malfunction may result in an accident.
- At Forward/Reverse rotation limits, make sure to wire the contacts with NC, negative-logic. Wiring contacts with NO, positive-logic may cause serious accidents.

## [DESIGN PRECAUTIONS]

### ⚠CAUTION

- When an inductive load such as a lamp, heater, or solenoid valve is controlled, a large current (approximately ten times greater than normal) may flow when the output is turned from off to on. Take proper measures so that the flowing current does not exceed the value corresponding to the maximum load specification of the resistance load.
- After the CPU module is powered on or is reset, the time taken to enter the RUN status varies depending on the system configuration, parameter settings, and/or program size. Design circuits so that the entire system will always operate safely, regardless of this variation in time.
- Simultaneously turn on and off the power supplies of the CPU module and extension modules.
- If a long-time power failure or an abnormal voltage drop occurs, the programmable controller stops, and output is turned off. When the power supply is restored, it will automatically restart (when the RUN/STOP/RESET switch is on the RUN side).

## [SECURITY PRECAUTIONS]

### ⚠WARNING

- To maintain the security (confidentiality, integrity, and availability) of the programmable controller and the system against unauthorized access, denial-of-service (DoS) attacks, computer viruses, and other cyberattacks from unreliable networks and devices via network, take appropriate measures such as firewalls, virtual private networks (VPNs), and antivirus solutions.

## [INSTALLATION PRECAUTIONS]

### ⚠WARNING

- Make sure to cut off all phases of the power supply externally before attempting installation or wiring work. Failure to do so may cause electric shock or damage to the product.
- Use the product within the generic environment specifications described in the MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware).
  Never use the product in areas with excessive dust, oily smoke, conductive dusts, corrosive gas (salt air, $Cl_2$, $H_2S$, $SO_2$ or $NO_2$), flammable gas, vibration or impacts, or expose it to high temperature, condensation, or rain and wind.
  If the product is used in such conditions, electric shock, fire, malfunctions, deterioration or damage may occur.

## [INSTALLATION PRECAUTIONS]

### ⚠CAUTION

- Do not touch the conductive parts of the product directly. Doing so may cause device failures or malfunctions.
- When drilling screw holes or wiring, make sure that cutting and wiring debris do not enter the ventilation slits of the programmable controller. Failure to do so may cause fire, equipment failures or malfunctions.
- For the product supplied together with a dust proof sheet, the sheet should be affixed to the ventilation slits before the installation and wiring work to prevent foreign objects such as cutting and wiring debris.
  However, when the installation work is completed, make sure to remove the sheet to provide adequate ventilation. Failure to do so may cause fire, equipment failures or malfunctions.
- Install the product on a flat surface. If the mounting surface is rough, excessive force will be applied to the PC board, thereby causing malfunction.
- Install the product securely using a DIN rail or mounting screws.
- Connect the expansion board and expansion adapter securely to their designated connectors. Loose connections may cause malfunctions.
- Make sure to affix the expansion board with tapping screws. Tightening torque should follow the specifications in the MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware). If the screws are tightened outside of the specified torque range, poor connections may cause malfunctions.
- Work carefully when using a screwdriver such as installation of the product. Failure to do so may cause damage to the product or accidents.
- Connect the extension cables, peripheral device cables, input/output cables and battery connecting cable securely to their designated connectors. Loose connections may cause malfunctions.
- When using an SD memory card, insert it into the SD memory card slot. Check that it is inserted completely. Poor contact may cause malfunction.
- Turn off the power to the programmable controller before attaching or detaching the following devices. Failure to do so may cause device failures or malfunctions.
  - Peripheral devices, expansion board, expansion adapter, and connector conversion adapter
  - Extension modules, bus conversion module, and connector conversion module
  - Battery

## [WIRING PRECAUTIONS]

### ⚠WARNING

- Make sure to cut off all phases of the power supply externally before attempting installation or wiring work. Failure to do so may cause electric shock or damage to the product.
- Make sure to attach the terminal cover, provided as an accessory, before turning on the power or initiating operation after installation or wiring work. Failure to do so may cause electric shock.
- The temperature rating of the cable should be 80℃ or more.
- Make sure to wire the screw terminal block in accordance with the following precautions. Failure to do so may cause electric shock, equipment failures, a short-circuit, wire breakage, malfunctions, or damage to the product.
  - The disposal size of the cable end should follow the dimensions described in the MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware).
  - Tightening torque should follow the specifications in the MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware).
  - Tighten the screws using a Phillips-head screwdriver No.2 (shaft diameter 6 mm or less). Make sure that the screwdriver does not touch the partition part of the terminal block.
- Make sure to properly wire to the terminal block (European type) in accordance with the following precautions. Failure to do so may cause electric shock, equipment failures, a short-circuit, wire breakage, malfunctions, or damage to the product.
  - The disposal size of the cable end should follow the dimensions described in the MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware).
  - Tightening torque should follow the specifications in the MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware).
  - Twist the ends of stranded wires and make sure that there are no loose wires.
  - Do not solder-plate the electric wire ends.
  - Do not connect more than the specified number of wires or electric wires of unspecified size.
  - Fix the electric wires so that neither the terminal block nor the connected parts are directly stressed.
- Make sure to properly wire to the spring clamp terminal block in accordance with the following precautions.
  Failure to do so may cause electric shock, equipment failures, a short-circuit, wire breakage, malfunctions, or damage to the product.
  - The disposal size of the cable end should follow the dimensions described in the MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware).
  - Twist the ends of stranded wires and make sure that there are no loose wires.
  - Do not solder-plate the electric wire ends.
  - Do not connect more than the specified number of wires or electric wires of unspecified size.
  - Fix the electric wires so that neither the terminal block nor the connected parts are directly stressed.

## [WIRING PRECAUTIONS]

### ⚠CAUTION

- Do not supply power externally to the [24+] and [24V] terminals (24VDC service power supply) on the CPU module or extension modules. Doing so may cause damage to the product. Note that power may be supplied even when an electronic load which equips with an internal bias power supply is connected.
- Perform class D grounding (grounding resistance: 100Ω or less) to the grounding terminal on the CPU module and extension modules with a wire 2 ㎟ or thicker.
  Do not use common grounding with heavy electrical systems (refer to the MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)).
- Connect the power supply to the dedicated terminals specified in the MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware). If an AC power supply is connected to a DC input/output terminal or DC power supply terminal, the programmable controller will burn out.
- Do not wire vacant terminals externally. Doing so may damage the product.
- Install module so that excessive force will not be applied to terminal blocks, power connectors, I/O connectors, communication connectors, or communication cables. Failure to do so may result in wire damage/breakage or programmable controller failure.
- Make sure to observe the following precautions in order to prevent any damage to the machinery or accidents due to malfunction of the programmable controller caused by abnormal data written to the programmable controller due to the effects of noise:
  - Do not bundle the power line, control line, input/output cables and communication cables together with or lay them close to the main circuit, high-voltage line, load line or power line. As a guideline, lay the power line, control line and connection cables at least 100 mm away from the main circuit, high-voltage line, load line or power line.
  - Ground the shield of the shield wire or shielded cable at one point on the programmable controller. However, do not use common grounding with heavy electrical systems.
  - Ground the shield of the analog input/output cable in accordance with the manuals of each model. However, do not use common grounding with heavy electrical systems.

## [STARTUP AND MAINTENANCE PRECAUTIONS]

### ⚠WARNING

- Do not touch any terminal while the programmable controller's power is on. Doing so may cause electric shock or malfunctions.
- Before cleaning or retightening terminals, cut off all phases of the power supply externally. Failure to do so may cause electric shock.
- Before modifying the program in operation, forcible output, running or stopping the programmable controller, read through this manual carefully, and ensure complete safety. An operation error may damage the machinery or cause accidents.
- Do not change the program in the programmable controller from two or more peripheral equipment devices at the same time. (i.e. from an engineering tool and a GOT) Doing so may cause destruction or malfunction of the programmable controller program.
- Use the battery for memory backup in conformance to the MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware).
  - Use the battery for the specified purpose only.
  - Connect the battery correctly.
  - Do not charge, disassemble, heat, put in fire, short-circuit, connect reversely, weld, swallow or burn the battery, or apply excessive forces (vibration, impact, drop, etc.) to the battery.
  - Do not store or use the battery at high temperatures or expose to direct sunlight.
  - Do not expose to water, bring near fire or touch liquid leakage or other contents directly.

  Incorrect handling of the battery may cause heat excessive generation, bursting, ignition, liquid leakage or deformation, and lead to injury, fire or failures and malfunction of facilities and other equipment.

## [STARTUP AND MAINTENANCE PRECAUTIONS]

### ⚠CAUTION

- Do not disassemble or modify the programmable controller. Doing so may cause fire, equipment failures, or malfunctions.
  For repair, contact your local Mitsubishi Electric representative.
- Turn off the power to the programmable controller before connecting or disconnecting any extension cable. Failure to do so may cause equipment failures or malfunctions.
- Turn off the power to the programmable controller before attaching or detaching the following devices. Failure to do so may cause equipment failures or malfunctions.
  - Peripheral devices, expansion board, expansion adapter, and connector conversion adapter
  - Extension modules, bus conversion module, and connector conversion module
  - Battery
- Since there are risks such as burn injuries, please do not touch the surface of the equipment with bare hands when it is operating in an environment which exceeds ambient temperature of 50℃.

## [OPERATION PRECAUTIONS]

### ⚠CAUTION

- Construct an interlock circuit in the program so that the whole system always operates on the safe side before executing the control (for data change) of the programmable controller in operation. Read the manual thoroughly and ensure complete safety before executing other controls (for program change, parameter change, forcible output and operation status change) to the programmable controller in operation. Otherwise, the machine may be damaged and accidents may occur by erroneous operations.

## [DISPOSAL PRECAUTIONS]

### ⚠CAUTION

- Please contact a certified electronic waste disposal company for the environmentally safe recycling and disposal of your device.
- When disposing of batteries, separate them from other waste according to local regulations. (For details of the Battery Directive in EU countries, refer to the MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware).)

## [TRANSPORTATION PRECAUTIONS]

### ⚠CAUTION

- When transporting the programmable controller with the optional battery, turn on the programmable controller before shipment, confirm that the battery mode is set using a parameter and the BAT LED is OFF, and check the battery life. If the programmable controller is transported with the BAT LED ON or the battery exhausted, the battery-backed data may be unstable during transportation.
- The programmable controller is a precision instrument. During transportation, avoid impacts larger than those specified in the general specifications of the MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware) by using dedicated packaging boxes and shock-absorbing palettes. Failure to do so may cause failures in the programmable controller. After transportation, verify operation of the programmable controller and check for damage of the mounting part, etc.
- When transporting lithium batteries, follow required transportation regulations. (For details on the regulated products, refer to the MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware).)
- When fumigants that contain halogen materials such as fluorine, chlorine, bromine, and iodine are used for disinfecting and protecting wooden packaging from insects, they cause malfunction when entering our products. Please take necessary precautions to ensure that remaining materials from fumigant do not enter our products, or treat packaging with methods other than fumigation (heat method). Additionally, disinfect and protect wood from insects before packing products.

# INTRODUCTION

This manual contains text, diagrams and explanations which will guide the reader in the correct installation, safe use and operation of the FX5 Programmable Controllers and should be read and understood before attempting to install or use the module.
Always forward it to the end user.

## Target modules

| Item | Model |
|---|---|
| FX5S CPU module | FX5S-30MR/ES, FX5S-30MT/ES, FX5S-30MT/ESS, FX5S-40MR/ES, FX5S-40MT/ES, FX5S-40MT/ESS, FX5S-60MR/ES, FX5S-60MT/ES, FX5S-60MT/ESS, FX5S-80MR/ES*1, FX5S-80MT/ES*1, FX5S-80MT/ESS*1, FX5S-30MR/DS, FX5S-30MT/DS, FX5S-30MT/DSS, FX5S-40MR/DS, FX5S-40MT/DS, FX5S-40MT/DSS, FX5S-60MR/DS, FX5S-60MT/DS, FX5S-60MT/DSS, FX5S-80MR/DS*1, FX5S-80MT/DS*1, FX5S-80MT/DSS*1 |
| FX5UJ CPU module | FX5UJ-24MR/ES, FX5UJ-24MT/ES, FX5UJ-24MT/ESS, FX5UJ-40MR/ES, FX5UJ-40MT/ES, FX5UJ-40MT/ESS, FX5UJ-60MR/ES, FX5UJ-60MT/ES, FX5UJ-60MT/ESS, FX5UJ-24MR/DS, FX5UJ-24MT/DS, FX5UJ-24MT/DSS, FX5UJ-40MR/DS, FX5UJ-40MT/DS, FX5UJ-40MT/DSS, FX5UJ-60MR/DS, FX5UJ-60MT/DS, FX5UJ-60MT/DSS |
| FX5U CPU module | FX5U-32MR/ES, FX5U-32MT/ES, FX5U-32MT/ESS, FX5U-64MR/ES, FX5U-64MT/ES, FX5U-64MT/ESS, FX5U-80MR/ES, FX5U-80MT/ES, FX5U-80MT/ESS, FX5U-32MR/DS, FX5U-32MT/DS, FX5U-32MT/DSS, FX5U-64MR/DS, FX5U-64MT/DS, FX5U-64MT/DSS, FX5U-80MR/DS, FX5U-80MT/DS, FX5U-80MT/DSS |
| FX5UC CPU module | FX5UC-32MT/D, FX5UC-32MT/DSS, FX5UC-32MT/DS-TS, FX5UC-32MT/DSS-TS, FX5UC-32MR/DS-TS, FX5UC-64MT/D, FX5UC-64MT/DSS, FX5UC-96MT/D, FX5UC-96MT/DSS |
| High-speed pulse input/ output module | FX5-16ET/ES-H, FX5-16ET/ESS-H |
| Analog adapter | FX5-4AD-ADP, FX5-4DA-ADP, FX5-4AD-PT-ADP, FX5-4AD-TC-ADP, FX5-4A-ADP |

*1 Area-specific model

## Regarding use of this product

- This product has been manufactured as a general-purpose part for general industries, and has not been designed or manufactured to be incorporated in a device or system used in purposes related to human life.
- Before using the product for special purposes such as nuclear power, electric power, aerospace, medicine or passenger movement vehicles, consult Mitsubishi Electric.
- This product has been manufactured under strict quality control. However when installing the product where major accidents or losses could occur if the product fails, install appropriate backup or failsafe functions in the system.

## Note

- If in doubt at any stage during the installation of the product, always consult a professional electrical engineer who is qualified and trained in the local and national standards. If in doubt about the operation or use, please consult the nearest Mitsubishi Electric representative.
- Since the examples indicated by this manual, technical bulletin, catalog, etc. are used as a reference, please use it after confirming the function and safety of the equipment and system. Mitsubishi Electric will accept no responsibility for actual use of the product based on these illustrative examples.
- This manual content, specification etc. may be changed without a notice for improvement.
- The information in this manual has been carefully checked and is believed to be accurate; however, if you notice a doubtful point, an error, etc., please contact the nearest Mitsubishi Electric representative. When doing so, please provide the manual number given at the end of this manual.

# CONTENTS

# RELEVANT MANUALS

| Manual name <manual number> | Description |
|---|---|
| MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware) <SH-082452ENG> | Describes the details of hardware of the CPU module, including performance specifications, wiring, installation, and maintenance. |
| MELSEC iQ-F FX5 User's Manual (Application) <JY997D55401> (This manual) | Describes the basic knowledge required for program design, functions of the CPU module, devices/labels, and parameters. |
| MELSEC iQ-F FX5 Programming Manual (Program Design) <JY997D55701> | Describes the specifications of ladder, ST, FBD/LD, and SFC programs, and labels. |
| MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/ Function Blocks) <JY997D55801> | Describes the specifications of instructions and functions that can be used in programs. |
| MELSEC iQ-F FX5 User's Manual (Communication) <SH-082625ENG> | Describes the communication function of the CPU module built-in and the Ethernet module. |
| GX Works3 Operating Manual <SH-081215ENG> | Describes the system configuration, parameter settings, and online operations of GX Works3. |

# TERMS

Unless otherwise specified, this manual uses the following terms.

| Term | Description |
|---|---|
| Engineering tool | The product name of the software package for the MELSEC programmable controllers |

# GENERIC TERMS AND ABBREVIATIONS

Unless otherwise specified, this manual uses the following generic terms and abbreviations.

| Generic term/abbreviation | Description |
|---|---|
| Analog adapter | Generic term for FX5-4AD-ADP, FX5-4DA-ADP, FX5-4AD-PT-ADP, FX5-4AD-TC-ADP, and FX5-4A-ADP |
| Battery | Generic term for FX3U-32BL |
| Bus conversion module | Generic term for Bus conversion module (extension cable type) and Bus conversion module (extension connector type) |
| Communication adapter | Generic term for FX5-232ADP and FX5-485ADP |
| Communication board | Generic term for FX5-232-BD, FX5-485-BD, and FX5-422-BD-GOT |
| Complete flag | Generic term for user-specified complete flags and FX3 compatible device flags that are turned on at normal/abnormal completion of the positioning instruction |
| Expansion adapter | Generic term for adapter for FX5 CPU module |
| Expansion board | Generic term for board for FX5S CPU module, FX5UJ CPU module, and FX5U CPU module |
| Extension module | Generic term for FX5 extension modules, FX3 extension modules, Extension modules (extension cable type) and Extension modules (extension connector type) |
| Extension power supply module | Generic term for FX5 extension power supply module and FX3 extension power supply module |
| FX3 | Generic term for FX3S, FX3G, FX3GC, FX3U, and FX3UC programmable controllers |
| FX5 CPU module | Generic term for FX5S CPU module, FX5UJ CPU module, FX5U CPU module, and FX5UC CPU module |
| FX5S CPU module | Generic term for FX5S-30MR/ES, FX5S-30MT/ES, FX5S-30MT/ESS, FX5S-40MR/ES, FX5S-40MT/ES, FX5S-40MT/ESS, FX5S-60MR/ES, FX5S-60MT/ES, FX5S-60MT/ESS, FX5S-80MR/ES[*1], FX5S-80MT/ES[*1], FX5S-80MT/ESS[*1], FX5S-30MR/DS, FX5S-30MT/DS, FX5S-30MT/DSS, FX5S-40MR/DS, FX5S-40MT/DS, FX5S-40MT/DSS, FX5S-60MR/DS, FX5S-60MT/DS, FX5S-60MT/DSS, FX5S-80MR/DS[*1], FX5S-80MT/DS[*1], and FX5S-80MT/DSS[*1] |
| FX5U CPU module | Generic term for FX5U-32MR/ES, FX5U-32MT/ES, FX5U-32MT/ESS, FX5U-64MR/ES, FX5U-64MT/ES, FX5U-64MT/ESS, FX5U-80MR/ES, FX5U-80MT/ES, FX5U-80MT/ESS, FX5U-32MR/DS, FX5U-32MT/DS, FX5U-32MT/DSS, FX5U-64MR/DS, FX5U-64MT/DS, FX5U-64MT/DSS, FX5U-80MR/DS, FX5U-80MT/DS, and FX5U-80MT/DSS |
| FX5UC CPU module | Generic term for FX5UC-32MT/D, FX5UC-32MT/DSS, FX5UC-64MT/D, FX5UC-64MT/DSS, FX5UC-96MT/D, FX5UC-96MT/DSS, FX5UC-32MT/DS-TS, FX5UC-32MT/DSS-TS, and FX5UC-32MR/DS-TS |
| FX5UJ CPU module | Generic term for FX5UJ-24MR/ES, FX5UJ-24MT/ES, FX5UJ-24MT/ESS, FX5UJ-40MR/ES, FX5UJ-40MT/ES, FX5UJ-40MT/ESS, FX5UJ-60MR/ES, FX5UJ-60MT/ES, FX5UJ-60MT/ESS, FX5UJ-24MR/DS, FX5UJ-24MT/DS, FX5UJ-24MT/DSS, FX5UJ-40MR/DS, FX5UJ-40MT/DS, FX5UJ-40MT/DSS, FX5UJ-60MR/DS, FX5UJ-60MT/DS, and FX5UJ-60MT/DSS |
| GX Works3 | The product name of the software package, SWnDND-GXW3, for the MELSEC programmable controllers (The 'n' represents a version.) |
| High-speed pulse input/output module | Generic term for FX5-16ET/ES-H and FX5-16ET/ESS-H |
| I/O module | Generic term for Input modules, Output modules, Input/output modules, Powered input/output modules, and High-speed pulse input/output modules |
| Input module | Generic term for Input modules (extension cable type) and Input modules (extension connector type) |
| Input/output module | Generic term for Input/output modules (extension cable type) and Input/output modules (extension connector type) |
| Intelligent function module | Generic term for FX5 intelligent function modules and FX3 intelligent function modules |
| Output module | Generic term for Output modules (extension cable type) and Output modules (extension connector type) |
| Peripheral device | Generic term for engineering tools and GOTs |
| SD memory card | Generic term for NZ1MEM-2GBSD, NZ1MEM-4GBSD, NZ1MEM-8GBSD, NZ1MEM-16GBSD, L1MEM-2GBSD, and L1MEM-4GBSD SD memory cards<br>Abbreviation for Secure Digital Memory Card. Device that stores data using flash memory. |
| Table operation instruction | Generic term for the table operation (TBL) instruction, the multiple-table operation (DRVTBL) instruction, and the multiple-axis table operation (DRVMUL) instruction |

*1 These models are offered for specific regions.

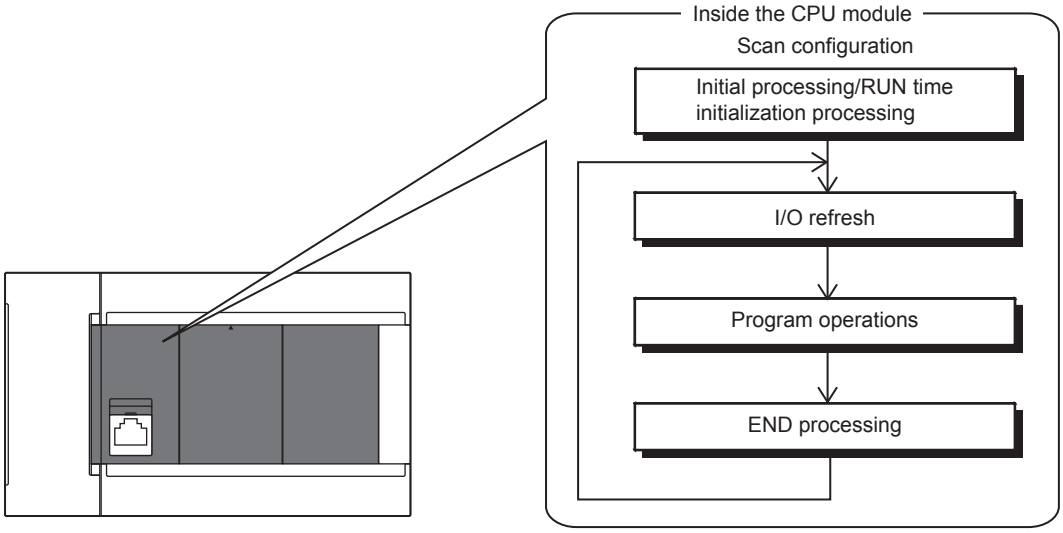
# PART 1 PROGRAMMING

This part consists of the following chapters.

# 1 PROGRAM EXECUTION

## 1.1 Scan Configuration

The configuration of the scan of the CPU module is explained below.




### Initial processing and initialization processing in RUN mode

Initial processing according to CPU module status and initialization processing in the RUN status are explained below.

○: Performed, ×: Not performed

| Processing item | CPU module status | | | |
|---|---|---|---|---|
| | At power ON | At reset | STOP→RUN after write to programmable controller*1 | At STOP→RUN |
| Initialization of input/output module | ○ | ○ | × | × |
| Boot from SD memory card | ○ | ○ | × | × |
| CPU parameter check | ○ | ○ | × | × |
| System parameter check | ○ | ○ | × | × |
| Initialization of device/label outside latch range (bit device: OFF, word device: 0) | ○ | ○ | × | × |
| Assignment of I/O numbers of input/output module | ○ | ○ | × | × |
| Setting of module parameters | ○ | ○ | × | × |
| Setting of device | ○ | ○ | ○ | ○ |

*1 Indicates an instance of power OFF→ON or setting to RUN status without a reset after modifying parameters or program in STOP status.

**Point**

At STOP→RUN after writing to the FX5U/FX5UC CPU module, the following operations are added in CPU module firmware version "1.015" or later. The FX5S/FX5UJ CPU modules support the following operations from the first released product.

- When stored in CPU module: Update program file, FB files, global label setting file, initial device value file
- When stored in SD memory card: Update initial device value file

However, if other parameters are changed, the above is not updated. To update, please perform power supply OFF→ON or reset.

## I/O refresh

Execute I/O refresh before starting program operations.

- Input ON/OFF data input from input module/intelligent function module to CPU module
- Output ON/OFF data input from CPU module to output module/intelligent function module

**Point**

When executing constant scan, I/O refresh is executed after the constant scan waiting time ends.

## Program operations

Step 0 of each program up to the END/FEND instruction is executed according to program settings. This program is called the "main routine". Main routine programs can be divided into subroutines. (☞ Page 38 Subroutine program)

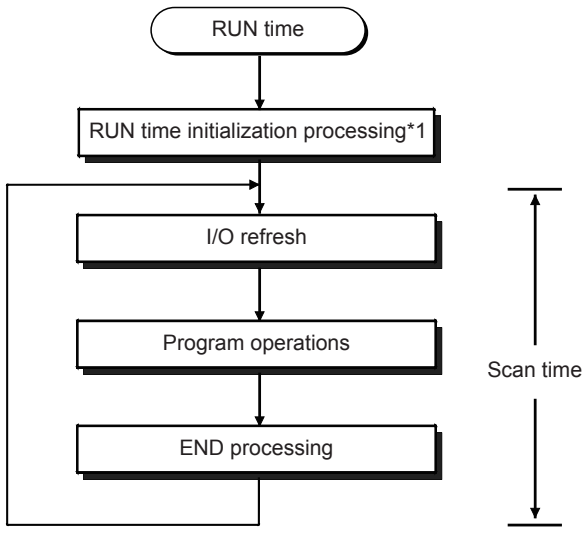
## END processing

END processing involves the following processes:

- Link refreshing of network modules
- Link refreshing of CC-Link IE Field Network Basic
- Refreshing of intelligent function modules
- Instruction termination processing
- Device/label access service processing
- Resetting of the watchdog timer
- Device collection by the data logging function
- Self-diagnostic processing
- Setting of values to special relays/special registers (set timing: when END processing is executed)

# 1.2 Scan Time

The CPU module repeats the following processing. The scan time is the sum total of each process and execution time.




*1 This process is included in the initial scan time.

## Initial scan time

This refers to the initial scan time when the CPU module is in the RUN mode.

### How to check the initial scan time

The initial scan time can be checked by the following information:

- Value stored in SD518 (initial scan time (ms)), SD519 (initial scan time (μs))
- Program list monitor (GX Works3 Operating Manual)

### Monitoring the initial scan time

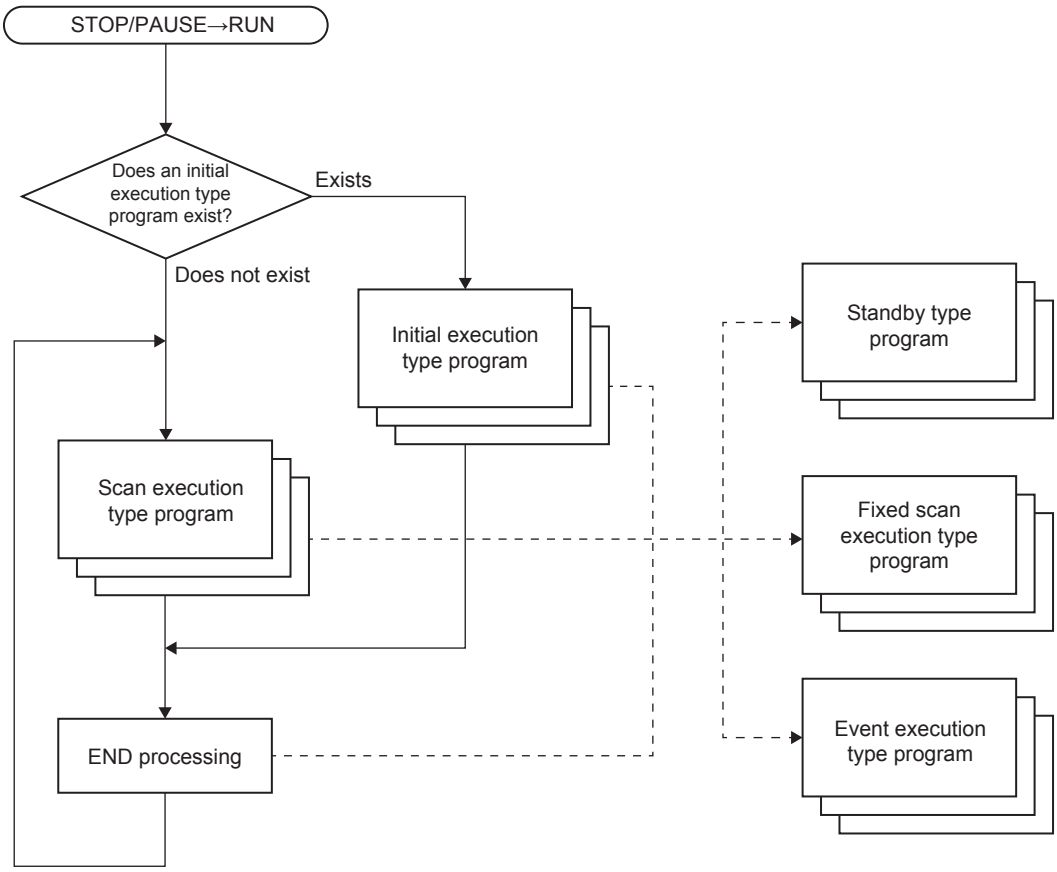
The initial scan time is monitored by the initial scan time execution monitor time. (☞ Page 114 SCAN MONITORING FUNCTION)

#### ■Initial scan time execution monitor time precautions

- Set an initial execution monitor time longer then the execution time of the initial scan time. An error occurs when the initial scan time exceeds the set initial execution monitor time.
- The measurement error margin of the initial scan execution monitor time is 10ms. For example, if the initial execution monitor time (t) is set to 100ms, an error occurs in the initial scan time in the range 100ms < t < 110ms range.

# 1.3 Program Execution Sequence

When the CPU module enters the RUN status, the programs are executed successively according to the execution type of the programs and execution order setting.




**Point**

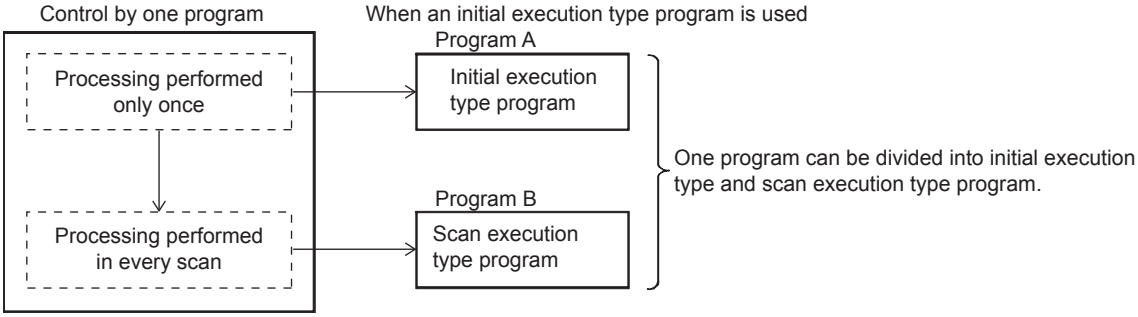
When the execution type of the programs is the same, the programs are executed in the order in which the execution order was set.

# 1.4 Execution Type of Program

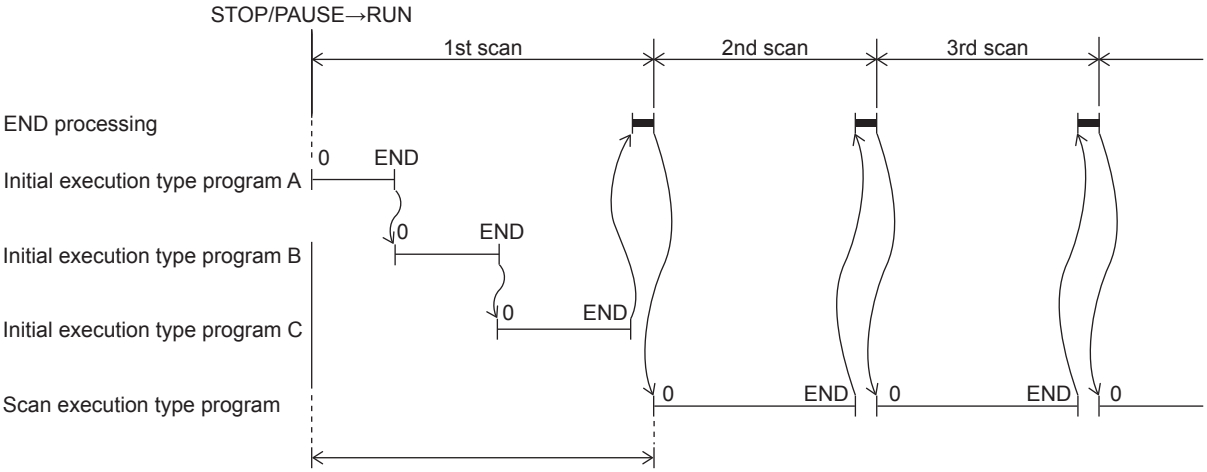
Set the program execution conditions.

## Initial execution type program

This program type is executed only once when the CPU module changes from the STOP/PAUSE to the RUN status. This program type is used for programs, that do not need to be executed from the next scan once they are executed, like initial processing on an intelligent function module.




Also, the execution time of initial execution type programs is the same as the initial scan time.
When multiple initial execution type programs are executed, the execution time of the initial execution type programs becomes the time until execution of all initial execution type programs is completed.




Initial scan time is the sum of the execution time of initial execution type programs and the END processing time.

### Precautions

The precautions for initial execution type programs are explained below.

#### ■Restrictions in programming

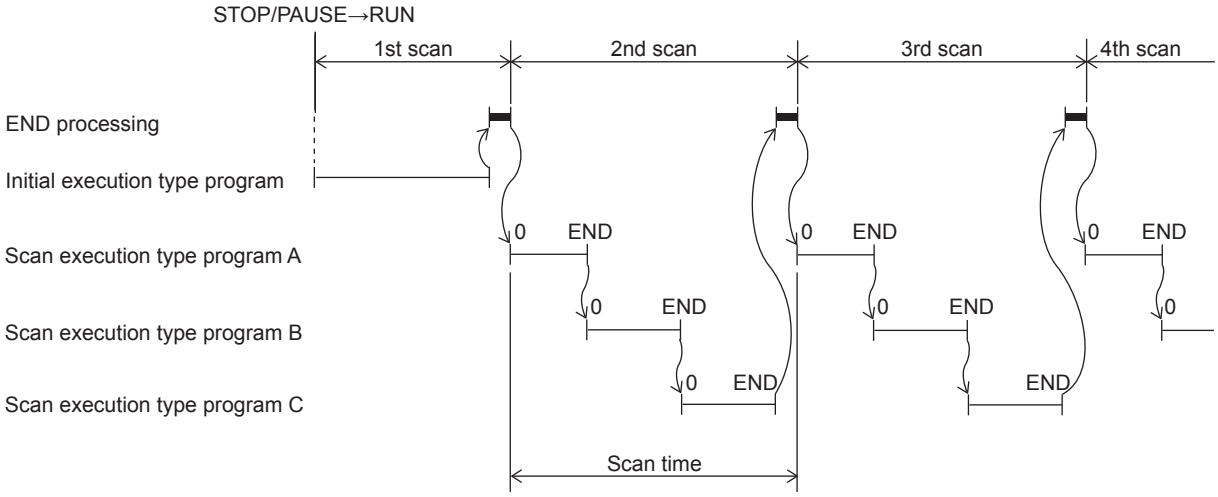
With initial execution type programs, do not use instructions that require several scans to complete execution (instructions for which completion devices exist).

Ex.

e.g. RBFM and WBFM instructions

# Scan execution type program

This program type is executed only once per scan from the scan following the scan where an initial execution type program was executed.




When multiple scan execution type programs are executed, the execution time of the scan execution type programs becomes the time until execution of all scan execution type programs is completed. Note, however, that when a program/event execution type program is executed before a scan execution type program is completed, the execution time of these programs is included in the scan time.

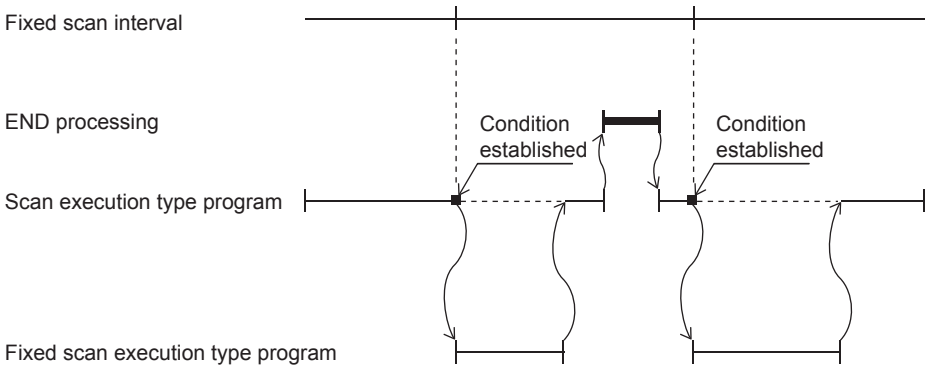
**Point**

- For the SFC program, only the scan execution type program can be specified.
- For SM402 (After RUN, ON for one scan only) and SM8002 (Initial pulse NO contact) in the scan execution type program, the action differs depending on the following.

- When there is not an initial execution type program: SM402 and SM8002 are executed.
- When there is an initial execution type program: SM402 and SM8002 are not executed.

# Fixed scan execution type program

An interrupt program which is executed at a specified time interval. Different from the normal interrupt program, this type of program does not require interrupt pointer (I) and IRET instruction to be written (pointer is assigned by parameter). Execution is performed by program file basis.
You can use 4 files of fixed scan execution type programs at the maximum.




**Point**

To execute a fixed scan execution type program, the EI instruction must be used to enable interrupts.

Make the following settings for fixed scan execution type program in CPU parameter.

- Interrupt pointer setting (Interrupt from internal timer: I28 to I31)
- Fixed scan interval setting



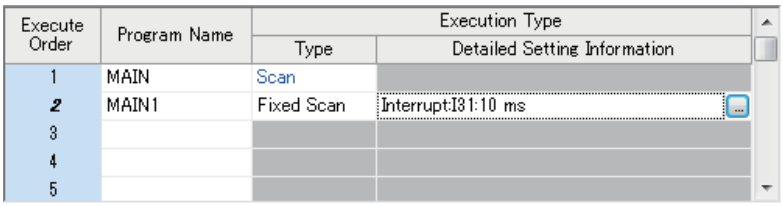
## Interrupt pointer setting

The interrupt pointer (Interrupt from internal timer: I28 to I31) assigned to a fixed scan execution type program is set up.

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [CPU Parameter] ⇨ "Program Setting" ⇨ "Program Setting" ⇨ "Detailed Setting" ⇨ "Detailed Setting Information"

1. Open the program setting window.
2. Set type as fixed scan.
3. Specify interrupt pointer.

### Window




### Displayed items

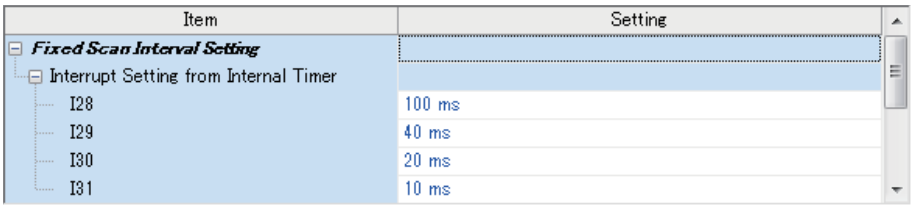
| Item | Description | Setting range | Default |
|---|---|---|---|
| Interrupt Pointer | Set the interrupt pointer which is assigned to fixed scan execution type program. | • I28<br>• I29<br>• I30<br>• I31 | I31 |
| Specified Time Intervals | Fixed scan interval setting value is displayed.<br>Setup is performed on another window. (☞ Page 31 Fixed scan interval setting) | — | — |

## Fixed scan interval setting

Sets the fixed scan interval setting of the fixed scan execution type program. (It is the same as setting for interrupt from internal timer.)

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [CPU Parameter] ⇨ "Interrupt Settings" ⇨ "Fixed Scan Interval Setting"

### Window




### Displayed items

| Item | | Description | Setting range | Default |
|---|---|---|---|---|
| Interrupt Setting from Internal Timer | I28 | Sets the execution interval of I28. | 1 to 60000ms (1ms units) | 100ms |
| | I29 | Sets the execution interval of I29. | 1 to 60000ms (1ms units) | 40ms |
| | I30 | Sets the execution interval of I30. | 1 to 60000ms (1ms units) | 20ms |
| | I31 | Sets the execution interval of I31. | 1 to 60000ms (1ms units) | 10ms |

## Action when the execution condition is satisfied

Performs the following action.

### ■If the execution condition is satisfied before the interrupt is enabled by the EI instruction

The program enters the waiting status and is executed when the interrupt is enabled. Note that if the execution condition for this fixed scan execution type program is satisfied more than once during the waiting status, the program is executed only once when the interrupt is enabled.

### ■When there are two or more fixed scan execution type programs

When the specified time intervals expire in the same timing, the programs are executed in order according to the priority (I31 > I30 > I29 > I28) of the periodic interrupt pointer.

### ■If another or the same execution condition is satisfied while the fixed scan execution type program is being executed

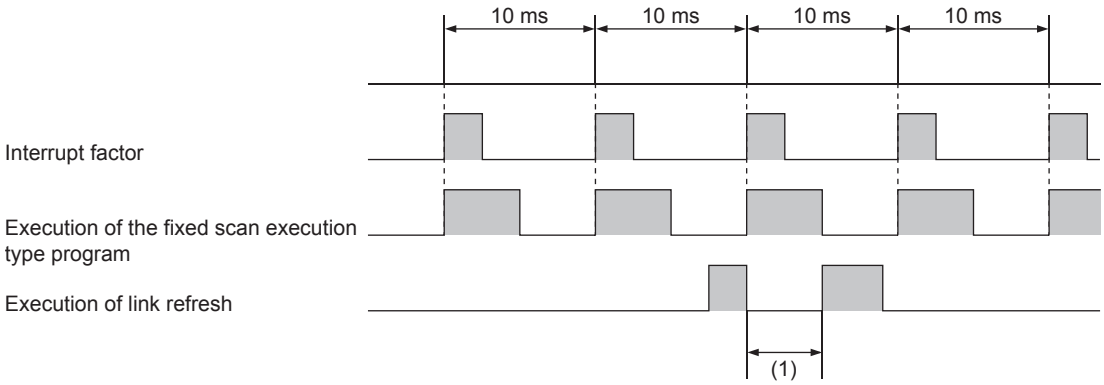
Operates according to the fixed scan execution mode setting.

### ■If the execution condition is satisfied while the interrupt is disabled by the system

Operates according to the fixed scan execution mode setting.

### ■If an interrupt factor occurs during link refresh

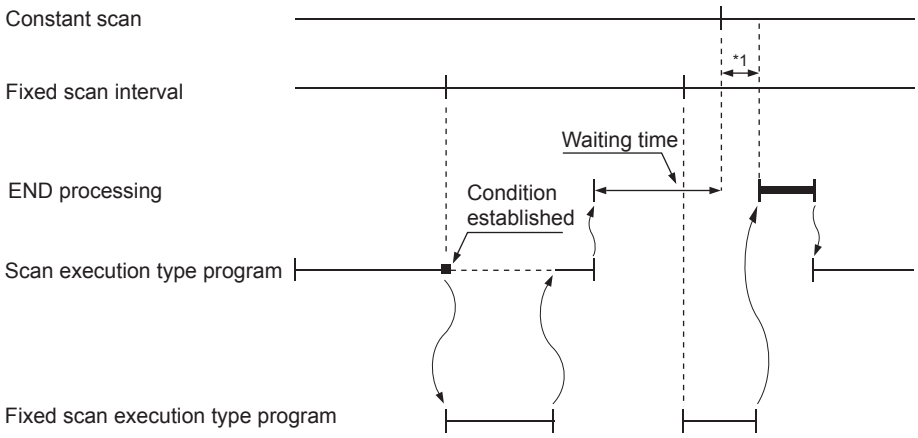
Suspends link refresh and executes the fixed scan execution type program. Even while station unit block guarantee is enabled for cyclic data during refresh of such links as CC-Link IE Field Network, if the fixed scan execution type program uses a device specified as the refresh target, station unit block guarantee for cyclic data is not available.




(1) Suspends link refresh and executes the fixed scan execution type program.

### ■When an interrupt is generated during a standby while executing constant scan

Executes the fixed scan execution type program.




*1 If processing does not finish during the waiting time, the scan time is extended.

### ■If another interrupt occurs while the fixed scan execution type program is being executed

If an interrupt program is triggered while the fixed scan execution type program is being executed, the program operates in accordance with the interrupt priority.

## Processing when the fixed scan execution type program starts

The same processing as when the interrupt program starts. (☞ Page 43 Processing at startup of interrupt program)

## Fixed scan execution mode

If execution condition for a fixed scan execution type program and fixed cycle interrupt (I28 to I31) based on the internal timer of the CPU module is satisfied while interruption is disabled, the operation of the program execution after interruption becomes allowed is specified. However, if execution condition is satisfied while interruption is set to be disabled because of a DI instruction or the like, this is out of the scope of the fixed scan execution mode.

**Point**

"Interrupts disabled" refers to the following:

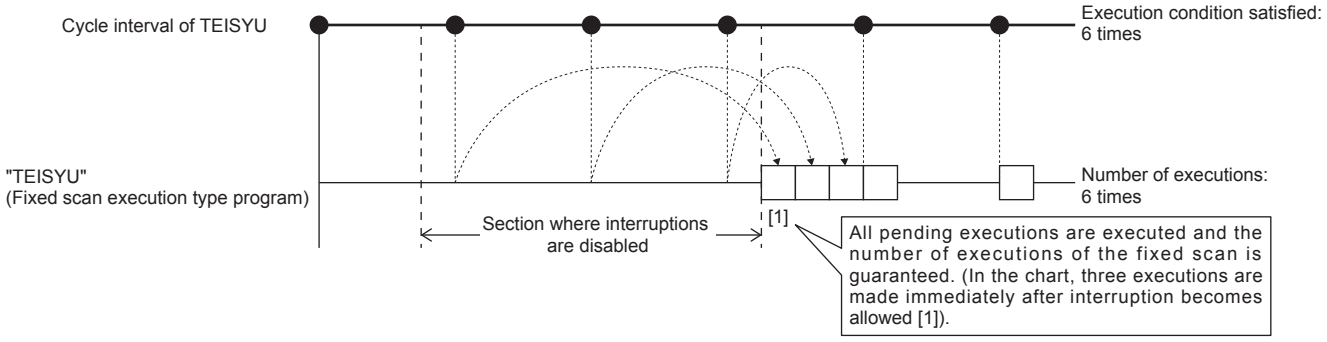
- A program having an interrupt priority higher than or the same as the corresponding program is currently being executed.
- The corresponding program is currently being executed.
- Program execution is currently at a part in which interrupts are disabled by the system.

### ■Operation in the fixed scan execution mode

This section describes the operation which can be performed in the fixed scan execution mode.

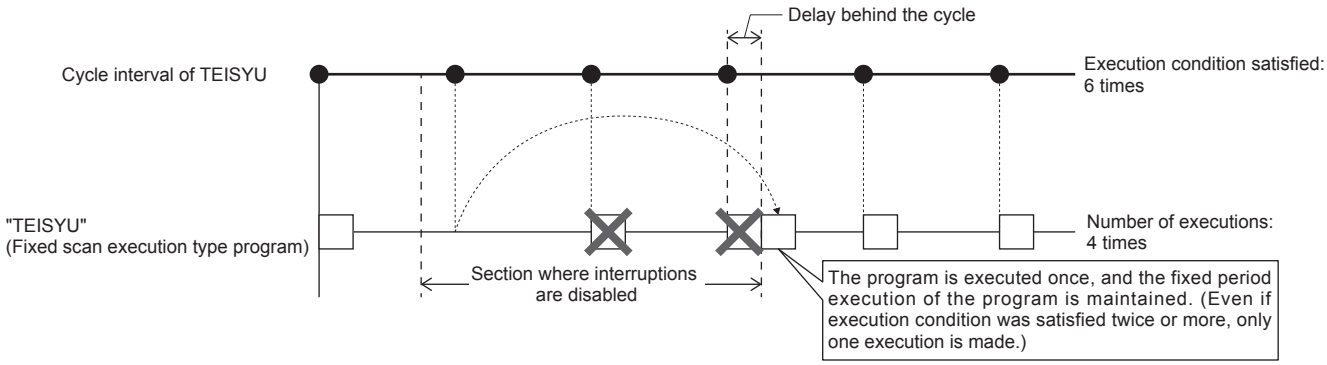
- Execution Count Takes Priority

The program is executed for all the pending number of executions so that it can be executed the same number of times as execution condition was satisfied.




- Precede Fixed Scan

When the waiting for execution, one execution is made when interrupt becomes allowed. Even if execution condition was satisfied twice or more, only one execution is performed.

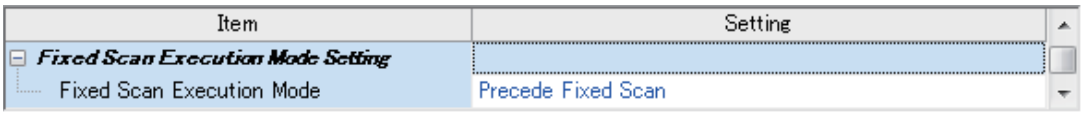


### ■Fixed scan execution mode setting

Use the fixed scan execution mode setting.

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [CPU Parameter] ⇨ "Interrupt Settings" ⇨ "Fixed Scan Execution Mode Setting"

#### Window

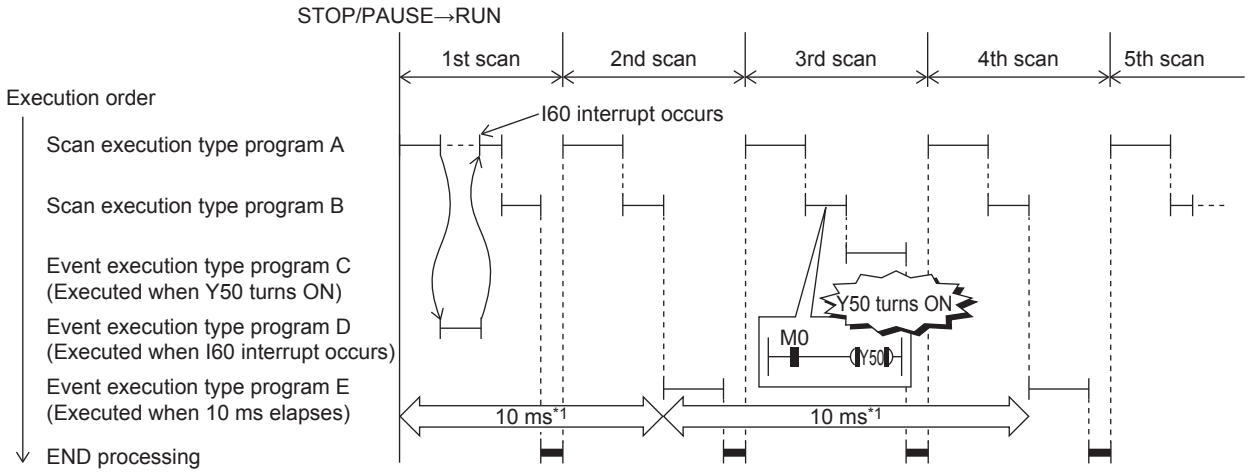



#### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Fixed Scan Execution Mode | For Precede Fixed Scan, the periodicity of the program is maintained. For Execution Count Takes Priority, the program is executed for all pending number of executions. | • Precede Fixed Scan<br>• Execution Count Takes Priority | Precede Fixed Scan |

## Event execution type program

Execution of this program type is triggered by a user-specified event. (☞ Page 34 Trigger type)



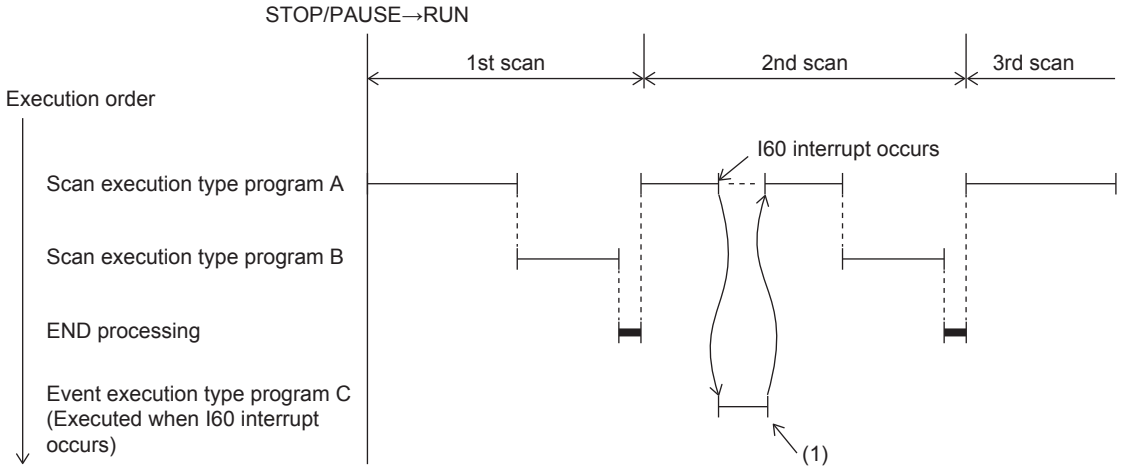

*1 Measurement of elapsed time is 10ms or more because it is determined depending on the scan time.

### Trigger type

Triggers for event execution type programs are explained below. (☞ Page 36 Trigger setting)

## ■Generation of interrupt by interrupt pointer (I)

The program is executed once, immediately, when a specified interrupt cause is generated. An interrupt pointer label can be appended by adding the FEND instruction to a different program, and the program description partitioned by the IRET instruction can be turned into an exclusive program.




(1) Event execution type program C is executed immediately when the specified event is generated.

• Specifiable interrupt pointer (I)

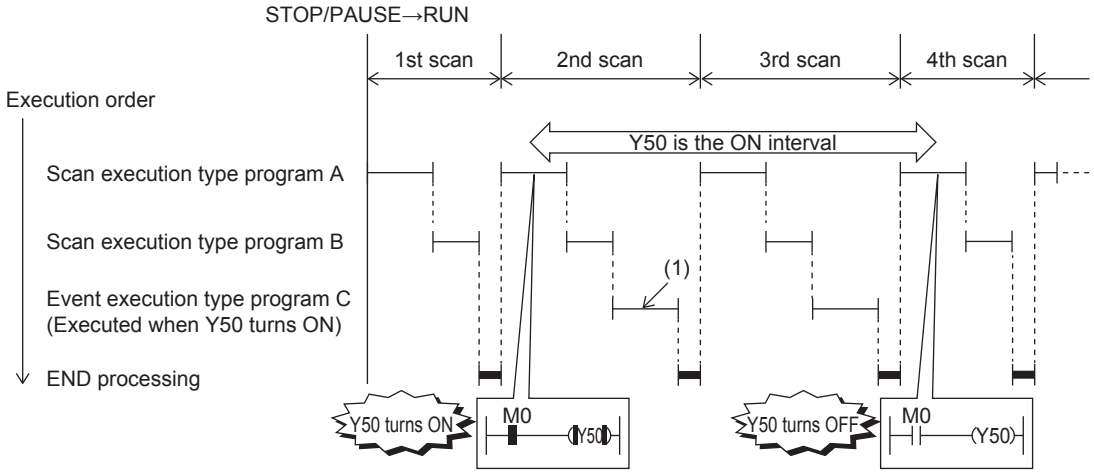
Specifiable interrupt pointers are I0 to I15, I16 to I23, and I50 to I177.

**Point**

Execution conditions for the event execution type program which is triggered by interrupt occurred by the interrupt pointer (I) are the same as those for general interrupt programs. (☞ Page 40 Operation when an interrupt is generated)

## ■Bit data ON (TRUE)

When it is the turn of the corresponding program to be executed, the program is executed if the specified bit data is ON. This eliminates the need for creating a program for monitoring triggers in a separate program. After the specified bit data changes from ON (TRUE) to OFF (FALSE) and it is the turn of the corresponding event execution type program to be executed, output (Y) currently used in the corresponding program and the current values of timer (T) can be cleared.




(1) The program is executed if Y50 is ON when it is the turn of event execution type program C to be executed.

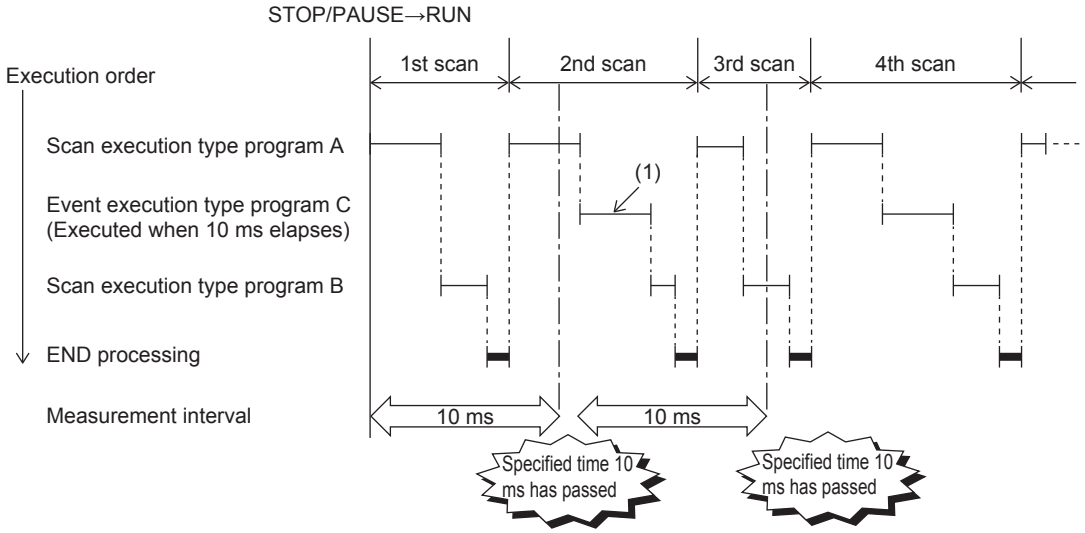
Applicable devices are as follows.

| Item | | Description |
|---|---|---|
| Device*1 | Bit device | X (DX), Y, M, L, F, SM, B, SB |
| | Bit specification in word device | D, SD, W, SW, R, U□\G□ |

*1 Indexed devices cannot be specified.

### ■Elapsed time

The program is executed once when it is the turn of the corresponding program to be executed first after the CPU module is run and the specified time has elapsed. For second execution onwards, the time is re-calculated from the start of the previous event execution type program. When it is the turn of the corresponding program to be executed first after specified time has elapsed, program execution is repeated. Output (Y) currently used in the corresponding program and the current values of timer (T) can be cleared at the next scan following execution of the corresponding program. This will not be always executing an interrupt at a constant cycle but can be used when executing a specified program after a specified time has elapsed.




(1) When it is the turn of the first execution after the specified time has elapsed, event execution type program C is executed.

**Point**

Output and timer current values are not cleared even when the program is set so that output and timer current values are cleared, if the scan time is longer than the elapsed time set value.

## Trigger setting

Use the event execution type detail setting.

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [CPU Parameter] ⇨ "Program Setting"

### Operating procedure

"Program Setting" window

| Item | Setting |
|---|---|
| Program Setting | |
| Program Setting | <Detailed Setting> |

"Detailed Setting" window

| Execute Order | Program Name | Execution Type | |
|---|---|---|---|
| | | Type | Detailed Setting Information |
| 1 | MAIN | Event | Bit ON:Do Not Clear: |
| 2 | | | |

"Event Execution Type Detailed Setting" window

| Item | Setting |
|---|---|
| Trigger Type | ON of Bit Data (TRUE) |
| Interruption Occurrence | |
| ON of Bit Data (TRUE) | |
| Clear Output and Current Value of Timer | Do Not Clear |
| Passing Time | |
| Unit | ms |
| Clear Output and Current Value of Timer | Do Not Clear |

1. Click "Detailed Setting" on the Program Setting.
2. Select the program name and set the execution type to "Event".
3. Click "Detailed Setting Information".
4. Set the trigger type to execute the event execution type program.

### Displayed items

| Item | | Description | Setting range | Default |
|---|---|---|---|---|
| Interruption Occurrence | | Sets the interrupt pointer used as the trigger. | I0 to I23, I50 to I177 | — |
| ON of Bit Data (TRUE) | | Sets the device used as the trigger. | ☞ Page 35 Bit data ON (TRUE) | — |
| Clear Output and Current Value of Timer | | Sets that the current values of the output (Y), and timer (T) used in this program are cleared at the execution turn of the event execution type program that comes after the specified bit data is OFF. | • Do Not Clear<br>• Clear | Do Not Clear |
| Passing Time | Unit | Sets the time passed. | • When "ms" is selected: 1 to 65535ms (in units of 1ms)<br>• When "s" is selected: 1 to 65535s (in units of 1s) | — |
| | Clear Output and Current Value of Timer | Sets that the current values of the output (Y), and timer (T) used in this program are cleared at the execution turn of the event execution type program that comes after the specified time passes. | • Do Not Clear<br>• Clear | — |

**Point**

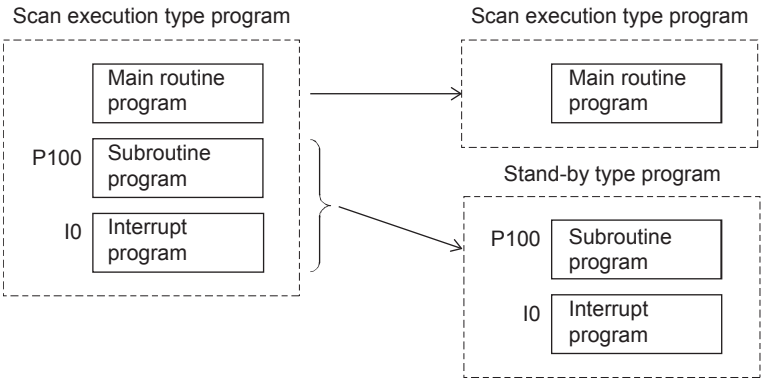
When "Clear Output and Current Value of Timer" is enabled together with "ON of Bit Data (TRUE)" or "Passing Time", the current values of the output (Y) and timer (T) of this program can be cleared at the first execution turn of this program that comes after the trigger turns OFF.

# Stand-by type program

This program is executed only when there is an execution request.

## Saving programs in library

Subroutine programs or interrupt programs are saved as standby type programs so that they can be used when controlled separately from the main routine program. Multiple subroutine programs and interrupt programs can be created in one standby type program.




## How to execute

Execute standby type programs as follows.

- Create sub-routine programs and interrupt programs in the standby type program which is called up by a pointer, etc. or when an interrupt is generated.

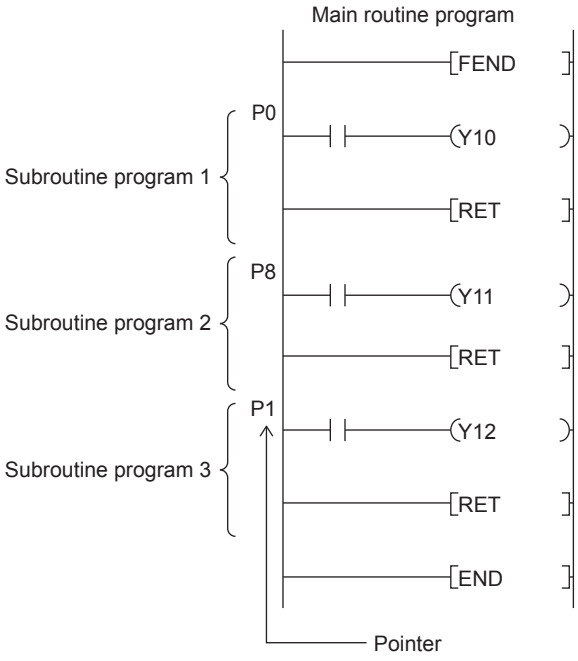
# 1.5 Program Type

Programs that use pointers (P) or interrupt pointers (I) are explained below.

## Subroutine program

This is the program from pointer (P) up to the RET instruction. Subroutine programs are executed only when they are called by the CALL instruction. Pointer type labels also can be used instead of pointers (P). The applications of subroutine programs are as follows:

- By grouping programs that are executed multiple times in one scan into a single subroutine program, the number of steps in the entire program can be reduced.
- A program that is executed only under certain conditions can be saved as a subroutine program which shortens the scan time proportionately.




**Point**

- Subroutine programs can also be managed as separate programs by turning them into standby type programs. (☞ Page 37 Stand-by type program)
- Pointers need not be programmed starting with the smallest number.

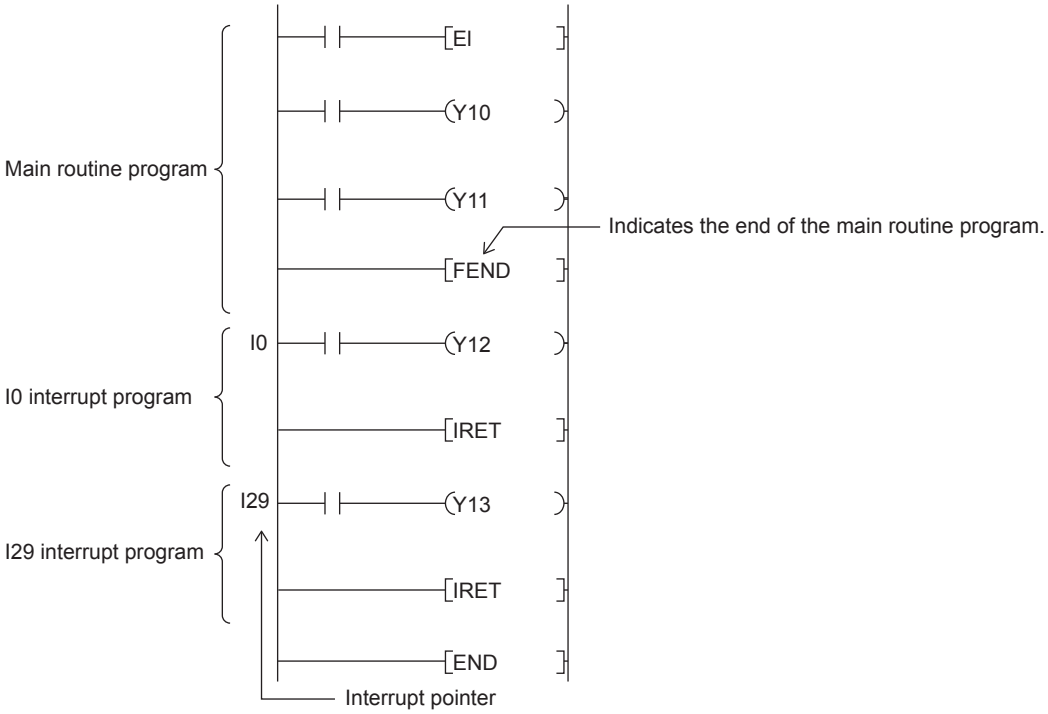
### Precautions

The precautions when using subroutine programs are explained below.

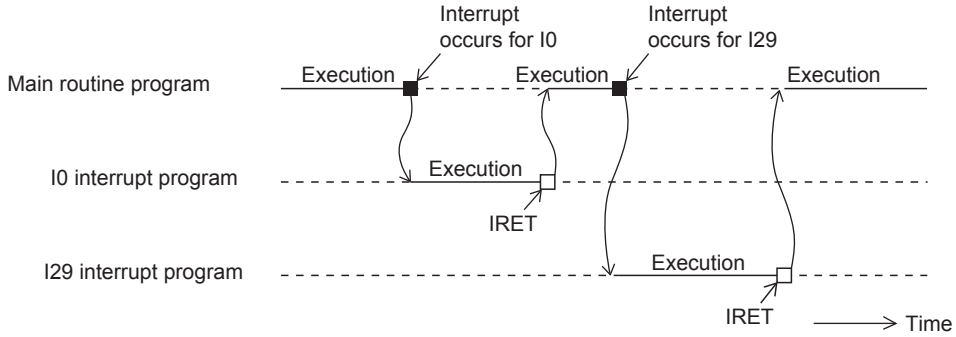
- Do not use timers (T, ST). Note, however, that timers can be used when a timer coil (OUT T☐ instruction) is always executed only once in one scan.
- An error occurs when program execution returns to the call source program and the program is terminated without using the RET instruction.
- An error occurs when there is no pointer (P) or pointer type global label in FB or FUN.
- When the CALL instruction is used in the operation output of the step of the SFC program, even though the transition condition is established and the step is deactivated, the output of the call destination is not turned OFF. When turning OFF the output of the call destination, use the XCALL instruction.

# Interrupt program

This is the program from interrupt pointer (I) up to the IRET instruction.




When an interrupt is generated, the interrupt program corresponding to that interrupt pointer number is executed. Note, however, that interrupt enabled status must be set with the EI instruction before executing the interrupt program.




**Point**

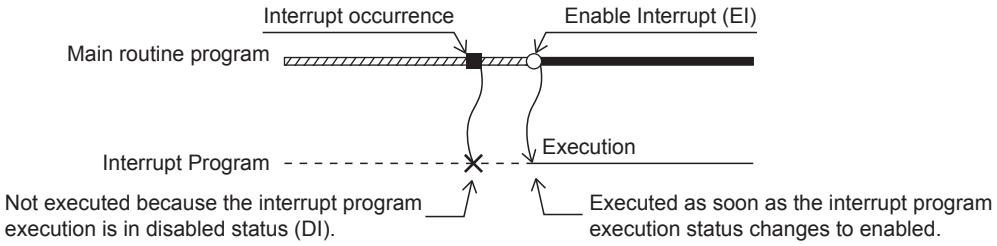
- Only one interrupt program can be created with one interrupt pointer number.
- Interrupt pointers need not be programmed starting with the smallest number.
- Interrupt programs can also be managed as separate programs by turning them into standby type programs. (☞ Page 37 Stand-by type program)

## Operation when an interrupt is generated

Operation when an interrupt is generated is explained below.

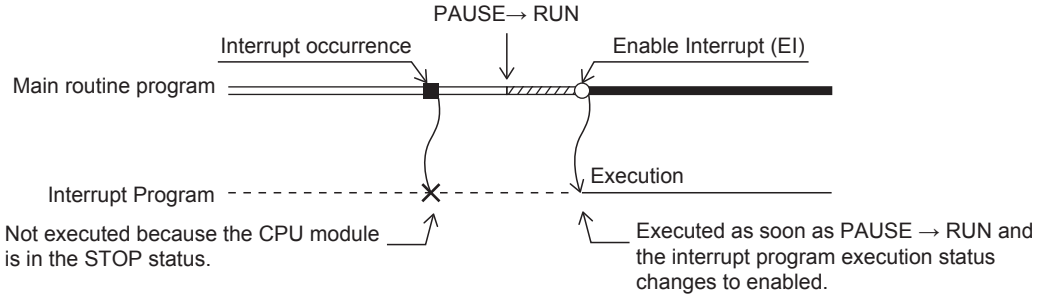
### ■If an interrupt cause occurs when interrupt is disabled (DI)

The interrupt that was generated is stored, and the stored interrupt program is executed the moment that the status changes to interrupt enabled. An interrupt is stored only once even if the same interrupt is generated multiple times. Note, however, that all interrupts cause are discarded when interrupt disable is specified by the IMASK and SIMASK instructions.



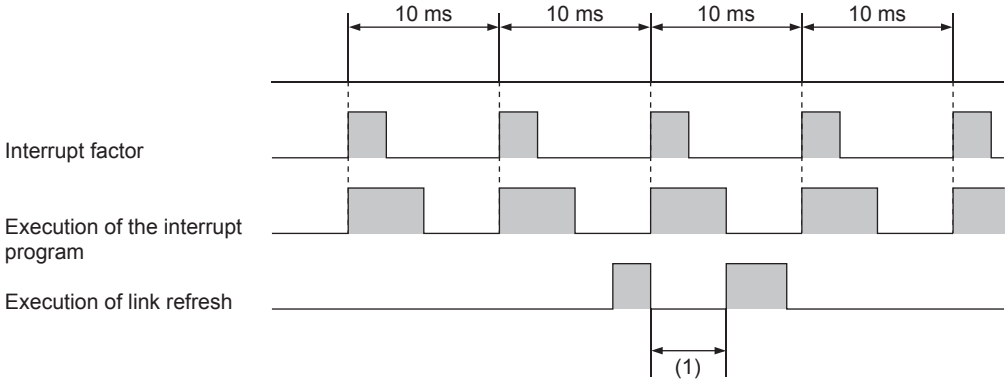

### ■When an interrupt cause is generated by a PAUSE status

The interrupt program is executed the moment that the CPU module changes to the RUN status and the status changes to interrupt enabled. An interrupt is stored only once when the same interrupt is generated multiple times before the CPU module changes to the RUN status.




### ■If an interrupt factor occurs during link refresh

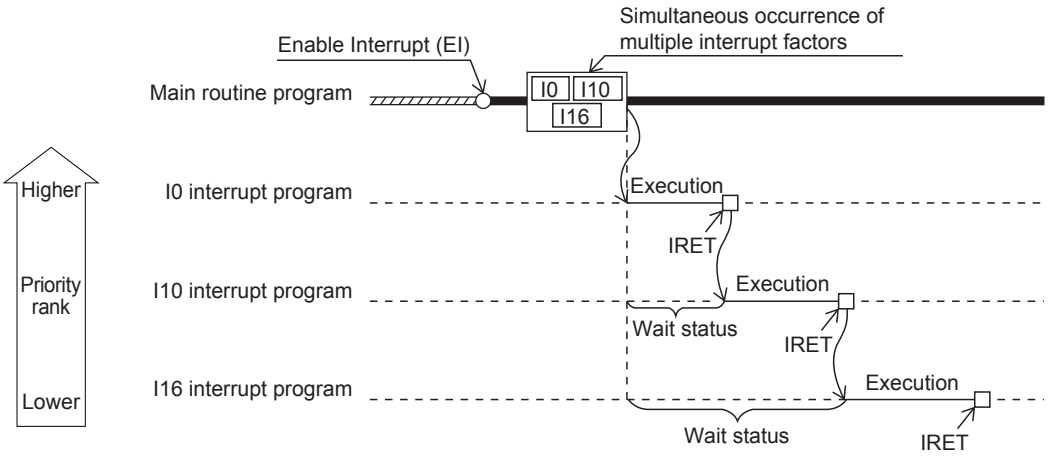
Suspends link refresh and executes the interrupt program. Even though station unit block guarantee is enabled for cyclic data during refresh of such links as CC-Link IE Field Network, if the interrupt program uses a device specified as the refresh target, station unit block guarantee for cyclic data is not available.




(1) Suspends link refresh and executes the interrupt program.

## ■When multiple interrupts are generated at the same time while in an interrupt enabled status

Interrupt programs are executed in order starting from program having the highest priority. Interrupt programs also run in order of priority rank when multiple interrupt programs having the same priority are generated simultaneously.




## ■When an interrupt is generated during a standby while executing constant scan

The interrupt program for that interrupt is executed.

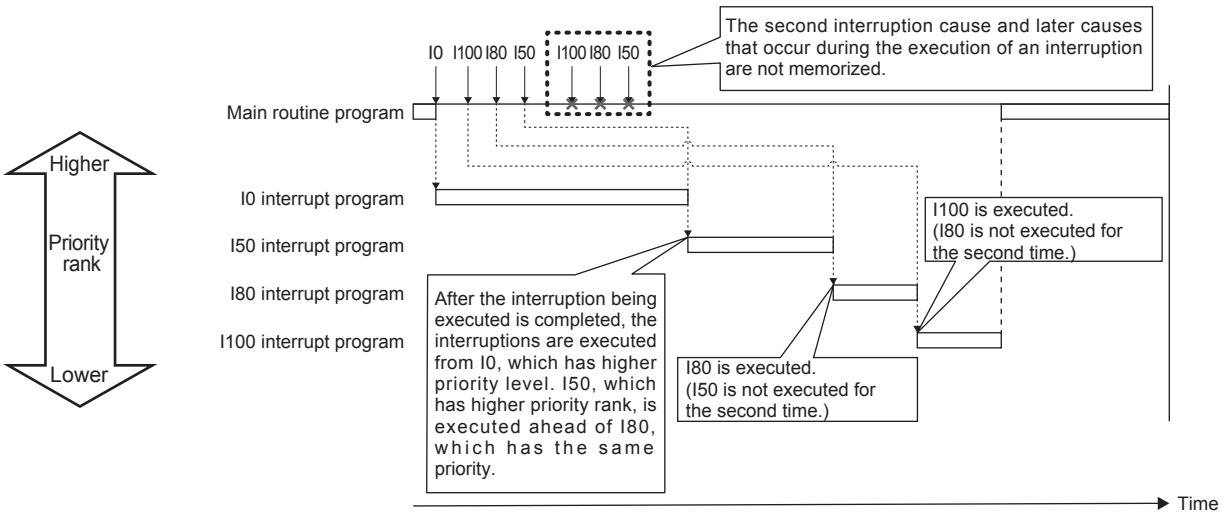
## ■When another interrupt is generated during execution of the interrupt program

If an interrupt such as a fixed scan execution type program (including an interrupt which triggers the event execution type program) is triggered while an interrupt program is being executed, the program operates in accordance with the interrupt priority.

## ■If an interrupt cause with the same or a lower priority occurs while the interrupt program is being executed

- For I0 to I23 and I50 to I177

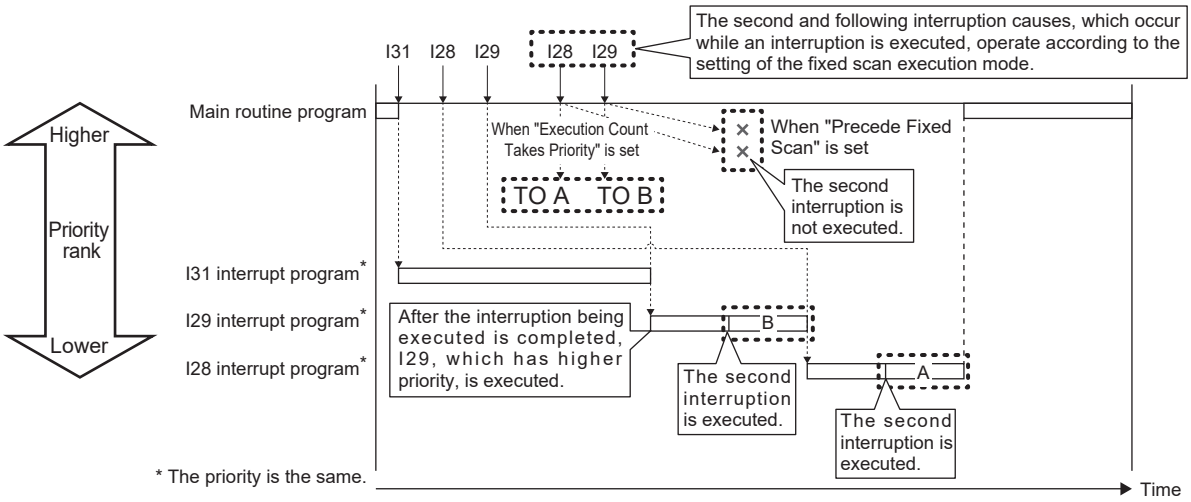
The interrupt cause that occurred is memorized, and the interrupt program corresponding to the cause will be executed after the running interrupt program finishes. An interrupt is stored only once even if the same interrupt is generated multiple times.



• For I28 to I31

The interrupt cause that occurred is memorized, and the interrupt program corresponding to the cause will be executed after the running interrupt program finishes. If the same interrupt cause occurs multiple times, it will be memorized once but operation at the second and later occurrences depends on setting of the fixed scan execution mode. (☞ Page 33 Fixed scan execution mode)

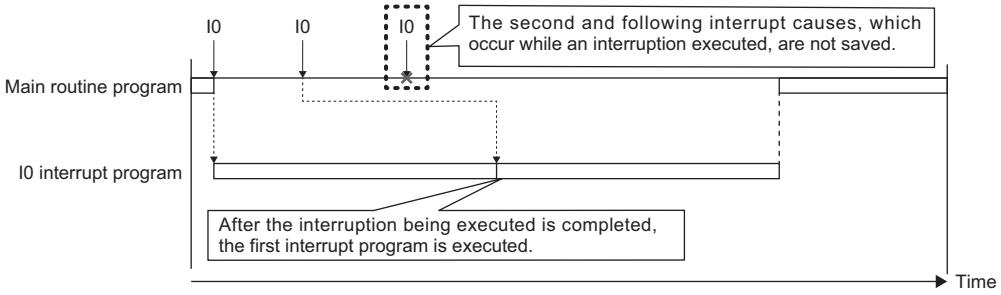
When "Execution Count Takes Priority" is enabled, the interrupt program corresponding to the memorized interrupt causes will be executed after the running interrupt program finishes. When "Precede Fixed Scan" is enabled, the second and later occurrences will not be memorized.




## ■If the same interrupt cause occurs while the interrupt program is being executed

• For I0 to I23 and I50 to I177

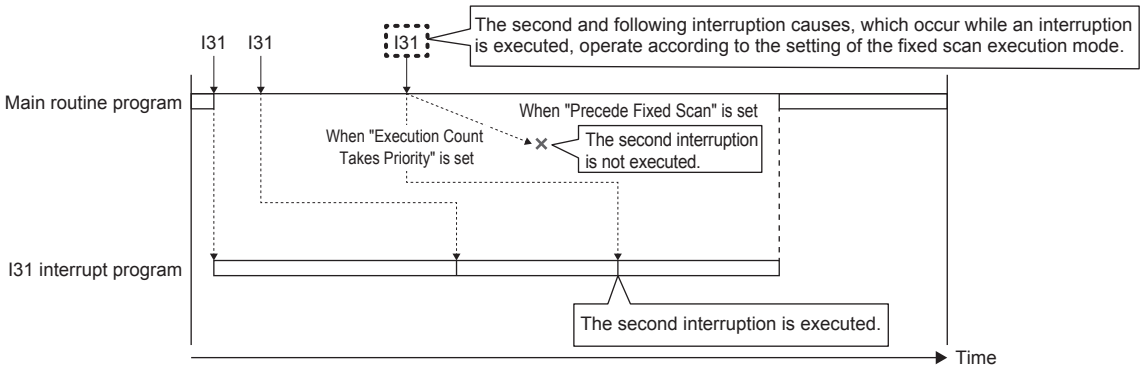
The interrupt cause that occurred is memorized, and the interrupt program corresponding to the cause will be executed after the running interrupt program finishes. An interrupt is stored only once even if the same interrupt is generated multiple times.




• For I28 to I31

The interrupt cause that occurred is memorized, and the interrupt program corresponding to the cause will be executed after the running interrupt program finishes. If the same interrupt cause occurs multiple times, it will be memorized once but operation at the second and later occurrences depends on setting of the fixed scan execution mode. (☞ Page 33 Fixed scan execution mode)

When "Execution Count Takes Priority" is enabled, the interrupt program corresponding to the memorized interrupt cause will be executed after the running interrupt program finishes. When "Precede Fixed Scan" is enabled, the second and later occurrences will not be memorized.

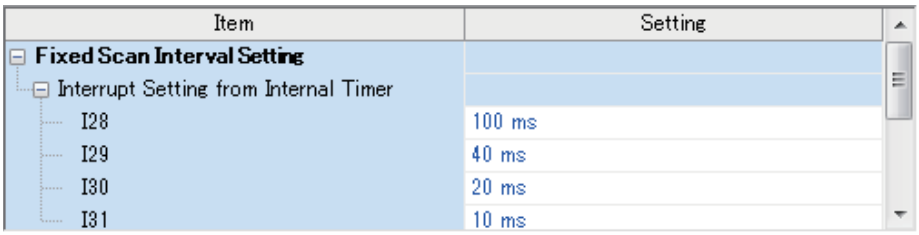


## Setting the interrupt cycle

Set the interrupt cycle of interrupts I28 to I31 using the internal timer of the interrupt pointer.

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [CPU Parameter] ⇨ "Interrupt Settings" ⇨ "Fixed Scan Interval Setting"

### Window




### Displayed items

| Item | | Description | Setting range | Default |
|---|---|---|---|---|
| Interrupt Setting from Internal Timer | I28 | Sets the execution interval of I28. | 1 to 60000ms (1ms units) | 100ms |
| | I29 | Sets the execution interval of I29. | 1 to 60000ms (1ms units) | 40ms |
| | I30 | Sets the execution interval of I30. | 1 to 60000ms (1ms units) | 20ms |
| | I31 | Sets the execution interval of I31. | 1 to 60000ms (1ms units) | 10ms |

## Processing at startup of interrupt program

Processing is as follows when an interrupt program is started up.

- Purge/restore of index registers (Z, LZ)

### ■Purge/restore of index registers (Z, LZ)

When an interrupt program is started up, the values of the index registers (Z, LZ) in the currently executing program are purged, and those values are handed over to the interrupt program. Then, when an interrupt program is terminated, the purged values are restored to the currently executing program.

## Precautions

The precautions for interrupt programs are explained below.

### ■Restrictions in programming

- The PLS/PLF instructions execute OFF processing at the scan following instruction execution. ON devices remain ON until the interrupt program runs again and the instruction is executed.
- Only a routine timer can be used in an interrupt program. Timers (T, ST) cannot be used.

### ■Splitting of data

Processing may be interrupted during instruction execution and an interrupt programs can be executed. Accordingly, splitting of data might occur if the same devices are used by both the interrupt program and the program that is aborted by the interrupt. Implement the following preventive measure.

- Set instructions that will result in inconsistencies if interrupted to "interrupt disabled" using the DI instruction.
- When using bit data, ensure that the same bit data is not used by both the interrupt program and the program that is aborted by the interrupt.

### ■Interrupt precision is not improved

If interrupt precision is not improved, this might be remedied by implementing the following:

- Give higher priority to the interrupt that needs higher precision.
- Use an interrupt pointer with high interrupt priority order.
- Recheck the section of interruption disabled.

# 2 PROCESSING OF OPERATIONS ACCORDING TO CPU MODULE OPERATION STATUS

The CPU module has three operation statuses as follows:

- RUN status
- STOP status
- PAUSE status

Processing of operations on the CPU module in each status is explained below.

## Processing of operations in RUN status

In the RUN mode, operations in the sequence program are executed repeatedly in order step 0→END (FEND) instruction→step 0.

### ■Output when CPU module enters RUN mode

Operation results are output after the sequence program is executed for the duration of one scan.
The device memory other than the output (Y) holds the state immediately before the RUN state. However, if device initial value is set up, this initial value is set.

### ■Processing time until start of operation

The processing time from the CPU module switching from STOP→RUN up to start of execution of operations in the sequence program fluctuates according to the system configuration and parameter settings. (Normally, this time is within one second.)

## Processing of operations in STOP status

In the STOP status, execution of operations in the sequence program is stopped by the RUN/STOP/RESET switch or a remote stop. The CPU module also enters the STOP status when a stop error occurs.

### ■Output when CPU module enters STOP status

When the CPU module enters the STOP status, all output points (Y) turn OFF. For device memory other than outputs (Y), non-latch devices are cleared and latch devices are held.
However, when SM8033 is on and CPU module switches RUN→STOP, it is possible to hold an output state and the current value of a device.

#### Precautions

When the SM8033 is ON, PC write with an engineering tool cannot be performed.

## Processing of operations in paused status

In a paused status, execution of operations in the sequence program is stopped after one scan execution but with outputs and device memory states held, by a remote pause.

## Processing of operations by the CPU module during switch operations

Processing of operations by the CPU module is as follows according to the RUN or STOP mode.

| RUN/STOP status | Processing of operations by CPU module | | | |
|---|---|---|---|---|
| | Processing of operations in sequence program | External output | Device memory | |
| | | | Other than Y | Y |
| RUN→STOP | The program is executed up to the END instruction and then stops. | All output points turn OFF. | Latch devices are held, and non-latch devices are cleared. | All output points turn OFF. |
| STOP→RUN | Program execution starts from step 0. | Operation results are output after the programmable controller is run for the duration of one scan. | The states of device memories immediately before the CPU module entered the RUN mode are held.<br>Note, however, that when device initial values are set, the device initial values are set. | Operation results are output after the programmable controller is run for the duration of one scan. |

**Point**

The CPU module performs the following processing regardless of RUN or STOP status or PAUSE status.

- Refreshing of input/output modules
- Automatic refreshing of intelligent function modules
- Self-diagnostic processing
- Device/label access service processing
- Setting of values to special relays/special registers (set timing: when END processing is executed)

For this reason, the following operations can be performed even in the STOP status or paused status:

- Monitoring of I/O or test operations by the engineering tool
- Reading/writing from external device using SLMP
- N:N Network
- MODBUS RTU slave

# 3 CPU MODULE MEMORY CONFIGURATION

## 3.1 Memory Configuration

CPU module memory is explained below.

### Memory configuration

The configuration of CPU module memory is explained below.

| Memory type | | Application |
|---|---|---|
| CPU built-in memory | Data memory | The following files are stored in this memory:<br>• Program files, FB files<br>• Restored information files<br>• Parameter files<br>• Files that contain device comments, etc. |
| | Device/label memory | Data areas for internal devices/labels, etc. are located in this memory. |
| | Signal flow memory | This memory is used to memorize the execution status of the instruction in the last scan. |
| | Temporary area | This memory is used temporarily by the system during the scan process. It is used as the label defined by the function or the instruction operand added by the system. |
| SD memory card | | This is for storing files that contain device comments, etc. and folders and files that are created by SD memory card functions. |

#### Data memory

The following files are stored in data memory.

| Category | File type | Max. number of files | Storage area size | Remarks |
|---|---|---|---|---|
| Program | Program file | 32 | 1 Mbytes | — |
| | FB files | 16 (Up to 15 for user) | | — |
| Restored information | Restored information files | 48 | 1 Mbytes | — |
| Parameters | Parameter files common to system | 1 | 1 Mbytes | — |
| | CPU parameter file | 1 | | — |
| | Module parameter file | 1 | | — |
| | Module extension parameter | 18 | | — |
| | Remote password | 1 | | — |
| | Device data storage file | 1 | | — |
| | Global label setting file | 1 | | — |
| | Data logging setting file | 4 | | — |
| | Memory dump setting file | 1 | | — |
| | Device initial values file | 1 | | — |
| | Device station parameter file*1 | 80*2 | | — |
| | Firmware update prohibited file | 1 | | — |
| Comments | Device comment file | 1 | 2 Mbytes | — |

*1 Only FX5U/FX5UC CPU module is supported.

*2 When the firmware version of the FX5U/FX5UC CPU module is "1.230" or earlier, the maximum number of the files is 60.

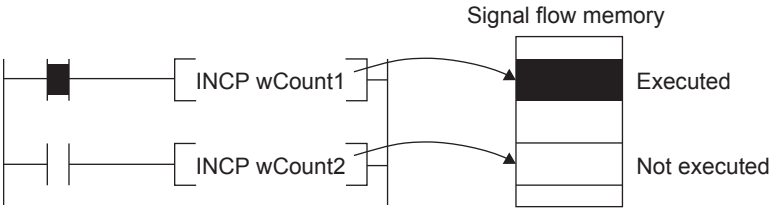
## Device/label memory

Device/label memory has the following areas.

| Area | Storage area size | Application |
|---|---|---|
| Device/label memory (standard) | 48 K words | ■FX5S/FX5UJ CPU module<br>• R, W, SW, labels, and latch labels are fixed in the memory. |
| | 63 K words | ■FX5U/FX5UC CPU module<br>• R, W, SW, labels, and latch labels can be placed in this memory in variable lengths.<br>• R and W can be backed up in the event of a power interruption only when the optional battery is installed. Also, latch label capacity can be increased when the battery is installed. |
| Device/label memory (fast) | 12 K words | ■FX5S/FX5U/FX5UC CPU module<br>• Bit devices, T, ST, C, LC, D, Z, and LZ are fixed in the memory.<br>■FX5U/FX5UC CPU module<br>• Bit devices, T, ST, C, LC, D, Z, LZ, labels, and latch labels can be placed in this memory in variable lengths. |

## Signal flow memory

This memory is used to memorize the execution status of the instruction in the last scan. The CPU module judges whether to execute a rising/falling edge execution instruction by referring to the signal flow memory.




The execution status of the last instruction is stored in the signal flow memory in two ways: executed or not executed. The instructions that refer to the signal flow memory judge whether to execute a rising/falling edge execution instruction depending on the input condition of the instruction and the execution status of the last instruction stored in the signal flow memory.

- For a program, the same number of areas as steps of the program are assigned to the signal flow memory (for program).
- For a function, the signal flow memory is not assigned since the instructions that refer to the last execution status of the signal flow memory cannot be used in the function.
- For a subroutine-type function block, the same number of areas as the function block steps are assigned to the signal flow memory (for FB). Different areas are assigned to each instance. When the macro type function block is called from the subroutine type function block, the areas including the ones used for the macro type function block are assigned.
- For a macro type function block, the same number of areas as the number of steps of the macro type function block are assigned to the signal flow memory (for program).

For instances of the function block, refer to the following.

MELSEC iQ-F FX5 Programming Manual (Program Design)

**Point**

The signal flow unit is 1 bit.

[FX5S/FX5UJ CPU module]

The program capacity is fixed at 48000 steps, and the capacity of the signal flow memory is as follows.

- Signal flow memory (for program): 48000 step (6000 byte)
- Signal flow memory (for FB): 131072 step (16K byte)

[FX5U/FX5UC CPU module]

The capacity of the signal flow memory varies according to the program capacity setting.

- Signal flow memory (for program)

- 64000 step…64000 step (8000 byte)
- 128000 step…128000 step (16000 byte)

- Signal flow memory (for FB)

- 64000 step…131072 step (16K byte)
- 128000 step…262144 step (32K byte)

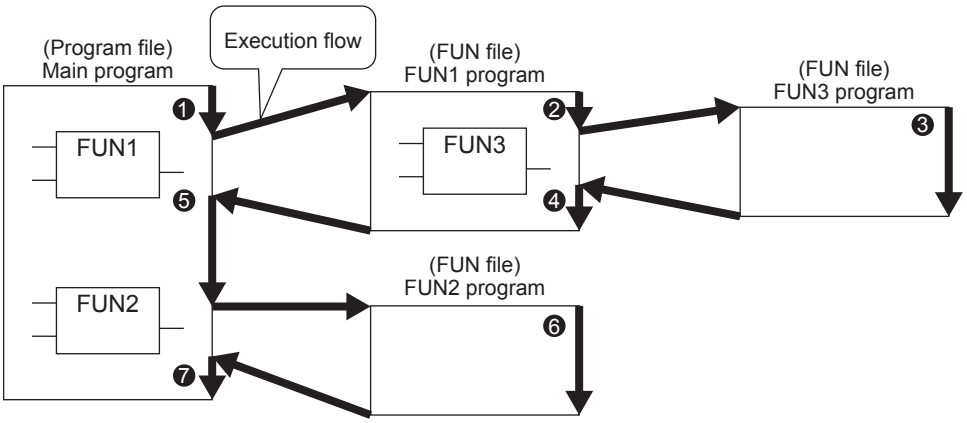
## Temporary area

This area is used temporarily by the system during the scan process. It is used as the label defined by the function or the instruction operand added by the system.

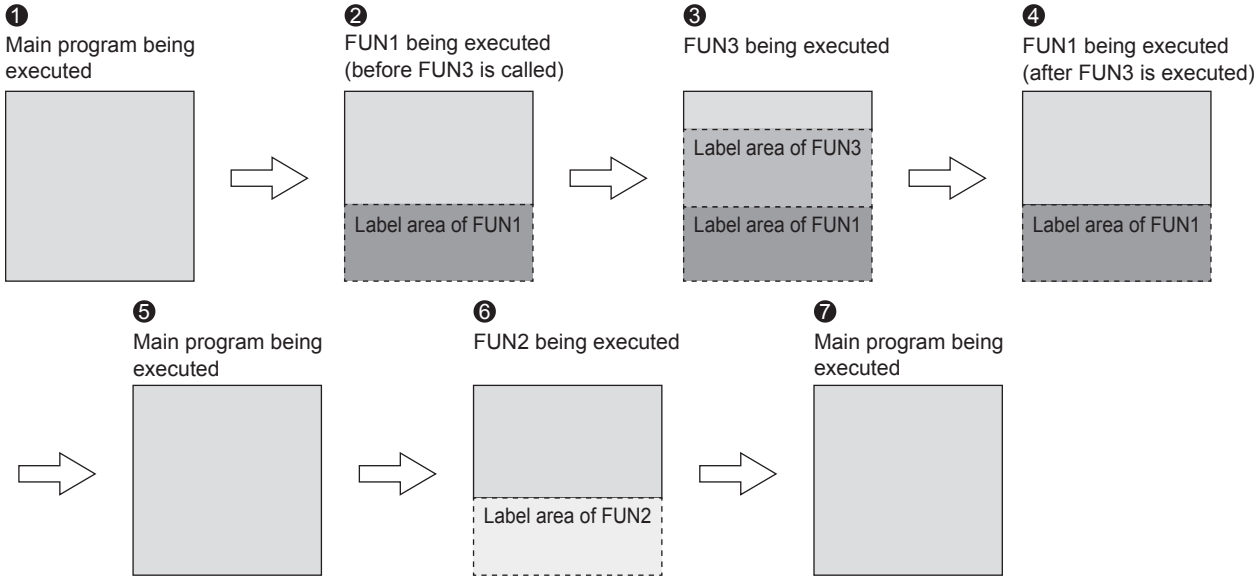
Part of the temporary area is occupied when execution of the function or instruction is started. The area is released when the execution is completed.

Examples of changes in the state of temporary area when executing a function are shown below.

### ■Program example




### ■Changes in the state of temporary area




**Point**

[FX5S/FX5UJ CPU module]

The capacity of temporary area is 32767 word.

[FX5U/FX5UC CPU module]

The capacity of the temporary area varies according to the program capacity setting.

- 64000 step…700 word
- 128000 step…32767 word

## SD memory card

The following files are stored in SD memory card.

| Category | File type | Max. number of files | Remarks |
|---|---|---|---|
| Program | Program file | 32 | — |
| | FB files | 16 (Up to 15 for user) | — |
| Parameters | Parameter files common to system | 1 | — |
| | CPU parameter file | 1 | — |
| | Module parameter file | 1 | — |
| | Module extension parameter | 18 | — |
| | Memory card parameter | 1 | — |
| | Remote password | 1 | — |
| | Global label setting file | 1 | — |
| | Data logging setting file | 4 | — |
| | Initial device value file | 1 | — |
| | Device station parameter file*1 | 80*2 | — |
| Comments | Device comment file | 1 | — |
| Extended file register | Extended file register file | 1 | — |

*1 Only FX5U/FX5UC CPU module is supported.

*2 When the firmware version of the FX5U/FX5UC CPU module is "1.230" or earlier, the maximum number of the files is 60.

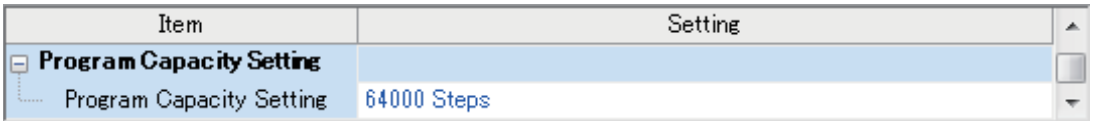
# 3.2 Program Capacity Setting

Set to change program capacity.

Only FX5U/FX5UC CPU module is supported. For supported version of program capacity setting, refer to ☞ Page 971 Added and Enhanced Functions.

Navigation window ⇨ [Parameter] ⇨ [FX5UCPU] ⇨ [CPU Parameter] ⇨ "Program Setting" ⇨ "Program Capacity Setting"

### Window




### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Program Capacity Setting | Set to change program capacity. | • 64000 Steps<br>• 128000 Steps | 64000 Steps |

### Precautions

If 128000 steps is selected, the operation is changed as follows.

- Signal flow*1 area for FB is expanded from 16K bytes to 32K bytes.
- Temporary area capacity is expanded from 700 words to 32767 words.
- Execution time for each instruction is prolonged.

Do not write a program with more than 64000 steps to the CPU module firmware version earlier than "1.100". The program does not operate normally.

*1 Signal flow: The execution status that the last time an operation of a program or an FB is executed in each step

# 3.3 Files

The CPU module files are explained below.

## File type and storage destination memory

File types and their storage destination memory are explained below.

○: Can be stored, ×: Cannot be stored

| File type | CPU built-in memory | SD memory card | File name (extension) |
|---|---|---|---|
| | Data memory | | |
| | Drive No.4 | Drive No.2 | |
| Program | ○ | ○ | ANY_STRING.PRG |
| FB files | ○ | ○ | ANY_STRING.PFB |
| CPU parameters | ○ | ○ | CPU.PRM |
| System parameters | ○ | ○ | SYSTEM.PRM |
| Module parameters | ○ | ○ | UNIT.PRM |
| Module extension parameter (for intelligent function module) | ○ | ○ | UEXmmmnn.PRM*2 |
| Memory card parameter | × | ○ | MEMCARD.PRM |
| Device comments | ○ | ○ | ANY_STRING.DCM |
| Device initial values | ○ | ○ | ANY_STRING.DID |
| Event history | ○ | ○ | EVENT.LOG |
| Device data storage file | ○ | ○*1 | DEVSTORE.QST |
| Global label setting file | ○ | ○ | GLBLINF.IFG |
| General-purpose data | × | ○ | ANY_STRING. (CSV/BIN) |
| Data logging setting file | ○ | ○ | LOGnn.LIS*3 |
| Memory dump setting file | ○ | × | MEMDUMP.DPS |
| Remote password | ○ | ○ | 00000001.SYP |
| Module extension parameter (for protocol setting) | ○ | ○ | UEX3FF01.PPR*4<br>UEX3FF00.PPR*5 |
| Firmware update | × | ○ | ■FX5S CPU module<br>• F5Snvvvv.SYF*6<br>■FX5UJ CPU module<br>• F5Jnvvvv.SYF*6<br>■FX5U/FX5UC CPU module<br>• F50nvvvv.SYF*6<br>■Intelligent function module<br>• F5mmvvvv.SYF*7 |
| Firmware update prohibited | ○ | ○*1 | FWUPDP.SYU |
| System file for backing up CPU module data | × | ○ | $BKUP_CPU_INF.BSC |
| Device/label data file for backing up CPU module data | × | ○ | BKUP_CPU_DEVLAB.BKD |
| System file for CPU module auto exchange function | × | ○ | $BKUP_CPU_EXCHANGE.DAT |
| Extended file register file | × | ○ | EXFILER.ERD |
| Device station parameter file | ○ | ○ | SLAVEmmmnnnoooo.NSP*8*9 |
| Web server binary file | × | ○ | F5WebFilexxxxxx.HVF*10 |

*1 Can be stored but cannot operate as a function.
*2 mmm indicates the module number (3-digit hexadecimal). nn is the serial number (2-digit hexadecimal) for each module.
*3 nn corresponds to the setting number and is 01 through 04.
*4 For serial communications file.
*5 For Ethernet file.
*6 n is 0 through F.
vvvv is the version information. (4-digit decimal)
*7 mm is the intelligent function module information.
vvvv is the version information. (4-digit decimal)
*8 mmm is the module number, nnn is the number of modules, and oooo is the serial number.
*9 Only FX5U/FX5UC CPU module is supported.
*10 xxxxxx is the version information.

# Executable file operations

File operations that can be executed on each file are explained below. This operation is possible only when the operation status of the CPU module is the STOP status.

○: Can be executed, —: No corresponding operation

| File type | Operation with engineering tool | | | Operation with FTP server function[*1] | | | Operation via instruction[*3] | |
|---|---|---|---|---|---|---|---|---|
| | Write | Read | Delete | Write[*2] | Read | Delete | Write | Read |
| Program | ○ | ○ | ○ | ○ | ○ | ○[*5] | — | — |
| FB files | ○ | ○ | ○ | ○ | ○ | ○[*5] | — | — |
| Parameters | ○ | ○ | ○ | ○ | ○ | ○[*5] | — | — |
| Device comments | ○ | ○ | ○ | ○ | ○ | ○[*5] | — | — |
| Device initial values | ○ | ○ | ○ | ○ | ○ | ○[*5] | — | — |
| Global label setting file | ○ | ○ | ○ | ○ | ○ | ○[*5] | — | — |
| Device data storage file | — | — | — | ○[*5] | ○ | ○[*5] | ○ | ○ |
| General-purpose data | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Data logging setting file | ○[*6] | ○[*6] | ○[*6] | ○ | ○ | ○ | — | — |
| Memory dump setting file | ○ | ○ | ○ | × | × | × | — | — |
| Remote password | ○ | ○ | ○ | ○ | ○ | ○[*5] | — | — |
| Firmware update prohibited file | ○ | ○ | ○ | ○ | ○ | ○ | — | — |
| System file for backing up CPU module data | — | — | — | ○ | ○ | ○[*5] | — | — |
| Device/label data file for backing up CPU module data | — | — | — | ○ | ○ | ○[*5] | — | — |
| System file for CPU module auto exchange function | — | — | — | ○ | ○ | ○[*5] | — | — |
| Extended file register file | ○ | ○ | —[*7] | ○ | ○ | ○[*5] | ○[*8] | ○ |
| Device station parameter file[*4] | ○ | ○ | ○ | ○ | ○ | ○[*5] | — | — |

*1 Only files stored on the SD memory card (drive No. 2) are the target.
*2 Writing is possible when the "Allow Online Change" is set to "Enable" with the FTP server settings.
*3 Modification of data in files, such as execution of the ERREAD/ERWRITE/ERINIT instruction or SP.FWRITE/SP.FREAD instruction.
*4 Only FX5U/FX5UC CPU module is supported.
*5 Available only when the CPU module operation status is STOP. A communication error occurs when operated in the RUN state.
*6 Operation on CPU Module Logging Configuration Tool.
All the file operation of the target memory unlike memory during data logging execution is possible.
*7 The extended file registers (ER) can be initialized at once.
*8 The extended file registers (ER) can be initialized at once by the ERINIT instruction.

# 3.4 Memory Operation

## Initialization and value clear

Each memory can be initialized and cleared to zero by using the engineering tool. For details on the operation method, refer to the following.

GX Works3 Operating Manual

| Items to be specified in the engineering tool | | | Target |
|---|---|---|---|
| Initialization | Data memory | | Deletes all the folders and files in the program memory and data memory. |
| | SD memory card | | Deletes all the folders and files in the SD memory card. |
| Clear value (when CPU built-in memory is selected) | Device, Label | Zero clear | Excluding devices and labels with latch specified, clears the following to zero: X, Y, M, L, B, F, SB, S, T, ST, C, LC, D, W, SW, Z, LZ, R, and all labels (including module labels). |
| | | Zero clear (including Latches (1) and (2)) | Including devices and labels with latch specified, clears the following to zero: X, Y, M, L, B, F, SB, S, T, ST, C, LC, D, W, SW, Z, LZ, R, and all labels (including module labels). |
| Clear value (when SD memory card is selected) | | | Initializes all extended file registers (ER) with FFFFH. |

**Point**

If the power goes off during initialization or zero clear, the memory is left in the state of that point, and it is necessary to re-execute the memory operation.

### Memory initialization during execution of another function

No memory can be initialized during execution of the following function. Check that the following function is not being executed and then initialize the memory.

- CPU module data backup/restoration function

### Clearing values during execution of another function

#### ■CPU module data backup/restoration function

During execution of the CPU module data backup/restoration function, devices, labels, and latch areas cannot be cleared to zero. Check that the CPU module data backup/restoration function is not being executed and then clear devices, labels, and latch areas to zero.

# 4 DEVICES

This chapter explains devices.

## 4.1 List of Devices

A list of devices is provided below.

| Division | Type | Device name | Symbol | Notation |
|---|---|---|---|---|
| User device | Bit | Input | X | Octal |
| | Bit | Output | Y | Octal |
| | Bit | Internal relay | M | Decimal |
| | Bit | Latch relay | L | Decimal |
| | Bit | Link relay | B | Hexadecimal |
| | Bit | Annunciator | F | Decimal |
| | Bit | Link special relay | SB | Hexadecimal |
| | Bit | Step relay | S | Decimal |
| | Bit/word | Timer | T (Contact: TS, Coil: TC, Current value: TN) | Decimal |
| | Bit/word | Retentive timer | ST (Contact: STS, Coil: STC, Current value: STN) | Decimal |
| | Bit/word | Counter | C (Contact: CS, Coil: CC, Current value: CN) | Decimal |
| | Bit/Double word | Long counter | LC (Contact: LCS, Coil: LCC, Current value: LCN) | Decimal |
| | Word | Data register | D | Decimal |
| | Word | Link register | W | Hexadecimal |
| | Word | Link special register | SW | Hexadecimal |
| System device | Bit | Special relay | SM | Decimal |
| | Word | Special register | SD | Decimal |
| Module access device (U□\G□)*1 | Word | Module access device | G | Decimal |
| Index register | Word | Index register | Z | Decimal |
| | Double word | Long index register | LZ | Decimal |
| File registers | Word | File registers | R | Decimal |
| | Word | Extended file register | ER | Decimal |
| Nesting | — | Nesting | N | Decimal |
| Pointer | — | Pointer | P | Decimal |
| | — | Interrupt pointer | I | Decimal |
| SFC | — | SFC block device | BL | Decimal |
| | — | SFC transition device | TR | Decimal |
| Constant | — | Decimal constant | K | Decimal |
| | — | Hexadecimal constant | H | Hexadecimal |
| | — | Real constant | E | — |
| | — | Character string constant | — | — |

*1 The FX5S CPU module is not supported.

**Point**

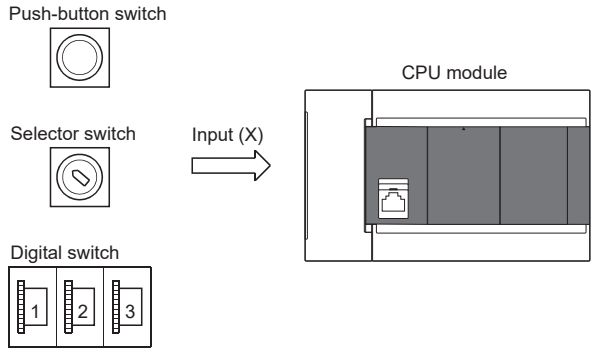
Specify code of timer/retentive timer/counter/long counter by T/ST/C/LC if type is determined like instruction when specifying device. If type is not determined, specify by code from among contact, coil or current value according to type. Current value can however also be specified by T/ST/C/LC.

# 4.2 User Devices

This section explains user devices.

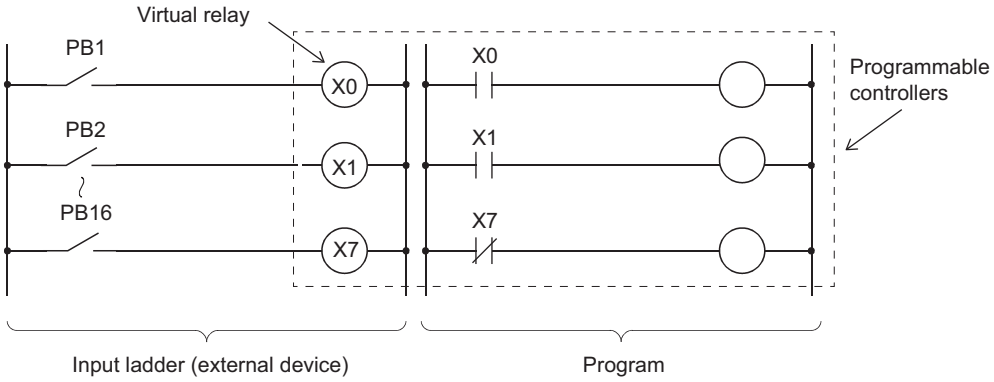
## Input (X)

Provides the CPU module with commands and data by external devices such as push buttons, selector switches, limit switches, digital switches, etc.



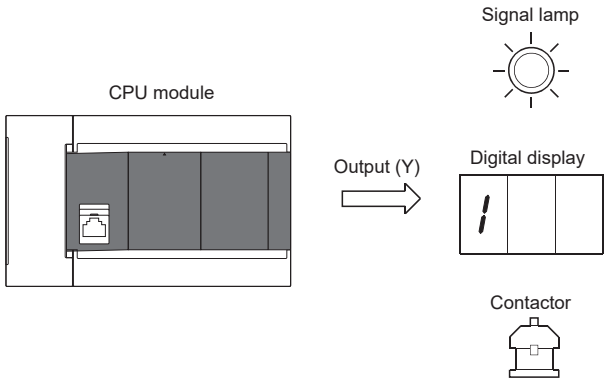

### Concept of input

You can think each input point as having a virtual relay Xn built into a single CPU module. The program uses NO/NC contact of Xn.




## Output (Y)

Outputs program control results to devices such as external signal lamps, digital indicators, contactors, and solenoids.



# Internal relay (M)

Device intended to be used as an auxiliary relay inside the CPU module. All internal relays with latch disabled are turned off by the following operation.

- CPU module power OFF→ON
- Reset

All internal relays are turned OFF by the following operation.

- Latch clear

# Latch relay (L)

Auxiliary relay that can latch (backup by battery) in the CPU module. Computation results (ON/OFF information) are latched even when performing the following operations.

- CPU module power OFF→ON
- Reset

# Link relay (B)

Device intended to be used as a CPU side device when refreshing bit data between CPU module and network module.

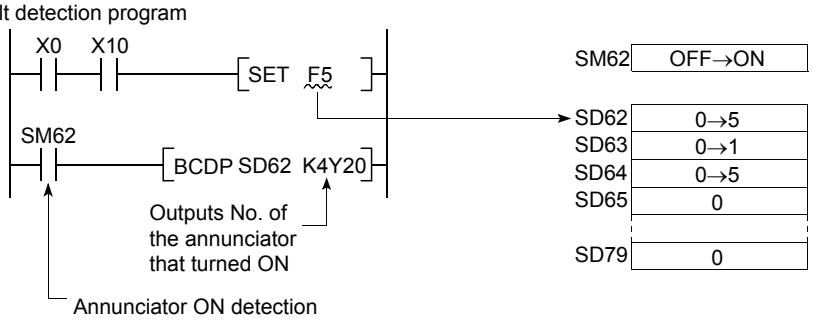
## Refreshing network module that uses link relay (B)

Sends/receives data mutually between network module link relays (LB) and link relay (B) in the CPU module. Set refresh range by parameters of the network module. Link relays not used for refresh can be used for other purposes.

# Annunciator (F)

Internal relay used for program for detecting equipment errors/faults created by the user. When the annunciator (F) is turned ON, SM62 (Annunciator (F) Detection) turns ON, and the number of annunciator devices that are ON and their numbers are stored from SD62 (Annunciator (F) Detection No.) to SD79 (Annunciator (F) Detection No. Table).

Fault detection program




## How to turn annunciator (F) ON

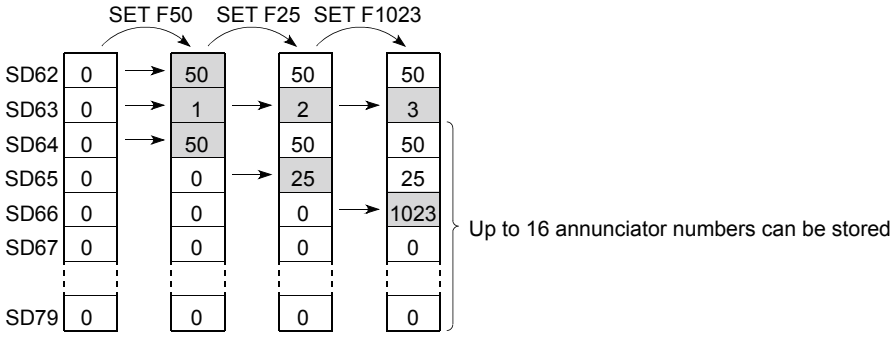
Use SET F☐ instruction. The annunciator (F) turns ON only during the rise time of input conditions (OFF→ON); the annunciator (F) remains ON even if the input condition is OFF.

**Point**

- The annunciator (F) can also be turned ON by OUT F☐ instruction, but because it is processed every scan, scan time is slower than when using SET F☐ instruction.
- If it is turned ON by means other than SET F☐ instruction or OUT F☐ instruction (e.g. MOV instruction), operation is the same as for internal relay. Thus, in SM62 does not turn ON, and annunciator (F) numbers are not stored in SD62 and SD64 (Annunciator (F) Detection No. table) to SD79.

### ■Processing when annunciator (F) is ON

Data stored in the special register becomes as follows.




1. Annunciator (F) numbers that are ON are stored in SD64 to SD79 in sequence.
2. Annunciator (F) numbers that are stored in SD64 are stored in SD62.
3. Increments contents of SD63 (Annunciator (F) Detection Number) by +1.

**Point**

If 17 or more annunciators are ON, the numbers are not stored in SD64 to SD79.

## How to turn annunciator (F) OFF

Annunciators (F) are turned OFF by the following instruction.

| Instruction | Application |
|---|---|
| RST F☐ instruction | Used to turn OFF annunciator (F) number set by SET F☐ instruction. |
| BKRST instruction | Used to turn a specified range of annunciator (F) numbers OFF in a batch. |

**Point**

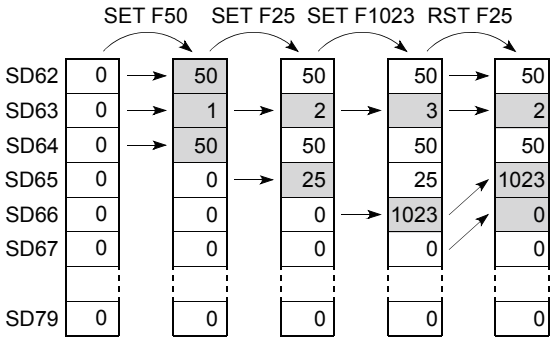
You can turn OFF by OUT F☐ as well, but "Processing when annunciator (F) is OFF" described below is not carried out even if annunciator numbers are turned OFF by OUT F☐ instruction. If annunciator (F) numbers are turned OFF by OUT F☐ instruction, you must execute the RST F☐/BKRST instruction given above.

### ■Processing when annunciator (F) is OFF

Data stored in the special register becomes as follows.

- Data stored in SD62 to SD79 when RST F☐ instruction or BKRST instruction is executed

1. Annunciator (F) numbers specified in the RST F☐ instruction or the BKRST instruction are erased, and annunciator (F) numbers stored subsequent to those erased are moved up.
2. If annunciator (F) numbers stored in SD64 are turned OFF, new annunciator (F) numbers stored in SD64 are stored in SD62.
3. Decrements contents of SD63 by -1. If SD63 is "0", SM62 is turned OFF.



# Link special relay (SB)

Communication and error detection status of network modules are output to link special relays within the network. Link special relays (SB) are devices intended to be used as a refresh destination for link special relays within the network. Link special relays not used for refresh can be used for other purposes.

# Step relay (S)

Device to perform process stepping control. Purposes are as follows. Device which is not used can be used for purposes such as auxiliary relay.

- Step ladder (MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks))
- SFC program (MELSEC iQ-F FX5 Programming Manual (Program Design))

- Specifies a step.
- SFC control instruction
- Specifies a step No. to check the SFC program (monitor and change of the current value) by the engineering tool.

# Timer (T/ST)

Device whereby measurement starts when the timer coil is turned ON, time up occurs when current value reaches the setting value, and the contact is turned ON. The timer is an addition type counter. When time is up, the current value and setting value are the same value.

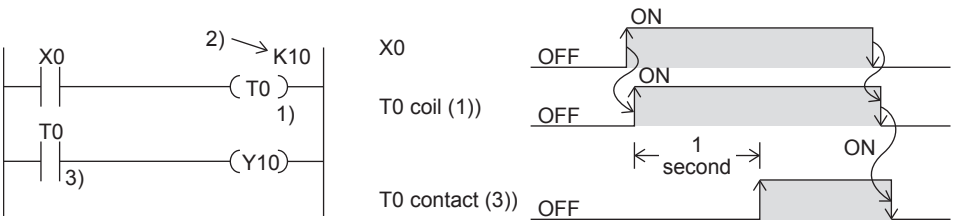
## Types of timers

There are timers (T) for which current value is maintained in 16 bits, and retentive timers (ST) that maintain the current value even when the coil is turned off.*1

*1 Current value of timers (T) becomes "0" when the coil is turned OFF.

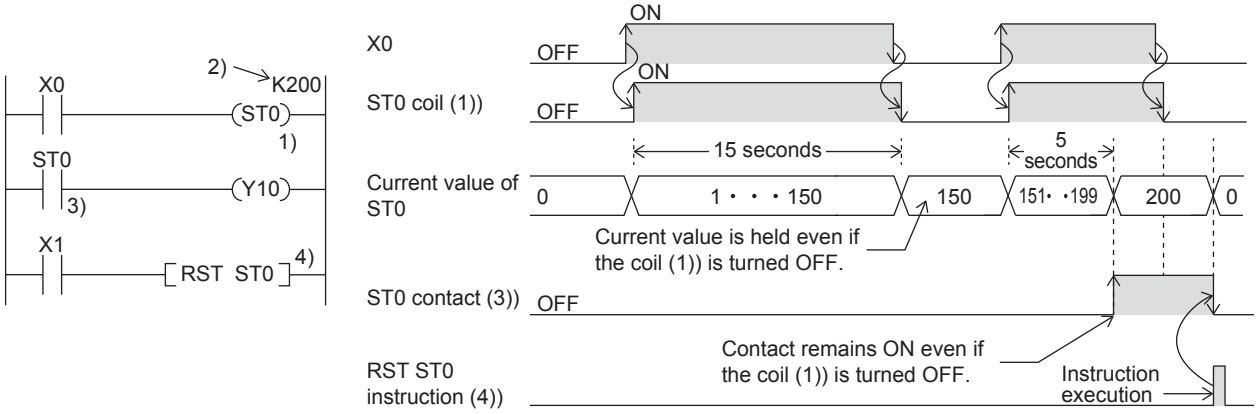
### ■Timer (T)

Measurement starts when the timer's coil is turned ON. Time up occurs when the current value of the timer matches the setting value and the timer's contact is turned ON. When the timer's coil is turned OFF, the current value becomes "0" and the timer's contact is turned OFF.



### ■Retentive timer (ST)

Measures time for which the coil is ON. Measurement starts when the retentive timer's coil is turned ON, and when the current value matches the setting value (time up), the retentive timer's contact is turned ON. The current value and ON/OFF status of the contact are maintained even if the retentive timer's coil is turned OFF. When the coil is turned back ON, measurement resumes from the current value maintained. The current value is cleared and the retentive timer is turned OFF by the RST ST☐ instruction.




### ■Low-speed timer/Timer/High-speed timer (T/ST)

Low-speed timers, timers and high-speed timers are the same device. The timer is specified (by instruction) as a low-speed timer, timer, or high-speed timer. If for example, you specify "OUT T0," the timer is a low-speed timer (100 ms); if you specify "OUTH T0," it is a timer (10 ms); if you specify "OUTHS T0," it is a high-speed timer (1 ms). The same goes for retentive timers.

### ■Routine timer (T)

The routine timer is a timer (100ms) that can operate even with a program that is not necessarily executed with every scan. Eight timers can be used at the maximum. This timer counts when the OUT T☐ instruction, the ANS instruction, or the END instruction is executed.

To use a routine timer, it is necessary to set the parameter. (☞ Page 60 Routine timer setting)

## Current value and measurement range of timer

### ■Timer

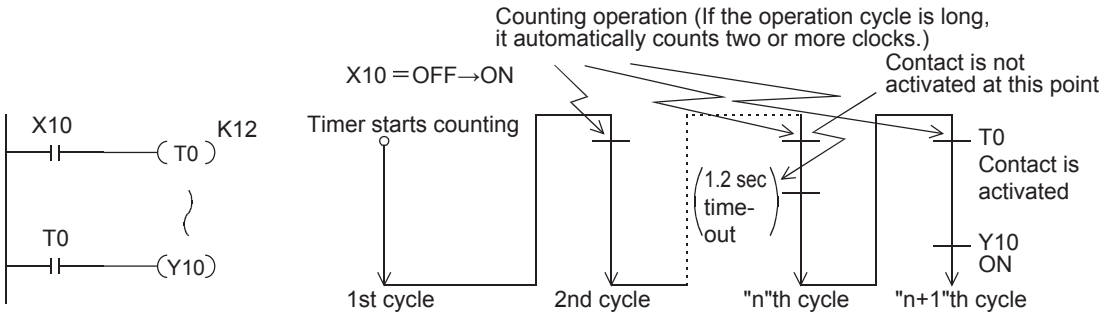
The current value range is 0 to 32767.

## Timer processing method

The timer's coil is turned ON/OFF, the current value is updated and the contact is turned ON/OFF when timer's coil (OUT T☐ instruction) is executed.

## Details on timer operation and timer accuracy

A timer (T/ST) starts counting when a coil is driven, and its output contact turns on when the first coil instruction is executed after the timer has reached timeout.




As shown in the above operation diagram, the accuracy of operation of the timer contact after the coil is driven until the contact turns on is shown in the following outline:

$T^{+T_0}_{-\alpha}$

T :Timer set value (sec )
T0:Operation cycle (sec)
α :0.001 sec (timer for 1 ms), 0.01 sec (timer for 10 ms) or 0.1 sec (timer for 100 ms)

If the contact is programmed before the timer coil, "+2T0" is obtained in the worst case.
When the timer set value is "0", the output contact turns on when a coil instruction is executed in the next cycle.
Setting the timer to a small value increases the variability of the time taken for the timer contact to activate. If such a case causes a problem, please consider using the high-speed timer.

## The difference between a timer and a routine timer

Described below is the difference between a timer and a routine timer.

| Item | Timer | Routine timer |
|---|---|---|
| Resolution | 100 ms/10 ms /1 ms | 100 ms |
| The timing of counting (count up) | When the OUT T☐ instruction or the ANS instruction is executed | • When the OUT T instruction or the ANS instruction is executed<br>• If the OUT T instruction or the ANS instruction is not executed, the counting starts when the END instruction is executed. |
| The timing of time up (the operation at the output contact) | When the OUT T☐ instruction or the ANS instruction is executed | • When the OUT T instruction or the ANS instruction is executed<br>• When the END instruction is executed |
| Device | T, ST | T |

## Precautions when using timers

Precautions when using timers are as follows.

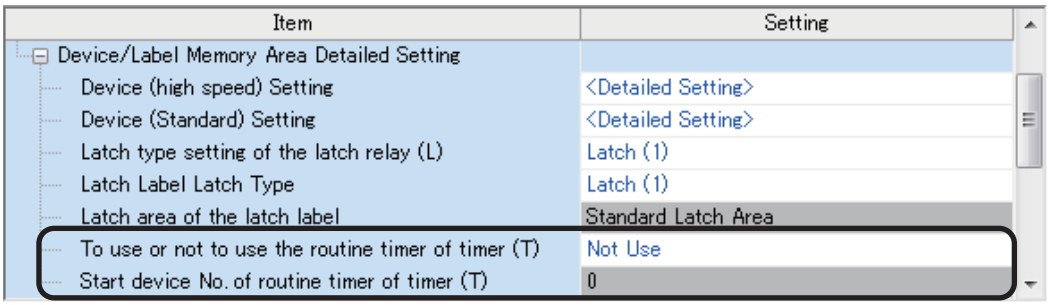
- Do not specify the same timer coil (OUT T☐ instruction) more than once per scan. If you do, the current value of the timer is updated when each respective timer coil is executed, so measurement cannot be performed normally.
- When timer is not used for data collection for each scan: While the coil on a timer (e.g. T1) is turned on, the timer coil (the OUT T☐ instruction) cannot be skipped by the instructions such as the CJ. If a timer's coil is skipped, the timer's current value is not updated, so measurement cannot be performed normally. In addition, when the timer exists in a subroutine program, be sure to execute a subroutine call including T1 coil only once for each scanning operation while the coil of the timer (e.g. T1) is turned on. If not executed, measurement cannot be performed normally.
- The timer cannot be used in the initial execution type program, fixed scan execution type program, or event execution type program. The timer can be used in standby type programs if the coil of timer (OUT T☐ instruction) is executed one time for one scan using a subroutine program.
- The timer cannot be used in interrupt programs. The timer can be used in subroutine programs or FB programs if the coil of timer (OUT T☐ instruction) is executed one time for one scan.
- If setting value is "0": The output contact operates when the coil instruction of the next cycle is executed.
- If setting value is modified after time up: The timer remains in time up status and does not operate even if the setting value is raised higher than the current value after time up.

## Routine timer setting

The setting of the routine timer is made.

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [CPU Parameter] ⇨ "Memory/Device Setting" ⇨ "Device/Label Memory Area Setting"

### Window




### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| To use or not to use the routine timer of timer (T) | Whether the routine timer is used is set. | • Not use<br>• Use | Not use |
| Start device No. of routine timer of timer (T) | The initial device of the routine timer is set. | ■FX5S/FX5U/FX5UC CPU module<br>• 0 to 511<br>■FX5U/FX5UC CPU module<br>• 0 to 1023 | 0 |

# Counter (C/LC)

Device that counts number of rises of input conditions in the program. Counters are addition type counters; they count up when the count value matches the setting value, and the contact is turned ON.

For FX3-compatible high-speed counters, refer to ☞ Page 290 FX3-compatible High-speed Counter Function.

## Counter type

There is counter (C) that maintains the counter value in 16 bits and the long counter (LC) that maintains the counter value in 32 bits. Counter (C) and long counter (LC) are separate devices. You can set number of device points for each. However, for FX5UJ CPU module, the number of device points is fixed.

### ■Counter (C)

Uses 1 word as 1 point. The counting range is from 0 to 65535.

### ■Long counter (LC)

Uses 2 words as 1 point. The counting range is from 0 to 4294967295.

## Count processing

Count processing is as follows when counter's coil is executed.

### ■When the OUT C☐ instruction/OUT LC☐ instruction is executed

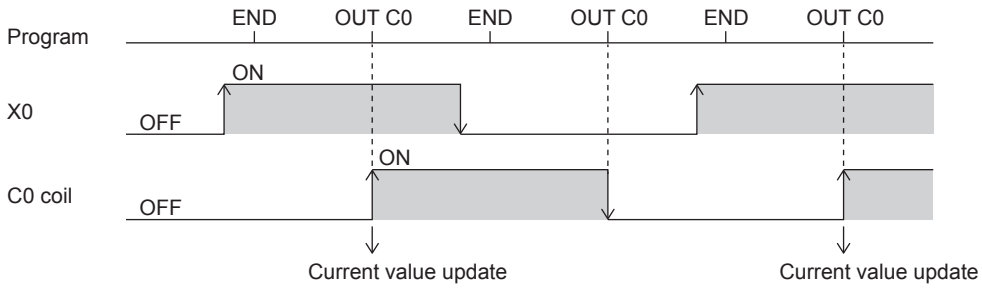
The counter's coil is turned ON/OFF, the current value is updated (count value +1) and contact ON/OFF processing is executed.

### ■Current value update (count value +1)

Current value is updated (count value +1) when counter coil input rises (OFF→ON). Current value is not updated when coil input is OFF, ON, or turned ON→OFF.

[Ladder example]

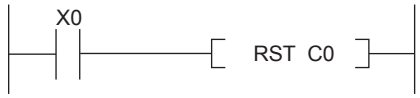

[Current value update timing]



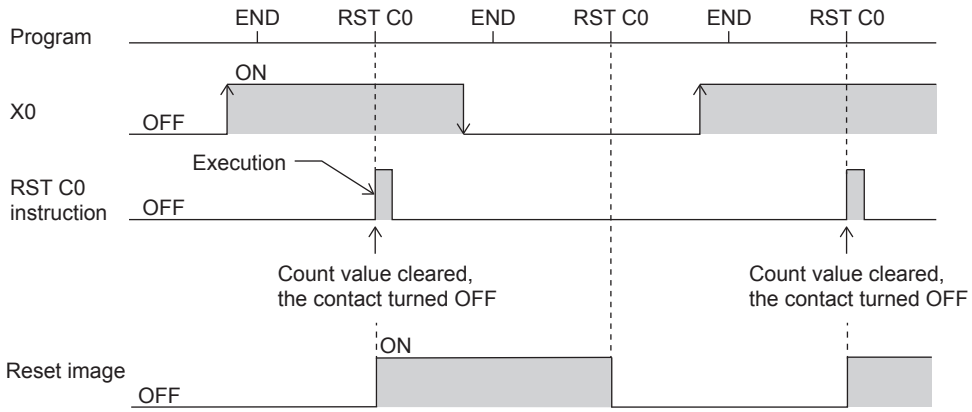

## Counter reset

Current value of counters is not cleared even if its coil input is turned OFF. To clear (reset) the current value of the counter and turn the contact OFF, use the RST C☐ instruction/RST LC☐ instruction. The counter value is cleared and the contact is turned OFF as soon as the RST C☐ instruction is executed.

[Ladder example]



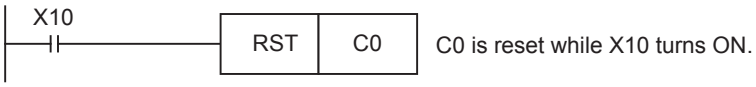

[Counter reset timing]



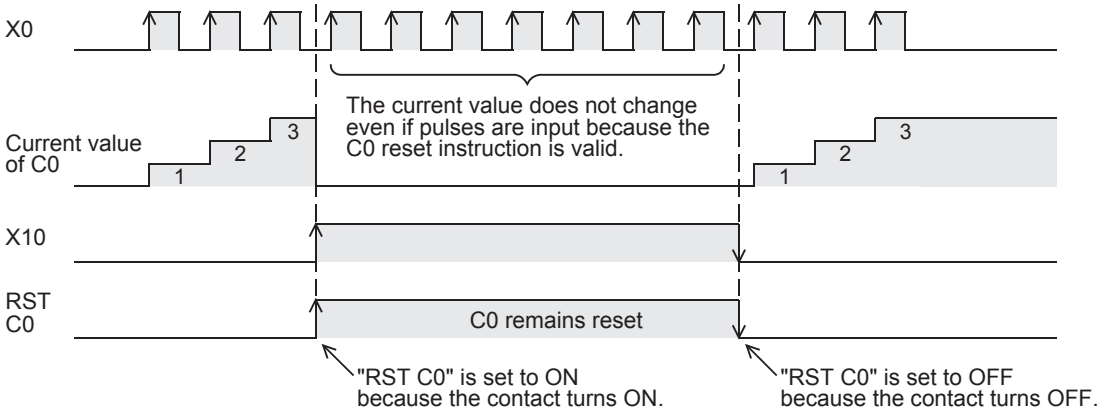
### Precautions when performing counter reset

- When a counter is reset by the RST instruction, it cannot count until the RST instruction is set to OFF.

[Program example]




[Timing chart]




- When the counter is set as a latch device, the current value of a counter, output contact operation, and the reset image are latched.
- If the ZRST instruction is used, the RST image of a counter is reset.

## Data register (D)

Device capable of storing numerical data.

## Link register (W)

Device intended to be used as a CPU side device when refreshing word data between CPU module and network module.

### Refreshing network module that uses link register (W)

Sends/receives data mutually between link registers (LW) in network module and link register (W) in the CPU module. Set refresh range by parameters of the network module. Link registers not used for refresh can be used for other purposes.

## Link special register (SW)

Word data such as communication and error detection status information of network modules is output to link special relays within the network. Link special registers (SW) are devices intended to be used as a refresh destination for link special registers within the network. Link special registers not used for refresh can be used for other purposes.

# 4.3 System Devices

System devices are devices for the system. Assignment/capacity are fixed and cannot be changed by the user.

## Special relay (SM)

The programmable controller contains internal relays with fixed specifications, so it cannot be used in the program like a conventional internal relay. It can however be turned ON/OFF to control the CPU module as needed. (☞ Page 776 Special Relay List)

## Special register (SD)

The programmable controller contains internal register with fixed specifications, so it cannot be used in the program like a conventional internal register. Data, however, can be written to control the CPU module as needed. (☞ Page 803 Special Register List)

# 4.4 Module Access Device

Device that allows you to directly access the buffer memory of intelligent function modules connected to the CPU module from the CPU module.
The FX5S CPU module is not supported.



## Specification method

Specified by U [module number of intelligent function modules]\[buffer memory address].
(Example: U5\G11)

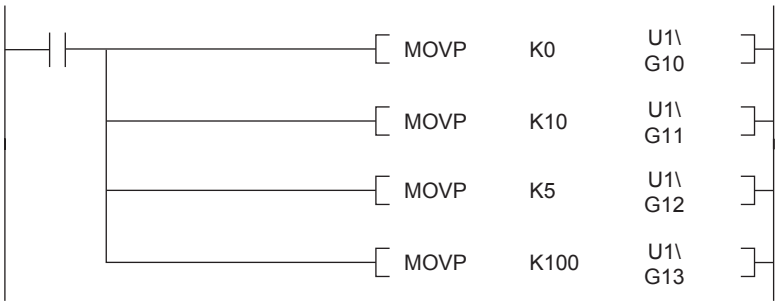
## Processing speed

Processing speed of reading/writing by module access device is faster than using FROM/TO instruction. (Example: MOV U2\G11 D0) When reading the buffer memory of a module access device and executing another process by 1 instruction, the processing speed would be approximately the total of processing speed of FROM/TO instruction and processing speed of instruction. (Example: +U2\G11 D0 D10)

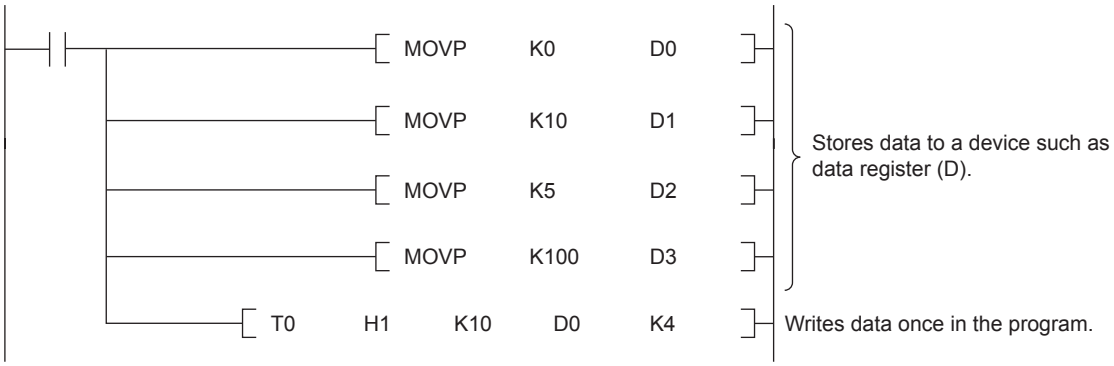
**Point**

If reading/writing data of the buffer memory using module access device at least 2 times in the program, you can speed up processing time by reading/writing at a single place in the program using a FROM/TO instruction.

• Writing using multiple module access devices




• Writing at single place in program using TO instruction



### Precautions

- If module access device is used in an interrupt program with the priority 1, operation error (3580H) occurs. Module access device operates in an interrupt program with the priority 2 or 3.
- When FROM/TO instruction is executed in an interrupt program to an FX3 intelligent function module that is connected to the bus conversion module or later, operation error (3580H) occurs.

# 4.5 Index Register (Z/LZ)

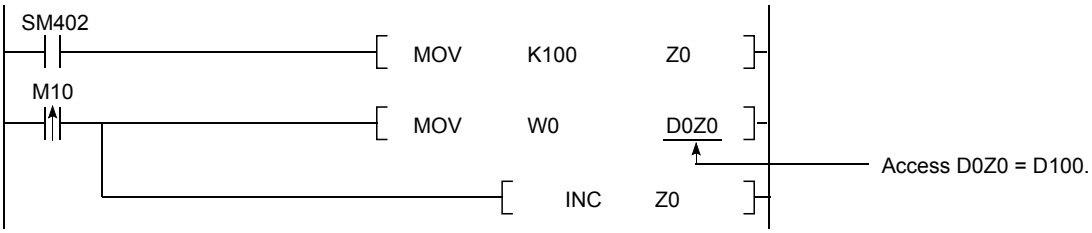
Device used for indexing of devices.

## Types of index registers

There are 2 types: the index register (Z) and long index register (LZ)

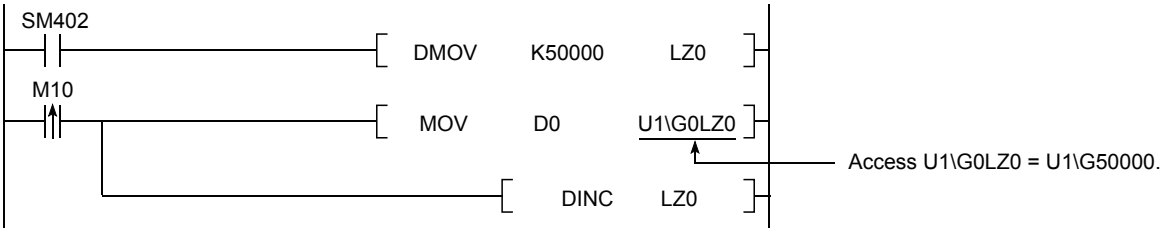
### Index register (Z)

Used for 16-bit index modification.




### Long index register (LZ)

Used for 32-bit index modification.




## Device for which index modification can be performed

The following table lists the devices that can be targeted for index modification.

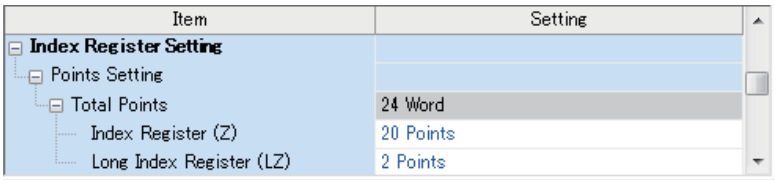
| Item | Description |
|---|---|
| Index modification by the index register (Z) | All devices |
| Index modification by the long index register (LZ) | U□\G, K, H |

## Index register setting

A total of 24 words can be used for index register (Z) and long index register (LZ). The FX5S/FX5U/FX5UC CPU modules can change the number of points by parameter.

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [CPU Parameter] ⇨ "Memory/Device Setting" ⇨ "Index Register Setting"

### Window




### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Total Points | Show the total number of points for index register and long index register. | — | — |
| Index Register (Z) | Set the number of points for index registers. | ■FX5S/FX5U/FX5UC CPU module<br>• 0 to 24 points (2 point unit)<br>■FX5UJ CPU module<br>• 20 points (fixed) | 20 points |
| Long Index Register (LZ) | Set the number of points for long index registers. | ■FX5S/FX5U/FX5UC CPU module<br>• 0 to 12 points (1 point unit)<br>■FX5UJ CPU module<br>• 2 points (fixed) | 2 points |

# 4.6 File Register (R/ER)

Device capable of storing numerical data.

## Types of file register

There are 2 types: the file register (R) and extended file register (ER)

### File register (R)

The device held in the CPU built-in memory.

### Extended file register (ER)

The device held only in the SD memory card. The extended file register (ER) function can be used with the programs (dedicated instructions) or GX Works3.

**Point**

- For supported version of extended file register (ER), refer to ☞ Page 971 Added and Enhanced Functions.
- Extended file register (ER) can be used only when the SD memory card is inserted to the CPU module.

# Extended file register (ER) function

## Function to use the program (dedicated instructions)

Extended file register (ER) functions that can be used by applied instructions are shown below.

- ERREAD instruction: Reading function of extended file register (ER)
- ERWRITE instruction: Writing (transfer) function of extended file register (ER)
- ERINIT instruction: Batch initialization function of extended file register (ER)

For each applied instruction, refer to MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks).

**Point**

Extended file register (ER) function is not applicable to the file register (R) stored into the SD memory card by the memory dump function.

### ■Reading function of extended file register (ER)

The current value of the extended file register (ER) stored into the SD memory card can be read from the file register (R) in the CPU built-in memory by using ERREAD instruction.

The device number of data transfer source and data transfer destination is the same number. (When ER0 to 100 are read, the values are stored to R0 to 100.) In using the ERREAD instruction, the maximum number of device points which can be read from the extended file register (ER) is 32768.

### ■Writing (transfer) function of extended file register (ER)

The current value of the file register (R) in the CPU built-in memory can be written (transferred) to the extended file register (ER) in the SD memory card by using ERWRITE instruction.

The device number of data transfer source and data transfer destination is the same number. (When R0 to 100 are written, the values are stored to ER0 to 100.) In using the ERWRITE instruction, the maximum number of device points which can be written to the extended file register (ER) is 32768.

### ■Batch initialization function of extended file register (ER)

All the points of the extended file register (ER) in the SD memory card can be initialized in a batch by using ERINIT instruction.

If all the points of the file register (R) in the CPU built-in memory are initialized, you must write K0 by FMOV instruction, etc.

## Function to use the GX Works3

Extended file register (ER) functions that can be used by GX Works3 are shown below.

- Data batch reading function
- Data batch writing function
- Data batch initialization (clearing values) function
- Data batch initialization (memory initialization) function

For operation of GX Works3, refer to GX Works3 Operating Manual.

**Point**

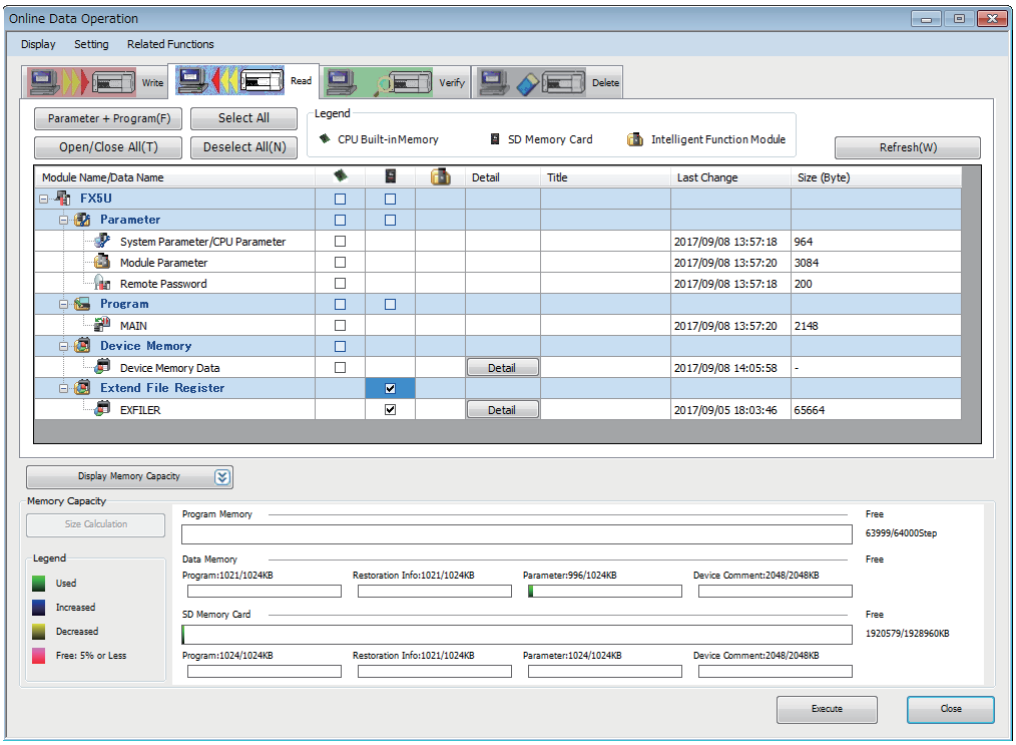
- Extended file register (ER) function by GX Works3 cannot specify the target device points; instead, all of the device points become the target.
- The device memory in the project of GX Works3, and the file register (R) in the CPU built-in memory and SD memory card will not be updated by these functions.

## ■Data batch reading function

All the current values of the extended file register (ER) stored into the SD memory card can be read from the device memory in the project of GX Works3 (extended file register (ER)) in a batch.

[Online] ⇨ [Read from PLC]

### Window




Check the "Extended File Register" box under SD memory card, execute read, and the current value of the extended file register (ER) in the SD memory card will be stored to the device memory in the project of GX Works3 (extended file register (ER)).

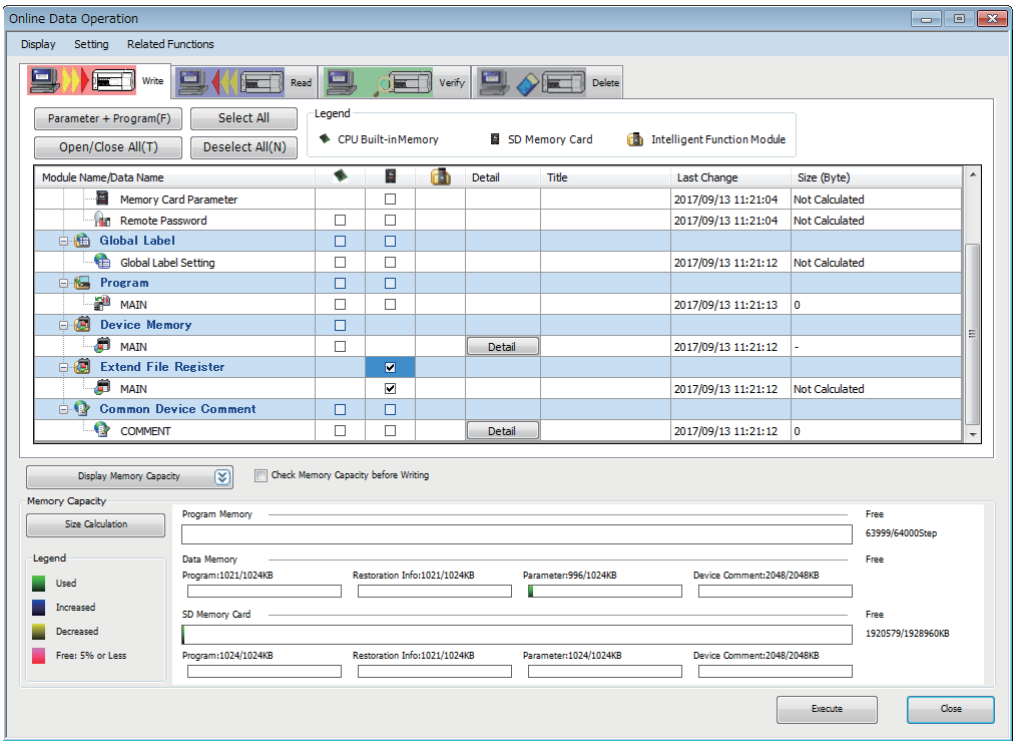
All the points (32768 points) of the extended file register (ER) in the SD memory card are read from the device memory in the project of GX Works3 without depending on the user's device point setting of the file register (R). (☞ Page 81 Device Setting)

## ■Data batch writing function

All the value registered to the device memory in the project of GX Works3 (extended file register (ER)) can be written to the extended file register (ER) in the SD memory card in a batch.

[Online] ⇨ [Write to PLC]

### Window



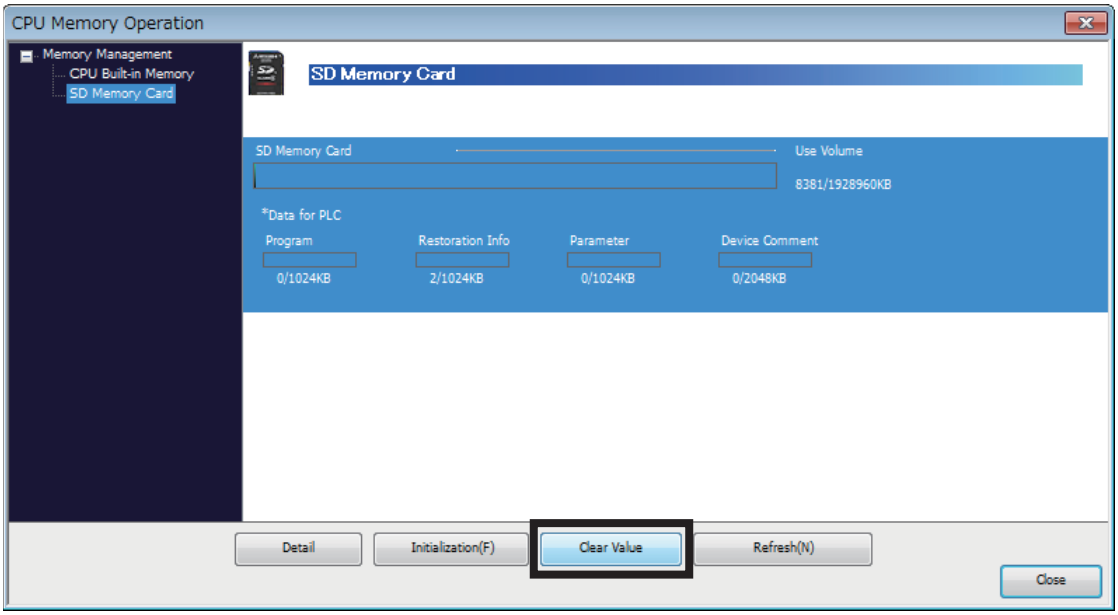

Check the "Extended File Register" box under SD memory card, execute write, and the value of the device memory in the project of GX Works3 (extended file register (ER)) will be stored to the extended file register (ER) in the SD memory card. All the points (32768 points) of the device memory in the project of GX Works3 are written to the extended file register (ER) in the SD memory card without depending on the user's device point setting of the file register (R). (☞ Page 81 Device Setting)

## ■Data batch initialization (clearing values) function

All of the extended file register (ER) in the SD memory card can be cleared from GX Works3 in a batch.

[Online] ⇨ [CPU Memory Operation]

### Window



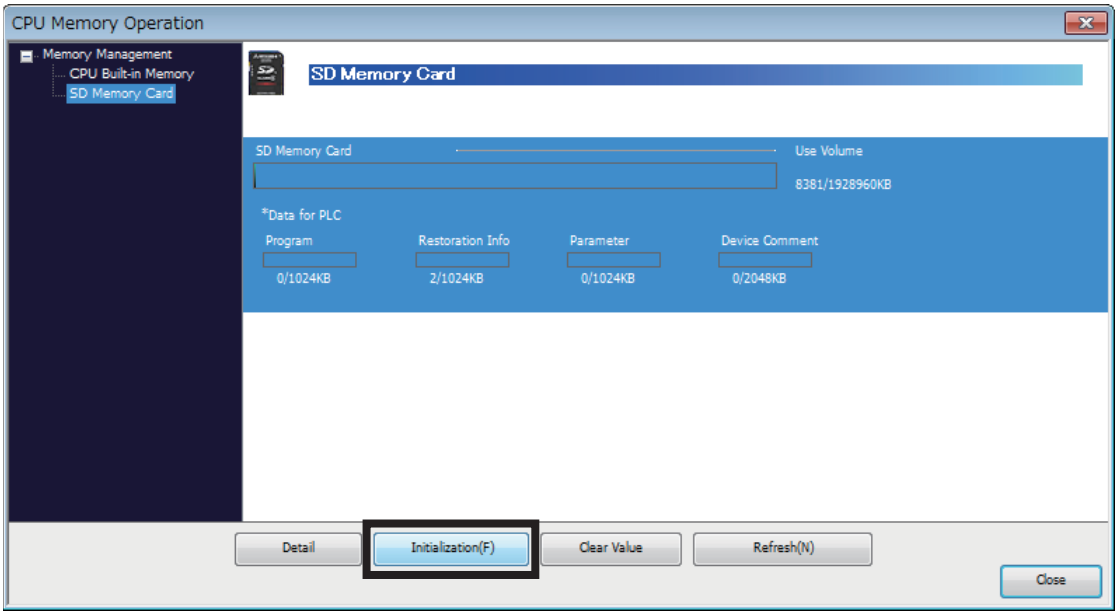

Switch the screen to the memory operation screen of the SD memory card, select [Clear Value], and the extended file register (ER) in the SD memory card is initialized.

## ■Data batch initialization (memory initialization) function

The extended file register (ER) in the SD memory card can be initialized (formatted) from GX Works3. However, in addition to the extended file register (ER), all of the folders and files in the SD memory card are formatted.

[Online] ⇨ [CPU Memory Operation]

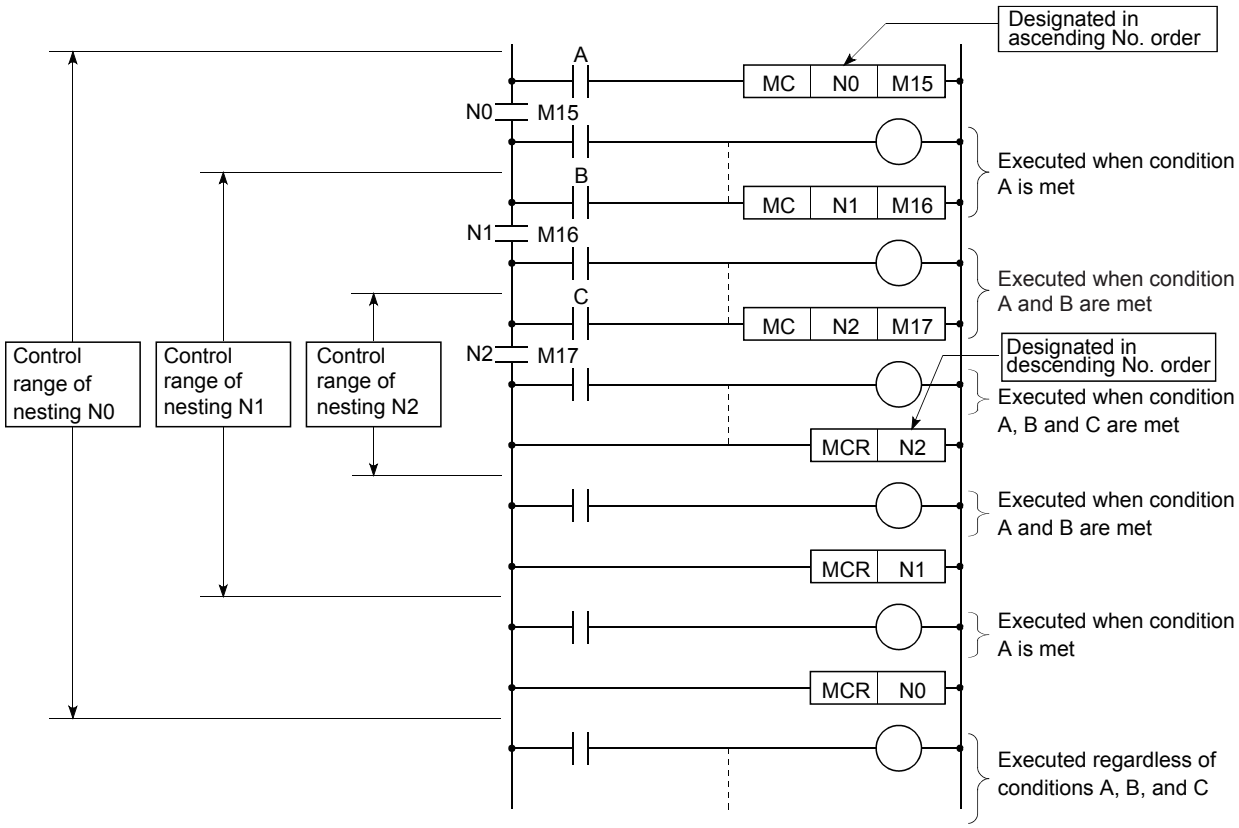
### Window




Switch the screen to the memory operation screen of the SD memory card, select [Initialization], and all of the data in the SD memory card including the extended file register (ER) is initialized.

# 4.7 Nesting (N)

Device for programming operating conditions by nesting using master control instructions (MC/MCR instruction)*1. Operation conditions are specified in ascending order (N0 to N14) from outside the nesting.




*1 Instruction for creating an efficient circuit switching program by switching common bus of the circuit.

# 4.8 Pointer (P)

Device used by instructions such as jump instruction (CJ instruction) and subroutine program call instruction (CALL instruction, etc.). Types of pointers are as follows.

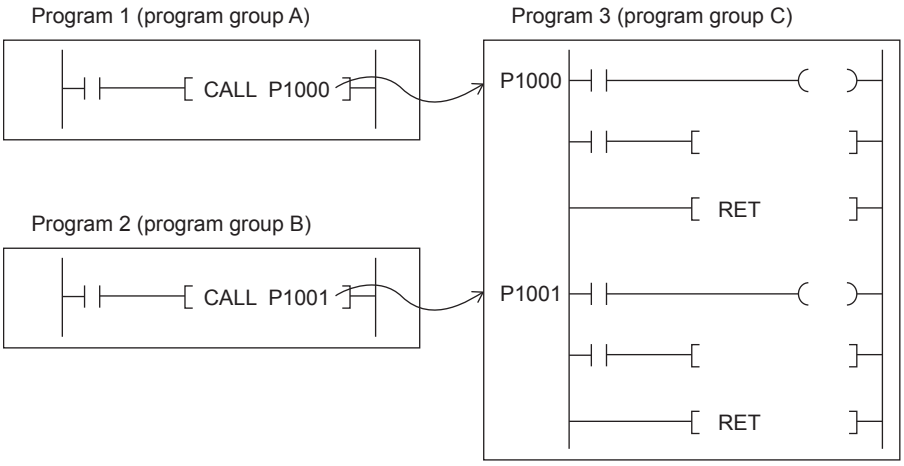
| Pointer | Description |
|---|---|
| Global pointers | Pointers that can be referred to from all programs. |
| Label assignment pointers | Pointers used by assignment to labels. Pointer numbers assigned to labels are automatically determined by engineering tool; the user cannot specify pointer numbers to be assigned. |

Pointers are used for the following purposes.

- Specifies label and where to jump to for jump instruction (CJ instruction).
- Specifies label (top of subroutine program) and call destination of subroutine instruction (CALL instruction, etc.).

## Global pointers

Pointer for calling subroutine from all programs being run.




### Precautions when using global pointers

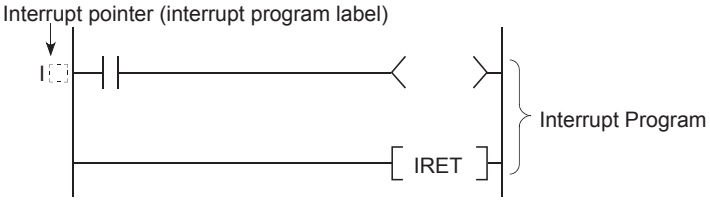
- A global pointer of the same pointer number cannot be set as a label for more than one location.
- The initial pointer number for global pointers is fixed to "0".

## Label assignment pointers

Pointer assigned to pointer type labels. Pointer for label assignment are automatically assigned to pointer type labels by engineering tool. Pointer numbers of pointers for label assignment cannot be directly specified. By defining pointer type labels, you can specify destination for jump instruction or subroutine program by label instead of pointer such as P0.

# 4.9 Interrupt Pointer (I)

Device used as label at top of interrupt program. Can be used by all running programs.




**Point**

- Setting the execution type of program to the event execution type eliminates the need to write (I☐) the interrupt pointer. (☞ Page 35 Generation of interrupt by interrupt pointer (I))
- If the interrupt pointer numbers are I0 to I15 and a pattern program is created at the beginning of the program, it operates as an input interrupt delay function. (☞ Page 111 Input Interrupt Delay Function)

# Interrupt causes of the interrupt pointer numbers

A list of interrupts is provided below.

| Interrupt | Interrupt pointer number | Description |
|---|---|---|
| Input interrupt | I0 to I15 | Interrupt pointer used for input interrupt of CPU module (with/without delay). Up to 8 points can be used. |
| High-speed comparison match interrupt | I16 to I23 | Interrupt pointer used for high-speed comparison match interrupt of CPU module. |
| Interrupt by internal timer | I28 to I31 | Interrupt pointer used for fixed cycle interrupt by internal timer. |
| Interrupt from module | I50 to I177 | Interrupt pointer used for a module that has interrupt function. |

# The priority for the interrupt pointer numbers and interrupt factors

The priority for the interrupt pointer numbers and interrupt factors are indicated.

| Interrupt pointer number | Interruption cause | Interrupt priority | Interrupt priority order | Remarks |
|---|---|---|---|---|
| I0 | Input interrupt (Input terminal: X0 to X17) | 1 to 3 | 1 | • The default value for priority is "2".<br>• X0 to X17 are assigned as I0 to I15.<br>• The priority of the input interrupt delay function is 2 to 3. If 1 is set, it operates without delay time. |
| I1 | | | 2 | |
| I2 | | | 3 | |
| I3 | | | 4 | |
| I4 | | | 5 | |
| I5 | | | 6 | |
| I6 | | | 7 | |
| I7 | | | 8 | |
| I8 | | | 9 | |
| I9 | | | 10 | |
| I10 | | | 11 | |
| I11 | | | 12 | |
| I12 | | | 13 | |
| I13 | | | 14 | |
| I14 | | | 15 | |
| I15 | | | 16 | |
| I16 | High-speed comparison match interrupt | 1 to 3 | 17 | The default value for priority is "2". |
| I17 | | | 18 | |
| I18 | | | 19 | |
| I19 | | | 20 | |
| I20 | | | 21 | |
| I21 | | | 22 | |
| I22 | | | 23 | |
| I23 | | | 24 | |
| I28 | Interrupt by internal timer | 1 to 3 | 28 | The default value for priority is "2". |
| I29 | | | 27 | |
| I30 | | | 26 | |
| I31 | | | 25 | |
| I50 to I177 | Interrupt from module | 2 to 3 | 29 to 156 | • The default value for priority is "2".<br>• The highest priority rank is I50 and the lowest is I177. |

**Point**

- The interrupt priority is the order which is executed at the time of the multiple interrupt. The lower the numerical value, the higher the interrupt priority.
- The interrupt priority order is the order which is executed when the interrupt factor with the same interrupt priority is generated.

# 4.10 SFC Devices

These are the devices used by the SFC function.

## SFC block device (BL)

This device is used when specifying SFC program blocks. This device is also used when specifying step No. through such methods as verifying (monitor, current value changes) SFC programs with SFC control instructions or the engineering tool. (MELSEC iQ-F FX5 Programming Manual (Program Design))

**Point**

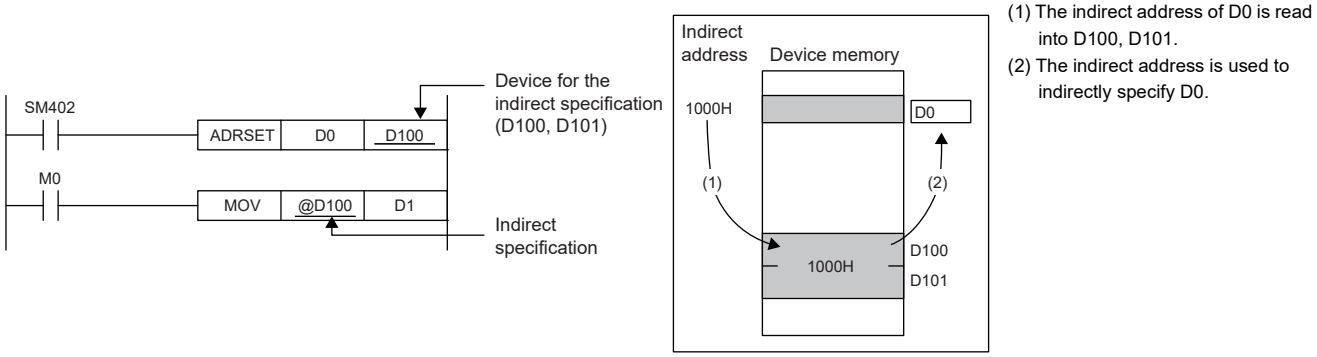
To start the SFC block device for the SFC program while ON/OFF information of the SFC block device (BL) are maintained (continuation start), an option battery is required.

## SFC transition device (TR)

This device is used when specifying SFC program transition conditions. This device can only be used for device comments for transition conditions. (MELSEC iQ-F FX5 Programming Manual (Program Design))

# 4.11 Indirect Specification

Specify the device using the indirect address of device. Store the indirect address of device to be specified into the device for indirect specification, and write as "@ + Device for indirect specification".




The indirect specification can be used in the device/label memory.

### Indirect address of device

To specify, use the 32-bit data, and to hold the value, use the device of two words. The indirect address of the device can be obtained with the ADRSET instruction. The ADRSET instruction specifies the indirect address of the device using instructions that handle 32-bit data. For the ADRSET instruction, refer to the following.

MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks)

### Devices that can allow indirect specification

This section lists devices that can allow indirect specification.

| Type | Device*1 |
|---|---|
| Devices that can allow indirect specification where @ is added | D, W, SW, SD, U□\G, R |
| Device that can acquire the indirect address through the ADRSET instruction | D, W, SW, SD, R |

*1 Devices that cannot be used as operands of instructions cannot be used even when they are indirectly specified.

# 4.12 Constant

This section explains constants.

## Decimal constant (K)

Device that specifies decimal data for the program. Specified by K☐. (e.g. K1234).

The specification range is determined by type of argument data of instruction using a decimal constant.

| Argument data type of instruction | | Specification range of decimal constants |
|---|---|---|
| Data size | Data type name | |
| 16 bits | Word (signed) | K-32768 to K32767 |
| | Word (unsigned)/Bit string (16-bit) | K0 to K65535 |
| 32 bits | Double word (signed) | K-2147483648 to K2147483647 |
| | Double word (unsigned)/Bit string (32-bit) | K0 to K4294967295 |

## Hexadecimal constant (H)

Device that specifies hexadecimal data for the program. Specified by H☐. (e.g. H1234)

When specifying BCD data, specify each digit of hexadecimal number in 0 to 9. The specification range is determined by type of argument data of instruction using a hexadecimal constant. If data size is 16 bits, H0 to HFFFF; if 32 bits, H0 to HFFFFFFFF.

## Real constant (E)

Device that specifies real numbers for the program. Specified by E☐. (e.g. E1.234)

### Setting range of real numbers

The setting range of real numbers is explained below.

$-2^{128} \leq Device \leq -2^{-126}$, 0, $2^{-126} \leq Device \leq 2^{128}$

(E-3.40282347+38 to E-1.17549435-38, 0, E1.17549435-38 to E3.40282347+38)

### Operation during calculation

#### ■Operation at overflow and underflow

Operation is as follows if overflow or underflow occurs during calculation.

- When overflow occurs: An error is returned.
- When underflow occurs: 0 is returned (no error occurs).

#### ■Operation when special value*1 is input

If calculation is performed when input data is a special value, an error occurs. If "-0" occurs during calculation, it is treated as "+0"; the calculation result does not become "-0".

*1 Special values are -0, denormalized numbers, non-numbers, ±∞.

### Programming expressions

Real numbers can be specified by the following expressions.

- Normal expression: Specify a numeric value as is. (Example: E10.2345 in the case of 10.2345)
- Scientific notation: Specify a numeric value in the format "numeric value" ×10n. (Example: E1.234+3 in the case of 1234. "+3" represents "$10^3$".)

## Character string constant

The character string can be specified by enclosing it with single quotation marks (' ') or double quotation marks (" "). (Example: "ABCDE") Note that the NULL character*1 becomes the termination character.

*1 Character string: 00H
Unicode character string: 0000H

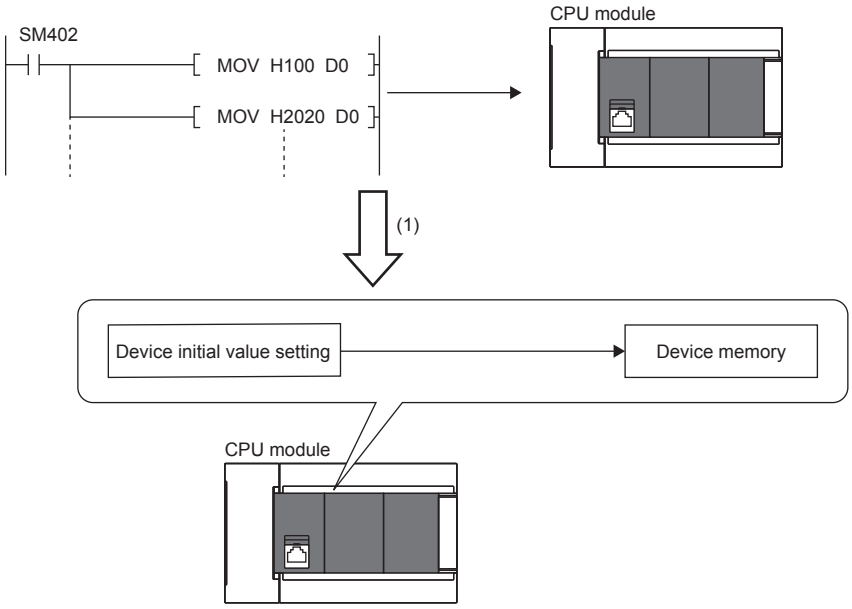
**Point**

For details on character string data, refer to the following.
MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks)

# 4.13 Initial Device Value Setting



Directly sets the initial value of a device used by the program (i.e., not via the program).




(1) If initial device values are used, a program to set data to the devices becomes unnecessary.

# Setting initial device values

This section describes the settings of initial device values.

## Setting procedure

The procedure for using initial device values is as follows.

1. First, the user must create an initial device value file. To set initial values to a global device, create an initial device value file (with any name) which sets these initial values, and specify the range of the values.
2. On the device memory, set up initial device value data within the range specified in the initial device value file.

📖GX Works3 Operating Manual

3. In the "Device Memory Register Diversion", select the device memory which was set up in Step 2. Setting "Device Memory Register Diversion" enables data set up on the device memory to be used as initial device values for the device which is specified in the initial device value file.

📖GX Works3 Operating Manual

4. Configure CPU parameters. (☞ Page 76 Initial value setting)
5. Write the set initial device value file and the CPU parameters to the CPU module.

📖GX Works3 Operating Manual

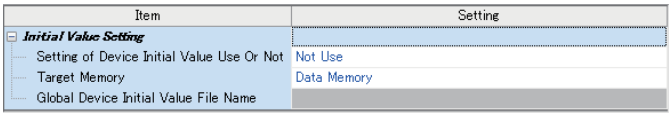
6. The data in the specified initial device value file is automatically set to the specified device when the CPU module is powered off and on, reset, or the status changes from STOP to RUN.

## Initial value setting

Configure the initial value setting.

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [CPU Parameter] ⇨ "File Setting" ⇨ "Initial Value Setting"

### Window




### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Setting of Device Initial Value Use Or Not | Sets whether or not to use initial device values. | • Not use<br>• Use | Not use |
| Target Memory | Sets the storage memory for the initial device value file. | • Memory card<br>• Data memory | Data memory |
| Global Device Initial Value File Name | Sets the name of the initial global device value file.*1 | 60 characters or less | — |

*1 If nothing is specified, initial global device values are not applied.

## Number of initial device value settings and maximum range of one range

Up to 1000 ranges can be set in one initial device value file. Up to 8000 data points can be set in one range.

# 4.14 Applicable Devices

For details on devices to which initial device/label values can be set, refer to the following.

📖GX Works3 Operating Manual

# 5 LABELS

Label is identifier (character string) that specifies a character string in I/O data or internal processing. When a label is used in programming, a program can be created without being conscious about the device No.*1

*1 Label and device can be used in mixed manner.

**Point**

For details on label, refer to the following.

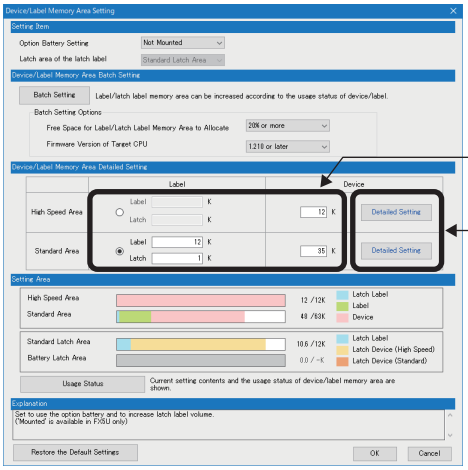
MELSEC iQ-F FX5 Programming Manual (Program Design)

# MEMO

# 6 CAPACITY SETTING OF EACH AREA IN DEVICE/LABEL MEMORY

The capacity of each area in device/label memory can be specified.

For FX5UJ CPU module, the setting cannot be changed but the content can be checked.




| Item | Symbol | Device | | Latch (1) | Latch (2) |
|---|---|---|---|---|---|
| | | Points | Range | | |
| Input | X | 1024 | 0 to 1777 | | |
| Output | Y | 1024 | 0 to 1777 | | |
| Internal Relay | M | 7680 | 0 to 7679 | 500 to 7679 | No Setting |
| Link Relay | B | 256 | 0 to FF | No Setting | No Setting |
| Link Special Rela | SB | 512 | 0 to 1FF | | |
| Annunciator | F | 128 | 0 to 127 | No Setting | No Setting |
| Step Relay | S | 4096 | 0 to 4095 | 500 to 4095 | |
| Timer | T | 512 | 0 to 511 | No Setting | No Setting |
| Retentive Timer | ST | 16 | 0 to 15 | 0 to 15 | No Setting |
| Counter | C | 256 | 0 to 255 | 100 to 199 | No Setting |
| Long Counter | LC | 64 | 0 to 63 | 20 to 63 | No Setting |
| Data Register | D | 8000 | 0 to 7999 | 200 to 7999 | No Setting |
| Latch Relay | L | 7680 | 0 to 7679 | | |
| Area Capacity | | | 12.0K Word | | 11.0K Word |
| Total Device | | | 11.2K Word | | 9.6K Word |
| Total Word Device | | | 10.2K Word | | 8.1K Word |
| Total Bit Device | | | 15.9K Bit | | 25.1K Bit |

(1) The capacity of each area can be changed. (☞ Page 80 Device/Label Memory Area Setting)

(2) The number of points of user devices can be changed. (☞ Page 81 Device Setting)

## 6.1 Default Capacity of Each Area

The default capacity of each area is as follows.

| Item | Capacity |
|---|---|
| Device (high speed) Area Capacity | 12 K words |
| Device (standard) Area Capacity | 35 K words |
| Label Area Capacity | 12 K words |
| Latch Label Area Capacity | 1 K words |

## 6.2 The Setting Range of the Capacity of Each Area

The setting range of the capacity of each area on the device/label memory is as follows.

| Item | Setting range of capacity of each area |
|---|---|
| Device (high speed) Area Capacity | 0 to 12 K words |
| Device (standard) Area Capacity | ■FX5S CPU module<br>0 to 48 K words<br>■FX5U/FX5UC CPU module<br>0 to 63 K*1 words |
| Label Area Capacity | 0 to 63 K*1 words |
| Latch Label Area Capacity | ■FX5S CPU module<br>0 to 5K words<br>■FX5U/FX5UC CPU module<br>0 to 63 K*1 words |

*1 For supported version, refer to ☞ Page 971 Added and Enhanced Functions.

### Restriction of a label/latch label area capacity

**■When device area setting using by label/latch label is standard area**

Label Area Capacity + Latch Label Area Capacity + Device (standard) Area Capacity ≤ 63 K*1 Word (1 K word unit)

**■When device area setting using by label/latch label is high speed area**

Label Area Capacity + Latch Label Area Capacity + Device (high speed) Area Capacity ≤ 12 K Word (1 K word unit)

### ■When FB is used

When using FB, the reserved area for adding labels other than the labels defined for FB will be used.

The following capacities are consumed per FB instance.

Label area: 48 words

Latch area: 16 words

*1 For supported version, refer to ☞ Page 971 Added and Enhanced Functions.

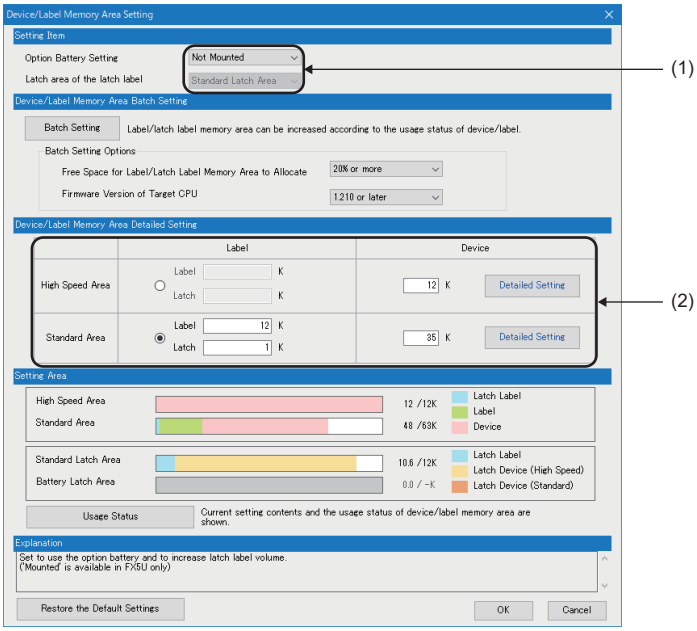
# 6.3 Device/Label Memory Area Setting

The capacity of each data area allocated within the device/label memory can be changed.

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [CPU Parameter] ⇨ "Memory/Device Setting" ⇨ "Detailed Setting" ⇨ "Device/Label Memory Area Setting" window

## Operating procedure

"Device/Label Memory Area Setting" window




1. In "Option Battery Setting", select whether or not to use a option battery. (Only when the option battery is used)
2. In "Device/Label Memory Area Setting" window, set the capacity of each area.

## Displayed items

(1) Whether or not to use an option battery, and latch area setting for the latch type label can be changed.

Only FX5U/FX5UC CPU module is supported.

| Items | Description | Setting range | Default |
|---|---|---|---|
| Option Battery Setting | Set when using option battery. The points which can be held can be increased by this setup. | • Not Mounted<br>• Mounted | Not Mounted |
| Latch area of the latch label | The latch device of standard area can be held with a battery. The latch area of latch label can be changed to battery latch area from standard latch area (nonvolatile memory). | • Standard Latch Area<br>• Battery Latch Area | Standard Latch Area |

(2) The device/label memory area capacity can be set.

| Items | Label | Device |
|---|---|---|
| High-speed Area<br>Standard Area | Label:<br>Set label area capacity used in the global label, local label.*1<br>Latch:<br>Set the latch label area capacity used for the latch type label.*1 | Set the capacity of device (standard) area. The number of device points in the detail settings, and the latch settings can be changed. For details, refer to ☞ Page 81 Device Setting. |

*1 For details on the setting range for each area capacity, refer to ☞ Page 79 The Setting Range of the Capacity of Each Area.

**Point**

High-speed area: Area which can be accessed at high speed. Latch is always held by nonvolatile memory.
Standard area: Area which can be held when option battery is used. In addition, about a latched type label, when a latch area is set as a standard latch area, latch type label is held by nonvolatile memory.

# 6.4 Device Setting

The number of points of each user device can be changed.

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [CPU Parameter] ⇨ "Memory/Device Setting" ⇨ "Device/Label Memory Area Setting" ⇨ "Device/Label Memory Area Detailed Setting" ⇨ "Device (high speed) Setting/Device (standard) Setting" ⇨ "Detailed Setting"

## Window

"Device (high speed) Setting" details window

| Item | Symbol | Device | | Latch (1) | Latch (2) |
|---|---|---|---|---|---|
| | | Points | Range | | |
| Input | X | 1024 | 0 to 1777 | | |
| Output | Y | 1024 | 0 to 1777 | | |
| Internal Relay | M | 7680 | 0 to 7679 | Setting | No Setting |
| Link Relay | B | 256 | 0 to FF | No Setting | No Setting |
| Link Special Relay | SB | 512 | 0 to 1FF | | |
| Annunciator | F | 128 | 0 to 127 | No Setting | No Setting |
| Step Relay | S | 4096 | 0 to 4095 | Setting | |
| Timer | T | 512 | 0 to 511 | No Setting | No Setting |
| Retentive Timer | ST | 16 | 0 to 15 | Setting | No Setting |
| Counter | C | 256 | 0 to 255 | Setting | No Setting |
| Long Counter | LC | 64 | 0 to 63 | Setting | No Setting |
| Data Register | D | 8000 | 0 to 7999 | Setting | No Setting |
| Latch Relay | L | 7680 | 0 to 7679 | | |
| Area Capacity | | | 12.0K Word | | 11.0K Word |
| Total Device | | | 11.9K Word | | 9.6K Word |
| Total Word Device | | | 10.2K Word | | 8.1K Word |
| Total Bit Device | | | 27.9K Bit | | 25.1K Bit |

"Device (standard) Setting" details window

| Item | Symbol | Device | | Latch (1) | Latch (2) |
|---|---|---|---|---|---|
| | | Points | Range | | |
| File Register | R | 32768 | 0 to 32767 | No Setting | No Setting |
| Link Register | W | 512 | 0 to 1FF | No Setting | No Setting |
| Link Special Register | SW | 512 | 0 to 1FF | | |
| Area Capacity | | | 35.0K Word | | ---- |
| Total Device | | | 33.0K Word | | 0.0K Word |
| Total Word Device | | | 33.0K Word | | 0.0K Word |
| Total Bit Device | | | 0.0K Bit | | 0.0K Bit |

**Point**

Specify each item so that the total number of points for each user device does not exceed the capacity of the device area. (☞ Page 80 Device/Label Memory Area Setting)

# Range of use of device points

The following table lists the range of use of device points to be set in the device setting.

## Device (high speed) Setting

| Type | Device name | Symbol | Range of use | | Increment of setting | |
|---|---|---|---|---|---|---|
| | | | FX5S/FX5U/FX5UC CPU module | FX5UJ CPU module | FX5S/FX5U/FX5UC CPU module | FX5UJ CPU module |
| Bit | Input | X | X0 to X1777 | X0 to X1777 | — | — |
| Bit | Output | Y | Y0 to Y1777 | Y0 to Y1777 | — | — |
| Bit | Internal relay | M | M0 to M32767 | M0 to M7679 | 64 points | — |
| Bit | Link relay | B | B0 to B7FFF | B0 to B7FF | 64 points | — |
| Bit | Link special relay | SB | SB0 to SB7FFF | SB0 to SB7FF | 64 points | — |
| Bit | Annunciator | F | F0 to F32767 | F0 to F127 | 64 points | — |
| Bit | Step relay | S | S0 to S4095 | S0 to S4095 | — | — |
| Word | Timer | T | T0 to T1023 | T0 to T511 | 16 points | — |
| Word | Retentive timer | ST | ST0 to ST1023 | ST0 to ST15 | 16 points | — |
| Word | Counter | C | C0 to C1023 | C0 to C255 | 16 points | — |
| Word | Long counter | LC | LC0 to LC1023 | LC0 to LC63 | 16 points | — |
| Word | Data register | D | D0 to D7999 | D0 to D7999 | 4 points | — |
| Bit | Latch relay | L | L0 to L32767 | L0 to L7679 | 64 points | — |

## Device (standard) Setting

| Type | Device name | Symbol | Range of use | | Increment of setting | |
|---|---|---|---|---|---|---|
| | | | FX5S/FX5U/FX5UC CPU module | FX5UJ CPU module | FX5S/FX5U/FX5UC CPU module | FX5UJ CPU module |
| Word | File registers | R | R0 to R32767 | R0 to R32767 | 4 points | — |
| Word | Link register | W | W0 to W7FFF | W0 to W3FF | 4 points | — |
| Word | Link special register | SW | SW0 to SW7FFF | SW0 to SW3FF | 4 points | — |

**Point**

Extended file register (ER) is the device held only in the SD memory card. The device setting is not required for an extended file register (ER), and range of use is ER0 to ER32767.

# 7 DEVICE/LABEL ACCESS SERVICE PROCESSING SETTING

This is a function to optionally designate the frequency of execution of the service process that is carried out by the END process in the parameter.
Improvement of communication response with peripheral equipment and extension of scan time by the service process can be controlled by service process setting function. With this, building an optimal service process environment on the system is possible.

## About device/label access service processing

Device/label access service processing is a response process for the request statement from peripheral equipment that occurs asynchronously with the scan process. (A process of "Interpretation of Request statement→Internal processing based on the request→Creating response statement" for 1 request statement)
The execution timing of the service process is during the END process.

**Point**

When every request statement from all connected peripheral equipment is executed in each END process, depending on the number of request statements arriving during 1 scan, the impact on scan time (delay, scattering) may be big. Therefore, by setting the frequency (number of ports) of device/label access service processing to be executed in 1 END processing and regulating the frequency of device/label access service processing according to the system built, ensuring balance between scan time and response time to the peripheral equipment can be achieved.

## Compatibility of service process setting

The compatibility of service process setting is described below.
○: Target, —: Not applicable

| Communication type | Function | Compatible CPU module | | |
|---|---|---|---|---|
| | | FX5S | FX5UJ | FX5U/FX5UC |
| Serial communication | MELSOFT connection | ○ | ○ | ○ |
| | MC protocol communication | ○ | ○ | ○ |
| | MODBUS communication (slave) | ○ | ○ | ○ |
| | N:N Network | — | — | — |
| | MODBUS communication (master) | — | — | — |
| | Non-protocol communication | — | — | — |
| | Inverter communication | — | — | — |
| | Predefined protocol support | — | — | — |
| | Parallel link | — | — | — |
| Ethernet communication | MELSOFT connection | ○ | ○ | ○ |
| | SLMP communication | ○ | ○ | ○ |
| | Simple CPU communication (server) | ○ | ○ | ○ |
| | Socket communication | — | — | — |
| | Predefined protocol support | — | — | — |
| | Simple CPU communication (client) | — | — | — |
| USB communication | MELSOFT connection | ○ | ○ | — |

## Operation details of service process

The operation details of service process are described below.

The following table shows the methods for service process with their respective features.

| Device/label access service processing setting | Scan performance | | Service process performance | | Device splitting*5 | Features |
|---|---|---|---|---|---|---|
| | Extension*1 | Stability*2 | Response time*3 | Stability*4 | | |
| None | Large | Medium | Fast | High | None | Effective when service process is given precedence. |
| Set the frequency of service process | Medium | High | Medium | Medium | None | Effective when scan process is given precedence. |

*1 Shows the maximum a scan time is extended by the service process.
*2 Shows the extent of fluctuation of scan time or the degree of scattering by the service process.
*3 Shows the time between receiving a service process request from the peripheral equipment to returning a response.
*4 Shows the extent of fluctuation of time until returning the response or the degree of scattering due to the contents of service process request from the peripheral equipment.
*5 Shows if device splitting will occur.

### ■Device/label access service processing setting "No Setting"

Since all service processes can be executed normally for every scan time, steady communication is possible even on a system that uses multiple peripheral equipment.

**Point**

Wait for request process will not be executed when there is no request data.

### ■Device/label access service processing setting "Set Processing Counts"

Because a frequency of service process executed in 1 scan time can be set, the scan time is stabilized even on a system that uses multiple peripheral equipment.

## Operation during STOP/PAUSE

Regardless of the service process settings during STOP/PAUSE, execute all requests in scan 1.

However, a request from the identical port will be processed only 1 time in 1 scan.

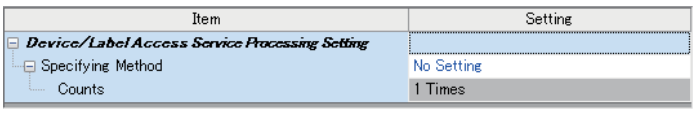
For example, after serial communication CH1 process, even if serial communication CH1 receives a new command request again when Ethernet connection 1 is in process, the 2nd request is not executed in this scan and will be carried over to the next scan.

## Setting method

The device/label access service processing can be configured as follows.

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [CPU Parameter] ⇨ "Service Processing Setting" ⇨ "Device/Label Access Service Processing Setting"

### Window




### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Specifying Method | Set the method of device/label access service processing. | • Set Processing Counts<br>• No Setting | No Setting |
| Counts | Set the number of executions of device/label access service processing. | 1 to 10 [Time] (1 time Unit) | — |

## Precautions

If "Set Processing Counts" is selected and many service process frequencies are set, when multiple requests are received at the same time, scan time may be prolonged to a large extent, so please exercise caution.

# PART 2 CPU MODULE BUILT-IN FUNCTIONS

This part consists of the following chapters.

# 8 FUNCTION LIST

The following table lists the functions of the CPU module.

○: Supported, △: Limitedly supported, ×: Not supported

| Function | | Description | Compatible CPU module | | | Reference |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| Program capacity setting | | Set to change program capacity. | × | × | ○ | Page 49 |
| Initial device value setting | | Sets the initial values of devices used in the program directly (not via the program) to the devices. | ○ | ○ | ○ | Page 75 |
| Device/label memory area setting | | Sets the capacity of each area in the device/label memory. | ○ | × | ○ | Page 79 |
| Device/label access service processing setting | | Sets the number of execution times of the device/label access service processing executed by END processing, with parameter. | ○ | ○ | ○ | Page 83 |
| Firmware update function | | Updates the firmware of the module. | ○ | ○ | ○ | Page 89 |
| Online change | Changing ladder blocks while online | Writes the part of a program edited on the ladder editor using the engineering tool to the CPU module in units of ladder blocks. Edited contents spanning multiple portions can be written to the CPU module at once. | ○ | ○ | ○ | Page 106 |
| Interrupt function | Multiple interrupt function | When an interrupt occurs while an interrupt program triggered by another cause is running, stops the program if its priority is lower than that of the new interrupt, and runs the higher-priority program whenever its execution condition is satisfied. | ○ | ○ | ○ | Page 109 |
| | Input interrupt delay function | Execution of the interrupt program can be delayed in units of 1 ms. | ○ | ○ | ○ | Page 111 |
| Scan monitoring function (Watchdog timer setting) | | Detects an error in the hardware and program of the CPU module by monitoring the scan time. | ○ | ○ | ○ | Page 114 |
| Constant scan | | Keeps the scan time constant and executes program repeatedly. | ○ | ○ | ○ | Page 116 |
| Remote operation | Remote RUN/STOP | Changes the CPU module status to the RUN/STOP/PAUSE status externally while the RUN/STOP/RESET switch of the CPU module is in RUN status. | ○ | ○ | ○ | Page 118 |
| | Remote PAUSE | | | | | |
| | Remote RESET | Resets the CPU module externally while the CPU module is in the STOP status. | ○ | ○ | ○ | |
| Latch function | | Holds the contents of the device and label of the CPU module when the power is turned ON etc. | ○ | ○ | ○ | Page 123 |
| RAS function | Self-diagnostics function | Self-diagnoses the CPU module to see whether an error exist or not. | ○ | ○ | ○ | Page 127 |
| | Error clear | Batch-clears all the continuation errors being detected. | ○ | ○ | ○ | |
| | Event history function | Collects operations executed and errors detected from the modules, and saves them in the CPU module, expansion board, expansion adapter, and intelligent module. The saved logs can be checked in chronological order. | ○ | ○ | ○ | |
| External input/output forced on/off function | | Forcibly turns on/off the external input/output from the engineering tool. | ○ | ○ | ○ | Page 135 |
| Clock function | | This function is used for the time management in the function which the system operates such as the date of the event history function, and data logging function. | ○ | ○ | ○ | Page 141 |
| Security function | | Protects resources stored in PCs and resources in the units in the system of the FX5 from illegal access by a third party such as theft, alteration, accidental operation and unauthorized execution. | ○ | ○ | ○ | Page 145<br>GX Works3 Operating Manual |
| Data logging function | | Collects data at the specified interval or any desired timing, and stores them as a file on the SD memory card. | △*1 | ○ | ○ | Page 147 |
| Memory dump function | | Saves the data in the devices of the CPU module at a desired timing. | △*1 | ○ | ○ | Page 197 |

| Function | | Description | Compatible CPU module | | | Reference |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| Internal buffer capacity setting | | Sets the capacity of the area (internal buffer) used by the system to temporarily store the results of data logging and memory dump processing. | ○ | ○ | ○ | Page 206 |
| Data backup/restoration function | | Backs up program files, parameter files, and device/label data files in a CPU module to an SD memory card. The backup data can be restored as needed. | △*1 | ○ | ○ | Page 208 |
| Real-time monitor function | | Monitors the data in the specified device of the CPU module at a specified interval or at a desired timing in real time. | ○ | ○ | ○ | Page 226 |
| Memory card function | SD memory card forced stop | Makes the SD memory card unavailable without turning OFF the power even when the function accessing the SD memory card is executed. | △*1 | ○ | ○ | Page 228 |
| | Boot operation | Transfers the file stored in the SD memory card to the transfer destination memory judged automatically by the CPU module when the power is turned ON or is reset. | △*1 | ○ | ○ | |
| High-speed input/output function | High-speed counter function | Performs high-speed counter, pulse width measurement, input interruption, etc. by using the input of the CPU module or high-speed pulse input/output module. | ○ | ○ | ○ | Page 232 |
| | Pulse width measurement function | | | | | Page 299 |
| | Input interrupt function | | | | | Page 71 |
| | PWM output function | Executes a PWM output by using the transistor output of the CPU module or high-speed pulse input/output module. | ○ | ○ | ○ | Page 321 |
| Positioning function | | Executes positioning operation by using the transistor output of the CPU module or high-speed pulse input/ output module. | ○ | ○ | ○ | Page 333 |
| Analog function | | Uses the analog input function and analog output so that voltage input/voltage output can be performed. | ○ | ○ | ○ | Page 543 |
| PID control via instruction function | | Performs PID control by the PID instruction. | ○ | ○ | ○ | Page 566 |
| PID control via parameter function | | Performs PID control (standard PID control, heating-cooling PID control) by using GX Works3 parameters. | ○ | ○ | ○ | Page 604 |
| IP filter function | | Identifies the IP address of external devices over Ethernet, and blocks access from an invalid IP address. | ○ | ○ | ○ | MELSEC iQ-F FX5 User's Manual (Communication) |
| Built-in Ethernet function | | An Ethernet related function such as connection to MELSOFT products and GOTs, socket communication, file transfer function (FTP server, FTP client), Web server (HTTP), SNTP client, and simple CPU communication function. | ○ | ○ | ○ | MELSEC iQ-F FX5 User's Manual (Communication) |
| CC-Link IE Field Network Basic function | | Exchanges data between the master station and remote station using general-purpose Ethernet. | ○ | ○ | ○ | CC-Link IE Field Network Basic Reference Manual |
| Serial communication function | | A function related to the serial communication such as N:N Network, parallel link, MC protocol, inverter communication function and non-protocol communication. | ○ | ○ | ○ | MELSEC iQ-F FX5 User's Manual (Communication) |
| MODBUS communication function | | Connection with the products which support MODBUS RTU/TCP is available. The master and slave functions can be used. | ○ | ○ | ○ | MELSEC iQ-F FX5 User's Manual (Communication) |
| SFC function | | Executes programs written in sequential function chart (SFC). | ○ | ○ | ○ | MELSEC iQ-F FX5 Programming Manual (Program Design) |

*1 An SD memory card module is required.

# 9 FIRMWARE UPDATE FUNCTION



This function is used when the user obtains the firmware update file from the Mitsubishi Electric FA website, and updates the firmware version.

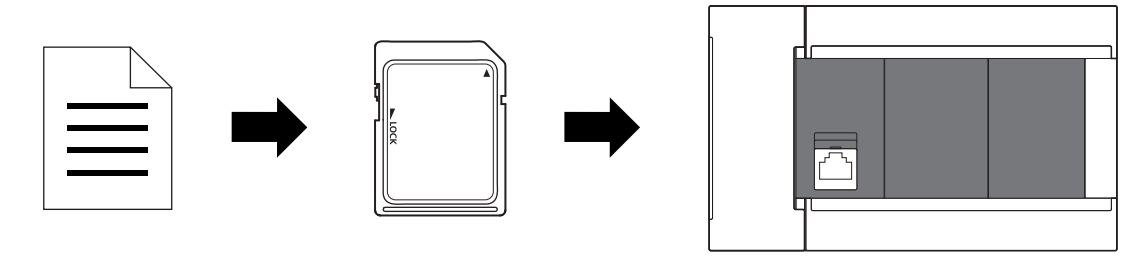
The firmware can be updated by the following methods.

| Method | Description |
|---|---|
| Update using an SD memory card | The CPU module firmware can be updated only with an SD memory card without using any special tool. |
| Update using the engineering tool | The CPU module/intelligent function module firmware can be updated by using the engineering tool. |

For supported version of firmware update function, refer to ☞ Page 971 Added and Enhanced Functions.

## 9.1 Update Using an SD Memory Card

The CPU module firmware can be updated by using an SD memory card. The firmware can be updated only with an SD memory card without using special software.




Firmware update file　　SD memory card　　CPU module

**Point**

- In system configurations where the CPU module (system) for which the firmware to be updated is connected to a network, etc., an error may occur when the firmware update is executed. Therefore, confirm the system's safety before executing the firmware update.
- Back up the various data such as the programs and parameters before executing the firmware update.

### Target models

The target models are listed below.

| Product name | Model name |
|---|---|
| FX5S CPU module | FX5S-30MR/ES, FX5S-30MT/ES, FX5S-30MT/ESS, FX5S-40MR/ES, FX5S-40MT/ES, FX5S-40MT/ESS, FX5S-60MR/ES, FX5S-60MT/ES, FX5S-60MT/ESS, FX5S-80MR/ES*1, FX5S-80MT/ES*1, FX5S-80MT/ESS*1, FX5S-30MR/DS, FX5S-30MT/DS, FX5S-30MT/DSS, FX5S-40MR/DS, FX5S-40MT/DS, FX5S-40MT/DSS, FX5S-60MR/DS, FX5S-60MT/DS, FX5S-60MT/DSS, FX5S-80MR/DS*1, FX5S-80MT/DS*1, FX5S-80MT/DSS*1 |
| FX5UJ CPU module | FX5UJ-24MR/ES, FX5UJ-24MT/ES, FX5UJ-24MT/ESS, FX5UJ-40MR/ES, FX5UJ-40MT/ES, FX5UJ-40MT/ESS, FX5UJ-60MR/ES, FX5UJ-60MT/ES, FX5UJ-60MT/ESS, FX5UJ-24MR/DS, FX5UJ-24MT/DS, FX5UJ-24MT/DSS, FX5UJ-40MR/DS, FX5UJ-40MT/DS, FX5UJ-40MT/DSS, FX5UJ-60MR/DS, FX5UJ-60MT/DS, FX5UJ-60MT/DSS |
| FX5U CPU module | FX5U-32MR/ES, FX5U-32MT/ES, FX5U-32MT/ESS, FX5U-64MR/ES, FX5U-64MT/ES, FX5U-64MT/ESS, FX5U-80MR/ES, FX5U-80MT/ES, FX5U-80MT/ESS, FX5U-32MR/DS, FX5U-32MT/DS, FX5U-32MT/DSS, FX5U-64MR/DS, FX5U-64MT/DS, FX5U-64MT/DSS, FX5U-80MR/DS, FX5U-80MT/DS, and FX5U-80MT/DSS |
| FX5UC CPU module | FX5UC-32MT/D, FX5UC-64MT/D, FX5UC-96MT/D, FX5UC-32MR/DS-TS, FX5UC-32MT/DS-TS, FX5UC-32MT/DSS, FX5UC-32MT/DSS-TS, FX5UC-64MT/DSS, FX5UC-96MT/DSS |

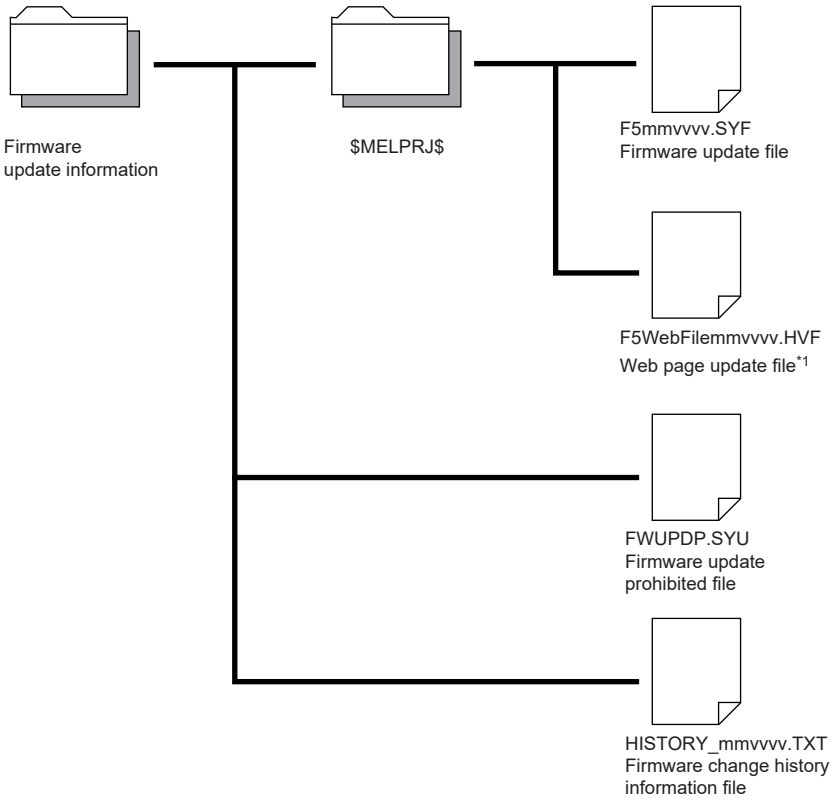
*1 These models are offered for specific regions.

# CPU module firmware update

## Firmware update method

### ■Preliminary preparations

1. Download the firmware update information for the model to be updated from the Mitsubishi Electric FA website.
2. Decompress the firmware update information (ZIP file).
3. Store the "$MELPRJ$" containing the firmware update file and Web page update file[*1] into the root folder of the SD memory card using a personal computer. When another "$MELPRJ$" is already stored in the SD memory card, delete the "$MELPRJ$" and then store the "$MELPRJ$" containing the firmware update file.




**Restriction**

When updating the firmware to version "1.060" and later on the FX5U/FX5UC CPU module, store the firmware update file and Web page update file in the same firmware update information (ZIP file) into the $MELPRJ$ folder. If the files which are not compatible with each other are stored into the $MELPRJ$ folder, the update will not be completed.

4. If updating of the firmware is prohibited, cancel the prohibit setting. (☞ Page 94 Canceling the firmware update prohibited setting)

**Restriction**

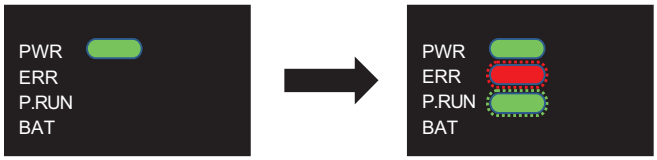
Store the "$MELPRJ$" folder into the SD memory card using a personal computer. The "$MELPRJ$" folder cannot be written into the SD memory card with the engineering tool.

5. Before executing the firmware update, back up the various data such as the programs and parameters stored in the CPU module by using the engineering tool. Also, use the backup/restoration function to hold latch devices. (☞ Page 208 DATA BACKUP/RESTORATION FUNCTION)

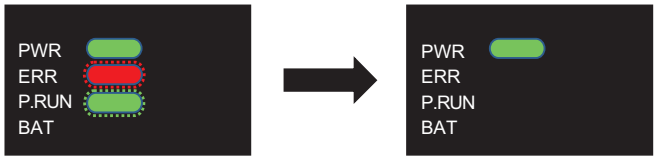
*1 The file attached to the firmware update information (ZIP file) of FX5U/FX5UC CPU module with firmware version "1.060" and later. The file is required when updating the firmware version "1.060" and later. For the FX5S/FX5UJ CPU modules, the file is required from the first released product.

## ■Operation

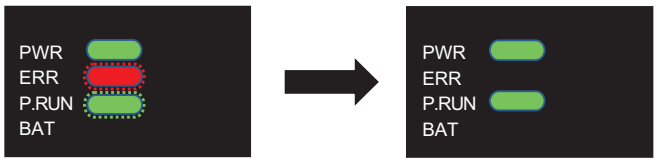
1. Execute RUN→STOP and turn the CPU module power OFF, and insert the SD memory card into the CPU module.
2. When the CPU module power turns on and the firmware update starts, the CARD LED blinks.
3. Wait until the RUN LED and ERR LED blink.*1 When the LEDs do not blink, refer to step 1 of ☞ Page 95 Troubleshooting.
4. Confirm that the RUN LED and ERR LED blink, and then restart or reset the CPU module.




5. The RUN LED and ERR LED blink. Wait until the LEDs turn off.*2 If the LEDs do not turn off, refer to step 2 of ☞ Page 95 Troubleshooting.
6. Confirm that the RUN LED and ERR LED turn off, and then restart or reset the CPU module.

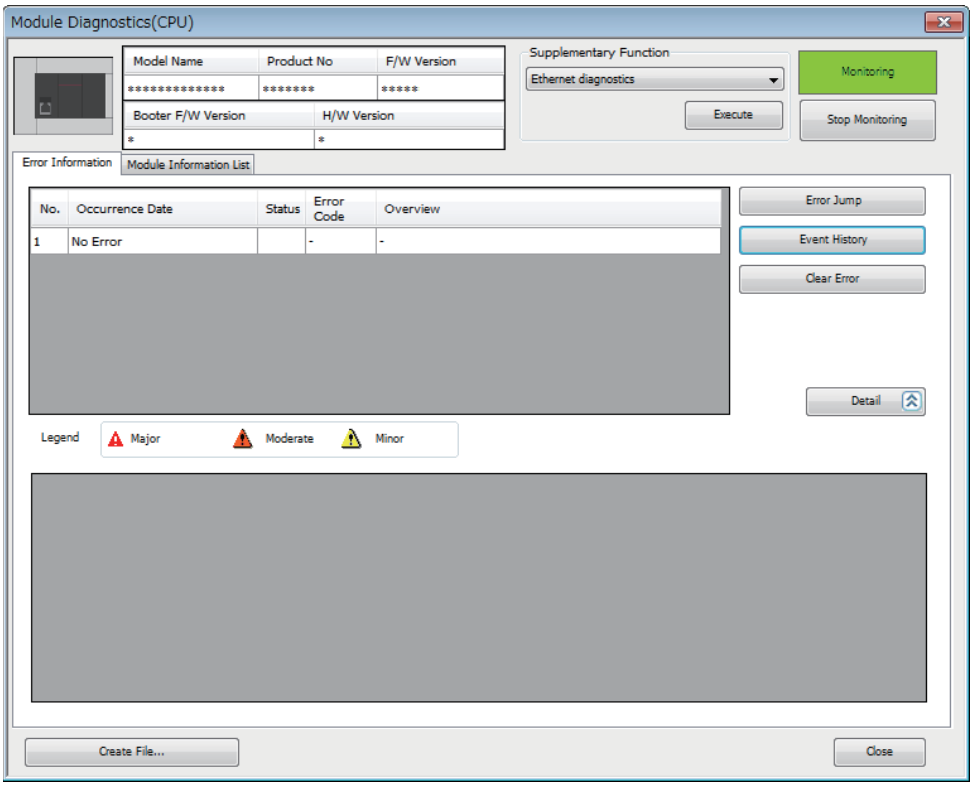



7. The RUN LED and ERR LED blink. Wait until the LEDs turn off.*3*4 When the firmware update is completed, the RUN LED and ERR LED stop blinking.




8. After the PWR LED turns on, check the engineering tool's "Module Diagnosis (CPU Diagnosis)", and check that the firmware version has been updated.

[Diagnostics] ⇨ [Module Diagnostics(CPU Diagnostics)]



**9.** Turn the CPU module power OFF and remove the SD memory card. Delete the firmware update file from the removed SD memory card.

*1 The waiting time is as follows.
· FX5S CPU module: Up to 70 seconds
· FX5UJ CPU module: Up to 120 seconds
· FX5U/FX5UC CPU module: Up to 90 seconds

*2 The waiting time is as follows.
· FX5S CPU module: Up to 60 seconds
· FX5UJ/FX5U/FX5UC CPU module: Up to 45 seconds

*3 The waiting time is as follows.
· FX5S CPU module: Up to 30 seconds
· FX5UJ CPU module: Up to 90 seconds
· FX5U/FX5UC CPU module: Up to 90 seconds

*4 For the FX5U/FX5UC CPU modules, this operation is required when the firmware version is "1.045" and later.

**Point**

- Communication with other modules and communication with the engineering tool or external devices is not possible while the firmware update is being executed.
- During firmware update, the data memory will be backed up[*5] to the SD memory card.[*7]
- If the firmware is updated correctly, the data memory will be restored[*5] from the SD memory card to the CPU built-in memory.[*7] After the data memory is restored, the data memory backup file in the SD memory card will be deleted.
- If the data memory fails to be restored, restart or reset the CPU module, and a recovery retry[*6] will be executed. [*7] While the data memory is being restored by recovery retry, the RUN LED and ERR LED blink slowly (five seconds or more). The LED will turn OFF when the file is correctly recovered. If the recovery fails again, the ERR LED will blink.
- The firmware version can also be confirmed with the special register (SD8001).
- After the firmware is updated, if a firmware update file that differs from the CPU module's firmware version is stored in the "$MELPRJ$" folder of the SD memory card, the firmware will be updated.

*5 Refer to ☞ Page 971 Added and Enhanced Functions for the versions that support data memory save/recovery of FX5U/FX5UC CPU module.

*6 Refer to ☞ Page 971 Added and Enhanced Functions for the versions that support data memory recovery retry of FX5U/FX5UC CPU module.

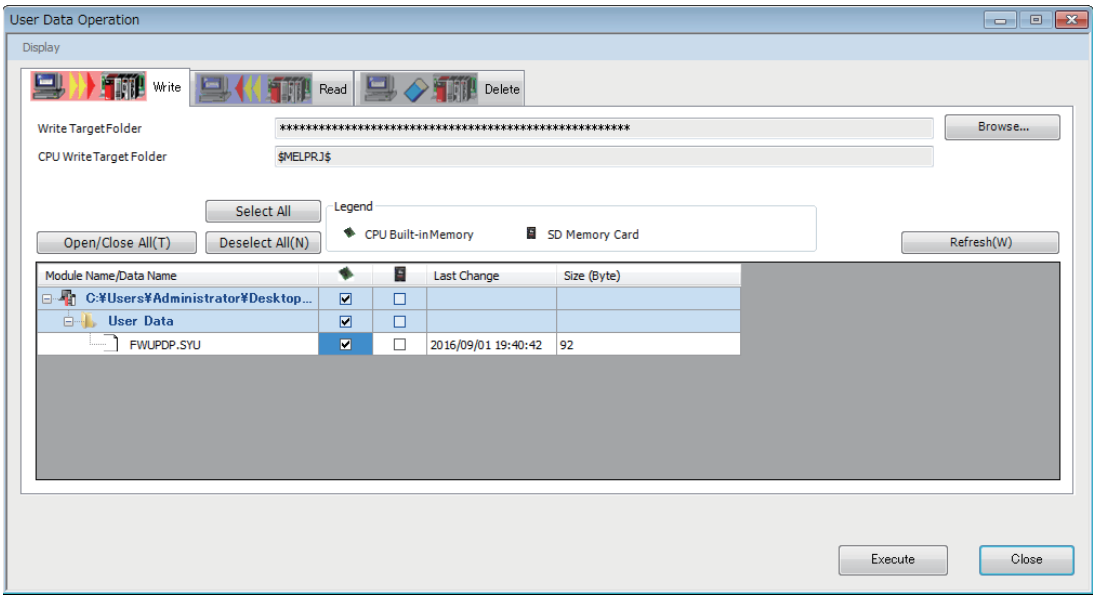
*7 For the FX5S CPU module, the firmware update can be executed without save/recovery, no save/recovery is executed.

## Firmware update prohibited setting

Updating of the firmware can be prohibited by writing the firmware update prohibited file into the CPU module.

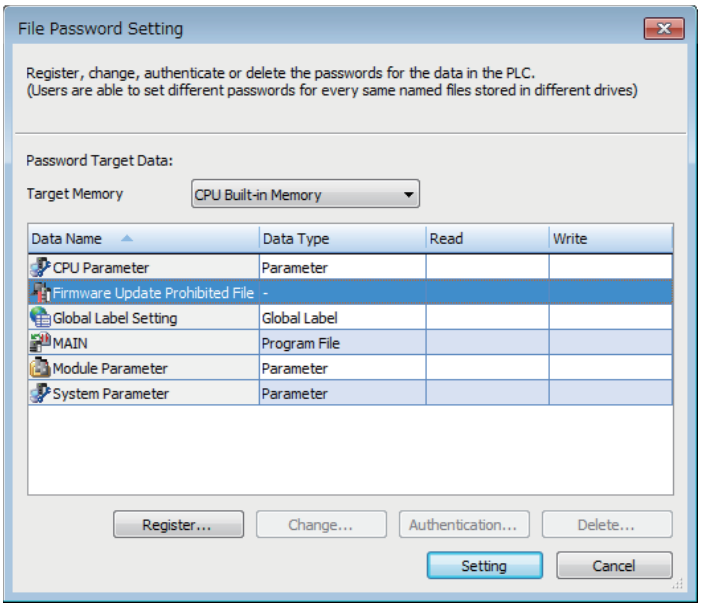
**1.** Using the engineering tool, select the folder containing the firmware update prohibited file (FWUPDP.SYU) as the write target file, and select the CPU built-in memory for the write target. The firmware update prohibited file is stored in the firmware update information downloaded during the preliminary preparations. (☞ Page 90 Firmware update method)

[Online] ⇨ [User Data] ⇨ [Write]




**2.** Using the engineering tool, set a file password for the firmware update prohibited file.*1

[Project] ⇨ [Security] ⇨ [File Password Setting]




For details on operation, refer to the following.

GX Works3 Operating Manual

*1 Refer to ☞ Page 971 Added and Enhanced Functions for the versions that support file password setting for the firmware update prohibited file.

**Point**

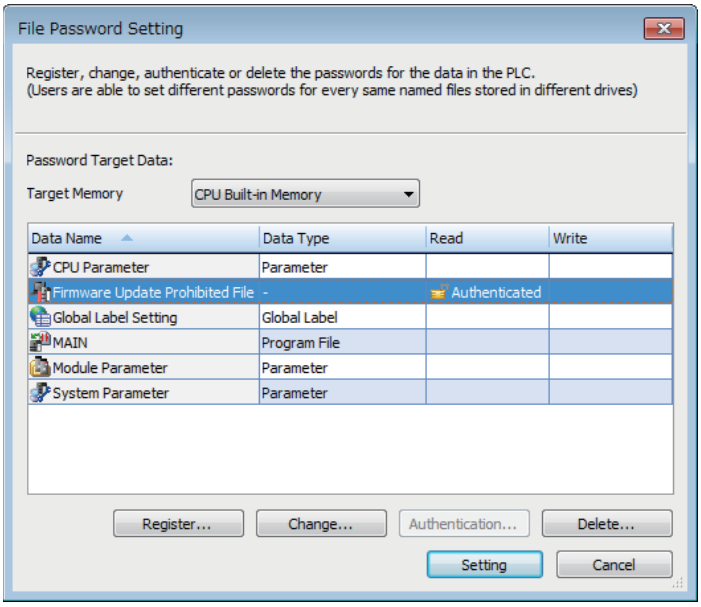
The firmware update permit/prohibit state can be confirmed with the special relay (SM912).

## Canceling the firmware update prohibited setting

When executing the firmware update, cancel the prohibit setting with the engineering tool.

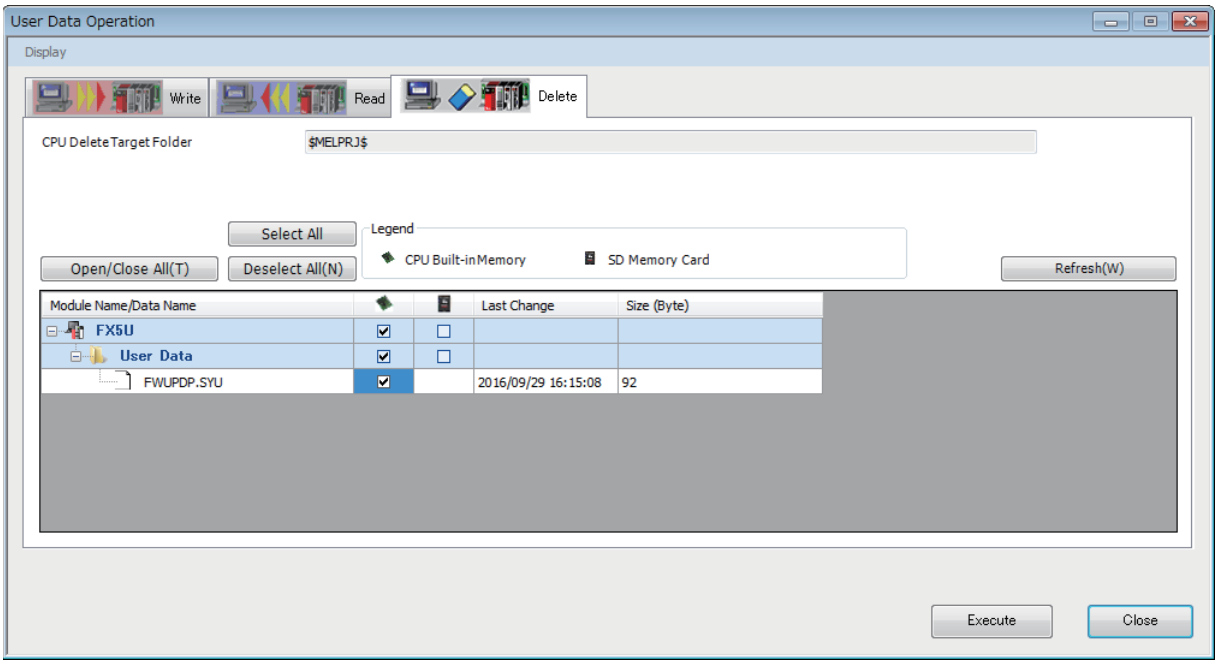
**1.** Delete the file password for the firmware update prohibited file.

[Project] ⇨ [Security] ⇨ [File Password Setting]




**2.** Delete the firmware update prohibited file from the CPU built-in memory.

[Online] ⇨ [User Data] ⇨ [Delete]




**Point**

The firmware update prohibited file can also be deleted with the following method. Note that the program, etc., will also be deleted.

- Memory operation (initialization) (GX Works3 Operating Manual)
- Clearing the CPU built-in memory before booting with boot operation (☞ Page 230 Boot Operation)

## Precautions

- Back up the various data such as the programs and parameters before executing the firmware update.
- Check the target model for the firmware update file and consult your local Mitsubishi representative. The firmware will not be updated if the target model does not match.
- Do not change the data (folder and file name) downloaded from the Mitsubishi Electric FA website.
- Do not turn the power OFF or reset the CPU module while the firmware update is in progress. Doing so may cause programs to be deleted.
- Do not remove the SD memory card while the firmware update is in progress. If the SD memory card is removed before the firmware update finishes, the process may end with an error.
- When the firmware version of the CPU module is updated by the firmware update function, some functions have restrictions depending on the serial No. For details on operation, refer to ☞ Page 971 Added and Enhanced Functions.
- To update the firmware of the CPU module to version "1.100" or later, use the CPU module with serial No. as follows.

- FX5UC-32MT/DS-TS and FX5UC-32MT/DSS-TS: Serial No.178****
- FX5U/FX5UC CPU module other than the above: Serial No.17X****

- For the FX5U/FX5UC CPU module with the serial No. 2114001 or later, downgrading to previous firmware version "1.220" or earlier cannot be performed. Update error (3040H) will occur and the firmware will not be updated.
- For the FX5UJ CPU module with the serial No. 2154001 or later, downgrading to previous firmware version "1.010" or earlier cannot be performed. Update error (3040H) will occur and the firmware will not be updated.
- For the FX5UJ-□MT/D□ and the FX5UJ-□MR/D□, downgrading to previous firmware version "1.050" or earlier cannot be performed. Update error (3040H) will occur and the firmware will not be updated.

## Troubleshooting

If an error occurs, take corrective action according to the error code. (☞ Page 855 List of error codes)

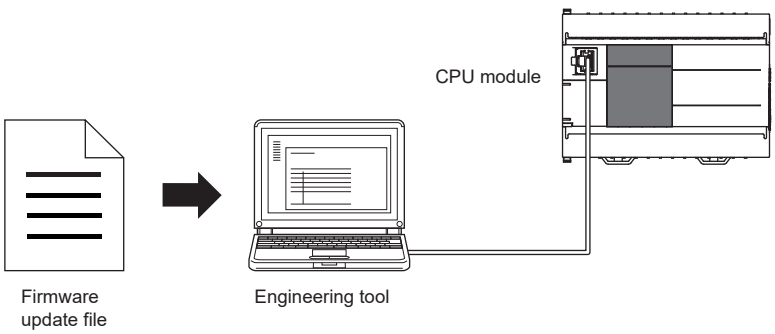
If the error cannot be judged by the error code, check the following items and troubleshoot the situation.

| Procedure | Error details | Action |
|---|---|---|
| 1 | The LED turns off and does not blink. | • Check that the SD memory card is inserted.<br>• If the FX5S CPU module is used, check that the SD memory card module is mounted.<br>• Check whether the folder name and file name to be stored in the SD memory card are correct.<br>• Check whether the same firmware version has already been written in.<br>• Obtain the firmware update file from the Mitsubishi Electric FA website, and update the file in the SD memory card. |
| 2 | The RUN LED turns off and the ERR LED is blinking. | Reset the CPU module. If the same situation occurs again, the hardware of the CPU module may be malfunctioning. Consult your local Mitsubishi Electric representative. |

# 9.2 Update Using the Engineering Tool

## CPU module firmware update

The CPU module firmware can be updated by using the engineering tool. This function enables the firmware to be updated without using an SD memory card.



## Target models

The target models are listed below.

| Product name | Model name |
|---|---|
| FX5S CPU module | FX5S-30MR/ES, FX5S-30MT/ES, FX5S-30MT/ESS, FX5S-40MR/ES, FX5S-40MT/ES, FX5S-40MT/ESS, FX5S-60MR/ES, FX5S-60MT/ES, FX5S-60MT/ESS, FX5S-80MR/ES*1, FX5S-80MT/ES*1, FX5S-80MT/ESS*1, FX5S-30MR/DS, FX5S-30MT/DS, FX5S-30MT/DSS, FX5S-40MR/DS, FX5S-40MT/DS, FX5S-40MT/DSS, FX5S-60MR/DS, FX5S-60MT/DS, FX5S-60MT/DSS, FX5S-80MR/DS*1, FX5S-80MT/DS*1, FX5S-80MT/DSS*1 |

*1 These models are offered for specific regions.

## Supported engineering tool

The engineering tool supporting the firmware update function is shown below.

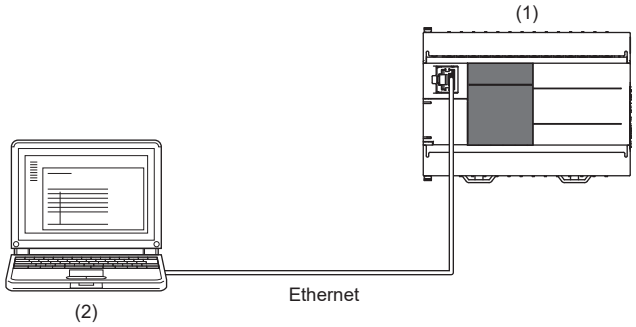
| Engineering tool | Software version |
|---|---|
| GX Works3 | "1.080J" or later |

## Communication route

The communication routes between the engineering tool supporting the firmware update function and the CPU module are shown below. For details, refer to the following.

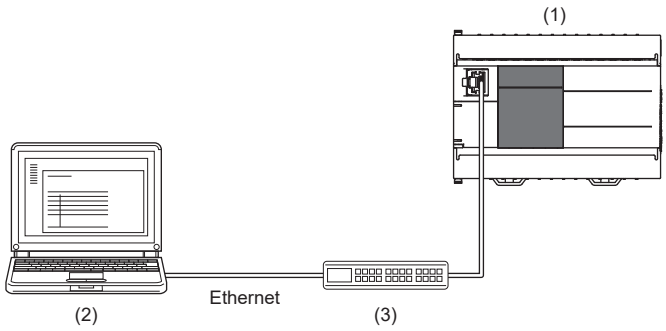
MELSEC iQ-F FX5 User's Manual (Communication)

### ■Direct connection to an Ethernet port



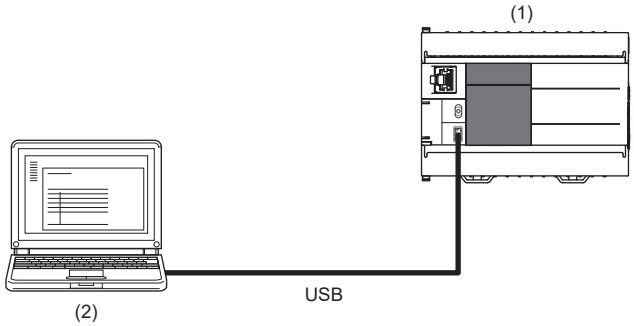

(1) CPU module (CPU module to be updated)
(2) Engineering tool

### ■Connection via hub




(1) CPU module (CPU module to be updated)
(2) Engineering tool
(3) Hub

### ■USB connection




(1) CPU module (CPU module to be updated)
(2) Engineering tool

## Firmware update method

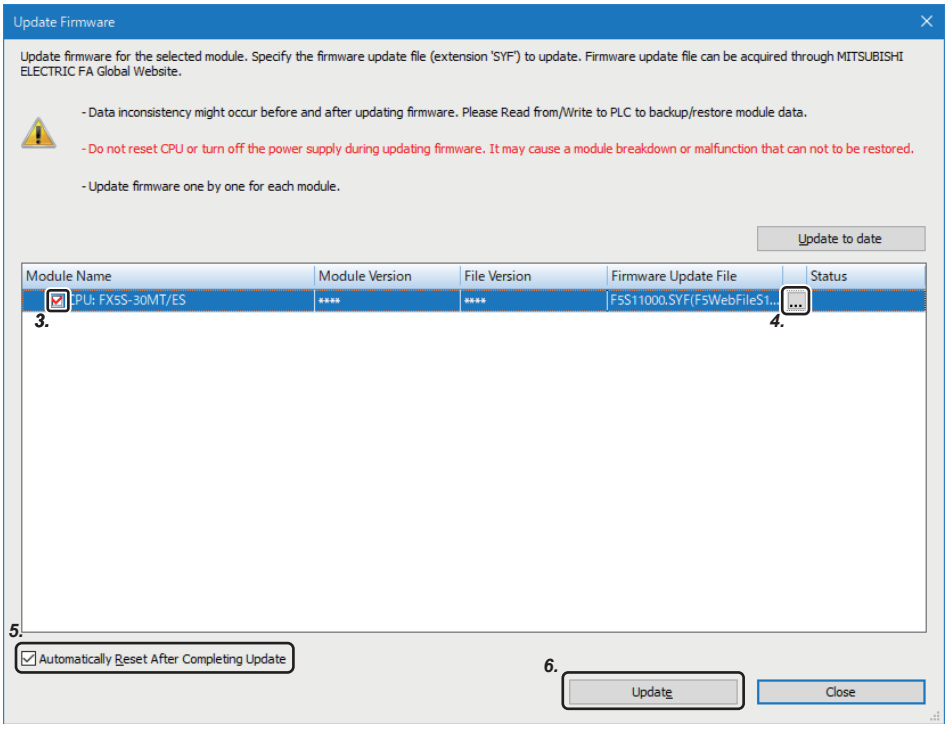
### ■Preliminary preparations

1. Download the firmware update information for the model to be updated from the Mitsubishi Electric FA website.
2. Decompress the firmware update information (ZIP file).
3. Store the "$MELPRJ$" folder containing the firmware update file and Web page update file into a desired folder.
4. Connect the engineering tool to the CPU module.
5. Stop the CPU module and system for which the firmware update function is to be executed. Turn off the power to other systems and devices connected to the CPU module. If the power cannot be turned off, disconnect communication cables.
6. Check that no other function is executed on the CPU module.
7. Check that no file operations such as writing to the programmable controller, online change, and file transfer function are executed. (If the update is started with a file operation being executed, the operated file may be damaged.)
8. If updating of the firmware is prohibited, cancel the prohibit setting. (☞ Page 94 Canceling the firmware update prohibited setting)
9. Check that no stop errors have occurred on the CPU module.
10. Before executing the firmware update, back up the various data such as the programs and parameters stored in the CPU module by using the engineering tool. Also, use the backup/restoration function to hold latch devices. (☞ Page 208 DATA BACKUP/RESTORATION FUNCTION)

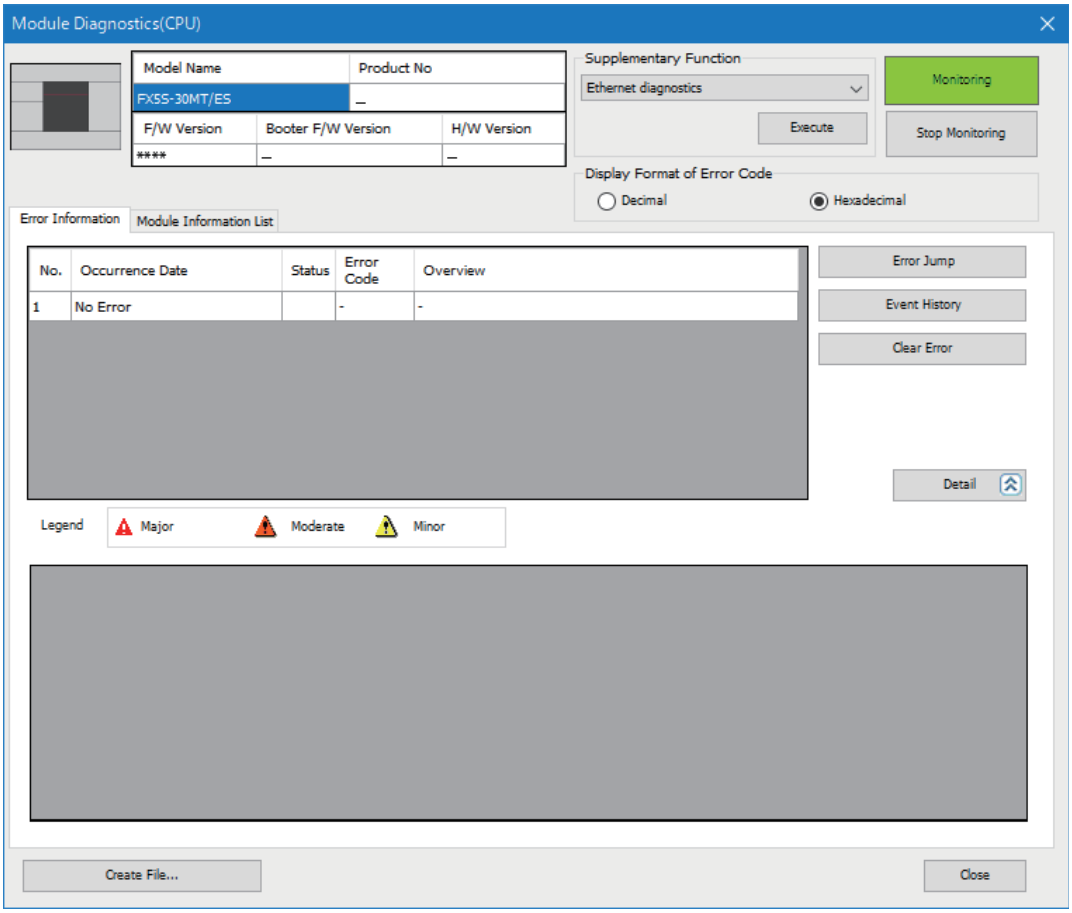
### ■Operation

1. Turn the CPU module power ON.
2. Display the firmware update screen of the engineering tool.

[Tool] ⇨ [Update Firmware]



3. Select the CPU module whose firmware will be updated.
4. Click [...], and select the firmware update file.
5. The CPU module is automatically reset. To prevent the CPU module from being automatically reset, deselect it. If it is deselected, the module will wait until it is manually reset after the completion of the firmware update.
6. Click [Update] to update the firmware. It takes about 2 minutes to complete the update. After the firmware update is started, the update status can be checked in the "Status" column.
7. If you did not check the box in 5 (Not automatically reset), turn the system power OFF and ON after the completion of the firmware update.
8. On the module diagnosis screen of the engineering tool, check that the firmware version has been updated.



## Firmware update prohibited setting

For the firmware update prohibited setting, refer to the following.

☞ Page 93 Firmware update prohibited setting
☞ Page 94 Canceling the firmware update prohibited setting

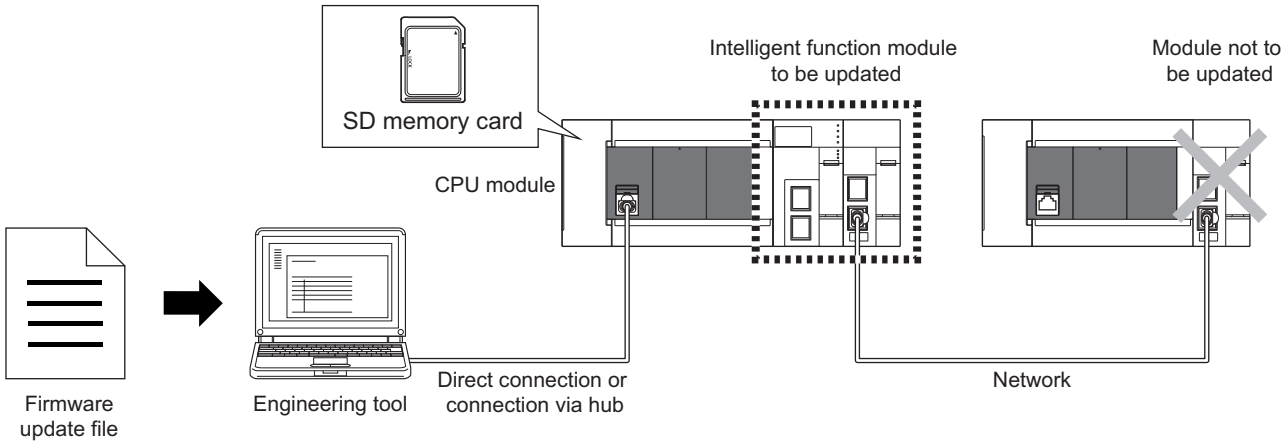
## Precautions

- Check the target model, and download the correct firmware update file from the Mitsubishi Electric FA website. The firmware will not be updated if the target model does not match.
- Do not change the data (folder and file name) downloaded from the Mitsubishi Electric FA website.
- If the CPU module to be updated cannot be selected in the engineering tool, update the engineering tool version.
- After checking that the CPU module to be updated is normally running, update the firmware.
- After checking that other functions have stopped, update the firmware.
- Update the firmware after checking that other systems connected on the network have stopped.
- Do not update the firmware while a function that accesses the SD memory card such as the file transfer function is in operation.
- Back up the various data such as the programs and parameters before executing the firmware update.
- Do not turn the power OFF or reset the CPU module while the firmware update is in progress.
- If the firmware update is interrupted due to reasons such as the cable between the CPU module and the engineering tool being disconnected or the engineering tool being terminated, the update may be completed with an error. For the recovery, check that the LED indication for the CPU module does not show that data is being written and reset the CPU module manually. When updating the firmware from a remote location, check that the CPU module can be reset manually before doing so.
- If the firmware update is completed with an error and "To Use or Not to Use DNS Server Settings" is set to "Use" in the web server settings, an error may occur. In this case, update the firmware again.
- If any of the following operations is performed during the period from the start to the end of the firmware update, the firmware update may complete with an error, or the module may be damaged.

- Turning off the power to the system under firmware update, or resetting the system
- Remotely operating from the engineering tool, or changing the operation status with the CPU module switch
- Operating the system under firmware update from an external device
- Connecting/disconnecting the communication cable connecting the CPU module and engineering tool
- Operating the engineering tool to start the firmware update
- Stopping the engineering tool

# Updating the firmware for the intelligent function module

The intelligent function module firmware can be updated by using the engineering tool.
Write the firmware update information from the engineering tool to the CPU module. The firmware of the target module can be updated by the CPU module writing the firmware information to the target module to be updated. (Hereinafter, the CPU module that writes the firmware update information is referred to as the update writing CPU module.)
An SD card must have been installed in the update writing CPU module in advance.




**Point**

- In other system configurations where the intelligent function module (system) for which the firmware to be updated is connected with a network, etc., an error may occur when the firmware update is executed. Therefore, confirm the system's safety before executing the firmware update.
- Back up the various data such as the programs in the CPU module and parameters before executing the firmware update.
- Only one intelligent function module can be updated by executing the function once.
- The intelligent function modules connected on the network are excluded from the firmware update.

## Target models

The target modules to be updated, and the models and versions compatible with the update writing CPU module are shown below.

### ■Update writing CPU module

The CPU modules that can write the firmware update file to the intelligent function modules via the engineering tool are shown below.

- FX5UJ CPU module
- FX5U CPU module
- FX5UC CPU module

### ■Target modules to be updated

The firmware of the following models can be updated.

| Target modules to be updated | | | | Firmware version of the update writing CPU module | Version of the engineering tool |
|---|---|---|---|---|---|
| Product | Model | Firmware version | Serial No. | | |
| Intelligent function module | FX5-ENET | "1.003" and above | 209**** and above | • FX5UJ CPU module "1.030" and above<br>• FX5U/FX5UC CPU module "1.240" and above | "1.075D" and above |
| | FX5-ENET/IP | "1.003" and above | 209**** and above | | |
| | FX5-CCLIEF | "1.005" and above | 20X**** and above | | |
| | FX5-CCLGN-MS | Initial product and above | Initial product and above | | |
| | FX5-OPC | Initial product and above | Initial product and above | | |
| | FX5-40SSC-G | Initial product and above | Initial product and above | | |
| | FX5-80SSC-G | Initial product and above | Initial product and above | | |

**Point**

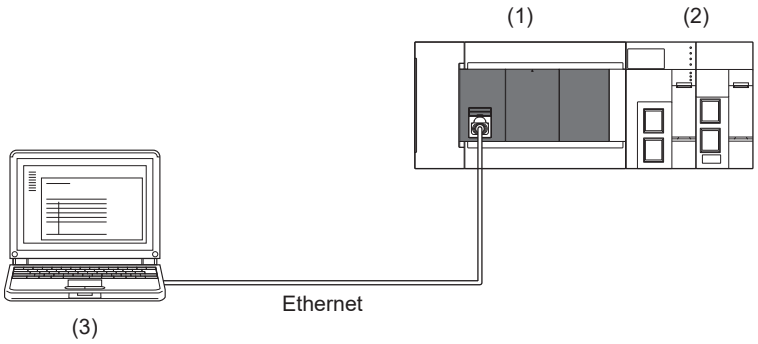
If the CPU module is not compatible, update the CPU module via an SD memory card. (☞ Page 89 Update Using an SD Memory Card)

## Communication route

The communication routes between the engineering tool supporting the firmware update function and the CPU module are shown below. For details, refer to the following.

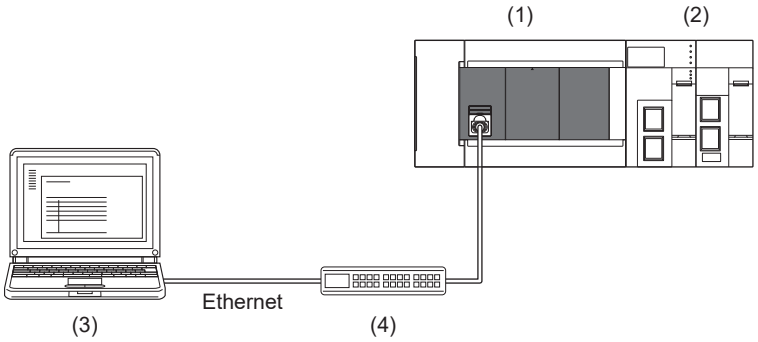
MELSEC iQ-F FX5 User's Manual (Communication)

### ■Direct Connection




(1) CPU module (Update writing CPU module)
(2) Intelligent function module (Target modules to be updated)
(3) Engineering tool

### ■Connection via hub




(1) CPU module (Update writing CPU module)
(2) Intelligent function module (Target modules to be updated)
(3) Engineering tool
(4) Hub

**Restriction**

Connection via GOT Transparent is not supported.

## Firmware update method

### ■Preliminary preparations

1. Download the firmware update information for the model to be updated from the Mitsubishi Electric FA website. (Firmware update file: F5mmvvvv.SYF)
2. If updating of the firmware is prohibited, cancel the prohibit setting. (☞ Page 94 Canceling the firmware update prohibited setting)
3. Before executing the firmware update, back up the various data such as the programs and parameters stored in the CPU module by using the engineering tool. Also, use the backup/restoration function to hold latch devices. (☞ Page 208 DATA BACKUP/RESTORATION FUNCTION)
4. Enable remote RESET. (☞ Page 121 Enabling remote RESET)
5. Execute RUN→STOP and turn the CPU module power OFF, and insert the SD memory card into the CPU module.

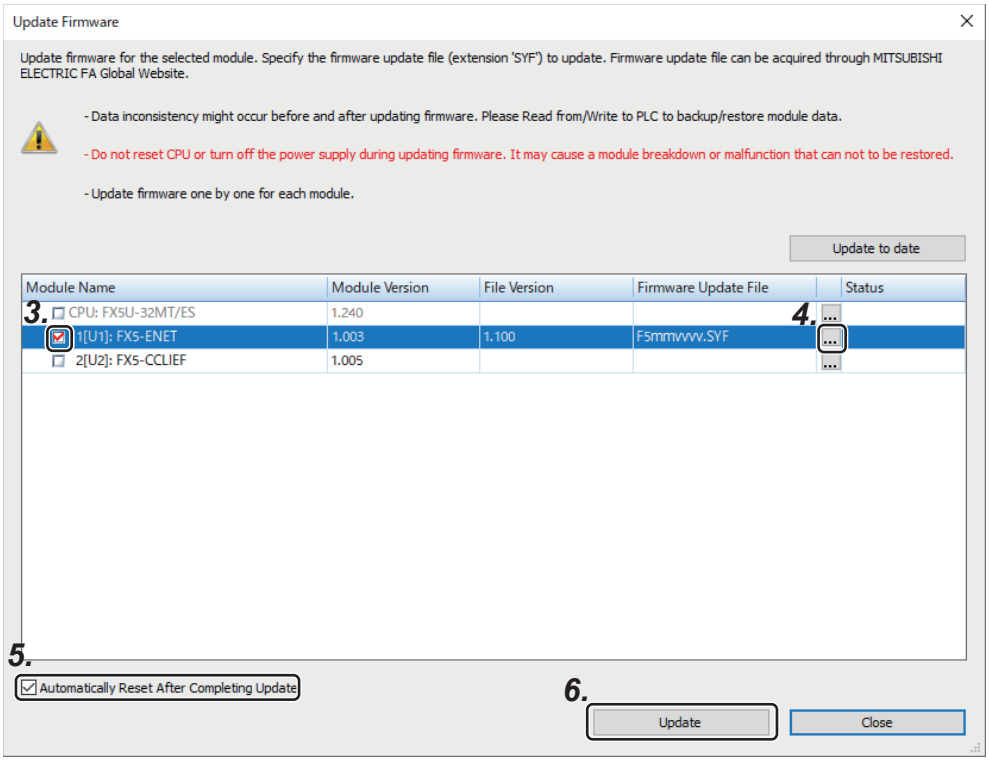
**Restriction**

If the SD memory card contains the firmware update files of the CPU module and intelligent function module, the firmware cannot be updated. Delete the firmware update files of the CPU module and intelligent function module from the SD memory card before starting the update.

### ■Operation

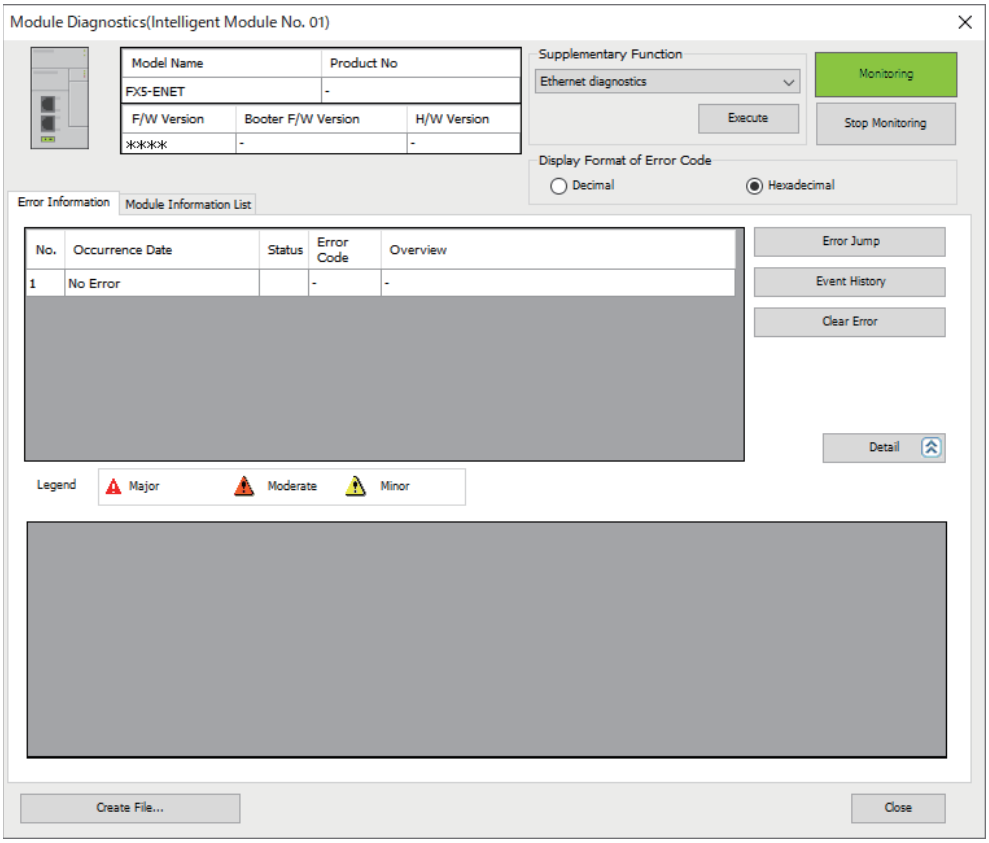
1. Turn the CPU module power ON.
2. Display the firmware update screen of the engineering tool.

[Tool] ⇨ [Update Firmware]



3. Select the intelligent function module whose firmware will be updated.
4. Click [...], and select the firmware update file.
5. The CPU module is automatically reset. To prevent the CPU module from being automatically reset, deselect it. If it is deselected, the module will wait until it is manually reset after the completion of the firmware update.
6. Click [Update] to update the firmware. It takes about 10 minutes to complete the update. After the firmware update is started, the update status can be checked in the "Status" column.
7. If you did not check the box in 5 (Not automatically reset), turn the system power OFF and ON after the completion of the firmware update.
8. To prohibit the remote RESET, disable remote RESET. (☞ Page 121 Enabling remote RESET)
9. On the "Module diagnosis (intelligent module)" window of the engineering tool, confirm that the firmware has been updated to the latest version.

[Diagnostics] ⇨ [System Monitor] ⇨ [Target module (intelligent function module)]




## Firmware update prohibited setting

For the firmware update prohibited setting, refer to the following.

☞ Page 93 Firmware update prohibited setting
☞ Page 94 Canceling the firmware update prohibited setting

## Precautions

- Check the target model, and download the correct firmware update file from the Mitsubishi Electric FA website. The firmware will not be updated if the target model does not match.
- Do not change the data (folder and file name) downloaded from the Mitsubishi Electric FA website.
- Before executing the firmware update, enable the CPU module reset setting. (☞ Page 121 Enabling remote RESET) If the update without enabling the reset setting was performed, do not turn the CPU module power OFF and ON or reset the module, and re-execute the update after enabling the reset setting.
- Update the firmware after confirming that the intelligent function module to be updated is normally running.
- Update the firmware after confirming that the function using the intelligent function module and SD memory card has stopped.
- Update the firmware after confirming that other systems connected on the network have stopped. Communication with other systems may be stopped.
- Back up the various data such as the programs and parameters before executing the firmware update.
- Do not turn the power OFF or reset the CPU module while the firmware update is in progress.
- Do not remove the SD memory card while the firmware update is in progress. If the SD memory card is removed before the firmware update finishes, the process may end with an error.
- If the automatic reset is disabled, manually turn the power OFF and ON after the completion of the update.
- If the system malfunctions after the completion of the firmware update, downgrade the firmware to the previous version. If your version is not found on the Mitsubishi Electric FA website, please consult your local Mitsubishi representative.
- If any of the following operations is performed during the period from the start to the end of the firmware update, the firmware update may complete with an error, or the module may be damaged.

- Turning OFF the power to the system under firmware update, or resetting the system
- Remotely operating from the engineering tool, or changing the operation status with the CPU module switch
- Removing the SD memory card
- Operating the system under firmware update from an external device
- Connecting/disconnecting the communication cable connecting the CPU module and engineering tool
- Connecting/disconnecting the module under firmware update
- Operating the engineering tool to start the firmware update
- Stopping the engineering tool

## Troubleshooting

If an error occurs, take corrective action according to the error code. (☞ Page 855 List of error codes)

If the error cannot be judged by the error code, check the following items and troubleshoot the situation.

| Error details | Action |
|---|---|
| The firmware update function screen is not displayed. | • Check that the communication route is connected to the built-in port of the CPU module (Ethernet (Ethernet port direct connection/connection via hub)), and re-execute the update.<br>• Check whether the firmware version of the CPU module is compatible with the update using the engineering tool. If the CPU module is not compatible, update the CPU module via an SD memory card. |
| The update file cannot be set. | Check that the firmware update file downloaded from the Mitsubishi Electric FA website has been selected, and re-execute the update. |
| The update is not performed even when [Update] is pressed, and an error message dialog is displayed. | • Check that the firmware update is not prohibited, and re-execute the update.<br>• Check whether or not the firmware update file of the CPU module or any intelligent function module remains in the "$MELPRJ$" folder in the SD memory card. If there is an unnecessary firmware update file, delete the file.<br>• Check that the SD memory card is inserted in the CPU module.<br>• Check that the version of the firmware update file is not the same as the firmware version of the module to be updated.<br>• Check that the remote reset setting is "Enable", and re-execute the update.<br>• Check that the firmware update file downloaded from the Mitsubishi Electric FA website has been selected, and re-execute the update. |
| An SD memory card error occurs during execution of the firmware update. | • Re-insert the SD memory card, and re-execute the update.<br>• Check that the SD memory card is not write-protected, and re-execute the update.<br>• Format the SD memory card, and re-execute the update.<br>If the same error still occurs after the above actions are taken, the SD memory card may have a hardware error. Replace the SD memory card. |
| The error code 1910H occurs during execution of the firmware update. | • Check whether or not the firmware update file of the CPU module or any intelligent function module not to be updated remains in the "$MELPRJ$" folder in the SD memory card. If there is an unnecessary firmware update file, delete the file.<br>• Format the SD memory card, and re-execute the update. |
| The error code 1911H occurs during execution of the firmware update. | Check that the specified intelligent function module is correctly inserted, and re-execute the update. |
| The error code 3040H occurs during execution of the firmware update. | • To execute the firmware update, an intelligent function module compatible with the new version is required. Please consult your local Mitsubishi representative.<br>• Check that the selected firmware update file matches the model of the module to be updated. |
| The error code 3041H or 3042H occurs during execution of the firmware update. | Check that the firmware update file downloaded from the Mitsubishi Electric FA website has been selected, and re-execute the update. |
| A communication timeout occurs during execution of the firmware update. | A communication timeout or a cable trouble may have occurred, or the programmable controller power is OFF or reset. Execute the following operations.<br>(1) Turn the CPU module power OFF and ON, and wait until the ERR LED and RUN LED flash. If the LEDs do not flash after 60 seconds, re-execute the firmware update.<br>(2) Turn the CPU module power OFF and ON again, and wait until the ERR LED and RUN LED turn off. After this, turn the CPU module power OFF and ON again. Then, the firmware update will be completed, and the module will start normally. If the ERR LED flashes and the RUN LED turns off, turn the CPU module power OFF and ON again.<br>In the following cases, the intelligent function module may have a hardware error. Please consult your local Mitsubishi representative.<br>• When the ERR LED flashes and the RUN LED turns off in (2), even after the CPU module power is turned OFF and ON twice, if the ERR LED flashes and the RUN LED turns off<br>• When the RUN LED does not turn off after 60 seconds in (2) |
| The firmware update is completed abnormally. | (1) Turn the CPU module power OFF and ON, and wait until the ERR LED and RUN LED turn off. If the LEDs do not flash, re-execute the firmware update.<br>(2) Turn the CPU module power OFF and ON again. Then, the firmware update will be completed, and the module will start normally. If the ERR LED flashes and the RUN LED turns off, turn the CPU module power OFF and ON again.<br>In the following cases, the intelligent function module may have a hardware error. Please consult your local Mitsubishi representative.<br>• When the ERR LED flashes and the RUN LED turns off in (2), even after the CPU module power is turned OFF and ON twice, if the ERR LED flashes and the RUN LED turns off<br>• When the RUN LED does not turn off after 60 seconds in (2) |

# 10 ONLINE CHANGE

This chapter describes online change.
Types of online change are as follows.

| Type | Description | Reference |
|---|---|---|
| Online ladder block change | Changes only part of the program or data during online change. | ☞ Page 106 Online Ladder Block Change<br>📖GX Works3 Operating Manual |
| Online change (SFC block) | Changes, adds, or deletes SFC blocks during online. | 📖MELSEC iQ-F FX5 Programming Manual (Program Design)<br>📖GX Works3 Operating Manual |

## 10.1 Online Ladder Block Change

Writes the portion edited on the ladder edit window of the engineering tool to the CPU module in increments of ladders. Edited contents spanning multiple files or multiple portions can be written to the CPU module at once.

**Point**

For details on the operating procedure of online ladder block change on engineering tools, refer to the following.
📖GX Works3 Operating Manual

### Editable contents

Within a program block, instructions and pointers (P, I) can be added, changed, or deleted. Also, as POU unit, program blocks can be added, changed, or deleted. However, when the program/FB file is not in agreement between engineering tool and a CPU module, it cannot be added, changed, or deleted.

### Range changeable in a single session

The following shows the number of steps and number of ladder blocks which can be changed in a single session.

- Number of ladder blocks in a file: 64 blocks or less (32767 steps or less)
- The total of the changed circuit block count in all files: 256 blocks or less
- The total capacity of the program file and the FB file after a change: 1 M bytes or less
- The total capacity of the target data for online change: 192 K bytes or less

### Online ladder block change during the boot operation

If online change of ladder block is executed from the SD memory card during boot operation, the corresponding file in the SD memory card, which is the boot source, can be changed as well.

### Precautions

This section describes the precautions on using online ladder block change.

#### Online change to SFC program

Online change to the SFC program cannot be performed. However, online change to the other programs which coexist with the SFC program (such as the ladder program) can be performed.

#### When deleting OUT instruction which is on

When deleting an OUT instruction (coil) which is not necessary for control, be sure to check that the OUT instruction is off before deleting it. If the OUT instruction is deleted without turning it off in advance, the output will be retained.

#### Program file not registered in program setting

A program file which is not registered in parameter setting cannot be written.

## The cautions at the time of repeatedly performing online change

When online change is performed repeatedly, RUN writing may not be able to be carried out due to insufficient memory in the CPU module. Please set the CPU module to STOP and write the program.

## The size of the target data at online change

When the size of the target data of online change exceeds 192 K bytes, online change fails and an error message is displayed on the engineering tool. The target data size may exceed 192 K bytes in the following cases:

- When the capacity of the edited program file exceeds 192 K byte
- When the total capacity of multiple edited program files exceeds 192 K byte

In the above mentioned cases, divide the program file in advance to reduce each file size, avoid performing online change to multiple program files all at one time (perform online changes to a few files at a time), or take other actions.*1

*1 Usually, online change is performed to only edited files. However, in the following cases, online change is performed to a file other than the edited file.
· When a global label or structure is changed, the program using the changed global label and structure is a target of online change.
· When FB or FUN is changed, the program using the changed FB and FUN is a target of online change.
For confirmation of the target file for online change and the file capacity, refer to the following.
GX Works3 Operating Manual

## Separate writing of a program and program restoration information

- It may take time to write data when writing a program and program restoration information separately.
- A project is automatically saved with the data writing. Therefore, it is necessary to register the project history in advance.
- If a project is not saved automatically, the data will also not be written to a CPU module.
- When writing fails, reset or cycle the power of the CPU module. Then, write the data to the CPU module in the STOP state.

When writing data to a CPU module by using the online program change function, a program and program restoration information can separately be written by setting "Yes" for the following option.

[Tool] ⇨ [Options] ⇨ "Convert" ⇨ "Online Program Change" ⇨ "Operational Setting" ⇨ "Divide to Write a Program and Program Restore Information"

**Point**

By writing a program and program restoration information separately, an error that occurs when the capacity of data to be written to a CPU module exceeds the maximum writable capacity may be cleared.
For supported version of separate writing of a program and program restoration information, refer to ☞ Page 971 Added and Enhanced Functions.

## When the online change (ladder block) is used

### ■Prohibited operation at online ladder block change

When an online change of ladder block, if the power is turned OFF or a reset is made, the process does not end normally. Such operation is made, execute rewriting to the programmable controller.

### ■Initializing the last execution if the ladder at online ladder block change has an FB call

- If a subroutine type FB is called in a FB definition, the execution information of the previous time in the FB definition of the subroutine type FB is not initialized.
- If a macro type FB is called in the FB definition of a subroutine type, the execution information of the previous time in the part equivalent to the macro type FB is not initialized either.

### ■Instructions not compatible with online ladder block change

Do not execute online change to ladder block including the following instruction.

DSZR/DDSZR instruction, DVIT/DDVIT instruction, TBL instruction, DRVTBL instruction, PLSV/DPLSV instruction, DRVI/DDRVI instruction, DRVA/DDRVA instruction, DRVMUL instruction, PLSY/DPLSY instruction, PWM/DPWM instruction, SPD/DSPD instruction, HIOEN/DHIOEN instruction, UDCNTF instruction, DABS instruction, ADPRW instruction, IVCK instruction, IVDR instruction, IVRD instruction, IVWR instruction, IVBWR instruction, IVMC instruction, S(P).CPRTCL instruction, RS2 instruction, SP.SOCOPEN instruction, SP.SOCCLOSE instruction, SP.SOCSND instruction, SP.SOCRCV instruction, SP.ECPRTCL instruction, RBFM instruction, WBFM instruction

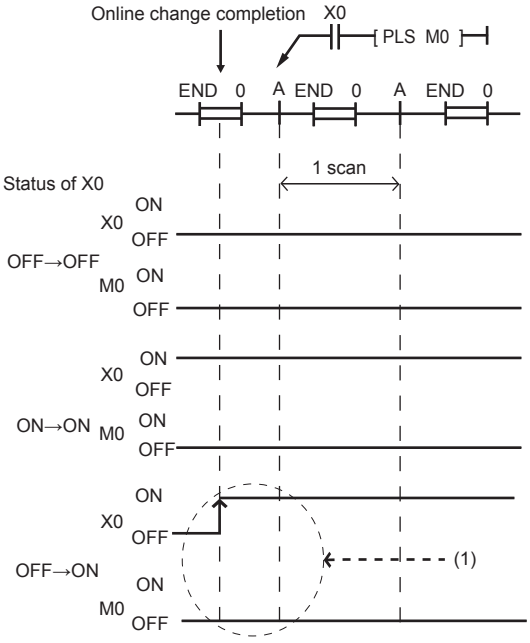
### ■The operation when a pulse related instruction is included in the range of an online ladder block change

The operation when a pulse related instruction is included in the range of an online ladder block change is as follows.

| Pulse related instruction | Description |
|---|---|
| Rising instruction<br>(PLS and □P instructions) | When a rising instruction exists within the range to be changed, the rising instruction will not be executed even if the execution condition (OFF to ON) is fulfilled at completion of online program change. |
| Falling instruction<br>(PLF and □F instructions) | When a falling instruction exists within the range to be changed, the falling instruction will not be executed even if the execution condition (ON to OFF) is fulfilled at completion of online program change. |

**Rising instruction**

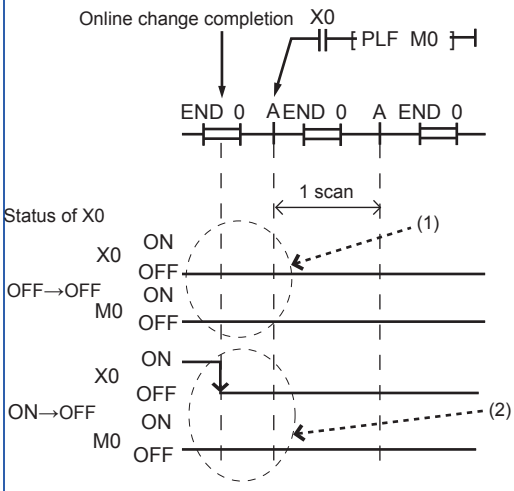
When a rising instruction exists within the range to be changed, the rising instruction will not be executed even if the execution condition (OFF to ON) is fulfilled at online change (ladder block).




(1) The rising instruction will not be executed even if the execution condition is OFF to ON.

**Falling instruction**

When a falling instruction exists within the range to be changed, the falling instruction will not be executed even if the execution condition (ON to OFF) is fulfilled at online change (ladder block).




(1) The falling instruction will not be executed even if the execution condition is OFF to OFF.
(2) If online program change and transition of ON to OFF occur simultaneously, the falling instruction will not be executed.

## Online change (ladder block) when another function is performed

Online ladder block change cannot be executed while executing the backup/restoration function. (☞ Page 208 DATA BACKUP/RESTORATION FUNCTION) Confirm that the backup/restoration function is not being executed before executing the online ladder block change.

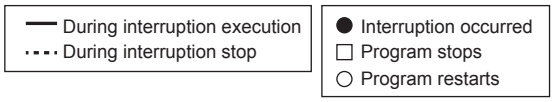
# 11 INTERRUPT FUNCTION

This chapter describes the interrupt function.

## 11.1 Multiple Interrupt Function

When an interrupt occurs while an interrupt program triggered by another cause is running, stops the program if its priority is lower than that of the new interrupt, and runs the higher-priority program whenever its execution condition is satisfied.



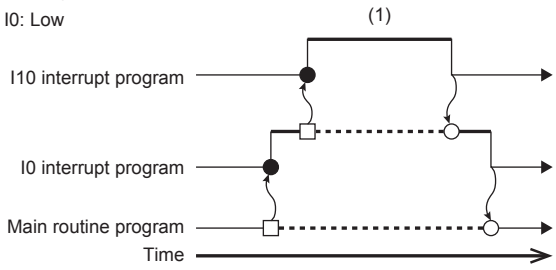



• When the multiple interruption function is enabled

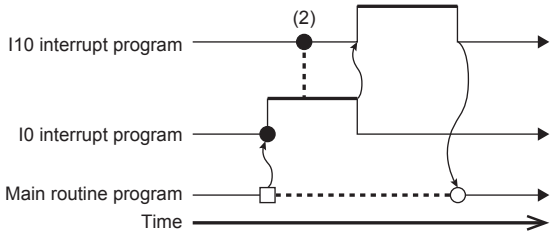
[Priority]

• I10: High

• I0: Low




• When not set (at default)




(1) A high-priority interrupt is executed by interrupting a low-priority interrupt.

(2) Even if a high-priority interrupt occurs, it enters the waiting status until the executing interrupt is completed.

### Precautions

A watchdog timer error may occur under the following conditions.

- When the interrupt frequency is high
- When the interrupt program execution time is long

When a watchdog timer error occurs, review the call frequency and execution time of the interrupt program.

## Interrupt priority

If the interrupt priority of a program for which its execution condition has been satisfied is higher than that of the running program, the programs are executed in accordance with their interrupt priority. If the interrupt priority of the new program is the same or lower, it enters the waiting status until the running program finishes. (☞ Page 72 The priority for the interrupt pointer numbers and interrupt factors)

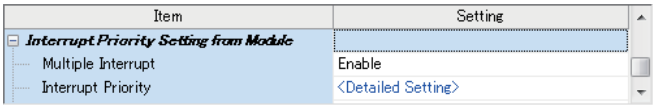
## Interrupt priority setting

The interrupt priority (1 to 3) of interruptions from modules can be changed.

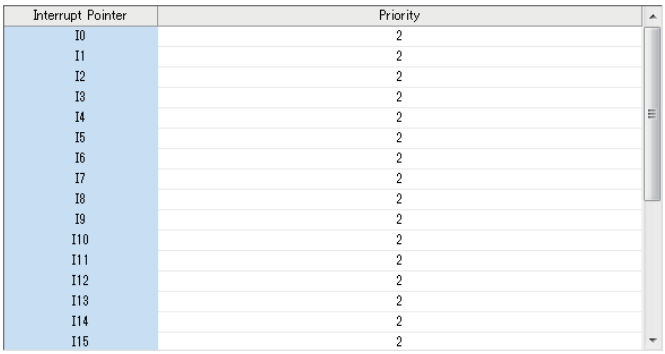
Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [CPU Parameter] ⇨ "Interrupt Settings" ⇨ "Interrupt Priority Setting from Module"

### Operating procedure

"Interrupt Settings" window




"Detailed Setting" window




1. Set Multiple Interrupt to "Enable" on the "Interrupt Settings" window, and click "Detailed Setting".
2. Change the priority of each interrupt pointer.

### Displayed items

| Item | | Description | Setting range | Default |
|---|---|---|---|---|
| Multiple Interrupt | | Sets whether or not to enable multiple interrupt. | • Disable<br>• Enable | Disable |
| Interrupt Priority | Detailed Setting | Sets the priority of the interrupt pointers I0 to I23, I28 to I31, and I50 to I177. | 1 to 3*1 | 2 |

*1 The lower the numerical value, the higher the interrupt priority.

## Disabling/enabling interrupts with a specified or lower priority

Interrupts with a priority equal or lower than that specified by the DI or EI instruction can be disabled or enabled even when multiple interrupts are present.

For details, refer to MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks).

**Point**

Disabled interrupt priorities and the current interrupt priority can be checked in SD758 (Interrupt disabling for each priority setting value) and SD757 (Current interrupt priority) respectively.

# 11.2 Input Interrupt Delay Function

The input interrupt delay function can delay the execution of the interrupt program in units of 1 ms.
By delaying the execution of the interrupt program, the installation position of the sensor used for the input interrupt can be adjusted by program without shifting the actual installation position.
The input interrupt delay function has the following specifications.
☞ Page 111 Delay time setting
☞ Page 112 Delay execution of the interrupt program



**Point**

- If this function is used for Interrupt (Rising) + Pulse Catch, pulse catch will not be delayed.
- For versions that support the input interrupt delay function, refer to the following.

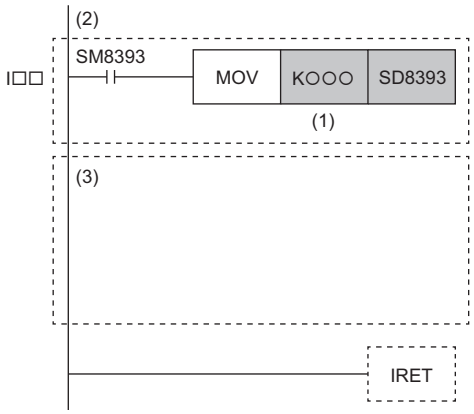
☞ Page 971 Added and Enhanced Functions

## Delay time setting

The delay time can be set in units of ms (1 to 32767) for the I0 to I15 interrupt pointers using the pattern program.

### Setting method

The delay time is set by the pattern program.
After the delay time specified by the pattern program has elapsed, the interrupt program is executed.




(1) Delay time (unit: ms)
(2) Contact for setting delay time
(3) Programs to be processed by input interrupts

- Always describe the delay time setting program at the top of the interrupt program, and change only the delay time (1). If it is not described at the top of the interrupt program, it will not be recognized as a pattern program and the delay time will not be set.
- Describe the pattern program in the interrupt pointers I0 to I15. If it is described in an interrupt pointer other than I0 to I15, it will not be recognized as a pattern program and the delay time will not be set.
- Only constants (K, H) or data register (D) can be used for this time setting. If any other device is used, the delay time setting becomes invalid and operates as a normal input interrupt. If the set data register (D) is 0 or less, the delay time setting becomes invalid and operates as a normal input interrupt.

**Point**

- The pattern programs written for each I-pointer number all use the same SM8393 (delay time setting contact) and SD8393 (delay time). However, different delay times can be set and operated for each I-pointer number.
- If the data register (D) is specified for the delay time setting of the pattern program, the delay time can be changed by changing the value of the data register (D) even while the CPU module is running. In that case, the value stored when the interrupt is generated becomes the delay time. However, if the value at that time is outside the range that can be specified as the delay time, the interrupt program is executed immediately without delay.

# Delay execution of the interrupt program

When an interrupt is generated, the execution of the interrupt program is delayed for the preset delay time.

## Interrupt priorities that can be used

The interrupt priorities that can be used with the input interrupt delay function are shown below.

| Interrupt priority | Availability | Remarks |
|---|---|---|
| 1 | × | If it is set, the program operates with no delay time. |
| 2 | ○ | — |
| 3 | ○ | — |

## Operation during delay

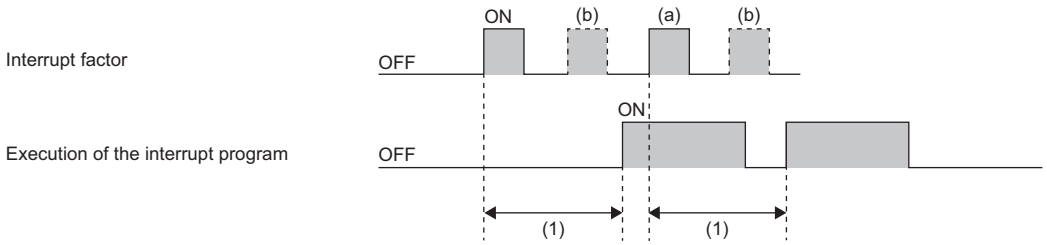
The following shows the relationship between delay time measurement and interrupt program execution when the status of the CPU module changes during the delay.

### ■If the same interrupt is generated

The interrupt generation timing and interrupt enable/disable patterns are shown below. If the interrupt is disabled, the delay time is not measured and the interrupt program is not executed.

| Interrupt generation timing | | Interrupt |
|---|---|---|
| During delay | | Disabled |
| Not during delay | Interrupt program running | Enabled |
| | Interrupt program not running | Enabled |

• Operation when the same interrupt is generated




(1) Delay time

(a) Enabled
(b) Disabled

If an interrupt is generated even when interrupt is disabled (DI), it will be delayed. After the delay time has elapsed, the interrupt program is executed as soon as interrupt is enabled (EI).

### ■If the input interrupt delay function operates in the PAUSE state

Even if the CPU module is in the PAUSE state, the delay time is measured when an interrupt is generated. Also, the delay time measurement continues even if the PAUSE state occurs during delay. If the delay time has elapsed during PAUSE, the interrupt program is executed when interrupt is enabled (EI) after RUN. If the same interrupt is generated multiple times during PAUSE, the first interrupt is stored only once.

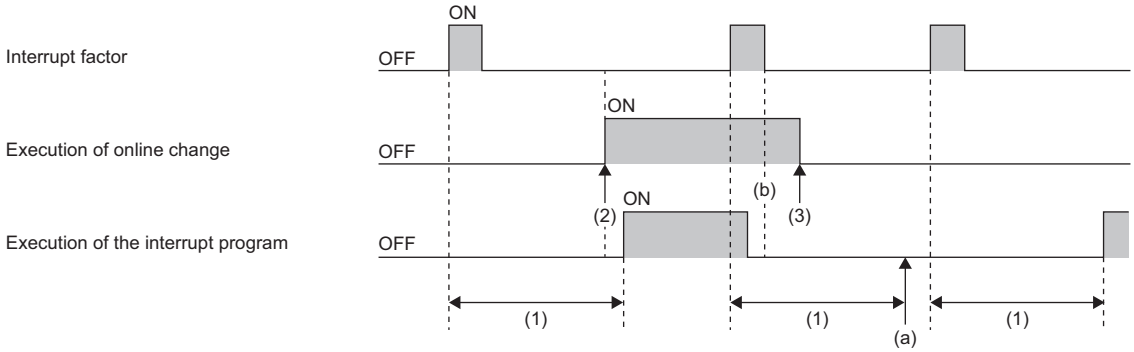
### ■If the input interrupt delay function operates while interrupt is disabled (DI)

The input interrupt delay function measures the delay time even if interrupt is disabled (DI) for the CPU module when an interrupt is generated.

If interrupt is disabled (DI) after the delay time has elapsed, the interrupt that was generated is stored, and the stored interrupt program is executed when interrupt is enabled (EI). If the same interrupt is generated multiple times, the first interrupt is stored only once. However, note that all interrupt causes are discarded when interrupt disable is specified by the IMASK and SIMASK instructions.

## Precautions

If online change is performed during the delay, the interrupt program will be executed after the delay time has elapsed. However, depending on the timing at which online change is performed, the delay time confirmation operation will not be executed, nor will the interrupt program that is executed after the delay elapses.




(1) Delay time
(2) Online change starts
(3) Online change disabled

(a) The interrupt program is not executed.
(b) Binary modification: The delay time measurement is discarded. Therefore, after the delay time has elapsed, the interrupt program is also not executed.

# 12 SCAN MONITORING FUNCTION

This function detects CPU module hardware or program errors by monitoring the scan time. Using the watchdog timer, which is an internal timer in the CPU module, the following scans are monitored.

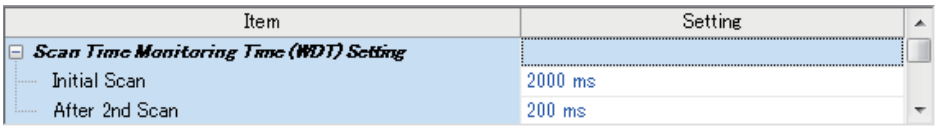
- Initial scan (1st scan)
- 2nd scan and after

## 12.1 Scan Time Monitoring Time Setting

Sets the scan time monitoring time.

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [CPU Parameter] ⇨ "RAS Setting" ⇨ "Scan Time Monitoring Time (WDT) Setting"

### Window




### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Initial Scan | Sets the scan-time monitoring time (WDT) for the initial scan (first scan). | 10 to 2000ms (10ms units) | 2000 ms |
| After 2nd Scan | Sets the scan-time monitoring time (WDT) for the second and later scans. | 10 to 2000ms (10ms units) | ■FX5S CPU module<br>500ms<br>■FX5U/FX5UC CPU module<br>200 ms |

## 12.2 Resetting of the Watchdog Timer

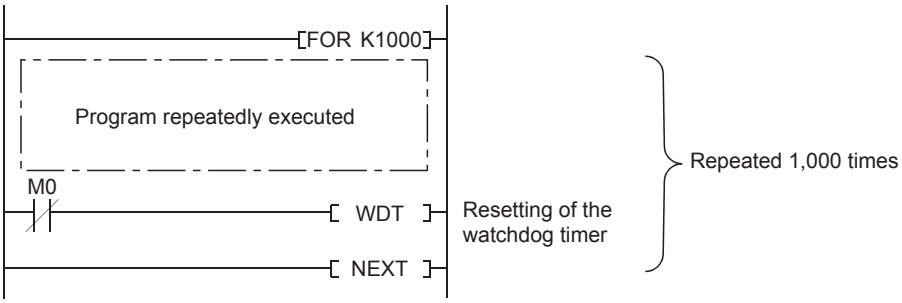
Resets the watchdog timer when the END/FEND instruction is executed. When the CPU module operates normally and executes the END/FEND instruction within the watchdog timer setting, the time of the watchdog timer will not time up. If the END/FEND instruction cannot be executed within the watchdog timer setting due to increased program execution as a result of hardware error or interrupt in the CPU module, the time of the watchdog timer will time up.

# 12.3 Precautions

The following precautions relate to the scan monitoring function.

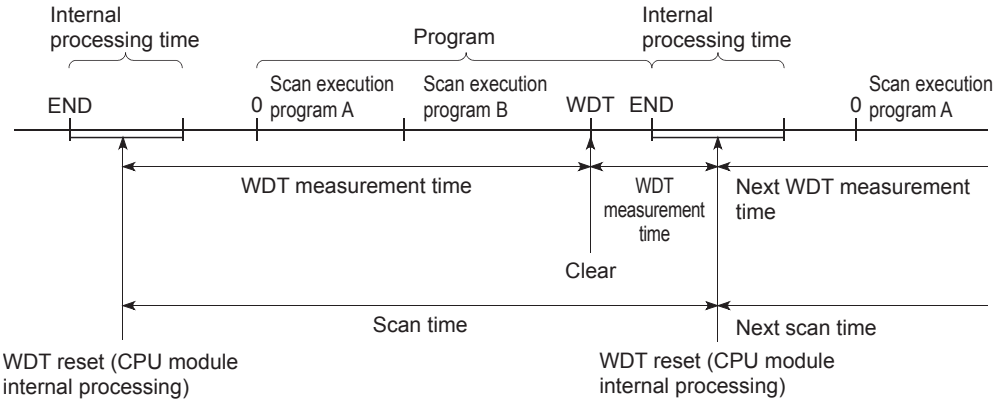
## Watchdog timer reset when executing a program repeatedly

The watchdog timer can be reset by executing the WDT instruction in a program. If the time of the watchdog timer is up while executing a program repeatedly by the FOR instruction and NEXT instruction, use the WDT instruction to reset the watchdog timer.




## Scan time when the WDT instruction is used

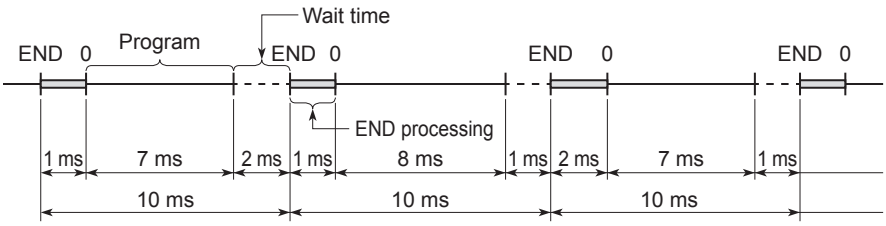
Even though the watchdog timer is reset using the WDT instruction, the scan time value is not reset. The scan timer value is the value measured up to the END instruction.



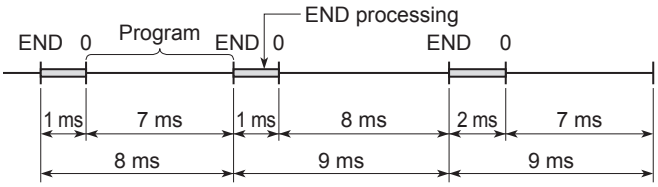
# 13 CONSTANT SCAN

Since the processing time differs as per the execution/non-execution of command used in the program, the scan timer changes with every scan. By setting the constant scan, because a program can be repeatedly executed while keeping scan time at a specified amount of time, even when the execution time of the program changes, the I/O refresh interval can be constant.

- When constant scan is set (Settings value=10 ms)




- When constant scan time is not set




## 13.1 Constant Scan Settings

Sets the constant scan setting.

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [CPU Parameter] ⇨ "RAS Setting" ⇨ "Constant Scan Setting"

### Window


### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Constant Scan | Sets the constant scan time. | ■FX5S/FX5UJ CPU module<br>• 0.5 to 2000ms (0.1ms units)<br>■FX5U/FX5UC CPU module<br>• 0.2 to 2000ms (0.1ms units) | — |

## Conditions of setting time

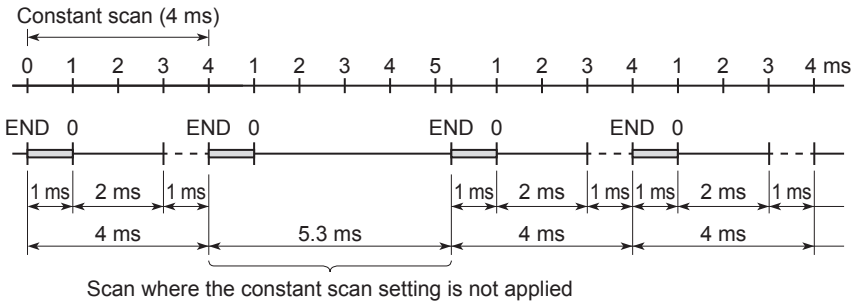
Set a value that meets the following relational equation for the setting time of the constant scan.

"WDT setting time" > "Constant scan setting time" > "Maximum scan time of the program"

When the maximum scan time of the program is longer than the setting time of the constant scan, it results in error. The constant scan time is ignored and it is executed with the scan time of the program.

**Ex.**

When the constant scan time is set to 4 ms




## Wait time from the execution of END process until the beginning of the next scan

When there is a processing mentioned below requested during wait time, the processing of the program is interrupted and the corresponding process is carried out.

- Interrupt program
- Fixed scan execution type program
- Event execution type program which triggers the generation of interruption
- Device/label access service processing

# 14 REMOTE OPERATION

A remote operation is an operation to externally change the operation status of the CPU module with the RUN/STOP/RESET switch of the CPU module set to the RUN position.
The following items show the types of remote operation.

- Remote RUN/STOP
- Remote PAUSE
- Remote RESET

## 14.1 Remote RUN/STOP

This operation externally changes the CPU module to RUN/STOP status with the RUN/STOP/RESET switch of the CPU module set to the RUN position. It is used to reach a CPU module in an inaccessible place or in case of changing the status of the CPU module in the control box to RUN/STOP status with an external signal.

### Applications of remote RUN/STOP

It is usable in the following cases.

- When the CPU module is in an inaccessible place
- When changing the status of the CPU module in the control box to RUN/STOP from outside

### Operation during remote RUN/STOP

In case of remote RUN/STOP, the operation of the program is as shown below.

#### At remote STOP

A program is executed up-to END instruction and changes to STOP status.

#### At remote RUN

When remote RUN is executed in the STOP status, once again the CPU module turns to RUN status and the program is executed from step 0.

### Method of execution of remote RUN/STOP

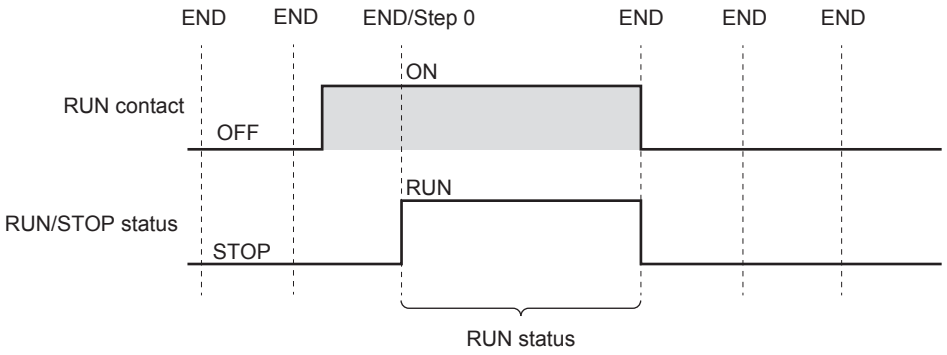
The following are the methods of execution of remote RUN/STOP.

#### Contact method

Set the RUN contact in the parameter. The allowable device range is X0 to X17.
Execute remote RUN/STOP by contact ON/OFF. Set the correspondence of ON/OFF and RUN/STOP operation of the contact in CPU parameters.

- When set to RUN at contacts ON

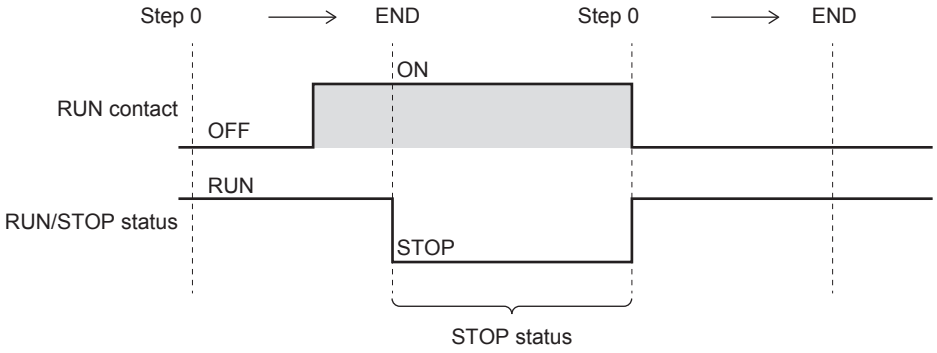
When contact is set to OFF, the CPU module is in the STOP status.
When contact is set to ON, the CPU module is in the RUN status.



• When set to RUN at contacts OFF

When contact is set to OFF, the CPU module is in the RUN status.

When contact is set to ON, the CPU module is in the STOP status.




## Engineering tool method

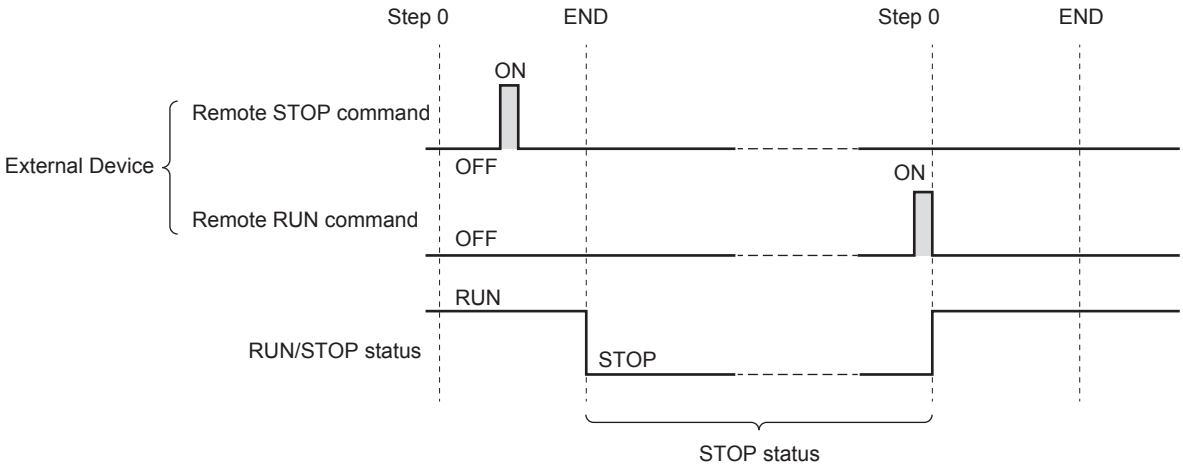
Refer to the following.

GX Works3 Operating Manual

## Method using external devices that use SLMP or MC protocol

Execute by SLMP or MC protocol 1C/3C/4C frame command. For details on commands, refer to the following manual.

MELSEC iQ-F FX5 User's Manual (Communication)




### Precautions

Describes the precautions on using remote RUN/STOP.

- When remote RUN is performed during execution of the data logging function, it may fail. In that case, wait for a while and retry remote RUN. (☞ Page 192 About remote operation)
- When remote STOP to RUN operation of the RUN contact during execution of the data logging function, it may take time to return to the RUN state.

# 14.2 Remote PAUSE

With the RUN/STOP/RESET switch set to the RUN position of the CPU module, the operation status is changed to PAUSE status from outside. The PAUSE status is a status in which operation of the CPU module is stopped by holding the ON/OFF status of all output (Y).

## Application of remote PAUSE

Remote PAUSE can be used to hold the output (Y) turned ON when the CPU module is in the RUN status, in the same ON status, even when the CPU module is changed to STOP status.

## Method of execution of remote PAUSE

The following are the methods of execution of remote PAUSE.

### Engineering tool method

Refer to the following.

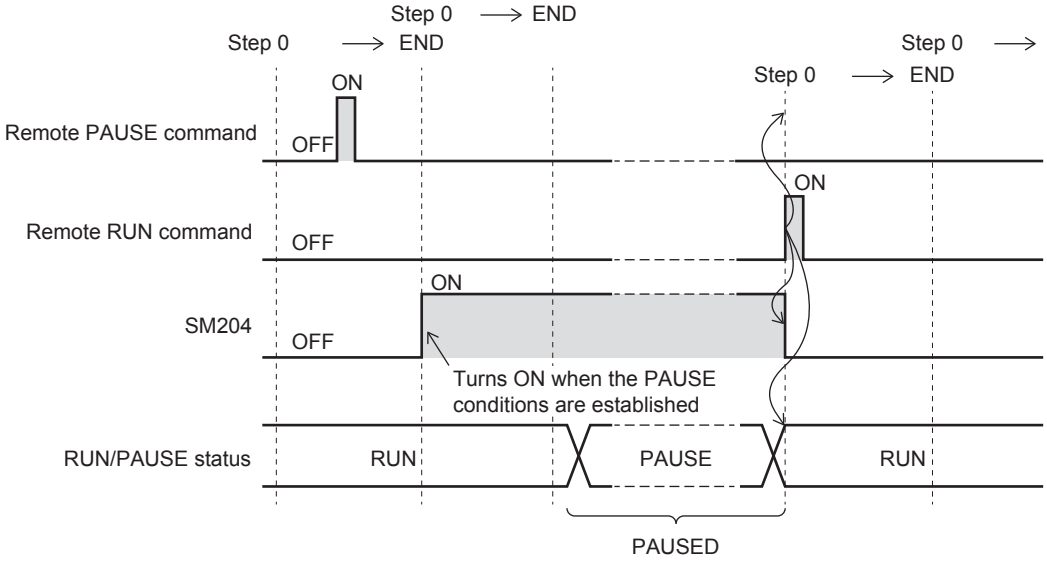
GX Works3 Operating Manual

### Method using external devices that use SLMP or MC protocol

Execute by SLMP or MC protocol 3C/4C frame command. For details on commands, refer to the following manual.

MELSEC iQ-F FX5 User's Manual (Communication)

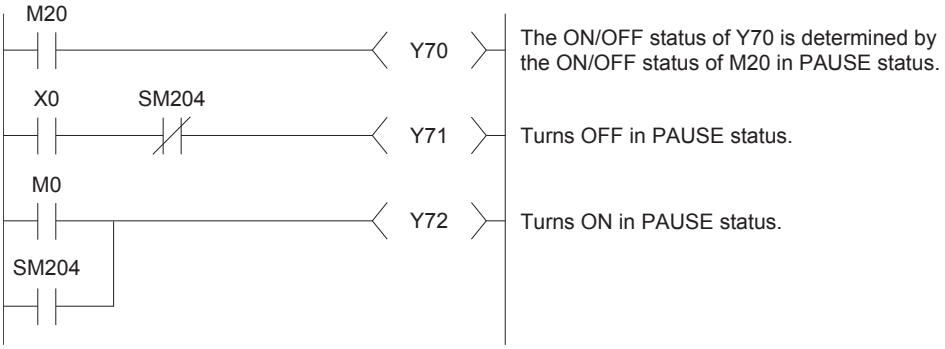
- Turns ON the PAUSE contact (SM204) when executing the END process of the scan that has received the remote PAUSE command. When a PAUSE contact is turned ON and the next scan is executed up-to the END process, the CPU module enters the PAUSE status and operation is stopped.
- When a remote RUN command is received, once again an operation of the sequence program is executed from step 0.



### Precautions

**■When keeping in forced ON or OFF status in advance**

When keeping in forced ON or OFF status in advance, interlock using the PAUSE contact (SM204).




# 14.3 Remote RESET



This is an operation to reset the CPU module by an external operation when the CPU module is in the STOP status. In addition, even if the RUN/STOP/RESET switch of the CPU module is set to RUN position, reset is possible when the CPU module has stopped due to occurrence of an error that can be detected by self-diagnosis function.

## Application of remote RESET

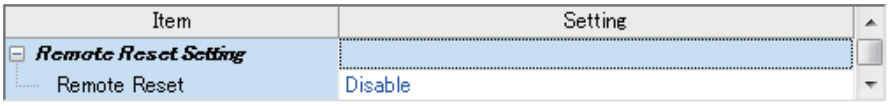
When a CPU module is in an inaccessible place and an error has occurred, CPU module can be reset by a remote operation.

## Enabling remote RESET

To remotely RESET, remote RESET must be enabled.

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [CPU Parameter] ⇨ "Operation Related Setting" ⇨ "Remote Reset Setting"

### Window




### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Remote Reset | Set whether or not to enable remote RESET. | • Disable<br>• Enable | Disable |

## Method of execution of remote RESET

The following are the methods of execution of remote RESET.

### Engineering tool method

Refer to the following.

GX Works3 Operating Manual

### Method using external devices that use SLMP or MC protocol

Execute by SLMP or MC protocol 3C/4C frame command. For details on commands, refer to the following manual.
MELSEC iQ-F FX5 User's Manual (Communication)

**Point**

When executing remote RESET, the settings that allow the remote reset of the CPU parameter must be written to CPU module beforehand. In the case that they are not set, remote RESET will not be possible.

#### Precautions

**■Remote RESET in RUN status**

When the CPU module is in RUN status, it cannot be reset by remote RESET. Change the CPU module to STOP status by operations like remote STOP and then execute remote RESET.

**■State after completion of the reset process**

When the reset process is completed on a CPU module on which remote RESET was executed, the CPU module will change to an operation status set by the RUN/STOP/RESET switch. Setting the RUN/STOP/RESET switch to the STOP position, will change the status to STOP and setting the switch to the RUN position will change the status to RUN.

**Point**

- Note that if a remote RESET is executed when the CPU module has stopped due to an error, the CPU module will change to an operation status set by the RUN/STOP/RESET switch, by reset process completion.
- If status of CPU module does not change even after executing remote RESET by engineering tool, check the remote reset settings in the CPU parameter. If it is not set, even after completion of the remote process of engineering tool, reset process of the CPU module will not be carried out.

**■When an error occurs due to noise**

When an error occurs in the CPU module due to noise, exercise caution as there is a possibility that the CPU module cannot be reset by remote RESET. When reset by remote RESET is not possible, either execute reset by RUN/STOP/RESET switch or once again start up the power of CPU module.

# 14.4 Relationship Between Remote Operation and CPU Module

### Relationship between remote operation and RUN/STOP status of the CPU module

The following table shows operation status of the CPU module by the combination of remote operation and RUN/STOP status of the CPU module.

| Switch RUN/STOP status | Remote operation | | | |
|---|---|---|---|---|
| | RUN*1 | STOP | PAUSE | RESET*2 |
| RUN | RUN | STOP | PAUSE | Operation not possible*3 |
| STOP | STOP | STOP | STOP | RESET*4 |

*1 When executing by the RUN contact, setting of RUN contact is required in the CPU parameter.
*2 Remote reset setting is required in the CPU parameter.
*3 When a CPU module is changed to STOP status by a remote operation, remote reset is possible.
*4 Includes even the cases where CPU module has stopped due to an error.

# 15 LATCH FUNCTION

The contents of each device/label of the CPU module is cleared in the cases described below and changed to its default value.

- At power OFF→ON of the CPU module
- At reset
- A power failure that exceeded allowable momentary power interruption

The contents of each device/label with latch setting will be maintained in case of power failure even in the above-mentioned cases. Therefore, when the data is managed by continuous control, even if power of the CPU is turned OFF or there is a power failure that exceeds the allowable momentary power interruption, all data can be maintained and control can be continued.

## 15.1 Types of Latch

There are two types of latches, latch (1) and latch (2).
Latch clear range can be set by selecting latch (1) or latch (2).
For latch clearing, refer to ☞ Page 126 Clearing of Data of the Latch Range.

## 15.2 Device/label that can be Latched

The devices and labels that can be latched are described below.



### The devices that can be latched

The devices that can be latched are described below.

#### ■FX5S CPU module

| Device | Specification method | Latch range | Applicable latch type |
|---|---|---|---|
| Internal relay (M) | Specify the latch range. | M384 to M1999 | Latch (1) or Latch (2) |
| Latch relay (L) | Specify the number of points. | L0 to L7679 | Latch (1) or Latch (2) |
| Link relay (B) | Specify the latch range. | — | Latch (1) or Latch (2) |
| Annunciator (F) | Specify the latch range. | F0 to F99 | Latch (1) or Latch (2) |
| Step relay (S) | Specify the latch range. | S0 to S4095 | Latch (1) only |
| Timer (T)/Accumulation timer (ST) | Specify the latch range. | —/ST0 to ST15 | Latch (1) or Latch (2) |
| Counter (C)/Long counter (LC) | Specify the latch range. | C16 to C199/LC20 to LC63 | Latch (1) or Latch (2) |
| Data register (D) | Specify the latch range. | D128 to D1999 | Latch (1) or Latch (2) |
| Extended file register (ER) | The latch setting is not required because extended file register (ER) is the device held only in the SD memory card. (All latch points fixed) | ER0 to ER32767 | — |

#### ■FX5UJ CPU module

| Device | Specification method | Latch range | Applicable latch type |
|---|---|---|---|
| Internal relay (M) | Specify the latch range. | M384 to M7679 | Latch (1) or Latch (2) |
| Latch relay (L) | Specify the latch range. | L0 to L7679 | Latch (1) or Latch (2) |
| Link relay (B) | Specify the latch range. | — | Latch (1) or Latch (2) |
| Annunciator (F) | Specify the latch range. | F0 to F99 | Latch (1) or Latch (2) |
| Step relay (S) | Specify the latch range. | S0 to S4095 | Latch (1) only |
| Timer (T)/Accumulation timer (ST) | Specify the latch range. | —/ST0 to ST15 | Latch (1) or Latch (2) |
| Counter (C)/Long counter (LC) | Specify the latch range. | C16 to C199/LC20 to LC63 | Latch (1) or Latch (2) |
| Data register (D) | Specify the latch range. | D128 to D7999 | Latch (1) or Latch (2) |
| Extended file register (ER) | The latch setting is not required because extended file register (ER) is the device held only in the SD memory card. (All latch points fixed) | ER0 to ER32767 | — |

### ■FX5U/FX5UC CPU module

| Device | Specification method | Latch range | Applicable latch type |
|---|---|---|---|
| Internal relay (M) | Specify the latch range. | M500 to M7679 | Latch (1) or Latch (2) |
| Latch relay (L) | Specify the number of points. | L0 to L7679 | Latch (1) or Latch (2) |
| Link relay (B) | Specify the latch range. | — | Latch (1) or Latch (2) |
| Annunciator (F) | Specify the latch range. | — | Latch (1) or Latch (2) |
| Step relay (S) | Specify the latch range. | S500 to S4095 | Latch (1) only |
| Timer (T)/Accumulation timer (ST) | Specify the latch range. | —/ST0 to ST15 | Latch (1) or Latch (2) |
| Counter (C)/Long counter (LC) | Specify the latch range. | C100 to C199/LC20 to LC63 | Latch (1) or Latch (2) |
| Data register (D) | Specify the latch range. | D200 to D7999 | Latch (1) or Latch (2) |
| Link register (W)*1 | Specify the latch range. | — | Latch (1) or Latch (2) |
| File register (R)*1 | Specify the latch range. | — | Latch (1) or Latch (2) |
| Extended file register (ER) | The latch setting is not required because extended file register (ER) is the device held only in the SD memory card. (All latch points fixed) | ER0 to ER32767 | — |

*1 Link register (W) and file register (R) can be latched only when an optional battery is used.

## Labels that can be latched

The labels that can be latched are described below.

| Label | Type | Attribute | Data type |
|---|---|---|---|
| Global label | VAR_GLOBAL | RETAIN | Basic data type, array, structure |
| Local label of the program block | VAR | | |
| Local label of the Function Block | VAR | | |
| | VAR_OUTPUT | | |
| | VAR_PUBLIC | | |

# 15.3 Latch Settings

# Latch settings

This subsection describes the latch setting.

## Setting latch on devices

A range of multiple latches can be set for 1 type of device. Two latch ranges, latch (1) and latch (2), can be set. However, make sure that the range of latch (1) and latch (2) is not overlapping.

## ■Latch range setting

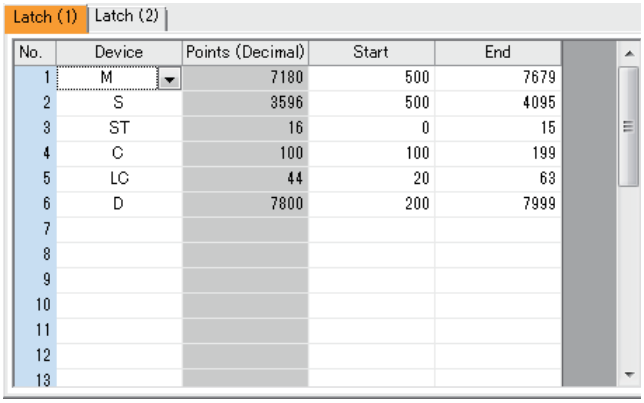
Set the device to latch, its range, and the latch type.

### Operating procedure

"Device Setting" window

| Item | Symbol | Device | | Latch (1) | Latch (2) |
|---|---|---|---|---|---|
| | | Points | Range | | |
| ***Input*** | ***X*** | 1024 | 0 to 1777 | | |
| Output | Y | 1024 | 0 to 1777 | | |
| Internal Relay | M | 7680 | 0 to 7679 | 500 to 7679 | No Setting |
| Link Relay | B | 256 | 0 to FF | No Setting | No Setting |
| Link Special Relay | SB | 512 | 0 to 1FF | | |
| Annunciator | F | 128 | 0 to 127 | No Setting | No Setting |
| Step Relay | S | 4096 | 0 to 4095 | 500 to 4095 | |
| Timer | T | 512 | 0 to 511 | No Setting | No Setting |
| Retentive Timer | ST | 16 | 0 to 15 | 0 to 15 | No Setting |
| Counter | C | 256 | 0 to 255 | 100 to 199 | No Setting |
| Long Counter | LC | 64 | 0 to 63 | 20 to 63 | No Setting |
| Data Register | D | 8000 | 0 to 7999 | 200 to 7999 | No Setting |
| Latch Relay | L | 7680 | 0 to 7679 | | |
| Area Capacity | | | 12.0K Word | | 11.0K Word |
| Total Device | | | 11.2K Word | | 9.6K Word |
| Total Word Device | | | 10.2K Word | | 8.1K Word |
| Total Bit Device | | | 15.9K Bit | | 25.1K Bit |

"Latch Range Setting" window




***1.*** Click "Detailed Setting" on the "Device Setting" window.

***2.*** In the "Device Setting" window, select the type of latch for the target device. The "Latch Range Setting" window is displayed.

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [CPU Parameter] ⇨ "Memory/Device Setting" ⇨ "Device/Label Memory Area Detailed Setting" ⇨ "Device (high speed) Setting" ⇨ "Detailed Setting"

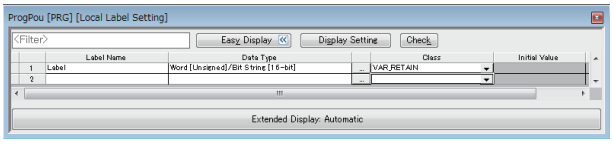
***3.*** Check the tab for the latch type, select the device to set and set the latch range (Start, End).

## Setting latch on labels

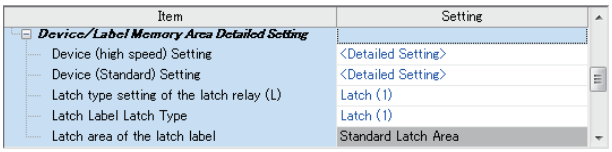
This subsection describes latch setting on labels.

### Operating procedure

Label edit window




"Device/Label Memory Area Detailed Setting" window




***1.*** In the label edit window, specify "RETAIN" for label attribute.

***2.*** There are two types of latch for labels: latch (1) and latch (2). Select one. The selected latch type is applied to all labels of with latch attribute.

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [CPU Parameter] ⇨ "Memory/Device Setting" ⇨ "Device/Label Memory Area Detailed Setting" ⇨ "Latch Label Latch Type"

# 15.4 Clearing of Data of the Latch Range

The data of the latch range can be cleared by the following ways.

## Method of latch clearing

By using engineering tools. (GX Works3 Operating Manual)

[Online] ⇨ [CPU memory operation]

The range cleared can be selected by performing CPU memory operation.

- Clear the devices outside the latch range.
- Clear the devices outside the latch range and the devices within the range of latch (1).
- Clear the devices outside the latch range, the devices within the range of latch (1) and the devices within the range of latch (2).

## Method of clearing by program

### ■Clearing by program

Execute an RST command to a latched device or clear by sending K0 in MOV/FMOV instructions.

### ■Clearing by special relay (SM8031 or SM8032)

- SM8031: Clear the devices outside the latch range.
- SM8032: Clear the range of latch (1) and the range of latch (2).

# 15.5 Precautions

The precaution to be taken when using a latch function is described below.

- When latch range and device no. of points are changed in the parameter, the latching for devices other than link register (W) and latch label will be the same as the latch settings before the change. Also, if the latch range setting parameter at the time of previous operation is different from that at the time of the current operation after the CPU module is powered OFF and ON or reset, the latch data is recovered only in the overlapping part of the latch ranges.
- When latch range and the number of devices are changed in the parameter, all latch labels are cleared to "0".
- When the CPU parameter, program file, FB file, and global label setting file are changed, all latch labels are cleared to "0". However, when SM9353 (clear/keep of latch labels during PC write) is ON, even if the program file, FB file, and global label setting file are changed, latch labels are not cleared.*1
- Special relays and special registers are not cleared even by performing CPU memory operation or special relay clearing.
- Extended file register (ER) cannot be cleared by special relays (SM8031, SM8032). Use ERINIT instruction, and data batch initialization (clearing values/memory initialization) function of GX Works3 when you clear an extended file register (ER). (☞ Page 66 Extended file register (ER) function)

*1 To keep the data of latch label, turn on SM9353 before changing the files. Note that SM9353 can back up the setting in the event of a power interruption, and the setting can be backed up once SM9353 is turned on.
For supported version of SM9353 (clear/keep of latch labels during PC write), refer to ☞ Page 971 Added and Enhanced Functions.

# 16 RAS FUNCTIONS

## 16.1 Self-Diagnostics Function

Checks if a problem exists with the CPU module.

### Self-diagnostics timing

If an error occurs when the CPU module is powered on or while it is in the RUN/STOP state, the CPU module detects, and displays it, and stops operation. However, depending on the error occurrence status or the instruction to execute, the CPU module may not be able to detect the error. Configure safety circuits external to the programmable controller to ensure that the entire system operates safely even in such a case.

### Check method of error

This section describes the check methods when error occurs.

#### Check method using special relay and special register

When the CPU module detects an error, it turns SM0 (Latest Self-diagnostics error (annunciator on included)) and SM1 (Latest Self-diagnostics error (annunciator on not included)) on and stores the error code corresponding to the error definition in SD0 (diagnostics error). If multiple errors are detected, the latest error code is stored in SD0. Use SM0, SM1, and SD0 on the program for the CPU module or mechanical interlock. Besides, the error code up to 16 pieces for the error contents being currently generated will be stored into SD10 (Self-diagnostics error code) to SD25 (Self-diagnostics error code). (The error code for the error content of 17th piece on and after will not be stored.)

#### Check method using LED

The error occurrence conditions can be checked through the lighting conditions of ERR LED. For details, refer to the following manual.

MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)

#### Check method using the engineering tool

The error or event history being currently generated can be checked in the Module diagnostics window. (GX Works3 Operating Manual)

**■Existing errors**

Up to 16 errors (description of errors) currently existing in the CPU module can be displayed. However, even when an additional error occurs after a stop error, the error information is not refreshed.

**Point**

The maximum number of displayable errors is 15 for continuation errors and 1 for stop errors. When 15 continuation errors are displayed and another one occurs, description of the new error is not displayed. Also, when an error with the same code has already been displayed, the date and time of occurrence and detailed information of the relevant error are not updated.

**■Error history**

Occurred errors is logged in the event history (☞ Page 130 Event History Function)

The event history is updated only when a battery error occurs, independent of the operating status of the CPU module. Also, when a battery error is detected after the occurrence of a stop error, the information on existing errors is not refreshed, and only the event history is updated.

# CPU module operation upon error detection setting

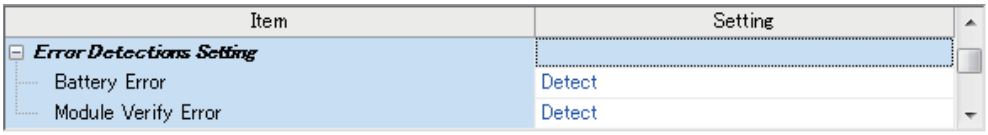
Configure each CPU Module Operation setting when an error is detected.

## Error detection setting

Sets whether or not to detect errors.

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [CPU Parameter] ⇨ "RAS Setting" ⇨ "Error Detections Setting"

### Window




### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Battery Error*1 | Sets whether or not to detect the battery error. | • Detect<br>• Not Detected | Detect |
| Module Verify Error | Sets whether or not to detect the module verification error. | • Detect<br>• Not Detected | Detect*2 |

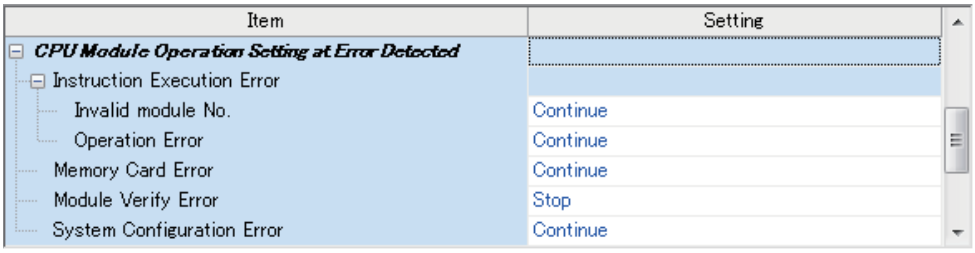
*1 Only FX5U/FX5UC CPU module is supported.
*2 For the FX5S CPU module, fixed to "Detect".

## CPU module operation upon error detection setting

Sets the CPU module operation upon error detection.

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [CPU Parameter] ⇨ "RAS Setting" ⇨ "CPU Module Operation Setting at Error Detected"

### Window




### Displayed items

| Item | | Description | Setting range | Default |
|---|---|---|---|---|
| Instruction Execution Error | Invalid module No. | Sets the CPU module operation upon detection of an incorrect module No. | • Continue<br>• Stop | Continue |
| | Operation Error | Sets the CPU module operation upon operation error. | • Continue<br>• Stop | Continue |
| Memory Card Error | | Sets the CPU module operation upon a memory card error. | • Continue<br>• Stop | Continue |
| Module Verify Error | | Sets the CPU module operation upon a module verification error. | • Continue<br>• Stop | Stop*1 |
| System Configuration Error | | Sets the CPU module operation upon a system configuration error. | • Continue<br>• Stop | Continue |

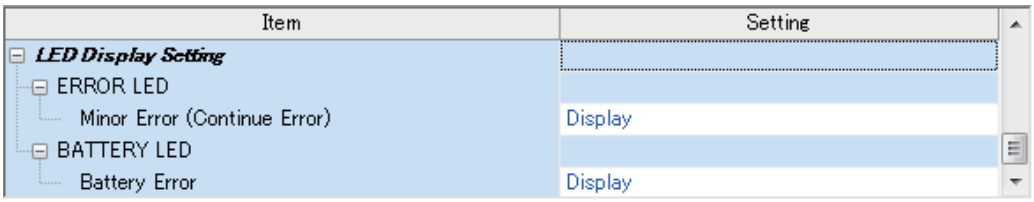
*1 For the FX5S CPU module, fixed to "Stop".

## LED display setting

Set whether or not to display the ERROR LED and BATTERY LED.

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [CPU Parameter] ⇨ "RAS Setting" ⇨ "LED Indication Setting"

### Window




### Displayed items

| Item | | Description | Setting range | Default |
|---|---|---|---|---|
| ERROR LED | Minor Error (Continue Error) | Sets whether or not the ERROR LED is displayed when a minor error occurs. | • Display<br>• Do Not Display | Display |
| BATTERY LED*1 | Battery Error | Sets whether or not the BATTERY LED is displayed when a battery error occurs. | • Display<br>• Do Not Display | Display |

*1 Only FX5U/FX5UC CPU module is supported.

# Error clear

This function clears all the existing continuation errors at once.

## Errors that can be cleared

| Error code | Error name |
|---|---|
| 1080H | ROM write count error |
| 1090H | Battery error |
| 1120H | SNTP clock setting error |
| 1200H | Module moderate error detected |
| 1800H | Annunciator ON |
| 1810H, 1811H | Operation error |
| 1900H | Constant scan time error |
| 1920H | IP address setting error |
| 1921H | IP address writing/clear request simultaneous detection |
| 1FE0H to 1FE6H, 2008H | Module configuration error |
| 2120H, 2121H | Memory card error |
| 2400H | Module verification error |
| 2440H, 2441H | Module major error |
| 2450H | Module major error detected |
| 2522H | Invalid interrupt |
| 2801H | Module specification error |
| 2820H, 2821H, 2822H, 2823H | Device specification error |
| 2840H | File name specification error |
| 3360H to 3362H | Nesting depth error |
| 3380H | Pointer execution error |
| 3400H to 3406H, 3420H, 3500H, 3502H to 3506H, 350AH, 350CH to 350FH, 3510H to 351EH, 3580H, 3581H, 3583H to 3588H, 3600H, 3611H to 361CH, 3621H to 362CH, 3631H to 363CH, 3641H to 364CH, 3651H to 365CH, 3661H to 366CH, 3671H to 367CH, 3681H to 368CH, 3691H to 369CH, 36A1H to 36ACH, 36B1H to 36BCH, 36F0H | Operation error |
| 3780H | High-speed comparison table maximum excess error |
| 3781H | Preset value range outside error |

## How to clear errors

Errors can be cleared in two ways:

### ■Using the engineering tool

Clear errors with the module diagnostics function of engineering tool. (GX Works3 Operating Manual)

### ■Using SM/SD

Clear errors by operating SM/SD.

1. Check SD0 (Latest self-diagnostics error code) to identify what errors are detected.
2. Clear the cause of each of the currently detected continuation errors.
3. Turn off and on SM50 (error reset).

**Point**

When clearing the error with the error code (2400H), set "Continue" to "Module Verification Error" in "CPU Module Operation Setting at Error Detected". (☞ Page 128 CPU module operation upon error detection setting) However, SM61 (I/O module verify error) which is turned ON when the error code (2400H) occurs is not turned OFF. To turn OFF SM61, the CPU module must be turned ON or reset.

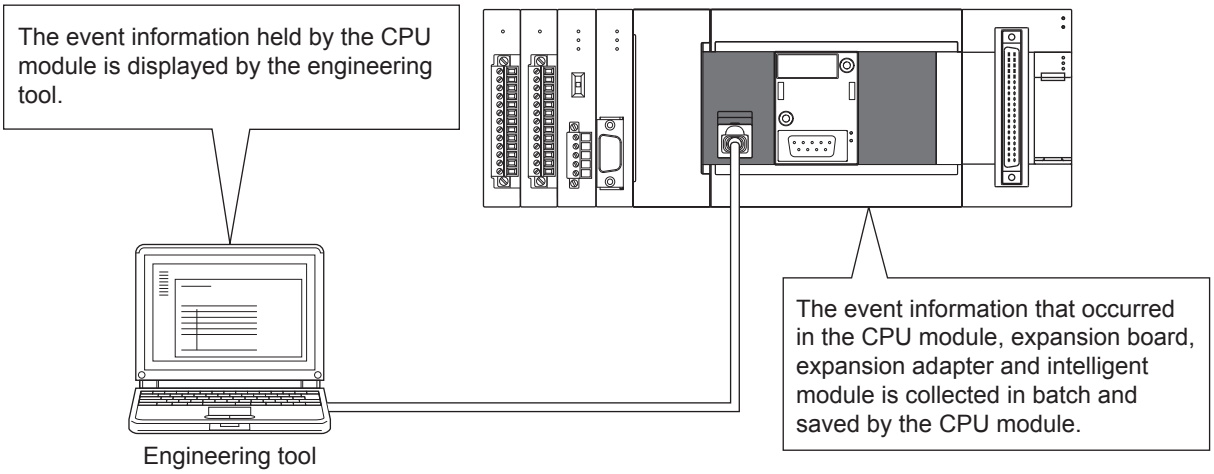
## Precautions

This section describes some precautions to take when using the error clear function:

- Since the function clears all of the currently detected continuation errors at once, errors that should not yet be cleared may be cleared.
- Use the RST instruction to reset each annunciator individually.

# 16.2 Event History Function

Information including errors detected in the CPU module, expansion board, expansion adapter and intelligent module, and errors that occur in the network is collected and saved by the CPU module. Once errors are stored, they can be checked chronologically. This function can be used to pinpoint the cause of faults that occur in the system or device.
For supported version of event history function, refer to ☞ Page 971 Added and Enhanced Functions.




**Point**

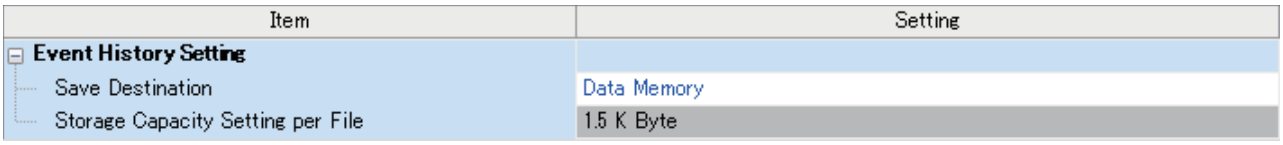
The event history information is constantly collected regardless of the operating state of the CPU module. There are occasions, however, when the event history information cannot be collected due to a major error in a module, a cable failure, or some other cause.

# Event history settings

Under normal circumstances, the event history function can be used with its default settings and need not be manually configured. The storage memory and size settings for event history files can be changed as needed. (☞ Page 132 Event history file)

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [CPU Parameter] ⇨ "RAS Setting" ⇨ "Event History Setting"

## Window




## Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Save Destination | Specify the storage location of event history files. | • Memory Card<br>• Data Memory<br>• Built-in RAM Battery Keeping*1 | Data Memory |
| Storage Capacity Setting per File | Specify the storage capacity per event history file. | • 1 to 2048K bytes (Save Destination: Memory Card)*2<br>• 1.5K bytes (fixed) (Save Destination: Data Memory)<br>• 1 to 64K bytes (Save Destination: Built-in RAM Battery Keeping)*1<br>Unit: 1K bytes | 1.5 K Byte |

*1 Only FX5U/FX5UC CPU module is supported.
*2 For the FX5S/FX5UJ CPU modules, fixed to 2048K bytes.

**Point**

An optional battery is required to use the built-in RAM battery keeping. For details, refer to the following.
MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)

# Logging of the event history

This section describes events saving for the event history.

## Which event history information is collected

### ■Target modules

The events collected for the event history are those that occur in the CPU module and in the expansion board, expansion adapter and intelligent module connected to the CPU module.

**Point**

The bus access errors that occur in the CPU module when the intelligent function module is connected are also collected to the event history.

### ■Target networks

Collection of event history for devices on a network supports only the built-in Ethernet port communication for the CPU module or intelligent function module. The communication status is a target for the event history.

## Events logged by the CPU module

Information logged in the event history includes errors initiator and other detailed information for troubleshooting purposes. For events that are logged in the event history on the CPU module, refer to ☞ Page 912 Event List.

## Event history file

The storage memory and file size for event history files can be changed in event history setting. (☞ Page 131 Event history settings)

### ■Storage memory

The following storage memory can be used.

- Data memory
- Built-in RAM battery keeping*1
- Memory card (SD memory card)

*1 Only FX5U/FX5UC CPU module is supported.

**Point**

For a system where the communication conditions are unstable and frequently change, the event history file size should be made large enough to accommodate a greater number of events. If this is the case, the SD memory card is highly recommended as the storage memory.

#### Precautions

- If the storage memory is the built-in RAM battery keep: when the battery is not loaded or the battery voltage is low, if an operation such as power is turned OFF → ON or RESET operation is made, the generated error will not be stored into the event history.
- If the storage memory is a memory card (SD memory card), the event history will not be stored when the SD memory card's write protect switch is enabled. (The event history file in the SD memory card can be read with the engineering tool.) Thus, if the SD memory card's write protect switch is changed from disabled to enabled during operation, and an event that saves to the event history occurs, a write to SD memory card error will occur. (Immediately after the error occurs, it can be checked with the engineering tool's module diagnosis. However, the occurring error will not be saved in the event history after the power has been turned OFF and ON or the module reset, etc.)
- If the storage memory is the memory card (SD memory card): when the SD memory card is not loaded, after power is turned OFF→ ON or after resetting operation, errors will not be stored into the event history.

### ■File size

The size for event history files can be changed in event history setting (☞ Page 131 Event history settings). If the storage size exceeds the specified size, records are deleted in order from the oldest one and the latest one is stored. An event history file size is obtained from the following calculation formula.

Event history file size = File header size + Event history management information size + (Number of records × Size per event history record)

| Element | Size |
|---|---|
| File header size | 20 bytes |
| Event history management information size | 12 bytes |
| Size per event history record*1 | 40 to 1112 bytes (variable) |

*1 Because the contents of detailed information may differ depending on the event to be saved or the detailed information may include a variable-length file name, the size per event history record is variable.

The number of events to be saved in the event history file differs depending on the event type to be saved.

### ■When files are created

An event history file is created when:

- The CPU module is turned off and on (if there is no event history file or after the event history settings are changed).
- The CPU module is reset (if there is no event history file or after the event history settings are changed).
- Initialization of the SD memory card (when no event history file exists)*1

*1 When a parameter is stored in the data memory, the event history file is created on the SD memory card, according to the event history setting.

The following table shows how the event history is treated depending on operation.

| Operation | Operation for the event history |
|---|---|
| Memory initialization | When this event occurs, the event history is stored into the internal memory. If the internal memory reaches the maximum number of event history records it can store, all subsequent events are lost (☞ Page 133 Loss of event history information) |
| Event history creation | The event history, which has been stored in the internal memory during absence of the event history file, is stored into the data memory or the SD memory card (If any event was lost, it is logged as "*HST.LOSS*"). |

Indicates the operation of the event history for the SD memory which was removed and mounted in the case that the save destination memory is the memory card (SD memory card).

| Operation | Operation for the event history |
|---|---|
| Removal of the SD memory card | When this event occurs, the event history is stored into the internal memory. If the internal memory reaches the maximum number of event history records it can store, all subsequent events are lost (☞ Page 133 Loss of event history information) |
| Installation of the SD memory card | The event history, which have been stored in the internal memory during absence of the SD memory card, is stored to the SD memory card. If the re-inserted SD memory card contains an event history file of the same file size, the CPU module continues to store the event history information. If the file size is different, the CPU module removes the existing event history file and creates a new event history file. |

### ■When parameters take effect

Any changed parameters take effect when:

- The CPU module is powered on
- The CPU module is reset

**Point**

Any changed parameters written in the storage memory with the CPU module in the STOP state does not take effect when the CPU module operating state is changed from STOP to RUN. In this case, the changed parameters will take effect the next time when the CPU module is turned off and on or reset.

## Loss of event history information

If events are detected frequently, some events may be lost without being collected. When event loss occurs, "*HST.LOSS*" appears in the "Event Code" field of the engineering tool.

# Viewing the event history

The event history can be viewed using the menus of the engineering tool. For operating procedures and how to interpret the displayed information, refer to the following:

GX Works3 Operating Manual

# Clearing the event history

The event history can be cleared using the event history window. Once the event history is cleared, the CPU module deletes all the event history information stored in the specified storage memory. For operating procedures and other details, refer to the following:

GX Works3 Operating Manual

# Precautions

## Clearing the event history during execution of another function

The event history cannot be cleared while executing the backup/restoration function. (Page 208 DATA BACKUP/ RESTORATION FUNCTION) Confirm that the backup/restoration function is not being executed before executing event history clear.

## Reading the event history during execution of another function

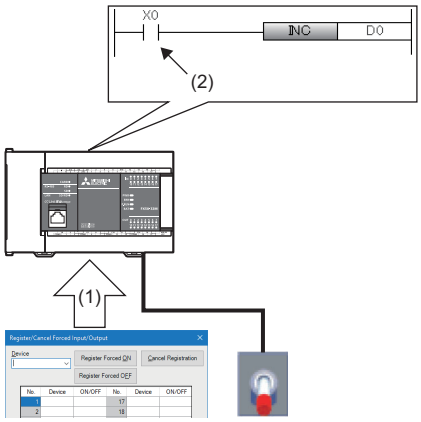
The event history cannot be read out while executing the restoration function. (Page 217 Restoration Function) Confirm that the restoration function is not being executed before reading the event history.

# 17 EXTERNAL INPUT/OUTPUT FORCED ON/OFF FUNCTION



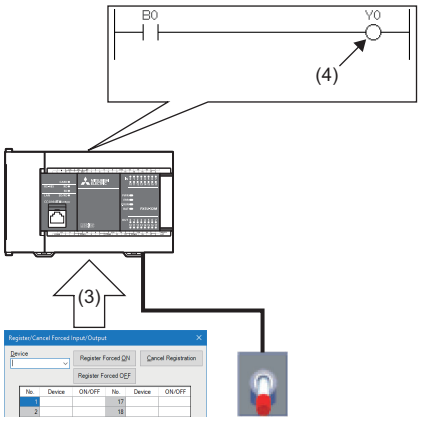
External inputs/outputs can be forcibly turned on and off from the engineering tool. This function enables input devices to be turned on and off regardless of the on/off state of the external inputs and enables the external outputs to be turned on and off regardless of the operation result of a program.

(External input)




(1) Turn off X0 forcibly.
(2) The input device is turned off regardless of the on/off state of the external input.

(External output)




(3) Turn on Y0 forcibly.
(4) The external output is turned on regardless of the operation result of the program.

**Restriction**

Before executing the external input/output forced on/off function, check the versions of the CPU module and engineering tool used. (☞ Page 971 Added and Enhanced Functions)

## Devices that allow forced on/off registration

The following lists the devices that allow forced on/off registration.

| Device | Range |
|---|---|
| Input | X0 to X1777 |
| Output | Y0 to Y1777 |

## Number of device points that allows forced on/off registration

A maximum of 32 points can be registered for input devices and output devices in total.

## Inputs/outputs for which forced on/off can be set

The following describes the inputs/outputs for which forced on/off can be set.

### ■Input

After the refreshed data from the module is reflected, the input devices for which forced on/off registration is set are forcibly turned on or off.

### ■Output

The following external outputs are turned on or off by refreshing output devices that have been forcibly turned on or off.

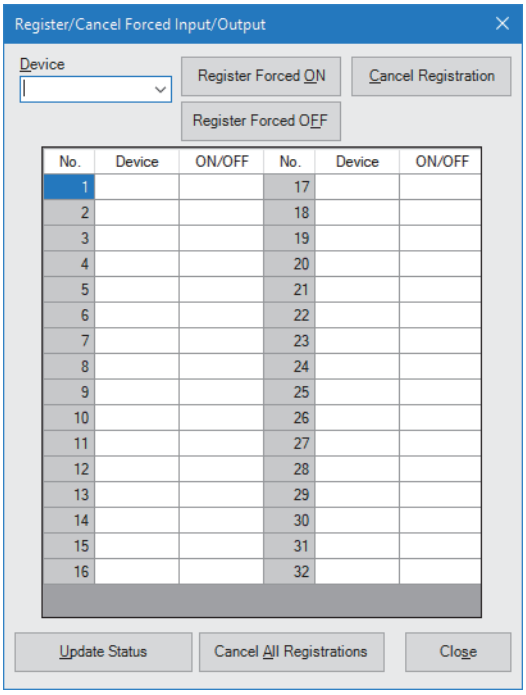
- Refresh target output of CPU module and I/O module
- Link refresh target output of network modules
- Link refresh target output of CC-Link IE Field Network Basic

## Operation method of forced on/off

Use the engineering tool for the forced on/off operation.

[Debug] ⇨ [Register/Cancel Forced Input/Output]

### Window




### Displayed items

| Item | Description |
|---|---|
| Device | Enter target devices (X, Y). |
| [Register Forced ON] button | Registers forced on for the entered devices (X, Y). |
| [Register Forced OFF] button | Registers forced off for the entered devices (X, Y). |
| [Cancel Registration] button | Cancels forced on/off for the registered devices (X, Y). |
| [Update Status] button | Displays the latest on/off states. |
| [Cancel All Registrations] button | Batch-cancels forced on/off for the registered devices (X, Y). |

## Behavior in forced on/off registration

The following describes the behavior in forced on/off registration.

### ■Behavior of an input device

Registering forced on/off turns on or off the input device regardless of the status of the external input. When an input device for which the forced on/off has been registered is changed in the program, the input device is turned on and off in accordance with the operation result of the program.

| Operation | Change in the input device in the program | Behavior of an input device |
|---|---|---|
| Forced on registration | Changed | • The input device is on when the program operation at every scan starts.<br>• The input device is turned on or off in accordance with the operation result of the program after the program operation at every scan started.*1 |
| | Not changed | The on state is held. |
| Forced off registration | Changed | • The output device is off when the program operation at every scan starts.<br>• The output device is turned on or off in accordance with the operation result of the program after the program operation at every scan started.*1 |
| | Not changed | The off state is held. |

*1 During monitoring, the value according to the forced on/off registration is monitored.

### ■Behavior of an output device

Registering forced on/off turns on or off the external output regardless of the operation result of the program. When an output device has been changed in the program, the output device is turned on and off in accordance with the operation result of the program. Therefore, the on/off states between the output device and external output may differ.

| Operation | Change in the output device in the program | Behavior of outputs | |
|---|---|---|---|
| | | Behavior of an output device | Behavior of an external output |
| Forced on registration | Changed | • The output device is on when the program operation at every scan starts.<br>• The output device is turned on or off in accordance with the operation result of the program after the program operation at every scan started.*1 | The external output is turned on regardless of the operation result of the program. |
| | Not changed | The on state is held. | |
| Forced off registration | Changed | • The output device is off when the program operation at every scan starts.<br>• The output device is turned on or off in accordance with the operation result of the program after the program operation at every scan started.*1 | The external output is turned off regardless of the operation result of the program. |
| | Not changed | The off state is held. | |

*1 During monitoring, the value according to the forced on/off registration is monitored.

## CPU module operating status

Forced on/off registration is allowed regardless of the CPU module operating status. However, when a stop error has occurred, the output devices and external outputs are turned off regardless of the forced on/off registration setting. While the operating status of the CPU module is STOP due to a stop error, forced on/off is enabled only for the input devices. If the CPU module is powered off and on or is reset, all the forced on/off registration information will be canceled.

## Forced on/off timing

The following table lists the timing to reflect the registered data in the forced on/off registration settings to the input/output devices or external outputs.

| Inputs/outputs for which forced on/off can be set | Reflection timing for the input devices | Reflection timing for the output devices or external outputs |
|---|---|---|
| FX5 CPU module input/output<br>Input/output of input/output module, input module, and output module*1*2 | • END processing (at input refresh)<br>• At program execution<br>• At instruction execution using the direct access input (DX) (LD, LDI, AND, ANI, OR, ORI, LDP, LDF, ANDP, ANDF, ORP, ORF, LDPI, LDFI, ANDPI, ANDFI, ORPI, ORFI) However, the registered data is not reflected to the input devices.*3<br>• At execution of the RFS(P) instruction, REF(P) instruction, and MTR instruction | • END processing (at output refresh)<br>• At program execution<br>• At instruction execution using the direct access output (DY) (OUT, SET, RST, PLS, PLF, FF, MC, SFT(P))<br>• At execution of the RFS(P) instruction, REF(P) instruction, and MTR instruction |
| Input/output of the CPU module assigned to RX and RY of CC-Link*2 | END processing (at link refresh) | |
| Input/output of the CPU module assigned to RX and RY of the CC-Link IE Field Network or CC-Link IE TSN*2 | END processing (at link refresh) | |
| Input/output of the CPU module assigned to RX and RY of the CC-Link IE Field Network Basic | END processing (at link refresh) | |
| Input/output of the CPU module assigned to AnyWireASLINK system refresh settings*2 | END processing (at link refresh) | |
| Input/output of the CPU module assigned to refresh settings of intelligent function module*2<br>• Analog input module<br>• Analog output module<br>• Multiple input module<br>• Temperature control module<br>• Positioning module<br>• Simple motion module<br>• Motion module | END processing (at link refresh) | |
| Input/output of the CPU module assigned to the simple CPU communication setting | END processing (at link refresh) | |

*1 High-speed input/output and part of the input/output used for positioning will not be affected by forced on/off. (☞ Page 139 Precautions)
*2 Only the FX5UJ, FX5U, and FX5UC CPU modules are supported.
*3 The operation of not changing the input device when executing an instruction (LD, LDI, AND, ANI, OR, ORI, LDP, LDF, ANDP, ANDF, ORP, ORF, LDPI, LDFI, ANDPI, ANDFI, ORPI, ORFI) using direct access input (DX) is the same as the existing operation.

## Checking the forced on/off execution status

The execution status of the forced on/off can be checked in the following ways.

### ■Engineering tool

The execution status can be checked with the [Update Status] button of the engineering tool. (☞ Page 136 Operation method of forced on/off)

### ■Special register

SD1488 (Debug function usage status) can be used to check whether the external input/output forced on/off function is used. (☞ Page 814 External input/output forced on/off function)

## Behavior in cancellation of forced on/off

Forced on/off registration can be canceled for each input/output device individually.

### ■Behavior of the device

| Inputs/outputs for which forced on/off can be set | | Change in input/output devices in the program | |
|---|---|---|---|
| | | Changed | Not changed |
| Input | FX5 CPU module input<br>Input of input/output module and input module*1 | The input device is turned on or off in accordance with the on/off state of the modules. | |
| | Input from RX of CC-Link*1 | The input device is turned on or off in accordance with the on/off state refreshed from CC-Link. | |
| | Input from RX of CC-Link IE Field Network or CC-Link IE TSN*1 | The input device is turned on or off in accordance with the on/off state refreshed from CC-Link IE Field Network or CC-Link IE TSN. | |
| | Input from RX of CC-Link IE Field Network Basic | The input device is turned on or off in accordance with the on/off state refreshed from CC-Link IE Field Network Basic. | |
| | Input of the CPU module assigned to AnyWireASLINK system refresh settings*1 | The input device is turned on or off in accordance with the on/off state refreshed from AnyWireASLINK system. | |
| | Input of the CPU module assigned to refresh settings of intelligent function module*1 | The input device is turned on or off in accordance with the on/off state refreshed from the intelligent function module. | |
| | Input of the CPU module assigned to the simple CPU communication setting*2 | The input device is turned on or off in accordance with the on/off state refreshed from the communication destination. | |
| | Input other than above (input without modules actually mounted) | The input device is turned on or off in accordance with operation result of the program. | The input device is turned on or off in accordance with the registered on/off state. |
| Output | FX5 CPU module output<br>Output of input/output module and output module*1 | The operation result of the program is output. | Data is output in accordance with the registered on/off state. |
| | Output to RY of CC-Link*1 | | |
| | Output to RY of CC-Link IE Field Network or CC-Link IE TSN*1 | | |
| | Output to RY of CC-Link IE Field Network Basic | | |
| | Output to network module of AnyWireASLINK system*1 | | |
| | Output to intelligent function module*1 | | |
| | Output to the communication destination of the simple CPU communication*3 | | |
| | Output other than above (output without modules actually mounted) | The output device is turned on or off in accordance with operation result of the program. (Refresh to external output is not executed.) | The output device is turned on or off in accordance with the registered on/off state. (Refresh to external output is not executed.) |

*1 Only the FX5UJ, FX5U, and FX5UC CPU modules are supported.
*2 Input from the communication partner is read into the input device and output device whose communication pattern is set to read.
*3 Output to the communication partner is written from the input device and output device whose communication pattern is set to write.

### ■CPU module operating status

Forced on/off registration can be canceled regardless of the CPU module operating status.

## Behavior in batch-cancellation of forced on/off registrations

All the forced on/off registrations can be canceled in a batch.

### ■Behavior of the device

The behavior of the device is the same as that of cancellation of forced on/off (for each device). (☞ Page 138 Behavior of the device)

### ■CPU module operating status

The behavior of the device is the same as that of cancellation of forced on/off (for each device). (☞ Page 138 CPU module operating status)

## Precautions

The following describes precautions for using the external input/output forced on/off function.

- Multiple engineering tools connected to the network can be used to register forced on/off for the same CPU module. In this case, note the following.
  - The forced on/off state registered last is handled as the on/off state of input/output devices.
  - Since the on/off state displayed in engineering tools may differ from that of the CPU module, update the on/off state displayed in engineering tools.
- Execution of interrupt programs which are executed at a fixed scan may delay depending on the number of forced on/off registrations and the number of refresh points of each refresh processing.
- If the output device is registered as forced on/off and the all outputs disable flag (SM8034) has turned on, the all outputs disable flag has priority. Since the all outputs disable flag has priority, all output terminals will be turned off regardless of the forced on/off registration, and the forced on/off will only be reflected to the output device.
- For the RUN contact setting specified with the CPU parameter file, forced on/off becomes disabled because RUN/STOP is performed by an external signal.
- Reflection of forced on/off until 10ms has elapsed after a momentary power failure is the same as the existing operation. When the input refresh disable flag (SM4488) turns on during momentary power failure
  - In the I/O refresh of END processing, the input device is not refreshed until 10ms has elapsed after the momentary power failure. Therefore, forced on/off is also not reflected.
  - For direct refresh (DX), the devices are refreshed to reflect the peripherals and enabled the forced on/off.
  - The output device is refreshed to reflect the forced on/off.
- If non-latch device clear (SM8031) has turned on, forced on/off will not be reflected.
- When the device batch clear or device/label memory batch clear is executed, the input/output device is cleared and forced on/off is reflected in the I/O refresh of END processing. For logging and memory dump, the value cleared for only one scan is collected.
- If the memory hold function (SM8033) is on, forced on/off will be reflected.
- When the CPU operating status changes from RUN to STOP or from PAUSE to STOP, the input/output device is cleared, and the forced on/off is reflected at I/O refresh of END processing. For memory dump, the value cleared for only one scan is collected.
- At execution of a high-speed input/output function simultaneously with the forced on/off function of the external input/output, the high-speed input/output function uses the external output, which reflects the forced on/off function while the output condition with the high-speed input/output function is not satisfied. Once the output condition with the high-speed input/output function is satisfied, the external output according to the specifications of the high-speed input/output function is executed.

  Example 1:When Y0 is set for the output destination device of the high-speed comparison table function and forced off is registered for Y0
  Before comparison match, forced off is reflected and Y0 becomes off. At the timing of the comparison match, Y0 outputs on, then at the timing of I/O refresh, the forced off is reflected again and Y0 returns to off.

  Example 2:When Y0 is set for "(d) device numbers for which pulses are output" of the PWM instruction and forced on is registered for Y0
  While the PWM instruction is being executed, pulses are output for Y0 by the PWM instruction, and forced off is not reflected.

  Therefore, do not simultaneously execute the high-speed input/output function and the forced on/off function of the external input/output.

• The following table lists the high-speed input/output functions that have external outputs.

| Function | Instruction | |
|---|---|---|
| High-speed counter function | High-speed I/O parameter | High-speed comparison table |
| | | Multiple point output, high-speed comparison table |
| | 32-bit data comparison set (DHSCS instruction) | |
| | 32-bit data comparison reset (DHSCR instruction) | |
| | 32-bit data band comparison (DHSZ instruction) | |
| PWM function | High-speed I/O parameter | |
| | Pulse width modulation (PWM/DPWM instruction) | |
| Positioning control function | High-speed I/O parameter | |
| | Pulse output (PLSY/DPLSY instruction) | |
| | Mechanical OPR (DSZR/DDSZR instruction) | |
| | Relative positioning (DRVI/DDRVI instruction) | |
| | Absolute positioning (DRVA/DDRVA instruction) | |
| | Interrupt 1-speed positioning (DVIT/DDVIT instruction) | |
| | Variable speed operation (PLSV/DPLSV instruction) | |
| | Single-table operation (TBL instruction) | |
| | Multiple-table operation (DRVTBL instruction) | |
| | Multiple-axis table operation (DRVMUL instruction) | |

# 18 CLOCK FUNCTION

The CPU module has an internal clock and is used to manage time in functions performed by the system such as dates of the event history function and the data logging function.



## 18.1 Time Setting

Time operation continues with the large internal capacitor in the CPU module even though the power in the CPU module is turned OFF or the power failure exceeds the allowable momentary power failure time.
If an optional battery is used in the FX5U/FX5UC CPU module, operation continues by the battery.

### Clock data

The clock data handled in the CPU unit is described below.

| Data name | Description |
|---|---|
| Year | 4 digits in calendar year (1980 to 2079) |
| Month | 1 to 12 |
| Day | 1 to 31 (Leap year auto detect) |
| Hour | 0 to 23 (24-hour system) |
| Minute | 0 to 59 |
| Second | 0 to 59 |
| Day-of-the-week | 0: Sunday, 1: Monday, 2: Tuesday, 3: Wednesday, 4: Thursday, 5: Friday, 6: Saturday |

### Changing the clock data

The clock data can be changed using the following methods.

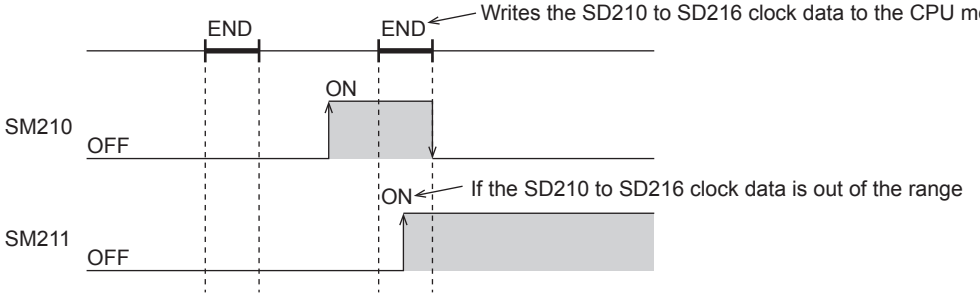
- Using engineering tools
- Using SM/SD
- Using instructions

#### Using the engineering tool

Clock data can be changed using Set Clock from the menu. (GX Works3 Operating Manual)

#### Using SM/SD

The values stored in SD210 (clock data) to SD216 (clock data) are written to the CPU module after END processing execution of scan when SM210 (clock data set request) is changed from OFF→ON. If the data from SD210 to SD216 is out of the valid range, SM211 (clock data set error) is turned ON, the values from SD210 to SD216 are not written in the CPU module.




#### Using instructions

Writes the clock data to the CPU module, using the TWR(P) instruction. (MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks))

# Reading clock data

There are the following methods to read clock data.

- Using SM/SD
- Using instructions

## Using SM/SD

Clock data is read to SD210 to SD216 when SM213 (clock data read request) is turned ON.

## Using instructions

Clock data is read from the CPU module using the TRD(P) instruction. (MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks))

# Precautions

The following describes precautions when setting the time.

## When setting the clock for the first time

The clock is not set when the product is shipped.

## Correcting the clock data

Even if a portion of the clock data is changed, be sure to write all the data to the CPU module again.

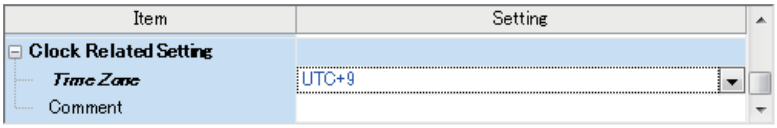
# 18.2 Setting Time Zone

The time zone used for the CPU module can be specified. Specifying the time zone enables the clock of the CPU module to work in the local time zone.

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [CPU Parameter] ⇨ "Operation Related Setting" ⇨ "Clock Related Setting"



## Window




## Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Time Zone | Sets the time zone used by the CPU module. | • UTC+13<br>• UTC+12<br>• UTC+11<br>• UTC+10<br>• UTC+9:30<br>• UTC+9<br>• UTC+8<br>• UTC+7<br>• UTC+6:30<br>• UTC+6<br>• UTC+5:45<br>• UTC+5:30<br>• UTC+5<br>• UTC+4:30<br>• UTC+4<br>• UTC+3:30<br>• UTC+3<br>• UTC+2<br>• UTC+1<br>• UTC<br>• UTC-1<br>• UTC-2<br>• UTC-3<br>• UTC-3:30<br>• UTC-4<br>• UTC-4:30<br>• UTC-5<br>• UTC-6<br>• UTC-7<br>• UTC-8<br>• UTC-9<br>• UTC-10<br>• UTC-11<br>• UTC-12 | UTC+9 |
| Comment | Enters a comment for the time zone (e.g., name of the city). | 1 to 32 letters | — |

**Point**

To reflect the time zone setting on the CPU module, the module must be restarted. If no parameter is set for the CPU module (factory setting), it operates with "UTC+9".

# 18.3 System Clock

There are two types of system clocks, one is to execute ON/OFF by the system and the other is to execute ON/OFF in the intervals specified by the user.

## Special relay used for system clock

Special relays used for system clock are as follows.

| Special relay | Name |
|---|---|
| SM400, SM8000 | Always ON |
| SM401, SM8001 | Always OFF |
| SM402, SM8002 | After RUN, ON for one scan only |
| SM403, SM8003 | After RUN, OFF for one scan only |
| SM409, SM8011 | 0.01 second clock |
| SM410, SM8012 | 0.1 second clock |
| SM411 | 0.2 second clock |
| SM412, SM8013 | 1 second clock |
| SM413 | 2 second clock |
| SM414 | 2n second clock |
| SM415 | 2n ms clock |
| SM8014 | 1 min clock |
| SM420, SM8330 | Timing clock output 1 |
| SM421, SM8331 | Timing clock output 2 |
| SM422, SM8332 | Timing clock output 3 |
| SM423, SM8333 | Timing clock output 4 |
| SM424, SM8334 | Timing clock output 5 |

## Special register used for system clock

Special registers used for system clock are as follows.

| Special register | Name |
|---|---|
| SD412 | One second counter |
| SD414 | 2n second clock setting |
| SD415 | 2n ms clock setting |
| SD420 | Scan counter |
| SD8330 | Counted number of scans for timing clock output 1 |
| SD8331 | Counted number of scans for timing clock output 2 |
| SD8332 | Counted number of scans for timing clock output 3 |
| SD8333 | Counted number of scans for timing clock output 4 |
| SD8334 | Counted number of scans for timing clock output 5 |

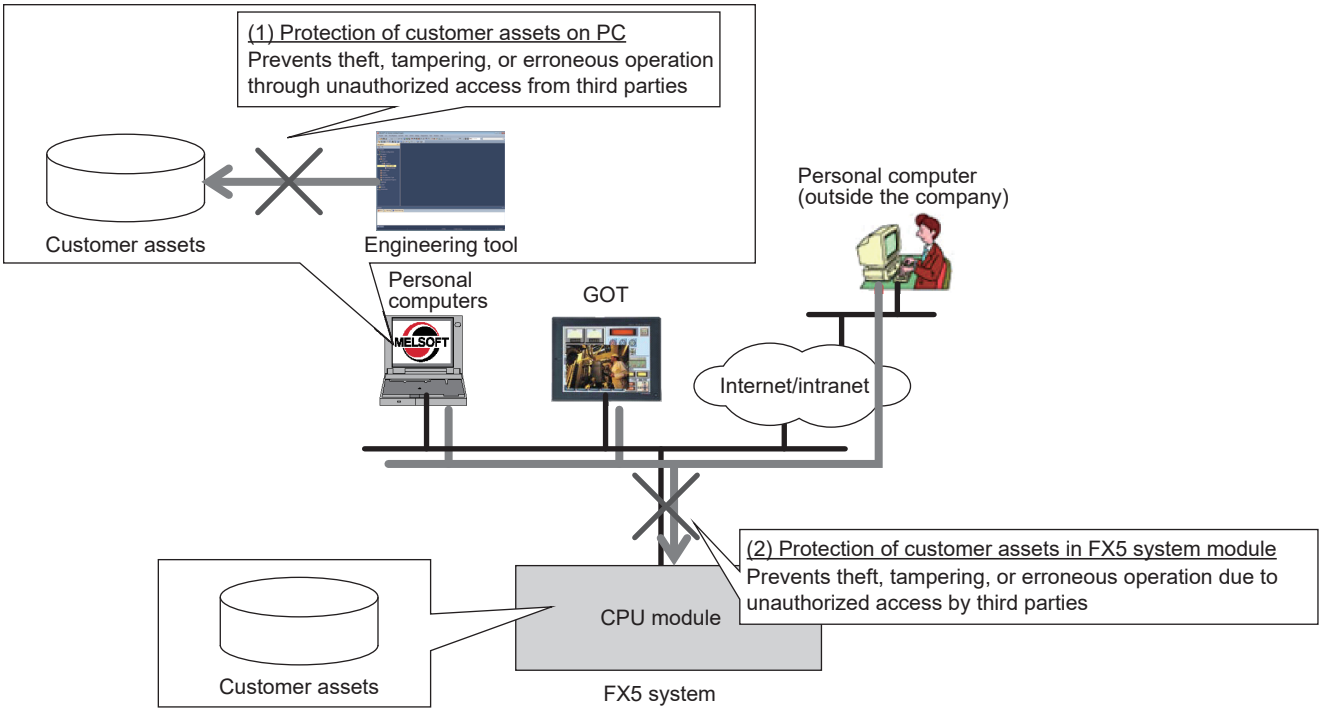
**Point**

SM420 to SM424, SM8330 to SM8334, and SD8330 to SD8334 are used by the DUTY instruction.
For the DUTY instruction, refer to the following.
MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks)

# 19 SECURITY FUNCTIONS



These functions prevent theft, tampering, wrongful operation, illegal execution, etc. of a customer's assets saved on a personal computer or in modules in the FX5 system as a result of illegal access by a third party. Use of the security functions according to the following purposes.




| Data protection target | Purpose | Function | Reference |
|---|---|---|---|
| Projects | To prevent illegal accessing and viewing of programs (in program component units). (Password is used.) | Block password function | GX Works3 Operating Manual |
| | To prevent illegal accessing and viewing of programs (in program file units). (Security key is used.) | Security key authentication function | |
| CPU Module | To prevent illegal execution of programs. (Security key is used.) | | |
| | To prevent illegal reading/writing of files. (Password is used.) | File password function | |
| | Blocks access from an invalid IP address by identifying the IP address of an external device via Ethernet. | IP filter function | MELSEC iQ-F FX5 User's Manual (Communication) |
| | To limit access from outside a specific communication path. (Password is used.) | Remote password function | GX Works3 Operating Manual<br>MELSEC iQ-F FX5 User's Manual (Communication) |

## Precautions

When a personal computer registered with a security key is misused by a third party, the outflow of program assets cannot be prevented. For this reason, the customer must adopt sufficient measures as explained below:

- Personal computer antitheft measures (using a wire lock, etc.)
- Management of personal computer users (deletion of unwanted accounts, strict control of login information, introduction of fingerprint authentication, etc.)

Also, when a personal computer registered with a security key malfunctions, locked project data cannot be accessed/viewed or edited. Mitsubishi Electric Corporation cannot be held responsible for any loss that may occur as a result of this with the customer, other individuals or organizations. For this reason, the customer must adopt sufficient measures as explained below:

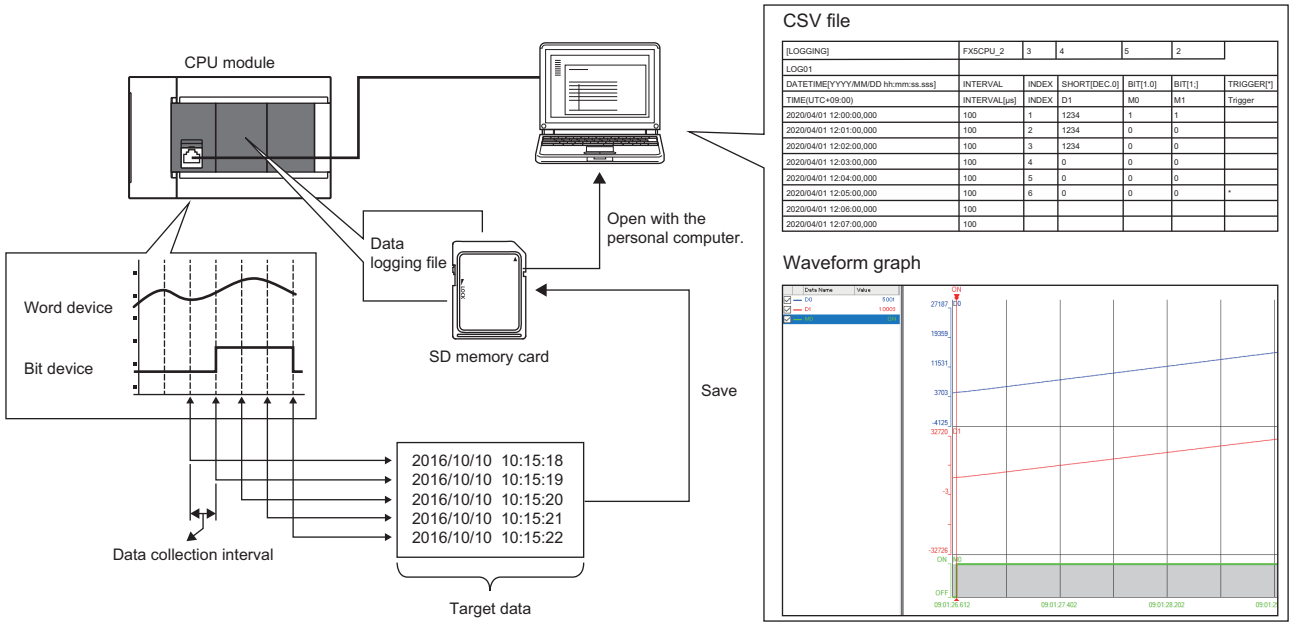
- Export registered security keys and import them into another personal computer.
- Store files containing exported security keys in a safe location.

# MEMO

# 20 DATA LOGGING FUNCTION



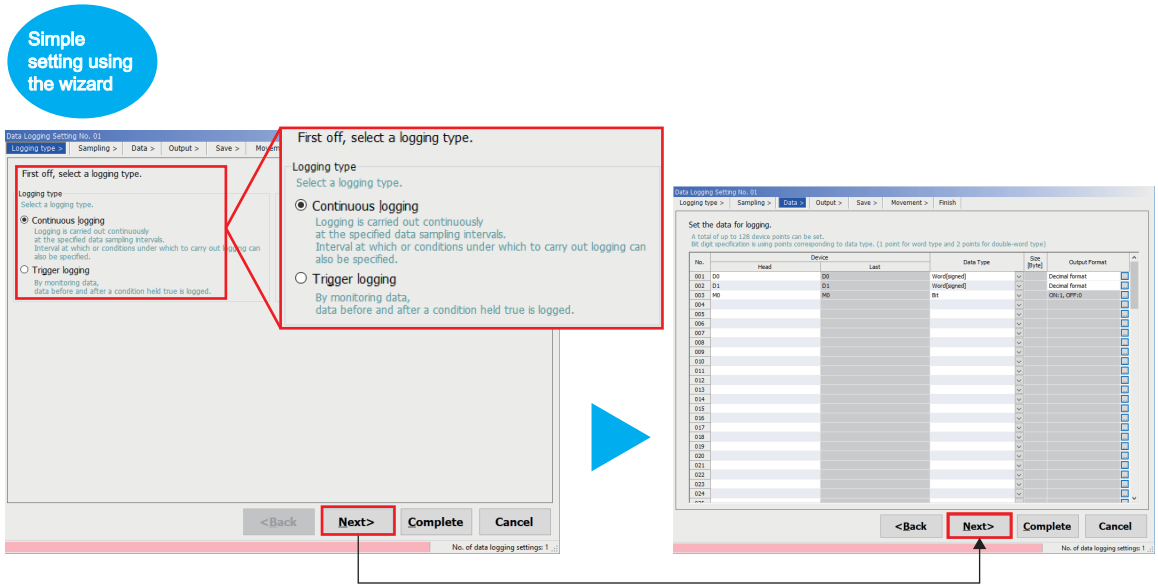
The data logging function is a function that collects device, character string, and other data at specified intervals or timing, and stores such data as a data file.
From the CPU Module Logging Configuration Tool (free of charge), such items as target data, collection interval, and start condition can be set easily.
A data logging file is saved into an SD memory card as a CSV file or binary file.
A data logging file can be opened on a personal computer and used for such purposes as creating reports and analyzing data.




When using the data logging function, check the firmware version of the CPU module.
☞ Page 971 Added and Enhanced Functions

**Point**

By using the CPU Module Logging Configuration Tool (free of charge), the data logging function can be set easily (not via the program).
The setting process is completed simply by entering data for the setting items according to the wizard window.




For the procedure for using the data logging function, refer to the following page.
☞ Page 150 Procedure for Using

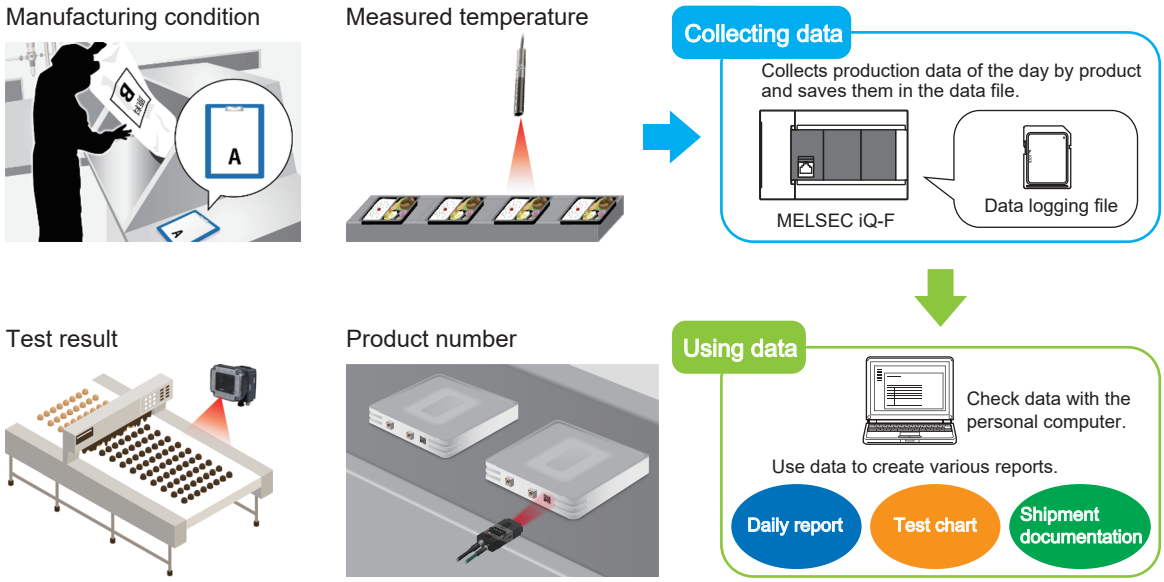
# 20.1 Application Example

Two types of data logging functions are available: Continuous logging and trigger logging. Application examples are shown below.

## Continuous logging

Data can be collected at specified intervals and recorded. This enables facility and product data to be managed with time stamps for use to achieve traceability.

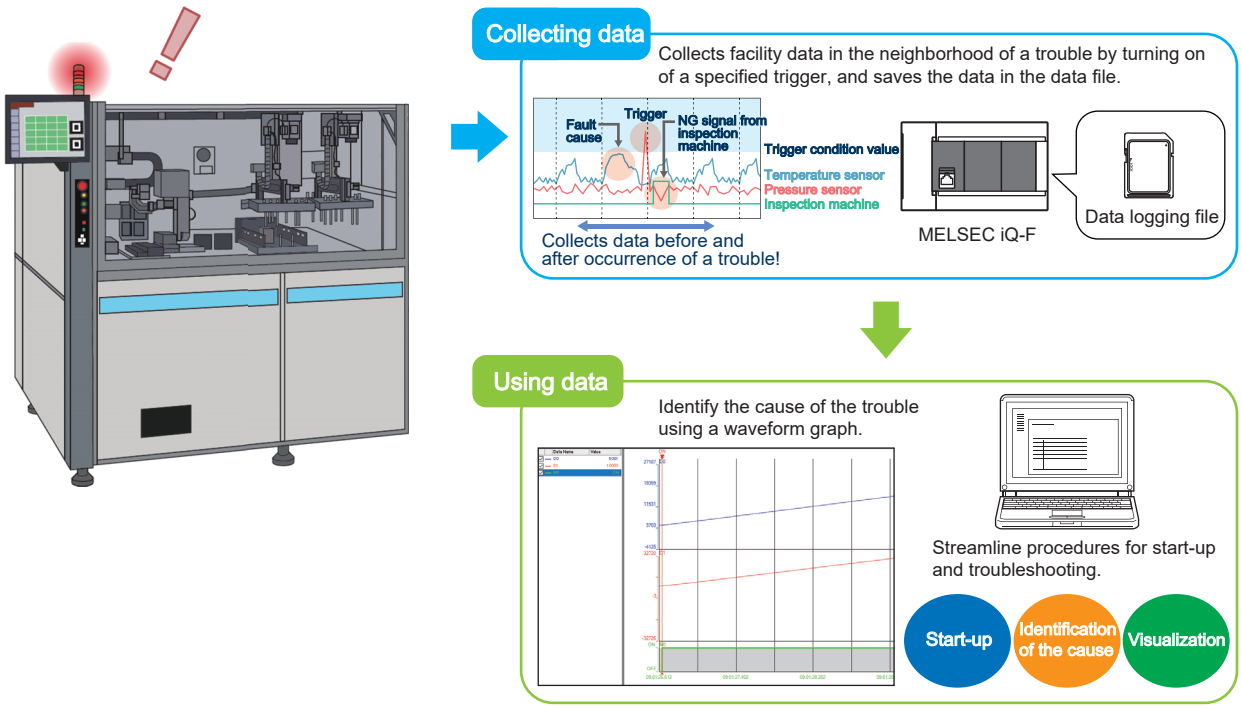
In addition, collected data logging files can be saved in CSV file format. A CSV file can be opened as a table and expected to be used for reports created by customers.




## Trigger logging

Data can be collected at a specified timing and a specified amount of data (a quantity of records) before and after the trigger condition is satisfied can be recorded.

For example, by specifying the device for facility error occurrence, only facility data before and after error occurrence can be saved as a data logging file. This enables data analysis when an error occurs to be performed efficiently.



# 20.2 Specifications List

Describes the specifications of the data logging function.

| Item | | | Specifications | Reference |
|---|---|---|---|---|
| Number of data logging settings*1 | | | 4 | — |
| Data storage location | | | • Data memory (only data logging configuration file)<br>• SD memory card | — |
| Logging type | | | • Continuous logging<br>• Trigger logging | Page 163 Logging type |
| Data collection | Collection interval | | • Each scanning cycle<br>• Time specification<br>• Condition specification (device specification) | Page 165 Data collection conditions |
| | Target data | Number of points for collection | Maximum of 512 (128 per setting) | Page 167 Number of data points |
| | | Data type | • Bit<br>• Word (signed)<br>• Double word (signed)<br>• Word (unsigned)<br>• Double word (unsigned)<br>• Single-precision real number<br>• String<br>• Numeric string<br>• Time | Page 168 Data type |
| Data processing | Trigger logging | Trigger condition | • Condition specification (device change specification)<br>• When trigger instruction executed | Page 168 Trigger condition |
| | | Trigger logging range | Number of records specified before and after the trigger establishment | Page 165 Number of records |
| | | Number of trigger establishments (number of events that can be handled as trigger) | one | — |
| | | Number of records | Maximum of 100000 | — |
| | Processing time*2 | | Top speed of 10 ms (for 8 points × 1 setting) | Page 189 Precautions |
| File output | File name | | Add date + file number | Page 937 Save |
| | File storage format | | • CSV file<br>• Binary file | Page 169 Data logging file |
| | Data output format | CSV file | • Decimal format<br>• Hexadecimal format<br>• Decimal fraction format<br>• Exponential format | Page 170 CSV file format |
| | | Binary file | • Word (signed)<br>• Double word (signed)<br>• Word (unsigned)<br>• Double word (unsigned)<br>• Single-precision real number | Page 172 Binary file format |
| Output file handling | Storage file switching | File switching timing | • Number of records<br>• File size<br>• Condition specification | Page 177 File switching condition |
| | | Maximum number of storage files | 1 to 65535 | Page 179 Storage file |
| Data logging file transfer function (FTP server auto transfer) | | | This function automatically transfers data logging files to the FTP server. | Page 181 Data logging file transfer function (FTP server auto transfer) |
| Setting Behavior at the Time of Transition to RUN | | | This function sets data logging operations when entering into RUN mode after the data logging setting is registered. | Page 188 Setting the operation at the time of transition to RUN |

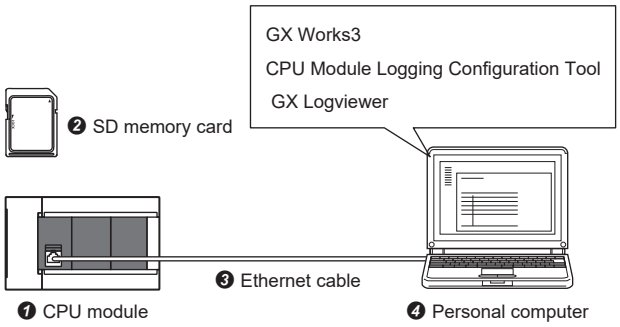
*1 Number of settings where an item such as a data logging start condition or trigger can be registered at the same time. Devices for a maximum of 128 points can be registered per setting.

*2 Processing time for which collection can be performed without losing data. Possible processing time differs depending on the number of points for collection (number of points × number of data logging settings).

# 20.3 Procedure for Using

## Devices and software to be used

The devices and software to be used for the data logging function are shown below.




| No. | Name | Description |
|---|---|---|
| ❶ | CPU module*1 | FX5 CPU module |
| ❷ | SD memory card | NZ1MEM-nGBSD (n means the number of bytes.) |
| ❸ | Ethernet cable | Standard Ethernet cable |
| ❹ | Personal computer | Personal computer in which the following software*2 is installed<br>• GX Works3<br>• CPU Module Logging Configuration Tool<br>• GX LogViewer |

*1 Use the CPU module with the latest firmware version. (☞ Page 89 FIRMWARE UPDATE FUNCTION)

*2 Use the latest version of software.

## Usage flow

The following shows the flow of using the data logging function. The detailed procedure is explained based on setting examples.

1. Set parameters using GX Works3. (☞ Page 153 Setting parameters)
2. Set data logging using the CPU Module Logging Configuration Tool. (☞ Page 154 Setting data logging)
3. Write the data logging settings to the CPU module. (☞ Page 157 Writing the data logging setting)
4. Start data logging execution. (☞ Page 158 Executing data logging)
5. Stop data logging execution. (☞ Page 159 Stopping data logging)
6. Save a data logging file in any location on the personal computer. (☞ Page 159 Saving data logging files)
7. Check the data logging file. For checking, the following three methods are available.

☞ Page 160 Setting example 1: Checking logging data with a CSV file*1

☞ Page 160 Example 2: Checking logging data on the program editor*2

☞ Page 161 Example 2: Checking logging data in a waveform graph

*1 Only when the data logging file storage format is set to a CSV file

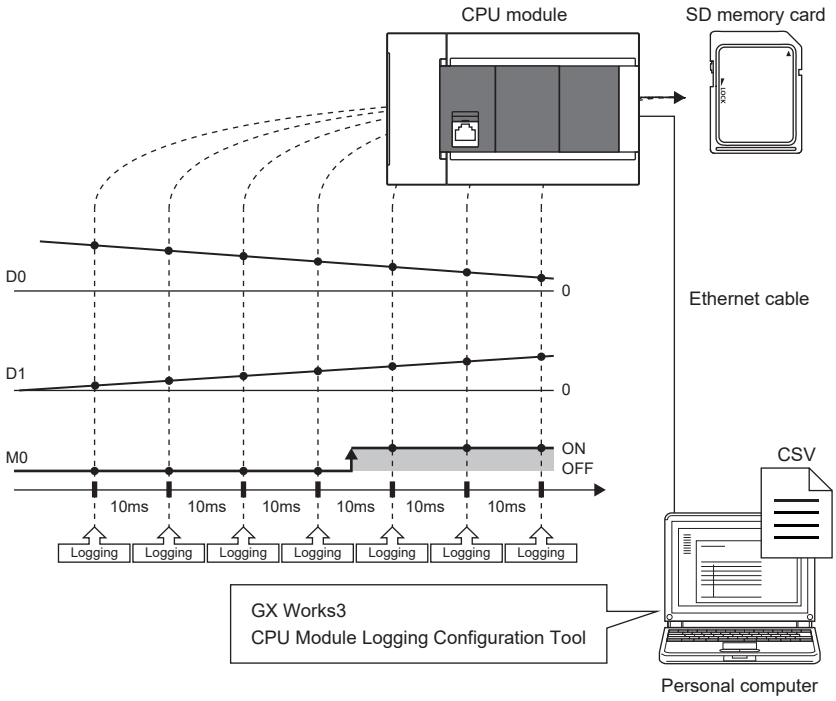
*2 Only when the data logging file storage format is set to a binary file

# Setting example

The procedures for using continuous logging and trigger logging are described with Setting example 1 and Setting example 2.

## Setting example 1: Continuous logging

The following shows a setting example of collecting device values of D0, D1, and M0 for 10 seconds at 10ms intervals after data logging execution is started by operating the tool.




| Setting item | Description |
|---|---|
| Logging type | Continuous logging |
| File storage format | CSV file |
| Number of records | 1000 records |
| Collection interval | Time specification: 10 milliseconds |
| Logging target data | D0, D1, M0 |

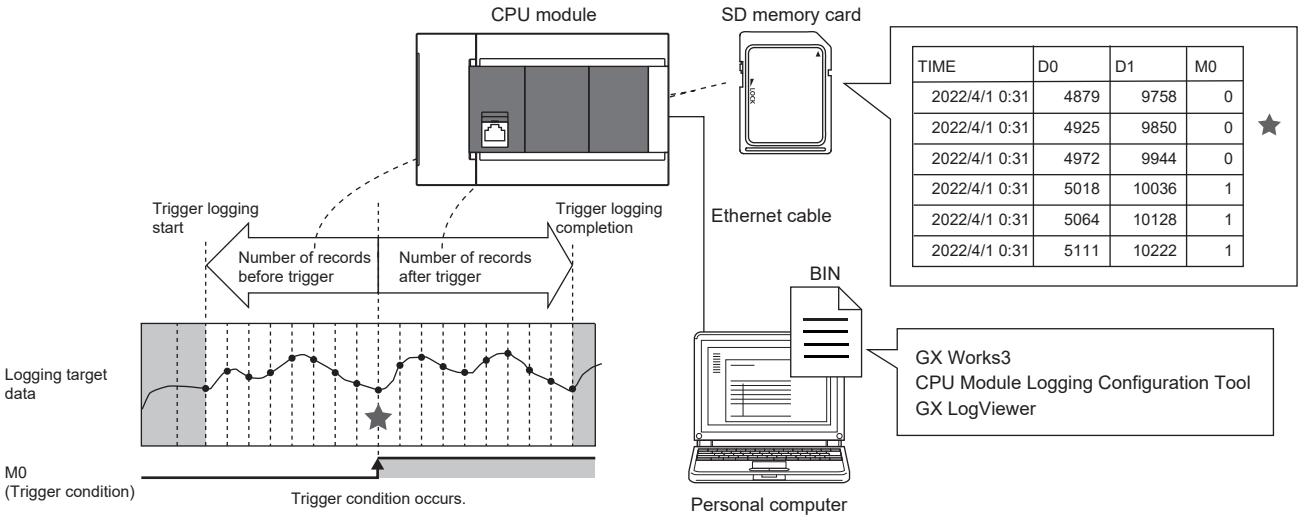
### ■Checking the data logging file

Check the saved data logging file (CSV file) by opening it on your personal computer.

| [LOGGING] | FX5CPU_2 | 3 | 4 | 5 | 2 |
|---|---|---|---|---|---|
| Logging test | | | | | |
| DATETIME[YYYY/MM/DD hh:mm:ss.sss] | INTERVAL | INDEX | SHORT[DEC.0] | SHORT[DEC.0] | BIT[1;0] |
| TIME | INTERVAL[us] | INDEX | D0 | D1 | M0 |
| 2022/4/1 0:31 | 10000 | 4001 | 16111 | 32222 | 1 |
| 2022/4/1 0:31 | 10000 | 4002 | 16158 | 32316 | 1 |
| 2022/4/1 0:31 | 10000 | 4003 | 16204 | 32408 | 1 |
| 2022/4/1 0:31 | 10000 | 4004 | 16250 | 32500 | 1 |
| 2022/4/1 0:31 | 10000 | 4005 | 16296 | 32592 | 1 |
| 2022/4/1 0:31 | 10000 | 4006 | 16343 | 32686 | 1 |
| 2022/4/1 0:31 | 10000 | 4007 | 16389 | -32758 | 0 |
| 2022/4/1 0:31 | 10000 | 4008 | 16435 | -32666 | 0 |
| 2022/4/1 0:31 | 10000 | 4009 | 16481 | -32574 | 0 |
| 2022/4/1 0:31 | 10000 | 4010 | 16528 | -32480 | 0 |

## Setting example 2: Trigger logging

The following shows a setting example of collecting device values of D0, D1, and M0 for two seconds immediately before and five seconds immediately after the trigger occurrence (M0 is "↑") at 10ms intervals after data logging execution is started by operating the tool.

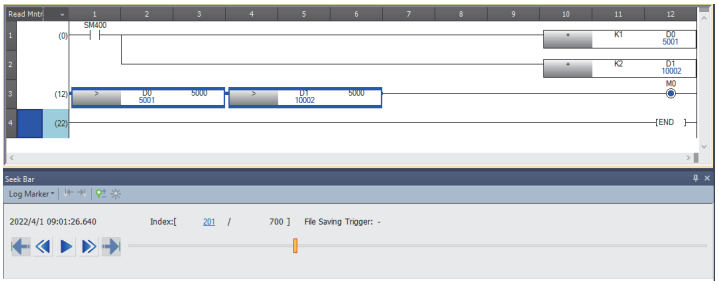



| TIME | D0 | D1 | M0 |
|---|---|---|---|
| 2022/4/1 0:31 | 4879 | 9758 | 0 |
| 2022/4/1 0:31 | 4925 | 9850 | 0 |
| 2022/4/1 0:31 | 4972 | 9944 | 0 |
| 2022/4/1 0:31 | 5018 | 10036 | 1 |
| 2022/4/1 0:31 | 5064 | 10128 | 1 |
| 2022/4/1 0:31 | 5111 | 10222 | 1 |

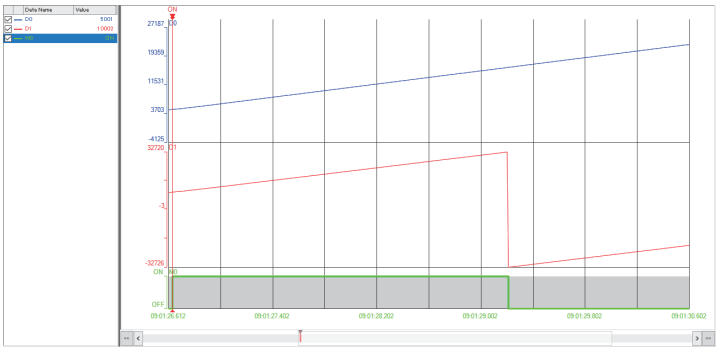
| Setting item | Description |
|---|---|
| Logging type | Trigger logging |
| File storage format | Binary file |
| Trigger | M0 is "↑" |
| Number of records | • Before trigger: 200 records<br>• After trigger 500 records |
| Collection interval | Time specification: 10 milliseconds |
| Logging target data | D0, D1, M0 |

### ■Checking the data logging file

Check the saved data logging file (bin file) by displaying data on the program editor using the offline monitor.

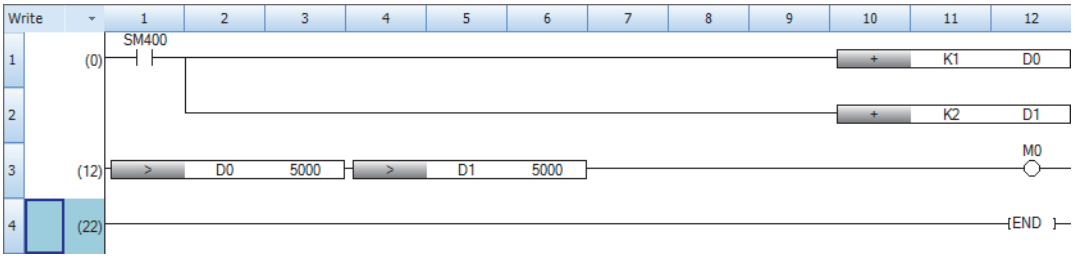


Check the saved data logging file (bin file) by displaying data in a waveform graph using GX LogViewer.



# Programs example

The following shows a program example of executing data logging in Setting example 1 and Setting example 2.




# Operating procedure



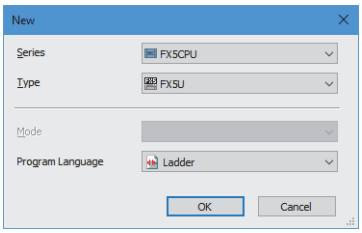
This section shows the operating procedure for Setting example 1 and Setting example 2 (the CPU Module Logging Configuration Tool windows show the setting details of Setting example 2).

## Setting parameters

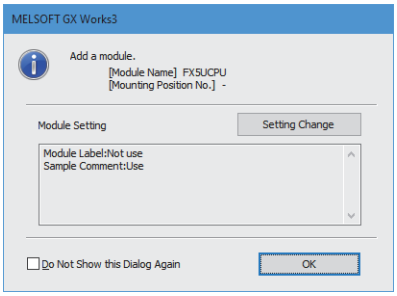
***1.*** Start GX Works3 and create a new project.

[Project] ⇨ [New]

***2.*** Select the details shown below and click [OK].

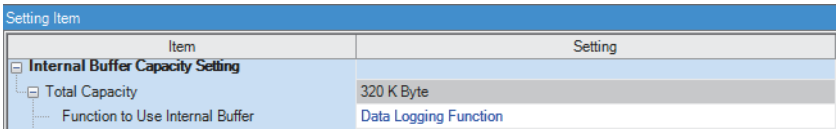



***3.*** Click [OK] with the details shown below as-is.




***4.*** Open "Memory/Device Setting" and check that "Function to Use Internal Buffer" is set to "Data Logging Function".

Navigation window ⇨ [Parameter] ⇨ [FX5UCPU] ⇨ [CPU Parameter] ⇨ [Memory/Device Setting]



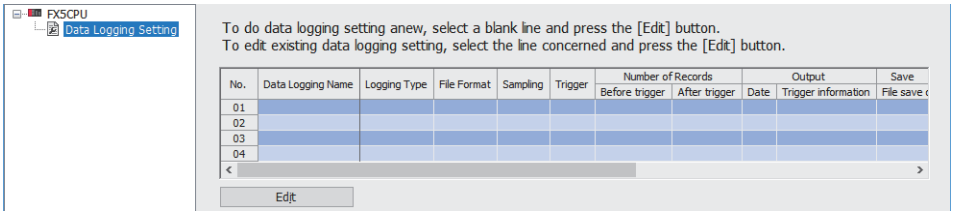
## Setting data logging

**1.** In the menu window of GX Works3, start the CPU Module Logging Configuration Tool.

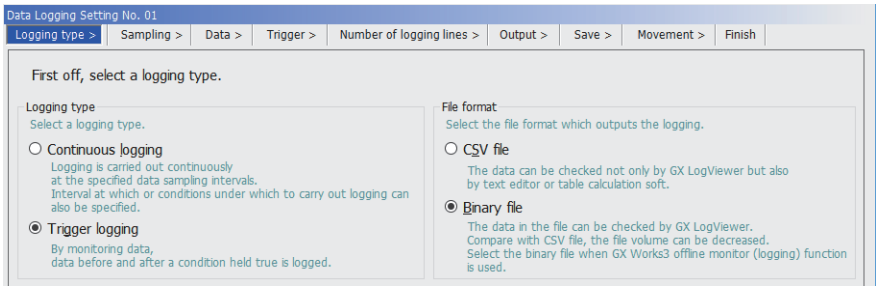
[Tool] ⇨ [Logging Configuration Tool]

**2.** Open the data logging setting window.

[Data Logging Setting] ⇨ [Edit]




**3.** Select "Logging type"[*1] and "File format"[*2], and click [Next].

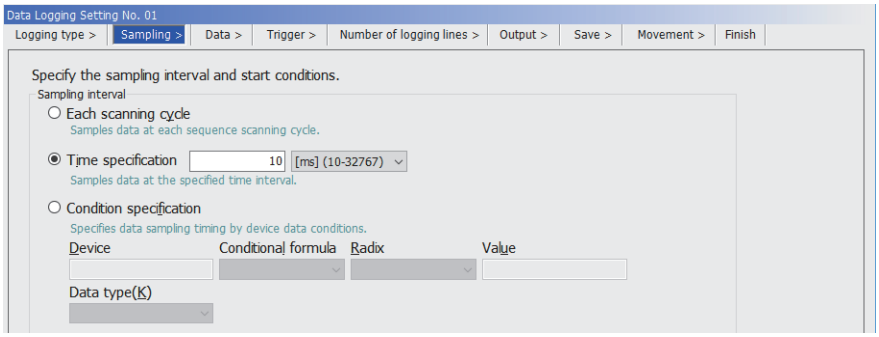



| Setting example 1 | Setting example 2 |
|---|---|
| ■Logging type<br>Select "Continuous logging".<br>■File format<br>Select "CSV file". | ■Logging type<br>Select "Trigger logging".<br>■File format<br>Select "Binary file". |

*1 For details on the setting details, refer to the following table.
☞ Page 163 Logging type

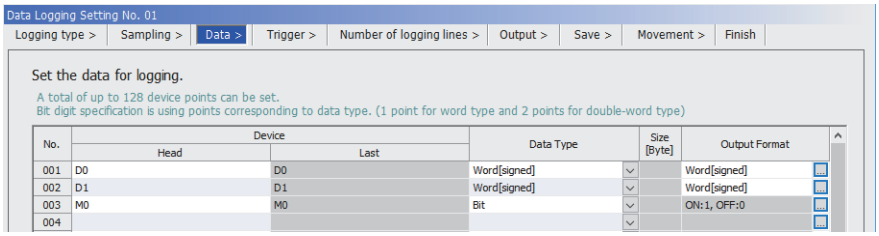
*2 For details on the setting details, refer to the following table.
☞ Page 169 Data logging file

**4.** Set the collection interval[*1], and click [Next]. Select "Time specification" this time, and enter 10 milliseconds.




*1 For details on the setting details, refer to the following table.
☞ Page 165 Data collection conditions

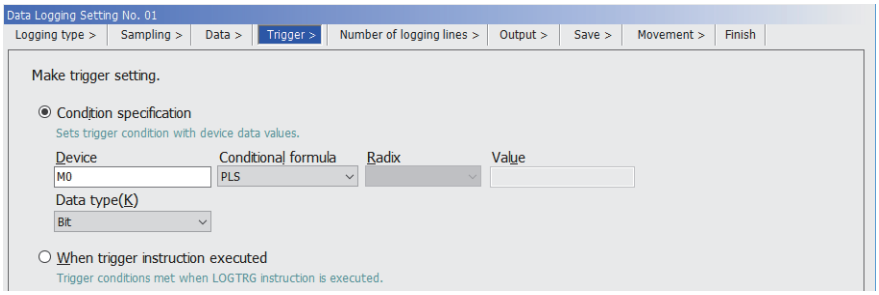
**5.** Set the logging target data[*1], and click [Next].




| Setting example 1 | Setting example 2 |
|---|---|
| Enter D0, D1, and M0 in the "Head" column. | Enter D0, D1, and M0 in the "Head" column. |

*1 For details on the setting details, refer to the following table.
☞ Page 167 Target data

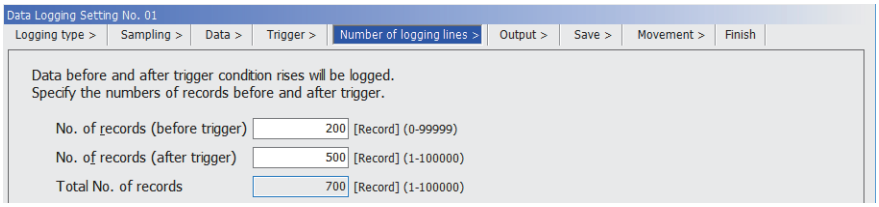
**6.** Set the trigger[*1], and click [Next]. This setting is performed only when trigger logging is selected for the logging type.




| Setting example 1 | Setting example 2 |
|---|---|
| No setting item Proceed to step 8. | • Select "Condition specification".<br>• Enter M0 for "Device".<br>• Select "↑" for "Conditional formula". |

*1 For details on the setting details, refer to the following table.
☞ Page 168 Trigger condition

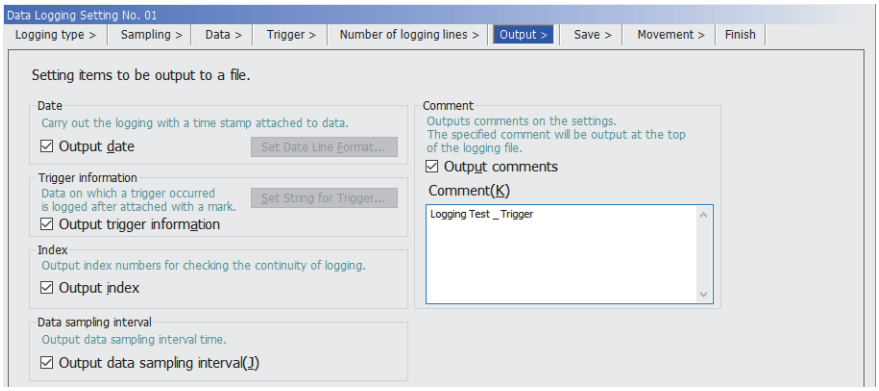
**7.** Specify a value for "Number of records (before trigger)/Number of records (after trigger)"[*1], and click [Next]. This setting is performed only when trigger logging is selected for the logging type.




| Setting example 1 | Setting example 2 |
|---|---|
| No setting item Proceed to step 8. | • Enter 200 for "Number of records (before trigger)".<br>• Enter 500 for "Number of records (after trigger)". |

*1 For details on the setting details, refer to the following table.
☞ Page 165 Number of records

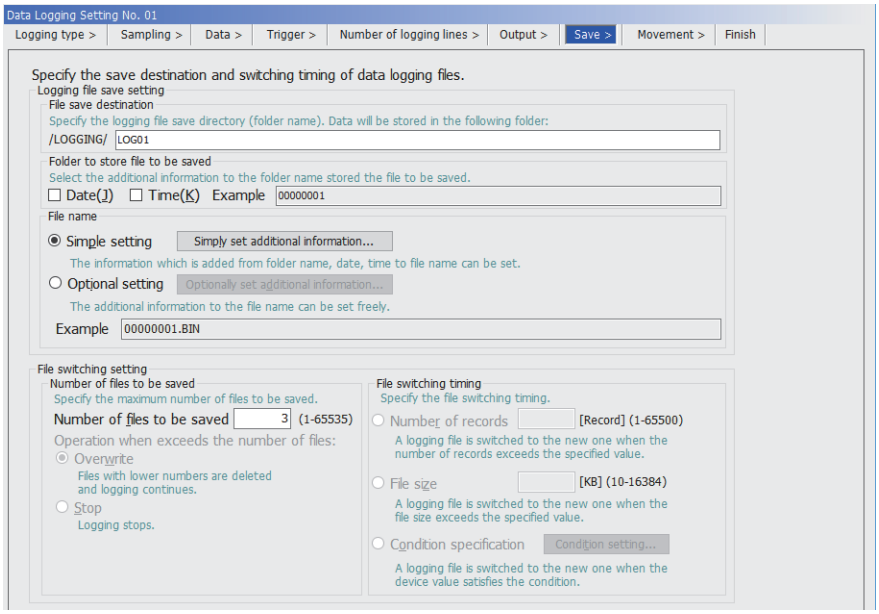
**8.** Set the items to be output into the file[*1], and click [Next].




| Setting example 1 | Setting example 2 |
|---|---|
| • Select the checkbox for "Output data".<br>• Select the checkbox for "Output index".<br>• Select the checkbox for "Output data sampling interval".<br>• Select the checkbox for "Output comments".<br>• Enter Logging Test_Continuation for "Comment". | • Select the checkbox for "Output data".<br>• Select the checkbox for "Output trigger information".<br>• Select the checkbox for "Output index".<br>• Select the checkbox for "Output data sampling interval".<br>• Select the checkbox for "Output comments".<br>• Enter Logging Test_Trigger for "Comment". |

*1 For details on the setting details, refer to the following table.
☞ Page 169 Data output specifications

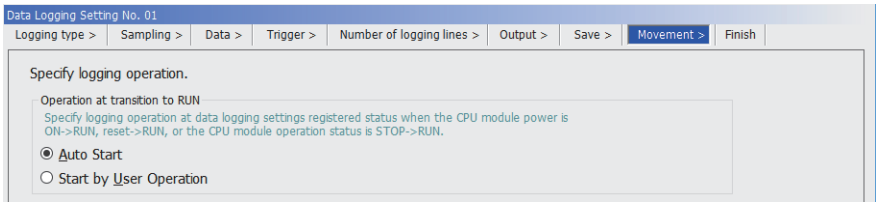
**9.** Set the logging file save destination and file switching[*1], and click [Next].




| Setting example 1 | Setting example 2 |
|---|---|
| • Enter LOG01 for "File save destination".<br>• Select "Simple setting" for "File name".<br>• Enter 3 for "Number of files to be saved".<br>• Select "Overwrite" for "Operation when exceeds the number of files".<br>• Select "Number of records" and enter 1000. | • Enter LOG01 for "File save destination".<br>• Select "Simple setting" for "File name".<br>• Enter 3 for "Number of files to be saved". |

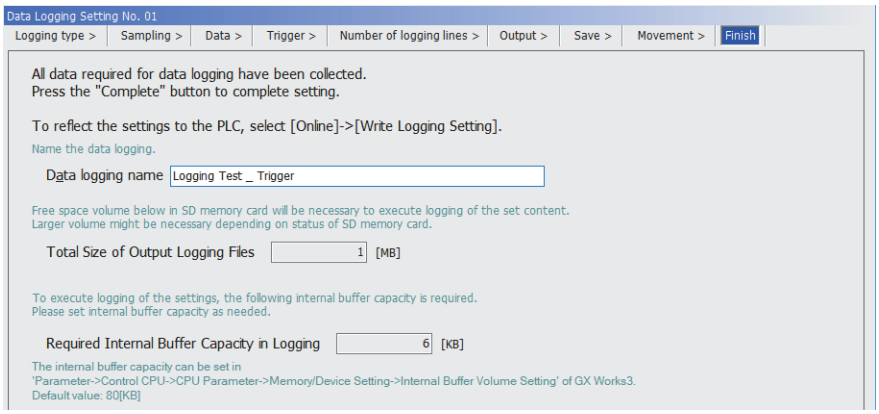
*1 For details on the setting details, refer to the following table.
☞ Page 175 Saving and file switching

**10.** Specify the logging operation when the mode transfers to RUN mode[*1]. Select "Auto Start" this time, and click [Next].




*1 For details on the setting details, refer to the following table.
☞ Page 188 Setting the operation at the time of transition to RUN

**11.** Check the set details, give any name[*1], and click [Finish].




*1 For details on the setting details, refer to the following table.
☞ Page 939 Finish

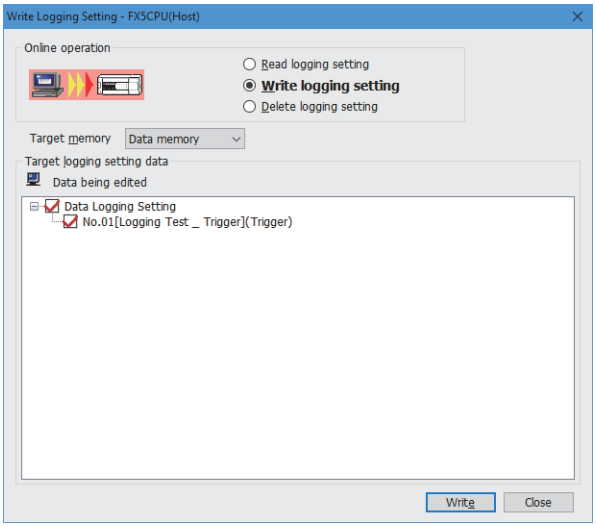
## Writing the data logging setting

**1.** Insert an SD memory card into the CPU module, and turn on the power.

**2.** Write the data logging settings to the data memory or SD memory card.

[Online] ⇨ [Write Logging Setting]

**3.** Click [Write].

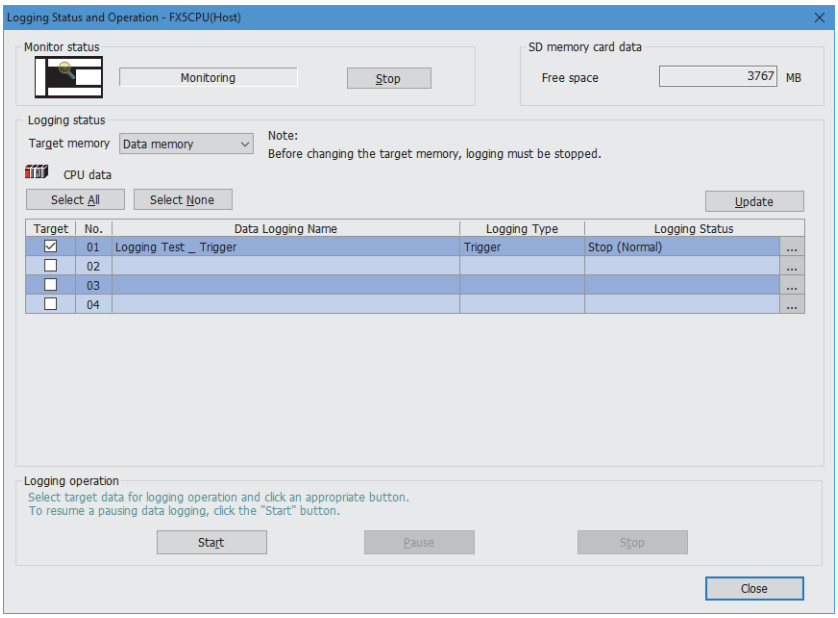


## Executing data logging

1. Set the CPU module to the RUN status.
2. Open the "Logging Status and Operation" window.

[Online] ⇨ [Logging Status and Operation]

3. Check the target of data logging execution (multiple targets can be selected). Select "No.01" this time.




4. Start the data logging by clicking the [Start] button. (When multiple items are selected, they are executed simultaneously.)
5. The logging status changes from "Stop (Normal)" to a state in the following table.

| Setting example 1 | Setting example 2 |
|---|---|
| "Collecting" | • Before trigger occurrence: "Waiting trigger Collecting before trigger"<br>• After trigger occurrence: "Collecting after trigger"<br>• After completion of collection: "Collection Completed" |

For the logging status, refer to the following.

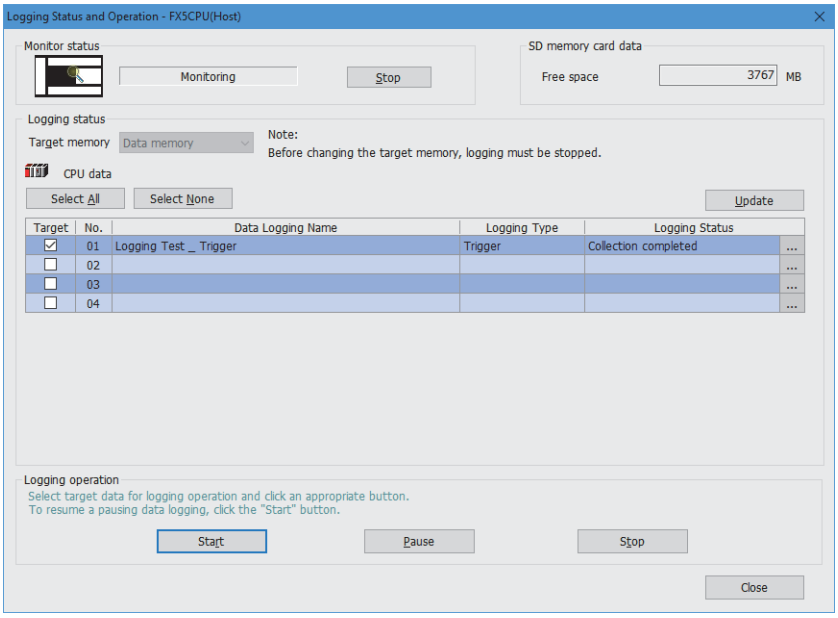
☞ Page 929 Logging status and operation

## Stopping data logging

1. Open the "Logging Status and Operation" window.

[Online] ⇨ [Logging Status and Operation]

2. Check the target of data logging stop.




3. Stop data logging execution by clicking the [Stop] button.

4. The logging status changes to "Stop (Normal)".

**Point**

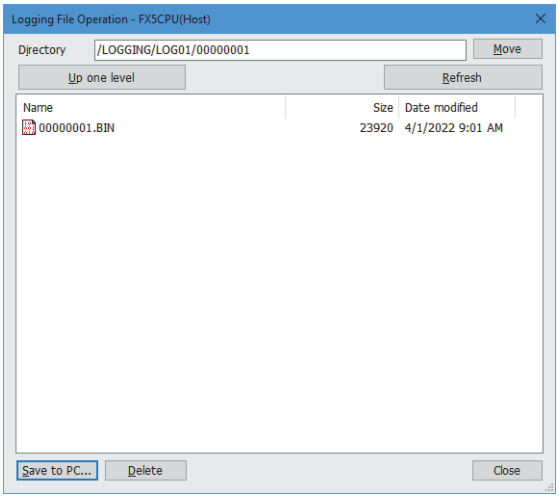
Data logging execution (start/stop/suspend) can also be executed by using a special relay.

☞ Page 162 Data Logging Execution by Special Relay

## Saving data logging files

1. Open the "Logging File Operation" window.

[Online] ⇨ [Logging File Operation]




2. Specify the directory and select the target file.

3. Click the [Save to PC] button.

4. Specify the save destination and click the [Save] button.

5. The data logging file is saved into the specified location.

## Setting example 1: Checking logging data with a CSV file

1. Open a data logging file (*.csv) saved in your personal computer using such an application as Excel.
2. The data logging data can be checked.

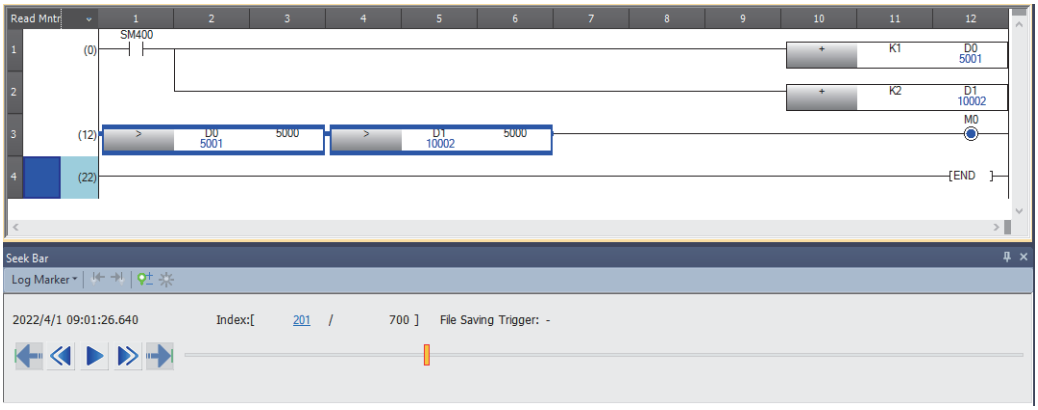
| [LOGGING] | FX5CPU_2 | 3 | 4 | 5 | 2 |
|---|---|---|---|---|---|
| Logging test | | | | | |
| DATETIME[YYYY/MM/DD hh:mm:ss.sss] | INTERVAL | INDEX | SHORT[DEC.0] | SHORT[DEC.0] | BIT[1;0] |
| TIME | INTERVAL[us] | INDEX | D0 | D1 | M0 |
| 2022/4/1 0:31 | 10000 | 4001 | 16111 | 32222 | 1 |
| 2022/4/1 0:31 | 10000 | 4002 | 16158 | 32316 | 1 |
| 2022/4/1 0:31 | 10000 | 4003 | 16204 | 32408 | 1 |
| 2022/4/1 0:31 | 10000 | 4004 | 16250 | 32500 | 1 |
| 2022/4/1 0:31 | 10000 | 4005 | 16296 | 32592 | 1 |
| 2022/4/1 0:31 | 10000 | 4006 | 16343 | 32686 | 1 |
| 2022/4/1 0:31 | 10000 | 4007 | 16389 | -32758 | 0 |
| 2022/4/1 0:31 | 10000 | 4008 | 16435 | -32666 | 0 |
| 2022/4/1 0:31 | 10000 | 4009 | 16481 | -32574 | 0 |
| 2022/4/1 0:31 | 10000 | 4010 | 16528 | -32480 | 0 |

## Example 2: Checking logging data on the program editor

1. Open the GX Works3 program used for data logging.
2. Start the offline monitor. Open a data logging file (*.bin) saved in your personal computer.

[Recording] ⇨ [Start Offline Monitor] ⇨ [Logging File]

3. The data logging data can be checked on the program editor.

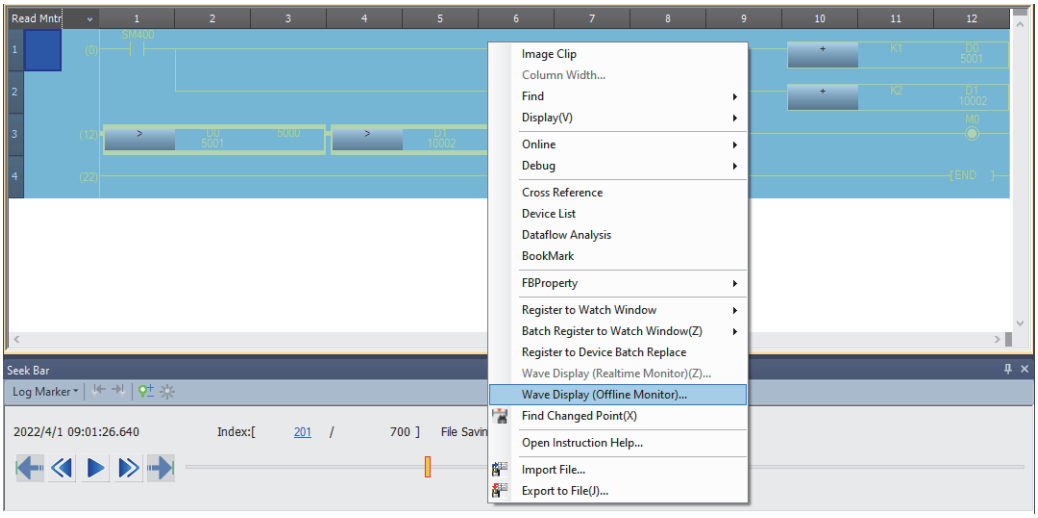


## Example 2: Checking logging data in a waveform graph

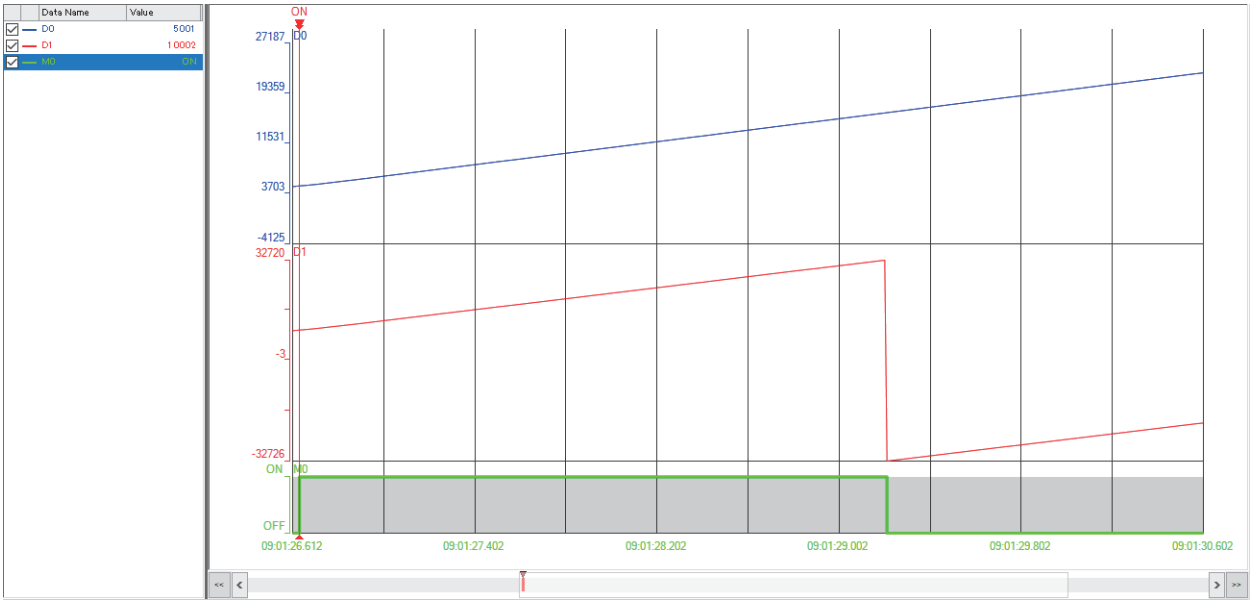
**1.** While using the offline monitor, select all devices on the program editor.

**2.** Perform the following operation on the program editor.

Right-click the mouse ⇨ [Wave Display (Offline Monitor)].




**3.** GX LogViewer starts, enabling the logging data to be checked in a waveform graph.




**Point**

For details on GX LogViewer, refer to the following:

GX LogViewer Version 1 Operating Manual

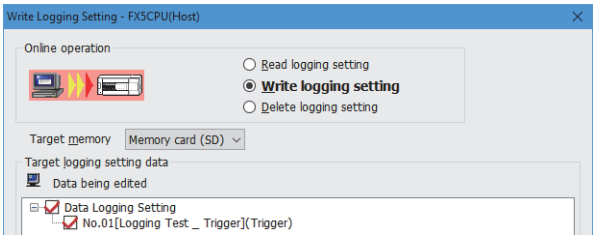
# 20.4 Data Logging Execution by Special Relay

The data logging setting can be registered by the special relay and be executed on the data logging setting file stored in the SD memory card. (Data logging operations such as start and stop can be performed without using the CPU Module Logging Configuration Tool.)
This operation can be used together with each operation of the CPU Module Logging Configuration Tool.

## Operating procedure

The following describes the procedure for executing data logging in Setting No.1 by using a special relay (SM).

1. Write the effective setting data to the SD memory card with CPU module logging setting tool.




2. When SM9300 (Data logging register/clear flag) is turned ON, the setting data in the SD memory card will be registered.
3. When SM1312 (Data logging suspend/resume flag) is turned OFF, the execution of data logging will start. (Data logging can be executed for multiple setting numbers simultaneously.)
4. To suspend the data logging, turn ON SM1312 (Data logging suspend/resume flag). To stop the data logging, turn OFF SM9300 (Data logging register/clear flag).

**Point**

- The data logging cannot be started even when writing the setting and turning power off and on or resetting. To start the data logging, make sure to turn ON the special relay (Data logging register/clear flag), and turn OFF the special relay (Data logging suspend/resume).
- With regards to the trigger logging, the data logging setting registration attempt fails if the trigger condition is satisfied.
- It takes a certain amount of time to stop or suspend the data logging after either of these commands is issued by special relay (because the data logging is not stopped or suspended unless the data stored in the internal buffer data has been transferred into the SD memory card in response to these commands).
- There may be a case where a time-out error occurs and the data logging is suspended after special relay starts the logging.

## Precautions

The data logging cannot be executed by the special relay for the data logging setting file stored in the data memory.

## Data logging resume

When an error occurs during the data logging execution, the following operation is required to resume the data logging from the program, etc.

## Operating procedure

1. Clear the cause of error, turn OFF the special relay (Data logging register/clear), and set the data logging status to the disable status.
2. After confirming the special relay (Data logging preparation) is OFF, turn ON the special relay (Data logging register/clear flag).
3. After confirming the special relay (Data logging preparation) is ON, turn OFF the special relay (Data logging suspend/resume).

### Special relay and special register used by the data logging function

For details on the special relays and special registers used by the data logging function, refer to the following:

- Special relay: Special relay related to the data logging function (☞ Page 781 Data logging function)
- Special register: Special register related with the data logging function (☞ Page 812 Data logging function)

# 20.5 Details of Specifications

## Logging type

The following table describes available methods of data collection.

| Logging type | Data collection method | Application |
|---|---|---|
| Continuous logging | Continuously collects specified data at specified interval or timing. | Allows the user to continuously record specified data for a certain period of time and check such data in any timing. |
| Trigger logging | Collects specified data at specified interval or timing and extracts a specified number of data records before and after the satisfaction of a trigger condition. | Allows the user to monitor the content of specified data before and after the satisfaction of a trigger condition. For example, by setting the device for error occurrence as a trigger, logging data before and after error occurrence can be checked. |

### Continuous logging

In continuous logging, the CPU module stores specified data in its internal buffer at a specified collection interval or timing and, at the time of a file save operation, it saves the data in a data logging file residing in the storage memory. The timing of a file save operation and the number of saved files can be specified using "File switching timing" and "Number of files to be saved" in the CPU Module Logging Configuration Tool.

To save a data logging file by specifying "File switching timing", even if a data logging file after file switching is not saved, the previously saved data logging file can be read.

If the "Stop" has been set for "Operation when exceeds the number of files" on the setting screen of the CPU Module Logging Configuration Tool, the collection will be finished when the number of saved files reaches the set "number of files to be saved".

#### ■To start continuous logging

Start data logging by start operation from the CPU Module Logging Configuration Tool or the special relay[*1].

#### ■To stop continuous logging

The user can clear the data logging setting registration stored in the CPU module and completely stop the data logging by stopping the data logging from CPU Module Logging Configuration Tool or special relay[*1]. (The special relay (data logging start) turns off.)

*1 This setting is valid only when the data logging setting file is written in the SD memory card. (☞ Page 162 Data Logging Execution by Special Relay)

#### ■To suspend/resume continuous logging

The user can suspend data logging with the data logging settings remaining intact by doing either of the following:

- Instruct the CPU Module Logging Configuration Tool or special relay[*1] to suspend data logging (the special relay (data logging start) turns off).
- Turn off to on the special relay (Data logging suspend/resume flag).

To resume continuous logging from suspension, do either of the following:

- Instruct the CPU Module Logging Configuration Tool or special relay[*1] to resume data logging (the special relay (data logging start) turns on).
- Turn on to off the special relay (Data logging suspend/resume flag).

*1 This setting is valid only when the data logging setting file is written in the SD memory card. (☞ Page 162 Data Logging Execution by Special Relay)

## Trigger logging

In trigger logging, the CPU module stores specified data in its internal buffer at a specified collection interval or timing; it extracts a specified number of data records before and after the satisfaction of a trigger condition and saves the extracted data in a data logging file residing in the storage memory. Note that data collection is performed not only at the specified collection interval or timing but also when a trigger condition is met. In addition, once a trigger condition is met, any subsequent trigger conditions are ignored.

When the data for the number of records specified by the CPU Module Logging Configuration Tool is collected and written to the storage memory, the collection will be finished.

### ■To start trigger logging

Start data logging by start operation from the CPU Module Logging Configuration Tool or the special relay[*1].

### ■To stop trigger logging

The user can clear the data logging setting registration stored in the CPU module and completely stop the data logging by stopping the data logging from CPU Module Logging Configuration Tool or special relay[*1]. (The special relay (data logging start) turns off.)

*1 This setting is valid only when the data logging setting file is written in the SD memory card. (☞ Page 162 Data Logging Execution by Special Relay)

### ■To suspend/resume trigger logging

The user can suspend data logging with the data logging settings remaining intact by doing either of the following:

- Instruct the CPU Module Logging Configuration Tool or special relay[*1] to suspend data logging (the special relay (data logging start) turns off).
- Turn off to on the special relay (Data logging suspend/resume flag).

To resume trigger logging from suspension, do either of the following:

- Instruct the CPU Module Logging Configuration Tool or special relay[*1] to resume data logging (the special relay (data logging start) turns on).
- Turn on to off the special relay (Data logging suspend/resume flag).

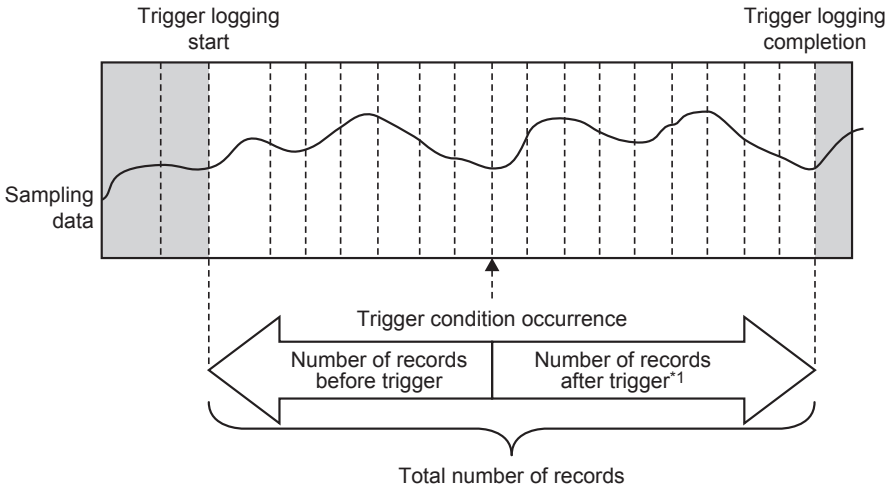
*1 This setting is valid only when the data logging setting file is written in the SD memory card. (☞ Page 162 Data Logging Execution by Special Relay)

### Precautions

If data logging is stopped or data collection is suspended before completion of trigger logging and then data logging is resumed, data collection will be started not from the last logging, but from the initial state before the trigger logging.

### ■Number of records

Specify the number of records to be collected before and after the satisfaction of a trigger condition. (☞ Page 935 Number of records)




*1 This number includes the record exactly at the time when the trigger condition is met.

**Point**

After starting data logging, if the trigger condition is met before data collection of the specified number of records (before trigger) is completed, the number of sampled records will be less than that specified.

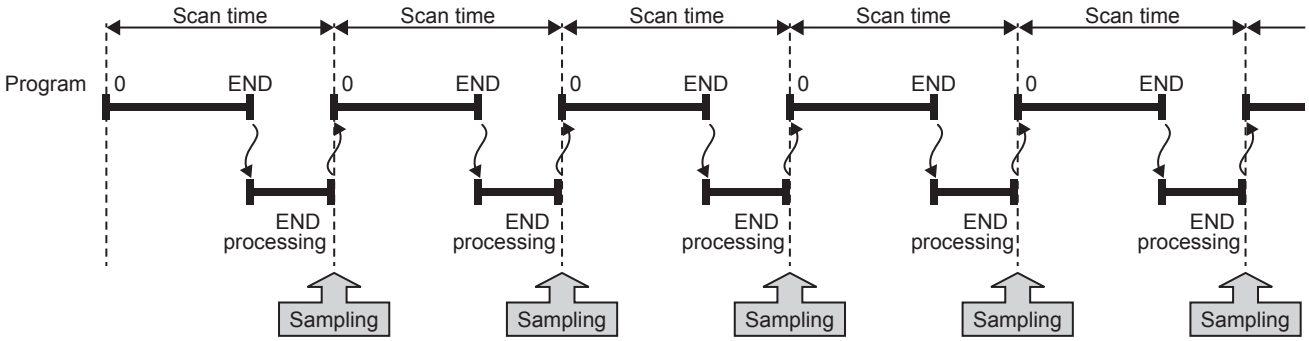
## Data collection conditions

This section describes the timing when data is collected and the conditions under which data is collected.

| Data collection conditions | Description |
|---|---|
| Each scanning cycle | Collects data during the END processing of each scan. |
| Time specification | Collects data during the END processing after specified time interval. |
| Condition specification | Collects data when the monitored data meets the specified condition during the END processing. |

### Each scanning cycle

Collects data during the END processing of each scan.




#### Precautions

When specifying each scanning cycle, make only one data logging setting.

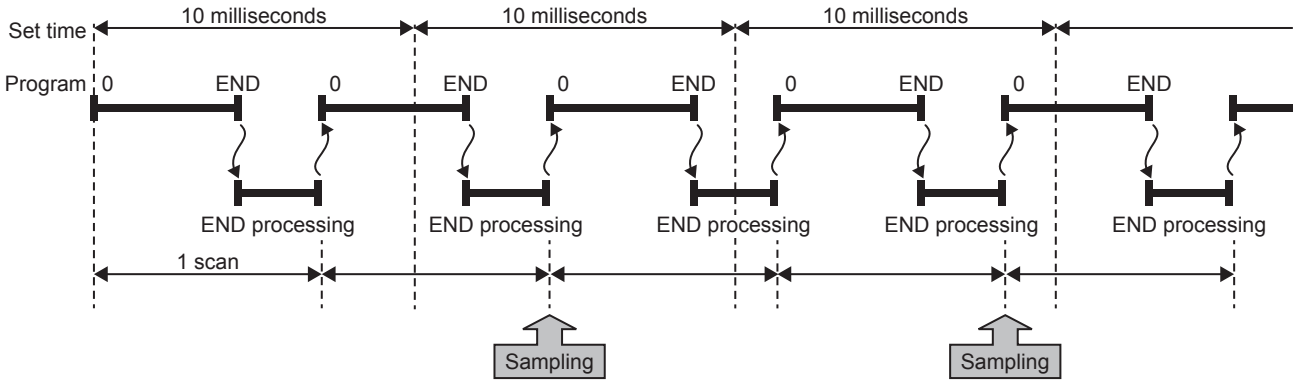
## Time specification

Allows the user to specify the collection time interval.

The CPU module starts collecting data at the time of the following END process after the specified time has elapsed. Ensure that the "Scan time" is less than "Time specification". If the scan time is longer than the specified time and the collection interval or the collection timing occurs more than once during the same scan, data is collected only once during the END processing. Data collection is performed on a scan by scan basis, which is the same operation as when "Each scanning cycle" is used.

Ex.

When the time interval is set to 10 milliseconds




## Condition specification

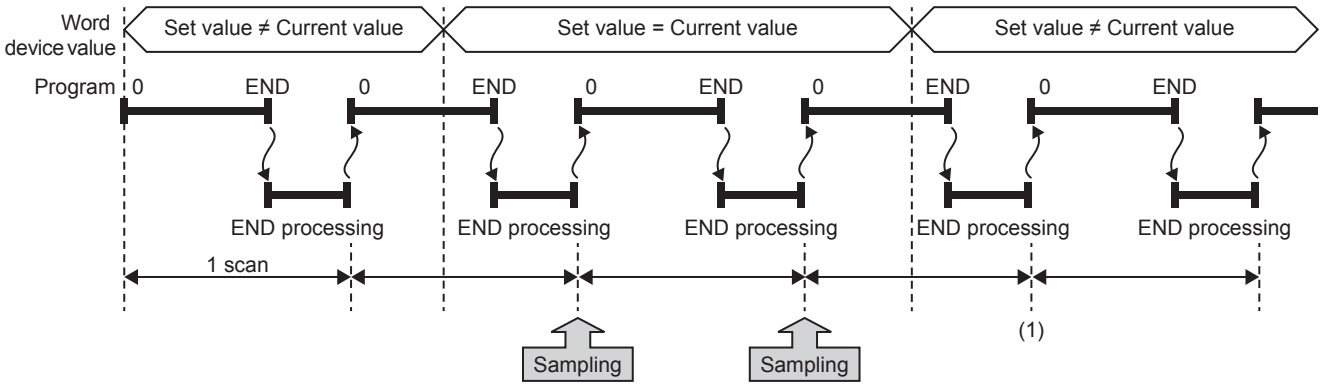
This option allows the user to set the data collection timing by specifying the device data conditions.

Collects data when the monitored data meets the specified condition during the END processing.

### ■To collect data continuously while the conditions are met

The following conditional formula causes the data logging function to collect data continuously while the conditions are met:

- =: When the current value of the monitored data is equal to the comparison value
- ≠: When the current value of the monitored data is not equal to the comparison value
- ≥: When the current value of the monitored data is equal to or larger than the comparison value
- >: When the current value of the monitored data is larger than the comparison value
- ≤: When the current value of the monitored data is equal to or smaller than the comparison value
- <: When the current value of the monitored data is smaller than the comparison value

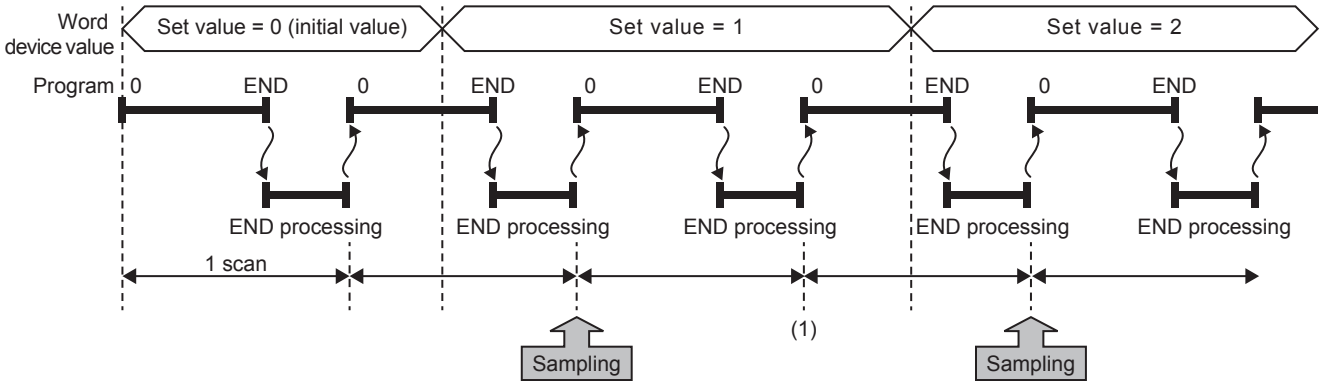



(1) During the END processing, the data logging function does not collect data because the conditions are not met.

### ■To collect data only when the state changes

The following conditional formula causes the data logging function to collect data only during the END processing for the scans where the conditional formula is met. It does not collect data for any single scan where the conditional formula is not met during the END processing (even if the conditional formula is met before the END processing is initiated).

- ↑: When the specified data turns off and on
- ↓: When the specified data turns on and off
- At change: When the current value of the specified data changes




(1) The data logging function does not collect data because there has been no change in state since the last scan.

### ■Specifying the monitored data

For monitored data, the following devices can be specified. The data types that can be selected include bit/word (unsigned), word (signed), double word (unsigned), and double word (signed).

| Type | Device*1 |
|---|---|
| Bit device*2 | X, Y, M, SM, L, B, F, SB, T (contact)*4, ST (contact)*4, C (contact)*4, LC (contact)*4, BL□\S□*5 |
| Word device*3 | T (Current value)*6, ST (Current value)*6, C (Current value)*6, D, SD, W, SW, R, U□\G□*7 |
| Double-word device | LC (current value)*6 |

*1 Index modification, and indirect specification cannot be specified.
*2 For bit devices, bit specification of word cannot be specified.
*3 For word devices, nibble specification of bit devices cannot be specified.
*4 To specify these devices with the CPU Module Logging Configuration Tool, use T (contact): TS, ST (contact): STS, C (contact): CS, LC (contact): LCS.
*5 Applicable only to FX5U/FX5UC CPU module.
*6 To specify these devices with the CPU Module Logging Configuration Tool, use T (current value): T or TN, ST (current value): ST or STN, C (current value): C or CN, and LC (current value): LC or LCN.
*7 This format is supported by the FX5UJ and FX5U/FX5UC CPU modules.

# Target data

This section describes the data to be collected by data logging.

## Number of data points

The data logging function can collect up to 512 data records. (4 settings × 128 records)*1

*1 Duplicate data records are counted as unique records.

## Data to be collected

The data for the following devices can be specified to be collected.

| Type | Device[*1] |
|---|---|
| Bit device[*2] | X, Y, M, SM, L, B, F, SB, T (contact)[*4], T (coil)[*4], ST (contact)[*4], ST (coil)[*4], C (contact)[*4], C (coil)[*4], LC (contact)[*4], LC (coil)[*4], BL□\S□[*5] |
| Word device[*3] | T (Current value)[*6], ST (Current value)[*6], C (Current value)[*6], D, SD, W, SW, R, U□\G□[*7] |
| Double-word device | LC (current value)[*6] |

*1 Index modification, and indirect specification cannot be specified.
*2 For bit devices, bit specification of word cannot be specified.
*3 For word devices, nibble specification of bit devices cannot be specified.
*4 To specify these devices with the CPU Module Logging Configuration Tool, use T (contact): TS, T (coil): TC, ST (contact): STS, ST (coil): STC, C (contact): CS, C (coil): CC, LC (contact): LCS, and LC (coil): LCC.
*5 Applicable only to FX5U/FX5UC CPU module.
*6 To specify these devices with the CPU Module Logging Configuration Tool, use T (current value): T or TN, ST (current value): ST or STN, C (current value): C or CN, and LC (current value): LC or LCN.
*7 This format is supported by the FX5UJ and FX5U/FX5UC CPU modules.

## Data type

The following table shows the number of data records for each data type.

| Data type | Number of data points |
|---|---|
| Bit | 1 |
| Word (signed) | 1 |
| Double word (signed) | 2 |
| Word (unsigned) | 1 |
| Double word (unsigned) | 2 |
| Single-precision real number | 2 |
| Time | 2 |
| String[*1*2] | Specified size/2[*3] |
| Numeric string[*2] | Specified size/2[*3] |

*1 Outputs the entered character code.
*2 Collected as binary data.
*3 The specified size can be 1 to 256. If the specified size is an odd number, the number of data records is rounded to the next higher integer. Example: The number of data records is 3 if the specified size is 5.

# Trigger condition

The following table lists the conditions to be used as a trigger.

| Trigger condition | Description |
|---|---|
| Condition specification | A trigger occurs when the monitored data meets the specified condition. |
| When trigger instruction executed | A trigger occurs when the LOGTRG instruction is executed. |

### Precautions

- When registering the data logging settings, ensure that the trigger conditions are not met. If the trigger conditions are met, the data logging settings cannot be registered.
- After the trigger condition is established in the trigger logging operation, if the trigger condition is met again, the CPU module does not recognize a new trigger condition.

## Condition specification

Configure the trigger condition based on the device data value. A trigger occurs when the monitored data meets the specified condition.

- ↑: When the specified data turns off and on
- ↓: When the specified data turns on and off
- =: When the monitored data is equal to the comparison value, regardless of whether or not its current value is equal
- ≠: When the monitored data is not equal to the comparison value, regardless of whether or not its current value is equal
- ≥: When the monitored data is greater than or equal to the comparison value, regardless of whether or not its current value is equal
- >: When the monitored data is greater than the comparison value, regardless of whether or not its current value is equal
- ≤: When the monitored data is less than or equal to the comparison value, regardless of whether or not its current value is equal
- <: When the monitored data is less than the comparison value, regardless of whether or not its current value is equal
- At change: When the current value of the specified data changes

### ■Specifying the monitored data

For the device change specification, monitored data can be configured to be collected from the devices listed in the following table. The data types that can be selected include bit/word (unsigned), word (signed), double word (unsigned), and double word (signed). If double word (unsigned) or double word (signed) is specified, a trigger occurs only when data equal to one double word is written. No trigger occurs when only the upper or lower word of a double word is written.

| Type | Device*1 |
|---|---|
| Bit device*2 | X, Y, M, SM, L, B, F, SB, T (contact)*4, ST (contact)*4, C (contact)*4, LC (contact)*4, BL□\S□*6 |
| Word device*3 | T (Current value)*5, ST (Current value)*5, C (Current value)*5, D, SD, W, SW, R, U□\G□*7 |
| Double-word device | LC (Current value)*5 |

*1 Index modification, and indirect specification cannot be specified.
*2 For bit devices, bit specification of word cannot be specified.
*3 For word devices, nibble specification of bit devices cannot be specified.
*4 To specify these devices with the CPU Module Logging Configuration Tool, use T (contact): TS, ST (contact): STS, C (contact): CS, LC (contact): LCS.
*5 To specify these devices with the CPU Module Logging Configuration Tool, use T (current value): T or TN, ST (current value): ST or STN, C (current value): C or CN, and LC (current value): LC or LCN.
*6 Only FX5U/FX5UC CPU module is supported.
*7 This format is supported by the FX5UJ and FX5U/FX5UC CPU modules.

## When trigger instruction executed

A trigger occurs when the LOGTRG instruction is executed. (MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks))

# Data logging file

This section describes data logging files.

The following storage formats are available for data logging files.

| File format | Application |
|---|---|
| CSV file format | This is a file format which can be open in generic-purpose application programs such as Excel and Notepad. GX LogViewer is also available for displaying data. |
| Binary file format | Comparing the CSV file format, the size of files is small and therefore quicker access to files is provided. GX LogViewer is also available for displaying data. |

## Data output specifications

The output specifications for each file format are shown below.

## ■CSV file format

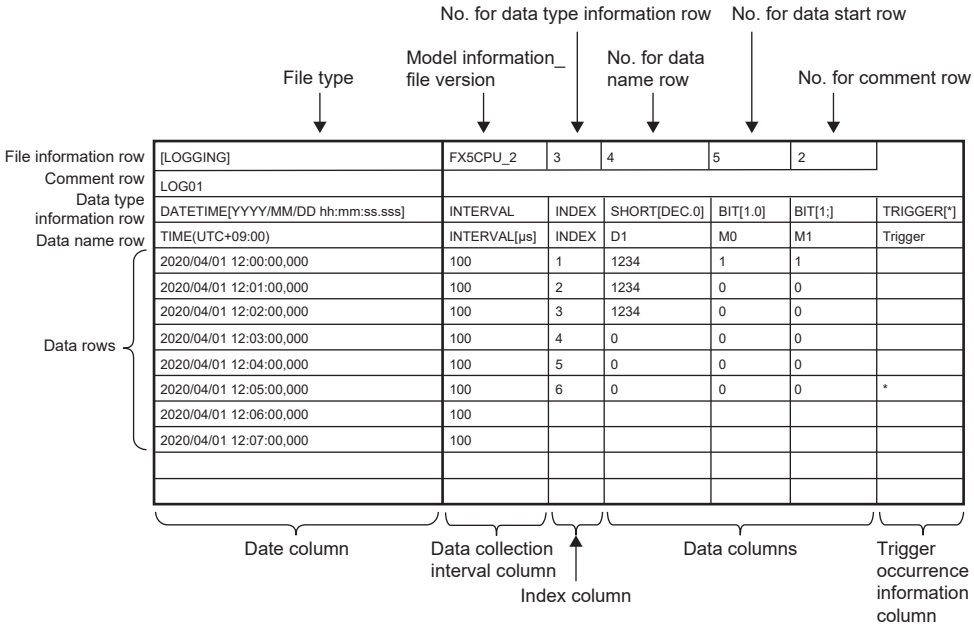
The specifications for the CSV file format and the details of the output data are shown below.

• Format specifications

| Item | Description |
|---|---|
| Delimiter | Commas (,) |
| Return code | CRLF (0x0D, 0x0A) |
| Character code | ASCII code or Shift-JIS code |
| Field data | Not enclosed by double quotation marks (" ")<br>Double quotation marks (" ") and commas (,) cannot be used in each data. |

• File format example

Output items can be specified (☞ Page 936 Output)




• Output content for each data

<File information row>

File-related information is displayed.

| Item | Description | Size |
|---|---|---|
| File type | [LOGGING] is output. | 9 bytes |
| Model information_file version | "FX5CPU_2" is displayed in the file version which describes the model information. | 8 bytes |
| No. for data type information row | Numerical value indicating the position of the data type information row from the top of the file is placed. | 1 byte |
| No. for data name row | Numerical value indicating the position of the data name row from the top of the file is placed. | 1 byte |
| No. for data start row | Numerical value indicating the starting position of the data row from the top of the file is placed. | 1 byte |
| No. for comment row | Numerical value indicating the position of the comment row from the top of the file is placed. When the comment row is not output, this field is blank. | 0 to 1 bytes |

Ex.

The total size of the file information row can be obtained by the following equation: (when comment is output)

9 (file type) + 8 (model information_file version) + 1 (data type information row number) + 1 (data name row number) + 1 (data start row number) + 1 (comment row number) + 5 (the number of commas) + 2 (CR + LF)

= 28 bytes

<Comment row>

Comments are displayed.

| Item | Description | Size |
|---|---|---|
| Comment | Comment specified in CPU Module Logging Configuration Tool is output (Up to 256 double-byte characters can be used.*1 When no comment is set, a blank row is output). | 0 to 512 bytes |

*1 Double quotation marks (" "), commas (,), and semicolons (;) cannot be used.

Ex.

The total size of the comment row can be obtained by the following equation:

Character size of the specified comment (depending on the specified character string. (A single-byte character is calculated as one byte and a double-byte character is calculated as two bytes.) + 2 (CR + LF)

<Data type information row>

The data type for each column is displayed. This information is output in the following format: (Data type)[(Additional information)].

| Item | "Data type" output content | Size | "Additional information" output content | Size |
|---|---|---|---|---|
| Date column | DATETIME | 8 bytes | Format is output.<br>[YYYY/MM/DD hh:mm:ss.sss] | 4 to 29 bytes |
| Data collection interval column | INTERVAL | 8 bytes | No additional information | 0 byte |
| Index column | INDEX | 5 bytes | No additional information | 0 byte |
| Data column | Bit type: BIT | 3 bytes | Bit type: [1;0] | 5 bytes |
| | 16-bit integer (signed): SHORT | 5 bytes | For decimal format: [DEC.0] | 7 bytes |
| | 16-bit integer (unsigned): USHORT | 6 bytes | For hexadecimal format: [HEX] | 5 bytes |
| | 32-bit integer (signed): LONG | 4 bytes | When the decimal fraction format is specified: [DEC. (number of digits of decimal part)] | 7 to 8 bytes |
| | 32-bit integer (unsigned): ULONG | 5 bytes | | |
| | Single-precision floating point (32-bit): FLOAT | 5 bytes | When the exponential format is specified: [EXP. (number of digits of decimal part)] | 7 to 8 bytes |
| | Character string type: STRING | 6 bytes | Character string type, numeric string type: the specified data length value (unit: bytes) is output. | 3 to 5 bytes |
| | Numeric string type: RAW | 3 bytes | | |
| | Time: TIME | 4 bytes | No additional information | 0 byte |
| Trigger occurrence information column | TRIGGER | 7 bytes | [(string occurred)] is output (semicolons (;), double quotation marks (" "), and commas (,) cannot be used). | 3 to 514 bytes |

Ex.

The size of the data type information row is determined by the following equation when data logging of 128 points of data (signed 16-bit integer, decimal format) is performed (The following sections in the "Output" window are set to be output: "Date" (the output format is YYYY/MM/DD hh:mm:ss.sss), "Data sampling interval", and "Index").

(8 + 25) (date column) + 8 (data collection interval column) + 5 (index column) + (5 + 7) × 128 (data column) + 132 (the number of commas) + 2 (CR + LF)

= 1716 bytes

<Data name row>

The data name for each column is displayed.

| Item | Description | Size |
|---|---|---|
| Date column | TIME (time zone) is output. | 4 bytes |
| Data collection interval column | INTERVAL[us] is output. | 12 bytes |
| Index column | INDEX is output. | 5 bytes |
| Data column | The specified device name is output. | 1 to 32 bytes |
| Trigger occurrence information column | Trigger is output. | 7 bytes |

Ex.

The size of the data name row is determined by the following equation when data logging of 128 data points from D100 to D227 is performed (The following sections in the "Output" window are set to be output: "Date", "Data sampling interval", and "Index").

4 (date column) + 12 (data collection interval column) + 5 (index column) + (4 × 128) (data column) + 132 (the number of commas) + 2 (CR + LF)

= 667 bytes

<Data row>

The collected data value is displayed. A single row means the data collection interval. The data collected by the trigger at a time is displayed in the single row.

| Item | Description | Size |
|---|---|---|
| Date column | Information is output according to the date information. | 1 to 32 bytes |
| Data collection interval column | The time interval from the previous collection time to the current collection time is output. If the maximum display range is exceeded, the count returns to 1 and starts again to output a new time interval<br>(unit: μs, display range: 1 to 100000000000). | 1 to 12 bytes |
| Index column | A value which increments in ascending order from 1 is output. When it exceeds the upper limit, it returns to 1 and increments again (range: 1 to 4294967295). | 1 to 10 bytes |
| Data column | The collected data value is output in a format and size in accordance with each data type. | — |
| | When bits are specified: bit On = 1 and bit Off = 0 are output. | 1 byte |
| | When signed word type is specified: data value is output according to the specified output type. | • Decimal format: 1 to 6 bytes<br>• Decimal fraction format: 1 to 21 bytes*1<br>• Exponential format: 5 to 21 bytes |
| | When unsigned word type is specified: data value is output according to the specified output type. | • Decimal format: 1 to 6 bytes<br>• Hexadecimal format: 1 to 4 bytes<br>• Decimal fraction format: 1 to 21 bytes*1<br>• Exponential format: 5 to 21 bytes |
| | When signed double word type is specified: data value is output according to the specified output type. | • Decimal format: 1 to 11 bytes<br>• Decimal fraction format: 1 to 26 bytes*1<br>• Exponential format: 5 to 22 bytes |
| | When unsigned double word type is specified: data value is output according to the specified output type. | • Decimal format: 1 to 11 bytes<br>• Hexadecimal format: 1 to 8 bytes<br>• Decimal fraction format: 1 to 26 bytes*1<br>• Exponential format: 5 to 22 bytes |
| | When single-precision real number is specified: data value is output according to the specified output type.*2 | • Decimal format: 1 to 11 bytes<br>• Decimal fraction format: 1 to 26 bytes<br>• Exponential format: 5 to 22 bytes |
| | When character string is specified: the specified character string is output.*3 | 1 to 256 bytes |
| | When numeric string is specified: the character string which is represented by the hexadecimal in increments of a byte is output without clearance.<br>[Ex.] When the start device is D0 and the numeric string is four bytes, it will be displayed as: D0:0x8A6B, D1:0x41C2 →"6B8AC241" | 2 to 512 bytes |
| | When time is specified: T#-24d20h31m23s648ms to T#24d20h31m23s647ms is displayed. | 13 to 20 bytes |
| Trigger occurrence information column | The specified character string is output when the trigger occurs. In other cases, no character string is output. | 0 to 512 bytes |

*1 When the numerical value to be output becomes out of the range of -2147483648.0 to 4294967295.0, it will be displayed in an equivalent format to "exponential format and the number of decimal part digits is nine".

*2 When the data value is not the output format specified in the data type, "NaN" will be output in the data row.

*3 When "0" which means the end of a character string is in the data, the subsequent data will not be output. Characters which is out of the range of ASCII or SJIS such as double quotation mark ("), comma (,), semicolon (;) will be replaced with period (.).

Ex.

The size of the data type information row is determined by the following equation when data logging of 128 points of data from D100 to D227 (unsigned word type, decimal format) is performed (The following sections in the "Output" window are set to be output: "Date" (the output format is YYYY/MM/DD hh:mm:ss.sss), "Data sampling interval", and "Index").

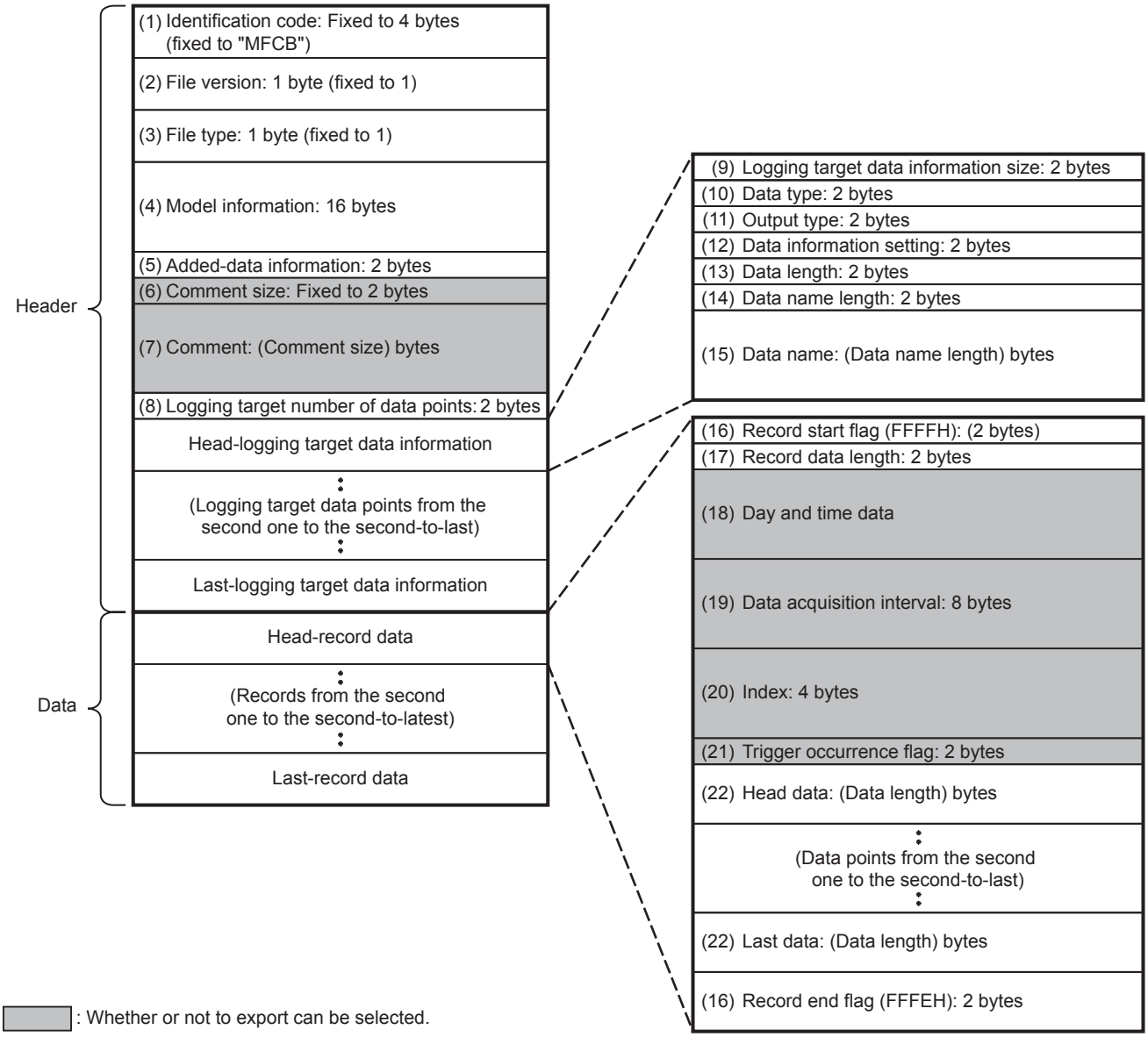
23 (date column) + 12 (data collection interval column) + 10 (index column) + (6 × 128) (data column) + 132 (the number of commas) + 2 (CR + LF)

= 947 bytes

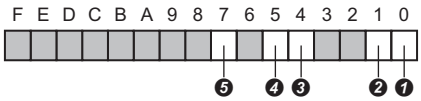
## ■Binary file format

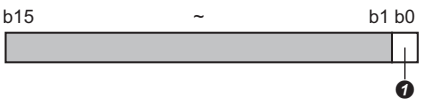
The following figure shows the configuration of the binary format and details of each data.

• Configuration figure of binary format




• Details of each data

| No. | Item | Description | Size (byte) |
|---|---|---|---|
| (1) | Identification code | MFCB is always output to identify the file. | 4 |
| (2) | File version | File version 1 is displayed. | 1 |
| (3) | File type | The file type is output. (fixed to 1: Continuous/trigger logging) | 1 |
| (4) | Model information | The module model name that outputted binary file is output. The CPU module in use is output in ASCII Code while the remaining area is filled with "0H". | 16 |
| (5) | Added-data information | The output selection setting for the data that can be output is output.<br>  <br><br>❶ 1: Output date and time data, 0: Do not output date and time data<br>❷ 1: Output a data sampling interval, 0: Do not output a data sampling interval<br>❸ 1: Output a trigger flag, 0: Do not output a trigger flag<br>❹ 1: Output index, 0: Do not output index<br>❺ 1: Output comments, 0: Do not output comments | 2 |
| (6) | Comment size | The comment length of (7) Comment is output. | 2 |
| (7) | Comment | The comment specified in the setting is output in Unicode. | 2 to 512 |
| (8) | Logging target number of logging target data | The number of data points of the data information ((10) to (15)) for data logging is output. | 2 |
| (9) | Logging target data information size | The total size of the data information ((10) to (15)) for data logging is output. | 2 |

| No. | Item | Description | Size (byte) |
|---|---|---|---|
| (10) | Data type | The numeric value shown below is output depending on the data type.<br>0000H: Bit<br>0001H: Word (signed)<br>0002H: Double word (signed)<br>0003H: Word (unsigned)<br>0004H: Double word (unsigned)<br>0005H: Single-precision real number<br>0007H: String<br>0008H: Numeric string<br>0009H: Time | 2 |
| (11) | Output type | The numeric value shown below is output depending on the set output format.<br>0001H: Word (signed)<br>0002H: Double word (signed)<br>0003H: Word (unsigned)<br>0004H: Double word (unsigned)<br>0005H: Single-precision real number<br>FFFFH: Bit, String, Numeric string, Time | 2 |
| (12) | Data information setting | The data-related information is output. | 2 |
| (13) | Data length | The data length of data is output. When the data type is the bit type, it will be output as two bytes. | 2 |
| (14) | Data name length | The length of the data name specified in the setting is output. | 2 |
| (15) | Data name | The data name specified in the setting is output in Unicode. | 2 to 512 |
| (16) | Record start Flag, Record end Flag | The flags for identifying the start and end of the record are output. The FFFFH is output for record start while the FFFEH is output for record end as the fixed flag. | 2 |
| (17) | Record data length | The total size of (18) Day and time data to (22) Last data is output. | 2 |
| (18) | Day and time data | The Day and time data is output.<br>b15 to b8 b7 to b0<br>Year \| Month — Year: Last 2 digits of the year, Month: 1 to 12<br>Day \| Time — Day: 1 to 31, Time: 0 to 23<br>Minute \| Second — Minute: 0 to 59, Second: 0 to 59<br>Millisecond — Millisecond: 0 to 999 | 8 |
| (19) | Data acquisition interval | The time interval from the previous collection time to the current collection time is output. (Unit: μs, Display range: 1 to 100000000000 (When it exceeds the max value, it returns to "1" and incrementing runs again.)) After logging collection is started, 0 is stored at the first collection. | 8 |
| (20) | Index | The index number ranging from 1 to 4294967295 of data, which was collected by the data logging function, is output. When it exceeds the maximum value, it returns to "1" and incrementing runs again. If missing occurs in processing data, index will be reassigned from 1 again. | 4 |
| (21) | Trigger occurrence flag | The trigger occurrence information is output.<br>  <br>1: Trigger occurred, 0: Trigger not occurred | 2 |
| (22) | Data | Data collected by the data logging function is output corresponding to (13) Data length and (10) Data type.<br>• When bits are specified: bit On = 1 and bit Off = 0 are output.<br>• When word type (signed/unsigned) or double-word type (signed/unsigned) is specified: the data values are output in the specified unit.<br>• When single-precision real number is specified: data value is output in the specified unit. (☞ Page 175 Numerical value range for each output type)<br>• When character string type is specified: the character string with the specified size is output. If the character string terminator "0" exists in the middle of data, NULL is generated on from said point onward until the terminator of the specified size.<br>• When numeric string type is specified: the data value with the specified size is output.<br>• When time is specified: data value is output in ms units. | • Bit: 2<br>• Word (signed/ unsigned)): 2<br>• Double word (signed/ unsigned): 4<br>• Single-precision real number: 4<br>• String/numeric string: 1 to 256<br>• Time: 4 |

## Numerical value range for each output type

Describes the numerical value ranges that can be output for each output type.

### ■Integer type

The following table lists the numerical value ranges that can be expressed for each integer type.

| Output format | Lower limit | Upper limit |
|---|---|---|
| Word (unsigned) | 0 | 65535 |
| Word (signed) | -32768 | 32767 |
| Double word (unsigned) | 0 | 4294967295 |
| Double word (signed) | -2147483648 | 2147483647 |

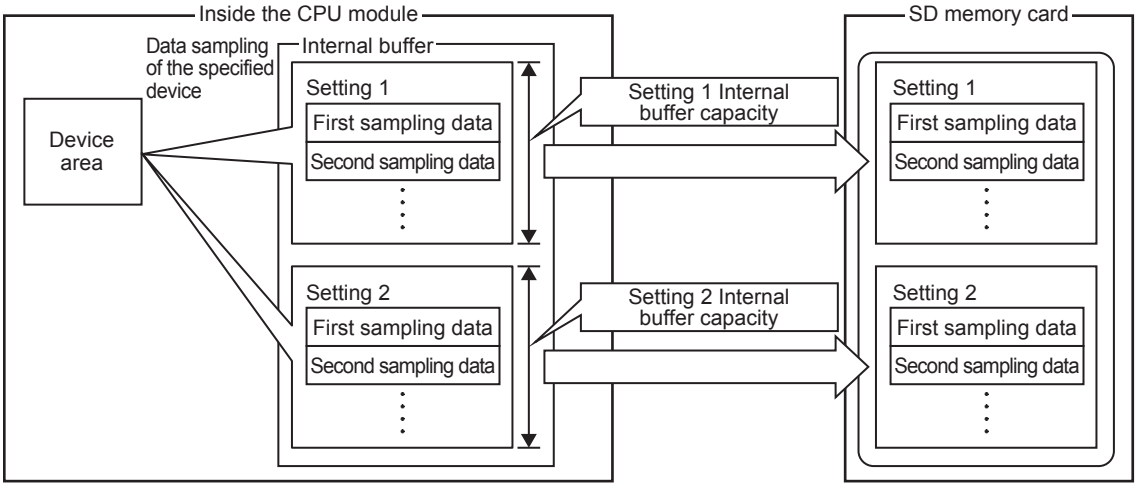
### ■Real number type

The following table lists the numerical value ranges that can be expressed for each real number type.

| Output format | Negative value | | Positive value | |
|---|---|---|---|---|
| | Lower limit | Upper limit | Lower limit | Upper limit |
| Single-precision real number | -3.4028235E+38 | -1.401298E-45 | 1.401298E-45 | 3.4028235E+38 |

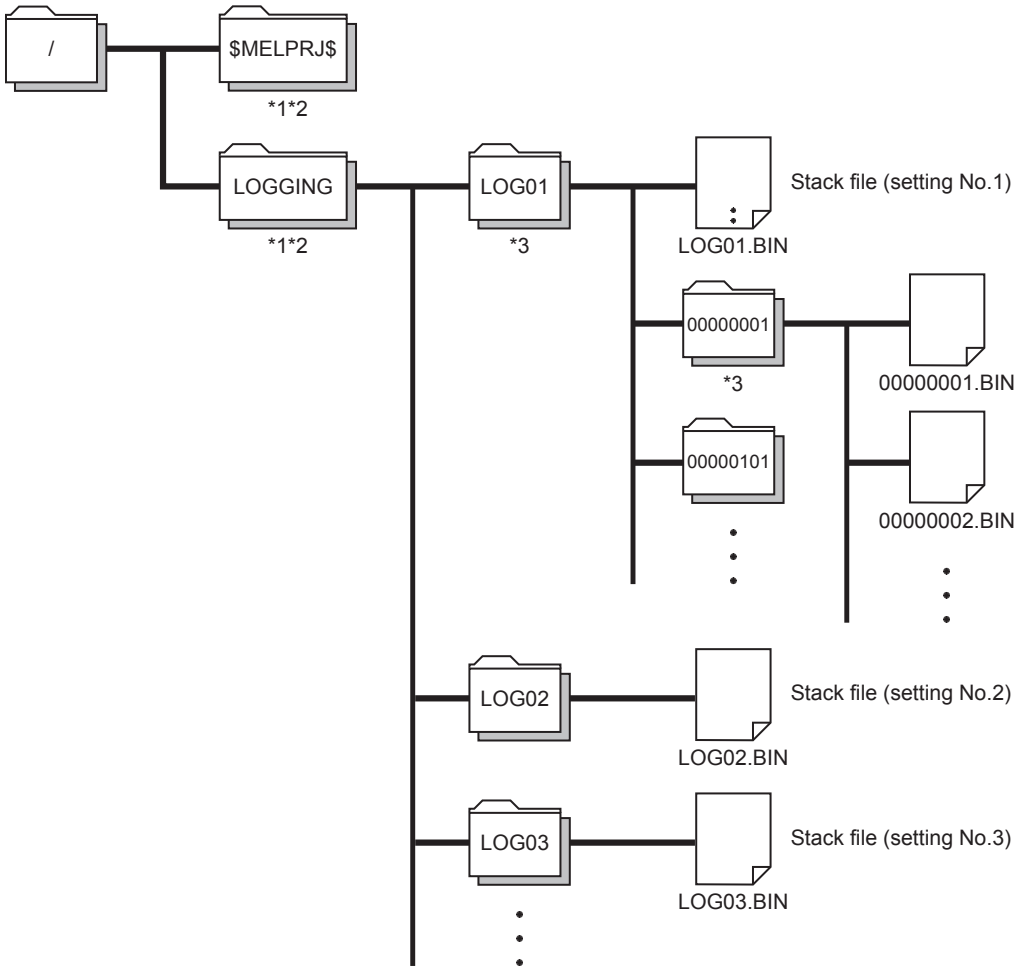
# Saving and file switching

The collected data is temporarily stored in the specified internal buffer. (☞ Page 180 Internal buffer) The data stored in the internal buffer is stored into the SD memory card at the time of a file save operation.



## Destinations to save data logging files

The following figure shows the folder configuration of the SD memory card attaching to a CPU module.




*1 Folder names cannot be modified.

*2 Do not create folders/files under the $MELPRJ$ and LOGGING folders using a personal computer or other device.

*3 To remove unnecessary folders, use the following methods:

· Use a personal computer.

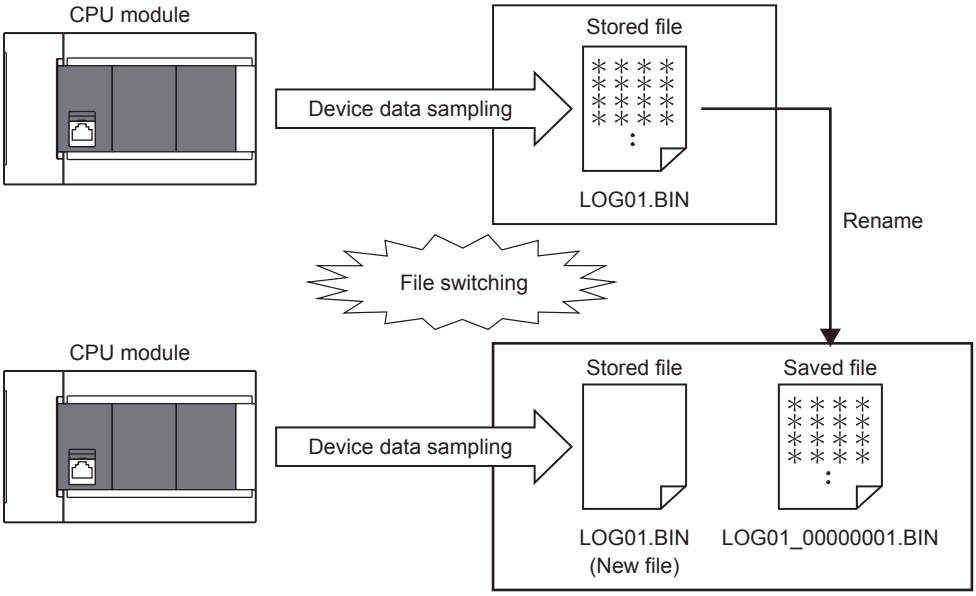
· Logging file operation (☞ Page 931 Logging file operation)

## Switching to a storage file

The data collected by data logging is temporarily stored in a stack file that resides in the SD memory card. The stack file can be switched to a storage file to free the space in the SD memory card.

File switching works as follows:

1. The CPU module writes collected data into a stack file (such as LOG01.BIN).
2. It changes the file name when the storage file switching condition is met.*1
3. It creates a new stack file.
4. It continues to write collected data into the newly created stack file.




*1 The file name format can be customized. (☞ Page 937 Save)
The file number of the most recent storage file is stored in the special register (Latest storage file number).

## File switching condition

In continuous logging, a file switching condition is selected from the following. Note that trigger logging does not require the configuration of these settings because the stack file is automatically switched to a storage file after as much data as the specified number of records is written into the stack file.

Special relay (logging data storage file switching in progress) can be used to check if storage file switching is in progress.

The following table lists the setting items that can be used to specify the file switching condition.

| Setting item | Description |
|---|---|
| Number of records | Specify the number of records within the range of 1 to 65500. |
| File size*1 | Specify the number of kilobytes within the range of 10 to 16384K bytes. |
| Condition specification*1 | Specify conditions of the device data to be executed for file switching. |

*1 File switching occurs before the file grows beyond the specified size.

However, file switching occurs regardless of the setting when:

- The number of records has reached 65500;
- The file size has reached 16M bytes;
- The CPU module is stopped or suspended/resumed.
- Data logging is started and there is an existing stack file.

### ■Operation example

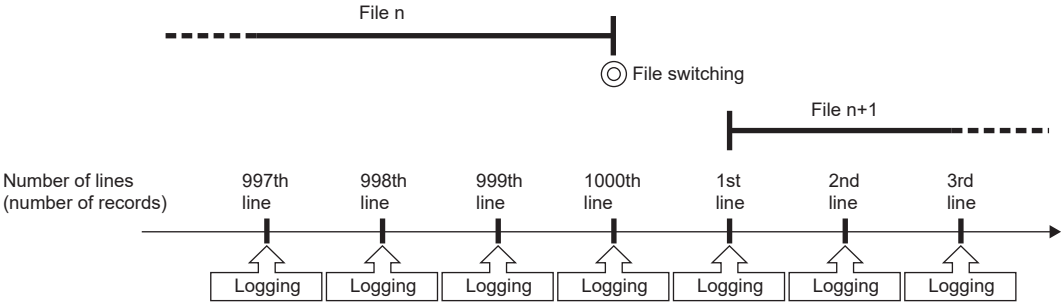
The following figures show operation examples for various file switching timings.

At the timing ◎ in each operation example, file switching (the processing below) is performed.

- Creating a storage file
- Deleting data in a file that is collecting data (the file becomes a file containing only a header.)

Ex.

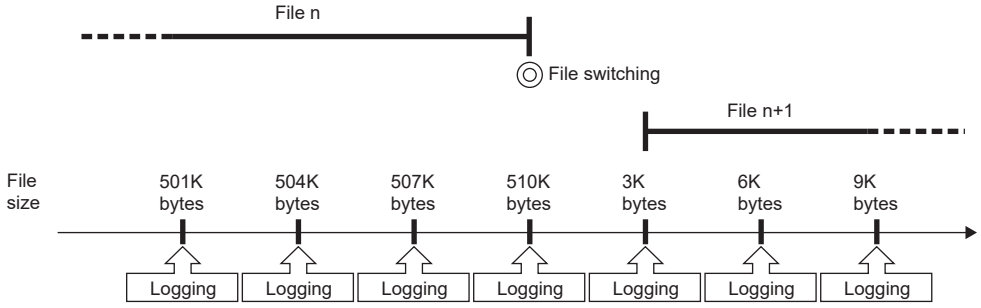
Number of records: 1000




Ex.

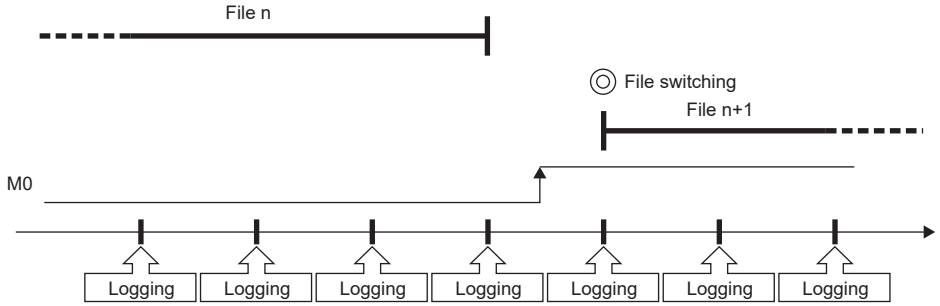
File size specification: 512KB

File switching is performed before the file grows beyond the specified size. When the file format is a CSV file, since the output size of one row (record) varies depending on the data value, the timing of file switching is judged by estimating the next output size based on the current output size.




Ex.

Condition specification: M0=ON




## ■Condition specification

Configure the trigger condition based on the device data value. A trigger occurs when the monitored data meets the specified condition.

- ↑: When the specified data turns off and on
- ↓: When the specified data turns on and off
- =: When the monitored data is equal to the comparison value, regardless of whether or not its current value is equal
- ≠: When the monitored data is not equal to the comparison value, regardless of whether or not its current value is equal
- ≥: When the monitored data is greater than or equal to the comparison value, regardless of whether or not its current value is equal
- >: When the monitored data is greater than the comparison value, regardless of whether or not its current value is equal
- ≤: When the monitored data is less than or equal to the comparison value, regardless of whether or not its current value is equal
- <: When the monitored data is less than the comparison value, regardless of whether or not its current value is equal
- At change: When the current value of the specified data changes

### ■Specifying the monitored data

For the device change specification, monitored data can be specified from the devices listed in the following table. The data types that can be selected include bit/word (unsigned), word (signed), double word (unsigned), and double word (signed). If double word (unsigned) or double word (signed) is specified, a trigger occurs only when data equal to one double word is written. No trigger occurs when only the upper or lower word of a double word is written.

| Type | Device*1 |
|---|---|
| Bit device*2 | X, Y, M, SM, L, B, F, SB, T (contact)*4, ST (contact)*4, C (contact)*4, LC (contact)*4 |
| Word device*3 | T (Current value)*5, ST (Current value)*5, C (Current value)*5, D, SD, W, SW, R, U□\G□*6 |
| Double-word device | LC (Current value)*5 |

*1 Index modification, and indirect specification cannot be specified.
*2 For bit devices, bit specification of word cannot be specified.
*3 For word devices, nibble specification of bit devices cannot be specified.
*4 To specify these devices with the CPU Module Logging Configuration Tool, use T (contact): TS, ST (contact): STS, C (contact): CS, LC (contact): LCS.
*5 To specify these devices with the CPU Module Logging Configuration Tool, use T (current value): T or TN, ST (current value): ST or STN, C (current value): C or CN, and LC (current value): LC or LCN.
*6 This format is supported by the FX5UJ and FX5U/FX5UC CPU modules.



## Storage file

The CPU module creates a subfolder ("storage file container folder") under the file storage folder and writes storage files to that storage file container folder. One storage file container folder can contain up to 256 storage files. When the files contained in the current storage file container folder reach the maximum number, the CPU module creates a new storage file container folder at the time of next storage file switching and begins writing storage files to that new folder. The number of files that can be contained in one file storage folder is configurable within the range of 1 to 65535.

**Point**

The base folder name of a storage file container folder is an eight-digit (hexadecimal) number. This number matches the lowest of the serial numbers of the files contained in the directory. Date and time stamps can be appended to the folder name.

## Action to take when the maximum number of storage files is exceeded

Either "Overwrite" or "Stop"*1 can be selected as the action to take when the maximum number of storage files is exceeded.

*1 This settings is not configurable for trigger logging.

### ■When "Overwrite" is selected

When the storage file switching condition is met after the specified maximum number of storage files is exceeded, the CPU module deletes the file with the lowest serial number and creates a new file that has a serial number incremented by one from the highest serial number, allowing data logging to continue. In addition, if deleting the file with the lowest serial number results in an empty folder, the CPU module deletes that folder as well.

### ■When "Stop" is selected

As described in the following table, the action differs depending on when the specified maximum number of storage files is exceeded.

| Occurrence timing | Occurrence condition | Operation |
|---|---|---|
| When data logging is started | There exist more storage files than the specified maximum number when data logging is started. | • If an attempt is made to register the data logging settings from within the CPU Module Logging Configuration Tool, an error is generated, resulting in failure to run data logging.<br>• If an attempt is made to register*1 the data logging settings from outside the CPU Module Logging Configuration Tool, the special relay (data logging error) turns on and the special register (data logging error cause) stores the cause of the error, resulting in failure to run data logging. |
| While data logging is running | The specified maximum number of storage files is reached due to file switching upon the satisfaction of the storage file switching condition. | Data logging stops and enters into the completion state. The special relay (data logging completed) turns on to indicate that data logging is completed. |

*1 When an attempt is made to register the data logging settings again, the CPU module enters into the data logging completed state. The special relay (data logging completed) turns on to indicate that data logging is completed.

## Internal buffer

The internal buffer is a system area used to temporarily store collected data.

### ■Internal buffer capacity setting

FX5U/FX5UC CPU module can change the internal buffer capacity with an engineering tool. (☞ Page 206 INTERNAL BUFFER CAPACITY SETTING) For trigger logging, increasing the internal buffer capacity allows for a larger number of data records to be collected before a trigger, and also helps to prevent processing overflow. If the free space in the internal buffer is still insufficient after increasing the internal buffer capacity, use the following workarounds:

- Increase the data collection interval or timing.
- Reduce the number of data records to be collected.
- Lower the frequency of file switching.

#### Precautions

When changing the capacity of the internal buffer during execution of the data logging function, pay attention to the followings.

- If the internal buffer capacity field for the running setting No. is left blank so that the internal buffer capacity for the setting No. will not be used, an error will occur when the data logging is resumed after it is stopped. (An error will not occur when data is written to the CPU module.)
- If the internal buffer capacity for the running setting No. is changed to a value smaller than the set value, some data may be lost when the data logging is resumed after it is stopped.

### ■Amount of internal buffer consumed

This value can be calculated by multiplying "Number of data points" by 2 bytes. Note, however, that additional space is consumed by columns configured for output, as indicated below:

- Date/time column: 10 bytes
- Data collection interval column: 8 bytes
- Index column: 4 bytes

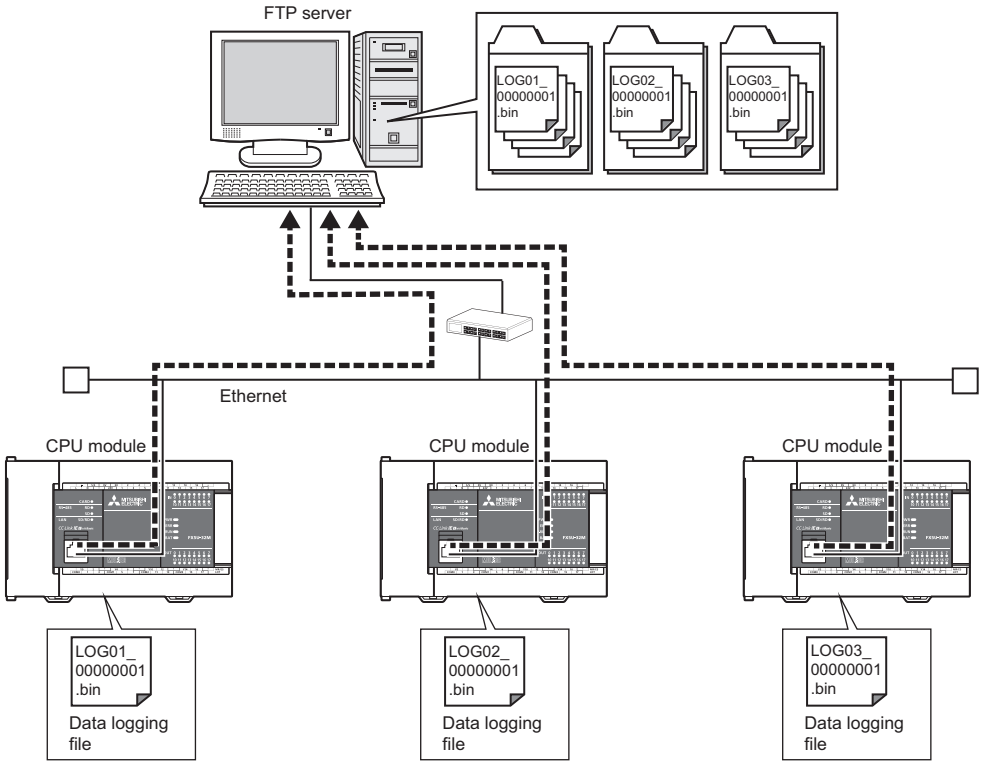
Ex.

When data logging is configured to collect as much data as one setting × 128 records and output all of the columns (i.e., maximum allowable configuration):

128 × 2 + (10 + 8 + 4) = 278 bytes

# Data logging file transfer function (FTP server auto transfer)

This function automatically transfers data logging files to the FTP server.




**Restriction**

Before executing the function, check the versions of the CPU module and CPU Module Logging Configuration Tool used. (☞ Page 971 Added and Enhanced Functions)

**Point**

An FTP server is required for the data logging file transfer function. For details on the server, refer to the manual for the server used.

The operation of this function is checked with the following FTP server.

| Item | Supported operating system |
|---|---|
| FTP server whose operation is checked by Mitsubishi | Microsoft® Internet Information Services (IIS)<br>The supported operating systems are as follows:<br>• Microsoft® Windows® 10 |

## Specifications

| Item | | Description |
|---|---|---|
| Transfer destination server setting | Server specification | Specified with the IP address |
| | Control port number | Variable (default: 21)<br>• 1 to 65535 |
| Creation of subdirectory in transfer destination server directory | | Allowed*1<br>(The tool provides the option of not creating a subdirectory.) |
| File transfer method | | All files are transferred in order starting from the files whose version number is smaller in each setting number. |
| Retry setting | | Transfer continues until retry time.<br>• 1 to 1440 minutes |
| File deletion at transfer completion | | Allowed |

*1 Set whether to allow subfolder creation for each 256 files.

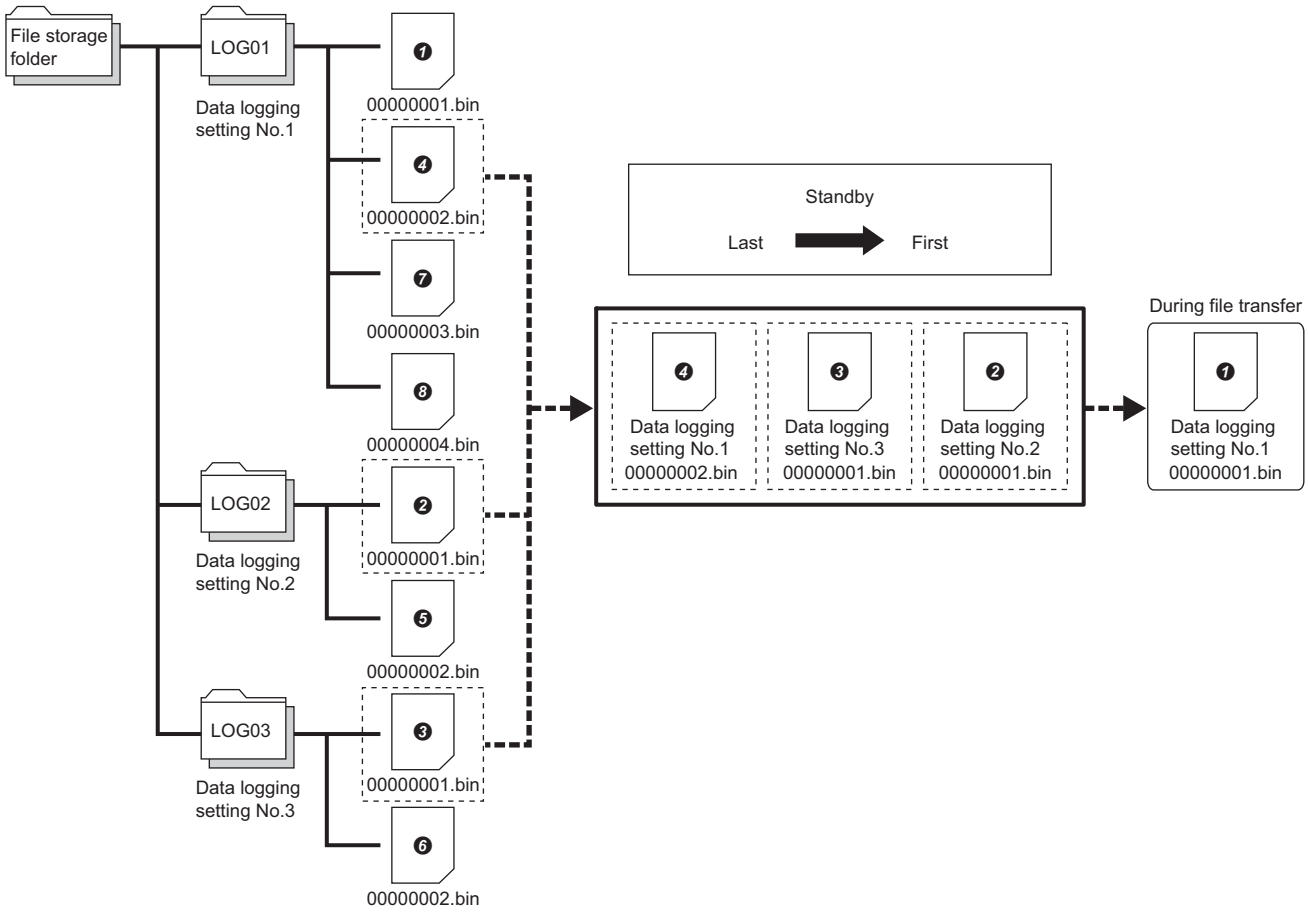
## Data logging file operation

Data logging file transfer starts when the data logging file transfer function is set using CPU Module Logging Configuration Tool, and the data logging file is saved in the CPU module by the data logging start operation. After the data logging file transfer function starts, the saved data logging file is automatically transferred to the FTP server. If the data logging operation is completed or the user has operated CPU Module Logging Configuration Tool to stop data logging, the data logging file transfer function is stopped at the completion of the transfer of the stored data logging files.

### ■Transfer specifications of the data logging file

- Data logging files are transferred one by one from each setting number (folder).
- If multiple files exist in multiple setting numbers, a file which has the smallest serial number in the lowest setting number is transferred.
- Only one file per setting number can be the standby file.

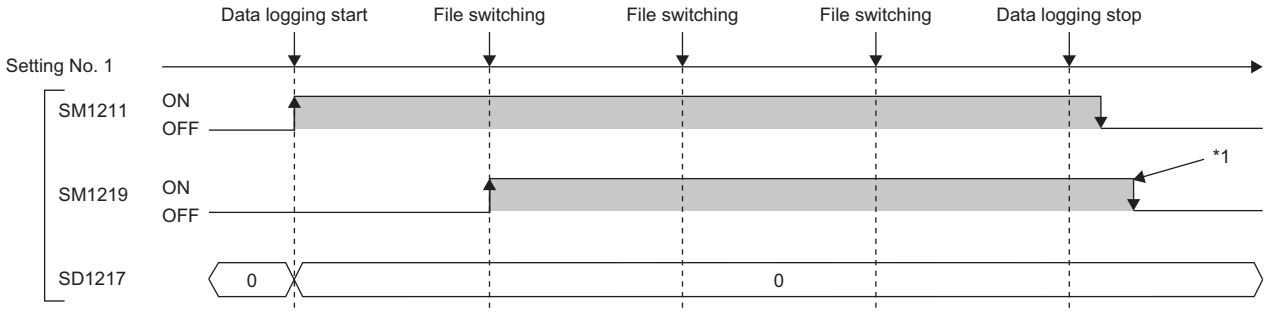
For example, in the following data structure, files are transferred from the file ❶. (Files are transferred in order from ❶ → ❷ →...→ ❼ → ❽.)




- If an error occurs during a file transfer, the data logging file caused the error is omitted from the standby files. A following file in the same setting number becomes a new standby file.
- If the file switching timing occurs during a file transfer, the data logging file created by the file switching becomes a standby file.
- If the data logging operation is completed or the user has operated CPU Module Logging Configuration Tool to stop data logging, the data logging file transfer is stopped at the completion of the transfer of the stored data logging files.

### ■Start timing of file transfer

After data logging is started, the transfer of the files created at the file switching timing in the data logging function starts. When the transfer is started, the special relay (data logging file transfer execution status flag) for each setting number turns on. They turn off after all the files are transferred.




- SM1211: Data logging setting No.1 Data logging start
- SM1219: Data logging setting No.1 Data logging file transfer execution status flag
- SD1217: Data logging setting No.1 Data logging file transfer error cause

*1 SM1219 does not turn off until all the files are transferred.

## FTP server setting

### ■FTP server setting

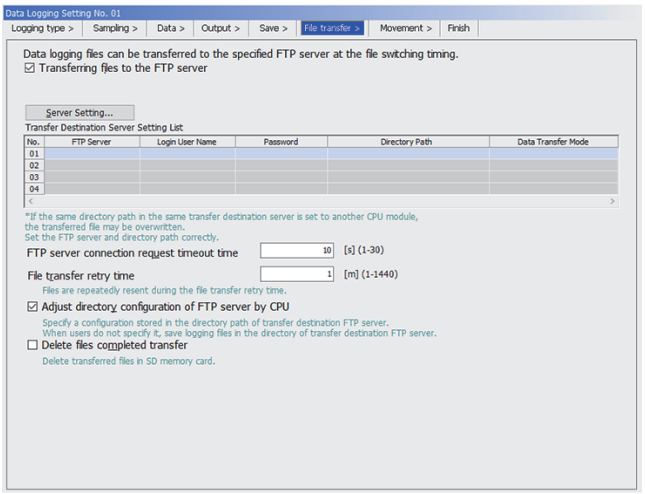
Set the login name, password, and home directory to the FTP server. Authorize the user of the data logging file transfer function to read/write files. (📖Manual for the server used)

### ■Engineering tool setting

***1.*** Set the IP address of the CPU module. Set the subnet mask and default gateway as necessary.

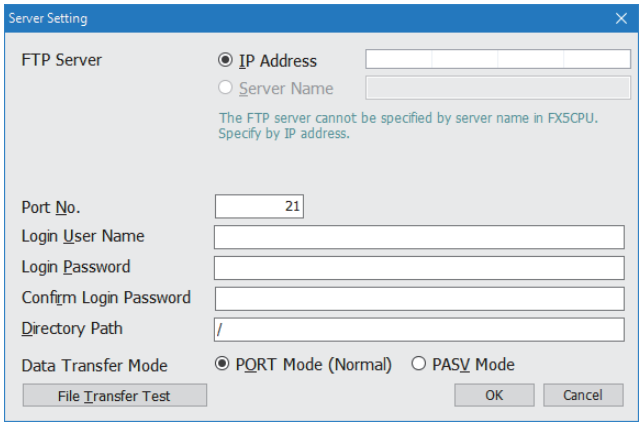
[Navigation window] ⇨ [Parameter] ⇨ CPU module ⇨ [Module Parameter] ⇨ [Ethernet Port] ⇨ [Basic Settings] ⇨ [Own Node Settings] ⇨ [IP Address]

### ■Setting of CPU Module Logging Configuration Tool




***1.*** Select the "Transferring files to the FTP server" check box in "File transfer" of CPU Module Logging Configuration Tool. (☞ Page 154 Setting data logging)

***2.*** Click the [Server Setting] button.




3. Configure the server setting.
4. Click the [File Transfer Test] button to execute the file transfer test to the FTP server. Before operating the system, execute the file transfer test and ensure the connection with the FTP server. (☞ Page 184 File transfer test)
5. Set the timeout time and other items on the "File transfer" window. (☞ Page 185 Setting on the "File transfer" window)
6. Write the setting from CPU Module Logging Configuration Tool. (☞ Page 927 Write logging setting)
7. The transfer is started at the logging file switching timing. (☞ Page 183 Start timing of file transfer)

## File transfer test

Check the communication status and settings by transferring a test file from the CPU module to the FTP server. The file transfer to the FTP server can be checked before system operation.

### ■Procedure for the file transfer test

The following describes the procedure for the file transfer test.

1. Configure the transfer destination server setting in CPU Module Logging Configuration Tool. (☞ Page 183 Setting of CPU Module Logging Configuration Tool)
2. Click the [File Transfer Test] button in the "FTP Setting" window to execute the file transfer test.
3. Check the execution result.
4. Check that the test file is transferred to the FTP server.

### ■Structure of a test file

The following table lists structures of a test file to be transferred to the FTP server.

| Item | Description | Example |
|---|---|---|
| Test file name | MELSEC_CPU_FTP_TEST_**.txt<br>** indicates the data logging setting number (two digits, with zero-padding). | For setting No.1<br>MELSEC_CPU_FTP_TEST_01.txt |
| Contents of the test file | The IP address of the CPU module, test execution date, and test execution time are described. For the date and time, the clock data in the CPU module is used. | For IP address: 192.168.3.39, date: October 01, 2017, time: 11:22:33<br>192.168.3.39_20171001_112233 |

### ■File transfer test specification

- The FTP server connection request timeout time is fixed to 10 seconds.
- Even if the file transfer test fails due to a communication error, the retry is not executed.
- Even if the file transfer test fails, the error is not stored in the file transfer error history. (☞ Page 941 File Transfer Error Log)

### ■Precautions

- File transfer tests cannot be executed simultaneously with another configuration tool. Execute the file transfer test after the file transfer test from another configuration tool is completed.
- If the engineering tool is operated or monitored from the same connection destination of the same computer during the file transfer test, the operation or monitoring will be executed after the file transfer test completion. If a communication timeout error occurs due to the execution of the file transfer test, extend the communication time check period on the engineering tool.
- If the file transfer test is attempted while the file is being transferred, the file transfer test will be executed after the file is transferred. Therefore, if the file size of the data logging file during file transfer is large, it takes time until the execution of the file transfer test, and a communication timeout error may occur in the CPU Module Logging Configuration Tool. In this case, extend the communication time check period on the CPU Module Logging Configuration Tool.



## Setting on the "File transfer" window

### ■FTP server connection request timeout time

Set the waiting time from when the connection request from the CPU module to the FTP server is sent to when the response is received. If no response is received from the FTP server within the connection request timeout time, an error occurs.

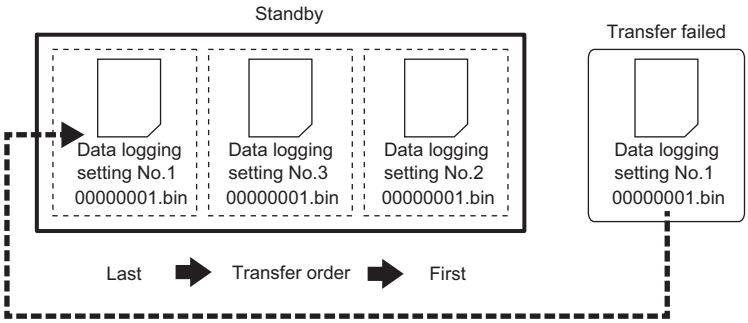
### ■File transfer retry time

Set the time to retry the file transfer when the file transfer fails due to an error caused by communication failure such as the network error between the CPU module and the FTP server.

The data logging file failed to be transferred is in the standby state and the retry starts. The file is resent until the file transfer retry time elapses. Even when the file transfer fails again due to a communication error, the file will be on standby for the reverse transfer again without an error of the data logging file transfer function.

Ex.

When a data logging file of the data logging setting No.1 has not been transferred due to a network failure




The retry ends when the network is recovered and retry of the file transfer succeeds.

Retry ends if the following conditions are met during retry. For such a case, an error will occur in the data logging file transfer function.

| Conditions for ending retry | Operation when retry ends |
|---|---|
| If data logging file transfer fails due to something other than a communication error | The same error as the last resend occurs. |
| If the file transfer retry time has elapsed when the resend fails | The same error as the last resend occurs. |
| If file transfer is interrupted due to ☞ Page 187 Stopping the data logging file transfer during retry | An error will occur in the data logging file transfer function (file transfer stop: 4C0E). |

## ■Matching the folder structure of the transfer destination FTP server with the CPU module

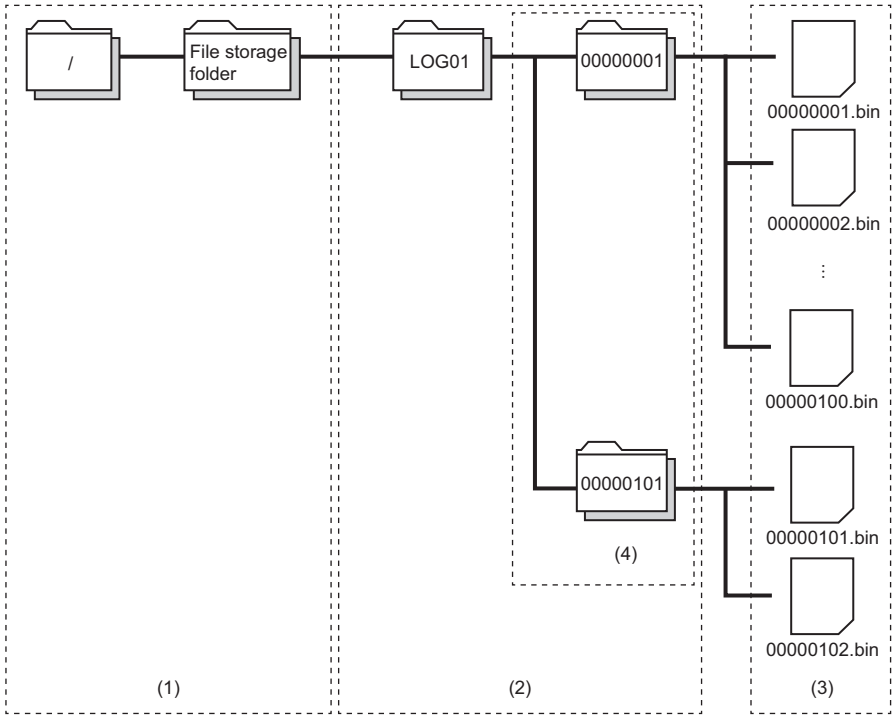
When the data logging file is transferred, the directory is automatically created in the specified folder path of the FTP server so that the structure is the same as the storage destination (☞ Page 176 Destinations to save data logging files).

If the same file exists, the file will be overwritten.

• When the folder structure is matched with the CPU module

The folder path (1) specified in the server setting, folder structure (2), logging files transferred (3).

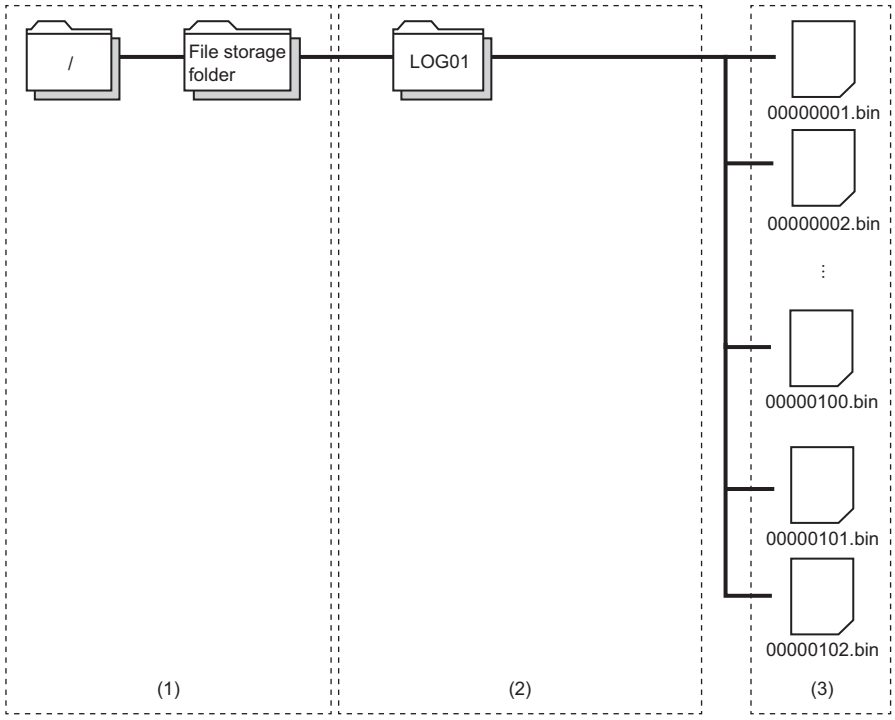
In the folder structure (2), subdirectories (4) are created.




• When the folder structure is not matched with the CPU module

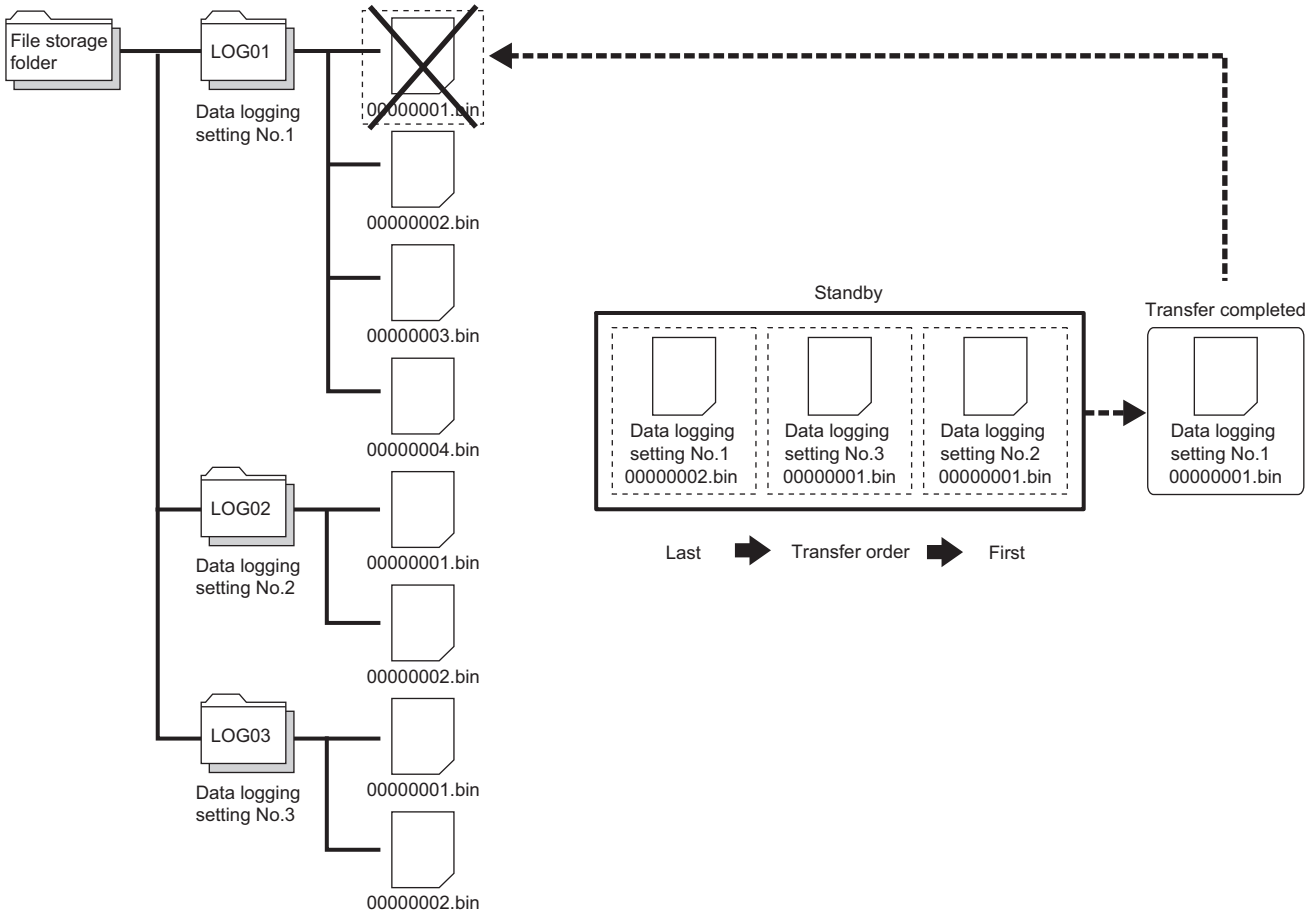
The folder structure of the FTP server consists of the storage destination structures of the data logging file excluding the subdirectory.

The folder path (1) specified in the server setting, folder structure (2), logging files transferred (3).



### ■Deleting files completed transfer

At the completion of data logging file transfer, transferred files are automatically deleted. If there is no file in the saved file storage folder (subdirectory) as a result of the file deletion, the saved file storage folder (subdirectory) is deleted while data logging is stopped.




**Point**

- Even if "Delete files completed transfer" is specified, data logging operates (overwrites or stops) using the settings when the number of files stored by the data logging function exceeds the maximum value of the number of files to be saved.

## Data logging file transfer status

The file transfer status, the data logging name, and the IP address of the file transfer destination FTP server can be checked. They can be checked on the data logging file transfer status window of CPU Module Logging Configuration Tool. (☞ Page 940 Data Logging File Transfer Status)

## File transfer error log

Error history including the date and time of error occurrence, data logging No., and the error codes can be checked. They can be checked on the file transfer error log window of CPU Module Logging Configuration Tool. (☞ Page 941 File Transfer Error Log)

## Stopping the data logging file transfer

After data logging is stopped, the data logging file transfer stops when no standby file for the data logging file transfer is left. However, after data logging is stopped, if the data logging file transfer is being retried and does not stop, the file transfer in progress can be stopped by following the procedure below.

1. Set the data logging setting number for SD1203 (Data logging file transfer stop information). Multiple data logging setting numbers can be set for SD1203.
2. Turn off and on SM1203 (Data logging file transfer stop request). When multiple data logging setting numbers are specified for SD1203 and SM1203 is turned off and on, SM1203 turns off after the data logging file transfer of all the data logging setting numbers stops.
3. At the completion of the file transfer stop processing, an error is stored in each data logging file transfer error cause of the files being transferred and in the standby (retry) state.

For the file transfer stopped by the stop request, files which have not been transferred cannot be transferred even if the data logging of the same setting number is restarted and the file transfer is executed. To transfer a file that has not yet been transferred, use the FTP server function to transfer the file to the server after data logging file transfer has stopped.

**Point**

- When the data logging status of the data logging setting No. which has been set by SD1203 (Data logging file transfer stop information) is other than stop, or the data logging file transfer is not enabled in the data logging setting, turning off and on SM1203 (Data logging file transfer stop request) does not execute the stop processing and SM1203 turns off.
- When the data logging is in the collection completed state or when an error occurs, file transfer cannot be stopped by SM1203 (Data logging file transfer stop request). To stop file transfer, stop the data logging function.

# Setting the operation at the time of transition to RUN

This function configures the operation of data logging that occurs when the user performs the following operations (transition to RUN) after the data logging setting are registered. (☞ Page 938 Logging operation)

- Turning off and on the CPU module and switching to the RUN mode
- Resetting and running the CPU module
- Stopping and running the CPU module

**Point**

The operation at the time of transition to RUN can be set individually for each setting number (1 to 4).

## Operation at the time of transition to RUN

The operation at the time of transition to RUN can be set to either of the followings.

### ■Auto start

After the user performs one of the operations listed above, data logging automatically starts when the operating status of the CPU module changes from STOP to RUN.

**Point**

To first start data logging, the user must instruct the CPU Module Logging Configuration Tool to start data logging.

### ■Start by user operation

After the user performs one of the operations listed above, the data logging state is switched to "Waiting start Not collected" when the operating status of the CPU module changes from STOP to RUN. To start data logging again, the user must instruct the CPU Module Logging Configuration Tool to start data logging.

## Data logging operation that occurs after operating status of CPU module has changed

Data logging does not continue when the operating state of the CPU module changes from RUN to STOP or PAUSE after it has been started. The data logging state changes to "Waiting RUN Not collected" and data collection is stopped.

# 20.6 Precautions

This section describes precautions to take when using the data logging function.

## Missing data

The term "missing data" means that some of the collected data is missing, resulting in data discontinuity.
Missing data occurs under the following conditions:

| Item | Description |
|---|---|
| Data logging function processing time | When data logging is executed by specifying for the collection interval a time interval shorter than the processing time required by the CPU module for data storage. |
| Processing overflow | • When the internal buffer responsible for tentatively storing the logged data is unable to store new logged data because the SD memory card does not store data<br>• When you attempt to register the data logging while the CPU module is in the process of logging collecting, collecting before trigger or collecting after trigger |
| Operations for the CPU module | The CPU module has been stopped and run with "Operation at transition to RUN" set to "Auto Start". |
| | The CPU module has been turned off and on with "Operation at transition to RUN" set to "Auto Start". |
| | The CPU module has been reset and run with "Operation at transition to RUN" set to "Auto Start". |
| Operation from engineering tools, CPU Module Logging Configuration Tool, and external devices via protocols such as SLMP | • When the CPU module is suspended and restarted, and operation for displaying the logging state is performed from CPU Module Logging Configuration Tool<br>• File read*1, write, delete, or verification |

*1 The following operation also is included:
· Online operation which displays data by operation such as read from the programmable controller performed from an engineering tool (retrieval and display of a list of files on the CPU module)
· View of the event history (retrieval of the event history from the CPU module)

If the data logging file transfer function has been used, logging collection performance deteriorates. Therefore, the frequency of missing data may increase.

### ■Data logging function processing time

The data logging function processing time indicates the minimum time value that allows data collection without data loss when executing data logging.
It shows the collection interval at which data can be collected under the following conditions.

- Logging type = continuous logging
- Scan time = 5ms
- Internal buffer capacity setting = 80K bytes as per one setting (default setting)
- Collection setting = Time specification (data collection at time interval)
- Data setting = Data register (D) (Data type: Word (signed))
- Binary Output setting = Output date (output format is default), Output data sampling interval, Output index, Output comments
- Save setting = Operation when exceeds the number of files: Overwriting, File switch timing: 10000
- SD memory card: NZ1MEM-4GBSD used

| Points | | Collection interval where data can be collected |
|---|---|---|
| 8 points | (8 points × 1 setting) | 10ms |
| 16 points | (16 points × 1 setting) | 15ms |
| 64 points | (64 points × 1 setting) | 45ms |
| 128 points | (128 points × 1 setting) | 100ms |
| 256 points | (128 points × 2 setting) | 150ms |
| 512 points | (128 points × 4 setting) | 250ms |

#### Precautions

- If the SD memory card is accessed frequently during operations with the engineering tool or CPU module logging setting tool or with operations using FTP, set a longer collection interval than the interval given above.
- If a load on Ethernet communication is heavy for such a reason as using socket communication and SLMP communication, set a longer collection interval than the interval given above.

### ■Processing overflow

In normal cases when the usage of the internal buffer reaches the specified maximum capacity, the CPU module overwrites the data stored in the storage memory on a first-in first-out basis. If the internal buffer becomes full before all of the data stored in it is saved to the storage memory, however, the CPU module does not overwrite the existing data and stops storing data in the internal buffer, thus resulting in missing data. This situation is referred to as processing overflow. Upon the occurrence overflow, the special register (Number of processing overflow occurrences) stores the number of times when processing overflow occurred.

## Errors generated during data logging

No diagnostic error occurs if an error occurs during data logging, the SM applicable to the special relay (data logging error) setting No. turns on, and the error cause is stored in the SD applicable to the special register (data logging error cause) setting No. Note that if the data logging with the special relay fails at the time of register/clear, the cause of occurred error is stored in a special register (the data logging register/clear error code) applicable to the setting No.

## Mutual exclusion of the data logging function

This section describes the mutual exclusion of the data logging function.

### ■When another function is executed during the execution of the data logging function

The following table lists the cases when another function is executed during the execution of the data logging function.

| Function that has been already executed | Function to be executed later | Operation |
|---|---|---|
| Data logging function | Data logging function | When the data logging is started using the CPU Module Logging Configuration Tool to the same data logging setting number, the data logging to be executed later cannot be executed. However, the data logging to be executed later can be executed to a data logging setting number different from the data logging setting number currently being executed. |
| | | For the execution of multiple data loggings, the data logging settings stored in different target memory areas cannot be executed at the same time. |
| | Memory dump function | The data logging function and memory dump function cannot be used simultaneously. |
| | Data backup function | The data backup function cannot be executed while a logging setting file is being written/deleted or a logging setting is being registered/cleared. |
| | Data restoration function | The data restoration function cannot be executed while a logging setting file is being written/read/deleted or a logging setting is being registered/cleared. |

### ■When the data logging function is executed during the execution of another function

The following table lists the cases when the data logging function is executed during the execution of another function.

| Function that has been already executed | Function to be executed later | Operation |
|---|---|---|
| Memory dump function | Data logging function | The data logging function and memory dump function cannot be used simultaneously. |
| Data backup function | | While the data backup function is being executed, a logging setting file cannot be written/deleted and a logging setting cannot be registered/cleared. |
| Data restoration function | | While the data restoration function is being executed, a logging setting file cannot be written/read/deleted and a logging setting cannot be registered/cleared. |

## Locations from which data logging can be performed

Data logging cannot be performed from multiple locations to the same setting number. The CPU module supports data logging performed concurrently at a maximum of 4 locations assigned to setting numbers 1 to 4.

## Retention and clearance of data logging settings

The data logging settings registered in the CPU module are latched and thus survive across a power cycle (power off and on) or reset of the CPU module in normal cases. In the following cases, however, the data logging status is cleared to the unregistered state and therefore the setting data must be written again:

- The CPU module is turned off and on or reset without an SD memory card that contains the data logging setting file.
- The replaced SD memory card does not contain the data logging setting file and the CPU module is turned off and on or is reset.*1

*1 If the data logging setting file contained in the replacement (new) SD memory card is different from that contained in the replaced (old) SD memory card, the data logging setting file contained in the replacement SD memory card becomes registered.

## Stopping/suspending data logging

After data logging is stopped or suspended from within the CPU Module Logging Configuration Tool or special relay, all the data in the internal buffer is written into the target memory. If a small number of records or a small file size is specified as part of the storage file switching condition, writes to the target memory may take a longer time.

## Operation against the failure to register data logging setting files

When an attempt to register multiple data logging setting files at the same time is made and fails for some of them, the CPU module runs data logging for the setting files that have been successfully registered.

## Numbering of the storage files used during data logging

### ■If one or more numbered storage files already exist in the specified file storage folder

The new file is given a file name that uses a number incremented by one from the highest number among the existing files.
If the data logging file transfer setting is set to delete the file after transfer, numbering to new storage files starts from 1 because no files exist in the folder at the time of restarting data logging.

### ■If one or more storage file folders exist but no storage files in them

A new file is stored into a folder with the lowest number and given the same number as the folder.
Also, if the file transfer setting is set to delete the file after transfer, the folder will not be deleted during logging, but will be deleted if there are no files in the folder when the logging is stopped.
However, if there are 258 or more folders under the said conditions, a new folder is created and the file is given the same number as the new folder.
When the file transfer setting is set to delete the file that has been transferred, the existing folders are deleted if no files exist in the folders at the time of the data logging stop. (The existing folders are not deleted while the data logging is in progress.)

## Operation that occurs while collected data is stored in the target memory

If one of the following operations is performed while collected data is stored in the target memory, any unsaved data is cleared and not reflected to the results:

- Turning power of the CPU module off and on
- Reset

If one of the following operations is performed, unsaved data continues to be stored in the target memory:

- Stopping the CPU module
- Stopping/suspending data logging from within the CPU Module Logging Configuration Tool
- Issuing the LOGTRGR instruction

## Creating files and folders

Under the "LOGGING" folder that contains data logging setting files and data logging files, do not attempt to create files or folders using a personal computer or other device. Doing so may result in deletion of files and folders.

## Changing the clock data

Whatever changes, such as advancing or reverting the clock, are made to the clock data of the CPU module during data logging, the CPU module performs data collection at the specified collection interval/timing, but the date/time column in the output file reports the changed clock data.

## Access to the SD memory card

If data logging is performed with a small setting of the data collection interval/timing or with a large number of records to be collected, access (read/write) to the SD memory card occurs so frequently that a delay occurs in completing the access. To avoid such a delay, use the following workarounds:

- Increase the data collection interval/timing.
- Reduce the number of data records to be collected.
- Lower the frequency of file switching.

## Changing the operating status of the CPU module

The operating state of the CPU module should not be changed until the completion of the following operations and registrations:

- Save of the data in the internal buffer by changing the state of the CPU module from RUN to STOP or instructing the CPU Module Logging Configuration Tool to stop or suspend the CPU module
- Registering multiple data logging sessions' settings*1
- Registering data logging settings with any unused folders remaining in the storage memory*1

*1 Data logging settings are also registered when the CPU module is stopped and run.

**Point**

- To shorten the time required to register multiple data logging sessions' settings, reduce the number of data logging sessions.
- To shorten the time required to register data logging settings with any unused folders remaining in the storage memory, delete the unused folders before registration.

## File operation during execution of data logging

Describes file operation during execution of data logging.

| Target file | File operation | Operation |
|---|---|---|
| Data logging setting file | Write | During execution of data logging, it is not possible to write or the delete data logging setting file being used. |
| | Delete | |
| | Initialize | During execution of data logging, it is not possible to initialize the memory storing the data logging setting file being executed. |
| | Folder delete | Folders cannot be deleted from the $MELPRJ$ folder in which the data logging setting file is stored. |
| Data Logging File | Write | During execution of data logging, it is not possible to write or delete data, or delete folders corresponding to the data logging file being used. |
| | Delete | |
| | Folder delete | |
| | Initialize | During execution of data logging, it is not possible to initialize the memory storing the data logging file being executed. |

## About remote operation

When remote RUN is performed while the data logging function is in the following execution status, the remote RUN may fail. In that case, wait for a while and retry remote RUN. If remote RUN still cannot be executed, check whether remote RUN is acceptable and retry remote RUN.

| Execution state of data logging function | The situation to accept remote RUN |
|---|---|
| Data saving into memory card in progress | No special relay (Data logging data saving into memory card in progress) is on. |
| Registration of the data logging setting from CPU Module Logging Configuration Tool in progress | The special relay (data logging preparation) and the special relay (data logging start) corresponding to the setting number of the data logging setting, which is being registered in the way shown in the left column, are on. |

## RUN operation through switching operation or the RUN contact

During execution of data logging, when the status of the CPU module is switched from STOP to RUN with the RUN/STOP/RESET switch, or when remote STOP to RUN operation of the RUN contact, it may take time to return to the RUN state.

## Data logging file transfer function (FTP server auto transfer)

### ■Starting data logging during logging result file transfer

Data logging with the same setting number cannot be started during transfer to the FTP server. If it is started, a file transfer error (4C0DH) will occur. Start it after the transfer is completed.

### ■Powering off or reset operation during file transfer

- A standby file waiting to be transferred will not be transferred even when data logging resumes the next time. It will be transferred from the logging file created when data logging resumes.
- The transfer file will not be transferred correctly, and the file being transferred may remain.

### ■If the SD memory card is removed during file transfer

If the SD memory card is removed without the SD memory card forced disable function being executed during file transfer, note the following.

- File transfer will stop because a logging function error (4C02H)[*1] will occur. Therefore, it is necessary to insert the SD memory card again and restart the logging function to resume file transfer.
- A standby file waiting to be transferred will not be transferred even when data logging resumes the next time. It will be transferred from the logging file created when data logging resumes.

*1 When file transfer is set, a file transfer error (4C0BH) will occur if the file is being transferred (file is being accessed).

### ■Ethernet communication

- The data logging file transfer function uses the built-in Ethernet port of the CPU module when transferring data logging files to the FTP server. Therefore, use the engineering tool to set the IP address for the module parameter.
- The data logging file transfer function dynamically uses the own station port numbers F230H to FFFEH when performing FTP communication. During execution, therefore, do not specify own station port numbers F230H to FFFEH of the socket communications function connection establishment instruction (SP.SOCOPEN). Otherwise, the instruction may be completed with an error.
- For the SLMP communications, port numbers set with the parameters take priority from after power-on or reset is canceled until power-off or reset. Therefore, even if F230H to FFFEH are specified for the own station port number in parameter settings, the SLMP communications will not be affected by the data logging file transfer function.
- File transfer processing time differs depending on the Ethernet line load ratio (network congestion), operating status of other communication functions (such as MELSOFT connection, SLMP communication, socket communication, CC-Link IE Field Network Basic) and system configuration.
- During data logging file transfer using the data logging file transfer function, the Ethernet communication load increases.
  - When other communication functions such as MELSOFT connection and SLMP communications are executed using UDP, data may be lost at UDP reception and timeout and other errors may occur. Therefore, the communication using TCP is recommended while the data logging file transfer function is running.
  - When other communication functions such as MELSOFT connection and SLMP communications are executed, their completion are delayed.

### ■Transfer destination FTP server

- The FTP server software uses the internal clock data of the FTP server to determine the creation date and time and update date and time of the data logging file transferred to the FTP server. Therefore, the creation date and time and update date and time of the data logging file in the CPU module and the data logging file transferred to the FTP server may differ.
- The login user set in the transfer destination server setting must have file access permissions (file write permissions, directory creation permissions).
- If a communication error, a file access error, or a file transfer stop error occurs during the file transfer, the data logging file being transferred may remain in the FTP server. Since the data cannot be guaranteed for the data logging file with a file transfer error, check the file transfer error history and do not refer to the data logging file with a file transfer error.
- Even when the data logging file is transferred successfully, a data logging file transfer error occurs if the operation to stop data logging file transfer function is performed before logging out from the FTP server or logout fails.

### ■Power off to on/reset operation

- If the CPU module is powered off and on or is reset during data logging file transfer, data logging files being transferred may remain in the FTP server.
- The files being transferred and in the standby (retry) status when the CPU module is powered off or reset are not transferred again after the power-on or reset is canceled.

### ■Stopping data logging file transfer

- If file transfer is stopped by a data logging file transfer stop request after data logging stops, the next time data logging with the same setting number is started, the logging file saved by file switching will be transferred. Therefore, files which have not been transferred will not be transferred by a stop request. For standby files, use the FTP server function to transfer them to the server.
- When "Overwrite" is selected for the operation for when the number of files exceeds the maximum number of files to be saved in the data logging function, the file being transferred may be overwritten and a file transfer error may occur if the file transfer speed is slow. To ensure the file transfer, set a large value for the number of files to be saved and select "Stop" for the operation for when the number of files exceeds the maximum number of files to be saved, so that the files that have completed transfer are to be deleted.

### ■File operation

- If a data logging file in the CPU module is read by a tool such as GX LogViewer during the data logging file transfer, the file being read cannot be deleted and the deletion process goes into retry, which may cause the data logging file transfer to stop. Do not read the logging file in the SD memory card during transfer, but read the file transferred to the server.
- If a file is accessed (read/written) during the data logging file transfer, the more files to transfer, the slower the file access (read/write) will be completed.

### ■Simultaneous use with data logging file transfer function

If the file transfer function instruction (SP.FTPGET/FTPPUT) and the data logging file transfer function are used at the same time:

- If the function executed later is the file transfer function instruction, the function instruction will not be executed.
- If the function executed later is the data logging file transfer function, the transfer function will be executed after the file transfer function instruction is completed.

Do not use the FTP server function and data logging file transfer function at the same time.

# 20.7 SD Memory Card Life and Replacement

This section describes the life of the SD memory card used for the data logging function and the replacement procedure.

## SD memory card life

An SD memory card has a life (restriction on writing data). The following shows the calculation method of an SD memory card life when the data logging function is used. Note that the actual life of the card varies depending on usage conditions and environment. Therefore, use the calculated life as a rough standard for the replacement of the card.

### Calculation formula of SD memory card life

SD memory card life (year) = Total size of data that can be written (G bytes) ÷ Size of data to be written per year (G bytes/year)

### Total size of data that can be written

Capacity × Number of writes

For the capacity of applicable SD memory cards and the number of writes, refer to the following.

MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)

## Size of data to be written per year

The size of data to be written per year is obtained by the following formula.

Size of data to be written per year (G bytes/year)= ((DS1[*1] + 6144) × DN1 + ··· + (DSn[*1] + 6144) × DNn + (DCS1[*1] + 6144) × DCN1 + ··· + (DCSn[*1] + 6144) × DCNn) ÷ 1073741824

*1 Round up DSn and DCSn to a multiple of 512.

DSn, DNn, DCSn, and DCNn are obtained as follows.

### ■Data logging data size per record (DSn)

CSV file output format: Refer to the data. (☞ Page 170 CSV file format)

Binary file output format: Refer to the data. (☞ Page 172 Binary file format)

### ■Number of records for data logging per year (DNn)

Continuous logging: DNn = 60 × 60 × 24 × 365 ÷ Collection interval and timing (seconds)[*1] × Operating rate[*2]

Trigger logging: DNn = Total number of records[*3]

*1 The value that is determined depending on the condition set in "Sampling" when "Continuous logging" is selected for the logging type. (When the value is determined in milliseconds, convert the value into seconds.)

*2 Calculate the ratio using the operating time per year of the CPU module. For example, if the operating time per year is 5000 hours, the operating rate is calculated as follows: 5000 ÷ (24 × 365) = 0.57.

*3 The value set in "Number of logging lines" when "Trigger logging" is selected for the logging type.

### ■Header size of data logging (DCSn)

CSV file output format: Refer to the header. (☞ Page 170 CSV file format)

Binary file output format: Refer to the header. (☞ Page 172 Binary file format)

### ■Number of file switching times for the data logging per year (DCNn)

Calculate this number with an estimated number according to the save setting of the data logging and system operations. For example, when 1000 records are set in "Number of records" of "File switching timing" in the save setting and "Each scanning cycle" is specified for "Sampling interval" in the sampling setting, the time interval of the file switching is obtained by multiplying the scan time by 1000. Therefore, the number of file switching times for the data logging per year is obtained by the following formula: 60 × 60 × 24 × 365 ÷ (Scan time (second) × 1000).

# SD memory card replacement

SD memory cards can be replaced using the SD memory card forced disable function even while data logging is in progress. (☞ Page 228 SD Memory Card Forced Stop) This function works by disabling data writes to the SD memory card while allowing data collection to continue. (Data collection continues in accordance with the settings registered when data logging is started.)

**Point**

If SD memory card replacement causes processing overflow, make adjustments by changing the collection interval, internal buffer capacity, or other settings.

## Operation during SD memory card replacement

Mounting the replaced SD memory card on the CPU module causes a "LOGGING" folder to be created. When becoming ready for running the logging function, the CPU module resumes the data transfer into the SD memory card.

The CPU module operates differently as follows depending on the folder configuration in the replaced SD memory card.

| Folder constitution | Operation of after SD memory card replacement |
|---|---|
| The folder not exist. | LOGGING folder is made. |
| Only LOGGING folder | • LOGGING folder is renamed by LOGGING_OLD.<br>• LOGGING folder is made. |
| Only LOGGING_OLD folder | LOGGING folder is made. |
| LOGGING folder<br>LOGGING_OLD folder | Data logging state changes to error state. |

### Precautions

If the internal buffer becomes full during the time between SD memory card replacement and the resumption of data writes to the SD memory card, processing overflow occurs resulting in missing data.

## Storage file numbers after SD memory card replacement

The numbering of the first storage file created after SD memory card replacement differs depending on the storage file switching condition, as described in the following table.

| Storage file switching condition | Storage file numbers after SD memory card replacement |
|---|---|
| Overwrite | Numbering continues from the number of the last storage file contained in the replaced SD memory card. |
| Stop | Numbering begins at 00000001.*1 |

*1 While the data logging file transfer function is used, numbering begins at 00000001 only when the "Delete files completed transfer" is disabled in the "File transfer" of CPU Module Logging Configuration Tool.

**Point**

If the new SD memory card contains a "LOGGING" and "LOGGING_OLD" folder, data logging cannot be executed. Ensure that the new SD memory card does not contain a "LOGGING" and "LOGGING_OLD" folder.

## Logging state during SD memory card replacement

SD memory cards can be replaced without depending on the current data logging state.

## Operations during SD memory card replacement

If one of the following operations is performed during the time between the removal and installation of SD memory cards, any data collected during that time will not be stored in the new SD memory card.

- Stop and run*1
- Power off and on*1
- Reset*1
- Suspend data logging
- Stop data logging

*1 An error is generated if data logging was previously running based on the setting file contained in the replaced SD memory card.

## Operations after SD memory card replacement

If the SD memory card was replaced while data logging was running based on the data logging setting file contained in the SD memory card, the data logging setting file contained in the new SD memory card is used when data logging is started next. If the new SD memory card does not contain the data logging setting file, data logging is not started.

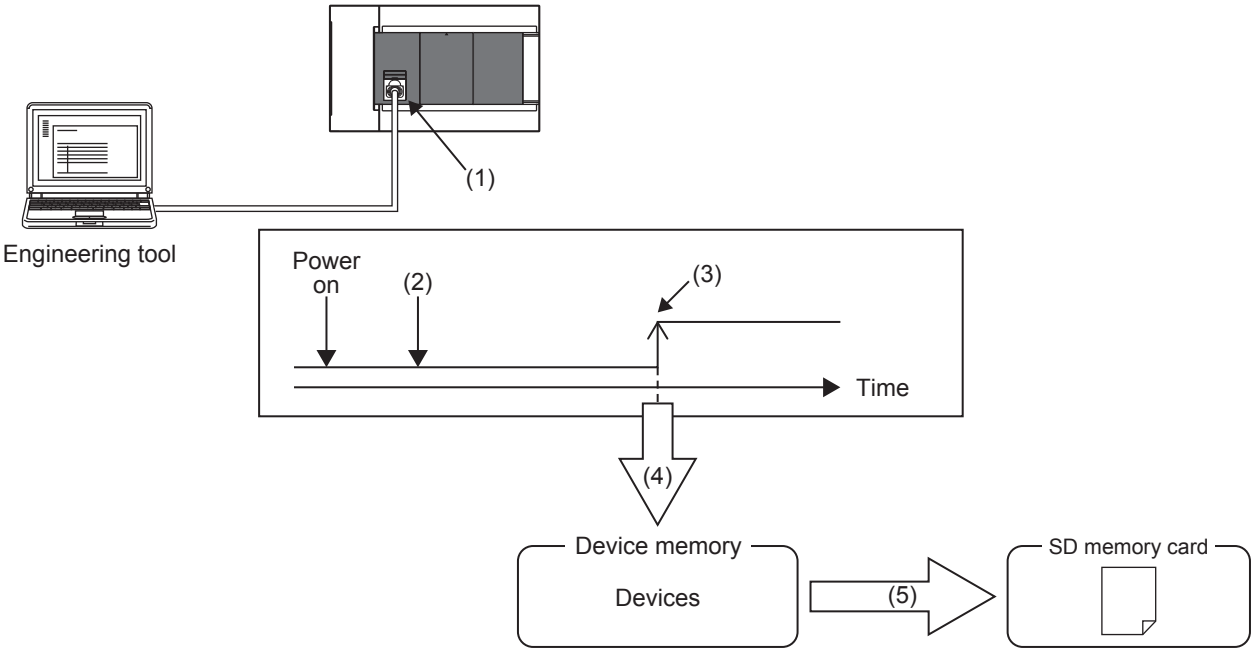
## Stack file remaining in the replaced SD memory card

Replacing an SD memory card that contains a stack file may result in the stack file remaining in the replaced SD memory card along with storage files. If the stack file is remaining in the replaced SD memory card, recover the latest data contained in the stack file by doing the following:

- Retrieve the data from the stack file and combine the data with a storage file.
- Save the stack file as a storage file.

# 21 MEMORY DUMP FUNCTION

This function stores device values of the CPU module at any given timing. Checking data at the desired timing through the function facilitates the analysis of problems which occur depending on a particular condition.




(1) Perform memory dump settings.
(2) Enters a wait state for the trigger after the memory dump setting file has been written.
(3) Establishment of the trigger condition
(4) Start of data collection
(5) The memory dump file is stored in the SD memory card. (☞ Page 202 Memory Dump File)

**Point**

For supported version of memory dump function, refer to ☞ Page 971 Added and Enhanced Functions.

**Restriction**

- This function can be used only when the internal buffer usage function is set to "memory dump function". (☞ Page 206 INTERNAL BUFFER CAPACITY SETTING)
- Memory dump can be performed only between the same models. (FX5U CPU module and FX5UC CPU module are treated as the same models.)

# 21.1 Object Data

This section describes the data to be collected by memory dump.

## Data to be collected

Of the devices listed below, all devices that are within the range specified in the device settings are subject to the collection.

| Type | Device |
|---|---|
| Bit device | X, Y, M, L, B, F, SB, T (contact), T (coil), ST (contact), ST (coil), C (contact), C (coil), LC (contact), LC (coil), S, SM, BL□\S□ |
| Word device | T (current value), ST (current value), C (current value), D, W, SW, SD, R, Z |
| Double-word device | LC (current value), LZ |

**Point**

For BL□\S□ (step relay with block specification), data collection is performed only when the SFC program exists. (📖MELSEC iQ-F FX5 Programming Manual (Program Design))

# 21.2 Trigger Condition

The following table lists the conditions to be used as a trigger. Set the trigger condition in the memory dump settings. (📖GX Works3 Operating Manual)

| Trigger condition | Description |
|---|---|
| Device specification | Data are collected when the specified monitoring target data (bit data) turns on during the END processing. |
| At the occurrence of an error | Data is collected using the SM0 (latest self-diagnosis error) OFF→ON as the trigger. |

### Precautions

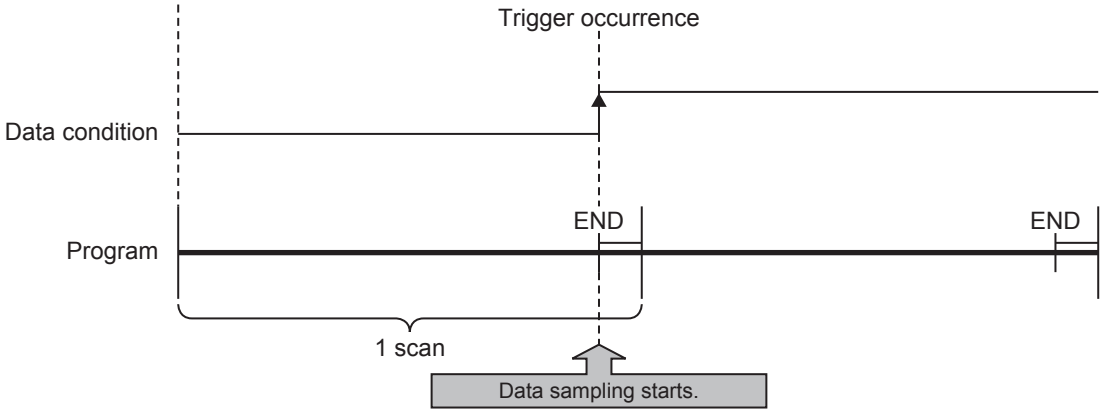
On the occurrence of consecutive triggers, if the status of data save due to the previous occurrence of trigger is "Save complete" of collected data, the next trigger is recognized as a trigger again. Note that events other than the above are not recognized as a trigger condition.

**Point**

A trigger can be generated with trigger conditions combined. (☞ Page 200 Combining trigger conditions)

## Device specification

Data are collected when the specified monitoring target data turns on during the END processing.




For monitoring data, the following devices can be specified.

| Type | Device*1 |
|---|---|
| Bit device | X, Y, M, L, F, SM, B, SB, T (contact)*2, ST (contact)*2, C (contact)*2, LC (contact)*2 |

*1 Index modification, and indirect specification cannot be specified.

*2 To specify these devices with the engineering tool, use T (contact): TS, ST (contact): STS, C (contact): CS, and LC (contact): LCS.

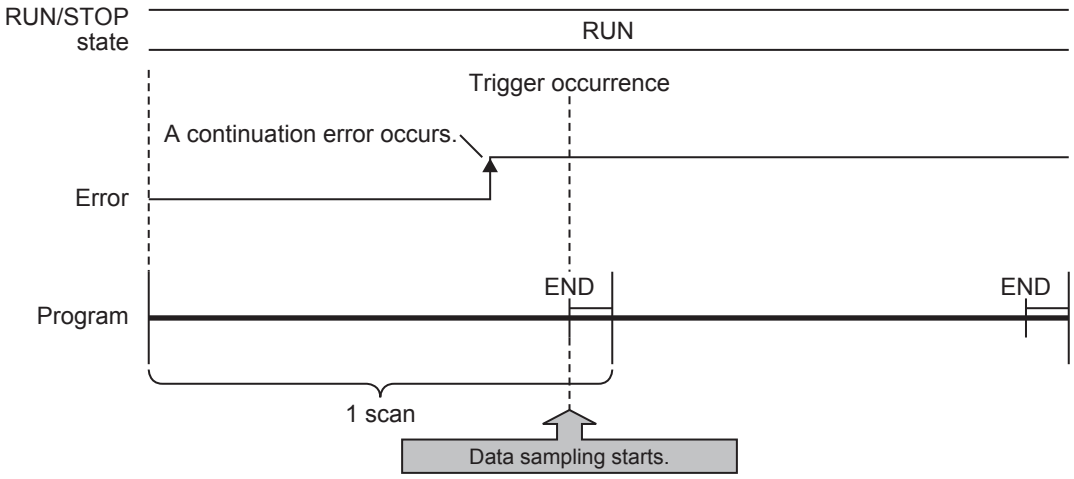
### Precautions

Even though the value of the monitoring target data changes during a single scan, if the value during the END processing is same as that during the last END processing, it is not recognized as a trigger.

## At the occurrence of an error

Data is collected using the SM0 (latest self-diagnosis error) OFF→ON as the trigger.
The trigger occurs at the END process of the scan in which the error occurred.

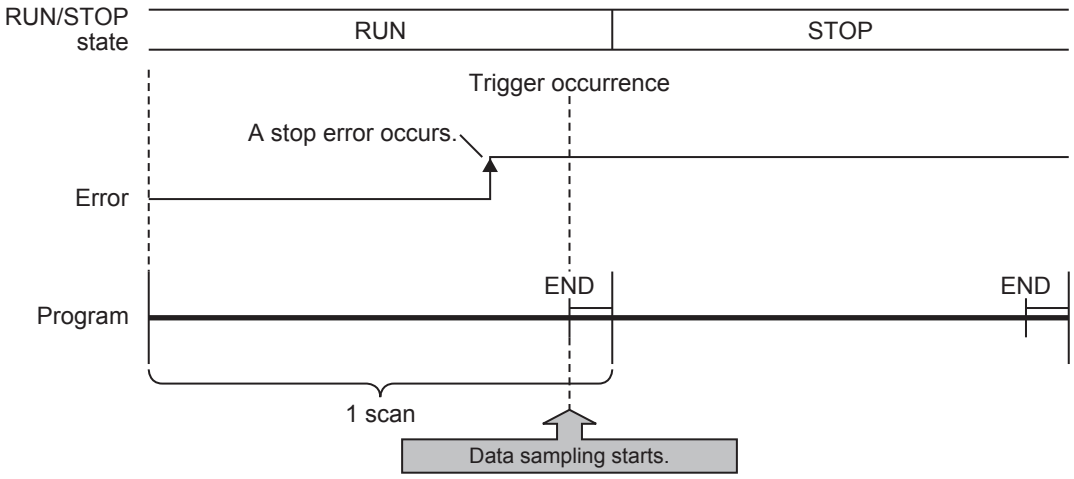
### At the occurrence of a continuation error




### Precautions

If the same continuous error occurs after SM0 turns ON, it will not be recognized as a trigger, so data will not be collected.
Being recognized as a trigger requires the error to be cleared.

### At the occurrence of a stop error

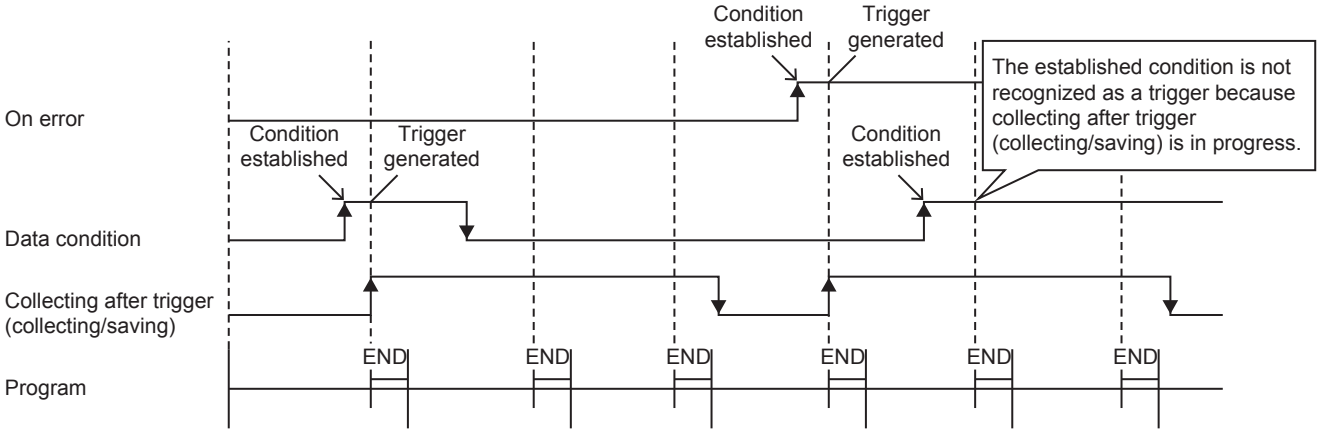



**Point**

Even if an error occurs, if the function (analog function, etc.) does not cause SM0 to turn ON, memory dump using SM0 as the trigger cannot be executed. By specifying a device for each function's error display with the device specification, memory dump can be executed even when an error occurs in a function that does not cause SM0 to turn ON.

## Combining trigger conditions

A trigger can be generated with trigger conditions combined. This combination is based on an OR condition. The establishment of a condition, either device specification or error code specification, results in data collection.




### Precautions

If the trigger conditions are established again during data collection, the state will not be recognized as a trigger so data will not be collected.

**Point**

If the trigger conditions for both device specification and error occurrence are established within the same scan, the trigger conditions for error occurrence will have priority.

# 21.3 Procedure for Memory Dump

This section describes the procedure for memory dump. Note that each operation of the memory dump function is performed with the engineering tool.

[Debug] ⇨ [Memory Dump]

For how to view and operate the window, refer to the following.

GX Works3 Operating Manual

1. Configure the memory dump settings by the menu operation in the engineering tool.
2. Writing the memory dump setting file results in a wait state for the trigger. Whether the CPU module is in a RUN state, STOP state (including stop error*1), or PAUSE state, a wait state for the trigger results.

*1 Limited to where the trigger condition is device specification.

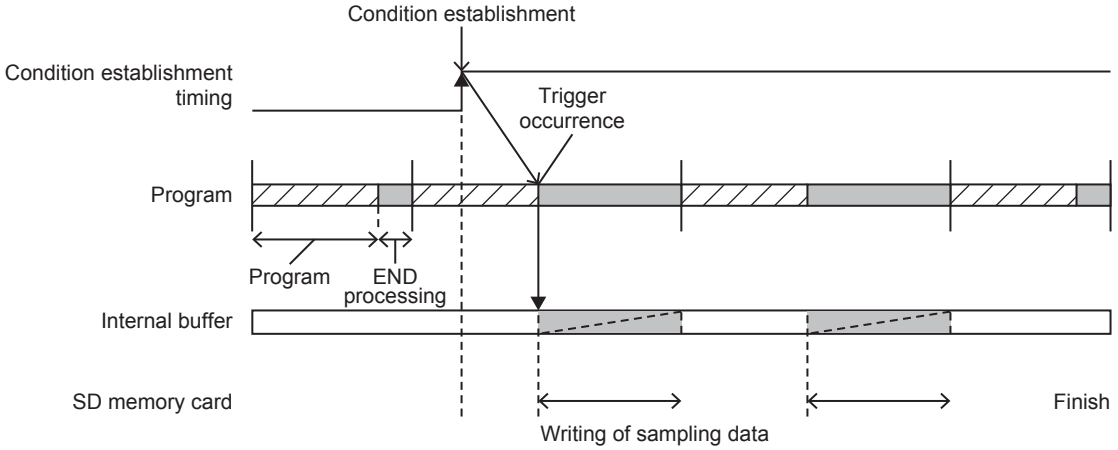
**Point**

- If the memory dump setting file is stored, the memory dump will be executed when the CPU module power is turned OFF→ON or reset.
- The engineering tool allows the memory dump status to be checked.

3. Establishment of the trigger condition initiates data collection, saving the memory dump file to the SD memory card.
4. The contents of the memory dump file (collected device data) can be checked with the engineering tool.

# 21.4 Flow of Data Collection

Collected data is stored in the internal buffer, where the data is partitioned at END processing and saved in the SD memory card. When a trigger is generated, the END process will take longer than usual.




### Precautions

- If a user interrupt occurs while transferring the device data to the internal buffer, a data inconsistency will occur.
- If a user interrupt occurs while transferring double-word devices, an inconsistency will occur in the high-order and low-order word devices.

## Effect on the scan time

If the memory dump function detects a trigger, the scan time will increase as follows when collecting the data.

- FX5UJ CPU module: Approx. 25ms
- FX5U/FX5UC CPU module: Approx. 15ms (Approx. 16ms if SFC program exists)

# 21.5 Memory Dump File

This file stores data that is collected through memory dump (collection result by memory dump). Data collected by one execution is saved in one file. The memory dump file is saved in a binary format and stored under the "MEMDUMP" folder.

## Save file name

The file name can be arbitrarily set within a range of 64 characters (extension and period included) together with an auto-assigned number (00 to 99). Specify the save file name in the memory dump settings. (GX Works3 Operating Manual)

Ex.

MEMDUMP_00*1

*1 Between a specified file name (MEMDUMP) and an auto-assigned number (00), the single-byte underbar (_) is added. If a file name with 5 or less characters is specified, the lowercase characters used in the file name may be handled as uppercase characters.

When the memory dump function is registered, the debug folder (DEBUG (fixed)) and the memory dump folder (MEMDUMP (fixed)) are created in the SD memory card. The memory dump file (result file) is stored in the memory dump folder. One folder can contain a maximum of 100 files. If any file does not exist in creating a save file, the file with the number 00 is created. If any file already exists in creating a save file, the behavior is as follows:

| Number of files | Behavior |
|---|---|
| For less than 100 | Creates a file*2 assigning the number obtained by adding 1 to the number of the file where the creation date and time is the latest. |
| For 100 (maximum) | Deletes the file where the creation date and time is the oldest and creates a new file using the deleted number as it is. |

*2 If the corresponding file number is 99, a file with file number 00 is created.

# 21.6 States of the Memory Dump Function

The state of the memory dump function is reflected in the memory dump status. The engineering tool allows the memory dump status to be checked. (GX Works3 Operating Manual)

## Memory dump status

The following table lists the memory dump status.

| Memory dump status | Description |
|---|---|
| Stop | State in which memory dump is not registered |
| Trigger-wait not collected | A state in which data is not yet collected and establishment of the trigger condition is being waited |
| Collecting after trigger | A state in which collection of the data after trigger is in progress (includes a state in which collected data is being saved in the target memory) |
| Collection completed | A state in which collection of a specified data is completed |
| Error | A state in which a memory dump error occurs and memory dump fails |

# 21.7 Sizes of Files Used for the Memory Dump Function

This section shows the sizes of files used for the memory dump function.

## Capacity of the memory dump setting file

The capacity of the memory dump setting file varies depending on the length of the save file name. The following formula is used for the calculation:

- Capacity of memory dump setting file = (((Number of characters of save file name[*1] × 2 bytes + 1201 bytes (fixed)) + 3) ÷ 4)[*2] × 4

*1 Except for the period and extension.

*2 The remainder is discarded.

## Capacity of the memory dump file

The capacity of the memory dump file is given by the total of the following items:

- Capacity of memory dump file = Volume of header + Volume of data of program file name[*1] + Volume of device data + Volume of local device data[*1]

*1 Only when BL□\S□ (step relay with block specification) is collected.

### Volume of header

The volume of header is given by:

- Volume of header = 1088 bytes (fixed)

### Volume of data of program file name

Volume of data of program file name is given by the total of the following items. Only when BL□\S□ (step relay with block specification) is collected, this data is created in the memory dump file.

- Volume of data of program file name = 16 bytes (fixed) + (Number of programs × (2 bytes (length of program file name) + 130 bytes (program file name))

### Volume of device data

The volume of device data is given by the total of the following items. Note that this data is always created in the memory dump file regardless of the settings of CPU parameters.

- Volume of device data = 520 bytes (fixed) + Volume of collected device data

#### ■Volume of collected device data

[FX5S/FX5U/FX5UC CPU modules]

The volume of collected device data is given by the following:

- Volume of collected device data = (Total number of points of bit devices ÷ 8) + (Total number of points of word devices × 2) + (Total number of points of word devices × 4)

[FX5UJ CPU module]

The volume of collected device data is 116702 bytes (fixed).

### Volume of local device data

The volume of local device data is given by the total of the following items. Only when BL□\S□ (step relay with block specification) is collected, this data is created in the memory dump file.

- Volume of local device data = 16 bytes (fixed) + (Number of programs × 4 bytes) + Volume of local device contents
- Volume of local device contents = 580 bytes (fixed) + Volume of collected local device data[*1]

*1 The total of volume which is given by calculating the number of points of S (step relay) which is assigned to each block of BL0 to BL31 of the SFC program by the following volume of block data.
Volume of block data = ((the number of points of S (step relay) which is assigned to block + 15) ÷ 16) × 2

# 21.8 Special Relay and Special Register Used in the Memory Dump Function

For details on the special relay and special register used in the memory dump function, refer to the following:

- Special relay: Special relay relating to the memory dump function (☞ Page 782 Memory dump function)
- Special register: Special register relating to the memory dump function (☞ Page 814 Memory dump function)

# 21.9 Precautions for the Memory Dump Function

This section describes precautions to take when using the memory dump function

## Mutual exclusion of the memory dump function

The mutual exclusion of the memory dump function is as follows.

### ■When another function is executed

The following table lists the cases when another function is executed during the execution of the memory dump function*1.

| Function that has been already executed | Function to be executed later | Operation |
|---|---|---|
| Memory dump function | Data logging function | The memory dump function and data logging function cannot be used simultaneously. |
| | Data backup function | The data backup function cannot be executed while memory dump is being registered/cleared. |
| | Data restoration function | The data restoration function cannot be executed while a memory dump file or memory dump setting file is being read or memory dump is being registered/cleared. |

*1 Indicates the state in which the memory dump status is "Collecting after trigger" or the save status is "Saving in progress".

### ■When the memory dump function is executed during the execution of another function

The following table lists the cases when the memory dump function is executed during the execution of another function.

| Function that has been already executed | Function to be executed later | Operation |
|---|---|---|
| Data logging function | Memory dump function | The memory dump function and data logging function cannot be used simultaneously. |
| Data backup function | | While the data backup function is being executed, memory dump cannot be registered/cleared. |
| Data restoration function | | While the data restoration function is being executed, a memory dump file or memory dump setting file cannot be read or memory dump cannot be registered/cleared. |

### ■When the memory dump function is executed

The following table shows the cases where the file operation related to the memory dump function is executed while the memory dump function is in execution.*1

| Target file | File operation | Operation |
|---|---|---|
| Memory dump setting file | Write | Settings that are subsequently written during the execution of the memory dump function are reflected after the completion of save, not reflected immediately. |
| | Delete | If the memory dump setting file is subsequently deleted during the execution of the memory dump function, the memory dump settings are cleared after the completion of save. |
| | Initialize | Initialization fails on the memory dump setting file during the execution of the memory dump function. |
| Memory dump file | Write, read, delete, and initialize | Write, read, delete, and initialize on the memory dump file cannot be performed during the execution of the memory dump function. |

*1 Indicates the state in which the memory dump status is "Collecting after trigger" or the save status is "Saving in progress".

## Operation on each individual file

Write, read, delete, and initialize are possible on each file. The following table shows whether each operation is possible or not depending on the execution status of memory dump.

○: Operation possible, ×: Operation not possible

| File type | Operation to be performed | | | | | |
|---|---|---|---|---|---|---|
| | Read | | Write/delete | | Initialize | |
| | Not during execution*1 | During execution*1 | Not during execution*1 | During execution*1 | Not during execution*1 | During execution*1 |
| Memory dump setting file | ○ | ○ | ○ | ○ | ○*2 | × |
| Memory dump file | ○ | × | ○ | × | ○ | × |

*1 Indicates the state in which the memory dump status is "Collecting after trigger".

*2 The memory dump function is canceled when the memory dump setting file is initialized (when data memory is initialized).

## Where to carry out memory dump

Concurrent execution from multiple sources is not allowed. In the CPU module, execution at a time from only one source is possible.

## Creating files and folders

Under the "MEMDUMP" folder containing memory dump files, do not create any files or folders using a personal computer or other device. Doing so may result in deletion of files and folders.

## Access to the SD memory card

The SD memory card is so frequently accessed that a delay occurs in completing the access to the SD memory card (read/write).

## Operation when creating memory dump file

Do not turn the CPU module power OFF, reset, or eject the SD memory card while creating the memory dump file. An error such as failure to create file or failure to read created file may occur.

## Simultaneous execution with the file transfer function (FTP client)

Do not transfer the file during writing with the memory dump function by the SP.FTPPUT/SP.FTPGET instruction.

## Event history function

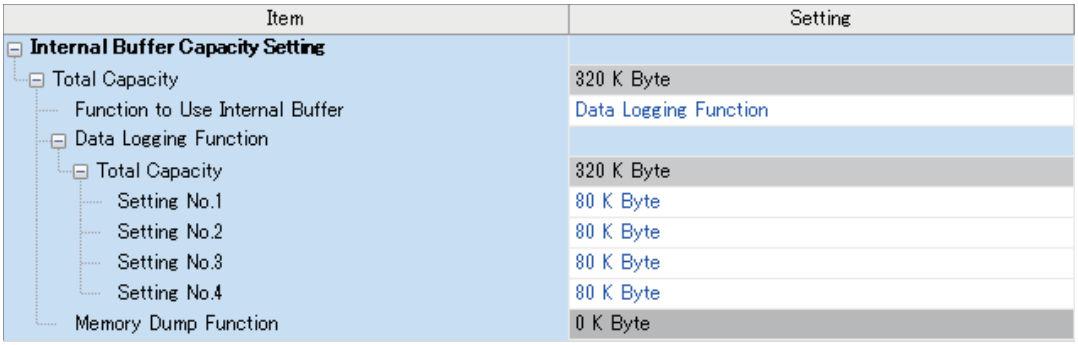
If the memory dump trigger conditions are established when saving the event information in the SD memory card by generating an event with the event history function, only data collection will be executed with the memory dump function. Transfer to the SD memory card will be executed when the event history function has completed file access. In the same manner, if an event is generated with the event history function that saves during memory dump execution, the event history function data will be transferred to the SD memory card after memory dump transfer to the SD memory card is completed.

# 22 INTERNAL BUFFER CAPACITY SETTING

Configure the capacity of an area (internal buffer) that the system consumes to temporarily store the result of data logging and the collection result of memory dump. When using the data logging function, adjusting the internal buffer capacity allows an increase in the number of collected data and reduces the risk of processing overflow.

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [CPU Parameter] ⇨ "Memory/Device Setting" ⇨ "Internal Buffer Capacity Setting"

## Window




## Displayed items

| Item | | Description | Setting range | Default |
|---|---|---|---|---|
| Total Capacity | | Shows the total of the internal buffer capacity set in the data logging function or the memory dump function. | ■FX5S/FX5UJ CPU module<br>• 320K bytes (fixed)<br>■FX5U/FX5UC CPU module<br>• 0 to 320K bytes | 320K bytes |
| Function to Use Internal Buffer | | Set the function to use the internal buffer. | • Data Logging Function<br>• Memory Dump Function | Data Logging Function |
| Data Logging Function | Total Capacity | Shows the total of the internal buffer capacity used for the data logging function. | — | 320K bytes |
| | Setting No.1 to 4 | The internal buffer capacity used for each Setting No. of Data Logging Function. | ■FX5S/FX5UJ CPU module<br>• Each setting range: 80K bytes (fixed)<br>• Total setting range: 320K bytes (fixed)<br>■FX5U/FX5UC CPU module<br>• Each setting range: 32 to 320K bytes (in increments of 1K bytes)*1<br>• Total setting range: 32 to 320K bytes | 80K bytes |
| Memory Dump Function | | Set the internal buffer capacity used for the memory dump function. | 192K bytes (fixed)*2 | 192K bytes |

*1 0K byte (fixed) when using memory dump function.
*2 0K byte (fixed) when using data logging function.

**Point**

The internal buffer is also consumed by the real-time monitor function. The internal buffer capacity consumed by the real-time monitor function is 64K byte (fixed).

**Restriction**

For supported version of FX5U/FX5UC CPU module internal buffer capacity setting, refer to ☞ Page 971 Added and Enhanced Functions.

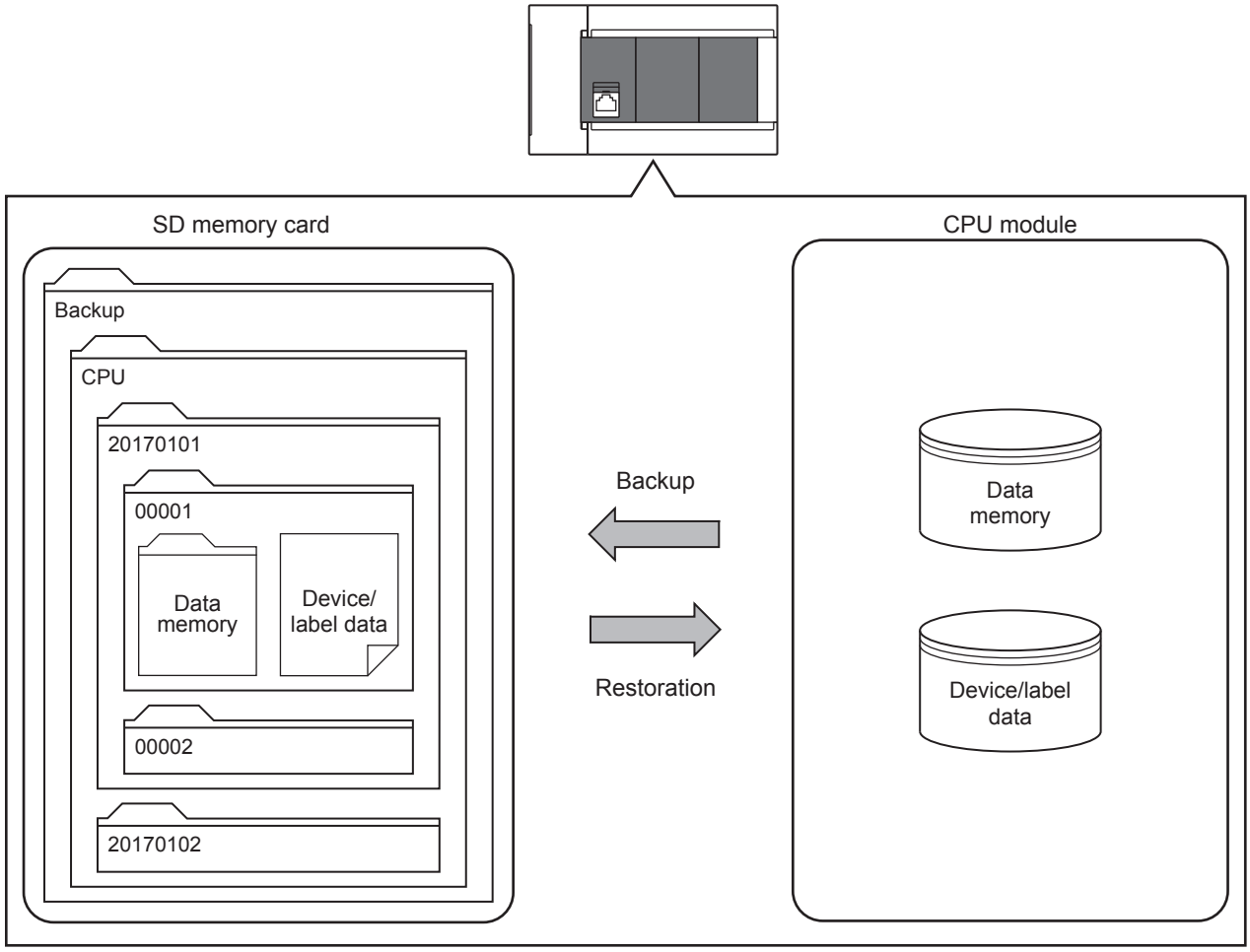
# MEMO

# 23 DATA BACKUP/RESTORATION FUNCTION

This function backs up the data memory and device/label data[*1] and the SFC program execution status[*2] of a CPU module to an SD memory card. The data backed up in the SD memory card can be restored as required.

*1 Module access devices and buffer memory are excluded.

*2 Only the FX5U/FX5UC CPU modules are supported.




The following table lists the methods of the data backup/restoration.

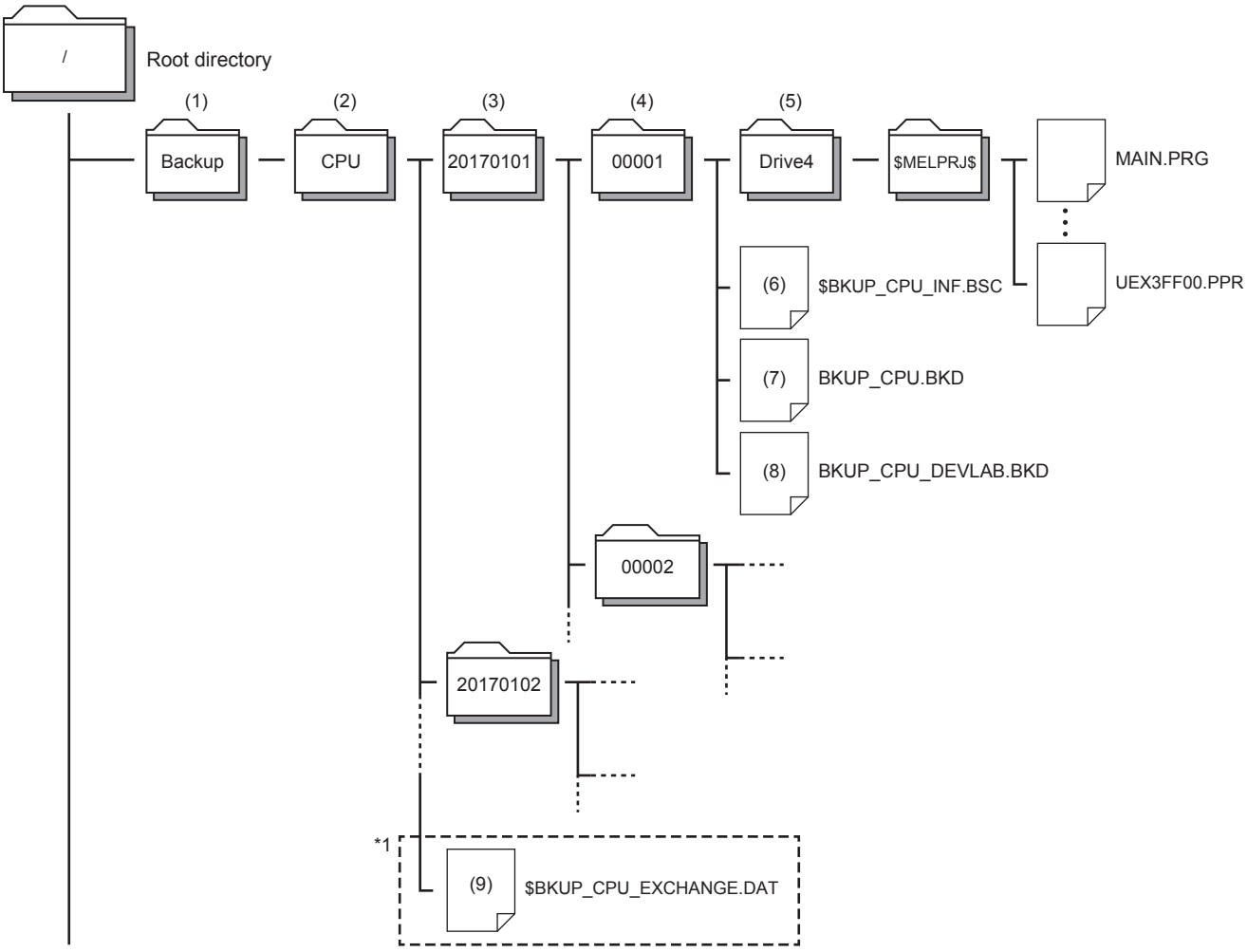
| Function | | Reference |
|---|---|---|
| Backup function | Backup processing triggered by turning on SM1351 (Normal mode) | Page 213 |
| | Backup processing triggered by turning on SM1351 (CPU module auto exchange function) | Page 214 |
| Restoration function | Restoration processing triggered by turning on SM1354 | Page 219 |
| | Automatic restoration using SD955 | Page 220 |
| | Restoration triggered by CPU module auto exchange | Page 221 |

**Point**

- For supported version of FX5U/FX5UC CPU module data backup/restoration function, refer to ☞ Page 971 Added and Enhanced Functions.
- The CPU module device/label data is changed when restoration is executed. Thus, after restoration, confirm the restored data carefully before using it. (Check the data with GX Works3.)

## Backup data

Backup data is saved in an SD memory card. The following shows the folder structure of backup data.




*1 When backing up by CPU module auto exchange mode (Deleting existing data), if the system file for CPU module auto exchange function is stored in the CPU data folder, only the latest folder will exist for the date folder and number folder.

### ■Folder

| No. | Folder type | Folder name | Number of storable folders | Description |
|---|---|---|---|---|
| (1) | Backup data folder | Backup (Fixed) | 1 | A folder for storing all backup data |
| (2) | CPU data folder | CPU (Fixed) | 1 | A folder for storing backup data of the CPU module |
| (3) | Date folder | Automatically determined*1<br>Folder name format: YYYYMMDD<br>• YYYY: Year when the data was backed up (four digits)<br>• MM: Month when the data was backed up (two digits)<br>• DD: Day when the data was backed up (two digits) | Depends on the capacity of the SD memory card used*2 | Folders for storing backup data by date |
| (4) | Number folder | Automatically determined*1<br>Folder name: Sequentially numbered from 00001 to 32767 (five digits) | Depends on the capacity of the SD memory card used*2 | Folders for storing information per backup data. Each backup data created on a date is stored in sequentially numbered folders. |
| (5) | Drive folder | Drive4 (Fixed) | One in each Number folder | Folders for storing folders/files stored in each drive of the backup target CPU module, separated by drive |

*1 Date folders and number folders are automatically named by the CPU module.

*2 The maximum number of storable folders is 32767. However, when backing up with the CPU module auto exchange mode (Deleting existing data), the folders other than the latest folder will be deleted.

### ■Back up file

| No. | File type | File name | Description |
|---|---|---|---|
| (6) | System file for backing up CPU module data | $BKUP_CPU_INF.BSC | Files for storing the information required at restoration of data, such as a list of backup data and identification information of the CPU module. |
| (7) | Backup data file for backing up CPU module data | BKUP_CPU.BKD | The following data is stored.<br>• Data on operations of the data logging setting<br>• Data for restarting the SFC program from the block and step where the processing was stopped |
| (8) | Device/label data file for backing up CPU module data | BKUP_CPU_DEVLAB.BKD | Device/label data is stored. |
| (9) | System file for CPU module auto exchange function | $BKUP_CPU_EXCHANGE.DAT | Information required for restoration with the CPU module auto exchange, such as restoration target directory path name, etc., is stored. |

## Backup/restoration target data

Backup target data is all target data in the CPU module. (☞ Page 210 Backup/restoration target files)
Restoration target data is set with SD954 (Restoration target data setting). (☞ Page 217 Restoration target data)

### ■Backup/restoration target drives

Target drives is Drive4 (Data memory).

### ■Backup/restoration target files

The following table lists backup/restoration target files.
○: Available, ×: Not available

| File type | Backup/restoration |
|---|---|
| Program | ○ |
| FB files | ○ |
| CPU parameters | ○ |
| System parameters | ○ |
| Module parameters | ○ |
| Module extension parameter | ○ |
| Memory card parameter | × |
| Device comments | ○ |
| Device initial values | ○ |
| Event history | ○ |
| Global label settings | ○ |
| Device data storage file | ○ |
| Data logging setting file | ○ |
| Memory dump setting file | ○ |
| Remote password | ○ |
| Firmware update | × |
| Firmware update prohibited | ○ |
| Extended file register file | × |
| Device station parameter file*1 | ○ |
| Web server binary file | × |
| General-purpose data | × |

*1 Applicable only to FX5U/FX5UC CPU module.

### ■The number of CPU module backup data that can be stored in an SD memory card

The number of CPU module backup data that can be stored in an SD memory card is 32767.
The number of files that can be backed up and restored (the number of backup source data files) depends on the maximum number of files of the drive. (☞ Page 46 CPU MODULE MEMORY CONFIGURATION)

## ■Backup/restoration target device data

○: Available, ×: Not available

| Classification | Device name | Symbol | Backup/restoration possibility*1 | |
|---|---|---|---|---|
| | | | Backup | Restoration |
| User device | Input | X | ○ | ○ |
| | Output | Y | × | × |
| | Internal relay | M | ○ | ○ |
| | Latch relay | L | ○ | ○ |
| | Link relay | B | ○ | ○ |
| | Annunciator | F | ○ | ○ |
| | Link special relay | SB | ○ | ○ |
| | Step relay | S | ○ | ○ |
| | Timer | T | ○ | ○ |
| | Retentive timer | ST | ○ | ○ |
| | Counter | C | ○ | ○ |
| | Long counter | LC | ○ | ○ |
| | Data register | D | ○ | ○ |
| | Link register | W | ○ | ○ |
| | Link special register | SW | ○ | ○ |
| System device | Special relay | SM | ○ | ○*2 |
| | Special register | SD | ○ | ○*2 |
| Module access device (U□\G□) | Module access device | G | × | × |
| Index register | Index register | Z | ○ | ○ |
| | Long index register | LZ | ○ | ○ |
| File register | File register | R | ○ | ○ |
| | Extended file register | ER | × | × |
| Nesting | Nesting | N | × | × |
| Pointer | Pointer | P | × | × |
| | Interrupt pointer | I | × | × |
| SFC*3 | SFC block device | BL | × | × |
| | SFC transition device | TR | × | × |
| Constant | Decimal constant | K | × | × |
| | Hexadecimal constant | H | × | × |
| | Real constant | E | × | × |
| | Character string constant | — | × | × |

*1 Device data may be overwritten depending on the mounting status (I/O refresh) of each module or the refresh settings.

*2 Values may be overwritten to the areas used by the system after the restoration processing.
Restoring or not restoring can be selected with either of SD955 (restoration function setting) or SD9352 (CPU module auto exchange function setting).

*3 Only FX5U/FX5UC CPU module is supported.

## ■Backup/restoration target label data

○: Available, ×: Not available

| Classification | Backup/restoration possibility*1 | |
|---|---|---|
| | Backup | Restoration |
| Global label (including module labels) | ○ | ○*2 |
| Global label with latch specified | ○ | ○ |
| Local label | ○ | ○ |
| Local label with latch specified | ○ | ○ |

*1 Device data may be overwritten depending on the mounting status (I/O refresh) of each module or the refresh settings.

*2 For module labels, the write areas from a module to the CPU module may be overwritten when the refresh settings have been made.

## Progress of the backup/restoration processing

The progress of the backup/restoration processing can be checked with SD1350 (Number of uncompleted folders/files of CPU module data backup/restoration) or SD1351 (Progression status of CPU module data backup/restoration).

| Special register | Description |
|---|---|
| SD1350 | Displays the number of remaining backup/restoration target folders and files.<br>• When the backup/restoration processing is started, the total number of backup/restoration folders and files is stored.<br>• When the backup/restoration processing is completed, 0 is stored. |
| SD1351 | Displays the progress of the backup/restoration processing in percentage (0 to 100%).<br>However, the progress of automatic restoration using SD955 and restoration with CPU module auto exchange are displayed only when the restoration finishes correctly (100%). |

# 23.1 Backup Function

This function backs up the CPU module data memory and device/label data onto the SD memory card. A new folder is created during the backup, and the data is backed up with a file format into that folder.

**Point**

The backup function operates even when the CPU module is in the RUN state.
When executing the backup function with the CPU module in the RUN state, do not change device/label data during execution of the function. Doing so may cause data inconsistency of the device/label data and the contents of the backup data may unintentionally change.

## Operation mode

Backup modes include the normal mode and CPU module auto exchange mode. The operation mode is set with SD9350 (Operation mode setting).

| Value of SD9350 | Operation mode | Reference |
|---|---|---|
| 0 | Normal mode | Page 213 |
| 1 | CPU module auto exchange function (Deleting existing data) | Page 214 |
| 2 | CPU module auto exchange function (Holding existing data) | |

## Restoration target data setting

When backing up (CPU module auto exchange mode) by turning SM1351 ON, the data targeted for restoration with CPU module auto exchange is set. Set with SD9351 (CPU module automatic replacement function Restore target data setting).

| Value of SD9351 | Restoration target data setting |
|---|---|
| 0 | Only device/label data |
| 1 | All target data |
| 2 | All target data excluding device/label data |

The settings are reflected onto the system file for CPU module auto exchange function.

## Restoration of the special relay and special register

Set whether or not to restore the special relays and special registers with the CPU module auto exchange when backing up with SM1351 ON (CPU module auto exchange mode). Set with SD9352 (CPU module auto exchange function setting) b14 (special relay, special register restoration (CPU module auto exchange function)).

| b14 of SD9352 | Restoration target data setting |
|---|---|
| OFF | The special relay and special register are not restored. |
| ON | The special relay and special register are restored. |

The settings are reflected onto the system file for CPU module auto exchange function.

### Initializing target data

When backing up with SM1351 ON (CPU module auto exchange mode), set whether or not to initialize the drive other than the SD memory card at the time of restoration by the CPU module auto exchange. Set with SD9352 (CPU module auto exchange function setting) b1 (initialize during CPU module auto exchange function).
This setting is valid only when the SD9351 (CPU module automatic replacement function Restore target data setting) value is 1 (restoration target data is all target data).

| b1 of SD9352 | Restoration target data setting |
|---|---|
| OFF | Do not initialize. |
| ON | Initialize. |

The settings are reflected onto the system file for CPU module auto exchange function.

### Setting of operation after restoration

When using backup processing triggered by turning on SM1351 (CPU module auto exchange mode), after restoration is executed with CPU module auto exchange, the CPU module operation can be continued from the backed up state or from the initialized state. This can be set with SD9352 (CPU module auto exchange function setting) b15 (setting of operation after CPU module auto exchange function). The operation of each item using the operation setting after restoration is shown below.

| Item | Setting of operation after restoration by CPU module auto exchange | |
|---|---|---|
| | Continue operation from backed up state (b15 of SD9352 = ON) | Operate from initialized state (b15 of SD9352 = OFF) |
| Initial device value | Do not set device initial values after restoration. | Set device initial values after restoration. (Device data from backed up state is overwritten with device initial values.) |
| SFC program | When "Resume Start" was selected before data backup, the SFC program is resumed after restoration processing.*1 | The SFC program is not resumed after restoration processing even though "Resume Start" was selected before data restoration. |
| Event history | Set event history during backup. | Do not set backup event history, and create new file. |

*1 When a battery is not mounted, the start of the SFC program is initial start regardless of setting of operation after restoration.

The settings are reflected onto the system file for CPU module auto exchange function.
Note that this setting is invalid since the device initial value file, SFC program, and event history file are not restored when the value in SD9351 (CPU module automatic replacement function Restore target data setting) is 0 (restoration target data are only device/label data).

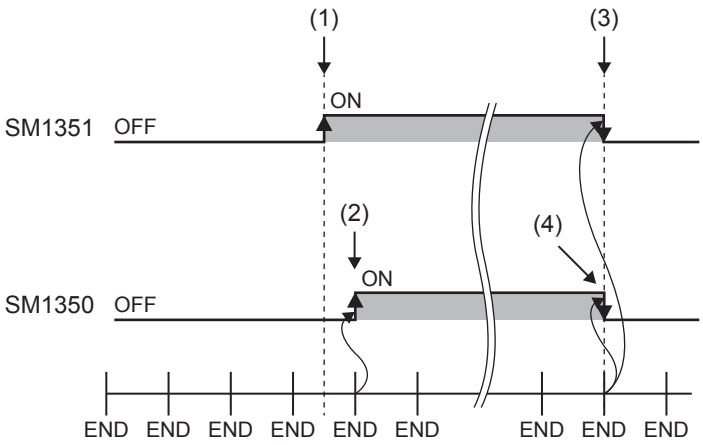
## Backup processing triggered by turning on SM1351 (Normal mode)

Data in the CPU module is backed up at a desired timing. Each time backup is requested, the year, date and serial No. of the date folder and number folder are updated (newly created), and the following backup data is created.

- System file for backing up CPU module data
- Backup data file for backing up CPU module data
- Device/label data file for backing up CPU module data

## Operating procedure

1. Set 0 (Normal mode) for SD9350 (Operation mode setting).
2. Turn on SM1351 (Data backup execution request).




(1) Turn on SM1351.
(2) The system turns on SM1350 (Data backup status flag).
(3) The system turns off SM1351 after the backup processing is completed.
(4) The system turns off SM1350.

If the backup processing is completed with an error and SM953 (Data backup error check flag) turns on, check SD953 (Backup error cause), take actions, and then back up the data again as required.

**Point**

- The execution status of the backup processing can be checked with SD1350 (Number of uncompleted folders/files of CPU module data backup/restoration) and SD1351 (Progression status of CPU module data backup/restoration). (☞ Page 212 Progress of the backup/restoration processing)
- If the system file for the CPU module auto exchange function is stored in the CPU data folder, the system file for the CPU module auto exchange function will be deleted when the backup execution request (SM1351) changes from OFF to ON.

# Backup processing triggered by turning on SM1351 (CPU module auto exchange function)

Data in the CPU module is backed up at a desired timing. The operation during back up differs according to the SD9350 (operation mode setting) value.

## Operation mode

### ■CPU module auto exchange mode (Deleting existing data)

When the SD9350 value is 1, each time the backup is requested, all of the data under the CPU data folder in the SD memory card is deleted, and a date folder, number folder, and the backup data are created. (Only the latest backup file is stored on the SD memory card.)

### ■CPU module auto exchange mode (Holding existing data)

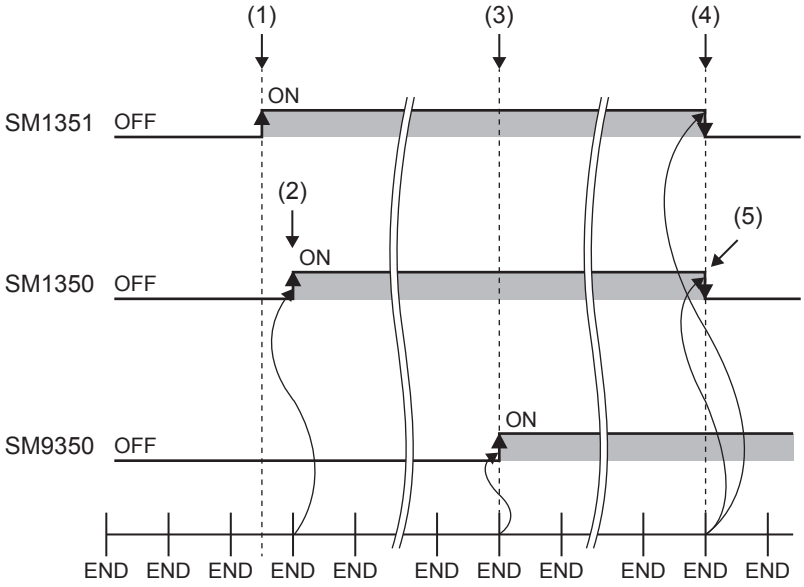
When the SD9350 value is 2, each time the backup is requested, the year, date, and serial No. of the date folder and number folder are updated (newly created), and the backup data is created. (Multiple backup folders are stored on the SD memory card.)

The backup files created during the backup processing triggered by turning on SM1351 (CPU module auto exchange mode) are shown below.

- System file for backing up CPU module data
- Backup data file for backing up CPU module data
- Device/label data file for backing up CPU module data
- System file for CPU module auto exchange function

### Operating procedure

1. SM9350 (CPU module auto exchange function enable/disable flag) is turned OFF (enable).
2. Set SD9350 (Operation mode setting) to 1 or 2[*1].
3. With SD9351 (CPU module automatic replacement function Restore target data setting), set the data to be restored when executing restoration with CPU module auto exchange.[*2]
4. Make each setting with SD9352 (CPU module auto exchange function setting) b1[*2], 14, and 15[*2].
5. Turn on SM1351 (Data backup execution request).




(1) Turn on SM1351.
(2) The system turns on SM1350 (Data backup status flag).
(3) System file for CPU module auto exchange function is created, and the system turns SM9350 (CPU module auto exchange function enable/disable flag) ON (disable).
(4) The system turns off SM1351 after the backup processing is completed.
(5) The system turns off SM1350.

*1 Only 1 (CPU module auto exchange mode (delete existing data)) is valid with firmware version of FX5U/FX5UC CPU module earlier than "1.050".
*2 For the FX5U/FX5UC CPU modules, this operation is required when the firmware version is "1.050" or later.

If the backup processing is completed with an error and SM953 (Data backup error check flag) turns on, check SD953 (Backup error cause), take actions, and then back up the data again as required.

**Point**

The execution status of the backup processing can be checked with SD1350 (Number of uncompleted folders/files of CPU module data backup/restoration) and SD1351 (Progression status of CPU module data backup/restoration). (☞ Page 212 Progress of the backup/restoration processing)

## Checking backup errors

When an error has occurred, a diagnostic error is not detected and an error code is stored in SD953 (Backup error cause). (☞ Page 855 List of error codes)

## Precautions

The following describes the precautions for the backup function.

### Prohibited operation during execution of the backup processing

Do not perform the following operations during execution of the backup processing.

- Attaching or detaching the SD memory card
- Powering off or resetting the CPU module

The above mentioned operations leave the backup data in the SD memory card in an incomplete state which is in the middle of the backup processing.

Do not use these data for a restoration. If these data are used, the restoration completes with an error.

## Suspending backup processing

The following operation can suspend a backup processing.

• Setting the SD memory card forced disable

Suspending a backup processing leaves the backup data in the SD memory card in an incomplete state which is in the middle of the backup processing. Do not use these data for a restoration. If these data are used, the restoration completes with an error.

## Device/label data

To execute the backup processing, do not change device/label data during execution of the processing. Since device/label data is divided into multiple scans and backed up, changes in the device/label data may cause data inconsistency.

## Operations and functions that cannot be performed

While the following operations or functions are being executed, the backup processing cannot be executed.

The following operations and functions cannot be executed during execution of the backup processing.

| Operation or function | | |
|---|---|---|
| Operation from GX Works3 | Initializing the CPU built-in memory/SD memory card | |
| | Clearing values (Devices, labels, latches) | |
| | Reading data from the programmable controller | |
| | Writing data to the programmable controller | |
| | Verifying data with the programmable controller | |
| | Deleting data in the programmable controller | |
| | Online change | |
| | Event history function (Updating event history data, clearing event history) | |
| | File password function | |
| | Security key authentication function (Writing/deleting a security key to/in the CPU module) | |
| | Predefined protocol support function (Writing/reading/verifying protocol setting data) | |
| | Memory dump function (Memory dump setting/reading results, registering/clearing memory dump) | |
| Operation using the CPU module logging configuration tool | Data logging function (Writing/reading/deleting a logging setting file, registering/clearing a logging setting) | |
| | Operation of a logging file (deletion) | |
| Others | Initial device values (CPU module: STOP → RUN) | |
| | • SLMP<br>• MC protocol | Remote latch clear |
| | Ethernet communication | File transfer function (FTP server) |
| | | File transfer function (FTP client) |

## Special relay and special register that function as flags to execute other functions

Before executing the backup processing, turn off the special relay and special register that function as flags to execute other functions. If the backup processing is executed when they are on, the corresponding function request may turn on and the function may be executed at the restoration of data in the special relay and special register.

## SFC program status

Do not change the status of the SFC program, such as step active status and transition conditions during execution of the backup processing. If the status of the SFC program was changed, the backup processing is completed with an error.

### Time required for completing the backup processing

It may take time for the backup to finish in the following cases:

- When the size of data or number of folders/files stored on the CPU module is large
- When a function that accesses the SD memory card, such as data logging function or event history function (save destination: SD memory card), is operating
- When Ethernet communication is in progress

If the backup does not finish, format the SD memory card, or re-insert the memory card. If the backup still does not finish, the SD memory card may have a hardware error, so replace the SD memory card.

#### Precautions

The scan time increases during backup.

### Backup when changing the parameters

If the CPU module parameters have been changed, power off and on the CPU module or reset the CPU module to apply the parameters. Then execute backup. If backup is executed before the parameter changes are applied, restoration may not be carried out correctly.

### Random folder/file

Do not create a random folder/file in the CPU data folder. The backup will not function correctly in the CPU module auto exchange mode.



## 23.2 Restoration Function

This function restores backup data in the SD memory card to the CPU module.

### Restoration target folder

Set restoration target data among backup data in the SD memory card with SD956 (Restoration target date folder setting) to SD958 (Restoration target number folder setting). The latest backup data can be restored with b13 (Restoration target folder) of SD955 (Restoration function setting).

| Special register | Description |
|---|---|
| b13 of SD955 | Set the restoration function setting with bit patterns.<br>• Off: Data specified with the restoration target folders is restored.<br>• On: The latest data is restored.*1 |
| SD957, SD956 | Specify the date folder of the restoration target data in BCD.<br>SD957: Year, SD956: Month and date |
| SD958 | Specify the folder number (00001 to 32767) of restoration target data. |

*1 The latest data is the backup data with the largest number in the newest date folder.

### Restoration target data

Restoration target data is set with SD954 (Restoration target data setting).

| Value of SD954 | Restoration target data setting |
|---|---|
| 0 | All target data |
| 1 | Only device/label data |
| 2 | All target data excluding device/label data |

Note that this function is invalid when restoring with CPU module auto exchange.

## Restoration of the special relay and special register

The setting for whether or not to restore the special relays and special registers differs according to the restoration function being executed.

### ■For restoration triggered by turning SM1354 ON, and automatic restoration using SD955

Set with SD955 (restoration function setting) b14 (special relay, special register restoration).

| b14 of SD955 | Restoration target data setting |
|---|---|
| OFF | The special relay and special register are not restored. |
| ON | The special relay and special register are restored. |

### ■Restoration by CPU module auto exchange

The special relay and special register are restored based on the system file for CPU module auto exchange function, so a setting is not required. (☞ Page 212 Restoration of the special relay and special register)

### ■Special relays and special registers that are not restored

Even when restoration is executed, the following special relays and special registers are not restored.

- SM953 (Data backup error check flag)
- SM959 (Data restoration error check flag)
- SM1350 (Data backup status flag)
- SM1351 (Data backup execution request)
- SM1353 (Data restoration status flag)
- SM1354 (Data restoration execution request)
- SM8492 (IP address storage area write request)
- SM8495 (IP address storage area clear request)
- SD953 (Backup error cause)
- SD959 (Restoration error cause)
- SD1350 (Number of uncompleted folders/files of CPU module data backup/restoration)
- SD1351 (Progression status of CPU module data backup/restoration)

## Initialization during automatic restoration

When executing automatic restoration with SD955, set whether or not to initialize the drives other than the SD memory card with SD955 (restoration function setting) b1 (initialize during automatic restoration). This function is valid only when SD954 (restoration target data setting) is 0 (all target data).

| b1 of SD955 | Restoration target data setting |
|---|---|
| OFF | Do not initialize. |
| ON | Initialize. |

### Setting of operation after restoration

Set whether after restoration the CPU module operation is to continue from the backup state or from the initialized state with SD955 (restoration function setting) b15 (setting of operation after restoration). The operation of each item using the operation setting after restoration is shown below.

| Item | Setting of operation after restoration | |
|---|---|---|
| | Continue operation from backed up state(b15 of SD955 = ON) | Operate from initialized state (b15 of SD955 = OFF) |
| Initial device value | Do not set device initial values after restoration. | Set device initial values after restoration. (Device data from backed up state is overwritten with device initial values.) |
| SFC program | When "Resume Start" was selected before data backup, the SFC program is resumed after restoration processing.*1 | The SFC program is not resumed after restoration processing even though "Resume Start" was selected before data restoration. |
| Event history | Set event history during backup. | Do not set backup event history, and create new file. |

*1 When a battery is not mounted, the start of the SFC program is initial start regardless of setting of operation after restoration.

Note that this setting is invalid since the device initial value file, SFC program, and event history file are not restored when the value in SD954 (Restoration target data setting) is 1 (restoration target data are only device/label data). Also, this setting is invalid by restoration with CPU module auto exchange.

## Restoration processing triggered by turning on SM1354

Backup data is restored at a desired timing. When restoration is requested, the CPU module backup data based on the following files in the designated folders are restored.

- System file for backing up CPU module data
- Backup data file for backing up CPU module data
- Device/label data file for backing up CPU module data

**Point**

Restoration, triggered by turning on SM1354, should be used to check the backup data or to check the operation before running the main one. To start main working operation of the system with the backup data, use automatic restoration using SD955 or restoration with CPU module auto exchange.

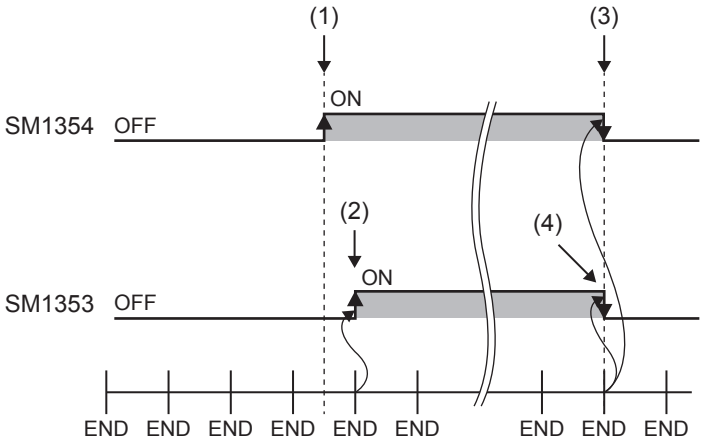
**Restriction**

The restoration processing triggered by turning on SM1354 (Data restoration execution request) can be executed only when the CPU module is the STOP state.

### Operating procedure

1. Set restoration target data with SD954 (restoration target data setting).*1
2. Set restoration target folders with SD956 (Restoration target date folder setting) to SD958 (Restoration target number folder setting). (However, this is not required when SD955 (restoration function setting) b13 (restoration target folder) is turned ON in step 3.)
3. Set each setting with the b13 to 15*2 of SD955.
4. Set the CPU module to the STOP state.

**5.** Turn on SM1354 (Data restoration execution request).




(1) Turn on SM1354.
(2) The system turns on SM1353 (Data restoration status flag).
(3) The system turns off SM1354 after the restoration processing is completed.
(4) The system turns off SM1353.

*1 Only 1 (only device/label data) is valid with firmware version of FX5U/FX5UC CPU module earlier than "1.050".
*2 The b15 (operation after restoration setting) setting is required when the firmware version is "1.050" or later for the FX5U/FX5UC CPU modules.

If the restoration processing is completed with an error and SM959 (Data restoration error check flag) turns on, check SD959 (Restoration error cause), take actions, and then restore the data again as required.

**Point**

The execution status of the restoration processing can be checked with SD1350 (Number of uncompleted folders/files of CPU module data backup/restoration) and SD1351 (Progression status of CPU module data backup/restoration). (☞ Page 212 Progress of the backup/restoration processing)

# Automatic restoration using SD955

Backup data is automatically restored when the CPU module is powered on or is reset. When restoration is executed, the CPU module backup data based on the following files in the designated folders are restored.

- System file for backing up CPU module data
- Backup data file for backing up CPU module data
- Device/label data file for backing up CPU module data

## Operating procedure

**1.** Set restoration target data with SD954 (restoration target data setting).*1

**2.** Set restoration target folders with SD956 (Restoration target date folder setting) to SD958 (Restoration target number folder setting). (However, this is not required when SD955 (restoration function setting) b13 (restoration target folder) is turned ON in step 3.)

**3.** Set each setting with the b1, b13 to 15*2 of SD955.

**4.** Turn on the b0 (Auto restoration request) of SD955.

**5.** Power off and on or reset the CPU module.

*1 Only 1 (only device/label data) is valid with firmware version of FX5U/FX5UC CPU module earlier than "1.050".
*2 The b1 (initialization during automatic restoration) and b15 (operation after restoration setting) settings are required when the firmware version is "1.050" or later for the FX5U/FX5UC CPU modules.

If the restoration processing is completed with an error and SM959 (Data restoration error check flag) turns on, check SD959 (Restoration error cause), take actions, and then restore the data again as required.

**Point**

- Since the special register set for the automatic restoration is a latch area, setting data is held.
- SD955 (Restoration function setting) holds its setting even after the CPU module is powered off and on or is reset. Thus, if the CPU module is powered off and on or is reset while the b0 (Auto restoration request) of SD955 is on, the automatic restoration is executed again. For not performing the automatic restoration when the CPU module is powered off and on or is reset the next time, turn off b0 of SD955 after a restoration is completed and then power off and on or reset the CPU module.

# Restoration triggered by CPU module auto exchange

At power ON or at reset, the backup data is automatically reset without the need for a command. When restoration is executed, the CPU module backup data is restored based on the system file for the CPU module auto exchange function in the SD memory card.

**Restriction**

The CPU module auto exchange is executed only when the system file for the CPU module auto exchange function created with backup during the CPU module auto exchange mode is stored on the SD memory card.

## Operating procedure

1. Insert the SD memory card containing the system file for CPU module auto exchange function created with backup during the CPU module auto exchange mode into the CPU module.
2. SM9350 (CPU module auto exchange function enable/disable flag) is turned OFF (enable). (For CPU module backed up with the CPU module auto exchange mode, or CPU module restored with CPU module auto exchange)
3. Power off and on or reset the CPU module.

When the restoration finishes correctly, the system turns SM9350 (CPU module auto exchange function enable/disable flag) ON (disable).

If the restoration processing is completed with an error and SM959 (Data restoration error check flag) turns on, check SD959 (Restoration error cause), take actions, and then restore the data again as required.

**Point**

- SM9350 (CPU module auto exchange function enable/disable flag) turns ON (enable) each time restoration is executed with CPU module auto exchange, so unless SM9350 is turned OFF (enabled) specifically, restoration with CPU module auto exchange will not be executed each time the power is turned OFF and ON or reset.
- The CPU module target data is restored based on the system file for CPU module auto exchange function so the SD955 (restore function setting) setting is disabled.

# Checking restoration errors

- When an error occurs in the restoration processing triggered by turning on SM1354, a diagnostic error is not detected and an error code is stored in SD959 (Restoration error cause). (☞ Page 855 List of error codes)
- A diagnosis error will be detected if an error occurs during restoration with the SD955 automatic restoration and CPU module auto exchange. An error code is also stored in SD959. (☞ Page 855 List of error codes)

# Precautions

The following describes the precautions for the restoration function.

## Prohibited operation during execution of the restoration processing

Do not perform the following operations during execution of the restoration processing.

- Attaching or detaching the SD memory card
- Powering off or resetting the CPU module

The above mentioned operations leave the data in the CPU module in an incomplete state which is in the middle of the restoration processing. Do not run the CPU module with this incomplete state. Doing so may cause an unintended operation. Execute restoration again, or write the data to the CPU module after initialization of the CPU module.

## Suspending the restoration processing

The following operation can suspend a restoration processing.

- Setting the SD memory card forced disable

Suspension during a restoration leaves the data in the CPU module in an incomplete state which is in the middle of the restoration processing. Do not run the CPU module with this incomplete state. Doing so may cause an unintended operation. Execute restoration again, or write the data to the CPU module after initialization of the CPU module.

**Restriction**

Automatic restoration using SD955 and restoration using CPU module auto exchange cannot be suspended.

## Types of CPU modules that execute restoration

Make sure CPU module model being restored is the same model as the backup source CPU module. Restoration of different models is not possible.

## When error is occurring in CPU module

Restoration may not be possible if a parameter error is occurring in the CPU module at the restoration destination.

## Changing the operating status during execution of restoration

During execution of the restoration processing, the CPU module remains in the STOP state even if the RUN/STOP/RESET switch is changed from the STOP to RUN position or the remote RUN or the remote PAUSE is executed. The following operation will take place if the CPU module operation status is changed while executing restoration.

- If the restoration target data is all target data or all target data excluding device/label data, the specified operation status will not be entered when restoration is completed.
- If performing restoration without parameter change (parameter of backup date and restoration destination CPU module are same), the specified operation status will be entered.
- The specified operation status is entered after restoration is completed only when the restoration target data is device/label data.
- If performing automatic restoration or restoration with CPU module auto exchange, the specified operation status will be entered when restoration is completed.

## Operations and functions that cannot be performed

While the following operations or functions are being executed, the restoration processing cannot be executed.
The following operations and functions cannot be executed during execution of the restoration processing.

| Operation or function | | |
|---|---|---|
| Operation from GX Works3 | Initializing the CPU built-in memory/SD memory card | |
| | Clearing values (Devices, extended file registers, labels, latches) | |
| | Reading data from the programmable controller | |
| | Writing data to the programmable controller | |
| | Verifying data with the programmable controller | |
| | Deleting data in the programmable controller | |
| | Online change | |
| | Event history function (Updating event history data, clearing event history) | |
| | File password function | |
| | Security key authentication function (Writing/deleting a security key to/in the CPU module) | |
| | Predefined protocol support function (writing/reading/verifying protocol setting data) | |
| | Memory dump function (Memory dump setting/reading results, registering/clearing memory dump) | |
| Operation using the CPU module logging configuration tool | Data logging function (Writing/reading/deleting a logging setting file, registering/clearing a logging setting) | |
| | Operation of a logging file (deletion) | |
| Others | • SLMP<br>• MC protocol | Remote latch clear |
| | Ethernet communication | File transfer function (FTP server) |
| | | File transfer function (FTP client) |

## Functions that cannot be executed simultaneously with automatic restoration or CPU module auto exchange

Do not execute automatic restoration using SD955, or restoration by automatic restoration using SD955 and CPU module auto exchange simultaneously with the following functions.

- Firmware update function (☞ Page 89 FIRMWARE UPDATE FUNCTION)
- Boot operation (☞ Page 230 Boot Operation)

If these are executed simultaneously, automatic restoration or restoration with CPU module auto exchange will not function.

## Operation of when the data logging function is used

If data is backed up during execution of the data logging function and the function has been set to be started automatically when the operating status of the CPU module is changed to RUN, the data logging function will be automatically executed when the status of the CPU module changes to RUN after the restoration processing. To restart the data logging function after the restoration processing without the above setting, use the CPU module logging configuration tool.

## When the SFC program is restarted from where the program was stopped

Specify the continue start. When the continue start has not been specified, the SFC program will be started from the block 0 and step 0 even though the bit 15 of SD955 is on (the continue start is executed).

## When using IP address change function

If executing backup when an IP address is stored in the IP address storage area (system memory), the IP address will change at the following timing during restoration.

- Restoration processing triggered by turning on SM1354: When the CPU module is powered off and on or is reset after the restoration processing
- Automatic restoration using SD955: When the restoration processing is executed
- Restoration triggered by CPU module auto exchange: When restoration is executed.

## Data protected by security functions

### ■File password function

Unlock the file passwords of the files in the backup target CPU module. If any files to which file passwords have been set exist in the CPU module, the files are not restored.

### ■Security key authentication function

Locked programs can be restored regardless of whether security keys have been written or not. However, when the security key has not been written to the CPU module after the restoration processing, the program cannot be executed. Restore unlocked backup data or set the same security key.

## Abnormal completion of restoration

Since the restoration processing will be completed with an error, do not execute the restoration processing in the following cases.

- Data in a backup folder has been deleted. (Do not delete the data in backup folders that are likely to be used for restoration.)
- Backup data has problems. (Backup data has been changed or the CPU module was powered off during execution of the backup processing.)

## When the same name folder or file exists in the restoration target CPU module

If the name of a folder or file in the restoration target CPU module and the name of a folder or file in backup data are identical, the folder or file in the module will be overwritten by that in the backup data.

## Status of the restoration destination CPU module

If the status of the restoration destination CPU module differs from that of the CPU module at the backup processing (such as programs or parameters), the restoration may not be executed.
When the backup data to be restored is backed up in a different status from that of the restoration destination CPU module, store 0 (All target data) to SD954 (Restoration target data setting) and execute the automatic restoration.

## Applying the restored data

There are parameters that are applied only when the CPU module power is turned OFF→ON or reset. Thus, if the data is restored while operation is stopped, and then the state is changed from STOP to RUN, the CPU module may not run with the backed up data. In this case, turn OFF→ON the power or reset the CPU module. The device/label data other than the latch specified devices/labels is initialized when the CPU module power is turned OFF→ON or reset, so restore only the device/label data again as needed.

## Stop monitoring at restoration

Stop monitoring before executing the restoration processing.
When the restoration processing is executed, programs, parameters, and device/label values may not be properly monitored because they are changing.

## Conditions for executing automatic restoration and CPU module auto exchange

The restoration executed for automatic restoration using SD955 and restoration with CPU module auto exchange differs according to the following conditions.

| Auto restoration request (b0 of SD955) | CPU module auto exchange function enable/disable flag (SM9350) | Presence of system file for CPU module auto exchange function | Executed restoration |
|---|---|---|---|
| ON | OFF (Enable) | Existing | Restoration triggered by CPU module auto exchange |
| ON | OFF (Enable) | None | Automatic restoration using SD955 |
| ON | ON (Disable) | None | Automatic restoration using SD955 |
| ON | ON (Disable) | Existing | Automatic restoration using SD955 |
| OFF | OFF (Enable) | Existing | Restoration triggered by CPU module auto exchange |
| OFF | OFF (Enable) | None | No process |
| OFF | ON (Disable) | Existing | No process |
| OFF | ON (Disable) | None | No process |

## Time required for completing the restoration processing

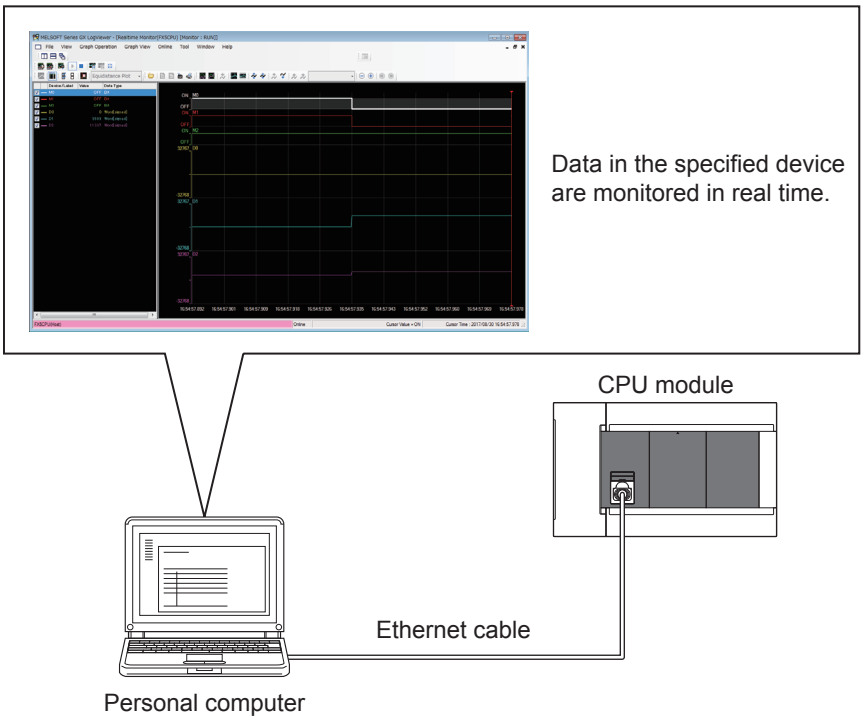
It may take some time for restoration to finish if Ethernet communication is in progress.

## The relation between the data to be restored and the firmware version of the CPU module

Do not restore the program with the program capacity setting of 128000 steps to the FX5U/FX5UC CPU module with the firmware version earlier than "1.100". The program may not operate normally. For the program capacity setting, refer to ☞ Page 49 Program Capacity Setting.

# 24 REAL-TIME MONITOR FUNCTION

This function monitors the contents of a specified device of the CPU module in real time with a specified interval or a desired timing. The function can be set with GX LogViewer, where the value changes of a specified device can be shown graphically. Saving the set data and displayed graphs makes it possible to simplify the settings and check the graphs at a later time.
For details on the function, refer to GX LogViewer Version 1 Operating Manual.




**Point**

For supported version of real-time monitor function, refer to Page 971 Added and Enhanced Functions.

# MEMO

# 25 MEMORY CARD FUNCTION

The following explains the functions that use SD memory card.
If an SD memory card is used on the FX5S CPU module, the SD memory card module is required.

## 25.1 SD Memory Card Forced Stop

SD memory card can be disabled without turning power ON→OFF, even when a function that uses SD memory card is being executed, such as when the data logging function is running.

### Methods of SD memory card forced stop

The methods of SD memory card forced stop are as described below.

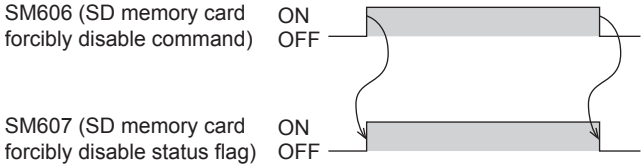
#### ■Operation by SD memory card disable switch

1. Press the SD memory card access control switch for 1 second or longer.*1
2. The CARD LED will flash on → turn off.*1*2
3. Remove the SD card.

*1 For the SD memory card module, slide and hold the SD memory card access control switch to OFF (upward) for 1 second or longer.
*2 If there is a function accessing the SD memory card, the CARD LED will flash off after the access of that function is complete. Therefore, the time from flash on to flash off will be different depending on the function.

#### ■Operation by special relay

1. Turn ON SM606 (SD memory card forcibly disable command).




2. Check if CARD LED has turned off or SM607 (SD memory card forcibly disable status flag) has turned ON.
3. Remove the SD card.

## Operation of function accessing SD memory card

The following table shows the operation when the main function is executed while SD memory card is being accessed and when SD memory card is accessed after SD memory card is disabled.

| Function under execution | | When main function is executed while SD memory card is being accessed | When SD memory card is accessed after SD memory card is disabled |
|---|---|---|---|
| Boot operation | | After completing execution function, SD memory card turns to disabled status. | — |
| • Access to the label/device comment in the SD memory card<br>• Device/label initialization operation at STOP→RUN | | | CPU module error occurs.*1 |
| Access to the SD memory card by engineering tool/ SLMP/file transfer function (FTP server, FTP client) | | Error handling occurs. | Error handling occurs. |
| Data logging function | | This function works by disabling data writes to the SD memory card while allowing data collection to continue.<br>(☞ Page 195 SD memory card replacement) | — |
| Memory dump function | | Error handling occurs. | — |
| Event history function (Save destination: SD memory card) | Logging of the event history | After the event history in the internal memory is stored in the SD memory card, the SD memory card turns to disabled status. | —*2 |
| | Viewing/clearing the event history | Error handling occurs. | Error handling occurs. |
| Data backup/restoration function | | At completion of the backup/restoration processing of a file, the SD memory card is disabled, the backup/restoration function is completed with an error, and then the cause of error is stored in a special register. | The cause of error is stored in a special register. |
| Extended file register (ER) function | | Extended file register (ER) function is completed with an error, and SD memory card turns to disabled status.<br>Also, a operation error 3586H occurs. | A operation error 3586H occurs. |
| File operation instruction | | The function is completed with an error, and the SD memory card turns to disabled status.<br>8000H is stored in the completion status of the file operation instruction. | 8000H is stored in the completion status of the file operation instruction. |

*1 Operation is same as when the SD memory card is not attached.
*2 While being removed, the SD memory card is not accessed. (☞ Page 133 When files are created)

## Releasing the SD memory card forced stop status

After the SD memory card has turned to disable status, release the SD memory card forced stop status by the operation shown below.

1. Load SD card again.*1
2. When a forced stop operation is carried out by SM606, turn OFF SM606.

*1 The CARD LED will blink→light up.

## Precautions

The precaution regarding SD memory card forced stop is described below.

- When a forced stop operation is carried out by both the SD memory card disable switch and by SM606, operation carried out earlier becomes valid, and the operation carried out later becomes invalid. For example, after the forced stop by SD memory card disable switch, when SM606 is turned ON→OFF without removing the SD memory card, the disable status of the SD memory card can be released. After the forced stop by SD memory card disable switch, when SD memory card is removed and then SM606 is turned ON, SM606 operation is ignored.

# 25.2 Boot Operation

At the time of power OFF→ON or reset of the CPU module, a file which is stored on the SD memory card is transferred to the memory of the transfer destination which the CPU module judged automatically.

## Boot operation procedure

The selectable files for boot operation are listed below.

1. Carry out the boot file settings.
2. Load SD memory card.
3. Write the boot file settings and boot file to the SD memory card.*1
4. Turn OFF→ON the power or reset the CPU module.

*1 There are two types of writing method to the SD memory card: Online Data Operation (via the CPU module) and Memory Card Operation (direct from the personal computer). For details, refer to the following.
GX Works3 Operating Manual

## Specifiable file types

The procedure of boot operation is explained below.

- Parameter files (system parameters, CPU parameters, module parameters, module extension parameters)
- Remote password
- Global labels (global label setting files)
- Program files (programs, restored information)
- FB files (FB, restored information)
- Device comments
- Initial device values

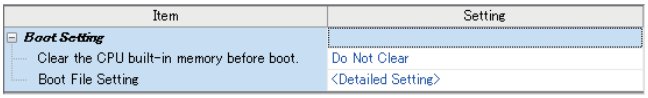
## Configuring the boot setting

Carry out the settings required for the boot operation.

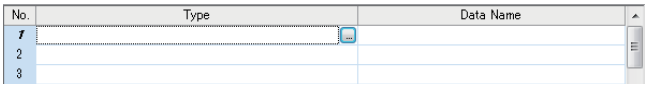
Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [Memory Card Parameter] ⇨ [Boot Setting]

### Operating procedure

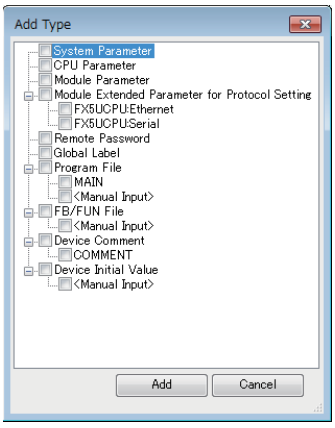
"Boot Setting" window




"Boot File Setting" window




"Add Type" window




1. Click "Detailed Setting" on the "Boot File Setting" window.
2. Click the "Type" column. The maximum number of boot files that can be specified is the same as the number of files that can be stored in the storage memory.
3. Select type for the boot file. (Multiple selection possible)

"Boot File Setting" window

| No. | Type | Data Name |
|---|---|---|
| 1 | System Parameter | SYSTEM |
| 2 | CPU Parameter | CPU |
| 3 | Module Parameter | UNIT |
| 4 | Module Extended Parameter for Protocol Setting(FX5UCPU-Ethernet) | UEX3FF00 |
| 5 | Module Extended Parameter for Protocol Setting(FX5UCPU-Serial) | UEX3FF01 |
| 6 | Remote Password | 00000001 |
| 7 | Global Label | GLBLINF |
| 8 | Program File | MAIN |
| 9 | Program File | |
| 10 | FB/FUN File | |
| 11 | Device Comment | COMMENT |
| 12 | Device Initial Value | |

***4.*** Set the data name (file name).

### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Clear the CPU built-in memory before boot | Sets whether or not to clear the CPU built-in memory upon file transfer from the SD memory card. | • Do Not Clear<br>• Clear | Do Not Clear |
| Boot File Setting | Sets the files used for boot operation from the SD memory card. | — | — |

## Maximum number of boot files that can be specified

It is the same as the number of files that can be stored in transfer destination memory.

## Operation when security functions are enabled

This section describes the operation when security functions are enabled.

### ■When a security key is set

When a security key is set to the boot target program file and the security of the program file does not match with that of the CPU module, a boot error occurs. Also, when no security key is written to the CPU module, a boot error occurs as well.

| Security key of boot target program file | Security key of CPU module | Security key match/mismatch | Boot program execution |
|---|---|---|---|
| Set | Written | Match | Execute |
| | Written | Mismatch | Not execute (boot error) |
| | Not written | — | Not execute (boot error) |

### ■When a file password is set

If a file password is set on both the source boot file and destination file, the file can be transferred only when the passwords match. Furthermore, the file transfer does not work if a file password is set only on either one.

| Transferring boot file | | Transferred boot file | | Password match/ mismatch | Transfer |
|---|---|---|---|---|---|
| File | File password setting | File | File password setting | | |
| Existing | Set | Existing | Set | Match | Yes |
| | | | | Mismatch | No |
| | | | Not set | — | No |
| | | Not set | — | | Yes |
| | Not set | Existing | Set | | No |
| | | | Not set | | Yes |
| | | Not set | — | | Yes |

## Precautions

The precautions on the boot operation are explained below.

- The parameter file existing on the module of the transfer destination is overwritten, when a parameter file is set to the boot file. Further, if a parameter file is stored in the SD memory card, but not set to the boot file, the operation will follow the parameter file on the module.
- Note that the model of the program written on the SD memory card (program specified in the boot file settings) and the model of the CPU module must be the same.

# 26 HIGH-SPEED INPUT/OUTPUT FUNCTION

The high-speed input/output function is explained below.
Each respective function is set by parameters in GX Works3.
High-speed pulse input/output module is supported only for FX5UJ and FX5U/FX5UC CPU modules.

| Function | | Reference |
|---|---|---|
| High-speed counter function | Normal mode | Page 246 |
| | Pulse density measurement mode | Page 249 |
| | Rotational speed measurement mode | Page 251 |
| FX3-compatible high-speed counter function | | Page 290 |
| Pulse width measurement function | | Page 299 |
| Pulse catch function | Pulse catch function | Page 310 |
| | FX3-compatible pulse catch function | Page 315 |
| General-purpose input functions | | Page 318 |
| PWM function | | Page 321 |
| Positioning function | | Page 334 |

## 26.1 High-speed Counter Function

High-speed counter function is explained below.

### High-speed counter function overview

The high-speed counter is a function that counts the number of high-speed pulse inputs that cannot be counted by a conventional counter, using the general purpose input terminal of the CPU module or high-speed pulse input/output module.
High-speed pulse input/output module is supported only for FX5UJ and FX5U/FX5UC CPU modules.
Depending on the input (module) to be used, each function of the high-speed counter is limited as follows:
○: Supported, ×: Not supported

| Input type | High-speed counter operation mode | | | High-speed counter dedicated instructions | |
|---|---|---|---|---|---|
| | Normal mode | Pulse density measurement mode | Rotational speed measurement mode | HIOEN/DHIOEN instruction | DHSCS, DHSCR, DHSZ instruction |
| CPU module | ○ | ○ | ○ | ○ | ○ |
| High-speed pulse input/output module | ○ | × | × | ○ | × |

The high-speed counter assigns input and function settings by parameters and operates using the HIOEN/DHIOEN instruction.

**Point**

Parameter setting and the HIOEN/DHIOEN instruction are always required to use the high-speed counter.

#### High-speed counter parameter setting

High-speed counter channels (input allocation, function) and high-speed counter comparison table, etc., are set by parameters. (☞ Page 245 High-speed counter parameters)

#### High-speed counter operation mode

The three high-speed counter operation modes are as follows.
Operation mode is set by parameter. (☞ Page 245 High-speed counter parameters)

**■Normal mode**

Select normal mode if you want to use as an ordinary high-speed counter. (☞ Page 246 High-speed counter (normal mode))

### ■Pulse density measurement mode

Select pulse density measurement mode if you want to count the number of pulses for a specified amount of time. (☞ Page 249 High-speed counter (pulse density measurement mode))

### ■Rotational speed measurement mode

Select rotational speed measurement mode if you want to measure speed for a specified amount of time. (☞ Page 251 High-speed counter (rotational speed measurement mode))



## Input comparison

When the current value and the set value of the high-speed counter are compared and when they match, the output of the specified device can be performed. (normal mode) Also, the current value and the preset value can be compared. (Preset input comparison)

☞ Page 254 High-speed comparison table

☞ Page 257 Multiple point output, high-speed comparison tables

The normal input comparison or operation when there is preset input can be set by the parameter setting of the high-speed counter (normal mode).

| Item | | Description |
|---|---|---|
| **Preset Input Enable/ Disable** | **Input Comparison Enable/ Disable** | |
| Enable | Enable | • Perform "comparison at counting + output to the specified device".<br>• Change the current value to the preset value when the preset input is detected.<br>• Perform output to the specified device when the current value matches with the comparison value by the preset input. |
| Enable | Disable | • Perform "comparison at counting + output to the specified device".<br>• Change the current value to the preset value when the preset input is detected. |
| Disable | Disable | Perform "comparison at counting + output to the specified device". |

Whether or not to perform the preset input comparison can be set by the special devices. (☞ Page 266 High-speed counter preset input comparison)

**Point**

Use the parameter setting value of the high-speed counter (normal mode) as the preset value. (☞ Page 246 High-speed counter (normal mode))

### Precautions

The comparison operation of the preset input comparison may not be performed depending on the timing of the preset input. When the comparison operation is required at every preset input, configure the interrupt settings for the input (X) that is to be used in the preset. Then, write the comparison operation in the interrupt program. (☞ Page 283 Precautions when using high-speed counters)

## High-speed counter dedicated instructions

The high-speed counter starts and stops counting using the HIOEN/DHIOEN instruction for the high-speed counter. (📖MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks))

## Other high-speed counter instructions

In addition to the dedicated instructions, there are instructions such as DHSCS, DHSCR, and DHSZ (hereafter referred to as "high-speed comparison instruction") for high-speed counters.

For details, refer to the following.

📖MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks)

# High-speed counter function execution procedure

The high-speed counter function execution procedure is as follows.

***1.*** Check the specifications of the high-speed counter.

Check specifications such as maximum frequency and type of high-speed counter. (☞ Page 234 High-speed counter specifications)

***2.*** Connect the CPU module to the external device.

For details on wiring to external devices, refer to the following manual

MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)

***3.*** Set the parameters.

Set parameters such as channel (CH) of the high-speed counter. (☞ Page 245 High-speed counter parameters)

***4.*** Create the program.

Create program for using the high-speed counter.

***5.*** Run the program.

# High-speed counter specifications

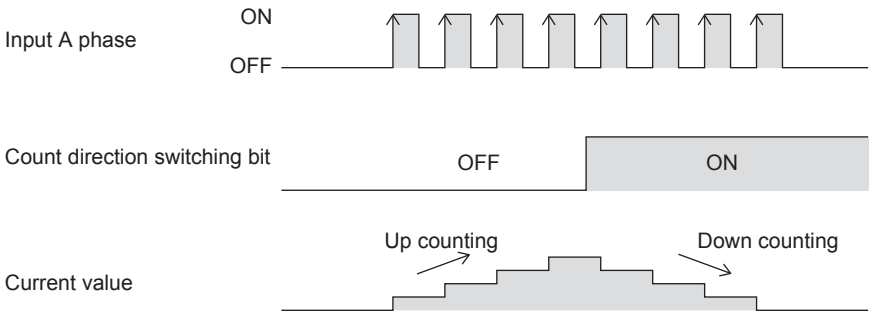
High-speed counter specifications are explained below.

## Types of high-speed counters

Types of high-speed counters are as follows.

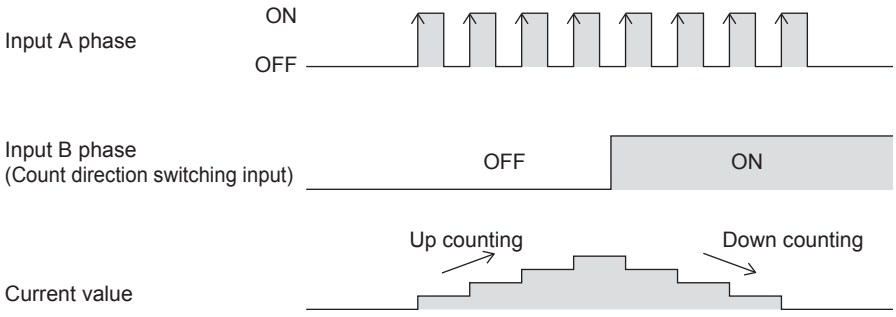
### ■1 phase, 1 input counter (S/W)

Counting method of 1 phase, 1 input counter (S/W) is as follows.



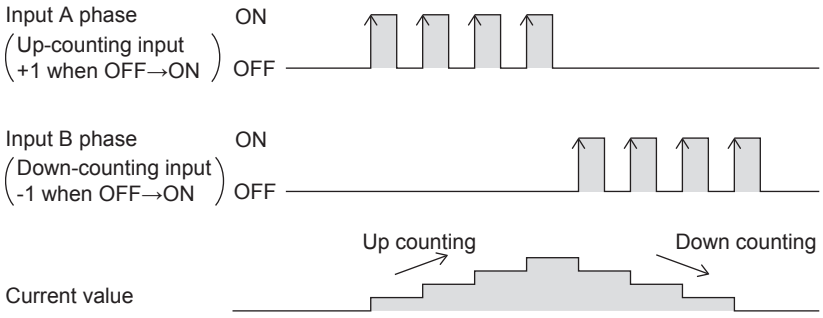

### ■1 phase, 1 input counter (H/W)

Counting method of 1 phase, 1 input counter (H/W) is as follows.



## ■1 phase, 2 input counter

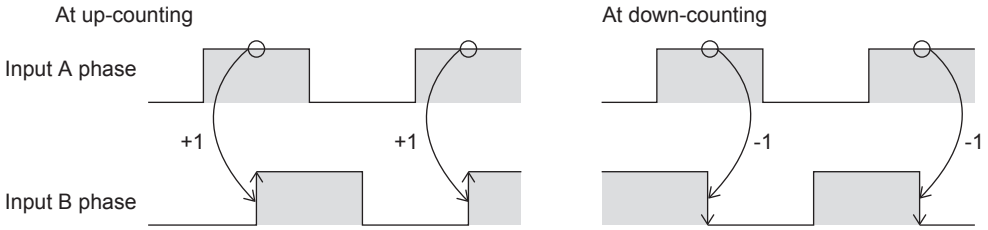
Counting method of 1 phase, 2 input counter is as follows.




## ■2 phase, 2 input counter [1 edge count]

Counting method of 2 phase, 2 input counter [1 edge count] is as follows.

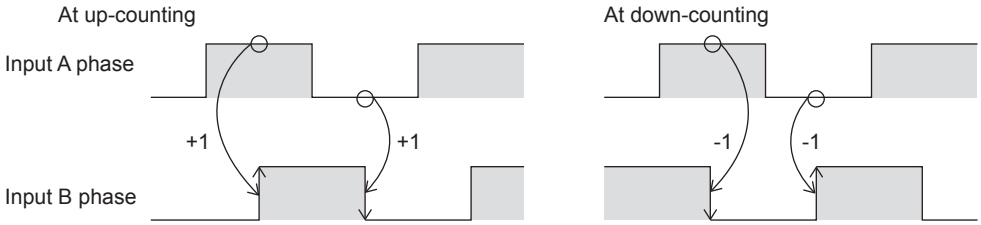
| Up/down counter | Counter timing |
|---|---|
| At up-counting | 1 count up when input A phase is ON and input B phase switches OFF→ON |
| At down-counting | 1 count down when input A phase is ON and input B phase switches ON→OFF |




## ■2 phase, 2 input counter [2 edge count]

Counting method of 2 phase, 2 input counter [2 edge count] is as follows.

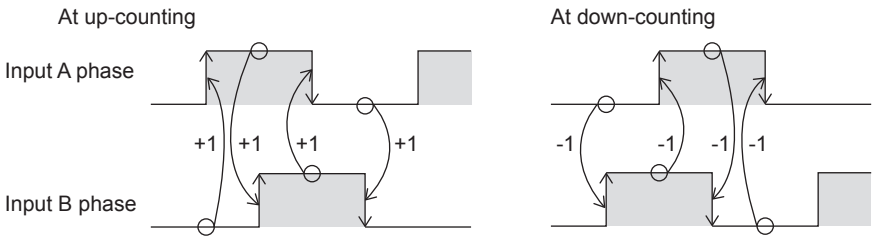
| Up/down counter | Counter timing |
|---|---|
| At up-counting | 1 count up when input A phase is ON and input B phase switches OFF→ON<br>1 count up when input A phase is OFF and input B phase switches ON→OFF |
| At down-counting | 1 count down when input A phase is ON and input B phase switches ON→OFF<br>1 count down when input A phase is OFF and input B phase switches OFF→ON |



### ■2 phase, 2 input counter [4 edge count]

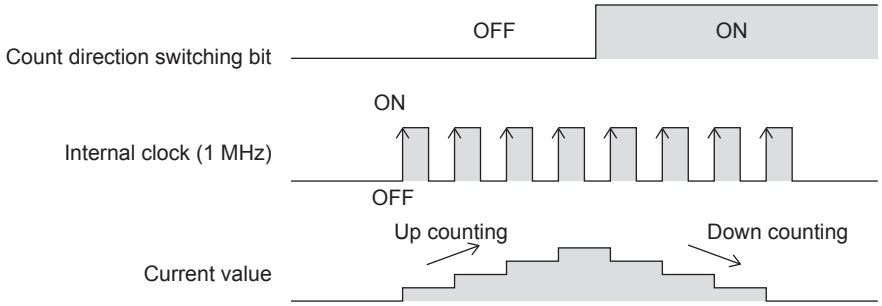
Counting method of 2 phase, 2 input counter [4 edge count] is as follows.

| Up/down counter | Counter timing |
|---|---|
| At up-counting | 1 count up when input B phase is OFF and input A phase switches OFF→ON<br>1 count up when input A phase is ON and input B phase switches OFF→ON<br>1 count up when input B phase is ON and input A phase switches ON→OFF<br>1 count up when input A phase is OFF and input B phase switches ON→OFF |
| At down-counting | 1 count down when input A phase is OFF and input B phase switches OFF→ON<br>1 count down when input B phase is ON and input A phase switches OFF→ON<br>1 count down when input A phase is ON and input B phase switches ON→OFF<br>1 count down when input B phase is OFF and input A phase switches ON→OFF |




### ■Internal clock

Counting method of internal clock is as follows.



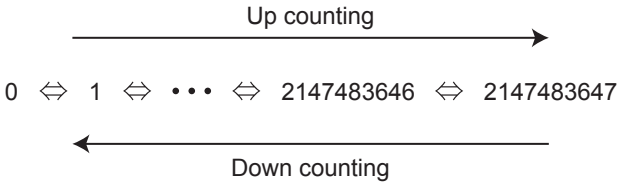

**Point**

Under ordinary circumstances, the internal clock counts up/down by 1 MHz clock. External input is not used.

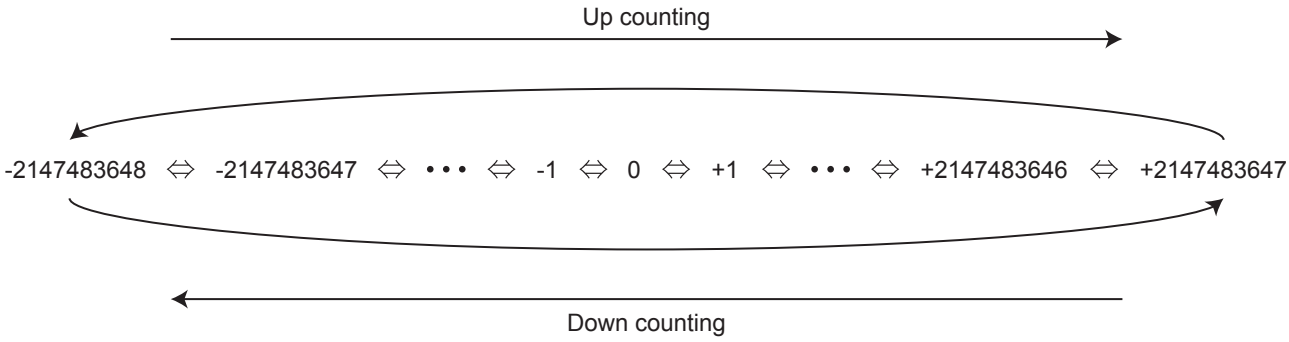
## High-speed counter form

High-speed counter form becomes ring counter depending on the ring length setting.

### ■When ring length is set



### ■When ring length is not set (ring counter)






## Maximum frequency

The maximum frequency that each type of counter can count is as follows.

For details concerning maximum frequency by input assignment, refer to ☞ Page 241 Input assignment-wise / maximum frequency for high-speed counters.

### ■FX5S/FX5UJ CPU module

| Counter type | Maximum frequency |
|---|---|
| 1 phase, 1 input counter (S/W) | 100 kHz |
| 1 phase, 1 input counter (H/W) | 100 kHz |
| 1 phase, 2 input counter | 100 kHz |
| 2 phase, 2 input counter [1 edge count] | 100 kHz |
| 2 phase, 2 input counter [2 edge count] | 50 kHz |
| 2 phase, 2 input counter [4 edge count] | 25 kHz |
| Internal clock | 1 MHz (fixed) |

### ■FX5U/FX5UC CPU module

| Counter type | Maximum frequency |
|---|---|
| 1 phase, 1 input counter (S/W) | 200 kHz |
| 1 phase, 1 input counter (H/W) | 200 kHz |
| 1 phase, 2 input counter | 200 kHz |
| 2 phase, 2 input counter [1 edge count] | 200 kHz |
| 2 phase, 2 input counter [2 edge count] | 100 kHz |
| 2 phase, 2 input counter [4 edge count] | 50 kHz |
| Internal clock | 1 MHz (fixed) |

### Precautions

- The input circuit has restrictions for maximum frequency.

| FX5UJ CPU module | Maximum frequency |
|---|---|
| X0, X1, X3, X4 | 100 kHz |
| X2, X5, X6, X7 | 10 kHz |

| FX5U-32M☐, FX5UC-32M☐ | FX5U-64M☐, FX5U-80M☐, FX5UC-64M☐, FX5UC-96M☐ | High-speed pulse input/output module*1 | Maximum frequency |
|---|---|---|---|
| X0 to X5 | X0 to X7 | X☐ to X☐+5 | 200kHz |
| X6 to X17 | X10 to X17 | X☐+6, X☐+7 | 10 kHz |

*1 The number in ☐ is the head input number for each high-speed pulse input/output module.

- If input response time is set, maximum frequency is affected by the setting value.
- Under ordinary circumstances, the internal clock counts at 1 MHz (fixed) during operation.

## Matched output performance

### ■CPU module

If output is to Y0 to Y17 using high-speed comparison instructions (DHSCS, DHSCR, DHSZ instruction), high-speed comparison table, or multiple point output high-speed comparison table, time from pulse input→comparison of count value (match)→output to Y is follows.

- FX5S/FX5UJ CPU module: 10μs + input response time
- FX5U/FX5UC CPU module: 5μs + input response time

If output is to Y20 or subsequent, time from pulse input to output is affected by communication and user interrupt.

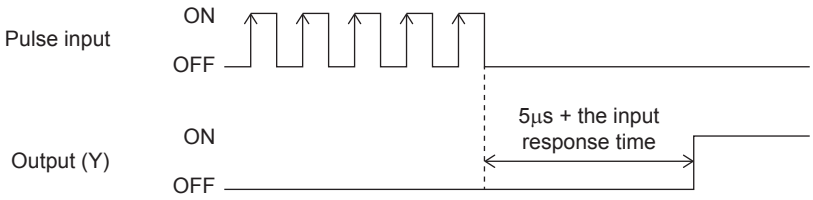
### ■High-speed pulse input/output module

The matched output from the high-speed comparison table is possible only in the same module.

The time from pulse input→comparison of count value (match)→output to Y is 5 μs + the input response time.

### ■Operation diagram

An operation diagram is shown below. (Comparison value: 5)




## Count range

-2147483648 to +2147483647. These are signed 32-bit ring counters.

Ring length setting is however in the range of 0 to 2147483647.

# Assignment for high-speed counters

## Input assignment for high-speed counters

Assignment for input devices of high-speed counters is set by parameters.

Assignment is determined according to functions set for each channels by parameter.

When using internal clock, assignment is same as 1-phase, 1-count (S/W) and A phase is not used.

Input assignment of high-speed counters is as follows.

### ■FX5S/FX5UJ CPU module

| CH | High-speed counter type | X0 | X1 | X2 | X3 | X4 | X5 | X6 | X7 | X10 | X11 | X12 | X13 | X14 | X15 | X16 | X17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CH1 | 1-phase 1-count (S/W) | A | P | | | | | E | | | | | | | | | |
| | 1-phase 1-count (H/W) | A | B | P | | | | E | | | | | | | | | |
| | 1-phase 2-count | A | B | P | | | | E | | | | | | | | | |
| | 2-phase 2-count | A | B | P | | | | E | | | | | | | | | |
| CH2 | 1-phase 1-count (S/W) | | A | P | | | | | E | | | | | | | | |
| | 1-phase 1-count (H/W) | | A | B | P | | | | E | | | | | | | | |
| | 1-phase 2-count | | A | B | P | | | | E | | | | | | | | |
| CH3 | 1-phase 1-count (S/W) | | | A | P | | | | | E | | | | | | | |
| | 1-phase 1-count (H/W) | | | A | B | P | | | | E | | | | | | | |
| | 1-phase 2-count | | | A | B | P | | | | E | | | | | | | |
| CH4 | 1-phase 1-count (S/W) | | | | A | P | | | | | E | | | | | | |
| | 1-phase 1-count (H/W) | | | | A | B | P | | | | E | | | | | | |
| | 1-phase 2-count | | | | A | B | P | | | | E | | | | | | |
| | 2-phase 2-count | | | | A | B | P | | | | E | | | | | | |

| CH | High-speed counter type | X0 | X1 | X2 | X3 | X4 | X5 | X6 | X7 | X10 | X11 | X12 | X13 | X14 | X15 | X16 | X17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CH5 | 1-phase 1-count (S/W) | | | | | A | P | | | | | E | | | | | |
| | 1-phase 1-count (H/W) | | | | | A | B | P | | | | E | | | | | |
| | 1-phase 2-count | | | | | A | B | P | | | | E | | | | | |
| CH6 | 1-phase 1-count (S/W) | | | | | | A | P | | | | | E | | | | |
| | 1-phase 1-count (H/W) | | | | | | A | B | P | | | | E | | | | |
| | 1-phase 2-count | | | | | | A | B | P | | | | E | | | | |
| | 2-phase 2-count | | | | | | A | B | P | | | | E | | | | |
| CH7 | 1-phase 1-count (S/W) | | | | | | | A | P | | | | | E | | | |
| | 1-phase 1-count (H/W) | | | | | | | A | B | P | | | | E | | | |
| | 1-phase 2-count | | | | | | | A | B | P | | | | E | | | |
| | 2-phase 2-count | | | | | | | A | B | P | | | | E | | | |
| CH8 | 1-phase 1-count (S/W) | | | | | | | | A | P | | | | | E | | |
| | 1-phase 1-count (H/W) | | | | | | | | A | B | P | | | | E | | |

A: Input A phase (In the case of 1-phase 1-count, pulse input is employed and in the case of 1-phase 2-count, pulse input of down-counting direction is employed.)

B: Input B phase (In the case of 1-phase 1-count (H/W), direction switch input is employed and in the case of 1-phase 2-count, pulse input of down-counting direction is employed.)

P: Input external preset

E: Input external enable

### ■FX5U/FX5UC CPU module

| CH | High-speed counter type | X0 | X1 | X2 | X3 | X4 | X5 | X6 | X7 | X10 | X11 | X12 | X13 | X14 | X15 | X16 | X17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CH1 | 1-phase 1-count (S/W) | A | | | | | | | | P | E | | | | | | |
| | 1-phase 1-count (H/W) | A | B | | | | | | | P | E | | | | | | |
| | 1-phase 2-count | A | B | | | | | | | P | E | | | | | | |
| | 2-phase 2-count | A | B | | | | | | | P | E | | | | | | |
| CH2 | 1-phase 1-count (S/W) | | A | | | | | | | | | P | E | | | | |
| | 1-phase 1-count (H/W) | | | A | B | | | | | | | P | E | | | | |
| | 1-phase 2-count | | | A | B | | | | | | | P | E | | | | |
| | 2-phase 2-count | | | A | B | | | | | | | P | E | | | | |
| CH3 | 1-phase 1-count (S/W) | | | A | | | | | | | | | | P | E | | |
| | 1-phase 1-count (H/W) | | | | | A | B | | | | | | | P | E | | |
| | 1-phase 2-count | | | | | A | B | | | | | | | P | E | | |
| | 2-phase 2-count | | | | | A | B | | | | | | | P | E | | |
| CH4 | 1-phase 1-count (S/W) | | | | A | | | | | | | | | | | P | E |
| | 1-phase 1-count (H/W) | | | | | | | A | B | | | | | | | P | E |
| | 1-phase 2-count | | | | | | | A | B | | | | | | | P | E |
| | 2-phase 2-count | | | | | | | A | B | | | | | | | P | E |
| CH5 | 1-phase 1-count (S/W) | | | | | A | | | | P | E | | | | | | |
| | 1-phase 1-count (H/W) | | | | | | | | | A | B | P | E | | | | |
| | 1-phase 2-count | | | | | | | | | A | B | P | E | | | | |
| | 2-phase 2-count | | | | | | | | | A | B | P | E | | | | |
| CH6 | 1-phase 1-count (S/W) | | | | | | A | | | | | P | E | | | | |
| | 1-phase 1-count (H/W) | | | | | | | | | | | A | B | P | E | | |
| | 1-phase 2-count | | | | | | | | | | | A | B | P | E | | |
| | 2-phase 2-count | | | | | | | | | | | A | B | P | E | | |
| CH7 | 1-phase 1-count (S/W) | | | | | | | A | | | | | | P | E | | |
| | 1-phase 1-count (H/W) | | | | | | | | | | | | | A | B | P | E |
| | 1-phase 2-count | | | | | | | | | | | | | A | B | P | E |
| | 2-phase 2-count | | | | | | | | | | | | | A | B | P | E |

| CH | High-speed counter type | X0 | X1 | X2 | X3 | X4 | X5 | X6 | X7 | X10 | X11 | X12 | X13 | X14 | X15 | X16 | X17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CH8 | 1-phase 1-count (S/W) | | | | | | | | A | | | | | | | P | E |
| | 1-phase 1-count (H/W) | | | | | | | | | | | | | | | A | B |
| | 1-phase 2-count | | | | | | | | | | | | | | | A | B |
| | 2-phase 2-count | | | | | | | | | | | | | | | A | B |
| CH1 to CH8 | Internal clock | Not used | | | | | | | | | | | | | | | |

A: Input A phase

B: Input B phase (direction switch input is however employed in the case of 1-phase 1-count [H/W])

P: Input external preset

E: Input external enable

## ■High-speed pulse input/output module

☐ of each input is the head input number for high-speed pulse input/output module.

| CH | High-speed counter type | X☐ | X☐+1 | X☐+2 | X☐+3 | X☐+4 | X☐+5 | X☐+6 | X☐+7 |
|---|---|---|---|---|---|---|---|---|---|
| CH9, CH11, CH13, CH15 | 1-phase 1-count (S/W) | A | P | | | | | E | |
| | 1-phase 1-count (H/W) | A | B | P | | | | E | |
| | 1-phase 2-count | A | B | P | | | | E | |
| | 2-phase 2-count | A | B | P | | | | E | |
| CH10, CH12, CH14, CH16 | 1-phase 1-count (S/W) | | | | A | P | | | E |
| | 1-phase 1-count (H/W) | | | | A | B | P | | E |
| | 1-phase 2-count | | | | A | B | P | | E |
| | 2-phase 2-count | | | | A | B | P | | E |
| CH9 to CH16 | Internal clock | Not used | | | | | | | |

A: Input A phase

B: Input B phase (direction switch input is however employed in the case of 1-phase 1-count [H/W])

P: Input external preset

E: Input external enable

**Point**

The high-speed pulse input/output module channel numbers are assigned as described below. From nearest to the CPU module, the high-speed pulse input/output modules are ordered as the first module, second module, etc.

- High-speed pulse input/output module first module: CH9, CH10
- High-speed pulse input/output module second module: CH11, CH12
- High-speed pulse input/output module third module: CH13, CH14
- High-speed pulse input/output module fourth module: CH15, CH16

## Input assignment-wise / maximum frequency for high-speed counters

Input assignment-wise maximum frequency for high-speed counters is as follows.

### ■FX5S/FX5UJ CPU module

| CH | High-speed counter type | X0 | X1 | X2 | X3 | X4 | X5 | X6 | X7 | X10 | X11 | X12 | X13 | X14 | X15 | X16 | X17 | Maximum frequency |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CH1 | 1-phase 1-count (S/W) | A | P | | | | | E | | | | | | | | | | 100 kHz |
| | 1-phase 1-count (H/W) | A | B | P | | | | E | | | | | | | | | | 100 kHz |
| | 1-phase 2-count | A | B | P | | | | E | | | | | | | | | | 100 kHz |
| | 2-phase 2-count [1 edge count] | A | B | P | | | | E | | | | | | | | | | 100 kHz |
| | 2-phase 2-count [2 edge count] | A | B | P | | | | E | | | | | | | | | | 50 kHz |
| | 2-phase 2-count [4 edge count] | A | B | P | | | | E | | | | | | | | | | 25 kHz |
| CH2 | 1-phase 1-count (S/W) | | A | P | | | | | E | | | | | | | | | 100 kHz |
| | 1-phase 1-count (H/W) | | A | B | P | | | | E | | | | | | | | | 100 kHz |
| | 1-phase 2-count | | A | B | P | | | | E | | | | | | | | | 10 kHz |
| CH3 | 1-phase 1-count (S/W) | | | A | P | | | | | E | | | | | | | | 10 kHz |
| | 1-phase 1-count (H/W) | | | A | B | P | | | | E | | | | | | | | 10 kHz |
| | 1-phase 2-count | | | A | B | P | | | | E | | | | | | | | 10 kHz |
| CH4 | 1-phase 1-count (S/W) | | | | A | P | | | | | E | | | | | | | 100 kHz |
| | 1-phase 1-count (H/W) | | | | A | B | P | | | | E | | | | | | | 100 kHz |
| | 1-phase 2-count | | | | A | B | P | | | | E | | | | | | | 100 kHz |
| | 2-phase 2-count [1 edge count] | | | | A | B | P | | | | E | | | | | | | 100 kHz |
| | 2-phase 2-count [2 edge count] | | | | A | B | P | | | | E | | | | | | | 50 kHz |
| | 2-phase 2-count [4 edge count] | | | | A | B | P | | | | E | | | | | | | 25 kHz |
| CH5 | 1-phase 1-count (S/W) | | | | | A | P | | | | | E | | | | | | 100 kHz |
| | 1-phase 1-count (H/W) | | | | | A | B | P | | | | E | | | | | | 100 kHz |
| | 1-phase 2-count | | | | | A | B | P | | | | E | | | | | | 10 kHz |
| CH6 | 1-phase 1-count (S/W) | | | | | | A | P | | | | | E | | | | | 10 kHz |
| | 1-phase 1-count (H/W) | | | | | | A | B | P | | | | E | | | | | 10 kHz |
| | 1-phase 2-count | | | | | | A | B | P | | | | E | | | | | 10 kHz |
| | 2-phase 2-count [1 edge count] | | | | | | A | B | P | | | | E | | | | | 10 kHz |
| | 2-phase 2-count [2 edge count] | | | | | | A | B | P | | | | E | | | | | 5 kHz |
| | 2-phase 2-count [4 edge count] | | | | | | A | B | P | | | | E | | | | | 2.5 kHz |
| CH7 | 1-phase 1-count (S/W) | | | | | | | A | P | | | | | E | | | | 10 kHz |
| | 1-phase 1-count (H/W) | | | | | | | A | B | P | | | | E | | | | 10 kHz |
| | 1-phase 2-count | | | | | | | A | B | P | | | | E | | | | 10 kHz |
| | 2-phase 2-count [1 edge count] | | | | | | | A | B | P | | | | E | | | | 10 kHz |
| | 2-phase 2-count [2 edge count] | | | | | | | A | B | P | | | | E | | | | 5 kHz |
| | 2-phase 2-count [4 edge count] | | | | | | | A | B | P | | | | E | | | | 2.5 kHz |
| CH8 | 1-phase 1-count (S/W) | | | | | | | | A | P | | | | | E | | | 10 kHz |
| | 1-phase 1-count (H/W) | | | | | | | | A | B | P | | | | E | | | 10 kHz |

A: Input A phase, B: Input B phase, P: Input external preset, E: Input external enable

## ■FX5U-32M□, FX5UC-32M□

**Point**

- X6 to X17 are input frequencies up to 10 kHz, regardless of maximum frequency value.
- Preset input and Enable Input are input frequencies up to 10 kHz, regardless of maximum frequency value.

| CH | High-speed counter type | X0 | X1 | X2 | X3 | X4 | X5 | X6 | X7 | X10 | X11 | X12 | X13 | X14 | X15 | X16 | X17 | Maximum frequency |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CH1 | 1-phase 1-count (S/W) | A | | | | | | | | P | E | | | | | | | 200 kHz |
| | 1-phase 1-count (H/W) | A | B | | | | | | | P | E | | | | | | | 200 kHz |
| | 1-phase 2-count | A | B | | | | | | | P | E | | | | | | | 200 kHz |
| | 2-phase 2-count [1 edge count] | A | B | | | | | | | P | E | | | | | | | 200 kHz |
| | 2-phase 2-count [2 edge count] | A | B | | | | | | | P | E | | | | | | | 100 kHz |
| | 2-phase 2-count [4 edge count] | A | B | | | | | | | P | E | | | | | | | 50 kHz |
| CH2 | 1-phase 1-count (S/W) | | A | | | | | | | | | P | E | | | | | 200 kHz |
| | 1-phase 1-count (H/W) | | | A | B | | | | | | | P | E | | | | | 200 kHz |
| | 1-phase 2-count | | | A | B | | | | | | | P | E | | | | | 200 kHz |
| | 2-phase 2-count [1 edge count] | | | A | B | | | | | | | P | E | | | | | 200 kHz |
| | 2-phase 2-count [2 edge count] | | | A | B | | | | | | | P | E | | | | | 100 kHz |
| | 2-phase 2-count [4 edge count] | | | A | B | | | | | | | P | E | | | | | 50 kHz |
| CH3 | 1-phase 1-count (S/W) | | | A | | | | | | | | | | P | E | | | 200 kHz |
| | 1-phase 1-count (H/W) | | | | | A | B | | | | | | | P | E | | | 200 kHz |
| | 1-phase 2-count | | | | | A | B | | | | | | | P | E | | | 200 kHz |
| | 2-phase 2-count [1 edge count] | | | | | A | B | | | | | | | P | E | | | 200 kHz |
| | 2-phase 2-count [2 edge count] | | | | | A | B | | | | | | | P | E | | | 100 kHz |
| | 2-phase 2-count [4 edge count] | | | | | A | B | | | | | | | P | E | | | 50 kHz |
| CH4 | 1-phase 1-count (S/W) | | | | A | | | | | | | | | | | P | E | 200 kHz |
| | 1-phase 1-count (H/W) | | | | | | | A | B | | | | | | | P | E | 10 kHz |
| | 1-phase 2-count | | | | | | | A | B | | | | | | | P | E | 10 kHz |
| | 2-phase 2-count [1 edge count] | | | | | | | A | B | | | | | | | P | E | 10 kHz |
| | 2-phase 2-count [2 edge count] | | | | | | | A | B | | | | | | | P | E | 5 kHz |
| | 2-phase 2-count [4 edge count] | | | | | | | A | B | | | | | | | P | E | 2.5 kHz |
| CH5 | 1-phase 1-count (S/W) | | | | | A | | | | P | E | | | | | | | 200 kHz |
| | 1-phase 1-count (H/W) | | | | | | | | | A | B | P | E | | | | | 10 kHz |
| | 1-phase 2-count | | | | | | | | | A | B | P | E | | | | | 10 kHz |
| | 2-phase 2-count [1 edge count] | | | | | | | | | A | B | P | E | | | | | 10 kHz |
| | 2-phase 2-count [2 edge count] | | | | | | | | | A | B | P | E | | | | | 5 kHz |
| | 2-phase 2-count [4 edge count] | | | | | | | | | A | B | P | E | | | | | 2.5 kHz |

| CH | High-speed counter type | X0 | X1 | X2 | X3 | X4 | X5 | X6 | X7 | X10 | X11 | X12 | X13 | X14 | X15 | X16 | X17 | Maximum frequency |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CH6 | 1-phase 1-count (S/W) | | | | | | A | | | | | P | E | | | | | 200 kHz |
| | 1-phase 1-count (H/W) | | | | | | | | | | | A | B | P | E | | | 10 kHz |
| | 1-phase 2-count | | | | | | | | | | | A | B | P | E | | | 10 kHz |
| | 2-phase 2-count [1 edge count] | | | | | | | | | | | A | B | P | E | | | 10 kHz |
| | 2-phase 2-count [2 edge count] | | | | | | | | | | | A | B | P | E | | | 5 kHz |
| | 2-phase 2-count [4 edge count] | | | | | | | | | | | A | B | P | E | | | 2.5 kHz |
| CH7 | 1-phase 1-count (S/W) | | | | | | | A | | | | | | P | E | | | 10 kHz |
| | 1-phase 1-count (H/W) | | | | | | | | | | | | | A | B | P | E | 10 kHz |
| | 1-phase 2-count | | | | | | | | | | | | | A | B | P | E | 10 kHz |
| | 2-phase 2-count [1 edge count] | | | | | | | | | | | | | A | B | P | E | 10 kHz |
| | 2-phase 2-count [2 edge count] | | | | | | | | | | | | | A | B | P | E | 5 kHz |
| | 2-phase 2-count [4 edge count] | | | | | | | | | | | | | A | B | P | E | 2.5 kHz |
| CH8 | 1-phase 1-count (S/W) | | | | | | | | A | | | | | | | P | E | 10 kHz |
| | 1-phase 1-count (H/W) | | | | | | | | | | | | | | | A | B | 10 kHz |
| | 1-phase 2-count | | | | | | | | | | | | | | | A | B | 10 kHz |
| | 2-phase 2-count [1 edge count] | | | | | | | | | | | | | | | A | B | 10 kHz |
| | 2-phase 2-count [2 edge count] | | | | | | | | | | | | | | | A | B | 5 kHz |
| | 2-phase 2-count [4 edge count] | | | | | | | | | | | | | | | A | B | 2.5 kHz |

A: Input A phase, B: Input B phase, P: Input external preset, E: Input external enable

### ■FX5U-64M□, FX5U-80M□, FX5UC-64M□, FX5UC-96M□

**Point**

- X10 to X17 are input frequencies up to 10 kHz, regardless of maximum frequency value.
- Preset input and Enable Input are input frequencies up to 10 kHz, regardless of maximum frequency value.

| CH | High-speed counter type | X0 | X1 | X2 | X3 | X4 | X5 | X6 | X7 | X10 | X11 | X12 | X13 | X14 | X15 | X16 | X17 | Maximum frequency |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CH1 | 1-phase 1-count (S/W) | A | | | | | | | | P | E | | | | | | | 200 kHz |
| | 1-phase 1-count (H/W) | A | B | | | | | | | P | E | | | | | | | 200 kHz |
| | 1-phase 2-count | A | B | | | | | | | P | E | | | | | | | 200 kHz |
| | 2-phase 2-count [1 edge count] | A | B | | | | | | | P | E | | | | | | | 200 kHz |
| | 2-phase 2-count [2 edge count] | A | B | | | | | | | P | E | | | | | | | 100 kHz |
| | 2-phase 2-count [4 edge count] | A | B | | | | | | | P | E | | | | | | | 50 kHz |
| CH2 | 1-phase 1-count (S/W) | | A | | | | | | | | | P | E | | | | | 200 kHz |
| | 1-phase 1-count (H/W) | | | A | B | | | | | | | P | E | | | | | 200 kHz |
| | 1-phase 2-count | | | A | B | | | | | | | P | E | | | | | 200 kHz |
| | 2-phase 2-count [1 edge count] | | | A | B | | | | | | | P | E | | | | | 200 kHz |
| | 2-phase 2-count [2 edge count] | | | A | B | | | | | | | P | E | | | | | 100 kHz |
| | 2-phase 2-count [4 edge count] | | | A | B | | | | | | | P | E | | | | | 50 kHz |

| CH | High-speed counter type | X0 | X1 | X2 | X3 | X4 | X5 | X6 | X7 | X10 | X11 | X12 | X13 | X14 | X15 | X16 | X17 | Maximum frequency |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CH3 | 1-phase 1-count (S/W) | | | A | | | | | | | | | | P | E | | | 200 kHz |
| | 1-phase 1-count (H/W) | | | | | A | B | | | | | | | P | E | | | 200 kHz |
| | 1-phase 2-count | | | | | A | B | | | | | | | P | E | | | 200 kHz |
| | 2-phase 2-count [1 edge count] | | | | | A | B | | | | | | | P | E | | | 200 kHz |
| | 2-phase 2-count [2 edge count] | | | | | A | B | | | | | | | P | E | | | 100 kHz |
| | 2-phase 2-count [4 edge count] | | | | | A | B | | | | | | | P | E | | | 50 kHz |
| CH4 | 1-phase 1-count (S/W) | | | | A | | | | | | | | | | | P | E | 200 kHz |
| | 1-phase 1-count (H/W) | | | | | | | A | B | | | | | | | P | E | 200 kHz |
| | 1-phase 2-count | | | | | | | A | B | | | | | | | P | E | 200 kHz |
| | 2-phase 2-count [1 edge count] | | | | | | | A | B | | | | | | | P | E | 200 kHz |
| | 2-phase 2-count [2 edge count] | | | | | | | A | B | | | | | | | P | E | 100 kHz |
| | 2-phase 2-count [4 edge count] | | | | | | | A | B | | | | | | | P | E | 50 kHz |
| CH5 | 1-phase 1-count (S/W) | | | | | A | | | | P | E | | | | | | | 200 kHz |
| | 1-phase 1-count (H/W) | | | | | | | | | A | B | P | E | | | | | 10 kHz |
| | 1-phase 2-count | | | | | | | | | A | B | P | E | | | | | 10 kHz |
| | 2-phase 2-count [1 edge count] | | | | | | | | | A | B | P | E | | | | | 10 kHz |
| | 2-phase 2-count [2 edge count] | | | | | | | | | A | B | P | E | | | | | 5 kHz |
| | 2-phase 2-count [4 edge count] | | | | | | | | | A | B | P | E | | | | | 2.5 kHz |
| CH6 | 1-phase 1-count (S/W) | | | | | | A | | | | | P | E | | | | | 200 kHz |
| | 1-phase 1-count (H/W) | | | | | | | | | | | A | B | P | E | | | 10 kHz |
| | 1-phase 2-count | | | | | | | | | | | A | B | P | E | | | 10 kHz |
| | 2-phase 2-count [1 edge count] | | | | | | | | | | | A | B | P | E | | | 10 kHz |
| | 2-phase 2-count [2 edge count] | | | | | | | | | | | A | B | P | E | | | 5 kHz |
| | 2-phase 2-count [4 edge count] | | | | | | | | | | | A | B | P | E | | | 2.5 kHz |
| CH7 | 1-phase 1-count (S/W) | | | | | | | A | | | | | | P | E | | | 200 kHz |
| | 1-phase 1-count (H/W) | | | | | | | | | | | | | A | B | P | E | 10 kHz |
| | 1-phase 2-count | | | | | | | | | | | | | A | B | P | E | 10 kHz |
| | 2-phase 2-count [1 edge count] | | | | | | | | | | | | | A | B | P | E | 10 kHz |
| | 2-phase 2-count [2 edge count] | | | | | | | | | | | | | A | B | P | E | 5 kHz |
| | 2-phase 2-count [4 edge count] | | | | | | | | | | | | | A | B | P | E | 2.5 kHz |
| CH8 | 1-phase 1-count (S/W) | | | | | | | | A | | | | | | | P | E | 200 kHz |
| | 1-phase 1-count (H/W) | | | | | | | | | | | | | | | A | B | 10 kHz |
| | 1-phase 2-count | | | | | | | | | | | | | | | A | B | 10 kHz |
| | 2-phase 2-count [1 edge count] | | | | | | | | | | | | | | | A | B | 10 kHz |
| | 2-phase 2-count [2 edge count] | | | | | | | | | | | | | | | A | B | 5 kHz |
| | 2-phase 2-count [4 edge count] | | | | | | | | | | | | | | | A | B | 2.5 kHz |

A: Input A phase, B: Input B phase, P: Input external preset, E: Input external enable

### ■High-speed pulse input/output module

**Point**

- X□+6 and X□+7 are input frequencies up to 10 kHz, regardless of maximum frequency value.
- Preset input and Enable Input are input frequencies up to 10 kHz, regardless of maximum frequency value.

□ of each input is the head input number for high-speed pulse input/output module.

| CH | High-speed counter type | X□ | X□+1 | X□+2 | X□+3 | X□+4 | X□+5 | X□+6 | X□+7 | Maximum frequency |
|---|---|---|---|---|---|---|---|---|---|---|
| CH9, CH11, CH13, CH15 | 1-phase 1-count (S/W) | A | P | | | | | E | | 200 kHz |
| | 1-phase 1-count (H/W) | A | B | P | | | | E | | 200 kHz |
| | 1-phase 2-count | A | B | P | | | | E | | 200 kHz |
| | 2-phase 2-count [1 edge count] | A | B | P | | | | E | | 200 kHz |
| | 2-phase 2-count [2 edge count] | A | B | P | | | | E | | 100 kHz |
| | 2-phase 2-count [4 edge count] | A | B | P | | | | E | | 50 kHz |
| CH10, CH12, CH14, CH16 | 1-phase 1-count (S/W) | | | | A | P | | | E | 200 kHz |
| | 1-phase 1-count (H/W) | | | | A | B | P | | E | 200 kHz |
| | 1-phase 2-count | | | | A | B | P | | E | 200 kHz |
| | 2-phase 2-count [1 edge count] | | | | A | B | P | | E | 200 kHz |
| | 2-phase 2-count [2 edge count] | | | | A | B | P | | E | 100 kHz |
| | 2-phase 2-count [4 edge count] | | | | A | B | P | | E | 50 kHz |

A: Input A phase, B: Input B phase, P: Input external preset, E: Input external enable

# High-speed counter parameters

High-speed counter parameters are explained below.

High-speed counter parameters are set by GX Works3.

## Outline of parameters

High-speed counter settings, high-speed comparison table, multiple point output high-speed comparison table and input response time are set by parameters.

The primary items that can be set by parameters are as follows.

- Basic settings
- High-speed comparison table setting
- Multiple point output high-speed table setting
- Input response time setting

## Parameter setting

High-speed counter parameter setting method is explained below.

For parameter setting of each operation, refer to the following.

- For high-speed counters (normal mode), refer to ☞ Page 246 High-speed counter (normal mode).
- For high-speed counter (pulse density measurement mode), refer to ☞ Page 249 High-speed counter (pulse density measurement mode).
- For high-speed counter (rotational speed measurement mode), refer to ☞ Page 251 High-speed counter (rotational speed measurement mode).
- For high-speed comparison table, refer to ☞ Page 254 High-speed comparison table.
- For multiple point output, high-speed comparison tables, refer to ☞ Page 257 Multiple point output, high-speed comparison tables.
- For input response time, refer to ☞ Page 318 General-purpose Input Functions.

**Point**

Parameters are enabled when the CPU module is powered ON or after a reset. In addition, operations different from the parameter settings are possible by transferring values to special relays and special registers while changing these values in the program.

For details concerning special relays and specials registers for high-speed counters, refer to ☞ Page 776 Special Relay List, ☞ Page 803 Special Register List.

# High-speed counter (normal mode)

Normal mode for high-speed counters is explained below.

Use normal mode if you want to use as an ordinary high-speed counter.

## Parameter setting

Set operation mode to normal mode by high-speed counter parameter setting.

Sets detailed settings for channel used.

### ■CPU module

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [Module Parameter] ⇨ [High Speed I/O] ⇨ "Input Function" ⇨ "High Speed Counter" ⇨ "Detailed Setting" ⇨ "Basic Settings"

#### Window

| Item | CH1 | CH2 | CH3 |
|---|---|---|---|
| **Use/Do Not Use Counter** | **Set whether to use counter or not.** | | |
| Use/Not Use | Enable | Enable | Enable |
| **Operation Mode** | **Set operation mode.** | | |
| Operation Mode | Normal Mode | Normal Mode | Normal Mode |
| **Pulse Input Mode** | **Set pulse input mode.** | | |
| Pulse Input Mode | 1-Phase 1 Input (S/W Up/Down Switch) | 1 Phase 2 Input | 2 Phase 4 Multiple |
| **Preset Input** | **Set preset input.** | | |
| Preset Input Enable/Disable | Disable | Enable | Disable |
| Input logic | Positive Logic | Positive Logic | Positive Logic |
| Input Comparison Enable/Disable | Disable | Disable | Disable |
| Control Switch | Rising | Falling | Rising |
| **Preset Value** | | | |
| Preset Value | 0 | 100 | 200 |
| **Enable Input** | **Set enable input.** | | |
| Enable Input Enable/Disable | Disable | Disable | Enable |
| Input logic | Positive Logic | Positive Logic | Negative Logic |
| **Ring Length Setting** | **Set ring length.** | | |
| Ring Length Enable/Disable | Disable | Disable | Enable |
| Ring Length | | | 50000 |
| **Measurement Unit Time** | **Set the measurement unit time (ms) for the pulse density measurement mode and rotation speed measurement mode.** | | |
| Measurement Unit Time | | | |
| **No.of Pulse per Rotation** | **Set the number of pulses per rotation when using the rotation speed measurement mode.** | | |
| No. of Pulse per Rotation | | | |

#### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Use/Not Use | Set whether use counter or not. | • Disable<br>• Enable | Disable |
| Operation Mode | Set operation mode. | • Normal Mode<br>• Pulse Density Assumption Mode<br>• Rotation Speed Measurement Mode | — |
| Pulse Input Mode | Set pulse input mode. | • 1-Phase 1 Input (S/W Up/Down Switch)<br>• 1-Phase 1 Input (H/W Up/Down Switch)<br>• 1 Phase 2 Input<br>• 2 Phase 1 Multiple<br>• 2 Phase 2 Multiple<br>• 2 Phase 4 Multiple<br>• Internal Clock (1MHz) | — |

| Item | Description | Setting range | Default |
|---|---|---|---|
| Preset Input Enable/ Disable | Set the preset value when preset input is enabled. Change the current value to the preset value when the preset is detected. The preset value cannot be set when the preset input is disabled. | • Disable<br>• Enable | — |
| Input logic | Sets preset input logic when preset input is enabled. | • Positive Logic<br>• Negative Logic | — |
| Input Comparison Enable/ Disable | Perform output to the specified device when input comparison is enabled and the current value matches with the comparison value by the preset input. Output to the specified device is not performed when input comparison is disabled and the current value matches with the comparison value by the preset input. | • Disable<br>• Enable | — |
| Control Switch | Sets preset execution timing when preset input is enabled. | • Rising<br>• Falling<br>• Rising + Falling Edge<br>• Always During Input ON | — |
| Preset Value | Sets preset value when preset input is enabled. | -2147483648 to +2147483647 | — |
| Enable Input Enable/ Disable | Set whether to "enable" or "disable" the enable input. | • Disable<br>• Enable | — |
| Input logic | Set the enable input logic value. | • Positive Logic<br>• Negative Logic | — |
| Ring Length Enable/ Disable | Sets whether to "enable" or "disable" the ring length for ring counters. | • Disable<br>• Enable | — |
| Ring Length | Sets ring length when ring length setting is enabled. | 2 to 2147483648 | — |
| Measurement Unit Time | Not available for high-speed counters (normal mode). | — | — |
| No. of Pulse per Rotation | | | |

## ■High-speed pulse input/output module

Add the high-speed pulse input/output module.

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Right-click ⇨ Add New Module

After adding the high-speed pulse input/output module, make settings on the screen displayed from the following operation.

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ [1 to 16 (high-speed pulse input/output module)] ⇨ [Module Parameter] ⇨ "Input Function" ⇨ "High Speed Counter" ⇨ "Detailed Setting" ⇨ "Basic Settings"

### Window

| Item | CH9 | CH10 |
|---|---|---|
| **Use/Do Not Use Counter** | **Set whether to use counter or not.** | |
| Use/Not Use | Enable | Enable |
| **Operation Mode** | **Set operation mode.** | |
| Operation Mode | Normal Mode | Normal Mode |
| **Pulse Input Mode** | **Set pulse input mode.** | |
| Pulse Input Mode | 1-Phase 1 Input (S/W Up/Down Switch) | 1-Phase 1 Input (S/W Up/Down Switch) |
| **Preset Input** | **Set preset input.** | |
| Preset Input Enable/Disable | Disable | Enable |
| Input logic | Positive Logic | Positive Logic |
| Input Comparison Enable/Disable | Disable | Enable |
| Control Switch | Rising | Falling |
| **Preset Value** | | |
| Preset Value | 0 | 5000 |
| **Enable Input** | **Set enable input.** | |
| Enable Input Enable/Disable | Disable | Enable |
| Input logic | Positive Logic | Negative Logic |
| **Ring Length Setting** | **Set ring length.** | |
| Ring Length Enable/Disable | Disable | Enable |
| Ring Length | | 10000 |

Shown above is the screen at the time when the first high-speed pulse input/output module is selected.

### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Use/Not Use | Set whether use counter or not. | • Disable<br>• Enable | Disable |
| Operation Mode | Set operation mode. The mode is fixed to Normal Mode. | Normal Mode | — |
| Pulse Input Mode | Set pulse input mode. | • 1-Phase 1 Input (S/W Up/Down Switch)<br>• 1-Phase 1 Input (H/W Up/Down Switch)<br>• 1 Phase 2 Input<br>• 2 Phase 1 Multiple<br>• 2 Phase 2 Multiple<br>• 2 Phase 4 Multiple<br>• Internal Clock (1MHz) | — |
| Preset Input Enable/ Disable | Set whether to "enable" or "disable" the preset input of counter. | • Disable<br>• Enable | — |
| Input logic | Sets preset input logic when preset input is enabled. | • Positive Logic<br>• Negative Logic | — |
| Input Comparison Enable/ Disable | Sets whether to "enable" or "disable" input comparison when preset input is enabled. | • Disable<br>• Enable | — |
| Control Switch | Sets preset execution timing when preset input is enabled. | • Rising<br>• Falling<br>• Rising + Falling Edge<br>• Always During Input ON | — |
| Preset Value | Sets preset value when preset input is enabled. | -2147483648 to +2147483647 | — |
| Enable Input Enable/ Disable | Set whether to "enable" or "disable" the enable input. | • Disable<br>• Enable | — |
| Input logic | Set the enable input logic value. | • Positive Logic<br>• Negative Logic | — |
| Ring Length Enable/ Disable | Sets whether to "enable" or "disable" the ring length for ring counters. | • Disable<br>• Enable | — |
| Ring Length | Sets ring length when ring length setting is enabled. | 2 to 2147483648 | — |

**Point**

Parameters are enabled when the CPU module is powered ON or after a reset. In addition, operations different from the parameter settings are possible by transferring values to special relays and special registers while changing these values in the program.
For details concerning special relays and specials registers for high-speed counters, refer to ☞ Page 776 Special Relay List, ☞ Page 803 Special Register List.

## Starting/stopping high-speed counter measurement

High-speed counters cannot count by setting the parameter alone.
The HIOEN/DHIOEN instruction is required to start/stop the count.
For the HIOEN/DHIOEN instruction, refer to 📖MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/ Function Blocks).

## Read/write of current value of high-speed counter

The current value of the high-speed counter is stored in a special register for each channel. You can check current value by monitoring the value. The value may however differ from the actual value because the special register is updated during END processing.
You can read the latest value using the HCMOV/DHCMOV instruction.
For details concerning specials registers for high-speed counters, refer to ☞ Page 803 Special Register List.
For information for the HCMOV/DHCMOV instruction, refer to 📖MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks).

### Precautions

- Input used varies according to channel selected and pulse input mode.
- If not using preset input or enable input, you can use it as input for other functions.
- If mode is other than normal mode, preset input cannot be used.
- Use the HIOEN/DHIOEN instruction to start high-speed counter measurement.
- There are common precautions when using high-speed counters. For details, refer to ☞ Page 283 Precautions when using high-speed counters.



# High-speed counter (pulse density measurement mode)

The pulse density measurement mode for high-speed counters is explained below. The pulse density measurement mode is not supported in high-speed pulse input/output modules.
When in pulse density measurement mode, pulse is counted from count input of the high-speed counter, and the number of pulses for a specified amount of time is automatically counted.

## Parameter setting

Set operation mode to pulse density measurement mode by high-speed counter parameter setting.
Sets detailed settings for channel used.

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [Module Parameter] ⇨ [High Speed I/O] ⇨ "Input Function" ⇨ "High Speed Counter" ⇨ "Detailed Setting" ⇨ "Basic Settings"

### Window

| Item | CH1 | CH2 | CH3 |
|---|---|---|---|
| **Use/Do Not Use Counter** | **Set whether to use counter or not.** | | |
| Use/Not Use | Enable | Enable | Enable |
| **Operation Mode** | **Set operation mode.** | | |
| Operation Mode | Pulse Density Measurement Mode | Pulse Density Measurement Mode | Pulse Density Measurement Mode |
| **Pulse Input Mode** | **Set pulse input mode.** | | |
| Pulse Input Mode | 1-Phase 1 Input (S/W Up/Down Switch) | 1-Phase 1 Input (H/W Up/Down Switch) | 2 Phase 2 Multiple |
| **Preset Input** | **Set preset input.** | | |
| Preset Input Enable/Disable | Disable | Disable | Disable |
| Input logic | Positive Logic | Positive Logic | Positive Logic |
| Input Comparison Enable/Disable | Disable | Disable | Disable |
| Control Switch | Rising | Rising | Rising |
| **Preset Value** | | | |
| Preset Value | 0 | 0 | 0 |
| **Enable Input** | **Set enable input.** | | |
| Enable Input Enable/Disable | Disable | Disable | Disable |
| Input logic | Positive Logic | Positive Logic | Positive Logic |
| **Ring Length Setting** | **Set ring length.** | | |
| Ring Length Enable/Disable | Disable | Disable | Disable |
| Ring Length | | | |
| **Measurement Unit Time** | **Set the measurement unit time (ms) for the pulse density measurement mode and rotation speed measurement mode.** | | |
| Measurement Unit Time | 1000 | 2000 | 30000 |
| **No.of Pulse per Rotation** | **Set the number of pulses per rotation when using the rotation speed measurement mode.** | | |
| No. of Pulse per Rotation | | | |

### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Use/Not Use | Set whether use counter or not. | • Disable<br>• Enable | Disable |
| Operation Mode | Set operation mode. | • Normal Mode<br>• Pulse Density Assumption Mode<br>• Rotation Speed Measurement Mode | — |

| Item | Description | Setting range | Default |
|---|---|---|---|
| Pulse Input Mode | Set pulse input mode. | • 1-Phase 1 Input (S/W Up/Down Switch)<br>• 1-Phase 1 Input (H/W Up/Down Switch)<br>• 1 Phase 2 Input<br>• 2 Phase 1 Multiple<br>• 2 Phase 2 Multiple<br>• 2 Phase 4 Multiple<br>• Internal Clock (1MHz) | — |
| Preset Input Enable/ Disable | Not available for high-speed counters (pulse density measurement mode). | — | — |
| Input logic | | | |
| Input Comparison Enable/ Disable | | | |
| Control Switch | | | |
| Preset Value | | | |
| Enable Input Enable/ Disable | Set whether to "enable" or "disable" the enable input. | • Disable<br>• Enable | — |
| Input logic | Set the enable input logic value. | • Positive Logic<br>• Negative Logic | — |
| Ring Length Enable/ Disable | Not available for high-speed counters (pulse density measurement mode). | — | — |
| Ring Length | | | |
| Measurement Unit Time | Set measurement unit time. (Unit: ms) | 1 to 2147483647 | — |
| No. of Pulse per Rotation | Not available for high-speed counters (pulse density measurement mode). | — | — |

**Point**

Parameters are enabled when the CPU module is powered ON or after a reset. In addition, operations different from the parameter settings are possible by transferring values to special relays and special registers while changing these values in the program.
For details concerning special relays and specials registers for high-speed counters, refer to ☞ Page 776 Special Relay List, ☞ Page 803 Special Register List.

## Pulse density measurement mode start/stop

The pulse density measurement mode cannot measure by setting the parameter alone.
The HIOEN/DHIOEN instruction is required to start/stop measurement.
For the HIOEN/DHIOEN instruction, refer to 📖MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/ Function Blocks).

## Pulse density

Pulse density is stored in the special register for each channel.
For details concerning specials registers for high-speed counters, refer to ☞ Page 803 Special Register List.

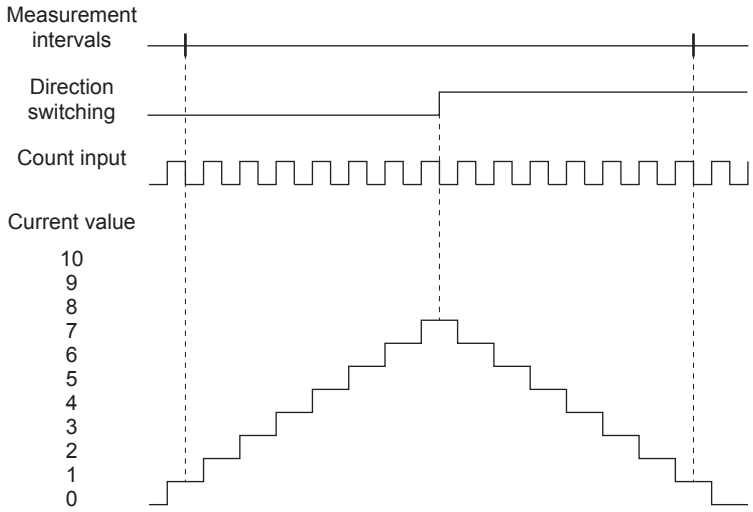
### Precautions

#### ■Count direction switch during measurement

The pulse density measurement mode calculates pulse density based on difference in measuring unit time of the current value of high-speed counters. You should therefore note that the input number of pulses may differ from the measurement value when count direction of a high-speed counter is switched within the same measuring unit time.

Ex.

When pulse density is measured, 14 pulses are input within measuring unit time, but the current value of the high-speed counter remains "0", as shown in the following figure. As a result, pulse density is "0" for this measuring unit time.




### ■Operation when counting in the minus direction

Pulse density can also be measured when pulses are input in the direction whereby current value of high-speed counter is reduced.

### ■Operation at overflow of high-speed counter current value

Pulse density measurement can continue even when current value of high-speed counter overflows during measurement.

### ■Relationship with the SPD/DSPD instruction

If pulse density measurement has already been started by the HIOEN/DHIOEN instruction, the SPD/DSPD instruction cannot be used for the same channel.

If pulse density is currently being measured by the SPD/DSPD instruction, pulse density measurement cannot be started for the same channel.

For details on the SPD/DSPD instruction, refer to 📖MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks).

### ■Other precautions

There are common precautions when using high-speed counters. For details, refer to ☞ Page 283 Precautions when using high-speed counters.

## High-speed counter (rotational speed measurement mode)

The rotational speed measurement mode for high-speed counters is explained below. The rotational speed measurement mode is not supported in high-speed pulse input/output modules.

When in rotational speed measurement mode, pulse is counted from count input of the high-speed counter, and the rotational speed for a specified amount of time is automatically calculated.

### Parameter setting

Set operation mode to rotational speed measurement mode by high-speed counter parameter setting.

Sets detailed settings for channel used.

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [Module Parameter] ⇨ [High Speed I/O] ⇨ "Input Function" ⇨ "High Speed Counter" ⇨ "Detailed Setting" ⇨ "Basic Settings"

## Window

| Item | CH1 | CH2 | CH3 |
|---|---|---|---|
| **Use/Do Not Use Counter** | **Set whether to use counter or not.** | | |
| Use/Not Use | Enable | Enable | Enable |
| **Operation Mode** | **Set operation mode.** | | |
| Operation Mode | Rotation Speed Measurement Mode | Rotation Speed Measurement Mode | Rotation Speed Measurement Mode |
| **Pulse Input Mode** | **Set pulse input mode.** | | |
| Pulse Input Mode | 1-Phase 1 Input (S/W Up/Down Switch) | 2 Phase 2 Multiple | 2 Phase 4 Multiple |
| **Preset Input** | **Set preset input.** | | |
| Preset Input Enable/Disable | Disable | Disable | Disable |
| Input logic | Positive Logic | Positive Logic | Positive Logic |
| Input Comparison Enable/Disable | Disable | Disable | Disable |
| Control Switch | Rising | Rising | Rising |
| **Preset Value** | | | |
| Preset Value | 0 | 0 | 0 |
| **Enable Input** | **Set enable input.** | | |
| Enable Input Enable/Disable | Disable | Disable | Disable |
| Input logic | Positive Logic | Positive Logic | Positive Logic |
| **Ring Length Setting** | **Set ring length.** | | |
| Ring Length Enable/Disable | Disable | Disable | Disable |
| Ring Length | | | |
| **Measurement Unit Time** | **Set the measurement unit time (ms) for the pulse density measurement mode and rotation speed measurement mode.** | | |
| Measurement Unit Time | 1000 | 3000 | 20000 |
| **No.of Pulse per Rotation** | **Set the number of pulses per rotation when using the rotation speed measurement mode.** | | |
| No. of Pulse per Rotation | 1000 | 10000 | 15000 |

## Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Use/Not Use | Set whether use counter or not. | • Disable<br>• Enable | Disable |
| Operation Mode | Set operation mode. | • Normal Mode<br>• Pulse Density Assumption Mode<br>• Rotation Speed Measurement Mode | — |
| Pulse Input Mode | Set pulse input mode. | • 1-Phase 1 Input (S/W Up/Down Switch)<br>• 1-Phase 1 Input (H/W Up/Down Switch)<br>• 1 Phase 2 Input<br>• 2 Phase 1 Multiple<br>• 2 Phase 2 Multiple<br>• 2 Phase 4 Multiple<br>• Internal Clock (1MHz) | — |
| Preset Input Enable/ Disable | Not available for high-speed counters (rotational speed measurement mode). | — | — |
| Input logic | | | |
| Input Comparison Enable/ Disable | | | |
| Control Switch | | | |
| Preset Value | | | |
| Enable Input Enable/ Disable | Set whether to "enable" or "disable" the enable input. | • Disable<br>• Enable | — |
| Input logic | Set the enable input logic value. | • Positive Logic<br>• Negative Logic | — |
| Ring Length Enable/ Disable | Not available for high-speed counters (rotational speed measurement mode). | — | — |
| Ring Length | | | |
| Measurement Unit Time | Set measurement unit time. (Unit: ms) | 1 to 2147483647 | — |
| No. of Pulse per Rotation | Set the No. of pulses per rotation. (Unit: pulse) | 1 to 2147483647 | — |

**Point**

Parameters are enabled when the CPU module is powered ON or after a reset. In addition, operations different from the parameter settings are possible by transferring values to special relays and special registers while changing these values in the program.
For details concerning special relays and specials registers for high-speed counters, refer to ☞ Page 776 Special Relay List, ☞ Page 803 Special Register List.



## Rotational speed measurement mode start/stop

The rotational speed measurement mode cannot measure by setting the parameter alone.
The HIOEN/DHIOEN instruction is required to start/stop measurement.
For the HIOEN/DHIOEN instruction, refer to 📖MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks).

## Rotational speed

Rotational speed is stored in the special register for each channel. (Unit: r/min)
For details concerning specials registers for high-speed counters, refer to ☞ Page 803 Special Register List.

### Precautions

#### ■Count direction switch during measurement

The rotational speed measurement mode calculates rotational speed based on current value difference of high-speed counters in the measuring unit time. You should therefore note that the input number of pulses may differ from the measurement value when count direction of a high-speed counter is switched within the same measuring unit time.

#### ■Operation when counting in the minus direction

Rotational speed can also be measured when pulses are input in the direction whereby current value of high-speed counter is reduced.

#### ■Operation at overflow of high-speed counter current value

Rotational speed measurement can continue even when current value of high-speed counter overflows during measurement.

#### ■Relationship with the SPD/DSPD instruction

If rotational speed measurement has already been started by the HIOEN/DHIOEN instruction, the SPD/DSPD instruction cannot be used for the same channel.
Inversely, if pulse density is currently being measured by the SPD/DSPD instruction, rotational speed measurement cannot be started for the same channel.
For details on the SPD/DSPD instruction, refer to 📖MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks).

#### ■Other precautions

There are common precautions when using high-speed counters. For details, refer to ☞ Page 283 Precautions when using high-speed counters.

# High-speed comparison table

The high-speed comparison table is explained below.

Used to set high-speed comparison table for high-speed counters.

## Parameter setting

Sets match output setting for high-speed counters.

### ■CPU module

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [Module Parameter] ⇨ [High Speed I/O] ⇨ "Input Function" ⇨ "High Speed Counter" ⇨ "Detailed Setting" ⇨ "High Speed Compare Table"

#### Window

| NO. | Counter CH | Comparison Type | Output Destination Device | Comparison Value 1 Specification Method | Comparison Value 1 Direct | Comparison Value 1 Indirect | Comparison Value 2 Specification Method | Comparison Value 2 Direct | Comparison Value 2 Indirect |
|---|---|---|---|---|---|---|---|---|---|
| 1 | CH1 | Set | Y0 | Direct Specification | 100 | | Direct Specification | 0 | |
| 2 | CH2 | Set | Y1 | Indirect Specification | 0 | D101 | Direct Specification | 0 | |
| 3 | CH3 | Band Area Comparis | Y2 | Direct Specification | 200 | | Direct Specification | 300 | |
| 4 | CH4 | Band Area Comparis | Y3 | Indirect Specification | 0 | D103 | Indirect Specification | 0 | D105 |
| 5 | Disable | Set | | Direct Specification | 0 | | Direct Specification | 0 | |

#### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Counter CH | Set the counter CH of coincidence output target. | Disable, CH1 to CH8 | Disable |
| Comparison Type | Set comparison type. | • Set<br>• Reset<br>• Self Reset<br>• Band Area Comparison | Set |
| Output Destination Device | Sets output destination device for output comparison results of comparison value 1 and comparison value 2. | Bit device (Y, M), Interrupt pointer (I16 to I23) | — |
| Comparison Value 1 Specification Method | Sets the specification method of comparison value 1. | • Direct Specification<br>• Indirect Specification | Direct Specification |
| Comparison Value 1 Direct | Sets value (comparison value 1) to be compared with current value of high-speed counter. (When direct specification is selected) | -2147483648≤Comparison value 1≤+2147483647 | 0 |
| Comparison Value 1 Indirect | Sets device (comparison value 1) to be compared with current value of high-speed counter. (When indirect specification is selected) | Word device (D, R) | — |
| Comparison Value 2 Specification Method | If band comparison is set to comparison type, sets the specification method of comparison value 2. | • Direct Specification<br>• Indirect Specification | — |
| Comparison Value 2 Direct | If band comparison is set to comparison type, sets value (comparison value 2) to be compared with current value of high-speed counter. (When direct specification is selected) | Comparison value 1≤Comparison value 2≤2147483647 | — |
| Comparison Value 2 Indirect | If band comparison is set to comparison type, sets device (comparison value 2) to be compared with current value of high-speed counter. (When indirect specification is selected) | Word device (D, R) | — |

### ■High-speed pulse input/output module

Add the high-speed pulse input/output module.

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Right-click ⇨ Add New Module

After adding the high-speed pulse input/output module, make settings on the screen displayed from the following operation.

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ [1 to 16 (high-speed pulse input/output module)] ⇨ [Module Parameter] ⇨ "Input Function" ⇨ "High Speed Counter" ⇨ "Detailed Setting" ⇨ "High Speed Compare Table"

## Window

| NO. | Counter CH | Comparison Type | Output Destination Device | Comparison Value 1 Specification Method | Comparison Value 1 Direct | Comparison Value 1 Indirect |
|---|---|---|---|---|---|---|
| 1 | CH+0(CH9) | Set | Y0 | Direct Specification | 100 | |
| 2 | CH+1(CH10) | Reset | Y1 | Indirect Specification | 0 | D100 |
| 3 | Disable | Set | | Direct Specification | 0 | |

Shown above is the screen at the time when the first high-speed pulse input/output module is selected.



## Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Counter CH | Set the counter CH of coincidence output target. | Disable, CH+0(CH□),CH+1(CH□+1)*1 | Disable |
| Comparison Type | Set comparison type. | • Set<br>• Reset<br>• Self Reset | Set |
| Output Destination Device | Sets output destination device for output comparison results of comparison value 1 and comparison value 2. | Bit device (Y, M), Interrupt pointer (I50 to I177) | — |
| Comparison Value 1 Specification Method | Sets the specification method of comparison value 1. | • Direct Specification<br>• Indirect Specification | Direct Specification |
| Comparison Value 1 Direct | Sets value (comparison value 1) to be compared with current value of high-speed counter. (When direct specification is selected) | -2147483648≤Comparison value 1≤+2147483647 | 0 |
| Comparison Value 1 Indirect | Sets device (comparison value 1) to be compared with current value of high-speed counter. (When indirect specification is selected) | Word device (D, R) | — |

*1 The number in □ is first module: 9, second module: 11, third module: 13, fourth module: 15.

**Point**

- You can create an open table entry before table setting is complete.
- Table settings can be made in any order. Be careful when the current value is changed by self-reset at a table along the way, as table processing starts with the first table then the following tables in order.

# High-speed comparison table operation

Operation of each type of high-speed comparison table operation is explained below.

### ■Set to ON

When comparison value 1 matches the current value of the set high-speed counter, the bit device specified as the output destination device is set. If interrupt pointer has been specified for output destination device, the interrupt program of the specified interrupt pointer is run simultaneously when it matches comparison value 1.

Operation is the same as for the DHSCS instruction. For information on the DHSCS instruction, refer to 📖MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks).

### ■Reset

When comparison value 1 matches the current value of the set high-speed counter, the bit device specified as the output destination device is reset.

Operation is the same as for the DHSCR instruction. For information on the DHSCR instruction, refer to 📖MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks).

### ■Self-reset

When comparison value 1 matches the current value of the set high-speed counter, the current value becomes the preset value. After comparison processing is executed for this table, comparison processing of this high speed counter in later tables is performed using the preset value.

Operation is the same as self-reset for the DHSCR instruction. For information on the DHSCR instruction, refer to 📖MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks).

### ■Zone Compare

Based on the current high-speed counter value, comparison value 1, and comparison value 2, one of the three output devices from the head output device will be set. The rest are reset. High-speed pulse input/output module is not supported.

| | | | Set |
|---|---|---|---|
| Comparison value 1 | > Current value | | → Head output device |
| Comparison value 1 | ≤ Current value | ≤ Comparison value 2 | → Head output device +1 |
| Current value | > Comparison value 2 | | → Head output device +2 |

Operation is the same as for the DHSZ instruction. For information on zone comparison and DHSZ instruction, refer to 📖MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks).

## Comparison start/stop for high-speed comparison table

High-speed comparison tables cannot execute comparison by setting the parameter alone.
The HIOEN/DHIOEN instruction is required to start/stop the high-speed comparison table.
For the HIOEN/DHIOEN instruction, refer to 📖MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks).

**Point**

The HIOEN/DHIOEN instruction is required to start/stop high-speed counters as well when using a high-speed comparison table.
Measurement is not conducted by starting the high-speed comparison table alone, and the high-speed comparison table therefore does not operate.
When the number of the high-speed comparison table that is executed is number 17 or higher, use the DHIOEN instruction.

### Precautions

#### ■Number of tables that can be set

Up to 32 tables for the CPU module and up to 15 tables for the high-speed pulse input/output module can be set. Empty tables are not included in the number of tables.
However, number of tables that can be set differs depending on the version. (☞ Page 971 Added and Enhanced Functions)

#### ■Processing order

High-speed comparison tables are processed in sequence starting from the first table.

#### ■Operation start timing

High-speed comparison tables are updated during END processing. If started/stopped by the HIOEN/DHIOEN instruction, the table is applied starting from the next scan. Caution must be exercised when controlling high-speed comparison tables using the HIOEN/DHIOEN instruction several times within the same scan.

Ex.
Table operation is as follows when multiple HIOEN/DHIOEN instructions are executed within the same scan.
Tables 1, 2 and 4 are started at the 1st HIOEN/DHIOEN instruction.
Tables 3 and 5 are started, and 2 and 4 are stopped at the 2nd HIOEN/DHIOEN instruction.
Table 2 is started and 5 is stopped at the 3rd HIOEN/DHIOEN instruction.
Tables 1, 2 and 3 operate.

#### ■Operation when using internal clock

Self-reset cannot be used for channels set to internal clock by pulse input mode.

#### ■Other precautions

There are common precautions when using high-speed counters. For details, refer to ☞ Page 283 Precautions when using high-speed counters.

# Multiple point output, high-speed comparison tables

Multiple point output, high-speed comparison tables are explained below. The multiple point output, high-speed comparison tables is not supported in high-speed pulse input/output modules.

Use to set multiple point output, high-speed comparison tables for high-speed counters.

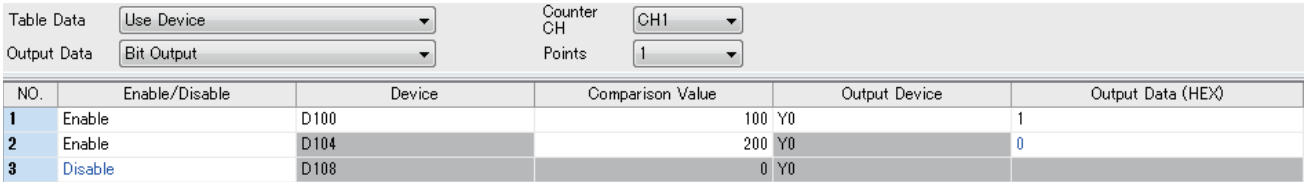


## Parameter setting

Sets match output table comparison setting for high-speed counters.

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [Module Parameter] ⇨ [High Speed I/O] ⇨ "Input Function" ⇨ "High Speed Counter" ⇨ "Detailed Setting" ⇨ "Multi-point Output High Speed Compare Table"

### Window




### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Table Data | Sets whether or not to use user device for table data. | • Do Not Use Device<br>• Use Device | Do Not Use Device |
| Counter CH | Set Comparison Target CH. | CH1 to CH8 | CH1 |
| Output Data | Sets the type of output data. | • Bit Output<br>• Word Output | Bit Output |
| Points | Sets the number of output data points. | • Bit Output<br>1 to 16<br>• Word Output<br>1 to 2 | 1 |
| Enable/Disable | Sets whether to "enable" or "disable" table data. | • Disable<br>• Enable | Disable |
| Device | Set the device used for table data. | Word device (D, R) | — |
| Comparison Value | Sets value (comparison value) to be compared with current value of high-speed counter. | -2147483648≤Comparison value≤+2147483647 | — |
| Output Device | Sets the output destination device of output data. | • Bit Output<br>Y, M<br>• Word Output<br>D, R | — |
| Output Data (HEX) | Sets output data. | According to output device | — |

**Point**

- When using user devices, you can change comparison value or output data while the program is running.
- When using user devices, each table occupies 4 devices. Word devices are used in order starting from the initial device.

## Multiple point output, high-speed comparison table operation

Operation of each type high-speed comparison table is explained below.

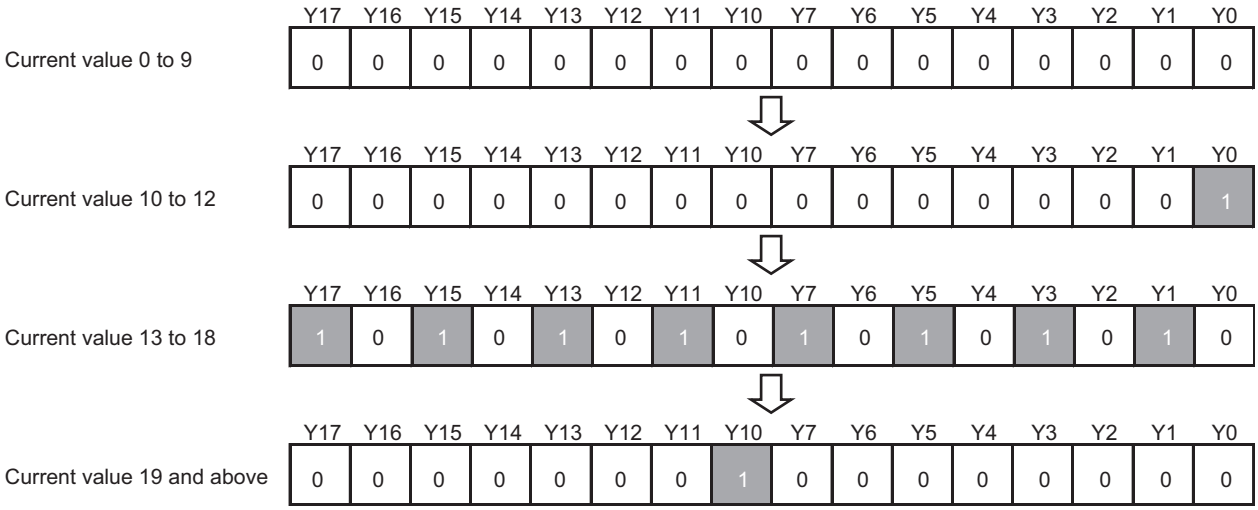
### ■Bit output

When comparison value 1 matches the current value of the set high-speed counter, output data is transferred to the output devices.

Ex.

Bit output, initial output device: Y0, Output points: 16

| Table number | Comparison value | Output data |
|---|---|---|
| Table 1 | 10 | H0001 |
| Table 2 | 13 | HAAAA |
| Table 3 | 19 | H0100 |



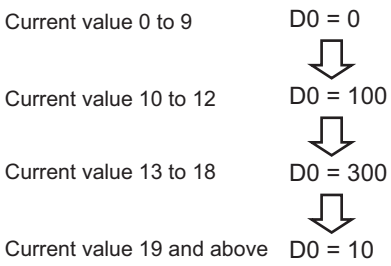

### ■Word output

When comparison value 1 matches the current value of the set high-speed counter, output data is transferred to the output devices.

Ex.

Word output, initial output device: D0, Output points: 1

| Table number | Comparison value | Output data |
|---|---|---|
| Table 1 | 10 | K100 |
| Table 2 | 13 | K300 |
| Table 3 | 19 | K10 |



## Comparison start/stop for multiple point output, high-speed comparison table

Multiple point output, high-speed comparison tables cannot execute comparison by setting the parameter alone.
The HIOEN/DHIOEN instruction is required to start/stop multiple point output, high-speed comparison tables.
For the HIOEN/DHIOEN instruction, refer to MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/ Function Blocks).



**Point**

The HIOEN/DHIOEN instruction is required to start/stop high-speed counters as well when using a multiple point output, high-speed comparison table.
Measurement is not conducted by starting the multiple point output, high-speed comparison table alone, and the high-speed comparison table therefore does not operate.

### Precautions

#### ■Setting number

Up to 128 tables can be set.

#### ■Device value when using user device

Parameters and user devices are handled as follows when using user devices.

Ex.
If D0 is set to initial device

| Table number | User device | |
|---|---|---|
| | Comparison value | Output data |
| Table 1 | D1, D0 | D3, D2 |
| Table 2 | D5, D4 | D7, D6 |
| Table 3 | D9, D8 | D11, D10 |
| Table 4 | D13, D12 | D15, D14 |
| Table 5 | D17, D16 | D19, D18 |

#### ■When final table comparison is complete

When comparison processing has been completed up to the last set table, SM5001 turns ON. The high-speed counter current value is not cleared.

#### ■Operation start timing

Multiple point output, high-speed comparison tables are enabled as soon as the HIOEN/DHIOEN instruction is executed.

#### ■Table operation interval

The comparison value or input frequency must be set so the comparison value and high-speed counter current value match at intervals of following value.

- FX5S/FX5UJ CPU module: 200μs or more for each table
- FX5U/FX5UC CPU module: 100μs or more for each table

#### ■Processing order

Multiple point output, high-speed comparison tables are processed in sequence starting from the first table. Only 1 table per count is processed.

#### ■Table setting value update timing

When using user devices, you can change the table setting values by modifying the values of the device. However, the comparison value and output data values of the table currently being compared and the next table cannot be changed. If you modify the comparison values or output data, you can modify data of the next table in the sequence and those subsequent.
The table number of which the table is being currently compared can be checked in the special register (SD5000).

#### ■Other precautions

There are common precautions when using high-speed counters. For details, refer to ☞ Page 283 Precautions when using high-speed counters.

# High-speed comparison match starts

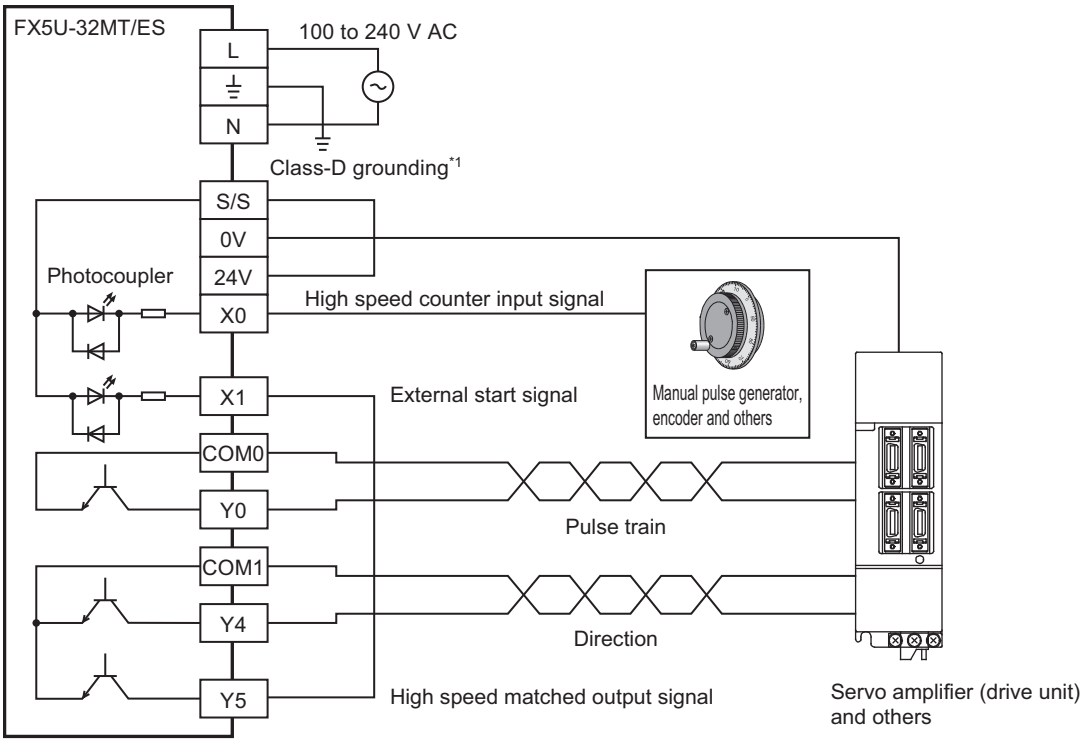
Use the high-speed counter function and external start signal (☞ Page 385 External Start Signal) to start positioning operation when the specified number of inputs is detected. Examples of the wiring and parameter setting that start positioning operation when the input is detected 100 times are shown below.

For details on the high-speed counter function, refer to the following.

☞ Page 232 High-speed Counter Function

## System configuration example

The wiring when the FX5U CPU module (transistor) is used is shown below. For the other wiring, refer to connection examples of each servo amplifier.




*1 Be sure to use the class-D grounding method (grounding resistance: 100 Ω or less).

## Parameter setting example

Set the high speed I/O setting to the following parameter in GX Works3. A parameter that is not described here does not need to be set.

### ■High-speed counter

[Navigation window] ⇨ [Parameter] ⇨ Module model name ⇨ [Module Parameter] ⇨ [High Speed I/O] ⇨ [Input Function] ⇨ [High Speed Counter] ⇨ [Detailed Setting] ⇨ [Basic Settings]

| Item | CH1 |
|---|---|
| **Use/Do Not Use Counter** | **Set whether to use counter or not.** |
| Use/Not Use | Enable |
| **Operation Mode** | **Set operation mode.** |
| Operation Mode | Normal Mode |
| **Pulse Input Mode** | **Set pulse input mode.** |
| Pulse Input Mode | 1-Phase 1 Input (S/W Up/Down Switch) |

Set the CH1 parameter as follows.

| Use/Do Not Use Counter | Operation Mode | Pulse Input Mode |
|---|---|---|
| Use | Normal Mode | 1-Phase 1 Input (S/W Up/Down Switch) |

## ■High-speed comparison table

[Navigation window] ⇨ [Parameter] ⇨ Module model name ⇨ [Module Parameter] ⇨ [High Speed I/O] ⇨ [Input Function] ⇨ [High Speed Counter] ⇨ [Detailed Setting] ⇨ [High Speed Compare Table]

| NO. | Counter CH | Comparison Type | Output Destination Device | Comparison Value 1 Specification Method | Comparison Value 1 Direct |
|---|---|---|---|---|---|
| 1 | CH1 | Set | Y5 | Direct Specification | 100 |

Set the No.1 parameter as follows.

| Counter CH | Comparison Type | Output Destination Device | Comparison Value 1 Specification Method | Comparison Value 1 Direct |
|---|---|---|---|---|
| CH1 | Set | Y5 | Direct Specification | 100 |

## ■Positioning

[Navigation window] ⇨ [Parameter] ⇨ Module model name ⇨ [Module Parameter] ⇨ [High Speed I/O] ⇨ [Output Function] ⇨ [Positioning] ⇨ [Detailed Setting] ⇨ [Basic Settings]

| Item | Axis1 |
|---|---|
| **Basic Parameter 1** | **Set basic parameter 1.** |
| Pulse Output Mode | 1:PULSE/SIGN |
| Output Device (PULSE/CW) | Y0 |
| Output Device (SIGN/CCW) | Y4 |
| Rotation Direction Setting | 0: Current Address Increment with Forward Run Pulse Output |
| Unit Setting | 0: Motor System (pulse, pps) |
| No. of Pulse per Rotation | 2000 pulse |
| Movement Amount per Rotation | 1000 pulse |
| Position Data Magnification | 1: X Single |
| **Basic Parameter 2** | **Set basic parameter 2.** |
| **Detailed Setting Parameter** | **Set the detailed setting parameter.** |
| External Start Signal Enable/Disable | 1: Valid |
| External Start Signal Device No. | X1 |
| External Start Signal Logic | 0: Positive Logic |

Set the axis 1 parameter as follows.

| Basic Parameter 1 | | | Detailed Setting Parameter | | |
|---|---|---|---|---|---|
| Pulse Output Mode | Output Device (PULSE/CW) | Output Device (SIGN/CCW) | External Start Signal Enable/Disable | External Start Signal Device No. | External Start Signal Logic |
| 1: PULSE/SIGN | Y0 | Y4 | 1: Enabled | X1 | 0: Positive Logic |

# Operation example

Wire and set the parameter setting following this example to perform the following positioning operation (high-speed comparison match start).

1. The drive contact of the positioning instruction for axis 1 turns on. (External start signal standby)
2. When the high-speed counter input (X0) of channel 1 is detected 100 times, the high-speed counter match output Y5 turns on.
3. When Y5 turns on, the external start signal X1 turns on.
4. Positioning operation of axis 1 starts after the external start signal is detected.

# Special relay details

Details concerning special relays used for high-speed counters are explained below.

## High-speed counter operating

Device for monitoring operation status of each channel of the high-speed counter.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | | | | |
|---|---|---|---|---|---|---|---|
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 |
| SM4500 | SM4501 | SM4502 | SM4503 | SM4504 | SM4505 | SM4506 | SM4507 |

| High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|
| First module | | Second module | | Third module | | Fourth module | |
| CH9 | CH10 | CH11 | CH12 | CH13 | CH14 | CH15 | CH16 |
| SM4508 | SM4509 | SM4510 | SM4511 | SM4512 | SM4513 | SM4514 | SM4515 |

### ■Operation description

The content of the operation when ON and when OFF is as follows.

| Operation when ON | Operation when OFF |
|---|---|
| High-speed counter operating | High-speed counter stopped |

**Point**

These devices also operate when the FX3 compatible high-speed counter function is valid.

### ■Update timing

The timing of device update is as follows.

| ON | OFF |
|---|---|
| • High-speed counter driven by the HIOEN/DHIOEN instruction<br>• SPD/DSPD instruction ON execution<br>• UDCNTF instruction is executed ON (when the FX3 compatible high-speed counter function is valid) | • High-speed counter stopped by the HIOEN/DHIOEN instruction<br>• Power ON, reset, STOP, PAUSE<br>• UDCNTF instruction is executed OFF (when the FX3 compatible high-speed counter function is valid) |

## High-speed counter pulse density/rotational speed being measured

Device for monitoring operation of the high-speed counter when using pulse density/rotational speed measurement mode.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 |
|---|---|---|---|---|---|---|---|
| SM4516 | SM4517 | SM4518 | SM4519 | SM4520 | SM4521 | SM4522 | SM4523 |

### ■Operation description

The content of the operation when ON and when OFF is as follows.

| Operation when ON | Operation when OFF |
|---|---|
| Pulse density/rotational speed measurement mode operating<br>Updates measurement results by measuring unit time. | Pulse density/rotational speed measurement mode stopped or not being used |

**Point**

If the FX3 compatible high-speed counter function is valid, these devices operate only when the SPD/DSPD instruction operates.

### ■Update timing

The timing of device update is as follows.

| ON | OFF |
|---|---|
| • Pulse density/rotational speed measurement mode is set in parameter and pulse density/rotational speed measurement is driven by the HIOEN/DHIOEN instruction.<br>• SPD/DSPD instruction ON execution | • Pulse density/rotational speed measurement mode is set in parameter and pulse density/rotational speed measurement is stopped by the HIOEN/DHIOEN instruction.<br>• SPD/DSPD instruction OFF execution<br>• Power ON, reset, STOP, PAUSE |



## High-speed counter overflow

Flag that detects counter value overflow of high-speed counter.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | | | | |
|---|---|---|---|---|---|---|---|
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 |
| SM4532 | SM4533 | SM4534 | SM4535 | SM4536 | SM4537 | SM4538 | SM4539 |

| High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|
| First module | | Second module | | Third module | | Fourth module | |
| CH9 | CH10 | CH11 | CH12 | CH13 | CH14 | CH15 | CH16 |
| SM4540 | SM4541 | SM4542 | SM4543 | SM4544 | SM4545 | SM4546 | SM4547 |

### ■Operation description

The content of the operation when ON and when OFF is as follows.

| Operation when ON | Operation when OFF |
|---|---|
| Overflow occurs<br>(Current value counted = +1 past maximum positive value) | Overflow does not occur |

**Point**

- Does not operate when ring length setting is enabled.
- These devices also operate when the FX3 compatible high-speed counter function is valid.

### ■Update timing

The timing of device update is as follows.

| ON | OFF |
|---|---|
| • Overflow occurs (This is updated with the END processing. When the FX3 compatible high-speed counter function is valid, the updating is made also when instruction UDCNTF instruction is executed ON.) | • When OFF by the user<br>• Power ON, reset<br>• STOP/PAUSE→RUN<br>• SM50 turned ON |

## High-speed counter underflow

Flag that detects counter value underflow of high-speed counter.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | | | | |
|---|---|---|---|---|---|---|---|
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 |
| SM4548 | SM4549 | SM4550 | SM4551 | SM4552 | SM4553 | SM4554 | SM4555 |

| High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|
| First module | | Second module | | Third module | | Fourth module | |
| CH9 | CH10 | CH11 | CH12 | CH13 | CH14 | CH15 | CH16 |
| SM4556 | SM4557 | SM4558 | SM4559 | SM4560 | SM4561 | SM4562 | SM4563 |

### ■Operation description

The content of the operation when ON and when OFF is as follows.

| Operation when ON | Operation when OFF |
|---|---|
| Underflow occurs<br>(Current value counted = -1 past maximum negative value) | Underflow does not occur |

**Point**

- Does not operate when ring length setting is enabled.
- These devices also operate when the FX3 compatible high-speed counter function is valid.

### ■Update timing

The timing of device update is as follows.

| ON | OFF |
|---|---|
| • Underflow occurs (This is updated with the END processing. When the FX3 compatible high-speed counter function is valid, the updating is made also when UDCNTF instruction is executed ON.) | • When OFF by the user<br>• Power ON, reset<br>• STOP/PAUSE→RUN<br>• SM50 turned ON |

## High-speed counter count direction monitor

Device for monitoring counter direction.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | | | | |
|---|---|---|---|---|---|---|---|
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 |
| SM4564 | SM4565 | SM4566 | SM4567 | SM4568 | SM4569 | SM4570 | SM4571 |

| High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|
| First module | | Second module | | Third module | | Fourth module | |
| CH9 | CH10 | CH11 | CH12 | CH13 | CH14 | CH15 | CH16 |
| SM4572 | SM4573 | SM4574 | SM4575 | SM4576 | SM4577 | SM4578 | SM4579 |

### ■Operation description

The content of the operation when ON and when OFF is as follows.

| Operation when ON | Operation when OFF |
|---|---|
| High-speed counter counting in direction whereby current value is reduced (Down-counting) | High-speed counter counting in direction whereby current value is increased (Up-counting) |

**Point**

These devices also operate when the FX3 compatible high-speed counter function is valid.

### ■Update timing

The timing of device update is as follows.

| ON | OFF |
|---|---|
| • Down-counting (This is updated with the END processing. When the FX3 compatible high-speed counter function is valid, the updating is made also when UDCNTF instruction is executed ON.) | • Up-counting (This is updated with the END processing. When the FX3 compatible high-speed counter function is valid, the updating is made also when UDCNTF instruction is executed ON.)<br>• Power ON, reset<br>• STOP/PAUSE→RUN |

## High-speed counter (1-phase 1-input S/W) (internal clock) count direction switch

Device for switching counter direction when using 1-phase 1-input (S/W) counter or internal clock.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | | | | |
|---|---|---|---|---|---|---|---|
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 |
| SM4580 | SM4581 | SM4582 | SM4583 | SM4584 | SM4585 | SM4586 | SM4587 |

| High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|
| First module | | Second module | | Third module | | Fourth module | |
| CH9 | CH10 | CH11 | CH12 | CH13 | CH14 | CH15 | CH16 |
| SM4588 | SM4589 | SM4590 | SM4591 | SM4592 | SM4593 | SM4594 | SM4595 |

### ■Operation description

The content of the operation when ON and when OFF is as follows.

| Operation when ON | Operation when OFF |
|---|---|
| High-speed counter current value counted -1 when input A phase ON | High-speed counter current value counted +1 when input A phase ON |

**Point**

- Setting is ignored for counter other than 1-phase 1-input (S/W), internal clock.
- These devices also operate when the FX3 compatible high-speed counter function is valid.

### ■Update timing

The timing of device update is as follows.

| ON | OFF |
|---|---|
| When ON by the user (update by END processing) | • When OFF by the user (update by END processing)<br>• Power ON, reset<br>• STOP/PAUSE→RUN |

**Point**

Can also be modified while the high-speed counter is operating.

## High-speed counter preset input logic

These devices are used for setting the preset input logic.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | | | | |
|---|---|---|---|---|---|---|---|
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 |
| SM4596 | SM4597 | SM4598 | SM4599 | SM4600 | SM4601 | SM4602 | SM4603 |

| High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|
| First module | | Second module | | Third module | | Fourth module | |
| CH9 | CH10 | CH11 | CH12 | CH13 | CH14 | CH15 | CH16 |
| SM4604 | SM4605 | SM4606 | SM4607 | SM4608 | SM4609 | SM4610 | SM4611 |

### ■Operation description

The content of the operation when ON and when OFF is as follows.

| Operation when ON | Operation when OFF |
|---|---|
| The preset input operates with negative logic | The preset input operates with positive logic |

**Point**

- The timing to execute the preset is determined by the preset input logic and the preset control switch.
- These devices also operate when the FX3 compatible high-speed counter function is valid.

### ■Update timing

The timing of device update is as follows.

| ON | OFF |
|---|---|
| • When ON by the user<br>• When set to negative logic with parameters | • When OFF by the user<br>• When set to positive logic with parameters |

**Point**

Cannot be modified while the high-speed counter is operating. Operates in the configured status when the high-speed counter starts.

## High-speed counter preset input comparison

These devices are used to specify whether or not to perform a comparison with the preset value when there is preset input.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | | | | |
|---|---|---|---|---|---|---|---|
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 |
| SM4612 | SM4613 | SM4614 | SM4615 | SM4616 | SM4617 | SM4618 | SM4619 |

| High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|
| First module | | Second module | | Third module | | Fourth module | |
| CH9 | CH10 | CH11 | CH12 | CH13 | CH14 | CH15 | CH16 |
| SM4620 | SM4621 | SM4622 | SM4623 | SM4624 | SM4625 | SM4626 | SM4627 |

### ■Operation description

The content of the operation when ON and when OFF is as follows.

| Operation when ON | Operation when OFF |
|---|---|
| Execute comparison processing with the preset value when there is preset input | Do not execute comparison processing when there is preset input |

**Point**

These devices also operate when the FX3 compatible high-speed counter function is valid.

### ■Update timing

The timing of device update is as follows.

| ON | OFF |
|---|---|
| • When ON by the user<br>• When set to enabled with parameters | • When OFF by the user<br>• When set to disabled with parameters |

**Point**

- Cannot be modified while the high-speed counter is operating. Operates in the configured status when the high-speed counter starts.
- When the current value of a high-speed counter is rewritten with the HCMOV/DHCMOV instruction, the comparison process is not executed.
- When the preset control switch is set to "Constant when ON", the preset input comparison is disabled.

### Precautions

The comparison operation of the preset input comparison may not be performed depending on the timing of the preset input. When the comparison operation is required at every preset input, configure the interrupt settings for the input (X) that is to be used in the preset. Then, write the comparison operation in the interrupt program. (☞ Page 283 Precautions when using high-speed counters)



## High-speed counter enable input logic

These devices are used for setting the enable input logic.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | | | | |
|---|---|---|---|---|---|---|---|
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 |
| SM4628 | SM4629 | SM4630 | SM4631 | SM4632 | SM4633 | SM4634 | SM4635 |

| High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|
| First module | | Second module | | Third module | | Fourth module | |
| CH9 | CH10 | CH11 | CH12 | CH13 | CH14 | CH15 | CH16 |
| SM4636 | SM4637 | SM4638 | SM4639 | SM4640 | SM4641 | SM4642 | SM4643 |

### ■Operation description

The content of the operation when ON and when OFF is as follows.

| Operation when ON | Operation when OFF |
|---|---|
| The enable input operates with negative logic<br>(Enabled when the enable input is OFF) | The enable input operates with positive logic<br>(Enabled when the enable input is ON) |

**Point**

These devices also operate when the FX3 compatible high-speed counter function is valid.

### ■Update timing

The timing of device update is as follows.

| ON | OFF |
|---|---|
| • When ON by the user<br>• When set to negative logic with parameters | • When OFF by the user<br>• When set to positive logic with parameters |

**Point**

Cannot be modified while the high-speed counter is operating. Operates in the configured status when the high-speed counter starts.

## High-speed counter ring length setting

These devices enable or disable the ring length setting for ring counters.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | | | | |
|---|---|---|---|---|---|---|---|
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 |
| SM4644 | SM4645 | SM4646 | SM4647 | SM4648 | SM4649 | SM4650 | SM4651 |

| High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|
| First module | | Second module | | Third module | | Fourth module | |
| CH9 | CH10 | CH11 | CH12 | CH13 | CH14 | CH15 | CH16 |
| SM4652 | SM4653 | SM4654 | SM4655 | SM4656 | SM4657 | SM4658 | SM4659 |

### ■Operation description

The content of the operation when ON and when OFF is as follows.

| Operation when ON | Operation when OFF |
|---|---|
| Enables the ring length setting for a ring counter<br>(Counts in the range of 0 to ring length counter-1) | Disables the ring length setting for a ring counter<br>(Counts in the range of -2147483648 to +2147483647) |

**Point**

These devices do not operate when the FX3 compatible high-speed counter function is valid.

### ■Update timing

The timing of device update is as follows.

| ON | OFF |
|---|---|
| • When ON by the user<br>• When set to enabled with parameters | • When OFF by the user<br>• When set to disabled with parameters |

**Point**

- Cannot be modified while the high-speed counter is operating. Operates in the configured status when the high-speed counter starts.
- The ring length setting is disabled if the pulse density measurement mode or rotational speed measurement mode is selected.

#### Precautions

If these devices are turned on when a high-speed counter's current value is out of the ring length range, the current value when the high-speed counter is operated is as follows.

- Lower than lower limit value → Lower limit value
- Higher than upper limit value → Upper limit value

## High-speed comparison table (high-speed compare instruction) operation

This device is for monitoring the operational status of the high-speed counter's high-speed comparison table and the high-speed comparison instruction.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | | | | | High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | First module | | Second module | | Third module | | Fourth module | |
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 | CH9 | CH10 | CH11 | CH12 | CH13 | CH14 | CH15 | CH16 |
| SM4980 | | | | | | | | SM4984 | | SM4988 | | SM4992 | | SM4996 | |

### ■Operation description

The content of the operation when ON and when OFF is as follows.

| Operation when ON | Operation when OFF |
|---|---|
| High-speed comparison table operating<br>When the high-speed counter current value and the high-speed comparison table set value or the DHSCS, DHSCR, DHSZ instruction set value are equal, the specified bit device is set or reset. | High-speed comparison table stopped<br>Even when the high-speed counter current value and the high-speed comparison table set value or the DHSCS, DHSCR, DHSZ instruction set value are equal, the specified bit device does not change. |

**Point**

These devices also operate when the FX3 compatible high-speed counter function is valid.

### ■Update timing

The timing of device update is as follows.

| ON | OFF |
|---|---|
| • Match output driven by the DHIOEN instruction<br>• ON execution by DHSCS, DHSCR, DHSZ instruction | • Match output stopped by the DHIOEN instruction and DHSCS, DHSCR, DHSZ instructions all OFF<br>• Power ON, reset, STOP, PAUSE |



## High-speed comparison table (high-speed compare instruction) error occurrence

This device turns ON when driving the DHSCS, DHSCR, and DHSZ instructions in excess of the limitation of the number of instructions driven at the same time or driving the high-speed comparison table in excess of the limitation of the number of the tables starting at the same time.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | | | | | High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | First module | | Second module | | Third module | | Fourth module | |
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 | CH9 | CH10 | CH11 | CH12 | CH13 | CH14 | CH15 | CH16 |
| SM4982 | | | | | | | | SM4986 | | SM4990 | | SM4994 | | SM4998 | |

### ■Operation description

The content of the operation when ON and when OFF is as follows.

| Operation when ON | Operation when OFF |
|---|---|
| • DHSCS, DHSCR, DHSZ instructions operated in excess of the limitation of the number of instructions driven at the same time.<br>• An operation was made in excess of the limit of number of tables of the high speed comparison table starting at the same time. | When there is no error<br>DHSCS, DHSCR, DHSZ instructions, and high-speed comparison table can operate |

**Point**

- Even when this device turns on, if the operation setting of the CPU module operation upon error detection setting (☞ Page 128 CPU module operation upon error detection setting) is "Continue", the DHSCS, DHSCR, DHSZ instructions within the range of the number of instructions driven at the same time will operate. For the limitation of the number of instructions driven at the same time, refer to ☞ Page 283 Precautions when using high-speed counters.
- These devices also operate when the FX3 compatible high-speed counter function is valid.

### ■Update timing

The timing of device update is as follows.

| ON | OFF |
|---|---|
| • Updated in END processing<br>• If an error occurs while the FX3 compatible DHSCS,DHSCR,and DHSZ instruction ON execution, an operation is made also when the high-speed counter function is valid. | • When OFF by the user<br>• Power ON, reset |

## Multi-point output high-speed comparison table operation

This device is for monitoring the operational status of the high-speed counter's multi-point output high-speed comparison tables.

### ■Corresponding devices

The device number is shared for all channels of the CPU module.

| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 |
|---|---|---|---|---|---|---|---|
| SM5000 | | | | | | | |

### ■Operation description

The content of the operation when ON and when OFF is as follows.

| Operation when ON | Operation when OFF |
|---|---|
| Multi-point output high-speed comparison table operating<br>When the high-speed counter current value is equal to the set value specified in the multi-point output high-speed comparison table parameters, the specified pattern of output or the data transfer operates. | Multi-point output high-speed comparison tables stopped<br>Even when the high-speed counter current value is equal to the set value specified in the multi-point output high-speed comparison table parameters, the specified pattern of output or the data transfer is not executed. |

**Point**

These devices also operate when the FX3 compatible high-speed counter function is valid.

### ■Update timing

The timing of device update is as follows.

| ON | OFF |
|---|---|
| • Match output driven by the HIOEN/DHIOEN instruction<br>• ON execution by DHSCS, DHSCR, DHSZ instruction | • Match output stopped by the HIOEN/DHIOEN instruction and DHSCS, DHSCR, DHSZ instructions all OFF<br>• Power ON, reset, STOP, PAUSE<br>• SM8034 turned ON |

## Multi-point output high-speed comparison table completion

This device turns ON when the high-speed counter's multi-point output high-speed comparison tables have finished comparing all of the set tables.

### ■Corresponding devices

The device number is shared for all channels of the CPU module.

| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 |
|---|---|---|---|---|---|---|---|
| SM5001 | | | | | | | |

### ■Operation description

The content of the operation when ON and when OFF is as follows.

| Operation when ON | Operation when OFF |
|---|---|
| Multi-point output high-speed comparison table completion<br>The comparison of the final table has finished | Multi-point output high-speed comparison tables not finished<br>The comparison has not finished up to the final table |

**Point**

These devices also operate when the FX3 compatible high-speed counter function is valid.

### ■Update timing

The timing of device update is as follows.

| ON | OFF |
|---|---|
| When multi-point output high-speed comparison tables have finished processing the set amount of tables | • When OFF by the user<br>• Power ON, reset, STOP, PAUSE |

# Special register details

This section describes details about the special registers used with the high-speed counters.

## High-speed counter current value



These devices store the current values of the high-speed counters.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | | | | |
|---|---|---|---|---|---|---|---|
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 |
| SD4501, SD4500 | SD4531, SD4530 | SD4561, SD4560 | SD4591, SD4590 | SD4621, SD4620 | SD4651, SD4650 | SD4681, SD4680 | SD4711, SD4710 |

| High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|
| First module | | Second module | | Third module | | Fourth module | |
| CH9 | CH10 | CH11 | CH12 | CH13 | CH14 | CH15 | CH16 |
| SD4741, SD4740 | SD4771, SD4770 | SD4801, SD4800 | SD4831, SD4830 | SD4861, SD4860 | SD4891, SD4890 | SD4921, SD4920 | SD4951, SD4950 |

### ■Description

These devices stores the current values of the high-speed counters.

These are signed 32-bit ring counters. (Upper limit value+1 changes to → lower limit value, lower limit value-1 changes to → upper limit value.)

When the ring length is not set, lower limit value: -2147483648, upper limit value: 2147483647.

When the ring length is set, lower limit value: 0, upper limit value: ring length-1.

**Point**

- To rewrite the current value, use the HCMOV/DHCMOV instruction and transfer the desired value. However, this is the upper limit when set to a value that exceeds the upper limit value, and this is the lower limit value when set to a value that is less than the lower limit value.
- If the current value falls outside the ring length range when the ring length is set, the upper and lower limit values of the ring length are ignored and the current value is used.
- The current value is retained even when the power is OFF.
- When the FX3 compatible high-speed counter function is valid, the same value as one in the LC device (LC35 to LC55) used as the high-speed counter is stored. When the current value is rewritten, the value in the device is also changed, as well as the other way around.

### ■Update timing

The current value of the high-speed counter is updated in END processing or when the HCMOV/DHCMOV instruction is executed. Further, when the FX3 compatible high-speed counter function is valid, the value is updated also when UDCNTF instruction is executed.

### ■Clear timing

The timing when the device is cleared is as follows.

- Cleared by the HCMOV/DHCMOV instruction
- When the RST LC☐ instruction executes ON (only when the FX3 compatible high-speed counter function is valid and the applicable LC device is used)
- Power ON, reset, RUN→STOP (only when the FX3 compatible high-speed counter function is valid and the applicable LC device is used)

## High-speed counter maximum value

These devices store the maximum values of the high-speed counters.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | | | | |
|---|---|---|---|---|---|---|---|
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 |
| SD4503, SD4502 | SD4533, SD4532 | SD4563, SD4562 | SD4593, SD4592 | SD4623, SD4622 | SD4653, SD4652 | SD4683, SD4682 | SD4713, SD4712 |

| High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|
| First module | | Second module | | Third module | | Fourth module | |
| CH9 | CH10 | CH11 | CH12 | CH13 | CH14 | CH15 | CH16 |
| SD4743, SD4742 | SD4773, SD4772 | SD4803, SD4802 | SD4833, SD4832 | SD4863, SD4862 | SD4893, SD4892 | SD4923, SD4922 | SD4953, SD4952 |

### ■Description

These devices stores the maximum values of the high-speed counters.

**Point**

- To rewrite the maximum value, only the HCMOV/DHCMOV instruction can be used.
- If using the enable input, the maximum value is updated when the enable input is ON.
- These devices also operate when the FX3 compatible high-speed counter function is valid.
- If LC45 (CH3: Operation equivalent to C245), LC50 (CH4: Operation equivalent to C250) or LC55 (CH4: Operation equivalent to C255) are used when the FX3 compatible high-speed counter function is valid, special register is updated for the first time when enable input is ON. (☞ Page 293 Assignment for FX3-compatible high-speed counters) After that, regardless of enable input, special register is updated when the high-speed counter starts.

### ■Update timing

When the current value of a high-speed counter exceeds the maximum value, the value is updated in END processing. When the value is read using the HCMOV/DHCMOV instruction, it is first updated to the latest value and then read. Further, when the FX3 compatible high-speed counter function is valid, the value is updated also when UDCNTF instruction is executed.

### ■Clear timing

The timing when the device is cleared is as follows.

- Power ON, Reset

## High-speed counter minimum value

These devices store the minimum values of the high-speed counters.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | | | | |
|---|---|---|---|---|---|---|---|
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 |
| SD4505, SD4504 | SD4535, SD4534 | SD4565, SD4564 | SD4595, SD4594 | SD4625, SD4624 | SD4655, SD4654 | SD4685, SD4684 | SD4715, SD4714 |

| High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|
| First module | | Second module | | Third module | | Fourth module | |
| CH9 | CH10 | CH11 | CH12 | CH13 | CH14 | CH15 | CH16 |
| SD4745, SD4744 | SD4775, SD4774 | SD4805, SD4804 | SD4835, SD4834 | SD4865, SD4864 | SD4895, SD4894 | SD4925, SD4924 | SD4955, SD4954 |

### ■Description

These devices stores the minimum values of the high-speed counters.

**Point**

- To rewrite the minimum value, only the HCMOV/DHCMOV instruction can be used.
- If using the enable input, the minimum value is updated when the enable input is ON.
- These devices also operate when the FX3 compatible high-speed counter function is valid.
- If LC45 (CH3: Operation equivalent to C245), LC50 (CH4: Operation equivalent to C250) or LC55 (CH4: Operation equivalent to C255) are used when the FX3 compatible high-speed counter function is valid, special register is updated for the first time when enable input is ON. (☞ Page 293 Assignment for FX3-compatible high-speed counters) After that, regardless of enable input, special register is updated when the high-speed counter starts.

### ■Update timing

When the current value of a high-speed counter becomes less than the minimum value, the value is updated in END processing. When the value is read using the HCMOV/DHCMOV instruction, it is first updated to the latest value and then read. Further, when the FX3 compatible high-speed counter function is valid, the value is updated also when UDCNTF instruction is executed.

### ■Clear timing

The timing when the device is cleared is as follows.

- Power ON, Reset

## High-speed counter pulse density

These devices store the measurement results of pulse density measurement mode.

### ■Corresponding devices

The device numbers corresponding to each channel of the CPU module are as follows.

| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 |
|---|---|---|---|---|---|---|---|
| SD4507, SD4506 | SD4537, SD4536 | SD4567, SD4566 | SD4597, SD4596 | SD4627, SD4626 | SD4657, SD4656 | SD4687, SD4686 | SD4717, SD4716 |

### ■Description

These devices store the measurement results of pulse density measurement mode (rotational speed measurement mode).

**Point**

- These devices also store the pulse density measurement when in rotational speed measurement mode.
- If the FX3 compatible high-speed counter function is valid, these devices operate only when the SPD/DSPD instruction operates.

### ■Update timing

The pulse density is updated at each measurement unit time when set to pulse density measurement mode (rotational speed measurement mode) with parameters.

### ■Clear timing

The timing when the device is cleared is as follows.

- Power ON, Reset, STOP/PAUSE→RUN

## High-speed counter rotational speed

These devices store the measurement results of rotational speed measurement mode.

### ■Corresponding devices

The device numbers corresponding to each channel of the CPU module are as follows.

| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 |
|---|---|---|---|---|---|---|---|
| SD4509, SD4508 | SD4539, SD4538 | SD4569, SD4568 | SD4599, SD4598 | SD4629, SD4628 | SD4659, SD4658 | SD4689, SD4688 | SD4719, SD4718 |

### ■Description

These devices store the measurement results of rotational speed measurement mode.

**Point**

- These devices also store the rotational speed when in pulse density measurement mode.
- These devices do not operate when the FX3 compatible high-speed counter function is valid.

### ■Update timing

The rotational speed is updated at each measurement unit time when set to rotational speed measurement mode with parameters.

### ■Clear timing

The timing when the device is cleared is as follows.

- Power ON, Reset, STOP/PAUSE→RUN

## High-speed counter preset control switch

These devices set the preset input operation of the high-speed counters.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | | | | |
|---|---|---|---|---|---|---|---|
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 |
| SD4510 | SD4540 | SD4570 | SD4600 | SD4630 | SD4660 | SD4690 | SD4720 |

| High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|
| First module | | Second module | | Third module | | Fourth module | |
| CH9 | CH10 | CH11 | CH12 | CH13 | CH14 | CH15 | CH16 |
| SD4750 | SD4780 | SD4810 | SD4840 | SD4870 | SD4900 | SD4930 | SD4960 |

### ■Description

These devices set the timing to execute preset input. The table below shows the operations of the setting values.

| Setting value | Description |
|---|---|
| 0 | Executes the preset on the rising edge. |
| 1 | Executes the preset on the falling edge. |
| 2 | Executes the preset on both edges. |
| 3 | Constantly executes the preset when ON.*1 |
| Other than above | Operates as the rising edge.<br>Executes the preset on the rising edge. |

*1 When the preset control switch is set to "3: Constant when ON", the preset input comparison cannot be used even if the parameter of the preset input comparison (special relay) is enabled.

**Point**

- While the high-speed counter is operating, the value is not reflected even if modified. It operates in the status when the high-speed counter starts.
- These devices also operate when the FX3 compatible high-speed counter function is valid.

## ■Clear timing

The timing when the device is cleared is as follows.

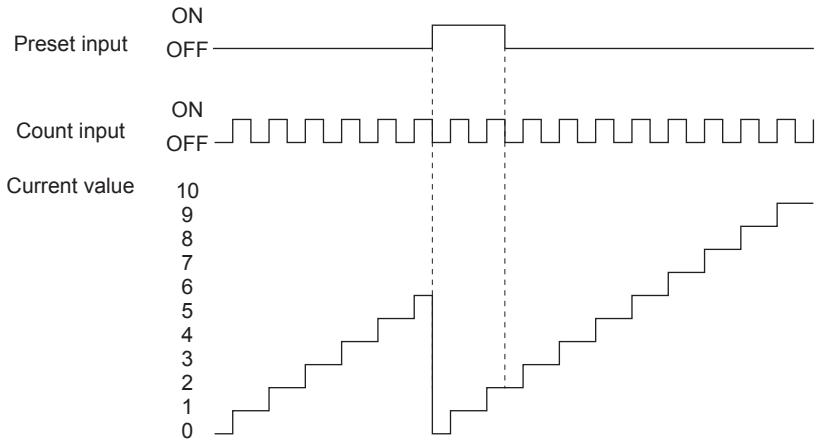
- Power ON, Reset, STOP→RUN

## ■Description of operation

This section describes the operations when the preset input logic and the preset control switch are combined. The preset value is set to 0.

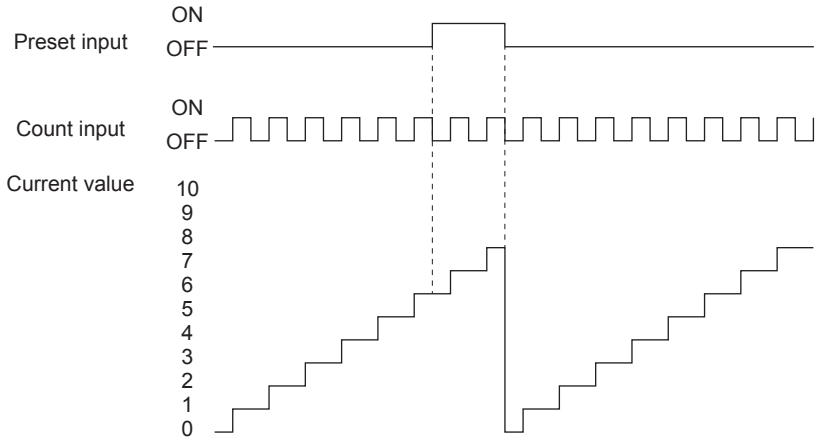
- Operation when preset input logic: positive logic, preset control switch: rising edge

The preset is executed when the preset input changes OFF→ON.



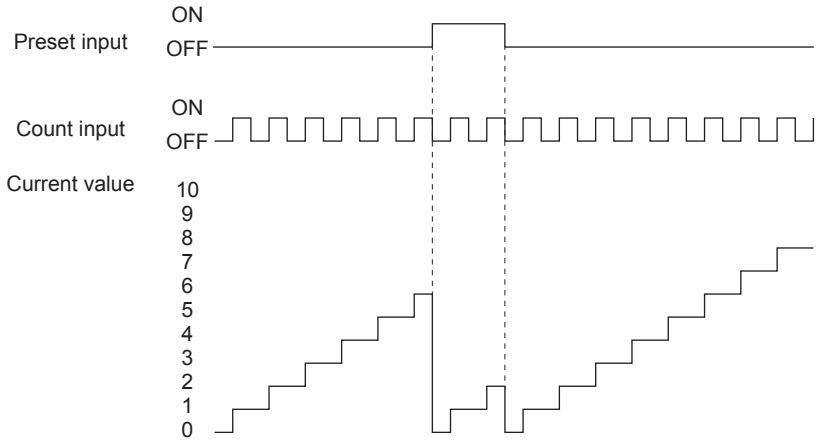

- Operation when preset input logic: positive logic, preset control switch: falling edge

The preset is executed when the preset input changes ON→OFF.



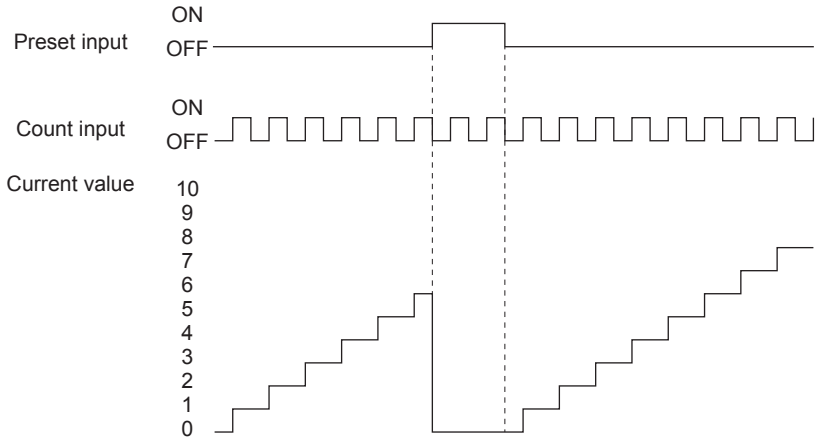

- Operation when preset input logic: positive logic, preset control switch: rising edge + falling edge

The preset is executed when the preset input changes OFF→ON and when it changes ON→OFF.



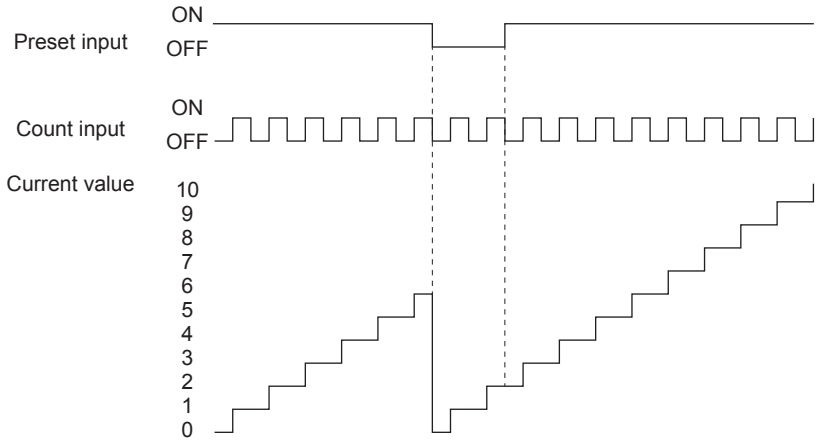
• Operation when preset input logic: positive logic, preset control switch: constant when ON

The preset is constantly executed while the preset input is ON.



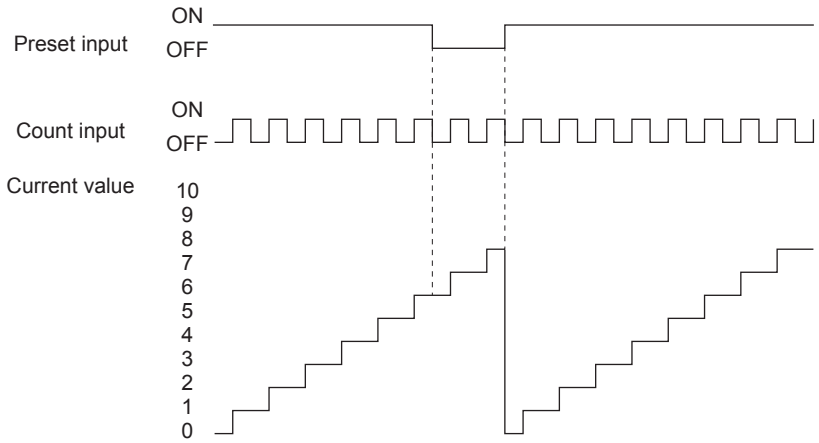

• Operation when preset input logic: negative logic, preset control switch: rising edge

The preset is executed when the preset input changes ON→OFF.



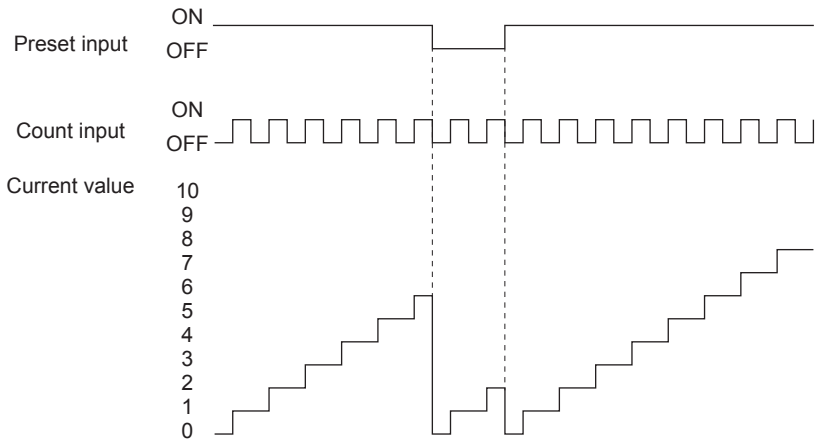

• Operation when preset input logic: negative logic, preset control switch: falling edge

The preset is executed when the preset input changes OFF→ON.



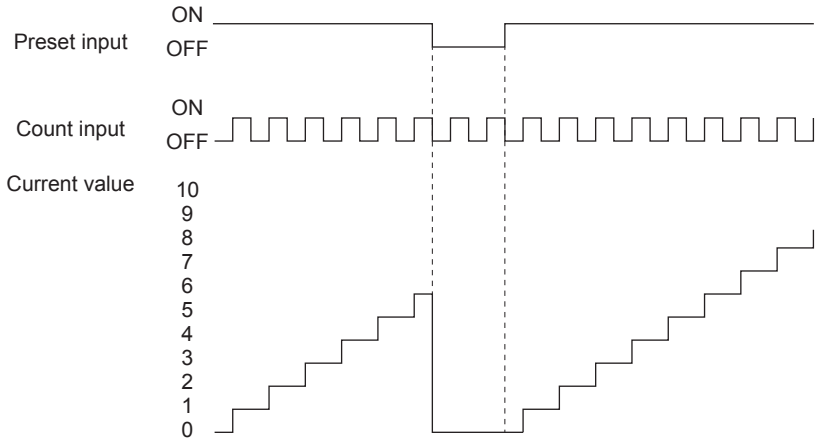
• Operation when preset input logic: negative logic, preset control switch: rising edge + falling edge

The preset is executed when the preset input changes ON→OFF and when it changes OFF→ON.




• Operation when preset input logic: negative logic, preset control switch: constant when ON

The preset is constantly executed while the preset input is OFF.




## High-speed counter preset value

These devices set the values to store in the current values when presets are executed.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | | | | |
|---|---|---|---|---|---|---|---|
| **CH1** | **CH2** | **CH3** | **CH4** | **CH5** | **CH6** | **CH7** | **CH8** |
| SD4513, SD4512 | SD4543, SD4542 | SD4573, SD4572 | SD4603, SD4602 | SD4633, SD4632 | SD4663, SD4662 | SD4693, SD4692 | SD4723, SD4722 |

| High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|
| **First module** | | **Second module** | | **Third module** | | **Fourth module** | |
| **CH9** | **CH10** | **CH11** | **CH12** | **CH13** | **CH14** | **CH15** | **CH16** |
| SD4753, SD4752 | SD4783, SD4782 | SD4813, SD4812 | SD4843, SD4842 | SD4873, SD4872 | SD4903, SD4902 | SD4933, SD4932 | SD4963, SD4962 |

### ■Description

These devices set the values to set for the current values when presets are executed.

If the preset value is set to be more than the ring length, an error occurs when the high-speed counter is started.

**Point**

- The preset value can also be modified while the high-speed counter is operating. The update timing is END processing.
- These devices also operate when the FX3 compatible high-speed counter function is valid.

### ■Clear timing

The timing when the device is cleared is as follows.

- Power ON, Reset, STOP→RUN

## High-speed counter ring length

These devices set the ring length of the high-speed counters.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | | | | |
|---|---|---|---|---|---|---|---|
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 |
| SD4515, SD4514 | SD4545, SD4544 | SD4575, SD4574 | SD4605, SD4604 | SD4635, SD4634 | SD4665, SD4664 | SD4695, SD4694 | SD4725, SD4724 |

| High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|
| First module | | Second module | | Third module | | Fourth module | |
| CH9 | CH10 | CH11 | CH12 | CH13 | CH14 | CH15 | CH16 |
| SD4755, SD4754 | SD4785, SD4784 | SD4815, SD4814 | SD4845, SD4844 | SD4875, SD4874 | SD4905, SD4904 | SD4935, SD4934 | SD4965, SD4964 |

### ■Description

These devices set the ring length of the high-speed counters.

These set values are valid when the ring length setting is set to enabled.

**Point**

- While the high-speed counter is operating, the value is not reflected even if modified. It operates in the status when the high-speed counter starts.
- These devices do not operate when the FX3 compatible high-speed counter function is valid.

### ■Clear timing

The timing when the device is cleared is as follows.

- Power ON, Reset, STOP→RUN

### Precautions

If the ring length is set to less than the lower limit value or more than the upper limit value, the ring length operates at the lower limit value or the upper limit value. However, the set value is stored as is.

## High-speed counter measurement unit time

These devices set the measurement unit of pulse density measurement mode.

### ■Corresponding devices

The device numbers corresponding to each channel of the CPU module are as follows.

| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 |
|---|---|---|---|---|---|---|---|
| SD4517, SD4516 | SD4547, SD4546 | SD4577, SD4576 | SD4607, SD4606 | SD4637, SD4636 | SD4667, SD4666 | SD4697, SD4696 | SD4727, SD4726 |

### ■Description

These devices set the time to measure pulse density (rotational speed) in 1 ms units when high-speed counters are operating in pulse density measurement mode.

**Point**

- If the value is modified while the high-speed counter is operating, the rewritten value is reflected after the measurement before the value was modified is finished.
- If the FX3 compatible high-speed counter function is valid, these devices operate only when the SPD/DSPD instruction operates. The value in the operand of the SPD/DSPD instruction is written.

### ■Clear timing

The timing when the device is cleared is as follows.

- Power ON, Reset, STOP→RUN

#### Precautions

If the set value for the measurement unit time is set to less than the lower limit value or more than the upper limit value, the measurement unit time operates at the lower limit value or the upper limit value. However, the set value is stored as is.



## High-speed counter number of pulses per rotation

These devices set the number of pulses per rotation for rotational speed measurement mode.

### ■Corresponding devices

The device numbers corresponding to each channel of the CPU module are as follows.

| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 |
|---|---|---|---|---|---|---|---|
| SD4519, SD4518 | SD4549, SD4548 | SD4579, SD4578 | SD4609, SD4608 | SD4639, SD4638 | SD4669, SD4668 | SD4699, SD4698 | SD4729, SD4728 |

### ■Description

These devices set the number of pulses per rotation when a high-speed counter operates in rotational speed measurement mode. The rotational speed is measured with the set value.

**Point**

- If the value is modified while the high-speed counter is operating, the rewritten value is reflected after the measurement before the value was modified is finished.
- These devices do not operate when the FX3 compatible high-speed counter function is valid.

### ■Clear timing

The timing when the device is cleared is as follows.

- Power ON, Reset, STOP→RUN

#### Precautions

If the set value for the number of pulses per rotation is set to less than the lower limit value or more than the upper limit value, the number of pulses per rotation operates at the lower limit value or the upper limit value. However, the set value is stored as is.

## High-speed comparison table (high-speed compare instruction) error occurrence error code

This device stores the high-speed comparison table, high-speed comparison instruction error.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | | | | | High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | First module | | Second module | | Third module | | Fourth module | |
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 | CH9 | CH10 | CH11 | CH12 | CH13 | CH14 | CH15 | CH16 |
| SD4982 | | | | | | | | SD4986 | | SD4990 | | SD4994 | | SD4998 | |

### ■Description

This device stores the error code when an error occurs in the high-speed comparison table, high-speed comparison instruction.

**Point**

These devices also operate when the FX3 compatible high-speed counter function is valid.

### ■Clear timing

The timing when the device is cleared is as follows.

- Power ON, Reset, SM50 turned ON

### ■Error code

High-speed comparison table maximum excess error: 3780H

## Multi-point output high-speed comparison table comparison number

This device stores the number of the table currently being compared in the multi-point output high-speed comparison tables.

### ■Corresponding devices

The device number is shared for all channels of the CPU module.

| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 |
|---|---|---|---|---|---|---|---|
| SD5000 | | | | | | | |

### ■Description

This device stores the number of the table currently being compared in the multi-point output high-speed comparison tables. If 0, the multi-point output high-speed comparison tables have stopped.

**Point**

- When rewriting the comparison value or output data for the multi-point output high-speed comparison tables, the table numbers from the table numbers that follow after the next table number of the table being compared can be rewritten.
- The table number being compared and the next table number after that can be rewritten, but they will not be compared.
- These devices also operate when the FX3 compatible high-speed counter function is valid.

### ■Clear timing

The timing when the device is cleared is as follows.

- Power ON, Reset, STOP→RUN

# Special relays/special registers capable of high-speed transfers with the HCMOV/DHCMOV instruction

The table below shows the devices that can read and write the latest value with the HCMOV/DHCMOV instruction from special relays and special registers related to the high-speed counters. When special relays and special registers are specified for (s) and (d) of instructions other than the HCMOV/DHCMOV instruction, the operation is the same as one compatible with the MOV/DMOV instruction.

### Precautions

- Transfer is not possible between an SM supporting high-speed transfer and an SD supporting high-speed transfer.
- When the device supporting high-speed transfer is set as the transfer source (s) by the DHCMOV instruction while the high-speed input/output function is stopped, the previous value before stop is read out. However, if the function is not executed even once, the initial value is read out.

## Special relays for individual channels

○: High-speed transfer capable (special relay is immediately updated)

△: Normal transfer capable (special relay is updated in END processing)

×: Transfer not possible (read-only)

| Special relay | Function | Compatible with HCMOV/DHCMOV instruction | | Compatible with MOV/DMOV instruction | |
|---|---|---|---|---|---|
| | | (s) | (d) | (s) | (d) |
| SM4500 to SM4515 | High-speed counter operating | △ | × | △ | × |

| Special relay | Function | Compatible with HCMOV/ DHCMOV instruction | | Compatible with MOV/ DMOV instruction | |
|---|---|---|---|---|---|
| | | (s) | (d) | (s) | (d) |
| SM4516 to SM4531 | High-speed counter pulse density/rotational speed being measured | △ | × | △ | × |
| SM4532 to SM4547 | High-speed counter overflow*1 | ○ | ○ | △ | △ |
| SM4548 to SM4563 | High-speed counter underflow*1 | ○ | ○ | △ | △ |
| SM4564 to SM4579 | High-speed counter count direction monitor*1 | ○ | × | △ | × |
| SM4580 to SM4595 | High-speed counter (1-phase 1-input S/W) count direction switch*1 | △ | ○ | △ | △ |
| SM4596 to SM4611 | High-speed counter preset input logic | △ | △ | △ | △ |
| SM4612 to SM4627 | High-speed counter preset input comparison | △ | △ | △ | △ |
| SM4628 to SM4643 | High-speed counter enable input logic | △ | △ | △ | △ |
| SM4644 to SM4659 | High-speed counter ring length setting | △ | △ | △ | △ |

*1 In a program with interruption priority 1, the HCMOV/DHCMOV instruction specified with a device for the high-speed pulse input/output module cannot be executed.

## Special relays shared by all channels

○: High-speed transfer capable (special relay is immediately updated)

△: Normal transfer capable (special relay is updated in END processing)

×: Transfer not possible (read-only)

| Special relay | Function | Compatible with HCMOV/ DHCMOV instruction | | Compatible with MOV/ DMOV instruction | |
|---|---|---|---|---|---|
| | | (s) | (d) | (s) | (d) |
| SM4980 | High-speed comparison table (high-speed compare instruction) operation (CPU module) | △ | × | △ | × |
| SM4982 | High-speed comparison table (high-speed compare instruction) error occurrence (CPU module) | △ | △ | △ | △ |
| SM4984 | High-speed comparison table operation (high-speed pulse input/ output module first module) | △ | × | △ | × |
| SM4986 | High-speed comparison table error occurrence (high-speed pulse input/output module first module) | △ | △ | △ | △ |
| SM4988 | High-speed comparison table operation (high-speed pulse input/ output module second module) | △ | × | △ | × |
| SM4990 | High-speed comparison table error occurrence (high-speed pulse input/output module second module) | △ | △ | △ | △ |
| SM4992 | High-speed comparison table operation (high-speed pulse input/ output module third module) | △ | × | △ | × |
| SM4994 | High-speed comparison table error occurrence (high-speed pulse input/output module third module) | △ | △ | △ | △ |
| SM4996 | High-speed comparison table operation (high-speed pulse input/ output module fourth module) | △ | × | △ | × |
| SM4998 | High-speed comparison table error occurrence (high-speed pulse input/output module fourth module) | △ | △ | △ | △ |
| SM5000 | Multi-point output high-speed comparison table operation | △ | × | △ | × |
| SM5001 | Multi-point output high-speed comparison table completion | ○ | △ | △ | △ |

## Special registers for individual channels

This section only lists the devices for high-speed counter CH1. The devices for high-speed counter CH2 and subsequent counters have the same operation as CH1.

○: High-speed transfer capable (special register is immediately updated)

△: Normal transfer capable (special register is updated in END processing)

×: Transfer not possible (read-only)

| Special register | Function | Compatible with HCMOV/ DHCMOV instruction | | Compatible with MOV/ DMOV instruction | |
|---|---|---|---|---|---|
| | | (s) | (d) | (s) | (d) |
| SD4500 | High-speed counter current value (CH1)*1 | ○ | ○ | △ | × |
| SD4501 | | | | | |
| SD4502 | High-speed counter maximum value (CH1)*1 | ○ | ○ | △ | × |
| SD4503 | | | | | |
| SD4504 | High-speed counter minimum value (CH1)*1 | ○ | ○ | △ | × |
| SD4505 | | | | | |
| SD4506 | High-speed counter pulse density (CH1) | △ | △ | △ | △ |
| SD4507 | | | | | |
| SD4508 | High-speed counter rotational speed (CH1) | △ | △ | △ | △ |
| SD4509 | | | | | |
| SD4510 | High-speed counter preset control switch (CH1) | △ | △ | △ | △ |
| SD4512 | High-speed counter preset value (CH1)*1 | △ | ○ | △ | △ |
| SD4513 | | | | | |
| SD4514 | High-speed counter ring length (CH1) | △ | △ | △ | △ |
| SD4515 | | | | | |
| SD4516 | High-speed counter measurement unit time (CH1) | △ | △ | △ | △ |
| SD4517 | | | | | |
| SD4518 | High-speed counter number of pulses per rotation (CH1) | △ | △ | △ | △ |
| SD4519 | | | | | |

*1 In a program with interruption priority 1, the HCMOV/DHCMOV instruction specified with a device for the high-speed pulse input/output module cannot be executed.

**Point**

Always use DHCMOV (32-bit instruction) for devices that use 2 words. When the HCMOV instruction (16-bit instruction) is used, it operates the same as the normal MOV instruction.

## Special registers shared by all channels

○: High-speed transfer capable (special register is immediately updated)

△: Normal transfer capable (special register is updated in END processing)

×: Transfer not possible (read-only)

| Special register | Function | Compatible with HCMOV/ DHCMOV instruction | | Compatible with MOV/ DMOV instruction | |
|---|---|---|---|---|---|
| | | (s) | (d) | (s) | (d) |
| SD4982 | High-speed comparison table (high-speed compare instruction) error occurrence error code (CPU module) | △ | △ | △ | △ |
| SD4986 | High-speed comparison table error occurrence error code (high-speed pulse input/output module first module) | △ | △ | △ | △ |
| SD4990 | High-speed comparison table error occurrence error code (high-speed pulse input/output module second module) | △ | △ | △ | △ |
| SD4994 | High-speed comparison table error occurrence error code (high-speed pulse input/output module third module) | △ | △ | △ | △ |
| SD4998 | High-speed comparison table error occurrence error code (high-speed pulse input/output module fourth module) | △ | △ | △ | △ |
| SD5000 | Multi-point output high-speed comparison table comparison number | △ | × | △ | △ |

# Precautions when using high-speed counters

This section describes the precautions when using high-speed counters.

## Common precautions when using high-speed counter instructions and parameters



This section describes the common precautions when using high-speed comparison tables and multi-point output comparison tables with the high-speed counter instructions (DHSCS, DHSCR, DHSZ instructions) or parameters. For the individual precautions on high-speed counter instructions, refer to MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks).

### ■High-speed counter devices

The current values for high-speed counters are checked with special registers for each channel.

To start or stop counting of the high-speed counters, use the HIOEN/DHIOEN instruction or the SPD/DSPD instruction.

- High-speed counter start/stop conditions

| Function | Start | Stop |
|---|---|---|
| Counting | • HIOEN/DHIOEN instruction<br>• SPD/DSPD instruction | • HIOEN/DHIOEN instruction<br>• SPD/DSPD instruction*1 |
| Comparison processing | • HIOEN/DHIOEN instruction<br>• DHSCS, DHSCR, DHSZ instructions | • HIOEN/DHIOEN instruction<br>• DHSCS, DHSCR, DHSZ instructions*2 |

*1 Can be stopped when counting was started with the SPD/DSPD instruction.

*2 Can be stopped when the high-speed comparison table is not set with parameters.

### ■Precautions for the counting operation when the current value is changed

For the high-speed counter instructions, high-speed comparison tables, and multi-point output high-speed comparison tables, comparison processing is performed when the current value of the high-speed counter has changed due to pulse input. When the preset input comparison function is also enabled, comparison processing is also performed when the preset is executed. However, please note that the comparison processing is not performed when the current value of the high-speed counter is changed with the following methods.

- When the current value of a high-speed counter was rewritten with the HCMOV/DHCMOV instruction.
- When the current value of the high-speed counter is reset with the RST instruction or the ZRST instruction (when the FX3 compatible high-speed counter function is valid)
- When the current value of the high-speed counter was changed by a self-reset. (When the preset input comparison function is disabled)
- When high-speed counter current value is the ON or OFF output result of the comparison of the DHSCS, DHSCR, DHSZ instructions.
- When high-speed counter current value is the ON or OFF output result of the comparison of a high-speed comparison table.

### ■Preset input comparison operation

When the preset input comparison is enabled and preset control switching is set to constant when ON, the preset input comparison does not operate.

The comparison operation of the preset input comparison may not be performed depending on the timing of the preset input. When the comparison operation is required at every preset input, configure the interrupt settings for the input (X) that is to be used in the preset. Then, write the comparison operation in the interrupt program.

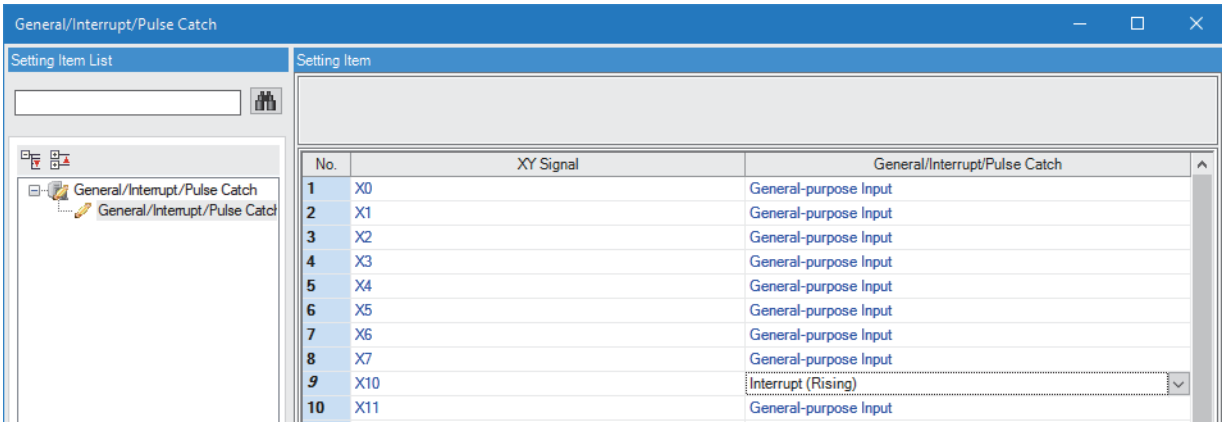
#### Program example

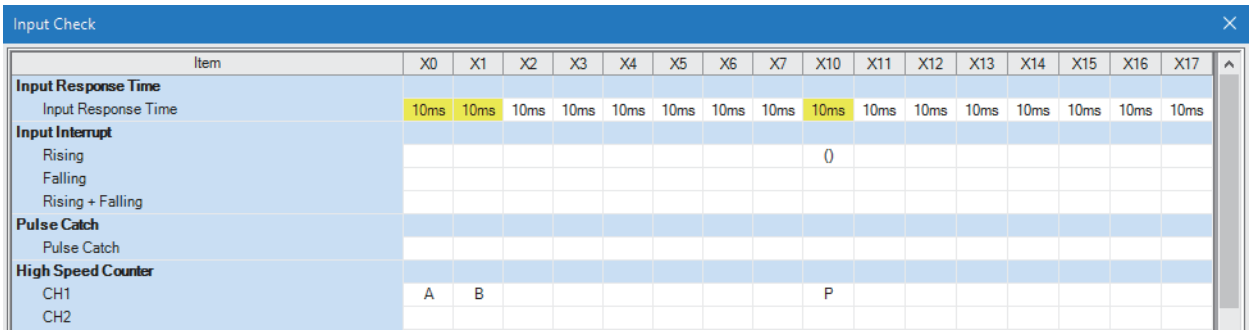
- When the high-speed counter CH1 of the CPU module is used for two-phase count

In addition to the settings of the high-speed counter CH1, set the input interrupt for X10 that is used for the preset of CH1 in "General/Interrupt/Pulse Catch" in the module parameter.

The following setting is used as an example.

| XY signal | General/interrupt/pulse catch |
|---|---|
| X10 | Interrupt (Rising) |

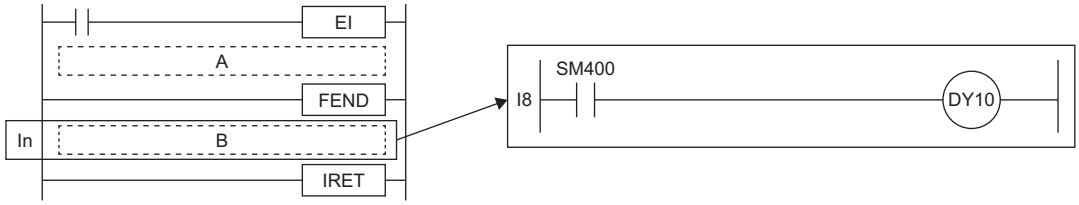



The interrupt pointer is assigned to I8 (fixed).

Program the processing required for preset input with the interrupt program of I8.

In the following example, DY10 is directly output when an interrupt of I8 occurs (when CH1 preset input is enabled).



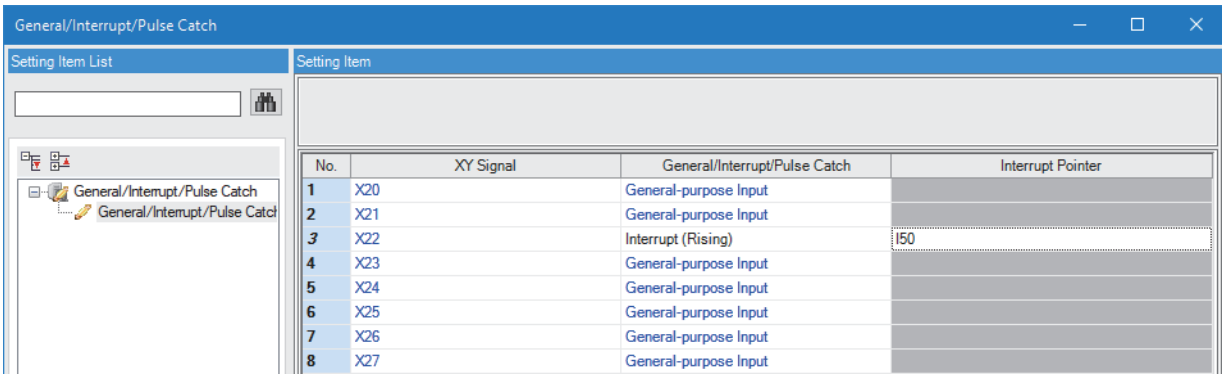

A: Sequence program
B: Interrupt program

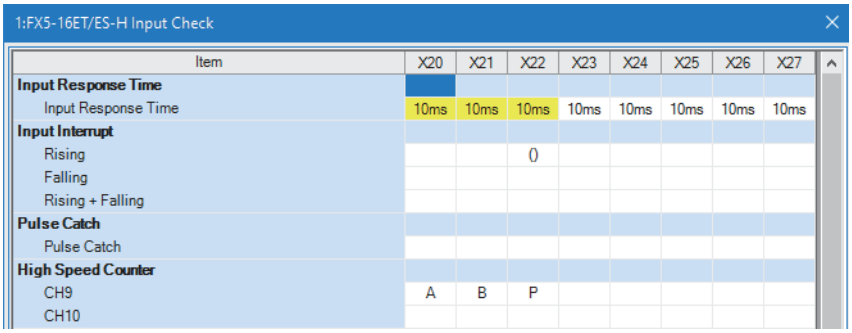
• When the high-speed counter CH9 of the high-speed pulse I/O module is used for two-phase count

In addition to the settings of the high-speed counter CH9, set the input interrupt for X22 that is used for the preset of CH9 in "General/Interrupt/Pulse Catch" in the module parameter.

The following setting is used as an example.

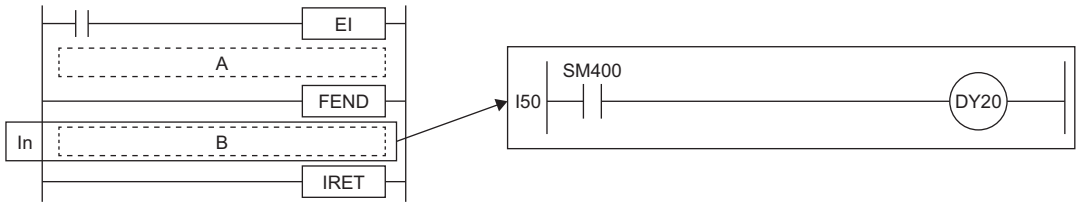
| XY signal | General/interrupt/pulse catch | Interrupt pointer |
|---|---|---|
| X22 | Interrupt (Rising) | I50 |






Program the processing required for preset input with the interrupt program of I50.

In the following example, DY20 is directly output when an interrupt of I50 occurs (when CH9 preset input is enabled).




A: Sequence program

B: Interrupt program

## ■Timing at which the instruction is enabled

The DHSCS, DHSCR, DHSZ instructions are enabled at the END instruction for the scan in which the instructions are driven. Even when the comparison value is changed, it is updated at the END instruction for the scan in which it was changed.

## ■Configuring high-speed comparison tables with parameters

Operations of DHSCS, DHSCR, DHSZ instructions of the same comparison value are executed after high-speed comparison tables set with parameters. The high-speed comparison table is processed sequentially from the top of the table.

## ■High-speed counter current value modification operation by instructions

The table below shows the operations when the current value of a high-speed counter is rewritten by instructions.

| Instruction | High-speed counter current value |
|---|---|
| HCMOV/DHCMOV instruction | ☞ Page 280 Special relays/special registers capable of high-speed transfers with the HCMOV/DHCMOV instruction |
| MOV instruction, etc. | |
| RST instruction | Cannot reset. The special register value is overwritten in END processing. |
| ZRST instruction | Cannot reset. The special register value is overwritten in END processing. |

## ■Limitation in the number of instances of each instruction in a program and number of instructions driven at the same time

When DHSCS, DHSCR, DHSZ instructions are driven at the same time in excess of the upper limit, the instructions after the upper limit do not operate.

| Instruction | Limitation in number of instructions driven at same time |
|---|---|
| DHSCS | Up to 32 instructions can be driven at the same time.<br>There is no limitation in the number used in programs. |
| DHSCR | |
| DHSZ | |

• Configuring high-speed comparison tables with parameters

The number of instructions driven at the same time decreases by 1 for each high-speed comparison table driven by the HIOEN/DHIOEN instruction.

The HIOEN/DHIOEN instruction that drives the high-speed comparison table is capable of driving at the same time 32 instructions in the case of a CPU module and 15 instructions in the case of a high-speed pulse input/output module.

**Restriction**

Set up the program and configure the settings within the range calculated with the following equation due to the limitations described above.

• CPU module

32 ≥ Number of driven high-speed comparison tables + Number of DHSCS, DHSCR, DHSZ instructions driven at the same time

However, restriction of number of high-speed comparisons differs depending on the version. (☞ Page 971 Added and Enhanced Functions)

• High-speed pulse input/output module

15 ≥ Number of driven high-speed comparison tables

## ■User interrupt

During a program with interruption priority 1, the HIOEN/DHIOEN instruction cannot be executed to start or stop the high-speed counter of a high-speed pulse input/output module. (☞ Page 109 Interrupt priority)

## ■Operation when the all output disable flag (SM8034) is ON

When the all output disable flag (SM8034) is turned ON, the outputs that were turned ON by high-speed comparison tables, high-speed comparison instructions, or multi-point output high-speed tables are turned OFF. (The image remains ON.)

If SM8034 is turned OFF, the outputs that were turned OFF return to the original state.

For high-speed comparison tables and high-speed comparison instructions, high-speed counters do not stop and comparison processing is performed even when SM8034 is ON, and the image turns ON if there is a match. The actual output is output when SM8034 is OFF.

For multi-point output high-speed comparison tables, the high-speed counter for which the multi-point output high-speed comparison table is operating is stopped when SM8034 is turned ON, and multi-point output comparison processing is also stopped. High-speed counters and multi-point output high-speed comparison tables cannot be operated by turning OFF SM8034 and need to be restarted by the HIOEN/DHIOEN instruction.

The normal high-speed counter function continues to perform counting without being influenced by SM8034.

## ■Operation of high-speed comparison table and multiple point output high-speed comparison tables

Do not use the channel of the same high-speed counter on a high-speed comparison table and a multi-point output high-speed comparison table. An error may occur.

## Functions that share inputs and outputs

When using input/output for high-speed input/output function, other high-speed input/output functions cannot be used together depending on the combination. For details on the positioning function, refer to the following.

☞ Page 350 POSITIONING CONTROL FUNCTION



### ■FX5UJ CPU module

• Input

The following functions occupy inputs of the high-speed input/output function.

| Function | | Up to CH/axis | Device | Simultaneous useable function |
|---|---|---|---|---|
| Input interrupt*1 | Interrupt (Rising) | 8 CH | X0 to X17 | The functions other than high-speed counter (input A phase, input B phase) |
| | Interrupt (Falling) | | | |
| | Interrupt (Rising + Falling) | | | |
| | Interrupt (Rising) + Pulse Catch | | | Cannot be combined |
| High-speed counter | Input A phase | 8 CH*2 | X0 to X17 | — |
| | Input B phase | | | |
| | Input external preset | | | Input interrupt |
| | Input external enable | | | |
| Pulse width measurement | | 4 CH | X0, X1, X3, X4 | Input interrupt |
| Positioning | Near-point dog signal | 3 axis | X0 to X17 | • Input interrupt<br>• Zero signal |
| | Zero signal | 3 axis | X0 to X17 | • Input interrupt<br>• Near-point dog signal |
| | Interrupt input signal 1 (Normal mode) | 3 axis | X0 to X17 | Input interrupt |
| | External start signal | 3 axis | X0 to X17 | Input interrupt |

*1 If used simultaneously with another function, the input logic of the other function is applied.

*2 When external preset input and external enable input are used, the number of usable channels is decreased depending on the counter type.

• Output

The following functions occupy outputs of the high-speed input/output function. The following functions cannot be combined with other high-speed input/output functions.

| Function | | Up to CH/axis | Device |
|---|---|---|---|
| PWM*1 | | 4 CH | Y0 to Y7 |
| Positioning | PULSE | 3 axis | Y0 to Y2 |
| | SIGN | | Y0 to Y17 |
| | Clear signal | 3 axis | Y0 to Y17 |

*1 When positioning is not used, the output devices (Y) for which the positioning setting is enabled with parameters can be used as PWM outputs or general-purpose devices having no parameter.

### Precautions

Do not specify an output device (Y) used by the high-speed input/output function as the output destination of the high-speed comparison table. This may cause an unexpected operation.

## ■FX5S/FX5U/FX5UC CPU module

• Input

The following functions occupy inputs of the high-speed input/output function.

| Function | | Up to CH/axis | Device | Simultaneous useable function |
|---|---|---|---|---|
| Input interrupt*1 | Interrupt (Rising) | 8 CH | X0 to X17 | The functions other than high-speed counter (input A phase, input B phase) |
| | Interrupt (Falling) | | | |
| | Interrupt (Rising + Falling) | | | |
| | Interrupt (Rising) + Pulse Catch | | | Cannot be combined |
| High-speed counter | Input A phase | 8 CH*2 | X0 to X17 | — |
| | Input B phase | | | |
| | Input external preset | | | Input interrupt |
| | Input external enable | | | |
| Pulse width measurement | | 4 CH | X0 to X7 | Input interrupt |
| Positioning | Near-point dog signal | 4 axis | X0 to X17 | • Input interrupt<br>• Zero signal |
| | Zero signal | 4 axis | X0 to X17 | • Input interrupt<br>• Near-point dog signal |
| | Interrupt input signal 1 (Normal mode) | 4 axis | X0 to X17 | Input interrupt |
| | External start signal | 4 axis | X0 to X17 | Input interrupt |

*1 If used simultaneously with another function, the input logic of the other function is applied.

*2 When external preset input and external enable input are used, the number of usable channels is decreased depending on the counter type.

• Output

The following functions occupy outputs of the high-speed input/output function. The following functions cannot be combined with other high-speed input/output functions.

| Function | | Up to CH/axis | Device |
|---|---|---|---|
| PWM*1 | | 4 CH | Y0 to Y7 |
| Positioning | PULSE | 4 axis | Y0 to Y3 |
| | SIGN | | Y0 to Y17 |
| | CW | 2 axis | Y0, Y1 |
| | CCW | | Y2, Y3 |
| | Clear signal | 4 axis | Y0 to Y17 |

*1 When positioning is not used, the output devices (Y) for which the positioning setting is enabled with parameters can be used as PWM outputs or general-purpose devices having no parameter.

### Precautions

Do not specify an output device (Y) used by the high-speed input/output function as the output destination of the high-speed comparison table. This may cause an unexpected operation.

### ■High-speed pulse input/output module

• Input

The following functions occupy inputs of the high-speed input/output function. The channels and the axis numbers are in module internal order.

| Device*1 | Input interrupt*1*2 | High-speed counter | Pulse width measurement | Positioning |
|---|---|---|---|---|
| X□ | X□ | CH1 Input A phase | — | — |
| X□+1 | X□+1 | CH1 Input B phase/external preset | — | — |
| X□+2 | X□+2 | CH1 Input external preset | — | Axis2 Zero signal |
| X□+3 | X□+3 | CH2 Input A phase | CH1 | Axis2 Interrupt input signal 1 |
| X□+4 | X□+4 | CH2 Input B phase/external preset | CH2 | Axis1 Interrupt input signal 1 |
| X□+5 | X□+5 | CH2 Input external preset | — | Axis1 Zero signal |
| X□+6 | X□+6 | CH1 Input external enable | — | Axis2 External start signal |
| X□+7 | X□+7 | CH2 Input external enable | — | Axis1 External start signal |

*1 The number in □ is the head input number for each high-speed pulse input/output module.

*2 Simultaneous use with a function other than the high-speed counter (A phase/B phase input) is possible. However, use with the channel 2 external enable input of the high-speed counter is not possible. However, the input logic of other functions is applied.

• Output

The following functions occupy outputs of the high-speed input/output function. The channels and the axis numbers are in module internal order. The following functions cannot be combined with other high-speed input/output functions.

| Device*1 | PWM | Positioning |
|---|---|---|
| Y□ | — | Axis1 PULSE/CW |
| Y□+1 | CH1 | Axis2 PULSE/CW |
| Y□+2 | — | Axis1 Clear signal |
| Y□+3 | — | Axis2 Clear signal |
| Y□+4 | — | Axis1 SIGN/CCW |
| Y□+5 | CH2 | Axis2 SIGN/CCW |
| Y□+6 | — | — |
| Y□+7 | — | — |

*1 The number in □ is the head output number for each high-speed pulse input/output module.

#### Precautions

Do not specify an output device (Y) used by the high-speed input/output function as the output destination of the high-speed comparison table. This may cause an unexpected operation.

## Restrictions on simultaneous execution of the high-speed comparison table and high-speed comparison instructions

There is a limit in the number of simultaneous executions of the high-speed comparison table and high-speed comparison instructions (DHSCS, DHSCR, DHSZ instruction). Shown below are conditions included in the number of simultaneous executions.

| Item | CPU module | High-speed pulse input/output module |
|---|---|---|
| Maximum executions | 32 | 15 |
| High-speed counter function | • Drive high-speed comparison table (Drive HIOEN/DHIOEN instruction)<br>• Drive DHSCS, DHSCR, DHSZ instruction | • Drive high-speed comparison table (Drive HIOEN/DHIOEN instruction) |
| Positioning function | • Interrupt input signal 1 (High-speed mode) setting is enabled | • OPR setting is enabled<br>• Interrupt input signal 1 (High-speed mode) setting is enabled |

**Point**

- For the high-speed comparison table, only the tables driven by the HIOEN/DHIOEN instruction are included in the number of the simultaneous executions.
- When the positioning function setting is made, high-speed comparison table becomes occupied and is included in the number of simultaneous executions.

# 26.2 FX3-compatible High-speed Counter Function

FX3-compatible high-speed counter function is explained below.

## FX3-compatible high-speed counter function overview

The FX3 compatible high-speed counter can assign the input terminals compatible with FX3 and use the device equivalent to C235 to C255 of FX3 as LC35 to LC55 (high-speed counter). The FX3-compatible high-speed counter function is not supported in high-speed pulse input/output modules.
If the FX3 compatible high-speed counter is used, it is necessary to use the parameter to set the FX3 compatible high-speed counter to be valid.
This section describes the device (LC35 to LC55) of the FX3 compatible high-speed counter as an LC device.

**Point**

The FX3 compatible high-speed counter is convenient if it is used when a replacement is made from FX3 or for a similar occasion. If a high-speed counter is newly used, use the high-speed counter function of FX5.
(☞ Page 232 High-speed Counter Function)

## How to start/stop the high-speed counter using the LC device

When using a FX3-compatible high-speed counter by the UDCNTF instruction, perform starting/stopping the counting of the high-speed counter. For details of the UDCNTF instruction, refer to 📖MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks).

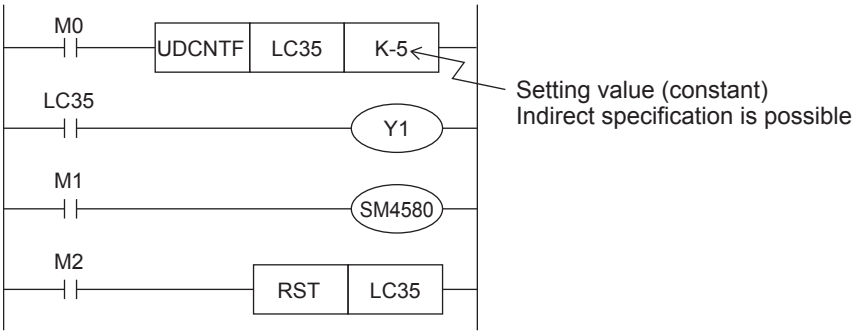
### Count direction switching

FX3-compatible high-speed count direction switching is performed by ON/OFF of the following methods.

- SM4580 to SM4595 (high-speed counter CH1 to CH16 (1-phase 1-input S/W) count direction switching)

### Programs example

In the case of a program shown below, the counting starts when M0 turns ON, and the counting stops when M0 turns OFF. When the counter increases from -6 or less to -5 or higher during an execution of the UDCNTF instruction, the counter contact turns ON, and the counter contact turns OFF when the counter decreases from -5 or higher to -6 or lower. ON/OFF of M1 switches the counting direction. To count from 0, turn ON M2 to reset LC35.



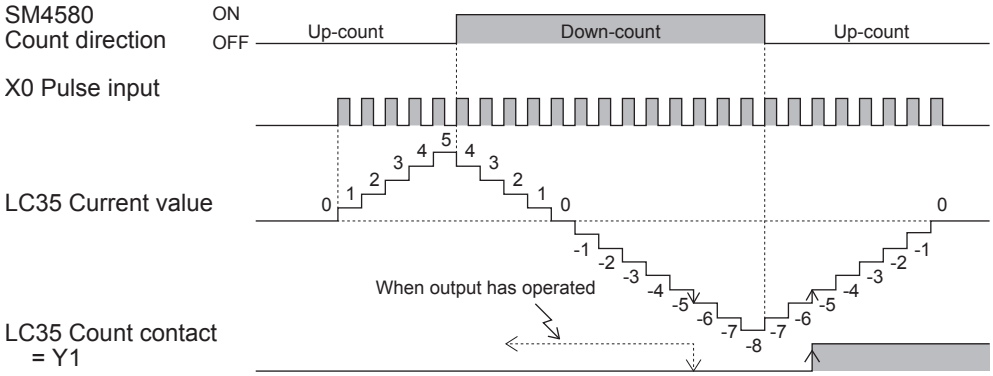

**Point**

- The current value of LC35 is updated when the UDCNTF instruction is executed.
- When LC35 is set to (s) of the DHCMOV instruction, the newest value can be read out.
- When a high-speed comparison instruction (DHSCS instruction, DHSCR instruction, DHSZ instruction), a high-speed comparison table, or a multi-point output high-speed comparison table are used, an accurate comparison and matched output processing can be executed.

The set value (positive or negative) can be specified by a constant (K) or the contents of data registers (D). When data registers are used, 32-bit data composed of two consecutive devices are treated as set values. If D0 is specified, the pair of D1 and D0 are the setting value of 32 bits.

## Operation example

The operation of LC35 in the programming example described above is as shown below.




# The elements of the composition of the LC device

Each element that composes the LC device is shown below.

| Item | Description |
|---|---|
| Counting coil | This is the activation contact to start the counting of the LC device. When the UDCNTF instruction is turned OFF→ON, the status turns ON and the counting of the input signal becomes possible. |
| Setting value | This is K○ specified with UDCNTF LC□ K○. An indirect specification is acceptable. |
| Current value | This is the current value of the counter. The value increases or decreases depending on the input pulse. |
| Counter contact | This turns ON when the current value of the LC device changes from a value less than the setting value to the setting value or higher. This can be used as LD LC□. |
| Reset coil | This turns ON when the RST instruction with the LC device specified turns OFF→ON, and turns OFF when the RST instruction turns ON→OFF. When the reset coil is ON, the counting is not executed even if the count coil is ON, and the current value is always 0. |

# The comparison between the UDCNTF instruction and HIOEN/DHIOEN instruction

The comparison between the UDCNTF instruction and the HIOEN/DHIOEN instruction is described below.

## The availability of use when the FX3 compatibility function is enable/disable

○: Use, —: Not use

| FX3-compatible function enable/disable | UDCNTF instruction | HIOEN/DHIOEN instruction |
|---|---|---|
| Disable | — | ○ |
| Enable | ○ | ○ |

**Point**

The LC device can be used as a high-speed counter only when the FX3 compatible function is valid. However, this is only the LC device that is set up with parameter. Also, it is possible to use the HIOEN/DHIOEN instruction.

## Starting/stopping the counting of the high-speed counter

The start and stop of the counting of the high-speed counter of the UDCNTF instructions and HIOEN/DHIOEN instructions with the FX3 compatible function valid are described below.

For the UDCNTF instruction or HIOEN/DHIOEN instruction, refer to MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks).

○: Supported, ×: Not supported, —: Not compatible

| Starting/stopping the counting of the high-speed counter | UDCNTF instruction | HIOEN/DHIOEN instruction |
|---|---|---|
| The start of the high-speed counter | ○ | ○ |
| The simultaneous start of multiple CH | × | ○ |
| The simultaneous stop of multiple CH | × | ○ |
| The start→stop and the stop→start of the same CH in one scan | ○ | ○ |
| The stop of the counter started by the UDCNTF instructions in the same step | ○ | — |
| The stop of the counter started by the UDCNTF instructions in a different step | ○ | × |
| The stop of the counter started by the HIOEN/DHIOEN instruction the same step | — | ○ |
| The stop of the counter started by the HIOEN/DHIOEN instruction a different step | ○ | ○ |

**Point**

- If the UDCNTF instructions and HIOEN/DHIOEN instructions are used for the same CH, it is not possible to use the HIOEN/DHIOEN instruction to stop the high-speed counter started by UDCNTF instructions. On the other hand, the instruction started by the HIOEN/DHIOEN instruction can be stopped by executing ON→OFF of UDCNTF instructions. Use caution when the HIOEN/DHIOEN instruction and UDCNTF instructions are used together.
- Do not drive the same LC device number at the same time.
- Do not duplicate output (double coil) the same LC device number with multiple instructions.

## The operation of each element of the current value of a started counter and the LC device

Shown below is the operations of the SD device, the current value of the LC device, and each element of the LC device when the counting is started with UDCNTF instructions or is started with the HIOEN/DHIOEN instruction while the FX3 compatible function is valid.

○: Operate, ×: Not operate

| The current value of the SD device, each element of the LC device | The start with UDCNTF instruction | The start with HIOEN/DHIOEN instruction |
|---|---|---|
| The current value of the SD device | ○ | ○ |
| The current value of the LC device | ○ | ○ |
| The LC device counting coil | ○ | × |
| The counter contact point of the LC device | ○ | × |
| The reset coil of the LC device | ○ | ○ |

**Point**

- When a count is started by HIOEN/DHIOEN instruction, although LC device changes, neither a counting coil nor the counter contact operates. Moreover, when operation is started by HIOEN/DHIOEN instruction and LC□ corresponding to CH is reset, during the RST instruction ON, operation is stopped and calculation is resumed in OFF of the RST instruction.

# Assignment for FX3-compatible high-speed counters

## The high-speed counter number that can be specified with each CH

Shown here are the high-speed counter numbers (C235 to C255) of FX3 that can be selected with each CH.

○: Change is possible, —: Change is impossible

| CH | High-speed counter No. | Pulse input mode | Corresponding devices | Preset input logic change |
|---|---|---|---|---|
| CH1 | C235 | 1-phase 1-count (S/W) | LC35 | — |
| CH1 | C241 | 1-phase 1-count (S/W) | LC41 | ○ |
| CH1 | C244 | 1-phase 1-count (S/W) | LC44 | ○ |
| CH1 | C246 | 1-phase 2-count | LC46 | — |
| CH1 | C247 | 1-phase 2-count | LC47 | ○ |
| CH1 | C249 | 1-phase 2-count | LC49 | ○ |
| CH1 | C251 | 2-phase 2-count (1 edge count/4 edge count) | LC51 | — |
| CH1 | C252 | 2-phase 2-count (1 edge count/4 edge count) | LC52 | ○ |
| CH1 | C254 | 2-phase 2-count (1 edge count/4 edge count) | LC54 | ○ |
| CH2 | C236 | 1-phase 1-count (S/W) | LC36 | — |
| CH3 | C237 | 1-phase 1-count (S/W) | LC37 | — |
| CH3 | C242 | 1-phase 1-count (S/W) | LC42 | ○ |
| CH3 | C245 | 1-phase 1-count (S/W) | LC45 | ○ |
| CH4 | C238 | 1-phase 1-count (S/W) | LC38 | — |
| CH4 | C248 | 1-phase 2-count | LC48 | ○ |
| CH4 | C248 (OP) | 1-phase 2-count | LC48 | — |
| CH4 | C250 | 1-phase 2-count | LC50 | ○ |
| CH4 | C253 | 2-phase 2-count (1 edge count/4 edge count) | LC53 | ○ |
| CH4 | C253 (OP) | 2-phase 2-count (1 edge count/4 edge count) | LC53 | — |
| CH4 | C255 | 2-phase 2-count (1 edge count/4 edge count) | LC55 | ○ |
| CH5 | C239 | 1-phase 1-count (S/W) | LC39 | — |
| CH5 | C243 | 1-phase 1-count (S/W) | LC43 | ○ |
| CH6 | C240 | 1-phase 1-count (S/W) | LC40 | — |
| CH7 | C244 (OP) | 1-phase 1-count (S/W) | LC44 | — |
| CH7 | C254 (OP) | 2-phase 2-count (1 edge count) | LC54 | — |
| CH8 | C245 (OP) | 1-phase 1-count (H/W) | LC45 | — |

## The assignment of the high-speed counter and the maximum frequency when the FX3 compatible function is valid

Shown below is the assignment of the high-speed counter and the maximum frequency when the FX3 compatible function is valid.

| CH | High-speed counter No. | FX5 corresponding devices | X0 | X1 | X2 | X3 | X4 | X5 | X6 | X7 | Maximum frequency | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | FX5UJ CPU module | FX5U/ FX5UC CPU module (32 points type) | FX5U/ FX5UC CPU module (64 points or more type) |
| CH1 | C235 | LC35 | A | | | | | | | | 100 kHz | 200 kHz | 200 kHz |
| CH2 | C236 | LC36 | | A | | | | | | | 100 kHz | 200 kHz | 200 kHz |
| CH3 | C237 | LC37 | | | A | | | | | | 10 kHz | 200 kHz | 200 kHz |
| CH4 | C238 | LC38 | | | | A | | | | | 100 kHz | 200 kHz | 200 kHz |
| CH5 | C239 | LC39 | | | | | A | | | | 100 kHz | 200 kHz | 200 kHz |
| CH6 | C240 | LC40 | | | | | | A | | | 10 kHz | 200 kHz | 200 kHz |
| CH1 | C241 | LC41 | A | P | | | | | | | 100 kHz | 200 kHz | 200 kHz |
| CH3 | C242 | LC42 | | | A | P | | | | | 10 kHz | 200 kHz | 200 kHz |
| CH5 | C243 | LC43 | | | | | A | P | | | 100 kHz | 200 kHz | 200 kHz |
| CH1 | C244 | LC44 | A | P | | | | | E | | 100 kHz | 200 kHz | 200 kHz |
| CH7 | C244 (OP) | LC44 | | | | | | | A | | 10 kHz | 10 kHz | 200 kHz |
| CH3 | C245 | LC45 | | | A | P | | | | E | 10 kHz | 200 kHz | 200 kHz |
| CH8 | C245 (OP) | LC45 | | | | | | | | A | 10 kHz | 10 kHz | 200 kHz |
| CH1 | C246 | LC46 | A | B | | | | | | | 100 kHz | 200 kHz | 200 kHz |
| CH1 | C247 | LC47 | A | B | P | | | | | | 100 kHz | 200 kHz | 200 kHz |
| CH4 | C248 | LC48 | | | | A | B | P | | | 100 kHz | 200 kHz | 200 kHz |
| CH4 | C248 (OP) | LC48 | | | | A | B | | | | 100 kHz | 200 kHz | 200 kHz |
| CH1 | C249 | LC49 | A | B | P | | | | E | | 100 kHz | 200 kHz | 200 kHz |
| CH4 | C250 | LC50 | | | | A | B | P | | E | 100 kHz | 200 kHz | 200 kHz |
| CH1 | C251 (1 edge count) | LC51 | A | B | | | | | | | 100 kHz | 200 kHz | 200 kHz |
| CH1 | C251 (4 edge count) | LC51 | A | B | | | | | | | 25 kHz | 50 kHz | 50 kHz |
| CH1 | C252 (1 edge count) | LC52 | A | B | P | | | | | | 100 kHz | 200 kHz | 200 kHz |
| CH1 | C252 (4 edge count) | LC52 | A | B | P | | | | | | 25 kHz | 50 kHz | 50 kHz |
| CH4 | C253 (1 edge count) | LC53 | | | | A | B | P | | | 100 kHz | 200 kHz | 200 kHz |
| CH4 | C253 (4 edge count) | LC53 | | | | A | B | P | | | 25 kHz | 50 kHz | 50 kHz |
| CH4 | C253 (OP) (1 edge count) | LC53 | | | | A | B | | | | 100 kHz | 200 kHz | 200 kHz |
| CH4 | C253 (OP) (4 edge count) | LC53 | | | | A | B | | | | 25 kHz | 50 kHz | 50 kHz |
| CH1 | C254 (1 edge count) | LC54 | A | B | P | | | | E | | 100 kHz | 200 kHz | 200 kHz |
| CH1 | C254 (4 edge count) | LC54 | A | B | P | | | | E | | 25 kHz | 50 kHz | 50 kHz |
| CH7 | C254 (OP) | LC54 | | | | | | | A | B | 10 kHz | 10 kHz | 200 kHz |
| CH4 | C255 (1 edge count) | LC55 | | | | A | B | P | | E | 100 kHz | 200 kHz | 200 kHz |
| CH4 | C255 (4 edge count) | LC55 | | | | A | B | P | | E | 25 kHz | 50 kHz | 50 kHz |

A: Input A phase, B: Input B phase, P: Input external preset, E: Input external enable

# FX3-compatible high-speed counter setting

This section describes the setting of the case when the FX3 compatible high-speed counter is used.
FX3-compatible high-speed counter are set by GX Works3.

**Point**

- If a high-speed comparison table or a multi-point output high-speed comparison table is used, it is necessary to set the parameter in the same manner as the FX5 high-speed counter.
- It is necessary to specify also the input response time.



## Parameter setting

FX3-compatible high-speed counter parameter setting method is explained below.
For parameter setting of each operation, refer to the following.

- For FX3-compatible high-speed counters, refer to ☞ Page 295 FX3-compatible high-speed counter.
- For high-speed comparison table, refer to ☞ Page 254 High-speed comparison table.
- For multiple point output, high-speed comparison tables, refer to ☞ Page 257 Multiple point output, high-speed comparison tables.
- For input response time, refer to ☞ Page 318 General-purpose Input Functions.

# FX3-compatible high-speed counter

FX3 compatible high-speed counter setting method is explained below.

***1.*** Set the method of specifying the high-speed counter to "long counter setting".

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [Module Parameter] ⇨ [High Speed I/O] ⇨ "Input Function" ⇨ "High Speed Counter" ⇨ "Detailed Setting" ⇨ "Other"

### Window

| Item | CH |
|---|---|
| **Specification method for high speed counter** | **Select the high-speed counter for the FX3 series compatible input assignment.** |
| Specification method for high speed counter | Long Counter Specification |

### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Specification method for high speed counter | Set up whether or not to use FX3 compatibility assignment for high speed counter.<br>• When using FX5 high-speed counter, choose "normal".<br>• When using FX3 compatible high-speed counter, choose "long counter specification". | • Normal<br>• Long Counter Specification | Normal |

***2.*** Set up the FX3 compatible high-speed counter.

The counter number and function that can be specified are different from CH to CH. (☞ Page 293 Assignment for FX3-compatible high-speed counters)

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [Module Parameter] ⇨ [High Speed I/O] ⇨ "Input Function" ⇨ "High Speed Counter" ⇨ "Detailed Setting" ⇨ "Basic Settings"

## Window

| Item | CH1 | CH2 | CH3 |
|---|---|---|---|
| **Use/Do Not Use Counter** | **Set whether to use counter or not.** | | |
| Use/Not Use | Enable | Enable | Enable |
| **Counter device** | **Select the high-speed counter for the FX3 series compatible input assignment.** | | |
| Counter device | LC35 (Operation equivalent to C235) | LC36 (Operation equivalent to C236) | LC37 (Operation equivalent to C237) |
| **Operation Mode** | **Set operation mode.** | | |
| Operation Mode | Normal Mode | Normal Mode | Normal Mode |
| **Pulse Input Mode** | **Set pulse input mode.** | | |
| Pulse Input Mode | 1-Phase 1 Input (S/W Up/Down Switch) | 1-Phase 1 Input (S/W Up/Down Switch) | 1-Phase 1 Input (S/W Up/Down Switch) |
| **Preset Input** | **Set preset input.** | | |
| Preset Input Enable/Disable | Disable | Disable | Disable |
| Input logic | Positive Logic | Positive Logic | Positive Logic |
| Preset Value | 0 | 0 | 0 |
| Input Comparison Enable/Disable | Enable | Enable | Disable |
| Control Switch | Rising | Rising + Falling Edge | Falling |
| **Enable Input** | **Set enable input.** | | |
| Enable Input Enable/Disable | Disable | Disable | Disable |
| Input logic | Positive Logic | Positive Logic | Positive Logic |
| **Ring Length Setting** | **Set ring length.** | | |
| Ring Length Enable/Disable | Disable | Disable | Disable |
| Ring Length | 2147483648 | 2147483648 | 2147483648 |
| **Measurement Unit Time** | **Set the measurement unit time (ms) for the pulse density measurement mode and rotation speed measurement mode.** | | |
| Measurement Unit Time | 1000 | 1000 | 1000 |
| **No. of Pulse per Rotation** | **Set the number of pulses per rotation when using the rotation speed measurement mode.** | | |
| No. of Pulse per Rotation | 1000 | 1000 | 1000 |

## Displayed items

| Item | Description | Setting range | | Default |
|---|---|---|---|---|
| Use/Not Use | Set whether use counter or not. | • Disable<br>• Enable | | — |
| Counter device | Select the high speed counter of input assignment which is compatible with FX3. | CH1 | • LC35 (Operation equivalent to C235)<br>• LC41 (Operation equivalent to C241)<br>• LC44 (Operation equivalent to C244)<br>• LC46 (Operation equivalent to C246)<br>• LC47 (Operation equivalent to C247)<br>• LC49 (Operation equivalent to C249)<br>• LC51 (Operation equivalent to C251)<br>• LC52 (Operation equivalent to C252)<br>• LC54 (Operation equivalent to C254) | — |
| | | CH2 | • LC36 (Operation equivalent to C236) | |
| | | CH3 | • LC37 (Operation equivalent to C237)<br>• LC42 (Operation equivalent to C242)<br>• LC45 (Operation equivalent to C245) | |
| | | CH4 | • LC38 (Operation equivalent to C238)<br>• LC48 (Operation equivalent to C248)<br>• LC50 (Operation equivalent to C250)<br>• LC53 (Operation equivalent to C253)<br>• LC55 (Operation equivalent to C255)<br>• LC48 (Operation equivalent to C248(OP))<br>• LC53 (Operation equivalent to C253(OP)) | |
| | | CH5 | • LC39 (Operation equivalent to C239)<br>• LC43 (Operation equivalent to C243) | |
| | | CH6 | • LC40 (Operation equivalent to C240) | |
| | | CH7 | • LC44 (Operation equivalent to C244(OP))<br>• LC54 (Operation equivalent to C254(OP)) | |
| Counter device | Select the high speed counter of input assignment which is compatible with FX3. | CH8 | • LC45 (Operation equivalent to C245(OP)) | — |
| Operation Mode | Not available for FX3-compatible high-speed counters. | — | | — |
| Pulse Input Mode | Set pulse input mode. | • 2 Phase 1 Multiple<br>• 2 Phase 4 Multiple | | — |
| Preset Input Enable/ Disable | Not available for FX3-compatible high-speed counters | — | | — |

| Item | Description | Setting range | Default |
|---|---|---|---|
| Input logic | Sets preset input logic when preset input is enabled. | • Positive Logic<br>• Negative Logic | — |
| Preset Value | Not available for FX3-compatible high-speed counters. | — | — |
| Input Comparison Enable/ Disable | Sets whether to "enable" or "disable" input comparison when preset input is enabled. | • Disable<br>• Enable | — |
| Control Switch | Sets preset execution timing when preset input is enabled. | • Rising<br>• Falling<br>• Rising + Falling Edge<br>• Always During Input ON | — |
| Enable Input Enable/ Disable | Not available for FX3-compatible high-speed counters | — | — |
| Input logic | | | |
| Ring Length Enable/ Disable | | | |
| Ring Length | | | |
| Measurement Unit Time | | | |
| No. of Pulse per Rotation | | | |

**Point**

Parameters are enabled when the CPU module is powered ON or after a reset.

# Special relays/LC devices capable of high-speed transfers with the HCMOV/DHCMOV instruction

Shown below are the special relay/LC device that can read and write the latest value with the HCMOV/DHCMOV instruction when the FX3 compatible high-speed counter function is valid. When special relays and LC devices are specified for (s) and (d) of instructions other than the HCMOV/DHCMOV instruction, the operation is the same as that of the MOV/DMOV instruction.

The same operation as when the FX3 compatible high-speed counter is not valid is made for the special relay/special register capable of high-speed transfers with the HCMOV/DHCMOV instruction other than those described in the list below. (☞ Page 280 Special relays/special registers capable of high-speed transfers with the HCMOV/DHCMOV instruction)

## Special relay

○: High-speed transfer capable (special relay is immediately updated)

△: Normal transfer capable (special relay is updated in END processing)

×: Transfer not possible (read-only)

| Special relay | Function | Compatible with HCMOV/ DHCMOV instruction | | Compatible with MOV/ DMOV instruction | |
|---|---|---|---|---|---|
| | | (s) | (d) | (s) | (d) |
| SM8246 | LC46 counting direction monitoring | ○ | × | △ | × |
| SM8247 | LC47 counting direction monitoring | ○ | × | △ | × |
| SM8248 | LC48 counting direction monitoring | ○ | × | △ | × |
| SM8249 | LC49 counting direction monitoring | ○ | × | △ | × |
| SM8250 | LC50 counting direction monitoring | ○ | × | △ | × |
| SM8251 | LC51 counting direction monitoring | ○ | × | △ | × |
| SM8252 | LC52 counting direction monitoring | ○ | × | △ | × |
| SM8253 | LC53 counting direction monitoring | ○ | × | △ | × |
| SM8254 | LC54 counting direction monitoring | ○ | × | △ | × |
| SM8255 | LC55 counting direction monitoring | ○ | × | △ | × |

## LC device

○: High-speed transfer capable (special register is immediately updated)

△: Normal transfer capable (special register is updated in END processing)

×: Transfer not possible (read-only)

| LC device | Function | Compatible with DHCMOV instruction | | Compatible with DMOV instruction | |
|---|---|---|---|---|---|
| | | (s) | (d) | (s) | (d) |
| LC35 | High-speed counter current value (CH1) | ○ | ○ | △ | × |
| LC36 | High-speed counter current value (CH2) | ○ | ○ | △ | × |
| LC37 | High-speed counter current value (CH3) | ○ | ○ | △ | × |
| LC38 | High-speed counter current value (CH4) | ○ | ○ | △ | × |
| LC39 | High-speed counter current value (CH5) | ○ | ○ | △ | × |
| LC40 | High-speed counter current value (CH6) | ○ | ○ | △ | × |
| LC41 | High-speed counter current value (CH1) | ○ | ○ | △ | × |
| LC42 | High-speed counter current value (CH3) | ○ | ○ | △ | × |
| LC43 | High-speed counter current value (CH5) | ○ | ○ | △ | × |
| LC44 | High-speed counter current value (CH1)/High-speed counter current value (CH7) | ○ | ○ | △ | × |
| LC45 | High-speed counter current value (CH3)/High-speed counter current value (CH8) | ○ | ○ | △ | × |
| LC46 | High-speed counter current value (CH1) | ○ | ○ | △ | × |
| LC47 | High-speed counter current value (CH1) | ○ | ○ | △ | × |
| LC48 | High-speed counter current value (CH4) | ○ | ○ | △ | × |
| LC49 | High-speed counter current value (CH1) | ○ | ○ | △ | × |
| LC50 | High-speed counter current value (CH4) | ○ | ○ | △ | × |
| LC51 | High-speed counter current value (CH1) | ○ | ○ | △ | × |
| LC52 | High-speed counter current value (CH1) | ○ | ○ | △ | × |
| LC53 | High-speed counter current value (CH4) | ○ | ○ | △ | × |
| LC54 | High-speed counter current value (CH1)/High-speed counter current value (CH7) | ○ | ○ | △ | × |
| LC55 | High-speed counter current value (CH4) | ○ | ○ | △ | × |

# Precautions when using FX3-compatible high-speed counters

Shown below are the precautions for using the FX3 compatible high-speed counter. For any other precautions, see the precautions for each function.

- When the FX3 compatible function is valid, it is possible to specify the LC device in (s1) of the DHSCS instruction/DHSCR instruction and (s) of the DHSZ instruction. If an LC device that is not used as high-speed counter is specified, an error occurs, and the DHSCS instruction, the DHSCR instruction, and the DHSZ instruction do not operate.
- Set up the table with the CH number of the counter if the table number of the high-speed comparison table/the multi-point output high-speed comparison table needs to be specified.
- To clear the current value of the LC device, use the DHCMOV instruction or the RST instruction to clear it.
- Use the latch setting to use LC35 to LC55 with the high-speed counter of the FX3 compatible function.
- The reset coil of the LC device is cleared when the power is set from OFF to ON.
- For the functions that share inputs with FX3-compatible high-speed counter function, refer to ☞ Page 287 Functions that share inputs and outputs.

# 26.3 Pulse Width Measurement Function

This section describes the pulse width measurement function.



## Pulse width measurement function overview

Pulse width/period measurement of up to 12 channels is possible from the CPU module and the high-speed pulse input/output module. The pulse width/period measurement function stores the values of 0.5 μs ring counters at the input signal rising edge and falling edge to special data registers. This function also stores the difference in the counter values (pulse width) between the rising edge and the falling edge or stores the difference in the counter values (cycle) between the previous rising edge and the current rising edge to special data registers in units of 0.5 μs.

For the pulse width measurement function, input channel assignments, logical switch, and measurement mode settings are configured with parameters, and measurements are started/stopped using the HIOEN/DHIOEN instruction.

High-speed pulse input/output module is supported only for FX5UJ and FX5U/FX5UC CPU modules.

**Point**

To use the pulse width measurement function, parameter settings and the HIOEN/DHIOEN instruction are always required.

## Pulse width measurement specifications

This section describes the pulse width measurement function specifications.

### Pulse input signals

#### ■FX5S CPU module

Pulse width measurements can be used for a maximum of 4 channels.

The input device assignment is as follows. (fixed)

| CPU module | | | |
|---|---|---|---|
| CH1 | CH2 | CH3 | CH4 |
| X0 | X1 | X3 | X4 |

The table below shows the measurement frequencies.

| CPU module | Measurement frequencies |
|---|---|
| X0, X1, X3, X4 | 100 kHz |

The table below shows the measurement precision.

| Item | | Description |
|---|---|---|
| Possible measurement range | Cycle | 10 μs |
| | Pulse width | 10 μs |
| Maximum measurable signal width | | 1073s741ms823μs |
| Resolution | | 0.5 μs |

#### ■FX5UJ CPU module and high-speed pulse I/O module

Pulse width measurements can be used for a maximum of 12 channels. (CPU module 4CH + high-speed pulse input/output module 2CH × 4 modules)

The input device assignment is as follows. (Fixed for CPU modules)

| CPU module | | | | High-speed pulse I/O module*1 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | First module | | Second module | | Third module | | Fourth module | |
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 | CH9 | CH10 | CH11 | CH12 |
| X0 | X1 | X3 | X4 | X□+3 | X□+4 | X□+3 | X□+4 | X□+3 | X□+4 | X□+3 | X□+4 |

*1 The number in □ is the head input number for each high-speed pulse input/output module.

The table below shows the measurement frequencies.

• FX5UJ CPU module

| CPU module | Measurement frequencies |
|---|---|
| X0, X1, X3, X4 | 100 kHz |

• High-speed pulse input/output module

| High-speed pulse input/output module*2 | Measurement frequencies |
|---|---|
| X□+3, X□+4 | 200 kHz |

*2 The number in □ is the head input number for each high-speed pulse input/output module.

The table below shows the measurement precision.

• FX5UJ CPU module

| Item | | Description |
|---|---|---|
| Possible measurement range | Cycle | 10 μs |
| | Pulse width | 10 μs |
| Maximum measurable signal width | | 1073s741ms823μs |
| Resolution | | 0.5 μs |

• High-speed pulse input/output module

| Item | | Description |
|---|---|---|
| Possible measurement range | Cycle | 5 μs |
| | Pulse width | 5 μs |
| Maximum measurable signal width | | 1073s741ms823μs |
| Resolution | | 0.5 μs |

### ■FX5U/FX5UC CPU module and high-speed pulse input/output module

Pulse width measurements can be used for a maximum of 12 channels. (CPU module 4CH + high-speed pulse input/output module 2CH × 4 modules)

The input device assignment is as follows.

| CPU module | | | | High-speed pulse input/output module*1 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | First module | | Second module | | Third module | | Fourth module | |
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 | CH9 | CH10 | CH11 | CH12 |
| X0 to X7 (Any device can be set.) | | | | X□+3 | X□+4 | X□+3 | X□+4 | X□+3 | X□+4 | X□+3 | X□+4 |

*1 The number in □ is the head input number for each high-speed pulse input/output module.

The table below shows the measurement frequencies.

| FX5U-32M□, FX5UC-32M□ | FX5U-64M□, FX5U-80M□, FX5UC-64M□, FX5UC-96M□ | High-speed pulse input/output module*2 | Measurement frequencies |
|---|---|---|---|
| X0 to X5 | X0 to X7 | X□+3, X□+4 | 200 kHz |
| X6 to X7 | — | — | 10 kHz |

*2 The number in □ is the head input number for each high-speed pulse input/output module.

The table below shows the measurement precision.

| Item | | Description |
|---|---|---|
| Possible measurement range | Cycle | 5 μs |
| | Pulse width | 5 μs |
| Maximum measurable signal width | | 1073s741ms823μs |
| Resolution | | 0.5 μs |

## Pulse measurements

The pulse width and period are stored in special devices by the END instruction. (☞ Page 776 Special Relay List)

## Pulse width maximum value and minimum value

The maximum value and minimum value of the pulse width from the start of measurements are stored in special devices. (☞ Page 776 Special Relay List)

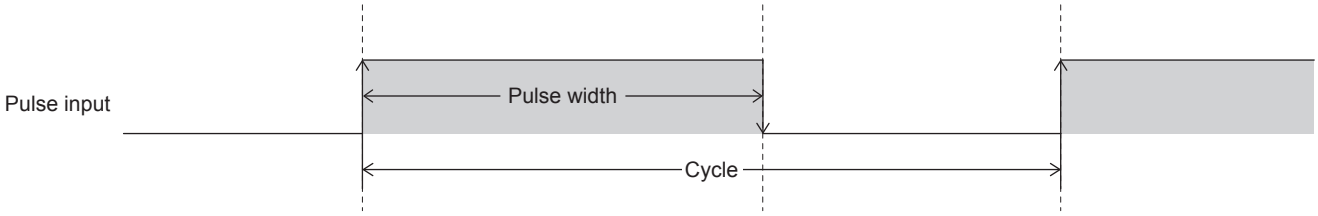
## Period maximum value and minimum value

The maximum value and minimum value of the period from the start of measurements are stored in special devices.
(☞ Page 776 Special Relay List)

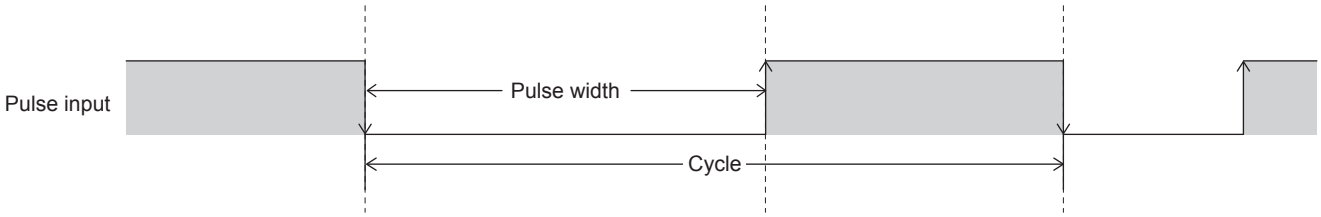
## Switching positive logic/negative logic

The pulse input logic can be switched.
Positive logic or negative logic can be set for each channel with parameter settings.

### ■Operation for positive logic




### ■Operation for negative logic




## Continuous measurement/one-time measurement mode

The pulse width measurement mode can be set.
The table below shows the measurement modes for pulse width measurements.

| Mode | Description |
|---|---|
| 1 time measurement mode | Measures the pulse width and period only once from the start of the measurement. |
| Always measurement mode | Constantly measures the pulse width and period. |

**Point**

The measurement mode can be changed by using a special relay. (☞ Page 776 Special Relay List)

## Signal delay time measurement

In a user program, the delay time between signals can be calculated from the rising or falling ring counters of 2 inputs.
(☞ Page 308 Examples of program)

# Pulse measurement function execution procedure

The pulse measurement function execution procedure is shown below.

***1.*** Check the pulse measurement specifications.

Check the specifications such as the measurement frequency of pulse measurements. (☞ Page 299 Pulse width measurement specifications)

***2.*** Connect the CPU module to the external device.

For details on wiring to external devices, refer to the following manual

MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)

***3.*** Set the parameters.

Configure the parameters such as the pulse measurement channel settings. (☞ Page 302 Pulse width measurement parameters)

***4.*** Create the program.

Create the program for using pulse measurements.

***5.*** Run the program.

# Pulse width measurement parameters

This section explains the parameters for pulse width measurement.

Set the parameters for pulse width measurement in GX Works3.

## Outline of parameters

Parameters for pulse width measurement are input allocation, logical switch, measurement modes and input response time.

## Parameter setting

The following explains how to set the parameters for pulse width measurement.

For input response time, refer to ☞ Page 318 General-purpose Input Functions.

### ■CPU module

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [Module Parameter] ⇨ [High Speed I/O] ⇨ "Input Function" ⇨ "Pulse Width Measurement" ⇨ "Detailed Setting"

#### Window

| Item | CH1 | CH2 | CH3 | CH4 |
|---|---|---|---|---|
| **Use Pulse Width Measurement** | **Set whether to use pulse width measurement or not.** | | | |
| Use/Not Use | Enable | Enable | Enable | Disable |
| **Input Signal** | **Set input signal.** | | | |
| Input Signal | X0 | X1 | X3 | X0 |
| **Switch Logic** | **Set switching logic.** | | | |
| Switch Logic | Positive Logic | Negative Logic | Positive Logic | Positive Logic |
| **Measurement Mode** | **Set measurement mode.** | | | |
| Measurement Mode | Always Measurement Mode | 1 Time Measurement Mode | 1 Time Measurement Mode | Always Measurement Mode |

#### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Use Pulse Width Measurement | Set whether to use pulse width measurement or not. | • Disable<br>• Enable | Disable |
| Input Signal | Set input signal. | ■FX5S/FX5UJ CPU module<br>CH1 (X0), CH2 (X1), CH3 (X3), CH4 (X4)<br>■FX5U/FX5UC CPU module<br>X0 to X7 | — |
| Logical Switch | Set logical switch. | • Positive Logic<br>• Negative Logic | — |
| Measurement Mode | Set measurement mode. | • Always Measurement Mode<br>• 1 Time Measurement Mode | — |

### ■High-speed pulse input/output module

Add the high-speed pulse input/output module.

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Right-click ⇨ Add New Module

After adding the high-speed pulse input/output module, make settings on the screen displayed from the following operation.

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ [1 to 16 (high-speed pulse input/output module)] ⇨ [Module Parameter] ⇨ [High Speed I/O] ⇨ "Input Function" ⇨ "Pulse Width Measurement" ⇨ "Detailed Setting"



#### Window

| Item | CH5 | CH6 |
|---|---|---|
| **Use Pulse Width Measurement** | **Set whether to use pulse width measurement or not.** | |
| Use/Not Use | Enable | Enable |
| **Input Signal** | **Set input signal.** | |
| Input Signal | X23 | X24 |
| **Switch Logic** | **Set switching logic.** | |
| Switch Logic | Positive Logic | Negative Logic |
| **Measurement Mode** | **Set measurement mode.** | |
| Measurement Mode | Always Measurement Mode | 1 Time Measurement Mode |

Shown above is the screen at the time when the first high-speed pulse input/output module is selected.

#### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Use Pulse Width Measurement | Set whether to use pulse width measurement or not. | • Disable<br>• Enable | Disable |
| Input Signal | Use input signal. The input number is fixed for each channel. | • CH□: X■+3*1<br>• CH□+1: X■+4*1 | — |
| Logical Switch | Set logical switch. | • Positive Logic<br>• Negative Logic | — |
| Measurement Mode | Set measurement mode. | • Always Measurement Mode<br>• 1 Time Measurement Mode | — |

*1 The number in □ is first module: 5, second module: 7, third module: 9, fourth module: 11.
The number in ■ is the head input number for each high-speed pulse input/output module.

**Point**

Parameters are enabled when the CPU module is powered ON or after a reset.

# Details of special relays/special registers

Details of special relays/special registers used in pulse width measurement are explained below.

## Pulse width measurement status flag

This flag is a device for monitoring the measurement in progress/measurement stopped status of pulse width measurement.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | First module | | Second module | | Third module | | Fourth module | |
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 | CH9 | CH10 | CH11 | CH12 |
| SM5020 | SM5021 | SM5022 | SM5023 | SM5024 | SM5025 | SM5026 | SM5027 | SM5028 | SM5029 | SM5030 | SM5031 |

### ■Update timing

This device turns ON when the HIOEN/DHIOEN instruction is executed. It turns OFF at the END instruction when the measurement mode is the 1 time measurement mode.

### ■Clear timing

The timing when the device is cleared is as follows.

- Power OFF→ON
- Reset
- STOP/PAUSE→RUN
- RUN→STOP/PAUSE
- When measurement is stopped by the HIOEN/DHIOEN instruction

## Period measurement complete

This flag turns ON at the end of the 1st period measurement. During measurement in the always measurement mode, it stays ON.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | First module | | Second module | | Third module | | Fourth module | |
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 | CH9 | CH10 | CH11 | CH12 |
| SM5036 | SM5037 | SM5038 | SM5039 | SM5040 | SM5041 | SM5042 | SM5043 | SM5044 | SM5045 | SM5046 | SM5047 |

### ■Update timing

Devices are updated by the END instruction.

### ■Clear timing

The timing when the device is cleared is as follows.

- Power OFF→ON
- Reset
- STOP/PAUSE→RUN
- The first END instruction after measurement is started by the HIOEN/DHIOEN instruction

**Point**

When the HCMOV/DHCMOV instruction is used, the latest value can be read.

## Pulse width measurement complete

This flag turns ON at the end of the 1st pulse width measurement. During measurement in the always measurement mode, it stays ON.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | First module | | Second module | | Third module | | Fourth module | |
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 | CH9 | CH10 | CH11 | CH12 |
| SM5052 | SM5053 | SM5054 | SM5055 | SM5056 | SM5057 | SM5058 | SM5059 | SM5060 | SM5061 | SM5062 | SM5063 |

### ■Update timing

Devices are updated by the END instruction.

### ■Clear timing

The timing when the device is cleared is as follows.

- Power OFF→ON
- Reset
- STOP/PAUSE→RUN
- The first END instruction after measurement is started by the HIOEN/DHIOEN instruction

**Point**

When the HCMOV/DHCMOV instruction is used, the latest value can be read.

## Measurement mode

The measurement mode can be checked. The measurement mode can also be changed by turning special relays ON/OFF.

OFF: Always measurement mode

ON: 1 time measurement mode

**Point**

Measurement mode is applied when measurement is started by the HIOEN/DHIOEN instruction.

If the measurement mode is changed during measurement, operation in the measurement mode after the change begins when the next measurement is started.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | First module | | Second module | | Third module | | Fourth module | |
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 | CH9 | CH10 | CH11 | CH12 |
| SM5068 | SM5069 | SM5070 | SM5071 | SM5072 | SM5073 | SM5074 | SM5075 | SM5076 | SM5077 | SM5078 | SM5079 |

### ■Clear timing

The timing when the device is cleared is as follows.

- Power OFF→ON
- Reset
- STOP/PAUSE→RUN

## Rising edge ring counter value

The ring counter value when the rising edge is detected is stored.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | First module | | Second module | | Third module | | Fourth module | |
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 | CH9 | CH10 | CH11 | CH12 |
| SD5021, SD5020 | SD5041, SD5040 | SD5061, SD5060 | SD5081, SD5080 | SD5101, SD5100 | SD5121, SD5120 | SD5141, SD5140 | SD5161, SD5160 | SD5181, SD5180 | SD5201, SD5200 | SD5221, SD5220 | SD5241, SD5240 |

### ■Update timing

Devices are updated by the END instruction.

### ■Clear timing

The timing when the device is cleared is as follows.

- Power OFF→ON
- Reset
- STOP/PAUSE→RUN

## Falling edge ring counter value

The ring counter value when the falling edge is detected is stored.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | First module | | Second module | | Third module | | Fourth module | |
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 | CH9 | CH10 | CH11 | CH12 |
| SD5023, SD5022 | SD5043, SD5042 | SD5063, SD5062 | SD5083, SD5082 | SD5103, SD5102 | SD5123, SD5122 | SD5143, SD5142 | SD5163, SD5162 | SD5183, SD5182 | SD5203, SD5202 | SD5223, SD5222 | SD5243, SD5242 |

### ■Update timing, clear timing

Same as the rising edge ring counter value (☞ Page 305 Rising edge ring counter value)

## Pulse width latest value

The latest value of the pulse width is stored.

**Point**

- When logic switching is set to positive logic, the difference from the falling edge up to the rising edge.
- When logic switching is set to negative logic, the difference from the rising edge up to the falling edge.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | First module | | Second module | | Third module | | Fourth module | |
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 | CH9 | CH10 | CH11 | CH12 |
| SD5025, SD5024 | SD5045, SD5044 | SD5065, SD5064 | SD5085, SD5084 | SD5105, SD5104 | SD5125, SD5124 | SD5145, SD5144 | SD5165, SD5164 | SD5185, SD5184 | SD5205, SD5204 | SD5225, SD5224 | SD5245, SD5244 |

### ■Update timing, clear timing

Same as the rising edge ring counter value (☞ Page 305 Rising edge ring counter value)

## Pulse width maximum value

The maximum value of the pulse width is stored.

**Point**

- When logic switching is set to positive logic, the difference from the falling edge up to the rising edge.
- When logic switching is set to negative logic, the difference from the rising edge up to the falling edge.
- The maximum value of the pulse width can be changed only by the HCMOV/DHCMOV instruction.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | First module | | Second module | | Third module | | Fourth module | |
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 | CH9 | CH10 | CH11 | CH12 |
| SD5027, SD5026 | SD5047, SD5046 | SD5067, SD5066 | SD5087, SD5086 | SD5107, SD5106 | SD5127, SD5126 | SD5147, SD5146 | SD5167, SD5166 | SD5187, SD5186 | SD5207, SD5206 | SD5227, SD5226 | SD5247, SD5246 |

### ■Update timing

Devices are updated by the END instruction.

When the HCMOV/DHCMOV instruction is executed, devices are updated immediately.

### ■Clear timing

The timing when the device is cleared is as follows.

- Power OFF→ON
- Reset
- STOP/PAUSE→RUN
- When "0" is written by the HCMOV/DHCMOV instruction

## Pulse width minimum value

The minimum value of the pulse width is stored.

**Point**

- When logic switching is set to positive logic, the difference from the falling edge up to the rising edge.
- When logic switching is set to negative logic, the difference from the rising edge up to the falling edge.
- The minimum value of the pulse width can be changed only by the HCMOV/DHCMOV instruction.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | First module | | Second module | | Third module | | Fourth module | |
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 | CH9 | CH10 | CH11 | CH12 |
| SD5029, SD5028 | SD5049, SD5048 | SD5069, SD5068 | SD5089, SD5088 | SD5109, SD5108 | SD5129, SD5128 | SD5149, SD5148 | SD5169, SD5168 | SD5189, SD5188 | SD5209, SD5208 | SD5229, SD5228 | SD5249, SD5248 |

### ■Update timing, clear timing

Same as the pulse width maximum value (☞ Page 306 Pulse width maximum value)

## Period latest value

The latest value of the period is stored.

**Point**

- When logic switching is set to positive logic, the difference from the latest rising edge up to the previous rising edge.
- When logic switching is set to negative logic, the difference from the latest falling edge up to the previous falling edge.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | First module | | Second module | | Third module | | Fourth module | |
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 | CH9 | CH10 | CH11 | CH12 |
| SD5031, SD5030 | SD5051, SD5050 | SD5071, SD5070 | SD5091, SD5090 | SD5111, SD5110 | SD5131, SD5130 | SD5151, SD5150 | SD5171, SD5170 | SD5191, SD5190 | SD5211, SD5210 | SD5231, SD5230 | SD5251, SD5250 |

### ■Update timing, clear timing

Same as the rising edge ring counter value (☞ Page 305 Rising edge ring counter value)

## Period maximum value

The maximum value of the period is stored.

**Point**

- When logic switching is set to positive logic, the difference from the latest rising edge up to the previous rising edge.
- When logic switching is set to negative logic, the difference from the latest falling edge up to the previous falling edge.
- The maximum value of the period can be changed only by the HCMOV/DHCMOV instruction.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | First module | | Second module | | Third module | | Fourth module | |
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 | CH9 | CH10 | CH11 | CH12 |
| SD5033, SD5032 | SD5053, SD5052 | SD5073, SD5072 | SD5093, SD5092 | SD5113, SD5112 | SD5133, SD5132 | SD5153, SD5152 | SD5173, SD5172 | SD5193, SD5192 | SD5213, SD5212 | SD5233, SD5232 | SD5253, SD5252 |

### ■Update timing, clear timing

Same as the pulse width maximum value (☞ Page 306 Pulse width maximum value)

### Period minimum value

The minimum value of the period is stored.

**Point**

- When logic switching is set to positive logic, the difference from rising edge to rising edge.
- When logic switching is set to negative logic, the difference from the previous falling edge up to the latest falling edge.
- The minimum value of the period can be changed only by the HCMOV/DHCMOV instruction.

#### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | First module | | Second module | | Third module | | Fourth module | |
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 | CH9 | CH10 | CH11 | CH12 |
| SD5035, SD5034 | SD5055, SD5054 | SD5075, SD5074 | SD5095, SD5094 | SD5115, SD5114 | SD5135, SD5134 | SD5155, SD5154 | SD5175, SD5174 | SD5195, SD5194 | SD5215, SD5214 | SD5235, SD5234 | SD5255, SD5254 |

#### ■Update timing, clear timing

Same as the pulse width maximum value (☞ Page 306 Pulse width maximum value)

## Cautions when using the pulse width measurement function

- When the HCMOV/DHCMOV instruction is used, the latest ring counter value, pulse width, cycle, maximum value, and minimum value can be obtained.
- The measurement mode can be changed using the special relays. Note, however, that the measurement mode cannot be changed during pulse width measurement. To change the measurement mode, stop pulse width measurement, change the measurement mode and then resume measurement.
- Pulse measurement is possible only while in RUN status. Pulse width measurement is stopped by RUN→PAUSE and RUN→STOP.
- In a program with interruption priority 1, the HIOEN/DHIOEN instruction cannot be executed to start or stop pulse width measurement of the high-speed pulse input/output module.
- In a program with interruption priority 1, HCMOV/DHCMOV instruction specified with the following devices for the high-speed input/output module cannot be executed.

- Period measurement complete
- Pulse width measurement complete
- Rising edge ring counter value
- Falling edge ring counter value
- Pulse width latest value
- Pulse width maximum value
- Pulse width minimum value
- Period latest value
- Period maximum value
- Period minimum value

- For functions that share inputs with the pulse width measurement function, refer to ☞ Page 287 Functions that share inputs and outputs.

## Examples of program

An example of a program using the pulse width measurement function is explained below.

### Outline of operation

A program for measuring the delay time between the rising edges of input signals X1 and X2 on the FX5U CPU module is explained below.

## Parameter setting

This program assumes that parameters are set as follows.

Input signals X1 and X2 are assigned to CH1 (X1) and CH2 (X2) by parameters. CH3 and CH4 need not be set.

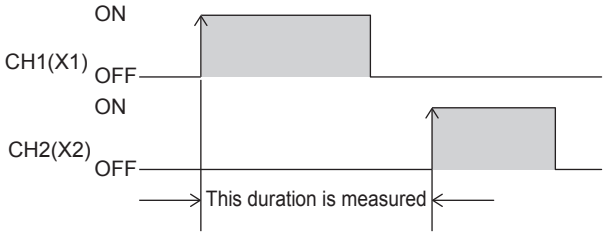
| Item | CH to be used | |
|---|---|---|
| | CH1 | CH2 |
| Input signal | X1 | X2 |
| Input logic switching | Positive logic | Positive logic |
| Measurement mode | Always measurement mode | Always measurement mode |



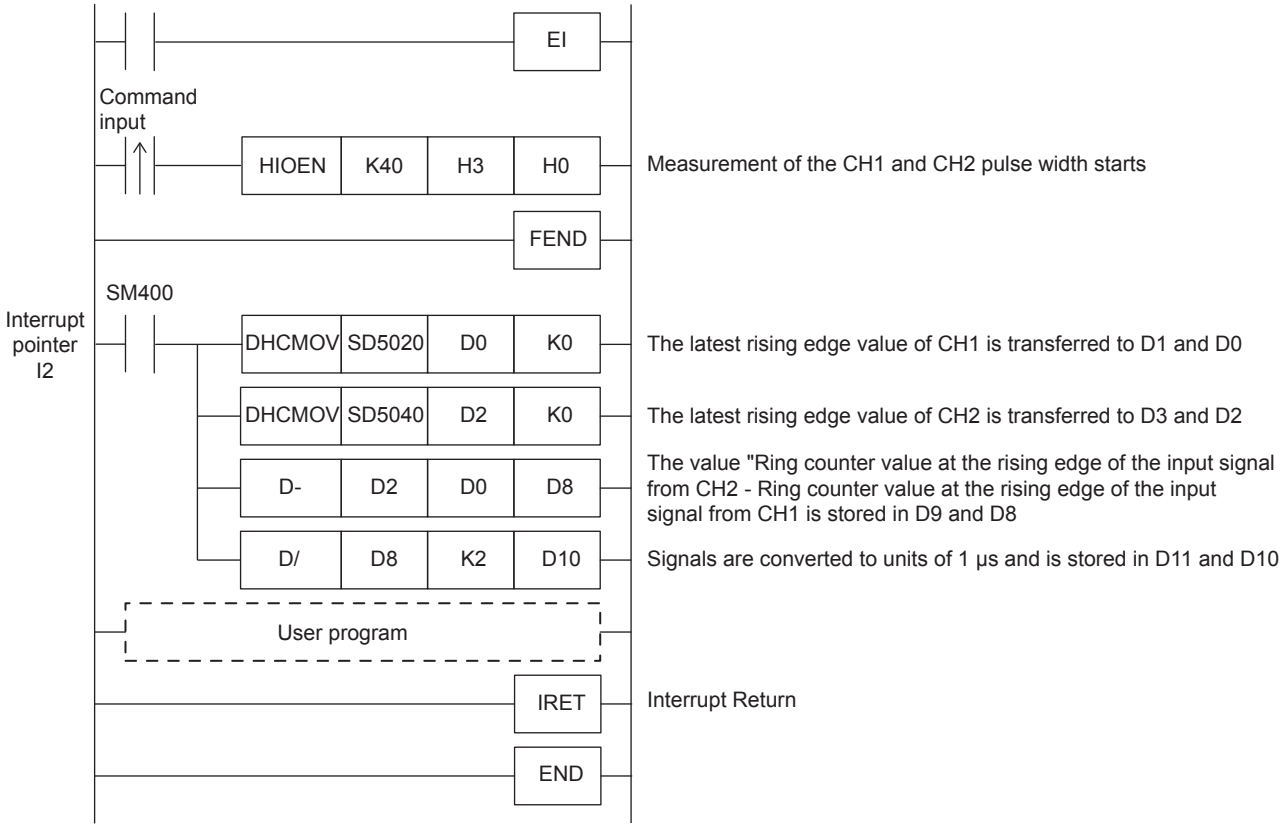
## Program

An operation diagram and program are shown below.

### ■Operation diagram




### ■Program




## Precautions

If high-speed pulse input/output module operates in an interrupt program with the priority 1, operation error (3580H) occurs.

The high-speed pulse input/output module operates in an interrupt program with the priority 2 or 3.

# 26.4 Pulse Catch Function

This section explains the pulse catch function.

## Outline of pulse catch function

The pulse catch function enables pulse signals that are incompletely sampled in regular input processing to be caught. Inputs X0 to X17 on the CPU module and all inputs on the high-speed pulse input/output module can be used on up to 40 channels (CPU module: 8 points, high-speed pulse input/output module 8 points × 4 modules).

To use the pulse catch function, pulse catch setting and the input response time must be set with parameters.

An FX3-compatible pulse catch function is mounted on only the CPU module. For details of functions, refer to ☞ Page 315 FX3-compatible Pulse Catch Function.

**Point**

The pulse catch function and FX3-compatible pulse catch function can be used simultaneously.

## Specifications of pulse catch function

The specifications of the pulse catch function are explained below.

### Performance specifications

Pulse catches can be used on inputs X0 to X17 of the CPU module and all inputs on the high-speed pulse input/output module.

#### ■FX5S CPU module

• Input response time

Input response times are shown below.

| FX5S-30M□, FX5S-40M□, FX5S-60M□, FX5S-80M□ | Input response time |
|---|---|
| X0, X1, X3, X4 | 10 μs |
| X2, X5, X6, X7 | 100 μs |
| X10 to X17 | 200 μs |

• Detectable pulse width

Pulse widths that satisfy the following condition can be detected.

Pulse input ON width > input response time

#### ■FX5UJ CPU module and high-speed pulse I/O module

• Input response time

Input response times are shown below.

| FX5UJ-24M□ | FX5UJ-40M□, FX5UJ-60M□ | High-speed pulse I/O module*1 | Input response time |
|---|---|---|---|
| X0, X1, X3, X4 | X0, X1, X3, X4 | X□ to X□+5 | 10μs |
| X2, X5, X6, X7 | X2, X5, X6, X7 | X□+6, X□+7 | 100μs |
| X10 to X15 | X10 to X17 | — | 200 μs |

*1 The number in □ is the head input number for each high-speed pulse input/output module.

• Detectable pulse width

Pulse widths that satisfy the following condition can be detected.

Pulse input ON width > input response time

### ■FX5U/FX5UC CPU module and high-speed pulse input/output module

• Input response time

Input response times are shown below.

| FX5U-32M□, FX5UC-32M□ | FX5U-64M□, FX5U-80M□, FX5UC-64M□, FX5UC-96M□ | High-speed pulse input/output module*1 | Input response time |
|---|---|---|---|
| X0 to X5 | X0 to X7 | X□ to X□+5 | 5 μs |
| X6 to X17 | X10 to X17 | X□+6, X□+7 | 100 μs |

*1 The number in □ is the head input number for each high-speed pulse input/output module.

• Detectable pulse width

Pulse widths that satisfy the following condition can be detected.

Pulse input ON width > input response time

**Point**

Pulses cannot be detected normally if the above condition is not satisfied. Set the input response time so that the above condition is satisfied.

## Pulse catch function execution procedure

The procedure for executing the pulse catch function is explained below.

***1.*** Check the pulse catch specifications.

Check specifications such as the input response time of the pulse catch. (☞ Page 310 Specifications of pulse catch function)

***2.*** Connect the CPU module to the external device.

For details on wiring to external devices, refer to the following manual

MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)

***3.*** Set the parameters.

Set the pulse catch setting and other parameters. (☞ Page 311 Pulse catch parameters)

***4.*** Create the program.

***5.*** Run the program.

## Pulse catch parameters

This section explains the pulse catch parameters.

Set the pulse catch parameters in GX Works3.

### Outline of parameters

Pulse catch parameters are pulse catch setting and input response time.

## Parameter setting

This section explains how to set pulse catch parameters.

For input response time, refer to ☞ Page 318 General-purpose Input Functions.

### ■CPU module

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [Module Parameter] ⇨ [High Speed I/O] ⇨ "Input Function" ⇨ "General/Interrupt/Pulse Catch" ⇨ "Detailed Setting"

#### Window

| No. | XY Signal | General/Interrupt/Pulse Catch |
|---|---|---|
| 1 | X0 | Interrupt (Rising) + Pulse Catch |
| 2 | X1 | General-purpose Input |
| 3 | X2 | General-purpose Input |
| 4 | X3 | General-purpose Input |
| 5 | X4 | General-purpose Input |
| 6 | X5 | General-purpose Input |
| 7 | X6 | General-purpose Input |
| 8 | X7 | General-purpose Input |
| 9 | X10 | General-purpose Input |
| 10 | X11 | General-purpose Input |
| 11 | X12 | General-purpose Input |
| 12 | X13 | General-purpose Input |
| 13 | X14 | General-purpose Input |
| 14 | X15 | General-purpose Input |
| 15 | X16 | General-purpose Input |
| 16 | X17 | General-purpose Input |

#### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| General/Interrupt/Pulse Catch | Set the function to be used.<br>Set to "Interrupt (Rising) + Pulse Catch". | • General-purpose Input<br>• Interrupt (Rising)<br>• Interrupt (Falling)<br>• Interrupt (Rising + Falling)<br>• Interrupt (Rising) + Pulse Catch | General-purpose Input |

### ■High-speed pulse input/output module

Add the high-speed pulse input/output module.

High-speed pulse input/output module is supported for FX5UJ/FX5U/FX5UC CPU modules.

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Right-click ⇨ Add New Module

After adding the high-speed pulse input/output module, make settings on the screen displayed from the following operation.

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ [1 to 16 (high-speed pulse input/output module)] ⇨ [Module Parameter] ⇨ "Input Function" ⇨ "General/Interrupt/Pulse Catch" ⇨ "Detailed Setting"

#### Window

| No. | XY Signal | General/Interrupt/Pulse Catch | Interrupt Pointer |
|---|---|---|---|
| 1 | X20 | Interrupt (Rising) + Pulse Catch | |
| 2 | X21 | General-purpose Input | |
| 3 | X22 | General-purpose Input | |
| 4 | X23 | General-purpose Input | |
| 5 | X24 | General-purpose Input | |
| 6 | X25 | General-purpose Input | |
| 7 | X26 | General-purpose Input | |
| 8 | X27 | General-purpose Input | |

Shown above is the screen at the time when the first high-speed pulse input/output module is selected.

### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| General/Interrupt/Pulse Catch | Set the function to be used.<br>Set to "Interrupt (Rising) + Pulse Catch". | • General-purpose Input<br>• Interrupt (Rising)<br>• Interrupt (Falling)<br>• Interrupt (Rising + Falling)<br>• Interrupt (Rising) + Pulse Catch | General-purpose Input |
| Interrupt Pointer | Set the interrupt pointer (I) which is assigned to each input.<br>The pulse catch function does not use an interrupt pointer. | I50 to I177 | — |

**Point**

Parameters are enabled when the CPU module is powered ON or after a reset.

# Operation of pulse catch function

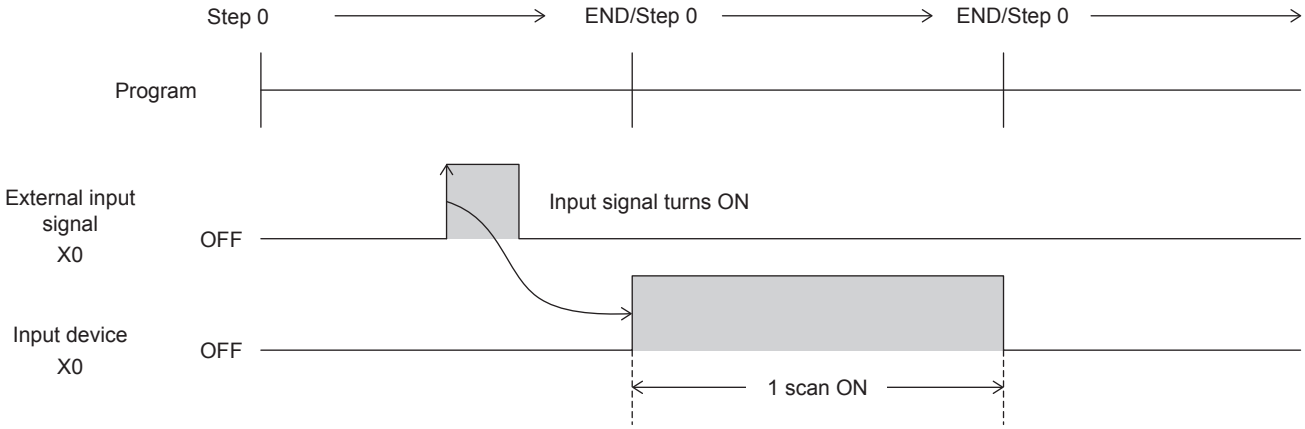
Operation of the pulse catch function is explained below.

## Basic operation of pulse catch function

The corresponding input device is turned ON for the duration of the scan following the scan where the pulse signal is detected. The input device is turned OFF at the END instruction.

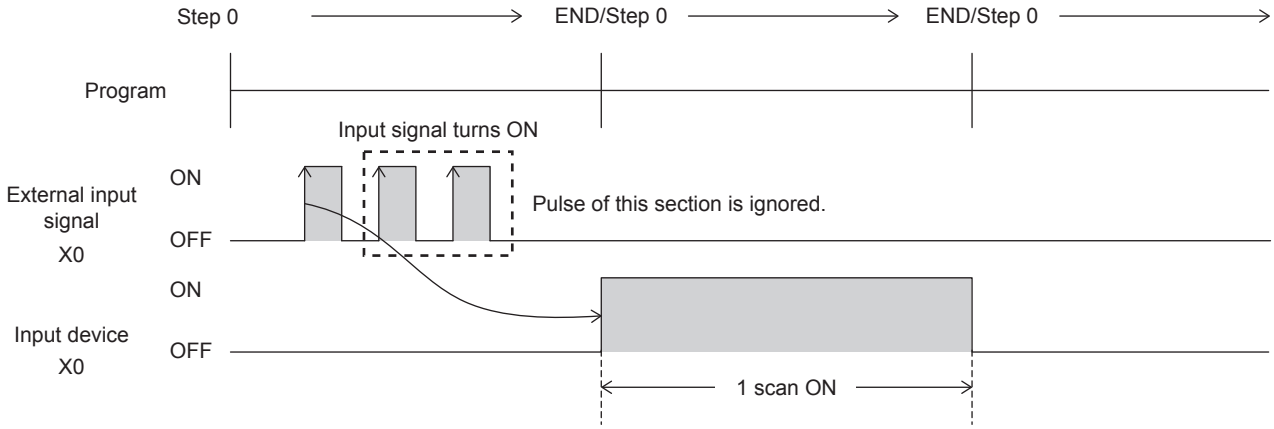
### ■Operation when input signal is used as pulse catch function

The rising edge of the external input signal (X0) is detected, and the input device is turned ON only during the following scan.



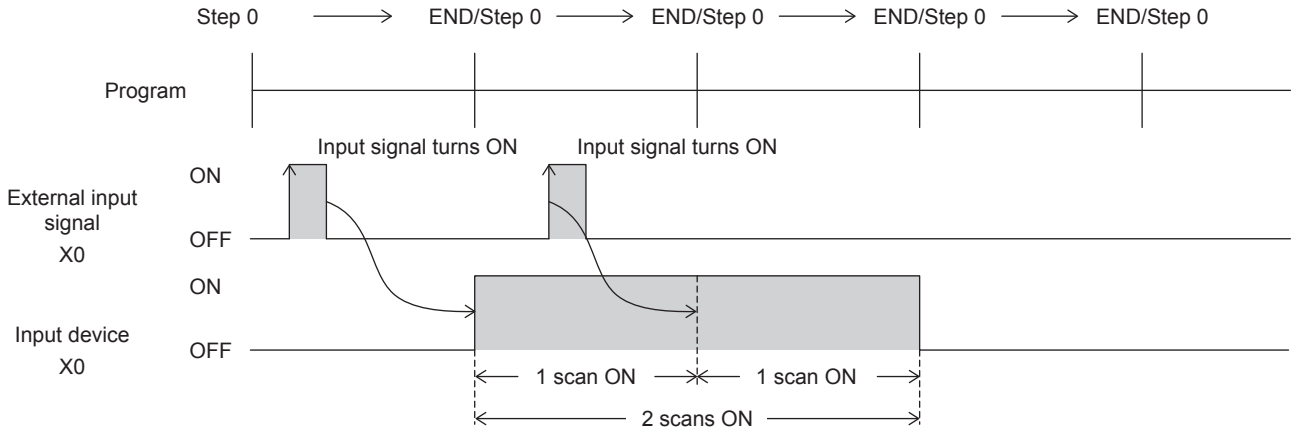

### ■Operation when multiple pulses are detected within one scan

The second pulse onwards is ignored. Input pulse signals at intervals of one scan or longer.



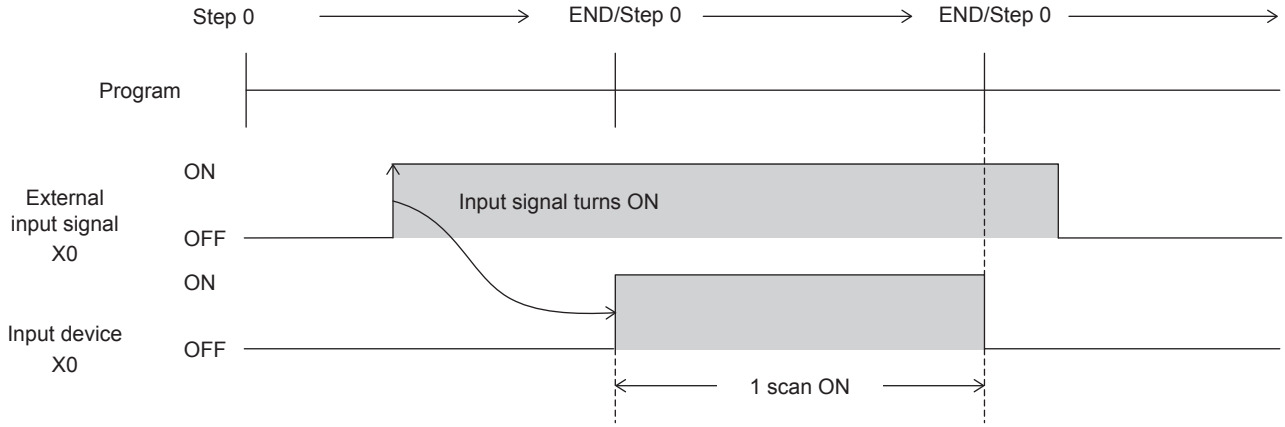
### ■Operation when the same pulse is detected for two scans or more

The input device is turned ON for the detected number of scans. Input pulse signals at intervals of one scan or longer.




### ■Operation when a pulse having an ON width of two scans or more is input

The input device is turned ON for one scan only.




## Cautions when using the pulse catch function

- The pulse catch function operates only when "Interrupt (Rising) + Pulse Catch" is set with parameters.
- The pulse catch function can be used on inputs X0 to X17 on the CPU module. Note, however, that these inputs can be used on up to 8 points.
- For the functions that share inputs with pulse catch function, refer to ☞ Page 287 Functions that share inputs and outputs.

Do not perform the following on inputs for which the pulse catch function is selected. Doing so results in the input device not turning ON normally in one scan after the pulse is detected.

- Use of direct device (DX)
- Execution of input refreshing during execution of the REF, RFS, MTR instructions, etc.

# 26.5 FX3-compatible Pulse Catch Function

This section explains the FX3-compatible pulse catch function.

## Outline of FX3-compatible pulse catch function

An FX3-compatible pulse catch function is mounted on the CPU module,
When the input signal X0 to X7 turns OFF→ON, a special relay (SM8170 to SM8177) is immediately set to ON by interrupt processing. Use of these special relays in a normal sequence program enables pulse signals that are incompletely sampled in regular input processing to be caught.
To use the FX3-compatible pulse catch function, pulse catch setting and the input response time must be set with parameters.
Functions equivalent to the MELSEC Q/L series pulse catch function are also mounted. For details of functions, refer to
☞ Page 310 Pulse Catch Function.

**Point**

The pulse catch function and FX3-compatible pulse catch function can be used simultaneously.

## Specifications of FX3-compatible pulse catch function

This specifications of the FX3-compatible pulse catch function are explained below.

### Performance specifications

FX3-compatible pulse catches can be used on inputs X0 to X7.

#### ■FX5S/FX5UJ CPU module

• Input response time

Input response times are shown below.

| FX5S/FX5UJ CPU module | Input response time |
|---|---|
| X0, X1, X3, X4 | 10 μs |
| X2, X5, X6, X7 | 100 μs |

• Assignment of input numbers and special relays

The assignments of input numbers and special relays are explained below.

| Input number | Corresponding special relay |
|---|---|
| X0 | SM8170 |
| X1 | SM8171 |
| X2 | SM8172 |
| X3 | SM8173 |
| X4 | SM8174 |
| X5 | SM8175 |
| X6 | SM8176 |
| X7 | SM8177 |

#### ■FX5U/FX5UC CPU module

• Input response time

Input response times are shown below.

| FX5U-32M□, FX5UC-32M□ | FX5U-64M□, FX5U-80M□, FX5UC-64M□, FX5UC-96M□ | Input response time |
|---|---|---|
| X0 to X5 | X0 to X7 | 5 μs |
| X6 to X7 | — | 100 μs |

• Assignment of input numbers and special relays

The assignments of input numbers and special relays are explained below.

| Input number | Corresponding special relay |
|---|---|
| X0 | SM8170 |
| X1 | SM8171 |
| X2 | SM8172 |
| X3 | SM8173 |
| X4 | SM8174 |
| X5 | SM8175 |
| X6 | SM8176 |
| X7 | SM8177 |

# FX3-compatible pulse catch function execution procedure

The procedure for executing the FX3-compatible pulse catch function is explained below.

***1.*** Check the FX3-compatible pulse catch specifications.

Check specifications such as the input response time and corresponding special relay of the FX3-compatible pulse catch. (☞ Page 315 Specifications of FX3-compatible pulse catch function)

***2.*** Connect the CPU module to the external device.

For details on wiring to external devices, refer to the following manual

📖MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)

***3.*** Set the parameters.

Set the pulse catch setting and other parameters. (☞ Page 316 FX3-compatible pulse catch parameters)

***4.*** Create the program.

Create the program for using pulse catch.

***5.*** Run the program.

# FX3-compatible pulse catch parameters

This section explains the FX3-compatible pulse catch parameters.

Set the FX3-compatible pulse catch parameters in GX Works3.

## Outline of parameters

FX3-compatible pulse catch parameters are pulse catch setting and input response time.

For input response time, refer to ☞ Page 318 General-purpose Input Functions.

## Parameter setting

This section explains how to set FX3-compatible pulse catch parameters.

### ■CPU module

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [Module Parameter] ⇨ [High Speed I/O] ⇨ "Input Function" ⇨ "General/Interrupt/Pulse Catch" ⇨ "Detailed Setting"

#### Window

| No. | XY Signal | General/Interrupt/Pulse Catch |
|---|---|---|
| 1 | X0 | Interrupt (Rising) + Pulse Catch |
| 2 | X1 | General-purpose Input |
| 3 | X2 | General-purpose Input |
| 4 | X3 | General-purpose Input |
| 5 | X4 | General-purpose Input |
| 6 | X5 | General-purpose Input |
| 7 | X6 | General-purpose Input |
| 8 | X7 | General-purpose Input |

### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| General/Interrupt/Pulse Catch | Set the function to be used.<br>Set to "Interrupt (Rising)" or "Interrupt (Rising) + Pulse Catch". | • General-purpose Input<br>• Interrupt (Rising)<br>• Interrupt (Falling)<br>• Interrupt (Rising + Falling)<br>• Interrupt (Rising) + Pulse Catch | General-purpose Input |



**Point**

Parameters are enabled when the CPU module is powered ON or after a reset.

# Operation of FX3-compatible pulse catch function

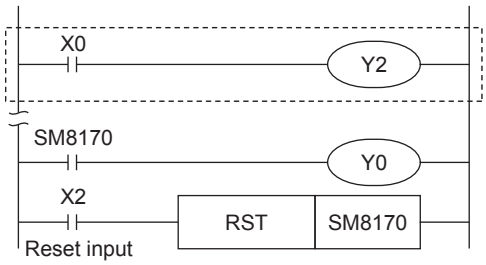
Operation of the FX3-compatible pulse catch function is explained below.

## Operation of FX3-compatible pulse catch function

When the status of the input (X0 to X7) changes OFF→ON, a special relay (SM8170 to SM8177) is immediately set to ON by interrupt processing. Pulse catch operates even when an input interrupt is also set in duplicate with other functions. Note, however, that the pulse catch must be set with parameters.

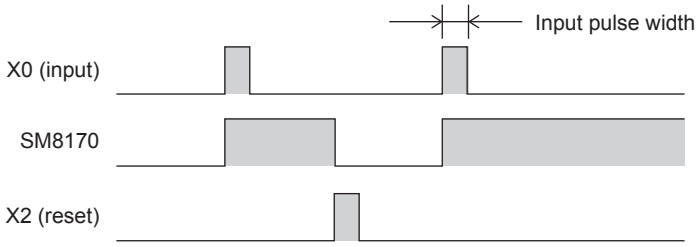
### ■Examples of program

When the status of the X0 changes OFF→ON, SM8170 is immediately set to ON by interrupt processing. To capture input again, turn X2 ON to reset SM8170. (X0 is assumed to be set with parameters.)




### ■Operation diagram

An operation diagram of the above program example is shown below.




# Cautions when using the FX3-compatible pulse catch function

- The FX3-compatible pulse catch function operates only when "Interrupt (Rising)" or "Interrupt (Rising) + Pulse Catch" is set with parameters.
- To capture input again, the special relay that is set must be reset by the program. Accordingly, new input cannot be captured until the special relay that is set is reset.
- The special relays for FX3-compatible pulse catch are cleared at STOP→RUN and a reset.
- The FX3-compatible pulse catch function is executed regardless of the operations of the special relays for disabling interrupts.
- The FX3-compatible pulse catch function is executed regardless of the operations of the EI, DI instruction.
- For the functions that share inputs with FX3-compatible pulse catch function, refer to ☞ Page 287 Functions that share inputs and outputs.

# 26.6 General-purpose Input Functions

The FX5 programmable controller general-purpose inputs are explained below.

## Outline of general-purpose input functions

For general-purpose inputs of the FX5 programmable controller, the input response time can be set by parameters.

## Specifications of general-purpose inputs

### Performance specifications

Input response times can be set to general-purpose inputs.

#### ■FX5S CPU module

• Input response time setting

Input response times that can be set are shown below. The default value is 10 ms.

| Input number set value | Input response time set value |
|---|---|
| X0 to X17 | No Setting, 10μs, 50μs, 0.1ms, 0.2ms, 0.4ms, 0.6ms, 1ms, 5ms, 10ms, 20ms, 70ms |

**Point**

- The value obtained by adding on the value of the hardware filter is the actual input response time.
- The input response time of X20 or later for the CPU module is invalid.

• Hardware filter value

The delay times of the hardware filter on the CPU module and high-speed pulse I/O module are shown below.

| Input number | Hardware filter value | |
|---|---|---|
| FX5S-30M□, FX5S-40M□, FX5S-60M□, FX5S-80M□ | ON | OFF |
| X0, X1, X3, X4 | 5 μs | 5 μs |
| X2, X5, X6, X7 | 30 μs | 50 μs |
| X10 to X17 | 50 μs | 150 μs |
| X20 or later | 10ms or less | 10ms or less |

• Input response time setting units

The following table lists the units (1 point unit/8 point unit) that can be set for the input response time of each CPU module.

| CPU module | X0 to X7 | X10 to X17 |
|---|---|---|
| FX5S CPU module | 1 point unit/8 points units | 1 point unit/8 points units |

#### ■FX5UJ CPU module

• Input response time setting

Input response times that can be set are shown below. The default value is 10 ms.

| Input number set value | Input response time set value |
|---|---|
| X0 to X377 | No Setting, 10 μs, 50 μs, 0.1 ms, 0.2 ms, 0.4 ms, 0.6 ms, 1 ms, 5 ms, 10 ms, 20 ms, 70 ms |

**Point**

- The value obtained by adding on the value of the hardware filter is the actual input response time.
- The input response time of X20 or later for the CPU module is invalid.

• Hardware filter value

The delay times of the hardware filter on the CPU module and high-speed pulse input/output module are shown below.
The hardware filter value of I/O modules is 50μs when the value is on, and 150μs when the value is off.

| Input number | | Hardware filter value | |
|---|---|---|---|
| FX5UJ-24M□ | FX5UJ-40M□, FX5UJ-60M□ | ON | OFF |
| X0, X1, X3, X4 | X0, X1, X3, X4 | 5 μs | 5 μs |
| X2, X5, X6, X7 | X2, X5, X6, X7 | 30 μs | 50 μs |
| X10 to X15 | X10 to X17 | 50 μs | 150 μs |
| — | X20 or later | Approx. 10ms | Approx. 10ms |

• Input response time setting units

The following table lists the units (1 point unit/8 point unit) that can be set for the input response time of each CPU module.

| CPU module | X0 to X7 | X10 to X17 |
|---|---|---|
| FX5UJ CPU module | 1 point unit/8 points units | 1 point unit/8 points units |

## ■FX5U/FX5UC CPU module

• Input response time setting

Input response times that can be set are shown below. The default value is 10 ms.

| Input number set value | Input response time set value |
|---|---|
| X0 to X577 | No Setting, 10 μs, 50 μs, 0.1 ms, 0.2 ms, 0.4 ms, 0.6 ms, 1 ms, 5 ms, 10 ms, 20 ms, 70 ms |

**Point**

The value obtained by adding on the value of the hardware filter is the actual input response time.

• Hardware filter value

The delay times of the hardware filter on the CPU module and high-speed pulse input/output module are shown below.
The hardware filter value of I/O modules is 50μs when the value is on, and 150μs when the value is off.

| Input number | | Hardware filter value | |
|---|---|---|---|
| FX5U-32M□, FX5UC-32M□ | FX5U-64M□, FX5U-80M□, FX5UC-64M□, FX5UC-96M□ | ON | OFF |
| X0 to X5 | X0 to X7 | 2.5 μs | 2.5 μs |
| X6 to X17 | X10 to X17 | 30 μs | 50 μs |
| — | X20 or later | 50 μs | 150 μs |

• Input response time setting units

The following table lists the units (1 point unit/8 point unit) that can be set for the input response time of each CPU module.

| CPU module | X0 to X7 | X10 to X17 | X20 to X27 | X30 to X37 | X40 to X47 | X50 to X57 |
|---|---|---|---|---|---|---|
| FX5U-32M□, FX5UC-32M□ | 1 point unit/8 points units | 1 point unit/8 points units | — | — | — | — |
| FX5U-64M□, FX5UC-64M□ | 1 point unit/8 points units | 1 point unit/8 points units | 1 point unit/8 points units | 1 point unit/8 points units | — | — |
| FX5U-80M□ | 1 point unit/8 points units | 1 point unit/8 points units | 1 point unit/8 points units | 1 point unit/8 points units | 8 points units*1 | — |
| FX5UC-96M□ | 1 point unit /8 point units | 1 point unit /8 point units | 1 point unit /8 point units | 1 point unit /8 point units | 8 point units*1 | 8 point units*2 |

*1 When 1 point unit is set for the input response time using GX Works3, X41 to X47 operate with the input response time set to X40.
*2 When 1 point unit is set for the input response time using GX Works3, X51 to X57 operate with the input response time set to X50.

### ■High-speed pulse input/output module

• Input response time setting

Input response times that can be set are shown below. The default value is 10 ms.

| Input number set value | Input response time set value |
|---|---|
| X0 to X577 | No Setting, 10 μs, 50 μs, 0.1 ms, 0.2 ms, 0.4 ms, 0.6 ms, 1 ms, 5 ms, 10 ms, 20 ms, 70 ms |

**Point**

The value obtained by adding on the value of the hardware filter is the actual input response time.

• Hardware filter value

The delay time of the hardware filter of the high-speed pulse input/output module is shown below.

The hardware filter value of I/O modules is 50μs when the value is on, and 150μs when the value is off.

| Input number | Hardware filter value | |
|---|---|---|
| High-speed pulse input/output module*1 | ON | OFF |
| X□ to X□+5 | 2.5 μs | 2.5 μs |
| X□+6, X□+7 | 30 μs | 50 μs |

*1 The number in □ is the head input number for each high-speed pulse input/output module.

• Input response time setting units

All the points of the high-speed pulse input/output module are in the unit of one point or 8 points.

# General-purpose input function parameters

This section explains the general-purpose input parameters.

Set the input response time parameters in GX Works3.

## Parameter setting

This section explains how to set the input response time parameters. Set the input response time.

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [Module Parameter] ⇨ [Input Response Time]

### Window

| Item | Setting |
|---|---|
| **X0-X7** | **Specify the input response time of X0 to X7.** |
| Response Type | High-Speed |
| X0 | 10ms |
| X1 | 10ms |
| X2 | 10ms |
| X3 | 10ms |
| X4 | 10ms |
| X5 | 10ms |
| X6 | 10ms |
| X7 | 10ms |
| **X10-X17** | **Specify the input response time of X10 to X17.** |
| Response Type | Normal |
| X10 | 10ms |
| X11 | 10ms |
| X12 | 10ms |
| X13 | 10ms |
| X14 | 10ms |
| X15 | 10ms |
| X16 | 10ms |
| X17 | 10ms |

Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Response Type | Select the input response time between 1 point unit and 8 point unit.<br>High-Speed: 1 point unit<br>Normal: 8 point units | • High-Speed<br>• Normal | — |
| ■FX5S CPU module<br>• X0 to X17<br>■FX5UJ CPU module<br>• X0 to X377<br>■FX5U/FX5UC CPU module<br>• X0 to X577 | Set the input response time. | • No Setting<br>• 10 μs<br>• 50 μs<br>• 0.1ms<br>• 0.2ms<br>• 0.4ms<br>• 0.6ms<br>• 1ms<br>• 5ms<br>• 10ms<br>• 20ms<br>• 70ms | 10ms |

**Point**

Parameters are enabled when the CPU module is powered ON or after a reset.

# 26.7 PWM Function

This chapter explains the PWM function.

## Outline of PWM output

The CPU module and the high-speed pulse input/output module allow PWM output on up to 12 channels.
For PWM output, the output channel assignment, pulse/cycle units, output pulse logic, pulse width, cycle, etc. are set using parameters, and the HIOEN/DHIOEN instruction is used to start/stop pulse output.
Also, the regular PWM/DPWM instruction can be used.
High-speed pulse input/output module is supported only for FX5UJ and FX5U/FX5UC CPU modules.

## PWM output specifications

The PWM output specifications are explained below.

### Number of output channels

#### ■FX5S CPU module

Up to 4 channels can be used for PWM output.
The output device assignment is as follows.

| CPU module | | | |
|---|---|---|---|
| CH1 | CH2 | CH3 | CH4 |
| Y0 to Y7 (Any device can be set.) | | | |

### ■FX5UJ/FX5U/FX5UC CPU module and high-speed pulse input/output module

Up to 12 channels (CPU module 4CH + high-speed pulse input/output module 2CH × 4 modules) can be used for PWM output.

The output device assignment is as follows.

| CPU module | | | | High-speed pulse input/output module*1 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | First module | | Second module | | Third module | | Fourth module | |
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 | CH9 | CH10 | CH11 | CH12 |
| Y0 to Y7 (Any device can be set.) | | | | Y□+1 | Y□+5 | Y□+1 | Y□+5 | Y□+1 | Y□+5 | Y□+1 | Y□+5 |

**Point**

Outputs (Y) assigned for PWM output in parameter settings cannot be used by the positioning function.

*1 The number in □ is the head output number for each high-speed pulse input/output module.

## Setting range of period and pulse width

The setting values that can be set for cycle and pulse width are shown below.

### ■FX5S CPU module

| Output number | Period | | Pulse width | |
|---|---|---|---|---|
| CPU module | 1 ms units | 1 μs units | 1 ms units | 1 μs units |
| Y0 to Y3 | 1 to 2147483 ms | 10 to 2147483647μs | 1 to 2147483 ms | 5 to 2147483647μs |
| Y4 to Y7 | 1 to 2147483 ms | 400 to 2147483647μs | 1 to 2147483 ms | 200 to 2147483647μs |

### ■FX5UJ CPU module

| Output number | Period | | Pulse width | |
|---|---|---|---|---|
| CPU module | 1 ms units | 1 μs units | 1 ms units | 1 μs units |
| Y0 to Y2 | 1 to 2147483 ms | 5 to 2147483647μs | 1 to 2147483 ms | 2 to 2147483647μs |
| Y3 to Y7 | 1 to 2147483 ms | 400 to 2147483647μs | 1 to 2147483 ms | 200 to 2147483647μs |

### ■FX5U/FX5UC CPU module

| Output number | Period | | Pulse width | |
|---|---|---|---|---|
| FX5U/FX5UC CPU module | 1 ms units | 1 μs units | 1 ms units | 1 μs units |
| Y0 to Y3 | 1 to 2147483 ms | 1 to 2147483647μs | 1 to 2147483 ms | 1 to 2147483647μs |
| Y4 to Y7 | 1 to 2147483 ms | 400 to 2147483647μs | 1 to 2147483 ms | 200 to 2147483647μs |

### ■High-speed pulse input/output module

| Output number | Period | | Pulse width | |
|---|---|---|---|---|
| High-speed pulse input/output module*1 | 1 ms units | 1 μs units | 1 ms units | 1 μs units |
| Y□+1, Y□+5 | 1 to 2147483 ms | 1 to 2147483647μs | 1 to 2147483 ms | 1 to 2147483647μs |

*1 The number in □ is the head output number for each high-speed pulse input/output module.

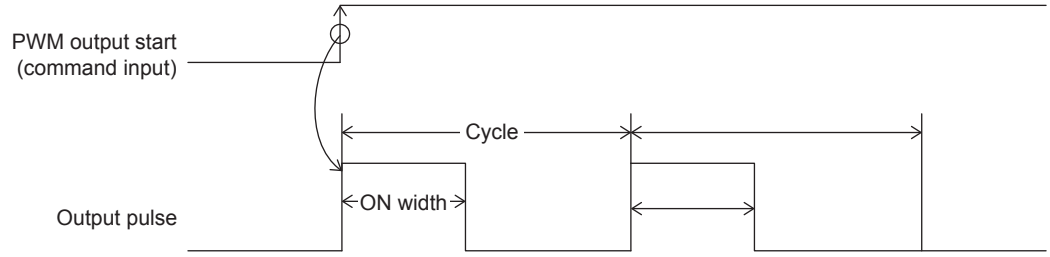
The response time for actual output varies depending on the connected load. Check the output specifications of the module that uses PWM outputs. For the output specifications, refer to the manual of each module.

## Relationship between cycle and pulse width

The relationship between period and pulse width is shown below.

### ■When positive logic is set

The relationship between the period and pulse width when the output pulse logic at start of pulse output is set to "Positive Logic" is shown below. (The pulse width is called the "ON width".)

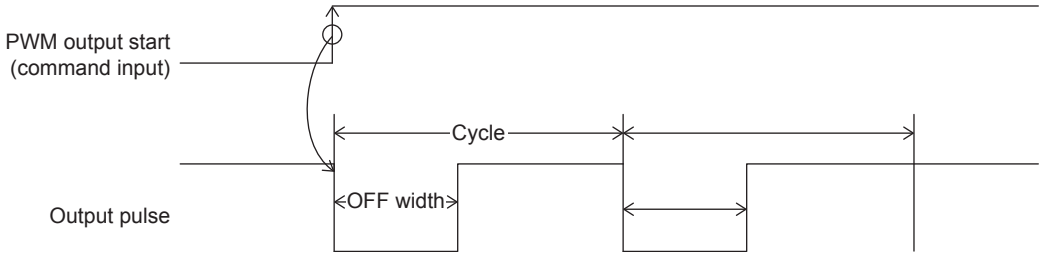



**Point**

- When positive logic is set, PWM output begins from output ON.)
- Pulse output is stopped at the specified number of pulses.
- Pulse output stops in the output (Y) status of before PWM output was started.

### ■When negative logic is set

The relationship between the period and pulse width when the output pulse logic at start of pulse output is set to "Negative Logic" is shown below. (The pulse width is called the "OFF width".)




**Point**

- When negative logic is set, PWM output begins when the output pulse turns OFF.
- Pulse output is stopped at the specified number of pulses.
- Pulse output stops in the output (Y) status of before PWM output was started.

## PWM driving method

PWM output is driven by either of the following methods.

### ■Driven by HIOEN/DHIOEN instruction

The logical settings like output destination, cycle, pulse width, output pulse logic, etc. are set in parameters, and the HIOEN/DHIOEN instruction is used to execute pulse output. For parameters, refer to ☞ Page 324 PWM output parameters.

For the HIOEN/DHIOEN instruction, refer to 🕮MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks).

### ■Driven by PWM/DPWM instruction

The PWM/DPWM instruction is used to execute pulse output.

For the PWM/DPWM instruction, refer to 🕮MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks).

# PWM output function execution procedure

The procedure for executing the PWM output function is explained below.

***1.*** Check the specifications of PWM output.

Check specifications such as pulse output performance of PWM output. (☞ Page 321 PWM output specifications)

***2.*** Connect the CPU module to the external device.

For details on wiring to external devices, refer to the following manual

MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)

***3.*** Set the parameters.

Set the output destination, cycle, pulse width, output pulse logic, etc. of the PWM in parameters, (☞ Page 324 PWM output parameters)

***4.*** Create the program.

Create the program for using PWM output.

***5.*** Run the program.

# PWM output parameters

This section explains the PWM output parameters.

Set the PWM output parameters in GX Works3.

## Outline of parameters

PWM output parameters are output destination, pulse width/cycle unit, output pulse logic, pulse width, and period.

## Parameter setting

This section explains how to set the PWM output parameters.

Set the output destination, pulse width/cycle unit, output pulse logic, pulse width, period, etc. of the channel to be used.

### ■CPU module

Navigation window ⇨ [Parameter] ⇨ [Module model name] ⇨ [Module Parameter] ⇨ [High Speed I/O] ⇨ "Output Function" ⇨ "PWM" ⇨ "Detailed Setting"

#### Window

| Item | CH1 | CH2 | CH3 | CH4 |
|---|---|---|---|---|
| **Use PWM Output** | **Set whether to use PWM output or not.** | | | |
| Use/Not Use | Enable | Enable | Disable | Enable |
| **Output Signal** | **Set the output destination device.** | | | |
| Output Signal | Y0 | Y1 | Y0 | Y3 |
| **Pulse Width/Cycle Unit** | **Set pulse width/cycle unit.** | | | |
| Pulse Width/Cycle Unit | 1ms | 1micro-s | 1ms | 1ms |
| **Output Pulse Logic** | **Set output pulse logic.** | | | |
| Output Pulse Logic | Positive Logic | Positive Logic | Positive Logic | Negative Logic |
| **Pulse Width** | **Set pulse width.** | | | |
| Pulse Width | 10 ms | 100 micro-s | 1 ms | 200 ms |
| **Cycle** | **Set cycle.** | | | |
| Cycle | 20 ms | 500 micro-s | 1 ms | 300 ms |

## Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Use PWM Output | Set whether to use PWM output or not. | • Disable<br>• Enable | Disable |
| Output Signal | Set the output destination device of output signal. | Y0 to Y7 | — |
| Pulse Width/Cycle Unit | Set pulse width/cycle unit. | • 1ms<br>• 1 μs | — |
| Output Pulse Logic | Sets output pulse logic. | • Positive Logic<br>• Negative Logic | — |
| Pulse Width | Sets the ON/OFF width of the pulse. | ■FX5S CPU module<br>• When pulse width/period unit is set to 1ms<br>Y0 to Y3: 1 to 2147483ms<br>Y4 to Y7: 1 to 2147483ms<br>• When pulse width/period unit is set to 1 μs<br>Y0 to Y3: 5 to 2147483647 μs<br>Y4 to Y7: 200 to 2147483647 μs<br>■FX5UJ CPU module<br>• When pulse width/period unit is set to 1 ms<br>Y0 to Y2: 1 to 2147483ms<br>Y3 to Y7: 1 to 2147483ms<br>• When pulse width/period unit is set to 1 μs<br>Y0 to Y2: 2 to 2147483647 μs<br>Y3 to Y7: 200 to 2147483647 μs<br>■FX5U/FX5UC CPU module<br>• When pulse width/period unit is set to 1 ms<br>Y0 to Y3: 1 to 2147483ms<br>Y4 to Y7: 1 to 2147483ms<br>• When pulse width/period unit is set to 1 μs<br>Y0 to Y3: 2 to 2147483647 μs<br>Y4 to Y7: 200 to 2147483647 μs | — |
| Cycle | Sets cycle. | ■FX5S CPU module<br>• When pulse width/period unit is set to 1ms<br>Y0 to Y3: 1 to 2147483ms<br>Y4 to Y7: 1 to 2147483ms<br>• When pulse width/period unit is set to 1 μs<br>Y0 to Y3: 10 to 2147483647 μs<br>Y4 to Y7: 400 to 2147483647 μs<br>■FX5UJ CPU module<br>• When pulse width/period unit is set to 1 ms<br>Y0 to Y2: 1 to 2147483ms<br>Y3 to Y7: 1 to 2147483ms<br>• When pulse width/period unit is set to 1 μs<br>Y0 to Y2: 5 to 2147483647 μs<br>Y3 to Y7: 400 to 2147483647 μs<br>■FX5U/FX5UC CPU module<br>• When pulse width/period unit is set to 1 ms<br>Y0 to Y3: 1 to 2147483ms<br>Y4 to Y7: 1 to 2147483ms<br>• When pulse width/period unit is set to 1 μs<br>Y0 to Y3: 5 to 2147483647 μs<br>Y4 to Y7: 400 to 2147483647 μs | — |

## ■High-speed pulse input/output module

Add the high-speed pulse input/output module.

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Right-click ⇨ Add New Module

After adding the high-speed pulse input/output module, make settings on the screen displayed from the following operation.

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ [1 to 16 (high-speed pulse input/output module)] ⇨ [Module Parameter] ⇨ "Output Function" ⇨ "PWM" ⇨ "Detail Setting"

### Window

| Item | CH5 | CH6 |
|---|---|---|
| **Use PWM Output** | **Set whether to use PWM output or not.** | |
| Use/Not Use | Enable | Enable |
| **Output Signal** | **Set the output destination device.** | |
| Output Signal | Y21 | Y25 |
| **Pulse Width/Cycle Unit** | **Set pulse width/cycle unit.** | |
| Pulse Width/Cycle Unit | 1ms | 1micro-s |
| **Output Pulse Logic** | **Set output pulse logic.** | |
| Output Pulse Logic | Positive Logic | Negative Logic |
| **Pulse Width** | **Set pulse width.** | |
| Pulse Width | 100 ms | 300 micro-s |
| **Cycle** | **Set cycle.** | |
| Cycle | 500 ms | 1000 micro-s |

Shown above is the screen at the time when the first high-speed pulse input/output module is selected.

### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Use PWM Output | Set whether to use PWM output or not. | • Disable<br>• Enable | Disable |
| Output Signal | The output destination device of output signal. The output number is fixed for each channel. | • CH□: Y■+1*1<br>• CH□+1: Y■+5*1 | — |
| Pulse Width/Cycle Unit | Set pulse width/cycle unit. | • 1ms<br>• 1 μs | — |
| Output Pulse Logic | Sets output pulse logic. | • Positive Logic<br>• Negative Logic | — |
| Pulse Width | Sets the ON/OFF width of the pulse. | • When pulse width/period unit is set to 1 ms<br>1 to 2147483 ms<br>• When pulse width/period unit is set to 1 μs<br>1 to 2147483647μs | — |
| Cycle | Sets cycle. | • When pulse width/cycle unit is set to 1 ms<br>1 to 2147483 ms<br>• When pulse width/period unit is set to 1 μs<br>1 to 2147483647μs | — |

*1 The number in □ is first module: 5, second module: 7, third module: 9, fourth module: 11.
The number in ■ is the head output number for each high-speed pulse input/output module.

**Point**

The items specified in the parameters are stored in special devices when the CPU module is set from STOP to RUN.

# Details of special relays/special registers

Details of special relays/special registers used in PWM output are explained below.



## Operation monitor

This device is for monitoring the operation/stopped status of PWM output.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | First module | | Second module | | Third module | | Fourth module | |
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 | CH9 | CH10 | CH11 | CH12 |
| SM5300 | SM5301 | SM5302 | SM5303 | SM5304 | SM5305 | SM5306 | SM5307 | SM5308 | SM5309 | SM5310 | SM5311 |

### ■Update timing

The timing of device update is as follows.

| ON | OFF |
|---|---|
| • PWM output driven by HIOEN/DHIOEN instruction<br>• PWM/DPWM instruction ON execution | • PWM output stopped by HIOEN/DHIOEN instruction<br>• After end of output of the specified number of pulses<br>• PWM/DPWM instruction OFF execution<br>• Activation contact turned OFF<br>• Power OFF→ON, reset, RUN→STOP/PAUSE |

## PWM output complete flag

This device is for monitoring the completion status (normal completion) of PWM output.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | First module | | Second module | | Third module | | Fourth module | |
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 | CH9 | CH10 | CH11 | CH12 |
| SM5316 | SM5317 | SM5318 | SM5319 | SM5320 | SM5321 | SM5322 | SM5323 | SM5324 | SM5325 | SM5326 | SM5327 |

### ■Update timing

The timing of device update is as follows.

| ON | OFF |
|---|---|
| • At execution of the PWM/DPWM, HIOEN/DHIOEN instruction or the END processing after the output of the specified pulse count is output | • Power OFF→ON, reset, STOP/PAUSE→RUN<br>• When pulse output starts<br>• When turned OFF by the user |

**Point**

If the number of output pulses is set to "0" (unlimited output), PWM output complete flag is not turned ON.

## PWM output abnormal end flag

This device is for monitoring the end status (abnormal end) of PWM output.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | First module | | Second module | | Third module | | Fourth module | |
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 | CH9 | CH10 | CH11 | CH12 |
| SM5332 | SM5333 | SM5334 | SM5335 | SM5336 | SM5337 | SM5338 | SM5339 | SM5340 | SM5341 | SM5342 | SM5343 |

### ■Update timing

The timing of device update is as follows.

| ON | OFF |
|---|---|
| • At stop of pulse output due to an error in the setting value of the pulse width, period, or output pulse count<br>• At stop of pulse output due to the relation of pulse width > period<br>• In the case of forced stop with SM8034 (all output disable) or output cannot be started | • Power OFF→ON, reset, STOP/PAUSE→RUN<br>• When pulse output starts<br>• When turned OFF by the user<br>• After forced stop by SM8034 (all output disable), SM8034 is turned off, and PWM output resumes (only when unlimited output) |

**Point**

The ON timing of the PWM output abnormal end flag includes startup of the PWM/DPWM, HIOEN/ DHIOEN instruction.

## Number of output pulses

The number of output pulses of PWM output is stored.

When "0" is set, output is continued without any limitation.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | First module | | Second module | | Third module | | Fourth module | |
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 | CH9 | CH10 | CH11 | CH12 |
| SD5301, SD5300 | SD5317, SD5316 | SD5333, SD5332 | SD5349, SD5348 | SD5365, SD5364 | SD5381, SD5380 | SD5397, SD5396 | SD5413, SD5412 | SD5429, SD5428 | SD5445, SD5444 | SD5461, SD5460 | SD5477, SD5476 |

### ■Update timing

The timing to reflect the device in operation is as follows.

- When the HCMOV/DHCMOV instruction is executed (values updated immediately)
- When the PWM/DPWM instruction is executed
- END processing

### ■Clear timing

The timing when the device is cleared is as follows.

- STOP/PAUSE→RUN

**Point**

- If the number of output pulses written is equal to or smaller than the number of pulses that have already been output, pulse output is stopped after the pulses being currently output are completed.
- If the number of output pulses written is greater than the number of pulses that have already been output, pulse output is stopped after the specified number of pulses are output.
- If the number of output pulses is set to "0" (output without any limitation), the value cannot be changed while pulses are being output.
- The number of output pulses cannot be changed to "0" (output without any limitation) while pulses are being output.

## Pulse width

The pulse width of PWM output is stored.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | First module | | Second module | | Third module | | Fourth module | |
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 | CH9 | CH10 | CH11 | CH12 |
| SD5303, SD5302 | SD5319, SD5318 | SD5335, SD5334 | SD5351, SD5350 | SD5367, SD5366 | SD5383, SD5382 | SD5399, SD5398 | SD5415, SD5414 | SD5431, SD5430 | SD5447, SD5446 | SD5463, SD5462 | SD5479, SD5478 |

### ■Update timing

The timing to reflect the device in operation is as follows.

- When the HCMOV/DHCMOV instruction is executed (values updated immediately)
- When the PWM/DPWM instruction is executed
- END processing

### ■Clear timing

The timing when the device is cleared is as follows.

- STOP/PAUSE→RUN

**Point**

- The pulse width and cycle can be changed even while pulses are being output.
- The pulse width and cycle are stored in the unit specified by the parameter (ms or μs).

## Period

The period of PWM output is stored.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CPU module | | | | High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | First module | | Second module | | Third module | | Fourth module | |
| CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 | CH9 | CH10 | CH11 | CH12 |
| SD5305, SD5304 | SD5321, SD5320 | SD5337, SD5336 | SD5353, SD5352 | SD5369, SD5368 | SD5385, SD5384 | SD5401, SD5400 | SD5417, SD5416 | SD5433, SD5432 | SD5449, SD5448 | SD5465, SD5464 | SD5481, SD5480 |

### ■Update timing

The timing to reflect the device in operation is as follows.

- When the HCMOV/DHCMOV instruction is executed (values updated immediately)
- When the PWM/DPWM instruction is executed
- END processing

### ■Clear timing

The timing when the device is cleared is as follows.

- STOP/PAUSE→RUN

**Point**

- The pulse width and cycle can be changed even while pulses are being output.
- The pulse width and cycle are stored in the unit specified by the parameter (ms or μs).

## Number of output pulses current value monitor

The current value of the number of output pulses of PWM output is stored.

### ■Corresponding devices

The device numbers corresponding to each channel are as follows.

| CH1 | CH2 | CH3 | CH4 |
|---|---|---|---|
| SD5307, SD5306 | SD5323, SD5322 | SD5339, SD5338 | SD5355, SD5354 |

### ■Update timing

The timing to reflect the device in operation is as follows.

- When the HCMOV/DHCMOV instruction is executed (values updated immediately)
- When the PWM/DPWM instruction is executed
- END processing

### ■Clear timing

The timing when the device is cleared is as follows.

- Power OFF→ON
- Reset
- STOP/PAUSE→RUN

**Point**

- If the number of output pulses is set to "0" (output without any limitation), the number of output pulse current value monitor is fixed at "0".
- The number of output pulse current value monitor can be changed even while pulses are being output.

# Cautions when using the PWM function

- Set the pulse width and period for each module as follows.

| Module | Pulse width | Period |
|---|---|---|
| FX5S CPU module | 5μs or more | 10μs or more |
| FX5UJ CPU module | 2μs or more | 5μs or more |
| FX5U/FX5UC CPU module | | |
| High-speed pulse input/output module | | |

- Set the value so that pulse width ≤ period.
- The PWM/DPWM instruction is not executed when a channel number not selected for PWM output in parameters setting is specified by the PWM/DPWM instruction.
- If the all output disable flag (SM8034) is turned ON while PWM is output, PWM output is stopped. However, when the number of output pulses is "0" (unlimited output), the operation restarts when SM8034 is turned OFF.
- In a program with interruption priority 1, the HCMOV/DHCMOV instruction specified with the following devices cannot be executed.

- Number of output pulses
- Pulse width
- Period

- For functions that share outputs with the PWM function, refer to ☞ Page 287 Functions that share inputs and outputs.

# Examples of program

An example of a program using the PWM function is explained below.

## Outline of operation

An example of a program using output Y0 on the FX5U CPU module to output one pulse with a delay is explained below.



## Parameter setting

This program assumes that parameters are set as follows.

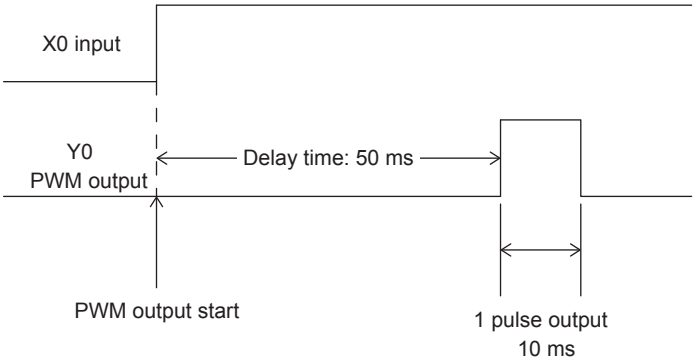
CH2, CH3 and CH4 need not be set.

| Item | CH to be used |
|---|---|
| | CH1 |
| Output destination | Y0 |
| Output pulse logic | Negative logic (Output from OFF) |
| Pulse width | 50 ms |
| Cycle | 60 ms |

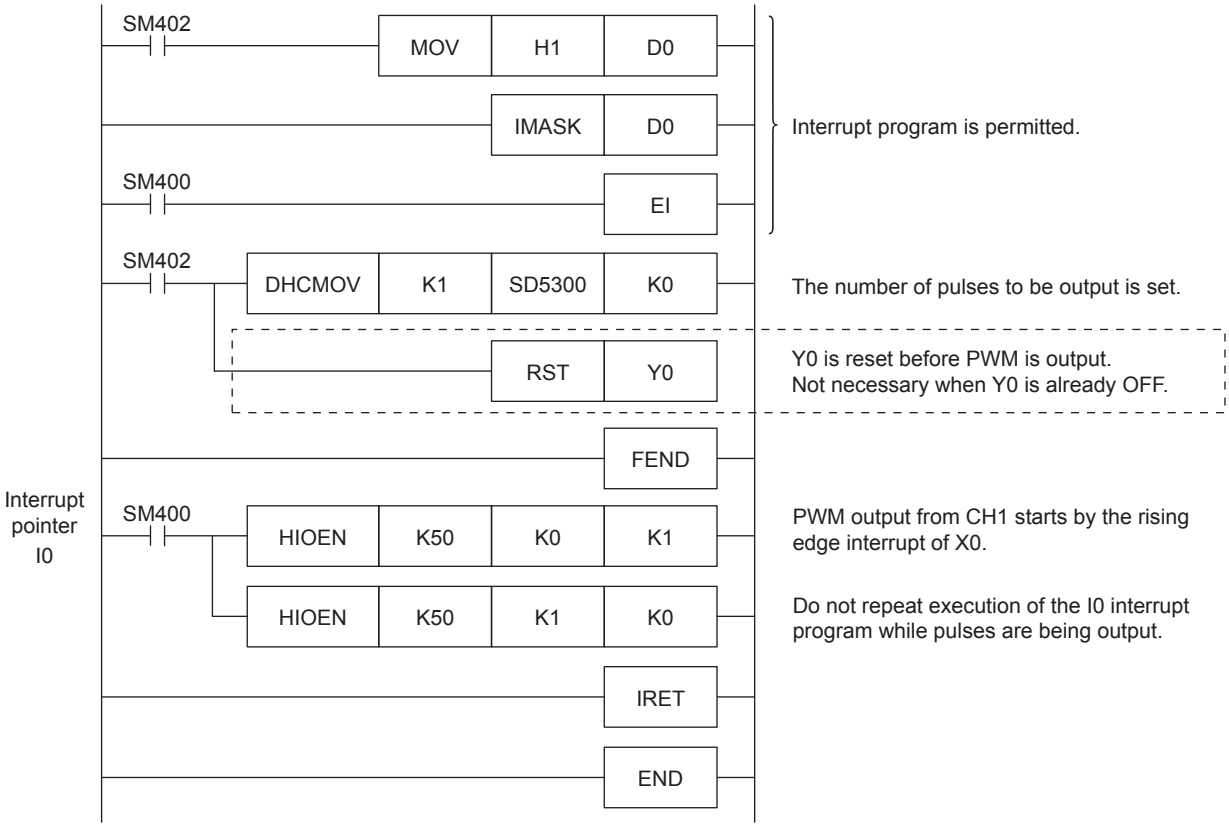
## Program

An operation diagram and program are shown below.

### ■Operation diagram



## ■Program




## Precautions

- PWM in the same channel as an ongoing PWM execution cannot be executed by the alternate of the PWM/DPWM instruction and HIOEN/DHIOEN instruction. However, the PWM operation that is already in execution continues.
- If a channel with invalid PWM output parameters is executed by HIOEN/DHIOEN instruction, the PWM output is not executed.
- In a program with interruption priority 1, the HIOEN/DHIOEN or PWM/DPWM instruction to start or stop PWM output of the high-speed pulse input/output module (CH5 to CH12) cannot be executed. (☞ Page 109 Interrupt priority)

# PART 3 POSITIONING FUNCTIONS

This part consists of the following chapters.

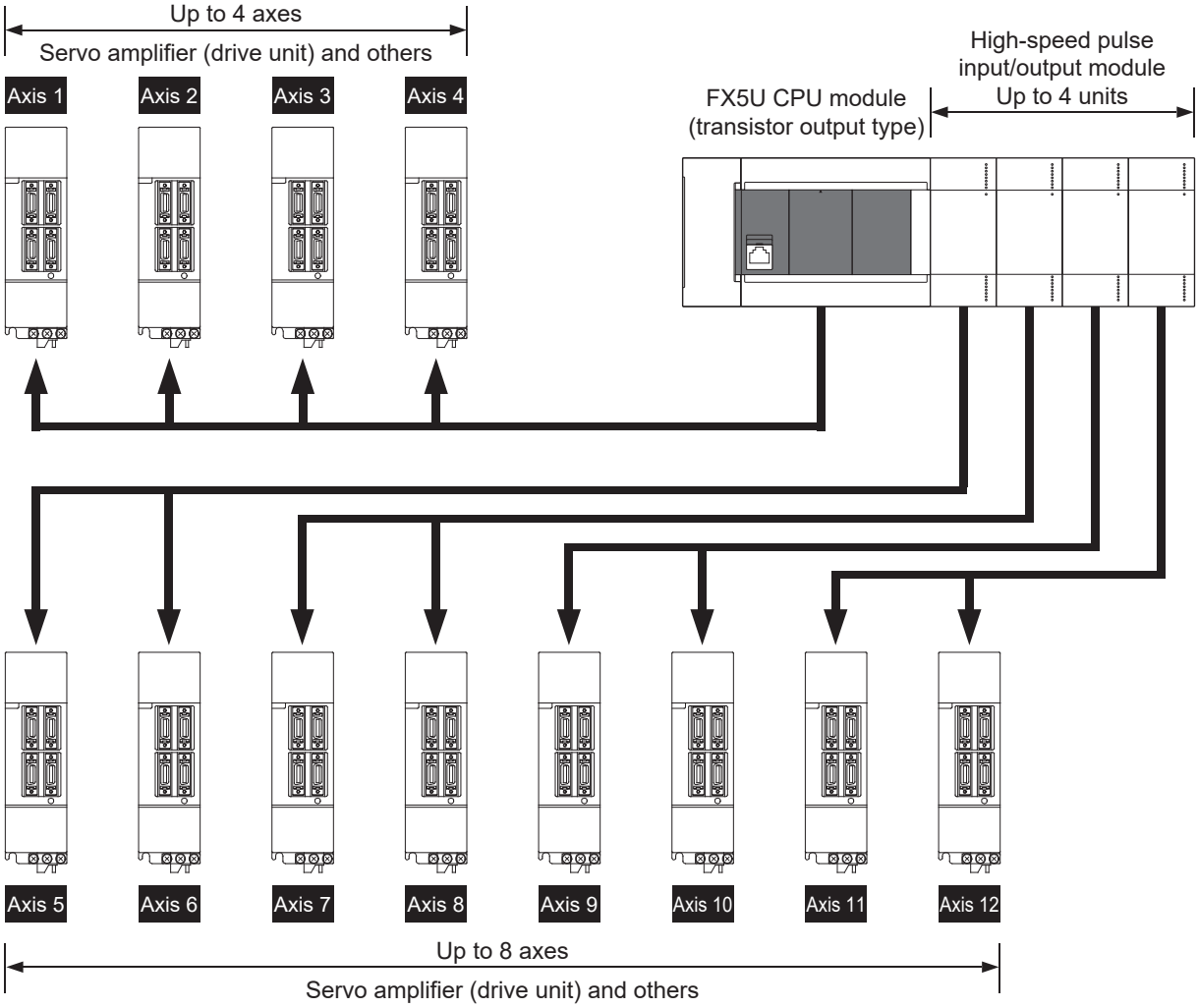
# 27 OUTLINE

The CPU module (transistor output) and high-speed pulse input/output module can perform positioning control by outputting pulse signals to servo motors or stepping motors. Increase the pulse frequency to increase the motor speed. Increase the number of pulses to increase the number of motor revolutions. In other words, set the pulse frequency to determine the workpiece transfer (positioning) speed. Set the number of pulses to determine the workpiece transfer distance.

## 27.1 Features

- Positioning functions include positioning using the CPU module built-in I/O and positioning using the high-speed pulse input/output module. For applicable version of high-speed pulse input/output module, refer to ☞ Page 971 Added and Enhanced Functions.
- The positioning function can control up to 12 axes for positioning operations. (CPU module: 4 axes, High-speed pulse input/output module: 2 axes × 4 modules)
- Use positioning instructions and positioning parameters for positioning control.
- The pulse output method can be PULSE/SIGN mode or CW/CCW mode. General-purpose outputs can output a pulse train of 200 kpps (100 kpps for the FX5S CPU module).
- The positioning function is compatible with MELSERVO MR-J4□A, MR-J3□A and MR-JN□A series servo amplifiers.

System



# 27.2 Setup Procedure for Positioning Control

***1.*** Check specifications of incorporated positioning functions

For performance specifications, input specifications and output specifications, refer to ☞ Page 338 SPECIFICATIONS.

For control function and auxiliary function, refer to ☞ Page 350 POSITIONING CONTROL FUNCTION.

For connection equipment specifications, refer to the manual for each connection equipment.

***2.*** System configuration and unit selection

Refer to the following manual and the manual for each connection equipment.

📖MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)

***3.*** Wiring

Refer to the following manual and the manual for each connection equipment.

📖MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)

***4.*** Parameter settings in GX Works3[*1]

For setting method and details of parameters, refer to ☞ Page 366 POSITIONING PARAMETER.

For table setting method and operations of control method, refer to ☞ Page 489 TABLE OPERATION.

***5.*** Creating programs in GX Works3[*1]

For details of each positioning instruction, refer to ☞ Page 404 POSITIONING INSTRUCTION.

For common items of each positioning instruction and cautions for program creation, refer to ☞ Page 526 PROGRAMMING.

*1 For details on connecting procedures to a CPU module and operating procedures of GX Works3, refer to 📖GX Works3 Operating Manual.

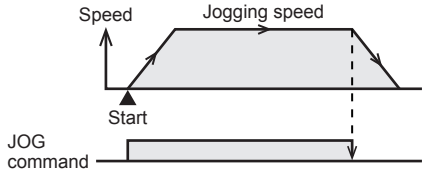
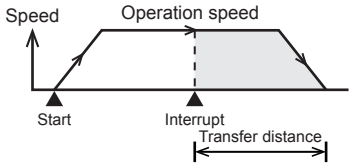
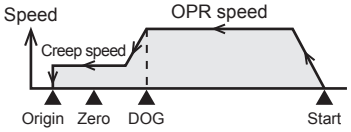
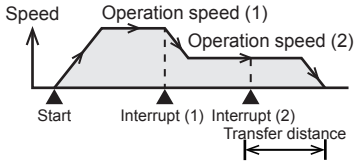
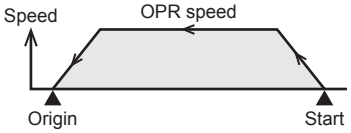
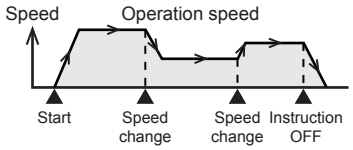
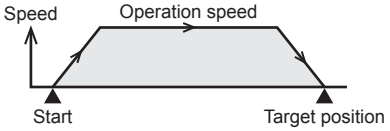
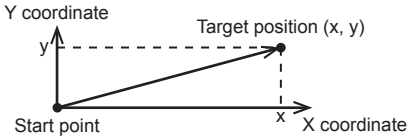
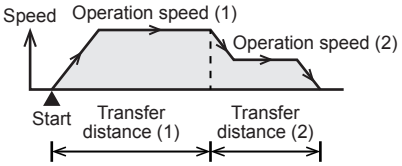
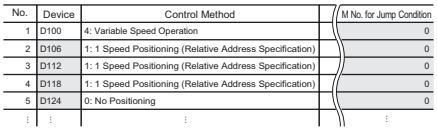
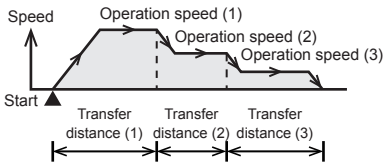
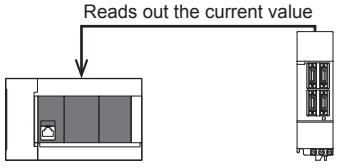
# 28 FUNCTION LIST

When the positioning instructions and the positioning parameters are used together, various positioning operations are enabled.

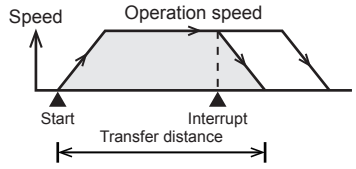
☞ Page 404 POSITIONING INSTRUCTION

☞ Page 366 POSITIONING PARAMETER

The positioning functions of the FX5 programmable controller are shown below.

| Positioning operation pattern | Reference | Positioning operation pattern | Reference |
|---|---|---|---|
| JOG operation (substituted by variable speed operation)<br>  | Page 356 | Interrupt 1-speed positioning<br>  | Page 354 |
| Mechanical OPR<br>  | Page 351 | Interrupt 2-speed positioning<br>  | Page 355 |
| High-speed OPR<br>  | Page 351 | Variable speed operation<br>  | Page 356 |
| 1-speed positioning<br>  | Page 352 | Simple linear interpolation operation (2-axis simultaneous start)*1<br>  | Page 357 |
| 2-speed positioning<br>  | Page 352 | Table operation<br>  | Page 356 |
| Multi-speed operation<br>  | Page 353 | Absolute position detection system<br>  | Page 485 |

| No. | Device | Control Method | M No. for Jump Condition |
|---|---|---|---|
| 1 | D100 | 4: Variable Speed Operation | 0 |
| 2 | D106 | 1: 1 Speed Positioning (Relative Address Specification) | 0 |
| 3 | D112 | 1: 1 Speed Positioning (Relative Address Specification) | 0 |
| 4 | D118 | 1: 1 Speed Positioning (Relative Address Specification) | 0 |
| 5 | D124 | 0: No Positioning | 0 |

| Positioning operation pattern | Reference | Positioning operation pattern | Reference |
|---|---|---|---|
| Interrupt stop<br>  <br> | Page 353 | — | — |

*1 Only FX5S/FX5U/FX5UC CPU module and high-speed pulse input/output module support this operation.

# 29 SPECIFICATIONS

For general specifications, power supply and system configuration, refer to the following manuals.
MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)

## 29.1 Performance Specifications

The following list shows performance specifications of the positioning function.
For details on positioning parameter, refer to Page 366 POSITIONING PARAMETER.

| Item | Description | | | |
|---|---|---|---|---|
| | FX5S CPU module | FX5UJ CPU module | FX5U/FX5UC CPU module | High-speed pulse input/output module[*1] |
| Number of control axes | 4 axes[*2]<br>Pulse can be output from general-purpose outputs of the CPU module (axis 1: Y0, axis 2: Y1, axis 3: Y2, and axis 4: Y3). | 3 axes<br>Pulse can be output from general-purpose outputs of the CPU module (axis 1: Y0, axis 2: Y1, and axis 3: Y2). | 4 axes[*2]<br>Pulse can be output from general-purpose outputs of the CPU module (axis 1: Y0, axis 2: Y1, axis 3: Y2, and axis 4: Y3). | 2 axes /module, up to 4 modules can be connected<br>Pulse can be output from general-purpose outputs of the high-speed pulse input/output module.<br>• First module axis 5: Y□, axis 6: Y□+1<br>• Second module axis 7: Y□, axis 8: Y□+1<br>• Third module axis 9: Y□, axis 10: Y□+1<br>• Fourth module axis 11: Y□, axis 12: Y□+1<br>The number in □ is the head output number for each high-speed pulse input/output module. |
| Pulse output form | Transistor | | | |
| Maximum frequency | 100 kpps (100 kpps in pulses) | 200 kpps (200 kpps in pulses) | | |
| Positioning program | Created in sequence program<br>Table operation (can be set in GX Works3.)<br>• When the positioning table data set to use device: 100 data points/axis<br>• When the positioning table data set to do not use device: 32 data points/axis | | | Created in sequence program<br>Table operation (can be set in GX Works3.)<br>• When the positioning table data set to use device: 100 data points/axis |
| Position data | 1 point (set in sequence program) | | | |

| Item | | | Description | | | |
|---|---|---|---|---|---|---|
| | | | FX5S CPU module | FX5UJ CPU module | FX5U/FX5UC CPU module | High-speed pulse input/output module*1 |
| Positioning | Pulse output mode | | PULSE/SIGN mode<br>CW/CCW mode | PULSE/SIGN mode | PULSE/SIGN mode<br>CW/CCW mode | |
| | Positioning range | Control unit | Motor system, machine system, multiple system, | | | |
| | | Number of pulses per rotation | 0 to 2147483647 | | | |
| | | Travel distance per rotation | 1 to 2147483647 | | | |
| | | Positioning data magnification | 1, 10, 100, 1000 (times) | | | |
| | | Positioning range | -2147483648 to +2147483647 (motor/machine/multiple unit system)*3 | | | |
| | Speed command*4 | Speed command unit | Determined by the set unit system | | | |
| | | Bias speed | 0 to 100 kpps (motor/multiple unit system)<br>0 to 2147483647 (machine unit system) | 0 to 200 kpps (motor/multiple unit system)<br>0 to 2147483647 (machine unit system) | | |
| | | Maximum speed | 1 pps to 100 kpps (motor/multiple unit system)<br>1 to 2147483647 (machine/multiple unit system) | 1 pps to 200 kpps (motor/multiple unit system)<br>1 to 2147483647 (machine/multiple unit system) | | |
| | | OPR speed | 1 pps to 100 kpps (motor/multiple unit system)<br>1 to 2147483647 (machine unit system) | 1 pps to 200 kpps (motor/multiple unit system)<br>1 to 2147483647 (machine unit system) | | |
| Positioning | Speed command*4 | Creep speed | 1 pps to 100 kpps (motor/multiple unit system)<br>1 to 2147483647 (machine unit system) | 1 pps to 200 kpps (motor/multiple unit system)<br>1 to 2147483647 (machine unit system) | | |
| | | Acceleration time | 0 to 32767 ms | | | |
| | | Deceleration time | 0 to 32767 ms | | | |
| | Acceleration/deceleration process | | Trapezoidal acceleration/deceleration | | | |
| | Absolute position detection (ABS current value reading) | | DABS instruction used | | | |
| | Interpolation | | Simple linear interpolation operation by 2-axis simultaneous start | — | Simple linear interpolation operation by 2-axis simultaneous start | |
| Start time (time until pulse output is started after execution of the instruction is started) | | | When using the external start signal: 50 μs or less<br>Interpolation operation: 300 μs or less | When using the external start signal: 50 μs or less | When using the external start signal: 50 μs or less<br>Interpolation operation: 300 μs or less | When using the external start signal: 300 μs or less<br>Interpolation operation: 400 μs or less |

*1 Only FX5UJ/FX5U/FX5UC CPU module can be connected.
*2 The number of control axes is two when the pulse output mode is CW/CCW mode.
*3 Set the number of output pulses per operation to 2147483647 or lower.
*4 For the start speed, refer to ☞ Page 404 Start speed.

# 29.2 Input Specifications

The input specifications of the CPU module and high-speed pulse input/output module are explained below.
Note that the simultaneous turning-on rate of the CPU module is restricted. For details on this restriction, refer to the following manuals.
MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)

## FX5S CPU module

| Item | | Specifications |
|---|---|---|
| Input signal voltage | | 24 V DC +20%, -15% |
| Input impedance | X0 to X7 | 4.3 kΩ |
| | X10 and subsequent | 5.6 kΩ |
| Input signal current | X0 to X7 | 5.1 mA/24 V DC |
| | X10 and subsequent | 4.0 mA/24 V DC |
| ON input sensitivity current | X0 to X7 | 3.5 mA or more |
| | X10 and subsequent | 3.0 mA or more |
| OFF input sensitivity current | | 1.5 mA or less |
| Input response time (H/W filter delay) | X0, X1, X3, X4 | ON: 5.0 μs or less<br>OFF: 5.0 μs or less |
| | X2, X5 to X7 | ON: 30 μs or less<br>OFF: 50 μs or less |
| | X10 to X17 | ON: 50 μs or less<br>OFF: 150 μs or less |
| | X20 or subsequent | ON: Approx. 10 ms<br>OFF: Approx. 10 ms |
| Input response time (Digital filter setting value)*1 | | None, 10 μs, 50 μs, 0.1 ms, 0.2 ms, 0.4 ms, 0.6 ms, 1 ms, 5 ms, 10 ms (initial values), 20 ms, 70 ms |
| Input signal type | Sink input | No-voltage contact input<br>NPN open collector transistor |
| | Source input | No-voltage contact input<br>PNP open collector transistor |
| Indication of input motion | | Turning on the input will light the LED indicator lamp |

*1 This can be set only for X0 to X17.

## FX5UJ CPU module

| Item | | Specifications |
|---|---|---|
| Input signal voltage | | 24 V DC +20%, -15% |
| Input impedance | X0 to X7 | 4.3 kΩ |
| | X10 and subsequent | 5.6 kΩ |
| Input signal current | X0 to X7 | 5.3 mA/24 V DC |
| | X10 and subsequent | 4.0 mA/24 V DC |
| ON input sensitivity current | X0 to X7 | 3.5 mA or more |
| | X10 and subsequent | 3.0 mA or more |
| OFF input sensitivity current | | 1.5 mA or less |
| Input response time (H/W filter delay) | X0, X1, X3, X4 | ON: 5.0 μs or less<br>OFF: 5.0 μs or less |
| | X2, X5 to X7 | ON: 30 μs or less<br>OFF: 50 μs or less |
| | X10 to X17 | ON: 50 μs or less<br>OFF: 150 μs or less |
| | X20 or subsequent | ON: Approx. 10 ms<br>OFF: Approx. 10 ms |
| Input response time (Digital filter setting value) | | None, 10 μs, 50 μs, 0.1 ms, 0.2 ms, 0.4 ms, 0.6 ms, 1 ms, 5 ms, 10 ms (initial values), 20 ms, 70 ms |
| Input signal type | | No-voltage contact input<br>Sink input: NPN open collector transistor<br>Source input: PNP open collector transistor |
| Indication of input motion | | Turning on the input will light the LED indicator lamp |

## FX5U CPU module

| Item | | | Specifications |
|---|---|---|---|
| Input signal voltage | | | 24 V DC +20%, -15% |
| Input impedance | | X0 to X17 | 4.3 kΩ |
| | | X20 or subsequent | 5.6 kΩ |
| Input signal current | | X0 to X17 | 5.3 mA/24 V DC |
| | | X20 or subsequent | 4.0 mA/24 V DC |
| ON input sensitivity current | | X0 to X17 | 3.5 mA or more |
| | | X20 or subsequent | 3.0 mA or more |
| OFF input sensitivity current | | | 1.5 mA or less |
| Input response time (H/W filter delay) | FX5U-32MT/☐ | X0 to X5 | ON: 2.5 μs or less<br>OFF: 2.5 μs or less |
| | FX5U-64MT/☐, FX5U-80MT/☐ | X0 to X7 | |
| | FX5U-32MT/☐ | X6 to X17 | ON: 30 μs or less<br>OFF: 50 μs or less |
| | FX5U-64MT/☐, FX5U-80MT/☐ | X10 to X17 | |
| | | X20 or subsequent | ON: 50 μs or less<br>OFF: 150 μs or less |
| Input response time (Digital filter setting value) | | | None, 10 μs, 50 μs, 0.1 ms, 0.2 ms, 0.4 ms, 0.6 ms, 1 ms, 5 ms, 10 ms (initial values), 20 ms, 70 ms |
| Input signal type | | | No-voltage contact input<br>Sink input: NPN open collector transistor<br>Source input: PNP open collector transistor |
| Indication of input motion | | | Turning on the input will light the LED indicator lamp |

## FX5UC CPU module

| Item | | | Specifications |
|---|---|---|---|
| Input signal voltage | | | 24 V DC +20%, -15% |
| Input impedance | | X0 to X17 | 4.3 kΩ |
| | | X20 or subsequent | 5.6 kΩ |
| Input signal current | | X0 to X17 | 5.3 mA/24 V DC |
| | | X20 or subsequent | 4.0 mA/24 V DC |
| ON input sensitivity current | | X0 to X17 | 3.5 mA or more |
| | | X20 or subsequent | 3.0 mA or more |
| OFF input sensitivity current | | | 1.5 mA or less |
| Input response time (H/W filter delay) | FX5UC-32MT/☐ | X0 to X5 | ON: 2.5 μs or less<br>OFF: 2.5 μs or less |
| | FX5UC-64MT/☐, FX5UC-96MT/☐ | X0 to X7 | |
| | FX5UC-32MT/☐ | X6 to X17 | ON: 30 μs or less<br>OFF: 50 μs or less |
| | FX5UC-64MT/☐, FX5UC-96MT/☐ | X10 to X17 | |
| | FX5UC-64MT/☐, FX5UC-96MT/☐ | X20 or subsequent | ON: 50 μs or less<br>OFF: 150 μs or less |
| Input response time (Digital filter setting value) | | | None, 10 μs, 50 μs, 0.1 ms, 0.2 ms, 0.4 ms, 0.6 ms, 1 ms, 5 ms, 10 ms (initial values), 20 ms, 70 ms |
| Input signal type | FX5UC-☐MT/D | | No-voltage contact input<br>NPN open collector transistor |
| | FX5UC-☐MT/DSS | | No-voltage contact input<br>Sink input: NPN open collector transistor<br>Source input: PNP open collector transistor |
| Indication of input motion | FX5UC-☐MT/D(SS) | | Turning on the input will light the LED indicator lamp (DISP switch IN side) |
| | FX5UC-32MT/DS(S)-TS | | Turning on the input will light the LED indicator lamp |

## High-speed pulse input/output module

| Item | | Specifications |
|---|---|---|
| Input signal voltage | | 24 V DC +20%, -15% |
| Input impedance | | 4.3 kΩ |
| Input signal current | | 5.3 mA/24 V DC |
| ON input sensitivity current | | 3.5 mA or more |
| OFF input sensitivity current | | 1.5 mA or less |
| Input response time (H/W filter delay) | X☐ to X☐+5*1 | ON: 2.5 μs or less<br>OFF: 2.5 μs or less |
| | X☐+6, X☐+7*1 | ON: 30 μs or less<br>OFF: 50 μs or less |
| Input response time (Digital filter setting value) | | None, 10 μs, 50 μs, 0.1 ms, 0.2 ms, 0.4 ms, 0.6 ms, 1 ms, 5 ms, 10 ms (initial values), 20 ms, 70 ms |
| Input signal type | | No-voltage contact input<br>Sink input: NPN open collector transistor<br>Source input: PNP open collector transistor |
| Indication of input motion | | Turning on the input will light the LED indicator lamp |

*1 ☐: Head input number for high-speed pulse input/output module

# Input assignment

Input numbers of the CPU module and high-speed pulse input/output module are assigned as follows.
For parameter settings in GX Works3, refer to ☞ Page 366 POSITIONING PARAMETER.

## CPU module

| Application | | Input number | Remarks |
|---|---|---|---|
| Stop command | | All input points | Connect a line to any input.<br>If the line-connected input is turned on, the following operations stop the pulse output.<br>• Turn off the positioning instruction signal.<br>• Turn on the pulse output stop command.<br>• Turn on the pulse decelerate and stop command. |
| OPR | Start command | All input points | Connect a line to any input.<br>When the line-connected input is turned on, drive the DSZR/DDSZR instruction. (☞ Page 413 Mechanical OPR) |
| | Near-point signal (DOG) | X0 to X17*1 | Connect a line to the input specified in the parameter setting of GX Works3.<br>The signal does not occupy the input interrupt function, and its edge is detected with a 1-ms interrupt.<br>For the near-point signal, refer to ☞ Page 392 Near-point Dog Signal. |
| | Zero signal | X0 to X17*1 | Connect a line to the input specified in the parameter setting of GX Works3.<br>The input interrupt function is assigned forcibly to a specified input.<br>For the zero signal, refer to ☞ Page 393 Zero Signal. |
| ABS read | | All input points | Connect a line if it is necessary to use the absolute position detection system.<br>Connect a line to the input specified by the DABS instruction. (☞ Page 485 Absolute Position Detection System)<br>3 consecutive input points are used for this function. |
| External start signal | | X0 to X17 | Connect a line to the input specified in the parameter setting of GX Works3.<br>The input interrupt function is assigned forcibly to a specified input. |
| Interrupt input signal 1 | | X0 to X17 | Connect a line to the input specified in the parameter setting of GX Works3.<br>The input interrupt function is assigned forcibly to a specified input. |
| Interrupt input signal 2 | | X0 to X17 | Connect a line to the input specified in the table parameter setting of GX Works3.<br>The signal does not occupy the input interrupt function, and its edge is detected with a 1-ms interrupt. |
| Forward rotation limit (LSF) | | All input points | Connect a line to any input.<br>When the line-connected input is turned on, the forward limit relay must be turned on.<br>The forward limit depends on the axis number as shown in the following table.<br>Axis 1: SM5660 / Axis 2: SM5661 / Axis 3: SM5662 / Axis 4*2: SM5663 |
| Reverse rotation limit (LSR) | | All input points | Connect a line to any input.<br>When the line-connected input is turned on, reverse limit relay must be turned on.<br>The reverse limit depends on the axis number as shown in the following table.<br>Axis 1: SM5676 / Axis 2: SM5677 / Axis 3: SM5678 / Axis 4*2: SM5679 |

*1 In the case of FX3 compatible operand, DSZR/DDSZR instruction can use bit device other than X. In this case, the near-point signal (DOG) and zero signal must be assigned to the same device. For details, refer to ☞ Page 413 Mechanical OPR.

*2 Only FX5S/FX5U/FX5UC CPU module can use the devices of axis 4.

## High-speed pulse input/output module

<table>
<tr><th colspan="2">Application</th><th>Axis*1</th><th>Input number</th><th>Remarks</th></tr>
<tr><td colspan="2">Stop command</td><td>All axes</td><td>All input points*2</td><td>Connect a line to any input.<br>If the line-connected input is turned on, the following operations stop the pulse output.<br>• Turn off the positioning instruction signal.<br>• Turn on the pulse output stop command.<br>• Turn on the pulse decelerate and stop command.</td></tr>
<tr><td rowspan="3">OPR</td><td>Start command</td><td>All axes</td><td>All input points*2</td><td>Connect a line to any input.<br>When the line-connected input is turned on, drive the DSZR/DDSZR instruction. (☞ Page 413 Mechanical OPR)</td></tr>
<tr><td>Near-point signal (DOG)</td><td>All axes</td><td>All input points*2</td><td>Connect a line to the input specified in the parameter setting of GX Works3.<br>The signal does not occupy the input interrupt function, and its edge is detected with a 1-ms interrupt.<br>For the near-point signal, refer to ☞ Page 392 Near-point Dog Signal.</td></tr>
<tr><td rowspan="2">Zero signal</td><td>5, 7, 9, 11</td><td>X□+5*3</td><td rowspan="2">Connect a line to fixed assignment input in each module.<br>For the zero signal, refer to ☞ Page 393 Zero Signal.</td></tr>
<tr><td>6, 8, 10, 12</td><td>X□+2*3</td></tr>
<tr><td colspan="2">ABS read</td><td>All axes</td><td>All input points*2</td><td>Connect a line if it is necessary to use the absolute position detection system.<br>Connect a line to the input specified by the DABS instruction. (☞ Page 485 Absolute Position Detection System)<br>3 consecutive input points are used for this function.</td></tr>
<tr><td colspan="2" rowspan="2">External start signal</td><td>5, 7, 9, 11</td><td>X□+7*3</td><td rowspan="2">Connect a line to fixed assignment input in each module.</td></tr>
<tr><td>6, 8, 10, 12</td><td>X□+6*3</td></tr>
<tr><td colspan="2" rowspan="2">Interrupt input signal 1</td><td>5, 7, 9, 11</td><td>X□+4*3</td><td rowspan="2">Connect a line to fixed assignment input in each module.</td></tr>
<tr><td>6, 8, 10, 12</td><td>X□+3*3</td></tr>
<tr><td colspan="2">Forward rotation limit (LSF)</td><td>All axes</td><td>All input points*2</td><td>Connect a line to any input.<br>When the line-connected input is turned on, the forward limit relay must be turned on.<br>The forward limit depends on the axis number as shown in the following table.<br><table><tr><th>Axis 5</th><th>Axis 6</th><th>Axis 7</th><th>Axis 8</th><th>Axis 9</th><th>Axis 10</th><th>Axis 11</th><th>Axis 12</th></tr><tr><td>SM5664</td><td>SM5665</td><td>SM5666</td><td>SM5667</td><td>SM5668</td><td>SM5669</td><td>SM5670</td><td>SM5671</td></tr></table></td></tr>
<tr><td colspan="2">Reverse rotation limit (LSR)</td><td>All axes</td><td>All input points*2</td><td>Connect a line to any input.<br>When the line-connected input is turned on, reverse limit relay must be turned on.<br>The reverse limit depends on the axis number as shown in the following table.<br><table><tr><th>Axis 5</th><th>Axis 6</th><th>Axis 7</th><th>Axis 8</th><th>Axis 9</th><th>Axis 10</th><th>Axis 11</th><th>Axis 12</th></tr><tr><td>SM5680</td><td>SM5681</td><td>SM5682</td><td>SM5683</td><td>SM5684</td><td>SM5685</td><td>SM5686</td><td>SM5687</td></tr></table></td></tr>
</table>

*1 The axes of high-speed pulse input/output module are assigned as described below. The high-speed pulse input/output modules are ordered as the first module, second module, next modules from nearest to the CPU module.

| First module | | Second module | | Third module | | Fourth module | |
|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 |

*2 CPU module inputs can also be used.

*3 □: Head input number for high-speed pulse input/output module
The inputs that have not been assigned to a function by GX Works3 parameter can be used as general-purpose inputs.

# 29.3 Output Specifications

This section describes the transistor output specifications of the CPU module and high-speed pulse input/output module.
Note that the simultaneous turning-on rate of the CPU module is restricted. For details on this restriction, refer to the following manuals.
MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)

## CPU module

For MELSERVO series servo amplifiers, use a sink input/sink output type CPU module.

| Item | | | Specifications |
|---|---|---|---|
| External power supply | | | 5 to 30 V DC |
| Maximum load | FX5S-□MT/□ | | 0.5 A/point<br>The total load current per common terminal should be the following value or less.<br>• 3 output point common: 0.6 A<br>• 4 output point common: 0.8 A |
| | FX5UJ-□MT/□ | | 0.5 A/point<br>The total load current per common terminal should be the following value or less.<br>• 3 output point common: 0.6 A<br>• 4 output point common: 0.8 A |
| | FX5U-□MT/□ | | 0.5 A/point<br>The total load current per common terminal should be the following value or less.<br>• 4 output point common: 0.8 A<br>• 8 output point common: 1.6 A |
| | FX5UC-□MT/□ | | Y0 to Y3: 0.3 A/point<br>Y4 or subsequent: 0.1 A/point<br>The total load current per common terminal should be 0.8 A*1 or less. |
| Open-circuit leakage current | | | 0.1 mA or less at 30 V DC |
| Voltage drop when ON | FX5S-□MT/□ | Y0 to Y3 | 1.0 V or less |
| | FX5UJ-□MT/□ | Y0 to Y2 | 1.0 V or less |
| | FX5U-□MT/□, FX5UC-□MT/□ | Y0 to Y3 | |
| | FX5S-□MT/□ | Y4 or subsequent | 1.5 V or less |
| | FX5UJ-□MT/□ | Y3 or subsequent | |
| | FX5U-□MT/□, FX5UC-□MT/□ | Y4 or subsequent | |
| Response time | FX5S-□MT/□ | Y0 to Y3 | 5 μs or less at 10 mA or more (5 to 24 V DC) |
| | FX5UJ-□MT/□ | Y0 to Y2 | 2.5 μs or less at 10 mA or more (5 to 24 V DC) |
| | FX5U-□MT/□, FX5UC-□MT/□ | Y0 to Y3 | |
| | FX5S-□MT/□ | Y4 or subsequent | 0.2 ms or less at 200 mA (24 V DC) |
| | FX5UJ-□MT/□ | Y3 or subsequent | |
| | FX5U-□MT/□ | Y4 or subsequent | |
| | FX5UC-□MT/□ | | |
| Indication of output motion | FX5S-□MT/□, FX5UJ-□MT/□, FX5U-□MT/□, FX5UC-32MT/DS(S)-TS | | LED on panel turns on when output |
| | FX5UC-□MT/D(SS) | | LED on panel turns on when output (DISP switch OUT side) |

*1 When two COM■ (or +V■) terminals are connected outside the CPU module, the total load current is 1.6 A or less. Where ■ indicates: 0, 1 or 2

To use the positioning instruction, adjust the load current of the NPN open collector output to 10 to 100 mA (5 to 24 V DC).

| Item | Description |
|---|---|
| Operation voltage range | 5 to 24 V DC |
| Operation current range | 10 to 100 mA |
| Output frequency | ■FX5S CPU module<br>100 kpps or less<br>■FX5UJ/FX5U/FX5UC CPU module<br>200 kpps or less |

## High-speed pulse input/output module

For MELSERVO series servo amplifiers, use a sink input/sink output type FX5-16ET/ES-H.

| Item | | Specifications |
|---|---|---|
| External power supply | | 5 to 30 V DC |
| Output type | FX5-16ET/ES-H | Transistor/sink output |
| | FX5-16ET/ESS-H | Transistor/source output |
| Maximum load | | 1.6 A/8 point common |
| Open-circuit leakage current | | 0.1 mA or less at 30 V DC |
| Voltage drop when ON | Y□, Y□+1, Y□+4, Y□+5*1 | 1.0 V or less |
| | Y□+2, Y□+3, Y□+6, Y□+7*1 | 1.5 V or less |
| Response time | Y□, Y□+1, Y□+4, Y□+5*1 | 2.5 μs or less at 10 mA or more (5 to 24 V DC) |
| | Y□+2, Y□+3, Y□+6, Y□+7*1 | 0.2 ms or less at 200 mA (24 V DC) |
| Indication of output motion | | LED on panel turns on when output |

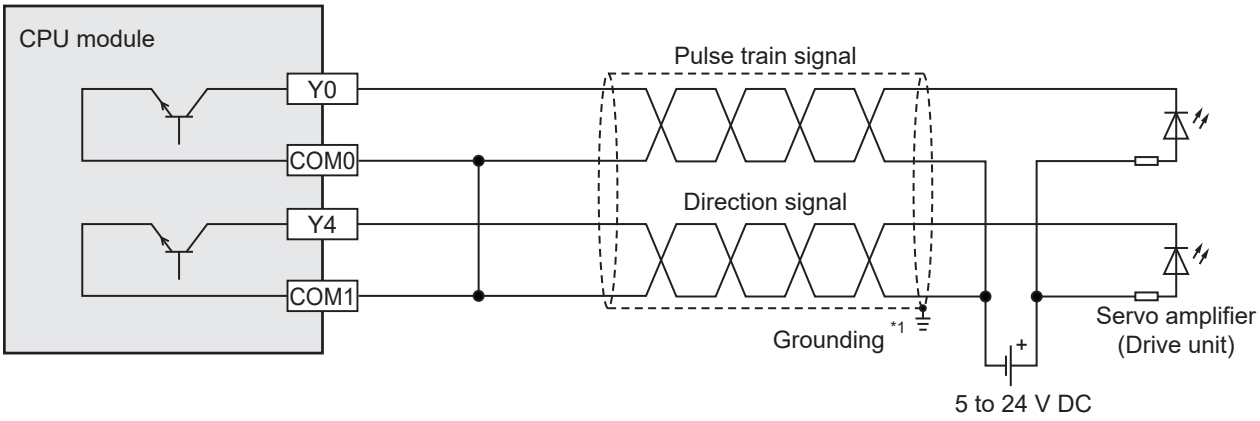
*1 The number in □ is the head output number for each high-speed pulse input/output module.

To use the positioning instruction, adjust the load current of the NPN open collector output to 10 to 100 mA (5 to 24 V DC).

| Item | Description |
|---|---|
| Operation voltage range | 5 to 24 V DC |
| Operation current range | 10 to 100 mA |
| Output frequency | 200 kpps or less |

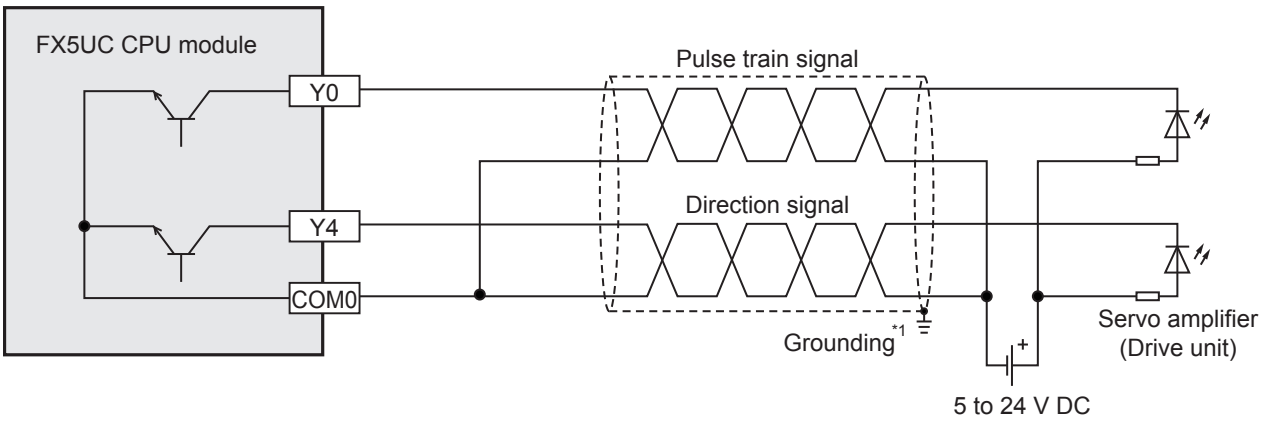
## Sink internal output circuit

### ■FX5S/FX5UJ/FX5U CPU module



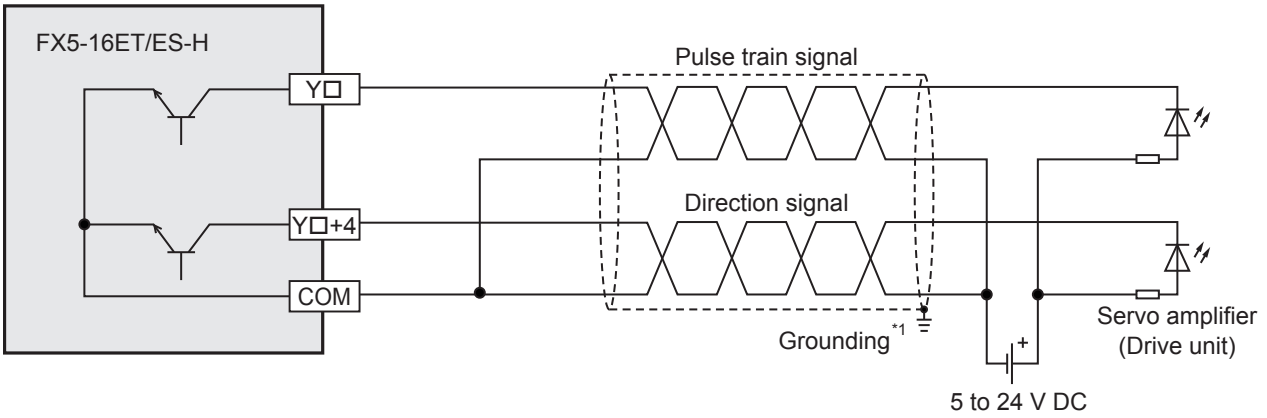

*1 To ground the unit, refer to the servo amplifier (drive unit) manual.
If the grounding method is not specified, carry out class-D grounding (grounding resistance: 100 Ω or less).

### ■FX5UC CPU module




*1 To ground the unit, refer to the servo amplifier (drive unit) manual.
If the grounding method is not specified, carry out class-D grounding (grounding resistance: 100 Ω or less).

### ■FX5-16ET/ES-H

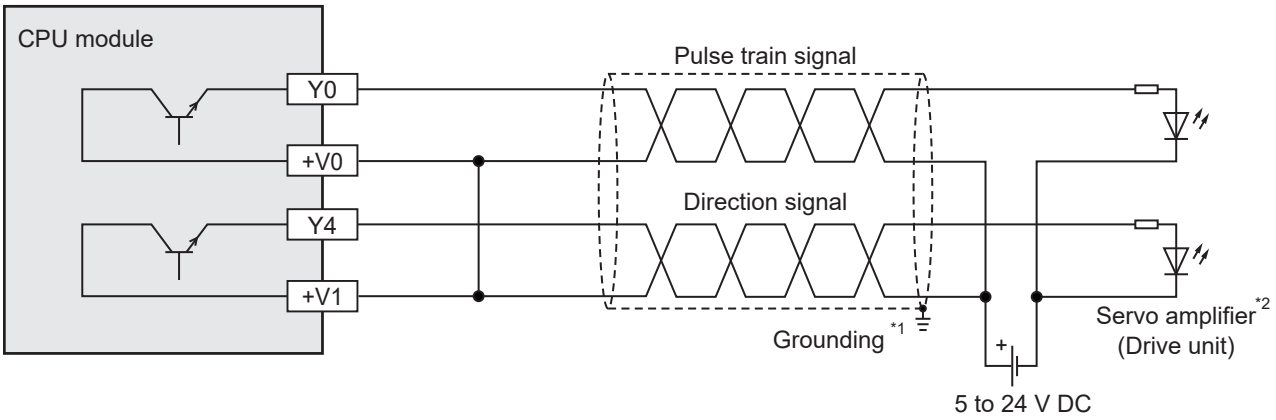



*1 To ground the unit, refer to the servo amplifier (drive unit) manual.
If the grounding method is not specified, carry out class-D grounding (grounding resistance: 100 Ω or less).



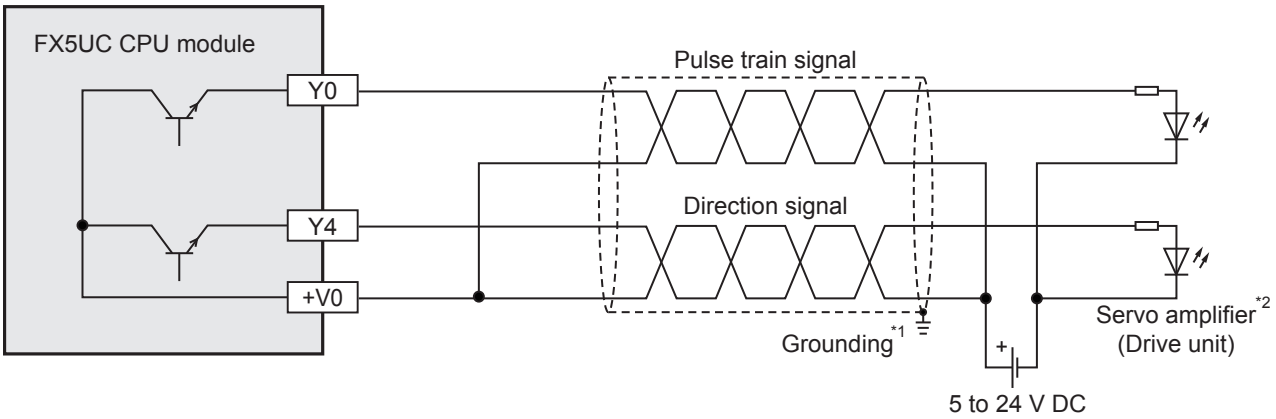
## Source internal output circuit

### ■FX5S/FX5UJ/FX5U CPU module



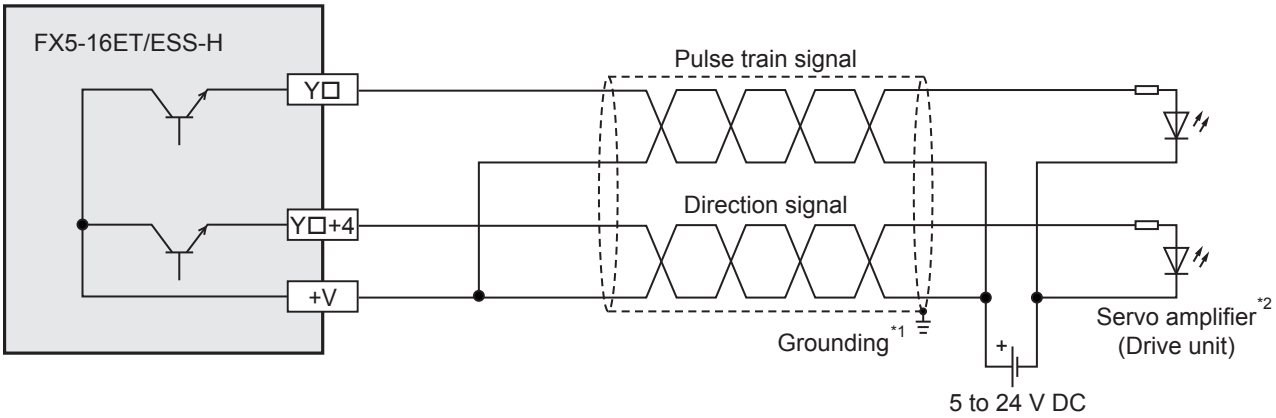

*1 To ground the unit, refer to the servo amplifier (drive unit) manual.
If the grounding method is not specified, carry out class-D grounding (grounding resistance: 100 Ω or less).
*2 For MELSERVO series servo amplifiers, use a sink output type FX5U CPU module.

### ■FX5UC CPU module




*1 To ground the unit, refer to the servo amplifier (drive unit) manual.
If the grounding method is not specified, carry out class-D grounding (grounding resistance: 100 Ω or less).
*2 For MELSERVO series servo amplifiers, use a sink output type FX5UC CPU module.

### ■FX5-16ET/ESS-H




*1 To ground the unit, refer to the servo amplifier (drive unit) manual.
If the grounding method is not specified, carry out class-D grounding (grounding resistance: 100 Ω or less).

*2 For MELSERVO series servo amplifiers, use an FX5-16ET/ES-H (sink output type).

# Assignment of output numbers

Output numbers of the CPU module and high-speed pulse input/output module are assigned as follow.

For parameter settings in GX Works3, refer to ☞ Page 366 POSITIONING PARAMETER.

## FX5UJ CPU module

| Application | | Output number | Remarks |
|---|---|---|---|
| Pulse output destination | PULSE | Y0 to Y2 | The assignment is determined according to the output mode specified in GX Works3. |
| Rotation direction signal | SIGN | Y0 to Y17*1 | |
| Clear signal | | Y0 to Y17 | When using the clear signal in the DSZR/DDSZR instruction, wire to the output specified in the high speed I/O parameter of GX Works3. (☞ Page 413 Mechanical OPR, Page 391 Clear Signal Output) |

| Axis number | Output mode | Y0 | Y1 | Y2 | Y3 | Y4 | Y5 | Y6 | Y7 | Y10 | Y11 | Y12 | Y13 | Y14 | Y15 | Y16 | Y17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis1 | PULSE/SIGN | PLS | SIGN | | | | | | | | | | | | | | |
| Axis2 | PULSE/SIGN | SIGN | PLS | SIGN | | | | | | | | | | | | | |
| Axis3 | PULSE/SIGN | SIGN | | PLS | SIGN | | | | | | | | | | | | |

PLS: Pulse train signal, SIGN: Direction signal

*1 Specify an output number for transistor output. Any output can be selected.

## FX5S/FX5U/FX5UC CPU module

| Application | | Output number | Remarks |
|---|---|---|---|
| Pulse output destination | PULSE | Y0 to Y3 | The assignment is determined according to the output mode specified in GX Works3. |
| | CW | Y0, Y1 | |
| Rotation direction signal | SIGN | Y0 to Y17*1 | |
| | CCW | Y2, Y3 | |
| Clear signal | | Y0 to Y17 | When using the clear signal in the DSZR/DDSZR instruction, wire to the output specified in the high speed I/O parameter of GX Works3. (☞ Page 413 Mechanical OPR, Page 391 Clear Signal Output) |

| Axis number | Output mode | Y0 | Y1 | Y2 | Y3 | Y4 | Y5 | Y6 | Y7 | Y10 | Y11 | Y12 | Y13 | Y14 | Y15 | Y16 | Y17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis1 | PULSE/SIGN | PLS | SIGN | | | | | | | | | | | | | | |
| | CW/CCW | CW | - | CCW | - | | | | | | | | | | | | |
| Axis2 | PULSE/SIGN | SIGN | PLS | SIGN | | | | | | | | | | | | | |
| | CW/CCW | - | CW | - | CCW | - | | | | | | | | | | | |
| Axis3 | PULSE/SIGN | SIGN | | PLS | SIGN | | | | | | | | | | | | |
| | CW/CCW | - | | | | | | | | | | | | | | | |
| Axis4 | PULSE/SIGN | SIGN | | | PLS | SIGN | | | | | | | | | | | |
| | CW/CCW | - | | | | | | | | | | | | | | | |

PLS: Pulse train signal, SIGN: Direction signal, CW: Forward pulse train, CCW: Reverse pulse train

*1 Specify an output number for transistor output. Any output can be selected.

## High-speed pulse input/output module

The assignment is determined according to the output mode specified in GX Works3.

| Application | | Output number*1 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | First module | | Second module | | Third module | | Fourth module | |
| | | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 |
| Pulse output destination | PULSE/CW | Y□ | Y□+1 | Y□ | Y□+1 | Y□ | Y□+1 | Y□ | Y□+1 |
| Rotation direction signal | SIGN/CCW | Y□+4 | Y□+5 | Y□+4 | Y□+5 | Y□+4 | Y□+5 | Y□+4 | Y□+5 |
| Clear signal | | Y□+2 | Y□+3 | Y□+2 | Y□+3 | Y□+2 | Y□+3 | Y□+2 | Y□+3 |

*1 The number in □ is the head output number for each high-speed pulse input/output module.
The high-speed pulse input/output modules are ordered as the first module, second module, next modules from nearest to the CPU module.

# 30 POSITIONING CONTROL FUNCTION

The positioning control outputs pulses with each positioning instruction and operates based on the positioning parameters (such as for speed and for operation flag). This chapter describes control patterns that are available for combinations of the positioning instructions and the positioning parameters.

For details on each positioning instruction, refer to ☞ Page 404 POSITIONING INSTRUCTION.
For details on the control method of the table operation, refer to ☞ Page 492 Operations of Control Method.
For details on each positioning parameter, refer to ☞ Page 372 Details of Parameters.

## 30.1 List of Control Functions

The following list shows the positioning functions.

### List of control patterns

The following list shows the positioning function patterns.

Each control pattern is operated by corresponding positioning instruction.

○: Supported, —: Not supported

| Operation pattern | | Supported operation pattern | | | Reference |
|---|---|---|---|---|---|
| | | CPU module | | High-speed pulse input/ output module | |
| | | FX5S/FX5U/ FX5UC | FX5UJ | | |
| OPR control | Mechanical OPR | ○ | ○ | ○ | Page 351 |
| | High-speed OPR | ○ | ○ | ○ | Page 351 |
| Positioning control | 1-speed positioning | ○ | ○ | ○ | Page 352 |
| | 2-speed positioning | ○ | ○ | ○ | Page 352 |
| | Multi-speed operation | ○ | ○ | ○ | Page 353 |
| | Interrupt stop | ○ | ○ | ○ | Page 353 |
| | Interrupt 1-speed positioning | ○ | ○ | ○ | Page 354 |
| | Interrupt 2-speed positioning | ○ | ○ | — | Page 355 |
| | Variable speed operation | ○ | ○ | ○ | Page 356 |
| | Table operation | ○ | ○ | ○ | Page 356 |
| | Simple linear interpolation operation (2-axis simultaneous start) | ○ | — | ○ | Page 357 |

### List of auxiliary functions

The following list shows the auxiliary positioning functions that can be added to the control patterns above.

○: Supported, —: Not supported

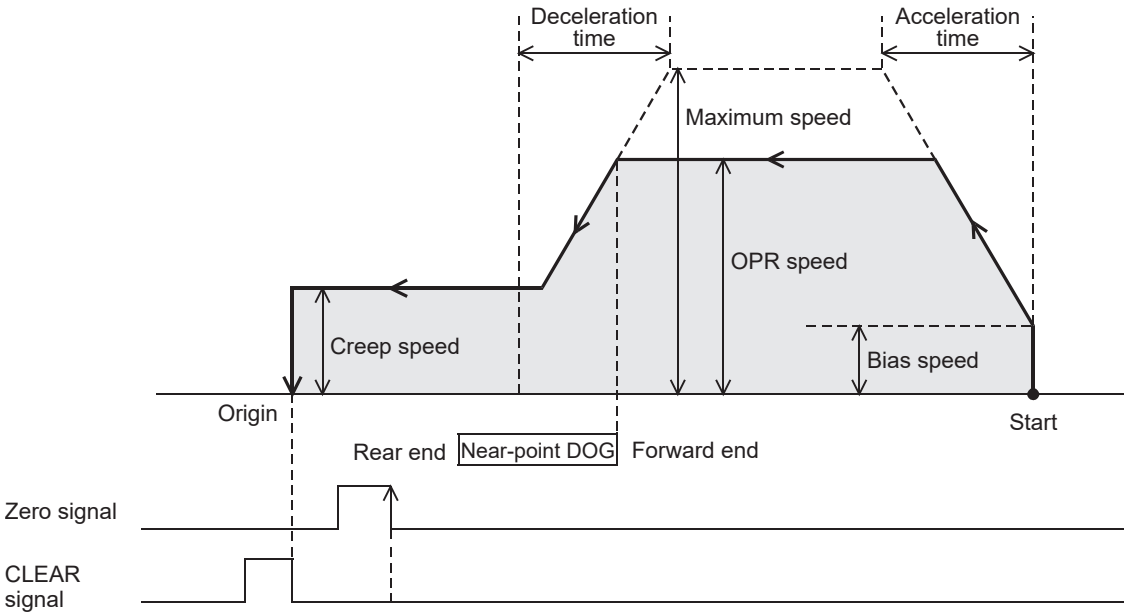
| Auxiliary function | Supported auxiliary functions | | | Reference |
|---|---|---|---|---|
| | CPU module | | High-speed pulse input/ output module | |
| | FX5S/FX5U/ FX5UC | FX5UJ | | |
| Dog search function | ○ | ○ | ○ | Page 358 |
| Dwell time | ○ | ○ | ○ | Page 360 |
| OPR zero signal counts | ○ | ○ | ○ | Page 360 |
| Forward limit and reverse limit | ○ | ○ | ○ | Page 361 |
| Positioning address change during positioning operation | ○ | ○ | ○ | Page 361 |
| Command speed change during positioning operation | ○ | ○ | ○ | Page 362 |
| Pulse decelerate and stop | ○ | ○ | ○ | Page 363 |
| Remaining distance operation | ○ | ○ | ○ | Page 364 |
| Multiple axes simultaneous activation | ○ | ○ | ○ | Page 365 |
| Detection of absolute position | ○ | ○ | ○ | Page 365 |
| All module reset when a stop error occurs | — | — | ○ | Page 365 |

# 30.2 OPR Control

This section describes details of the OPR control.

## Mechanical OPR

The DSZR/DDSZR instruction starts the OPR operation in the direction set by the OPR direction setting. (☞ Page 389 OPR Direction) After the speed has reached the OPR speed, the operation will be performed at the specified OPR speed. Deceleration is started when the near-point dog signal is detected and the operation continues at creep speed. (☞ Page 392 Near-point Dog Signal) The pulse output is stopped when the zero signal is detected for the specified number of times after the near-point dog signal is detected, and the mechanical OPR is completed. (☞ Page 393 Zero Signal) When the OPR dwell time is set, the mechanical OPR is not completed until the dwell time has elapsed. (☞ Page 360 Dwell time)

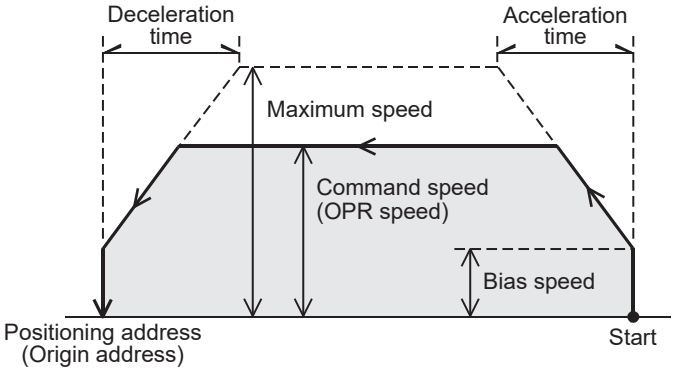



## High-speed OPR

The positioning is performed for the zero point address established by the mechanical OPR. The OPR can be performed at high-speed without using the near-point signal and the zero signal.

Set operands of instructions so that positioning address = zero position address[*1], command speed = OPR speed in the 1-speed positioning (absolute address). (☞ Page 390 Starting Point Address)

*1 Set the OPR address (can be specified in word device). With the table operation, the high-speed OPR can be performed only when the positioning table data is set to use device.




The following table shows applicable positioning instructions and control methods of the table operation.

| Positioning instruction | Table operation control method |
|---|---|
| Absolute positioning (DRVA/DDRVA) instruction | 2: 1 Speed Positioning (Absolute Address Specification) |
| Table operation (TBL[*2]/DRVTBL/DRVMUL) instruction | |

*2 Only CPU module is supported.

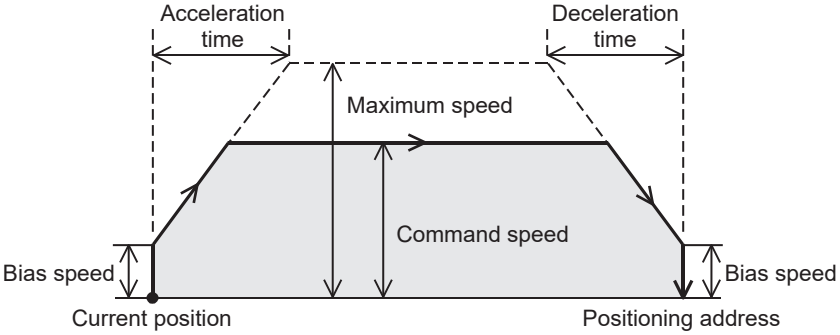
# 30.3 Positioning Control

This section describes details of the positioning control.

## 1-speed positioning

Acceleration is started at the bias speed when pulses are output by the positioning instruction. After the speed has reached the specified speed, the operation will be performed at the specified speed up to the point that deceleration must be performed. The operation decelerates in the vicinity of the target position and stops the pulse output at the position specified by the positioning address.

Both the relative address and the absolute address can be used for 1-speed positioning.




The following table shows applicable positioning instructions and control methods of the table operation.

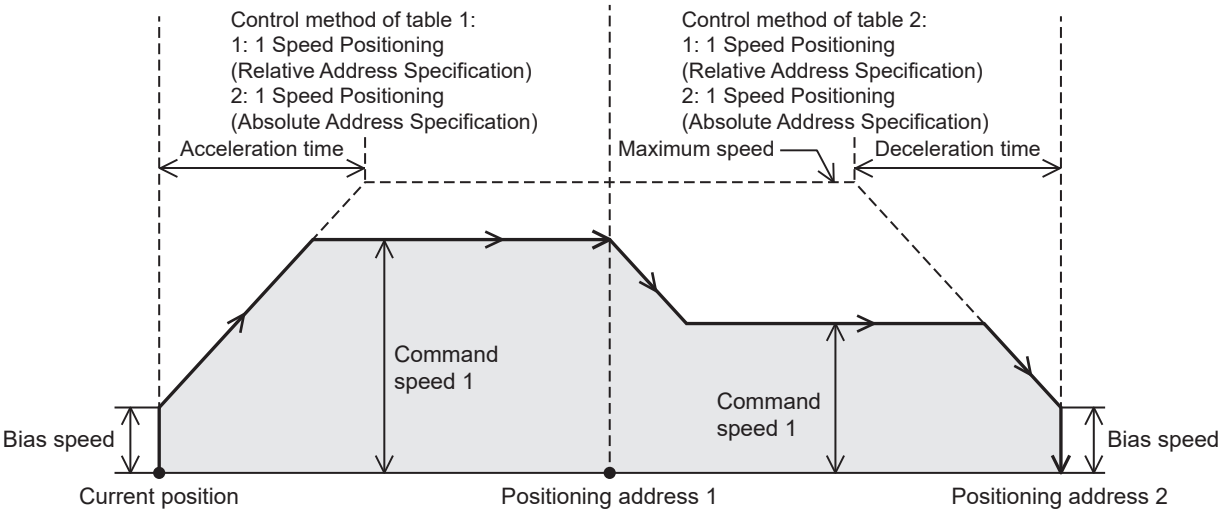
| Positioning instruction | Table operation control method |
|---|---|
| Relative positioning (DRVI/DDRVI) instruction | • 1: 1 Speed Positioning (Relative Address Specification)<br>• 2: 1 Speed Positioning (Absolute Address Specification) |
| Absolute positioning (DRVA/DDRVA) instruction | |
| Table operation (TBL*1/DRVTBL/DRVMUL) instruction | |

*1 Only CPU module is supported.

## 2-speed positioning

The 1-speed positioning of table 1 (excluding the deceleration stop) is performed by the table operation instruction. (☞ Page 352 1-speed positioning) After the target position is reached, the 1-speed positioning of table 2 is performed from acceleration/deceleration.

2-speed positioning is performed when two 1-speed positionings are operated continuously by the continuous operation of the DRVTBL/DRVMUL instruction. Both relative address and absolute address can be used for the two 1-speed positionings. (☞ Page 523 Continuous operation)



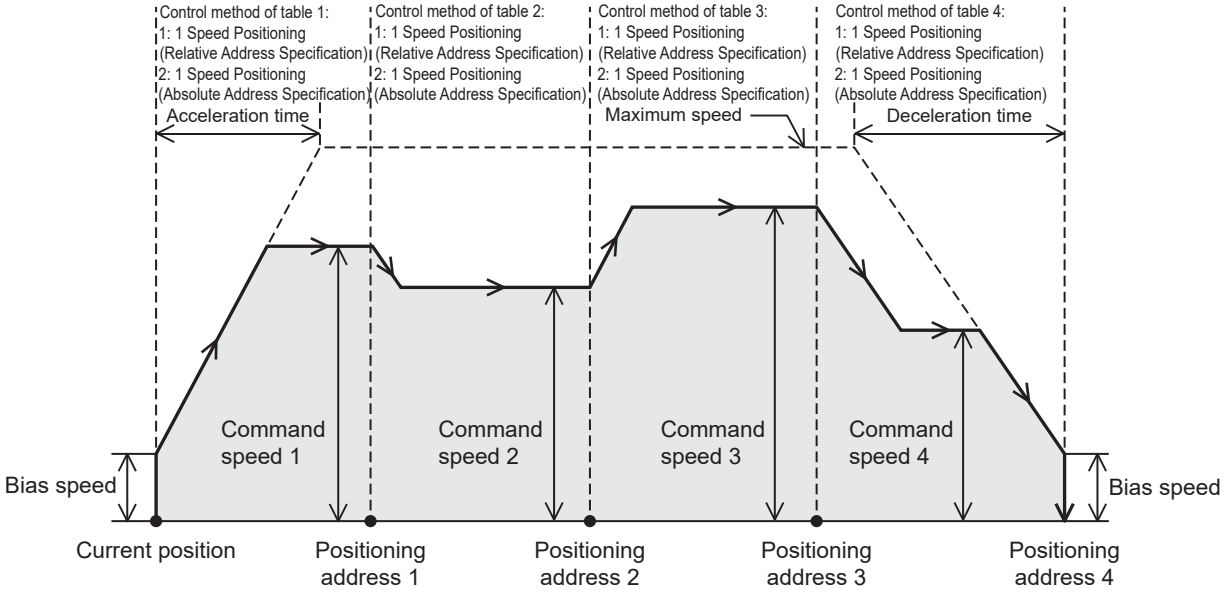

The following table shows applicable control methods of the table operation.

| Positioning instruction | Table operation control method |
|---|---|
| Table operation (DRVTBL/DRVMUL) instruction | • 1: 1 Speed Positioning (Relative Address Specification)<br>• 2: 1 Speed Positioning (Absolute Address Specification) |

# Multi-speed operation

1-speed positioning operation (excluding the deceleration stop) is continued several times by the table operation instruction. (☞ Page 352 1-speed positioning) At the last table, the operation decelerates and stops in the point that the speed can be reduced.

The multi-speed positioning is performed when two or more 1-speed positionings are operated continuously by the continuous operation of the DRVTBL/DRVMUL instruction. (☞ Page 523 Continuous operation) Both relative address and absolute address can be used for the 1-speed positionings. The figure shows an example of a 4-speed operation.

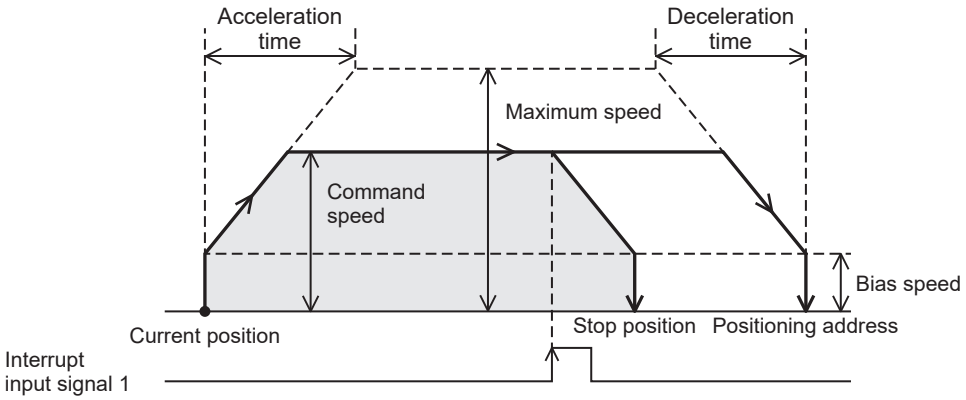



The following table shows applicable control methods of the table operation.

| Positioning instruction | Table operation control method |
|---|---|
| Table operation (DRVTBL/DRVMUL) instruction | • 1: 1 Speed Positioning (Relative Address Specification)<br>• 2: 1 Speed Positioning (Absolute Address Specification) |

# Interrupt stop

1-speed positioning is performed by the table operation instruction. (☞ Page 352 1-speed positioning) When the interruption input signal 1 is detected during pulse output operation, the operation decelerates and stops. (☞ Page 383 Interrupt Input Signal 1) Both relative address and absolute address can be used for the interrupt stop.




The following table shows applicable control methods of the table operation.

| Positioning instruction | Table operation control method |
|---|---|
| Table operation (TBL*1/DRVTBL/DRVMUL) instruction | • 6: Interrupt Stop (Relative Address Specification)<br>• 7: Interrupt Stop (Absolute Address Specification) |

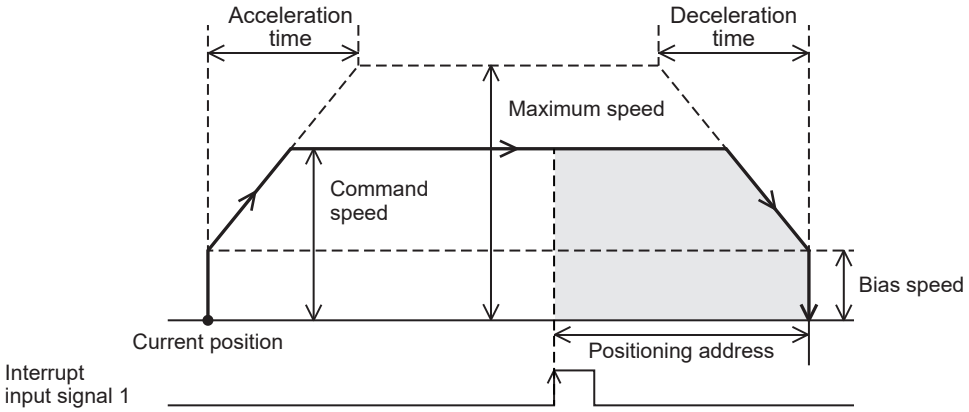
*1 Only CPU module is supported.

### Precautions

When the interrupt input signal 1 does not turn on, the operation is the same as the 1-speed positioning.

## Interrupt 1-speed positioning

Acceleration is started at the bias speed when pulses are output by the positioning instruction. After the speed has reached the specified speed, the operation will be performed at the specified speed. When the interrupt input signal 1 is detected, the operation continues at the same speed as the command speed up to the point that deceleration must be performed, and decelerates and stops the pulse output at the position specified by the positioning address. (☞ Page 383 Interrupt Input Signal 1)




The following table shows applicable positioning instructions and control methods of the table operation.

| Positioning instruction | Table operation control method |
|---|---|
| Interrupt 1-speed positioning (DVIT/DDVIT) instruction | 3: Interrupt 1 Speed Positioning |
| Table operation (TBL*1/DRVTBL/DRVMUL) instruction | |

*1 Only CPU module is supported.

### Precautions

The pulse output is not stopped unless the interrupt input signal 1 is turned on.

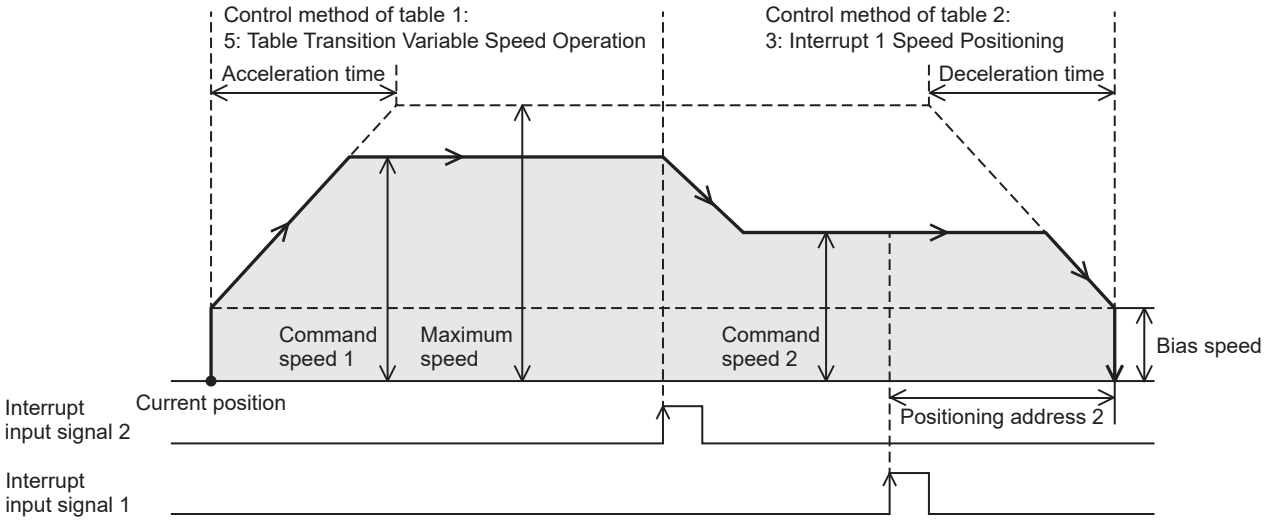
When using continuous operation of the table operation instruction, the interrupt 1-speed positioning can be used only when the previous table is set to Table Transition Variable Speed Operation.

# Interrupt 2-speed positioning

The variable speed operation of table 1 is performed by the table operation instruction. (☞ Page 356 Variable speed operation) When the interrupt input signal 2 is turned on, the interrupt 1-speed positioning of table 2 is performed from acceleration/deceleration. (☞ Page 354 Interrupt 1-speed positioning) The operation command speed can be changed until the interrupt input signal 2 turns on.

Interrupt 2-speed positioning is achieved when control method [5: Table Transition Variable Speed Operation] is transferred to control method [3: Interrupt 1 Speed Positioning] by the table operation instruction.

Only CPU module is supported.




The following table shows applicable control methods of the table operation.

| Positioning instruction | Table operation control method |
|---|---|
| Table operation (TBL[*1]/DRVTBL/DRVMUL) instruction | • 5: Table Transition Variable Speed Operation[*1]<br>• 3: Interrupt 1 Speed Positioning |

*1 Only CPU module is supported.

## Precautions

- The pulse output is not stopped unless the interrupt input signal 1 and 2 are turned on.
- When 0 is set for the command speed in the Table Transition Variable Speed Operation, the operation decelerates and stops. When the drive contact of the table operation instruction is on, the operation can be restarted when the command speed is set again.

**Point**

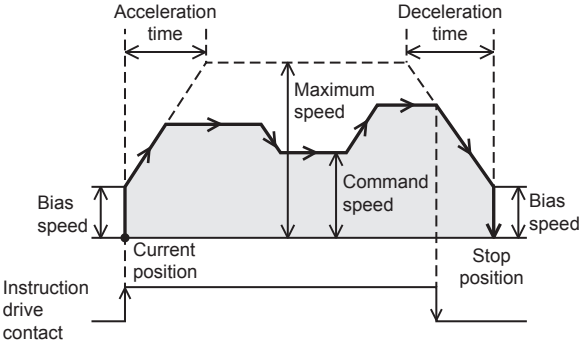
For the high-speed pulse input/output module, substitution for the interrupt 2-speed positioning is possible by changing the command speed in mid-operation (☞ Page 362 Command speed change during positioning operation) of the interrupt 1-speed positioning.

# Variable speed operation

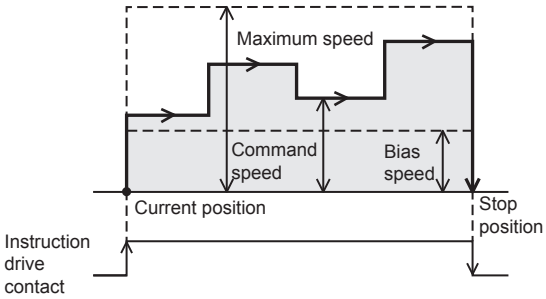
Acceleration is started at the bias speed when pulses are output by the positioning instruction. After the speed has reached the specified speed, the operation will be performed at the specified speed. When the command speed is changed, the operation can change the speed to the specified speed. When the drive contact of the positioning instruction turns off, the operation decelerates and stops. The pulse output at the command speed is not stopped unless the instruction drive contact is turned off.

When setting 0 for the acceleration time and the deceleration time, speed change will be performed without the acceleration/deceleration operation.

■With acceleration/deceleration operation




■Without acceleration/deceleration (0 is set to the acceleration time and the deceleration time.)




The following table shows applicable positioning instructions and control methods of the table operation.

| Positioning instruction | Table operation control method |
|---|---|
| Variable speed operation (PLSV/DPLSV) instruction | 4: Variable Speed Operation |
| Table operation (TBL*1/DRVTBL/DRVMUL) instruction | |

*1 Only CPU module is supported.

## Precautions

When 0 is set for the command speed, the operation decelerates and stops (when 0 is set for the deceleration time, the operation stops immediately). When the drive contact of the positioning instruction is on, the operation can be restarted when the command speed is set again.

# Table operation

A positioning control program can be set with the table set in GX Works3. The specified table operation is started by the table operation instruction.

The TBL instruction performs the operation of a single table, the DRVTBL instruction performs the stepping operation and continuous operation of multiple tables, and the DRVMUL instruction can handle tables of multiple axes (continuous operation possible). (☞ Page 521 Stepping operation, Page 523 Continuous operation)

However, the TBL instruction is available only for the CPU module.

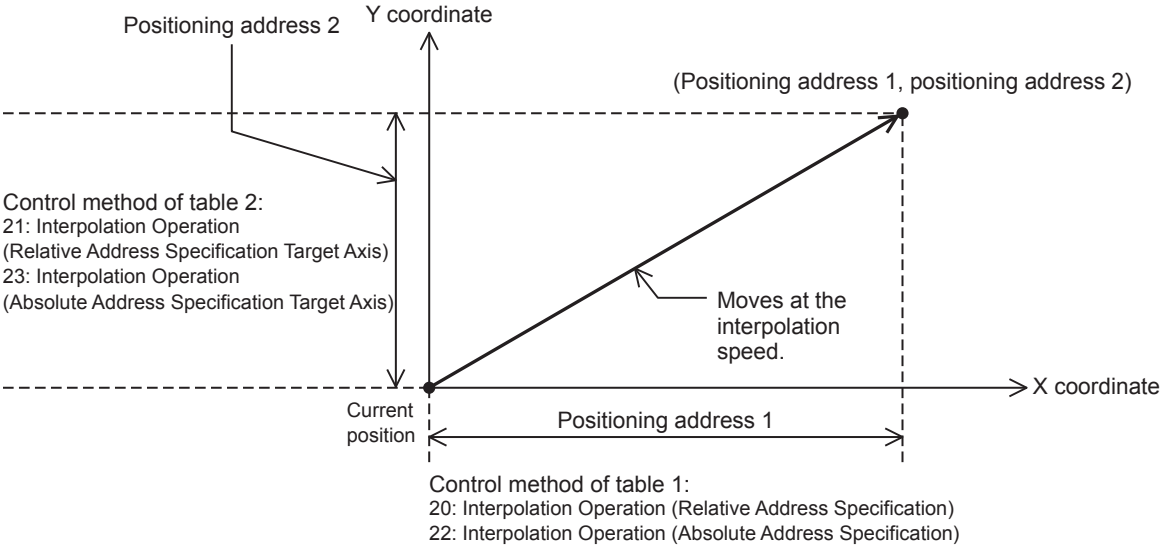
For details of the table operation, refer to ☞ Page 489 TABLE OPERATION.

| No. | Device | Control Method | Axis to be Interpolated | Positioning Address | Command Speed | Dwell Time | Interrupt Counts | Interrupt Input Signal 2 Device No. | Jump Destination Table No. | M No. for Jump Condition |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | D100 | 4: Variable Speed Operation | Axis 2 Specification | 0 pulse | 10000 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 2 | D106 | 1: 1 Speed Positioning (Relative Address Specification) | Axis 2 Specification | 100000 pulse | 30000 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 3 | D112 | 1: 1 Speed Positioning (Relative Address Specification) | Axis 2 Specification | -10000 pulse | 2000 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 4 | D118 | 1: 1 Speed Positioning (Relative Address Specification) | Axis 2 Specification | 20000 pulse | 140000 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 5 | D124 | 0: No Positioning | Axis 2 Specification | 0 pulse | 1 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 6 | D130 | 0: No Positioning | Axis 2 Specification | 0 pulse | 1 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 7 | D136 | 0: No Positioning | Axis 2 Specification | 0 pulse | 1 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 8 | D142 | 0: No Positioning | Axis 2 Specification | 0 pulse | 1 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 9 | D148 | 3: Interrupt 1 Speed Positioning | Axis 2 Specification | 30000 pulse | 100000 pps | 10 ms | 1 Times | X0 | 1 | 0 |
| 10 | D154 | 3: Interrupt 1 Speed Positioning | Axis 2 Specification | 2000 pulse | 20000 pps | 10 ms | 1 Times | X0 | 1 | 0 |
| ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ |

# Simple linear interpolation operation (2-axis simultaneous start)

The work piece will travel to the target position at the specified vector speed (interpolation operation) by the table operation instruction. In this interpolation operation of two axes, the CPU module calculates the start timing based on the positioning address and the command speed set in the table. The interpolation speed can be specified by combined speed and reference-axis speed. (☞ Page 397 Interpolation Speed Specified Method) For maximum speed, bias speed, the acceleration time, and deceleration time, use the reference-axis setting.

Only FX5S/FX5U/FX5UC CPU module and high-speed pulse input/output module support this operation.




The following table shows applicable control methods of the table operation.

| Positioning instruction | Table operation control method |
|---|---|
| Table operation (TBL*1/DRVTBL/DRVMUL) instruction | • 20: Interpolation Operation (Relative Address Specification)<br>• 21: Interpolation Operation (Relative Address Specification Target Axis)<br>• 22: Interpolation Operation (Absolute Address Specification)<br>• 23: Interpolation Operation (Absolute Address Specification Target Axis) |

*1 Only CPU module is supported.

## Precautions

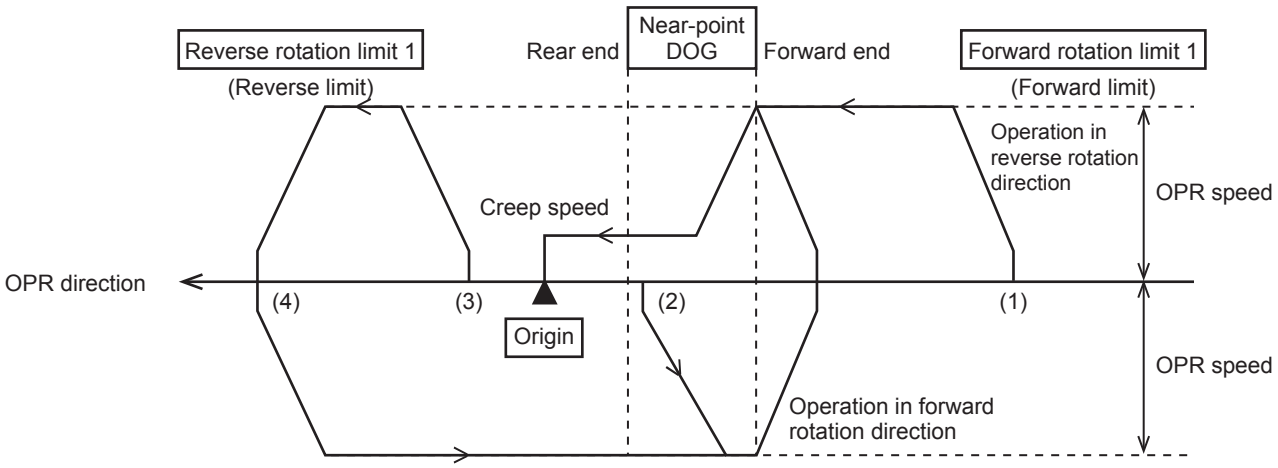
The 2 axes used must be from the same module. (Example. The combination of a reference-axis in the CPU module and a counterpart axis in a high-speed pulse input/output module is not allowed.)

# 30.4 Auxiliary Function

This section describes auxiliary functions of the positioning.

## Dog search function

If the forward rotation limit and the reverse rotation limit are used, the DOG search function can be used for OPR. (☞ Page 361 Forward limit and reverse limit) The OPR operation depends on the OPR start position.




### (1) If the start position is before the near-point dog:

1. When the DSZR/DDSZR instruction is executed, OPR will be started.
2. Transfer operation will be started in the OPR direction at the OPR speed.
3. If the front end of the near-point dog is detected, the speed will be reduced to the creep speed.
4. After detecting the rear end of the near-point dog, if the zero signal is detected for the specified number of times is detected, the operation will be stopped.

### (2) If the start position is in the near-point dog area:

1. When the DSZR/DDSZR instruction is executed, OPR will be started.
2. Transfer operation will be started in the opposite direction of the OPR direction at the OPR speed.
3. If the front end of the near-point dog is detected, the speed will decelerate and the operation will stop. (The workpiece will come out of the near-point dog area.)
4. Transfer operation will be started in the OPR direction at the OPR speed. (The workpiece will enter the near-point dog area again.)
5. If the front end of the near-point dog is detected, the speed will be reduced to the creep speed.
6. After detecting the rear end of the near-point dog, if the zero signal is detected for the specified number of times is detected, the operation will be stopped.

### (3) If the start position is after the near-point dog:

1. When the DSZR/DDSZR instruction is executed, OPR will be started.
2. Transfer operation will be started in the OPR direction at the OPR speed.
3. If the reverse rotation limit 1 (reverse rotation limit) is detected, the speed will decelerate, and the operation will stop.
4. Transfer operation will be started in the opposite direction of the OPR direction at the OPR speed.
5. If the front end of the near-point dog is detected, the speed will decelerate and the operation will stop. (The workpiece will detect (come out) the near-point dog area.)
6. Transfer operation will be started in the OPR direction at the OPR speed. (The workpiece will enter the near-point dog area again.)
7. If the front end of the near-point dog is detected, the speed will be reduced to the creep speed.
8. After detecting the rear end of the near-point dog, if the zero signal is detected for the specified number of times is detected, the operation will be stopped.

### (4) If the limit switch in the OPR direction turns on (if the start position is at reverse rotation limit 1):

1. When the DSZR/DDSZR instruction is executed, OPR will be started.
2. Transfer operation will be started in the opposite direction of the OPR direction at the OPR speed.
3. If the front end of the near-point dog is detected, the speed will decelerate and the operation will stop. (The workpiece will detect (come out) the near-point dog area.)
4. Transfer operation will be started in the OPR direction at the OPR speed. (The workpiece will enter the near-point dog area again.)
5. If the front end of the near-point dog is detected, the speed will be reduced to the creep speed.
6. After detecting the rear end of the near-point dog, if the zero signal is detected for the specified number of times is detected, the operation will be stopped.

**Point**

When the same device is specified for the near-point dog signal and the zero signal and OPR zero signal counts is 1, OPR is stopped when the OPR is completed by the near-point dog signal detection, not by the zero signal detection. When the timing of counting start of the number of zero signals is set to the front end of near-point dog, the number of zero signals is counted from when the near-point dog signal is detected.

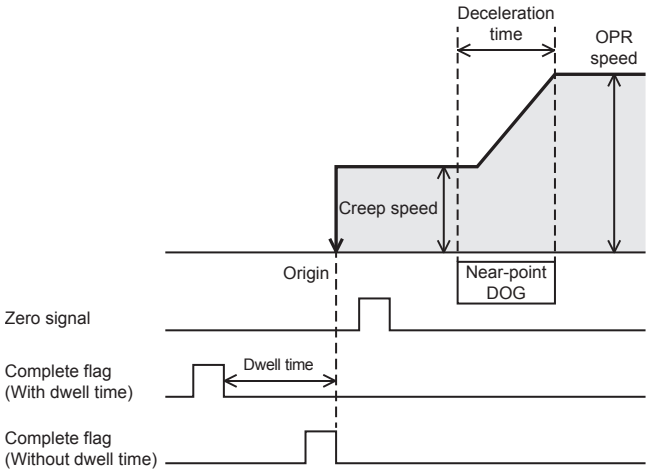
# Dwell time

Set the time (dwell time) until the complete flag turns on after positioning operation is completed between 0 and 32767 ms. (☞ Page 402 Complete flag) When the positioning operation is completed, the complete flag remains off until the dwell time has elapsed.

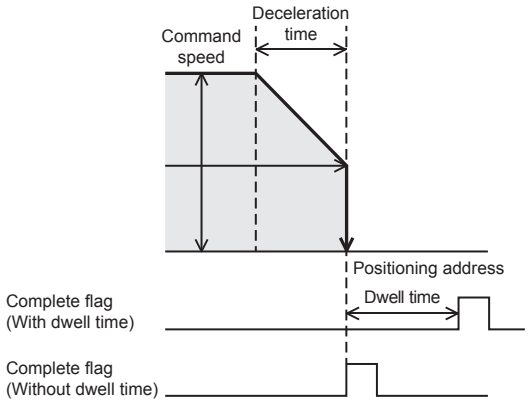
Dwell time applies to the DSZR/DDSZR instruction and the table operation instruction. If the CLEAR signal is output by the DSZR/DDSZR instruction, the dwell time applies when the CLEAR signal turns off.

Set the dwell time of DSZR/DDSZR instruction with the positioning parameter. (☞ Page 392 OPR Dwell Time) Set the dwell time of the table operation instruction for the control method of each table with the table operation parameter. (☞ Page 395 Dwell Time)

■OPR (DSZR/DDSZR) instruction

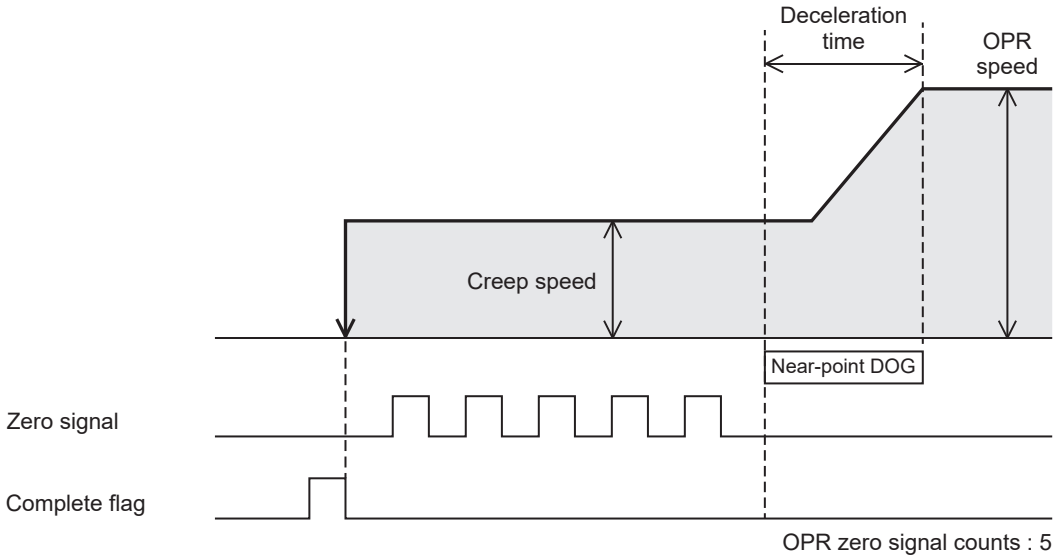



■Table operation instruction (control method: [1 Speed Positioning])




# OPR zero signal count

When the DSZR/DDSZR instruction is used, the OPR zero signal counts is counted after the zero signal count start timing. (☞ Page 393 Zero Signal) When the number of the zero signals has reached specified number, pulse output is stopped. The setting range is from 0 to 32767. When not counting the OPR zero signal counts, set 1. The pulse output is stopped when the OPR zero signal counts has reached specified number even during the deceleration operation.

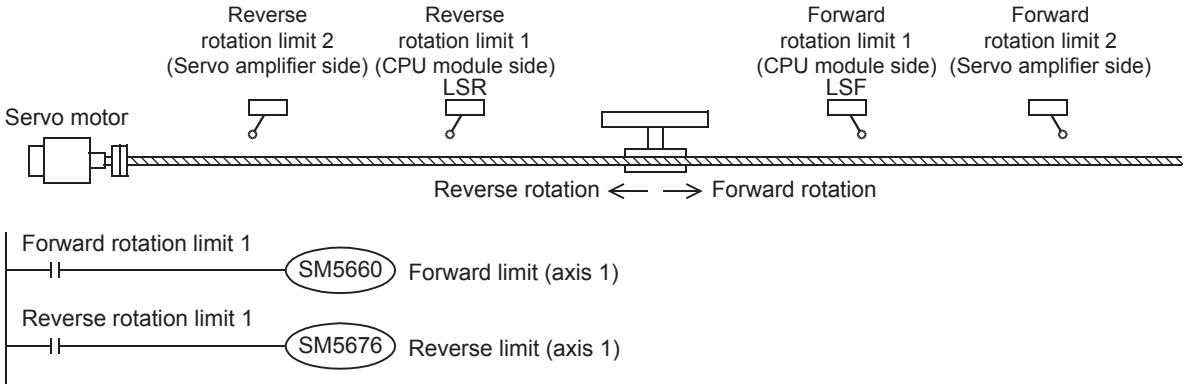



## Precautions

When the OPR zero signal counts is set to 0, the motor stops immediately after the forward end or rear end (selected by parameter) of near-point dog is detected. Note that immediate stop may damage the machine because the motor stops immediately.

# Forward limit and reverse limit

When using the servo motor, the forward rotation limit and the reverse rotation limit can be set for the servo amplifier.
To use the DOG search function for OPR, or to set the forward rotation limit or the reverse rotation limit for operations other than OPR using the CPU module, set the forward rotation limit 1 (LSF) and reverse rotation limit 1 (LSR) for the CPU module so that these limit switches can be activated before the forward rotation limit 2 or reverse rotation limit 2 of the servo amplifier.
As shown in the following figure, interlock the forward rotation limit 1 (LSF) with the forward limit, and the reverse rotation limit 1 (LSR) with the reverse limit.




The following table lists the corresponding devices. Related devices of axis 4 are available only for the FX5S/FX5U/FX5UC CPU module.

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 |
| Forward limit | SM5660 | SM5661 | SM5662 | SM5663 | SM5664 | SM5665 | SM5666 | SM5667 | SM5668 | SM5669 | SM5670 | SM5671 |
| Reverse limit | SM5676 | SM5677 | SM5678 | SM5679 | SM5680 | SM5681 | SM5682 | SM5683 | SM5684 | SM5685 | SM5686 | SM5687 |

## Precautions

If the forward rotation limit 1 (LSF) and the reverse rotation limit 1 (LSR) cannot be set, observe the following items:

- Even if forward rotation limit 2 or reverse rotation limit 2 turns on and the servo motor is automatically stopped, the positioning instruction currently being driven cannot recognize the motor being stopped. Therefore, pulses will be continuously output until the instruction is deactivated.
- The dog search function cannot be used.

# Positioning address change during positioning operation

This function changes positioning address during positioning operation.

- For positioning instructions, by specifying a word device as an operand and changing the value, positioning address can be changed during positioning operation.
- For the table operation, by setting the positioning table data in devices and changing the operand value of the control method of a table, positioning address can be changed during positioning operation. Only the last table can be changed in the case of continuous operation.

The changed value is applied when the positioning instruction is executed at the next scan.
The following table shows applicable positioning instructions and control methods of the table operation.

| Positioning instruction | Table operation control method |
|---|---|
| Pulse Y output (PLSY/DPLSY) instruction*1 | • 1: 1 Speed Positioning (Relative Address Specification)<br>• 2: 1 Speed Positioning (Absolute Address Specification)<br>• 3: Interrupt 1 Speed Positioning<br>• 6: Interrupt Stop (Relative Address Specification)<br>• 7: Interrupt Stop (Absolute Address Specification) |
| Relative positioning (DRVI/DDRVI) instruction | |
| Absolute positioning (DRVA/DDRVA) instruction | |
| Interrupt 1-speed positioning (DVIT/DDVIT) instruction | |
| Table operation (TBL*1/DRVTBL/DRVMUL) instruction | |

*1 Only CPU module is supported.

### Precautions

- The current address at start of a positioning instruction is used as the basis, thus, positioning operation is performed with the current address at startup as the basis even when the positioning address is changed during positioning operation.
- The PLSY/DPLSY instruction is stopped immediately when set to a value equal to or less than the number of pulses that have been already output.
- If the positioning address is changed to a value that reverses the current rotation direction, the rotation direction is reversed*2 after deceleration stop and the positioning is started for the positioning address.
- When an address that positioning address cannot decelerate in time is set, the transfer direction is reversed*2 after deceleration stop and the positioning is started for the positioning address.
- A reversed operation makes it impossible to change the positioning address during positioning operation until positioning operation is reactivated.
- When positioning address is changed to a large remaining transfer distance during the deceleration operation with small remaining transfer distance, the positioning operation is performed after re-acceleration.
- When the transfer distance from the current address exceeds -2147483648 to +2147483647 in pulse in the positioning operation with relative address specification, the operation ends with an error after deceleration stop.
- If a table other than the last one is changed in the case of continuous operation, the change may not be reflected on the operation correctly.

*2 The waiting time for the pulse reverse after deceleration stop is "1 ms + scan time". Set the new positioning address after confirming that it does not affect the system. At this time, pulse output in the reversed direction is started regardless of the dwell time.

## Command speed change during positioning operation

This function changes operation speed during positioning operation.

- For positioning instructions, by specifying a word device as an operand that specifies the command speed (for the DSZR/DDSZR instruction, the OPR speed and the creep speed) and changing the value, operation speed can be changed during operation.
- For the table operation, by setting the positioning table data in devices and changing the operand value of the corresponding control method, command speed can be changed during positioning operation.

The changed value is applied when the positioning instruction is executed at the next scan.

The following table shows applicable positioning instructions and control methods of the table operation.

| Positioning instruction | Table operation control method |
|---|---|
| Pulse Y output (PLSY/DPLSY) instruction*1 | • 1: 1 Speed Positioning (Relative Address Specification)<br>• 2: 1 Speed Positioning (Absolute Address Specification)<br>• 3: Interrupt 1 Speed Positioning*3<br>• 4: Variable Speed Operation<br>• 5: Table Transition Variable Speed Operation*1<br>• 6: Interrupt Stop (Relative Address Specification)*3<br>• 7: Interrupt Stop (Absolute Address Specification)*3 |
| Mechanical OPR (DSZR/DDSZR) instruction*2 | |
| Relative positioning (DRVI/DDRVI) instruction | |
| Absolute positioning (DRVA/DDRVA) instruction | |
| Interrupt 1-speed positioning (DVIT/DDVIT) instruction*3 | |
| Variable speed operation (PLSV/DPLSV) instruction | |
| Table operation (TBL*1/DRVTBL/DRVMUL) instruction | |

*1 Only CPU module is supported.

*2 A change in the command speed after the zero signal is detected is applied when the positioning instruction is next driven again.

*3 A change in the command speed after the interrupt input signal 1 is detected is applied when the positioning instruction is next driven again.

### Precautions

- When command speed is lower than bias speed, the bias speed is applied. The PLSY/DPLSY instruction, PLSV/DPLSV instruction and the table operation instruction (control method: [4: Variable Speed Operation] or [5: Table Transition Variable Speed Operation]) can be changed to lower than the bias speed.
- Do not change command speed to 200 kpps or more in pulse. For the FX5S CPU module, the command speed must be less than 100 kpps in pulse.
- If the creep speed is changed to a speed equal to or faster than the OPR speed during operation at creep speed by the DSZR/DDSZR instruction, the speed is changed to the OPR speed.
- For instruction or control method other than the PLSY/DPLSY instruction, PLSV/DPLSV instruction and the table operation instruction (control method: [4: Variable Speed Operation] or [5: Table Transition Variable Speed Operation]), do not set 0 for the command speed. The operation ends with an error.
- If the command speed is changed to 0 during PLSY/DPLSY instruction operation, the operation does not end with error but it immediate stops. As long as the drive contact is on, changing the command speed restarts pulse output. However, if the command speed is changed to negative value during operation, the operation ends with an error.
- If the command speed of the PLSV/DPLSV instruction or the table operation instruction (control method: [4: Variable Speed Operation] or [5: Table Transition Variable Speed Operation]) is changed to 0 during operation, the operation does not end with error but it decelerates to a stop. As long as the drive contact is on, changing the command speed restarts pulse output.
- If the speed is changed to reverse the rotation direction, pulses are output inversely after deceleration stop. The waiting time for the pulse reverse after deceleration stop is "1 ms + scan time". Set the new command speed after confirming that it does not affect the system.
- When operation speed is changed for acceleration with small remaining travel distance, the speed is increased to a speed at which deceleration stop is still possible (the operation is not performed at the changed speed), then decelerates.



## Pulse decelerate and stop

When the pulse decelerate and stop command is turned on during positioning operation, the positioning operation can be decelerated and stopped. (☞ Page 385 Pulse decelerate and stop command) When positioning operation is stopped by the pulse decelerate and stop command, remaining distance operation can be performed with positioning instructions. (☞ Page 364 Remaining distance operation)

The following table lists the corresponding devices. Related devices of axis 4 are available only for the FX5S/FX5U/FX5UC CPU module.

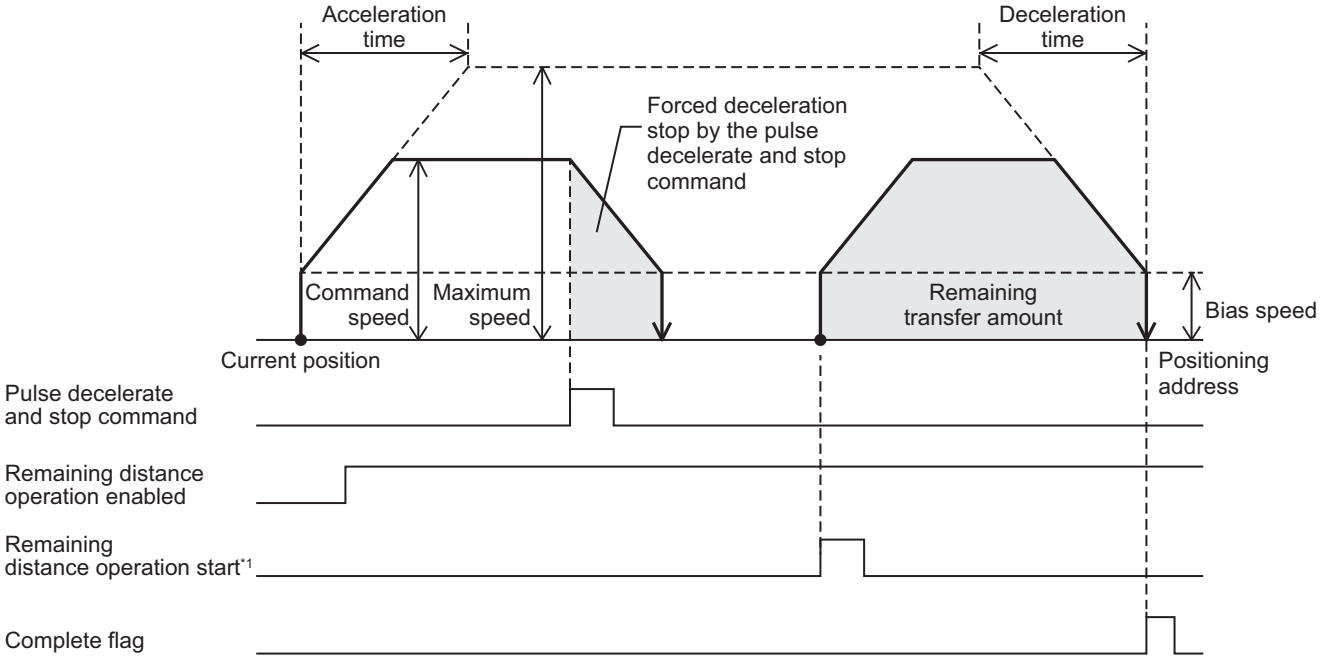
| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 |
| Pulse decelerate and stop command | SM5644 | SM5645 | SM5646 | SM5647 | SM5648 | SM5649 | SM5650 | SM5651 | SM5652 | SM5653 | SM5654 | SM5655 |

### Precautions

- When this function is used with remaining distance operation-compatible instructions with remaining distance operation enabled and non-table operation control method (other than remaining distance operation), the operation ends with an error.
- PLSY/DPLSY instruction stops immediately.
- For the PLSV/DPLSV instruction and table operation instruction (control method: [4: Variable Speed Operation] or [5: Table Transition Variable Speed Operation]), the operation ends normally. When operation is performed without acceleration/deceleration operation, the operation stops immediately.
- When this function is used during stepping operation and the table operation instruction (control method: [4: Variable Speed Operation] or [5: Table Transition Variable Speed Operation]), the following table is activated after deceleration stop.

# Remaining distance operation

When pulse output is stopped by the pulse decelerate and stop command during positioning instruction operation and the remaining distance operation enabled is ON, the remaining distance operation ready status is acquired. (☞ Page 387 Remaining distance operation, Page 363 Pulse decelerate and stop) When the pulse decelerate and stop command turns off, the remaining distance operation starts. Or if the external start signal (when enabled) is detected, remaining transfer amount from deceleration stop is output. After the remaining distance operation is completed, the complete flag turns on. (☞ Page 385 External Start Signal)




*1 The external start signal can start the remaining distance operation as well.

The following table shows applicable positioning instructions and control methods of the table operation.

| Positioning instruction | Table operation control method |
|---|---|
| Relative positioning (DRVI/DDRVI) instruction | • 1: 1 Speed Positioning (Relative Address Specification)<br>• 2: 1 Speed Positioning (Absolute Address Specification)<br>• 6: Interrupt Stop (Relative Address Specification)<br>• 7: Interrupt Stop (Absolute Address Specification) |
| Absolute positioning (DRVA/DDRVA) instruction | |
| Table operation (TBL*2/DRVTBL/DRVMUL) instruction | |

*2 Only CPU module is supported.

Changes to the positioning address and command speed during positioning operation are valid until the system starts deceleration stop under the pulse decelerate and stop command. After deceleration stop, changes are applied when the positioning instruction is started again.

When dwell time is set, and the remaining distance operation start command is turned on immediately after deceleration stop, remaining distance operation is started regardless of the dwell time.

## Precautions

- Where the system starts the remaining distance operation after changing the positioning address under the relative address specification, positioning operation is performed with the current address at start of the positioning or table instruction as the basis.
- After the interrupt input signal 1 is detected, the table operation instruction (control method: [6: Interrupt Stop (Relative Address Specification)] or [7: Interrupt Stop (Absolute Address Specification)]) becomes unable to execute the remaining distance operation.
- For positioning instructions or control methods of the table operation that are not compatible with the remaining distance operation, only deceleration stop is performed. The operation ends with an error. For the PLSV/DPLSV instruction and table operation instruction (control method: [4: Variable Speed Operation] or [5: Table Transition Variable Speed Operation]), after the deceleration stop the operation ends normally.
- When the operation is stopped by other than the pulse decelerate and stop command remaining distance operation enabled is ON, the operation ends with an error. (☞ Page 406 Pulse output stop)

## Multiple axes simultaneous activation

Tables for up to 4 axes can be activated at the same time with the DRVMUL instruction. Continuous operation can be performed. (☞ Page 523 Continuous operation) After the operation is started, each axis operates independently, thus, table shift timing during continuous operation does not need to be considered.

### Precautions

- The axes to be driven simultaneously must be from the same module. (Example. The combination of axis 1 and axis 2 in the CPU module and axis 5 and axis 6 in a high-speed pulse input/output module is not allowed.)
- 3 axes can be simultaneously driven for the FX5UJ CPU module.
- 2 axes can be simultaneously driven for the high-speed pulse input/output module.

## Detection of absolute position

The absolute position (ABS) data of the servo amplifier can be read with the DABS instruction.
For the absolute position detection operation, refer to ☞ Page 486 Outline of operation.

## All module reset when a stop error occurs

When the system intends to stop the pulse output but fails to do so due to a bus error, this function resets all the extension modules while immediately stopping the pulse output. (☞ Page 385 Enabled/Disabled Reset All Modules at Error Stop)
For supported versions for all module reset when a stop error occurs, refer to ☞ Page 971 Added and Enhanced Functions.

**Point**

In addition, all modules are reset when the following conditions are satisfied.
- All module reset instruction (SM4210) is turned ON
- F5F5H (reset permission code) is stored in the all module reset instruction permission code (SD4210)

### Precautions

An error occurs when stop by reset. To restart operation of the extension module, turn the power of the CPU module from off to on or reset the system.

# 31 POSITIONING PARAMETER

This chapter describes the parameters for the positioning function and relevant devices.
Set the parameters of the positioning using the high speed I/O parameter, operand, and special devices.
For the parameters of the table operation, refer to ☞ Page 489 TABLE OPERATION.

## 31.1 Setting Method

The following list shows the setting methods for the positioning parameter.

### High Speed I/O Parameter

High speed I/O parameter settings can be made from GX Works3. The following describes the details of the positioning setting.

- Basic Setting (☞ Page 367 Basic setting)
- Axis #1 Positioning Data to Axis #12 Positioning Data (☞ Page 489 Table setting method)
- Input Check (☞ Page 370 Input check)
- Output Confirmation (☞ Page 371 Output check)

### Operand

The command speed or positioning address can be set by operand for each positioning instruction or control method for table operation. When specifying a word device (if table operation, when the positioning table data is set to use device) as an operand, the value can be changed during operation. For the details of operand, refer to the following.

☞ Page 404 POSITIONING INSTRUCTION
☞ Page 489 TABLE OPERATION

### Special Device

Values of special devices for positioning parameters can be read or written from engineering tool or program. Changes to the special devices during positioning operation are applied when the positioning instruction is started again. However, the changed pulse output stop command, pulse decelerate and stop command, forward limit, reverse limit, table shift command, remaining distance operation enabled and remaining distance operation start are applied in the next scan.
The values of special devices for positioning parameters can be also read or written to by high-speed current value transfer (HCMOV/DHCMOV) instruction and data transfer (MOV/DMOV) instructions.
For the details of special device that can be read or written to, refer to the following.

☞ Page 372 Details of Parameters
☞ Page 776 Special Relay List

# Basic setting

The items set in basic setting correspond to the positioning parameters of each axis. In special devices corresponding to parameters, values set in the basic setting are stored as the initial values when the power of CPU module is STOP→RUN. When items occupying I/O are changed, the high speed I/O assignment parameters are also refreshed together.
For parameters, refer to ☞ Page 372 Details of Parameters.

## Window

### ■CPU module

[Navigation window] ⇨ [Parameter] ⇨ Module model name ⇨ [Module Parameter] ⇨ [High Speed I/O] ⇨ [Output Function] ⇨ [Positioning] ⇨ [Detailed Setting] ⇨ [Basic Settings]

| Item | Axis1 | Axis2 | Axis3 | Axis4 |
|---|---|---|---|---|
| **Basic Parameter 1** | **Set basic parameter 1.** | | | |
| Pulse Output Mode | 2:CW/CCW | 1:PULSE/SIGN | 0: Not Used | 1:PULSE/SIGN |
| Output Device (PULSE/CW) | Y0 | Y1 | Y2 | Y3 |
| Output Device (SIGN/CCW) | Y2 | Y5 | Y6 | Y7 |
| Rotation Direction Setting | 0: Current Address Increment with Forward Run Pulse Output | 1: Current Address Increment with Reverse Run Pulse Output | 0: Current Address Increment with Forward Run Pulse Output | 0: Current Address Increment with Forward Run Pulse Output |
| Unit Setting | 0: Motor System (pulse, pps) | 1: Machine System (um, cm/min) | 0: Motor System (pulse, pps) | 2: Machine System (0.0001inch, inch/min) |
| No. of Pulse per Rotation | 2000 pulse | 3000 pulse | 2000 pulse | 2000 pulse |
| Movement Amount per Rotation | 1000 pulse | 2000 um | 1000 pulse | 1000 X 0.0001 inch |
| Position Data Magnification | 1: X Single | 1: X Single | 1: X Single | 10: X 10 Times |
| **Basic Parameter 2** | **Set basic parameter 2.** | | | |
| Interpolation Speed Specification Method | 1: Reference Axis Speed | 0: Composite Speed | 0: Composite Speed | 0: Composite Speed |
| Max. Speed | 120000 pps | 200000 cm/min | 100000 pps | 150000 inch/min |
| Bias Speed | 1500 pps | 1800 cm/min | 0 pps | 1000 inch/min |
| Acceleration Time | 1000 ms | 1000 ms | 100 ms | 1000 ms |
| Deceleration Time | 100 ms | 100 ms | 100 ms | 100 ms |
| **Detailed Setting Parameter** | **Set the detailed setting parameter.** | | | |
| External Start Signal Enable/Disable | 1: Valid | 0: Invalid | 0: Invalid | 1: Valid |
| External Start Signal Device No. | X0 | X0 | X0 | X6 |
| External Start Signal Logic | 0: Positive Logic | 0: Positive Logic | 0: Positive Logic | 0: Positive Logic |
| Interrupt Input Signal 1 Enable/Disable | 0: Invalid | 0: Invalid | 0: Invalid | 1: Valid |
| Interrupt Input Signal 1 Mode | 0: High Speed Mode | 0: High Speed Mode | 0: High Speed Mode | 1: Standard Mode |
| Interrupt Input Signal 1 Device No. | X0 | X0 | X0 | X2 |
| Interrupt Input Signal 1 Logic | 0: Positive Logic | 0: Positive Logic | 0: Positive Logic | 0: Positive Logic |
| Interrupt Input Signal 2 Logic | 0: Positive Logic | 0: Positive Logic | 0: Positive Logic | 1: Negative Logic |
| **OPR Parameter** | **Set the OPR parameter.** | | | |
| OPR Enable/Disable | 1: Valid | 1: Valid | 0: Invalid | 0: Invalid |
| OPR Direction | 1: Positive Direction (Address Increment Direction) | 0: Negative Direction (Address Decrement Direction) | 0: Negative Direction (Address Decrement Direction) | 0: Negative Direction (Address Decrement Direction) |
| Starting Point Address | 100 pulse | -10000 um | 0 pulse | 0 X 0.001 inch |
| Clear Signal Output Enable/Disable | 1: Valid | 1: Valid | 1: Valid | 1: Valid |
| Clear Signal Output Device No. | Y10 | Y11 | Y0 | Y0 |
| OPR Dwell Time | 0 ms | 100 ms | 0 ms | 0 ms |
| Near-point Dog Signal Device No. | X7 | X10 | X0 | X0 |
| Near-point Dog Signal Logic | 0: Positive Logic | 1: Negative Logic | 0: Positive Logic | 0: Positive Logic |
| Zero Signal Device No. | X4 | X5 | X0 | X0 |
| Zero Signal Logic | 0: Positive Logic | 1: Negative Logic | 0: Positive Logic | 0: Positive Logic |
| Zero Signal OPR Zero Signal Counts | 1 | 1 | 1 | 1 |
| Zero Signal Count Start Time | 0: Near-point Dog Latter Part | 1: Near-point Dog Front Part | 0: Near-point Dog Latter Part | 0: Near-point Dog Latter Part |

## ■High-speed pulse input/output module

Navigation window ⇨ Parameter ⇨ Module Information ⇨ Right-click ⇨ Add New Module

After adding the high-speed pulse input/output module, make settings on the screen displayed from the following operation.

Navigation window ⇨ Parameter ⇨ Module Information ⇨ 1 to 16 (high-speed input/output module) ⇨ Module Parameter ⇨ Output Function ⇨ Positioning ⇨ Detailed Setting ⇨ Basic Settings

| Item | Axis5 | Axis6 |
|---|---|---|
| **Basic Parameter 1** | **Set basic parameter 1.** | |
| Pulse Output Mode | 2:CW/CCW | 1:PULSE/SIGN |
| Output Device (PULSE/CW) | Y20 | Y21 |
| Output Device (SIGN/CCW ) | Y24 | Y25 |
| Rotation Direction Setting | 0: Current Address Increment with Forward Run Pulse Output | 1: Current Address Increment with Reverse Run Pulse Output |
| Unit Setting | 0: Motor System (pulse, pps) | 1: Machine System (um, cm/min) |
| No. of Pulse per Rotation | 2000 pulse | 3000 pulse |
| Movement Amount per Rotation | 1000 pulse | 2000 um |
| Position Data Magnification | 1: X Single | 1: X Single |
| **Basic Parameter 2** | **Set basic parameter 2.** | |
| Interpolation Speed Specification Method | 1: Reference Axis Speed | 0: Composite Speed |
| Max. Speed | 120000 pps | 200000 cm/min |
| Bias Speed | 1500 pps | 1800 cm/min |
| Acceleration Time | 1000 ms | 1000 ms |
| Deceleration Time | 100 ms | 100 ms |
| **Detailed Setting Parameter** | **Set the detailed setting parameter.** | |
| External Start Signal Enable/Disable | 1: Valid | 0: Invalid |
| External Start Signal Device No. | X27 | X26 |
| External Start Signal Logic | 0: Positive Logic | 0: Positive Logic |
| Interrupt Input Signal 1 Enable/Disable | 0: Invalid | 1: Valid |
| Interrupt Input Signal 1 Mode | 0: High Speed Mode | 0: High Speed Mode |
| Interrupt Input Signal 1 Device No. | X24 | X23 |
| Interrupt Input Signal 1 Logic | 0: Positive Logic | 0: Positive Logic |
| **OPR Parameter** | **Set the OPR parameter.** | |
| OPR Enable/Disable | 1: Valid | 1: Valid |
| OPR Direction | 1: Positive Direction (Address Increment Direction) | 0: Negative Direction (Address Decrement Direction) |
| Starting Point Address | 100 pulse | -10000 um |
| Clear Signal Output Enable/Disable | 1: Valid | 1: Valid |
| Clear Signal Output Device No. | Y22 | Y23 |
| OPR Dwell Time | 0 ms | 100 ms |
| Near-point Dog Signal Device No. | X20 | X21 |
| Near-point Dog Signal Logic | 0: Positive Logic | 1: Negative Logic |
| Zero Signal Device No. | X25 | X22 |
| Zero Signal OPR Zero Signal Counts | 1 | 1 |
| Zero Signal Count Start Time | 0: Near-point Dog Latter Part | 0: Near-point Dog Latter Part |
| **Axis Common Parameter** | **Set the axis common parameter** | |
| Enable/Disable Reset All Modules at Error Stop | 1: Valid | |

Shown above is the screen at the time when the first high-speed pulse input/output module is selected.

## Parameter list

The following table lists the positioning parameters that can be set in Basic Setting.

| Item | | Setting value | | | Reference |
|---|---|---|---|---|---|
| | | CPU module | High-speed pulse input/output module | | |
| | | | Axis ■[*4] | Axis ■+1[*4] | |
| Basic Parameter 1 | | | | | |
| Pulse Output Mode | | 0: Not Used, 1: PULSE/SIGN, 2: CW/CCW[*1] | | | Page 372 |
| Output Device | PULSE/CW | FX5S/FX5U/FX5UC: Y0 to Y3[*2][*3]<br>FX5UJ: Y0 to Y2[*2] | Y□[*5] | Y□+1[*5] | Page 373 |
| | SIGN/CCW | Y0 to Y17[*3] | Y□+4[*5] | Y□+5[*5] | |
| Rotation Direction Setting | | 0: Current Address Increment with Forward Run Pulse Output, 1: Current Address Increment with Reverse Run Pulse Output | | | Page 374 |
| Unit Setting | | 0: Motor System (pulse, pps)<br>1: Machine System (μm, cm/min)<br>2: Machine System (0.0001 inch, inch/min)<br>3: Machine System (mdeg, 10 deg/min)<br>4: Multiple System (μm, pps)<br>5: Multiple System (0.0001 inch, pps)<br>6: Multiple System (mdeg, pps) | | | Page 375 |
| No. of Pulse per Rotation | | 1 to 2147483647 | | | Page 376 |
| Movement Amount per Rotation | | 1 to 2147483647 | | | Page 376 |
| Position Data Magnification | | 1: × Single, 10: × 10 Times, 100: × 100 Times, 1000: × 1000 Times | | | Page 377 |
| Basic Parameter 2 | | | | | |
| Interpolation Speed Specified Method[*1] | | 0: Composite Speed, 1: Reference Axis Speed | | | Page 397 |
| Max. Speed | | 1 to 2147483647 | | | Page 379 |
| Bias Speed | | 0 to 2147483647 | | | Page 379 |
| Acceleration Time | | 0 to 32767 ms | | | Page 380 |
| Deceleration Time | | 0 to 32767ms | | | Page 380 |
| Detailed Setting Parameter | | | | | |
| External Start Signal | Enabled/Disabled | 0: Disabled, 1: Enabled | | | Page 385 |
| | Device No. | X0 to X17 | X□+7[*5] | X□+6[*5] | |
| | Logic | 0: Positive Logic, 1: Negative Logic | | | |
| Interrupt Input Signal 1 | Enabled/Disabled | 0: Disabled, 1: Enabled | | | Page 383 |
| | Mode | 0: High Speed Mode, 1: Standard Mode | | | |
| | Device No. | X0 to X17 | X□+4[*5] | X□+3[*5] | |
| | Logic | 0: Positive Logic, 1: Negative Logic | | | |
| Interrupt Input Signal 2 Logic | | 0: Positive Logic, 1: Negative Logic | — | | Page 396 |
| OPR Parameter | | | | | |
| OPR Enabled/Disabled | | 0: Disabled, 1: Enabled | | | Page 389 |
| OPR Direction | | 0: Negative Direction (Address Decrement Direction), 1: Positive Direction (Address Increment Direction) | | | Page 389 |
| Starting Point Address | | -2147483648 to +2147483647 | | | Page 390 |
| Clear Signal Output | Enabled/Disabled | 0: Disabled, 1: Enabled | | | Page 391 |
| | Device No. | Y0 to Y17 | Y□+2[*5] | Y□+3[*5] | Page 392 |
| OPR Dwell Time | | 0 to 32767 ms | | | Page 392 |
| Near-point Dog Signal | Device No. | X0 to X17 | X0 to X377 (Optional) | | Page 392 |
| | Logic | 0: Positive Logic, 1: Negative Logic | | | |
| Zero Signal | Device No. | X0 to X17 | X□+5[*5] | X□+2[*5] | Page 393 |
| | Logic | 0: Positive Logic, 1: Negative Logic | — | | |
| | OPR zero signal counts | 0 to 32767 | | | |
| | Count Start Time | 0: Near-point Dog Latter Part, 1: Near-point Dog Front Part | | | |
| Axis Common Parameter | | | | | |
| Enabled/Disabled Reset All Modules at Error Stop | | — | 0: Disabled, 1: Enabled | | Page 385 |

*1 Only FX5S/FX5U/FX5UC CPU module and high-speed pulse input/output module can use this item or setting.
*2 PULSE/CW is fixed to the output device (Y) of "axis number -1".
*3 In the CW/CCW mode, PULSE/CW and SIGN/CCW are fixed to Y0 (CW)/Y2 (CCW), Y1 (CW)/Y3 (CCW).
*4 The number in ■ is first module: 5, second module: 7, third module: 9, fourth module: 11.
*5 □: Head input/output number for each high-speed pulse input/output module

# Input check

The usage status of the input device (X) can be checked from the input check window.

## Window

### ■CPU module

[Navigation window] ⇨ [Parameter] ⇨ Module model name ⇨ [Module Parameter] ⇨ [High Speed I/O] ⇨ [Input Check] ⇨ [Positioning]

| Item | X0 | X1 | X2 | X3 | X4 | X5 | X6 | X7 | X10 | X11 | X12 | X13 | X14 | X15 | X16 | X17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Positioning** | | | | | | | | | | | | | | | | |
| Axis 1 External Start Signal Positive Logic | () | | | | | | | | | | | | | | | |
| Axis 1 External Start Signal Negative Logic | | | | | | | | | | | | | | | | |
| Axis 1 Interrupt Input Signal 1 High Speed | | | | | | | | | | | | | | | | |
| Axis 1 Interrupt Input Signal 1 Standard Positive Logic | | | | | | | | | | | | | | | | |
| Axis 1 Interrupt Input Signal 1 Standard Negative Logic | | | | | | | | | | | | | | | | |
| Axis 1 Near-point Dog Signal | | | | | | | | () | | | | | | | | |
| Axis 1 Zero Signal Positive Logic | | | | | () | | | | | | | | | | | |
| Axis 1 Zero Signal Negative Logic | | | | | | | | | | | | | | | | |
| Axis 1 Interrupt Input Signal 2 | | | | | | | | | | | | | | | | |
| Axis 2 External Start Signal Positive Logic | | | | | | | | | | | | | | | | |
| Axis 2 External Start Signal Negative Logic | | | | | | | | | | | | | | | | |

### ■High-speed pulse input/output module

[Navigation window] ⇨ [Parameter] ⇨ [1 to 16 (high-speed pulse input/output module)] ⇨ [Module Parameter] ⇨ [Input Check] ⇨ [Positioning]

| Item | X20 | X21 | X22 | X23 | X24 | X25 | X26 | X27 |
|---|---|---|---|---|---|---|---|---|
| **Positioning** | | | | | | | | |
| Axis 5 External Start Signal Positive Logic | | | | | | | | () |
| Axis 5 External Start Signal Negative Logic | | | | | | | | |
| Axis 5 Interrupt Input Signal 1 High Speed | | | | | | | | |
| Axis 5 Interrupt Input Signal 1 Standard Positive Logic | | | | | | | | |
| Axis 5 Interrupt Input Signal 1 Standard Negative Logic | | | | | | | | |
| Axis 5 Near-point Dog Signal | () | | | | | | | |
| Axis 5 Zero Signal Positive Logic | | | | | | () | | |
| Axis 6 External Start Signal Positive Logic | | | | | | | | |
| Axis 6 External Start Signal Negative Logic | | | | | | | | |

Shown above is the screen at the time when the first high-speed pulse input/output module is selected.

# Output check

The usage status of the output device (Y) can be checked from the output check window.

## Window

### ■CPU module

[Navigation window] ⇨ [Parameter] ⇨ Module model name ⇨ [Module Parameter] ⇨ [High Speed I/O] ⇨ [Output Confirmation] ⇨ [Positioning]

| Item | Y0 | Y1 | Y2 | Y3 | Y4 | Y5 | Y6 | Y7 | Y10 | Y11 | Y12 | Y13 | Y14 | Y15 | Y16 | Y17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Positioning** | | | | | | | | | | | | | | | | |
| Axis 1 Pulse Output (PULSE) | | | | | | | | | | | | | | | | |
| Axis 1 Pulse Output (SIGN) | | | | | | | | | | | | | | | | |
| Axis 1 Pulse Output (CW) | () | | | | | | | | | | | | | | | |
| Axis 1 Pulse Output (CCW) | | | () | | | | | | | | | | | | | |
| Axis 1 Clear Signal | | | | | | | | | () | | | | | | | |
| Axis 2 Pulse Output (PULSE) | | () | | | | | | | | | | | | | | |
| Axis 2 Pulse Output (SIGN) | | | | | | () | | | | | | | | | | |
| Axis 2 Pulse Output (CW) | | | | | | | | | | | | | | | | |
| Axis 2 Pulse Output (CCW) | | | | | | | | | | | | | | | | |
| Axis 2 Clear Signal | | | | | | | | | | () | | | | | | |
| Axis 3 Pulse Output (PULSE) | | | | | | | | | | | | | | | | |
| Axis 3 Pulse Output (SIGN) | | | | | | | | | | | | | | | | |
| Axis 3 Pulse Output (CW) | | | | | | | | | | | | | | | | |
| Axis 3 Pulse Output (CCW) | | | | | | | | | | | | | | | | |
| Axis 3 Clear Signal | | | | | | | | | | | | | | | | |
| Axis 4 Pulse Output (PULSE) | | | | () | | | | | | | | | | | | |
| Axis 4 Pulse Output (SIGN) | | | | | | | | () | | | | | | | | |
| Axis 4 Pulse Output (CW) | | | | | | | | | | | | | | | | |
| Axis 4 Pulse Output (CCW) | | | | | | | | | | | | | | | | |
| Axis 4 Clear Signal | | | | | | | | | | | | | | | | |

### ■High-speed pulse input/output module

[Navigation window] ⇨ [Parameter] ⇨ [1 to 16 (high-speed pulse input/output module)] ⇨ [Module Parameter] ⇨ [Output Confirmation] ⇨ [Positioning]

| Item | Y20 | Y21 | Y22 | Y23 | Y24 | Y25 | Y26 | Y27 |
|---|---|---|---|---|---|---|---|---|
| **Positioning** | | | | | | | | |
| Axis 5 Pulse Output (PULSE) | | | | | | | | |
| Axis 5 Pulse Output (SIGN) | | | | | | | | |
| Axis 5 Pulse Output (CW) | () | | | | | | | |
| Axis 5 Pulse Output (CCW) | | | | | () | | | |
| Axis 5 Clear Signal | | | () | | | | | |
| Axis 6 Pulse Output (PULSE) | | () | | | | | | |
| Axis 6 Pulse Output (SIGN) | | | | | | () | | |
| Axis 6 Pulse Output (CW) | | | | | | | | |
| Axis 6 Pulse Output (CCW) | | | | | | | | |
| Axis 6 Clear Signal | | | | () | | | | |

Shown above is the screen at the time when the first high-speed pulse input/output module is selected.

# 31.2 Details of Parameters

The following describes the details of the parameters and relevant devices.

Note that parameters and relevant devices of axis 4 are available only for the FX5S/FX5U/FX5UC CPU module.

## Common item

The following lists the setting items related to common aspects of positioning operation.

### Pulse Output Mode

▶Setting method: High Speed I/O Parameter

Specify the pulse output method.

When [0: Not Used] is selected, the positioning function is not used.

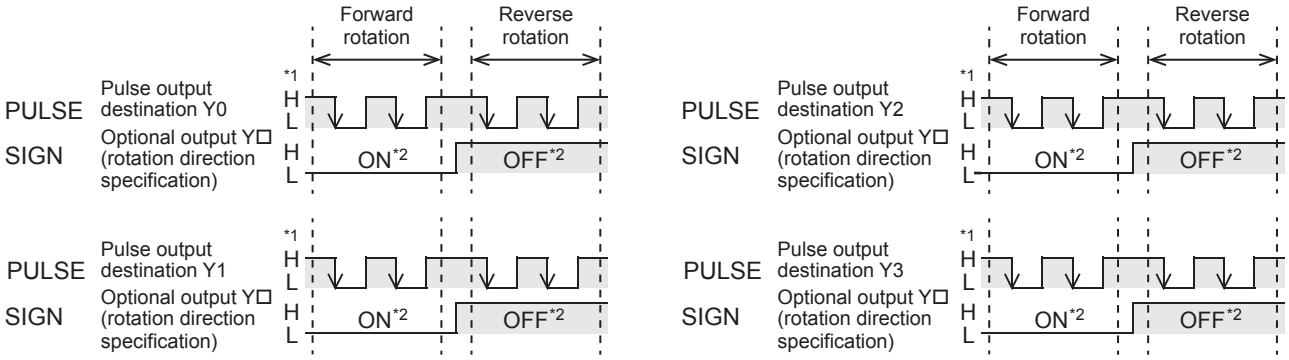
When [1: PULSE/SIGN] is selected, the positioning function is executed with the pulse train and direction signal output.

When [2: CW/CCW] is selected, the positioning function is executed with the outputs of the forward pulse train and reverse pulse train.

The following describes the output configuration in the PULSE/SIGN mode and CW/CCW mode.

#### ■PULSE/SIGN mode

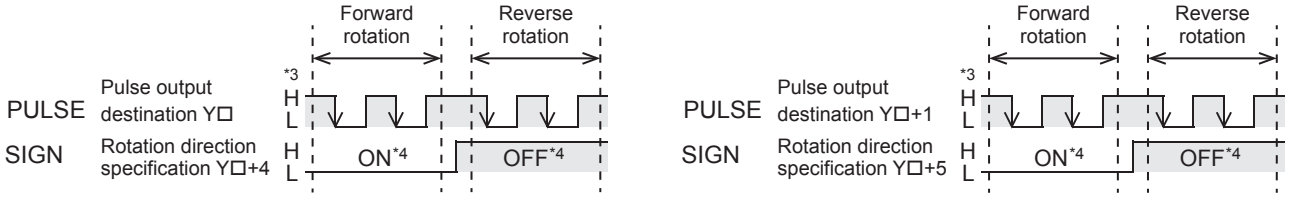
• CPU module




*1 "H" and "L" respectively represent the HIGH status and the LOW status of the waveform.

*2 "ON" and "OFF" represent the output status of the FX5 CPU module.

• High-speed pulse input/output module




*3 "H" and "L" respectively represent the HIGH status and the LOW status of the waveform.

*4 "ON" and "OFF" represent the output status of the high-speed pulse input/output module.

The following table lists the output assignment in the PULSE/SIGN mode.

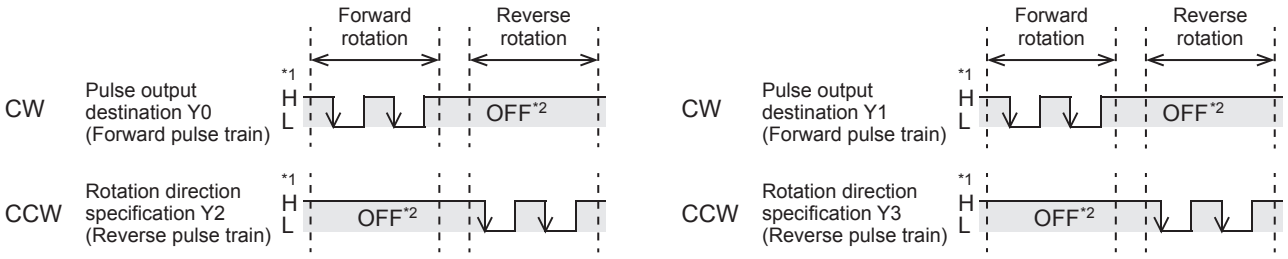
| Item | CPU module | | | | High-speed pulse input/output module*5 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 |
| PULSE | Y0 | Y1 | Y2 | Y3 | Y□ | Y□+1 | Y□ | Y□+1 | Y□ | Y□+1 | Y□ | Y□+1 |
| SIGN | Unused device among Y0 to Y17 (Any device can be set.) | | | | Y□+4 | Y□+5 | Y□+4 | Y□+5 | Y□+4 | Y□+5 | Y□+4 | Y□+5 |

*5 The number in □ is the head output number for each high-speed pulse input/output module.

## ■CW/CCW mode

• CPU module

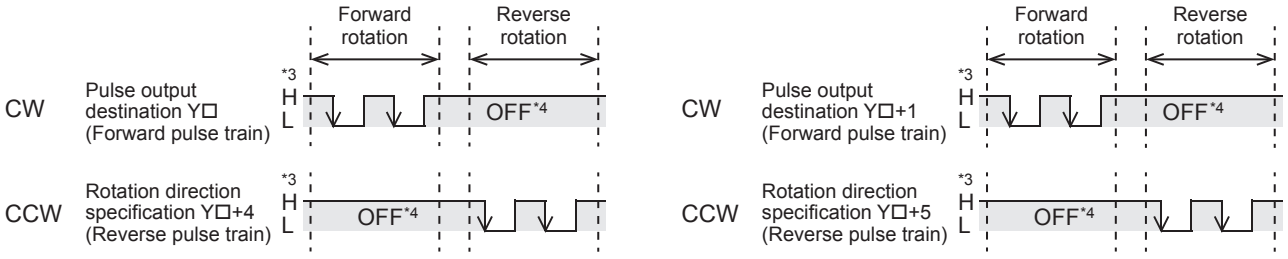
Only FX5S/FX5U/FX5UC CPU module support the CW/CCW mode.




*1 "H" and "L" respectively represent the HIGH status and the LOW status of the waveform.

*2 "ON" and "OFF" represent the output status of the CPU module.

• High-speed pulse input/output module




*3 "H" and "L" respectively represent the HIGH status and the LOW status of the waveform.

*4 "ON" and "OFF" represent the output status of the high-speed pulse input/output module.

The following table lists the output assignment in the CW/CCW mode. The positioning function can be executed for up to 10 axes.

| Item | CPU module | | | | High-speed pulse input/output module*5 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 |
| CW | Y0 | Y1 | — | | Y□ | Y□+1 | Y□ | Y□+1 | Y□ | Y□+1 | Y□ | Y□+1 |
| CCW | Y2 | Y3 | | | Y□+4 | Y□+5 | Y□+4 | Y□+5 | Y□+4 | Y□+5 | Y□+4 | Y□+5 |

*5 The number in □ is the head output number for each high-speed pulse input/output module.

**Point**

The PULSE/SIGN mode and CW/CCW mode can be used together. Examples of the combinations are as follows:

• CPU module

When axis 1 is used in CW/CCW mode, PULSE/SIGN mode can be set in axis 2 and 4.

When axis 2 is used in CW/CCW mode, PULSE/SIGN mode can be set in axis 1 and 3.

• High-speed pulse input/output module

The combination of axis 5 in CW/CCW mode and axis 6 in PULSE/SIGN mode, etc. are possible.

## Output Device

▶Setting method: High Speed I/O Parameter

Set outputs that are used as positioning outputs. Outputs that are not used as positioning outputs can be used as general-purpose output or PWM output.

For PWM output, refer to the following.

☞ Page 321 PWM Function

## ■PULSE/CW

PULSE output in PULSE/SIGN mode or CW output in CW/CCW mode is selected.

For the CW/CCW mode, this parameter does not need to be set for CW because the axis number and output device (Y) that executes outputs are fixed.

### ■SIGN/CCW

SIGN output in PULSE/SIGN mode or CCW output in CW/CCW mode is selected.

For the CW/CCW mode, this parameter does not need to be set for CCW because the axis number and output device (Y) that executes outputs are fixed.

## Rotation Direction Setting

▶Setting method: High Speed I/O Parameter, Special Device

Set the relationship between motor rotation direction and increase or decrease of the current address.

### ■High Speed I/O Parameter

When [0: Current Address Increment with Forward Run Pulse Output] is selected, the current address increases when forward pulses are output and decreases when reverse pulses are output.

When [1: Current Address Increment with Reverse Run Pulse Output] is selected, the current address increases when reverse pulses are output and decreases when forward pulses are output.

### ■Special Device

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| Rotation direction setting | SM5772 | SM5773 | SM5774 | SM5775 | SM5776 | SM5777 | SM5778 | SM5779 | SM5780 | SM5781 | SM5782 | SM5783 | R/W |

R/W: Read/Write

When rotation direction setting is turned off: The current address increases when forward pulses are output and decreases when reverse pulses are output.

When rotation direction setting is turned on: the current address increases when reverse pulses are output and decreases when forward pulses are output.

**Point**

For the PLSV/DPLSV instruction and table operation instruction (control method: [4: Variable Speed Operation] or [5: Table Transition Variable Speed Operation]), the direction of increase/decrease in the address and pulse output direction are determined by the sign of the command speed and rotation direction setting, as shown below.

| Item | | Rotation Direction Setting | |
|---|---|---|---|
| | | Current Value Increment with Forward Run Pulse Output | Current Value Increment with Reverse Run Pulse Output |
| Command speed | Positive direction | Output direction: Forward<br>Address: Increment | Output direction: Reverse<br>Address: Increment |
| | 0 | Output direction: No pulse output, Address: No increase or decrease | |
| | Negative direction | Output direction: Reverse<br>Address: Decrement | Output direction: Forward<br>Address: Decrement |

For the DSZR/DDSZR instruction, the direction of increase/decrease in the address and the pulse output direction are determined by the OPR direction and rotation direction setting. (☞ Page 420 OPR direction)

## Unit Setting

▶Setting method: High Speed I/O Parameter

Set the unit system (user unit) to be used for the positioning function.

The selected unit system is applied to the speed used for positioning instructions and operands of positioning-related special devices and positioning instructions (command speed, positioning address) as a unit. The unit types of the positioning control include the motor system unit, machine system unit, and multiple system unit.

| Unit system | Item | Position unit | Speed unit | Remarks |
|---|---|---|---|---|
| Motor System | [0: Motor System (pulse, pps)] | pulse | pps | Based on the number of pulses for position commands and speed commands. |
| Machine System | [1: Machine System (μm, cm/min)] | μm | cm/min | Based on position commands and μm, $10^{-4}$ inch and mdeg of speed. |
| | [2: Machine System (0.0001 inch, inch/min)] | $10^{-4}$inch | inch/min | |
| | [3: Machine System (mdeg, 10 deg/min)] | mdeg | 10 deg/min | |
| Multiple System | [4: Multiple System (μm, pps)] | μm | pps | Uses the machine system unit for position commands and motor system unit for speed command. |
| | [5: Multiple System (0.0001 inch, pps)] | $10^{-4}$inch | | |
| | [6: Multiple System (mdeg, pps)] | mdeg | | |

The following indicates the relation between the motor system unit and machine system unit.

- Transfer distance (pulse) = Transfer distance (μm, $10^{-4}$ inch, mdeg) × No. of pulses per rotation × Positioning data magnification ÷ Transfer distance per rotation
- Speed command (pps) = Speed command (cm/min, inch/min, 10 deg/min) × No. of pulses per rotation × $10^4$ ÷ Transfer distance per rotation ÷ 60

### Precautions

#### ■Command error when the machine system unit or multiple system unit is used:

Under the condition of the number of pulses per rotation = A, transfer distance per rotation = B, and relative transfer distance = C, the number of pulses that the CPU module should output is calculated from "C × (A/B)". Even if the result of (A/B) is not an integer, no calculation error occurs as long as the result of C × (A/B) is an integer. However, if the result of C × (A/B) is not an integer, a rounding error within one pulse occurs.

For positioning operations using absolute address, a rounding error within one pulse may occur. For positioning operations using relative address, errors may accumulate in the current address.

#### ■The position unit when the machine system unit or multiple system unit is used:

When the machine system or multiple system is set as the unit system, the number of pulses and transfer distance per rotation must be set. When the machine system or multiple system is set, the position unit is handled as the machine system unit of μm, $10^{-4}$ inch or mdeg. The unit can be selected from μm, $10^{-4}$ inch, and mdeg in the unit setting. However, consider that other positioning address and command speed all have the same unit, and then the same pulse output can be acquired as long as the setting value is the same even with different units. The following is a setting example.

Ex.

Setting example of control unit

Condition

| Setting item | Setting value | Remarks |
|---|---|---|
| Pulse No. of per Rotation | 4000 [pulse/REV] | — |
| Travel distance per rotation | 100 [μm/REV,$10^{-4}$ inch/REV, mdeg/REV] | — |
| Position Data Magnification | Single | The transfer distance is handled in μm, $10^{-4}$ inch or mdeg. |
| Electronic gear of servo amplifier (Setting of servo amplifier) | 1/1 | — |

### ■When set in μm

In the positioning operation with transfer distance of 100 [μm] and operation speed of 6 [cm/min], pulses are output as follows.

- Number of pulses to be generated = Transfer distance ÷ Transfer distance per rotation × Number of pulses per rotation = 100 [μm] ÷ 100 [μm/REV] × 4000 [pulse/REV] = 4000 [pulse]
- Pulse frequency = Operation speed*1 ÷ Transfer distance per rotation*1 × Number of pulses per rotation = 6 [cm/min] × $10^4$ ÷ 60 ÷ 100 [μm/REV] × 4000 [pulse/REV] = 40000 [pps]

*1 Adjust the units at calculation. 1 cm = $10^4$ μm, 1 min = 60 s

### ■When set in $10^{-4}$ inch

In the positioning operation with transfer distance of 100 [×$10^{-4}$ inch] and operation speed of 6 [inch/min], pulses are output as follows.

- Number of pulses to be generated = Transfer distance ÷ Transfer distance per rotation × Number of pulses per rotation = 100 [× $10^{-4}$ inch] ÷ 100 [× $10^{-4}$ inch/REV] × 4000 [pulse/REV] = 4000 [pulse]
- Pulse frequency = Operation speed*1 ÷ Transfer distance per rotation*1 × Number of pulses per rotation = 6 [inch/min] × $10^4$ ÷ 60 ÷ 100 [× $10^{-4}$ inch/REV] × 4000 [pulse/REV] = 40000 [pps]

*1 Adjust the units at calculation. 1 min = 60 s

### ■When set in mdeg

In the positioning operation with transfer distance of 100 [mdeg] and operation speed of 6 [deg/min], pulses are output as follows.

- Number of pulses to be generated = Transfer distance ÷ Transfer distance per rotation × Number of pulses per rotation = 100 [mdeg] ÷ 100 [mdeg/REV] × 4000 [pulse/REV] = 4000 [pulse]
- Pulse frequency = Operation speed*1 ÷ Transfer distance per rotation*1 × Number of pulses per rotation = 6 [10 deg/min] × $10^4$ ÷ 60 ÷ 100 [mdeg/REV] × 4000 [pulse/REV] = 40000 [pps]

*1 Adjust the units at calculation. 1 deg = $10^3$ mdeg, 1 min = 60 s

## No. of Pulse per Rotation

▶Setting method: High Speed I/O Parameter

Set the number of pulses required to rotate a motor once, within 1 to 2147483647. This parameter must be set when the unit setting is set to [Machine System] or [Multiple System]. When [Motor System] is set, the setting of this parameter is ignored.

### Precautions

When the servo amplifier has an electronic gear setting, set this parameter considering the multiplication of the electronic gear. The relation between the number of pulses per rotation and electronic gear is as follows.

- Number of pulses per rotation = Encoder resolution (positioning feedback pulse) ÷ Electronic gear

For electronic gear, refer to the manual for each servo amplifier.

## Movement Amount per Rotation

▶Setting method: High Speed I/O Parameter

Set the transfer distance of the machine per motor rotation within 1 to 2147483647. This parameter must be set when the unit setting is set to [Machine System] or [Multiple System]. When [Motor System] is set, the setting of this parameter is ignored.

## Position Data Magnification

▶Setting method: High Speed I/O Parameter

The values of positioning addresses can be multiplied by the Position Data Magnification. The available multiplying factors include single, 10 times, 100 times, and 1000 times. The following shows a setting example.

Ex.

For magnification by 1000 times

For the positioning address of 123, the following shows the actual address and transfer distance.

- Motor System unit: 123 × $10^3$ = 123000 [pulse]
- Machine/Multiple System unit: 123 × $10^3$ = 123000 [μm, $10^{-4}$ inch, mdeg] = 123 [mm, $10^{-1}$ inch, deg]

The following table lists the relation between the positioning data magnification of each unit system.

| Position Data Magnification | Unit system setting (position unit) | | | | Unit system setting (speed unit) | | | |
|---|---|---|---|---|---|---|---|---|
| | pulse | μm | 0.0001 inch | mdeg | pps | cm/min | inch/min | 10 deg/min |
| Single | pulse | μm | × 0.0001 inch | mdeg | pps | cm/min | inch/min | × 10 deg/min |
| 10 times | × 10 pulse | × 10 μm | × 0.001 inch | × 10 mdeg | | | | |
| 100 times | × 100 pulse | × 100 μm | × 0.01 inch | × 100 mdeg | | | | |
| 1000 times | × 1000 pulse | mm | × 0.1 inch | deg | | | | |

# Items related to speed

The following describes the setting items related to speed.



## Command speed

▶Setting method: Operand

Set the speed used in positioning operation. The user unit is set by unit setting. (☞ Page 375 Unit Setting)

The setting range differs depending on the positioning instruction and table operation control method. Set the command speed to 200 kpps*1 or lower in pulse (-200 kpps to +200 kpps*2 for the PLSV/DPLSV instruction or table operation instruction (control method [4: Variable Speed Operation], [5: Table Transition Variable Speed Operation])).

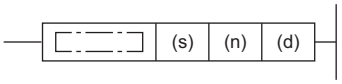
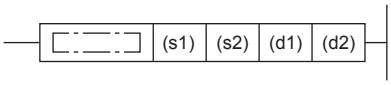
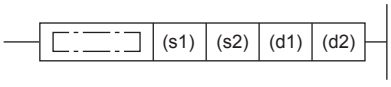
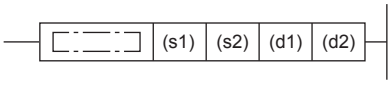
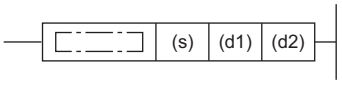
*1 100 kpps for the FX5S CPU module

*2 -100 kpps to +100 kpps for the FX5S CPU module

Even within the setting range, the following relation must be followed: bias speed ≤ command speed ≤ maximum speed.

When command speed is faster than the maximum speed, the maximum speed is applied. When positioning instruction start, if bias speed is faster than command speed, the bias speed is applied.

### ■Operand: Positioning Instruction

| Positioning instruction | | Operand | Range | Ladder | Reference |
|---|---|---|---|---|---|
| Pulse Y output*1*2 | PLSY | (s) | 0 to 65535 |  | Page 407 |
| | DPLSY | | 0 to 2147483647 | | |
| Relative positioning | DRVI | (s2) | 1 to 65535 |  | Page 423 |
| | DDRVI | | 1 to 2147483647 | | |
| Absolute positioning | DRVA | (s2) | 1 to 65535 |  | Page 433 |
| | DDRVA | | 1 to 2147483647 | | |
| Interrupt 1-speed positioning | DVIT | (s2) | 1 to 65535 |  | Page 442 |
| | DDVIT | | 1 to 2147483647 | | |
| Variable speed operation*1 | PLSV | (s) | -32768 to +32767 |  | Page 452 |
| | DPLSV | | -2147483648 to +2147483647 | | |

*1 When 0 is set for the command speed at start of a positioning instruction, instruction ends with an error.

*2 Only CPU module is supported.

### ■Operand: Table Operation Control Method

| Table operation control method | Operand | Range | Reference |
|---|---|---|---|
| 1: 1 Speed Positioning (Relative Address Specification) | Operand 2<br>(When the positioning table data is set to use device: Head device +2, +3) | 1 to 2147483647 | Page 493 |
| 2: 1 Speed Positioning (Absolute Address Specification) | | | Page 495 |
| 3: Interrupt 1 Speed Positioning | | | Page 497 |
| 4: Variable Speed Operation*1 | | -2147483648 to +2147483647 | Page 500 |
| 5: Table Transition Variable Speed Operation*1*2 | | | Page 502 |
| 6: Interrupt Stop (Relative Address Specification) | | 1 to 2147483647 | Page 504 |
| 7: Interrupt Stop (Absolute Address Specification) | | | Page 507 |
| 20: Interpolation Operation (Relative Address Specification)*3 | | | Page 511 |
| 22: Interpolation Operation (Absolute Address Specification)*3 | | | Page 516 |

*1 When 0 is set for the command speed at start of a positioning instruction, instruction ends with an error.
*2 Only CPU module is supported.
*3 Only FX5S/FX5U/FX5UC CPU module and high-speed pulse input/output module support this operation.

**Point**

The command speed can be changed during operation. (☞ Page 362 Command speed change during positioning operation)

## Current speed (user unit)

This indicates the positioning operation speed.

The user unit is set by unit setting. (☞ Page 375 Unit Setting) The range is 0 to 2147483647 (200 kpps*1 or lower in pulse).

*1 100 kpps for the FX5S CPU module

The following table lists the corresponding devices.

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| Current speed (user unit) | SD5504, SD5505 | SD5544, SD5545 | SD5584, SD5585 | SD5624, SD5625 | SD5664, SD5665 | SD5704, SD5705 | SD5744, SD5745 | SD5784, SD5785 | SD5824, SD5825 | SD5864, SD5865 | SD5904, SD5905 | SD5944, SD5945 | R |

R: Read-only

When the unit system is machine system unit, the current speed can be calculated from the equation below.

- Current speed (machine system unit) = Actual output frequency × 60 × Pulse No. of per Rotation ÷ Movement Amount per Rotation ÷ $10^4$

Before being stored in the current speed, the command speed in user unit is converted into pulse unit (pps), and then converted again into user unit. Thus, because of an error due to this calculation process, a value that is lower than the command speed may be stored.

### Precautions

In a program with interruption priority 1, the HCMOV/DHCMOV instruction specified with this device for high-speed pulse input/output module cannot be executed. (☞ Page 109 Interrupt priority)

## Max. Speed

▶Setting method: High Speed I/O Parameter, Special Device

Set the upper limit (maximum speed) for command speed, OPR speed, and creep speed. The user unit is set by unit setting. (☞ Page 375 Unit Setting)

The setting range is as follows.

| Module | Motor/multiple unit system | Machine unit system |
|---|---|---|
| FX5S CPU module | 1 pps to 100 kpps | 1 to 2147483647 |
| FX5UJ CPU module<br>FX5U CPU module<br>FX5UC CPU module<br>High-speed pulse input/output module | 1 pps to 200 kpps | 1 to 2147483647 |

Even within the setting range, each of the following relations must be followed: bias speed ≤ creep speed ≤ OPR speed ≤ maximum speed for the DSZR/DDSZR instruction and bias speed ≤ command speed ≤ maximum speed for the other instructions.

### ■Special Device

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| Maximum speed | SD5516, SD5517 | SD5556, SD5557 | SD5596, SD5597 | SD5636, SD5637 | SD5676, SD5677 | SD5716, SD5717 | SD5756, SD5757 | SD5796, SD5797 | SD5836, SD5837 | SD5876, SD5877 | SD5916, SD5917 | SD595, SD5957 | R/W |

R/W: Read/Write

## Bias Speed

▶Setting method: High Speed I/O Parameter, Special Device

Set the lower limit (bias speed) for command speed, OPR speed, and creep speed. The user unit is set by unit setting. (☞ Page 375 Unit Setting)

The setting range is as follows.

| Module | Motor/multiple unit system | Machine unit system |
|---|---|---|
| FX5S CPU module | 0 pps to 100 kpps | 0 to 2147483647 |
| FX5UJ CPU module<br>FX5U CPU module<br>FX5UC CPU module<br>High-speed pulse input/output module | 0 pps to 200 kpps | 0 to 2147483647 |

Even within the setting range, the following relation must be followed: bias speed ≤ command speed (OPR speed) ≤ maximum speed.

To control a stepping motor using each positioning instruction, set the bias speed considering the resonance range and the self-starting frequency of the stepping motor.

### ■Special Device

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| Bias speed | SD5518, SD5519 | SD5558, SD5559 | SD5598, SD5599 | SD5638, SD5639 | SD5678, SD5679 | SD5718, SD5719 | SD5758, SD5759 | SD5798, SD5799 | SD5838, SD5839 | SD5878, SD5879 | SD5918, SD5919 | SD5958, SD5959 | R/W |

R/W: Read/Write

## Acceleration Time

▶Setting method: High Speed I/O Parameter, Special Device

Set the time required for acceleration from the bias speed to the maximum speed.

The setting range of acceleration time is 0 to 32767 ms. If command speed is slower than the maximum speed, the actual acceleration time becomes shorter than the set time.

### ■Special Device

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| Acceleration time | SD5520 | SD5560 | SD5600 | SD5640 | SD5680 | SD5720 | SD5760 | SD5800 | SD5840 | SD5880 | SD5920 | SD5960 | R/W |

R/W: Read/Write

## Deceleration Time

▶Setting method: High Speed I/O Parameter, Special Device

Set the time required for deceleration from the maximum speed to the bias speed.

The setting range of deceleration time is 0 to 32767 ms. If command speed is slower than the maximum speed, the actual deceleration time becomes shorter than the set time.

### ■Special Device

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| Deceleration time | SD5521 | SD5561 | SD5601 | SD5641 | SD5681 | SD5721 | SD5761 | SD5801 | SD5841 | SD5881 | SD5921 | SD5961 | R/W |

R/W: Read/Write

### Precautions

When deceleration time is set to 0, deceleration is not performed. Because the motor stops immediately, the machine may be damaged.

# Items related to positioning address

The following describes the setting items related to positioning address.

## Positioning address

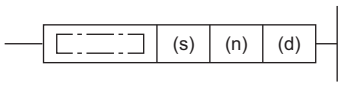
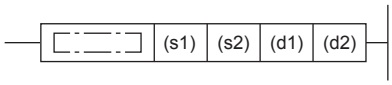
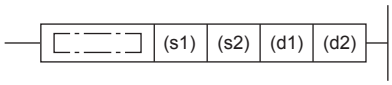
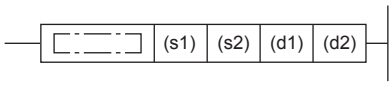
▶Setting method: Operand

Set the positioning address. The user unit is set by unit setting, and the value indicated does not include positioning data magnification. (☞ Page 375 Unit Setting, Page 377 Position Data Magnification)

The setting range differs depending on the positioning instruction and table operation control method.

Set the positioning address to -2147483648 to +2147483647 in pulse (0 to 2147483647 when PLSY/DPLSY instruction, -2147483648 to +2147483647 when positioning operation by absolute address).

## ■Operand: Positioning Instruction

| Positioning instruction | | Operand | Range | Ladder | Reference |
|---|---|---|---|---|---|
| Pulse Y output[*1] | PLSY | (n) | 0 to 65535 |  | Page 407 |
| | DPLSY | | 0 to 2147483647[*2] | | |
| Relative positioning | DRVI | (s1) | -32768 to +32767 |  | Page 423 |
| | DDRVI | | -2147483648 to +2147483647[*2] | | |
| Absolute positioning | DRVA | (s1) | -32768 to +32767 |  | Page 433 |
| | DDRVA | | -2147483648 to +2147483647[*2] | | |
| Interrupt 1-speed positioning | DVIT | (s1) | -32768 to +32767 |  | Page 442 |
| | DDVIT | | -2147483648 to +2147483647[*2] | | |

*1 Only CPU module is supported.
*2 Set the number of output pulses per instruction execution to 2147483647 or lower. (Except for the case when positioning address of DPLSY instruction is 0)

## ■Operand: Table Operation Control Method

| Table operation control method | Operand | Range | Reference |
|---|---|---|---|
| 1: 1 Speed Positioning (Relative Address Specification) | Operand 1<br>(When the positioning table data is set to use device: Head device +0, +1) | -2147483648 to +2147483647[*2] | Page 493 |
| 2: 1 Speed Positioning (Absolute Address Specification) | | | Page 495 |
| 3: Interrupt 1 Speed Positioning | | | Page 497 |
| 6: Interrupt Stop (Relative Address Specification) | | | Page 504 |
| 7: Interrupt Stop (Absolute Address Specification) | | | Page 507 |
| 20: Interpolation Operation (Relative Address Specification)[*1] | | | Page 511 |
| 21: Interpolation Operation (Relative Address Specification Target Axis)[*1] | | | Page 515 |
| 22: Interpolation Operation (Absolute Address Specification)[*1] | | | Page 516 |
| 23: Interpolation Operation (Absolute Address Specification Target Axis)[*1] | | | Page 520 |

*1 Only FX5S/FX5U/FX5UC CPU module and high-speed pulse input/output module support this operation.
*2 Set the number of output pulses per table to 2147483647 or lower.

**Point**

The positioning address can be changed during operation. Only the last table in table operation accepts the change in the case of continuous operation. (☞ Page 361 Positioning address change during positioning operation)
For interpolation operation, the change is applied only when the table operation instruction is next driven again.

### Precautions

Set the number of output pulses per instruction execution or per table to 2147483647 or lower. An error occurs if the number of pulses exceeds 2147483648. However, operation is performed normally if unlimited pulses are being output by PLSY/DPLSY instruction.

## Current address

▶Setting method: Special Device

Store the current address operated by the positioning instruction. The current address stores an absolute address and is increased or decreased depending on the rotation direction.

### ■Current address (user unit)

The user unit is set by unit setting, the value of the following formula (Value not including positioning data magnification) is stored. (☞ Page 375 Unit Setting, Page 377 Position Data Magnification)

- Current address (Motor system) = Movement amount (pulse unit) ÷ Position data magnification
- Current address (Machine/multiple system) = Movement amount (pulse unit) ÷ (No. of pulse per rotation × Position data magnification) × Movement amount per rotation

The address range is -2147483648 to +2147483647.

### ■Special Device

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| Current address (user unit) | SD5500, SD5501 | SD5540, SD5541 | SD5580, SD5581 | SD5620, SD5621 | SD5660, SD5661 | SD5700, SD5701 | SD5740, SD5741 | SD5780, SD5781 | SD5820, SD5821 | SD5860, SD5861 | SD5900, SD5901 | SD5940, SD5941 | R/W |

R/W: Read/Write

When the value in the devices above is changed, the current address (pulse unit) is also changed.

**Point**

- Writing can be performed to the current address (user unit) only by the HCMOV/DHCMOV instruction. However, writing to the current address (user unit) during positioning operation is disabled.
- Reading can be performed to the current value by the HCMOV/DHCMOV instruction.
- In a program with interruption priority 1, the HCMOV/DHCMOV instruction specified with this device for high-speed pulse input/output module cannot be executed. (☞ Page 109 Interrupt priority)

### Precautions

The current address (user unit) functions within the range of -2147483648 to +2147483647. However, an overflow or underflow occurs before the current address (pulse unit) is reached if the axis parameter is set in such a way that the number of pulses per rotation is greater than the number of transfer distance units per rotation. If that happens, overflow/underflow to the upper or lower limit value is stored in the device.

### ■Current address (pulse unit)

The unit is the motor system unit (pulse unit), and the value indicated includes positioning data magnification. (☞ Page 375 Unit Setting, Page 377 Position Data Magnification) The address range is -2147483648 to +2147483647.

### ■Special Device

| Name | FX *1 | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| Current address (pulse unit) | 5 | SD5502, SD5503 | SD5542, SD5543 | SD5582, SD5583 | SD5622, SD5623 | SD5662, SD5663 | SD5702, SD5703 | SD5742, SD5743 | SD5782, SD5783 | SD5822, SD5823 | SD5862, SD5863 | SD5902, SD5903 | SD5942, SD5943 | R/W |
| | 3 | SD8340, SD8341 | SD8350, SD8351 | SD8360, SD8361 | SD8370, SD8371 | — | — | — | — | — | — | — | — | R |

R: Read only, R/W: Read or Write

*1 5: FX5 dedicated device, 3: FX3 compatible device

When the value in the devices above changes, the current address (user unit) also changes automatically.

**Point**

- Writing can be performed to the current address (pulse unit) of FX5 dedicated device only by the HCMOV/DHCMOV instruction. However, writing to the current address (pulse unit) during positioning operation is disabled.
- Reading can be performed to the current value by the HCMOV/DHCMOV instruction.
- In a program with interruption priority 1, the HCMOV/DHCMOV instruction specified with this device for high-speed pulse input/output module cannot be executed. (☞ Page 109 Interrupt priority)

### Precautions

The current address (pulse unit) functions with the range of -2147483648 to +2147483647 pulses. However, if the upper limit is exceeded, current address overflows to the lower limit. If below the lower limit, current address underflows to the upper limit.

## Items related to operating command

The following lists the items related to the positioning operation.
For the input interrupt function, refer to the following.
☞ Page 232 HIGH-SPEED INPUT/OUTPUT FUNCTION

### Interrupt Input Signal 1

▶Setting method: High Speed I/O Parameter
When the DVIT/DDVIT instruction or table operation instruction (control method: [3: Interrupt 1 Speed Positioning], [6: Interrupt Stop (Relative Address Specification)], [7: Interrupt Stop (Absolute Address Specification)]) is used, set this parameter. If the interrupt input signal 1 is detected, an interrupt is performed.

#### ■Enabled/Disabled

Specify whether to use the interrupt input signal 1.
When [0: Disabled] is selected, the interrupt input signal 1 cannot be used.
When [1: Enabled] is selected, use interrupt input signal 1.

### Precautions

When interrupt input signal 1 is disabled, the DVIT/DDVIT instruction and table operation (control method: [3: Interrupt 1 Speed Positioning], [6: Interrupt Stop (Relative Address Specification)], [7: Interrupt Stop (Absolute Address Specification)]) do not operate and error occurs.

#### ■Mode

Specify detection mode of interrupt input signal 1.
When [0: High speed Mode] is selected, the DVIT/DDVIT instruction performs an interrupt when one input is detected. The table operation performs an interrupt when input is detected for the number of interrupt counts. (☞ Page 395 Interrupt Counts)
When [1: Standard Mode] is selected, an interrupt is performed when one input is detected.

**Point**

- The high-speed mode is faster than the standard mode in performing the operation from interrupt to pulse output.
- For supported versions for high-speed mode, refer to ☞ Page 971 Added and Enhanced Functions.

### ■Device No.

The interrupt input signal 1 assignment is as follows. For the high-speed pulse input/output module, the input is fixed as shown below, so setting is invalid.

| CPU module | | | | High-speed pulse input/output module*1 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | First module | | Second module | | Third module | | Fourth module | |
| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 |
| X0 to X17 (Any device can be set.) | | | | X□+4 | X□+3 | X□+4 | X□+3 | X□+4 | X□+3 | X□+4 | X□+3 |

*1 The number in □ is the head input number for each high-speed pulse input/output module.

Set the input response time (initial values: 10 ms) in input response time parameters. (☞ Page 318 General-purpose Input Functions)

### ■Logic

Specify the logic of interrupt input signal 1. In high-speed mode, it is fixed to positive logic, and the following setting is disabled.

When [0: Positive Logic] is selected, interrupt input signal 1 functions on a rising edge.

When [1: Negative Logic] is selected, interrupt input signal 1 functions on a falling edge.

#### Precautions

For details on the following precautions, refer to ☞ Page 528 Functions that share inputs and outputs.

- This is not usable if all inputs are occupied with another high-speed input/output function.
- In the case of standard mode, the input interrupt function is assigned forcibly to the specified input.
- In the case of high-speed mode, one high-speed comparison table is occupied, and this is included in the number of simultaneous execution of the high-speed comparison table and high-speed comparison instruction.

## Pulse output stop command

▶Setting method: Special Device

During the execution of a positioning instruction, if the pulse output stop command is turned on, the pulses being output will immediately stop. The instruction of the pulse output which is stopped ends with error.

### ■Special Device

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| Pulse output stop command | SM5628 | SM5629 | SM5630 | SM5631 | SM5632 | SM5633 | SM5634 | SM5635 | SM5636 | SM5637 | SM5638 | SM5639 | R/W |

R/W: Read/Write

**Point**

During positioning operation, a change in the pulse output stop command is applied at the next scan time.

#### Precautions

- Use pulse output stop command only if immediate stop is absolutely needed to avoid danger. Because the motor stops immediately, the machine may be damaged.
- For normal stop (deceleration and stop), turn off the positioning instruction and use the pulse decelerate and stop, forward limit, and reverse limit. (☞ Page 385 Pulse decelerate and stop command, Page 386 Forward limit, Page 386 Reverse limit)

## Pulse decelerate and stop command

▶Setting method: Special Device

During the execution of a positioning instruction, if the pulse decelerate and stop command is turned on, the pulses being output will decelerate and stop.

The instruction of the pulse output which is stopped ends with error after decelerate and stop. However, the PLSY/DPLSY instruction (when unlimited pulses are output), the PLSV/DPLSV instruction and table operation instruction (control method: [4: Variable Speed Operation] or [5: Table Transition Variable Speed Operation]) end normally. For remaining distance operation-compatible positioning instructions and table control methods, the remaining distance operation ready status is acquired by turning off the pulse decelerate and stop command when remaining distance operation enabled is on. (☞ Page 364 Remaining distance operation)

### ■Special Device

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| Pulse decelerate and stop command | SM5644 | SM5645 | SM5646 | SM5647 | SM5648 | SM5649 | SM5650 | SM5651 | SM5652 | SM5653 | SM5654 | SM5655 | R/W |

R/W: Read/Write

**Point**

During positioning operation, a change in the pulse decelerate and stop command is applied at the next scan.

### Precautions

When the deceleration time is set to 0, the PLSV/DPLSV instruction or table operation (control method: [4: Variable Speed Operation] or [5: Table Transition Variable Speed Operation]) is immediately stopped after the pulse decelerate and stop command turns on. (☞ Page 380 Deceleration Time)

## Enabled/Disabled Reset All Modules at Error Stop

▶Setting method: High Speed I/O Parameter

Specify whether to use the all module reset when a stop error occurs (☞ Page 365 All module reset when a stop error occurs). Only high-speed pulse input/output module is supported.

When [0: Disabled] is selected, all module reset when a stop error occurs cannot be used.

When [1: Enabled] is selected, use all module reset when a stop error occurs.

For supported versions for all module reset when a stop error occurs, refer to ☞ Page 971 Added and Enhanced Functions.

## External Start Signal

▶Setting method: High Speed I/O Parameter

Set this parameter to start positioning at high-speed using an external input signal.

This parameter can be used as a start command of the remaining distance operation or table shift command of stepping operation of the DRVTBL instruction. (☞ Page 364 Remaining distance operation, Page 521 Stepping operation)

### ■Enabled/Disabled

Specify whether to use the external start signal.

When [0: Disabled] is selected, the external start signal is not used.

When [1: Enabled] is selected, the external start signal is used.

With this parameter enabled, even when the drive contact of each positioning instruction is turned on, the standby status is held. In this status, turning on the set input signal starts positioning.

### ■Device No.

The external start signal assignment is as follows.

| CPU module | | | | High-speed pulse input/output module*1 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | First module | | Second module | | Third module | | Fourth module | |
| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 |
| X0 to X17 (Any device can be set.) | | | | X□+7 | X□+6 | X□+7 | X□+6 | X□+7 | X□+6 | X□+7 | X□+6 |

*1 The number in □ is the head input number for each high-speed pulse input/output module.

Set the input response time (initial values: 10 ms) in input response time parameters. (☞ Page 318 General-purpose Input Functions)

#### Precautions

This is not usable if all inputs are occupied with another high-speed input/output function. However, overlap of input numbers is allowed for input interrupts. (☞ Page 528 Functions that share inputs and outputs)

### ■Logic

Specify the logic of the external start signal.

When [0: Positive Logic] is selected, the external start signal functions on a rising edge.

When [1: Negative Logic] is selected, the external start signal functions on a falling edge.

## Forward limit

▶Setting method: Special Device

Forward limit notifies the CPU module of the forward limit.

If forward limit is turned on while positioning operation is being output in the forward direction, the speed will decelerate, and the operation will stop (the PLSY/DPLSY instruction will stop immediately). If forward limit is turned on while positioning operation is being output in the reverse direction, it is ignored.

For details on the operation, refer to ☞ Page 361 Forward limit and reverse limit. A specific operation pattern is applied when the DSZR/DDSZR instruction is used. (☞ Page 358 Dog search function) Operation ends with an error after deceleration stop when a positioning instruction other than the DSZR/DDSZR instruction is used.

### ■Special Device

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| Forward limit | SM5660 | SM5661 | SM5662 | SM5663 | SM5664 | SM5665 | SM5666 | SM5667 | SM5668 | SM5669 | SM5670 | SM5671 | R/W |

R/W: Read/Write

**Point**

During positioning operation, a change in the forward limit is applied at the next scan.

## Reverse limit

▶Setting method: Special Device

Reverse limit notifies the CPU module of the reverse limit.

If reverse limit is turned on while positioning operation is being output in the reverse direction, the speed will decelerate, and the operation will stop. If reverse limit is turned on while positioning operation is being output in the forward direction, it is ignored. However, it is effective for the PLSY/DPLSY instruction that operates in the forward direction. If reverse limit is turned on, the operation will stop immediately.

For details on the operation, refer to ☞ Page 361 Forward limit and reverse limit. A specific operation pattern is applied when the DSZR/DDSZR instruction is used. (☞ Page 358 Dog search function) Operation ends with an error after deceleration stop when a positioning instruction other than the DSZR/DDSZR instruction is used.

### ■Special Device

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| Reverse limit | SM5676 | SM5677 | SM5678 | SM5679 | SM5680 | SM5681 | SM5682 | SM5683 | SM5684 | SM5685 | SM5686 | SM5687 | R/W |

R/W: Read/Write

**Point**

During positioning operation, a change in the reverse limit is applied at the next scan.

## Remaining distance operation

▶Setting method: Special Device

For the remaining distance operation, refer to ☞ Page 364 Remaining distance operation.

### ■Remaining distance operation enabled

Remaining distance operation enabled enables remaining distance operation with remaining distance operation-compatible instructions.

If remaining distance operation enabled is on when deceleration stop is performed with the pulse decelerate and stop command, the remaining distance operation ready status is acquired. (☞ Page 385 Pulse decelerate and stop command)

For positioning instructions or a control method of the table operation that is not compatible with the remaining distance operation, the remaining distance ready status is not acquired even when remaining distance operation enabled is ON.

### ■Special Device

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| Remaining distance operation enabled | SM5596 | SM5597 | SM5598 | SM5599 | SM5600 | SM5601 | SM5602 | SM5603 | SM5604 | SM5605 | SM5606 | SM5607 | R/W |

R/W: Read/Write

**Point**

During positioning operation, a change in remaining distance operation enabled is applied at the next scan.

### Precautions

If the remaining distance operation enabled remains off until deceleration stop of the pulse decelerate and stop command, the remaining distance operation-compatible instruction ends with an error.

### ■Remaining distance operation start

In the remaining distance operation ready status, turning on remaining distance operation enabled after turning off the pulse decelerate and stop command starts remaining distance operation. (☞ Page 385 Pulse decelerate and stop command) In addition, remaining distance operation can be started with the external start signal, as well as the remaining distance operation start. (☞ Page 385 External Start Signal) Remaining distance operation start turns off when the remaining distance operation starts.

### ■Special Device

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| Remaining distance operation start | SM5612 | SM5613 | SM5614 | SM5615 | SM5616 | SM5617 | SM5618 | SM5619 | SM5620 | SM5621 | SM5622 | SM5623 | R/W |

R/W: Read/Write

**Point**

During positioning operation, a change in the remaining distance operation start is applied at the next scan.

#### Precautions

When the drive contact of a positioning instruction is turned off without remaining distance operation, the remaining distance operation is canceled.

## Items related to pulse Y output instruction

The following lists the items related to the pulse output (PLSY/DPLSY) instruction. Only CPU module is supported.

### Total number of pulses output from axis 1 and axis 2

▶Setting method: Special Device

The total number of the pulses output by PLSY/DPLSY instruction in axis 1 and axis 2. The total number is increased by forward rotation pulses, regardless of the setting of rotation direction, because the PLSY/DPLSY instruction outputs only forward rotation pulses. The pulse range is -2147483648 to +2147483647.

### ■Special Device

| Name | For compatibility with FX3 | | | | R/W |
|---|---|---|---|---|---|
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | |
| Total number of pulses output from axis 1 and axis 2 | SD8136, SD8137 | | — | — | R/W |

R/W: Read/Write

### Number of pulses output by PLSY instruction

▶Setting method: Special Device

The number of pulses output by PLSY/DPLSY instruction. The total number is increased by forward rotation pulses, regardless of the setting of rotation direction, because the PLSY/DPLSY instruction outputs only forward rotation pulses. The pulse range is -2147483648 to +2147483647.

### ■Special Device

| Name | For compatibility with FX3 | | | | R/W |
|---|---|---|---|---|---|
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | |
| Number of pulses output by PLSY instruction | SD8140, SD8141 | SD8142, SD8143 | — | — | R/W |

R/W: Read/Write

# Items related to OPR

The following lists the items related to the OPR. (☞ Page 351 Mechanical OPR, Page 413 Mechanical OPR)
For the input interrupt function, refer to the following.
☞ Page 232 HIGH-SPEED INPUT/OUTPUT FUNCTION

## OPR Enabled/Disabled

▶Setting method: High Speed I/O Parameter

Specify whether to use the OPR.

When [0: Disabled] is selected, OPR related parameters cannot be set.

When [1: Enabled] is selected, OPR related parameters can be set.

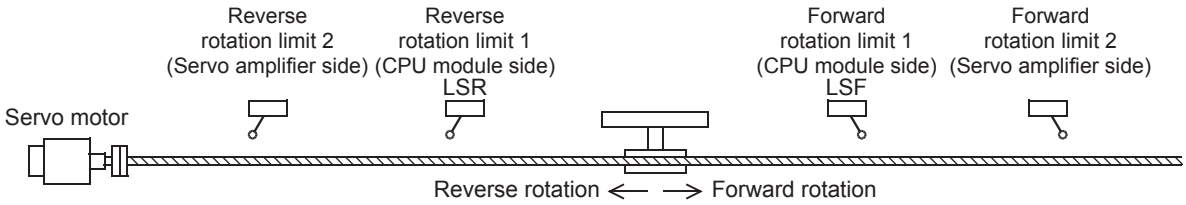
### Precautions

1 high-speed comparison table is occupied for an axis with OPR enabled for the high-speed pulse input/output module.
(☞ Page 254 High-speed comparison table)

## OPR Direction

▶Setting method: High Speed I/O Parameter, Special Device

Specify the direction when OPR is started.




### ■High Speed I/O Parameter

When [0: Negative Direction (Address Decrement Direction)] is selected, OPR starts in the direction in which address decreases.

When [1: Positive Direction (Address Increment Direction)] is selected, OPR starts in the direction in which address increases.

### ■Special Device

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| OPR direction specification | SM5804 | SM5805 | SM5806 | SM5807 | SM5808 | SM5809 | SM5810 | SM5811 | SM5812 | SM5813 | SM5814 | SM5815 | R/W |

R/W: Read/Write

OPR direction specification is turned off: OPR starts in the direction in which address decreases.

OPR direction specification is turned on: OPR starts in the direction in which address increases.

## Starting Point Address

▶Setting method: High Speed I/O Parameter, Special Device

Set the origin address for OPR.

The user unit is set by unit setting, and the value indicated does not include positioning data magnification. (☞ Page 375 Unit Setting, Page 377 Position Data Magnification) The origin address range is -2147483648 to +2147483647.

### ■Special Device

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| Origin address | SD5530, SD5531 | SD5570, SD5571 | SD5610, SD5611 | SD5650, SD5651 | SD5690, SD5691 | SD5730, SD5731 | SD5770, SD5771 | SD5810, SD5811 | SD5850, SD5851 | SD5890, SD5891 | SD5930, SD5931 | SD5970, SD5971 | R/W |

R/W: Read/Write

When OPR is completed, the same value as that in the device above is stored in the current address (user unit) and the current address (pulse unit).

## OPR speed

▶Setting method: Operand, Special Device

Set the speed at OPR of the machine. The user unit is set by unit setting. (☞ Page 375 Unit Setting)

The setting range is as follows.

| Module | Motor/multiple unit system | Machine unit system |
|---|---|---|
| FX5S CPU module | 1 pps to 100 kpps | 1 to 2147483647 |
| FX5UJ CPU module<br>FX5U CPU module<br>FX5UC CPU module<br>High-speed pulse input/output module | 1 pps to 200 kpps | 1 to 2147483647 |

Even within the setting range, the following relation must be followed: bias speed ≤ creep speed ≤ OPR speed ≤ maximum speed. When OPR speed is faster than the maximum speed, the maximum speed is applied.

### ■Operand: Positioning Instruction

When the following instruction is FX5 operand specified, instruction can set OPR speed.

| Instruction | | Operand | Range | Ladder | Reference |
|---|---|---|---|---|---|
| Mechanical OPR | DSZR | (s1) | 1 to 65535 |  | Page 413 |
| | DDSZR | | 1 to 2147483647 | | |

**Point**

The OPR speed can be changed during operation. (☞ Page 362 Command speed change during positioning operation)

### ■Special Device

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| OPR speed | SD5526, SD5527 | SD5566, SD5567 | SD5606, SD5607 | SD5646, SD5647 | SD5686, SD5687 | SD5726, SD5727 | SD5766, SD5767 | SD5806, SD5807 | SD5846, SD5847 | SD5886, SD5887 | SD5926, SD5927 | SD5966, SD5967 | R/W |

R/W: Read/Write

## Precautions

When OPR speed is set in the FX5 operand of the DSZR/DDSZR instruction (s1), the OPR speed is overwritten at execution of the instruction.

## Creep speed

▶Setting method: Operand, Special Device

Set the creep speed at OPR of the machine. The user unit is set by unit setting. (☞ Page 375 Unit Setting)

The setting range is as follows.

| Module | Motor/multiple unit system | Machine unit system |
|---|---|---|
| FX5S CPU module | 1 pps to 100 kpps | 1 to 2147483647 |
| FX5UJ CPU module<br>FX5U CPU module<br>FX5UC CPU module<br>High-speed pulse input/output module | 1 pps to 200 kpps | 1 to 2147483647 |

Even within the setting range, the following relation must be followed: bias speed ≤ creep speed ≤ OPR speed ≤ maximum speed. When creep speed is faster than OPR speed, the OPR speed is applied. When bias speed is faster than creep speed, the bias speed is applied.

### ■Operand: Positioning Instruction

When the following instruction is FX5 operand specified, instruction can set creep speed.

| Instruction | | Operand | Range | Ladder | Reference |
|---|---|---|---|---|---|
| Mechanical OPR | DSZR | (s2) | 1 to 65535 |  | Page 413 |
| | DDSZR | | 1 to 2147483647 | | |

**Point**

The creep speed can be changed during operation. (☞ Page 362 Command speed change during positioning operation)

### ■Special Device

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| Creep speed | SD5528, SD5529 | SD5568, SD5569 | SD5608, SD5609 | SD5648, SD5649 | SD5688, SD5689 | SD5728, SD5729 | SD5768, SD5769 | SD5808, SD5809 | SD5848, SD5849 | SD5888, SD5889 | SD5928, SD5929 | SD5968, SD5969 | R/W |

R/W: Read/Write

### Precautions

When creep speed is set in the FX5 operand of the DSZR/DDSZR instruction (s2), creep speed is overwritten at execution of the instruction.

## Clear Signal Output

Specify the output device (Y) to clear droop pulses of the servo amplifier at completion of OPR.

### ■Disabled/Enabled

▶Setting method: High Speed I/O Parameter, Special Device

Specify whether to use the clear signal output.

### ■High Speed I/O Parameter

When [0: Disabled] is selected, the clear signal output is not used.

When [1: Enabled] is selected, the clear signal output is used.

## ■Special Device

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| Clear signal output function enable | SM5820 | SM5821 | SM5822 | SM5823 | SM5824 | SM5825 | SM5826 | SM5827 | SM5828 | SM5829 | SM5830 | SM5831 | R/W |

R/W: Read/Write

Clear signal output function enable is turned off: The clear signal output is not used.

Clear signal output function enable is turned on: The clear signal output is used.

## ■Device No.

▶Setting method: High Speed I/O Parameter

The external start signal assignment is as follows. For high-speed pulse input/output module, it is fixed to the outputs shown below.

| CPU module | | | | High-speed pulse input/output module*1 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | First module | | Second module | | Third module | | Fourth module | |
| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 |
| Y0 to Y17 (Any device can be set.) | | | | Y□+2 | Y□+3 | Y□+2 | Y□+3 | Y□+2 | Y□+3 | Y□+2 | Y□+3 |

*1 The number in □ is the head output number for each high-speed pulse input/output module.

When the clear signal output is enabled, the clear signal is output from the specified device "20 ms + 1 scan time" after OPR is completed.

# OPR Dwell Time

▶Setting method: High Speed I/O Parameter, Special Device

Set the time until the completion flag for the DSZR/DDSZR instruction is turned on when OPR is completed. The setting range for the OPR dwell time is 0 to 32767 ms. (☞ Page 360 Dwell time)

## ■Special Device

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| OPR dwell time | SD5533 | SD5573 | SD5613 | SD5653 | SD5693 | SD5733 | SD5773 | SD5813 | SD5853 | SD5893 | SD5933 | SD5973 | R/W |

R/W: Read/Write

# Near-point Dog Signal

Specify the near-point dog signal to be used in OPR.

## ■Device No.

▶Setting method: High Speed I/O Parameter, Operand

The near-point dog signal does not occupy the input interrupt function, and its edge is detected with a 1-ms interrupt.

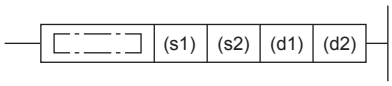
In CPU module for the same axis, the near-point dog signal can be set in the device to which the zero signal has already been set. In high-speed pulse input/output module, it can be set overlapped to any input device (X) other than the zero signal.

## ■High Speed I/O Parameter

The input devices (X) available for CPU module are X0 to X17. The input devices available for high-speed pulse input/output module are X0 to X377.

### ■Operand: Positioning Instruction

When the FX3 compatible operand is specified, DSZR/DDSZR instruction can set the near-point dog signal. The FX3 compatible operand specification is supported only in CPU module.

| Instruction | | Operand | Available device | Ladder | Reference |
|---|---|---|---|---|---|
| Mechanical OPR | DSZR | (s1) | X, Y, M, L, SM, F, B, SB |  | Page 413 |

## Precautions

- The CPU module cannot be used when the assignment of another high-speed input function occupies 8 channels. However, overlap of input numbers is allowed for input interrupts. (☞ Page 528 Functions that share inputs and outputs)
- When specifying an input device (X) as an operand, use the device assigned in high speed I/O parameter.

### ■Logic

▶Setting method: High Speed I/O Parameter

Specify the logic of the near-point dog signal.

When [0: Positive Logic] is selected, the near-point dog signal functions on a rising edge.

When [1: Negative Logic] is selected, the near-point dog signal functions on a falling edge.

## Precautions

This logic setting is not applied to the near-point dog signal for devices other than input device (X) specified by the DSZR/DDSZR instruction. The devices other than input device (X) functions on a rising edge.

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# Zero Signal

Specify the zero signal to be used in OPR.

### ■Device No.

▶Setting method: High Speed I/O Parameter, Operand

Zero signal is assigned forcibly to a specified input.

To use the near-point dog signal for stop, set the device to which the near-point dog signal is assigned.

### ■High Speed I/O Parameter

The zero signal assignment is as follows. For high-speed pulse input/output module, it is fixed to the inputs shown below.

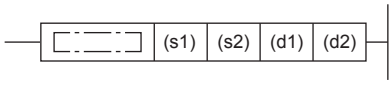
| CPU module | | | | High-speed pulse input/output module*1 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | First module | | Second module | | Third module | | Fourth module | |
| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 |
| X0 to X17 (Any device can be set.) | | | | X□+5 | X□+2 | X□+5 | X□+2 | X□+5 | X□+2 | X□+5 | X□+2 |

*1 The number in □ is the head input number for each high-speed pulse input/output module.

Set the input response time (initial values: 10 ms) in input response time parameters. (☞ Page 318 General-purpose Input Functions)

### ■Operand: Positioning Instruction

When the FX3 compatible operand is specified, DSZR/DDSZR instruction can set the zero signal. The FX3 compatible operand specification is supported only in CPU module.

| Instruction | | Operand | Available device | Ladder | Reference |
|---|---|---|---|---|---|
| Mechanical OPR | DSZR | (s2) | X, Y, M, L, SM, F, B, SB |  | Page 413 |

## Precautions

For details on the following precautions, refer to ☞ Page 528 Functions that share inputs and outputs.

[CPU module]

- This cannot be used when the assignment of another high-speed input function occupies 8 channels. However, it can overlap with an input interrupt.
- It is not allowed to specify the input device (X) of the high-speed pulse input/output module.
- When specifying an input device (X) as an operand, use the device assigned in high speed I/O parameter.
- When specifying a device other than input devices (X) as an operand, always use the same device as that for the near-point dog signal.

[High-speed pulse input/output module]

- If an input device is used by another high-speed input function, its simultaneous use is not allowed. However, it can overlap with an input interrupt.

### ■Logic

▶Setting method: High Speed I/O Parameter

Specify the logic of the zero signal. For the high-speed pulse input/output module, it is fixed to positive logic.

When [0: Positive Logic] is selected, the zero signal functions on a rising edge.

When [1: Negative Logic] is selected, the zero signal functions on a falling edge.

## Precautions

This logic setting is not applied to the zero signal of the device other than input device (X) specified by the DSZR/DDSZR instruction. The devices other than input device (X) functions on a rising edge.

### ■OPR Zero Signal Counts

▶Setting method: High Speed I/O Parameter, Special Device

Set the number of zero signals until OPR stops after detection of the near-point dog. The timing of counting start of the number of zero signals can be selected using the count start timing between the front end and rear end of the near-point dog. The setting range is from 0 to 32767. When the near-point dog signal and zero signal are set in the same device, the number of zero signals is fixed to 1.

### ■Special Device

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| OPR zero signal counts | SD5532 | SD5572 | SD5612 | SD5652 | SD5692 | SD5732 | SD5772 | SD5812 | SD5852 | SD5892 | SD5932 | SD5972 | R/W |

R/W: Read/Write

## Precautions

When the OPR zero signal counts is set to 0, the motor stops immediately after the near-point dog is detected. If a sudden stop may damage the devices, take the following measures.

- Set the creep speed to a low speed.
- Set the timing of counting start of the number of zero signals to the rear end of the near-point dog.
- Design the near-point dog so that the speed can be decelerated to the creep speed before counting the number of zero signals is started.

### ■Count Start Time

▶Setting method: High Speed I/O Parameter, Special Device

Specify the timing of counting start of the number of zero signals.

### ■High Speed I/O Parameter

When [0: Near-point Dog Latter Part] is selected, start counting at the falling edge of the near-point dog.

When [1: Near-point Dog Front Part] is selected, start counting at the rising edge of the near-point dog.

### ■Special Device

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| Zero signal count start time | SM5868 | SM5869 | SM5870 | SM5871 | SM5872 | SM5873 | SM5874 | SM5875 | SM5876 | SM5877 | SM5878 | SM5879 | R/W |

R/W: Read/Write

Zero signal count start timing is turned off: Start counting at the falling edge of the near-point dog.

Zero signal count start timing is turned on: Start at the rising edge of the near-point dog.

# Items related to table operation

The following lists the items specific to table operation.

## Dwell Time

▶Setting method: Operand

Set the time until the completion flag is turned on when table operation is completed. (☞ Page 360 Dwell time)

### ■Operand: Table Operation Control Method

| Table operation control method | Operand | Range | Reference |
|---|---|---|---|
| 1: 1 Speed Positioning (Relative Address Specification) | Operand 3<br>(When the positioning table data is set to use device: Head device +4) | 0 to 32767 ms | Page 493 |
| 2: 1 Speed Positioning (Absolute Address Specification) | | | Page 495 |
| 3: Interrupt 1 Speed Positioning | | | Page 497 |
| 4: Variable Speed Operation | | | Page 500 |
| 5: Table Transition Variable Speed Operation*1 | | | Page 502 |
| 6: Interrupt Stop (Relative Address Specification) | | | Page 504 |
| 7: Interrupt Stop (Absolute Address Specification) | | | Page 507 |
| 20: Interpolation Operation (Relative Address Specification)*2 | | | Page 511 |
| 22: Interpolation Operation (Absolute Address Specification)*2 | | | Page 516 |

*1 Only CPU module is supported.

*2 Only FX5S/FX5U/FX5UC CPU module and high-speed pulse input/output module support this operation.

**Point**

When the positioning table data is set to use device, dwell time can be changed during positioning operation. The change is applied when the table operation instruction is next driven again.

## Interrupt Counts

▶Setting method: Operand

Specify the number of inputs necessary for executing an interrupt of the table operation control method [3: Interrupt 1 Speed Positioning], [6: Interrupt Stop (Relative Address Specification)], [7: Interrupt Stop (Absolute Address Specification)] in the case where interrupt input signal 1 is in high-speed mode. (☞ Page 383 Mode)

No interrupt is made unless the input is detected for the number of times specified. If interrupt input signal 1 is in standard mode, the setting is disabled.

### ■Operand: Table Operation Control Method

| Table operation control method | Operand | Range | Reference |
|---|---|---|---|
| 3: Interrupt 1 Speed Positioning | Operand 4<br>(When the positioning table data is set to use device: Head device +5) | 1 to 32767 | Page 497 |
| 6: Interrupt Stop (Relative Address Specification) | | | Page 504 |
| 7: Interrupt Stop (Absolute Address Specification) | | | Page 507 |

## Interrupt Input Signal 2 Device No.

▶Setting method: Operand

Set an interrupt input device (X) for shifting to the next table after table operation control method [5: Table Transition Variable Speed Operation]. Only CPU module is supported.

### ■Operand: Table Operation Control Method

| Table operation control method | Operand | Range | Reference |
|---|---|---|---|
| 5: Table Transition Variable Speed Operation | Operand 4<br>(When the positioning table data is set to use device: Head device +5) | ■FX5S/FX5U/FX5UC CPU module<br>X0 to X17<br>■FX5UJ CPU module<br>FX5UJ-24MT/☐<br>• X0 to X15<br>FX5UJ-40MT/☐, FX5UJ-60MT/☐<br>• X0 to X17 | Page 502 |

**Point**

When the positioning table data is set to use device, interrupt input signal 2 device No. can be changed during positioning operation. Changes are applied when the table operation instruction is next driven again.

## Interrupt Input Signal 2 Logic

▶Setting method: High Speed I/O Parameter

Specify the logic of interrupt input signal 2 of the table operation instruction control method [5: Table Transition Variable Speed Operation]. Only CPU module is supported.

When [0: Positive Logic] is selected, interrupt input signal 2 functions on a rising edge.

When [1: Negative Logic] is selected, interrupt input signal 2 functions on a falling edge.

The interrupt input signal 2 does not occupy an input interrupt function, and its edge is detected with a 1-ms interrupt.

## Jump Destination Table No.

▶Setting method: Operand

Set the table number of the jump destination when the jump condition of the table operation control method [10: Condition Jump] is met (M No. for jump condition is on).

### ■Operand: Table Operation Control Method

| Table operation control method | Operand | Range | Reference |
|---|---|---|---|
| 10: Condition Jump | Operand 3<br>(When the positioning table data is set to use device: Head device +4) | 0 to 100*1 | Page 509 |

*1 1 to 32, when the positioning table data is not to use the device.

**Point**

When the positioning table data is set to use device, jump destination table No. can be changed during positioning operation. If the table being executed is located three or more tables before the condition jump, the change is applied at the next scan. If the table is located two or fewer tables before (after the condition is determined), the change is applied, but the condition jump is executed using the settings from when the condition was determined.

## M No. for Jump Condition

▶Setting method: Operand

Set an internal relay (M) to be used as a jump condition of the table operation control method [10: Condition Jump]. When M No. for jump condition is on, the condition jump is executed.

### ■Operand: Table Operation Control Method

| Table operation control method | Operand | Range | Reference |
|---|---|---|---|
| 10: Condition Jump | Operand 4<br>(When the positioning table data is set to use device: Head device +5) | 0 to 32767 | Page 509 |

**Point**

When the positioning table data is set to use device, M No. for jump condition can be changed during positioning operation. If the table being executed is located three or more tables before the condition jump, the change is applied at the next scan. If the table is located two or fewer tables before (after the condition is determined), the change is applied, but the condition jump is executed using the settings from when the condition was determined.

## Axis to be Interpolated

▶Setting method: Operand

Set the number of the counterpart axis for the simple interpolation operation of table operation control method [20: Interpolation Operation (Relative Address Specification)] or [22: Interpolation Operation (Absolute Address Specification)]. For the counterpart axis, control method [21: Interpolation Operation (Relative Address Specification Target Axis) or [23: Interpolation Operation (Absolute Address Specification Target Axis)] is assigned to the same table number as that specified in the axis to be interpolated. If a different control method is set to the counterpart axis, it is overwritten with Interpolation operation. Only FX5S/FX5U/FX5UC CPU module and high-speed pulse input/output module support interpolation operation.

### ■Operand: Table Operation Control Method

| Table operation control method | Operand | Range | Reference |
|---|---|---|---|
| 20: Interpolation Operation (Relative Address Specification) | Operand 4<br>(When the positioning table data is set to use device: Head device +5) | Axis 1 Specification to Axis 4 Specification | Page 511 |
| 22: Interpolation Operation (Absolute Address Specification) | | | Page 516 |

## Interpolation Speed Specified Method

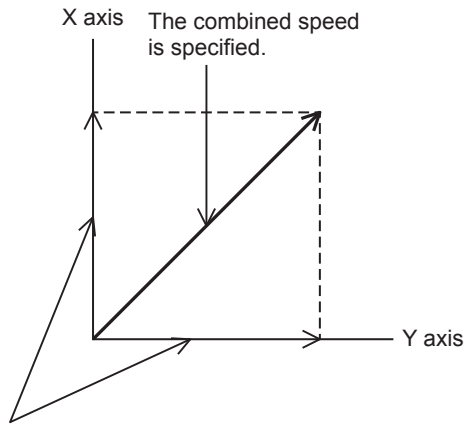
▶Setting method: High Speed I/O Parameter

Specify the speed specification method for interpolation operation in the table operation. Only FX5S/FX5U/FX5UC CPU module and high-speed pulse input/output module support interpolation operation.

When [0: Composite Speed] is selected, specify the moving speed of the control target and then the CPU module calculates the speed of each axis.

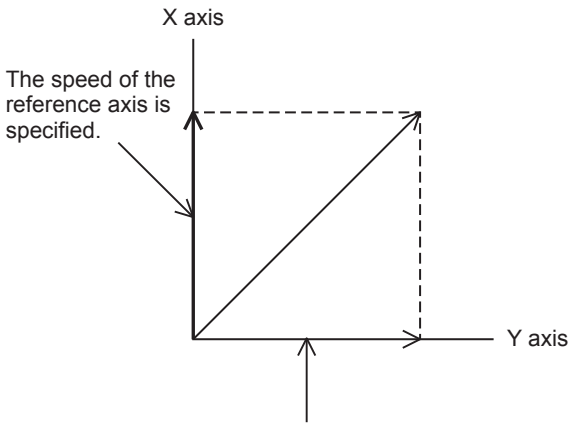
When [1: Reference Axis Speed] is selected, specify the speed of the reference axis and then the CPU module calculates the speed of the other axis.

When the combined speed is specified




The CPU module calculates these speeds.

When the reference-axis speed is specified




The CPU module calculates these speeds.

## Current speed (composite speed)

This indicates the positioning operation speed (composite speed) for the interpolation operation. When the interpolation speed specified method is [0: Composite Speed], the current speed is stored in the corresponding special device of the reference-axis.

The user unit is set by unit setting. (☞ Page 375 Unit Setting)

### ■Special Device

| Name | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|
| | First module | | Second module | | Third module | | Fourth module | | |
| | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| Current speed (composite speed) | SD5668, SD5669 | SD5708, SD5709 | SD5748, SD5749 | SD5788, SD5789 | SD5828, SD5829 | SD5868, SD5869 | SD5908, SD5909 | SD5948, SD5949 | R |

R: Read-only

### Precautions

In a program with interruption priority 1, the HCMOV/DHCMOV instruction specified with this device for high-speed pulse input/output module cannot be executed. (☞ Page 109 Interrupt priority)

## Table shift command

▶Setting method: Special Device

Table shift command is to switch to the following table in stepping operation of the DRVTBL instruction.

When stepping operation for a table is completed, if table shift command is OFF→ON, the positioning operation for the following table is started. (☞ Page 521 Stepping operation) When the positioning operation is still being executed for the previous table or it is not stepping operation of the DRVTBL instruction, OFF→ON this flag is ignored. The table can be switched to the following table with the external start signal too, like the table shift command. (☞ Page 385 External Start Signal)

### ■Special Device

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| Table shift command | SM5580 | SM5581 | SM5582 | SM5583 | SM5584 | SM5585 | SM5586 | SM5587 | SM5588 | SM5589 | SM5590 | SM5591 | R/W |

R/W: Read/Write

**Point**

During positioning operation, a change in the table shift command is applied at the next scan.

## Positioning execution table number

Use the positioning execution table number to check the table number being executed during table operation.

During activation of a table operation instruction, the table number that was executed last is held. During interpolation operation or multiple axes simultaneous activation, the table number is stored in the positioning execution table number of all the corresponding axes. After the table is executed, the table number is set to 0 when the drive contact of the table instruction is turned off. If there are pulses being output after the drive contact is turned off, the table number is set to 0 after the pulse output stops.

### ■Special Device

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| Positioning execution table number | SD5506 | SD5546 | SD5586 | SD5626 | SD5666 | SD5706 | SD5746 | SD5786 | SD5826 | SD5866 | SD5906 | SD5946 | R |

R: Read-only

## Positioning error (error occurrence table No.)

▶Setting method: Special Device

Use the positioning error to check the table number where a table operation error occurred.

For the error, refer to ☞ Page 854 Error check.

### ■Special Device

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| Positioning error (error occurrence table No.) | SD5511 | SD5551 | SD5591 | SD5631 | SD5671 | SD5711 | SD5751 | SD5791 | SD5831 | SD5871 | SD5911 | SD5951 | R/W |

R/W: Read/Write

After the positioning error occurrence flag turns on, a table No. is stored in the device above. If multiple errors occur, the device is overwritten with the table number where the last error occurred.

### Precautions

The table No. of the positioning error (error occurrence table No.) is not cleared by eliminating the error cause.

Turn on SM50 (Error Detection Reset Completion) from program or engineering tool, or use the continuation error batch clear function in the module diagnosis window of GX Works3 to clear the flag. (GX Works3 Operating Manual)

## Positioning table data initialization disable

▶Setting method: Special Device

Specify whether to use the positioning table data retaining function. (☞ Page 492 Positioning table data retaining function)

### ■Special Device

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| Positioning table data initialization disable | SM5916 | SM5917 | SM5918 | SM5919 | SM5920 | SM5921 | SM5922 | SM5923 | SM5924 | SM5925 | SM5926 | SM5927 | R/W |

R/W: Read/Write

For versions which support the positioning table data retaining function, refer to ☞ Page 971 Added and Enhanced Functions.

**Point**

When the positioning table data is set to use latch device and "Use an Initialization Invalid SM" is selected in GX Works3, turn on this device to use the positioning table data retaining function.

# Items related to monitor

The following describes the items related to monitor, such as the positioning address and speed.

## Pulse output monitor

Use the pulse output monitor to check whether pulses are being output from the output device (Y) set as an output device.
The pulse output monitor shows the pulse output status even when positioning operation is stopped.

### ■Special Device

| Name | FX *1 | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| Positioning output monitor | 5 | SM5516 | SM5517 | SM5518 | SM5519 | SM5520 | SM5521 | SM5522 | SM5523 | SM5524 | SM5525 | SM5526 | SM5527 | R |
| | 3 | SM8340 | SM8350 | SM8360 | SM8370 | — | — | — | — | — | — | — | — | |

R: Read-only

*1 5: FX5 dedicated device, 3: FX3 compatible device

### Precautions

- When the pulse output monitor is on, do not execute another positioning instruction that uses the corresponding axis.
- Do not write to the pulse output monitor using a transfer instruction. This may change the value and cause abnormal monitoring.

## Positioning instruction activation

Use "positioning instruction activation" to check whether or not a positioning instruction is being executed.
Even if no pulse is output, this flag is on while the instruction is being driven. Even after the drive contact of the positioning instruction is turned off, this flag remains on until the pulse output is stopped. Use this flag to prevent simultaneous activation of two or more positioning instructions for the same axis.

### ■Special Device

| Name | FX *1 | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| Positioning instruction activation | 5 | SM5500 | SM5501 | SM5502 | SM5503 | SM5504 | SM5505 | SM5506 | SM5507 | SM5508 | SM5509 | SM5510 | SM5511 | R |
| | 3 | SM8348 | SM8358 | SM8368 | SM8378 | — | — | — | — | — | — | — | — | |

R: Read-only

*1 5: FX5 dedicated device, 3: FX3 compatible device

### Precautions

Do not write to the pulse output monitor using a transfer instruction. This may change the value and cause abnormal monitoring.

## Positioning error occurrence

▶Setting method: Special Device

Use the positioning error occurrence to check whether or not an error specific to the positioning instruction occurs.
This flag turns on when an error specific to the positioning instruction occurs.

### ■Special Device

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| Positioning error occurrence | SM5532 | SM5533 | SM5534 | SM5535 | SM5536 | SM5537 | SM5538 | SM5539 | SM5540 | SM5541 | SM5542 | SM5543 | R/W |

R/W: Read/Write

After the positioning error occurrence is turned on, an error code is stored in the corresponding positioning error (error code).

#### Precautions

The positioning error occurrence flag is not cleared by eliminating the error cause.

Turn on SM50 (Error Detection Reset Completion) from program or engineering tool, or use the continuation error batch clear function in the module diagnosis window of GX Works3 to clear the flag. (GX Works3 Operating Manual)

## Positioning error (error code)

▶Setting method: Special Device

Use the following devices to check the error code of an error that has occurred in the positioning operation.

For the error codes, refer to ☞ Page 854 Error check.

### ■Special Device

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| Positioning error (error code) | SD5510 | SD5550 | SD5590 | SD5630 | SD5670 | SD5710 | SD5750 | SD5790 | SD5830 | SD5870 | SD5910 | SD5950 | R/W |

R/W: Read/Write

After the positioning error occurrence flag turns on, an error code is stored in the device above. If multiple errors occur, the old error is overwritten by a new error.

#### Precautions

The error code in the positioning error (error code) is not cleared by eliminating the error cause.

Turn on SM50 (Error Detection Reset Completion) from program or engineering tool, or use the continuation error batch clear function in the module diagnosis window of GX Works3 to clear the flag. (GX Works3 Operating Manual)

## Complete flag

▶Setting method: Operand

Use the complete flag to check whether or not a positioning instruction is completed. Note that the operation differs depending on the positioning instruction or the control method of the table operation. For details, refer to the complete flag of each positioning instruction and table operation control method.

### ■Instruction execution complete flag

When the positioning operation is completed normally, the instruction execution complete flag turns on. There are the following two types of instruction execution complete flags.

• User specification: The device of the operand specified by the positioning instruction (when FX5 operand specified)

This instruction execution complete flag is used only for the positioning instruction specified. The user-specified instruction execution flag is turned off by program or engineering tool or when the next positioning instruction is activated.

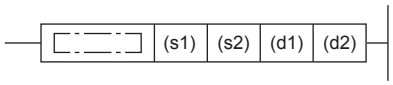
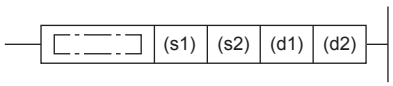
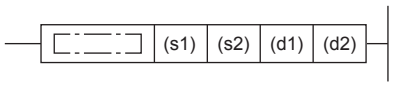
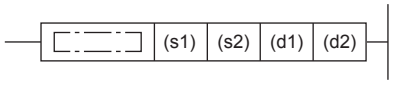
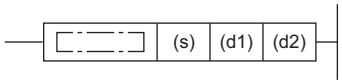
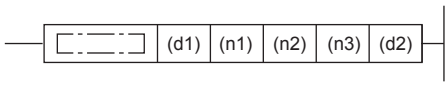
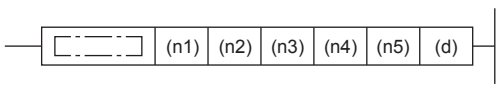
• SM8029: Instruction execution complete flag

This instruction execution complete flag is shared among positioning instructions other than the DRVMUL instruction. In programs, use the flag immediately after a positioning instruction. When the FX3 compatible operand is specified for the positioning instruction, only the instruction execution flag (SM8029) turns on. SM8029 turns off when the drive contact of the positioning instruction is turned off.

The instruction execution complete flags above turn on when pulses have been output. When dwell time is set for the DSZR/DDSZR instruction or table operation, the flag turns on when pulse output is complete or the clear signal turns off and the dwell time elapses.

### ■Operand: Positioning Instruction

When the following instruction is FX5 operand specified, instruction can set the complete flag.

| Instruction | | Operand | Available device | Ladder | Reference |
|---|---|---|---|---|---|
| Mechanical OPR | DSZR<br>DDSZR | (d2) | X, Y, M, L, SM, F, B, SB |  | Page 413 |
| Relative positioning | DRVI<br>DDRVI | (d2) | |  | Page 423 |
| Absolute positioning | DRVA<br>DDRVA | (d2) | |  | Page 433 |
| Interrupt 1-speed positioning | DVIT<br>DDVIT | (d2) | |  | Page 442 |
| Variable speed operation | PLSV<br>DPLSV | (d2) | |  | Page 452 |
| Multiple-table operation | DRVTBL | (d2) | |  | Page 470 |
| Multiple-axis table operation | DRVMUL | (d) | |  | Page 478 |

## ■Special Device

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| Instruction execution complete flag | SM8029 (FX3 compatible device) | | | | | | | | | | | | R |

R: Read-only

## ■Instruction execution abnormal end flag

When the positioning operation is completed abnormally, the instruction execution abnormal end flag turns on. There are the following two types of instruction execution abnormal end flags.

• User specification: The device of the operand specified by the positioning instruction (when FX5 operand specified)

This instruction execution abnormal end flag is used only for the positioning instruction specified. The user-specified instruction execution abnormal end flag is turned off by program or engineering tool or when the next positioning instruction is activated.

• SM8329: Instruction execution abnormal end flag

This instruction execution abnormal end complete flag is shared among positioning instructions other than the DRVMUL instruction. In programs, use the flag immediately after a positioning instruction. When the FX3 compatible operand is specified for the positioning instruction, only the instruction execution abnormal end flag (SM8329) turns on. SM8329 turns off when the drive contact of the positioning instruction is turned off.

For the conditions under which the instruction execution abnormal end flags above turn on, refer to the operation of the complete flag of each positioning instruction and the table operation control method. When dwell time is set for the DSZR/DDSZR instruction or table operation, the flag turns on when pulse output is complete and the dwell time elapses.

## ■Operand

Refer to instruction execution complete flag. The device of the operand specified by the positioning instruction is (d2) +1 ((d)+1 when DRVMUL instruction).

## ■Special Device

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | |
| Instruction execution abnormal end flag | SM8329 (FX3 compatible device) | | | | | | | | | | | | R |

R: Read-only

# 32 POSITIONING INSTRUCTION

This chapter describes positioning instructions that are used in the positioning function.
For the expression and execution type of the applied instruction, refer to 📖MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks).

## 32.1 Common Items

This section describes the common items in the positioning instruction. For auxiliary functions, refer to ☞ Page 358 Auxiliary Function.

### Operand specification method

The operand specification method includes two types: FX5 operand and FX3 compatible operand. The operand setting differs depending on the specification method. The items that cannot be set through operands positioning instruction follow the setting values of the positioning parameters. (☞ Page 366 POSITIONING PARAMETER)
The FX3 compatible operand is supported only in CPU module.
The DDSZR, DRVTBL, DRVMUL, and DABS instructions have only one operand specification method.

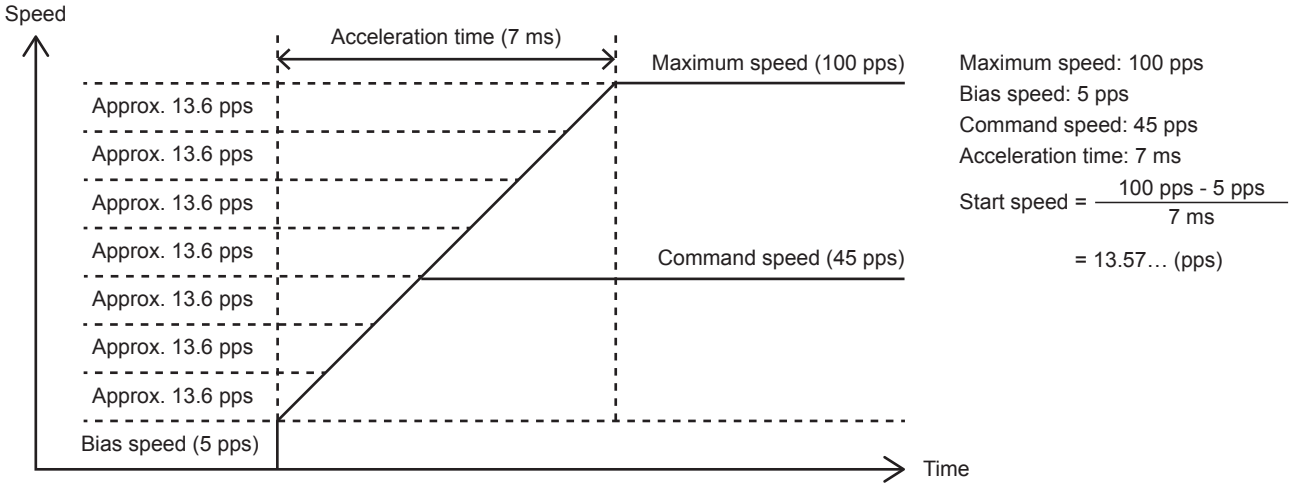
### Start speed

The start speed of instructions for specifying positioning addresses and table operation control methods, except for the PLSY/DPLSY instruction, PLSV/DPLSV instruction, and table operation instruction (control method: [4: Variable Speed Operation] or [5: Table Transition Variable Speed Operation]), is calculated by the following equation:

- Start speed = (Maximum speed - Bias speed) ÷ Acceleration time

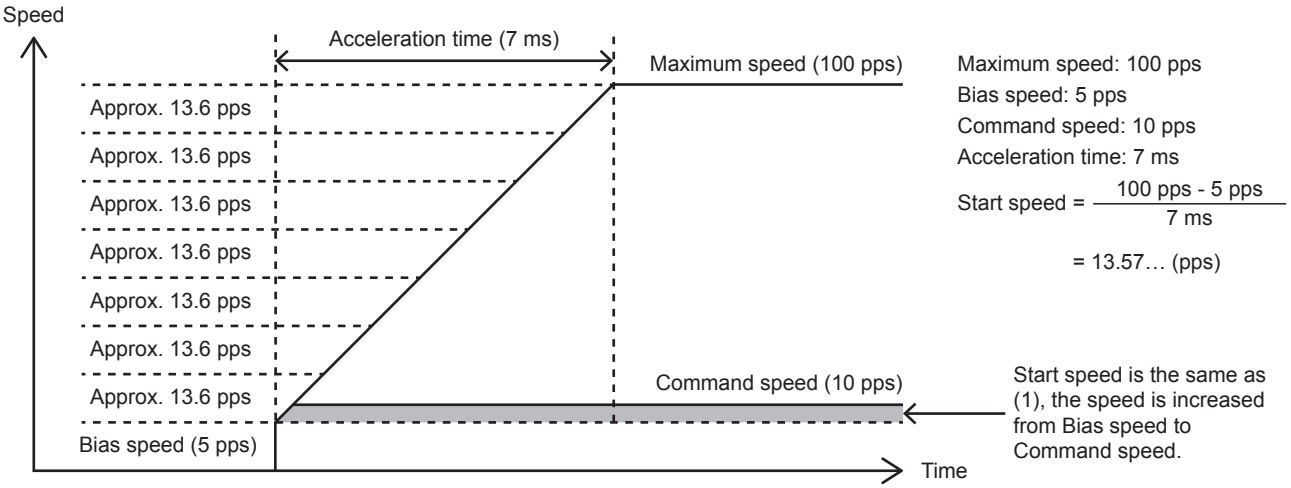
The start speed varies as follows, depending on the command speed and bias speed:
(1) Bias speed < Start speed < Command speed: Start speed = Start speed (the value from the equation above)

In the case of Bias speed (5 pps) < Start speed (Approx. 13.6 pps) < Command speed (45 pps)



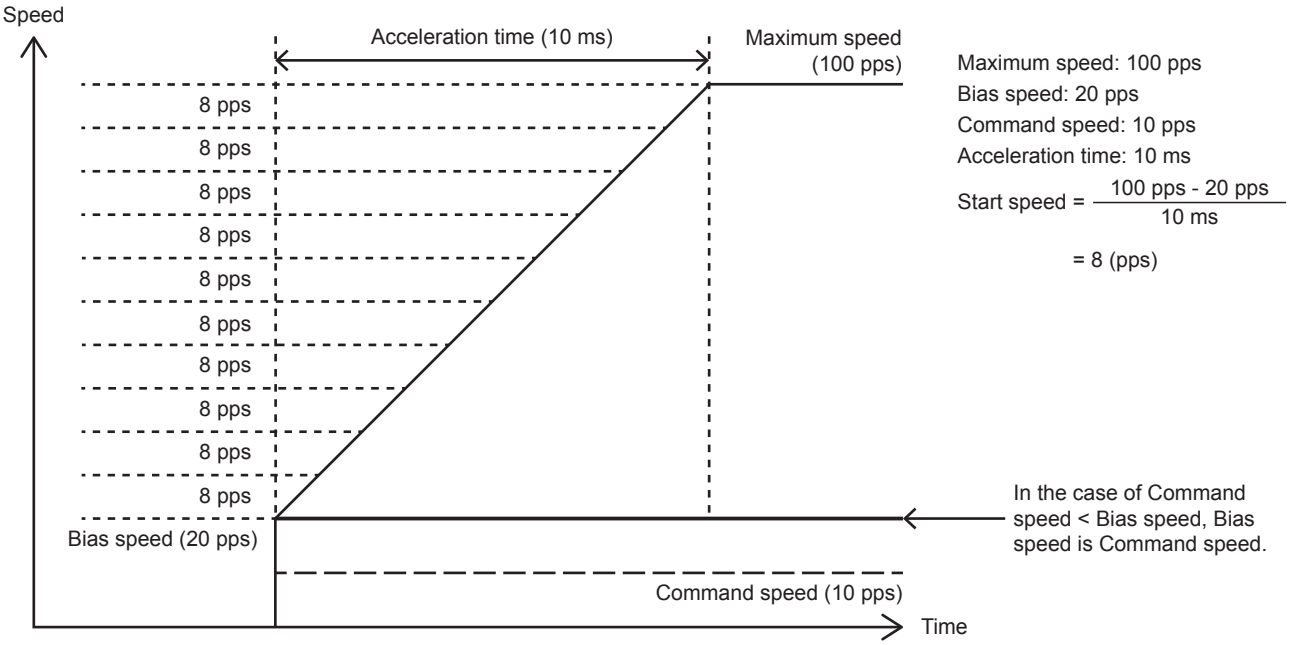
(2) Bias speed < Command speed < Start speed: Start speed = Command speed

In the case of Bias speed (5 pps) < Command speed (10 pps) < Start speed (Approx. 13.6 pps)




(3) Start speed < Bias speed, or Command speed < Bias speed: Start speed = Bias speed

In the case of Command speed (10 pps) < Bias speed (20 pps)




For the PLSV/DPLSV instruction and table operation instruction (control method: [4: Variable Speed Operation] or [5: Table Transition Variable Speed Operation]), the following equations are used instead of those above:

(4) Acceleration time = 0: Start speed = Command speed

(5) Acceleration time ≒ 0: Start speed = Bias speed

# Pulse output stop

The following table lists methods to stop pulse output, other than normal completion.
Select the stop method according to whether to use deceleration (deceleration stop or immediate stop) and to use the remaining distance operation. (☞ Page 364 Remaining distance operation)

| Operation | Deceleration*1 | Abnormal end flag | Remaining distance operation | Remarks | Reference |
|---|---|---|---|---|---|
| Pulse output stop command | Immediate stop | ON | None | Immediate stop without any conditions | Page 384 |
| All outputs disabled (SM8034) | Immediate stop | ON | None | Immediate stop without any conditions | — |
| Pulse decelerate and stop command | Deceleration stop | ON/OFF | Provided | With the corresponding instruction, the remaining distance operation can be used.<br>For remaining distance operation-compatible instructions (when the remaining distance operation is enabled), the PLSV/DPLSV instruction (when unlimited pulses are output), and table operation instruction (control method: [4: Variable Speed Operation] or [5: Table Transition Variable Speed Operation]), the abnormal end flag does not turn on. | Page 385 |
| Forward limit | Deceleration stop | ON | None | Effective only at forward rotation | Page 386 |
| Reverse limit | Deceleration stop | ON | None | Effective only at reverse rotation | Page 386 |
| All module reset when a stop error occurs | Immediate stop | ON | None | Immediate stop if a stop processing fails during pulse output due to a bus error<br>Only high-speed pulse input/output module is supported. | Page 365 |
| Turning off the instruction drive contact | Deceleration stop | ON*2 | None | Deceleration stop without any conditions<br>For the PLSY/DPLSY instruction, the PLSV/DPLSV instruction and table operation instruction (control method: [4: Variable Speed Operation] or [5: Table Transition Variable Speed Operation]), the abnormal end flag does not turn on. | — |
| Setting the command speed to 0 | Deceleration stop | ON/OFF | None | For the PLSY/DPLSY instruction, the PLSV/DPLSV instruction and table operation instruction (control method: [4: Variable Speed Operation] or [5: Table Transition Variable Speed Operation]), the abnormal end flag does not turn on.<br>When the command speed is changed, pulse output is restarted. | Page 362 |

*1 The PLSY/DPLSY instruction is stopped immediately by all the operations.
*2 Only the FX5 specified abnormal end flag is valid.

## Precautions

- Note that the immediate stop may damage the machine because the motor stops immediately.
- Pulse output stop takes priority over deceleration stop. Pulse outputs are immediately stopped if an immediate stop operation is performed during a deceleration stop operation.

# Operation at an error or abnormal end

The following describes operation at an error or abnormal end.

## Operation at an abnormal end

When operation of the positioning function ends with an error, pulse output is stopped.

- When an error occurs at start of a positioning instruction, pulse output is not started. Pulse output is also not started when a positioning instruction is executed with pulse output stopped, such as the pulse output stop command is on.
- When an error occurs during pulse output, deceleration stop is performed. To restart the positioning, eliminate the cause of the error that has caused the stop and then activate the positioning instruction again.
- When pulse output is stopped by an error status, the positioning instruction for the same axis cannot be activated until the drive contact of the positioning instruction is turned off or until the instruction is eliminated by online change.
- All axes except the one in which an error occurs keep operating normally. This is the same for multiple axes simultaneous activation using DRVMUL instruction. However, if an error leading to a stop occurs in one axis in interpolation operation, operation of both the axes are stopped.
- If an error occurs in table operation in the stepping operation or continuous operation, deceleration stop is performed and the tables that follow are not executed.

## Operation at an error

For the errors, refer to ☞ Page 854 Error check.

# Caution

For the items specific to each positioning instruction, refer to the cautions of each instruction.

For cautions on program creation, refer to ☞ Page 526 Cautions for Program Creation.

For cautions on each table operation, refer to the cautions of each control method or the corresponding positioning instruction. (☞ Page 492 Operations of Control Method)

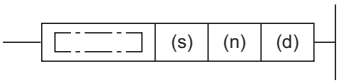
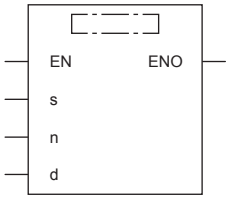


# 32.2 Pulse Y Output

This instruction generates a pulse signal. It generates only forward rotation pulses and increases the value of the current address. Only CPU module is supported.

## PLSY/DPLSY

This instruction executes pulse output.

| Ladder | ST | FBD/LD |
|---|---|---|
|  | ENO:=PLSY(EN,s,n,d);<br>ENO:=DPLSY(EN,s,n,d); |  |

## Setting data

### ■Description, range, data type (PLSY)

• FX5 operand

| Operand | Description | Range | Data type | Data type (label) |
|---|---|---|---|---|
| (s) | Word device number storing command speed or data*1 | 0 to 65535<br>(User system unit) | 16-bit unsigned binary | ANY16 |
| (n) | Word device number storing the positioning address or data*2 | 0 to 65535<br>(User system unit) | 16-bit unsigned binary | ANY16 |
| (d) | Axis number from which pulses are output | ■FX5S/FX5U/FX5UC CPU module<br>K1 to K4<br>■FX5UJ CPU module<br>K1 to K3 | 16-bit unsigned binary | ANY_ELEMENTARY (WORD) |
| EN | Execution condition | — | Bit | BOOL |
| ENO | Execution result | — | Bit | BOOL |

• FX3 compatible operand

| Operand | Description | Range | Data type | Data type (label) |
|---|---|---|---|---|
| (s) | Word device number storing command speed or data*1 | 0 to 65535<br>(User system unit) | 16-bit unsigned binary | ANY16 |
| (n) | Word device number storing the positioning address or data*2 | 0 to 65535<br>(User system unit) | 16-bit unsigned binary | ANY16 |
| (d) | Bit device number (Y) from which pulses are output | ■FX5S/FX5U/FX5UC CPU module<br>Y0 to Y3<br>■FX5UJ CPU module<br>Y0 to Y2 | Bit | ANY_ELEMENTARY (BOOL) |
| EN | Execution condition | — | Bit | BOOL |
| ENO | Execution result | — | Bit | BOOL |

*1 Command speed can be changed during positioning operation. (☞ Page 362 Command speed change during positioning operation)

*2 The positioning address can be changed during positioning operation. (☞ Page 361 Positioning address change during positioning operation)

### ■Description, range, data type (DPLSY)

• FX5 operand

| Operand | Description | Range | Data type | Data type (label) |
|---|---|---|---|---|
| (s) | Word device number storing command speed or data*1 | 0 to 2147483647<br>(User system unit) | 32-bit signed binary | ANY32 |
| (n) | Word device number storing the positioning address or data*2 | 0 to 2147483647<br>(User system unit) | 32-bit signed binary | ANY32 |
| (d) | Axis number from which pulses are output | ■FX5S/FX5U/FX5UC CPU module<br>K1 to K4<br>■FX5UJ CPU module<br>K1 to K3 | 16-bit unsigned binary | ANY_ELEMENTARY (WORD) |
| EN | Execution condition | — | Bit | BOOL |
| ENO | Execution result | — | Bit | BOOL |

• FX3 compatible operand

| Operand | Description | Range | Data type | Data type (label) |
|---|---|---|---|---|
| (s) | Word device number storing command speed or data*1 | 0 to 2147483647 (User system unit) | 32-bit signed binary | ANY32 |
| (n) | Word device number storing the positioning address or data*2 | 0 to 2147483647 (User system unit) | 32-bit signed binary | ANY32 |
| (d) | Bit device number (Y) from which pulses are output | ■FX5S/FX5U/FX5UC CPU module<br>Y0 to Y3<br>■FX5UJ CPU module<br>Y0 to Y2 | Bit | ANY_ELEMENTARY (BOOL) |
| EN | Execution condition | — | Bit | BOOL |
| ENO | Execution result | — | Bit | BOOL |

*1 Command speed can be changed during positioning operation.
*2 The positioning address can be changed during positioning operation.

## ■Available device (PLSY/DPLSY)

• FX5 operand

| Operand | Bit | Word | | | Double word | | Indirect specification | Constant | | | Others |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | X, Y, M, L, SM, F, B, SB, S | T, ST, C, D, W, SD, SW, R | U□\G□ | Z | LC | LZ | | K, H | E | $ | |
| (s) | ○ | ○ | ○ | ○ | ○*1 | ○*1 | ○ | ○ | — | — | — |
| (n) | ○ | ○ | ○ | ○ | ○*1 | ○*1 | ○ | ○ | — | — | — |
| (d) | — | ○ | ○ | ○ | — | — | ○ | ○ | — | — | — |

• FX3 compatible operand

| Operand | Bit | Word | | | Double word | | Indirect specification | Constant | | | Others |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | X, Y, M, L, SM, F, B, SB, S | T, ST, C, D, W, SD, SW, R | U□\G□ | Z | LC | LZ | | K, H | E | $ | |
| (s) | ○ | ○ | ○ | ○ | ○*1 | ○*1 | ○ | ○ | — | — | — |
| (n) | ○ | ○ | ○ | ○ | ○*1 | ○*1 | ○ | ○ | — | — | — |
| (d) | ○*2 | — | — | — | — | — | — | — | — | — | — |

*1 Only available for DPLSY instruction.
*2 FX5UJ CPU module: Only Y0 to Y2 devices can be used.
FX5S/FX5U/FX5UC CPU module: Only Y0 to Y3 devices can be used.

## Processing details

This instruction outputs pulse trains specified by the command speed (s) from the output (d) for the amount of forward rotation pulse specified by the positioning address (n).

# Related devices

The following lists the related special devices.

Related devices of axis 4 are available only for the FX5S/FX5U/FX5UC CPU module.

## Special relays

| FX5 dedicated | | | | FX3 compatible | | | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 1 | Axis 2 | Axis 3 | Axis 4 | | | | |
| — | — | — | — | SM8029 | | | | Instruction execution complete flag | × | R | Page 402 |
| — | — | — | — | SM8329 | | | | Instruction execution abnormal end flag | × | R | |
| SM5500 | SM5501 | SM5502 | SM5503 | SM8348 | SM8358 | SM8368 | SM8378 | Positioning instruction activation | × | R | Page 400 |
| SM5516 | SM5517 | SM5518 | SM5519 | SM8340 | SM8350 | SM8360 | SM8370 | Pulse output monitor | × | R | Page 400 |
| SM5532 | SM5533 | SM5534 | SM5535 | — | — | — | — | Positioning error occurrence | × | R/W | Page 400 |
| SM5628 | SM5629 | SM5630 | SM5631 | — | — | — | — | Pulse output stop command | × | R/W | Page 384 |
| SM5644 | SM5645 | SM5646 | SM5647 | — | — | — | — | Pulse decelerate and stop command | × | R/W | Page 385 |
| SM5660 | SM5661 | SM5662 | SM5663 | — | — | — | — | Forward limit | × | R/W | Page 386 |
| SM5676 | SM5677 | SM5678 | SM5679 | — | — | — | — | Reverse limit | × | R/W | Page 386 |

R: Read only, R/W: Read/write, ×: Not supported

## Special registers

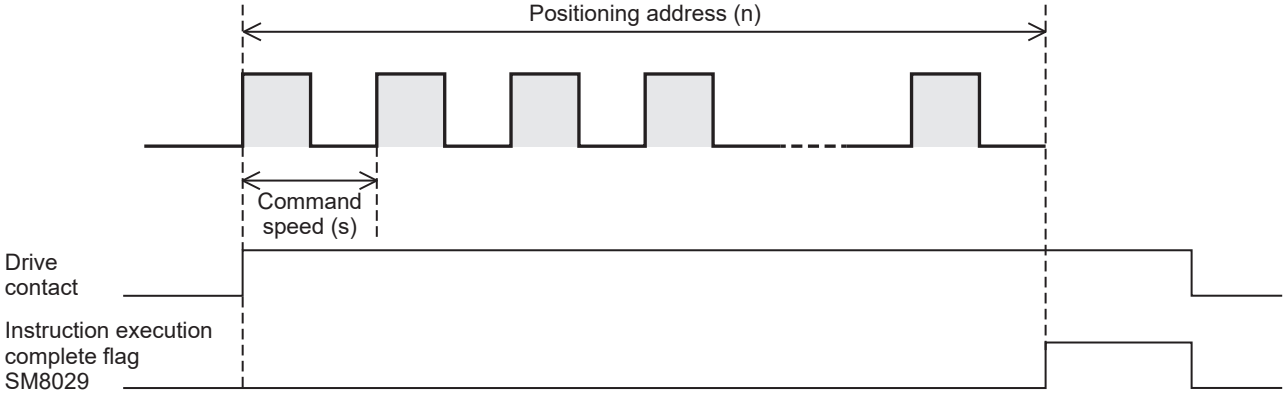
| FX5 dedicated | | | | FX3 compatible | | | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 1 | Axis 2 | Axis 3 | Axis 4 | | | | |
| — | — | — | — | SD8136, SD8137 | | — | — | Total number of pulses output from axis 1 and axis 2 | × | R/W | Page 388 |
| — | — | — | — | SD8140, SD8141 | SD8142, SD8143 | — | — | The number of pulse by PLSY instruction | × | R/W | Page 388 |
| SD5500, SD5501 | SD5540, SD5541 | SD5580, SD5581 | SD5620, SD5621 | — | — | — | — | Current address (user unit) | × | R/W*1 | Page 382 |
| SD5502, SD5503 | SD5542, SD5543 | SD5582, SD5583 | SD5622, SD5623 | SD8340, SD8341 | SD8350, SD8351 | SD8360, SD8361 | SD8370, SD8371 | Current address (pulse unit) | × | R/W*1 | Page 382 |
| SD5504, SD5505 | SD5544, SD5545 | SD5584, SD5585 | SD5624, SD5625 | — | — | — | — | Current speed (user unit) | × | R | Page 378 |
| SD5510 | SD5550 | SD5590 | SD5630 | — | — | — | — | Positioning error (error code) | × | R/W | Page 401 |

R: Read only, R/W: Read/write, ×: Not supported

*1 Only FX5 dedicated devices can be written by the HCMOV/DHCMOV instruction.

# Outline of operation

For each speed, refer to ☞ Page 377 Items related to speed.


## Basic operation

The following describes the basic operation.

1. After the drive contact is turned on, pulse output is started in command speed.
2. After reached the positioning address, pulse output is stopped.

## Operand specification

### ■When FX5 operand is specified

1. For (s), specify the command speed. Set to a value 0 to 200 kpps in pulse. For the FX5S CPU module, set to a value 0 to 100 kpps.

- PLSY: 0 to 65535 (User system unit)
- DPLSY: 0 to 2147483647 (User system unit)

2. For (n), specify the positioning address. (☞ Page 380 Positioning address) Set to a value 0 to 2147483647 in pulse.

- PLSY: 0 to 65535 (User system unit)
- DPLSY: 0 to 2147483647 (User system unit)

3. For (d), specify an axis number for which pulses are output.

Specify an axis number whose positioning parameters are set in the high speed I/O parameters. Operation cannot be performed if any other axis number is specified.

- FX5S/FX5U/FX5UC CPU module: K1 to K4 (Axis 1 to Axis 4)
- FX5UJ CPU module: K1 to K3 (Axis 1 to Axis 3)

### ■When the FX3 compatible operand is specified

1. For (s), specify the command speed. Set to a value 0 to 200 kpps in pulse. For the FX5S CPU module, set to a value 0 to 100 kpps.

- PLSY: 0 to 65535 (User system unit)
- DPLSY: 0 to 2147483647 (User system unit)

2. For (n), specify the positioning address. Set to a value 0 to 2147483647 in pulse.

- PLSY: 0 to 65535 (User system unit)
- DPLSY: 0 to 2147483647 (User system unit)

**3.** For (d), specify the pulse output number.

Specify an output device (Y) number set in the high speed I/O parameters. (☞ Page 372 Pulse Output Mode) Operation cannot be performed if any other axis number is specified.

- FX5S/FX5U/FX5UC CPU module: Y0 to Y3 (equivalent to axes 1 to 4)
- FX5UJ CPU module: Y0 to Y2 (equivalent to axes 1 to 3)

## Direction handling

- The PLSY/DPLSY instruction always increases the current address because the setting of rotation direction is disabled due to the absence of direction. (☞ Page 374 Rotation Direction Setting)
- When the output mode is CW/CCW mode, output is always performed from the device set to CW. (☞ Page 372 Pulse Output Mode)
- If reverse limit is used, it operates as forward limit.

## Items related to speed

- If the command speed is set to 0 when the instruction is activated, the operation ends with an error.
- If the command speed is changed to 0 during operation, the operation does not end with errors but it immediately stops. As long as the drive contact is on, changing the command speed restarts pulse output.
- The acceleration time and deceleration time are disabled because acceleration and deceleration are not performed.
- The bias speed is disabled because the speed is changed immediately.

## Positioning address

- If the positioning address is 0 when the instruction is activated, unlimited pulses are output.
- When unlimited pulses are being output, the operation ends normally if the pulse decelerate and stop command is turned on.
- The operation ends with an error if the positioning address is changed to a value smaller than the number of pulses that have been output or a value outside the range during positioning operation. The positioning address becomes invalid if it is changed from 0 to a value other than 0 or from a value other than 0 to 0 during positioning operation.

### Precautions

When unlimited pulses are not being output, set the number of output pulses per PLSY/DPLSY instruction execution to 2147483647 or lower. An error occurs if the number of pulses exceeds 2147483648.

## Operation of the complete flags

The following describes the operation timings of the complete flags.

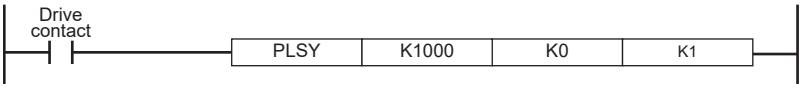
| Item | FX3 compatible | |
|---|---|---|
| | **Instruction execution complete flag (SM8029)** | **Instruction execution abnormal end flag (SM8329)** |
| ON condition | • From when pulse output of the specified positioning address is completed to when the drive contact is turned off<br>• Pulse decelerate and stop command (when unlimited pulses are being output) | From when the following operation or function is completed to when the drive contact is turned off<br>• The axis is already used.*1<br>• Pulse output stop command<br>• Pulse decelerate and stop command (when unlimited pulses are not being output)<br>• Limit of the moving direction<br>• All outputs disabled (SM8034)<br>• Positioning address error |
| ON → OFF condition | When the drive contact is turned off | |

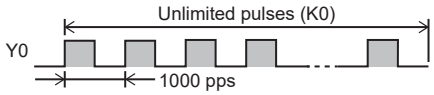
*1 The flag turns on only for one scan when the drive contact of the instruction turns from OFF to ON.

## Program example

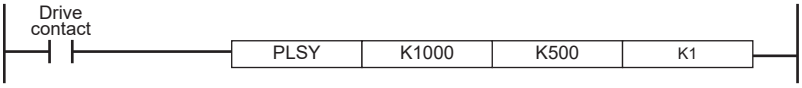
The following is a program example of pulse output from axis 1 (Y0).

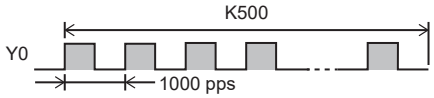
■Unlimited pulses output: Positioning address (operand (n)) = 0




■Pulse output: Positioning address (operand (n)) > 0



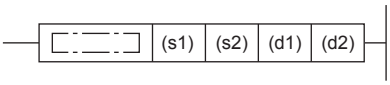
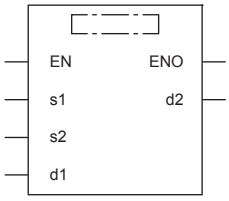

# 32.3 Mechanical OPR

If forward rotation pulses or reverse rotation pulses are generated, the positioning instruction will increase or decrease the value of the current address.

When the power of the CPU module is turned off, the value stored in the current address will be erased. For this reason, after turning on the power again, be sure to adjust the value of the current address in the CPU module to the current position of the machine. The positioning function uses the DSZR/DDSZR instruction (OPR instruction) to adjust the value of the current address in the CPU module to the current mechanical position.

### DSZR/DDSZR

This instruction executes mechanical OPR.

| Ladder | ST | FBD/LD |
|---|---|---|
|   | ENO:=DSZR(EN,s1,s2,d1,d2);<br>ENO:=DDSZR(EN,s1,s2,d1,d2); |   |

#### Setting data

**■Description, range, data type (DSZR)**

• FX5 operand

| Operand | Description | Range | Data type | Data type (label) |
|---|---|---|---|---|
| (s1) | Word device number storing OPR speed or data*1 | 1 to 65535<br>(User system unit) | 16-bit unsigned binary | ANY_ELEMENTARY (WORD) |
| (s2) | Word device number storing creep speed or data*1 | 1 to 65535<br>(User system unit) | 16-bit unsigned binary | ANY_ELEMENTARY (WORD) |
| (d1) | Axis number from which pulses are output | ■FX5S CPU module<br>K1 to K4<br>■FX5UJ CPU module<br>K1 to K3, K5 to K12<br>■FX5U/FX5UC CPU module<br>K1 to K12 | 16-bit unsigned binary | ANY_ELEMENTARY (WORD) |
| (d2) | Bit device number of the instruction execution complete flag and abnormal end flag | — | Bit | ANY_BOOL |
| EN | Execution condition | — | Bit | BOOL |
| ENO | Execution result | — | Bit | BOOL |

• FX3 compatible operand (Supported only for CPU module)

| Operand | Description | Range | Data type | Data type (label) |
|---|---|---|---|---|
| (s1) | Bit device number to which the near-point dog signal is input | — | Bit | ANY_ELEMENTARY (BOOL) |
| (s2) | Bit device number to which the zero signal is input | — | Bit | ANY_ELEMENTARY (BOOL) |
| (d1) | Bit device number (Y) from which pulses are output | ■FX5S/FX5U/FX5UC CPU module<br>Y0 to Y3<br>■FX5UJ CPU module<br>Y0 to Y2 | Bit | ANY_ELEMENTARY (BOOL) |
| (d2) | Bit device number from which rotation direction is output | — | Bit | ANY_BOOL |
| EN | Execution condition | — | Bit | BOOL |
| ENO | Execution result | — | Bit | BOOL |

*1 OPR speed and creep speed can be changed during positioning operation. (☞ Page 362 Command speed change during positioning operation)

## ■Description, range, data type (DDSZR)*1

| Operand | Description | Range | Data type | Data type (label) |
|---|---|---|---|---|
| (s1) | Word device number storing OPR speed or data*2 | 1 to 2147483647<br>(User system unit) | 32-bit signed binary | ANY32 |
| (s2) | Word device number storing creep speed or data*2 | 1 to 2147483647<br>(User system unit) | 32-bit signed binary | ANY32 |
| (d1) | Axis number from which pulses are output | ■FX5S CPU module<br>K1 to K4<br>■FX5UJ CPU module<br>K1 to K3, K5 to K12<br>■FX5U/FX5UC CPU module<br>K1 to K12 | 16-bit unsigned binary | ANY16 |
| (d2) | Bit device number of the instruction execution complete flag and abnormal end flag | — | Bit | ANY_BOOL |
| EN | Execution condition | — | Bit | BOOL |
| ENO | Execution result | — | Bit | BOOL |

*1 The DDSZR instructions have only one operand specification method.
*2 OPR speed and creep speed can be changed during positioning operation.

## ■Available device (DSZR/DDSZR*1)

• FX5 operand

| Operand | Bit | Word | | | Double word | | Indirect specification | Constant | | | Others |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | X, Y, M, L, SM, F, B, SB, S | T, ST, C, D, W, SD, SW, R | U□\G□ | Z | LC | LZ | | K, H | E | $ | |
| (s1) | ○ | ○ | ○ | ○ | ○*2 | ○*2 | ○ | ○ | — | — | — |
| (s2) | ○ | ○ | ○ | ○ | ○*2 | ○*2 | ○ | ○ | — | — | — |
| (d1) | — | ○ | ○ | ○ | — | — | ○ | ○ | — | — | — |
| (d2)*3 | ○ | ○*4 | — | — | — | — | — | — | — | — | — |

• FX3 compatible operand (Supported only for CPU module)

| Operand | Bit | Word | | | Double word | | Indirect specification | Constant | | | Others |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | X, Y, M, L, SM, F, B, SB, S | T, ST, C, D, W, SD, SW, R | U□\G□ | Z | LC | LZ | | K, H | E | $ | |
| (s1) | ○*5 | — | — | — | — | — | — | — | — | — | — |
| (s2) | ○*5*6 | — | — | — | — | — | — | — | — | — | — |
| (d1) | ○*7 | — | — | — | — | — | — | — | — | — | — |
| (d2) | ○*8 | — | — | — | — | — | — | — | — | — | — |

*1 The DDSZR instructions have only one operand specification method.
*2 Only available for DDSZR instruction.
*3 Two devices are occupied from the specified device.
*4 T, ST, C cannot be used.
*5 For X devices, always specify the device set in high speed I/O parameter.
*6 For device other than X device, set the device to which the near-point dog signal (s1) is assigned.
*7 FX5S/FX5U/FX5UC CPU module: Only Y0 to Y3 devices can be used.
FX5UJ CPU module: Only Y0 to Y2 devices can be used.
*8 When the output mode is CW/CCW, specify the CCW axis. When the output mode is PULSE/SIGN, only the SIGN output of the axis or general-purpose output can be specified.

### Processing details

This instruction executes mechanical OPR.
With the forward limit and reverse limit, OPR using the dog search function can be executed. (☞ Page 358 Dog search function)

## Related devices

The following lists the related special devices.
Related devices of axis 4 are available only for the FX5S/FX5U/FX5UC CPU module.

### Special relays

#### ■CPU module

| FX5 dedicated | | | | FX3 compatible | | | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 1 | Axis 2 | Axis 3 | Axis 4 | | | | |
| — | — | — | — | SM8029 | | | | Instruction execution complete flag | × | R | Page 402 |
| — | — | — | — | SM8329 | | | | Instruction execution abnormal end flag | × | R | |
| SM5500 | SM5501 | SM5502 | SM5503 | SM8348 | SM8358 | SM8368 | SM8378 | Positioning instruction activation | × | R | Page 400 |
| SM5516 | SM5517 | SM5518 | SM5519 | SM8340 | SM8350 | SM8360 | SM8370 | Pulse output monitor | × | R | Page 400 |
| SM5532 | SM5533 | SM5534 | SM5535 | — | — | — | — | Positioning error occurrence | × | R/W | Page 400 |
| SM5628 | SM5629 | SM5630 | SM5631 | — | — | — | — | Pulse output stop command | × | R/W | Page 384 |
| SM5644 | SM5645 | SM5646 | SM5647 | — | — | — | — | Pulse decelerate and stop command | × | R/W | Page 385 |
| SM5660 | SM5661 | SM5662 | SM5663 | — | — | — | — | Forward limit | × | R/W | Page 386 |
| SM5676 | SM5677 | SM5678 | SM5679 | — | — | — | — | Reverse limit | × | R/W | Page 386 |
| SM5772 | SM5773 | SM5774 | SM5775 | — | — | — | — | Rotation direction setting | ○ | R/W | Page 374 |
| SM5804 | SM5805 | SM5806 | SM5807 | — | — | — | — | OPR direction specification | ○ | R/W | Page 389 |
| SM5820 | SM5821 | SM5822 | SM5823 | — | — | — | — | Clear signal output function enable | ○ | R/W | Page 391 |
| SM5868 | SM5869 | SM5870 | SM5871 | — | — | — | — | Zero signal count start time | ○ | R/W | Page 394 |

R: Read only, R/W: Read/write, ○: Supported, ×: Not supported

### ■High-speed pulse input/output module

| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SM8029 (FX3 compatible device) | | | | | | | | Instruction execution complete flag | × | R | Page 402 |
| SM8329 (FX3 compatible device) | | | | | | | | Instruction execution abnormal end flag | × | R | |
| SM5504 | SM5505 | SM5506 | SM5507 | SM5508 | SM5509 | SM5510 | SM5511 | Positioning instruction activation | × | R | Page 400 |
| SM5520 | SM5521 | SM5522 | SM5523 | SM5524 | SM5525 | SM5526 | SM5527 | Pulse output monitor | × | R | Page 400 |
| SM5536 | SM5537 | SM5538 | SM5539 | SM5540 | SM5541 | SM5542 | SM5543 | Positioning error occurrence | × | R/W | Page 400 |
| SM5632 | SM5633 | SM5634 | SM5635 | SM5636 | SM5637 | SM5638 | SM5639 | Pulse output stop command | × | R/W | Page 384 |
| SM5648 | SM5649 | SM5650 | SM5651 | SM5652 | SM5653 | SM5654 | SM5655 | Pulse decelerate and stop command | × | R/W | Page 385 |
| SM5664 | SM5665 | SM5666 | SM5667 | SM5668 | SM5669 | SM5670 | SM5671 | Forward limit | × | R/W | Page 386 |
| SM5680 | SM5681 | SM5682 | SM5683 | SM5684 | SM5685 | SM5686 | SM5687 | Reverse limit | × | R/W | Page 386 |
| SM5776 | SM5777 | SM5778 | SM5779 | SM5780 | SM5781 | SM5782 | SM5783 | Rotation direction setting | ○ | R/W | Page 374 |
| SM5808 | SM5809 | SM5810 | SM5811 | SM5812 | SM5813 | SM5814 | SM5815 | OPR direction specification | ○ | R/W | Page 389 |
| SM5824 | SM5825 | SM5826 | SM5827 | SM5828 | SM5829 | SM5830 | SM5831 | Clear signal output function enable | ○ | R/W | Page 391 |
| SM5872 | SM5873 | SM5874 | SM5875 | SM5876 | SM5877 | SM5878 | SM5879 | Zero signal count start time | ○ | R/W | Page 394 |

R: Read only, R/W: Read/write, ○: Supported, ×: Not supported

## Special registers

### ■CPU module

| FX5 dedicated | | | | FX3 compatible | | | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 1 | Axis 2 | Axis 3 | Axis 4 | | | | |
| SD5500, SD5501 | SD5540, SD5541 | SD5580, SD5581 | SD5620, SD5621 | — | — | — | — | Current address (user unit) | × | R/W*1 | Page 382 |
| SD5502, SD5503 | SD5542, SD5543 | SD5582, SD5583 | SD5622, SD5623 | SD8340, SD8341 | SD8350, SD8351 | SD8360, SD8361 | SD8370, SD8371 | Current address (pulse unit) | × | R/W*1 | Page 382 |
| SD5504, SD5505 | SD5544, SD5545 | SD5584, SD5585 | SD5624, SD5625 | — | — | — | — | Current speed (user unit) | × | R | Page 378 |
| SD5510 | SD5550 | SD5590 | SD5630 | — | — | — | — | Positioning error (error code) | × | R/W | Page 401 |
| SD5516, SD5517 | SD5556, SD5557 | SD5596, SD5597 | SD5636, SD5637 | — | — | — | — | Maximum speed | ○ | R/W | Page 379 |
| SD5518, SD5519 | SD5558, SD5559 | SD5598, SD5599 | SD5638, SD5639 | — | — | — | — | Bias speed | ○ | R/W | Page 379 |
| SD5520 | SD5560 | SD5600 | SD5640 | — | — | — | — | Acceleration time | ○ | R/W | Page 380 |
| SD5521 | SD5561 | SD5601 | SD5641 | — | — | — | — | Deceleration time | ○ | R/W | Page 380 |
| SD5526, SD5527 | SD5566, SD5567 | SD5606, SD5607 | SD5646, SD5647 | — | — | — | — | OPR speed | ○ | R/W | Page 390 |
| SD5528, SD5529 | SD5568, SD5569 | SD5608, SD5609 | SD5648, SD5649 | — | — | — | — | Creep speed | ○ | R/W | Page 391 |
| SD5530, SD5531 | SD5570, SD5571 | SD5610, SD5611 | SD5650, SD5651 | — | — | — | — | Origin address | ○ | R/W | Page 390 |
| SD5532 | SD5572 | SD5612 | SD5652 | — | — | — | — | OPR zero signal counts | ○ | R/W | Page 394 |
| SD5533 | SD5573 | SD5613 | SD5653 | | | | | OPR dwell time | ○ | R/W | Page 392 |

R: Read only, R/W: Read/write, ○: Supported, ×: Not supported

*1 Only FX5 dedicated devices can be written by the HCMOV/DHCMOV instruction.

## ■High-speed pulse input/output module

| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SD5660, SD5661 | SD5700, SD5701 | SD5740, SD5741 | SD5780, SD5781 | SD5820, SD5821 | SD5860, SD5861 | SD5900, SD5901 | SD5940, SD5941 | Current address (user unit) | × | R/W*1 | Page 382 |
| SD5662, SD5663 | SD5702, SD5703 | SD5742, SD5743 | SD5782, SD5783 | SD5822, SD5823 | SD5862, SD5863 | SD5902, SD5903 | SD5942, SD5943 | Current address (pulse unit) | × | R/W*1 | Page 382 |
| SD5664, SD5665 | SD5704, SD5705 | SD5744, SD5745 | SD5784, SD5785 | SD5824, SD5825 | SD5864, SD5865 | SD5904, SD5905 | SD5944, SD5945 | Current speed (user unit) | × | R | Page 378 |
| SD5670 | SD5710 | SD5750 | SD5790 | SD5830 | SD5870 | SD5910 | SD5950 | Positioning error (error code) | × | R/W | Page 401 |
| SD5676, SD5677 | SD5716, SD5717 | SD5756, SD5757 | SD5796, SD5797 | SD5836, SD5837 | SD5876, SD5877 | SD5916, SD5917 | SD5956, SD5957 | Maximum speed | ○ | R/W | Page 379 |
| SD5678, SD5679 | SD5718, SD5719 | SD5758, SD5759 | SD5798, SD5799 | SD5838, SD5839 | SD5878, SD5879 | SD5918, SD5919 | SD5958, SD5959 | Bias speed | ○ | R/W | Page 379 |
| SD5680 | SD5720 | SD5760 | SD5800 | SD5840 | SD5880 | SD5920 | SD5960 | Acceleration time | ○ | R/W | Page 380 |
| SD5681 | SD5721 | SD5761 | SD5801 | SD5841 | SD5881 | SD5921 | SD5961 | Deceleration time | ○ | R/W | Page 380 |
| SD5686, SD5687 | SD5726, SD5727 | SD5766, SD5767 | SD5806, SD5807 | SD5846, SD5847 | SD5886, SD5887 | SD5926, SD5927 | SD5966, SD5967 | OPR speed | ○ | R/W | Page 390 |
| SD5688, SD5689 | SD5728, SD5729 | SD5768, SD5769 | SD5808, SD5809 | SD5848, SD5849 | SD5888, SD5889 | SD5928, SD5929 | SD5968, SD5969 | Creep speed | ○ | R/W | Page 391 |
| SD5690, SD5691 | SD5730, SD5731 | SD5770, SD5771 | SD5810, SD5811 | SD5850, SD5851 | SD5890, SD5891 | SD5930, SD5931 | SD5970, SD5971 | Origin address | ○ | R/W | Page 390 |
| SD5692 | SD5732 | SD5772 | SD5812 | SD5852 | SD5892 | SD5932 | SD5972 | OPR zero signal counts | ○ | R/W | Page 394 |
| SD5693 | SD5733 | SD5773 | SD5813 | SD5853 | SD5893 | SD5933 | SD5973 | OPR dwell time | ○ | R/W | Page 392 |

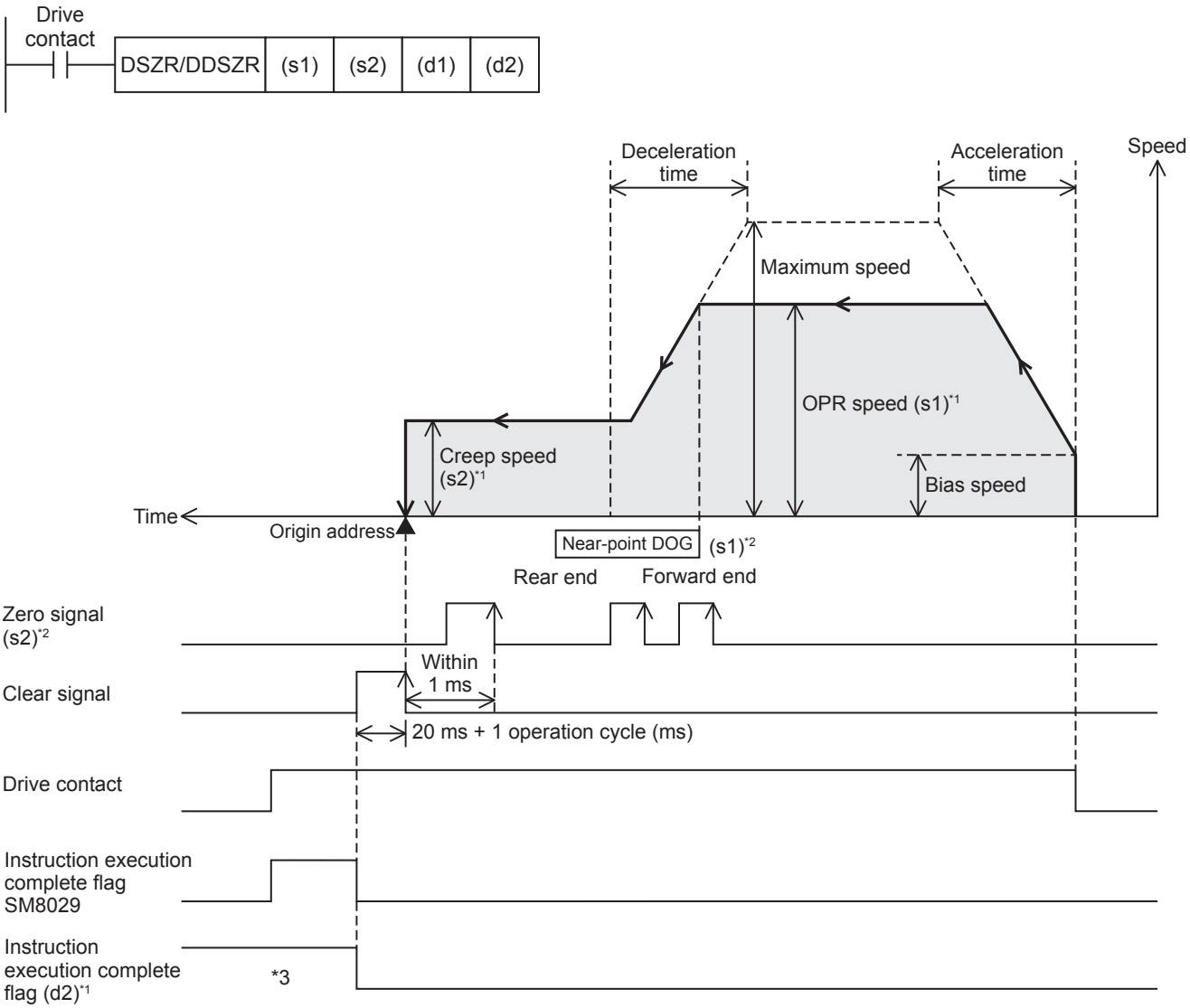
R: Read only, R/W: Read/write, ○: Supported, ×: Not supported

*1 Writing can be performed only by the HCMOV/DHCMOV instruction.

# Outline of operation

For each speed, refer to ☞ Page 377 Items related to speed.

For the items related to OPR, refer to ☞ Page 389 Items related to OPR.




*1 When FX5 operand is specified

*2 When the FX3 compatible operand is specified

*3 Remains on until it is turned off using program or engineering tool or the positioning instruction is next driven again.

## Basic operation

The following describes the basic operation.

1. After the drive contact is turned on, pulse output is started and the speed is increased from the bias speed.
2. After the speed has reached the OPR speed, the operation will be performed at the OPR speed.
3. After the near-point dog is detected, the speed is decreased.
4. After the speed has reached the creep speed, the operation will be performed at the creep speed.
5. After the near-point dog is turned from ON to OFF, pulse output is stopped when the zero signal is detected.

## Operand specification

### ■When FX5 operand is specified or the DDSZR instruction is used

**1.** For (s1), specify the OPR speed. Set to a value 1 pps to 200 kpps in pulse. For the FX5S CPU module, set to a value 1 to 100 kpps.

- DSZR: 1 to 65535 (User system unit)
- DDSZR: 1 to 2147483647 (User system unit)

**2.** For (s2), specify the creep speed. Set to a value 1 pps to 200 kpps in pulse. For the FX5S CPU module, set to a value 1 to 100 kpps.

- DSZR: 1 to 65535 (User system unit)
- DDSZR: 1 to 2147483647 (User system unit)

**3.** For (d1), specify an axis number for which pulses are output.

Specify an axis number whose positioning parameters are set in the high speed I/O parameters. Operation cannot be performed if any other axis number is specified.

[FX5S CPU module]

- K1 to K4: Axis 1 to Axis 4

[FX5UJ CPU module]

- K1 to K3: Axis 1 to Axis 3 (CPU module)
- K5, K6: Axis 5, Axis 6 (High-speed pulse input/output module first module)
- K7, K8: Axis 7, Axis 8 (High-speed pulse input/output module second module)
- K9, K10: Axis 9, Axis 10 (High-speed pulse input/output module third module)
- K11, K12: Axis 11, Axis 12 (High-speed pulse input/output module fourth module)

[FX5U/FX5UC CPU module]

- K1 to K4: Axis 1 to Axis 4 (CPU module)
- K5, K6: Axis 5, Axis 6 (High-speed pulse input/output module first module)
- K7, K8: Axis 7, Axis 8 (High-speed pulse input/output module second module)
- K9, K10: Axis 9, Axis 10 (High-speed pulse input/output module third module)
- K11, K12: Axis 11, Axis 12 (High-speed pulse input/output module fourth module)

**4.** For (d2), specify the bit devices of the instruction execution complete flag and abnormal end flag. (☞ Page 402 Complete flag)

- (d2): Instruction execution complete flag
- (d2)+1: Instruction execution abnormal end flag

### ■When the FX3 compatible operand is specified (Supported only for CPU module)

**1.** For (s1), specify the near-point dog signal input device number.

When an input device (X) is used, only the device that is specified with the high speed I/O parameter can be specified. The logic set with the high speed I/O parameter is applied. Bit devices can be specified, in addition to input devices (X). In that case, the relay operates on a rising edge.

**2.** For (s2), specify the zero signal input device number.

When an input device (X) is used, only the device that is specified with the high speed I/O parameter can be specified. The logic set with the high speed I/O parameter is applied. Bit devices can be specified, in addition to input devices (X). In that case, the relay operates on a rising edge.

**3.** For (d1), specify the pulse output number.

Specify an output device (Y) number set in the high speed I/O parameters. (☞ Page 372 Pulse Output Mode) Operation cannot be performed if any other axis number is specified.

- FX5S/FX5U/FX5UC CPU module: Y0 to Y3 (equivalent to axes 1 to 4)
- FX5UJ CPU module: Y0 to Y2 (equivalent to axes 1 to 3)

**4.** For (d2), specify the rotation direction signal output device number. (☞ Page 374 Rotation Direction Setting)
When an output device (Y) is used, only the device that is specified with the positioning parameter or a general-purpose output can be specified. However, if an output device (Y) to which PWM, PULSE/SIGN axis of another axis, or CW/CCW axis is assigned is specified, an error occurs without any operation.
For the PWM function, refer to the following.
☞ Page 321 PWM Function

## OPR direction

The pulse output direction is determined by the OPR direction and rotation direction setting. The following table lists operations performed when the origin return direction and rotation direction setting are used in combination. (☞ Page 374 Rotation Direction Setting)

| Item | | Rotation Direction Setting | |
|---|---|---|---|
| | | Current Value Increment with Forward Run Pulse Output | Current Value Increment with Reverse Run Pulse Output |
| OPR Direction | Positive Direction (Address Increment Direction) | Output direction: Forward<br>Address: Increment | Output direction: Reverse<br>Address: Increment |
| | Negative Direction (Address Decrement Direction) | Output direction: Reverse<br>Address: Decrement | Output direction: Forward<br>Address: Decrement |

## Operand change in positioning operation

During positioning operation for the OPR speed (s1) and creep speed (s2), the command speed can be changed before the zero signal is detected. If it is changed after the zero signal is detected, the change is applied when the DSZR/DDSZR instruction is next driven again.

## Operation of the complete flags

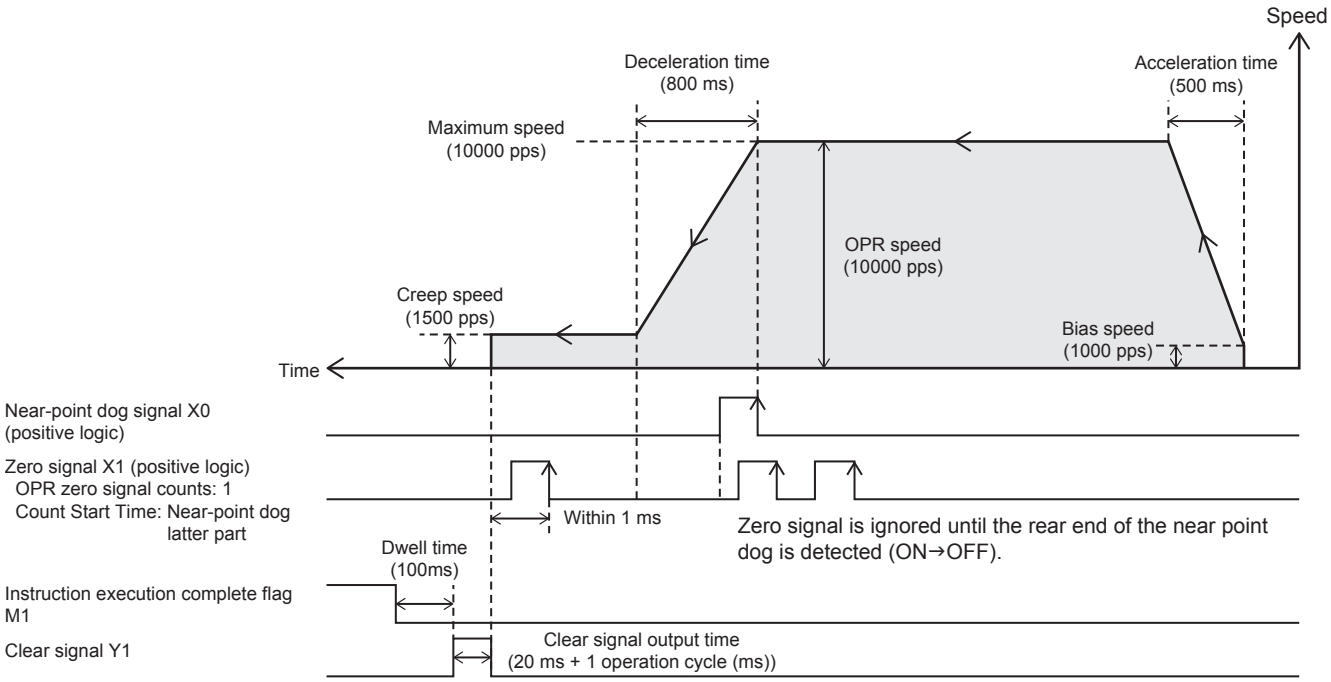
The following describes the operation timings of the complete flags.
The user-specified complete flags are valid only when specified using FX5 operand. If dwell time is specified, the user-specified complete flag turns on after the dwell time elapses.

| Item | FX3 compatible | | User specification | |
|---|---|---|---|---|
| | Instruction execution complete flag (SM8029) | Instruction execution abnormal end flag (SM8329) | Instruction execution complete flag (d2) | Instruction execution abnormal end flag (d2)+1 |
| ON condition | From when OPR is completed to when the drive contact is turned off | From when the following operation or function is completed to when the drive contact is turned off<br>• The axis is already used.*1<br>• Pulse output stop command<br>• Pulse decelerate and stop command<br>• All module reset when a stop error occurs*2<br>• All outputs disabled (SM8034)<br>• Origin address error<br>• Deceleration stop after OPR speed and creep speed are changed to 0<br>• Deceleration stop at limit detection after the near-point dog is detected | From when OPR is completed to when the ON → OFF condition is met | From when the following operation or function is completed to when the ON → OFF condition is met<br>• The axis is already used.<br>• The drive contact is turned off during positioning operation<br>• Pulse output stop command<br>• Pulse decelerate and stop command<br>• All module reset when a stop error occurs*2<br>• All outputs disabled (SM8034)<br>• Online change<br>• Origin address error<br>• Deceleration stop after OPR speed and creep speed are changed to 0<br>• Deceleration stop at limit detection after the near-point dog is detected |
| ON → OFF condition | When the drive contact is turned off | | The flag remains on until either of the following is performed.<br>• Turning off the flag by the user<br>• Restarting the positioning instruction | |

*1 The flag turns on only for one scan when the drive contact of the instruction turns from OFF to ON.
*2 Only high-speed pulse input/output module is supported.

# Program example

The following is a program example of OPR operation (axis 1).

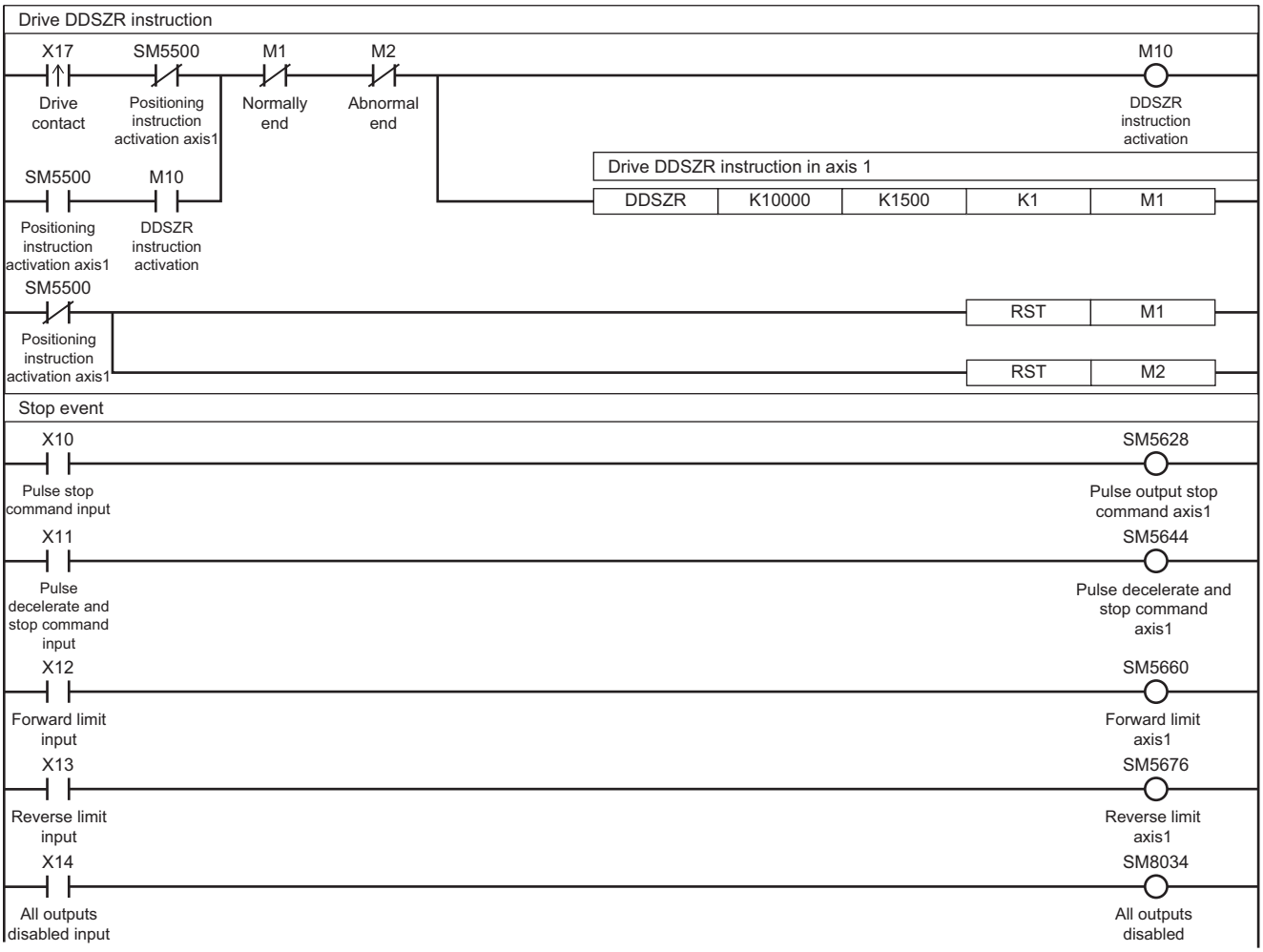



## Setting data

### ■Positioning parameter (high speed I/O parameter)

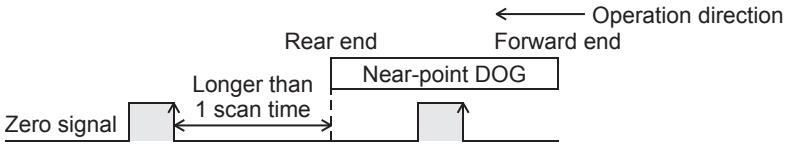
| Item | Axis 1 | Item | Axis 1 |
|---|---|---|---|
| ■Basic Parameter 1 | | ■Detailed Setting Parameter | |
| Pulse Output Mode | 1: PULSE/SIGN | External Start Signal Enabled/ Disabled | 0: Disabled |
| Output Device (PULSE/CW) | Y0 | Interrupt Input Signal 1 Enabled/ Disabled | 0: Disabled |
| Output Device (SIGN/CCW) | Y4 | Interrupt Input Signal 2 Logic | 0: Positive Logic |
| Rotation Direction Setting | 0: Current Address Increment with Forward Run Pulse Output | ■OPR Parameter | |
| Unit Setting | 0: Motor System (pulse, pps) | OPR Enabled/Disabled | 1: Enabled |
| No. of Pulse per Rotation | 2000 pulse | OPR Direction | 0: Negative Direction (Address Decrement Direction) |
| Movement Amount per Rotation | 1000 pulse | Starting Point Address | 0 pulse |
| Position Data Magnification | 1: × Single | Clear Signal Output Enabled/ Disabled | 1: Enabled |
| ■Basic Parameter 2 | | Clear Signal Output Device No. | Y1 |
| Interpolation Speed Specified Method | 0: Composite Speed | OPR Dwell Time | 100 ms |
| Max. Speed | 10000 pps | Near-point Dog Signal Device No. | X0 |
| Bias Speed | 1000 pps | Near-point Dog Signal Logic | 0: Positive Logic |
| Acceleration Time | 500 ms | Zero Signal Device No. | X1 |
| Deceleration Time | 800 ms | Zero Signal Logic | 0: Positive Logic |
| — | | Zero Signal OPR Zero Signal Counts | 1 |
| | | Zero Signal Count Start Time | 0: Near-point Dog Latter Part |

## Program example



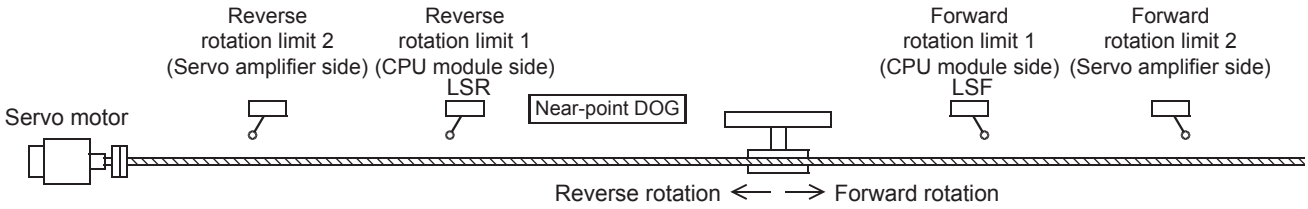

# Caution

- Detection of (the rear end and the front end of) the near-point dog will be affected by the input response time and the scan time of the sequence program. Secure 1 scan time or more from the rear end of the near-point dog to turning ON of the zero signal.
- Since the zero signal of the servo motor is used, adjust the relation between the rear end of the near-point dog and the zero signal as shown in the following figure. If fine adjustment of the origin position is needed, adjust the position of the near-point dog.

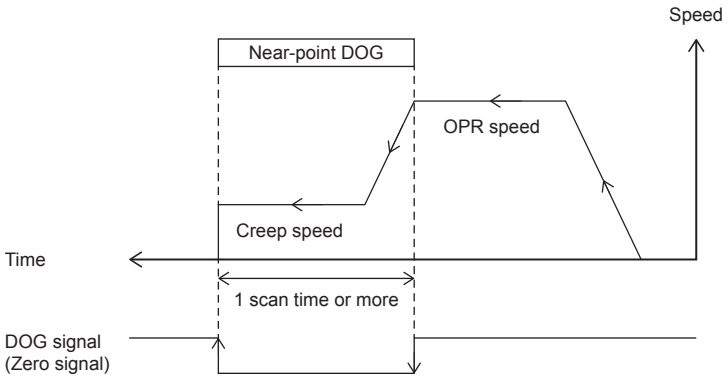



- Properly set the near-point dog so that the near-point dog can be kept at the ON status until the speed is reduced to the creep speed. Deceleration to the creep speed starts at the front end of the near-point dog, the operation stops at "the rear end of the near-point dog" or at "detection of the first zero signal after the rear end of the near-point dog", and the current address is cleared. If the speed is not reduced to the creep speed before detecting the rear end of the near-point dog, the operation may not be stopped at the specified position.

- Use the near-point dog between the reverse rotation limit 1 (LSR) and the forward rotation limit 1 (LSF). The intended operation may not be performed if the relationship among the near-point dog, reverse rotation limit 1 (LSR), and forward rotation limit 1 (LSF) is not as shown in the figure below.




- The creep speed should be sufficiently slow. Deceleration stop is not performed. For this reason, if the creep speed is not slow enough, the operation may not be stopped at the specified position due to inertia.
- When using the high-speed pulse input/output module with OPR zero signal counts set to 0, the position of the origin position varies under influence of the calculation period. If an operation to stop immediately after the detection of the dog signal is made, executing OPR with the following setting reduces the variance of the origin position. However, it is necessary to adjust the length of the near-point dog signal so that the time of OFF to ON of the near-point dog signal is one scan or longer.

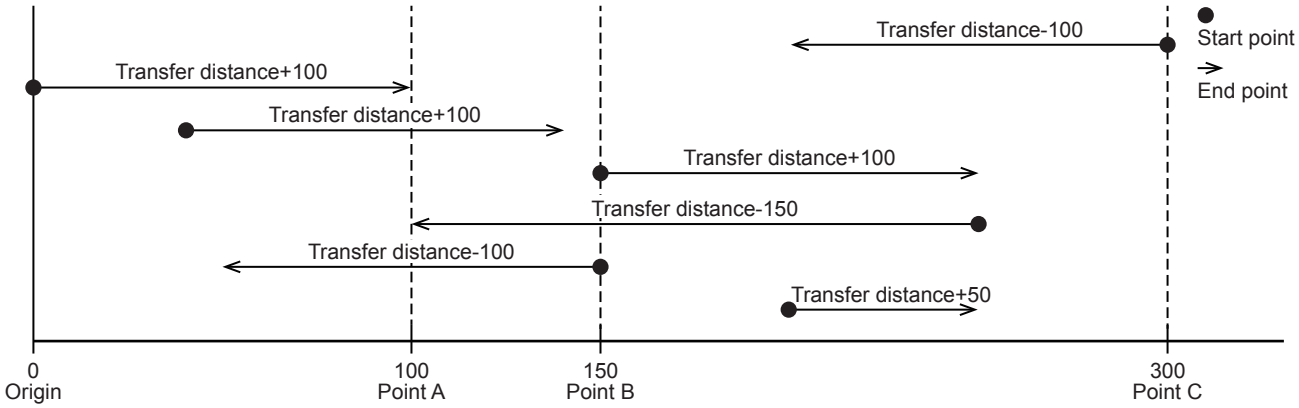



Positioning parameter (Zero Signal Device No.: X□+5)
- Zero Signal Count Start Time: Near-point Dog Latter Part
- Zero Signal OPR Zero Signal Counts: 1
- Near-point Dog Signal Device No.: X□+5 (same device as zero signal)
- Near-point Dog Signal Logic: Negative Logic

- If the dog search function cannot detect the near-point dog signal, the speed will decelerate and the operation will stop. The execution of the instruction ends with an error.
- In the case of the high-speed pulse input/output module, if the CJ instruction is used to skip the DSZR/DDSZR instruction, the near-point dog signals become undetectable. (☞ Page 527 When a user interrupt is used) If the instruction is skipped, the operation to detect the forward limit or reverse limit and stop is made.

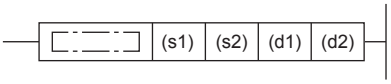
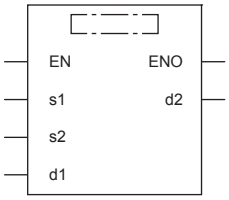
# 32.4 Relative Positioning

This instruction performs 1-speed positioning in the incremental method (positioning operation with a relative address). While regarding the current position as the start point, specify the transfer direction and the transfer distance (relative address) to determine the target position.



## DRVI/DDRVI

This instruction executes 1-speed positioning by relative address.

| Ladder | ST | FBD/LD |
|---|---|---|
|  | ENO:=DRVI(EN,s1,s2,d1,d2);<br>ENO:=DDRVI(EN,s1,s2,d1,d2); |  |

### Setting data

#### ■Description, range, data type (DRVI)

• FX5 operand

| Operand | Description | Range | Data type | Data type (label) |
|---|---|---|---|---|
| (s1) | Word device number storing the positioning address or data*1 | -32768 to +32767<br>(User system unit) | 16-bit signed binary | ANY16 |
| (s2) | Word device number storing command speed or data*2 | 1 to 65535<br>(User system unit) | 16-bit unsigned binary | ANY16 |
| (d1) | Axis number from which pulses are output | ■FX5S CPU module<br>K1 to K4<br>■FX5UJ CPU module<br>K1 to K3, K5 to K12<br>■FX5U/FX5UC CPU module<br>K1 to K12 | 16-bit unsigned binary | ANY_ELEMENTARY (WORD) |
| (d2) | Bit device number of the instruction execution complete flag and abnormal end flag | — | Bit | ANY_BOOL |
| EN | Execution condition | — | Bit | BOOL |
| ENO | Execution result | — | Bit | BOOL |

• FX3 compatible operand (Supported only for CPU module)

| Operand | Description | Range | Data type | Data type (label) |
|---|---|---|---|---|
| (s1) | Word device number storing the positioning address or data*1 | -32768 to +32767<br>(User system unit) | 16-bit signed binary | ANY16 |
| (s2) | Word device number storing command speed or data*2 | 1 to 65535<br>(User system unit) | 16-bit unsigned binary | ANY16 |
| (d1) | Bit device number (Y) from which pulses are output | ■FX5S/FX5U/FX5UC CPU module<br>Y0 to Y3<br>■FX5UJ CPU module<br>Y0 to Y2 | Bit | ANY_ELEMENTARY (BOOL) |
| (d2) | Bit device number from which rotation direction is output | — | Bit | ANY_BOOL |
| EN | Execution condition | — | Bit | BOOL |
| ENO | Execution result | — | Bit | BOOL |

*1 The positioning address can be changed during positioning operation. (☞ Page 361 Positioning address change during positioning operation)

*2 Command speed can be changed during positioning operation. (☞ Page 362 Command speed change during positioning operation)

## ■Description, range, data type (DDRVI)

• FX5 operand

| Operand | Description | Range | Data type | Data type (label) |
|---|---|---|---|---|
| (s1) | Word device number storing the positioning address or data*1 | -2147483648 to +2147483647 (User system unit) | 32-bit signed binary | ANY32 |
| (s2) | Word device number storing command speed or data*2 | 1 to 2147483647 (User system unit) | 32-bit signed binary | ANY32 |
| (d1) | Axis number from which pulses are output | ■FX5S CPU module K1 to K4 ■FX5UJ CPU module K1 to K3, K5 to K12 ■FX5U/FX5UC CPU module K1 to K12 | 16-bit unsigned binary | ANY_ELEMENTARY (WORD) |
| (d2) | Bit device number of the instruction execution complete flag and abnormal end flag | — | Bit | ANY_BOOL |
| EN | Execution condition | — | Bit | BOOL |
| ENO | Execution result | — | Bit | BOOL |

• FX3 compatible operand (Supported only for CPU module)

| Operand | Description | Range | Data type | Data type (label) |
|---|---|---|---|---|
| (s1) | Word device number storing the positioning address or data*1 | -2147483648 to +2147483647 (User system unit) | 32-bit signed binary | ANY32 |
| (s2) | Word device number storing command speed or data*2 | 1 to 2147483647 (User system unit) | 32-bit signed binary | ANY32 |
| (d1) | Bit device number (Y) from which pulses are output | ■FX5S/FX5U/FX5UC CPU module Y0 to Y3 ■FX5UJ CPU module Y0 to Y2 | Bit | ANY_ELEMENTARY (BOOL) |
| (d2) | Bit device number from which rotation direction is output | — | Bit | ANY_BOOL |
| EN | Execution condition | — | Bit | BOOL |
| ENO | Execution result | — | Bit | BOOL |

*1 The positioning address can be changed during positioning operation.

*2 Command speed can be changed during positioning operation.

## ■Available device (DRVI/DDRVI)

• FX5 operand

| Operand | Bit | Word | | | Double word | | Indirect specification | Constant | | | Others |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | X, Y, M, L, SM, F, B, SB, S | T, ST, C, D, W, SD, SW, R | U□\G□ | Z | LC | LZ | | K, H | E | $ | |
| (s1) | ○ | ○ | ○ | ○ | ○*1 | ○*1 | ○ | ○ | — | — | — |
| (s2) | ○ | ○ | ○ | ○ | ○*1 | ○*1 | ○ | ○ | — | — | — |
| (d1) | — | ○ | ○ | ○ | — | — | ○ | ○ | — | — | — |
| (d2)*2 | ○ | ○*3 | — | — | — | — | — | — | — | — | — |

• FX3 compatible operand (Supported only for CPU module)

| Operand | Bit | Word | | | Double word | | Indirect specification | Constant | | | Others |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | X, Y, M, L, SM, F, B, SB, S | T, ST, C, D, W, SD, SW, R | U□\G□ | Z | LC | LZ | | K, H | E | $ | |
| (s1) | ○ | ○ | ○ | ○ | ○*1 | ○*1 | ○ | ○ | — | — | — |
| (s2) | ○ | ○ | ○ | ○ | ○*1 | ○*1 | ○ | ○ | — | — | — |
| (d1) | ○*4 | — | — | — | — | — | — | — | — | — | — |
| (d2) | ○*5 | ○*3 | — | — | — | — | — | — | — | — | — |

*1 Only available for DDRVI instruction.
*2 Two devices are occupied from the specified device.
*3 T, ST, C cannot be used.
*4 FX5S/FX5U/FX5UC CPU module: Only Y0 to Y3 devices can be used.
FX5UJ CPU module: Only Y0 to Y2 devices can be used.
*5 When the output mode is CW/CCW, specify the CCW axis. When the output mode is PULSE/SIGN, only the SIGN output of the axis or general-purpose output can be specified.

### Processing details

This instruction executes 1-speed positioning by relative address. The target positioning address is specified in the incremental method, in which transfer direction and transfer distance (relative address) from current address are specified for positioning operation.

## Related devices

The following lists the related special devices.
Related devices of axis 4 are available only for the FX5S/FX5U/FX5UC CPU module.

### Special relays

#### ■CPU module

| FX5 dedicated | | | | FX3 compatible | | | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 1 | Axis 2 | Axis 3 | Axis 4 | | | | |
| — | — | — | — | SM8029 | | | | Instruction execution complete flag | × | R | Page 402 |
| — | — | — | — | SM8329 | | | | Instruction execution abnormal end flag | × | R | |
| SM5500 | SM5501 | SM5502 | SM5503 | SM8348 | SM8358 | SM8368 | SM8378 | Positioning instruction activation | × | R | Page 400 |
| SM5516 | SM5517 | SM5518 | SM5519 | SM8340 | SM8350 | SM8360 | SM8370 | Pulse output monitor | × | R | Page 400 |
| SM5532 | SM5533 | SM5534 | SM5535 | — | — | — | — | Positioning error occurrence | × | R/W | Page 400 |
| SM5596 | SM5597 | SM5598 | SM5599 | — | — | — | — | Remaining distance operation enabled | × | R/W | Page 387 |
| SM5612 | SM5613 | SM5614 | SM5615 | — | — | — | — | Remaining distance operation start | × | R/W | Page 387 |
| SM5628 | SM5629 | SM5630 | SM5631 | — | — | — | — | Pulse output stop command | × | R/W | Page 384 |
| SM5644 | SM5645 | SM5646 | SM5647 | — | — | — | — | Pulse decelerate and stop command | × | R/W | Page 385 |
| SM5660 | SM5661 | SM5662 | SM5663 | — | — | — | — | Forward limit | × | R/W | Page 386 |
| SM5676 | SM5677 | SM5678 | SM5679 | — | — | — | — | Reverse limit | × | R/W | Page 386 |
| SM5772 | SM5773 | SM5774 | SM5775 | — | — | — | — | Rotation direction setting | ○ | R/W | Page 374 |

R: Read only, R/W: Read/write, ○: Supported, ×: Not supported

### ■High-speed pulse input/output module

| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SM8029 (FX3 compatible device) | | | | | | | | Instruction execution complete flag | × | R | Page 402 |
| SM8329 (FX3 compatible device) | | | | | | | | Instruction execution abnormal end flag | × | R | |
| SM5504 | SM5505 | SM5506 | SM5507 | SM5508 | SM5509 | SM5510 | SM5511 | Positioning instruction activation | × | R | Page 400 |
| SM5520 | SM5521 | SM5522 | SM5523 | SM5524 | SM5525 | SM5526 | SM5527 | Pulse output monitor | × | R | Page 400 |
| SM5536 | SM5537 | SM5538 | SM5539 | SM5540 | SM5541 | SM5542 | SM5543 | Positioning error occurrence | × | R/W | Page 400 |
| SM5600 | SM5601 | SM5602 | SM5603 | SM5604 | SM5605 | SM5606 | SM5607 | Remaining distance operation enabled | × | R/W | Page 387 |
| SM5616 | SM5617 | SM5618 | SM5619 | SM5620 | SM5621 | SM5622 | SM5623 | Remaining distance operation start | × | R/W | Page 387 |
| SM5632 | SM5633 | SM5634 | SM5635 | SM5636 | SM5637 | SM5638 | SM5639 | Pulse output stop command | × | R/W | Page 384 |
| SM5648 | SM5649 | SM5650 | SM5651 | SM5652 | SM5653 | SM5654 | SM5655 | Pulse decelerate and stop command | × | R/W | Page 385 |
| SM5664 | SM5665 | SM5666 | SM5667 | SM5668 | SM5669 | SM5670 | SM5671 | Forward limit | × | R/W | Page 386 |
| SM5680 | SM5681 | SM5682 | SM5683 | SM5684 | SM5685 | SM5686 | SM5687 | Reverse limit | × | R/W | Page 386 |
| SM5776 | SM5777 | SM5778 | SM5779 | SM5780 | SM5781 | SM5782 | SM5783 | Rotation direction setting | ○ | R/W | Page 374 |

R: Read only, R/W: Read/write, ○: Supported, ×: Not supported

## Special registers



### ■CPU module

| FX5 dedicated | | | | FX3 compatible | | | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 1 | Axis 2 | Axis 3 | Axis 4 | | | | |
| SD5500, SD5501 | SD5540, SD5541 | SD5580, SD5581 | SD5620, SD5621 | — | — | — | — | Current address (user unit) | × | R/W*1 | Page 382 |
| SD5502, SD5503 | SD5542, SD5543 | SD5582, SD5583 | SD5622, SD5623 | SD8340, SD8341 | SD8350, SD8351 | SD8360, SD8361 | SD8370, SD8371 | Current address (pulse unit) | × | R/W*1 | Page 382 |
| SD5504, SD5505 | SD5544, SD5545 | SD5584, SD5585 | SD5624, SD5625 | — | — | — | — | Current speed (user unit) | × | R | Page 378 |
| SD5510 | SD5550 | SD5590 | SD5630 | — | — | — | — | Positioning error (error code) | × | R/W | Page 401 |
| SD5516, SD5517 | SD5556, SD5557 | SD5596, SD5597 | SD5636, SD5637 | — | — | — | — | Maximum speed | ○ | R/W | Page 379 |
| SD5518, SD5519 | SD5558, SD5559 | SD5598, SD5599 | SD5638, SD5639 | — | — | — | — | Bias speed | ○ | R/W | Page 379 |
| SD5520 | SD5560 | SD5600 | SD5640 | — | — | — | — | Acceleration time | ○ | R/W | Page 380 |
| SD5521 | SD5561 | SD5601 | SD5641 | — | — | — | — | Deceleration time | ○ | R/W | Page 380 |

R: Read only, R/W: Read/write, ○: Supported, ×: Not supported

*1 Only FX5 dedicated devices can be written by the HCMOV/DHCMOV instruction.

### ■High-speed pulse input/output module

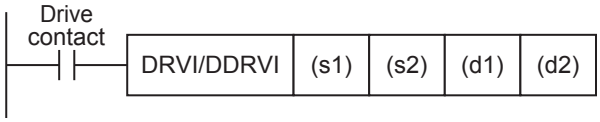
| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SD5660, SD5661 | SD5700, SD5701 | SD5740, SD5741 | SD5780, SD5781 | SD5820, SD5821 | SD5860, SD5861 | SD5900, SD5901 | SD5940, SD5941 | Current address (user unit) | × | R/W*1 | Page 382 |
| SD5662, SD5663 | SD5702, SD5703 | SD5742, SD5743 | SD5782, SD5783 | SD5822, SD5823 | SD5862, SD5863 | SD5902, SD5903 | SD5942, SD5943 | Current address (pulse unit) | × | R/W*1 | Page 382 |
| SD5664, SD5665 | SD5704, SD5705 | SD5744, SD5745 | SD5784, SD5785 | SD5824, SD5825 | SD5864, SD5865 | SD5904, SD5905 | SD5944, SD5945 | Current speed (user unit) | × | R | Page 378 |
| SD5670 | SD5710 | SD5750 | SD5790 | SD5830 | SD5870 | SD5910 | SD5950 | Positioning error (error code) | × | R/W | Page 401 |
| SD5676, SD5677 | SD5716, SD5717 | SD5756, SD5757 | SD5796, SD5797 | SD5836, SD5837 | SD5876, SD5877 | SD5916, SD5917 | SD5956, SD5957 | Maximum speed | ○ | R/W | Page 379 |
| SD5678, SD5679 | SD5718, SD5719 | SD5758, SD5759 | SD5798, SD5799 | SD5838, SD5839 | SD5878, SD5879 | SD5918, SD5919 | SD5958, SD5959 | Bias speed | ○ | R/W | Page 379 |
| SD5680 | SD5720 | SD5760 | SD5800 | SD5840 | SD5880 | SD5920 | SD5960 | Acceleration time | ○ | R/W | Page 380 |
| SD5681 | SD5721 | SD5761 | SD5801 | SD5841 | SD5881 | SD5921 | SD5961 | Deceleration time | ○ | R/W | Page 380 |

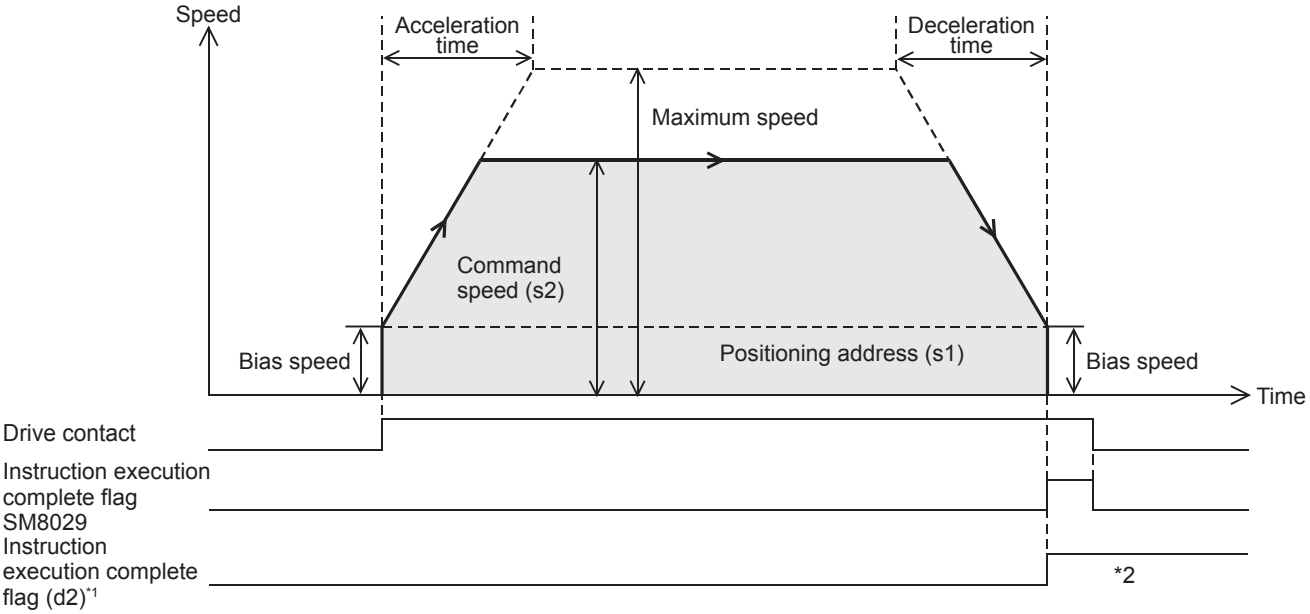
R: Read only, R/W: Read/write, ○: Supported, ×: Not supported

*1 Writing can be performed only by the HCMOV/DHCMOV instruction.

# Outline of operation

For each speed, refer to ☞ Page 377 Items related to speed.




*1 When FX5 operand is specified

*2 Remains on until it is turned off using program or engineering tool or the positioning instruction is next driven again.

## Basic operation

The following describes the basic operation.

***1.*** After the drive contact is turned on, pulse output is started and the speed is increased from the bias speed.

***2.*** After the speed has reached the specified speed, the operation will be performed in the specified speed.

***3.*** Deceleration starts from near the target position.

***4.*** After movement to the specified positioning address, pulse output is stopped.

## Operand specification

### ■When FX5 operand is specified

**1.** For (s1), specify the relative positioning address. (☞ Page 380 Positioning address)

Set to a value -2147483648 to +2147483647 in pulse.

- DRVI: -32768 to +32767 (User system unit)
- DDRVI: -2147483648 to +2147483647 (User system unit)

**2.** For (s2), specify the command speed. Set to a value 1 pps to 200 kpps in pulse. For the FX5S CPU module, set to a value 1 to 100 kpps.

- DRVI: 1 to 65535 (User system unit)
- DDRVI: 1 to 2147483647 (User system unit)

**3.** For (d1), specify an axis number for which pulses are output.

Specify an axis number whose positioning parameters are set in the high speed I/O parameters. Operation cannot be performed if any other axis number is specified.

[FX5S CPU module]

- K1 to K4: Axis 1 to Axis 4

[FX5UJ CPU module]

- K1 to K3: Axis 1 to Axis 3 (CPU module)
- K5, K6: Axis 5, Axis 6 (High-speed pulse input/output module first module)
- K7, K8: Axis 7, Axis 8 (High-speed pulse input/output module second module)
- K9, K10: Axis 9, Axis 10 (High-speed pulse input/output module third module)
- K11, K12: Axis 11, Axis 12 (High-speed pulse input/output module fourth module)

[FX5U/FX5UC CPU module]

- K1 to K4: Axis 1 to Axis 4 (CPU module)
- K5, K6: Axis 5, Axis 6 (High-speed pulse input/output module first module)
- K7, K8: Axis 7, Axis 8 (High-speed pulse input/output module second module)
- K9, K10: Axis 9, Axis 10 (High-speed pulse input/output module third module)
- K11, K12: Axis 11, Axis 12 (High-speed pulse input/output module fourth module)

**4.** For (d2), specify the bit devices of the instruction execution complete flag and abnormal end flag. (☞ Page 402 Complete flag)

- (d2): Instruction execution complete flag
- (d2)+1: Instruction execution abnormal end flag

### ■When the FX3 compatible operand is specified (Supported only for CPU module)

**1.** For (s1), specify the relative positioning address.

Set to a value -2147483648 to +2147483647 in pulse.

- DRVI: -32768 to +32767 (User system unit)
- DDRVI: -2147483648 to +2147483647 (User system unit)

**2.** For (s2), specify the command speed. Set to a value 1 pps to 200 kpps in pulse. For the FX5S CPU module, set to a value 1 to 100 kpps.

- DRVI: 1 to 65535 (User system unit)
- DDRVI: 1 to 2147483647 (User system unit)

**3.** For (d1), specify the pulse output number.

Specify an output device (Y) number set in the high speed I/O parameters. (☞ Page 372 Pulse Output Mode) Operation cannot be performed if any other axis number is specified.

- FX5S/FX5U/FX5UC CPU module: Y0 to Y3 (equivalent to axes 1 to 4)
- FX5UJ CPU module: Y0 to Y2 (equivalent to axes 1 to 3)

**4.** For (d2), specify the rotation direction signal output device number. (☞ Page 374 Rotation Direction Setting)

When an output device (Y) is used, only the device that is specified with the positioning parameter or a general-purpose output can be specified. However, if an output device (Y) to which PWM, PULSE/SIGN axis of another axis, or CW/CCW axis is assigned is specified, an error occurs without any operation.

For the PWM function, refer to the following.

☞ Page 321 PWM Function

### Precautions

Set the number of output pulses per DRVI/DDRVI instruction execution to 2147483647 or lower. An error occurs if the number of pulses exceeds 2147483648.

## Operation of the complete flags

The following describes the operation timings of the complete flags.

The user-specified complete flags are valid only when specified using FX5 operand.

| Item | FX3 compatible | | User specification | |
|---|---|---|---|---|
| | Instruction execution complete flag (SM8029) | Instruction execution abnormal end flag (SM8329) | Instruction execution complete flag (d2) | Instruction execution abnormal end flag (d2)+1 |
| ON condition | From when pulse output of the specified positioning address is completed to when the drive contact is turned off | From when the following operation or function is completed to when the drive contact is turned off<br>• The axis is already used.*1<br>• Pulse output stop command<br>• Pulse decelerate and stop command*2<br>• Limit of the moving direction<br>• All module reset when a stop error occurs*3<br>• All outputs disabled (SM8034)<br>• Positioning address error<br>• Deceleration stop after the command speed is changed to 0 | From when pulse output of the specified positioning address is completed to when the ON → OFF condition is met | From when the following operation or function is completed to when the ON → OFF condition is met<br>• The axis is already used.<br>• The drive contact is turned off during positioning operation.<br>• Pulse output stop command<br>• Pulse decelerate and stop command*2<br>• Limit of the moving direction<br>• All module reset when a stop error occurs*3<br>• All outputs disabled (SM8034)<br>• Online change<br>• Positioning address error<br>• Deceleration stop after the command speed is changed to 0 |
| ON → OFF condition | When the drive contact is turned off | | The flag remains on until either of the following is performed.<br>• Turning off the flag by the user<br>• Restarting the positioning instruction | |

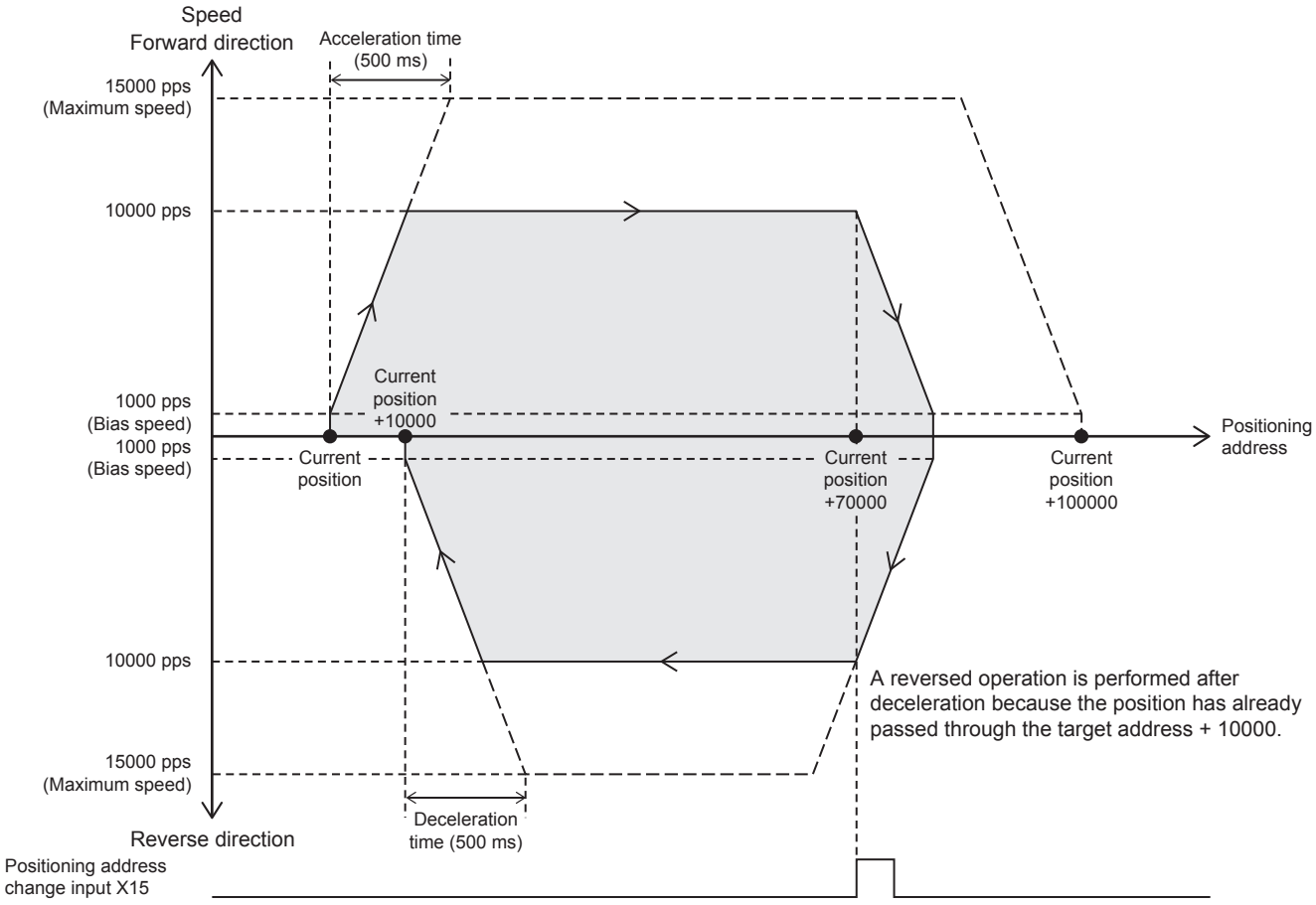
*1 The flag turns on only for one scan when the drive contact of the instruction turns from OFF to ON.

*2 When remaining distance operation enabled is turned on, abnormal end flag will not turn on. (☞ Page 387 Remaining distance operation enabled)

*3 Only high-speed pulse input/output module is supported.

# Program example

This program example shows a reversed operation that is performed by changing the positioning address at the current position + 70000 during relative positioning operation (axis 1).

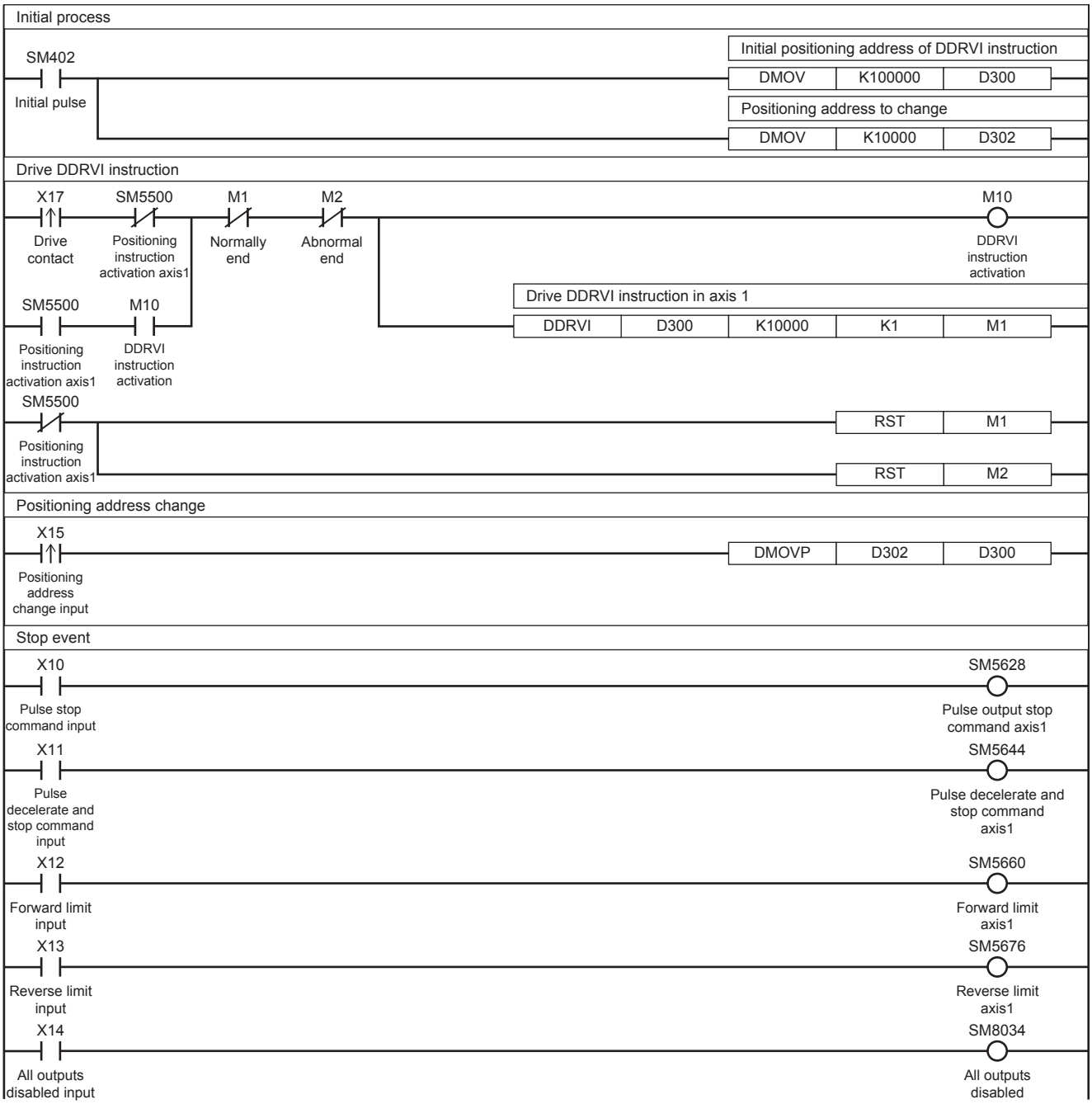



## Setting data

### ■Positioning parameter (high speed I/O parameter)

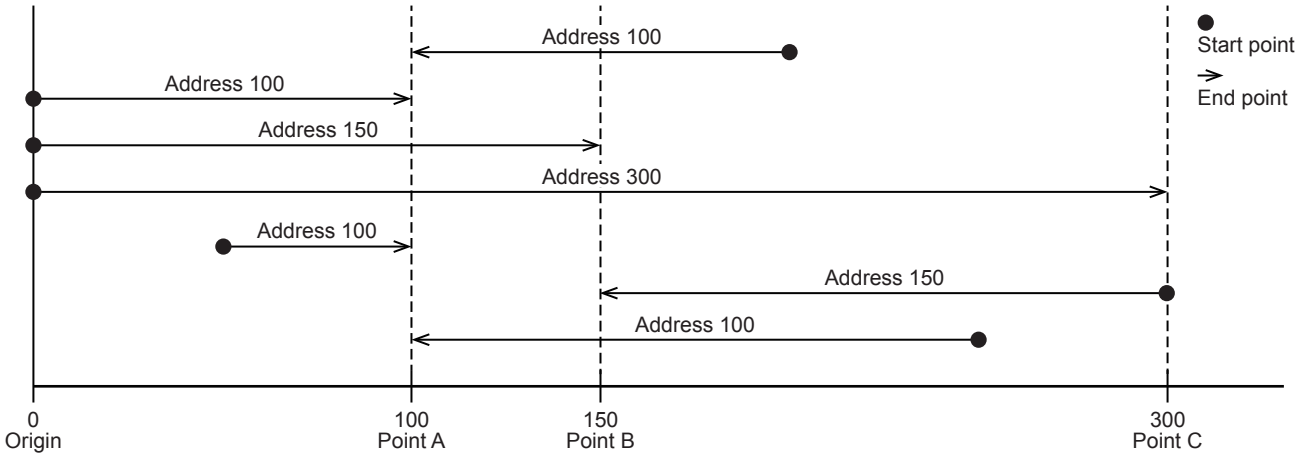
| Item | Axis 1 | Item | Axis 1 |
|---|---|---|---|
| ■Basic Parameter 1 | | ■Basic Parameter 2 | |
| Pulse Output Mode | 1: PULSE/SIGN | Interpolation Speed Specified Method | 0: Composite Speed |
| Output Device (PULSE/CW) | Y0 | Max. Speed | 15000 pps |
| Output Device (SIGN/CCW) | Y4 | Bias Speed | 1000 pps |
| Rotation Direction Setting | 0: Current Address Increment with Forward Run Pulse Output | Acceleration Time | 500 ms |
| Unit Setting | 0: Motor System (pulse, pps) | Deceleration Time | 500 ms |
| No. of Pulse per Rotation | 2000 pulse | ■Detailed Setting Parameter | |
| Movement Amount per Rotation | 1000 pulse | External Start Signal Enabled/ Disabled | 0: Disabled |
| Positioning Data Magnification | 1: × Single | Interrupt Input Signal 1 Enabled/ Disabled | 0: Disabled |
| — | | Interrupt Input Signal 2 Logic | 0: Positive Logic |
| | | ■OPR Parameter | |
| | | OPR Enabled/Disabled | 0: Disabled |

## Program example



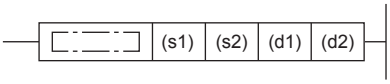
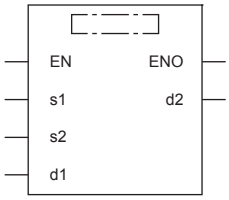
# 32.5 Absolute Positioning

This instruction performs 1-speed positioning in the absolute method (positioning operation with an absolute address). Specify the distance (absolute address) from the origin to the target position. In this case, any position can be the start point (current position).




## DRVA/DDRVA

This instruction executes 1-speed positioning by absolute address.

| Ladder | ST | FBD/LD |
|---|---|---|
|  | ENO:=DRVA(EN,s1,s2,d1,d2);<br>ENO:=DDRVA(EN,s1,s2,d1,d2); |  |





### Setting data

#### ■Description, range, data type (DRVA)

• FX5 operand

| Operand | Description | Range | Data type | Data type (label) |
|---|---|---|---|---|
| (s1) | Word device number storing the positioning address or data*1 | -32768 to +32767<br>(User system unit) | 16-bit signed binary | ANY16 |
| (s2) | Word device number storing command speed or data*2 | 1 to 65535<br>(User system unit) | 16-bit unsigned binary | ANY16 |
| (d1) | Axis number from which pulses are output | ■FX5S CPU module<br>K1 to K4<br>■FX5UJ CPU module<br>K1 to K3, K5 to K12<br>■FX5U/FX5UC CPU module<br>K1 to K12 | 16-bit unsigned binary | ANY_ELEMENTARY (WORD) |
| (d2) | Bit device number of the instruction execution complete flag and abnormal end flag | — | Bit | ANY_BOOL |
| EN | Execution condition | — | Bit | BOOL |
| ENO | Execution result | — | Bit | BOOL |

• FX3 compatible operand (Supported only for CPU module)

| Operand | Description | Range | Data type | Data type (label) |
|---|---|---|---|---|
| (s1) | Word device number storing the positioning address or data*1 | -32768 to +32767<br>(User system unit) | 16-bit signed binary | ANY16 |
| (s2) | Word device number storing command speed or data*2 | 1 to 65535<br>(User system unit) | 16-bit unsigned binary | ANY16 |
| (d1) | Bit device number (Y) from which pulses are output | ■FX5S/FX5U/FX5UC CPU module<br>Y0 to Y3<br>■FX5UJ CPU module<br>Y0 to Y2 | Bit | ANY_ELEMENTARY (BOOL) |
| (d2) | Bit device number from which rotation direction is output | — | Bit | ANY_BOOL |
| EN | Execution condition | — | Bit | BOOL |
| ENO | Execution result | — | Bit | BOOL |

*1 The positioning address can be changed during positioning operation. (☞ Page 361 Positioning address change during positioning operation)

*2 Command speed can be changed during positioning operation. (☞ Page 362 Command speed change during positioning operation)

## ■Description, range, data type (DDRVA)

• FX5 operand

| Operand | Description | Range | Data type | Data type (label) |
|---|---|---|---|---|
| (s1) | Word device number storing the positioning address or data*1 | -2147483648 to +2147483647<br>(User system unit) | 32-bit signed binary | ANY32 |
| (s2) | Word device number storing command speed or data*2 | 1 to 2147483647<br>(User system unit) | 32-bit signed binary | ANY32 |
| (d1) | Axis number from which pulses are output | ■FX5S CPU module<br>K1 to K4<br>■FX5UJ CPU module<br>K1 to K3, K5 to K12<br>■FX5U/FX5UC CPU module<br>K1 to K12 | 16-bit unsigned binary | ANY_ELEMENTARY (WORD) |
| (d2) | Bit device number of the instruction execution complete flag and abnormal end flag | — | Bit | ANY_BOOL |
| EN | Execution condition | — | Bit | BOOL |
| ENO | Execution result | — | Bit | BOOL |

• FX3 compatible operand (Supported only for CPU module)

| Operand | Description | Range | Data type | Data type (label) |
|---|---|---|---|---|
| (s1) | Word device number storing the positioning address or data*1 | -2147483648 to +2147483647<br>(User system unit) | 32-bit signed binary | ANY32 |
| (s2) | Word device number storing command speed or data*2 | 1 to 2147483647<br>(User system unit) | 32-bit signed binary | ANY32 |
| (d1) | Bit device number (Y) from which pulses are output | ■FX5S/FX5U/FX5UC CPU module<br>Y0 to Y3<br>■FX5UJ CPU module<br>Y0 to Y2 | Bit | ANY_ELEMENTARY (BOOL) |
| (d2) | Bit device number from which rotation direction is output | — | Bit | ANY_BOOL |
| EN | Execution condition | — | Bit | BOOL |
| ENO | Execution result | — | Bit | BOOL |

*1 The positioning address can be changed during positioning operation.

*2 Command speed can be changed during positioning operation.

## ■Available device (DRVA/DDRVA)

• FX5 operand

| Operand | Bit | Word | | | Double word | | Indirect specification | Constant | | | Others |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | X, Y, M, L, SM, F, B, SB, S | T, ST, C, D, W, SD, SW, R | U□\G□ | Z | LC | LZ | | K, H | E | $ | |
| (s1) | ○ | ○ | ○ | ○ | ○*1 | ○*1 | ○ | ○ | — | — | — |
| (s2) | ○ | ○ | ○ | ○ | ○*1 | ○*1 | ○ | ○ | — | — | — |
| (d1) | — | ○ | ○ | ○ | — | — | ○ | ○ | — | — | — |
| (d2)*2 | ○ | ○*3 | — | — | — | — | — | — | — | — | — |

• FX3 compatible operand (Supported only for CPU module)

| Operand | Bit | Word | | | Double word | | Indirect specification | Constant | | | Others |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | X, Y, M, L, SM, F, B, SB, S | T, ST, C, D, W, SD, SW, R | U□\G□ | Z | LC | LZ | | K, H | E | $ | |
| (s1) | ○ | ○ | ○ | ○ | ○*1 | ○*1 | ○ | ○ | — | — | — |
| (s2) | ○ | ○ | ○ | ○ | ○*1 | ○*1 | ○ | ○ | — | — | — |
| (d1) | ○*4 | — | — | — | — | — | — | — | — | — | — |
| (d2) | ○*4 | ○*3 | — | — | — | — | — | — | — | — | — |

*1 Only available for DDRVA instruction.
*2 Two devices are occupied from the specified device.
*3 T, ST, C cannot be used.
*4 FX5S/FX5U/FX5UC CPU module: Only Y0 to Y3 devices can be used.
FX5UJ CPU module: Only Y0 to Y2 devices can be used.
*5 When the output mode is CW/CCW, specify the CCW axis. When the output mode is PULSE/SIGN, only the SIGN output of the axis or general-purpose output can be specified.

## Processing details

This instruction executes 1-speed positioning by absolute address drive. The target positioning address is specified in the absolute method, in which positioning is performed with the target position specified based on the origin (absolute address).

# Related devices

The following lists the related special devices.

Related devices of axis 4 are available only for the FX5S/FX5U/FX5UC CPU module.

## Special relays

### ■CPU module

| FX5 dedicated | | | | FX3 compatible | | | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 1 | Axis 2 | Axis 3 | Axis 4 | | | | |
| — | — | — | — | SM8029 | | | | Instruction execution complete flag | × | R | Page 402 |
| — | — | — | — | SM8329 | | | | Instruction execution abnormal end flag | × | R | |
| SM5500 | SM5501 | SM5502 | SM5503 | SM8348 | SM8358 | SM8368 | SM8378 | Positioning instruction activation | × | R | Page 400 |
| SM5516 | SM5517 | SM5518 | SM5519 | SM8340 | SM8350 | SM8360 | SM8370 | Pulse output monitor | × | R | Page 400 |
| SM5532 | SM5533 | SM5534 | SM5535 | — | — | — | — | Positioning error occurrence | × | R/W | Page 400 |
| SM5596 | SM5597 | SM5598 | SM5599 | — | — | — | — | Remaining distance operation enabled | × | R/W | Page 387 |
| SM5612 | SM5613 | SM5614 | SM5615 | — | — | — | — | Remaining distance operation start | × | R/W | Page 387 |
| SM5628 | SM5629 | SM5630 | SM5631 | — | — | — | — | Pulse output stop command | × | R/W | Page 384 |
| SM5644 | SM5645 | SM5646 | SM5647 | — | — | — | — | Pulse decelerate and stop command | × | R/W | Page 385 |
| SM5660 | SM5661 | SM5662 | SM5663 | — | — | — | — | Forward limit | × | R/W | Page 386 |
| SM5676 | SM5677 | SM5678 | SM5679 | — | — | — | — | Reverse limit | × | R/W | Page 386 |
| SM5772 | SM5773 | SM5774 | SM5775 | — | — | — | — | Rotation direction setting | ○ | R/W | Page 374 |

R: Read only, R/W: Read/write, ○: Supported, ×: Not supported

### ■High-speed pulse input/output module

| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SM8029 (FX3 compatible device) | | | | | | | | Instruction execution complete flag | × | R | Page 402 |
| SM8329 (FX3 compatible device) | | | | | | | | Instruction execution abnormal end flag | × | R | |
| SM5504 | SM5505 | SM5506 | SM5507 | SM5508 | SM5509 | SM5510 | SM5511 | Positioning instruction activation | × | R | Page 400 |
| SM5520 | SM5521 | SM5522 | SM5523 | SM5524 | SM5525 | SM5526 | SM5527 | Pulse output monitor | × | R | Page 400 |
| SM5536 | SM5537 | SM5538 | SM5539 | SM5540 | SM5541 | SM5542 | SM5543 | Positioning error occurrence | × | R/W | Page 400 |
| SM5600 | SM5601 | SM5602 | SM5603 | SM5604 | SM5605 | SM5606 | SM5607 | Remaining distance operation enabled | × | R/W | Page 387 |
| SM5616 | SM5617 | SM5618 | SM5619 | SM5620 | SM5621 | SM5622 | SM5623 | Remaining distance operation start | × | R/W | Page 387 |
| SM5632 | SM5633 | SM5634 | SM5635 | SM5636 | SM5637 | SM5638 | SM5639 | Pulse output stop command | × | R/W | Page 384 |
| SM5648 | SM5649 | SM5650 | SM5651 | SM5652 | SM5653 | SM5654 | SM5655 | Pulse decelerate and stop command | × | R/W | Page 385 |
| SM5664 | SM5665 | SM5666 | SM5667 | SM5668 | SM5669 | SM5670 | SM5671 | Forward limit | × | R/W | Page 386 |
| SM5680 | SM5681 | SM5682 | SM5683 | SM5684 | SM5685 | SM5686 | SM5687 | Reverse limit | × | R/W | Page 386 |
| SM5776 | SM5777 | SM5778 | SM5779 | SM5780 | SM5781 | SM5782 | SM5783 | Rotation direction setting | ○ | R/W | Page 374 |

R: Read only, R/W: Read/write, ○: Supported, ×: Not supported

## Special registers

### ■CPU module

| FX5 dedicated | | | | FX3 compatible | | | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 1 | Axis 2 | Axis 3 | Axis 4 | | | | |
| SD5500, SD5501 | SD5540, SD5541 | SD5580, SD5581 | SD5620, SD5621 | — | — | — | — | Current address (user unit) | × | R/W*1 | Page 382 |
| SD5502, SD5503 | SD5542, SD5543 | SD5582, SD5583 | SD5622, SD5623 | SD8340, SD8341 | SD8350, SD8351 | SD8360, SD8361 | SD8370, SD8371 | Current address (pulse unit) | × | R/W*1 | Page 382 |
| SD5504, SD5505 | SD5544, SD5545 | SD5584, SD5585 | SD5624, SD5625 | — | — | — | — | Current speed (user unit) | × | R | Page 378 |
| SD5510 | SD5550 | SD5590 | SD5630 | — | — | — | — | Positioning error (error code) | × | R/W | Page 401 |
| SD5516, SD5517 | SD5556, SD5557 | SD5596, SD5597 | SD5636, SD5637 | — | — | — | — | Maximum speed | ○ | R/W | Page 379 |
| SD5518, SD5519 | SD5558, SD5559 | SD5598, SD5599 | SD5638, SD5639 | — | — | — | — | Bias speed | ○ | R/W | Page 379 |
| SD5520 | SD5560 | SD5600 | SD5640 | — | — | — | — | Acceleration time | ○ | R/W | Page 380 |
| SD5521 | SD5561 | SD5601 | SD5641 | — | — | — | — | Deceleration time | ○ | R/W | Page 380 |

R: Read only, R/W: Read/write, ○: Supported, ×: Not supported

*1 Only FX5 dedicated devices can be written by the HCMOV/DHCMOV instruction.

### ■High-speed pulse input/output module

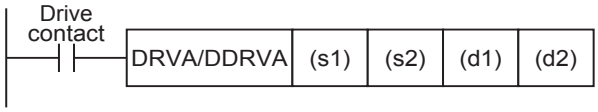
| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SD5660, SD5661 | SD5700, SD5701 | SD5740, SD5741 | SD5780, SD5781 | SD5820, SD5821 | SD5860, SD5861 | SD5900, SD5901 | SD5940, SD5941 | Current address (user unit) | × | R/W*1 | Page 382 |
| SD5662, SD5663 | SD5702, SD5703 | SD5742, SD5743 | SD5782, SD5783 | SD5822, SD5823 | SD5862, SD5863 | SD5902, SD5903 | SD5942, SD5943 | Current address (pulse unit) | × | R/W*1 | Page 382 |
| SD5664, SD5665 | SD5704, SD5705 | SD5744, SD5745 | SD5784, SD5785 | SD5824, SD5825 | SD5864, SD5865 | SD5904, SD5905 | SD5944, SD5945 | Current speed (user unit) | × | R | Page 378 |
| SD5670 | SD5710 | SD5750 | SD5790 | SD5830 | SD5870 | SD5910 | SD5950 | Positioning error (error code) | × | R/W | Page 401 |
| SD5676, SD5677 | SD5716, SD5717 | SD5756, SD5757 | SD5796, SD5797 | SD5836, SD5837 | SD5876, SD5877 | SD5916, SD5917 | SD5956, SD5957 | Maximum speed | ○ | R/W | Page 379 |
| SD5678, SD5679 | SD5718, SD5719 | SD5758, SD5759 | SD5798, SD5799 | SD5838, SD5839 | SD5878, SD5879 | SD5918, SD5919 | SD5958, SD5959 | Bias speed | ○ | R/W | Page 379 |
| SD5680 | SD5720 | SD5760 | SD5800 | SD5840 | SD5880 | SD5920 | SD5960 | Acceleration time | ○ | R/W | Page 380 |
| SD5681 | SD5721 | SD5761 | SD5801 | SD5841 | SD5881 | SD5921 | SD5961 | Deceleration time | ○ | R/W | Page 380 |

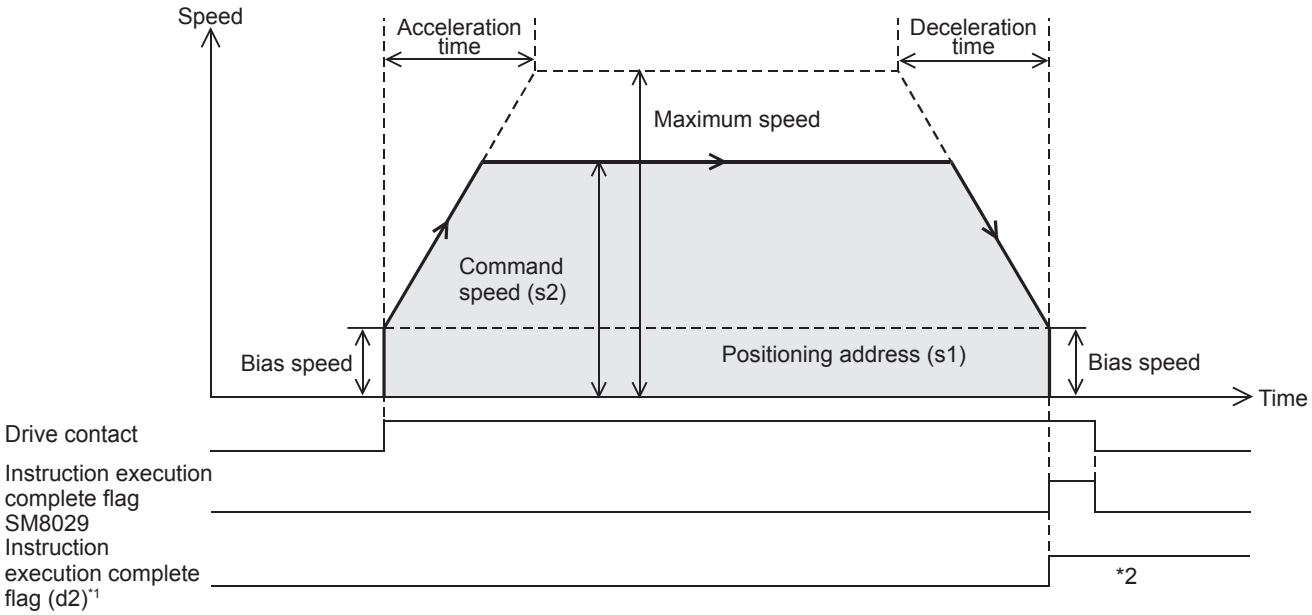
R: Read only, R/W: Read/write, ○: Supported, ×: Not supported

*1 Writing can be performed only by the HCMOV/DHCMOV instruction.

# Outline of operation

For each speed, refer to ☞ Page 377 Items related to speed.




*1 When FX5 operand is specified

*2 Remains on until it is turned off using program or engineering tool or the positioning instruction is next driven again.

## Basic operation

The following describes the basic operation.

1. After the drive contact is turned on, pulse output is started and the speed is increased from the bias speed.
2. After the speed has reached the specified speed, the operation will be performed in the specified speed.
3. Deceleration starts from near the target position.
4. At the specified positioning address, pulse output is stopped.

## Operand specification

### ■When FX5 operand is specified

1. For (s1), specify the absolute positioning address. (☞ Page 380 Positioning address)

Set to a value -2147483648 to +2147483647 in pulse. In addition, set the number of output pulses per positioning instruction execution to 2147483647 or lower.

- DRVA: -32768 to +32767 (User system unit)
- DDRVA: -2147483648 to +2147483647 (User system unit)

2. For (s2), specify the command speed. Set to a value 1 pps to 200 kpps in pulse. For the FX5S CPU module, set to a value 1 to 100 kpps.

- DRVA: 1 to 65535 (User system unit)
- DDRVA: 1 to 2147483647 (User system unit)

**3.** For (d1), specify an axis number for which pulses are output.

Specify an axis number whose positioning parameters are set in the high speed I/O parameters. Operation cannot be performed if any other axis number is specified.

[FX5S CPU module]

- K1 to K4: Axis 1 to Axis 4

[FX5UJ CPU module]

- K1 to K3: Axis 1 to Axis 3 (CPU module)
- K5, K6: Axis 5, Axis 6 (High-speed pulse input/output module first module)
- K7, K8: Axis 7, Axis 8 (High-speed pulse input/output module second module)
- K9, K10: Axis 9, Axis 10 (High-speed pulse input/output module third module)
- K11, K12: Axis 11, Axis 12 (High-speed pulse input/output module fourth module)

[FX5U/FX5UC CPU module]

- K1 to K4: Axis 1 to Axis 4 (CPU module)
- K5, K6: Axis 5, Axis 6 (High-speed pulse input/output module first module)
- K7, K8: Axis 7, Axis 8 (High-speed pulse input/output module second module)
- K9, K10: Axis 9, Axis 10 (High-speed pulse input/output module third module)
- K11, K12: Axis 11, Axis 12 (High-speed pulse input/output module fourth module)

**4.** For (d2), specify the bit devices of the instruction execution complete flag and abnormal end flag. (☞ Page 402 Complete flag)

- (d2): Instruction execution complete flag
- (d2)+1: Instruction execution abnormal end flag

### ■When the FX3 compatible operand is specified (Supported only for CPU module)

**1.** For (s1), specify the absolute positioning address.

Set to a value -2147483648 to +2147483647 in pulse. In addition, set the number of output pulses per positioning instruction execution to 2147483647 or lower.

- DRVA: -32768 to +32767 (User system unit)
- DDRVA: -2147483648 to +2147483647 (User system unit)

**2.** For (s2), specify the command speed. Set to a value 1 pps to 200 kpps in pulse. For the FX5S CPU module, set to a value 1 to 100 kpps.

- DRVA: 1 to 65535 (User system unit)
- DDRVA: 1 to 2147483647 (User system unit)

**3.** For (d1), specify the pulse output number.

Specify an output device (Y) number set in the high speed I/O parameters. (☞ Page 372 Pulse Output Mode) Operation cannot be performed if any other axis number is specified.

- FX5S/FX5U/FX5UC CPU module: Y0 to Y3 (equivalent to axes 1 to 4)
- FX5UJ CPU module: Y0 to Y2 (equivalent to axes 1 to 3)

**4.** For (d2), specify the rotation direction signal output device number. (☞ Page 374 Rotation Direction Setting)

When an output device (Y) is used, only the device that is specified with the positioning parameter or a general-purpose output can be specified. However, if an output device (Y) to which PWM, PULSE/SIGN axis of another axis, or CW/CCW axis is assigned is specified, an error occurs without any operation.

For the PWM function, refer to the following.

☞ Page 321 PWM Function

## Precautions

Set the number of output pulses per DRVA/DDRVA instruction execution to 2147483647 or lower. An error occurs if the number of pulses exceeds 2147483648.

## Operation of the abnormal end flag

The following describes the operation timings of the complete flags.

The user-specified complete flags are valid only when specified using FX5 operand.

| Item | FX3 compatible | | User specification | |
|---|---|---|---|---|
| | **Instruction execution complete flag (SM8029)** | **Instruction execution abnormal end flag (SM8329)** | **Instruction execution complete flag (d2)** | **Instruction execution abnormal end flag (d2)+1** |
| ON condition | From when pulse output of the specified positioning address is completed to when the drive contact is turned off | From when the following operation or function is completed to when the drive contact is turned off<br>• The axis is already used.*1<br>• Pulse output stop command<br>• Pulse decelerate and stop command*2<br>• Limit of the moving direction<br>• All module reset when a stop error occurs*3<br>• All outputs disabled (SM8034)<br>• Positioning address error<br>• Deceleration stop after the command speed is changed to 0 | From when pulse output of the specified positioning address is completed to when the ON → OFF condition is met | From when the following operation or function is completed to when the ON → OFF condition is met<br>• The axis is already used.<br>• The drive contact is turned off during positioning operation.<br>• Pulse output stop command<br>• Pulse decelerate and stop command*2<br>• Limit of the moving direction<br>• All module reset when a stop error occurs*3<br>• All outputs disabled (SM8034)<br>• Online change<br>• Positioning address error<br>• Deceleration stop after the command speed is changed to 0 |
| ON → OFF condition | When the drive contact is turned off | | The flag remains on until either of the following is performed.<br>• Turning off the flag by the user<br>• Restarting the positioning instruction | |

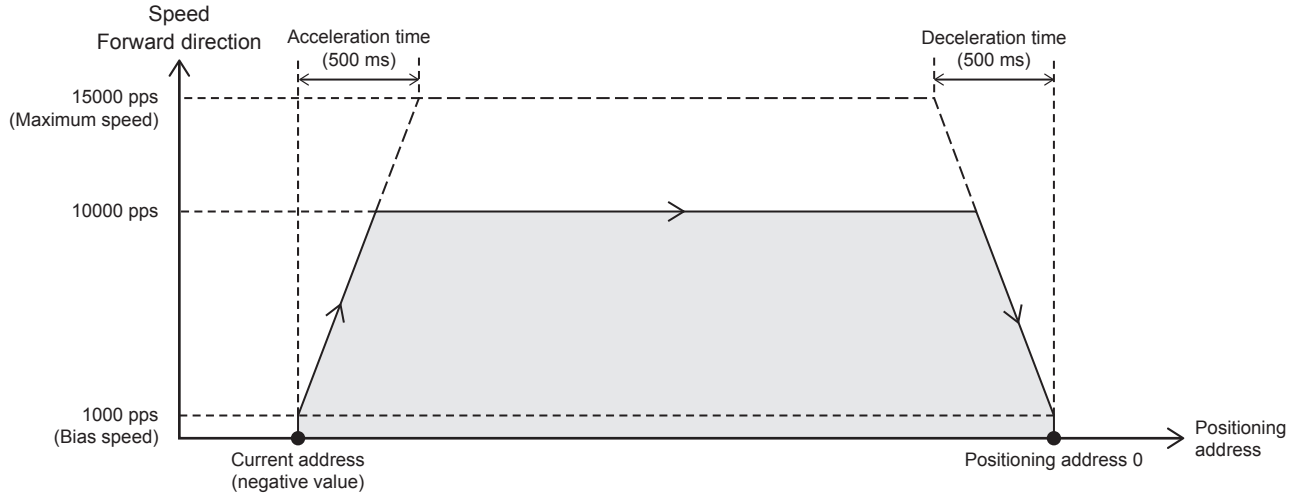
*1 The flag turns on only for one scan when the drive contact of the instruction turns from OFF to ON.

*2 When remaining distance operation enabled is turned on, abnormal end flag will not turn on. (☞ Page 387 Remaining distance operation enabled)

*3 Only high-speed pulse input/output module is supported.

# Program example

The following is a program example of absolute positioning (axis 1). If current address is a positive value, positioning operation would output in the reverse direction.

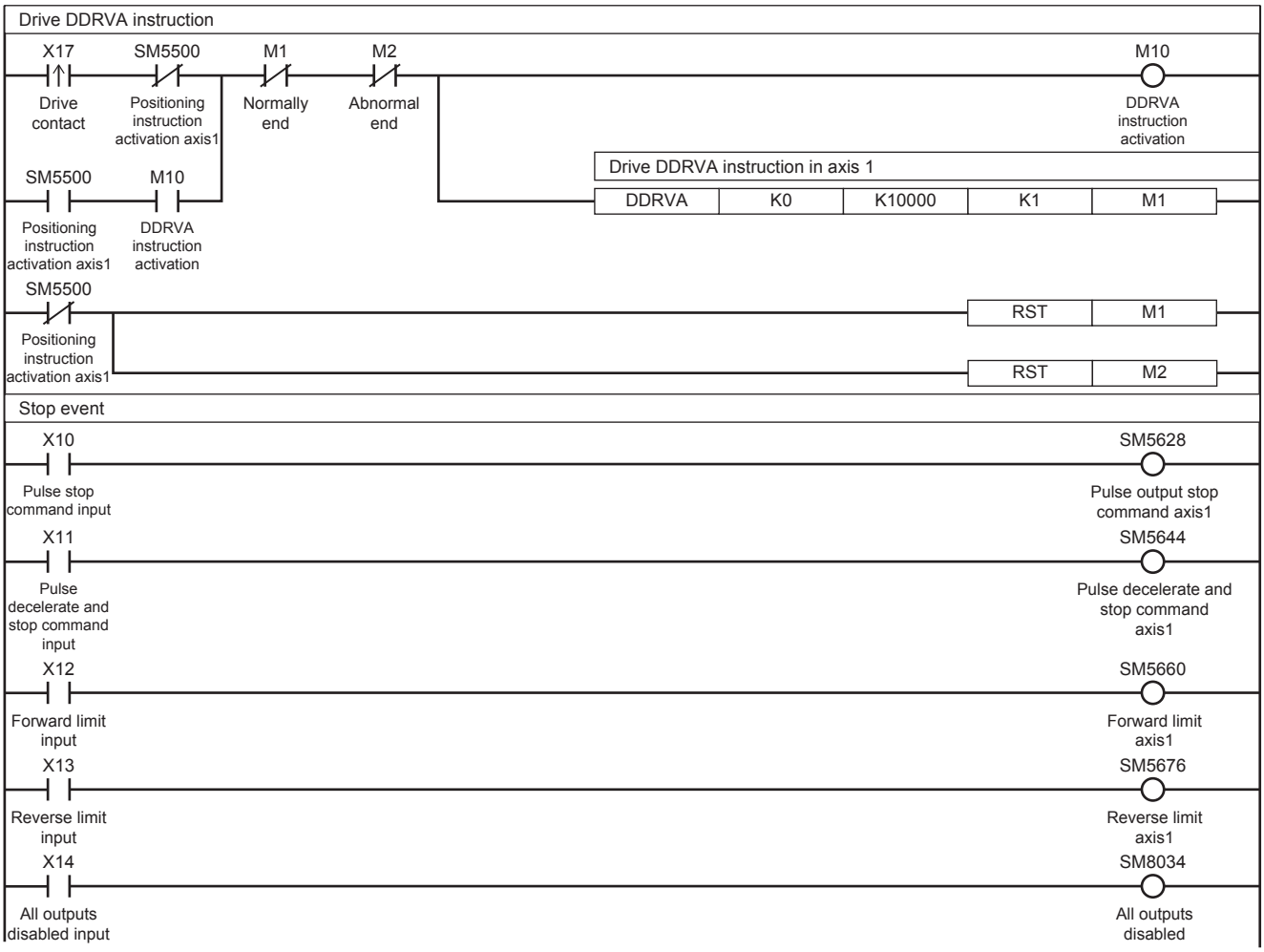


## Setting data

### ■Positioning parameter (high speed I/O parameter)

| Item | Axis 1 | Item | Axis 1 |
|---|---|---|---|
| ■Basic Parameter 1 | | ■Basic Parameter 2 | |
| Pulse Output Mode | 1: PULSE/SIGN | Interpolation Speed Specified Method | 0: Composite Speed |
| Output Device (PULSE/CW) | Y0 | Max. Speed | 15000 pps |
| Output Device (SIGN/CCW) | Y4 | Bias Speed | 1000 pps |
| Rotation Direction Setting | 0: Current Address Increment with Forward Run Pulse Output | Acceleration Time | 500 ms |
| Unit Setting | 0: Motor System (pulse, pps) | Deceleration Time | 500 ms |
| No. of Pulse per Rotation | 2000 pulse | ■Detailed Setting Parameter | |
| Movement Amount per Rotation | 1000 pulse | External Start Signal Enabled/ Disabled | 0: Disabled |
| Positioning Data Magnification | 1: × Single | Interrupt Input Signal 1 Enabled/ Disabled | 0: Disabled |
| — | | Interrupt Input Signal 2 Logic | 0: Positive Logic |
| | | ■OPR Parameter | |
| | | OPR Enabled/Disabled | 0: Disabled |

## Program example

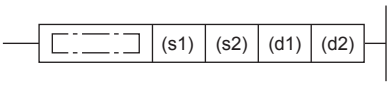
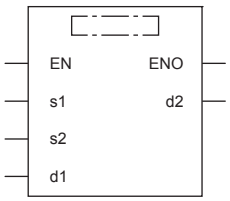


# 32.6 Interrupt 1-Speed Positioning

The positioning function uses the DVIT/DDVIT instruction to perform one-speed interrupt constant quantity feed.
With this instruction, interrupt signals can be controlled through user programs.

## DVIT/DDVIT

This instruction executes one-speed interrupt constant quantity feed.

| Ladder | ST | FBD/LD |
|---|---|---|
|  | ENO:=DVIT(EN,s1,s2,d1,d2);<br>ENO:=DDVIT(EN,s1,s2,d1,d2); |  |

### Setting data

#### ■Description, range, data type (DVIT)

• FX5 operand

| Operand | Description | Range | Data type | Data type (label) |
|---|---|---|---|---|
| (s1) | Word device number storing the positioning address or data*1 | -32768 to +32767<br>(User system unit) | 16-bit signed binary | ANY16 |
| (s2) | Word device number storing command speed or data*2 | 1 to 65535<br>(User system unit) | 16-bit unsigned binary | ANY16 |
| (d1) | Axis number from which pulses are output | ■FX5S CPU module<br>K1 to K4<br>■FX5UJ CPU module<br>K1 to K3, K5 to K12<br>■FX5U/FX5UC CPU module<br>K1 to K12 | 16-bit unsigned binary | ANY_ELEMENTARY (WORD) |
| (d2) | Bit device number of the instruction execution complete flag and abnormal end flag | — | Bit | ANY_BOOL |
| EN | Execution condition | — | Bit | BOOL |
| ENO | Execution result | — | Bit | BOOL |

• FX3 compatible operand (Supported only for CPU module)

| Operand | Description | Range | Data type | Data type (label) |
|---|---|---|---|---|
| (s1) | Word device number storing the positioning address or data*1 | -32768 to +32767<br>(User system unit) | 16-bit signed binary | ANY16 |
| (s2) | Word device number storing command speed or data*2 | 1 to 65535<br>(User system unit) | 16-bit unsigned binary | ANY16 |
| (d1) | Bit device number (Y) from which pulses are output | ■FX5S/FX5U/FX5UC CPU module<br>Y0 to Y3<br>■FX5UJ CPU module<br>Y0 to Y2 | Bit | ANY_ELEMENTARY (BOOL) |
| (d2) | Bit device number from which rotation direction is output | — | Bit | ANY_BOOL |
| EN | Execution condition | — | Bit | BOOL |
| ENO | Execution result | — | Bit | BOOL |

*1 The positioning address can be changed during positioning operation. (☞ Page 361 Positioning address change during positioning operation)

*2 Command speed can be changed during positioning operation. (☞ Page 362 Command speed change during positioning operation)

## ■Description, range, data type (DDVIT)

• FX5 operand

| Operand | Description | Range | Data type | Data type (label) |
|---|---|---|---|---|
| (s1) | Word device number storing the positioning address or data*1 | -2147483648 to +2147483647 (User system unit) | 32-bit signed binary | ANY32 |
| (s2) | Word device number storing command speed or data*2 | 1 to 2147483647 (User system unit) | 32-bit signed binary | ANY32 |
| (d1) | Axis number from which pulses are output | ■FX5S CPU module K1 to K4 ■FX5UJ CPU module K1 to K3, K5 to K12 ■FX5U/FX5UC CPU module K1 to K12 | 16-bit unsigned binary | ANY_ELEMENTARY (WORD) |
| (d2) | Bit device number of the instruction execution complete flag and abnormal end flag | — | Bit | ANY_BOOL |
| EN | Execution condition | — | Bit | BOOL |
| ENO | Execution result | — | Bit | BOOL |

• FX3 compatible operand (Supported only for CPU module)

| Operand | Description | Range | Data type | Data type (label) |
|---|---|---|---|---|
| (s1) | Word device number storing the positioning address or data*1 | -2147483648 to +2147483647 (User system unit) | 32-bit signed binary | ANY32 |
| (s2) | Word device number storing command speed or data*2 | 1 to 2147483647 (User system unit) | 32-bit signed binary | ANY32 |
| (d1) | Bit device number (Y) from which pulses are output | ■FX5S/FX5U/FX5UC CPU module Y0 to Y3 ■FX5UJ CPU module Y0 to Y2 | Bit | ANY_ELEMENTARY (BOOL) |
| (d2) | Bit device number from which rotation direction is output | — | Bit | ANY_BOOL |
| EN | Execution condition | — | Bit | BOOL |
| ENO | Execution result | — | Bit | BOOL |

*1 The positioning address can be changed during positioning operation.

*2 Command speed can be changed during positioning operation.

## ■Available device (DVIT/DDVIT)

• FX5 operand

| Operand | Bit | Word | | | Double word | | Indirect specification | Constant | | | Others |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | X, Y, M, L, SM, F, B, SB, S | T, ST, C, D, W, SD, SW, R | U□\G□ | Z | LC | LZ | | K, H | E | $ | |
| (s1) | ○ | ○ | ○ | ○ | — | — | ○ | ○ | — | — | — |
| (s2) | ○ | ○ | ○ | ○ | — | — | ○ | ○ | — | — | — |
| (d1) | — | ○ | ○ | ○ | — | — | ○ | ○ | — | — | — |
| (d2)*1 | ○ | ○*2 | — | — | — | — | — | — | — | — | — |

• FX3 compatible operand (Supported only for CPU module)

| Operand | Bit | Word | | | Double word | | Indirect specification | Constant | | | Others |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | X, Y, M, L, SM, F, B, SB, S | T, ST, C, D, W, SD, SW, R | U□\G□ | Z | LC | LZ | | K, H | E | $ | |
| (s1) | ○ | ○ | ○ | ○ | — | — | ○ | ○ | — | — | — |
| (s2) | ○ | ○ | ○ | ○ | — | — | ○ | ○ | — | — | — |
| (d1) | ○*3 | — | — | — | — | — | — | — | — | — | — |
| (d2) | ○*4 | ○*2 | — | — | — | — | — | — | — | — | — |

*1 Two devices are occupied from the specified device.
*2 T, ST, C cannot be used.
*3 FX5S/FX5U/FX5UC CPU module: Only Y0 to Y3 devices can be used.
FX5UJ CPU module: Only Y0 to Y2 devices can be used.
*4 When the output mode is CW/CCW, specify the CCW axis. When the output mode is PULSE/SIGN, only the SIGN output of the axis or general-purpose output can be specified.

### Processing details

This instruction executes one-speed interrupt constant quantity feed. From the point at which an interrupt input is detected, operation to the specified positioning address is performed at the specified speed.

# Related devices

The following lists the related special devices.
Related devices of axis 4 are available only for the FX5S/FX5U/FX5UC CPU module.

## Special relays

### ■CPU module

| FX5 dedicated | | | | FX3 compatible | | | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 1 | Axis 2 | Axis 3 | Axis 4 | | | | |
| — | — | — | — | SM8029 | | | | Instruction execution complete flag | × | R | Page 402 |
| — | — | — | — | SM8329 | | | | Instruction execution abnormal end flag | × | R | |
| SM5500 | SM5501 | SM5502 | SM5503 | SM8348 | SM8358 | SM8368 | SM8378 | Positioning instruction activation | × | R | Page 400 |
| SM5516 | SM5517 | SM5518 | SM5519 | SM8340 | SM8350 | SM8360 | SM8370 | Pulse output monitor | × | R | Page 400 |
| SM5532 | SM5533 | SM5534 | SM5535 | — | — | — | — | Positioning error occurrence | × | R/W | Page 400 |
| SM5628 | SM5629 | SM5630 | SM5631 | — | — | — | — | Pulse output stop command | × | R/W | Page 384 |
| SM5644 | SM5645 | SM5646 | SM5647 | — | — | — | — | Pulse decelerate and stop command | × | R/W | Page 385 |
| SM5660 | SM5661 | SM5662 | SM5663 | — | — | — | — | Forward limit | × | R/W | Page 386 |
| SM5676 | SM5677 | SM5678 | SM5679 | — | — | — | — | Reverse limit | × | R/W | Page 386 |
| SM5772 | SM5773 | SM5774 | SM5775 | — | — | — | — | Rotation direction setting | ○ | R/W | Page 374 |

R: Read only, R/W: Read/write, ○: Supported, ×: Not supported

### ■High-speed pulse input/output module

| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SM8029 (FX3 compatible device) | | | | | | | | Instruction execution complete flag | × | R | Page 402 |
| SM8329 (FX3 compatible device) | | | | | | | | Instruction execution abnormal end flag | × | R | |
| SM5504 | SM5505 | SM5506 | SM5507 | SM5508 | SM5509 | SM5510 | SM5511 | Positioning instruction activation | × | R | Page 400 |
| SM5520 | SM5521 | SM5522 | SM5523 | SM5524 | SM5525 | SM5526 | SM5527 | Pulse output monitor | × | R | Page 400 |
| SM5536 | SM5537 | SM5538 | SM5539 | SM5540 | SM5541 | SM5542 | SM5543 | Positioning error occurrence | × | R/W | Page 400 |
| SM5632 | SM5633 | SM5634 | SM5635 | SM5636 | SM5637 | SM5638 | SM5639 | Pulse output stop command | × | R/W | Page 384 |
| SM5648 | SM5649 | SM5650 | SM5651 | SM5652 | SM5653 | SM5654 | SM5655 | Pulse decelerate and stop command | × | R/W | Page 385 |
| SM5664 | SM5665 | SM5666 | SM5667 | SM5668 | SM5669 | SM5670 | SM5671 | Forward limit | × | R/W | Page 386 |
| SM5680 | SM5681 | SM5682 | SM5683 | SM5684 | SM5685 | SM5686 | SM5687 | Reverse limit | × | R/W | Page 386 |
| SM5776 | SM5777 | SM5778 | SM5779 | SM5780 | SM5781 | SM5782 | SM5783 | Rotation direction setting | ○ | R/W | Page 374 |

R: Read only, R/W: Read/write, ○: Supported, ×: Not supported

## Special registers

### ■CPU module

| FX5 dedicated | | | | FX3 compatible | | | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 1 | Axis 2 | Axis 3 | Axis 4 | | | | |
| SD5500, SD5501 | SD5540, SD5541 | SD5580, SD5581 | SD5620, SD5621 | — | — | — | — | Current address (user unit) | × | R/W*1 | Page 382 |
| SD5502, SD5503 | SD5542, SD5543 | SD5582, SD5583 | SD5622, SD5623 | SD8340, SD8341 | SD8350, SD8351 | SD8360, SD8361 | SD8370, SD8371 | Current address (pulse unit) | × | R/W*1 | Page 382 |
| SD5504, SD5505 | SD5544, SD5545 | SD5584, SD5585 | SD5624, SD5625 | — | — | — | — | Current speed (user unit) | × | R | Page 378 |
| SD5510 | SD5550 | SD5590 | SD5630 | — | — | — | — | Positioning error (error code) | × | R/W | Page 401 |
| SD5516, SD5517 | SD5556, SD5557 | SD5596, SD5597 | SD5636, SD5637 | — | — | — | — | Maximum speed | ○ | R/W | Page 379 |
| SD5518, SD5519 | SD5558, SD5559 | SD5598, SD5599 | SD5638, SD5639 | — | — | — | — | Bias speed | ○ | R/W | Page 379 |
| SD5520 | SD5560 | SD5600 | SD5640 | — | — | — | — | Acceleration time | ○ | R/W | Page 380 |
| SD5521 | SD5561 | SD5601 | SD5641 | — | — | — | — | Deceleration time | ○ | R/W | Page 380 |

R: Read only, R/W: Read/write, ○: Supported, ×: Not supported

*1 Only FX5 dedicated devices can be written by the HCMOV/DHCMOV instruction.

### ■High-speed pulse input/output module

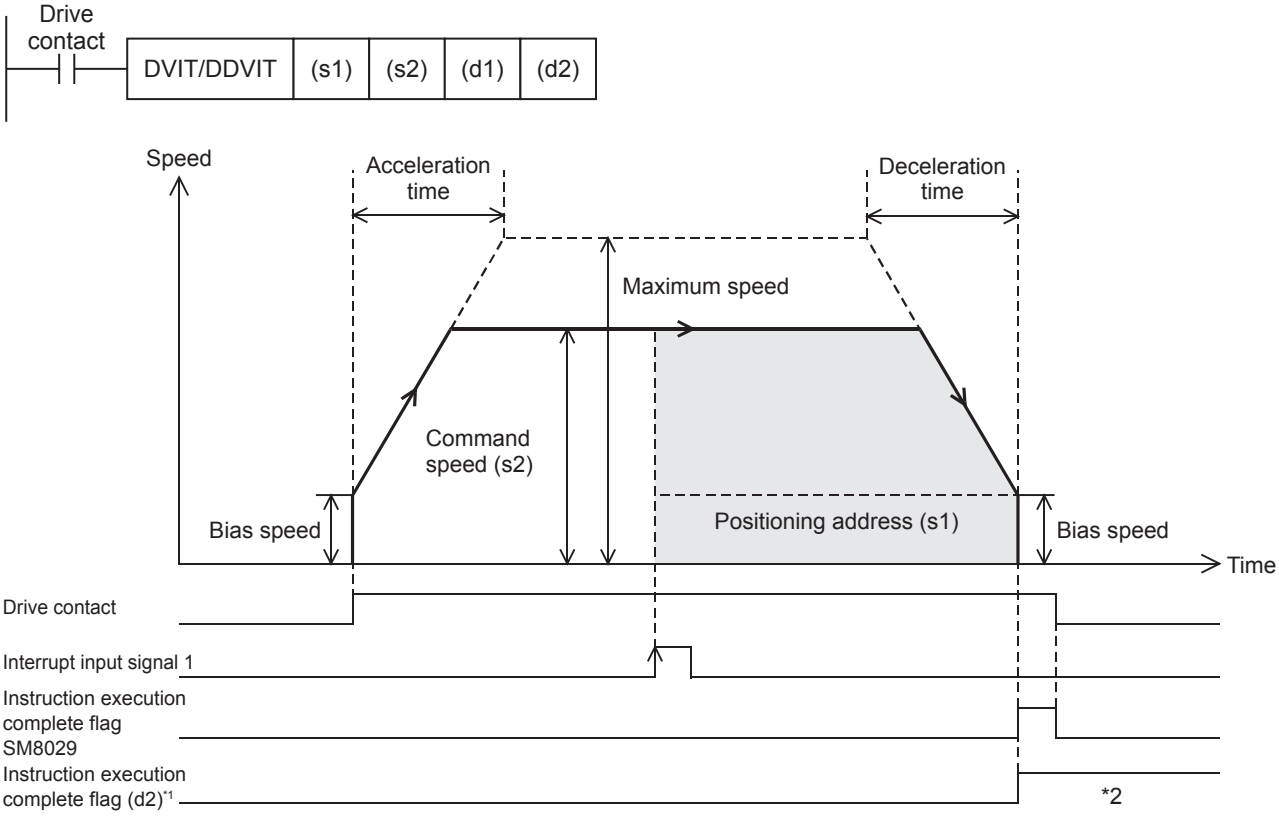
| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SD5660, SD5661 | SD5700, SD5701 | SD5740, SD5741 | SD5780, SD5781 | SD5820, SD5821 | SD5860, SD5861 | SD5900, SD5901 | SD5940, SD5941 | Current address (user unit) | × | R/W*1 | Page 382 |
| SD5662, SD5663 | SD5702, SD5703 | SD5742, SD5743 | SD5782, SD5783 | SD5822, SD5823 | SD5862, SD5863 | SD5902, SD5903 | SD5942, SD5943 | Current address (pulse unit) | × | R/W*1 | Page 382 |
| SD5664, SD5665 | SD5704, SD5705 | SD5744, SD5745 | SD5784, SD5785 | SD5824, SD5825 | SD5864, SD5865 | SD5904, SD5905 | SD5944, SD5945 | Current speed (user unit) | × | R | Page 378 |
| SD5670 | SD5710 | SD5750 | SD5790 | SD5830 | SD5870 | SD5910 | SD5950 | Positioning error (error code) | × | R/W | Page 401 |
| SD5676, SD5677 | SD5716, SD5717 | SD5756, SD5757 | SD5796, SD5797 | SD5836, SD5837 | SD5876, SD5877 | SD5916, SD5917 | SD5956, SD5957 | Maximum speed | ○ | R/W | Page 379 |
| SD5678, SD5679 | SD5718, SD5719 | SD5758, SD5759 | SD5798, SD5799 | SD5838, SD5839 | SD5878, SD5879 | SD5918, SD5919 | SD5958, SD5959 | Bias speed | ○ | R/W | Page 379 |
| SD5680 | SD5720 | SD5760 | SD5800 | SD5840 | SD5880 | SD5920 | SD5960 | Acceleration time | ○ | R/W | Page 380 |
| SD5681 | SD5721 | SD5761 | SD5801 | SD5841 | SD5881 | SD5921 | SD5961 | Deceleration time | ○ | R/W | Page 380 |

R: Read only, R/W: Read/write, ○: Supported, ×: Not supported

*1 Writing can be performed only by the HCMOV/DHCMOV instruction.

# Outline of operation

For each speed, refer to ☞ Page 377 Items related to speed.




*1 When FX5 operand is specified

*2 Remains on until it is turned off using program or engineering tool or the positioning instruction is next driven again.

## Basic operation

The following describes the basic operation.

1. After the drive contact is turned on, pulse output is started and the speed is increased from the bias speed.
2. After the speed has reached the specified speed, the operation will be performed in the specified speed.
3. From the point at which the interrupt input signal 1 is detected, operation for the specified positioning address is performed. (☞ Page 383 Interrupt Input Signal 1)
4. Deceleration starts from near the target position.
5. At the specified positioning address, pulse output is stopped.

## Operand specification

### ■When FX5 operand is specified

1. For (s1), specify the positioning address after the interrupt input signal 1 is detected. (☞ Page 380 Positioning address)

Set to a value -2147483648 to +2147483647 in pulse.

- DVIT: -32768 to +32767 (User system unit)
- DDVIT: -2147483648 to +2147483647 (User system unit)

2. For (s2), specify the command speed. Set to a value 1 pps to 200 kpps in pulse. For the FX5S CPU module, set to a value 1 to 100 kpps.

- DVIT: 1 to 65535 (User system unit)
- DDVIT: 1 to 2147483647 (User system unit)

3. For (d1), specify an axis number for which pulses are output.

Specify an axis number whose positioning parameters are set in the high speed I/O parameters. Operation cannot be performed if any other axis number is specified.

[FX5S CPU module]

- K1 to K4: Axis 1 to Axis 4

[FX5UJ CPU module]

- K1 to K3: Axis 1 to Axis 3 (CPU module)
- K5, K6: Axis 5, Axis 6 (High-speed pulse input/output module first module)
- K7, K8: Axis 7, Axis 8 (High-speed pulse input/output module second module)
- K9, K10: Axis 9, Axis 10 (High-speed pulse input/output module third module)
- K11, K12: Axis 11, Axis 12 (High-speed pulse input/output module fourth module)

[FX5U/FX5UC CPU module]

- K1 to K4: Axis 1 to Axis 4 (CPU module)
- K5, K6: Axis 5, Axis 6 (High-speed pulse input/output module first module)
- K7, K8: Axis 7, Axis 8 (High-speed pulse input/output module second module)
- K9, K10: Axis 9, Axis 10 (High-speed pulse input/output module third module)
- K11, K12: Axis 11, Axis 12 (High-speed pulse input/output module fourth module)

4. For (d2), specify the bit devices of the instruction execution complete flag and abnormal end flag. (☞ Page 402 Complete flag)

- (d2): Instruction execution complete flag
- (d2)+1: Instruction execution abnormal end flag

### ■When the FX3 compatible operand is specified (Supported only for CPU module)

**1.** For (s1), specify the positioning address after the interrupt input signal 1 is detected.

Set to a value -2147483648 to +2147483647 in pulse.

- DVIT: -32768 to +32767 (User system unit)
- DDVIT: -2147483648 to +2147483647 (User system unit)

**2.** For (s2), specify the command speed. Set to a value 1 pps to 200 kpps in pulse. For the FX5S CPU module, set to a value 1 to 100 kpps.

- DVIT: 1 to 65535 (User system unit)
- DDVIT: 1 to 2147483647 (User system unit)

**3.** For (d1), specify the pulse output number.

Specify an output device (Y) number set in the high speed I/O parameters. (☞ Page 372 Pulse Output Mode) Operation cannot be performed if any other axis number is specified.

- FX5S/FX5U/FX5UC CPU module: Y0 to Y3 (equivalent to axes 1 to 4)
- FX5UJ CPU module: Y0 to Y2 (equivalent to axes 1 to 3)

**4.** For (d2), specify the rotation direction signal output device number. (☞ Page 374 Rotation Direction Setting)

When an output device (Y) is used, only the device that is specified with the positioning parameter or a general-purpose output can be specified. However, if an output device (Y) to which PWM, PULSE/SIGN axis of another axis, or CW/CCW axis is assigned is specified, an error occurs without any operation.

For the PWM function, refer to the following.

☞ Page 321 PWM Function

## Interrupt input signal 1

After the interrupt input signal 1 is detected, pulses equivalent to the specified positioning address specified in (s1) are output starting from the detection point. Deceleration stop starts from point that deceleration must be performed.

### Precautions

- When the interrupt input signal 1 is disabled, the DVIT/DDVIT signal cannot be used.
- If the interrupt input signal 1 is not detected, pulse output at the command speed of (s2) continues until the signal is detected.
- If the total of the pulses that have already been output and pulses to be output after an interrupt exceeds 2147483648 when the interrupt input signal 1 is detected, an error occurs. From the point at which the interrupt input signal 1 is detected, deceleration stop is performed.
- When the interrupt input signal 1 is ON before the start of instruction, the interrupt input signal 1 is not detected even if the DVIT/DDVIT instruction is executed. However, in the case where the interruption input signal 1 is ON and the external start signal is turned ON when the external start signal is used, the interrupt input signal 1 is detected simultaneously when the DVIT/DDVIT instruction is driven.

## Operation of the complete flags

The following describes the operation timings of the complete flags.

The user-specified complete flags are valid only when specified using FX5 operand.

| Item | FX3 compatible | | User specification | |
|---|---|---|---|---|
| | **Instruction execution complete flag (SM8029)** | **Instruction execution abnormal end flag (SM8329)** | **Instruction execution complete flag (d2)** | **Instruction execution abnormal end flag (d2)+1** |
| ON condition | From when pulse output of the specified positioning address is completed to when the drive contact is turned off | From when the following operation or function is completed to when the drive contact is turned off<br>• The axis is already used.*1<br>• Pulse output stop command<br>• Pulse decelerate and stop command<br>• Limit of the moving direction<br>• All module reset when a stop error occurs*2<br>• All outputs disabled (SM8034)<br>• Positioning address error<br>• Deceleration stop after the command speed is changed to 0 | From when pulse output of the specified positioning address is completed to when the ON → OFF condition is met | From when the following operation or function is completed to when the ON → OFF condition is met<br>• The axis is already used.<br>• The drive contact is turned off during positioning operation.<br>• Pulse output stop command<br>• Pulse decelerate and stop command<br>• Limit of the moving direction<br>• All module reset when a stop error occurs*2<br>• All outputs disabled (SM8034)<br>• Online change<br>• Positioning address error<br>• Deceleration stop after the command speed is changed to 0 |
| ON → OFF condition | When the drive contact is turned off | | The flag remains on until either of the following is performed.<br>• Turning off the flag by the user<br>• Restarting the positioning instruction | |

*1 The flag turns on only for one scan when the drive contact of the instruction turns from OFF to ON.

*2 Only high-speed pulse input/output module is supported.

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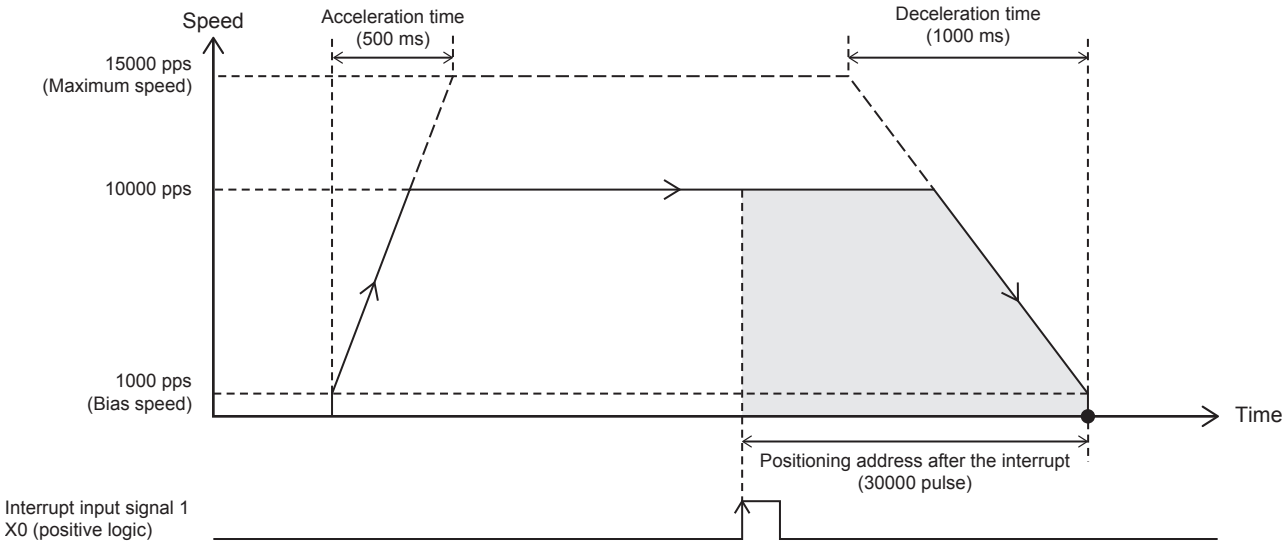
# Program example

The following is a program example of interrupt 1-speed positioning (axis 1).

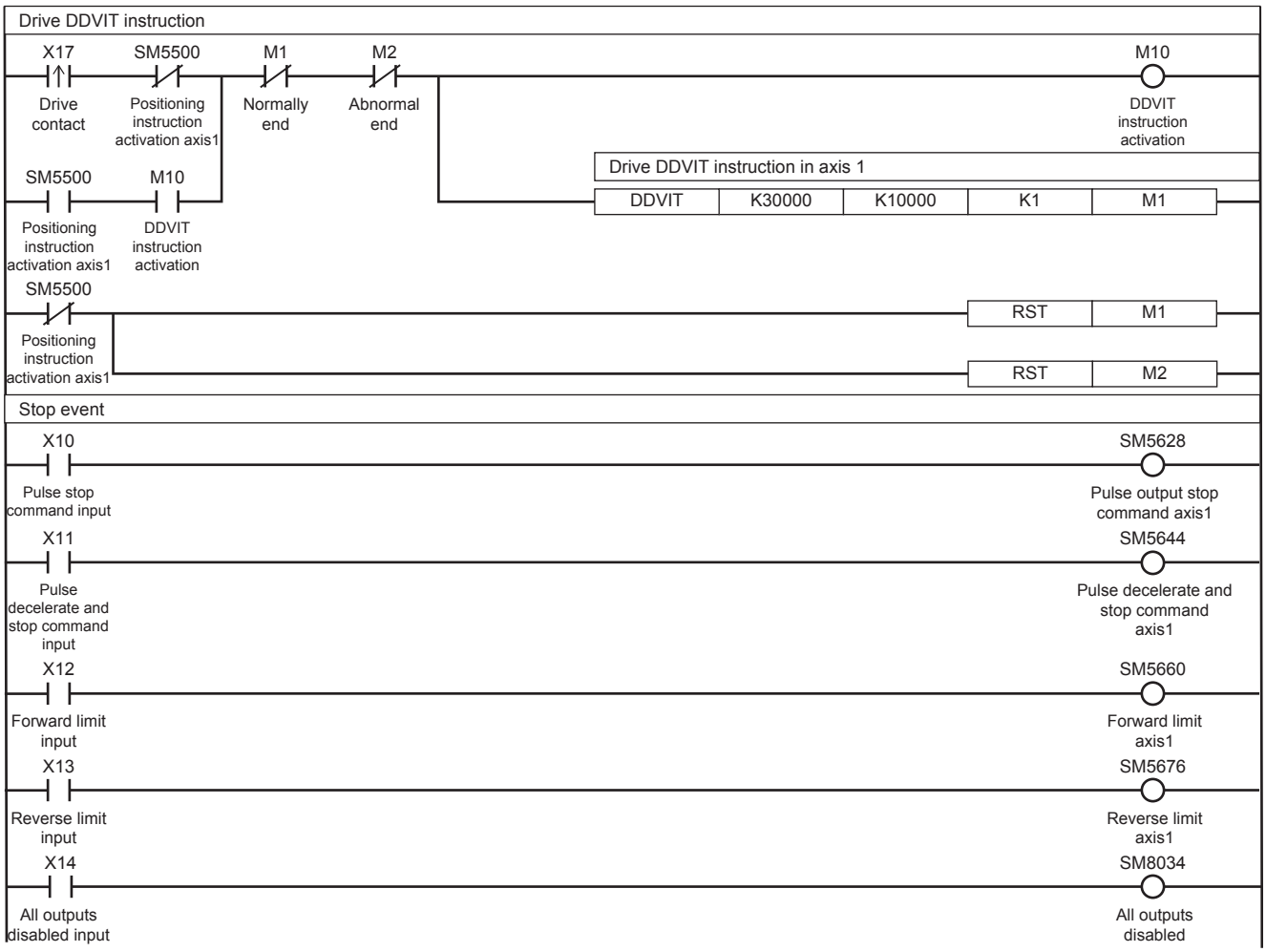


## Setting data

### ■Positioning parameter (high speed I/O parameter)

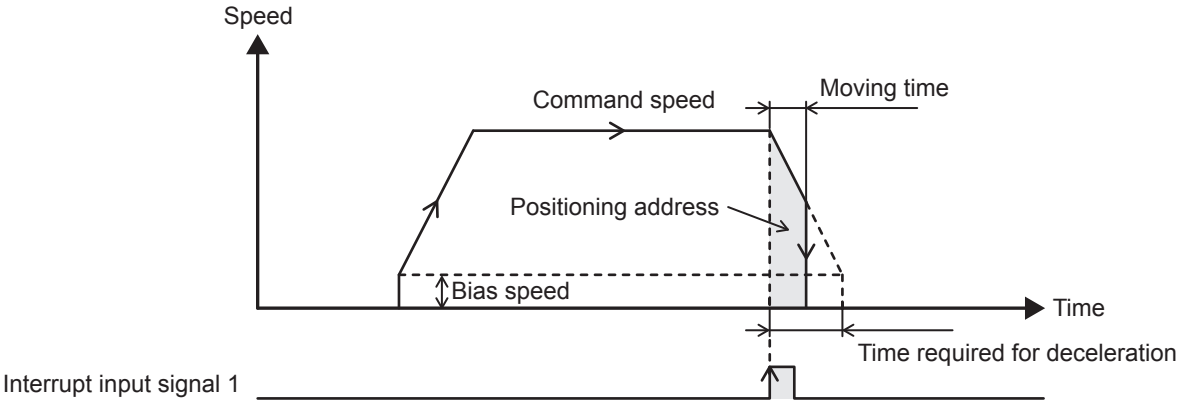
| Item | Axis 1 | Item | Axis 1 |
|---|---|---|---|
| ■Basic Parameter 1 | | ■Basic Parameter 2 | |
| Pulse Output Mode | 1: PULSE/SIGN | Interpolation Speed Specified Method | 0: Composite Speed |
| Output Device (PULSE/CW) | Y0 | Max. Speed | 15000 pps |
| Output Device (SIGN/CCW) | Y4 | Bias Speed | 1000 pps |
| Rotation Direction Setting | 0: Current Address Increment with Forward Run Pulse Output | Acceleration Time | 500 ms |
| Unit Setting | 0: Motor System (pulse, pps) | Deceleration Time | 1000 ms |
| No. of Pulse per Rotation | 2000 pulse | ■Detailed Setting Parameter | |
| Movement Amount per Rotation | 1000 pulse | External Start Signal Enabled/ Disabled | 0: Disabled |
| Positioning Data Magnification | 1: × Single | Interrupt Input Signal 1 Enabled/ Disabled | 1: Enabled |
| — | | Interrupt Input Signal 1 Mode | 1: Standard Mode |
| | | Interrupt Input Signal 1 Device No. | X0 |
| | | Interrupt Input Signal 1 Logic | 0: Positive Logic |
| | | Interrupt Input Signal 2 Logic | 0: Positive Logic |
| | | ■OPR Parameter | |
| | | OPR Enabled/Disabled | 0: Disabled |

## Program example



## Caution

- When 0 is set for the positioning address (s1) at start of the instruction, the operation ends with an error.
- If the positioning address (s1) is changed to 0 before the interrupt input signal 1 is detected, the operation decelerates and stops after the input interrupt occurs. After deceleration stop, the output direction is reversed to the address where the positioning address was changed and the operation ends normally.
- When transfer time to the positioning address is shorter than the time required for deceleration stop (the value set in (s1) is small), the operation immediately stops at the positioning address. Note that the immediate stop may damage the machine because the motor stops immediately.




- When the interrupt input signal 1 is detected during acceleration, the operation differs depending on the positioning address value (s1) as shown below.

***1.*** When the positioning address < the number of pulses required for deceleration from the current speed

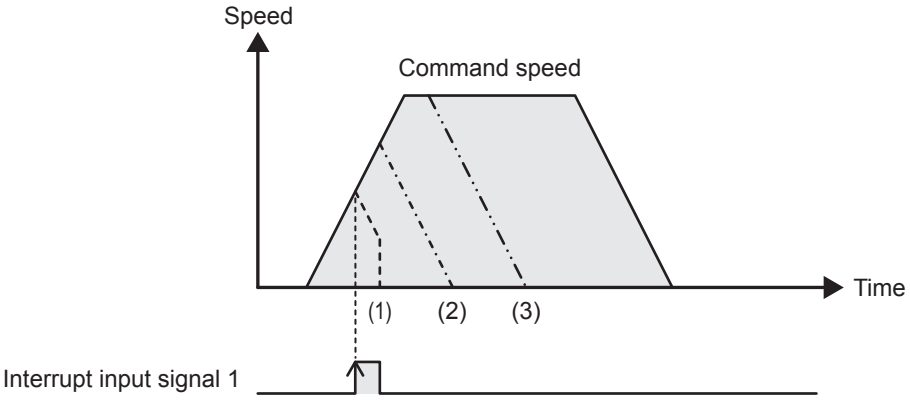
After the interrupt input signal 1 is turned on, deceleration immediately starts, and then the operation immediately stops when the positioning address is reached. Note that the immediate stop may damage the machine because the motor stops immediately.

***2.*** When the number of pulses required for deceleration from the current speed ≤ positioning address < the number of pulses required for acceleration/deceleration from the current speed

The speed is increased until the position at which the remaining number of pulses becomes the same as that required for deceleration. Then, deceleration stop is performed.

***3.*** When the number of pulses required for acceleration/deceleration from the current speed ≤ positioning address

The speed is increased to the command speed (s2). Then, deceleration stop is performed.

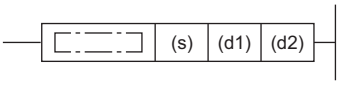
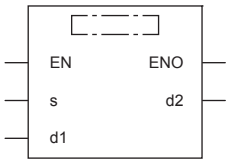


# 32.7 Variable Speed Operation

The positioning function uses the variable speed pulse output instruction equipped with the rotation direction designation function to perform variable speed operation.
This instruction can change the speed using the acceleration/deceleration speed.

## PLSV/DPLSV

This instruction outputs variable speed pulses with an assigned rotation direction output.

| Ladder | ST | FBD/LD |
|---|---|---|
|  | ENO:=PLSV(EN,s,d1,d2);<br>ENO:=DPLSV(EN,s,d1,d2); |  |

### Setting data

#### ■Description, range, data type (PLSV)

• FX5 operand

| Operand | Description | Range | Data type | Data type (label) |
|---|---|---|---|---|
| (s) | Word device number storing command speed or data*1 | -32768 to +32767<br>(User system unit) | 16-bit signed binary | ANY16 |
| (d1) | Axis number from which pulses are output | ■FX5S CPU module<br>K1 to K4<br>■FX5UJ CPU module<br>K1 to K3, K5 to K12<br>■FX5U/FX5UC CPU module<br>K1 to K12 | 16-bit unsigned binary | ANY_ELEMENTARY (WORD) |
| (d2) | Bit device number of the instruction execution complete flag and abnormal end flag | — | Bit | ANY_BOOL |
| EN | Execution condition | — | Bit | BOOL |
| ENO | Execution result | — | Bit | BOOL |

• FX3 compatible operand (Supported only for CPU module)

| Operand | Description | Range | Data type | Data type (label) |
|---|---|---|---|---|
| (s) | Word device number storing command speed or data | -32768 to +32767<br>(User system unit) | 16-bit signed binary | ANY16 |
| (d1) | Bit device number (Y) from which pulses are output | ■FX5S/FX5U/FX5UC CPU module<br>Y0 to Y3<br>■FX5UJ CPU module<br>Y0 to Y2 | Bit | ANY_ELEMENTARY (BOOL) |
| (d2) | Bit device number from which rotation direction is output | — | Bit | ANY_BOOL |
| EN | Execution condition | — | Bit | BOOL |
| ENO | Execution result | — | Bit | BOOL |

*1 OPR speed and creep speed can be changed during positioning operation. (☞ Page 362 Command speed change during positioning operation)

## ■Description, range, data type (DPLSV)

• FX5 operand

| Operand | Description | Range | Data type | Data type (label) |
|---|---|---|---|---|
| (s) | Word device number storing command speed or data*1 | -2147483648 to +2147483647 (User system unit) | 32-bit signed binary | ANY32 |
| (d1) | Axis number from which pulses are output | ■FX5S CPU module<br>K1 to K4<br>■FX5UJ CPU module<br>K1 to K3, K5 to K12<br>■FX5U/FX5UC CPU module<br>K1 to K12 | 16-bit unsigned binary | ANY_ELEMENTARY (WORD) |
| (d2) | Bit device number of the instruction execution complete flag and abnormal end flag | — | Bit | ANY_BOOL |
| EN | Execution condition | — | Bit | BOOL |
| ENO | Execution result | — | Bit | BOOL |

• FX3 compatible operand (Supported only for CPU module)

| Operand | Description | Range | Data type | Data type (label) |
|---|---|---|---|---|
| (s) | Word device number storing command speed or data*1 | -2147483648 to +2147483647 (User system unit) | 32-bit signed binary | ANY32 |
| (d1) | Bit device number (Y) from which pulses are output | ■FX5S/FX5U/FX5UC CPU module<br>Y0 to Y3<br>■FX5UJ CPU module<br>Y0 to Y2 | Bit | ANY_ELEMENTARY (BOOL) |
| (d2) | Bit device number from which rotation direction is output | — | Bit | ANY_BOOL |
| EN | Execution condition | — | Bit | BOOL |
| ENO | Execution result | — | Bit | BOOL |

*1 OPR speed and creep speed can be changed during positioning operation. (☞ Page 362 Command speed change during positioning operation)

## ■Available device (PLSV/DPLSV)

• FX5 operand

| Operand | Bit | Word | | | Double word | | Indirect specification | Constant | | | Others |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | X, Y, M, L, SM, F, B, SB, S | T, ST, C, D, W, SD, SW, R | U□\G□ | Z | LC | LZ | | K, H | E | $ | |
| (s) | ○ | ○ | ○ | ○ | ○*1 | ○*1 | ○ | ○ | — | — | — |
| (d1) | — | ○ | ○ | ○ | — | — | ○ | ○ | — | — | — |
| (d2)*2 | ○ | ○*3 | — | — | — | — | — | — | — | — | — |

• FX3 compatible operand (Supported only for CPU module)

| Operand | Bit | Word | | | Double word | | Indirect specification | Constant | | | Others |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | X, Y, M, L, SM, F, B, SB, S | T, ST, C, D, W, SD, SW, R | U□\G□ | Z | LC | LZ | | K, H | E | $ | |
| (s) | ○ | ○ | ○ | ○ | ○*1 | ○*1 | ○ | ○ | — | — | — |
| (d1) | ○*4 | — | — | — | — | — | — | — | — | — | — |
| (d2) | ○*5 | ○*3 | — | — | — | — | — | — | — | — | — |

*1 Only available for DPLSV instruction.
*2 Two devices are occupied from the specified device.
*3 T, ST, C cannot be used.
*4 FX5S/FX5U/FX5UC CPU module: Only Y0 to Y3 devices can be used.
FX5UJ CPU module: Only Y0 to Y2 devices can be used.
*5 When the output mode is CW/CCW, specify the CCW axis. When the output mode is PULSE/SIGN, only the SIGN output of the axis or general-purpose output can be specified.

## Processing details

This instruction outputs variable speed pulses with an assigned rotation direction output.

# Related devices

The following lists the related special devices.

Related devices of axis 4 are available only for the FX5S/FX5U/FX5UC CPU module.

## Special relays

### ■CPU module

| FX5 dedicated | | | | FX3 compatible | | | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 1 | Axis 2 | Axis 3 | Axis 4 | | | | |
| — | — | — | — | SM8029 | | | | Instruction execution complete flag | × | R | Page 402 |
| — | — | — | — | SM8329 | | | | Instruction execution abnormal end flag | × | R | |
| SM5500 | SM5501 | SM5502 | SM5503 | SM8348 | SM8358 | SM8368 | SM8378 | Positioning instruction activation | × | R | Page 400 |
| SM5516 | SM5517 | SM5518 | SM5519 | SM8340 | SM8350 | SM8360 | SM8370 | Pulse output monitor | × | R | Page 400 |
| SM5532 | SM5533 | SM5534 | SM5535 | — | — | — | — | Positioning error occurrence | × | R/W | Page 400 |
| SM5628 | SM5629 | SM5630 | SM5631 | — | — | — | — | Pulse output stop command | × | R/W | Page 384 |
| SM5644 | SM5645 | SM5646 | SM5647 | — | — | — | — | Pulse decelerate and stop command | × | R/W | Page 385 |
| SM5660 | SM5661 | SM5662 | SM5663 | — | — | — | — | Forward limit | × | R/W | Page 386 |
| SM5676 | SM5677 | SM5678 | SM5679 | — | — | — | — | Reverse limit | × | R/W | Page 386 |
| SM5772 | SM5773 | SM5774 | SM5775 | — | — | — | — | Rotation direction setting | ○ | R/W | Page 374 |

R: Read only, R/W: Read/write, ○: Supported, ×: Not supported

### ■High-speed pulse input/output module

| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SM8029 (FX3 compatible device) | | | | | | | | Instruction execution complete flag | × | R | Page 402 |
| SM8329 (FX3 compatible device) | | | | | | | | Instruction execution abnormal end flag | × | R | |
| SM5504 | SM5505 | SM5506 | SM5507 | SM5508 | SM5509 | SM5510 | SM5511 | Positioning instruction activation | × | R | Page 400 |
| SM5520 | SM5521 | SM5522 | SM5523 | SM5524 | SM5525 | SM5526 | SM5527 | Pulse output monitor | × | R | Page 400 |
| SM5536 | SM5537 | SM5538 | SM5539 | SM5540 | SM5541 | SM5542 | SM5543 | Positioning error occurrence | × | R/W | Page 400 |
| SM5632 | SM5633 | SM5634 | SM5635 | SM5636 | SM5637 | SM5638 | SM5639 | Pulse output stop command | × | R/W | Page 384 |
| SM5648 | SM5649 | SM5650 | SM5651 | SM5652 | SM5653 | SM5654 | SM5655 | Pulse decelerate and stop command | × | R/W | Page 385 |
| SM5664 | SM5665 | SM5666 | SM5667 | SM5668 | SM5669 | SM5670 | SM5671 | Forward limit | × | R/W | Page 386 |
| SM5680 | SM5681 | SM5682 | SM5683 | SM5684 | SM5685 | SM5686 | SM5687 | Reverse limit | × | R/W | Page 386 |
| SM5776 | SM5777 | SM5778 | SM5779 | SM5780 | SM5781 | SM5782 | SM5783 | Rotation direction setting | ○ | R/W | Page 374 |

R: Read only, R/W: Read/write, ○: Supported, ×: Not supported

## Special registers

### ■CPU module

| FX5 dedicated | | | | FX3 compatible | | | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 1 | Axis 2 | Axis 3 | Axis 4 | | | | |
| SD5500, SD5501 | SD5540, SD5541 | SD5580, SD5581 | SD5620, SD5621 | — | — | — | — | Current address (user unit) | × | R/W*1 | Page 382 |
| SD5502, SD5503 | SD5542, SD5543 | SD5582, SD5583 | SD5622, SD5623 | SD8340, SD8341 | SD8350, SD8351 | SD8360, SD8361 | SD8370, SD8371 | Current address (pulse unit) | × | R/W*1 | Page 382 |
| SD5504, SD5505 | SD5544, SD5545 | SD5584, SD5585 | SD5624, SD5625 | — | — | — | — | Current speed (user unit) | × | R | Page 378 |
| SD5510 | SD5550 | SD5590 | SD5630 | — | — | — | — | Positioning error (error code) | × | R/W | Page 401 |
| SD5516, SD5517 | SD5556, SD5557 | SD5596, SD5597 | SD5636, SD5637 | — | — | — | — | Maximum speed | ○ | R/W | Page 379 |
| SD5518, SD5519 | SD5558, SD5559 | SD5598, SD5599 | SD5638, SD5639 | — | — | — | — | Bias speed | ○ | R/W | Page 379 |
| SD5520 | SD5560 | SD5600 | SD5640 | — | — | — | — | Acceleration time | ○ | R/W | Page 380 |
| SD5521 | SD5561 | SD5601 | SD5641 | — | — | — | — | Deceleration time | ○ | R/W | Page 380 |

R: Read only, R/W: Read/write, ○: Supported, ×: Not supported

*1 Only FX5 dedicated devices can be written by the HCMOV/DHCMOV instruction.

### ■High-speed pulse input/output module

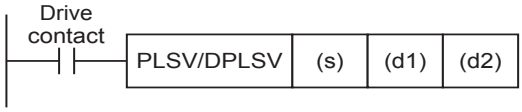
| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SD5660, SD5661 | SD5700, SD5701 | SD5740, SD5741 | SD5780, SD5781 | SD5820, SD5821 | SD5860, SD5861 | SD5900, SD5901 | SD5940, SD5941 | Current address (user unit) | × | R/W*1 | Page 382 |
| SD5662, SD5663 | SD5702, SD5703 | SD5742, SD5743 | SD5782, SD5783 | SD5822, SD5823 | SD5862, SD5863 | SD5902, SD5903 | SD5942, SD5943 | Current address (pulse unit) | × | R/W*1 | Page 382 |
| SD5664, SD5665 | SD5704, SD5705 | SD5744, SD5745 | SD5784, SD5785 | SD5824, SD5825 | SD5864, SD5865 | SD5904, SD5905 | SD5944, SD5945 | Current speed (user unit) | × | R | Page 378 |
| SD5670 | SD5710 | SD5750 | SD5790 | SD5830 | SD5870 | SD5910 | SD5950 | Positioning error (error code) | × | R/W | Page 401 |
| SD5676, SD5677 | SD5716, SD5717 | SD5756, SD5757 | SD5796, SD5797 | SD5836, SD5837 | SD5876, SD5877 | SD5916, SD5917 | SD5956, SD5957 | Maximum speed | ○ | R/W | Page 379 |
| SD5678, SD5679 | SD5718, SD5719 | SD5758, SD5759 | SD5798, SD5799 | SD5838, SD5839 | SD5878, SD5879 | SD5918, SD5919 | SD5958, SD5959 | Bias speed | ○ | R/W | Page 379 |
| SD5680 | SD5720 | SD5760 | SD5800 | SD5840 | SD5880 | SD5920 | SD5960 | Acceleration time | ○ | R/W | Page 380 |
| SD5681 | SD5721 | SD5761 | SD5801 | SD5841 | SD5881 | SD5921 | SD5961 | Deceleration time | ○ | R/W | Page 380 |

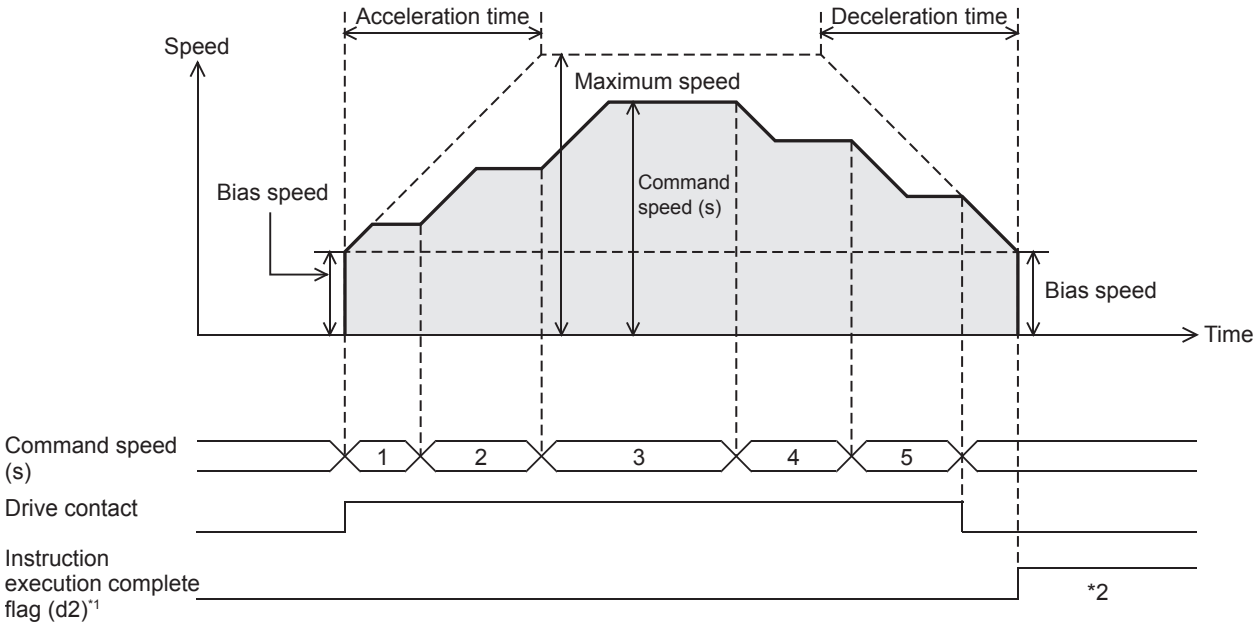
R: Read only, R/W: Read/write, ○: Supported, ×: Not supported

*1 Writing can be performed only by the HCMOV/DHCMOV instruction.

# Outline of operation

For each speed, refer to ☞ Page 377 Items related to speed.




*1 When FX5 operand is specified

*2 Remains on until it is turned off using program or engineering tool or the positioning instruction is next driven again.

## Basic operation

The following describes the basic operation.

***1.*** After the drive contact is turned on, pulse output is started and the speed is increased from the bias speed.

***2.*** After the speed has reached the specified speed, the operation will be performed in the specified speed.

***3.*** If the command speed is changed during operation, the speed is increased/decreased to the specified speed and operation continues.

***4.*** If the drive contact is turned off, the speed is decreased and pulse output is stopped.

## Operand specification

### ■When FX5 operand is specified

**1.** For (s), specify the command speed. Set to a value -200 kpps to +200 kpps in pulse. For the FX5S CPU module, set to a value -100 kpps to +100 kpps.

- PLSV: -32768 to +32767 (User system unit)
- DPLSV: -2147483648 to +2147483647 (User system unit)

**2.** For (d1), specify an axis number for which pulses are output.

Specify an axis number whose positioning parameters are set in the high speed I/O parameters. Operation cannot be performed if any other axis number is specified.

[FX5S CPU module]

- K1 to K4: Axis 1 to Axis 4

[FX5UJ CPU module]

- K1 to K3: Axis 1 to Axis 3 (CPU module)
- K5, K6: Axis 5, Axis 6 (High-speed pulse input/output module first module)
- K7, K8: Axis 7, Axis 8 (High-speed pulse input/output module second module)
- K9, K10: Axis 9, Axis 10 (High-speed pulse input/output module third module)
- K11, K12: Axis 11, Axis 12 (High-speed pulse input/output module fourth module)

[FX5U/FX5UC CPU module]

- K1 to K4: Axis 1 to Axis 4 (CPU module)
- K5, K6: Axis 5, Axis 6 (High-speed pulse input/output module first module)
- K7, K8: Axis 7, Axis 8 (High-speed pulse input/output module second module)
- K9, K10: Axis 9, Axis 10 (High-speed pulse input/output module third module)
- K11, K12: Axis 11, Axis 12 (High-speed pulse input/output module fourth module)

**3.** For (d2), specify the bit devices of the instruction execution complete flag and abnormal end flag. (☞ Page 402 Complete flag)

- (d2): Instruction execution complete flag
- (d2)+1: Instruction execution abnormal end flag

### ■When the FX3 compatible operand is specified (Supported only for CPU module)

**1.** For (s), specify the command speed. Set to a value -200 kpps to +200 kpps in pulse. For the FX5S CPU module, set to a value -100 kpps to +100 kpps.

- PLSV: -32768 to +32767 (User system unit)
- DPLSV: -2147483648 to +2147483647 (User system unit)

**2.** For (d1), specify the pulse output number.

Specify an output device (Y) number set in the high speed I/O parameters. (☞ Page 372 Pulse Output Mode) Operation cannot be performed if any other axis number is specified.

- FX5S/FX5U/FX5UC CPU module: Y0 to Y3 (equivalent to axes 1 to 4)
- FX5UJ CPU module: Y0 to Y2 (equivalent to axes 1 to 3)

**3.** For (d2), specify the rotation direction signal output device number. (☞ Page 374 Rotation Direction Setting)

When an output device (Y) is used, only the device that is specified with the positioning parameter or a general-purpose output can be specified. However, if an output device (Y) to which PWM, PULSE/SIGN axis of another axis, or CW/CCW axis is assigned is specified, an error occurs without any operation.

For the PWM function, refer to the following.

☞ Page 321 PWM Function

## Command speed

- If the command speed is changed to 0 during operation, the operation does not end with errors but is decelerated to a stop. As long as the drive contact is on, changing the command speed restarts pulse output.
- When 0 is set for the command speed at start of the instruction, the operation ends with an error.

## Acceleration/deceleration operation

- When acceleration time is set to 0, the speed is increased to the command speed immediately without acceleration operation.
- When deceleration time is set to 0, no deceleration operation is performed and operation immediately stops when the drive contact is turned off.

## Operation of the complete flags

The following describes the operation timings of the complete flags.

The user-specified complete flags are valid only when specified using FX5 operand.

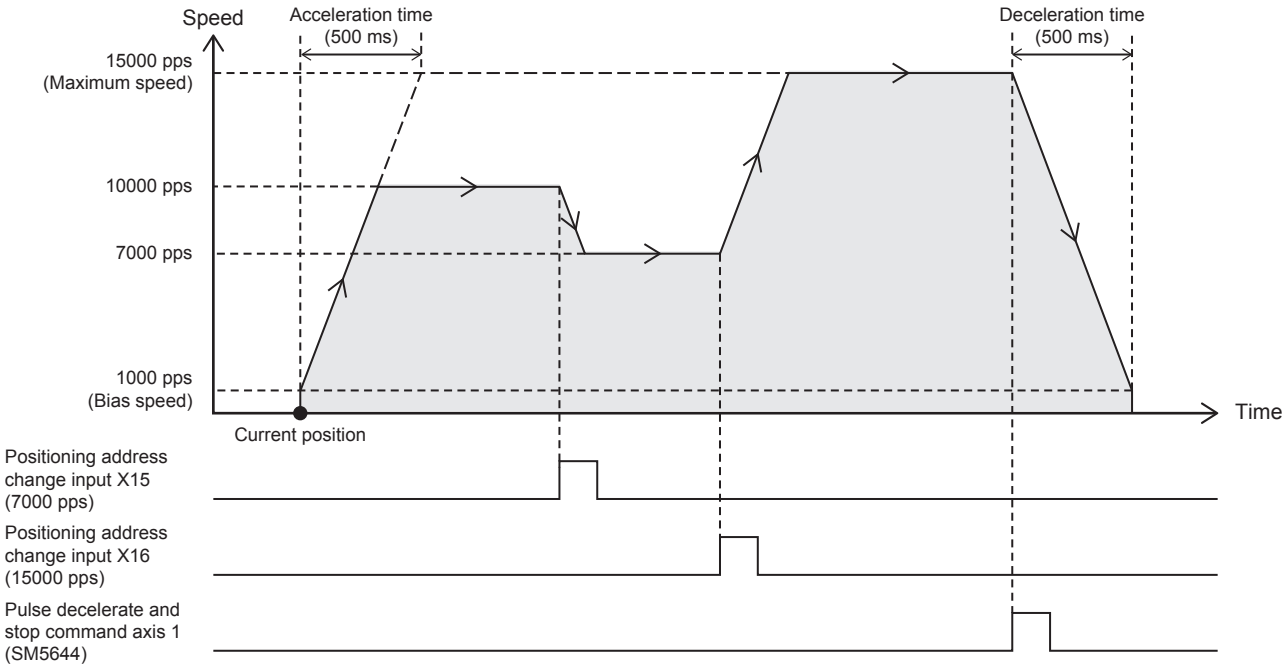
| Item | FX3 compatible | | User specification | |
|---|---|---|---|---|
| | **Instruction execution complete flag (SM8029)** | **Instruction execution abnormal end flag (SM8329)** | **Instruction execution complete flag (d2)** | **Instruction execution abnormal end flag (d2)+1** |
| ON condition | From when deceleration stop is performed by the pulse decelerate and stop command to when the ON → OFF condition is met | From when the following operation or function is completed to when the drive contact is turned off<br>• The axis is already used.*1<br>• Pulse output stop command<br>• Limit of the moving direction<br>• All module reset when a stop error occurs*2<br>• All outputs disabled (SM8034)<br>• When 0 is set for the command speed at start of the instruction | From when the drive contact is turned off or when deceleration stop is performed by the pulse decelerate and stop command to when the ON → OFF condition is met | From when the following operation or function is completed to when the ON → OFF condition is met<br>• The axis is already used.<br>• Pulse output stop command<br>• Limit of the moving direction<br>• All module reset when a stop error occurs*2<br>• All outputs disabled (SM8034)<br>• Online change<br>• When 0 is set for the command speed at start of the instruction |
| ON → OFF condition | When the drive contact is turned off | | The flag remains on until either of the following is performed.<br>• Turning off the flag by the user<br>• Restarting the positioning instruction | |

*1 The flag turns on only for one scan when the drive contact of the instruction turns from OFF to ON.

*2 Only high-speed pulse input/output module is supported.

# Program example

The following is a program example of variable speed operation (axis 1).

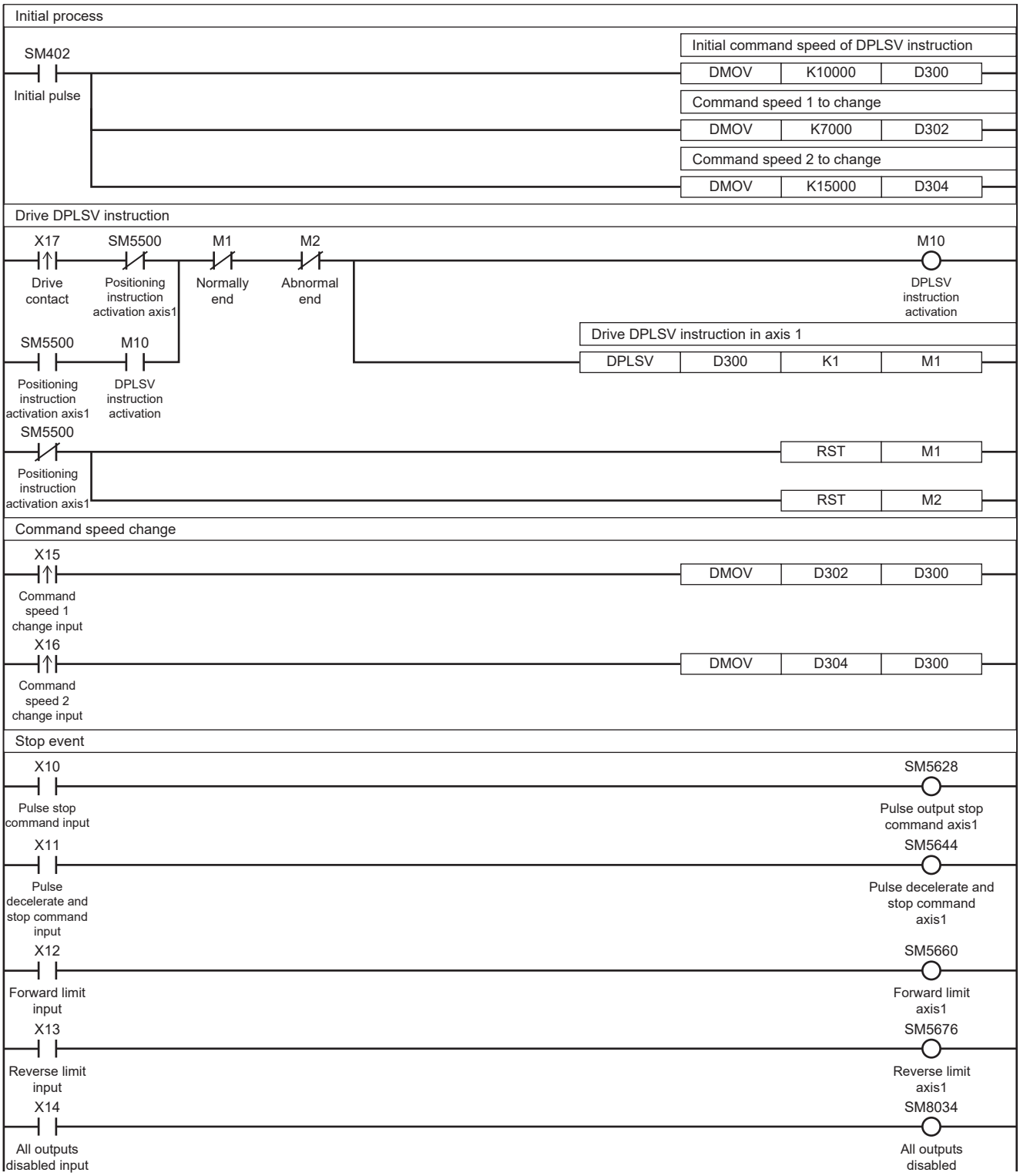



## Setting data

### ■Positioning parameter (high speed I/O parameter)

| Item | Axis 1 | Item | Axis 1 |
|---|---|---|---|
| ■Basic Parameter 1 | | ■Basic Parameter 2 | |
| Pulse Output Mode | 1: PULSE/SIGN | Interpolation Speed Specified Method | 0: Composite Speed |
| Output Device (PULSE/CW) | Y0 | Max. Speed | 15000 pps |
| Output Device (SIGN/CCW) | Y4 | Bias Speed | 1000 pps |
| Rotation Direction Setting | 0: Current Address Increment with Forward Run Pulse Output | Acceleration Time | 500 ms |
| Unit Setting | 0: Motor System (pulse, pps) | Deceleration Time | 500 ms |
| No. of Pulse per Rotation | 2000 pulse | ■Detailed Setting Parameter | |
| Movement Amount per Rotation | 1000 pulse | External Start Signal Enabled/ Disabled | 0: Disabled |
| Positioning Data Magnification | 1: × Single | Interrupt Input Signal 1 Enabled/ Disabled | 0: Disabled |
| — | | Interrupt Input Signal 2 Logic | 0: Positive Logic |
| | | ■OPR Parameter | |
| | | OPR Enabled/Disabled | 0: Disabled |

## Program example




# Caution

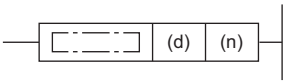
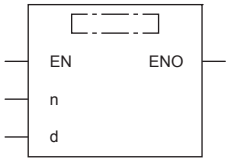
- If the speed is changed changing and thus, the sign of the command speed during operation, pulse output is started in the reversed direction after deceleration stop. The waiting time for the pulse output after deceleration stop is "1 ms + scan time". When the motor cannot be stopped during the waiting time, design a program so that sufficient waiting time is secured and then the output is restarted after deceleration stop by setting the command speed to 0 once.
- When 0 is set for the command speed at start of the instruction, the operation ends with an error.

# 32.8 Single-table Operation

This instruction executes the control method of one specified table set in the data table with GX Works3. Only CPU module is supported.

## TBL

This instruction executes one table specified in the table data set in GX Works3.

| Ladder | ST | FBD/LD |
|---|---|---|
|  | ENO:=TBL(EN,n,d); |  |

### Setting data

#### ■Description, range, data type

• FX5 operand

| Operand | Description | Range | Data type | Data type (label) |
|---|---|---|---|---|
| (d) | Axis number from which pulses are output | ■FX5S/FX5U/FX5UC CPU module<br>K1 to K4<br>■FX5UJ CPU module<br>K1 to K3 | 16-bit unsigned binary | ANY_ELEMENTARY (WORD) |
| (n) | Table number to be executed | 1 to 100*1 | 16-bit unsigned binary | ANY16_U |
| EN | Execution condition | — | Bit | BOOL |
| ENO | Execution result | — | Bit | BOOL |

• FX3 compatible operand

| Operand | Description | Range | Data type | Data type (label) |
|---|---|---|---|---|
| (d) | Bit device number (Y) from which pulses are output | ■FX5S/FX5U/FX5UC CPU module<br>Y0 to Y3<br>■FX5UJ CPU module<br>Y0 to Y2 | Bit | ANY_ELEMENTARY (BOOL) |
| (n) | Table number to be executed | 1 to 100*1 | 16-bit unsigned binary | ANY16_U |
| EN | Execution condition | — | Bit | BOOL |
| ENO | Execution result | — | Bit | BOOL |

*1 1 to 32 when the positioning table data is not set to use device

### ■Available device

• FX5 operand

| Operand | Bit | Word | | | Double word | | Indirect specification | Constant | | | Others |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | X, Y, M, L, SM, F, B, SB, S | T, ST, C, D, W, SD, SW, R | U□\G□ | Z | LC | LZ | | K, H | E | $ | |
| (d) | — | ○ | ○ | ○ | — | — | ○ | ○ | — | — | — |
| (n) | ○ | ○ | ○ | ○ | — | — | ○ | ○ | — | — | — |

• FX3 compatible operand

| Operand | Bit | Word | | | Double word | | Indirect specification | Constant | | | Others |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | X, Y, M, L, SM, F, B, SB, S | T, ST, C, D, W, SD, SW, R | U□\G□ | Z | LC | LZ | | K, H | E | $ | |
| (d) | ○*1 | — | — | — | — | — | — | — | — | — | — |
| (n) | ○ | ○ | ○ | ○ | — | — | ○ | ○ | — | — | — |

*1 FX5UJ CPU module: Only Y0 to Y2 devices can be used.
FX5S/FX5U/FX5UC CPU module: Only Y0 to Y3 devices can be used.

## Processing details

This instruction executes one table specified in the table data set in GX Works3.

For details on the table setting method and others, refer to ☞ Page 489 TABLE OPERATION.

# Related devices

The following lists the related special devices. The devices other than the following depend on the table control method.

Related devices of axis 4 are available only for the FX5S/FX5U/FX5UC CPU module.

## Special relays

| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|
| SM5916 | SM5917 | SM5918 | SM5919 | Positioning table data initialization disable | × | R/W | Page 399 |

R: Read only, R/W: Read/write, ×: Not supported

## Special registers

| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|
| SD5506 | SD5546 | SD5586 | SD5626 | Positioning execution table number | × | R | Page 398 |
| SD5511 | SD5551 | SD5591 | SD5631 | Positioning error (error occurrence table No.) | × | R/W | Page 399 |

R: Read only, R/W: Read/write, ×: Not supported

# Outline of operation


## Operand specification

### ■When FX5 operand is specified

***1.*** For (d), specify an axis number for which pulses are output.

Specify an axis number whose positioning parameters are set in the high speed I/O parameters. Operation cannot be performed if any other axis number is specified.

- FX5S/FX5U/FX5UC CPU module: K1 to K4 (Axis 1 to Axis 4)
- FX5UJ CPU module: K1 to K3 (Axis 1 to Axis 3)

***2.*** For (n), specify the table number (1 to 100[*1]) that is executed in the axis specified in (d).

*1 1 to 32 when the positioning table data is not set to use device

### ■When the FX3 compatible operand is specified

***1.*** For (d), specify the pulse output number.

Specify an output device (Y) number set in the high speed I/O parameters. (☞ Page 372 Pulse Output Mode) Operation cannot be performed if any other axis number is specified.

- FX5S/FX5U/FX5UC CPU module: Y0 to Y3 (equivalent to axes 1 to 4)
- FX5UJ CPU module: Y0 to Y2 (equivalent to axes 1 to 3)

***2.*** For (n), specify the table number (1 to 100[*1]) that is executed in the axis specified in (d).

*1 1 to 32 when the positioning table data is not set to use device

## Relation with the DRVTBL and DRVMUL instructions

- With the TBL instruction, only the specified table can be activated. Only the complete flag common with other instructions operates.
- With one DRVTBL instruction, multiple tables can be activated. In addition, the table execution method can be selected from the stepping operation and continuous operation. (☞ Page 470 Multiple-table Operation)
- With the DRVMUL instruction, tables for up to four axes can be activated at the same time. (☞ Page 478 Multiple-axis Table Operation) In addition, by indirectly specifying table numbers, continuous operation can be performed.
- For the DRVTBL and DRVMUL instructions, user-specified complete flags can be specified.

## Operation of the complete flags

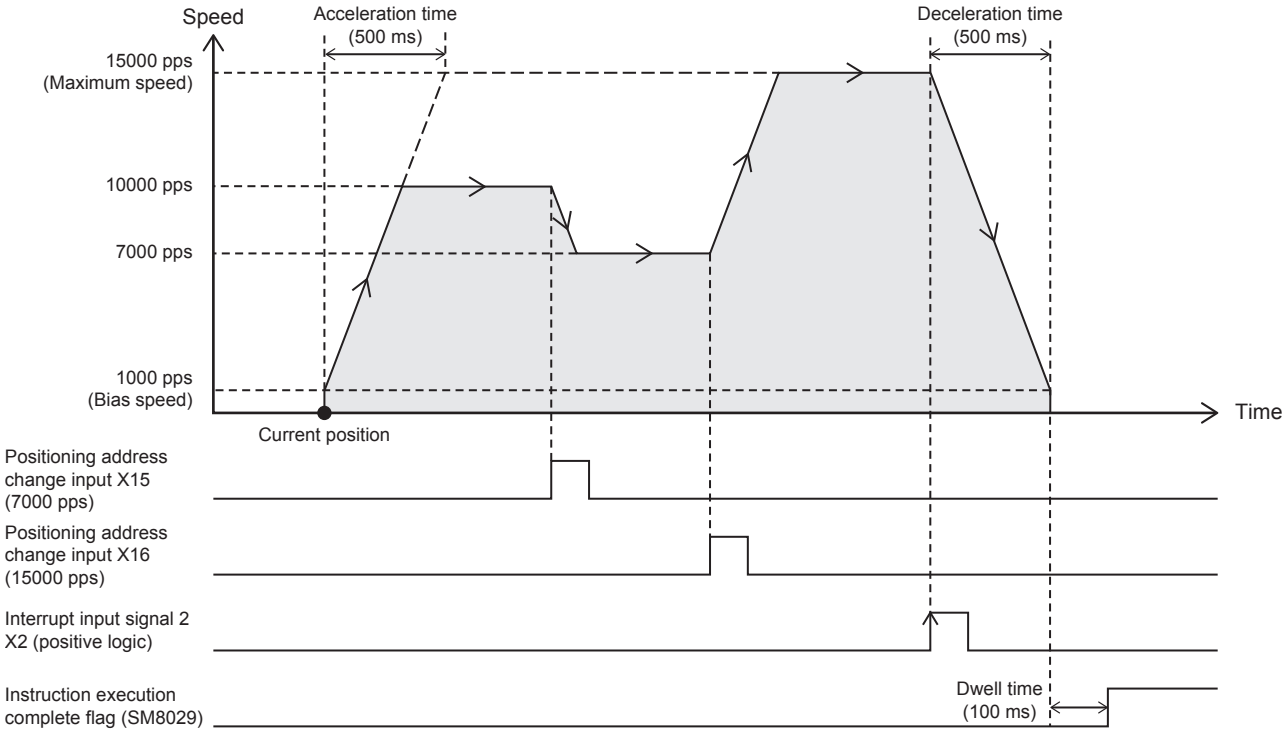
The operation timing of the complete flags depends on the table control method. (☞ Page 402 Complete flag)

# Program example

The following are program examples of using each table control method.

## Table transition variable speed operation

The following is a program example of control method [5: Table Transition Variable Speed Operation].




### Setting data

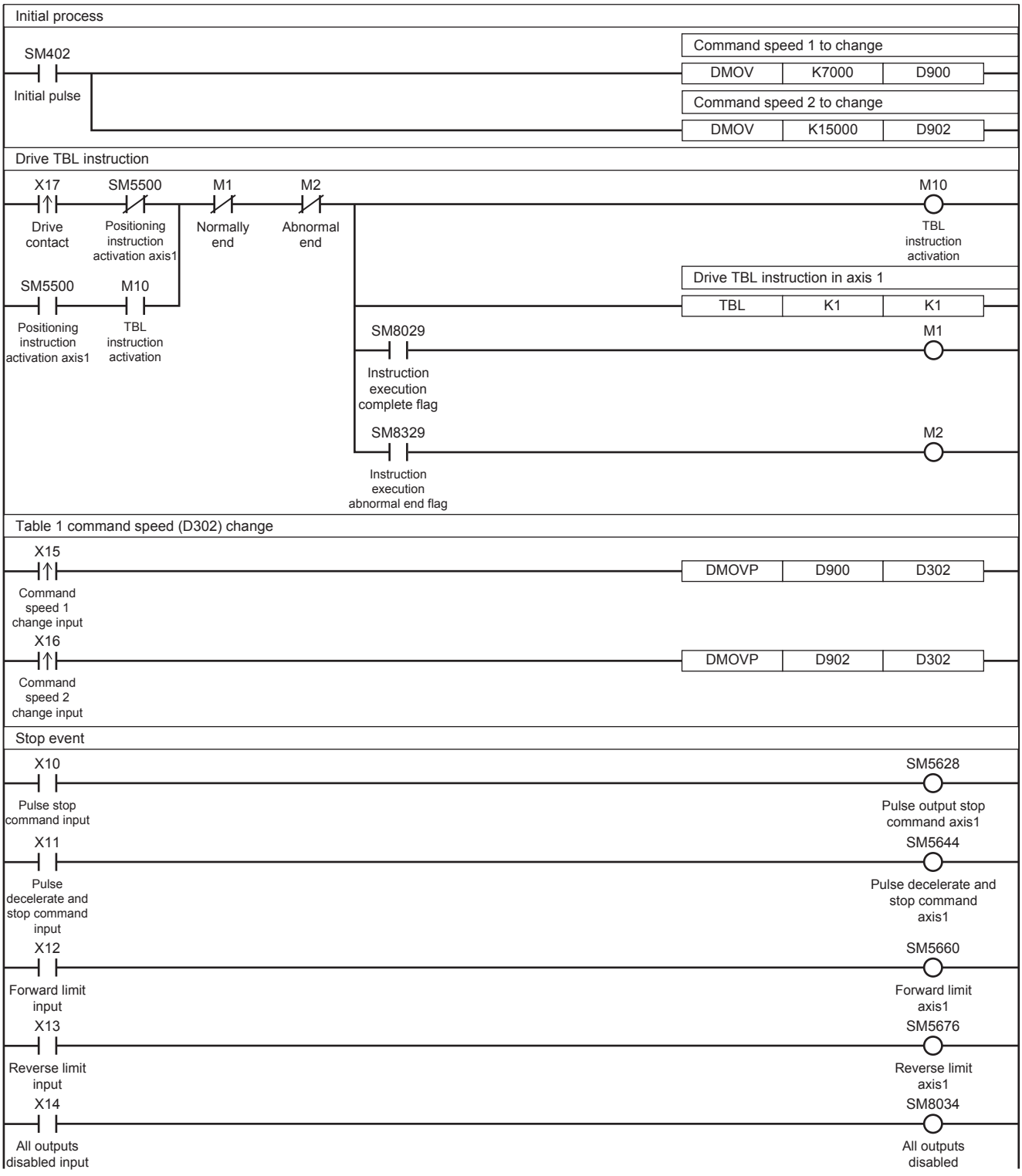
#### ■Positioning parameter (high speed I/O parameter)

| Item | Axis 1 | Item | Axis 1 |
|---|---|---|---|
| ■Basic Parameter 1 | | ■Basic Parameter 2 | |
| Pulse Output Mode | 1: PULSE/SIGN | Interpolation Speed Specified Method | 0: Composite Speed |
| Output Device (PULSE/CW) | Y0 | Max. Speed | 15000 pps |
| Output Device (SIGN/CCW) | Y4 | Bias Speed | 1000 pps |
| Rotation Direction Setting | 0: Current Address Increment with Forward Run Pulse Output | Acceleration Time | 500 ms |
| Unit Setting | 0: Motor System (pulse, pps) | Deceleration Time | 500 ms |
| No. of Pulse per Rotation | 2000 pulse | ■Detailed Setting Parameter | |
| Movement Amount per Rotation | 1000 pulse | External Start Signal Enabled/ Disabled | 0: Disabled |
| Positioning Data Magnification | 1: × Single | Interrupt Input Signal 1 Enabled/ Disabled | 0: Disabled |
| — | | Interrupt Input Signal 2 Logic | 0: Positive Logic |
| | | ■OPR Parameter | |
| | | OPR Enabled/Disabled | 0: Disabled |

#### ■Axis #1 Positioning Data (the positioning table data is set to use device)

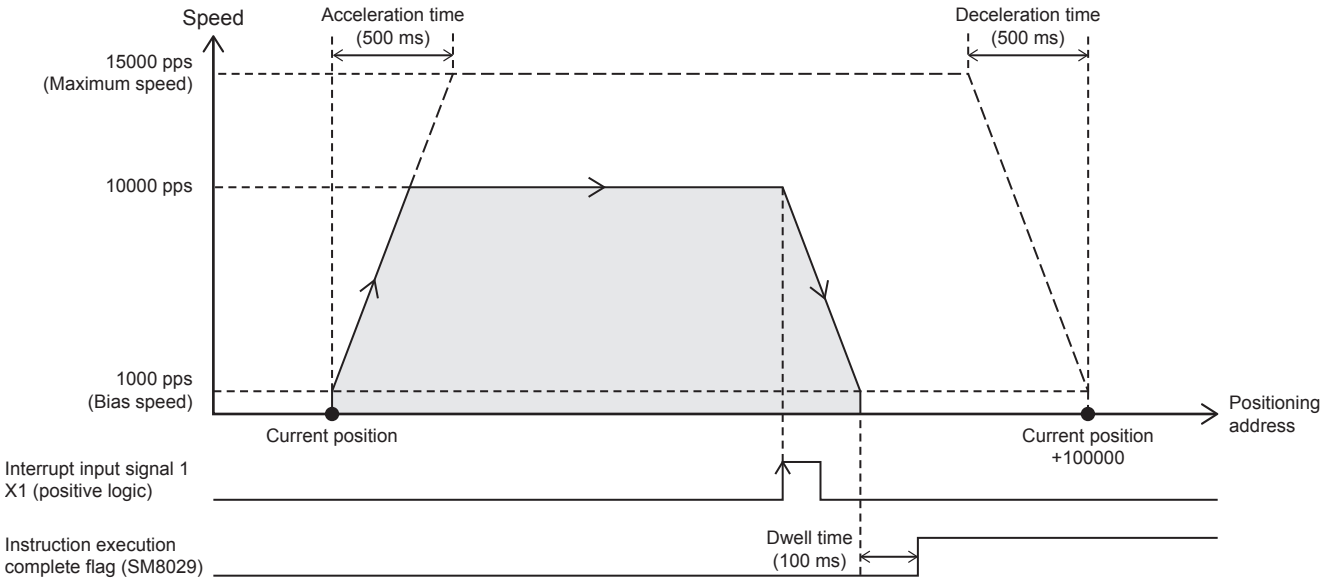
| No. | Device | Control Method | Command Speed | Dwell Time | Interrupt Input Signal 2 Device No. |
|---|---|---|---|---|---|
| 1 | D300 | 5: Table Transition Variable Speed Operation | 10000 pps | 100 ms | X2 |

## Program example



## Interrupt stop (relative address specification)

The following is a program example of control method [6: Interrupt Stop (Relative Address Specification)].




### Setting data

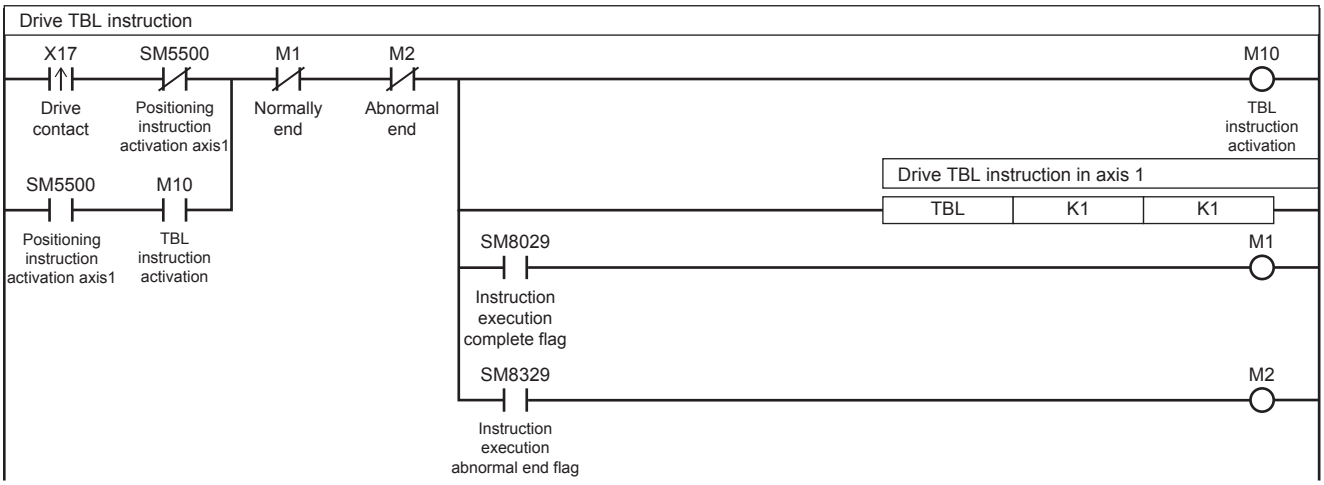
#### ■Positioning parameter (high speed I/O parameter)

| Item | Axis 1 | Item | Axis 1 |
|---|---|---|---|
| ■Basic Parameter 1 | | ■Basic Parameter 2 | |
| Pulse Output Mode | 1: PULSE/SIGN | Interpolation Speed Specified Method | 0: Composite Speed |
| Output Device (PULSE/CW) | Y0 | Max. Speed | 15000 pps |
| Output Device (SIGN/CCW) | Y4 | Bias Speed | 1000 pps |
| Rotation Direction Setting | 0: Current Address Increment with Forward Run Pulse Output | Acceleration Time | 500 ms |
| Unit Setting | 0: Motor System (pulse, pps) | Deceleration Time | 500 ms |
| No. of Pulse per Rotation | 2000 pulse | ■Detailed Setting Parameter | |
| Movement Amount per Rotation | 1000 pulse | External Start Signal Enabled/ Disabled | 0: Disabled |
| Positioning Data Magnification | 1: × Single | Interrupt Input Signal 1 Enabled/ Disabled | 1: Enabled |
| — | | Interrupt Input Signal 1 Mode | 1: Standard Mode |
| | | Interrupt Input Signal 1 Device No. | X1 |
| | | Interrupt Input Signal 1 Logic | 0: Positive Logic |
| | | Interrupt Input Signal 2 Logic | 0: Positive Logic |
| | | ■OPR Parameter | |
| | | OPR Enabled/Disabled | 0: Disabled |

#### ■Axis #1 Positioning Data (the positioning table data is set to use device)

| No. | Device | Control Method | Positioning Address | Command Speed | Dwell Time |
|---|---|---|---|---|---|
| 1 | D300 | 6: Interrupt Stop (Relative Address Specification) | 100000 pulse | 10000 pps | 100 ms |

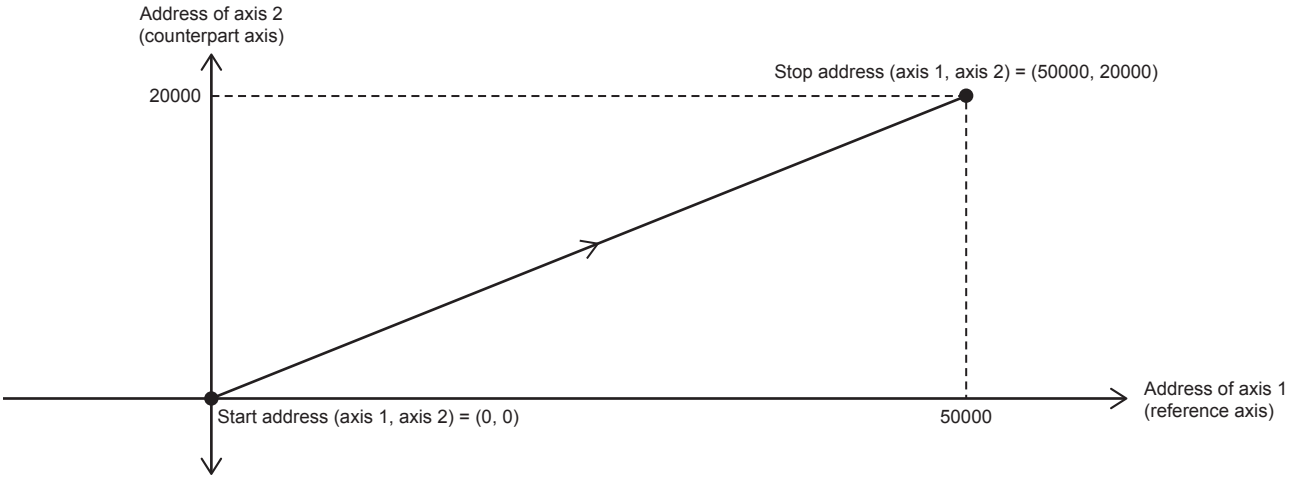
## Program example



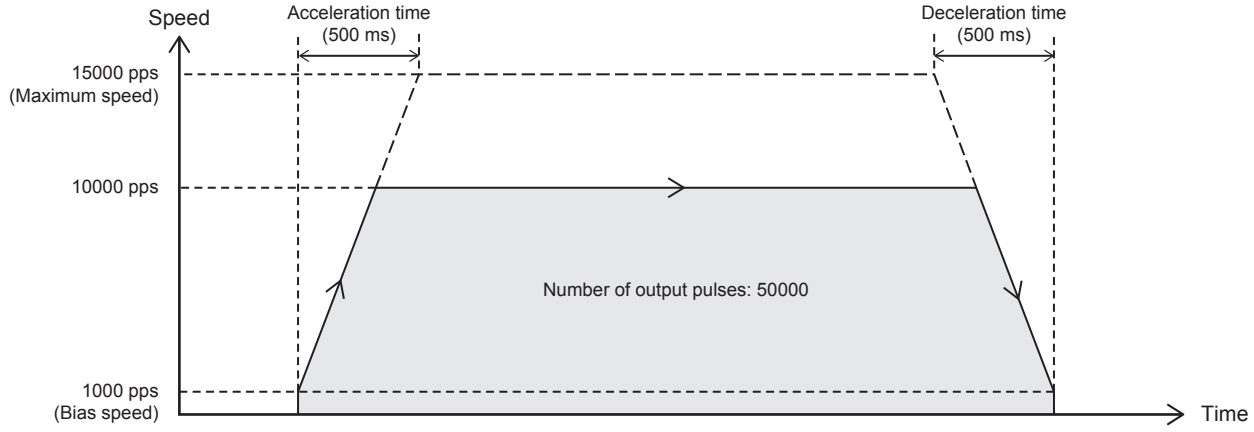

For the stop event, refer to ☞ Page 464 Table transition variable speed operation.

## Simple linear interpolation operation (relative address specification)

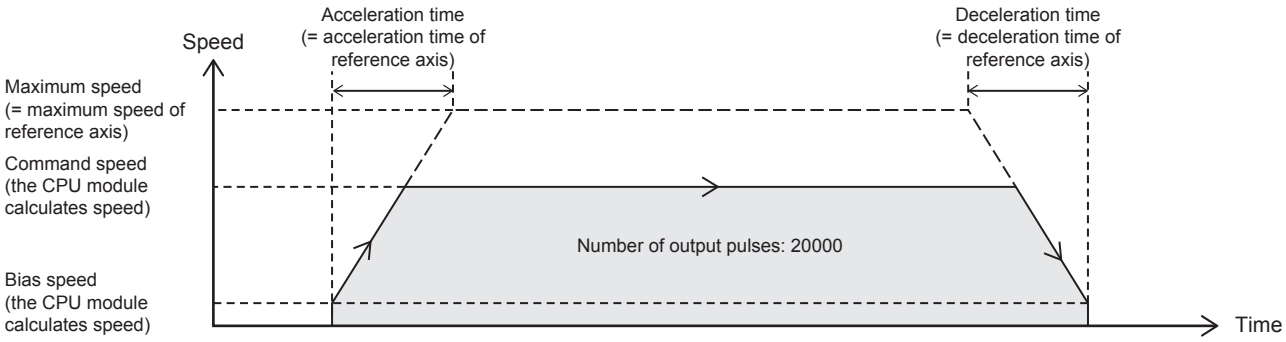
The following is a program example of control method [20: Interpolation Operation (Relative Address Specification)] and [21: Interpolation Operation (Relative Address Specification Target Axis)].




### ■Axis 1 (reference axis)



## ■Axis 2 (counterpart axis)




## Setting data

## ■Positioning parameter (high speed I/O parameter)

| Item | Axis 1 | Axis 2 |
|---|---|---|
| ■Basic Parameter 1 | | |
| Pulse Output Mode | 1: PULSE/SIGN | 1: PULSE/SIGN |
| Output Device (PULSE/CW) | Y0 | Y1 |
| Output Device (SIGN/CCW) | Y4 | Y5 |
| Rotation Direction Setting | 0: Current Address Increment with Forward Run Pulse Output | 0: Current Address Increment with Forward Run Pulse Output |
| Unit Setting | 0: Motor System (pulse, pps) | 0: Motor System (pulse, pps) |
| No. of Pulse per Rotation | 2000 pulse | 2000 pulse |
| Movement Amount per Rotation | 1000 pulse | 1000 pulse |
| Position Data Magnification | 1: × Single | 1: × Single |
| ■Basic Parameter 2 | | |
| Interpolation Speed Specified Method | 1: Reference Axis Speed | 0: Composite Speed |
| Max. Speed | 15000 pps | 100000 pps |
| Bias Speed | 1000 pps | 0 pps |
| Acceleration Time | 500 ms | 100 ms |
| Deceleration Time | 500 ms | 100 ms |
| ■Detailed Setting Parameter | | |
| External Start Signal Enabled/ Disabled | 0: Disabled | 0: Disabled |
| Interrupt Input Signal 1 Enabled/ Disabled | 0: Disabled | 0: Disabled |
| Interrupt Input Signal 2 Logic | 0: Positive Logic | 0: Positive Logic |
| ■OPR Parameter | | |
| OPR Enabled/Disabled | 0: Disabled | 0: Disabled |

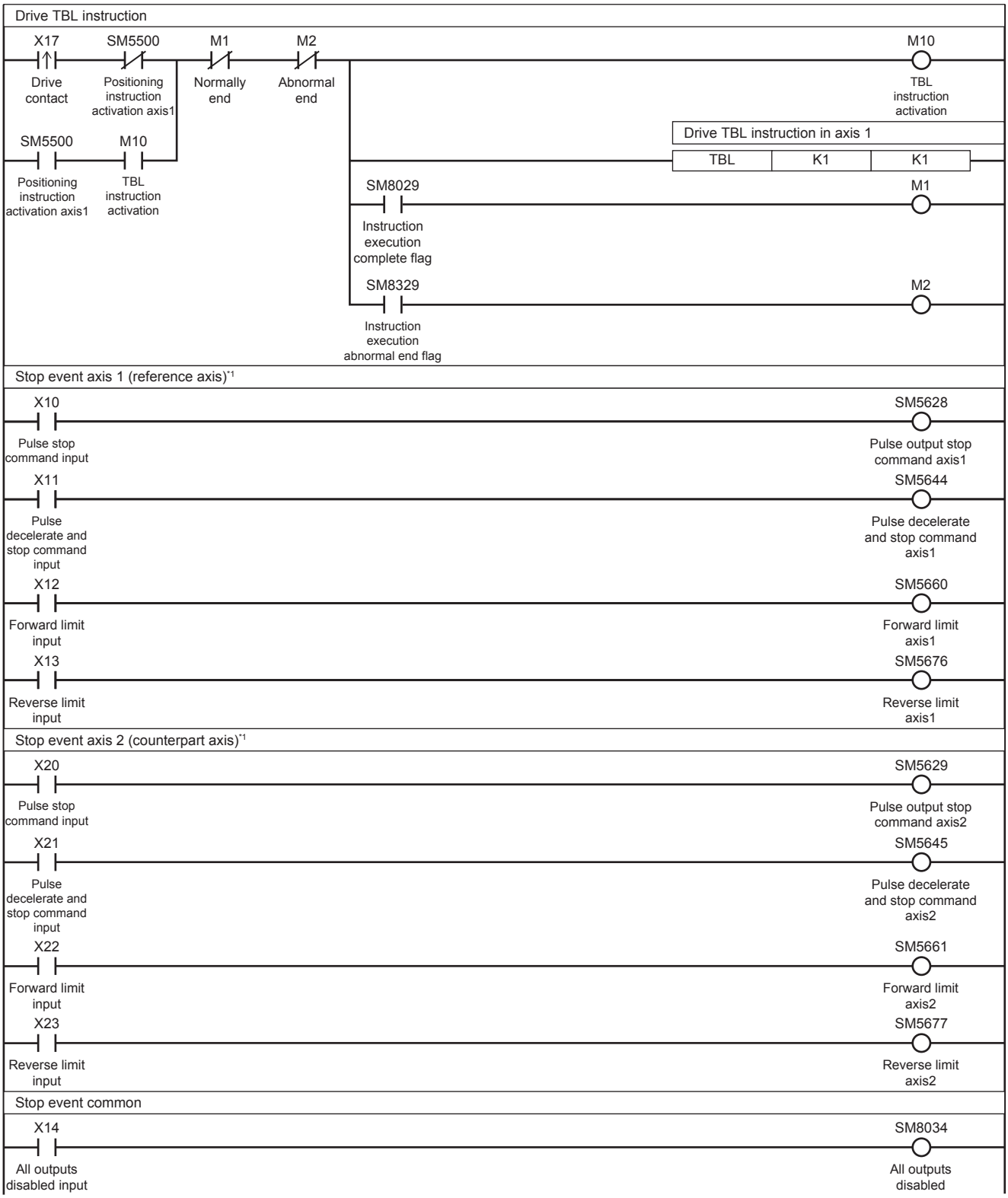
## ■Axis #1 Positioning Data

| No. | Device | Control Method | Axis to be Interpolated | Positioning Address | Command Speed | Dwell Time |
|---|---|---|---|---|---|---|
| 1 | — | 20: Interpolation Operation (Relative Address Specification) | Axis 2 Specification | 50000 pulse | 10000 pps | 100 ms |

## ■Axis #2 Positioning Data

| No. | Device | Control Method | Positioning Address |
|---|---|---|---|
| 1 | — | 21: Interpolation Operation (Relative Address Specification Target Axis) | 20000 pulse |

## Program example



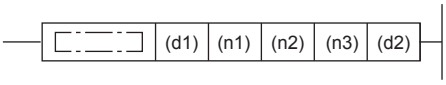
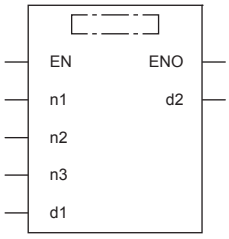

*1 When stop event, is detected in either of the reference axis or counterpart axis, both the axes are stop.

# 32.9 Multiple-table Operation

This instruction executes the control method of multiple specified tables set in the table data with GX Works3.

## DRVTBL

This instruction executes the table data set in GX Works3 in continuous operation or stepping operation.

| Ladder | ST | FBD/LD |
|---|---|---|
|  | ENO:=DRVTBL(EN,n1,n2,n3,d1,d2); |  |

### Setting data

#### ■Description, range, data type

| Operand | Description | Range | Data type | Data type (label) |
|---|---|---|---|---|
| (d1) | Axis number from which pulses are output | ■FX5S CPU module<br>K1 to K4<br>■FX5UJ CPU module<br>K1 to K3, K5 to K12<br>■FX5U/FX5UC CPU module<br>K1 to K12 | 16-bit unsigned binary | ANY16 |
| (n1) | Head table number to be executed | 1 to 100*1 | 16-bit unsigned binary | ANY16_U |
| (n2) | Last table number to be executed | 1 to 100*1 | 16-bit unsigned binary | ANY16_U |
| (n3) | Table execution method | 0, 1 | 16-bit unsigned binary | ANY16_U |
| (d2) | Bit device number of the instruction execution complete flag and abnormal end flag | — | Bit | ANYBIT_ARRAY (Number of elements:2) |
| EN | Execution condition | — | Bit | BOOL |
| ENO | Execution result | — | Bit | BOOL |

*1 CPU module is 1 to 32 when the positioning table data is not set to use device

#### ■Available device

| Operand | Bit | Word | | | Double word | | Indirect specification | Constant | | | Others |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | X, Y, M, L, SM, F, B, SB, S | T, ST, C, D, W, SD, SW, R | U□\G□ | Z | LC | LZ | | K, H | E | $ | |
| (d1) | ○ | ○ | ○ | ○ | — | — | ○ | ○ | — | — | — |
| (n1) | ○ | ○ | ○ | ○ | — | — | ○ | ○ | — | — | — |
| (n2) | ○ | ○ | ○ | ○ | — | — | ○ | ○ | — | — | — |
| (n3) | ○ | ○ | ○ | ○ | — | — | ○ | ○ | — | — | — |
| (d2) | ○ | ○*1 | — | — | — | — | — | — | — | — | — |

*1 T, ST, C cannot be used.

### Processing details

With one DRVTBL instruction, the table data set in GX Works3 can be executed in the continuous operation or stepping operation.

For details on the table setting method and others, refer to ☞ Page 489 TABLE OPERATION.

# Related devices

The following lists the related special devices. The devices other than the following depend on the table control method.
Related devices of axis 4 are available only for the FX5S/FX5U/FX5UC CPU module.

## Special relays

### ■CPU module

| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|
| SM5580 | SM5581 | SM5582 | SM5583 | Table shift command | × | R/W | Page 398 |
| SM5916 | SM5917 | SM5918 | SM5919 | Positioning table data initialization disable | × | R/W | Page 399 |

R/W: Read/write, ×: Not supported

### ■High-speed pulse input/output module

| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SM5584 | SM5585 | SM5586 | SM5587 | SM5588 | SM5589 | SM5590 | SM5591 | Table shift command | × | R/W | Page 398 |
| SM5920 | SM5921 | SM5922 | SM5923 | SM5924 | SM5925 | SM5926 | SM5927 | Positioning table data initialization disable | × | R/W | Page 399 |

R/W: Read/write, ×: Not supported

## Special registers

### ■CPU module

| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|
| SD5506 | SD5546 | SD5586 | SD5626 | Positioning execution table number | × | R | Page 398 |
| SD5511 | SD5551 | SD5591 | SD5631 | Positioning error (error occurrence table No.) | × | R/W | Page 399 |

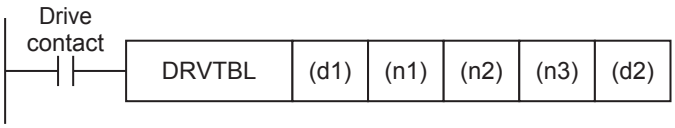
R: Read only, R/W: Read/write, ×: Not supported

### ■High-speed pulse input/output module

| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SD5666 | SD5706 | SD5746 | SD5786 | SD5826 | SD5866 | SD5906 | SD5946 | Positioning execution table number | × | R | Page 398 |
| SD5671 | SD5711 | SD5751 | SD5791 | SD5831 | SD5871 | SD5911 | SD5951 | Positioning error (error occurrence table No.) | × | R/W | Page 399 |

R: Read only, R/W: Read/write, ×: Not supported

# Outline of operation




## Operand specification

**1.** For (d1), specify an axis number (K1 to K12) for which pulses are output.

Specify an axis number whose positioning parameters are set in the high speed I/O parameters. Operation cannot be performed if any other axis number is specified.

[FX5S CPU module]

- K1 to K4: Axis 1 to Axis 4

[FX5UJ CPU module]

- K1 to K3: Axis 1 to Axis 3 (CPU module)
- K5, K6: Axis 5, Axis 6 (High-speed pulse input/output module first module)
- K7, K8: Axis 7, Axis 8 (High-speed pulse input/output module second module)
- K9, K10: Axis 9, Axis 10 (High-speed pulse input/output module third module)
- K11, K12: Axis 11, Axis 12 (High-speed pulse input/output module fourth module)

[FX5U/FX5UC CPU module]

- K1 to K4: Axis 1 to Axis 4 (CPU module)
- K5, K6: Axis 5, Axis 6 (High-speed pulse input/output module first module)
- K7, K8: Axis 7, Axis 8 (High-speed pulse input/output module second module)
- K9, K10: Axis 9, Axis 10 (High-speed pulse input/output module third module)
- K11, K12: Axis 11, Axis 12 (High-speed pulse input/output module fourth module)

**2.** For (n1), specify the head table number (1 to 100[*1]) that is executed in the axis specified in (d1).

**3.** For (n2), specify the last table number (1 to 100[*1]) that is executed in the axis specified in (d1).

The table operation continues until the last table specified in (n2) or table of control method [0: No Positioning] is executed. When (n1) and (n2) are the same, only one table is executed. When (n1) is greater than (n2), the table operation continues either until all the tables are executed or until a table for control method [0: No Positioning] is executed.

**4.** For (n3), specify the table operation method.

- K0: The stepping operation (☞ Page 521 Stepping operation)
- K1: The continuous operation (☞ Page 523 Continuous operation)

**5.** For (d2), specify the bit devices of the instruction execution complete flag and abnormal end flag. (☞ Page 402 Complete flag)

- (d2): Instruction execution complete flag
- (d2)+1: Instruction execution abnormal end flag

*1 CPU module is 1 to 32 when the positioning table data is not set to use device

## Table shift command

In the stepping operation (K0 in (n3)), when the table shift command is detected after operation of a table is completed, the following table is activated. (☞ Page 398 Table shift command) Tables can be shifted with the external start signal. (☞ Page 385 External Start Signal) For details, refer to ☞ Page 521 Stepping operation.

## Operation of the complete flags

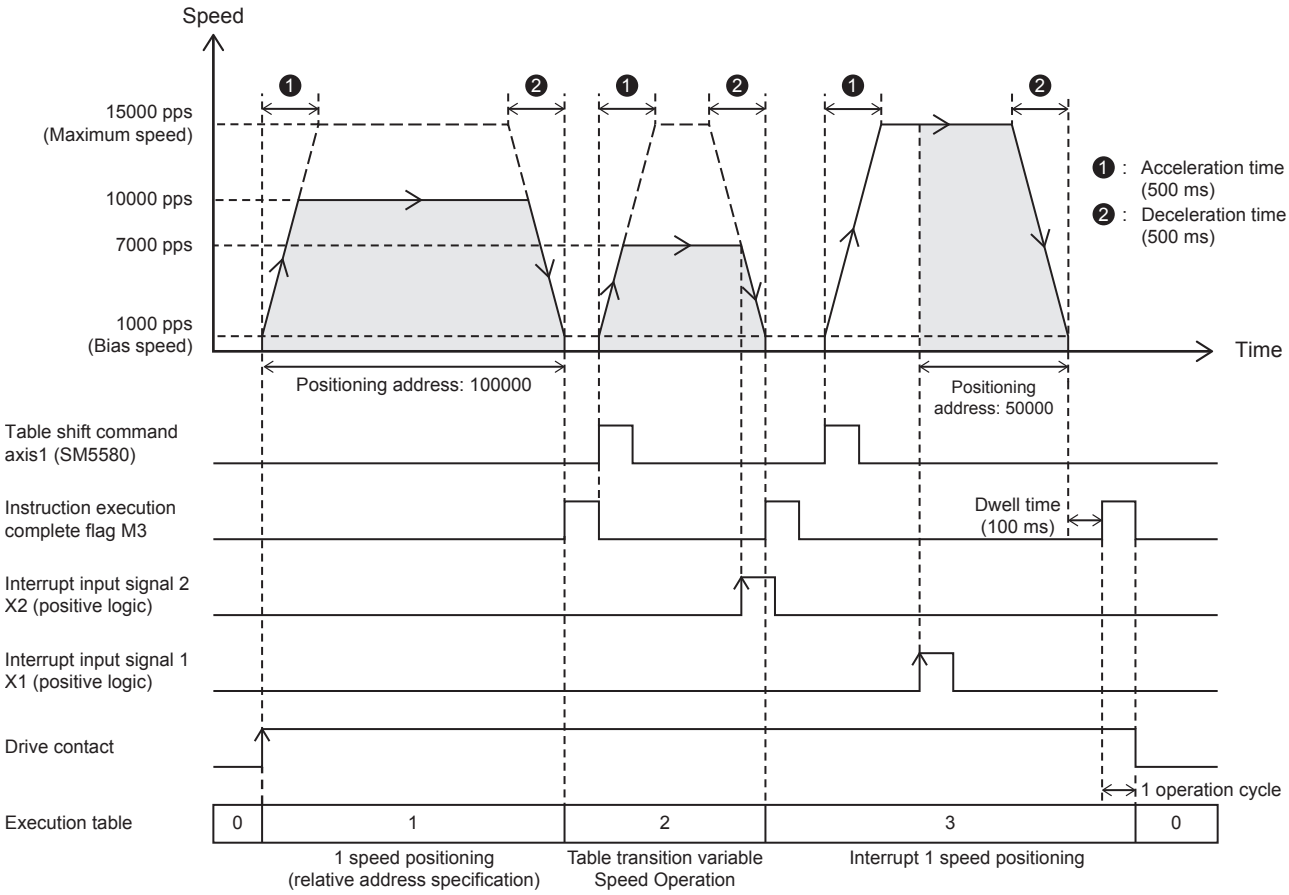
The operation timing of the complete flags depends on the table control method.

# Program example

The following are program examples for executing multiple tables.

## Stepping operation

This program example shows a stepping operation that is performed on axis 1 in order of control methods [1: 1 Speed Positioning (Relative Address Specification)], [5: Table Transition Variable Speed Operation], and [3: Interrupt 1 Speed Positioning].




### Setting data

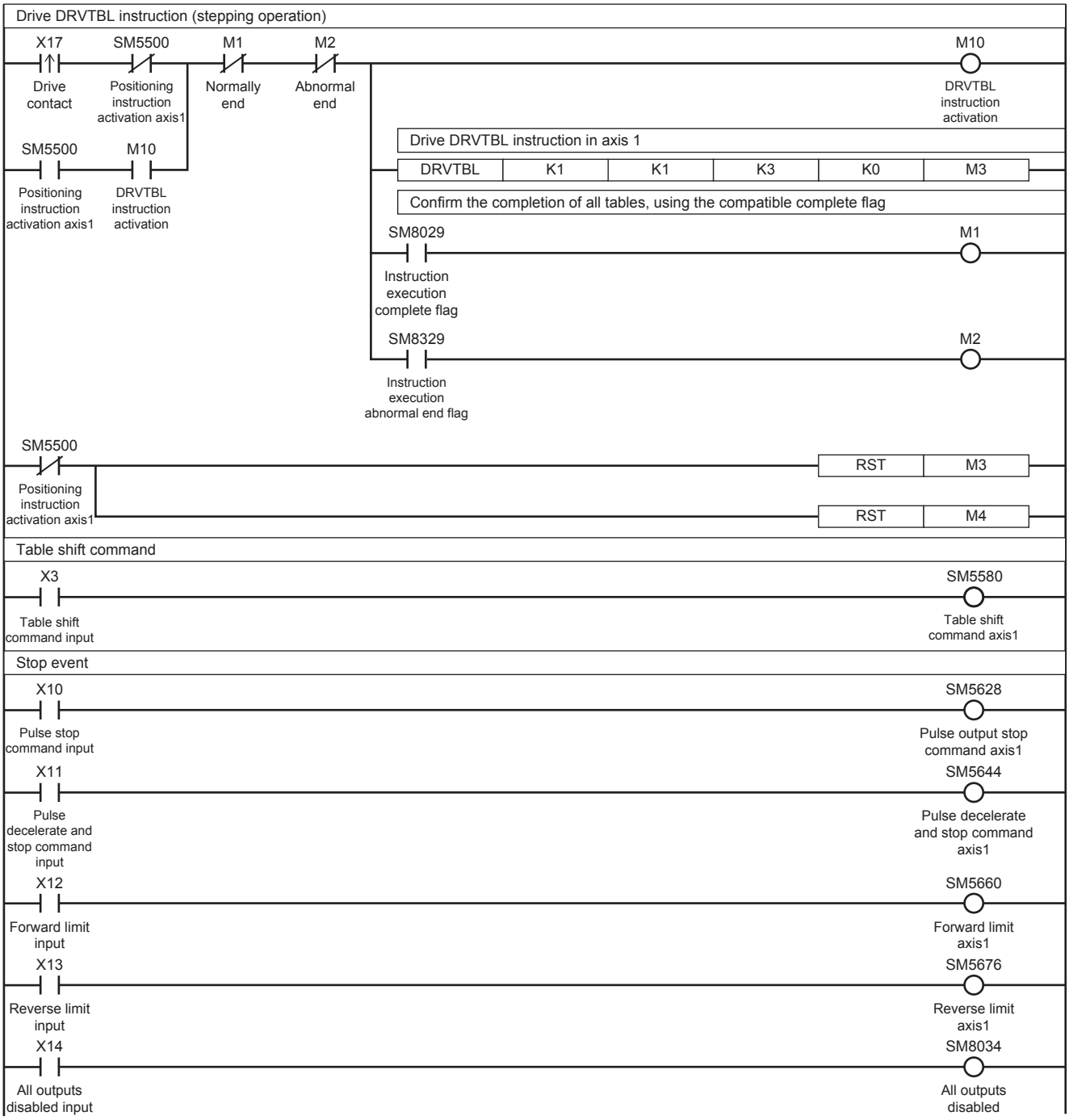
#### ■Positioning parameter (high speed I/O parameter)

| Item | Axis 1 | Item | Axis 1 |
|---|---|---|---|
| ■Basic Parameter 1 | | ■Basic Parameter 2 | |
| Pulse Output Mode | 1: PULSE/SIGN | Interpolation Speed Specified Method | 0: Composite Speed |
| Output Device (PULSE/CW) | Y0 | Max. Speed | 15000 pps |
| Output Device (SIGN/CCW) | Y4 | Bias Speed | 1000 pps |
| Rotation Direction Setting | 0: Current Address Increment with Forward Run Pulse Output | Acceleration Time | 500 ms |
| Unit Setting | 0: Motor System (pulse, pps) | Deceleration Time | 500 ms |
| No. of Pulse per Rotation | 2000 pulse | ■Detailed Setting Parameter | |
| Movement Amount per Rotation | 1000 pulse | External Start Signal Enabled/Disabled | 0: Disabled |
| Positioning Data Magnification | 1: × Single | Interrupt Input Signal 1 Enabled/Disabled | 1: Enabled |
| — | | Interrupt Input Signal 1 Mode | 1: Standard Mode |
| | | Interrupt Input Signal 1 Device No. | X1 |
| | | Interrupt Input Signal 1 Logic | 0: Positive Logic |
| | | Interrupt Input Signal 2 Logic | 0: Positive Logic |
| | | ■OPR Parameter | |
| | | OPR Enabled/Disabled | 0: Disabled |

## ■Axis #1 Positioning Data

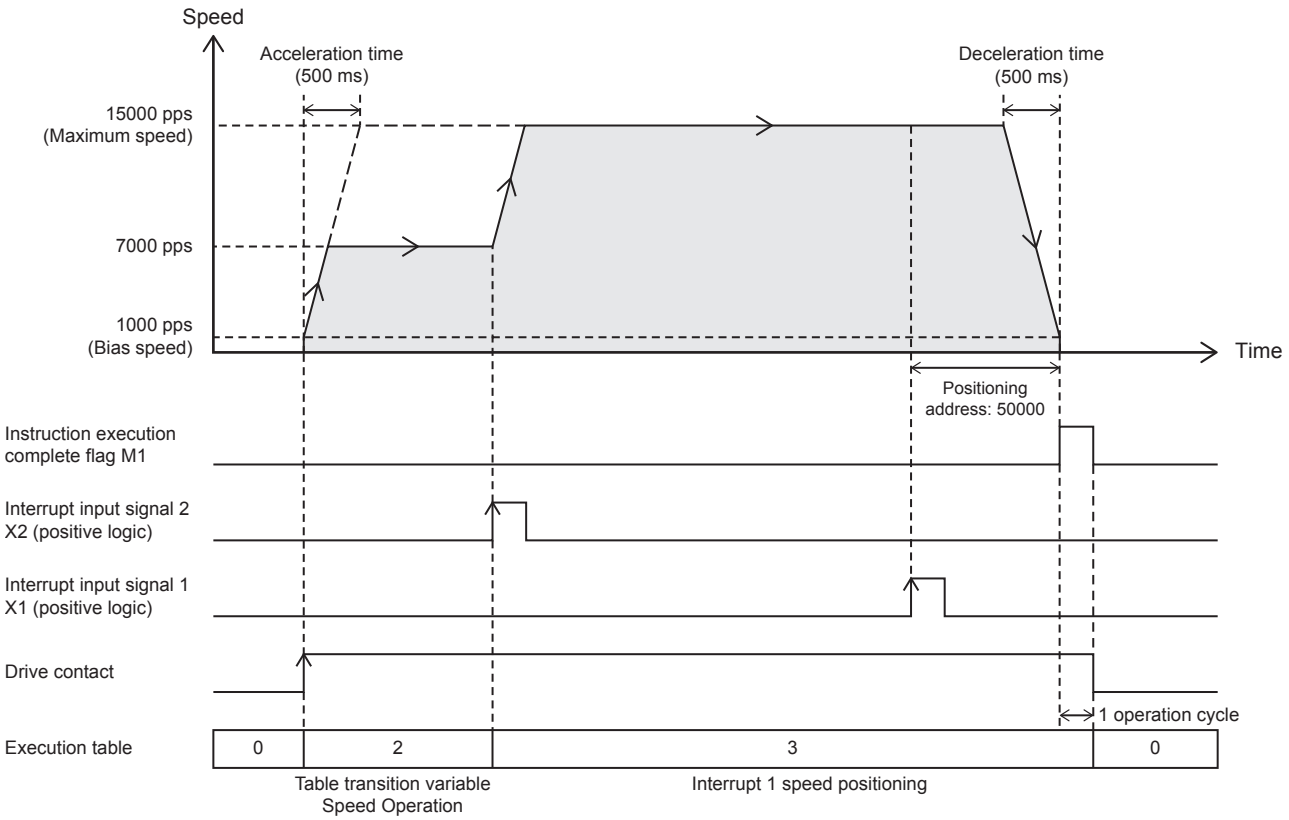
| No. | Device | Control Method | Positioning Address | Command Speed | Dwell Time | Interrupt Input Signal 2 Device No. |
|---|---|---|---|---|---|---|
| 1 | — | 1: 1 Speed Positioning (Relative Address Specification) | 100000 pulse | 10000 pps | 0 ms | — |
| 2 | — | 5: Table Transition Variable Speed Operation | — | 7000 pps | 0 ms | X2 |
| 3 | — | 3: Interrupt 1 Speed Positioning | 50000 pulse | 15000 pps | 100 ms | — |

## Program example



## Continuous operation

This program example shows a continuous operation (interrupt 2-speed positioning) that is performed on axis 1 in the order of control methods [5: Table Transition Variable Speed Operation] and [3: Interrupt 1 Speed Positioning], starting from table No. 2.




### Setting data

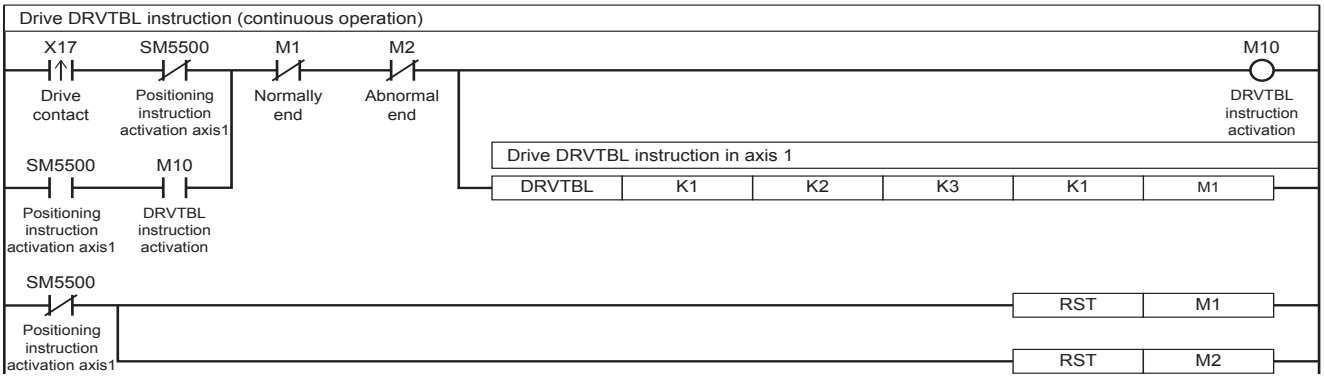
#### ■Positioning parameter (high speed I/O parameter)

| Item | Axis 1 | Item | Axis 1 |
|---|---|---|---|
| ■Basic Parameter 1 | | ■Basic Parameter 2 | |
| Pulse Output Mode | 1: PULSE/SIGN | Interpolation Speed Specified Method | 0: Composite Speed |
| Output Device (PULSE/CW) | Y0 | Max. Speed | 15000 pps |
| Output Device (SIGN/CCW) | Y4 | Bias Speed | 1000 pps |
| Rotation Direction Setting | 0: Current Address Increment with Forward Run Pulse Output | Acceleration Time | 500 ms |
| Unit Setting | 0: Motor System (pulse, pps) | Deceleration Time | 500 ms |
| No. of Pulse per Rotation | 2000 pulse | ■Detailed Setting Parameter | |
| Movement Amount per Rotation | 1000 pulse | External Start Signal Enabled/ Disabled | 0: Disabled |
| Positioning Data Magnification | 1: × Single | Interrupt Input Signal 1 Enabled/ Disabled | 1: Enabled |
| — | | Interrupt Input Signal 1 Mode | 1: Standard Mode |
| | | Interrupt Input Signal 1 Device No. | X1 |
| | | Interrupt Input Signal 1 Logic | 0: Positive Logic |
| | | Interrupt Input Signal 2 Logic | 0: Positive Logic |
| | | ■OPR Parameter | |
| | | OPR Enabled/Disabled | 0: Disabled |

### ■Axis #1 Positioning Data

| No. | Device | Control Method | Positioning Address | Command Speed | Dwell Time | Interrupt Input Signal 2 Device No. |
|---|---|---|---|---|---|---|
| 1 | — | 1: 1 Speed Positioning (Relative Address Specification) | 100000 pulse | 10000 pps | 0 ms | — |
| 2 | — | 5: Table Transition Variable Speed Operation | — | 7000 pps | 0 ms | X2 |
| 3 | — | 3: Interrupt 1 Speed Positioning | 50000 pulse | 15000 pps | 0 ms | — |

### Program example

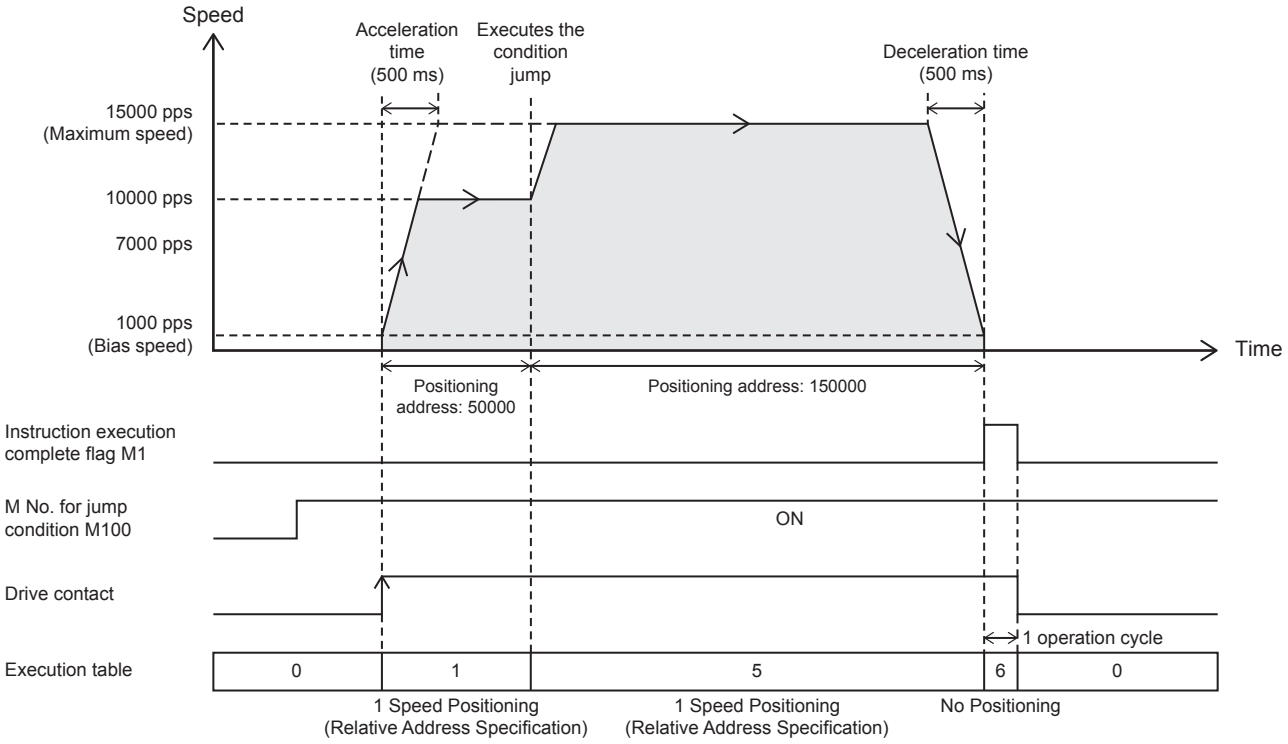



For the stop event, refer to ☞ Page 473 Stepping operation.

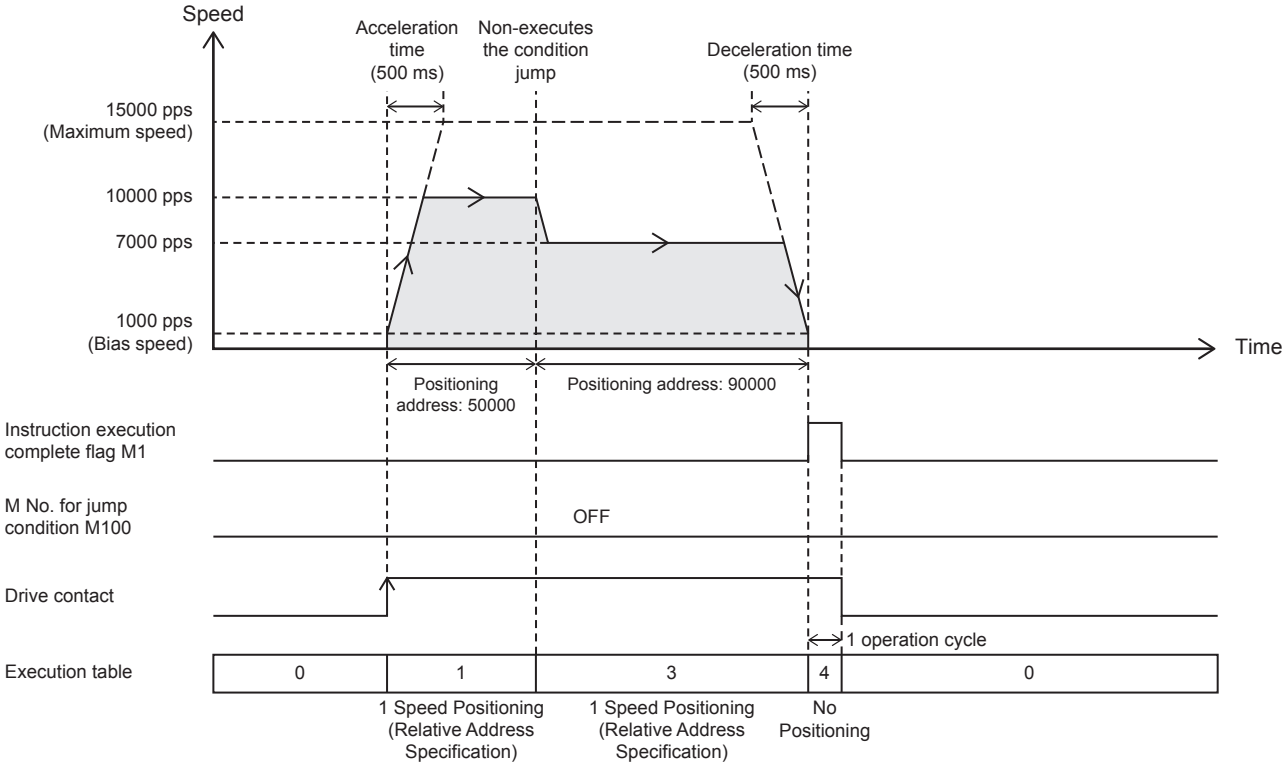
## Continuous operation (condition jump)

This program example shows the operation of a 2-speed positioning that is changed by the execution of control method [10: Condition Jump] on axis 1 (continuous operation).

### ■M No. for jump condition (M100) = ON: Executes the table 5



## ■M No. for jump condition (M100) = OFF: Executes the table 3




## Setting data



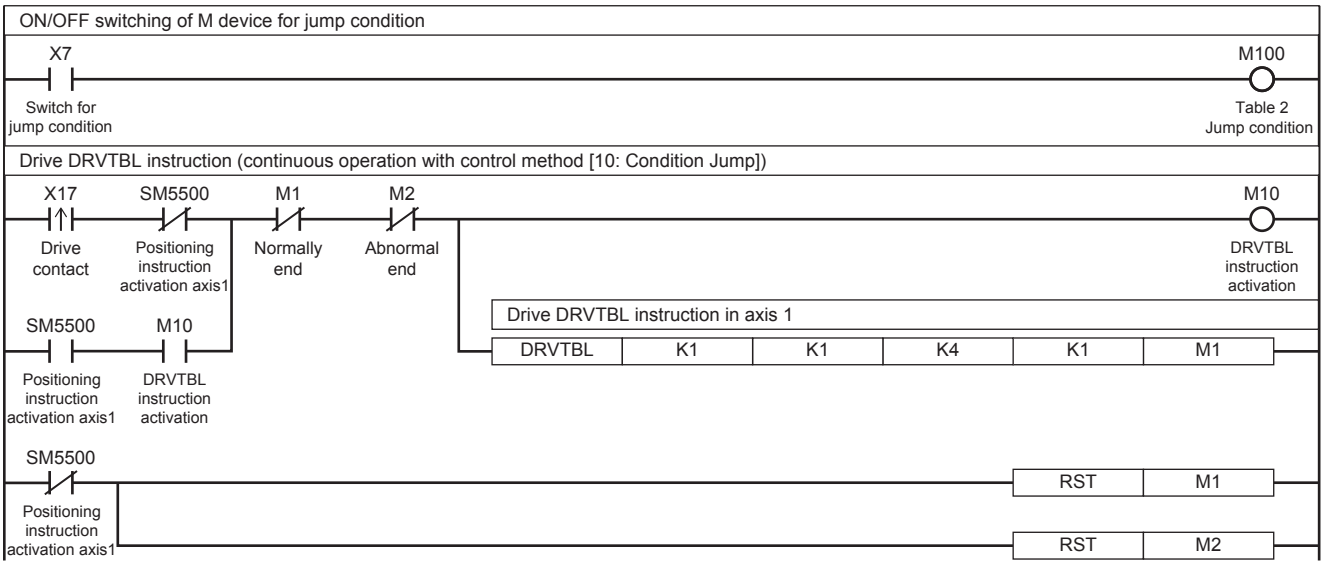
## ■Positioning parameter (high speed I/O parameter)

| Item | Axis 1 | Item | Axis 1 |
|---|---|---|---|
| ■Basic Parameter 1 | | ■Basic Parameter 2 | |
| Pulse Output Mode | 1: PULSE/SIGN | Interpolation Speed Specified Method | 0: Composite Speed |
| Output Device (PULSE/CW) | Y0 | Max. Speed | 15000 pps |
| Output Device (SIGN/CCW) | Y4 | Bias Speed | 1000 pps |
| Rotation Direction Setting | 0: Current Address Increment with Forward Run Pulse Output | Acceleration Time | 500 ms |
| Unit Setting | 0: Motor System (pulse, pps) | Deceleration Time | 500 ms |
| No. of Pulse per Rotation | 2000 pulse | ■Detailed Setting Parameter | |
| Movement Amount per Rotation | 1000 pulse | External Start Signal Enabled/ Disabled | 0: Disabled |
| Positioning Data Magnification | 1: × Single | Interrupt Input Signal 1 Enabled/ Disabled | 0: Disabled |
| — | | Interrupt Input Signal 2 Logic | 0: Positive Logic |
| | | ■OPR Parameter | |
| | | OPR Enabled/Disabled | 0: Disabled |

## ■Axis #1 Positioning Data

| No. | Device | Control Method | Positioning Address | Command Speed | Dwell Time | Jump Destination Table No. | M No. for Jump Condition |
|---|---|---|---|---|---|---|---|
| 1 | — | 1: 1 Speed Positioning (Relative Address Specification) | 50000 pulse | 10000 pps | 0 ms | — | — |
| 2 | — | 10: Condition Jump | — | — | — | 5 | 100 |
| 3 | — | 1: 1 Speed Positioning (Relative Address Specification) | 90000 pulse | 7000 pps | 0 ms | — | — |
| 4 | — | 0: No Positioning | — | — | — | — | — |
| 5 | — | 1: 1 Speed Positioning (Relative Address Specification) | 150000 pulse | 15000 pps | 0 ms | — | — |
| 6 | — | 0: No Positioning | — | — | — | — | — |

### Program example



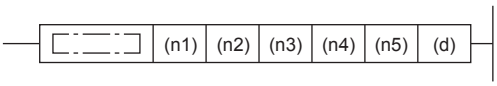
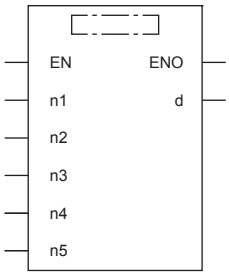

For the stop event, refer to ☞ Page 473 Stepping operation.

# 32.10 Multiple-axis Table Operation

This instruction executes the control method of specified table for multiple axes set in the table data with GX Works3.

## DRVMUL

This instruction executes the table data set in GX Works3 for multiple axes of one module simultaneously.

| Ladder | ST | FBD/LD |
|---|---|---|
|  | ENO:=DRVMUL(EN,n1,n2,n3,n4,n5,d); |  |

## Setting data

### ■Description, range, data type

| Operand | Description | Range | Data type | Data type (label) |
|---|---|---|---|---|
| (n1) | Head axis number | ■FX5S CPU module<br>K1<br>■FX5UJ/FX5U/FX5UC CPU module<br>K1, K5, K7, K9, K11 | 16-bit unsigned binary | ANY16_U |
| (n2) | Table number of the axis 1 | 0 to 100*1 | 16-bit unsigned binary | ANY16_U |
| (n3) | Table number of the axis 2 | 0 to 100*1 | 16-bit unsigned binary | ANY16_U |
| (n4) | Table number of the axis 3 | 0 to 100*1 | 16-bit unsigned binary | ANY16_U |
| (n5) | Table number of the axis 4 | 0 to 100*1 | 16-bit unsigned binary | ANY16_U |
| (d) | Bit device number of the instruction execution complete flag and abnormal end flag | — | Bit | ANYBIT_ARRAY (Number of elements:8) |
| EN | Execution condition | — | Bit | BOOL |
| ENO | Execution result | — | Bit | BOOL |

*1 CPU module is 1 to 32 when the positioning table data is not set to use device

### ■Available device

| Operand | Bit | Word | | | Double word | | Indirect specification | Constant | | | Others |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | X, Y, M, L, SM, F, B, SB, S | T, ST, C, D, W, SD, SW, R | U□\G□ | Z | LC | LZ | | K, H | E | $ | |
| (n1) | ○ | ○ | ○ | ○ | — | — | ○ | ○ | — | — | — |
| (n2) | ○ | ○ | ○ | ○ | — | — | ○ | ○ | — | — | — |
| (n3) | ○ | ○ | ○ | ○ | — | — | ○ | ○ | — | — | — |
| (n4) | ○ | ○ | ○ | ○ | — | — | ○ | ○ | — | — | — |
| (n5) | ○ | ○ | ○ | ○ | — | — | ○ | ○ | — | — | — |
| (d) | ○ | ○*1 | — | — | — | — | — | — | — | — | — |

*1 T, ST, C cannot be used.

## Processing details

This function executes the tables of multiple axes of simultaneously. After this function is executed, each axis operates independently and continuous operation can be performed. However, simultaneous execution is possible only for axes in the same module.

For details on the table setting method and others, refer to ☞ Page 489 TABLE OPERATION.

# Related devices

The following lists the related special devices. The devices other than the following depend on the table control method. Related devices of axis 4 are available only for the FX5S/FX5U/FX5UC CPU module.

## Special relays

### ■CPU module

| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|
| SM5916 | SM5917 | SM5918 | SM5919 | Positioning table data initialization disable | × | R/W | Page 399 |

R/W: Read/write, ×: Not supported

### ■High-speed pulse input/output module

| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SM5920 | SM5921 | SM5922 | SM5923 | SM5924 | SM5925 | SM5926 | SM5927 | Positioning table data initialization disable | × | R/W | Page 399 |

R/W: Read/write, ×: Not supported

## Special registers

### ■CPU module

| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|
| SD5506 | SD5546 | SD5586 | SD5626 | Positioning execution table number | × | R | Page 398 |
| SD5511 | SD5551 | SD5591 | SD5631 | Positioning error (error occurrence table No.) | × | R/W | Page 399 |

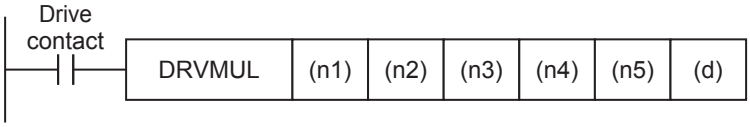
R: Read only, R/W: Read/write, ×: Not supported

### ■High-speed pulse input/output module

| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SD5666 | SD5706 | SD5746 | SD5786 | SD5826 | SD5866 | SD5906 | SD5946 | Positioning execution table number | × | R | Page 398 |
| SD5671 | SD5711 | SD5751 | SD5791 | SD5831 | SD5871 | SD5911 | SD5951 | Positioning error (error occurrence table No.) | × | R/W | Page 399 |

R: Read only, R/W: Read/write, ×: Not supported

# Outline of operation




## Operand specification

***1.*** For (n1), specify the head axis number for which pulses are output.

[FX5S CPU module]

- K1: Axis 1 (The tables of axes 1 to 4 are simultaneously executed.)

[FX5UJ CPU module]

- K1: Axis 1 (The tables of axes 1 to 3 are simultaneously executed.)
- K5: Axis 5 (The tables of axes 5 and 6 (High-speed pulse input/output module first module) are simultaneously executed.)
- K7: Axis 7 (The tables of axes 7 and 8 (High-speed pulse input/output module second module) are simultaneously executed.)
- K9: Axis 9 (The tables of axes 9 and 10 (High-speed pulse input/output module third module) are simultaneously executed.)
- K11: Axis 11 (The tables of axes 11 and 12 (High-speed pulse input/output module fourth module) are simultaneously executed.)

[FX5U/FX5UC CPU module]

- K1: Axis 1 (The tables of axes 1 to 4 are simultaneously executed.)
- K5: Axis 5 (The tables of axes 5 and 6 (High-speed pulse input/output module first module) are simultaneously executed.)
- K7: Axis 7 (The tables of axes 7 and 8 (High-speed pulse input/output module second module) are simultaneously executed.)
- K9: Axis 9 (The tables of axes 9 and 10 (High-speed pulse input/output module third module) are simultaneously executed.)
- K11: Axis 11 (The tables of axes 11 and 12 (High-speed pulse input/output module fourth module) are simultaneously executed.)

**2.** For (n2), specify the head table number (1 to 100*1) that is executed in the axis specified in (n1).

When the positioning instruction of the axis (n1) is not to be executed or positioning parameters of the axis (n1) are not set for high speed I/O parameter, specify K0. When (n2) is indirectly specified using a word device, continuous operation is performed. (☞ Page 523 Continuous operation) The specified word devices are assigned as follows.

- Device specified in (n2): Head table number
- Device specified in (n2) + 1: Last table number

**3.** For (n3), specify the head table number (1 to 100*1) that is executed in the axis specified in (n1) + 1.

When the positioning instruction of the axis (n1) + 1 is not to be executed or positioning parameters of the axis (n1) +1 are not set for high speed I/O parameter, specify K0. When (n3) is indirectly specified using a word device, continuous operation is performed. The specified word devices are assigned as follows.

- Device specified in (n3): Head table number
- Device specified in (n3) + 1: Last table number

**4.** For (n4), specify the head table number (1 to 100*1) that is executed in the axis specified in (n1) +2.

When the positioning instruction of the axis (n1) +2 is not to be executed, positioning parameters of the axis (n1) +2 are not set for high speed I/O parameter, or high-speed pulse input/output module ((n1) = K5, K7, K9, K11) are used, specify K0. When (n4) is indirectly specified using a word device, continuous operation is performed. The specified word devices are assigned as follows.

- Device specified in (n4): Head table number
- Device specified in (n4) + 1: Last table number

**5.** For (n5), specify the head table number (1 to 100*1) that is executed in the axis specified in (n1) + 3.

When the positioning instruction of the axis (n1) + 3 is not to be executed, positioning parameters of the axis (n1) +3 are not set for high speed I/O parameter, FX5UJ CPU module ((n1) = K1) or high-speed pulse input/output module ((n1) = K5, K7, K9, K11) are used, specify K0. When (n5) is indirectly specified using a word device, continuous operation is performed. The specified word devices are assigned as follows.

- Device specified in (n5): Head table number
- Device specified in (n5) + 1: Last table number

**6.** For (d), specify the bit devices of the instruction execution complete flag and abnormal end flag of each axis. The device assignment is as follows. (☞ Page 402 Complete flag)

- (d): Instruction execution complete flag of (n1)
- (d)+1: Instruction execution abnormal end flag of (n1)
- (d)+2: Instruction execution complete flag of (n1)+1
- (d)+3: Instruction execution abnormal end flag of (n1)+1
- (d)+4: Instruction execution complete flag of (n1)+2*2
- (d)+5: Instruction execution abnormal end flag of (n1)+2*2
- (d)+6: Instruction execution complete flag of (n1)+3*3
- (d)+7: Instruction execution abnormal end flag of (n1)+3*3

*1 CPU module is 1 to 32 when the positioning table data is not set to use device

*2 The complete flag is assigned only in CPU module.

*3 The complete flag or end flag is assigned only in FX5S/FX5U/FX5UC CPU module.

## When the interpolation operation table is specified

When interpolation operation is specified by the DRVMUL instruction, specify the table number only for the reference axis and set the table number of the counterpart axis to 0.

An error occurs otherwise.

## External start signal

The external start signal of the axis with the smallest number that satisfies the following conditions is enabled. When the external start signal of an axis is enabled, the external start signal of the other axes with larger numbers are disabled.

- External start signal is enabled.
- Table number with the axis specified is executed. (If pulses are not output in the table setting, the external start signal is disabled.)

## Operation of the complete flags

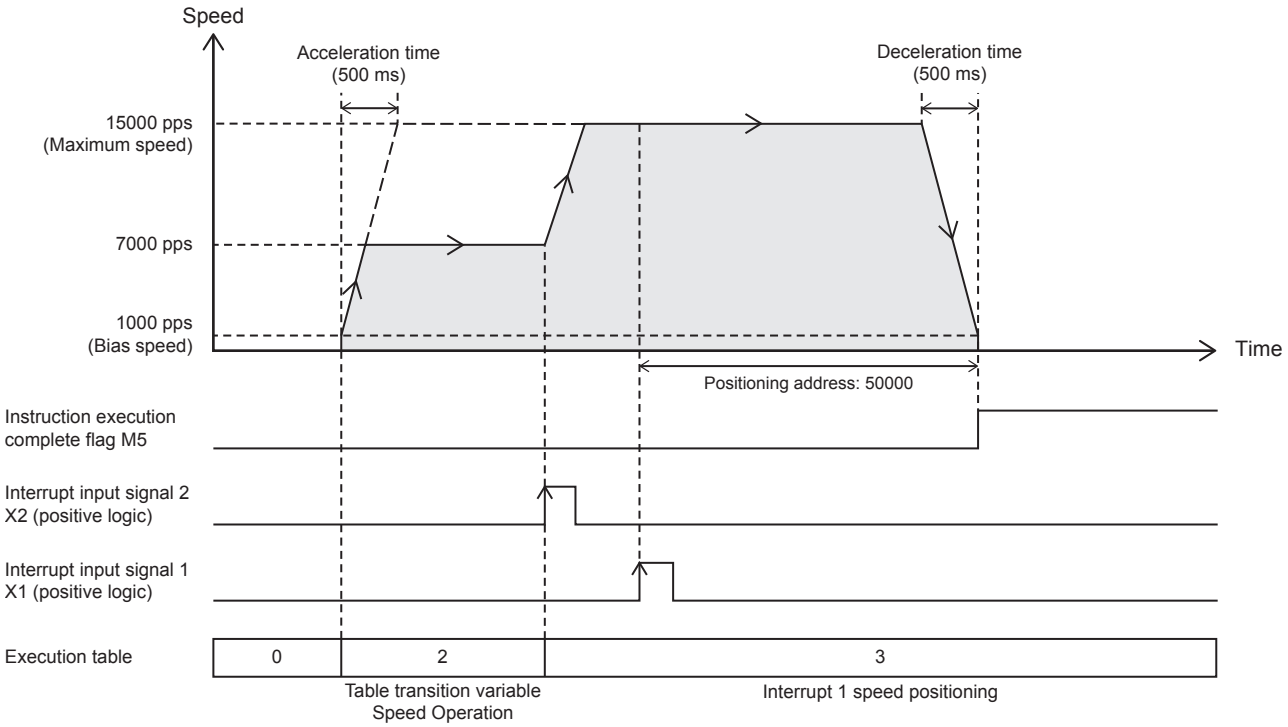
The operation timing of the complete flags depends on the table control method.

The FX3 compatible devices (SM8029 and SM8329) cannot be used.

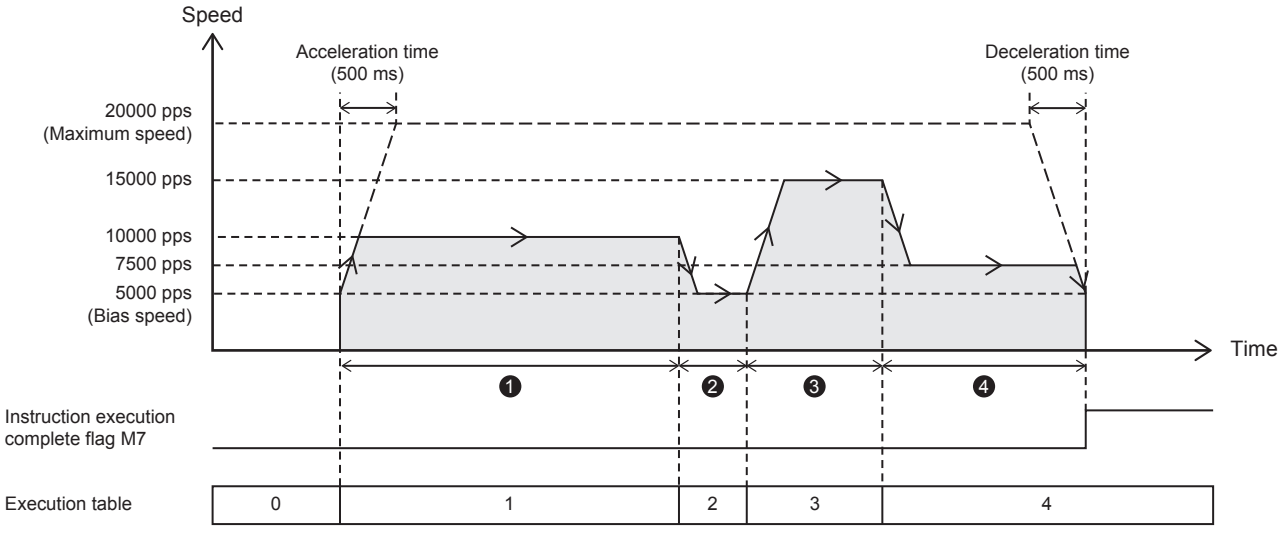
# Program example

The following is the program example of FX5S/FX5U/FX5UC CPU module that executes each operation of axes 1, 2, and 4 simultaneously.

■Axis 1 (Interrupt 2-speed positioning)




■Axis 2 (4-speed positioning)



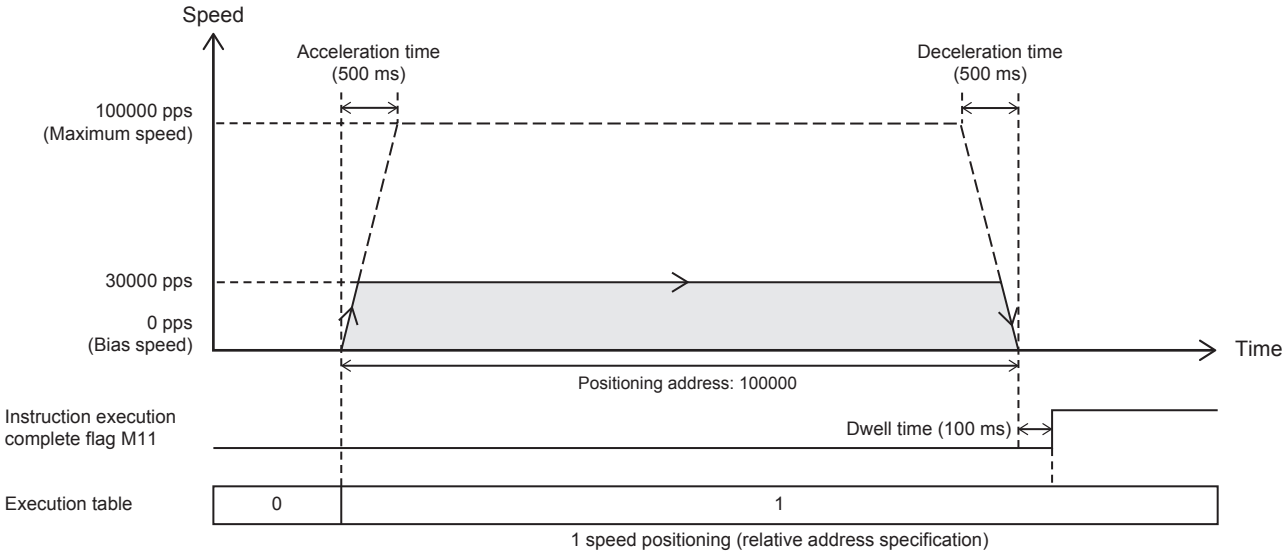

❶Control method [1: 1 Speed Positioning (Relative Address Specification)], positioning address: 50000

❷Control method [2: 1 Speed Positioning (Absolute Address Specification)], positioning address: 60000 (output only +10000)

❸Control method [1: 1 Speed Positioning (Relative Address Specification)], positioning address: 20000

❹Control method [1: 1 Speed Positioning (Relative Address Specification)], positioning address: 30000

■Axis 4 (1-speed positioning)




## Setting data

### ■Positioning parameter (high speed I/O parameter)

| Item | Axis 1 | Axis 2 | Axis 4 |
|---|---|---|---|
| ■Basic Parameter 1 | | | |
| Pulse Output Mode | 1: PULSE/SIGN | 1: PULSE/SIGN | 1: PULSE/SIGN |
| Output Device (PULSE/CW) | Y0 | Y1 | Y3 |
| Output Device (SIGN/CCW) | Y4 | Y5 | Y7 |
| Rotation Direction Setting | 0: Current Address Increment with Forward Run Pulse Output | 0: Current Address Increment with Forward Run Pulse Output | 0: Current Address Increment with Forward Run Pulse Output |
| Unit Setting | 0: Motor System (pulse, pps) | 0: Motor System (pulse, pps) | 0: Motor System (pulse, pps) |
| No. of Pulse per Rotation | 2000 pulse | 2000 pulse | 2000 pulse |
| Movement Amount per Rotation | 1000 pulse | 1000 pulse | 1000 pulse |
| Position Data Magnification | 1: × Single | 1: × Single | 1: × Single |
| ■Basic Parameter 2 | | | |
| Interpolation Speed Specified Method | 0: Composite Speed | 0: Composite Speed | 0: Composite Speed |
| Max. Speed | 15000 pps | 20000 pps | 100000 pps |
| Bias Speed | 1000 pps | 5000 pps | 0 pps |
| Acceleration Time | 500 ms | 500 ms | 500 ms |
| Deceleration Time | 500 ms | 500 ms | 500 ms |
| ■Detailed Setting Parameter | | | |
| External Start Signal Enabled/ Disabled | 0: Disabled | 0: Disabled | 0: Disabled |
| Interrupt Input Signal 1 Enabled/ Disabled | 1: Enabled | 0: Disabled | 0: Disabled |
| Interrupt Input Signal 1 Mode | 1: Standard Mode | — | — |
| Interrupt Input Signal 1 Device No. | X1 | — | — |
| Interrupt Input Signal 1 Logic | 0: Positive Logic | — | — |
| Interrupt Input Signal 2 Logic | 0: Positive Logic | 0: Positive Logic | 0: Positive Logic |
| ■OPR Parameter | | | |
| OPR Enabled/Disabled | 0: Disabled | 0: Disabled | 0: Disabled |

## ■Axis #1 Positioning Data

| No. | Device | Control Method | Positioning Address | Command Speed | Dwell Time | Interrupt Input Signal 2 Device No. |
|---|---|---|---|---|---|---|
| 1 | — | 1: 1 Speed Positioning (Relative Address Specification) | 100000 pulse | 10000 pps | 0 ms | — |
| 2 | — | 5: Table Transition Variable Speed Operation | — | 7000 pps | 0 ms | X2 |
| 3 | — | 3: Interrupt 1 Speed Positioning | 50000 pulse | 15000 pps | 0 ms | — |

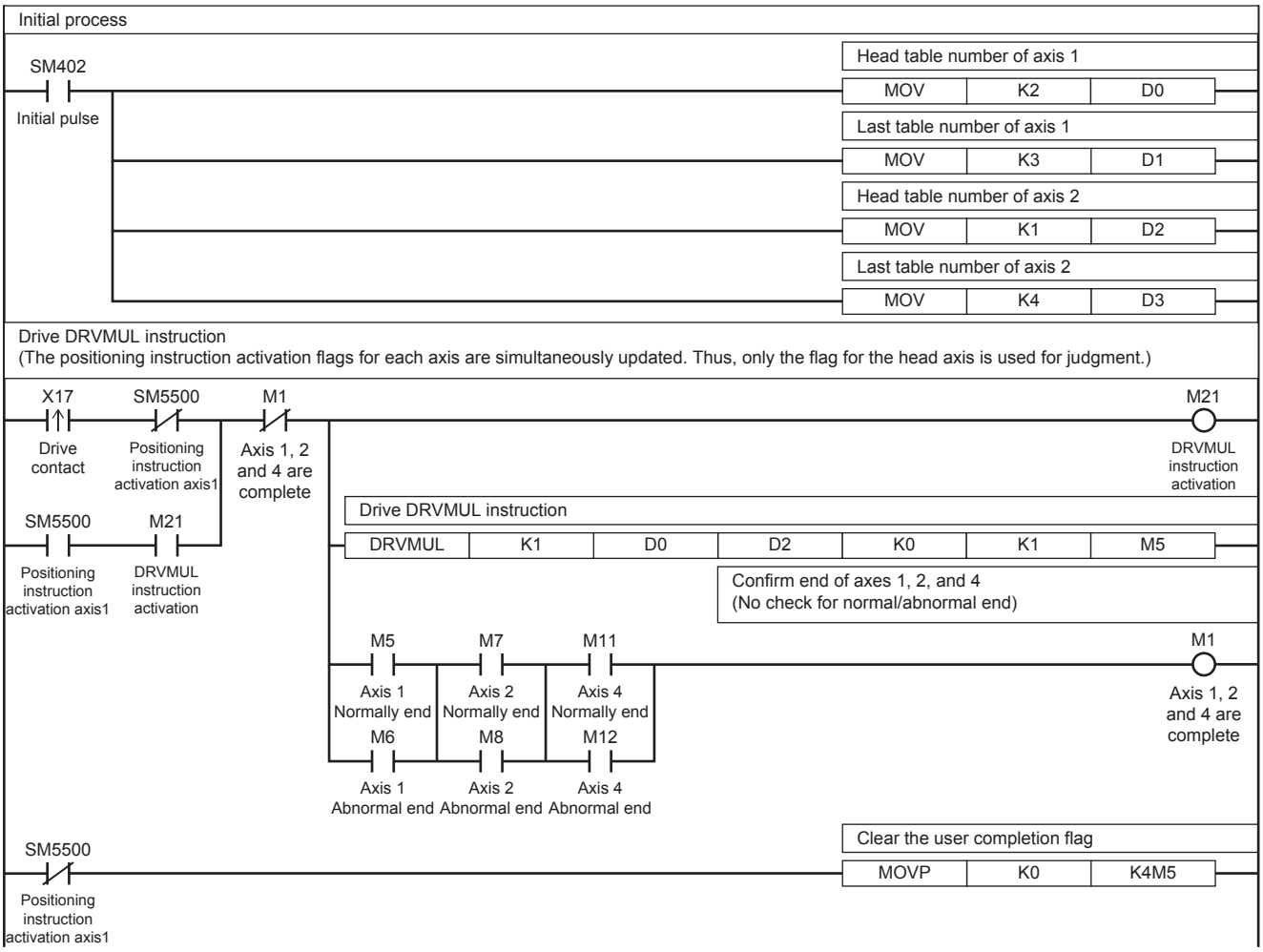
## ■Axis #2 Positioning Data

| No. | Device | Control Method | Positioning Address | Command Speed | Dwell Time |
|---|---|---|---|---|---|
| 1 | — | 1: 1 Speed Positioning (Relative Address Specification) | 50000 pulse | 10000 pps | 0 ms |
| 2 | — | 2: 1 Speed Positioning (Absolute Address Specification) | 60000 pulse | 5000 pps | 0 ms |
| 3 | — | 1: 1 Speed Positioning (Relative Address Specification) | 20000 pulse | 15000 pps | 0 ms |
| 4 | — | 1: 1 Speed Positioning (Relative Address Specification) | 30000 pulse | 7500 pps | 0 ms |

## ■Axis #4 Positioning Data

| No. | Device | Control Method | Positioning Address | Command Speed | Dwell Time |
|---|---|---|---|---|---|
| 1 | — | 2: 1 Speed Positioning (Absolute Address Specification) | 100000 pulse | 30000 pps | 100 ms |

## Program example

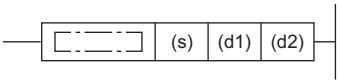
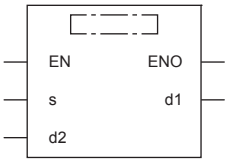


# 32.11 Absolute Position Detection System

With the use of the servo absolute position detection system, the positioning uses the current ABS value read-out (DABS) instruction to read out the current value (absolute position (ABS) data) from the MR-J4□A or MR-J3□A servo amplifier. The data is converted into pulse when being read.

## DABS

This instruction reads the absolute position (ABS) data when the servo amplifier is connected. The data is converted into pulse when being read.

| Ladder | ST | FBD/LD |
|---|---|---|
|  | ENO:=DABS(EN,s,d1,d2); |  |

### Setting data

#### ■Description, range, data type

| Operand | Description | Range | Data type | Data type (label) |
|---|---|---|---|---|
| (s) | First number of the device that inputs the output signal for the absolute position (ABS) data from the servo amplifier | — | Bit | ANYBIT_ARRAY (Number of elements:3) |
| (d1) | First number of the device that outputs the absolute position (ABS) data control signal to the servo amplifier | — | Bit | ANYBIT_ARRAY (Number of elements:3) |
| (d2) | Absolute position (ABS) data (32-bit value) storage device number | — | 32-bit signed binary | ANY32 |
| EN | Execution condition | — | Bit | BOOL |
| ENO | Execution result | — | Bit | BOOL |

#### ■Available device

| Operand | Bit | Word | | | Double word | | Indirect specification | Constant | | | Others |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | X, Y, M, L, SM, F, B, SB, S | T, ST, C, D, W, SD, SW, R | U□\G□ | Z | LC | LZ | | K, H | E | $ | |
| (s) | ○ | ○*1 | — | — | — | — | — | — | — | — | — |
| (d1) | ○ | ○*1 | — | — | — | — | — | — | — | — | — |
| (d2) | ○ | ○ | ○ | — | ○ | ○ | ○ | ○ | — | — | — |

*1 T, ST, C cannot be used.

### Processing details

This instruction reads the absolute position (ABS) data when the servo amplifier is connected. The data is converted into pulse when being read.

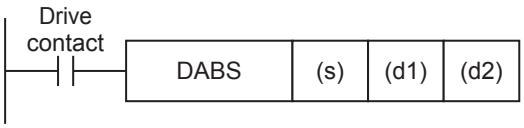
## Related devices

The following lists the related special devices.

| FX3 compatible | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|
| SM8029 | Instruction execution complete flag | × | R | Page 402 |
| SM8329 | Instruction execution abnormal end flag | × | R | |

R: Read only, ×: Not supported

# Outline of operation




## Operand specification

**1.** For (s), specify the first number of the device that inputs the output signal for ABS data from the servo amplifier. The device assignment is as follows.

- (s): ABS (bit 0)
- (s)+1: ABS (bit 1)
- (s)+2: "Send data ready" signal

**2.** For (d1), specify the first number of the device that outputs the ABS data control signal to the servo amplifier. The device assignment is as follows.

- (d1): Servo-ON signal
- (d1)+1: "ABS data transfer mode" signal
- (d1)+2: ABS request signal

**3.** For (d2), specify the number of the device that stores the ABS data (-2147483648 to +2147483647 in pulses) read from the servo amplifier.

Always specify a data register as the specified device. After that, transfer the ABS data from the data register in which the ABS data is stored to the current address (pulse unit) by the HCMOV/DHCMOV instruction.

## Detection of absolute position

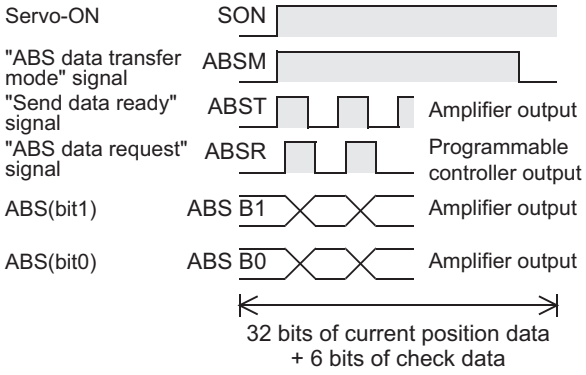
**1.** If the DABS instruction turns ON, the CPU module will activate the servo-ON output and the ABS transfer mode output.

**2.** 32+6-bit data communication will be performed while mutually checking the data sending/receiving condition using the "send data ready" signal and the "ABS data request" signal.

**3.** The 2-bit line (line for ABS bit 0 and bit 1) will be used for data transmission.

**4.** At the completion of ABS data read, the "Execution complete" flag will turn on.

Example of MR-J4□A




**Point**

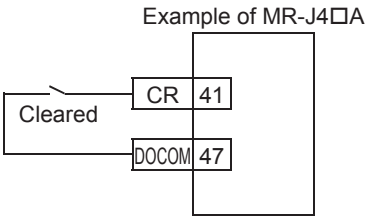
Up to 16 DABS instructions can be driven simultaneously.

## Initial OPR

When your system is established, even if your servo motor is equipped with an absolute position detection function, it is necessary to perform OPR at least once to send the clear signal to the servo motor.

Use one of the following methods for the initial OPR:

- Enable the clear signal function using the DSZR/DDSZR instruction, and perform OPR. (☞ Page 413 Mechanical OPR, Page 391 Clear Signal Output)
- Carry out OPR for the machine using the position adjustment method in the jogging operation mode or manual operation mode, and then input the clear signal. To input the clear signal to the servo amplifier, use the output of the programmable controller or the external switch shown in the following figure.



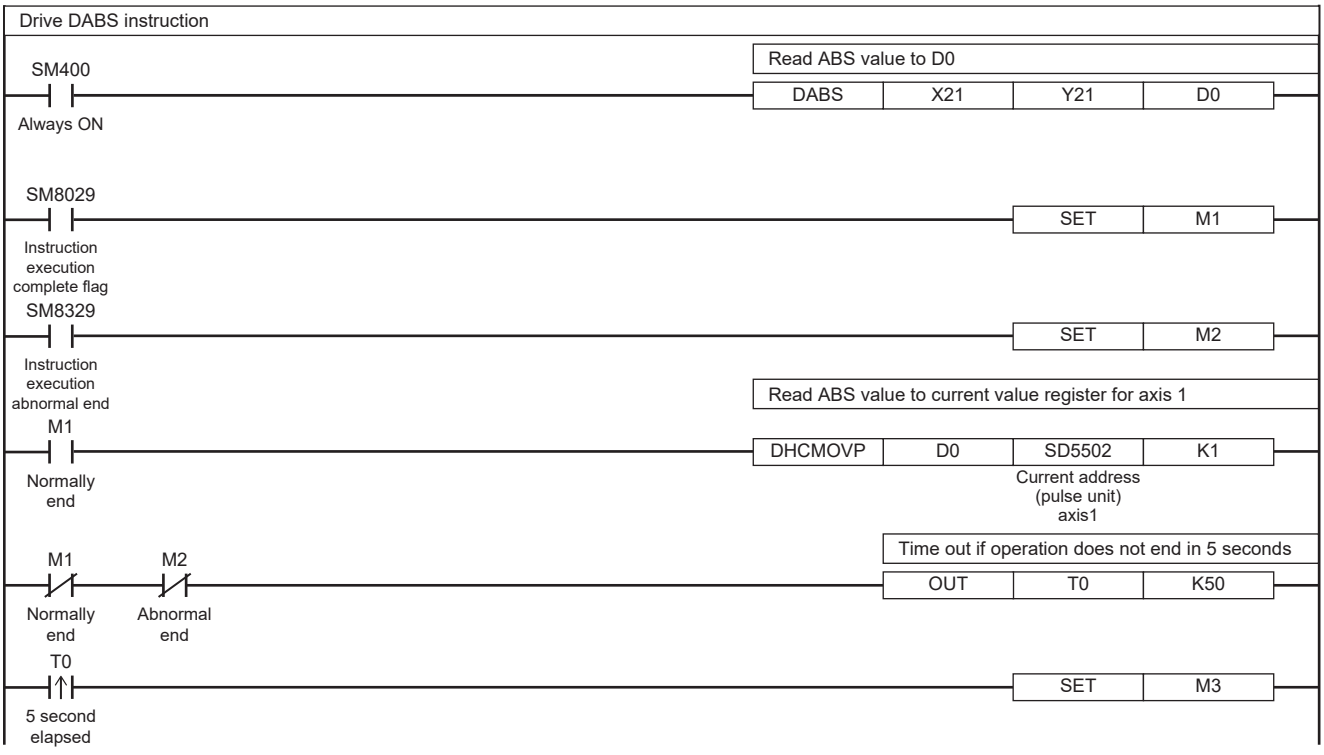

## Operation of the complete flags

The following describes the operation timings of the complete flags.

| Item | FX3 compatible | |
|---|---|---|
| | Instruction execution complete flag (SM8029) | Instruction execution abnormal end flag (SM8329) |
| ON condition | When ABS data has been normally read from the servo amplifier | From when the following error occurs to when the error cause is eliminated and the drive contact is turned off<br>• The three specified devices cannot be secured.<br>• Sum error of the ABS data read from the servo amplifier<br>• Upper limit on the number of ABS instructions simultaneously executed |
| ON → OFF condition | When the drive contact is turned off | |

# Program example

The following is a program example of reading the current ABS value.



## Caution

For details on the servo amplifier, refer to the manual for each servo amplifier.

- Set the timing sequence for powering on your system so that the power of the programmable controller is turned on after the power of the servo amplifier, or that power is turned on at the same time.
- Leave the drive contact ON after read the ABS value. If the instruction drive contact is turned off at the completion of ABS data read, the servo-ON (SON) signal will be turned off, and the operation will not be performed.
- If the drive contact is turned off during data reading, data reading will be stopped.
- If data communication with the servo amplifier fails, the failure is not detected as an error. Thus, monitor the error using the time-out error detection timer.
- When using the DABS instruction, set the rotation direction of the servo motor as follows. If the setting is incorrect, the current value controlled by the programmable controller may not match with the sign (positive or negative) in the servo amplifier after the ABS value is read.

| Rotation direction | Setting in servo amplifier |
|---|---|
| Current value is increased by forward rotation pulses | Forward rotation (CCW) when forward rotation pulses are input<br>Reverse rotation (CW) when reverse rotation pulses are input |
| Current value is decreased by reverse rotation pulses | Forward rotation (CW) when reverse rotation pulses are input<br>Reverse rotation (CCW) when forward rotation pulses are input |

# 33 TABLE OPERATION



This chapter describes the table operation in the following items.

- How to use the positioning table in GX Works3
- Operations of each control method
- How to execute multiple tables (stepping operation and continuous operation)

## 33.1 How to Use the Positioning Table

The following procedure is required to perform positioning in table operation.

1. Set the positioning parameter in the high speed I/O parameter of GX Works3. (☞ Page 366 Setting Method)
2. Set the table data in the high speed I/O parameter of GX Works3. (☞ Page 489 How to Use the Positioning Table)
3. Program the table operation instruction. (☞ Page 526 Table Operation Instruction)

This section describes procedure 2 above.

### Table setting method

Set the table in the high speed I/O of GX Works3.

#### Window

**■CPU module**

[Navigation window] ⇨ [Parameter] ⇨ Module model name ⇨ [Module Parameter] ⇨ [High Speed I/O] ⇨ [Output Function] ⇨ [Positioning] ⇨ [Detailed Setting] ⇨ [Positioning Data]*1

Table Data: Use Device (Axis 1 to Axis 4 Common)
Not to Use an Initialization Invalid SM (Initialization of table data can be invalid by SM)

| NO. | Device | Control Method | Axis to be Interpolated | Positioning Address | Command Speed | Dwell Time | Interrupt Counts | Interrupt Input Signal 2 Device No. | Jump Destination Table No. | M No. for Jump Condition |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | D100 | 4: Variable Speed Operation | Axis 2 Specification | 0 pulse | 10000 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 2 | D106 | 1: 1 Speed Positioning (Relative Address Specification) | Axis 2 Specification | 100000 pulse | 30000 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 3 | D112 | 1: 1 Speed Positioning (Relative Address Specification) | Axis 2 Specification | -10000 pulse | 2000 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 4 | D118 | 1: 1 Speed Positioning (Relative Address Specification) | Axis 2 Specification | 20000 pulse | 140000 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 5 | D124 | 0: No Positioning | Axis 2 Specification | 0 pulse | 1 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 6 | D130 | 0: No Positioning | Axis 2 Specification | 0 pulse | 1 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 7 | D136 | 0: No Positioning | Axis 2 Specification | 0 pulse | 1 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 8 | D142 | 0: No Positioning | Axis 2 Specification | 0 pulse | 1 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 9 | D148 | 3: Interrupt 1 Speed Positioning | Axis 2 Specification | 30000 pulse | 100000 pps | 10 ms | 20 Times | X0 | 1 | 0 |
| 10 | D154 | 3: Interrupt 1 Speed Positioning | Axis 2 Specification | 2000 pulse | 20000 pps | 10 ms | 10 Times | X0 | 1 | 0 |
| 11 | D160 | 0: No Positioning | Axis 2 Specification | 0 pulse | 1 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 12 | D166 | 0: No Positioning | Axis 2 Specification | 0 pulse | 1 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 13 | D172 | 4: Variable Speed Operation | Axis 2 Specification | 0 pulse | 10000 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 14 | D178 | 4: Variable Speed Operation | Axis 2 Specification | 0 pulse | 20000 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 15 | D184 | 4: Variable Speed Operation | Axis 2 Specification | 0 pulse | 10000 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 16 | D190 | 0: No Positioning | Axis 2 Specification | 0 pulse | 1 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 17 | D196 | 10: Condition Jump | Axis 2 Specification | 0 pulse | 1 pps | 0 ms | 1 Times | X0 | 2 | 100 |
| 18 | D202 | 0: No Positioning | Axis 2 Specification | 0 pulse | 1 pps | 0 ms | 1 Times | X0 | 1 | 0 |

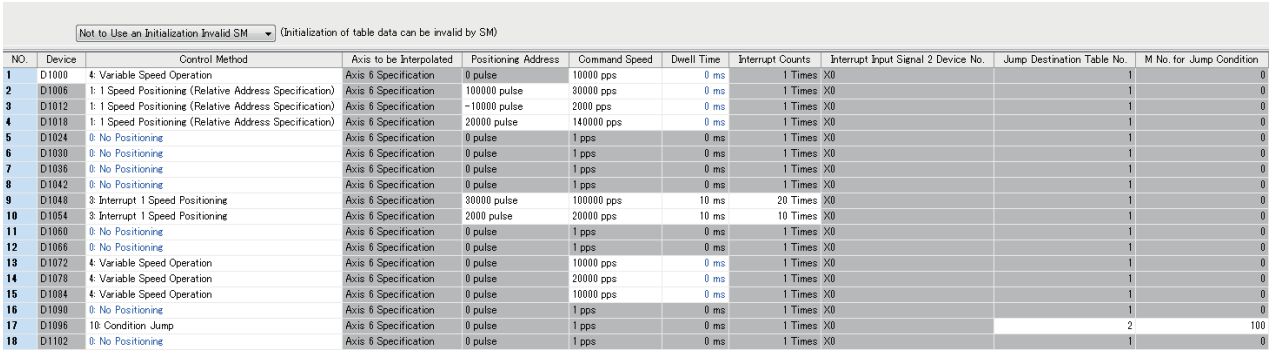
*1 When FX5SCPU/FX5UCPU is selected: Axis #1 Positioning Data to Axis #4 Positioning Data.
When FX5UJCPU is selected: Axis #1 Positioning Data to Axis #3 Positioning Data.

## ■High-speed pulse input/output module

Navigation window ⇨ Parameter ⇨ Module Information ⇨ Right-click ⇨ Add New Module

After adding the high-speed pulse input/output module, make settings on the screen displayed from the following operation.

Navigation window ⇨ Parameter ⇨ Module Information ⇨ 1 to 16 (high-speed pulse input/output module) ⇨ Module Parameter ⇨ Output Function ⇨ Positioning ⇨ Detailed Setting ⇨ Axis #5 Positioning Data to Axis #12 Positioning Data




| NO. | Device | Control Method | Axis to be Interpolated | Positioning Address | Command Speed | Dwell Time | Interrupt Counts | Interrupt Input Signal 2 Device No. | Jump Destination Table No. | M No. for Jump Condition |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | D1000 | 4: Variable Speed Operation | Axis 6 Specification | 0 pulse | 10000 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 2 | D1006 | 1: 1 Speed Positioning (Relative Address Specification) | Axis 6 Specification | 100000 pulse | 30000 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 3 | D1012 | 1: 1 Speed Positioning (Relative Address Specification) | Axis 6 Specification | -10000 pulse | 2000 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 4 | D1018 | 1: 1 Speed Positioning (Relative Address Specification) | Axis 6 Specification | 20000 pulse | 140000 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 5 | D1024 | 0: No Positioning | Axis 6 Specification | 0 pulse | 1 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 6 | D1030 | 0: No Positioning | Axis 6 Specification | 0 pulse | 1 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 7 | D1036 | 0: No Positioning | Axis 6 Specification | 0 pulse | 1 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 8 | D1042 | 0: No Positioning | Axis 6 Specification | 0 pulse | 1 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 9 | D1048 | 3: Interrupt 1 Speed Positioning | Axis 6 Specification | 30000 pulse | 100000 pps | 10 ms | 20 Times | X0 | 1 | 0 |
| 10 | D1054 | 3: Interrupt 1 Speed Positioning | Axis 6 Specification | 2000 pulse | 20000 pps | 10 ms | 10 Times | X0 | 1 | 0 |
| 11 | D1060 | 0: No Positioning | Axis 6 Specification | 0 pulse | 1 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 12 | D1066 | 0: No Positioning | Axis 6 Specification | 0 pulse | 1 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 13 | D1072 | 4: Variable Speed Operation | Axis 6 Specification | 0 pulse | 10000 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 14 | D1078 | 4: Variable Speed Operation | Axis 6 Specification | 0 pulse | 20000 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 15 | D1084 | 4: Variable Speed Operation | Axis 6 Specification | 0 pulse | 10000 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 16 | D1090 | 0: No Positioning | Axis 6 Specification | 0 pulse | 1 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 17 | D1096 | 10: Condition Jump | Axis 6 Specification | 0 pulse | 1 pps | 0 ms | 1 Times | X0 | 2 | 100 |
| 18 | D1102 | 0: No Positioning | Axis 6 Specification | 0 pulse | 1 pps | 0 ms | 1 Times | X0 | 1 | 0 |

Shown above is the screen at the time of the selection of the data for axis 5 positioning.

# Items setting

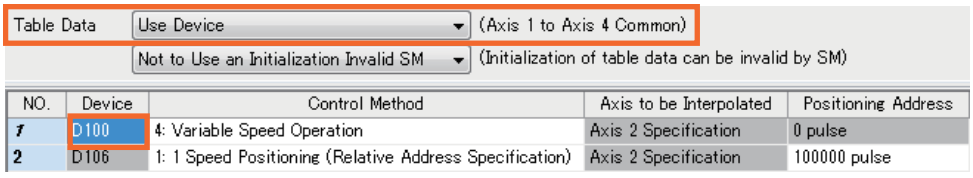
## ■Positioning table data use device setting

The table data specified is used as a parameter of the CPU module. Specify whether to set the parameter in user-specified word devices. Available devices are limited to data registers (D) and file registers (R).

It is always necessary to set the parameters to word devices for high-speed pulse input/output module.

| The positioning table data is set to use device | Parameter (The positioning table data is not set to use device)*1 |
|---|---|
| • Up to 100 tables can be used per axis.<br>• The command speed and positioning address can be changed while a program is being executed.<br>• Six word devices are occupied per table. | • No word devices are occupied.<br>• Up to 32 tables can be used per axis.<br>• The command speed and positioning address cannot be changed while a program is being executed. |

*1 Only CPU module is supported.




| NO. | Device | Control Method | Axis to be Interpolated | Positioning Address |
|---|---|---|---|---|
| 1 | D100 | 4: Variable Speed Operation | Axis 2 Specification | 0 pulse |
| 2 | D106 | 1: 1 Speed Positioning (Relative Address Specification) | Axis 2 Specification | 100000 pulse |

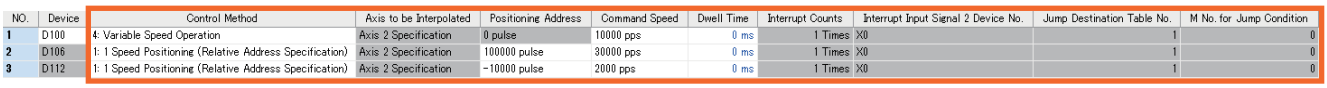
Select "Use Device" to specify a data register or file register in the "Device" field of table No. 1. With the specified device used as the head device, one table occupies six word devices, and 100 tables of word devices (600 word devices) are occupied in total. Devices can be set per axis, but the device range occupied by each axis must not overlap. Unoccupied devices can be used as general-purpose devices even when tables are set to the devices.

Table data is assigned to an operand of the control method of each table. When table data is set to a device, it is stored in the device corresponding to the data of the operand. Assuming that the head device is D100, devices are set as shown in the following table. The same operand numbers are also used when table data is not set to devices.

| Table No. | Device | Operand1 (+0, +1) | Operand2 (+2, +3) | Operand3 (+4) | Operand4 (+5) |
|---|---|---|---|---|---|
| 1 | D100 | D100, D101 | D102, D103 | D104 | D105 |
| 2 | D106 | D106, D107 | D108, D109 | D110 | D111 |
| 3 | D112 | D112, D113 | D114, D115 | D116 | D117 |
| ⋮ | | | | | |
| 100 | D694 | D694, D695 | D696, D697 | D698 | D699 |

## ■Table data

Set table parameters that are applied when a table operation instruction is executed.



| NO. | Device | Control Method | Axis to be Interpolated | Positioning Address | Command Speed | Dwell Time | Interrupt Counts | Interrupt Input Signal 2 Device No. | Jump Destination Table No. | M No. for Jump Condition |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | D100 | 4: Variable Speed Operation | Axis 2 Specification | 0 pulse | 10000 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 2 | D106 | 1: 1 Speed Positioning (Relative Address Specification) | Axis 2 Specification | 100000 pulse | 30000 pps | 0 ms | 1 Times | X0 | 1 | 0 |
| 3 | D112 | 1: 1 Speed Positioning (Relative Address Specification) | Axis 2 Specification | -10000 pulse | 2000 pps | 0 ms | 1 Times | X0 | 1 | 0 |

Set a control method and operands corresponding to the type.

When the positioning table data is set to use device, the operands of this table are set in the user devices. When the operands are set to use devices, the command speed and positioning address can be changed from word devices. Thus, the command speed and positioning address can be changed during positioning operation. The control method is not set in user devices, and thus cannot be changed. For tables in which the positioning type is not set, the setting control method [0: No positioning] is applied.

The following table lists setting items for each table of each axis.

| Item | Description | Reference |
|---|---|---|
| Control Method | 0: No Positioning | Page 492 |
| | 1: 1 Speed Positioning (Relative Address Specification) | Page 493 |
| | 2: 1 Speed Positioning (Absolute Address Specification) | Page 495 |
| | 3: Interrupt 1 Speed Positioning | Page 497 |
| | 4: Variable Speed Operation | Page 500 |
| | 5: Table Transition Variable Speed Operation*2 | Page 502 |
| | 6: Interrupt Stop (Relative Address Specification) | Page 504 |
| | 7: Interrupt Stop (Absolute Address Specification) | Page 507 |
| | 10: Condition Jump | Page 509 |
| | 20: Interpolation Operation (Relative Address Specification)*3 | Page 511 |
| | 21: Interpolation Operation (Relative Address Specification Target Axis)*3 | Page 515 |
| | 22: Interpolation Operation (Absolute Address Specification)*3 | Page 516 |
| | 23: Interpolation Operation (Absolute Address Specification Target Axis)*3 | Page 520 |
| Operand 1*1 | Positioning Address | Page 380 |
| Operand 2*1 | Command Speed | Page 377 |
| Operand 3*1 | Dwell Time | Page 395 |
| | Jump Destination Table No. | Page 396 |
| Operand 4*1 | Interrupt Counts | Page 395 |
| | Interrupt Input Signal 2 Device No. | Page 396 |
| | M No. for Jump Condition | Page 396 |
| | Axis to be Interpolated*3 | Page 397 |

*1 The setting details and whether the setting is available or not differ depending on the control method.

*2 Only CPU module is supported.

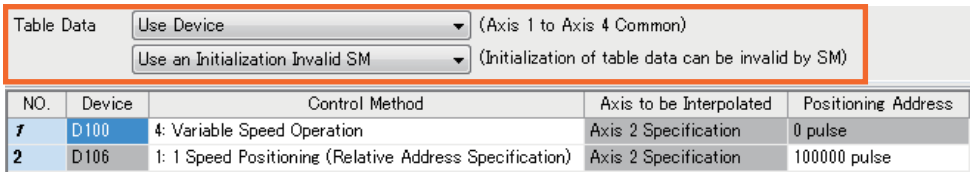
*3 Only FX5S/FX5U/FX5UC CPU module and high-speed pulse input/output module support interpolation operation.

### ■Positioning table data retaining function

This function retains the setting value of the device where the positioning table data is set.

When the positioning table data is changed from word devices (☞ Page 491 Table data), the table data setting value is overwritten with the setting value in GX Works3 after the power of the CPU module is turned OFF and ON, the programmable controller is stopped and restarted, or system is reset. To retain the table data settings value changed from word devices, use the positioning table data retaining function.

***1.*** "Use Device"*1 and "Use an Initialization Invalid SM" are selected in the table data.




***2.*** Turn on Positioning table data initialization disable (SM5916 to 5927). (☞ Page 399 Positioning table data initialization disable)

*1 Only CPU module

For versions which support the positioning table data retaining function, refer to ☞ Page 971 Added and Enhanced Functions.

#### Precautions

Use latch devices for the table data. (☞ Page 123 LATCH FUNCTION)

# 33.2 Operations of Control Method

The following describes the control method that can be set in a table.

For details of each table operation instruction, refer to ☞ Page 404 POSITIONING INSTRUCTION.

## No Positioning

The following describes control method [0: No Positioning].

#### Setting data

The following table shows the operand assignment.

| Item | Operand 1 | Operand 2 | Operand 3 | Operand 4 |
|---|---|---|---|---|
| Description | None | None | None | None |
| Range | — | — | — | — |
| Details | None | None | None | None |

#### Processing details

This table unconditionally turns on the positioning complete flag and ends the table operation instruction. This control method cannot be executed before the other positioning types.

If a table that is not set with a parameter (empty table) is specified, control method [0: No Positioning] is applied.

#### Precautions

- If a table with this positioning type is included between the first table and last table when multiple tables are executed such as continuous operation, tables that follow the table with control method [0: No Positioning] do not operate.
- The complete flag turns on after the operation of the previous table is decelerated to a stop and the dwell time elapses.
- When user devices are used, devices assigned to a table of control method [0: No Positioning] (first device +0 to +5) are not used in table operation. Users can use such devices for any purpose.

## Related devices

Related devices of axis 4 are available only for the FX5S/FX5U/FX5UC CPU module.

### ■CPU module

| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|
| SM8029 (FX3 compatible device) | | | | Instruction execution complete flag | × | R | Page 402 |
| SM8329 (FX3 compatible device) | | | | Instruction execution abnormal end flag | × | R | |

R: Read only, ×: Not supported

### ■High-speed pulse input/output module

| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SM8029 (FX3 compatible device) | | | | | | | | Instruction execution complete flag | × | R | Page 402 |
| SM8329 (FX3 compatible device) | | | | | | | | Instruction execution abnormal end flag | × | R | |

R: Read only, ×: Not supported

## Operation of the complete flags

The following describes the operation timings of the complete flags. Because dwell time cannot be specified, the flags turn on immediately after the condition is met.

| Item | FX3 compatible (Effective only at TBL instruction or DRVTBL instruction execution) | | User specification (Effective only at DRVTBL instruction or DRVMUL instruction execution) | |
|---|---|---|---|---|
| | Instruction execution complete flag (SM8029) | Instruction execution abnormal end flag (SM8329) | Instruction execution complete flag | Instruction execution abnormal end flag |
| ON condition | From when the table operation is started*1 to when the drive contact is turned off | Does not turn on. | From when the table operation is started*1 to when the ON → OFF condition is met | Does not turn on. |
| ON → OFF condition | When the drive contact is turned off | From when the table operation is started to when the drive contact is turned off | The flag remains on until either of the following is performed.<br>• Turning off the flag by the user<br>• Restarting the table instruction | |

*1 The completion flag immediately turns ON after the drive contact turns ON.

# 1 Speed Positioning (Relative Address Specification)

The following describes control method [1: 1 Speed Positioning (Relative Address Specification)].

### Setting data

The following table shows the operand assignment.

| Item | Operand 1*1 | Operand 2*2 | Operand 3*3 | Operand 4 |
|---|---|---|---|---|
| Description | Positioning Address | Command Speed | Dwell Time | None |
| Range | -2147483648 to +2147483647 (User system unit) | 1 to 2147483647 (User system unit) | 0 to 32767 (ms) | — |
| Details | Set the relative address within the range of -2147483648 to +2147483647*4 in pulse. | Set the speed within the range of 1 pps to 200 kpps in pulse. For the FX5S CPU module, set a value 1 pps to 100 kpps. | Dwell time is the time until the complete flag turns on after the positioning address is reached. | None |

*1 The positioning address can be changed during positioning operation. (☞ Page 361 Positioning address change during positioning operation) However, only the last table accepts the change in the case of continuous operation.
*2 Command speed can be changed during positioning operation. (☞ Page 362 Command speed change during positioning operation)
*3 When the positioning table data is set to use device, the value can be changed during positioning operation. The change is applied when the table operation instruction is restarted.
*4 Set the number of output pulses per table execution to 2147483647 or lower.

## Processing details

Operation with one table and operation of stepping operation are the same as that of the DRVI/DDRVI instruction. (☞ Page 521 Stepping operation, Page 423 Relative Positioning) However, if dwell time is set, the complete flag turns on after the dwell time elapses. (☞ Page 402 Complete flag)

In addition, this table can be specified for continuous operation. (☞ Page 523 Continuous operation)

## Precautions

The same cautions as for the DRVI/DDRVI instruction apply.

# Related devices

Other than the following, the related devices are the same as those of the DRVI/DDRVI instruction. Related devices of axis 4 are available only for the FX5S/FX5U/FX5UC CPU module.

### ■Special relays

• CPU module

| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|
| SM5916 | SM5917 | SM5918 | SM5919 | Positioning table data initialization disable | × | R/W | Page 399 |

R/W: Read/write, ×: Not supported

• High-speed pulse input/output module

| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SM5920 | SM5921 | SM5922 | SM5923 | SM5924 | SM5925 | SM5926 | SM5927 | Positioning table data initialization disable | × | R/W | Page 399 |

R/W: Read/write, ×: Not supported

### ■Special registers

• CPU module

| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|
| SD5506 | SD5546 | SD5586 | SD5626 | Positioning execution table number | × | R | Page 398 |
| SD5511 | SD5551 | SD5591 | SD5631 | Positioning error (error occurrence table No.) | × | R/W | Page 399 |

R: Read only, R/W: Read/write, ×: Not supported

• High-speed pulse input/output module

| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SD5666 | SD5706 | SD5746 | SD5786 | SD5826 | SD5866 | SD5906 | SD5946 | Positioning execution table number | × | R | Page 398 |
| SD5671 | SD5711 | SD5751 | SD5791 | SD5831 | SD5871 | SD5911 | SD5951 | Positioning error (error occurrence table No.) | × | R/W | Page 399 |

R: Read only, R/W: Read/write, ×: Not supported

## Operation of the complete flags

The following describes the operation timings of the complete flags. Because dwell time cannot be specified, the flags turn on immediately after the condition is met.

| Item | FX3 compatible (Effective only at TBL instruction or DRVTBL instruction execution) | | User specification (Effective only at DRVTBL instruction or DRVMUL instruction execution) | |
|---|---|---|---|---|
| | Instruction execution complete flag (SM8029) | Instruction execution abnormal end flag (SM8329) | Instruction execution complete flag | Instruction execution abnormal end flag |
| ON condition | From when pulse output of the specified positioning address is completed to when the drive contact is turned off | From when the following operation or function is completed to when the drive contact is turned off<br>• The axis is already used.*1<br>• Pulse output stop command<br>• Pulse decelerate and stop command*2<br>• Limit of the moving direction<br>• All module reset when a stop error occurs*3<br>• All outputs disabled (SM8034)<br>• Positioning address error<br>• Deceleration stop after the command speed is changed to 0<br>• Table shift cannot be completed in time | From when pulse output of the specified positioning address is completed to when the ON → OFF condition is met | From when the following operation or function is completed to when the ON → OFF condition is met<br>• The axis is already used.<br>• The drive contact is turned off during positioning operation<br>• Pulse output stop command<br>• Pulse decelerate and stop command*2<br>• Limit of the moving direction<br>• All module reset when a stop error occurs*3<br>• All outputs disabled (SM8034)<br>• Online change<br>• Positioning address error<br>• Deceleration stop after the command speed is changed to 0<br>• Table shift cannot be completed in time |
| ON → OFF condition | When the drive contact is turned off | | The flag remains on until either of the following is performed.<br>• Turning off the flag by the user<br>• Restarting the table instruction<br>• Shift to the next table | |

*1 The flag turns on only for one scan when the drive contact of the instruction turns from OFF to ON.
*2 When remaining distance operation enabled is turn on, abnormal end flag is not turn on. (☞ Page 387 Remaining distance operation enabled)
*3 Only high-speed pulse input/output module is supported.

# 1 Speed Positioning (Absolute Address Specification)

The following describes control method [2: 1 Speed Positioning (Absolute Address Specification)].

### Setting data

The following table shows the operand assignment.

| Item | Operand 1*1 | Operand 2*2 | Operand 3*3 | Operand 4 |
|---|---|---|---|---|
| Description | Positioning Address | Command Speed | Dwell Time | None |
| Range | -2147483648 to +2147483647 (User system unit) | 1 to 2147483647 (User system unit) | 0 to 32767 (ms) | — |
| Details | Set the absolute address within the range of -2147483648 to +2147483647*4 in pulse. | Set the speed within the range of 1 pps to 200 kpps in pulse. For the FX5S CPU module, set a value 1 pps to 100 kpps. | Dwell time is the time until the complete flag turns on after the positioning address is reached. | None |

*1 The positioning address can be changed during positioning operation. (☞ Page 361 Positioning address change during positioning operation) However, only the last table accepts the change in the case of continuous operation.
*2 Command speed can be changed during positioning operation. (☞ Page 362 Command speed change during positioning operation)
*3 When the positioning table data is set to use device, the value can be changed during positioning operation. The change is applied when the table operation instruction is restarted.
*4 Set the number of output pulses per table execution to 2147483647 or lower.

## Processing details

Operation with one table and operation of stepping operation are the same as that of the DRVA/DDRVA instruction. (☞ Page 521 Stepping operation, Page 433 Absolute Positioning) However, if dwell time is set, the complete flag turns on after the dwell time elapses. (☞ Page 402 Complete flag)

In addition, this table can be specified for continuous operation. (☞ Page 523 Continuous operation)

## Precautions

The same cautions as for the DRVA/DDRVA instruction apply.

# Related devices

Other than the following, the related devices are the same as those of the DRVA/DDRVA instruction. Related devices of axis 4 are available only for the FX5S/FX5U/FX5UC CPU module.

### ■Special relays

• CPU module

| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|
| SM5916 | SM5917 | SM5918 | SM5919 | Positioning table data initialization disable | × | R/W | Page 399 |

R/W: Read/write, ×: Not supported

• High-speed pulse input/output module

| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SM5920 | SM5921 | SM5922 | SM5923 | SM5924 | SM5925 | SM5926 | SM5927 | Positioning table data initialization disable | × | R/W | Page 399 |

R/W: Read/write, ×: Not supported

### ■Special registers

• CPU module

| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|
| SD5506 | SD5546 | SD5586 | SD5626 | Positioning execution table number | × | R | Page 398 |
| SD5511 | SD5551 | SD5591 | SD5631 | Positioning error (error occurrence table No.) | × | R/W | Page 399 |

R: Read only, R/W: Read/write, ×: Not supported

• High-speed pulse input/output module

| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SD5666 | SD5706 | SD5746 | SD5786 | SD5826 | SD5866 | SD5906 | SD5946 | Positioning execution table number | × | R | Page 398 |
| SD5671 | SD5711 | SD5751 | SD5791 | SD5831 | SD5871 | SD5911 | SD5951 | Positioning error (error occurrence table No.) | × | R/W | Page 399 |

R: Read only, R/W: Read/write, ×: Not supported

### Operation of the complete flags

The following describes the operation timings of the complete flags. Because dwell time cannot be specified, the flags turn on immediately after the condition is met.

| Item | FX3 compatible (Effective only at TBL instruction or DRVTBL instruction execution) | | User specification (Effective only at DRVTBL instruction or DRVMUL instruction execution) | |
|---|---|---|---|---|
| | Instruction execution complete flag (SM8029) | Instruction execution abnormal end flag (SM8329) | Instruction execution complete flag | Instruction execution abnormal end flag |
| ON condition | From when pulse output of the specified positioning address is completed to when the drive contact is turned off | From when the following operation or function is completed to when the drive contact is turned off<br>• The axis is already used.*1<br>• Pulse output stop command<br>• Pulse decelerate and stop command*2<br>• Limit of the moving direction<br>• All module reset when a stop error occurs*3<br>• All outputs disabled (SM8034)<br>• Positioning address error<br>• Deceleration stop after the command speed is changed to 0<br>• Table shift cannot be completed in time | From when pulse output of the specified positioning address is completed to when the ON → OFF condition is met | From when the following operation or function is completed to when the ON → OFF condition is met<br>• The axis is already used.<br>• The drive contact is turned off during positioning operation<br>• Pulse output stop command<br>• Pulse decelerate and stop command*2<br>• Limit of the moving direction<br>• All module reset when a stop error occurs*3<br>• All outputs disabled (SM8034)<br>• Online change<br>• Positioning address error<br>• Deceleration stop after the command speed is changed to 0<br>• Table shift cannot be completed in time |
| ON → OFF condition | When the drive contact is turned off | | The flag remains on until either of the following is performed.<br>• Turning off the flag by the user<br>• Restarting the table instruction<br>• Shift to the next table | |

*1 The flag turns on only for one scan when the drive contact of the instruction turns from OFF to ON.
*2 When remaining distance operation enabled is turn on, abnormal end flag is not turn on. (☞ Page 387 Remaining distance operation enabled)
*3 Only high-speed pulse input/output module is supported.

## Interrupt 1 Speed Positioning

The following describes the control method [3: Interrupt 1 Speed Positioning].

### Setting data

The following table shows the operand assignment.

| Item | Operand 1*1 | Operand 2*2 | Operand 3*3 | Operand 4*3 |
|---|---|---|---|---|
| Description | Positioning Address | Command speed | Dwell Time | Interrupt Counts |
| Range | -2147483648 to +2147483647 (User system unit) | 1 to 2147483647 (User system unit) | 0 to 32767 (ms) | 1 to 32767 |
| Details | Set the transfer distance after interrupt within the range of -2147483648 to +2147483647*4 in pulse. | Set the speed within the range of 1 pps to 200 kpps in pulse. For the FX5S CPU module, set a value 1 pps to 100 kpps. | Dwell time is the time until the complete flag turns on after the positioning address is reached. | This is the count of inputs that are necessary for interrupt. The setting is enabled only in the high-speed mode. |

*1 The positioning address can be changed during positioning operation. (☞ Page 361 Positioning address change during positioning operation) However, only the last table accepts the change in the case of continuous operation.
*2 Command speed can be changed during positioning operation. (☞ Page 362 Command speed change during positioning operation)
*3 When the positioning table data is set to use device, the value can be changed during positioning operation. The change is applied when the table operation instruction is restarted.
*4 Set the number of output pulses per table execution (the total number of pulses before and after the interrupt) to 2147483647 or lower.

## Processing details

Operation with one table and operation of stepping operation are the same as that of the DVIT/DDVIT instruction. (☞ Page 521 Stepping operation, Page 442 Interrupt 1-Speed Positioning) If dwell time is set, the complete flag turns on after the dwell time elapses. (☞ Page 402 Complete flag)

In addition, this table can be specified for continuous operation only for the CPU module. (☞ Page 523 Continuous operation)

## Precautions

Other than the following, the same as cautions for the DVIT/DDVIT instruction apply.

- Combinations other than the following cannot be used during continuous operation.

| Item | The first table | The second table |
|---|---|---|
| Control method | 3: Interrupt 1 Speed Positioning | — |
| | 5: Table Transition Variable Speed Operation | 3: Interrupt 1 Speed Positioning |

Control method [3: Interrupt 1 Speed Positioning] must be specified to the first or second table. If control method [3: Interrupt 1 Speed Positioning] is specified to the second table, only control method [5: Table Transition Variable Speed Operation] can be specified to the first table.

- Continuous operation cannot be used for the high-speed pulse input/output module. If this table is specified for continuous operation for the high-speed pulse input/output module, an error occurs.

# Related devices

Other than the following, the related devices are the same as those of the DVIT/DDVIT instruction. Related devices of axis 4 are available only for the FX5S/FX5U/FX5UC CPU module.

### ■Special relays

- CPU module

| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|
| SM5916 | SM5917 | SM5918 | SM5919 | Positioning table data initialization disable | × | R/W | Page 399 |

R/W: Read/write, ×: Not supported

- High-speed pulse input/output module

| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SM5920 | SM5921 | SM5922 | SM5923 | SM5924 | SM5925 | SM5926 | SM5927 | Positioning table data initialization disable | × | R/W | Page 399 |

R/W: Read/write, ×: Not supported

## ■Special registers

• CPU module

| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|
| SD5506 | SD5546 | SD5586 | SD5626 | Positioning execution table number | × | R | Page 398 |
| SD5511 | SD5551 | SD5591 | SD5631 | Positioning error (error occurrence table No.) | × | R/W | Page 399 |

R: Read only, R/W: Read/write, ×: Not supported

• High-speed pulse input/output module

| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SD5666 | SD5706 | SD5746 | SD5786 | SD5826 | SD5866 | SD5906 | SD5946 | Positioning execution table number | × | R | Page 398 |
| SD5671 | SD5711 | SD5751 | SD5791 | SD5831 | SD5871 | SD5911 | SD5951 | Positioning error (error occurrence table No.) | × | R/W | Page 399 |

R: Read only, R/W: Read/write, ×: Not supported

## Operation of the complete flags

The following describes the operation timings of the complete flags. Because dwell time cannot be specified, the flags turn on immediately after the condition is met.

| Item | FX3 compatible (Effective only at TBL instruction or DRVTBL instruction execution) | | User specification (Effective only at DRVTBL instruction or DRVMUL instruction execution) | |
|---|---|---|---|---|
| | Instruction execution complete flag (SM8029) | Instruction execution abnormal end flag (SM8329) | Instruction execution complete flag | Instruction execution abnormal end flag |
| ON condition | From when pulse output of the specified positioning address is completed to when the drive contact is turned off | From when the following operation or function is completed to when the drive contact is turned off<br>• The axis is already used.*1<br>• Pulse output stop command<br>• Pulse decelerate and stop command<br>• Limit of the moving direction<br>• All module reset when a stop error occurs*2<br>• All outputs disabled (SM8034)<br>• Positioning address error<br>• Deceleration stop after the command speed is changed to 0 | From when pulse output of the specified positioning address is completed to when the ON → OFF condition is met | From when the following operation or function is completed to when the ON → OFF condition is met<br>• The axis is already used.<br>• The drive contact is turned off during positioning operation<br>• Pulse output stop command<br>• Pulse decelerate and stop command<br>• Limit of the moving direction<br>• All module reset when a stop error occurs*2<br>• All outputs disabled (SM8034)<br>• Online change<br>• Positioning address error<br>• Deceleration stop after the command speed is changed to 0 |
| ON → OFF condition | When the drive contact is turned off | | The flag remains on until either of the following is performed.<br>• Turning off the flag by the user<br>• Restarting the table instruction<br>• Shift to the next table | |

*1 The flag turns on only for one scan when the drive contact of the instruction turns from OFF to ON.

*2 Only high-speed pulse input/output module is supported.

# Variable Speed Operation

The following describes control method [4: Variable Speed Operation].

## Setting data

The following table shows the operand assignment.

| Item | Operand 1 | Operand 2*1 | Operand 3*2 | Operand 4 |
|---|---|---|---|---|
| Description | None | Command Speed | Dwell Time | None |
| Range | — | -2147483648 to +2147483647 (User system unit) | 0 to 32767 (ms) | — |
| Details | None | Set the speed within the range of -200 kpps to +200 kpps in pulse. For the FX5S CPU module, set a value -100 kpps to +100 kpps. | Dwell time is the time until the complete flag turns on. | None |

*1 Command speed can be changed during positioning operation. (☞ Page 362 Command speed change during positioning operation)

*2 When the positioning table data is set to use device, the value can be changed during positioning operation. The change is applied when the table operation instruction is restarted.

## Processing details

Operation with one table and operation of stepping operation are the same as that of the PLSV/DPLSV instruction. (☞ Page 521 Stepping operation, Page 452 Variable Speed Operation) When this table is used, deceleration stop is performed by turning off the drive contact of the table operation instruction. If dwell time is set, the complete flag turns on after the dwell time elapses. (☞ Page 402 Complete flag)

## Precautions

Other than the following, the operation is the same as that of the PLSV/DPLSV instruction.

- When this table is used for stepping operation, the next table can be activated after stop using the pulse decelerate and stop command. (☞ Page 385 Pulse decelerate and stop command)
- This table cannot be specified for continuous operation.
- If the command speed is changed to 0 during positioning operation, pulses are decelerated to a stop but the table operation does not end. Thus, dwell time is not measured and tables are not switched. When the drive contact of the table operation instruction is on, changing the command speed restarts pulse output.

## Related devices

Other than the following, the related devices are the same as those of the PLSV/DPLSV instruction. Related devices of axis 4 are available only for the FX5S/FX5U/FX5UC CPU module.

### ■Special relays

- CPU module

| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|
| SM5916 | SM5917 | SM5918 | SM5919 | Positioning table data initialization disable | × | R/W | Page 399 |

R/W: Read/write, ×: Not supported

- High-speed pulse input/output module

| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SM5920 | SM5921 | SM5922 | SM5923 | SM5924 | SM5925 | SM5926 | SM5927 | Positioning table data initialization disable | × | R/W | Page 399 |

R/W: Read/write, ×: Not supported

## ■Special registers

• CPU module

| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|
| SD5506 | SD5546 | SD5586 | SD5626 | Positioning execution table number | × | R | Page 398 |
| SD5511 | SD5551 | SD5591 | SD5631 | Positioning error (error occurrence table No.) | × | R/W | Page 399 |

R: Read only, R/W: Read/write, ×: Not supported

• High-speed pulse input/output module

| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SD5666 | SD5706 | SD5746 | SD5786 | SD5826 | SD5866 | SD5906 | SD5946 | Positioning execution table number | × | R | Page 398 |
| SD5671 | SD5711 | SD5751 | SD5791 | SD5831 | SD5871 | SD5911 | SD5951 | Positioning error (error occurrence table No.) | × | R/W | Page 399 |

R: Read only, R/W: Read/write, ×: Not supported

## Operation of the complete flags

The following describes the operation timings of the complete flags. Because dwell time cannot be specified, the flags turn on immediately after the condition is met.

| Item | FX3 compatible (Effective only at TBL instruction or DRVTBL instruction execution) | | User specification (Effective only at DRVTBL instruction or DRVMUL instruction execution) | |
|---|---|---|---|---|
| | Instruction execution complete flag (SM8029) | Instruction execution abnormal end flag (SM8329) | Instruction execution complete flag | Instruction execution abnormal end flag |
| ON condition | Deceleration stop with the pulse decelerate and stop command | From when the following operation or function is completed to when the drive contact is turned off<br>• The axis is already used.*1<br>• Pulse output stop command<br>• Limit of the moving direction<br>• All module reset when a stop error occurs*2<br>• All outputs disabled (SM8034)<br>• A table that cannot be combined is specified. | Deceleration stop by drive contact off or pulse decelerate and stop command | From when the following operation or function is completed to when the ON → OFF condition is met<br>• The axis is already used.<br>• Pulse output stop command<br>• Limit of the moving direction<br>• All module reset when a stop error occurs*2<br>• All outputs disabled (SM8034)<br>• Online change<br>• A table that cannot be combined is specified. |
| ON → OFF condition | When the drive contact is turned off | | The flag remains on until either of the following is performed.<br>• Turning off the flag by the user<br>• Restarting the table instruction<br>• Shift to the next table | |

*1 The flag turns on only for one scan when the drive contact of the instruction turns from OFF to ON.

*2 Only high-speed pulse input/output module is supported.

# Table Transition Variable Speed Operation

The following describes control method [5: Table Transition Variable Speed Operation]. Only CPU module is supported.

## Setting data

The following table shows the operand assignment.

| Item | Operand 1 | Operand 2*1 | Operand 3*2 | Operand 4*2 |
|---|---|---|---|---|
| Description | None | Command Speed | Dwell Time | Interrupt Input Signal 2 Device No. |
| Range | — | -2147483648 to +2147483647 (User system unit) | 0 to 32767 (ms) | ■FX5S/FX5U/FX5UC CPU module<br>X0 to X17<br>■FX5UJ CPU module<br>FX5UJ-24MT/□<br>• X0 to X15<br>FX5UJ-40MT/□, FX5UJ-60MT/□<br>• X0 to X17 |
| Details | None | Set the speed within the range of -200 kpps to +200 kpps in pulse. For the FX5S CPU module, set a value -100 kpps to +100 kpps. | Dwell time is the time until the complete flag turns on. | Specify the input (X) number. |

*1 Command speed can be changed during positioning operation. (☞ Page 362 Command speed change during positioning operation)

*2 When the positioning table data is set to use device, the value can be changed during positioning operation. The change is applied when the table operation instruction is restarted.

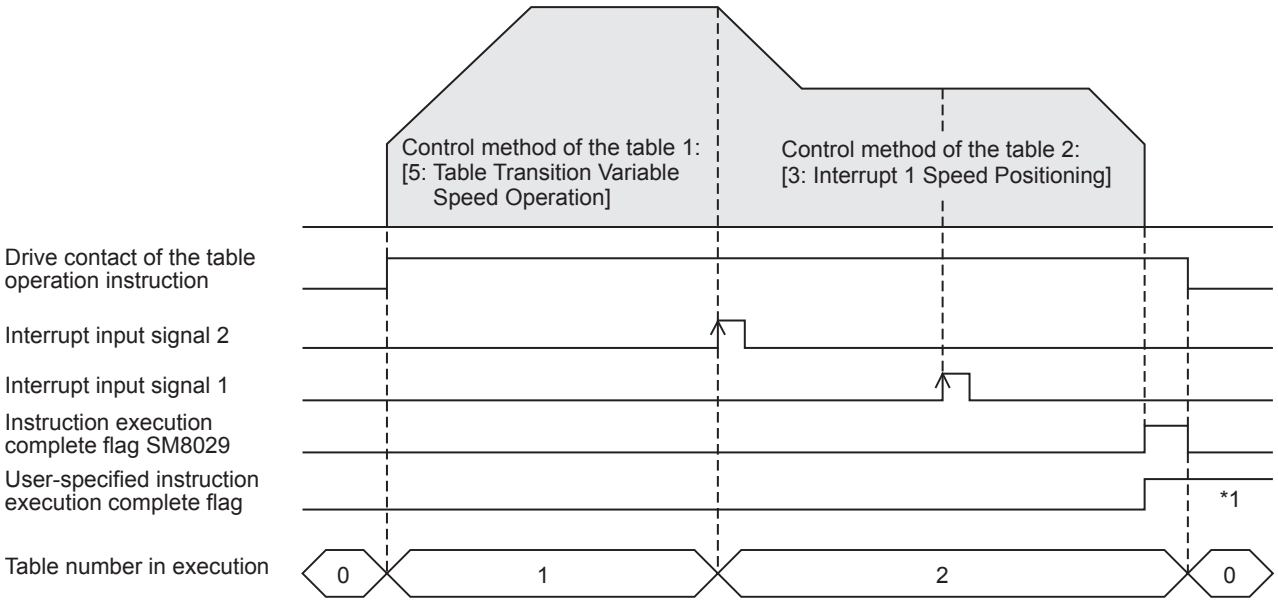
## Processing details

When the interrupt input signal 2 is detected, the table in execution is switched to the next table as interrupt processing. Then, the table following this table is operated. Until the interrupt input signal 2 is turned on, operation equivalent to the PLSV/DPLSV instruction or control method [4: Variable Speed Operation] is performed. (☞ Page 452 Variable Speed Operation, Page 500 Variable Speed Operation)

If dwell time is set, the complete flag turns on after the dwell time elapses. (☞ Page 402 Complete flag)

In addition, this table can be specified for continuous operation. (☞ Page 523 Continuous operation)

The following figure shows an example of an operation equivalent to interrupt 2-speed positioning combining control method [5: Table Transition Variable Speed Operation] and control method [3: Interrupt 1 Speed Positioning].




*1 Remains on until it is turned off using program or engineering tool, restarts the table operation instruction or until the next table is activated during the continuous operation.

### Precautions

Other than the following, the operation is the same as that of the PLSV/DPLSV instruction.

- If control method [0: No Positioning] is set to the next table, deceleration stop is performed to end the table operation by turning on the interrupt input signal 2. If control method [0: No Positioning] is set to the last table, the same operation is performed.
- If the next table is for variable speed operation or interpolation operation, deceleration stop is performed to end the table operation causing an error.
- When this table is used for stepping operation, the next table can be activated after a stop using the interrupt input signal 2 or pulse decelerate and stop command. If the pulse decelerate and stop command remains ON after stop, the table shift command is disabled.
- Table control methods that can be used in combination during continuous operation are [5: Table Transition Variable Speed Operation] and [3: Interrupt 1 Speed Positioning]. (☞ Page 497 Interrupt 1 Speed Positioning) An error occurs if Interrupt 1 Speed Positioning is executed after Table Transition Variable Speed Operation two or more times.
- If the command speed is changed to 0 during positioning operation, pulses are decelerated to a stop but the table operation does not end. Thus, dwell time is not measured and tables are not switched. When the drive contact of the table operation instruction is on, or changing to any value other than 0, the command speed restarts pulse output.

## Related devices

Other than the following, the related devices are the same as those of the PLSV/DPLSV instruction. Related devices of axis 4 are available only for the FX5S/FX5U/FX5UC CPU module.

### ■Special relays

| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|
| SM5916 | SM5917 | SM5918 | SM5919 | Positioning table data initialization disable | × | R/W | Page 399 |

R/W: Read/write, ×: Not supported

### ■Special registers

| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|
| SD5506 | SD5546 | SD5586 | SD5626 | Positioning execution table number | × | R | Page 398 |
| SD5511 | SD5551 | SD5591 | SD5631 | Positioning error (error occurrence table No.) | × | R/W | Page 399 |

R: Read only, R/W: Read/write, ×: Not supported

## Operation of the complete flags

The following describes the operation timings of the complete flags. Because dwell time cannot be specified, the flags turn on immediately after the condition is met.

| Item | FX3 compatible (Effective only at TBL instruction or DRVTBL instruction execution) | | User specification (Effective only at DRVTBL instruction or DRVMUL instruction execution) | |
|---|---|---|---|---|
| | Instruction execution complete flag (SM8029) | Instruction execution abnormal end flag (SM8329) | Instruction execution complete flag | Instruction execution abnormal end flag |
| ON condition | Deceleration stop by pulse decelerate and stop command | From when the following operation or function is completed to when the drive contact is turned off<br>• The axis is already used.*1<br>• Shift to the next table is impossible<br>• Pulse output stop command<br>• Limit of the moving direction<br>• All outputs disabled (SM8034) | Deceleration stop by drive contact off or pulse decelerate and stop command | From when the following operation or function is completed to when the ON → OFF condition is met<br>• The axis is already used.<br>• Shift to the next table is impossible<br>• Pulse output stop command<br>• Limit of the moving direction<br>• All outputs disabled (SM8034)<br>• Online change |
| ON → OFF condition | When the drive contact is turned off | | The flag remains on until either of the following is performed.<br>• Turning off the flag by the user<br>• Restarting the table instruction<br>• Shift to the next table | |

*1 The flag turns on only for one scan when the drive contact of the instruction turns from OFF to ON.

# Interrupt Stop (Relative Address Specification)

The following describes control method [6: Interrupt Stop (Relative Address Specification)].

### Setting data

The following table shows the operand assignment.

| Item | Operand 1*1 | Operand 2*2 | Operand 3*3 | Operand 4*3 |
|---|---|---|---|---|
| Description | Positioning Address | Command Speed | Dwell Time | Interrupt Counts |
| Range | -2147483648 to +2147483647 (User system unit) | 1 to 2147483647 (User system unit) | 0 to 32767 (ms) | 1 to 32767 |
| Details | Set the relative address within the range of -2147483648 to +2147483647*4 in pulse. | Set the speed within the range of 1 pps to 200 kpps in pulse. For the FX5S CPU module, set a value 1 pps to 100 kpps. | Dwell time is the time until the complete flag turns on after the positioning address is reached (interrupt stop). | This is the count of inputs that are necessary for interrupt. The setting is enabled only in the high-speed mode. |

*1 The positioning address can be changed during positioning operation. (☞ Page 361 Positioning address change during positioning operation) However, only the last table accepts the change in the case of continuous operation.

*2 Command speed can be changed during positioning operation. (☞ Page 362 Command speed change during positioning operation)

*3 When the positioning table data is set to use device, the value can be changed during positioning operation. The change is applied when the table operation instruction is restarted.

*4 Set the number of output pulses per table execution to 2147483647 or lower.

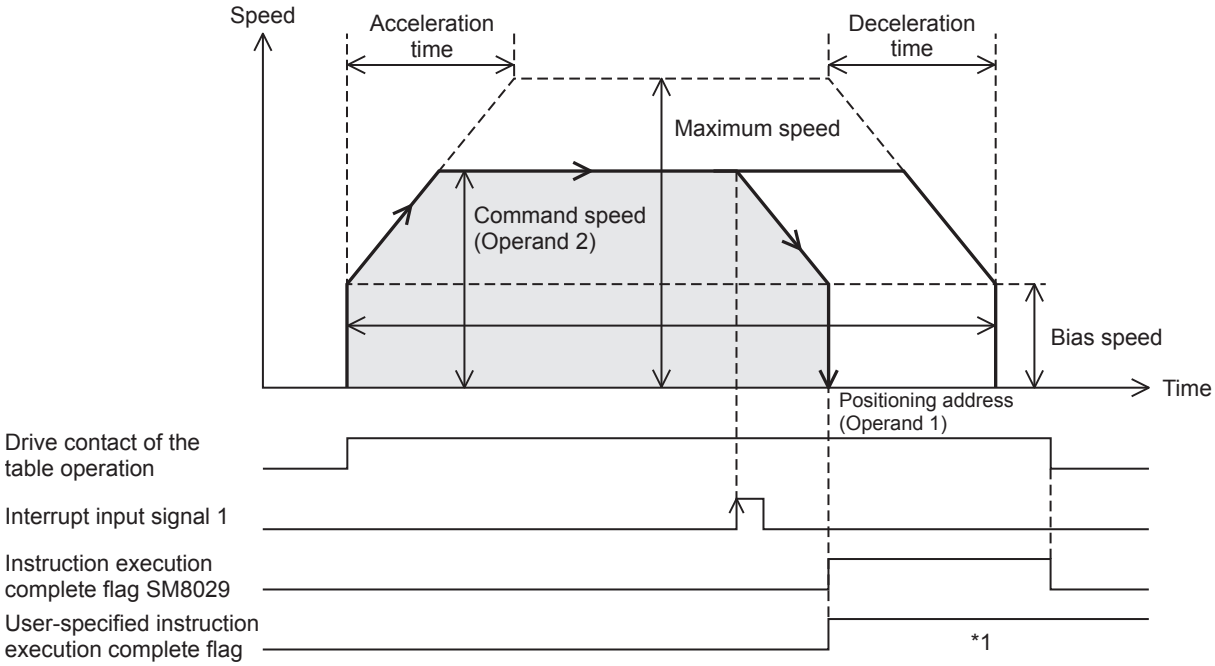
## Processing details

Deceleration stop is performed from the point where the interrupt input signal 1 is detected during positioning operation. (☞ Page 383 Interrupt Input Signal 1) When the interrupt input signal 1 is not detected, the operation becomes the same as that of the DRVI/DDRVI instruction or control method [1: 1 Speed Positioning (Relative Address Specification)]. (☞ Page 423 Relative Positioning, Page 493 1 Speed Positioning (Relative Address Specification))

If dwell time is set, the complete flag turns on after the dwell time elapses. (☞ Page 402 Complete flag)

In addition, this table can be specified for continuous operation. (☞ Page 523 Continuous operation)

The following example shows an interrupt stop with dwell time 0 ms.




*1 Remains on until it is turned off using program or engineering tool, restarts the table operation instruction or until the next table is activated during the continuous operation.

## Precautions

Other than the following, the same cautions as for the DRVI/DDRVI instruction apply.

- Specify the table as the last table when performing continuous operation. An error occurs if a table is operated after this table during continuous operation.
- During positioning operation, the positioning address (operand 1) and the command speed (operand 2) can be changed before the interrupt input signal 1 is detected. If they are changed after the interrupt input signal 1 is detected, the change is applied when the table operation instruction is next driven again.

## Related devices

Other than the following, the related devices are the same as those of the DRVI/DDRVI instruction. Related devices of axis 4 are available only for the FX5S/FX5U/FX5UC CPU module.

### ■Special relays

- CPU module

| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|
| SM5916 | SM5917 | SM5918 | SM5919 | Positioning table data initialization disable | × | R/W | Page 399 |

R/W: Read/write, ×: Not supported

• High-speed pulse input/output module

| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SM5920 | SM5921 | SM5922 | SM5923 | SM5924 | SM5925 | SM5926 | SM5927 | Positioning table data initialization disable | × | R/W | Page 399 |

R/W: Read/write, ×: Not supported

## ■Special registers

• CPU module

| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|
| SD5506 | SD5546 | SD5586 | SD5626 | Positioning execution table number | × | R | Page 398 |
| SD5511 | SD5551 | SD5591 | SD5631 | Positioning error (error occurrence table No.) | × | R/W | Page 399 |

R: Read only, R/W: Read/write, ×: Not supported

• High-speed pulse input/output module

| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SD5666 | SD5706 | SD5746 | SD5786 | SD5826 | SD5866 | SD5906 | SD5946 | Positioning execution table number | × | R | Page 398 |
| SD5671 | SD5711 | SD5751 | SD5791 | SD5831 | SD5871 | SD5911 | SD5951 | Positioning error (error occurrence table No.) | × | R/W | Page 399 |

R: Read only, R/W: Read/write, ×: Not supported

# Operation of the complete flags

The following describes the operation timings of the complete flags. Because dwell time cannot be specified, the flags turn on immediately after the condition is met.

| Item | FX3 compatible (Effective only at TBL instruction or DRVTBL instruction execution) | | User specification (Effective only at DRVTBL instruction or DRVMUL instruction execution) | |
|---|---|---|---|---|
| | Instruction execution complete flag (SM8029) | Instruction execution abnormal end flag (SM8329) | Instruction execution complete flag | Instruction execution abnormal end flag |
| ON condition | From when pulse output of the specified positioning address is completed or when deceleration stop is started by an interrupt input to when the drive contact is turned off | From when the following operation or function is completed to when the drive contact is turned off<br>• The axis is already used.*1<br>• Pulse output stop command<br>• Pulse decelerate and stop command*2<br>• Limit of the moving direction<br>• All module reset when a stop error occurs*3<br>• All outputs disabled (SM8034)<br>• Positioning address error<br>• Deceleration stop after the command speed is changed to 0<br>• Table shift cannot be completed in time | From when pulse output of the specified positioning address is completed or when deceleration stop is started by an interrupt input to when the ON → OFF condition is met | From when the following operation or function is completed to when the ON → OFF condition is met<br>• The axis is already used.<br>• The drive contact is turned off during positioning operation<br>• Pulse output stop command<br>• Pulse decelerate and stop command*2<br>• Limit of the moving direction<br>• All module reset when a stop error occurs*3<br>• All outputs disabled (SM8034)<br>• Online change<br>• Positioning address error<br>• Deceleration stop after the command speed is changed to 0<br>• Table shift cannot be completed in time |
| ON → OFF condition | When the drive contact is turned off | | The flag remains on until either of the following is performed.<br>• Turning off the flag by the user<br>• Restarting the table instruction<br>• Shift to the next table | |

*1 The flag turns on only for one scan when the drive contact of the instruction turns from OFF to ON.

*2 When remaining distance operation enabled is turn on, abnormal end flag is not turn on. (☞ Page 387 Remaining distance operation enabled)

*3 Only high-speed pulse input/output module is supported.

# Interrupt Stop (Absolute Address Specification)

The following describes control method [7: Interrupt Stop (Absolute Address Specification)]

## Setting data

The following table shows the operand assignment.

| Item | Operand 1*1 | Operand 2*2 | Operand 3*3 | Operand 4*3 |
|---|---|---|---|---|
| Description | Positioning Address | Command Speed | Dwell Time | Interrupt Counts |
| Range | -2147483648 to +2147483647 (User system unit) | 1 to 2147483647 (User system unit) | 0 to 32767 (ms) | 1 to 32767 |
| Details | Set the absolute address within the range of -2147483648 to +2147483647*4 in pulse. | Set the speed within the range of 1 pps to 200 kpps in pulse. For the FX5S CPU module, set a value 1 pps to 100 kpps. | Dwell time is the time until the complete flag turns on after the positioning address is reached (interrupt stop). | This is the count of inputs that are necessary for interrupt. The setting is enabled only in the high-speed mode. |

*1 The positioning address can be changed during positioning operation. (☞ Page 361 Positioning address change during positioning operation) However, only the last table accepts the change in the case of continuous operation.
*2 Command speed can be changed during positioning operation. (☞ Page 362 Command speed change during positioning operation)
*3 When the positioning table data is set to use device, the value can be changed during positioning operation. The change is applied when the table operation instruction is restarted.
*4 Set the number of output pulses per table execution to 2147483647 or lower.

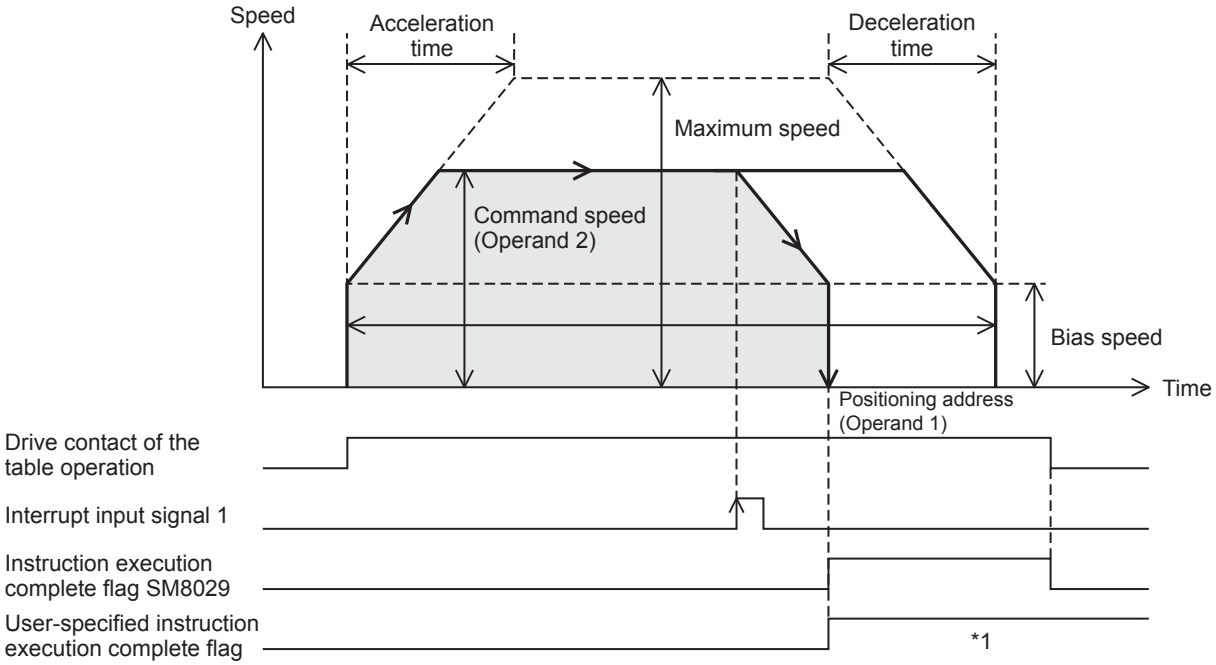
## Processing details

Deceleration stop is performed from the point where the interrupt input signal 1 is detected during positioning operation. (☞ Page 383 Interrupt Input Signal 1) When the interrupt input signal 1 is not detected, the operation becomes the same as that of the DRVA/DDRVA instruction or control method [2: 1 Speed Positioning (Absolute Address Specification)]. (☞ Page 433 Absolute Positioning, Page 495 1 Speed Positioning (Absolute Address Specification))

If dwell time is set, the complete flag turns on after the dwell time elapses. (☞ Page 402 Complete flag)

In addition, this table can be specified for continuous operation. (☞ Page 523 Continuous operation)

The following example shows an interrupt stop with dwell time 0 ms.




*1 Remains on until it is turned off using program or engineering tool, restarts the table operation instruction or until the next table is activated during the continuous operation.

### Precautions

Other than the following, the same cautions as for the DRVA/DDRVA instruction apply.

- Specify the table as the last table when performing continuous operation. An error occurs if a table is operated after this table during continuous operation.
- During positioning operation, the positioning address (operand 1) and the command speed (operand 2) can be changed before the interrupt input signal 1 is detected. If they are changed after the interrupt input signal 1 is detected, the change is applied when the table operation instruction is next driven again.

## Related devices

Other than the following, the related devices are the same as those of the DRVA/DDRVA instruction. Related devices of axis 4 are available only for the FX5S/FX5U/FX5UC CPU module.

### ■Special relays

- CPU module

| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|
| SM5916 | SM5917 | SM5918 | SM5919 | Positioning table data initialization disable | × | R/W | Page 399 |

R/W: Read/write, ×: Not supported

- High-speed pulse input/output module

| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SM5920 | SM5921 | SM5922 | SM5923 | SM5924 | SM5925 | SM5926 | SM5927 | Positioning table data initialization disable | × | R/W | Page 399 |

R/W: Read/write, ×: Not supported

### ■Special registers

- CPU module

| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|
| SD5506 | SD5546 | SD5586 | SD5626 | Positioning execution table number | × | R | Page 398 |
| SD5511 | SD5551 | SD5591 | SD5631 | Positioning error (error occurrence table No.) | × | R/W | Page 399 |

R: Read only, R/W: Read/write, ×: Not supported

- High-speed pulse input/output module

| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SD5666 | SD5706 | SD5746 | SD5786 | SD5826 | SD5866 | SD5906 | SD5946 | Positioning execution table number | × | R | Page 398 |
| SD5671 | SD5711 | SD5751 | SD5791 | SD5831 | SD5871 | SD5911 | SD5951 | Positioning error (error occurrence table No.) | × | R/W | Page 399 |

R: Read only, R/W: Read/write, ×: Not supported

## Operation of the complete flags

The following describes the operation timings of the complete flags. Because dwell time cannot be specified, the flags turn on immediately after the condition is met.

| Item | FX3 compatible (Effective only at TBL instruction or DRVTBL instruction execution) | | User specification (Effective only at DRVTBL instruction or DRVMUL instruction execution) | |
|---|---|---|---|---|
| | Instruction execution complete flag (SM8029) | Instruction execution abnormal end flag (SM8329) | Instruction execution complete flag | Instruction execution abnormal end flag |
| ON condition | From when pulse output of the specified positioning address is completed or when deceleration stop is started by an interrupt input to when the drive contact is turned off | From when the following operation or function is completed to when the drive contact is turned off<br>• The axis is already used.*1<br>• Pulse output stop command<br>• Pulse decelerate and stop command*2<br>• Limit of the moving direction<br>• All module reset when a stop error occurs*3<br>• All outputs disabled (SM8034)<br>• Positioning address error<br>• Deceleration stop after the command speed is changed to 0<br>• Table shift cannot be completed in time | From when pulse output of the specified positioning address is completed or when deceleration stop is started by an interrupt input to when the ON → OFF condition is met | From when the following operation or function is completed to when the ON → OFF condition is met<br>• The axis is already used.<br>• The drive contact is turned off during positioning operation<br>• Pulse output stop command<br>• Pulse decelerate and stop command*2<br>• Limit of the moving direction<br>• All module reset when a stop error occurs*3<br>• All outputs disabled (SM8034)<br>• Online change<br>• Positioning address error<br>• Deceleration stop after the command speed is changed to 0<br>• Table shift cannot be completed in time |
| ON → OFF condition | When the drive contact is turned off | | The flag remains on until either of the following is performed.<br>• Turning off the flag by the user<br>• Restarting the table instruction<br>• Shift to the next table | |

*1 The flag turns on only for one scan when the drive contact of the instruction turns from OFF to ON.
*2 When remaining distance operation enabled is turn on, abnormal end flag is not turn on. (☞ Page 387 Remaining distance operation enabled)
*3 Only high-speed pulse input/output module is supported.

# Condition Jump

The following describes control method [10: Condition Jump].

### Setting data

The following table shows the operand assignment.

| Item | Operand 1 | Operand 2 | Operand 3*1 | Operand 4 |
|---|---|---|---|---|
| Description | None | None | Jump Destination Table No. | M No. for Jump Condition |
| Range | — | — | 1 to 100 | 0 to 32767 |
| Details | None | None | Specify the table number of the jump destination when the jump condition is met. | Specify the number of the internal relay (M) of the jump condition. |

*1 When user devices are used, the value can be changed during positioning operation. When at table three tables or more before the table to be changed in stepping operation or continuous operation, the change is applied at the next scan.

### Processing details

The table to be executed next can be selected using conditions. When the jump condition internal relay (M) specified in operand 4 is ON at condition judgment, positioning of the table number of the jump destination specified in operand 3 is performed. When the jump condition is off, the table with the following number is executed. Operations after the jump all follow the jump-destination tables.
In addition, this table can be specified for continuous operation. (☞ Page 523 Continuous operation)

### Precautions

- When this table specified for last table, jump is not executed and operation ends normally after deceleration stop.
- In stepping operation, conditions are judged at completion of execution of the table immediately prior to control method [10: Condition Jump], and the jump destination table is immediately executed.
- In continuous operation, conditions are judged when execution of that table two tables before is started. When the jump-destination table is set to control method [10: Condition Jump], the conditions for that table are simultaneously judged and the next destination table is executed.
- If the table is located two or fewer tables before (after the condition is determined), the change is applied, but the condition jump is executed using the settings from when the condition was determined.
- Jumps to the table set to control method [10: Condition Jump] must be three times or less in a row. After the fourth jump, execution is stopped.

## Related devices

Related devices of axis 4 are available only for the FX5S/FX5U/FX5UC CPU module.

### ■Special relays

- CPU module

| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|
| SM5916 | SM5917 | SM5918 | SM5919 | Positioning table data initialization disable | × | R/W | Page 399 |

R/W: Read/write, ×: Not supported

- High-speed pulse input/output module

| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SM5920 | SM5921 | SM5922 | SM5923 | SM5924 | SM5925 | SM5926 | SM5927 | Positioning table data initialization disable | × | R/W | Page 399 |

R/W: Read/write, ×: Not supported

### ■Special registers

- CPU module

| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|
| SD5506 | SD5546 | SD5586 | SD5626 | Positioning execution table number | × | R | Page 398 |
| SD5511 | SD5551 | SD5591 | SD5631 | Positioning error (error occurrence table No.) | × | R/W | Page 399 |

R: Read only, R/W: Read/write, ×: Not supported

- High-speed pulse input/output module

| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SD5666 | SD5706 | SD5746 | SD5786 | SD5826 | SD5866 | SD5906 | SD5946 | Positioning execution table number | × | R | Page 398 |
| SD5671 | SD5711 | SD5751 | SD5791 | SD5831 | SD5871 | SD5911 | SD5951 | Positioning error (error occurrence table No.) | × | R/W | Page 399 |

R: Read only, R/W: Read/write, ×: Not supported

### Operation of the complete flags

The following describes the operation timings of the complete flags.

| Item | FX3 compatible*1 (Effective only at TBL instruction or DRVTBL instruction execution) | | User specification (Effective only at DRVTBL instruction or DRVMUL instruction execution) | |
|---|---|---|---|---|
| | Instruction execution complete flag (SM8029) | Instruction execution abnormal end flag (SM8329) | Instruction execution complete flag | Instruction execution abnormal end flag |
| ON condition | From when the condition jump is executed in the last table to when the drive contact is turned off | When jump destination table No. error occurs | From when the condition jump is executed in the last table | When jump destination table No. error occurs |
| ON → OFF condition | When the normal end condition is not met | When the abnormal end condition is not met | When instruction is driven | |

*1 Operate only when at last table.

# Interpolation Operation (Relative Address Specification)

The following describes control method [20: Interpolation Operation (Relative Address Specification)]. Only FX5S/FX5U/FX5UC CPU module and high-speed pulse input/output module support interpolation operation.

## Setting data

The following table shows the operand assignment.

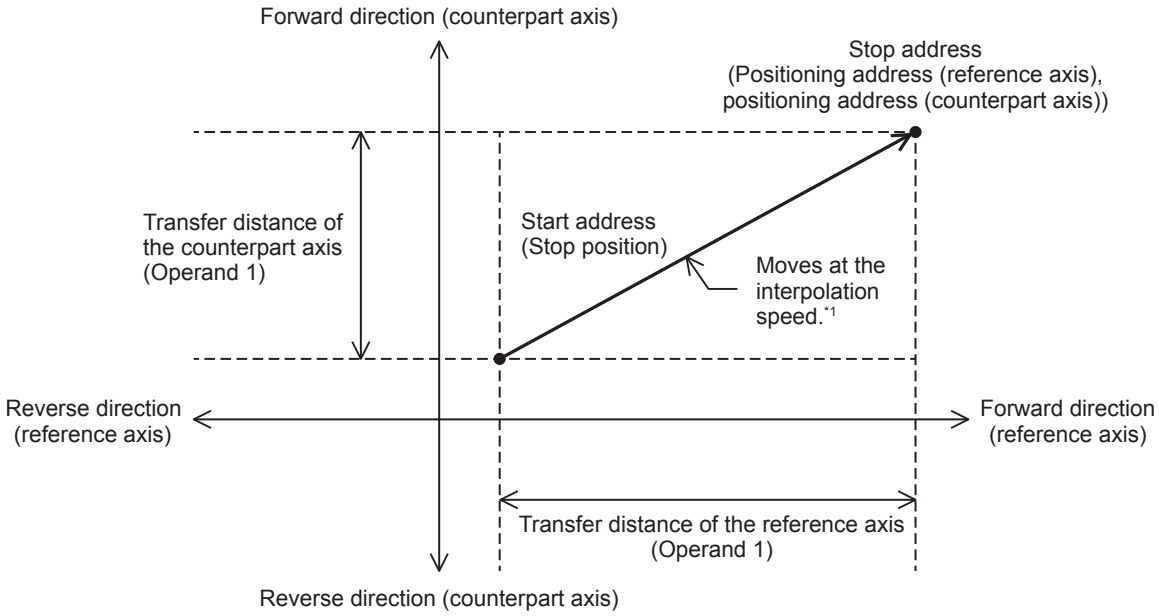
| Item | Operand 1*1 | Operand 2*1 | Operand 3*1 | Operand 4 |
|---|---|---|---|---|
| Description | Positioning Address | Command Speed | Dwell Time | Axis to be Interpolated |
| Range | -2147483648 to +2147483647 (User system unit) | 1 to 2147483647 (User system unit) | 0 to 32767 (ms) | Axis 1 Specification to Axis 4 Specification, 0 |
| Details | Set the relative address within the range of -2147483648 to +2147483647*2 in pulse. | Set the speed within the range of 1 pps to 200 kpps in pulse. For the FX5S CPU module, set a value 1 pps to 100 kpps. | Dwell time is the time until the complete flag turns on after the positioning address is reached. | For the CPU module, specify the axis number of the interpolation counterpart. In the case of the high-speed pulse input/output module, the reference-axis is fixed as the smaller number in the same module and the counterpart axis is fixed as the larger number, so specify 0. |

*1 When the positioning table data is set to use device, the value can be changed during positioning operation. The change is applied when the table operation instruction is restarted.

*2 Set the number of output pulses per table execution to 2147483647 or lower.

## Processing details

Using the reference axis (control method [20: Interpolation Operation (Relative Address Specification)]) and counterpart axis (control method [21: Interpolation Operation (Relative Address Specification Target Axis)]), which is specified in operand 4, linear interpolation positioning is performed. The transfer distance of the operation is the distance from the current stop position (start address) to the positioning addresses specified in operand 1 of the reference axis and the counterpart axis. (☞ Page 515 Interpolation Operation (Relative Address Specification Target Axis)) For the counterpart axis specified in operand 1, [21: Interpolation Operation (Relative Address Specification Target Axis)] is assigned as the control method in the same table number as that for the reference axis. If dwell time is set, the complete flag turns on after the dwell time elapses. (☞ Page 402 Complete flag)




*1 The calculation method differs depending on the specification method for the interpolation speed. (☞ Page 397 Interpolation Speed Specified Method)

## Precautions

- This table cannot be specified for continuous operation. When a table with this control method is executed in continuous operation, the operation is decelerated to a stop.
- When the specification method for the interpolation speed is [Reference-axis speed], set the axis with the longer positioning address as the reference axis. If the axis with the shorter positioning address is set as the reference axis, the speed of the longer axis may exceed the maximum speed and interpolation operation cannot be performed properly.
- When forward limit or reverse limit is detected in either of the reference axis or counterpart axis during interpolation operation, both the axes are decelerated to a stop.
- Do not change the value of operand 4.
- This function is not intended for purposes where high precision path is required because each axis is only started simultaneously.

Using the following or similar set values, in particular, may lead to a larger difference in stop time between each axis. Even when there is a difference in stop time, operation stops at the correct position.

***1.*** When there is a large difference in transfer distance between the reference axis and counterpart axis

***2.*** When the speed of the reference axis or counterpart axis is equal to or lower than the bias speed or exceeds the maximum speed

***3.*** When the speeds of the reference axis and counterpart axis are extremely slow

***4.*** When an extremely long acceleration time or deceleration time is set

If interpolation operation is aborted, the stop position of each axis may be off the straight line.

- If interpolation operation specified with a relative address is repeatedly used in machine or multiple unit system, calculation errors may accumulate for each axis.

## Related devices

### ■Special relays

• CPU module

| FX5 dedicated | | | | FX3 compatible | | | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 1 | Axis 2 | Axis 3 | Axis 4 | | | | |
| — | — | — | — | SM8029 | | | | Instruction execution complete flag | × | R | Page 402 |
| — | — | — | — | SM8329 | | | | Instruction execution abnormal end flag | × | R | |
| SM5500 | SM5501 | SM5502 | SM5503 | SM8348 | SM8358 | SM8368 | SM8378 | Positioning instruction activation | × | R | Page 400 |
| SM5516 | SM5517 | SM5518 | SM5519 | SM8340 | SM8350 | SM8360 | SM8370 | Pulse output monitor | × | R | Page 400 |
| SM5532 | SM5533 | SM5534 | SM5535 | — | — | — | — | Positioning error occurrence | × | R/W | Page 400 |
| SM5628 | SM5629 | SM5630 | SM5631 | — | — | — | — | Pulse output stop command | × | R/W | Page 384 |
| SM5644 | SM5645 | SM5646 | SM5647 | — | — | — | — | Pulse decelerate and stop command | × | R/W | Page 385 |
| SM5660 | SM5661 | SM5662 | SM5663 | — | — | — | — | Forward limit | × | R/W | Page 386 |
| SM5676 | SM5677 | SM5678 | SM5679 | — | — | — | — | Reverse limit | × | R/W | Page 386 |
| SM5772 | SM5773 | SM5774 | SM5775 | — | — | — | — | Rotation direction setting | ○ | R/W | Page 374 |
| SM5916 | SM5917 | SM5918 | SM5919 | — | — | — | — | Positioning table data initialization disable | × | R/W | Page 399 |

R: Read only, R/W: Read/write, ○: Supported, ×: Not supported

• High-speed pulse input/output module

| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SM8029 (FX3 compatible device) | | | | | | | | Instruction execution complete flag | × | R | Page 402 |
| SM8329 (FX3 compatible device) | | | | | | | | Instruction execution abnormal end flag | × | R | |
| SM5504 | SM5505 | SM5506 | SM5507 | SM5508 | SM5509 | SM5510 | SM5511 | Positioning instruction activation | × | R | Page 400 |
| SM5520 | SM5521 | SM5522 | SM5523 | SM5524 | SM5525 | SM5526 | SM5527 | Pulse output monitor | × | R | Page 400 |
| SM5536 | SM5537 | SM5538 | SM5539 | SM5540 | SM5541 | SM5542 | SM5543 | Positioning error occurrence | × | R/W | Page 400 |
| SM5632 | SM5633 | SM5634 | SM5635 | SM5636 | SM5637 | SM5638 | SM5639 | Pulse output stop command | × | R/W | Page 384 |
| SM5648 | SM5649 | SM5650 | SM5651 | SM5652 | SM5653 | SM5654 | SM5655 | Pulse decelerate and stop command | × | R/W | Page 385 |
| SM5664 | SM5665 | SM5666 | SM5667 | SM5668 | SM5669 | SM5670 | SM5671 | Forward limit | × | R/W | Page 386 |
| SM5680 | SM5681 | SM5682 | SM5683 | SM5684 | SM5685 | SM5686 | SM5687 | Reverse limit | × | R/W | Page 386 |
| SM5776 | SM5777 | SM5778 | SM5779 | SM5780 | SM5781 | SM5782 | SM5783 | Rotation direction setting | ○ | R/W | Page 374 |
| SM5920 | SM5921 | SM5922 | SM5923 | SM5924 | SM5925 | SM5926 | SM5927 | Positioning table data initialization disable | × | R/W | Page 399 |

R: Read only, R/W: Read/write, ○: Supported, ×: Not supported

## ■Special registers

• CPU module

| FX5 dedicated | | | | FX3 compatible | | | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 1 | Axis 2 | Axis 3 | Axis 4 | | | | |
| SD5500, SD5501 | SD5540, SD5541 | SD5580, SD5581 | SD5620, SD5621 | — | — | — | — | Current address (user unit) | × | R/W*1 | Page 382 |
| SD5502, SD5503 | SD5542, SD5543 | SD5582, SD5583 | SD5622, SD5623 | SD8340, SD8341 | SD8350, SD8351 | SD8360, SD8361 | SD8370, SD8371 | Current address (pulse unit) | × | R/W*1 | Page 382 |
| SD5504, SD5505 | SD5544, SD5545 | SD5584, SD5585 | SD5624, SD5625 | — | — | — | — | Current speed (user unit) | × | R | Page 378 |
| SD5506 | SD5546 | SD5586 | SD5626 | — | — | — | — | Positioning execution table number | × | R | Page 398 |
| SD5510 | SD5550 | SD5590 | SD5630 | — | — | — | — | Positioning error (error code) | × | R/W | Page 401 |
| SD5511 | SD5551 | SD5591 | SD5631 | — | — | — | — | Positioning error (error occurrence table No.) | × | R/W | Page 399 |
| SD5516, SD5517 | SD5556, SD5557 | SD5596, SD5597 | SD5636, SD5637 | — | — | — | — | Maximum speed | ○ | R/W | Page 379 |
| SD5518, SD5519 | SD5558, SD5559 | SD5598, SD5599 | SD5638, SD5639 | — | — | — | — | Bias speed | ○ | R/W | Page 379 |
| SD5520 | SD5560 | SD5600 | SD5640 | — | — | — | — | Acceleration time | ○ | R/W | Page 380 |
| SD5521 | SD5561 | SD5601 | SD5641 | — | — | — | — | Deceleration time | ○ | R/W | Page 380 |

R: Read only, R/W: Read/write, ○: Supported, ×: Not supported

*1 Only FX5 dedicated devices can be written by the HCMOV/DHCMOV instruction.

• High-speed pulse input/output module

| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SD5660, SD5661 | SD5700, SD5701 | SD5740, SD5741 | SD5780, SD5781 | SD5820, SD5821 | SD5860, SD5861 | SD5900, SD5901 | SD5940, SD5941 | Current address (user unit) | × | R/W*1 | Page 382 |
| SD5662, SD5663 | SD5702, SD5703 | SD5742, SD5743 | SD5782, SD5783 | SD5822, SD5823 | SD5862, SD5863 | SD5902, SD5903 | SD5942, SD5943 | Current address (pulse unit) | × | R/W*1 | Page 382 |
| SD5664, SD5665 | SD5704, SD5705 | SD5744, SD5745 | SD5784, SD5785 | SD5824, SD5825 | SD5864, SD5865 | SD5904, SD5905 | SD5944, SD5945 | Current speed (user unit) | × | R | Page 378 |
| SD5666 | SD5706 | SD5746 | SD5786 | SD5826 | SD5866 | SD5906 | SD5946 | Positioning execution table number | × | R | Page 398 |
| SD5668, SD5669 | SD5708, SD5709 | SD5748, SD5749 | SD5788, SD5789 | SD5828, SD5829 | SD5868, SD5869 | SD5908, SD5909 | SD5948, SD5949 | Current speed (composite speed) | × | R | Page 398 |
| SD5670 | SD5710 | SD5750 | SD5790 | SD5830 | SD5870 | SD5910 | SD5950 | Positioning error (error code) | × | R/W | Page 401 |
| SD5671 | SD5711 | SD5751 | SD5791 | SD5831 | SD5871 | SD5911 | SD5951 | Positioning error (error occurrence table No.) | × | R/W | Page 399 |
| SD5676, SD5677 | SD5716, SD5717 | SD5756, SD5757 | SD5796, SD5797 | SD5836, SD5837 | SD5876, SD5877 | SD5916, SD5917 | SD5956, SD5957 | Maximum speed | ○ | R/W | Page 379 |
| SD5678, SD5679 | SD5718, SD5719 | SD5758, SD5759 | SD5798, SD5799 | SD5838, SD5839 | SD5878, SD5879 | SD5918, SD5919 | SD5958, SD5959 | Bias speed | ○ | R/W | Page 379 |
| SD5680 | SD5720 | SD5760 | SD5800 | SD5840 | SD5880 | SD5920 | SD5960 | Acceleration time | ○ | R/W | Page 380 |
| SD5681 | SD5721 | SD5761 | SD5801 | SD5841 | SD5881 | SD5921 | SD5961 | Deceleration time | ○ | R/W | Page 380 |

R: Read only, R/W: Read/write, ○: Supported, ×: Not supported

*1 Writing can be performed only by the HCMOV/DHCMOV instruction.

## Operation of the complete flags

The following describes the operation timings of the complete flags.

If dwell time is specified, the flag turns on after the dwell time elapses.

| Item | FX3 compatible (Effective only at TBL instruction or DRVTBL instruction execution) | | User specification (Effective only at DRVTBL instruction or DRVMUL instruction execution) | |
|---|---|---|---|---|
| | Instruction execution complete flag (SM8029) | Instruction execution abnormal end flag (SM8329) | Instruction execution complete flag | Instruction execution abnormal end flag |
| ON condition | From when pulse output of the specified positioning address is completed to when the drive contact is turned off | From when the following operation or function is completed to when the drive contact is turned off<br>• Either the reference axis or counterpart axis is already used.*1<br>• Pulse output stop command<br>• Pulse decelerate and stop command<br>• Limit of the moving direction<br>• All module reset when a stop error occurs*2<br>• All outputs disabled (SM8034)<br>• Positioning address error<br>• Deceleration stop after the command speed is changed to 0 | From when pulse output of the specified positioning address is completed to when the ON → OFF condition is met | From when the following operation or function is completed to when the ON → OFF condition is met<br>• Either the reference axis or counterpart axis is already used.<br>• The drive contact is turned off during positioning operation<br>• Pulse output stop command<br>• Pulse decelerate and stop command<br>• Limit of the moving direction<br>• All module reset when a stop error occurs*2<br>• All outputs disabled (SM8034)<br>• Online change<br>• Positioning address error<br>• Deceleration stop after the command speed is changed to 0 |
| ON → OFF condition | When the drive contact is turned off | | The flag remains on until either of the following is performed.<br>• Turning off the flag by the user<br>• Restarting the table instruction<br>• Shift to the next table | |

*1 The flag turns on only for one scan when the drive contact of the instruction turns from OFF to ON.

*2 Only high-speed pulse input/output module is supported.

# Interpolation Operation (Relative Address Specification Target Axis)

The following describes control method [21: Interpolation Operation (Relative Address Specification Target Axis)]. Only FX5S/FX5U/FX5UC CPU module and high-speed pulse input/output module support interpolation operation.

### Setting data

The following table shows the operand assignment.

| Item | Operand 1*1 | Operand 2 | Operand 3 | Operand 4 |
|---|---|---|---|---|
| Description | Positioning Address | None | None | None |
| Range | -2147483648 to +2147483647 (User system unit) | — | — | — |
| Details | Set the relative address within the range of -2147483648 to +2147483647*2 in pulse. | None | None | None |

*1 When the positioning table data is set to use device, the value can be changed during positioning operation. The change is applied when the table operation instruction is restarted.

*2 Set the number of output pulses per table execution to 2147483647 or lower.

### Processing details

[21: Interpolation Operation (Relative Address Specification Target Axis)] is assigned to the same table number as that for control method [20: Interpolation Operation (Relative Address Specification)] specified in the interpolation reference axis.

For the interpolation operation, refer to ☞ Page 511 Interpolation Operation (Relative Address Specification).

### Precautions

- Interpolation operation cannot be activated from this table. Drive interpolation operation with the table control method [20: Interpolation Operation (Relative Address Specification)] of the reference axis.
- Each speed is calculated based on the speed of the reference axis.

## Related devices

Refer to ☞ Page 513 Related devices of control method [20: Interpolation Operation (Relative Address Specification)].

## Operation of the complete flags

Refer to ☞ Page 515 Operation of the complete flags of control method [20: Interpolation Operation (Relative Address Specification)].

# Interpolation Operation (Absolute Address Specification)

The following describes control method [22: Interpolation Operation (Absolute Address Specification)]. Only FX5S/FX5U/FX5UC CPU module and high-speed pulse input/output module support interpolation operation.

### Setting data

The following table shows the operand assignment.

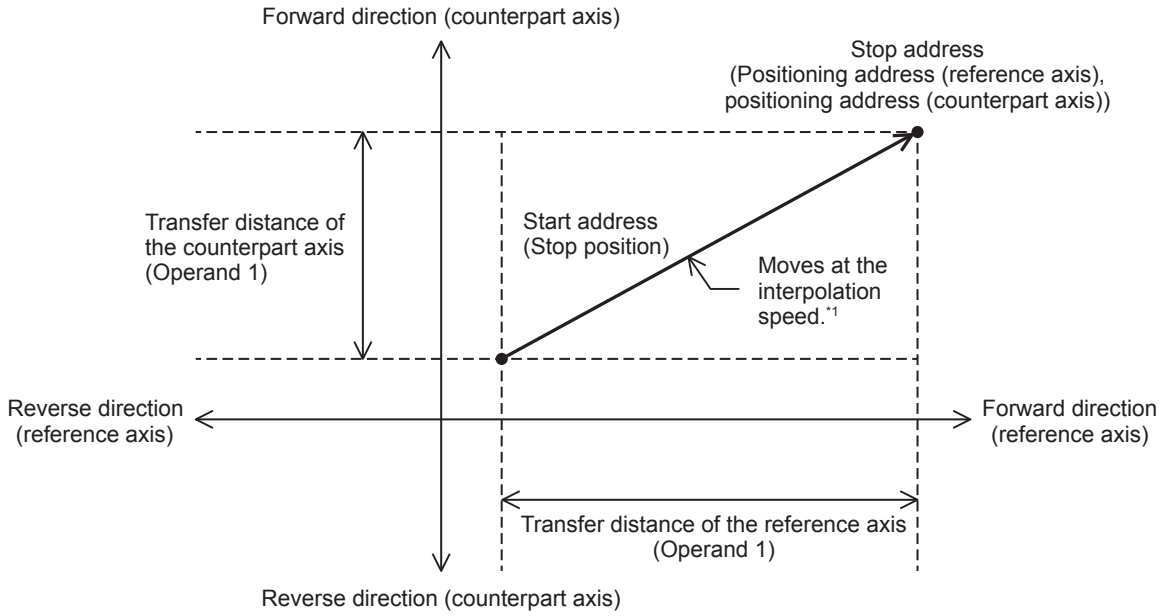
| Item | Operand 1*1 | Operand 2*1 | Operand 3*1 | Operand 4 |
|---|---|---|---|---|
| Description | Positioning Address | Command Speed | Dwell Time | Axis to be Interpolated |
| Range | -2147483648 to +2147483647 (User system unit) | 1 to 2147483647 (User system unit) | 0 to 32767 (ms) | Axis 1 Specification to Axis 4 Specification, 0 |
| Details | Set the absolute address within the range of -2147483648 to +2147483647*2 in pulse. | Set the speed within the range of 1 pps to 200 kpps in pulse. For the FX5S CPU module, set a value 1 pps to 100 kpps. | Dwell time is the time until the complete flag turns on after the positioning address is reached. | For the CPU module, specify the axis number of the interpolation counterpart. In the case of the high-speed pulse input/output module, the reference-axis is fixed as the smaller number in the same module and the counterpart axis is fixed as the larger number, so specify 0. |

*1 When the positioning table data is set to use device, the value can be changed during positioning operation. The change is applied when the table operation instruction is restarted.

*2 Set the number of output pulses per table execution to 2147483647 or lower.

## Processing details

Using the reference axis (control method [22: Interpolation Operation (Absolute Address Specification)]) and counterpart axis (control method [23: Interpolation Operation (Absolute Address Specification Target Axis)]), which is specified in operand 4, linear interpolation positioning is performed. The transfer distance of the operation is the distance from the current stop position (start address) to the positioning addresses specified in operand 1 of the reference axis and the counterpart axis. (☞ Page 520 Interpolation Operation (Absolute Address Specification Target Axis)) For the counterpart axis specified in operand 1, [23: Interpolation Operation (Relative Absolute Specification Target Axis)] is assigned as the control method in the same table number as that for the reference axis. If dwell time is set, the complete flag turns on after the dwell time elapses. (☞ Page 402 Complete flag)




*1 The calculation method differs depending on the specification method for the interpolation speed. (☞ Page 397 Interpolation Speed Specified Method)

## Precautions

- This table cannot be specified for continuous operation. When a table with this control method is executed in continuous operation, the operation is decelerated to a stop.
- When the specification method for the interpolation speed is [Reference-axis speed], set the axis with the longer positioning address as the reference axis. If the axis with the shorter positioning address is set as the reference axis, the speed of the longer axis may exceed the maximum speed and interpolation operation cannot be performed properly.
- When such as forward limit or reverse limit, is detected in either of the reference axis or counterpart axis during interpolation operation, both the axes are decelerated to a stop.
- Do not change the value of operand 4.
- This function is not intended for purposes where high precision path is required because each axis is only started simultaneously.

Using the following or similar set values, in particular, may lead to a larger difference in stop time between each axis. Even when there is a difference in stop time, operation stops at the correct position.

1. When there is a large difference in transfer distance between the reference axis and counterpart axis
2. When the speed of the reference axis or counterpart axis is equal to or lower than the bias speed or exceeds the maximum speed
3. When the speeds of the reference axis and counterpart axis are extremely slow
4. When an extremely long acceleration time or deceleration time is set

If interpolation operation is aborted, the stop position of each axis may be off the straight line.

## Related devices

### ■Special relays

• CPU module

| FX5 dedicated | | | | FX3 compatible | | | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 1 | Axis 2 | Axis 3 | Axis 4 | | | | |
| — | — | — | — | SM8029 | | | | Instruction execution complete flag | × | R | Page 402 |
| — | — | — | — | SM8329 | | | | Instruction execution abnormal end flag | × | R | |
| SM5500 | SM5501 | SM5502 | SM5503 | SM8348 | SM8358 | SM8368 | SM8378 | Positioning instruction activation | × | R | Page 400 |
| SM5516 | SM5517 | SM5518 | SM5519 | SM8340 | SM8350 | SM8360 | SM8370 | Pulse output monitor | × | R | Page 400 |
| SM5532 | SM5533 | SM5534 | SM5535 | — | — | — | — | Positioning error occurrence | × | R/W | Page 400 |
| SM5628 | SM5629 | SM5630 | SM5631 | — | — | — | — | Pulse output stop command | × | R/W | Page 384 |
| SM5644 | SM5645 | SM5646 | SM5647 | — | — | — | — | Pulse decelerate and stop command | × | R/W | Page 385 |
| SM5660 | SM5661 | SM5662 | SM5663 | — | — | — | — | Forward limit | × | R/W | Page 386 |
| SM5676 | SM5677 | SM5678 | SM5679 | — | — | — | — | Reverse limit | × | R/W | Page 386 |
| SM5772 | SM5773 | SM5774 | SM5775 | — | — | — | — | Rotation direction setting | ○ | R/W | Page 374 |
| SM5916 | SM5917 | SM5918 | SM5919 | — | — | — | — | Positioning table data initialization disable | × | R/W | Page 399 |

R: Read only, R/W: Read/write, ○: Supported, ×: Not supported

• High-speed pulse input/output module

| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SM8029 (FX3 compatible device) | | | | | | | | Instruction execution complete flag | × | R | Page 402 |
| SM8329 (FX3 compatible device) | | | | | | | | Instruction execution abnormal end flag | × | R | |
| SM5504 | SM5505 | SM5506 | SM5507 | SM5508 | SM5509 | SM5510 | SM5511 | Positioning instruction activation | × | R | Page 400 |
| SM5520 | SM5521 | SM5522 | SM5523 | SM5524 | SM5525 | SM5526 | SM5527 | Pulse output monitor | × | R | Page 400 |
| SM5536 | SM5537 | SM5538 | SM5539 | SM5540 | SM5541 | SM5542 | SM5543 | Positioning error occurrence | × | R/W | Page 400 |
| SM5632 | SM5633 | SM5634 | SM5635 | SM5636 | SM5637 | SM5638 | SM5639 | Pulse output stop command | × | R/W | Page 384 |
| SM5648 | SM5649 | SM5650 | SM5651 | SM5652 | SM5653 | SM5654 | SM5655 | Pulse decelerate and stop command | × | R/W | Page 385 |
| SM5664 | SM5665 | SM5666 | SM5667 | SM5668 | SM5669 | SM5670 | SM5671 | Forward limit | × | R/W | Page 386 |
| SM5680 | SM5681 | SM5682 | SM5683 | SM5684 | SM5685 | SM5686 | SM5687 | Reverse limit | × | R/W | Page 386 |
| SM5776 | SM5777 | SM5778 | SM5779 | SM5780 | SM5781 | SM5782 | SM5783 | Rotation direction setting | ○ | R/W | Page 374 |
| SM5920 | SM5921 | SM5922 | SM5923 | SM5924 | SM5925 | SM5926 | SM5927 | Positioning table data initialization disable | × | R/W | Page 399 |

R: Read only, R/W: Read/write, ○: Supported, ×: Not supported

## ■Special registers

• CPU module

| FX5 dedicated | | | | FX3 compatible | | | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 1 | Axis 2 | Axis 3 | Axis 4 | | | | |
| SD5500, SD5501 | SD5540, SD5541 | SD5580, SD5581 | SD5620, SD5621 | — | — | — | — | Current address (user unit) | × | R/W*1 | Page 382 |
| SD5502, SD5503 | SD5542, SD5543 | SD5582, SD5583 | SD5622, SD5623 | SD8340, SD8341 | SD8350, SD8351 | SD8360, SD8361 | SD8370, SD8371 | Current address (pulse unit) | × | R/W*1 | Page 382 |
| SD5504, SD5505 | SD5544, SD5545 | SD5584, SD5585 | SD5624, SD5625 | — | — | — | — | Current speed (user unit) | × | R | Page 378 |
| SD5506 | SD5546 | SD5586 | SD5626 | — | — | — | — | Positioning execution table number | × | R | Page 398 |
| SD5510 | SD5550 | SD5590 | SD5630 | — | — | — | — | Positioning error (error code) | × | R/W | Page 401 |
| SD5511 | SD5551 | SD5591 | SD5631 | — | — | — | — | Positioning error (error occurrence table No.) | × | R/W | Page 399 |
| SD5516, SD5517 | SD5556, SD5557 | SD5596, SD5597 | SD5636, SD5637 | — | — | — | — | Maximum speed | ○ | R/W | Page 379 |
| SD5518, SD5519 | SD5558, SD5559 | SD5598, SD5599 | SD5638, SD5639 | — | — | — | — | Bias speed | ○ | R/W | Page 379 |
| SD5520 | SD5560 | SD5600 | SD5640 | — | — | — | — | Acceleration time | ○ | R/W | Page 380 |
| SD5521 | SD5561 | SD5601 | SD5641 | — | — | — | — | Deceleration time | ○ | R/W | Page 380 |

R: Read only, R/W: Read/write, ○: Supported, ×: Not supported

*1 Only FX5 dedicated devices can be written by the HCMOV/DHCMOV instruction.

• High-speed pulse input/output module

| First module | | Second module | | Third module | | Fourth module | | Name | High speed I/O parameter | R/W | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | | | | |
| SD5660, SD5661 | SD5700, SD5701 | SD5740, SD5741 | SD5780, SD5781 | SD5820, SD5821 | SD5860, SD5861 | SD5900, SD5901 | SD5940, SD5941 | Current address (user unit) | × | R/W*1 | Page 382 |
| SD5662, SD5663 | SD5702, SD5703 | SD5742, SD5743 | SD5782, SD5783 | SD5822, SD5823 | SD5862, SD5863 | SD5902, SD5903 | SD5942, SD5943 | Current address (pulse unit) | × | R/W*1 | Page 382 |
| SD5664, SD5665 | SD5704, SD5705 | SD5744, SD5745 | SD5784, SD5785 | SD5824, SD5825 | SD5864, SD5865 | SD5904, SD5905 | SD5944, SD5945 | Current speed (user unit) | × | R | Page 378 |
| SD5666 | SD5706 | SD5746 | SD5786 | SD5826 | SD5866 | SD5906 | SD5946 | Positioning execution table number | × | R | Page 398 |
| SD5668, SD5669 | SD5708, SD5709 | SD5748, SD5749 | SD5788, SD5789 | SD5828, SD5829 | SD5868, SD5869 | SD5908, SD5909 | SD5948, SD5949 | Current speed (composite speed) | × | R | Page 398 |
| SD5670 | SD5710 | SD5750 | SD5790 | SD5830 | SD5870 | SD5910 | SD5950 | Positioning error (error code) | × | R/W | Page 401 |
| SD5671 | SD5711 | SD5751 | SD5791 | SD5831 | SD5871 | SD5911 | SD5951 | Positioning error (error occurrence table No.) | × | R/W | Page 399 |
| SD5676, SD5677 | SD5716, SD5717 | SD5756, SD5757 | SD5796, SD5797 | SD5836, SD5837 | SD5876, SD5877 | SD5916, SD5917 | SD5956, SD5957 | Maximum speed | ○ | R/W | Page 379 |
| SD5678, SD5679 | SD5718, SD5719 | SD5758, SD5759 | SD5798, SD5799 | SD5838, SD5839 | SD5878, SD5879 | SD5918, SD5919 | SD5958, SD5959 | Bias speed | ○ | R/W | Page 379 |
| SD5680 | SD5720 | SD5760 | SD5800 | SD5840 | SD5880 | SD5920 | SD5960 | Acceleration time | ○ | R/W | Page 380 |
| SD5681 | SD5721 | SD5761 | SD5801 | SD5841 | SD5881 | SD5921 | SD5961 | Deceleration time | ○ | R/W | Page 380 |

R: Read only, R/W: Read/write, ○: Supported, ×: Not supported

*1 Writing can be performed only by the HCMOV/DHCMOV instruction.

## Operation of the complete flags

The following describes the operation timings of the complete flags.

If dwell time is specified, the flag turns on after the dwell time elapses.

| Item | FX3 compatible (Effective only at TBL instruction or DRVTBL instruction execution) | | User specification (Effective only at DRVTBL instruction or DRVMUL instruction execution) | |
|---|---|---|---|---|
| | Instruction execution complete flag (SM8029) | Instruction execution abnormal end flag (SM8329) | Instruction execution complete flag | Instruction execution abnormal end flag |
| ON condition | From when pulse output of the specified positioning address is completed to when the drive contact is turned off | From when the following operation or function is completed to when the drive contact is turned off<br>• Either the reference axis or counterpart axis is already used.*1<br>• Pulse output stop command<br>• Pulse decelerate and stop command<br>• Limit of the moving direction<br>• All module reset when a stop error occurs*2<br>• All outputs disabled (SM8034)<br>• Positioning address error<br>• Deceleration stop after the command speed is changed to 0 | From when pulse output of the specified positioning address is completed to when the ON → OFF condition is met | From when the following operation or function is completed to when the ON → OFF condition is met<br>• Either the reference axis or counterpart axis is already used.<br>• The drive contact is turned off during positioning operation<br>• Pulse output stop command<br>• Pulse decelerate and stop command<br>• Limit of the moving direction<br>• All module reset when a stop error occurs*2<br>• All outputs disabled (SM8034)<br>• Online change<br>• Positioning address error<br>• Deceleration stop after the command speed is changed to 0 |
| ON → OFF condition | When the drive contact is turned off | | The flag remains on until either of the following is performed.<br>• Turning off the flag by the user<br>• Restarting the table instruction<br>• Shift to the next table | |

*1 The flag turns on only for one scan when the drive contact of the instruction turns from OFF to ON.

*2 Only high-speed pulse input/output module is supported.

# Interpolation Operation (Absolute Address Specification Target Axis)

The following describes control method [23: Interpolation Operation (Absolute Address Specification Target Axis)]. Only FX5S/FX5U/FX5UC CPU module and high-speed pulse input/output module support interpolation operation.

### Setting data

The following table shows the operand assignment.

| Item | Operand 1*1 | Operand 2 | Operand 3 | Operand 4 |
|---|---|---|---|---|
| Description | Positioning Address | None | None | None |
| Range | -2147483648 to +2147483647 (User system unit) | — | — | — |
| Details | Set the relative address within the range of -2147483648 to +2147483647*2 in pulse. | None | None | None |

*1 When the positioning table data is set to use device, the value can be changed during positioning operation. The change is applied when the table operation instruction is restarted.

*2 Set the number of output pulses per table execution to 2147483647 or lower.

### Processing details

[23: Interpolation Operation (Absolute Address Specification Target Axis)] is assigned to the same table number as that for control method [22: Interpolation Operation (Absolute Address Specification)] specified in the interpolation reference axis.

For the interpolation operation, refer to ☞ Page 516 Interpolation Operation (Absolute Address Specification).

### Precautions

- Interpolation operation cannot be activated from this table. Drive interpolation operation with the table control method [22: Interpolation Operation (Absolute Address Specification)] of the reference axis.
- Each speed is calculated based on the speed of the reference axis.

### Related devices

Refer to ☞ Page 518 Related devices of control method [22: Interpolation Operation (Absolute Address Specification)].

### Operation of the complete flags

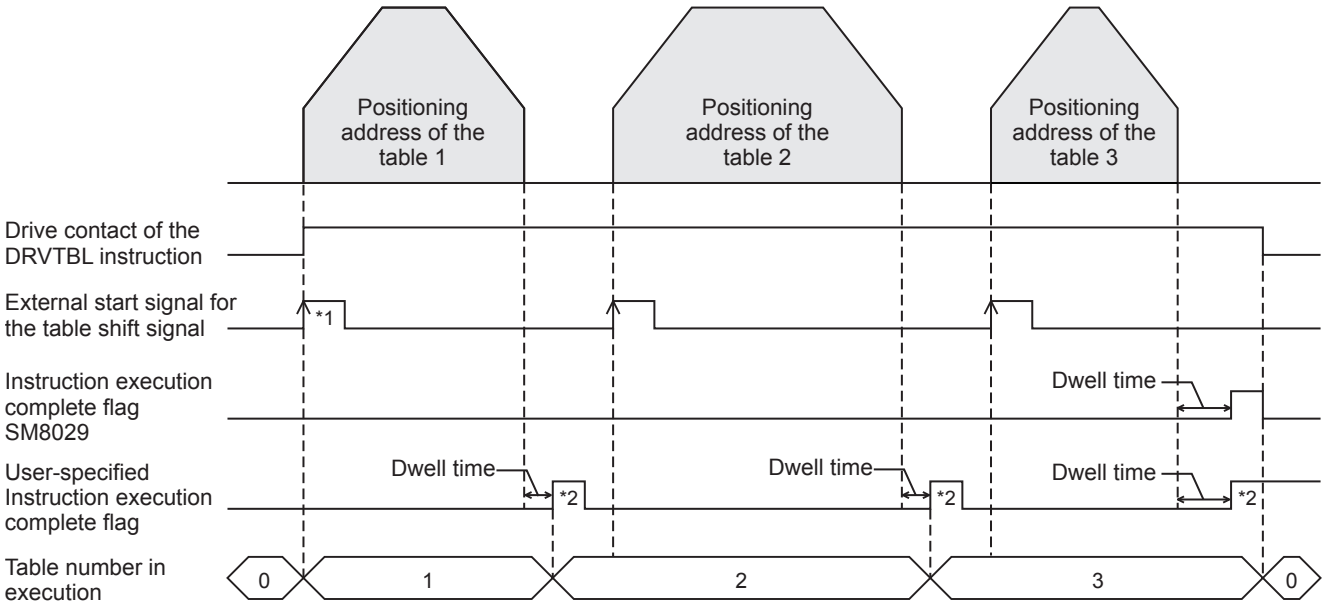
Refer to ☞ Page 520 Operation of the complete flags of control method [22: Interpolation Operation (Absolute Address Specification)].

# 33.3 How to Execute Multiple Tables

The execution method for multiple tables of the DRVTBL and DRVMUL instructions includes stepping operation and continuous operation.
This section describes how to execute each operation.

## Stepping operation

In stepping operation, with the DRVTBL instruction, specified tables are executed one by one. Only the DRVTBL instruction can execute this operation.
Every time a table ends, the complete flag turns on and the next table is not automatically activated. After the table shift command or external start signal is detected, the next table is executed. (☞ Page 398 Table shift command, Page 385 External Start Signal)
The following figure shows an example of stepping operation with the tables 1 to 3 and dwell time.




*1 When the external start signal is enabled, the drive contact and external start signal must be turned on to activate the positioning instruction.
*2 Remains on until the user turns off the flag or starts the next table.

## Operation

The following describes the operation of tables and flags in the stepping operation.

### ■Operation of the table

- Operation of each table in the stepping operation is the same as that of one-table operation.
- When a table with control method [0: No Positioning] is executed, or when the last table specified by the DRVTBL instruction is executed, execution of all the tables is completed. When the first table is greater than the last table, execution of all the tables is completed either when all the tables are executed or when control method [0: No Positioning] is executed.
- Even if the table shift command or external start signal is turned on before a table is completed, the next table is not activated. By turning on the table shift command or external start signal after the previous table is completed, the next table is executed.
- If the operation ends with an error when tables to be executed are left, the rest of the tables are not executed.
- Regardless whether the operation ends with or without errors, operation is started from the first table every time the instruction is turned on. The operation is not restarted from the last table of the previous operation.
- Some control methods can be used with the remaining distance operation. (☞ Page 364 Remaining distance operation)

### ■Operations by control method

- When a table with control method [0: No Positioning] is executed, all the tables are considered to be normally completed. Then, the complete flag turns on, and tables that follow the table with [0: No Positioning] are not executed.
- For control method [10: Condition Jump], the conditions are judged at execution of the table, and the table with the next number is immediately executed. (The judgment timing differs from that in continuous operation.)
- For control method [4: Variable Speed Operation] and control method [5: Table Transition Variable Speed Operation], after the pulse decelerate and stop command is detected, deceleration stop is performed, and the complete flag turns on after dwell time. Then, the next table becomes ready to be executed. For control method [5: Table Transition Variable Speed Operation], inputting the interrupt input signal 2 starts deceleration stop and enables the next table to be ready, in addition to the pulse decelerate and stop command.

### ■Operation of the flag

The user-specified positioning complete flag turns on for every table. (☞ Page 402 Complete flag) The complete flag that is on must be turned off by the user or turns off when execution of the next table is started. Instruction execution abnormal end flag (SM8029) turns on when execution of all the tables is completed.

### ■Operation with table (operand) setting

- Operands can be changed in mid-operation, similar to the one-table operation.
- Both absolute address and relative address can be used.

## Compatible control method

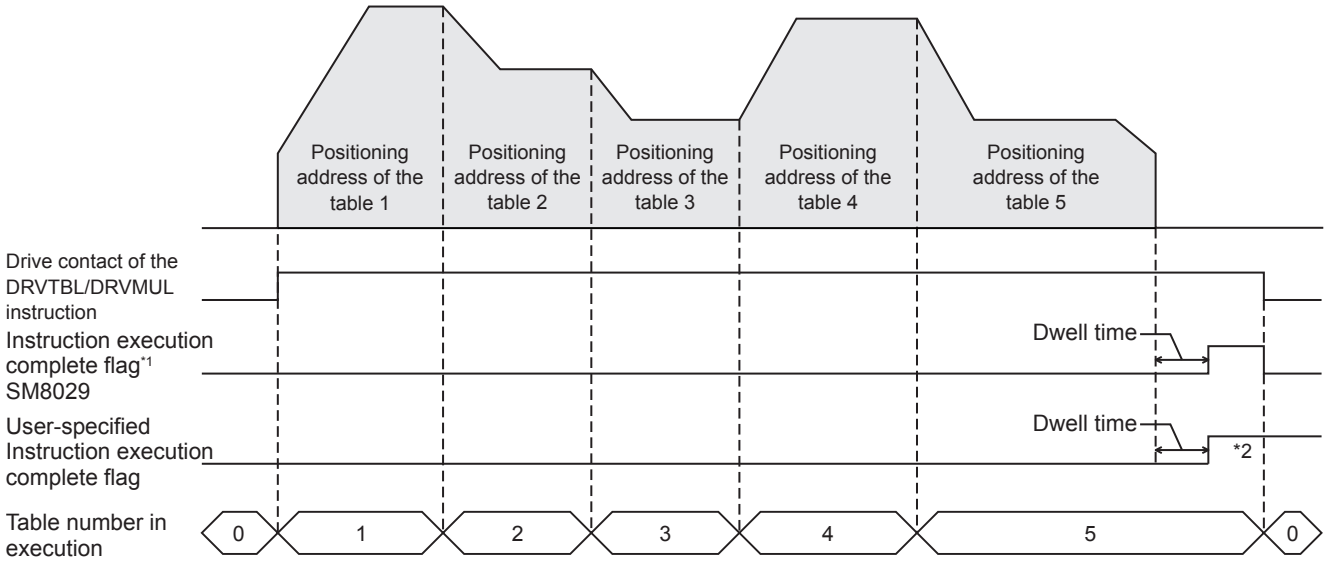
The following table lists operation of control methods of each table when stepping operation is specified.

| Control method | Operation | Reference |
|---|---|---|
| 0: No Positioning | When this type is specified, no pulses are output. The operation ends normally. | Page 492 |
| 1: 1 Speed Positioning (Relative Address Specification) | The table operates normally. | Page 493 |
| 2: 1 Speed Positioning (Absolute Address Specification) | The table operates normally. | Page 495 |
| 3: Interrupt 1 Speed Positioning | The table operates normally. | Page 497 |
| 4: Variable Speed Operation | The table operates normally. | Page 500 |
| 5: Table Transition Variable Speed Operation*1 | The table operates normally. | Page 502 |
| 6: Interrupt Stop (Relative Address Specification) | The table operates normally. | Page 504 |
| 7: Interrupt Stop (Absolute Address Specification) | The table operates normally. | Page 507 |
| 10: Condition Jump | Depends on the jump-destination table. | Page 509 |
| 20: Interpolation Operation (Relative Address Specification)*2 | The table operates normally. | Page 511 |
| 21: Interpolation Operation (Relative Address Specification Target Axis)*2 | When this type is specified, no pulses are output. The operation ends with an error. | Page 515 |
| 22: Interpolation Operation (Absolute Address Specification)*2 | The table operates normally. | Page 516 |
| 23: Interpolation Operation (Absolute Address Specification Target Axis)*2 | When this type is specified, no pulses are output. The operation ends with an error. | Page 520 |

*1 Only CPU module is supported.
*2 Only FX5S/FX5U/FX5UC CPU module and high-speed pulse input/output module support interpolation operation.

# Continuous operation

In continuous operation, operation is performed successively without deceleration stop between tables. The specified positioning address that has been output is the start address of the next table.
The positioning complete flag turns on when execution of all the specified tables is completed. Unlike stepping operation, the table shift command is not required.
The following figure shows an example of continuous operation with tables 1 to 5 (With dwell time).




*1 Only the DRVTBL instruction functions.
*2 Remains on until the user turns off the flag.

## Operation

The following describes the operation of tables and flags in the continuous operation.

### ■Operation of the table

- Dwell time of the last table is the time until the complete flag turns on after deceleration stop.
- When tables are executed successively causing a direction change, deceleration stop is performed once and then output is started in the reversed direction. The waiting time for the pulse output in the reversed direction after stop is "1 ms + scan time".
- If the operation ends with an error when tables to be executed are left, the rest of the tables are not executed.
- If a table that cannot be combined is executed, the operation ends with an error. In this case, the table before the table that cannot be combined is handled as the last table. After deceleration stop is performed for the previous table and dwell time elapses, the abnormal end flag turns on. The dwell time of the previous table is used.
- Some control methods can be used with the remaining distance operation. (☞ Page 364 Remaining distance operation)

### ■Operations by control method

- When a table with control method [0: No Positioning] is executed, all the tables are considered to be normally completed. Then, the positioning complete flag turns on, and tables that follow the table with control method [0: No Positioning] are not executed.
- The jump condition of control method [10: Condition Jump] is judged two tables before. (Example: If table 8 has control method [10: Condition Jump], the conditions are judged when execution of table 6 is started.) When the jump-destination table of control method [10: Condition Jump] has control method [10: Condition Jump], the conditions of control method [10: Condition Jump] of the jump-destination table are judged at the same time.

### ■Operation with table (operand) setting

- Set the command speeds and positioning addresses of each table so that tables are switched once per 10 ms or less frequently (except conditional jumps). If tables are switched more frequently than the above, table shift processing cannot be completed in time and operation is decelerated to a stop and ends with an error. (The tables that have been read operate normally.)
- The positioning address of the last table only can be changed in the case of continuous operation. Changes in the positioning addresses of tables other than the last table are ignored.
- The positioning address of the last table can be changed both in the address increasing direction and address decreasing direction. When the address is changed in the decreasing direction and the new address has already passed or when pulses required for deceleration stop are insufficient for the new address, pulses are output in the reverse direction after deceleration stop to reach the new positioning address. (The operation is the same as that of the DRVI/DDRVI and DRVA/DDRVA instructions.)

## Compatible control method

The following table lists control methods that can be used when continuous operation is specified.

| Continuous operation | | Rear table | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | No Positioning | 1 Speed Positioning (Relative Address Specification) | 1 Speed Positioning (Absolute Address Specification) | Interrupt 1 Speed Positioning*1 | Variable Speed Operation | Table Transition Variable Speed Operation*1 | Interrupt Stop (Relative Address Specification) | Interrupt Stop (Absolute Address Specification) | Condition Jump | Interpolation Operation (Relative Address Specification)*2 | Interpolation Operation (Absolute Address Specification)*2 |
| Forward table | 0: No Positioning | — | — | — | — | — | — | — | — | — | — | — |
| | 1: 1 Speed Positioning (Relative Address Specification) | ○ | ○ | ○ | × | × | × | ○ | ○ | ○ | × | × |
| | 2: 1 Speed Positioning (Absolute Address Specification) | ○ | ○ | ○ | × | × | × | ○ | ○ | ○ | × | × |
| | 3: Interrupt 1 Speed Positioning*1 | — | — | — | — | — | — | — | — | — | — | — |
| | 4: Variable Speed Operation | × | × | × | × | × | × | × | × | × | × | × |
| | 5: Table Transition Variable Speed Operation | ○ | × | × | *3 | × | ○ | × | × | ○ | × | × |
| | 6: Interrupt Stop (Relative Address Specification) | — | — | — | — | — | — | — | — | — | — | — |
| | 7: Interrupt Stop (Absolute Address Specification) | — | — | — | — | — | — | — | — | — | — | — |
| | 10: Condition Jump | ○ | △ | △ | × | × | △ | × | × | *4 | × | × |
| | 20: Interpolation Operation (Relative Address Specification)*2 | × | × | × | × | × | × | × | × | × | × | × |
| | 22: Interpolation Operation (Absolute Address Specification)*2 | × | × | × | × | × | × | × | × | × | × | × |

○: Can be used.

—: Cannot be used because operation ends after executing forward table.

×: Cannot be used.

△: Condition jump can be used depending on the forward table.

*1 Only CPU module is supported.

*2 Only FX5S/FX5U/FX5UC CPU module and high-speed pulse input/output module support interpolation operation.

*3 Can be used when control method [3: Interrupt 1 Speed Positioning] is specified as the second table.

*4 Can be used up to three times consecutively.

## Non-execution tables

Tables with positioning address setting such that no positioning is required are not executed and operation skips to the next table during continuous operation. The following table lists table non-execution conditions.

| Control method | Table non-execution conditions |
|---|---|
| 1: 1 Speed Positioning (Relative Address Specification) | Positioning address = 0 |
| 2: 1 Speed Positioning (Absolute Address Specification) | Positioning address = Current address when corresponding table is started*1 |
| 6: Interrupt Stop (Relative Address Specification) | Positioning address = 0 |
| 7: Interrupt Stop (Absolute Address Specification) | Positioning address = Current address when corresponding table is started*1 |

*1 The tables will be non-execution if specified as follows:
Table No.1: The positioning address of control method [1: 1 Speed Positioning (Relative Address Specification)] is 2000.
Table No.2: The positioning address of control method [2: 1 Speed Positioning (Absolute Address Specification)] is 2000.

### Precautions

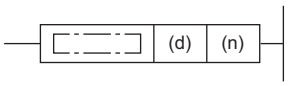
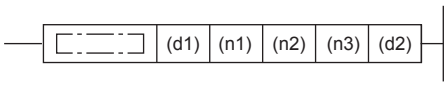
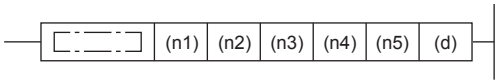
The table execution ends with an error if 4 or more consecutive tables are non-execution.

# 34 PROGRAMMING

This chapter describes common items and precautions related to programs.

## 34.1 Table Operation Instruction

After setting table data, create a program that uses the table. (☞ Page 489 TABLE OPERATION)
Specify the table No., in the operand of the table operation instruction.
The following table shows operands specified for each table operation instruction.

| Instruction | Operand | Ladder | Reference |
|---|---|---|---|
| TBL*1 | (n): Table number to be executed |  | Page 461 |
| DRVTBL | (n1): First table number to be executed<br>(n2): Last table number to be executed |  | Page 470 |
| DRVMUL | (n2): Table number of the axis 1<br>(n3): Table number of the axis 2<br>(n4): Table number of the axis 3<br>(n5): Table number of the axis 4 |  | Page 478 |

*1 Only CPU module is supported.

## 34.2 Cautions for Program Creation

The following describes cautions for program creation.

### User interrupt program

Only CPU module*1 can be executed in an interrupt program. If the high-speed pulse input/output module (axis 5 to axis 12) is executed in an interrupt program, an error occurs.

*1 FX5S/FX5U/FX5UC CPU module: Axis 1 to Axis 4
FX5UJ CPU module: Axis 1 to Axis 3

### Interrupt input signal 1

If the standard mode is used for interrupt signal input 1 for the high-speed pulse input/output module, approximately 2ms variance occurs before the start of the operation after the detection of interrupt input signal 1, so there is variance in travel distance after the detection of the interrupt input (changes depending on the interrupt request module). If this variance is not acceptable, use the high-speed mode or the CPU module.

### Positioning instructions in the same axis

- Do not activate multiple positioning instructions in the same axis. Another positioning instruction for the same axis cannot be driven until the pulses for the currently driven positioning operation are stopped and its drive contact is turned off.
- When the pulse output monitor is on, a positioning instruction that uses the corresponding axis cannot be used. (☞ Page 400 Pulse output monitor) While the pulse output monitor is on, even if the instruction drive contact is turned off, do not execute a positioning instruction that specifies the same axis number.

### Number of programmed positioning instructions

There is no limitation on the number of programmed positioning instructions. Programming one instruction two or more times does not cause any problems.

## External start signal

When the external start signal is enabled and off, a positioning instruction that uses the corresponding axis cannot be used. (☞ Page 385 External Start Signal) To use such a positioning instruction, turn on the drive contact of the instruction and then turn on the external start signal.



## Positioning instruction activation timing

### ■When the absolute position detection system is used

For the axis in which the absolute position detection system is used, activate the DABS instruction when the servo amplifier is powered on. (☞ Page 485 Absolute Position Detection System) After the ABS data has been read, the servo-ON (SON is on) status is retained, and it is disengaged when the DABS instruction is turned off. Activate the other instructions after the DABS instruction has read the ABS data.

### ■When the pulse output monitor is on

If the pulse output monitor is on, a positioning instruction (excluding the DABS instruction) that uses the same axis cannot be executed. (☞ Page 400 Pulse output monitor)

While a pulse output monitor is on even after the positioning instruction drive contact is set to off, a positioning instruction for the same output axis cannot be executed. Before re-executing a pulse output or positioning instruction, wait until the pulse output monitor turns off and one or more operation cycles pass.

### ■When a user interrupt is used

Driving a positioning instruction requires multiple scans and has both rising processing and falling processing. Thus, positioning does not operate normally if the positioning instruction is skipped by CJ instruction or if it is not executed every scan like inside an interrupt program. However, pulse output continues. Eliminating the instruction by online change also prevents the positioning from operating normally, and pulse output is stopped.

If the instruction is skipped, the complete flag does not turn on after the positioning operation stops. The complete flag turns on if the positioning instruction is executed again when CJ instruction is canceled or the user interrupt program is executed again. When the instruction is skipped, if disable all outputs (SM8034), pulse stop command, pulse decelerate and stop command, or limit in the movement direction is detected during a scan in which the positioning instruction is not executed, the positioning operation stops. The user-specified complete flag turns on, but the FX3 compatible complete flag (SM8029) does not turn on.

## Functions that share inputs and outputs

The inputs and outputs specified with the positioning parameter cannot be simultaneously used with another high-speed input/output function depending on the combination. (☞ Page 232 HIGH-SPEED INPUT/OUTPUT FUNCTION)

### ■CPU module

• Input

The following functions occupy inputs of the high-speed input/output function.

| Function | | Up to CH/axis | | Device | Simultaneous useable function |
|---|---|---|---|---|---|
| | | FX5S/FX5U/FX5UC | FX5UJ | | |
| Input interrupt*1 | Interrupt (Rising) | 8 CH | | X0 to X17 | The functions other than high-speed counter (input A phase, input B phase) |
| | Interrupt (Falling) | | | | |
| | Interrupt (Rising + Falling) | | | | |
| | Interrupt (Rising) + Pulse Catch | | | | Cannot be combined |
| High-speed counter | A phase input | 8 CH*2 | | X0 to X17 | — |
| | B phase input | | | | |
| | External preset input | | | | Input interrupt |
| | External enable input | | | | |
| Pulse width measurement | | 4 CH | | X0 to X7 | Input interrupt |
| Positioning | Near-point dog signal | 4 axes | 3 axes | X0 to X17 | • Input interrupt<br>• Zero signal |
| | Zero signal | 4 axes | 3 axes | X0 to X17 | • Input interrupt<br>• Near-point dog signal |
| | Interrupt input signal 1 | 4 axes | 3 axes | X0 to X17 | Input interrupt |
| | External start signal | 4 axes | 3 axes | X0 to X17 | Input interrupt |

*1 If used simultaneously with another function, the input logic of the other function is applied.

*2 When external preset input and external enable input are used, the number of usable channels is decreased depending on the counter type.

• Output

The following functions occupy outputs of the high-speed input/output function. The following functions cannot be combined with other high-speed input/output functions.

| Function | | Up to CH/axis | | Device | |
|---|---|---|---|---|---|
| | | FX5S/FX5U/FX5UC | FX5UJ | FX5S/FX5U/FX5UC | FX5UJ |
| PWM*1 | | 4 CH | | Y0 to Y7 | |
| Positioning | PULSE | 4 axes | 3 axes | Y0 to Y3 | Y0 to Y2 |
| | SIGN | | | Y0 to Y17 | |
| | CW | 2 axis | — | Y0, Y1 | — |
| | CCW | | | Y2, Y3 | |
| | Clear signal | 4 axes | 3 axes | Y0 to Y17 | |

*1 When positioning is not used, the output devices (Y) for which the positioning setting is enabled with parameters can be used as PWM outputs or general-purpose devices having no parameter.

### Precautions

Do not specify an output device (Y) used by the high-speed input/output function as the output destination of the high-speed comparison table.

### ■High-speed pulse input/output module

• Input

The following functions occupy inputs of the high-speed input/output function. The channels and the axis numbers are in module internal order.

| Device*1 | Input interrupt*2 | High-speed counter | Pulse width measurement | Positioning |
|---|---|---|---|---|
| X□ | X□ | CH1 Input A phase | — | — |
| X□+1 | X□+1 | CH1 Input B phase/external preset | — | — |
| X□+2 | X□+2 | CH1 Input external preset | — | Axis2 Zero signal |
| X□+3 | X□+3 | CH2 Input A phase | CH1 | Axis2 Interrupt input signal 1 |
| X□+4 | X□+4 | CH2 Input B phase/external preset | CH2 | Axis1 Interrupt input signal 1 |
| X□+5 | X□+5 | CH2 Input external preset | — | Axis1 Zero signal |
| X□+6 | X□+6 | CH1 Input external enable | — | Axis2 External start signal |
| X□+7 | X□+7 | CH2 Input external enable | — | Axis1 External start signal |

*1 The number in □ is the head input number for each high-speed pulse input/output module.

*2 Simultaneous use with a function other than the high-speed counter (A phase/B phase input) is possible. However, using with the channel 2 external enable input of the high-speed counter is not possible. However, the input logic of other functions is applied.

• Output

The following functions occupy outputs of the high-speed input/output function. The channels and the axis numbers are in module internal order. The following functions cannot be combined with other high-speed input/output functions.

| Device*1 | PWM | Positioning |
|---|---|---|
| Y□ | — | Axis1 PULSE/CW |
| Y□+1 | CH1 | Axis2 PULSE/CW |
| Y□+2 | — | Axis1 Clear signal |
| Y□+3 | — | Axis2 Clear signal |
| Y□+4 | — | Axis1 SIGN/CCW |
| Y□+5 | CH2 | Axis2 SIGN/CCW |
| Y□+6 | — | — |
| Y□+7 | — | — |

*1 The number in □ is the head output number for each high-speed pulse input/output module.

#### Precautions

Do not specify an output device (Y) used by the high-speed input/output function as the output destination of the high-speed comparison table.

## Restrictions on simultaneous execution of the high-speed comparison table and high-speed comparison instructions

There is a limit in the number of simultaneous executions of the high-speed comparison table and high-speed comparison instructions (DHSCS, DHSCR, DHSZ instruction). Shown below are the conditions included in the number of the simultaneous executions. For high-speed comparison table, refer to the following.

☞ Page 254 High-speed comparison table

For high-speed comparison instructions and HIOEN/DHIOEN instruction, refer to 🕮MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks).

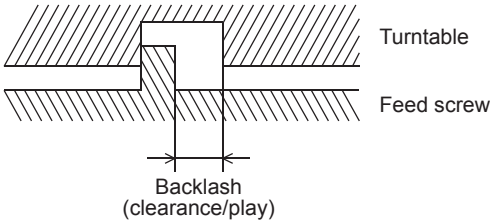
| Item | CPU module | High-speed pulse input/output module |
|---|---|---|
| Maximum executions | 32 | 15 |
| High-speed counter function | • Drive high-speed comparison table (Drive HIOEN/DHIOEN instruction)<br>• Drive DHSCS, DHSCR, DHSZ instruction) | • Drive high-speed comparison table (Drive HIOEN/DHIOEN instruction) |
| Positioning function | • Interrupt input signal 1 (High-speed mode) setting is enabled | • OPR setting is enabled (1 axis occupies 2 simultaneous executions.)<br>• Interrupt input signal 1 (High-speed mode) setting is enabled |

**Point**

- For the high-speed comparison table, only the tables driven by the HIOEN/DHIOEN instruction are included in the number of the simultaneous executions.
- When the positioning function setting is made, high-speed comparison table becomes occupied and is included in the number of simultaneous executions.

## Correction of backlash

The positioning function cannot correct mechanical backlash (clearance/play). If it is necessary to correct the backlash, set the number of output pulses taking into account the backlash that may be caused when reversing the transfer direction beforehand.




## Complete flag and completion of positioning operation

If the complete flag of a positioning instruction is turned on, then the execution of the instruction (such as pulse outputting operation) is complete (☞ Page 402 Complete flag). However, it is not certain whether the servo motor has stopped or not. Check the "positioning completion" signal of the servo amplifier (drive unit) to determine whether the servo motor has stopped.

## Online change

Do not perform online change if a positioning instruction is being executed (pulses are being output).
Operations if online change is performed while the instruction is executed are described in the following table.
Also do not perform online change if PWM is being executed.
For details on the PWM/DPWM instructions, refer to 📖MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks).

| Positioning instruction | | | Programmable controller operation when online change is performed while instruction is executed | Reference |
|---|---|---|---|---|
| Pulse Y output instruction*1 | PLSY/DPLSY | | Immediately stops pulse output. | Page 407 |
| Mechanical OPR instruction | DSZR/DDSZR | | Decelerates and stops pulse output. | Page 413 |
| Relative positioning instruction | DRVI/DDRVI | | | Page 423 |
| Absolute positioning instruction | DRVA/DDRVA | | | Page 433 |
| Interrupt 1-speed positioning instruction | DVIT/DDVIT | | | Page 442 |
| Variable speed operation instruction | PLSV/DPLSV | With acceleration/deceleration operation | Decelerates and stops pulse output. | Page 452 |
| | | Without acceleration/deceleration operation | Immediately stops pulse output. | |
| Single-table operation instruction*1 | TBL | | Online change cannot be performed. | Page 461 |
| Multiple-table operation instruction | DRVTBL | | | Page 470 |
| Multiple-axis table operation instruction | DRVMUL | | | Page 478 |

*1 Only CPU module is supported.

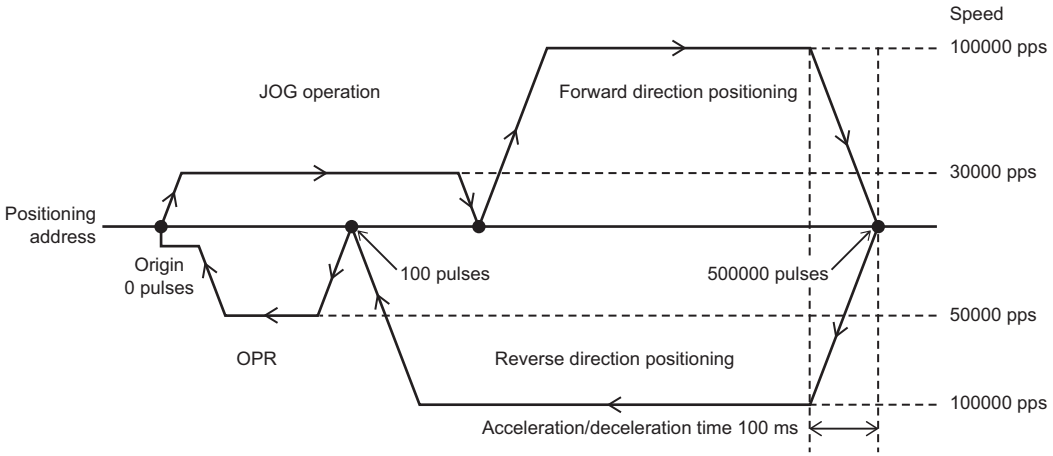
### Precautions

Note that immediate stop may damage the machine because the motor stops immediately.

# 34.3 Program Example



This program example shows the operation that controls the one-axis MELSERVO series amplifier.
Positioning is performed in the absolute position method by the OPR and forward/reverse rotation positioning as shown below. (Any JOG operation can be set.)

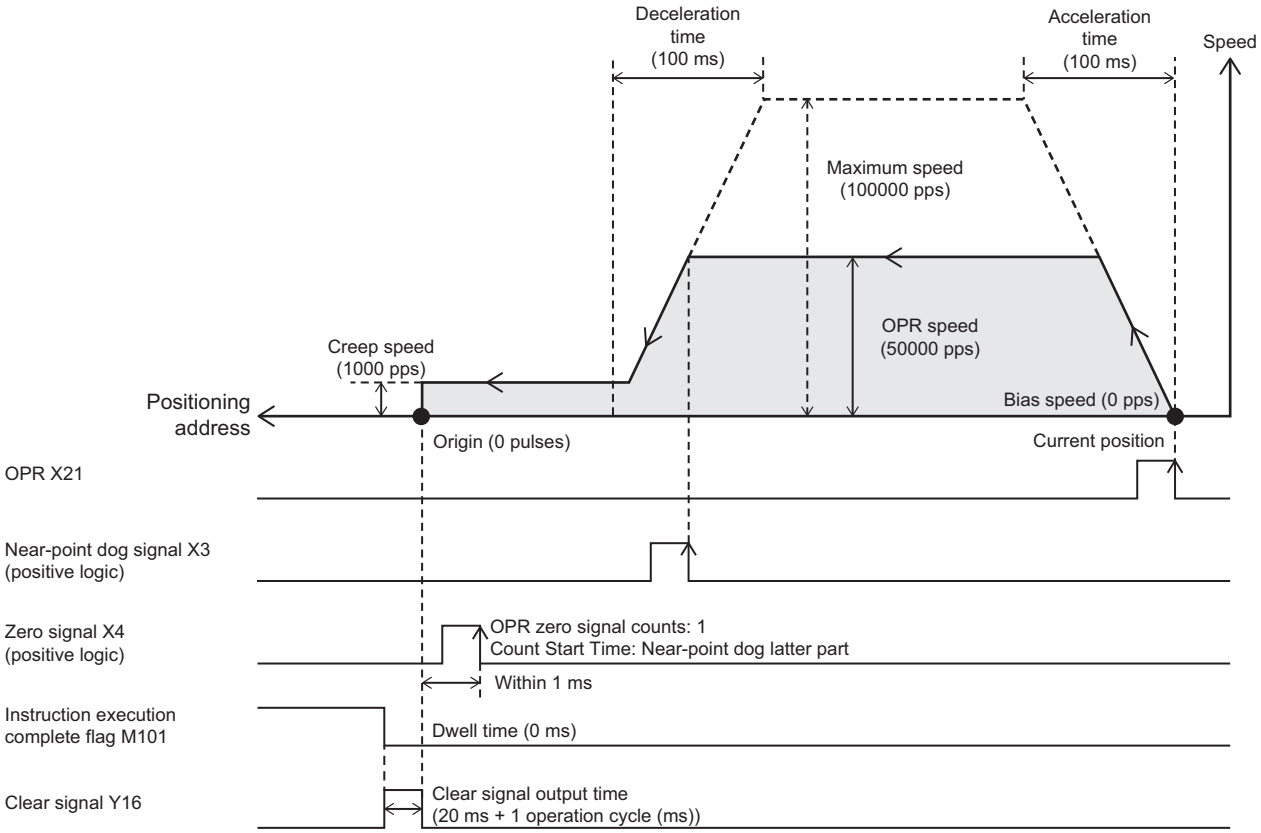



## Operation chart

Details for each positioning operation chart are shown below.

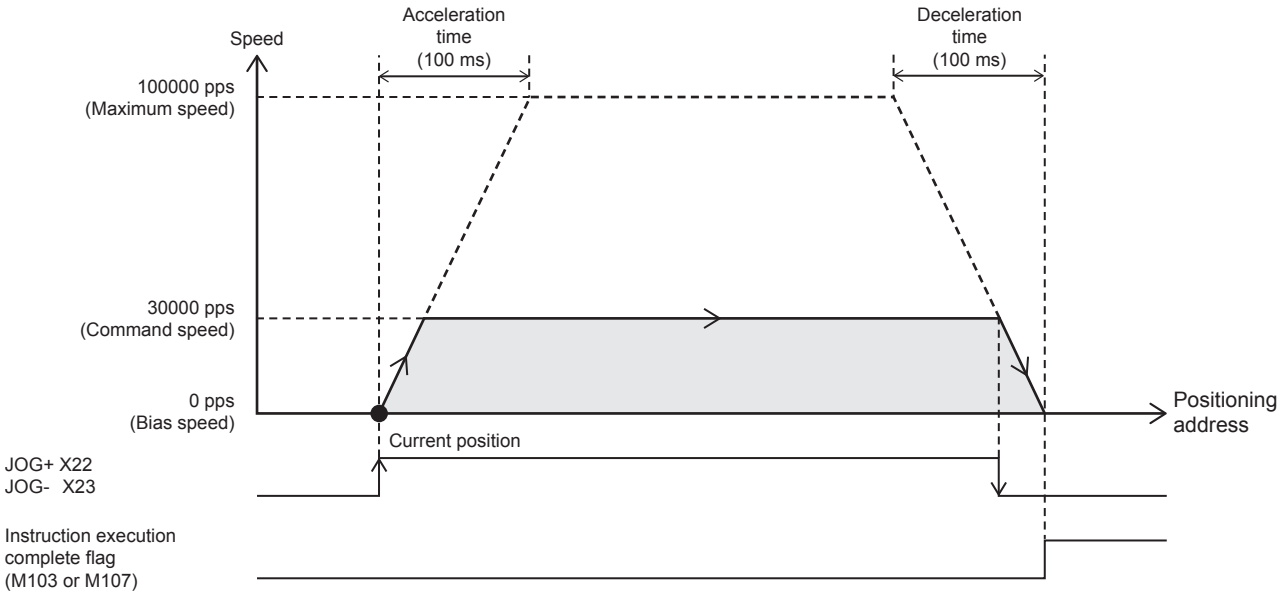
### ■OPR

When X21 is turned on, the positioning is started for the origin (0 pulse).



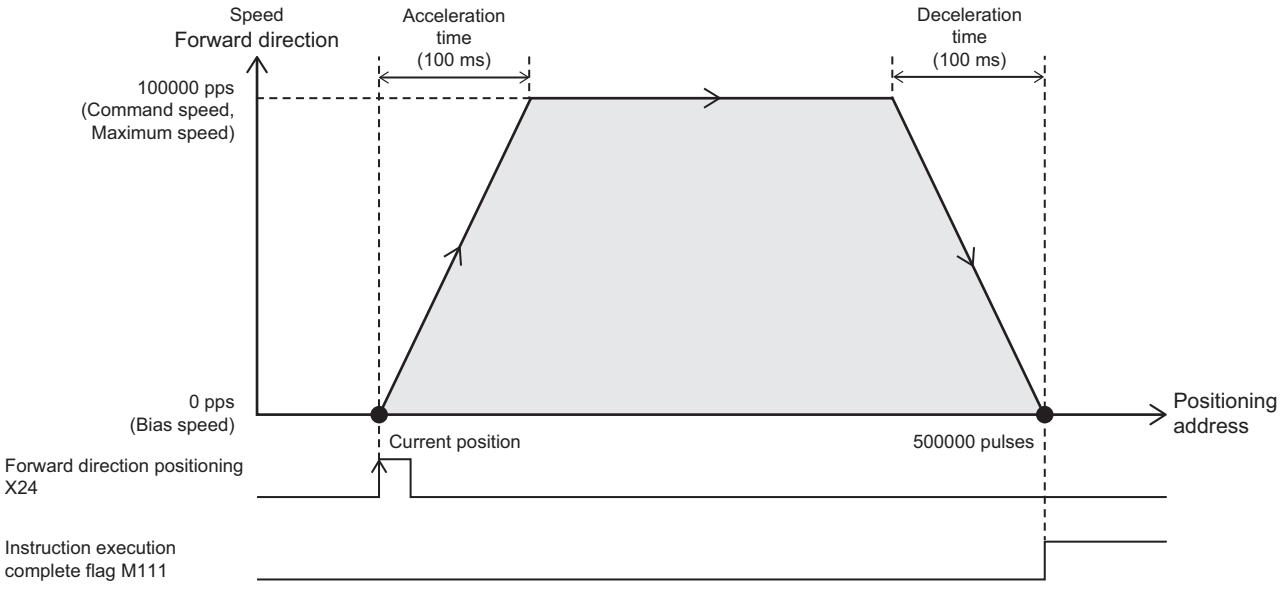
## ■JOG operation

When X22 is turned on, the JOG operation is started in the forward direction. When X23 is turned on, the JOG operation is started in the reverse direction. When X22 or X23 is turned off from on, the JOG operation decelerates and stops.



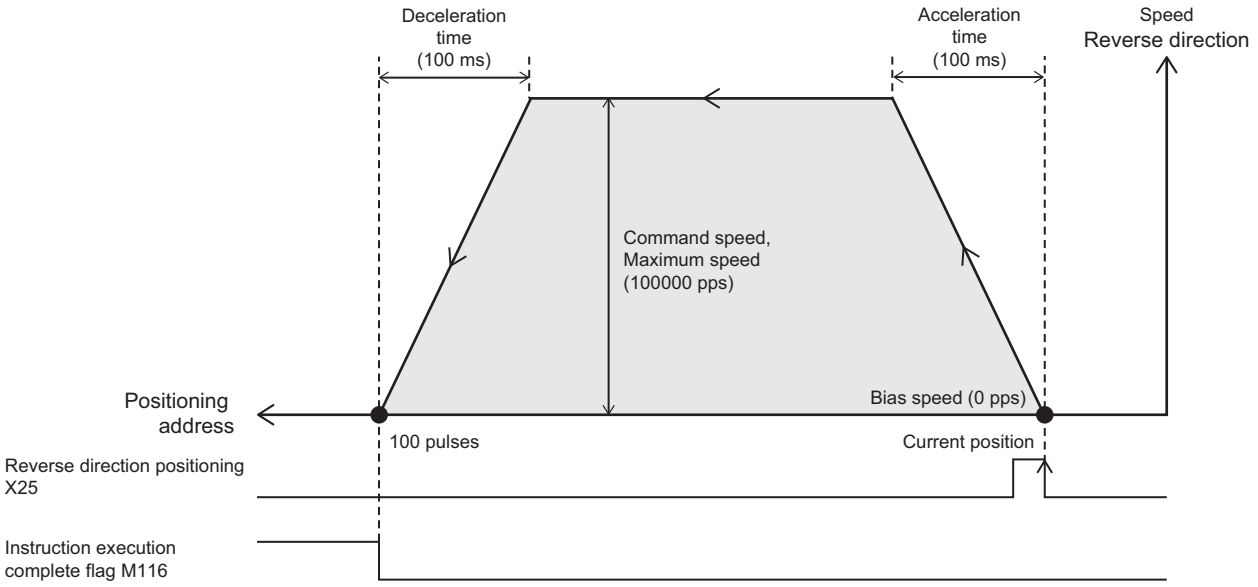

## ■Forward direction positioning

When X24 is turned on, the positioning is started for the target position (500000 pulses). If current address is 500001 pulses or more, positioning operation output in the reverse direction.



### ■Reverse direction positioning

When X25 is turned on, the positioning is started for the target position (100 pulses). If current address is less than 100 pulses, positioning operation output in the forward direction.




# Input/output assignment

The input/output assignment is as follows. (☞ Page 343 Input assignment, Page 348 Assignment of output numbers)
For example connection of MELSERVO series servo amplifier, refer to ☞ Page 944 Connection Example of Servo Amplifier.

## Input assignment

| Input number | Signal name | Connection destination |
|---|---|---|
| X3 | Near-point signal | Sensor, limit switch |
| X4 | Zero signal | Servo amplifier |
| X10 | Pulse stop command input | External switch |
| X11 | Pulse decelerate and stop command input | |
| X12 | Forward limit input | Sensor, limit switch |
| X13 | Reverse limit input | |
| X15 | Servo ready | Servo amplifier |
| X21 | OPR | External switch |
| X22 | JOG+ | |
| X23 | JOG- | |
| X24 | Forward direction positioning | |
| X25 | Reverse direction positioning | |

## Output assignment

| Output number | Signal name | Connection destination |
|---|---|---|
| Y0 | Pulse train (Pulse output destination) | Servo amplifier |
| Y4 | Direction (Rotation direction signal) | |
| Y16 | Clear signal | |

# Parameter setting

The setting values of the positioning parameters are shown below. (☞ Page 367 Basic setting)

## Setting data

| Item | Axis 1 | Item | Axis 1 |
|---|---|---|---|
| ■Basic Parameter 1 | | ■Detailed Setting Parameter | |
| Pulse Output Mode | 1: PULSE/SIGN | External Start Signal Enabled/ Disabled | 0: Disabled |
| Output Device (PULSE/CW) | Y0 | Interrupt Input Signal 1 Enabled/ Disabled | 0: Disabled |
| Output Device (SIGN/CCW) | Y4 | Interrupt Input Signal 2 Logic | 0: Positive Logic |
| Rotation Direction Setting | 0: Current Address Increment with Forward Run Pulse Output | ■OPR Parameter | |
| Unit Setting | 0: Motor System (pulse, pps) | OPR Enabled/Disabled | 1: Enabled |
| No. of Pulse per Rotation | 2000 pulse | OPR Direction | 0: Negative Direction (Address Decrement Direction) |
| Movement Amount per Rotation | 1000 pulse | Starting Point Address | 0 pulse |
| Position Data Magnification | 1: × Single | Clear Signal Output Enabled/ Disabled | 1: Enabled |
| ■Basic Parameter 2 | | Clear Signal Output Device No. | Y16 |
| Interpolation Speed Specified Method | 0: Composite Speed | OPR Dwell Time | 0 ms |
| Max. Speed | 100000 pps | Near-point Dog Signal Device No. | X3 |
| Bias Speed | 0 pps | Near-point Dog Signal Logic | 0: Positive Logic |
| Acceleration Time | 100 ms | Zero Signal Device No. | X4 |
| Deceleration Time | 100 ms | Zero Signal Logic | 0: Positive Logic |
| — | | Zero Signal OPR Zero Signal Counts | 1 |
| | | Zero Signal Count Start Time | 0: Near-point Dog Latter Part |

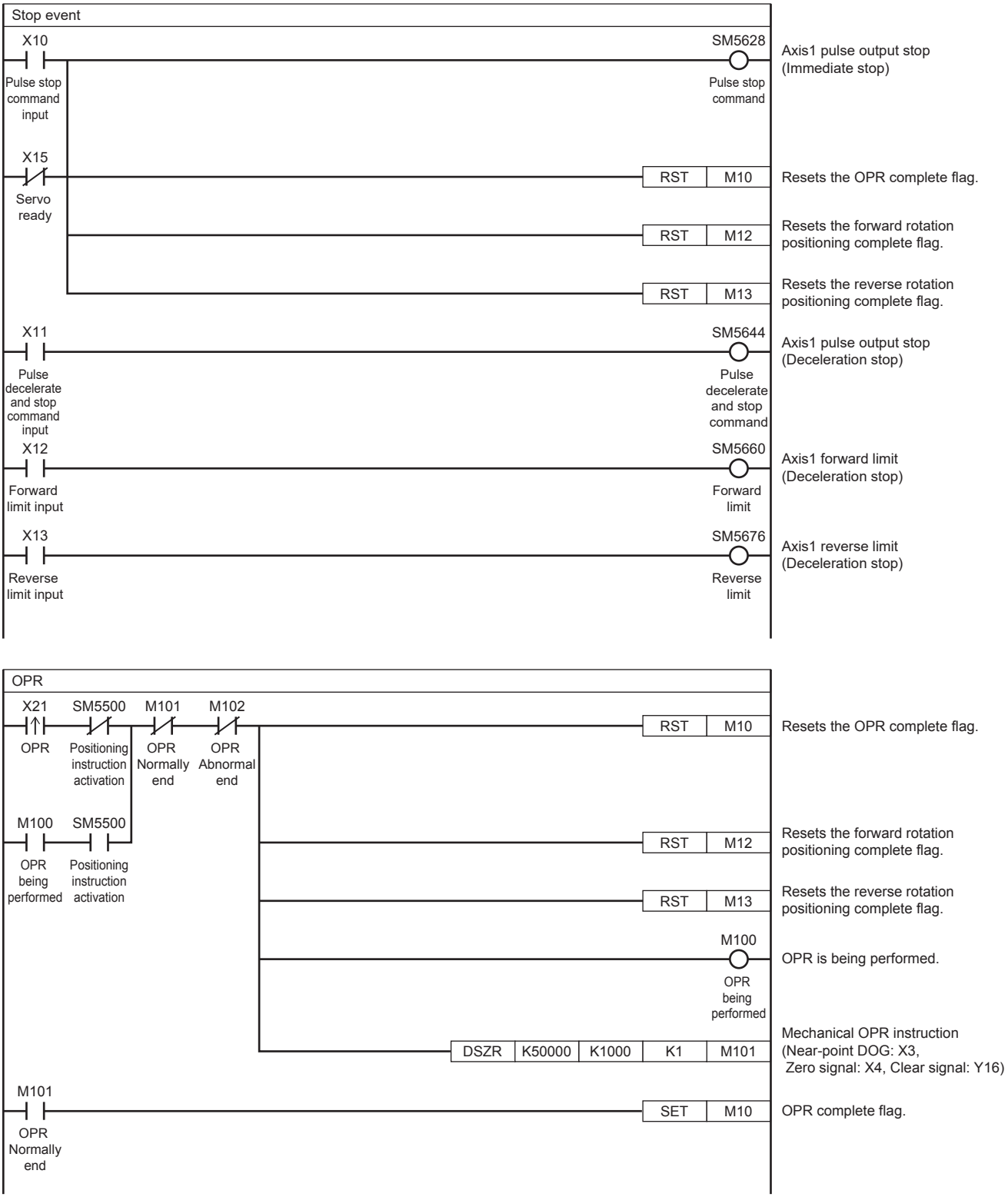
# Forward/reverse rotation program

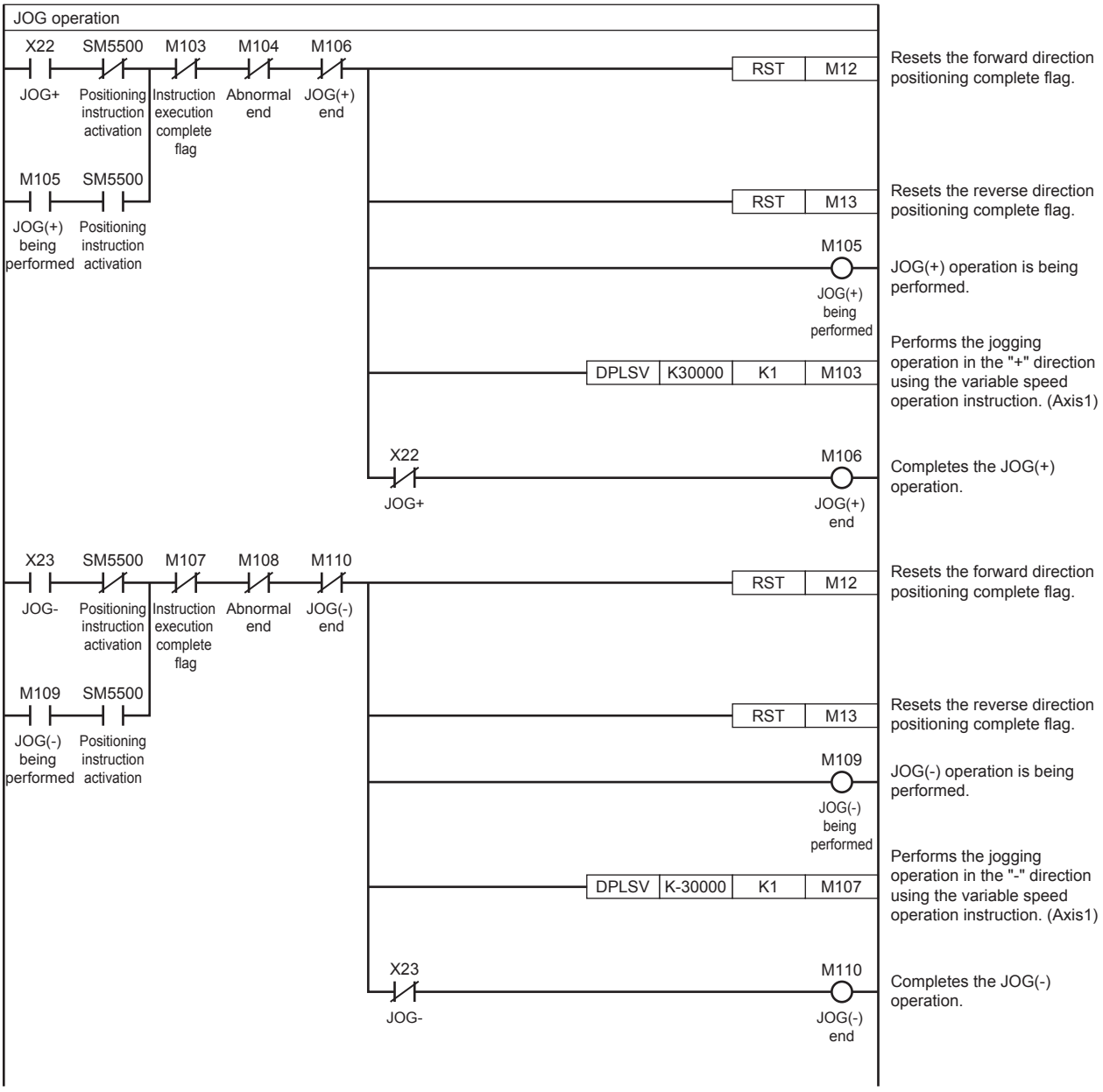
The positioning instructions used in the program examples are shown below.

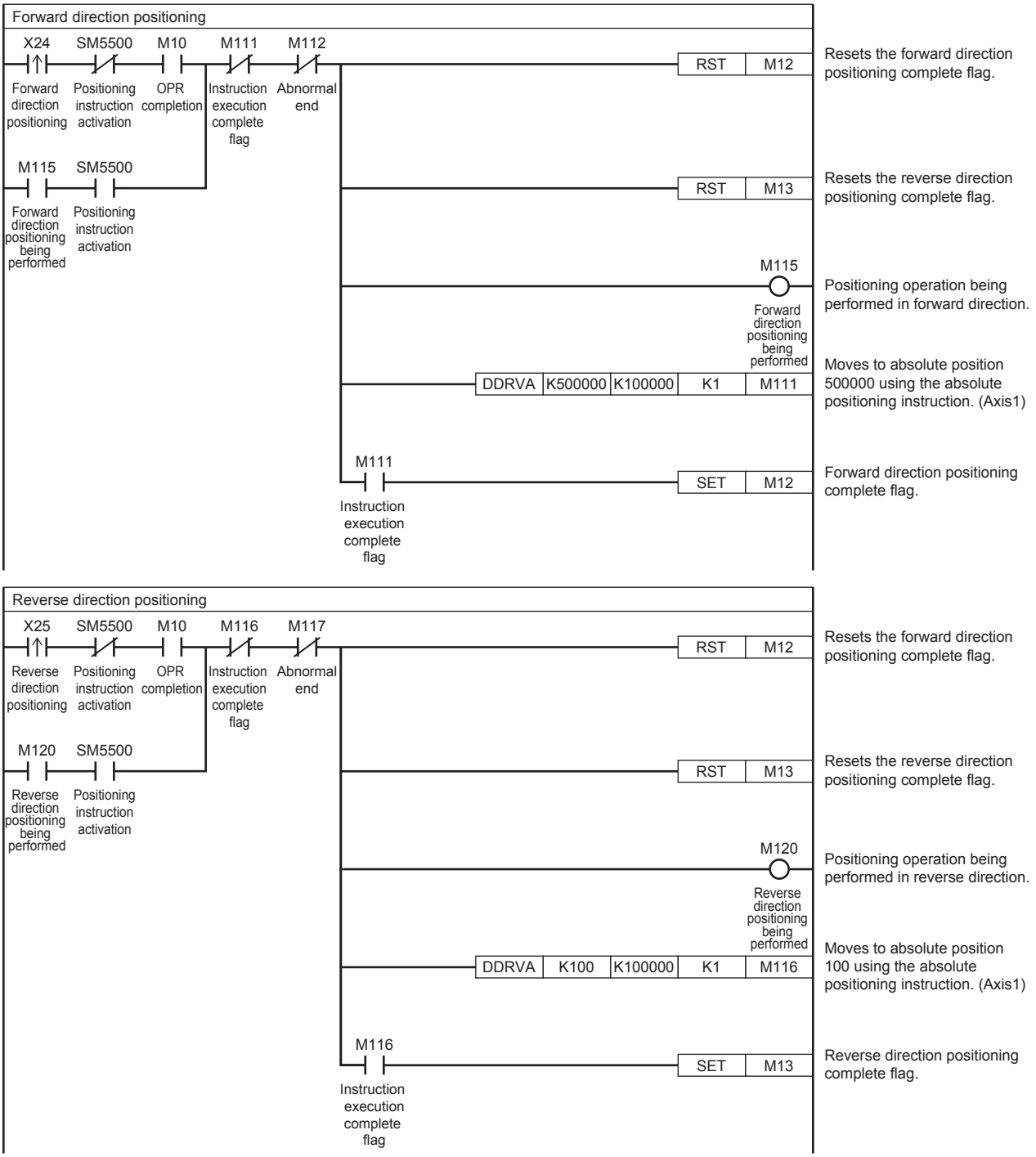
| Positioning instruction | | Reference |
|---|---|---|
| Mechanical OPR | DSZR/DDSZR | ☞ Page 413 |
| Absolute positioning | DRVA/DDRVA | ☞ Page 433 |
| Variable speed operation | PLSV/DPLSV | ☞ Page 452 |

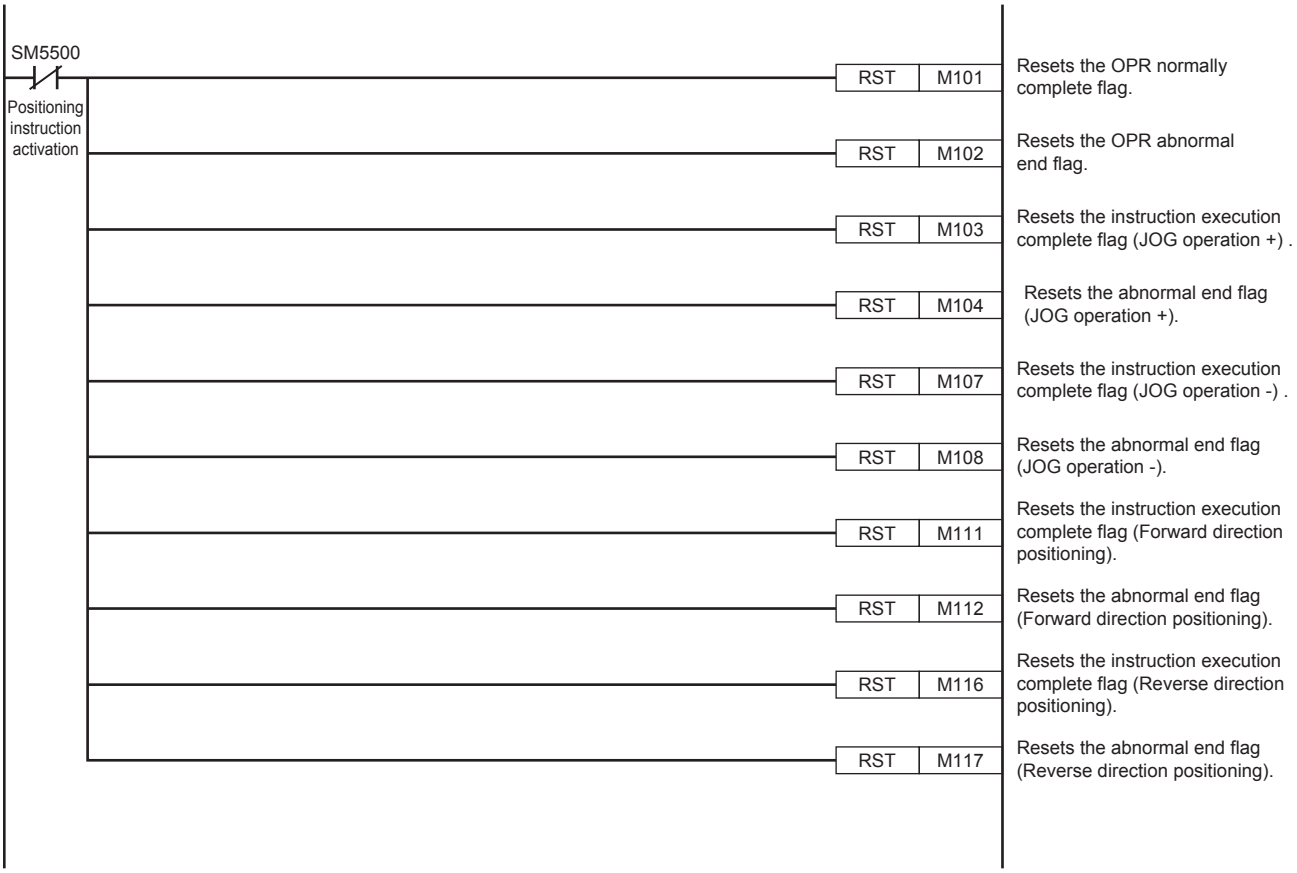


## Program example




JOG operation
X22
JOG+
SM5500
Positioning instruction activation
M103
Instruction execution complete flag
M104
Abnormal end
M106
JOG(+) end
RST M12
Resets the forward direction positioning complete flag.
M105
JOG(+) being performed
SM5500
Positioning instruction activation
RST M13
Resets the reverse direction positioning complete flag.
M105
JOG(+) being performed
JOG(+) operation is being performed.
DPLSV K30000 K1 M103
Performs the jogging operation in the "+" direction using the variable speed operation instruction. (Axis1)
X22
JOG+
M106
JOG(+) end
Completes the JOG(+) operation.
X23
JOG-
SM5500
Positioning instruction activation
M107
Instruction execution complete flag
M108
Abnormal end
M110
JOG(-) end
RST M12
Resets the forward direction positioning complete flag.
M109
JOG(-) being performed
SM5500
Positioning instruction activation
RST M13
Resets the reverse direction positioning complete flag.
M109
JOG(-) being performed
JOG(-) operation is being performed.
DPLSV K-30000 K1 M107
Performs the jogging operation in the "-" direction using the variable speed operation instruction. (Axis1)
X23
JOG-
M110
JOG(-) end
Completes the JOG(-) operation.


Forward direction positioning
X24
Forward direction positioning
SM5500
Positioning instruction activation
M10
OPR completion
M111
Instruction execution complete flag
M112
Abnormal end
RST M12
Resets the forward direction positioning complete flag.
M115
Forward direction positioning being performed
SM5500
Positioning instruction activation
RST M13
Resets the reverse direction positioning complete flag.
M115
Forward direction positioning being performed
Positioning operation being performed in forward direction.
DDRVA K500000 K100000 K1 M111
Moves to absolute position 500000 using the absolute positioning instruction. (Axis1)
M111
Instruction execution complete flag
SET M12
Forward direction positioning complete flag.
Reverse direction positioning
X25
Reverse direction positioning
SM5500
Positioning instruction activation
M10
OPR completion
M116
Instruction execution complete flag
M117
Abnormal end
RST M12
Resets the forward direction positioning complete flag.
M120
Reverse direction positioning being performed
SM5500
Positioning instruction activation
RST M13
Resets the reverse direction positioning complete flag.
M120
Reverse direction positioning being performed
Positioning operation being performed in reverse direction.
DDRVA K100 K100000 K1 M116
Moves to absolute position 100 using the absolute positioning instruction. (Axis1)
M116
Instruction execution complete flag
SET M13
Reverse direction positioning complete flag.




# 34.4 FX3 Compatible SM/SD

FX3 compatible devices can be used. Devices other than the instruction execution complete flag (SM8029) and the instruction execution abnormal end flag (SM8329) are supported for only CPU module.

Both the FX5 dedicated devices and FX3 compatible devices can be used if they have the same functionality.

For details on devices, refer to ☞ Page 372 Details of Parameters.

# 35 TROUBLESHOOTING

This chapter describes the errors and problems related to the positioning function.

## 35.1 LED Status During Pulse Output and Rotation Direction Output



Check the on/off status of LED indicator lamp on the CPU module that indicates the status of the output device (Y) to assess the positioning operation status. For other LEDs, refer to the following manuals.

MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)

| Signal | | CPU module | | | | High-speed I/O positioning*2 | | LED status during execution of positioning instruction | Description |
|---|---|---|---|---|---|---|---|---|---|
| | | Axis 1 | Axis 2 | Axis 3 | Axis 4*1 | Axis ■ | Axis ■+1 | | |
| Pulse output destination | PULSE (pulse train) | Y0 | Y1 | Y2 | Y3 | Y□ | Y□+1 | Flashing (turned on and off at high speed) | The pulse output operation is controlled by the positioning instruction. |
| | | | | | | | | OFF | One of the following has occurred:<br>1) The operation of the positioning instruction is completed.<br>2) An error occurred during positioning. The instruction, therefore, is not being executed. |
| | CW*1 (forward pulse train) | Y0 | Y1 | — | — | Y□ | Y□+1 | Flashing (turned on and off at high speed) | Forward operation is being executed for a positioning instruction.<br>Reverse pulse train is off. |
| | | | | | | | | OFF | One of the following has occurred:<br>1) The operation of the positioning instruction is completed.<br>2) An error occurred during positioning. The instruction, therefore, is not being executed. |
| Rotation direction output | SIGN (direction) | Y0 to Y17 | | | | Y□+4 | Y□+5 | ON | Forward operation is in execution. |
| | | | | | | | | OFF | One of the following has occurred:<br>1) The positioning instruction turns on, and operation is being performed in the reverse rotation direction.<br>2) An error occurred during positioning. The instruction, therefore, is not being executed. |
| | CCW*1 (reverse rotation pulse train) | Y2 | Y3 | — | — | Y□+4 | Y□+5 | Flashing (turned on and off at high speed) | Reverse operation is being executed for a positioning instruction.<br>Forward pulse train is off. |
| | | | | | | | | OFF | One of the following has occurred:<br>1) The operation of the positioning instruction is completed.<br>2) An error occurred during positioning. The instruction, therefore, is not being executed. |

*1 Only FX5S/FX5U/FX5UC CPU module is supported.

*2 The number in ■ is first module: 5, second module: 7, third module: 9, fourth module: 11.
The number in □ is the head output number for each high-speed pulse input/output module.

# 35.2 Servo Motor, Stepping Motor

If the servo motor or the stepping motor does not operate, check the following items.

***1.*** Check the wiring.

For the output specifications, refer to ☞ Page 345 Output Specifications.

For details on the MELSERVO series servo amplifier (drive unit), refer to the manuals for the unit used.

***2.*** Execute the positioning instruction, and then check the statuses of the following LED indicator lamps. (☞ Page 539 LED Status During Pulse Output and Rotation Direction Output)

- LED indicator lamp of the output specified as the pulse output destination device
- LED indicator lamp of the output specified as the rotation direction output device

***3.*** Verify that the same pulse output method is being applied for both the programmable controller and the servo amplifier (drive unit). (☞ Page 372 Pulse Output Mode)

***4.*** Check that the flag which stops the pulse is off. (☞ Page 406 Pulse output stop)

***5.*** Check the operation timing of the positioning instruction. (☞ Page 527 Positioning instruction activation timing)

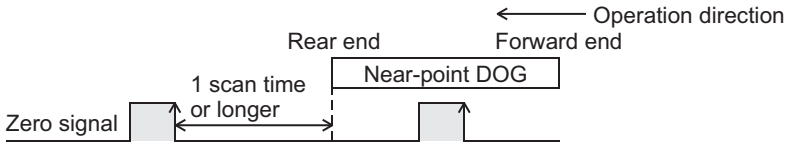
# 35.3 Stop Position

If operation is stopped at the wrong position, check the following items.

***1.*** Check whether the electronic gear of the servo amplifier (drive unit) is set properly. (☞ Page 375 Unit Setting)

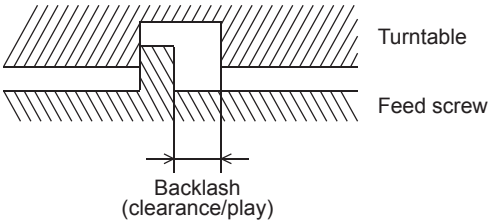
***2.*** Check whether the origin is set properly.

- Properly set the near-point dog so that the near-point dog signal can be kept in the ON status until the speed is reduced to the creep speed. (☞ Page 392 Near-point Dog Signal, Page 391 Creep speed) The DSZR/DDSZR instruction starts deceleration to the creep speed at the front end of the near-point dog, the operation stops at "the rear end of the near-point dog" or at "detection of the first zero signal after the rear end of the near-point dog", and the current address is cleared. (☞ Page 413 Mechanical OPR)
- The creep speed should be sufficiently slow. The DSZR/DDSZR instruction will not reduce the speed before stopping. For this reason, if the creep speed is not slow enough, the operation may not be stopped at the specified position due to inertia.
- Detection of (the rear end and the front end of) the near-point dog signal will be affected by the response time and the scan time of the sequence program. Ensure 1 scan time or more from the rear end of the dog to turning on of the zero signal.
- When the DSZR/DDSZR instruction is used, the zero signal of the servo motor is used. Adjust the relation between the rear end of the near-point dog and the zero signal as shown in the following figure. If fine adjustment of the origin position is needed, adjust the position of the near-point dog.




***3.*** If reciprocating operation (operation in the forward rotation direction and then reverse rotation direction) is not stopped at the specified position:

The positioning function cannot correct mechanical backlash (clearance/play). If it is necessary to correct the backlash or reverse the transfer direction, set the number of output pulses taking into account the backlash that may be caused beforehand.



# MEMO

# PART 4 ANALOG FUNCTIONS

This part consists of the following chapters.

# 36 CPU MODULE BUILT-IN ANALOG FUNCTION

This chapter describes the built into analog the FX5U CPU module.
The FX5U CPU module has 2 points of built-in analog voltage input and 1 point of built-in analog voltage output.
Values A/D-converted by the FX5U CPU module are written to special registers assigned to each channel. D/A-converted analog data are output when values are set to special registers in the FX5U CPU module.

## 36.1 Specifications

This section describes the specifications.

### Generic specifications

For the general specification, refer to the following manual.
MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)

### Performance specifications

This section describes the performance specifications.

#### Analog input

| Item | | Specifications |
|---|---|---|
| No. of analog input points | | 2 points (2 channels) |
| Analog input | Voltage | 0 to 10 V DC (input resistance 115.7 kΩ) |
| Digital output | | Unsigned 12-bit binary |
| Device allocation | | SD6020 (A/D-converted input data of ch1)<br>SD6060 (A/D-converted input data of ch2) |
| Input characteristics, max. resolution | Digital output value | 0 to 4000 |
| | Max. resolution | 2.5 mV |
| Accuracy<br>(Accuracy for the full scale of the digital output value) | Ambient temperature 25±5℃ | Within ±0.5% (±20 digit*2) |
| | Ambient temperature 0 to 55℃ | Within ±1.0% (±40 digit*2) |
| | Ambient temperature -20 to 0℃*1 | Within ±1.5% (±60 digit*2) |
| Conversion speed | | 30 μs/channel (data refreshed every operation cycle) |
| Absolute max. input | | -0.5 V, +15 V |
| Insulation method | | Inside the CPU module and the analog input circuit are not insulated.<br>Between input terminals (channels) is not insulated. |
| No. of occupied input/output points | | 0 point (does not pertain to the max. No. of input/output points of the CPU module.) |

*1 This specification does not apply to products manufactured before June 2016.
*2 "digit" refers to digital values.

## Analog output

| Item | | Specifications |
|---|---|---|
| No. of analog output points | | 1 point (1 channel) |
| Digital input | | Unsigned 12-bit binary |
| Analog output | Voltage | 0 to 10 V DC (external load resistance 2 k to 1 MΩ) |
| Device allocation | | SD6180 (Output setting data) |
| Output characteristics, max. resolution*1 | Digital input value | 0 to 4000 |
| | Max. resolution | 2.5 mV |
| Accuracy*2<br>(Accuracy for the full scale analog output value) | Ambient temperature 25±5℃ | Within ±0.5% (±50mV) |
| | Ambient temperature 0 to 55℃ | Within ±1.0% (±100mV) |
| | Ambient temperature -20 to 0℃*3 | Within ±1.5% (±150mV) |
| Conversion speed | | 30 μs (data refreshed every operation cycle) |
| Insulation method | | Inside the CPU module and the analog output circuit are not insulated. |
| No. of occupied input/output points | | 0 point (does not pertain to the max. No. of input/output points of the CPU module.) |

*1 There is a dead band near 0 V output, which is an area where some digital input values are not reflected to analog output values.

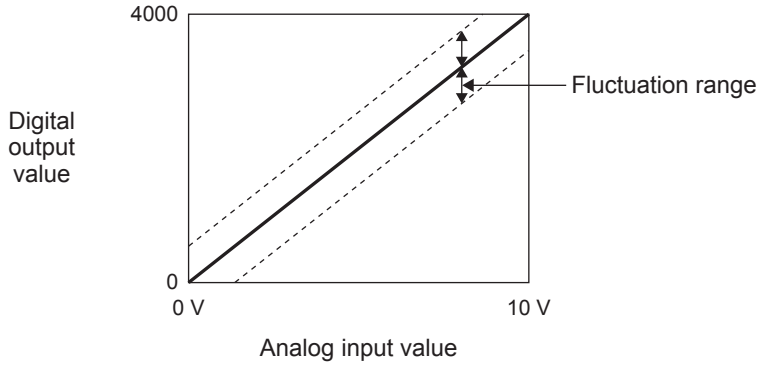
*2 External load resistance is set to 2 kΩ when shipped from the factory. Thus, output voltage will increase somewhat if the resistance is set higher than 2 kΩ. When the resistance is 1 MΩ, output voltage increases by a maximum of 2%.

*3 This specification does not apply to products manufactured before June 2016.

# Accuracy

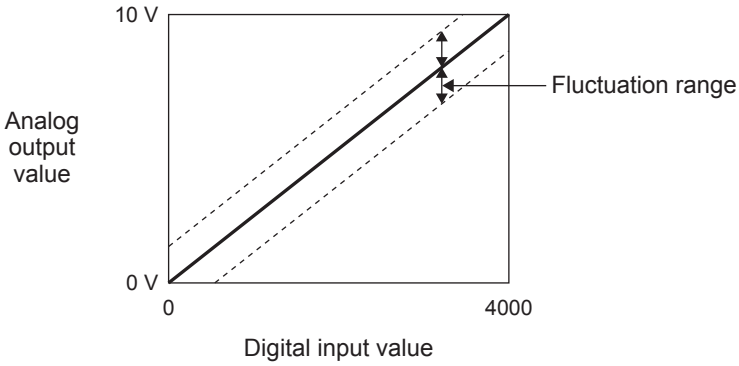
## Built-in analog input

Accuracy of A/D conversion is determined by the accuracy for the full scale of digital output value.
The accuracy is within ±0.5 % (±20 digits) at ambient temperature of 25±5℃, within ±1.0 % (±40 digits) at ambient temperature of 0 to 55℃, and within ±1.5 % (±60 digits) at ambient temperature of -20 to 0℃. (Except for the conditions under the influence of noise)




## Built-in analog output

Accuracy of D/A conversion is determined by the accuracy for the full scale of analog output value.
The accuracy is within ±0.5 % (±50mV) at ambient temperature of 25±5℃, within ±1.0 % (±100mV) at ambient temperature of 0 to 55℃, and within ±1.5 % (±150mV) at ambient temperature of -20 to 0℃. (Except for the conditions under the influence of noise)



# 36.2 List of Functions

The following table lists the functions.

## Analog input

| List of functions | | Description | Reference |
|---|---|---|---|
| A/D conversion enable/disable setting function | | Function to enable or disable A/D conversion per channel.<br>The conversion process time can be reduced by disabling conversion for unused channels. | Page 549 |
| A/D conversion method | Sampling processing | Method of converting each analog input at END processing to generate the equivalent digital output. | Page 550 |
| | Time average | Method of averaging the time of A/D conversion values and outputting these average values as the digital signal. | |
| | Count average | Method of averaging the count of A/D conversion values and outputting these average values as the digital signal. | |
| | Moving Average | Method of averaging the analog input for a specified count measured at every END process, and outputting these average values as the digital signal. | |
| Over scale detection function | | Function to detect analog input values that are over an input range. | Page 552 |
| Scaling function | | Function that converts user-defined maximum and minimum digital values in accordance with a configured scale. | Page 554 |
| Shift function | | Function that adds a specified amount to the A/D conversion value.<br>Fine adjustments during system startup can be easily performed. | Page 555 |
| Digital clipping function | | Function that specifies the maximum A/D conversion value as 4000 and the minimum value as 0 when voltage is input that exceeds the input range. | Page 553 |
| Maximum value/minimum value hold function | | Function that holds the minimum and maximum digital operation values. | Page 556 |
| Warning output function | | Function to output warning when digital operation values exceed the specified range. | Page 557 |
| Event history function | | Collects errors that occurred in the CPU module, and stores them as event information into the CPU module. | Page 558 |

## Analog output

| List of functions | Description | Reference |
|---|---|---|
| D/A conversion enable/disable function | Function to enable or disable D/A conversion.<br>When analog output is not used, the conversion process time can be reduced by disabling conversion. | Page 560 |
| D/A output enable/disable setting function | Specifies whether to output the D/A conversion value or output an offset value (HOLD setting value). | Page 560 |
| Analog output HOLD/CLEAR function | Sets the digital value before D/A conversion to the previous value or clears the value (0) depending on the operation status of the CPU module (RUN, STOP, and STOP error). | Page 561 |
| Analog output test when CPU module is in STOP status function | Outputs a user-defined analog value by setting the output enable/disable flag to enabled when the CPU module is stopped, and changing the digital value. | Page 562 |
| Scaling function | Function that converts user-defined maximum and minimum digital values in accordance with a configured scale. | Page 563 |
| Shift function | Function that adds a specified amount to the digital value.<br>Fine adjustments during system startup can be easily performed. | Page 564 |
| Warning output function | Function to output warning when digital values exceed the specified range. | Page 564 |
| Event history function | Collects errors that occurred in the CPU module, and stores them as event information into the CPU module. | Page 566 |

## PID control function

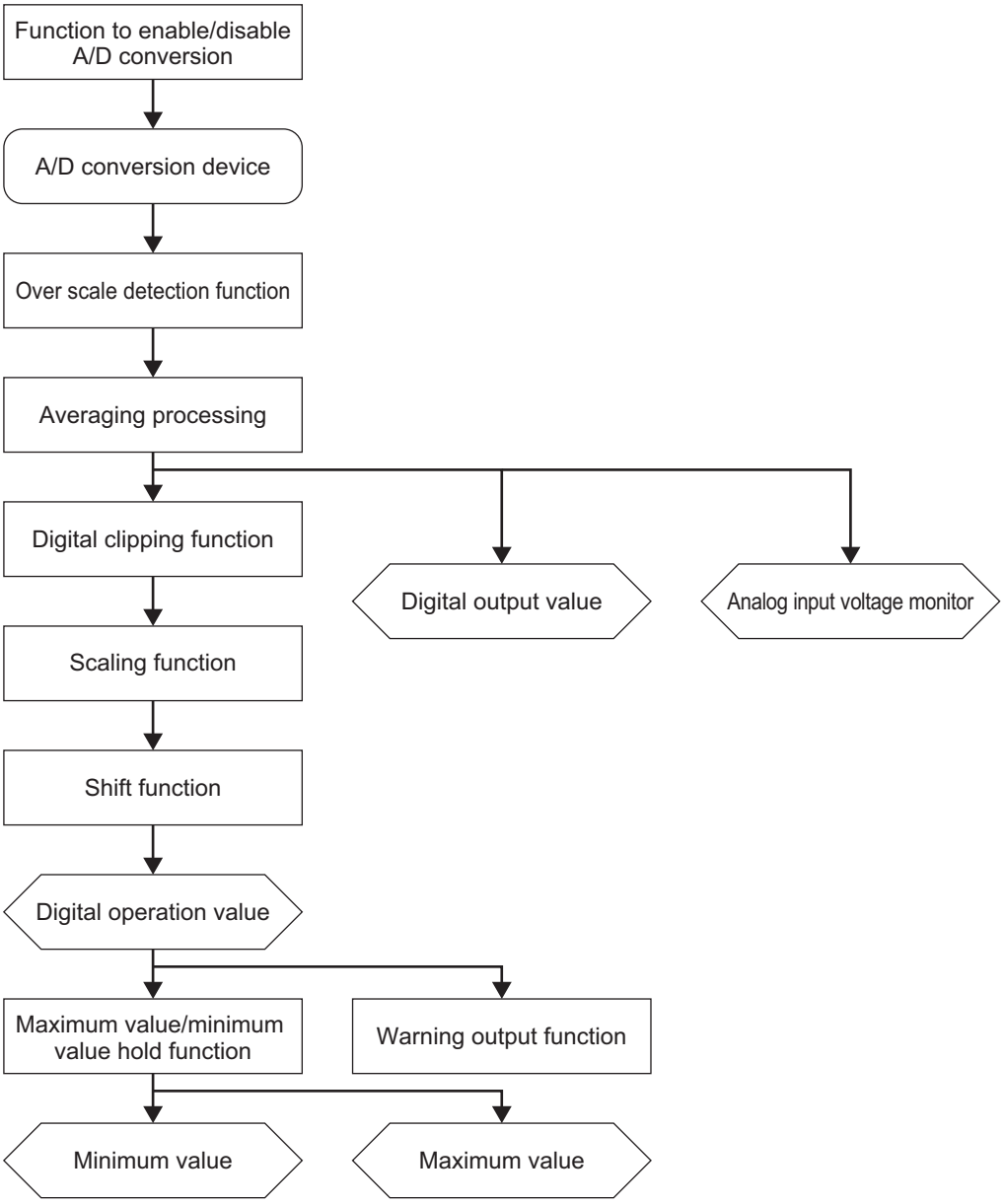
| List of functions | Description | Reference |
|---|---|---|
| PID control via instruction function | Performs PID control by the PID instruction. | Page 566 |
| PID control via parameter function | Performs PID control (standard PID control, heating-cooling PID control) by using GX Works3 parameters. | Page 604 |

# 36.3 Functions (Analog Input)

This section describes the functions of the built into analog the FX5U CPU module and the setting procedures for those functions.

## Processing of each function

The functions are processed in the order shown below.




### Digital output value

A digital value obtained by applying sampling processing or various types of averaging processing.

### Digital operation value

A value obtained by operating a digital output value using the digital clipping function, scaling function, or shift function. When any of the functions is not used, the same value as the digital output value is stored.

### Analog input voltage monitor

The input voltage value is displayed. Voltage is displayed in the following units.
Voltage: mV

### Maximum and minimum value

The maximum and minimum values of the digital operation values are stored.



## A/D conversion enable/disable setting function

This function controls whether to enable or disable the A/D conversion for each channel.
The conversion process time can be reduced by disabling conversion for unused channels.

### Corresponding devices

The devices which are used by the A/D conversion enable/disable setting function are listed below.

| Name | CH1 | CH2 |
|---|---|---|
| A/D conversion enable/disable setting | SM6021 | SM6061 |

### Setting methods

A/D conversion is enabled/disabled for each channel by the setting to enable/disable A/D conversion.

| Name | Allowable setting range | Default value |
|---|---|---|
| A/D conversion enable/disable setting | 0: Enable A/D conversion | 1: Disable A/D conversion |
| | 1: Disable A/D conversion | |

**Point**

Setting is enabled from the next END process that detected the change in the setting value. However, if there is a problem in the value set for the A/D conversion method, changing this setting from disabled to enabled will not result in an enabled status.

### Operation

The analog input is converted to a digital signal only for the channel(s) which have been enabled for A/D conversion by the setting to enable/disable A/D conversion.

**Point**

While A/D conversion is disabled, the A/D conversion method setting can be changed.

# A/D conversion method

Specify the method of A/D conversion for each channel.

The following A/D conversion methods are available.

| Method | Description |
|---|---|
| Sampling processing | Method of converting each analog input at END processing to generate the equivalent digital output. |
| Time average | Method of averaging the time of A/D conversion values and outputting these average values as the digital signal. |
| Count average | Method of averaging the count of A/D conversion values and outputting these average values as the digital signal. |
| Moving Average | Method of averaging the analog input for a specified count measured at every END process, and outputting these average values as the digital signal. |

## Corresponding devices

The devices which are used by the A/D conversion method are listed below.

| Name | CH1 | CH2 |
|---|---|---|
| Average processing specify | SD6023 | SD6063 |
| Time Average/Count Average/Moving Average setting | SD6024 | SD6064 |

## Setting methods

The procedure to change the A/D conversion method is described below.

***1.*** Disable A/D conversion.

***2.*** Specify the averaging process setting.

Use the averaging process setting for each channel to change the A/D conversion method.

| Name | Allowable setting range | Default value |
|---|---|---|
| Averaging process setting | 0: Sampling processing | 0: Sampling processing |
| | 1: Time average | |
| | 2: Count average | |
| | 3: Moving average | |

***3.*** Specify Time Average/Count Average/Moving Average setting.

When the averaging process (1 to 3) is specified by the averaging process setting, set the Time Average/Count Average/Moving Average setting with the relevant setting for the appropriate channel.

| Name | Allowable setting range | Default value |
|---|---|---|
| Time average | 1 to 10000 (ms) | 0 |
| Count average | 4 to 32767 (times) | |
| Moving Average | 2 to 64 (times) | |

***4.*** Enable A/D conversion.

## Operation

This section describes the operation of each A/D conversion method.

### ■Sampling processing

The analog input is sequentially converted into a digital signal through A/D conversion by the END process to create the digital output, and the digital output values and digital operation values are stored.

### ■Time average

A/D conversion is executed for a set time, the total value is averaged, and the digital output values and digital operation values are stored.

The processing count during the specified time changes depending on the number of channels enabled for conversion.

Number of processing times = Setting time ÷ Scan time



**Point**

If the set time is shorter than the scan time, the averaging processing is not executed, but the sampling value is output. For the initial output, however, the average of the first and second sampling values is output.

### ■Count average

A/D conversion is executed for a set number of times, the averaged value is output as the digital signal, and the digital output values and digital operation values are stored.

The time required to store the averaged value obtained by count average in the digital output values and digital operation values varies depending on the scan time.

Processing time = Set number of times × Scan time

**Point**

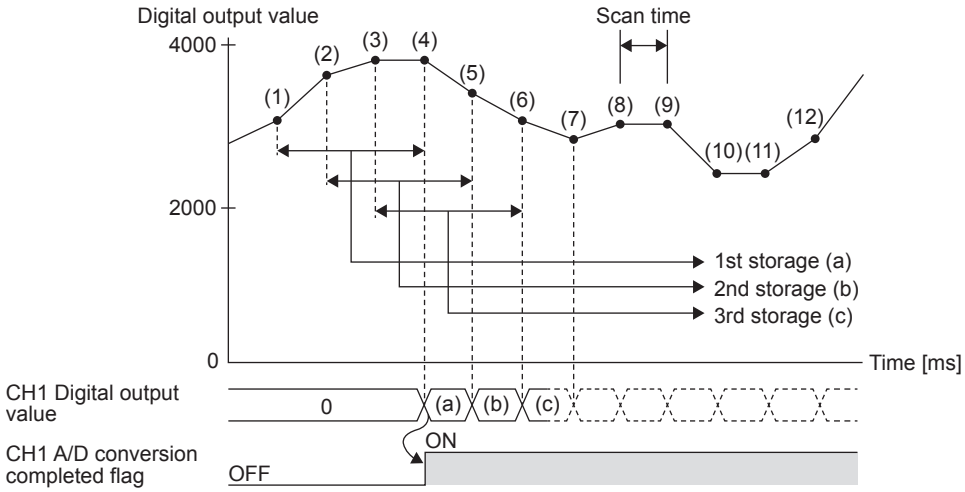
Because the count average requires a sum of at least two counts excluding the maximum and minimum values, the set number of times should be four or more.

### ■Moving average

The number of moving average processing of A/D conversion values can be specified, the averaged value is output as the digital signal, and the digital output values and digital operation values are stored.

Because the averaging process with specified count is performed for the A/D conversion value while transitioning between each conversion cycle, the latest digital output values and digital operation values are obtained.

The following figure shows the moving average processing of when the set number of times is five.



# Over scale detection function

Function to detect analog input values that are over an input range.

## Corresponding devices

The devices which are used by the over scale detection function are listed below.

| Name | CH1 | CH2 |
|---|---|---|
| Over scale detection flag | SM6022 | SM6062 |
| Over scale detection enable/disable setting | SM6024 | SM6064 |
| A/D conversion alarm clear request | SM6057 | SM6097 |
| A/D conversion alarm flag | SM6058 | SM6098 |
| A/D conversion latest alarm code | SD6058 | SD6098 |

## Setting methods

Enables/disables the over scale detection setting for each channel.

| Name | Allowable setting range | Default value |
|---|---|---|
| Over scale detection enable/disable setting | 0: Enabled | 0: Enabled |
| | 1: Disabled | |

**Point**

Setting is enabled from the next END process that detected the change in the setting value.

## Operation

Detected when the input analog voltage exceeds 10.2 V.

For the channel in which over-limit is detected, the digital output value before over-limit is stored, and the A/D conversion complete flag is turned off for this channel. Regardless of the over-limit detection flag reset, once the analog input value returns to 10.2 V, the A/D conversion complete flag will be turned on for this channel after the first update since the A/D conversion restart.

When using the averaging function, the averaging process is cleared at the time of the over-limit detection. The averaging process is restarted after over-limit is cleared.

### ■Detection cycle

This function is executed during the END process.

### ■Clearing the over-scale

After the analog input value returns to 10.2 V, turn on and off the alarm clear request.

Clearing the over-limit will result in the following status.

- The over-limit detection flag is cleared.
- The alarm code stored for the latest alarm code is cleared.

# Digital clipping function

Function that specifies the maximum A/D conversion value as 4000 and the minimum value as 0 when voltage is input that exceeds the input range.

## Corresponding devices

The devices which are used by the digital clipping function are listed below.

| Name | CH1 | CH2 |
|---|---|---|
| Digital clipping enable/disable setting | SM6029 | SM6069 |

## Setting methods

Enable digital clipping for the channels on which to use the digital clipping function.

| Name | Allowable setting range | Default value |
|---|---|---|
| Digital clipping enable/disable setting | 0: Enabled | 1: Disabled |
| | 1: Disabled | |

**Point**

- When the digital clipping function is disabled: digital output range (0 to 4095)
- When the digital clipping function is enabled: digital output range (0 to 4000)

## Operation

The following describes the operation of the digital clipping function.

This function specifies the maximum A/D conversion value as 4000 and the minimum value as 0 when voltage is input that exceeds the input range.

**Point**

Scaling and shift processing occur after digital clipping.

### Precautions

The scaling function operates as follows when not used with the digital clipping function.

The value after scaling will exceed the scaling upper limit value when a voltage is input that exceeds the voltage range.

# Scaling function

Function that converts user-defined maximum and minimum digital values in accordance with a configured scale.

## Corresponding devices

The devices which are used by the scaling function are listed below.

| Name | CH1 | CH2 |
|---|---|---|
| A/D conversion scaling enable/disable setting | SM6028 | SM6068 |
| A/D conversion error flag | SM6059 | SM6099 |
| Scaling upper limit value | SD6028 | SD6068 |
| Scaling lower limit value | SD6029 | SD6069 |
| A/D conversion latest error code | SD6059 | SD6099 |

## Setting methods

The procedure to use the scaling function is described below.

***1.*** Disable scaling.

| Name | Allowable setting range | Default value |
|---|---|---|
| Scaling enable/disable setting | 0: Enabled | 1: Disabled |
| | 1: Disabled | |

***2.*** Set the scaling upper limit value/scaling lower limit value.

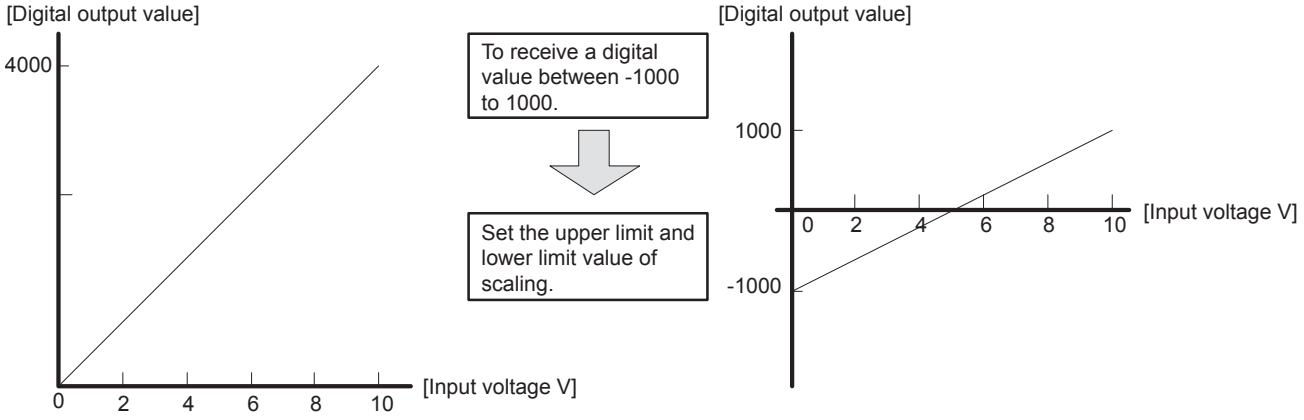
Set the scaling upper limit value to a value corresponding to the maximum A/D conversion value in the range (4000). Set the scaling lower limit value to a value corresponding to the minimum A/D conversion value in the range (0)

| Name | Allowable setting range | Default value |
|---|---|---|
| Scaling upper limit value | -32768 to +32767<br>(Upper limit value ≠ Lower limit value) | 0 |
| Scaling lower limit value | | |

***3.*** Enable scaling.

## Operation

The output digital value is scaled within a range between the user-defined scaling upper limit value and the scaling lower limit value.



### ■Calculation method of the scaling value

The value used is calculated from the following expression. (The value below the decimal point is rounded.)

$$\text{Value after scaling} = \frac{\text{Digital output value} \times (\text{scaling upper limit value} - \text{scaling lower limit value})}{4000} + \text{Scaling lower limit value}$$

**Point**

- The max. resolution will not increase even if the scaling upper limit value and the scaling lower limit value are set such that each digit is smaller than the max. resolution.
- If the scaling upper limit value is set lower than the scaling lower limit value, the digital operation value decreases as the input voltage increases.

#### Precautions

If both the scaling function and the digital clipping function are used simultaneously, the scaling calculation will be performed for the resulting digital operation value after digital clipping.

## Shift function

Function to add the set conversion value shift amount to the A/D conversion value and store the digital operation value. Changes to the conversion value shifting amount will be reflected in the digital operation value in real time, allowing fine adjustments to be easily performed during system startup.

### Corresponding devices

The devices which are used by the shift function are listed below.

| Name | CH1 | CH2 |
|---|---|---|
| Conversion value shift amount | SD6030 | SD6070 |

### Setting methods

Sets the conversion value shift amount for the channel for which you want to use the conversion value shift.

| Name | Allowable setting range | Default value |
|---|---|---|
| Conversion value shift amount | -32768 to +32767 | 0 |

**Point**

This function does not need to be set in advance. The user can perform conversion value shifts at any time.

### Operation

Adds a shifting amount to the A/D conversion value. The A/D conversion value with the added shift is stored as the digital operation value.
When the digital operation value resulting from the shift processing exceeds the range between -32768 and +32767, the value is fixed to the lower limit (-32768) or the upper limit (32767).
When using the sampling processing, the shift amount is added for every conversion cycle. When using the averaging processing, the shift amount is added for every averaging process cycle. The results are stored as the digital operation value.
When using the scaling function at the same time, shift processing is performed on the resulting value after scaling processing.

#### Precautions

When the shift function, digital clipping function, and scaling function are used together, the added shift is applied to the value after digital clipping and scaling, which results in a digital operation value range between -32768 to +32767.

# Maximum value/minimum value hold function

Function that holds the minimum and maximum digital operation values.

## Corresponding devices

The devices which are used by the function to hold minimum and maximum values are listed below.

| Name | CH1 | CH2 |
|---|---|---|
| Maximum value/minimum value reset completed flag | SM6025 | SM6065 |
| Maximum value reset request | SM6026 | SM6066 |
| Minimum value reset request | SM6027 | SM6067 |
| Maximum value | SD6026 | SD6066 |
| Minimum value | SD6027 | SD6067 |

## Setting methods

The user does not need to configure any settings.

## Operation

The maximum value and minimum value of the digital operation value are stored in the maximum value and minimum value of the special registers for each channel.

Turning on the maximum and minimum value reset request resets the maximum and minimum values for corresponding channel. After the reset, the update of values with current values stars again. The maximum value/minimum value reset completed flag will turn on.

The maximum and minimum value reset requests are not turned off automatically. To reset the values again, it is necessary to turn the requests OFF.

When the averaging processing, digital clipping function, scaling function, and shift function are enabled, the values resulting after the averaging processing, digital clipping, scaling, and a shift addition are stored as the maximum value and minimum value.

# Warning output function

The warning output flag for the corresponding channel turns ON when the digital operation value is equal to or greater than the process alarm upper upper limit value, is equal to or lower than the process alarm lower lower limit value, or falls within the warning output range.

## Corresponding devices

The devices which are used by the warning output function are listed below.

| Name | CH1 | CH2 |
|---|---|---|
| Warning output flag (process alarm upper limit) | SM6031 | SM6071 |
| Warning output flag (process alarm lower limit) | SM6032 | SM6072 |
| Warning output setting (process alarm) | SM6033 | SM6073 |
| A/D conversion alarm clear request | SM6057 | SM6097 |
| A/D conversion alarm flag | SM6058 | SM6098 |
| Process alarm upper upper limit value | SD6031 | SD6071 |
| Process alarm lower upper limit value | SD6032 | SD6072 |
| Process alarm upper lower limit value | SD6033 | SD6073 |
| Process alarm lower lower limit value | SD6034 | SD6074 |
| A/D conversion latest alarm code | SD6058 | SD6098 |

## Setting methods

The procedure to use the warning output function is described below.

***1.*** Disable the warning output setting (process alarm).

| Name | Allowable setting range | Default value |
|---|---|---|
| Warning output setting (process alarm) | 0: Enabled | 1: Disabled |
| | 1: Disabled | |

***2.*** Set the upper limit and lower limit values for the process alarm.

Four levels of values from the process alarm upper upper limit value to the process alarm lower lower limit value can be set for each channel that uses the warning output function (process alarm).

| Name | Allowable setting range | Default value |
|---|---|---|
| Process alarm upper upper limit value | -32768 to +32767<br>(Upper-upper limit value≥Upper-lower limit value≥Lower-upper limit value≥Lower-lower limit value) | 0 |
| Process alarm lower upper limit value | | |
| Process alarm upper lower limit value | | |
| Process alarm lower lower limit value | | |

***3.*** Enable the warning output setting (process alarm).

## Operation

The warning output flag (process alarm upper limit) or the warning output flag (process alarm lower limit) turns ON when the digital operation value is equal to or greater than the process alarm upper upper limit value, or is equal to or lower than the process alarm lower lower limit value, and the conditions to output a warning are satisfied.
This function executes for each averaging time and averaging count configured when time average and count average are specified. This function executes every conversion cycle when other A/D conversion methods are specified (Sampling processing and moving average).
The warning output flag (process alarm upper limit) or the warning output flag (process alarm lower limit) turns OFF after the warning is output when the digital operation value is lower than the process alarm upper lower limit value, or is larger than the process alarm lower upper limit value, and the conditions to output a warning are no longer satisfied.
However, the alarm code stored for the A/D conversion latest alarm code is not cleared.
To clear the alarm code stored in the latest A/D conversion alarm code, turn on and off the A/D conversion alarm clear request after all warning output flags (process alarm upper limit/process alarm lower limit) return to the OFF status. At this time, the A/D conversion alarm occurrence flag is also turned OFF.

### Precautions

When using the digital clipping function, scaling function, and shift function, the digital operation value resulting from digital clipping, scaling, and shift additions becomes the detection target for outputting a warning. Make sure to set the process alarm upper limit and lower limit values with regard to scaling and shift additions.

# Event history function

This function collects errors from built-in analog input of CPU module, and keeps them in the SD memory card, and data memory or battery backed built-in RAM of the CPU module.
The event information collected by the CPU module can be displayed on GX Works3 to check the occurrence history in chronological order.

| Event type | Classification | Description |
|---|---|---|
| System | Error | An error detected by the self diagnostics in each module. |

## Setting procedure

The event history function can be set from the event history setting window of GX Works3. For the setting procedure, refer to the following.
☞ Page 131 Event History Function

## Displaying event history

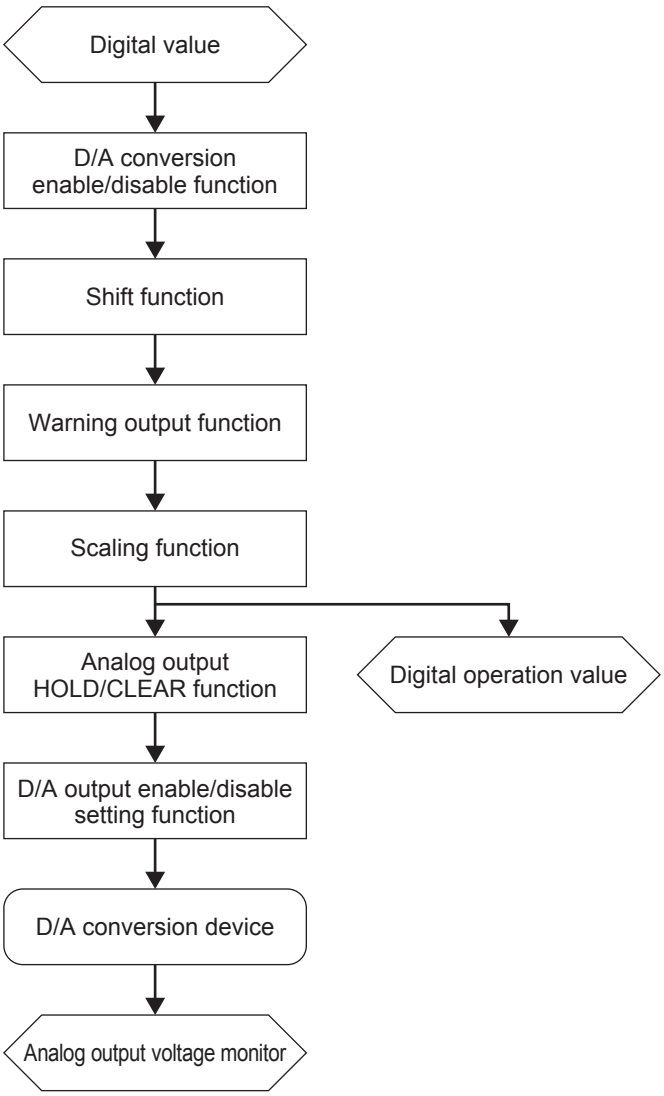
Access the menu of GX Works3. For details on the operating procedure and how to view the contents, refer to the following.
📖GX Works3 Operating Manual

# 36.4 Functions (Analog Output)

This section describes the functions of the built into analog the FX5U CPU module and the setting procedures for those functions.

## Processing of each function

The functions are processed in the order shown below.




### Digital value

The input digital value is stored.

### Digital operation value

A value obtained by operating a digital value using the scaling function or shift function. When any of the functions is not used, the same value as the digital value is stored.

### Analog output voltage monitor

The output analog value is displayed. Voltage is displayed in the following units.

Voltage: mV

# D/A conversion enable/disable function

Function to enable or disable D/A conversion per channel.
When analog output is not used, the conversion process time can be reduced by disabling conversion.

## Corresponding devices

The devices which are used by the D/A conversion enable/disable setting function are listed below.

| Name | CH1 |
|---|---|
| D/A conversion enable/disable setting | SM6180 |

## Setting methods

D/A conversion is enabled/disabled for each channel by the setting to enable/disable D/A conversion.

| Name | Allowable setting range | Default value |
|---|---|---|
| D/A conversion enable/disable setting | 0: Enable D/A conversion | 1: Disable D/A conversion |
| | 1: Disable D/A conversion | |

## Operation

D/A conversion is performed for the digital output value only for the channels for which D/A conversion has been enabled by the D/A conversion enable/disable setting, and output is performed based on the converted analog value for the channels whose D/A output is set to ON.

# D/A output enable/disable setting function

This function can specify whether to output the D/A conversion value or output an offset value (HOLD setting value) for each channel.

## Corresponding devices

The devices which are used by the D/A output enable/disable setting function are listed below.

| Name | CH1 |
|---|---|
| D/A output enable/disable setting | SM6181 |

## Setting methods

D/A output is enabled/disabled for each channel by the setting to enable/disable D/A output.

| Name | Allowable setting range | Default value |
|---|---|---|
| D/A output enable/disable setting | 0: Enable D/A output | 1: Disable D/A output |
| | 1: Disable D/A output | |

## Operation

Output is performed based on the digital output value only for the channels for which D/A output has been enabled by the D/A output enable/disable setting. An offset value (HOLD setting value) is output when the D/A output enable/disable flag is set to disable D/A output.

# Analog output HOLD/CLEAR function

Sets how to operate digital values to be converted to analog signals depending on the operation status of the CPU module (RUN, STOP, and STOP error). Select it from the following three ways: clear the value to 0; hold the previous value; set to a specified value.

## Corresponding devices

The devices which are used by the analog output HOLD/CLEAR function are listed below.

| Name | CH1 |
|---|---|
| D/A conversion enable/disable setting | SM6180 |
| HOLD/CLEAR setting | SD6183 |
| HOLD setting value | SD6184 |



## Setting methods

The procedure to use the analog output HOLD/CLEAR function is described below.

***1.*** Disable D/A conversion.

| Name | Allowable setting range | Default value |
|---|---|---|
| D/A conversion enable/disable setting | 0: Enable | 1: Disable |
| | 1: Disable | |

***2.*** Set the HOLD/CLEAR function setting.

Set for the HOLD/CLEAR function setting.

| Name | Allowable setting range | Default value |
|---|---|---|
| HOLD/CLEAR function setting | 0: CLEAR | 0 |
| | 1: Previous Value (Hold) | |
| | 2: Setting Value | |

***3.*** Set the HOLD setting value.

When "2: Setting Value" is chosen in the above 2, a value is set to HOLD setting value.

| Name | Allowable setting range | Default value |
|---|---|---|
| HOLD setting value | -32768 to +32767 | 0 |

***4.*** Enable D/A conversion.

## Operation

The following table lists the resulting analog output status depending on the combined configuration of the analog output HOLD/CLEAR function and the D/A output enable/disable flag.

| CPU module status | D/A output enable/disable setting | HOLD/CLEAR setting | Output status |
|---|---|---|---|
| RUN | Enabled | All settings | Shift and scaling value |
| | Disabled | All settings | 0 |
| STOP | Enabled | CLEAR | 0 |
| | Enabled | Previous Value (Hold) | Shift and scaling value |
| | Enabled | Setting Value | Output the value set for the HOLD setting value |
| | Disabled | All settings | 0 |
| PAUSE | Enabled | All settings | Shift and scaling value |
| | Disabled | All settings | 0 |
| Error occurs when RUN state cannot operate | Enabled | All settings | 0 |
| | Disabled | All settings | 0 |

# Analog output test when CPU module is in STOP status function

This function outputs a user-defined analog value by setting the output enable/disable flag to enabled when the CPU module is stopped, and changing the digital value.

## Corresponding devices

The devices that are used by analog test function when the CPU module is stopped are listed below.

| Name | CH1 |
|---|---|
| D/A conversion enable/disable setting | SM6180 |
| D/A output enable/disable setting | SM6181 |
| Digital value | SD6180 |

## Setting methods

The procedure to use the analog test function is described below.

***1.*** Change the operation conditions setting.

The following conditions must be satisfied to enable the analog output test.

| Description | Setting value |
|---|---|
| D/A conversion enable/disable | Conversion enabled |
| D/A output enable/disable | Output enabled |

***2.*** Update the digital value.

Set the digital value corresponding to the analog value to be output as a digital value.

## Operation

The digital input value will be converted to an analog signal by D/A conversion and be output regardless of whether the CPU module is in the RUN state or STOP state.

The settings for the shift function, scaling function, and warning output function are valid during the analog output test.

### Precautions

Even when the analog output HOLD/CLEAR function is operating, analog output can be changed by this function.

# Scaling function

Function that converts user-defined maximum and minimum digital values in accordance with a configured scale.

## Corresponding devices

The devices which are used by the scaling function are listed below.

| Name | CH1 |
|---|---|
| Scaling enable/disable setting | SM6188 |
| Scaling upper limit value | SD6188 |
| Scaling lower limit value | SD6189 |



## Setting methods

The procedure to use the scaling function is described below.

***1.*** Disable scaling.

| Name | Allowable setting range | Default value |
|---|---|---|
| Scaling enable/disable setting | 0: Enabled | 1: Disabled |
| | 1: Disabled | |

***2.*** Set the scaling upper limit value/scaling lower limit value.

The allowable setting range is shown in the following table.

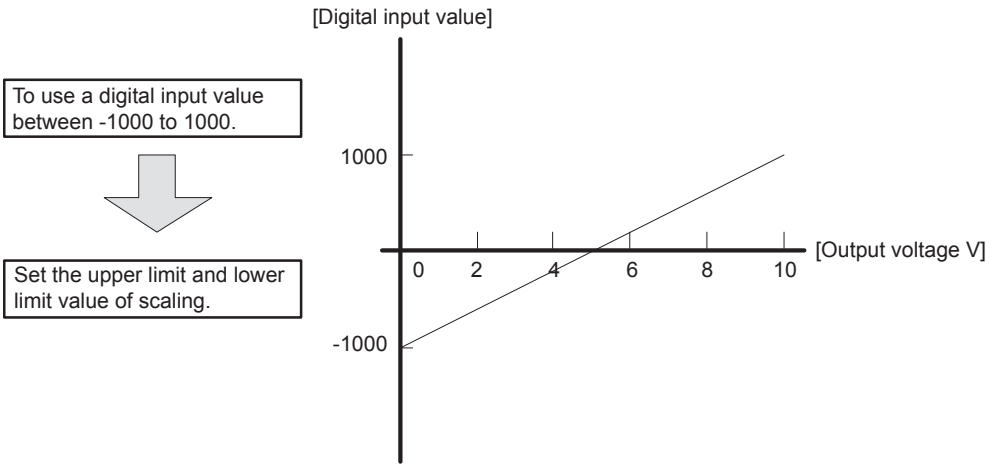
| Name | Allowable setting range | Default value |
|---|---|---|
| Scaling upper limit value | -32768 to +32767<br>(Upper limit value ≠ Lower limit value) | 0 |
| Scaling lower limit value | | |

***3.*** Enable scaling.

## Operation

Scaling is performed on the resulting value after shift processing is performed on the set digital value using the scaling upper limit value and scaling lower limit value. The value resulted from scaling is used for D/A conversion.

An example of scaling setting is shown below.




### ■Calculation method of the scaling value

When using the factory settings for the output range.

$$\text{Value after scaling} = \frac{4000}{\text{Scaling upper limit value - scaling lower limit value}} \times (\text{digital input value - scaling lower limit value})$$

# Shift function

Function that adds the set input value shift amount to the digital value.
Changes to the input value shift amount will be reflected in the digital operation value in real time, allowing fine adjustments to be easily performed during system startup.

## Corresponding devices

The devices which are used by the shift function are listed below.

| Name | CH1 |
|---|---|
| Input value shift amount | SD6190 |

## Setting methods

Set the desired input value shift amount when performing a shift addition.

| Name | Allowable setting range | Default value |
|---|---|---|
| Input value shift amount | -32768 to +32767 | 0 |

## Operation

When the added digital value resulting from the shift processing exceeds the range between -32768 and +32767, the value is fixed to the lower limit (-32768) or the upper limit (32767).
After the value is written for the input value shift amount, the input value shift amount is added to the digital value.

### Precautions

The scaling function and the warning output function are executed for the digital value to which the shift amount has been added.

# Warning output function

Function that checks the digital value set for output against the warning output upper limit and lower limit values configured in advance for each channel, and outputs a warning when the value is outside the set range.

## Corresponding devices

The devices which are used by the warning output function are listed below.

| Name | CH1 |
|---|---|
| Warning output upper limit value flag | SM6191 |
| Warning output lower limit value flag | SM6192 |
| Warning output setting | SM6193 |
| D/A conversion alarm clear request | SM6217 |
| D/A conversion alarm flag | SM6218 |
| Warning output upper limit value | SD6191 |
| Warning output lower limit value | SD6192 |
| D/A conversion latest alarm code | SD6218 |

## Setting methods

The procedure to use the warning output function is described below.

***1.*** Disable the warning output setting.

| Name | Allowable setting range | Default value |
|---|---|---|
| Warning output setting | 0: Enable | 1: Disable |
| | 1: Disable | |

**2.** Set the warning output upper limit value and warning output lower limit value.

Warning output upper limit value and warning output lower limit value can be set for each channel that uses the warning output function.

| Name | Allowable setting range | Default value |
|---|---|---|
| Warning output upper limit value | -32768 to +32767<br>(Upper limit value > Lower limit value) | 0 |
| Warning output lower limit value | | |

**3.** Enable the warning output setting.

## Operation

The judgment to output a warning is based on the resulting value after shift processing is performed on the digital input value. The warning output upper limit value flag turns ON for the corresponding channel when the input digital value exceeds the warning output upper limit value, and the warning output lower limit value flag turns ON when the input digital value is less than the warning output lower limit value.

Details of the warning output upper limit value flag are shown in the table below.

| Name | Allowable setting range |
|---|---|
| Warning output upper limit value flag | 0: Normal |
| | 1: Upper limit alarm ON |

Details of the warning output lower limit value flag are shown in the table below.

| Name | Allowable setting range |
|---|---|
| Warning output lower limit value flag | 0: Normal |
| | 1: Lower limit alarm ON |

The set warning output upper and lower limit values are used as the digital values for D/A conversion when there is a warning. After a warning occurs and the digital value becomes less than the warning output upper limit value or greater than the warning output lower limit value, the analog output value returns to the normal value. However, the warning output upper limit flag, warning output lower limit flag, D/A conversion alarm occurrence flag, and alarm code stored in "D/A conversion latest alarm code" are not cleared.

The following describes the procedure to clear the warning output.

After setting the digital value to a value smaller than the warning output upper limit value or larger than the warning output lower limit value, turn on and off the D/A conversion alarm clear request.

### Precautions

- When using the scaling function and shift function, the digital value resulting from scaling and shift additions becomes the detection target for outputting a warning. Make sure to set the warning output upper limit and lower limit values with regard to scaling and shift additions.
- A warning will be output when the digital value exceeds the warning output upper limit value or when the digital value is less than the warning output lower limit value.

## Event history function

This function collects errors from built-in analog output of CPU module, and keeps them in the SD memory card, and data memory or battery backed built-in RAM of the CPU module.
The event information collected by the CPU module can be displayed on GX Works3 to check the occurrence history in chronological order.

| Event type | Classification | Description |
|---|---|---|
| System | Error | An error detected by the self diagnostics in each module. |

### Setting procedure

The event history function can be set from the event history setting window of GX Works3. For the setting procedure, refer to the following.
☞ Page 131 Event History Function

### Displaying event history

Access the menu of GX Works3. For details on the operating procedure and how to view the contents, refer to the following.
📖GX Works3 Operating Manual

# 36.5 Function (PID Control Via Instruction)

## Outline of function

The PID instruction is used to perform PID control. The PID instruction requires the system to calculate the output (MV) value from the measured (PV) value. Through combining the P (proportional) action, I (integral) action, and D (derivative) action, the target (SV) value can be obtained.

• Alarm output function

The alarm function can be set for input variation (measured value) or output variation (value).

• Setting limit values

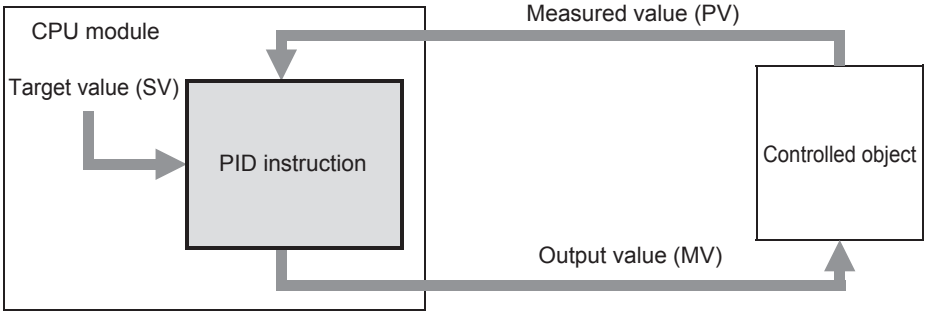
The upper limit and lower limit can be set for the output value.

• Auto-tuning function

The proportional gain (KP), integral time (TI) and differential time (TD) can be set automatically for both the limit cycle method and step response method.

• Operation method of the PID instruction

Both PID speed type operation and measured value differential type operation are executed.



# Basic operation expressions in PID instruction

The PID instruction executes using the speed type or measured value differential type operation expression. According to the content of b0 of (s3)+1 "operation setting (ACT)" specified by (s3) in the PID control, either forward operation or backward operation is executed. Each value required in the operation is specified by a corresponding parameter (s3) or later.

## Basic operation expression for PID control

| Operation setting (ACT) (s3+1: b0) | Operation expression | The meaning of the signs |
|---|---|---|
| Forward operation (OFF) | $\Delta MV=KP\{(EVn-EVn-1)+\frac{TS}{TI}EVn+Dn\}$<br>$EVn=PVnf-SV$<br>$Dn=\frac{TD}{TS+KD\cdot TD}(-2PVnf-1+PVnf+PVnf-2)+\frac{KD\cdot TD}{TS+KD\cdot TD}\cdot Dn-1$<br>$MVn=\Sigma\Delta MV$ | EVn: Deviation in sampling at this time<br>EVn-1: Deviation in previous cycle<br>SV: Target value<br>PVnf: Measured value in sampling at this time (after filter)<br>PVnf-1: Measured value in previous cycle (after filter)<br>PVnf-2: Measured value in two cycles before (after filter)<br>ΔMV: Output variation<br>MVn: Output value at this time<br>Dn: Differential term at this time<br>Dn-1: Differential term in previous cycle<br>TS: Sampling cycle<br>KP: Proportional gain<br>TI: Integral constant<br>TD: Differential constant<br>KD: Differential gain |
| Backward operation (ON) | $\Delta MV=KP\{(EVn-EVn-1)+\frac{TS}{TI}EVn+Dn\}$<br>$EVn=SV-PVnf$<br>$Dn=\frac{TD}{TS+KD\cdot TD}(2PVnf-1-PVnf-PVnf-2)+\frac{KD\cdot TD}{TS+KD\cdot TD}\cdot Dn-1$<br>$MVn=\Sigma\Delta MV$ | |

### ■Expression for calculating the measured value (after the filter) in sampling at this time (PVnf)

The value "PVnf" is obtained from the following expression based on the read measured value.

Measured value after filter: PVnf = PVn+L (PVnf-1-PVn)

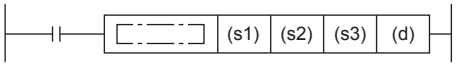
PVn: Measured value in sampling at this time
L: Filter coefficient
PVnf-1: Measured value in previous cycle (after filter)

# How to use PID instruction

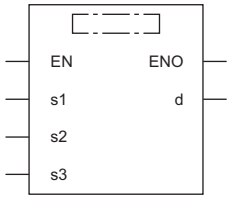
This instruction executes PID control which changes the output value according to the input variation.

For details on the PID instruction, refer to the following manual.

MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks)

| Ladder diagram | Structured text |
|---|---|
|  | ENO:=PID(EN,s1,s2,s3,d); |

**FBD/LD**




## Setting data

### ■Descriptions, ranges, and data types

| Operand | Description | Range | Data type | Data type (label) |
|---|---|---|---|---|
| (s1) | Device number storing the target value (SV) | -32768 to +32767 | 16-bit signed binary | ANY16*1 |
| (s2) | Device number storing the measured value (PV) | -32768 to +32767 | 16-bit signed binary | ANY16*1 |
| (s3) | Device number storing PID parameters | 1 to 32767 | 16-bit signed binary | ANY16*1 |
| (d) | Device number storing the output value (MV) | -32768 to +32767 | 16-bit signed binary | ANY16*1 |
| EN | Execution condition | — | Bit | BOOL |
| ENO | Execution result | — | Bit | BOOL |

*1 When setting using a label, use the global label assigned to the device.

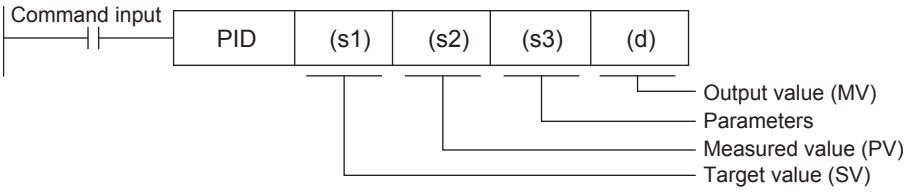
### ■Applicable devices

| Operand | Bit | Word | | | Double word | | Indirect specification | Constant | | | Others |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | X, Y, M, L, SM, F, B, SB, S | T, ST, C, D, W, SD, SW, R | U□\G□ | Z | LC | LZ | | K, H | E | $ | |
| (s1) | — | ○*1 | ○ | — | — | — | — | — | — | — | — |
| (s2) | — | ○*1 | ○ | — | — | — | — | — | — | — | — |
| (s3) | — | ○*1 | — | — | — | — | — | — | — | — | — |
| (d) | — | ○*1 | ○ | — | — | — | — | — | — | — | — |

*1 Only D, SD, R can be used.

## Processing details

- Once the target value (s1), measured value (s2) and PID parameters (s3) to (s3)+6 are set and the program is executed, the operation result (MV) is transferred to the output value (d) at every sampling time. The sampling time is specified by (s3).



### ■Set item

| Set item | | Description | Occupied points |
|---|---|---|---|
| (s1) | Target value (SV) | The target value (SV) is set.<br>The PID instruction does not change the settings.<br>[Caution on using the auto-tuning (limit cycle method)]<br>If the target value for auto-tuning is different from the target value in the PID control, it is necessary to set a value to which a bias value is added, and then store the actual target value when the auto-tuning flag turns OFF. | 1 point |
| (s2) | Measured value (PV) | This is the input value of the PID operation.<br>It is necessary to read a normal measurement data before the execution of the PID operation for the measurement value of PID (PV). If an input value from an analog input is used for the PID operation, use caution to its conversion time. | 1 point |
| (s3) | Parameter | PID control<br>25 devices are occupied from the head device specified in (s3) | 25 points |
| | | Auto-tuning: In the limit cycle method<br>29 devices are occupied from the head device specified in (s3) | 29 points |
| | | Auto-tuning: In the step response method ((s3)+1: b8 is set to OFF)<br>25 devices are occupied from the head device specified in (s3) | 25 points |
| | | Auto-tuning: In the step response method ((s3)+1: b8 is set to ON)<br>28 devices are occupied from the head device specified in (s3) | 28 points |
| (d) | Output value (MV) | PID control (normal processing)<br>The user sets the initial output value before driving the instruction. After that, the operation result is stored. | 1 point |
| | | Auto-tuning: In the limit cycle method<br>The Upper Limit Value (ULV) or Lower Limit Value (LLV) value is automatically output during auto-tuning. The specified MV value is output when auto-tuning is finished. | |
| | | Auto-tuning: In the step response method<br>The user sets the step output value before driving the instruction. The MV value is not changed by PID instruction during auto-tuning. | |

### ■Precautions for using the PID instruction

For the precautions for using the PID instruction, refer to the following manual.

📖MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks)

# Relationship between parameter setting and auto-tuning

## When auto-tuning is not executed (parameter setting)

It is necessary to write the set value of the parameters (s3) to (s3)+6 by means such as the MOV instruction before starting the PID operation when auto-tuning is not executed. If a device with a latch setting is specified, the setting data is retained even after the power to the CPU module is turned OFF; therefore, the writing at the 2nd power ON is not required.

For details on parameters, refer to ☞ Page 570 Parameter.

## When auto-tuning is executed

The proportional gain ((s3)+3), integral time ((s3)+4) and differential time ((s3)+6) are important constants for executing the auto-tuning function described later and for optimizing the PID control. These constants can be set automatically.

For a detailed description of auto-tuning, refer to ☞ Page 583 Auto-tuning.

# Parameter

| Set item | | | Description/Setting range | Remarks |
|---|---|---|---|---|
| (s3) | Sampling time (TS) | | 1 to 32767 (ms) | It cannot be shorter than operation cycle of the programmable controller. |
| (s3)+1 | Operation setting (ACT) | b0 | 0: Forward operation<br>1: Backward operation | Operation direction |
| | | b1 | 0: Input variation alarm is invalid<br>1: Input variation alarm is valid | — |
| | | b2 | 0: Output variation alarm is invalid<br>1: Output variation alarm is valid | Do not set b2 and b5 to ON at the same time. |
| | | b3 | Not used | — |
| | | b4 | 0: Auto-tuning is not executed.<br>1: Auto-tuning is executed | — |
| | | b5 | 0: Upper and lower limits of output value are not valid<br>1: Upper and lower limits of output value are valid | Do not set b2 and b5 to ON at the same time. |
| | | b6 | 0: Step response method<br>1: Limit cycle method | Select auto-tuning mode. |
| | | b7*2 | 0: Overshoot suppression processing invalid (FX3U compatible)<br>1: Overshoot suppression processing valid | When b7 is ON, the overshoot suppression processing is performed. |
| | | b8*2 | 0: Without the hunting suppression processing (FX3U compatible)<br>1: With the hunting suppression processing | This is valid when b4 is ON and b6 is OFF.<br>When b8 is ON, the hunting suppression processing is performed. |
| | | b9 to b15 | Not used | — |
| (s3)+2 | Input filter constant (α) | | 0 to 99[%] | When "0" is set, input filter is not provided. |
| (s3)+3 | Proportional gain (KP) | | 1 to 32767[%] | — |
| (s3)+4 | Integral time (TI) | | 0 to 32767[×100ms] | When "0" is set, it is handled as "∞" (no integration). |
| (s3)+5 | Differential gain (KD) | | 0 to 100[%] | When "0" is set, differential gain is not provided. |
| (s3)+6 | Differential time (TD) | | 0 to 32767[×10ms] | When "0" is set, differential is not executed. |
| (s3)+7 to<br>⋮<br>(s3)+19 | These devices are occupied for internal processing of PID operation. Do not change data. | | | |
| (s3)+20*1 | Input variation (incremental) alarm set value | | 0 to 32767 | It is valid when b1 of the operation setting (ACT) ((s3)+1) is "1". |
| (s3)+21*1 | Input variation (decremental) alarm set value | | 0 to 32767 | It is valid when b1 of the operation setting (ACT) ((s3)+1) is "1". |
| (s3)+22*1 | Output variation (incremental) alarm set value | | 0 to 32767 | It is valid when b2 and b5 of the operation setting (ACT) ((s3)+1) are "1" and "0". |
| | Output upper limit set value | | -32768 to +32767 | It is valid when b2 and b5 of the operation setting (ACT) ((s3)+1) are "0" and "1". |
| (s3)+23*1 | Output variation (decremental) alarm set value | | 0 to 32767 | It is valid when b2 and b5 of the operation setting (ACT) ((s3)+1) are "1" and "0". |
| | Output lower limit set value | | -32768 to +32767 | It is valid when b2 and b5 of the operation setting (ACT) ((s3)+1) are "0" and "1". |
| (s3)+24*1 | Alarm output | b0 | 0: Input variation (incremental) is not exceeded.<br>1: Input variation (incremental) is exceeded. | It is valid when b1 and b2 of the operation setting (ACT) ((s3)+1) are "1". |
| | | b1 | 0: Input variation (decremental) is not exceeded.<br>1: Input variation (decremental) is exceeded. | |
| | | b2 | 0: Output variation (incremental) is not exceeded.<br>1: Output variation (incremental) is exceeded. | |
| | | b3 | 0: Output variation (decremental) is not exceeded.<br>1: Output variation (decremental) is exceeded. | |

| Set item | | Description/Setting range | Remarks |
|---|---|---|---|
| ■The following setting is required when using the limit cycle method (b6 of the operation setting (ACT) ((s3)+1) is "1"). | | | |
| (s3)+25 | PV value threshold (hysteresis) width (SHPV) | Set it according to measured value (PV) fluctuation. | The setting below is required when the limit cycle method is used (when the operation setting (ACT) b6 is set to ON). |
| (s3)+26 | Output value upper limit (ULV) | Set maximum value (ULV) of output value (MV). | |
| (s3)+27 | Output value lower limit (LLV) | Set minimum value (LLV) of output value (MV). | |
| (s3)+28 | Wait setting from end of tuning cycle to start of PID control (KW) | -50 to +32717[%] | |
| ■The following setting is required when using the timeout time after maximum ramp (b6 and b8 of the operation setting (ACT) ((s3)+1) are "0" and "1") with the step response method. | | | |
| (s3)+25 | Timeout time setting value after maximum ramp (R) detection | 1 to 32767[s] | It is valid when b4, b6, and b8 of the operation setting (ACT) ((s3)+1) are "1", "0", and "1". |
| (s3)+26<br>(s3)+27 | These devices are occupied for internal processing of PID operation. Do not change data. | | |

*1 (s3)+20 to +24 become used only if b1, b2, or b5 are set to "1" to determine the action (ACT) (s3)+1.

*2 For supported version of each setting, refer to ☞ Page 971 Added and Enhanced Functions.



# Details of parameters

This chapter describes the details of parameters.

## Sampling time (s3)

Set the cycle time (ms) for the PID operation. Setting range: 1 to 32767 (ms)

• In PID control and auto-tuning (Limit cycle method)

Set the sampling time longer than the operation cycle of the programmable controller.

• In auto-tuning (Step response method)

Set the sampling time to 1000 ms (= 1 second) or more.

### ■Maximum error

The maximum error of the sampling time (TS) is from "- (one operation cycle+1 ms)" to "+ (one operation cycle)."

• When the sampling time (TS) is a small value

Fluctuation of the maximum error described above may cause a problem. In such a case, execute the PID instruction in the constant scan mode, or program it in a timer interrupt routine.

• When the sampling time (TS) is shorter than one operation cycle of the programmable controller

A PID operation error occurs, however when PID operation is executed, the sampling time (TS) is equal to the operation cycle of the programmable controller. In such a case, use the PID instruction in a timer interrupt, and clear (s3)+7 just before executing the PID instruction.

## Operation setting (s3)+1

### ■Forward operation/backward operation

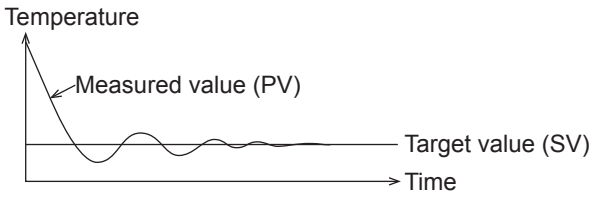
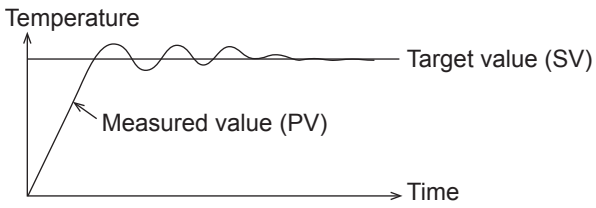
Set the PID control direction (forward or backward).

• During auto-tuning for the limit cycle method

It is necessary to set the PID control direction (forward or backward) for auto-tuning.

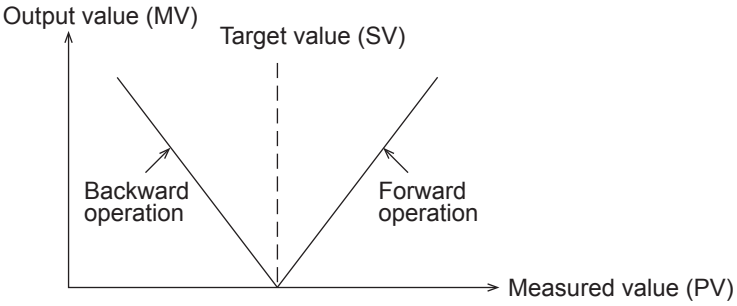
• During auto-tuning for the step response method

The PID control direction (forward or backward) is not required, as the direction is automatically set when auto-tuning is complete.

| Operation setting (s3)+1: b0 | | Operation |
|---|---|---|
| Forward operation (b0=OFF) | As the measured value (PV) becomes larger than the target value (SV), the output (MV) increases.<br>For example, cooling is a forward operation. |  |
| Backward operation (b0=ON) | As the measured value (PV) becomes smaller than the target value (SV), the output (MV) increases.<br>For example, heating is a backward operation. |  |

• Relationship between the forward/backward operation and the output (MV), measured value (PV) and target value (SV)

The relationship is as follows.



## ■Alarm setting (for input variation and output variation)

If b1 and b2 in (s3) +1 are turned ON, the input variation and the output variation can be checked. The check is executed by following the values of (s3) +20 to (s3) +23.

These parameters can be set in (s3)+24.

For details on operation of alarm output, refer to ☞ Page 582 Alarm output (s3)+24.

• Input variation

If the input variation alarm is used, turn ON b1 in (s3) +1, and specify the input variation alarm set value.

| Set item | | | Description/Setting range |
|---|---|---|---|
| Operation setting | (s3)+1: b1 | Input variation alarm | ON: Used<br>OFF: Not used |
| Input variation alarm set value | (s3)+20 | Input variation (incremental) alarm set value | 0 to 32767 |
| | (s3)+21 | Input variation (decremental) alarm set value | 0 to 32767 |

• Output variation

If the output variation alarm is used, turn ON b2 in (s3) +1, and specify the output variation alarm set value.

When this function is used, make sure to turn OFF b5 of (s3) +1.

| Set item | | | Description/Setting range |
|---|---|---|---|
| Operation setting | (s3)+1: b2 | Output variation alarm | ON: Used<br>OFF: Not used |
| | (s3)+1: b5 | Output value upper/lower limit setting | Make sure to set it to OFF |
| Output variation alarm set value | (s3)+22 | Output variation (incremental) alarm set value | 0 to 32767 |
| | (s3)+23 | Output variation (decremental) alarm set value | 0 to 32767 |

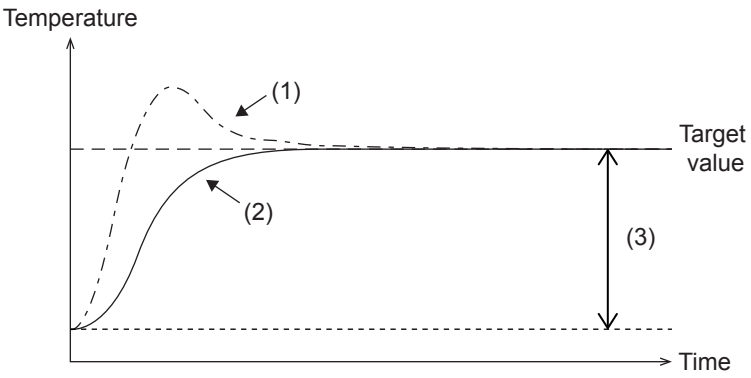
**Point**

Variation means (Current value) - (Previous value)

## ■Overshoot suppression setting

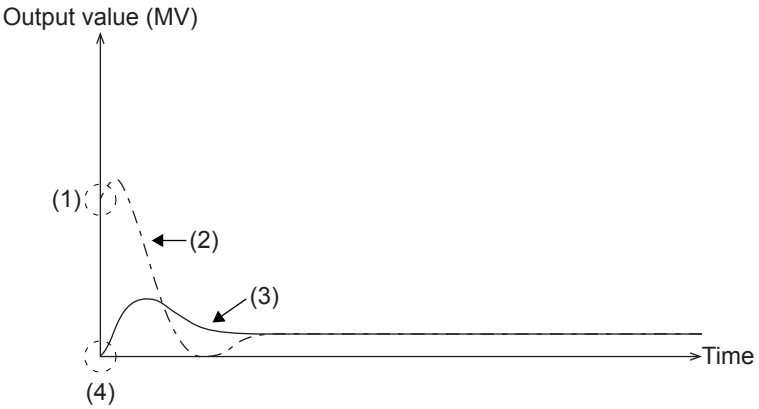
Set the overshoot suppression processing. Especially, when the difference between the target value and current value is big, turn b7 of (s3)+1 ON. It is effective to suppress the overshoot during PID control operation.

| Set item | | | Description/Setting range |
|---|---|---|---|
| Operation setting | (s3)+1: b7 | Overshoot suppression setting | ON: Used<br>OFF: Not used |




(1) Overshoot suppression setting invalid
(2) Overshoot suppression setting valid
(3) If overshoot suppression setting is invalid, the first output variation ΔMV is determined by this difference.

If the output variation rate ΔMV is large during the initial scan time, the output will be suppressed in the following manner.




(1) Initial output value is large
(2) Overshoot suppression setting invalid
(3) Overshoot suppression setting valid
(4) The output variation rate is forcibly set to 0, so the initial output value will be 0. (When offset value offset is 0)

**Point**

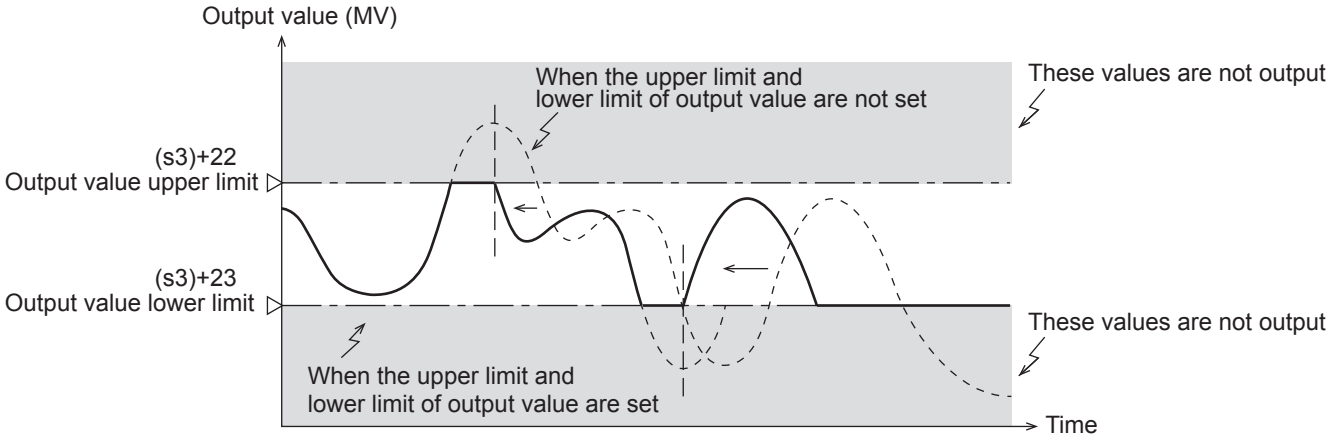
If the overshoot suppression setting is not used, the PID control operation with similar performance to the FX3 programmable controller will be executed.

## ■Upper and lower limits for output value

When the upper and lower limit settings of the output value are valid, the output value is as shown in the chart. The upper limit and lower limit of the output value can moderate the increase of the integral item in the PID control.

When using the upper limit and lower limit of the output value, make sure to set (s3)+1, b2 to OFF.

| Set item | | | Description/Setting range |
|---|---|---|---|
| Operation setting | (s3)+1: b2 | Output variation alarm | Make sure to set it to OFF |
| | (s3)+1: b5 | Output value upper/lower limit setting | ON: Used<br>OFF: Not used |



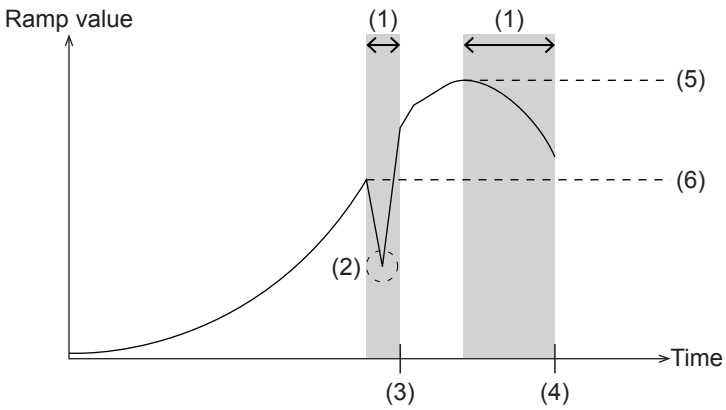

## ■Hunting suppression setting

Especially, if the step response method auto-tuning (☞ Page 583 Auto-tuning) is executed in an environment where the measurement value varies temporarily because of noise of the sensor and analog input, auto-tuning may not be executed correctly and hunting may occur during PID control operation.

When b8 of (s3)+1 is turned ON and the current input value is less than the previous input value temporarily, auto-tuning is not completed until the set timeout time has elapsed. Therefore, maximum ramp (R) can be obtained correctly. (See the figure below.)

To use this function, turn ON b4 of (s3)+1 and OFF b6 of (s3)+1.

| Set item | | | Description/Setting range |
|---|---|---|---|
| Operation setting | (s3)+1: b4 | Auto-tuning | Make sure to set it to ON |
| | (s3)+1: b6 | Auto-tuning mode | Make sure to set it to OFF |
| | (s3)+1: b8 | Hunting suppression setting | ON: Used<br>OFF: Not used |
| | (s3)+25 | Timeout time setting value after maximum ramp (R) detection | 1 to 32767 (second) |




(1) Timeout wait after maximum ramp (R) detection
(2) A decrease of ramp caused by temporary deviation of the input value
(3) Maximum ramp (R) is updated and auto tuning continues
(4) Timeout wait after maximum ramp (R) detection
(5) Maximum ramp (R) detection value at the end of auto tuning
(6) Maximum ramp (R) detection value at the end of auto tuning when this setting is not used

The ramp value is obtained with the following formula.

Ramp value = (current input value - previous input value) ÷ sampling time

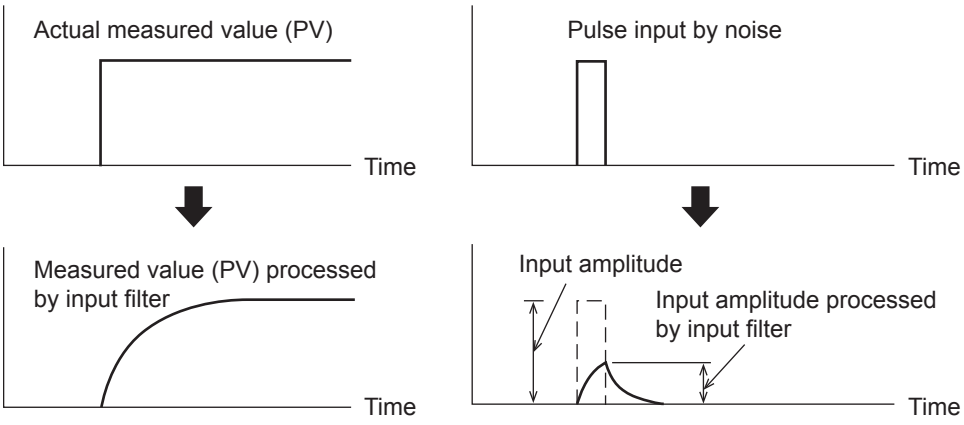
**Point**

If the hunting suppression setting is not used, the PID control operation with similar performance to the FX3 programmable controller will be executed.

## Input filter constant (s3)+2

The input filter ($\alpha$) is a software filter to reduce the fluctuation of the measured value (PV) caused by noise. By setting this time constant of the filter according to the control target characteristics and noise level, the effect of noise can be reduced. If the input filter value is too small, the filter effect is small. If the input filter value is too large, the input response is bad. Setting range: 0 to 99 (%).

Because the input filter ($\alpha$) acts on the target value (SV), all of the proportional operation, integral operation and differential operation are affected.



## Proportional gain (s3)+3

During the proportional operation, the output (MV) increases in proportion to the deviation (difference between the target value (SV) and the measured value (PV)). This deviation is called proportional gain (KP), and expressed in the following relational expression:

Output (MV) = Proportional gain (KP) × Deviation (EV)

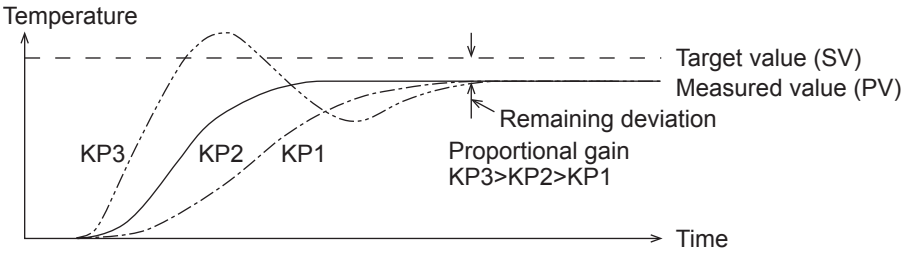
The reciprocal of the proportional gain (KP) is called proportional band.

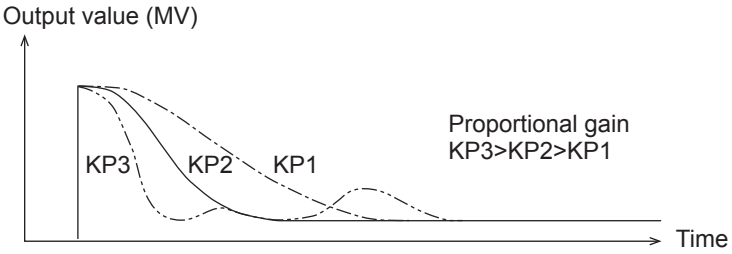
As the proportional gain (KP) is larger (as shown in the example below), the motion to let the measured value (PV) be nearer to the target value (SV) becomes stronger.

Setting range: 1 to 32767 (%)

Ex.

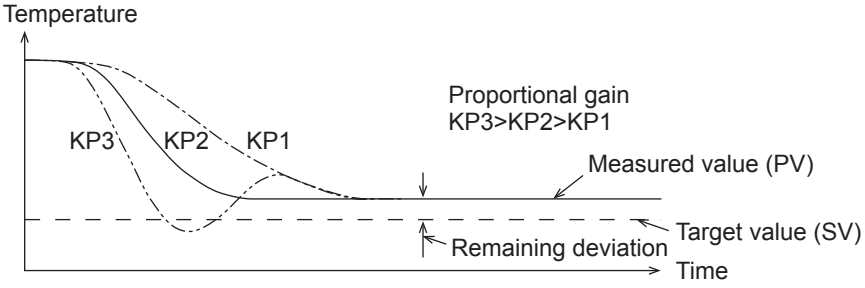
Proportional operation (P operation) in backward operation (heating)

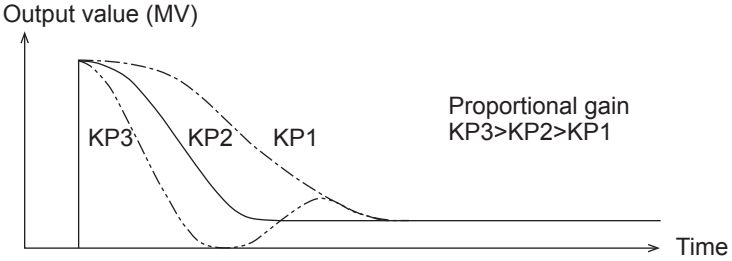



Ex.

Proportional operation (P operation) in forward operation (cooling)



## Integral time (s3)+4

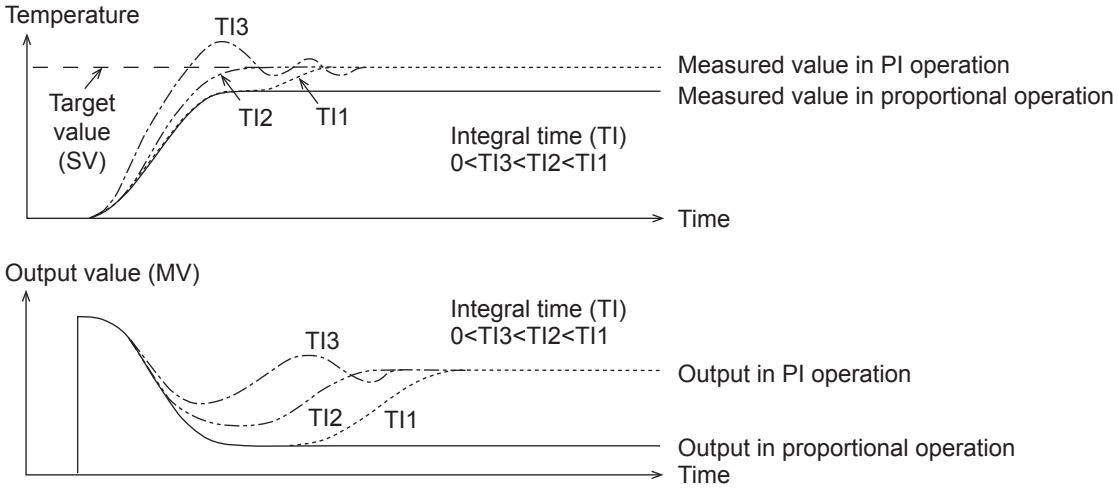
During the integral operation, the time after deviation is generated until the integral operation output becomes the proportional operation output. This is called integral time and is expressed as "TI".

As TI becomes smaller, the integral operation becomes stronger.

Setting range: 0 to 32767 (× 100 ms). "0" is handled as "∞" (no integration).

**Ex.**

PI operation in backward operation (heating)

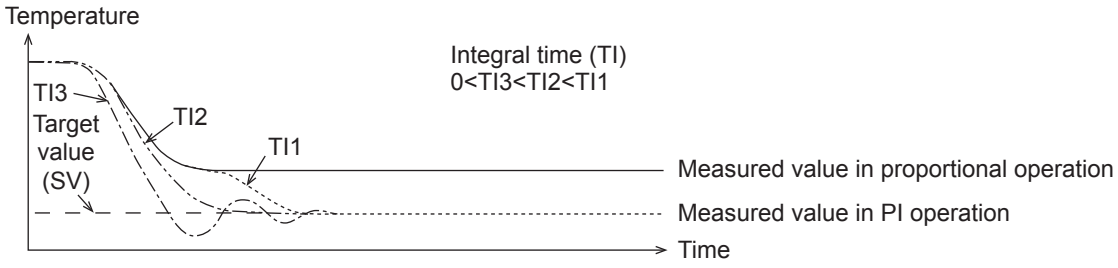


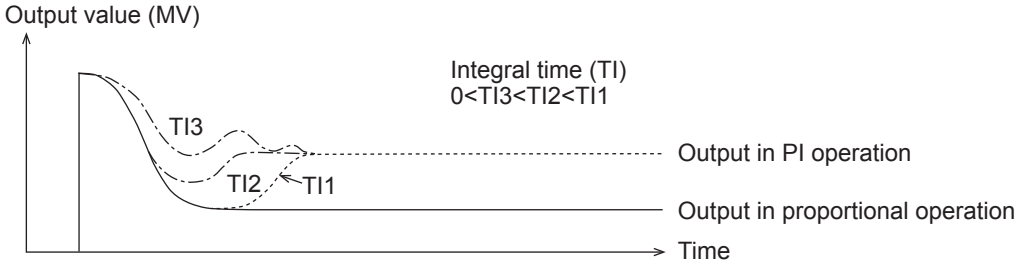




**Ex.**

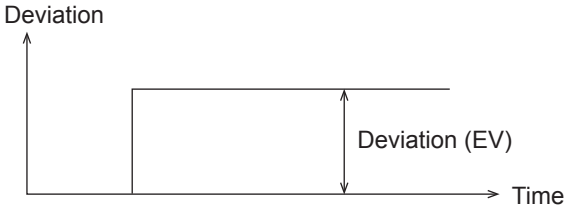
PI operation in forward operation (cooling)

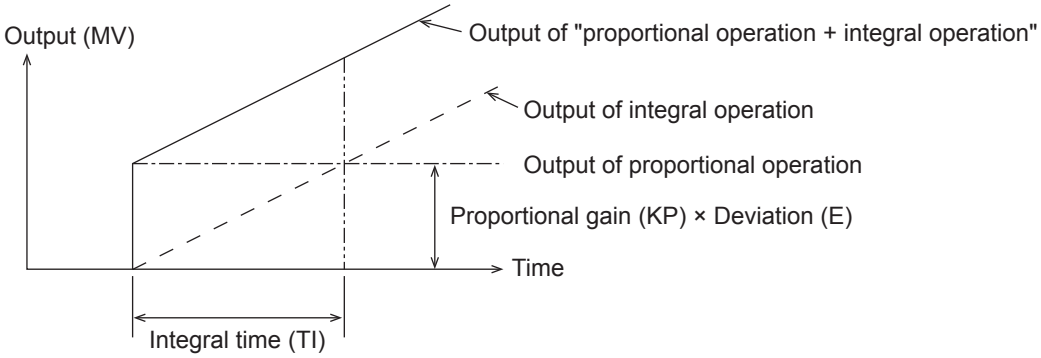


**Point**

The integral operation changes the output so that the continuously generated deviation is eliminated. As a result, the remaining deviation generated in the proportional operation can be eliminated.






## Differential gain (s3)+5

The filter is applied to the output at the differential operation. Setting range: 0 to 100 (%)

Only the differential operation is affected by the differential gain (KD).

- When the differential gain (KD) is small, the output is immediately given with regard to changes in the measured value (PV) caused by disturbance, etc.
- When the differential gain (KD) is large, the output is given after a long time with respect to changes in the measured value (PV) caused by disturbance, etc.

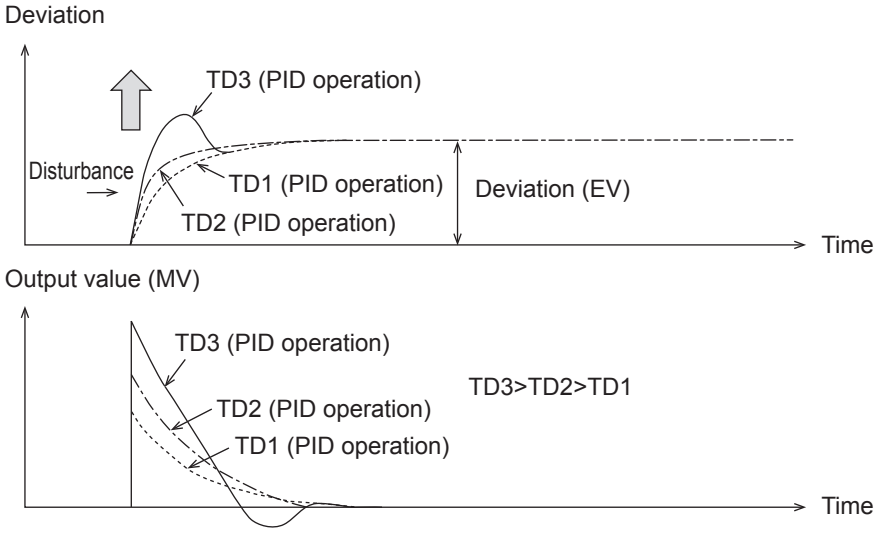
**Point**

Set the differential gain (KD) to "0", and then adjust the operation using the input filter ($\alpha$). If the output response is too close to the disturbance, increase the differential gain (KD).

## Differential time (s3)+6

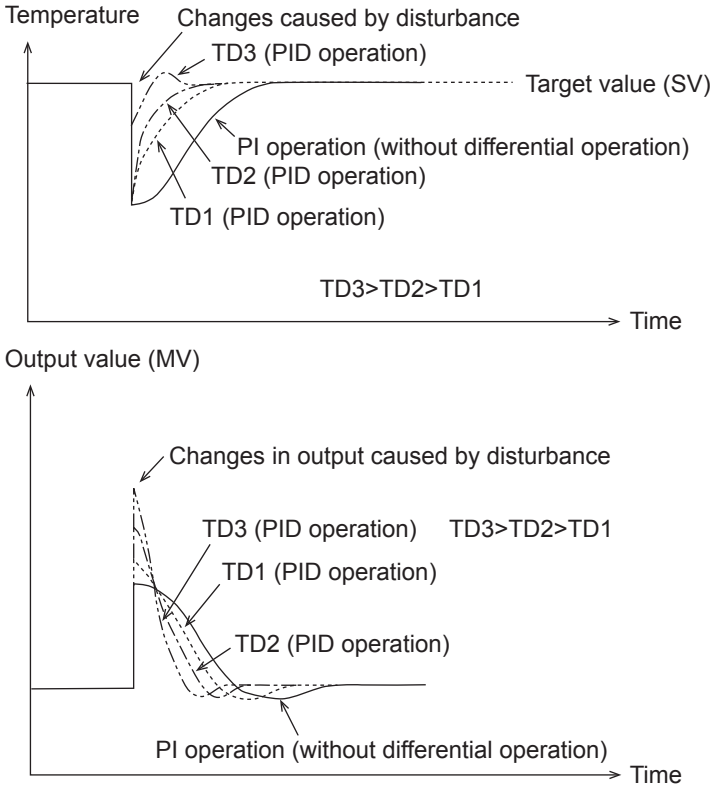
Use the differential time (TD) to respond sensitively to fluctuations in the measured value (PV) caused by disturbance, etc. and to minimize the fluctuations. Setting range: 0 to 32767 (× 10 ms)

- When the differential time (TD) is large, it prevent large fluctuation in the control target caused by disturbance, etc.
- It is not always necessary to use the differential time (TD) (when disturbance is small, for example).



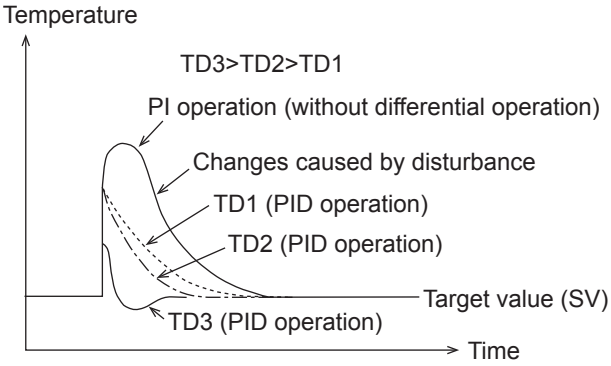

Ex.

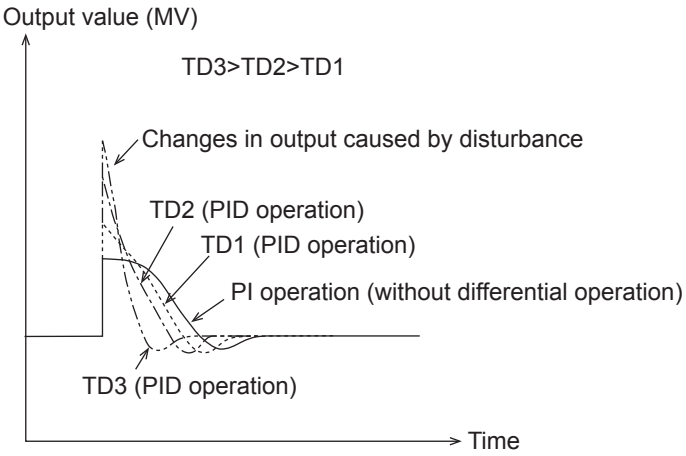
PID operation in backward operation (heating)



Ex.

PID operation in forward operation (cooling)



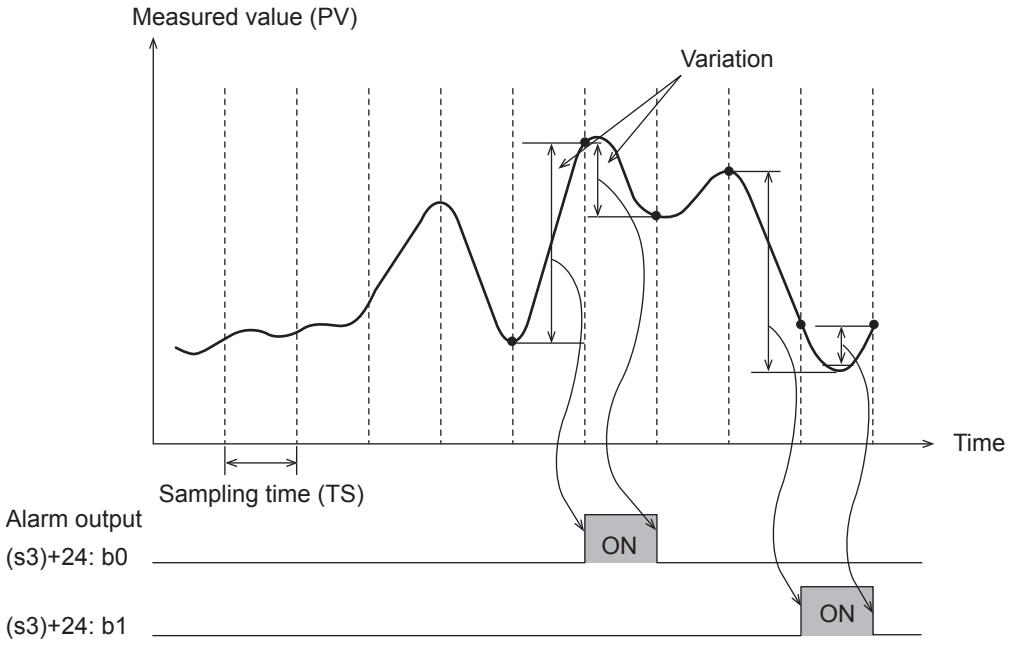



## Alarm output (s3)+24

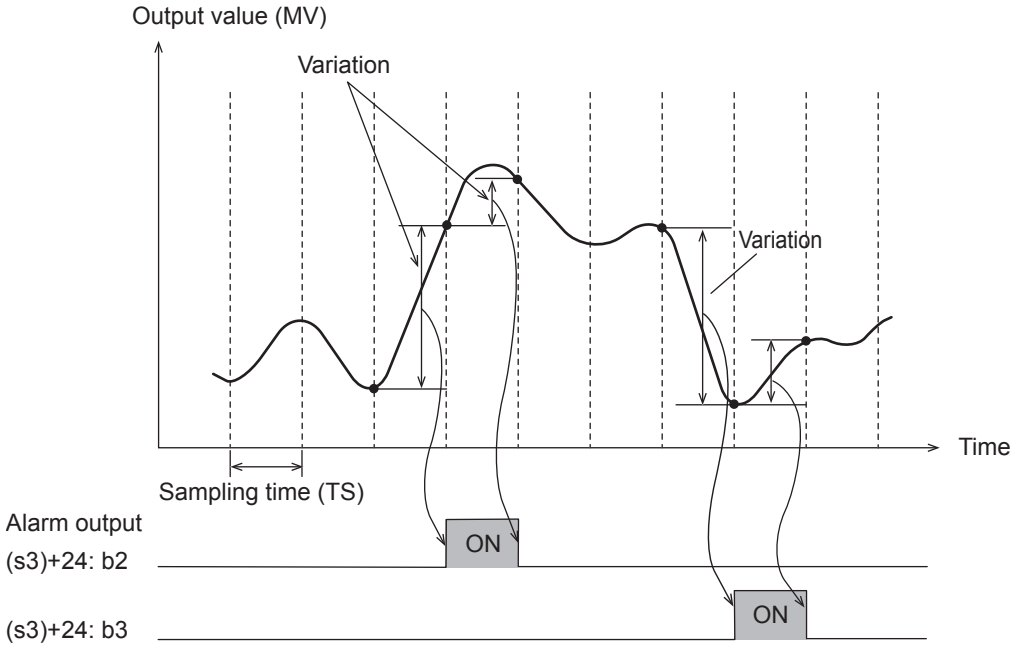
If the input variation and the output variation specified with (s3) +20 to (s3) +23 are exceeded, each bit of (s3) +24 turns ON as a warning output.

| Item | | Description | Remarks |
|---|---|---|---|
| Alarm output | (s3)+24: b0 | OFF: Input variation (incremental) is not exceeded.<br>ON: Input variation (incremental) is exceeded. | It is valid when operation setting (ACT) (b1 of (s3)+1) is "1". |
| | (s3)+24: b1 | OFF: Input variation (decremental) is not exceeded.<br>ON: Input variation (decremental) is exceeded. | |
| | (s3)+24: b2 | OFF: Output variation (incremental) is not exceeded.<br>ON: Output variation (incremental) is exceeded. | It is valid when operation setting (ACT) (b2 of (s3)+1) is "1". |
| | (s3)+24: b3 | OFF: Output variation (decremental) is not exceeded.<br>ON: Output variation (decremental) is exceeded. | |

### ■In the case of input variation




### ■In the case of output variation



# Auto-tuning

This section describes the auto-tuning function of PID instruction.

The auto-tuning function will automatically set the important constants, such as the proportional gain and the integral time, to ensure optimum PID control. There are two auto-tuning methods: limit cycle method and step response method.

## Limit cycle method

For acquiring satisfactory control results in PID control, it is necessary to obtain the optimal value of each constant (parameter) suitable to the control target. This paragraph explains the limit cycle method to obtain the amplitude (a) and vibration cycle ($\tau$, $\tau on$) of the input value, and then calculate the proportional gain (KP), integral time (TI) and differential time (TD) based on the expressions shown in the table below.

What is the limit cycle method changes in the input value in two-position control (in which the output Upper Limit Value (ULV) and output Lower Limit Value (LLV) are switched according to the deviation) are measured, and then three constants in the PID control are obtained.



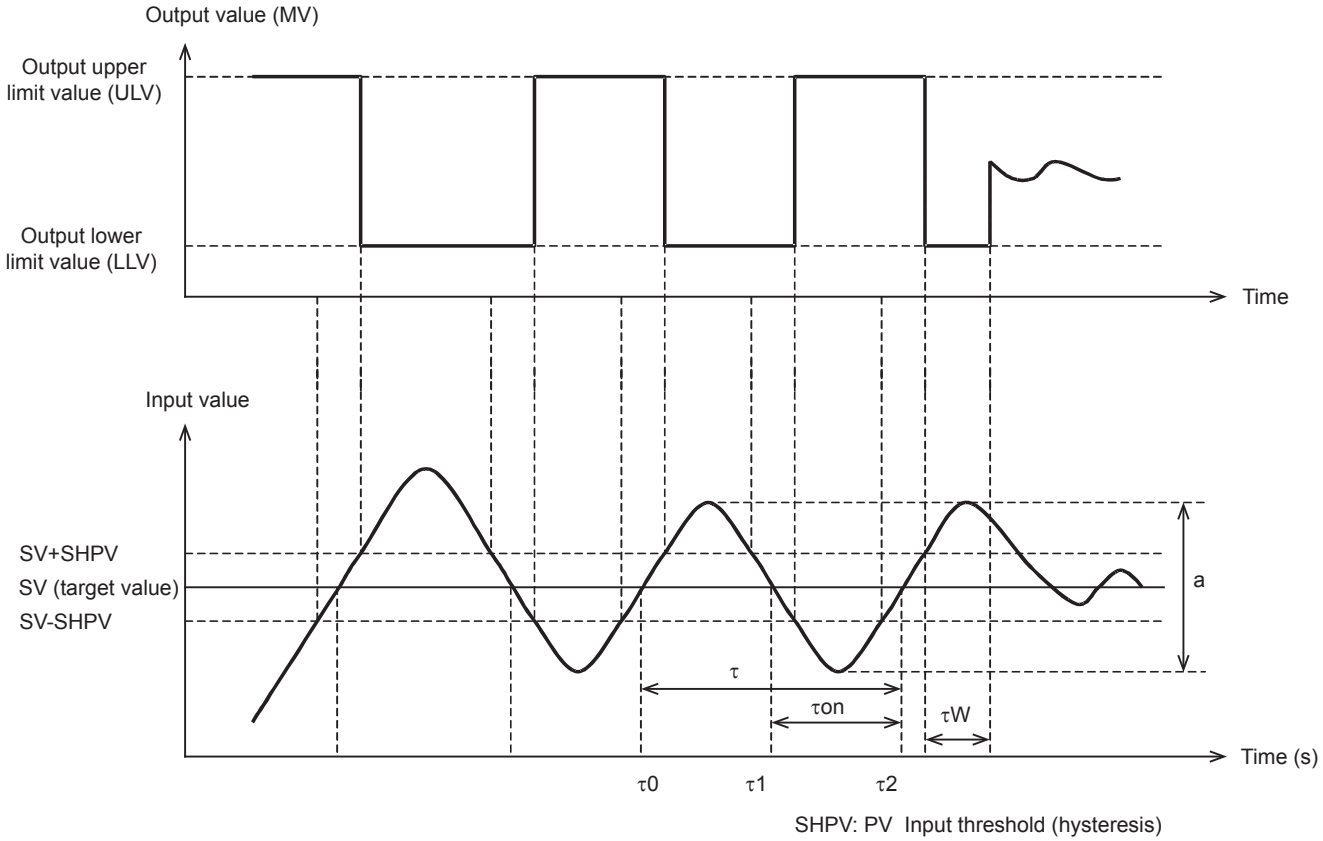
### ■How to obtain three constants in PID control (Reference)

• Operation characteristics and three constants

| Control type | Proportional gain (KP) [%] | Integral time (TI) [× 100 ms] | Differential time (TD) [× 10 ms] |
|---|---|---|---|
| Only proportional control (P operation) | $\frac{1}{a}(ULV-LLV)\times 100$ | — | — |
| PI control (PI operation) | $\frac{0.9}{a}(ULV-LLV)\times 100$ | $33\times\tau on\left(1-\frac{\tau on}{\tau}\right)$ | — |
| PID control (PID operation) | $\frac{1.2}{a}(ULV-LLV)\times 100$ | $20\times\tau on\left(1-\frac{\tau on}{\tau}\right)$ | $50\times\tau on\left(1-\frac{\tau on}{\tau}\right)$ |

• Operation characteristics (in an example of backward operation)

During the "τW" period after the tuning cycle is finished, the output value (MV) is held at the output Lower Limit Value (LLV), and then normal PID control is started. The value "τW" can be obtained by the expression "τW = (50 + KW)/100 × (τ - τon)", and the wait setting parameter "KW" can be set in the parameter (s3)+28. (Setting range: KW = -50 to +32717 [%]) (When the abnormal range is specified, "τW" is handled as "0")




SHPV: PV Input threshold (hysteresis)

## ■Parameters set in limit cycle method

The parameters specified in the limit cycle method are shown below.

| Parameter | Setting position |
|---|---|
| Proportional gain (KP) | (s3)+3 |
| Integral time (TI) | (s3)+4 |
| Differential time (TD) | (s3)+6 |

## ■Auto-tuning procedure

***1.*** Set forward or backward operation

Set the operation direction flag (b0) in the operation setting parameter (ACT) (s3)+1.

***2.*** Select the auto-tuning method (limit cycle method)

Set the auto-tuning method to ON (b6) in the operation setting parameter (ACT) (s3)+1. (When bit 6 is set to OFF, the step response method is selected.)

***3.*** Set the auto-tuning execution flag to ON

Set the auto-tuning execution flag to ON (b4) in the operation setting parameter (ACT) (s3)+1.

***4.*** Set the input filter

Set the input filter in the operation setting parameter (ACT) (s3)+2.

***5.*** Set the sampling time

Set the sampling time (s3).

***6.*** Set the Upper Limit Value (ULV)

Set the Upper Limit Value (ULV) of the output value (MV) in the operation setting parameter (ACT) (s3)+26.

***7.*** Set the Lower Limit Value (LLV)

Set the Lower Limit Value (LLV) of the output value (MV) in the operation setting parameter (ACT) (s3)+27.

***8.*** Set the threshold (hysteresis) (SHPV)

Set the threshold (hysteresis) width (SHPV) in the operation setting parameter (ACT) (s3)+25.

***9.*** Set the target value (SV)

Set the target value (SV) in (s1) of the PID instruction.

***10.*** Set the PID instruction command input ON to start auto-tuning

Auto-tuning is executed according to the measured value (PV).

When auto-tuning is completed, the auto-tuning flags (b4 and b6) turn OFF in the operation setting parameter (ACT): (s3)+1.

## Step response method

For acquiring satisfactory control results during PID control, it is necessary to obtain the optimal value of each constant (parameter) suitable for the control target. This paragraph explains the step response method to obtain three constants in the PID control (proportional gain (KP), integral time (TI) and differential time (TD)).

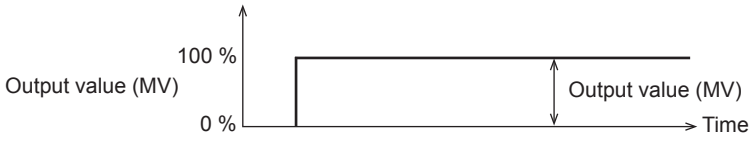
In this method, by giving stepped output from 0 to 100 % to the control system, three constants in the PID control are obtained from the operation characteristics (maximum ramp (R) and dead time (L)) and the input value variation. The stepped output may be obtained from 0 to 75 % or from 0 to 50 %.

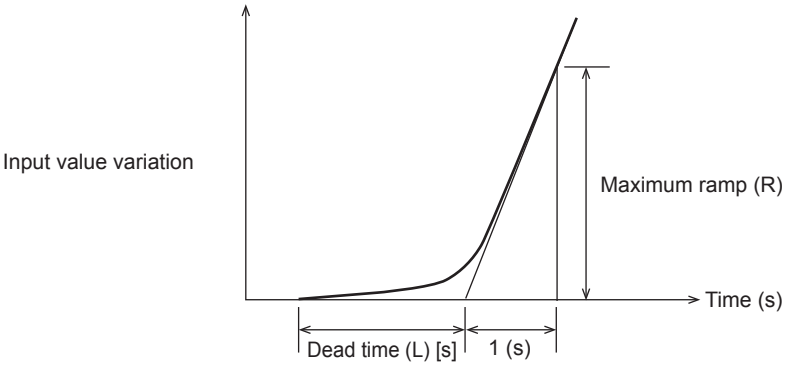
### ■How to obtain three constants in PID control (Reference)

• Operation characteristics and three constants

| Control type | Proportional gain (KP) [%] | Integral time (TI) [× 100 ms] | Differential time (TD) [× 10 ms] |
|---|---|---|---|
| Only proportional control (P operation) | $\frac{1}{RL} \times$ Output value (MV) $\times 100$ | — | — |
| PI control (PI operation) | $\frac{0.9}{RL} \times$ Output value (MV) $\times 100$ | 33L | — |
| PID control (PID operation) | $\frac{1.2}{RL} \times$ Output value (MV) $\times 100$ | 20L | 50L |

• Operation characteristics




### ■Parameters set in step response method

The parameters specified in the step response method are shown below.

| Parameter | Setting position |
|---|---|
| Operation setting (ACT) | (s3)+1: b0 (operation direction) |
| Proportional gain (KP) | (s3)+3 |
| Integral time (TI) | (s3)+4 |
| Differential time (TD) | (s3)+6 |

## ■Auto-tuning procedure

***1.*** Transferring the output value for auto-tuning to the output value (d)

Set the output value for auto-tuning to the maximum available output value multiplied by 0.5 to 1 for the output equipment.

***2.*** Setting the parameter (s3), target value (SV), etc. that cannot be set in autotuning according to the system

***3.*** Set the auto-tuning execution flag to ON

Set the auto-tuning execution flag to ON (b4) in the operation setting parameter (ACT) (s3)+1.

***4.*** Set the PID instruction command input ON to start auto-tuning

Auto-tuning is executed according to the measured value (PV).

When auto-tuning is completed, the auto-tuning flag (b4) turns OFF in the operation setting parameter (ACT): (s3)+1.

**Point**

Start auto-tuning while the system is stable.

If the system is unstable when auto-tuning is started, auto-tuning may not be executed normally.



## ■Cautions on auto-tuning setting

Note that auto-tuning may not be executed normally if the cautions described below are not followed

• Difference between the target value (SV) and the measured value (PV)

If the difference between the target value (SV) and the measured value (PV) is less than 75 when autotuning is started, auto-tuning is not executed normally. Accordingly, if the difference is less than 75, set the target value for auto-tuning. Set the target value again when auto-tuning is completed.

• Sampling time (TS)

Make sure the sampling time is set for auto-tuning to 1 second (1000 ms) or more. It is recommended that the sampling time is set to that it is considerably longer than the output change cycle.

## ■Cautions on auto-tuning execution

• Program countermeasures when the input value (PV) does not change

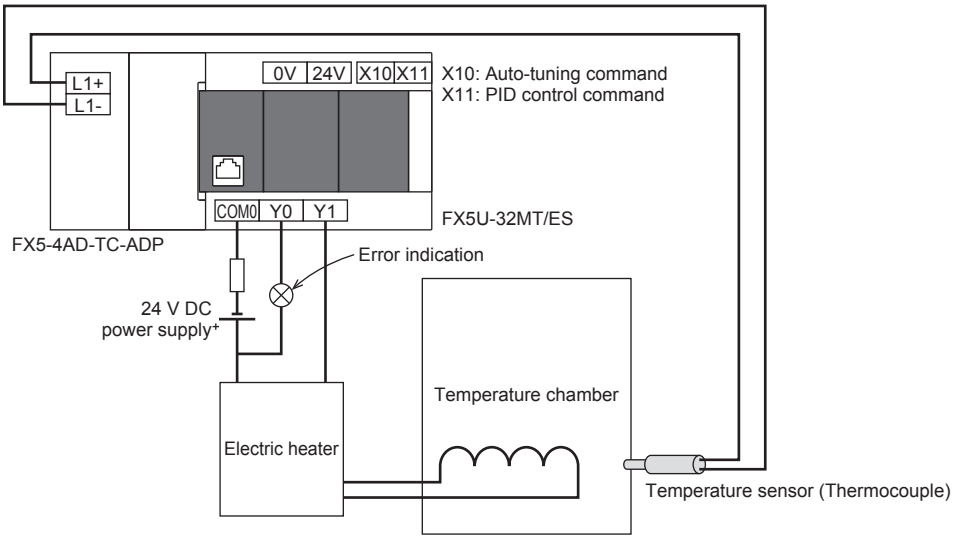
When the input value (PV) does not change normally due to factors such as wire breakage in an analog input line, auto-tuning is not finished. Detect and avoid such occurrences by introducing a sequence to monitor the input value or the elapsed time from the start of auto-tuning.

# Examples of program

## System configuration example

An example of the system configuration when the PID control function is used is shown below.

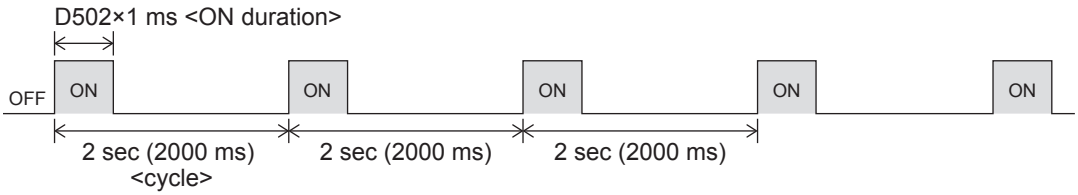
### ■System configuration



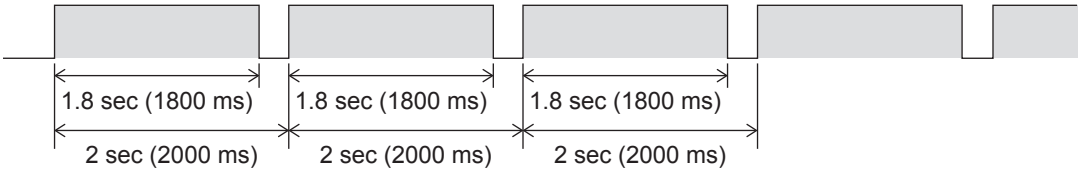

### ■Operation of the electric heater

The operation of the electric heater (Y1) is as follows.

- During PID control




- During auto-tuning (In case of 90% of maximum output)




### ■Program examples

| Program example | Description | Reference |
|---|---|---|
| Program example 1 | This is an example of the sample program for PID control. | Page 589 |
| Program example 2 | This is an example of the sample program for auto tuning (limit cycle method). | Page 591 |
| Program example 3 | This is an example of the sample program for auto tuning (step response method). | Page 593 |
| Program example 4 | This is an example of the sample program for auto tuning (limit cycle method) + PID control. | Page 595 |
| Program example 5 | This is an example of the sample program for auto tuning (step response method) + PID control. | Page 597 |

## Program example 1

This is an example of the sample program for PID control.

### ■Use device

The content of the devices used for the program is as follows.

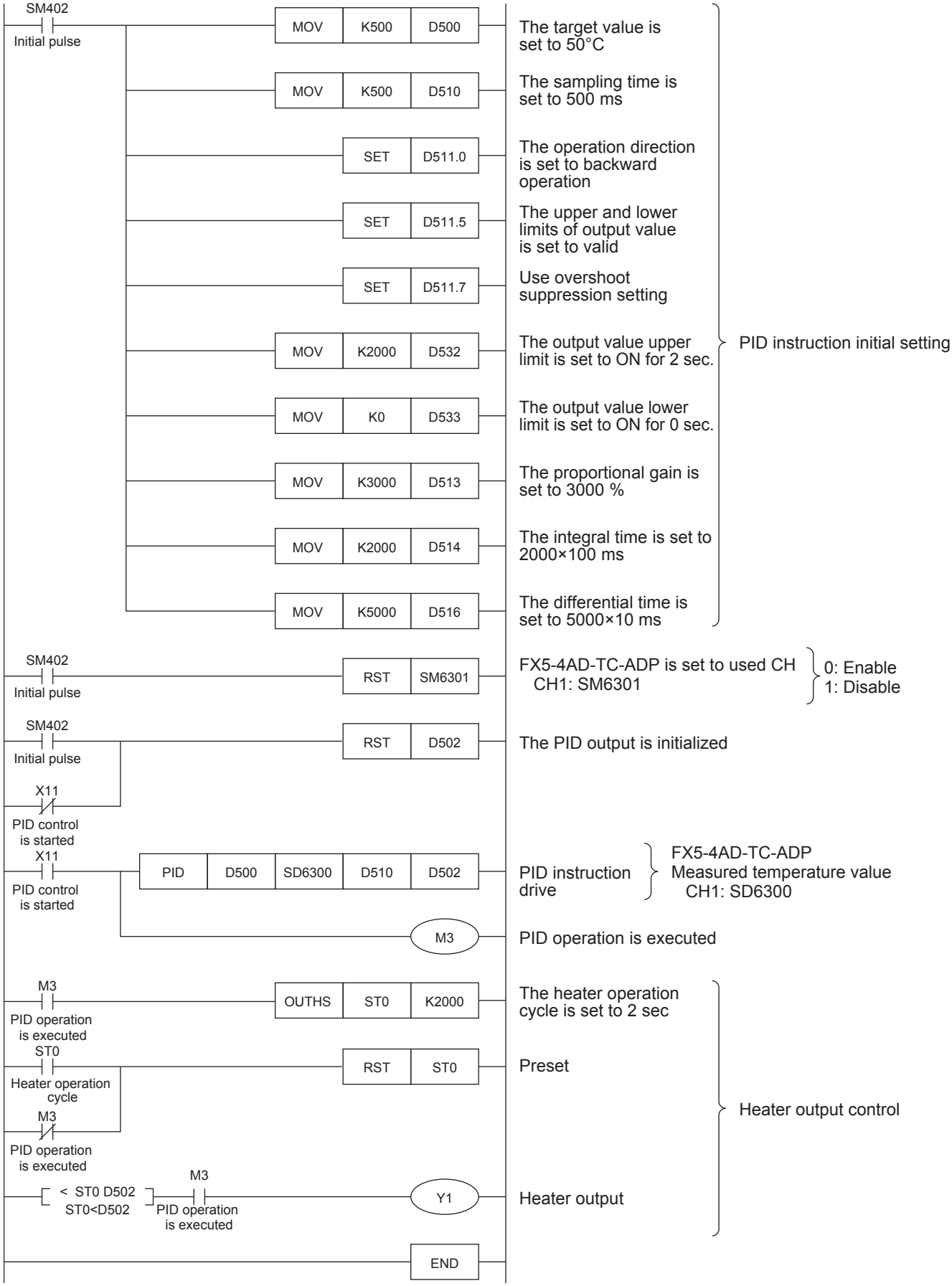
| Item | | | | Device | Setting value | |
|---|---|---|---|---|---|---|
| | | | | | During auto-tuning | During PID control |
| Target value (SV)*1 | | | (s1) | D500 | Not used | 500 (50.0℃) |
| Measured value (PV)*1 | | | (s2) | SD6300*2 | Not used | According to input value |
| Parameter | Sampling time (TS)*1 | | (s3) | D510 | Not used | 500 (500 ms) |
| | Operation setting (ACT) | Operation direction*1 | (s3)+1 b0 | D511.0 | Not used | 1 (Backward operation) |
| | | Input variation alarm | (s3)+1 b1 | D511.1 | Not used | 0 (Alarm is not provided) |
| | | Output variation alarm | (s3)+1 b2 | D511.2 | Not used | 0 (Alarm is not provided) |
| | | Auto-tuning | (s3)+1 b4 | D511.4 | Not used | 0 (AT is not provided) |
| | | Upper and lower limits of output value | (s3)+1 b5 | D511.5 | Not used | 1 (Setting is provided) |
| | | Select auto-tuning mode | (s3)+1 b6 | D511.6 | Not used | Not used |
| | | Overshoot suppression setting | (s3)+1 b7 | D511.7 | Not used | 1 (Used) |
| | | Hunting suppression setting | (s3)+1 b8 | D511.8 | Not used | Not used |
| | Input filter constant ($\alpha$) | | (s3)+2 | D512 | Not used | 0 (Input filter is not provided) |
| | Proportional gain (KP)*1 | | (s3)+3 | D513 | Not used | 3000 (3000 %) |
| | Integral time (TI)*1 | | (s3)+4 | D514 | Not used | 2000 (2000×100 ms) |
| | Differential gain (KD) | | (s3)+5 | D515 | Not used | 0 (Differential gain is not provided) |
| | Differential time (TD)*1 | | (s3)+6 | D516 | Not used | 5000 (5000×10 ms) |
| | Input variation (incremental) alarm set value | | (s3)+20 | D530 | Not used | Not used |
| | Input variation (decremental) alarm set value | | (s3)+21 | D531 | Not used | Not used |
| | Output variation (incremental) alarm set value Output upper limit set value | | (s3)+22 | D532 | Not used | 2000 (2 second) |
| | Output variation (decremental) alarm set value Output lower limit set value | | (s3)+23 | D533 | Not used | 0 (0 second) |
| | Alarm output | Input variation (incremental) is exceeded | (s3)+24 b0 | D534.0 | Not used | Not used |
| | | Input variation (decremental) is exceeded | (s3)+24 b1 | D534.1 | Not used | Not used |
| | | Output variation (incremental) is exceeded | (s3)+24 b2 | D534.2 | Not used | Not used |
| | | Output variation (decremental) is exceeded | (s3)+24 b3 | D534.3 | Not used | Not used |
| | PV value threshold (hysteresis) width (SHPV) | | (s3)+25 | D535 | — | — |
| | Output value upper limit (ULV) | | (s3)+26 | D536 | — | — |
| | Output value lower limit (LLV) | | (s3)+27 | D537 | — | — |
| | Wait setting from end of tuning cycle to start of PID control (KW) | | (s3)+28 | D538 | — | — |
| Output value (MV)*1 | | | (d) | D502 | Not used | According to operation |

—: This is an item not occupied.

*1 The setting is always necessary.

*2 When CH1 is used.

## ■Program


SM402
Initial pulse
MOV K500 D500
The target value is set to 50°C
MOV K500 D510
The sampling time is set to 500 ms
SET D511.0
The operation direction is set to backward operation
SET D511.5
The upper and lower limits of output value is set to valid
SET D511.7
Use overshoot suppression setting
MOV K2000 D532
The output value upper limit is set to ON for 2 sec.
MOV K0 D533
The output value lower limit is set to ON for 0 sec.
MOV K3000 D513
The proportional gain is set to 3000 %
MOV K2000 D514
The integral time is set to 2000×100 ms
MOV K5000 D516
The differential time is set to 5000×10 ms
PID instruction initial setting
SM402
Initial pulse
RST SM6301
FX5-4AD-TC-ADP is set to used CH
CH1: SM6301
0: Enable
1: Disable
SM402
Initial pulse
RST D502
The PID output is initialized
X11
PID control is started
X11
PID control is started
PID D500 SD6300 D510 D502
PID instruction drive
FX5-4AD-TC-ADP
Measured temperature value
CH1: SD6300
M3
PID operation is executed
M3
PID operation is executed
OUTHS ST0 K2000
The heater operation cycle is set to 2 sec
ST0
Heater operation cycle
RST ST0
Preset
M3
PID operation is executed
< ST0 D502
ST0<D502
M3
PID operation is executed
Y1
Heater output
Heater output control
END

## Program example 2

This is an example of the sample program for auto tuning (limit cycle method).

### ■Use device

The content of the devices used for the program is as follows.

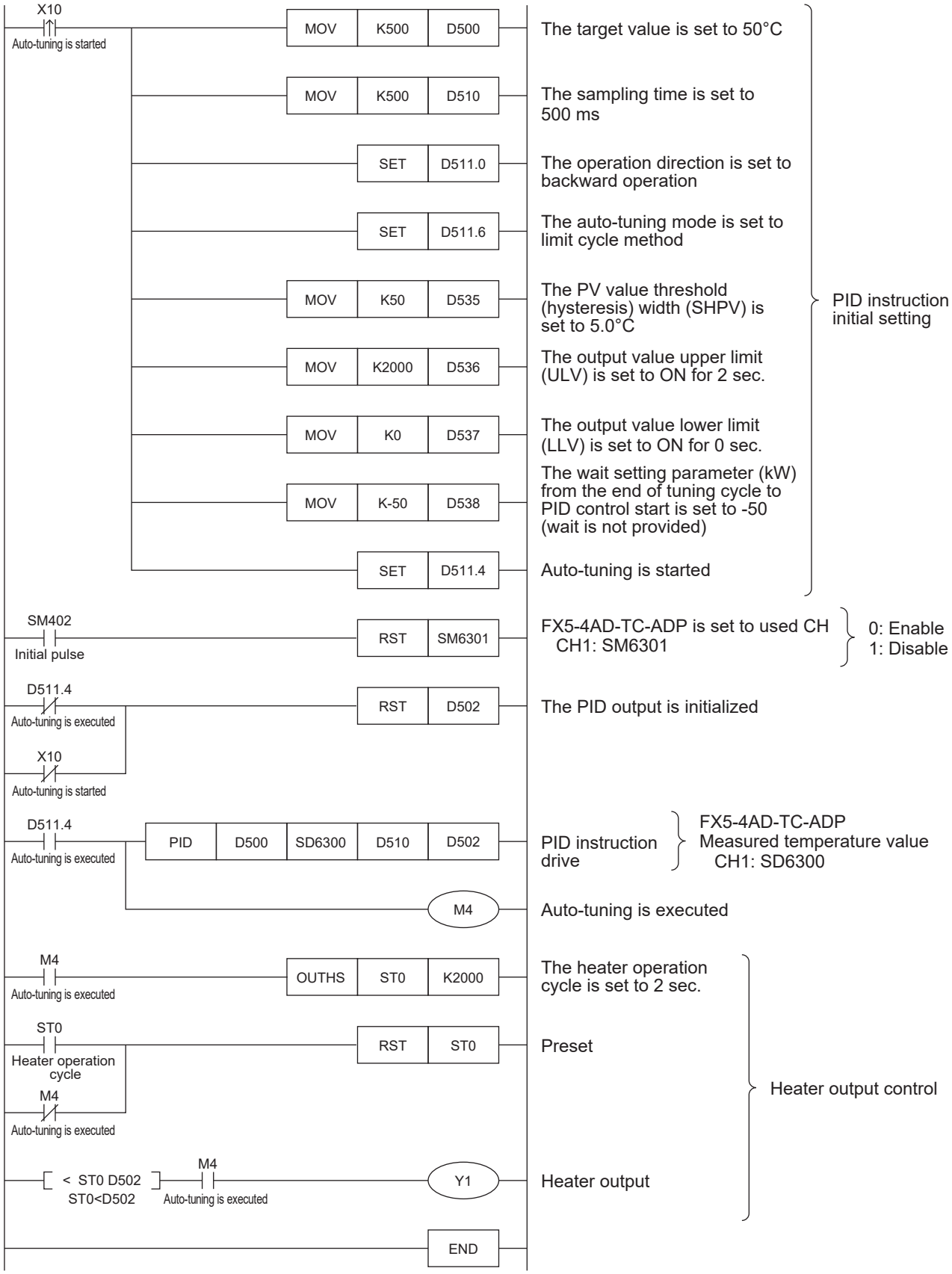
| Item | | | | Device | Setting value | |
|---|---|---|---|---|---|---|
| | | | | | During auto-tuning | During PID control |
| Target value (SV)*1 | | | (s1) | D500 | 500 (50.0℃) | Not used |
| Measured value (PV)*1 | | | (s2) | SD6300*2 | According to input value | Not used |
| Parameter | Sampling time (TS)*1 | | (s3) | D510 | 500 (500 ms) | Not used |
| | Operation setting (ACT) | Operation direction*1 | (s3)+1 b0 | D511.0 | 1 (Backward operation) | Not used |
| | | Input variation alarm | (s3)+1 b1 | D511.1 | 0 (Alarm is not provided) | Not used |
| | | Output variation alarm | (s3)+1 b2 | D511.2 | 0 (Alarm is not provided) | Not used |
| | | Auto-tuning | (s3)+1 b4 | D511.4 | 1 (AT is provided) | Not used |
| | | Upper and lower limits of output value | (s3)+1 b5 | D511.5 | 0 (Setting is not provided) | Not used |
| | | Select auto-tuning mode | (s3)+1 b6 | D511.6 | 1 (Limit cycle method) | Not used |
| | | Overshoot suppression setting | (s3)+1 b7 | D511.7 | Not used | Not used |
| | | Hunting suppression setting | (s3)+1 b8 | D511.8 | Not used | Not used |
| | Input filter constant (α) | | (s3)+2 | D512 | 0 (Input filter is not provided) | Not used |
| | Proportional gain (KP)*1 | | (s3)+3 | D513 | According to auto-tuning result | Not used |
| | Integral time (TI)*1 | | (s3)+4 | D514 | According to auto-tuning result | Not used |
| | Differential gain (KD) | | (s3)+5 | D515 | 0 (Differential gain is not provided) | Not used |
| | Differential time (TD)*1 | | (s3)+6 | D516 | According to auto-tuning result | Not used |
| | Input variation (incremental) alarm set value | | (s3)+20 | D530 | Not used | Not used |
| | Input variation (decremental) alarm set value | | (s3)+21 | D531 | Not used | Not used |
| | Output variation (incremental) alarm set value Output upper limit set value | | (s3)+22 | D532 | Not used | Not used |
| | Output variation (decremental) alarm set value Output lower limit set value | | (s3)+23 | D533 | Not used | Not used |
| | Alarm output | Input variation (incremental) is exceeded | (s3)+24 b0 | D534.0 | Not used | Not used |
| | | Input variation (decremental) is exceeded | (s3)+24 b1 | D534.1 | Not used | Not used |
| | | Output variation (incremental) is exceeded | (s3)+24 b2 | D534.2 | Not used | Not used |
| | | Output variation (decremental) is exceeded | (s3)+24 b3 | D534.3 | Not used | Not used |
| | PV value threshold (hysteresis) width (SHPV) | | (s3)+25 | D535 | 50 (5.0℃) | Not used |
| | Output value upper limit (ULV) | | (s3)+26 | D536 | 2000 (2 second) | Not used |
| | Output value lower limit (LLV) | | (s3)+27 | D537 | 0 (0 second) | Not used |
| | Wait setting from end of tuning cycle to start of PID control (KW) | | (s3)+28 | D538 | -50 (Wait is not provided) | Not used |
| Output value (MV)*1 | | | (d) | D502 | According to operation | Not used |

—: This is an item not occupied.

*1 The setting is always necessary.

*2 When CH1 is used.

## ■Program


X10
Auto-tuning is started
MOV K500 D500
The target value is set to 50°C
MOV K500 D510
The sampling time is set to 500 ms
SET D511.0
The operation direction is set to backward operation
SET D511.6
The auto-tuning mode is set to limit cycle method
MOV K50 D535
The PV value threshold (hysteresis) width (SHPV) is set to 5.0°C
MOV K2000 D536
The output value upper limit (ULV) is set to ON for 2 sec.
MOV K0 D537
The output value lower limit (LLV) is set to ON for 0 sec.
MOV K-50 D538
The wait setting parameter (kW) from the end of tuning cycle to PID control start is set to -50 (wait is not provided)
SET D511.4
Auto-tuning is started
PID instruction initial setting
SM402
Initial pulse
RST SM6301
FX5-4AD-TC-ADP is set to used CH
CH1: SM6301
0: Enable
1: Disable
D511.4
Auto-tuning is executed
RST D502
The PID output is initialized
X10
Auto-tuning is started
D511.4
Auto-tuning is executed
PID D500 SD6300 D510 D502
PID instruction drive
FX5-4AD-TC-ADP
Measured temperature value
CH1: SD6300
M4
Auto-tuning is executed
M4
Auto-tuning is executed
OUTHS ST0 K2000
The heater operation cycle is set to 2 sec.
ST0
Heater operation cycle
RST ST0
Preset
M4
Auto-tuning is executed
Heater output control
< ST0 D502
ST0<D502
M4
Auto-tuning is executed
Y1
Heater output
END

## Program example 3

This is an example of the sample program for auto tuning (step response method).

### ■Use device

The content of the devices used for the program is as follows.

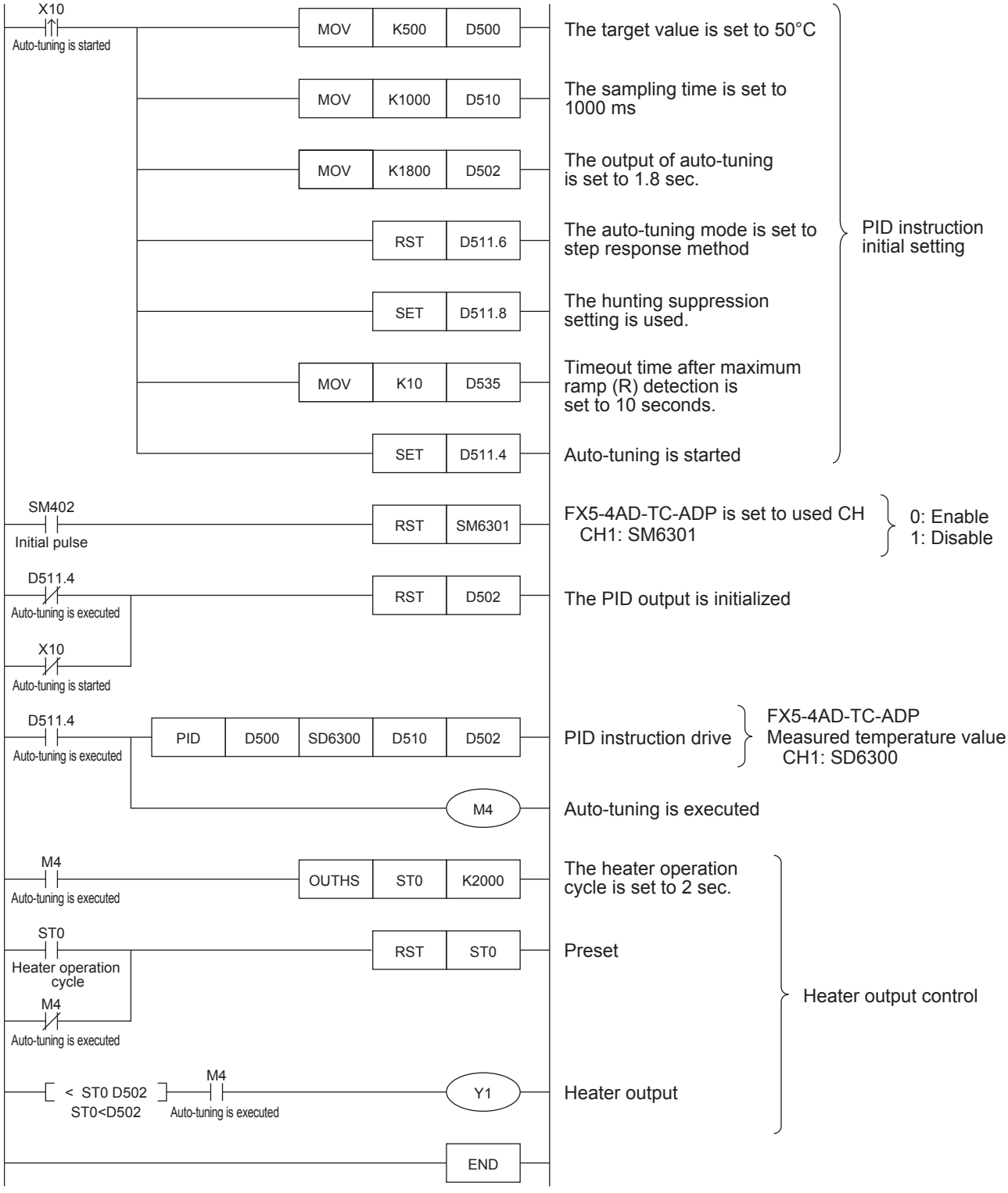
| Item | | | | Device | Setting value | |
|---|---|---|---|---|---|---|
| | | | | | During auto-tuning | During PID control |
| Target value (SV)*1 | | | (s1) | D500 | 500 (50.0℃) | Not used |
| Measured value (PV)*1 | | | (s2) | SD6300*2 | According to input value | Not used |
| Parameter | Sampling time (TS)*1 | | (s3) | D510 | 1000 (1000 ms) | Not used |
| | Operation setting (ACT) | Operation direction*1 | (s3)+1 b0 | D511.0 | According to auto-tuning result | Not used |
| | | Input variation alarm | (s3)+1 b1 | D511.1 | 0 (Alarm is not provided) | Not used |
| | | Output variation alarm | (s3)+1 b2 | D511.2 | 0 (Alarm is not provided) | Not used |
| | | Auto-tuning | (s3)+1 b4 | D511.4 | 1 (AT is provided) | Not used |
| | | Upper and lower limits of output value | (s3)+1 b5 | D511.5 | 0 (Setting is not provided) | Not used |
| | | Select auto-tuning mode | (s3)+1 b6 | D511.6 | 0 (Step response method) | Not used |
| | | Overshoot suppression setting | (s3)+1 b7 | D511.7 | Not used | Not used |
| | | Hunting suppression setting | (s3)+1 b8 | D511.8 | 1 (Timeout time is valid) | Not used |
| | Input filter constant ($\alpha$) | | (s3)+2 | D512 | 0 (Input filter is not provided) | Not used |
| | Proportional gain (KP)*1 | | (s3)+3 | D513 | According to auto-tuning result | Not used |
| | Integral time (TI)*1 | | (s3)+4 | D514 | According to auto-tuning result | Not used |
| | Differential gain (KD) | | (s3)+5 | D515 | 0 (Differential gain is not provided) | Not used |
| | Differential time (TD)*1 | | (s3)+6 | D516 | According to auto-tuning result | Not used |
| | Input variation (incremental) alarm set value | | (s3)+20 | D530 | Not used | Not used |
| | Input variation (decremental) alarm set value | | (s3)+21 | D531 | Not used | Not used |
| | Output variation (incremental) alarm set value Output upper limit set value | | (s3)+22 | D532 | Not used | Not used |
| | Output variation (decremental) alarm set value Output lower limit set value | | (s3)+23 | D533 | Not used | Not used |
| | Alarm output | Input variation (incremental) is exceeded | (s3)+24 b0 | D534.0 | Not used | Not used |
| | | Input variation (decremental) is exceeded | (s3)+24 b1 | D534.1 | Not used | Not used |
| | | Output variation (incremental) is exceeded | (s3)+24 b2 | D534.2 | Not used | Not used |
| | | Output variation (decremental) is exceeded | (s3)+24 b3 | D534.3 | Not used | Not used |
| | Timeout time setting value after maximum ramp (R) detection | | (s3)+25 | D535 | 10 (10 seconds) | Not used |
| | Used by system | | (s3)+26 | D536 | Not used | Not used |
| | Used by system | | (s3)+27 | D537 | Not used | Not used |
| | Wait setting from end of tuning cycle to start of PID control (KW) | | (s3)+28 | D538 | — | — |
| Output value (MV)*1 | | | (d) | D502 | 1800 (1.8 second) | Not used |

—: This is an item not occupied.

*1 The setting is always necessary.

*2 When CH1 is used.

## ■Program


X10
Auto-tuning is started
MOV K500 D500
The target value is set to 50°C
MOV K1000 D510
The sampling time is set to 1000 ms
MOV K1800 D502
The output of auto-tuning is set to 1.8 sec.
RST D511.6
The auto-tuning mode is set to step response method
SET D511.8
The hunting suppression setting is used.
MOV K10 D535
Timeout time after maximum ramp (R) detection is set to 10 seconds.
SET D511.4
Auto-tuning is started
PID instruction initial setting
SM402
Initial pulse
RST SM6301
FX5-4AD-TC-ADP is set to used CH
CH1: SM6301
0: Enable
1: Disable
D511.4
Auto-tuning is executed
RST D502
The PID output is initialized
X10
Auto-tuning is started
D511.4
Auto-tuning is executed
PID D500 SD6300 D510 D502
PID instruction drive
FX5-4AD-TC-ADP
Measured temperature value
CH1: SD6300
M4
Auto-tuning is executed
M4
Auto-tuning is executed
OUTHS ST0 K2000
The heater operation cycle is set to 2 sec.
ST0
Heater operation cycle
RST ST0
Preset
M4
Auto-tuning is executed
Heater output control
< ST0 D502
ST0<D502
M4
Auto-tuning is executed
Y1
Heater output
END

## Program example 4

This is an example of the sample program for auto tuning (limit cycle method) + PID control.

### ■Use device

The content of the devices used for the program is as follows.

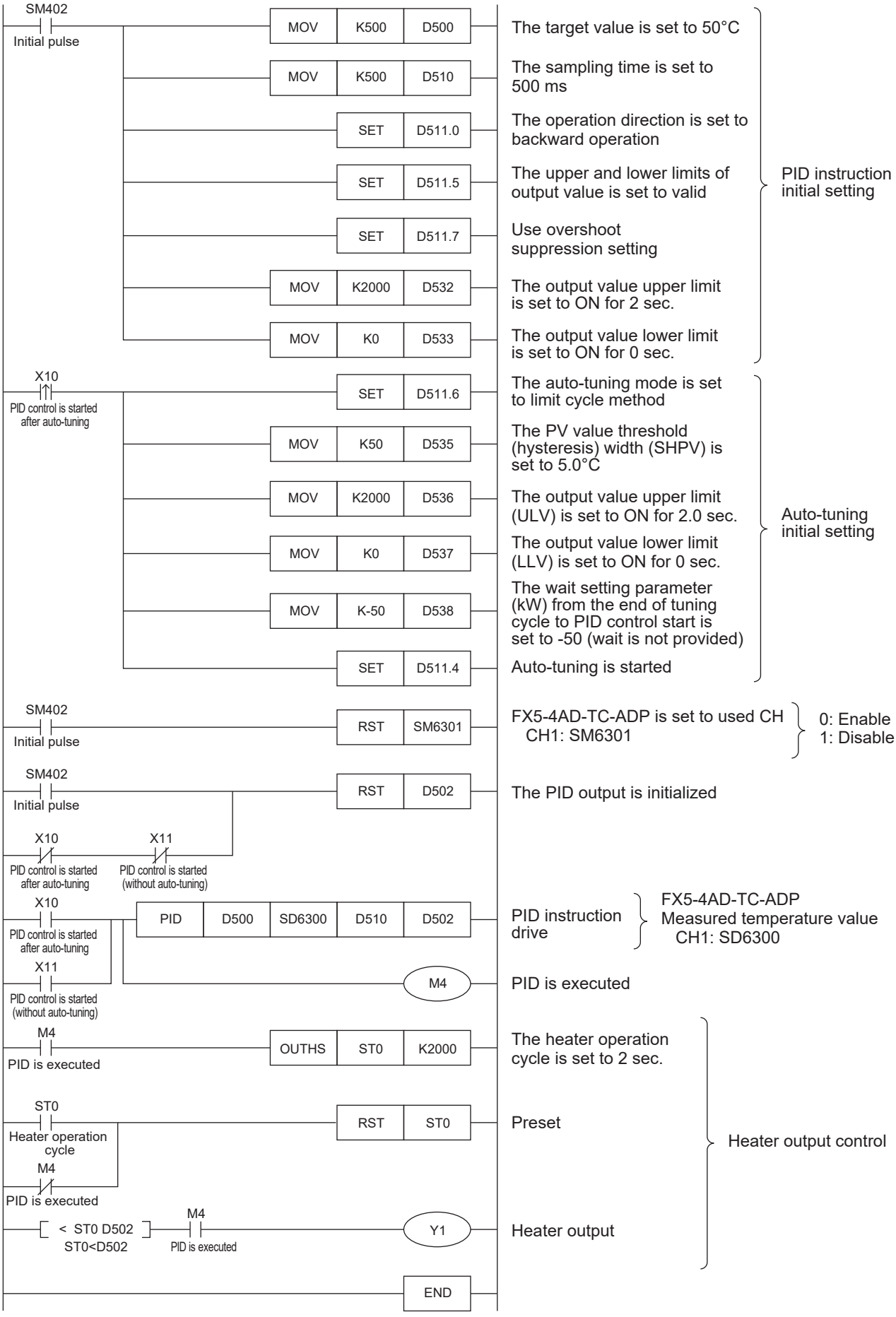
| Item | | | | Device | Setting value | |
|---|---|---|---|---|---|---|
| | | | | | During auto-tuning | During PID control |
| Target value (SV)*1 | | | (s1) | D500 | 500 (50.0℃) | 500 (50.0℃) |
| Measured value (PV)*1 | | | (s2) | SD6300*2 | According to input value | According to input value |
| Parameter | Sampling time (TS)*1 | | (s3) | D510 | 500 (500 ms) | 500 (500 ms) |
| | Operation setting (ACT) | Operation direction*1 | (s3)+1 b0 | D511.0 | 1 (Backward operation) | 1 (Backward operation) |
| | | Input variation alarm | (s3)+1 b1 | D511.1 | 0 (Alarm is not provided) | 0 (Alarm is not provided) |
| | | Output variation alarm | (s3)+1 b2 | D511.2 | 0 (Alarm is not provided) | 0 (Alarm is not provided) |
| | | Auto-tuning | (s3)+1 b4 | D511.4 | 1 (AT is provided) | 1 (AT is provided) |
| | | Upper and lower limits of output value | (s3)+1 b5 | D511.5 | 1 (Setting is provided) | 1 (Setting is provided) |
| | | Select auto-tuning mode | (s3)+1 b6 | D511.6 | 1 (Limit cycle method) | Not used |
| | | Overshoot suppression setting | (s3)+1 b7 | D511.7 | Not used | 1 (Used) |
| | | Hunting suppression setting | (s3)+1 b8 | D511.8 | Not used | Not used |
| | Input filter constant (α) | | (s3)+2 | D512 | 0 (Input filter is not provided) | 0 (Input filter is not provided) |
| | Proportional gain (KP)*1 | | (s3)+3 | D513 | According to auto-tuning result | According to auto-tuning result |
| | Integral time (TI)*1 | | (s3)+4 | D514 | According to auto-tuning result | According to auto-tuning result |
| | Differential gain (KD) | | (s3)+5 | D515 | 0 (Differential gain is not provided) | 0 (Differential gain is not provided) |
| | Differential time (TD)*1 | | (s3)+6 | D516 | According to auto-tuning result | According to auto-tuning result |
| | Input variation (incremental) alarm set value | | (s3)+20 | D530 | Not used | Not used |
| | Input variation (decremental) alarm set value | | (s3)+21 | D531 | Not used | Not used |
| | Output variation (incremental) alarm set value Output upper limit set value | | (s3)+22 | D532 | Not used | 2000 (2 second) |
| | Output variation (decremental) alarm set value Output lower limit set value | | (s3)+23 | D533 | Not used | 0 (0 second) |
| | Alarm output | Input variation (incremental) is exceeded | (s3)+24 b0 | D534.0 | Not used | Not used |
| | | Input variation (decremental) is exceeded | (s3)+24 b1 | D534.1 | Not used | Not used |
| | | Output variation (incremental) is exceeded | (s3)+24 b2 | D534.2 | Not used | Not used |
| | | Output variation (decremental) is exceeded | (s3)+24 b3 | D534.3 | Not used | Not used |
| | PV value threshold (hysteresis) width (SHPV) | | (s3)+25 | D535 | 50 (5.0℃) | Not used |
| | Output value upper limit (ULV) | | (s3)+26 | D536 | 2000 (2 second) | Not used |
| | Output value lower limit (LLV) | | (s3)+27 | D537 | 0 (0 second) | Not used |
| | Wait setting from end of tuning cycle to start of PID control (KW) | | (s3)+28 | D538 | -50 (Wait is not provided) | Not used |
| Output value (MV)*1 | | | (d) | D502 | According to operation | According to operation |

—: This is an item not occupied.

*1 The setting is always necessary.

*2 When CH1 is used.

## ■Program


SM402
Initial pulse
MOV K500 D500
The target value is set to 50°C
MOV K500 D510
The sampling time is set to 500 ms
SET D511.0
The operation direction is set to backward operation
SET D511.5
The upper and lower limits of output value is set to valid
SET D511.7
Use overshoot suppression setting
MOV K2000 D532
The output value upper limit is set to ON for 2 sec.
MOV K0 D533
The output value lower limit is set to ON for 0 sec.
PID instruction initial setting
X10
PID control is started after auto-tuning
SET D511.6
The auto-tuning mode is set to limit cycle method
MOV K50 D535
The PV value threshold (hysteresis) width (SHPV) is set to 5.0°C
MOV K2000 D536
The output value upper limit (ULV) is set to ON for 2.0 sec.
MOV K0 D537
The output value lower limit (LLV) is set to ON for 0 sec.
MOV K-50 D538
The wait setting parameter (kW) from the end of tuning cycle to PID control start is set to -50 (wait is not provided)
SET D511.4
Auto-tuning is started
Auto-tuning initial setting
SM402
Initial pulse
RST SM6301
FX5-4AD-TC-ADP is set to used CH
CH1: SM6301
0: Enable
1: Disable
SM402
Initial pulse
RST D502
The PID output is initialized
X10
PID control is started after auto-tuning
X11
PID control is started (without auto-tuning)
X10
PID control is started after auto-tuning
PID D500 SD6300 D510 D502
PID instruction drive
FX5-4AD-TC-ADP
Measured temperature value
CH1: SD6300
X11
PID control is started (without auto-tuning)
M4
PID is executed
M4
PID is executed
OUTHS ST0 K2000
The heater operation cycle is set to 2 sec.
ST0
Heater operation cycle
RST ST0
Preset
M4
PID is executed
< ST0 D502
ST0<D502
M4
PID is executed
Y1
Heater output
Heater output control
END

## Program example 5

This is an example of the sample program for auto tuning (step response method) + PID control.

### ■Use device

The content of the devices used for the program is as follows.

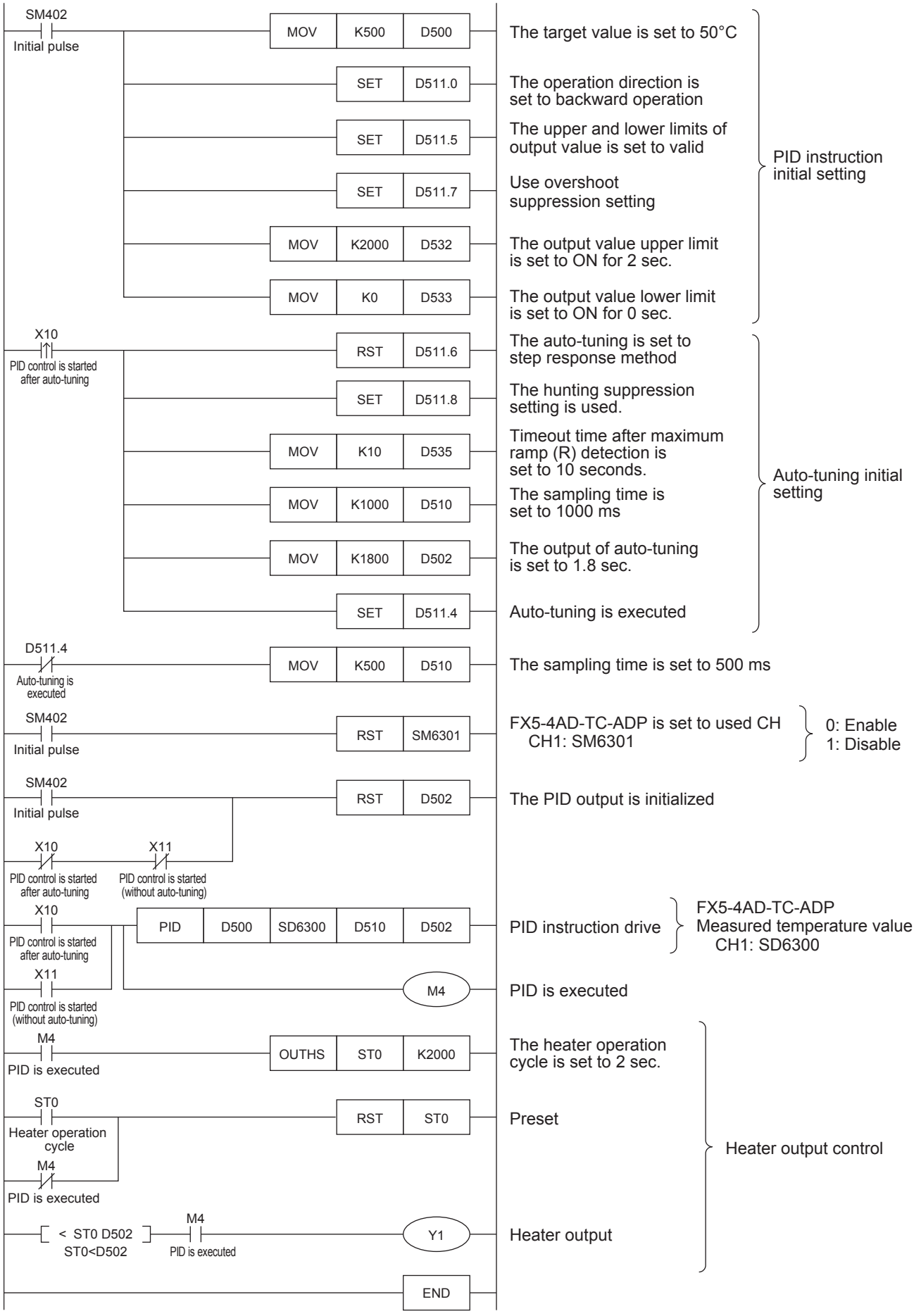
| Item | | | | Device | Setting value | |
|---|---|---|---|---|---|---|
| | | | | | During auto-tuning | During PID control |
| Target value (SV)*1 | | | (s1) | D500 | 500 (50.0℃) | 500 (50.0℃) |
| Measured value (PV)*1 | | | (s2) | SD6300*2 | According to input value | According to input value |
| Parameter | Sampling time (TS)*1 | | (s3) | D510 | 1000 (1000 ms) | 500 (500 ms) |
| | Operation setting (ACT) | Operation direction*1 | (s3)+1 b0 | D511.0 | According to auto-tuning result | According to auto-tuning result |
| | | Input variation alarm | (s3)+1 b1 | D511.1 | 0 (Alarm is not provided) | 0 (Alarm is not provided) |
| | | Output variation alarm | (s3)+1 b2 | D511.2 | 0 (Alarm is not provided) | 0 (Alarm is not provided) |
| | | Auto-tuning | (s3)+1 b4 | D511.4 | 1 (AT is provided) | 0 (AT is not provided) |
| | | Upper and lower limits of output value | (s3)+1 b5 | D511.5 | 1 (Setting is provided) | 1 (Setting is provided) |
| | | Select auto-tuning mode | (s3)+1 b6 | D511.6 | 0 (Step response method) | Not used |
| | | Overshoot suppression setting | (s3)+1 b7 | D511.7 | Not used | 1 (Used) |
| | | Hunting suppression setting | (s3)+1 b8 | D511.8 | 1 (Timeout time is valid) | Not used |
| | Input filter constant ($\alpha$) | | (s3)+2 | D512 | 0 (Input filter is not provided) | 0 (Input filter is not provided) |
| | Proportional gain (KP)*1 | | (s3)+3 | D513 | According to auto-tuning result | According to auto-tuning result |
| | Integral time (TI)*1 | | (s3)+4 | D514 | According to auto-tuning result | According to auto-tuning result |
| | Differential gain (KD) | | (s3)+5 | D515 | 0 (Differential gain is not provided) | 0 (Differential gain is not provided) |
| | Differential time (TD)*1 | | (s3)+6 | D516 | According to auto-tuning result | According to auto-tuning result |
| | Input variation (incremental) alarm set value | | (s3)+20 | D530 | Not used | Not used |
| | Input variation (decremental) alarm set value | | (s3)+21 | D531 | Not used | Not used |
| | Output variation (incremental) alarm set value<br>Output upper limit set value | | (s3)+22 | D532 | Not used | 2000 (2 second) |
| | Output variation (decremental) alarm set value<br>Output lower limit set value | | (s3)+23 | D533 | Not used | 0 (0 second) |
| | Alarm output | Input variation (incremental) is exceeded | (s3)+24 b0 | D534.0 | Not used | Not used |
| | | Input variation (decremental) is exceeded | (s3)+24 b1 | D534.1 | Not used | Not used |
| | | Output variation (incremental) is exceeded | (s3)+24 b2 | D534.2 | Not used | Not used |
| | | Output variation (decremental) is exceeded | (s3)+24 b3 | D534.3 | Not used | Not used |
| | Timeout time setting value after maximum ramp (R) detection | | (s3)+25 | D535 | 10 (10 seconds) | Not used |
| | Used by system | | (s3)+26 | D536 | Not used | Not used |
| | Used by system | | (s3)+27 | D537 | Not used | Not used |
| | Wait setting from end of tuning cycle to start of PID control (KW) | | (s3)+28 | D538 | — | — |
| Output value (MV)*1 | | | (d) | D502 | 1800 (1.8 second) | According to operation |

—: This is an item not occupied.

*1 The setting is always necessary.

*2 When CH1 is used.

## ■Program


SM402
Initial pulse
MOV K500 D500
The target value is set to 50°C
SET D511.0
The operation direction is set to backward operation
SET D511.5
The upper and lower limits of output value is set to valid
SET D511.7
Use overshoot suppression setting
MOV K2000 D532
The output value upper limit is set to ON for 2 sec.
MOV K0 D533
The output value lower limit is set to ON for 0 sec.
PID instruction initial setting
X10
PID control is started after auto-tuning
RST D511.6
The auto-tuning is set to step response method
SET D511.8
The hunting suppression setting is used.
MOV K10 D535
Timeout time after maximum ramp (R) detection is set to 10 seconds.
MOV K1000 D510
The sampling time is set to 1000 ms
MOV K1800 D502
The output of auto-tuning is set to 1.8 sec.
SET D511.4
Auto-tuning is executed
Auto-tuning initial setting
D511.4
Auto-tuning is executed
MOV K500 D510
The sampling time is set to 500 ms
SM402
Initial pulse
RST SM6301
FX5-4AD-TC-ADP is set to used CH
CH1: SM6301
0: Enable
1: Disable
SM402
Initial pulse
RST D502
The PID output is initialized
X10
PID control is started after auto-tuning
X11
PID control is started (without auto-tuning)
X10
PID control is started after auto-tuning
PID D500 SD6300 D510 D502
PID instruction drive
FX5-4AD-TC-ADP
Measured temperature value
CH1: SD6300
X11
PID control is started (without auto-tuning)
M4
PID is executed
M4
PID is executed
OUTHS ST0 K2000
The heater operation cycle is set to 2 sec.
ST0
Heater operation cycle
RST ST0
Preset
M4
PID is executed
Heater output control
< ST0 D502
ST0<D502
M4
PID is executed
Y1
Heater output
END

# Example of parameter adjustment and the effect on PID control operation

This section describes parameters that can be adjusted to improve the PID control result and the effect of the parameters.

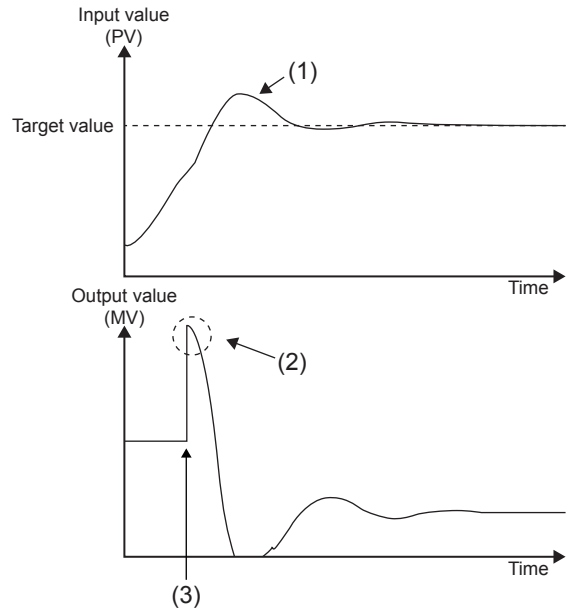
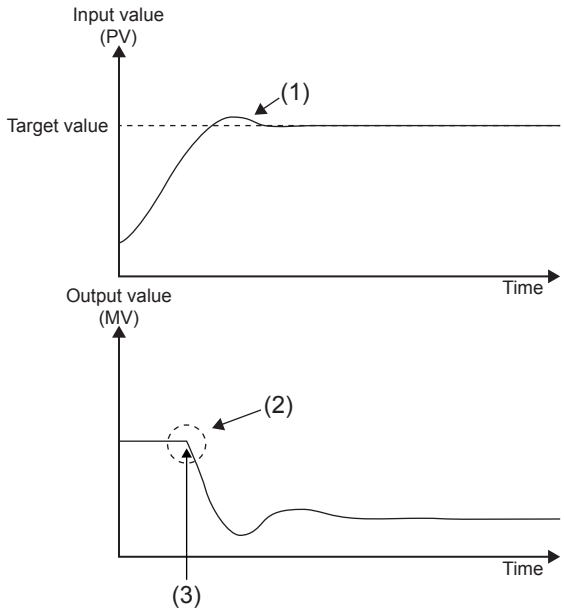
## Improvement of control results

The following table shows the outline of the details to be improved and methods for improvement.

| Details to be improved | Auto-Tuning | Contents |
|---|---|---|
| Overshoot suppression | Auto-tuning is executed | Use overshoot suppression setting. |
| | Auto-tuning is not executed | Use overshoot suppression setting. |
| | | Increase the integral time and execute. |
| | | Shorten the sampling time and execute. |
| Hunting suppression | Auto-tuning is executed | Use the hunting suppression setting. |
| | | Set the sampling time to be the output period or more and execute. |
| | | Increase the filter input value and execute. |
| | Auto-tuning is not executed | Decrease the proportional gain and execute. |
| | | Increase the differential time and execute. |
| | | Shorten the sampling time and execute. |
| Reduction of remaining deviation | — | Increase the filter input value and execute. |

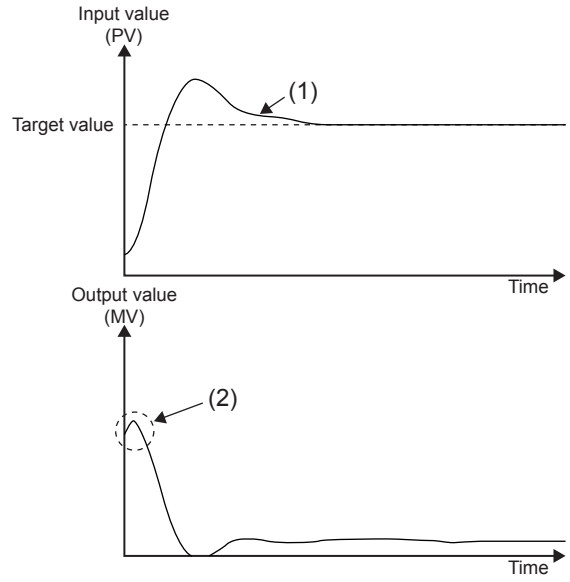
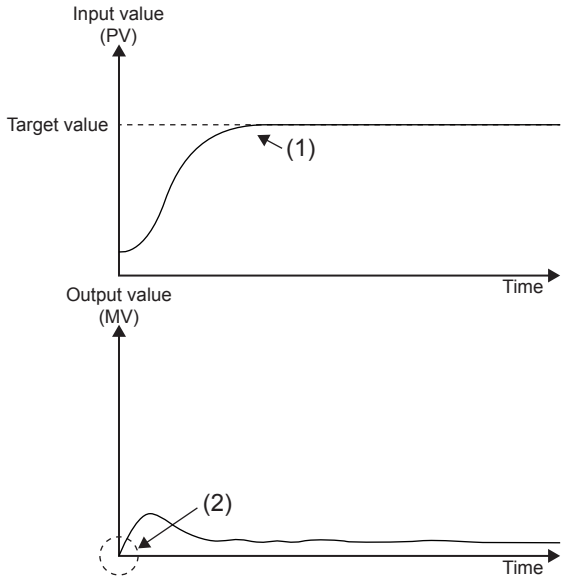
### ■Overshoot suppression (When auto-tuning is executed)

When the step response method and the PID control are executed continuously and the following results are obtained, use the overshoot suppression setting (turn ON b7 of (s3)+1). The overshoot amount may be suppressed.

| Control result when the overshoot suppression setting is not used | Control result when the overshoot suppression setting is used |
|---|---|
|  |  |
| (1) Overshoot<br>(2) The output is increased at the time of shifting to the PID control.<br>(3) Auto-tuning is finished | (1) The overshoot amount decreases.<br>(2) Overshoot is suppressed.<br>(3) Auto-tuning is finished |

## ■Overshoot suppression (When auto-tuning is not executed)

When the PID control is executed and a large initial output causes overshoot, use the overshoot suppression setting (b7 of (s3)+1 turns ON). The overshoot amount may be suppressed.

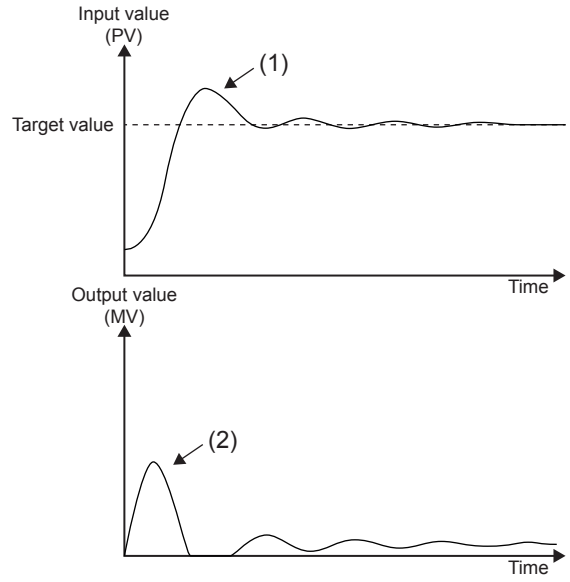
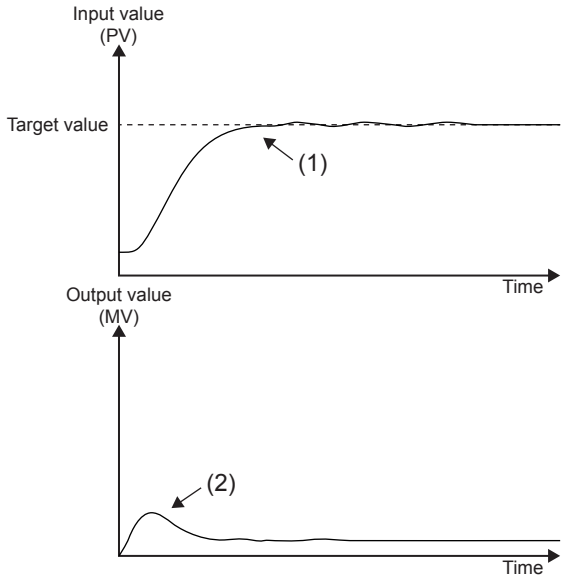
| Control result when the overshoot suppression setting is not used | Control result when the overshoot suppression setting is used |
|---|---|
|  |  |
| (1) Overshoot<br>(2) The initial output is large. | (1) Overshoot is suppressed.<br>(2) The initial output is suppressed. |

**Point**

When overshoot remains, suppress overshoot by increasing the integral time.

• Overshoot suppression by increasing the integral time

When overshoot occurs even if the initial output is suppressed by the overshoot suppression setting, increase the integral time ((s3)+4). Overshoot may be suppressed. However, when the integral time is increased excessively, reaching the target value may be delayed or remaining deviation may occur.

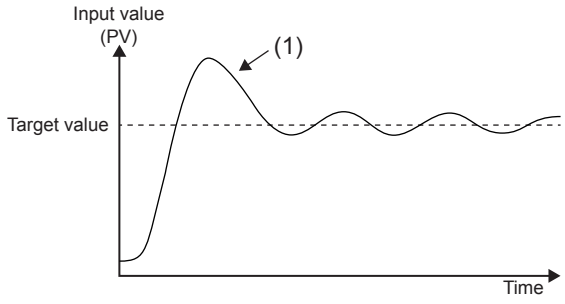
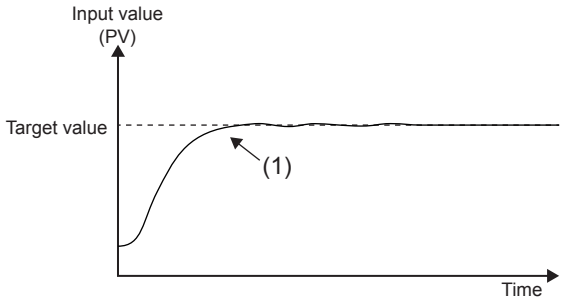
| Control result before the change | Control result when the integral time is increased |
|---|---|
|  |  |
| (1) Overshoot<br>(2) The peak of the output is large. | (1) Overshoot is suppressed.<br>(2) The peak of the output is small. |

**Point**

When the first output value is large, use the overshoot suppression setting first.

• Overshoot suppression by using sampling time

When the response speed of the control target is high, shorten the sampling time ((s3)+0) to control finely. Overshoot may be suppressed. However, if the sampling time is too short, it is easily affected by momentary fluctuation of noise.

| Control result before the change | Control result when the sampling time is shortened |
|---|---|
|  |  |
| (1) Overshoot | (1) Overshoot is suppressed. |

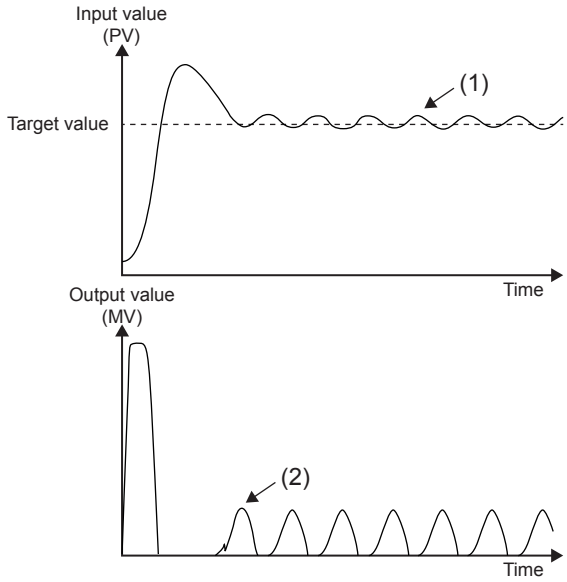
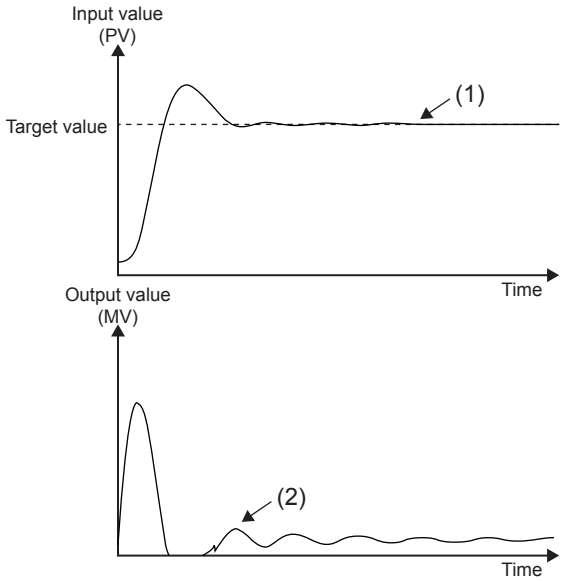
## ■Hunting suppression (When auto-tuning is executed)

When hunting occurs or the output is too large during the PID control using parameters obtained by the step response method, the parameter may be not appropriate because auto tuning is completed before the maximum ramp value that describes characteristics of the control target is obtained correctly.

Change the following setting. The correct maximum ramp value will be obtained and the result may improve.

• Hunting suppression setting

When the maximum ramp value cannot be obtained even if the settings of the sampling time and filter input value are changed, use the hunting suppression setting (turn ON b8 of ((S3)+1)). Timeout time setting value after maximum ramp detection ((S3)+25) is set so that auto tuning completion caused by a temporary ramp decrease can be avoided. Also, the timeout time (R) after maximum ramp detection setting value varies depending on the response speed of the control target.

| Control result when the maximum ramp value cannot be obtained | Control result when the maximum ramp value can be obtained |
|---|---|
|  |  |
| (1) Hunting<br>(2) The output fluctuation is large. | (1) Hunting is suppressed.<br>(2) The output fluctuation is small. |

• Sampling time

When the sampling time ((S3)+0) is short, it may be determined that the ramp does not increase because of the difference of the variation between the ON part and OFF part of the output period. Set the sampling time to be not less than the time of output period.

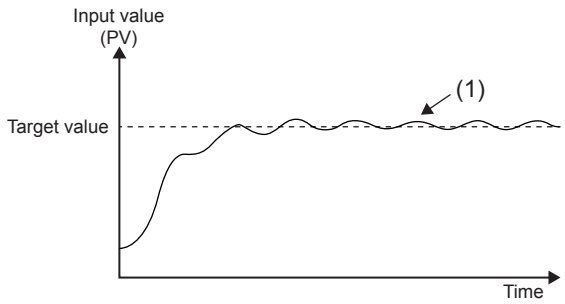
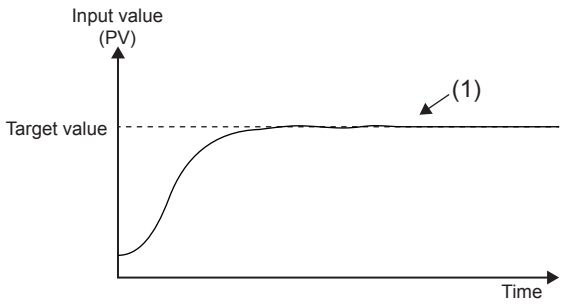
• Input filter value

When the filter input value ((S3)+2) is small, it is easily affected by a temporary ramp decrease caused by noise. Increase the filter input value.

## ■Hunting suppression (When auto-tuning is not executed)

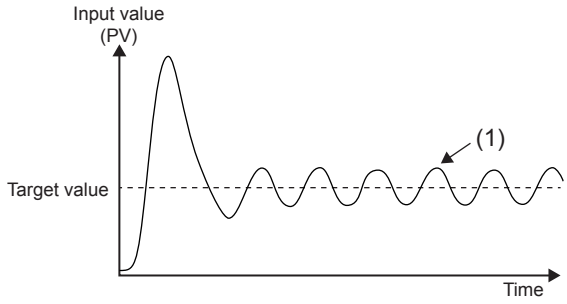
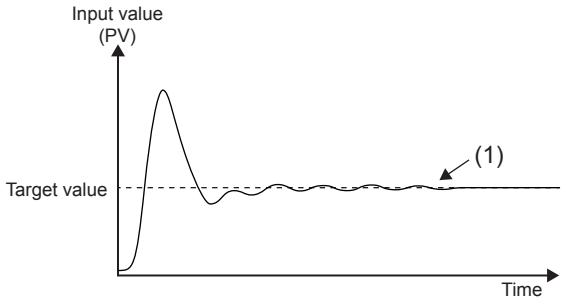
• Hunting suppression by decreasing the proportional gain

In the following control result case, decrease the proportional gain ((S3)+3). Hunting may be suppressed. However, if the proportional gain is too small, it takes time to reach the target value.

| Control result before the change | Control result when the proportional gain is decreased |
|---|---|
|  |  |
| (1) Hunting | (1) Hunting is suppressed. |

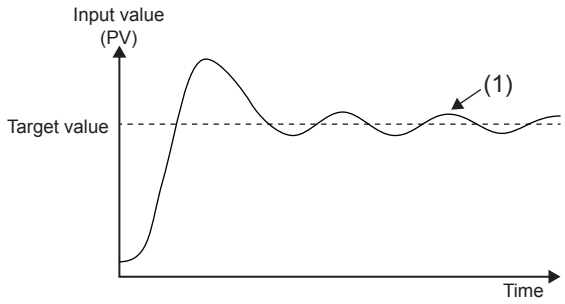
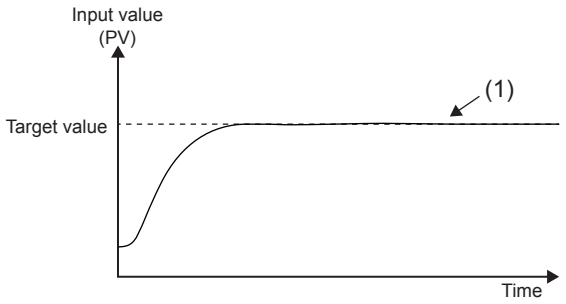
• Hunting suppression by increasing the differential time

In the following control result case, increase the differential time ((S3)+6). Hunting may be suppressed. However, if the differential time is too large, it is easily affected by momentary fluctuation of noise, and the control may be unstable.

| Control result before the change | Control result when the differential time is increased |
|---|---|
|  |  |
| (1) Hunting | (1) Hunting is suppressed. |

• Hunting suppression time by using the sampling time

When the response speed of the control target is high, shorten the sampling time ((S3)+0) to control finely. Hunting may be suppressed. However, if the sampling time is too short, it is easily affected by momentary fluctuation of noise, and the control may be unstable.

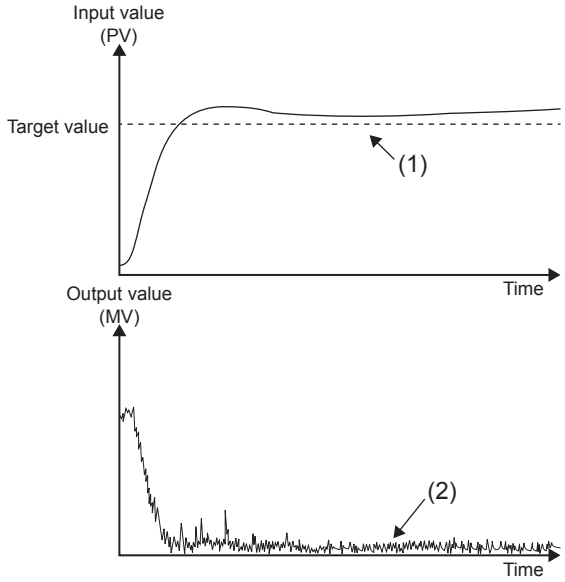
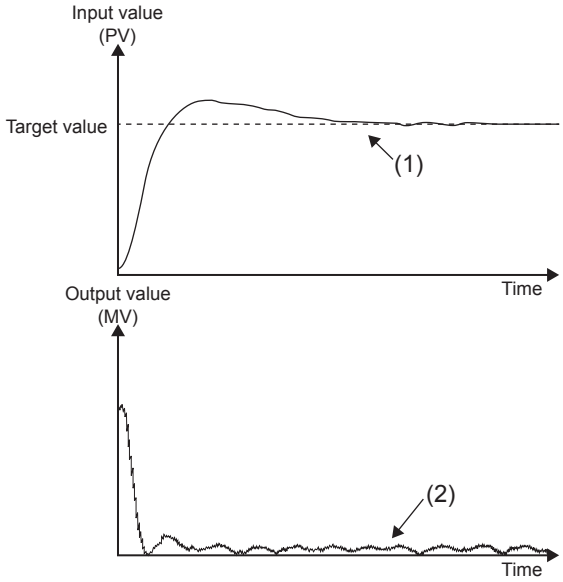
| Control result before the change | Control result when the sampling time is shortened. |
|---|---|
|  |  |
| (1) Hunting | (1) Hunting is suppressed. |

## Reduction of remaining deviation

When reducing the remaining deviation, the operation is as follows.

• Remaining deviation according to the input value

When the control result is stable around the target value and the required output value is small, the control result may not converge to the target value because of the influence of noise. In that case, increase the input filter constant ((s3)+2) to suppress the influence of noise. The control result may converge to the target value.

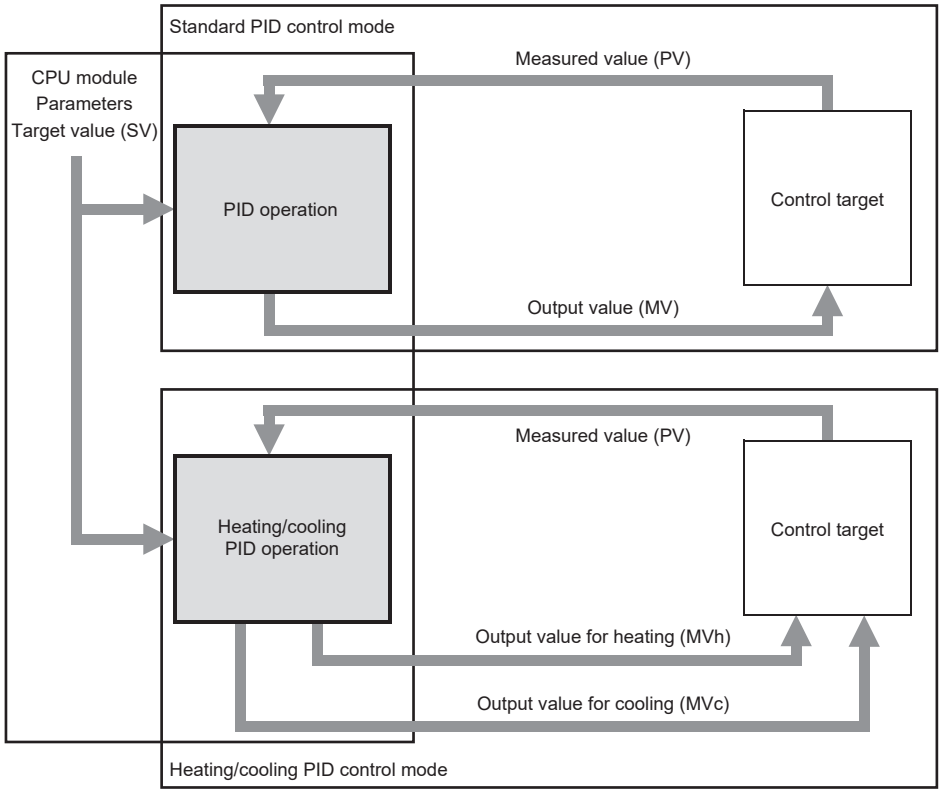
| Control result when the input filter is not used | Control result when the input filter constant is increased |
|---|---|
|  |  |
| (1) Deviation remains and the input value does not converge to the target value.<br>(2) Excessive output is generated in response to indirect changes. | (1) The input value converges to the target value.<br>(2) Excessive output is suppressed. |

# 36.6 Function (PID Control Via Parameter)

## Outline of function

PID control is performed by setting GX Works3 parameters. To make the measured value (PV) closer to the target value (SV), the PID control calculates the output (MV) value by combining the P (proportional) action, I (integral) action, and D (derivative) action.

In addition to "Standard PID control mode", which can be executed by the PID instruction, the PID control supports "Heating-cooling PID control mode", which operates the outputs of two systems: heating control and cooling control. Therefore, temperature control with higher accuracy can be realized.




**Point**

For details on the firmware versions of the supported CPU modules and the software versions of the engineering tool, refer to the following.

☞ Page 971 Added and Enhanced Functions

# Specifications list

The following table lists the specifications of the PID control via parameter function and the availability of each control mode.

○: Supported, ×: Not supported

| Specifications | | Description | Control mode | | Reference |
|---|---|---|---|---|---|
| | | | Standard PID control | Heating-cooling PID control | |
| Parameter setting | | Set heating/cooling PID control function data by using GX Works3 parameters. | ○ | ○ | Page 612 |
| Control mode selection | Standard PID control | Select between standard PID control, which performs either heating control or cooling control, and heating-cooling PID control, which performs both heating control and cooling control. | ○ | × | Page 614 |
| | Heating-cooling PID control | | × | ○ | |
| Forward operation/backward operation selection | | Select whether to perform forward operation or backward operation during standard PID control. | ○ | × | Page 614 |
| Control method*1 | Two-position control | Two-position control is a control method that uses the 0% output value (MV) and 100% output value (MV) for the sampling cycle. Turning on and off the output value (MV) repeatedly makes the temperature process value come close to the target value (SV), and the temperature is kept constant. | ○ | ○ | Page 615 |
| | P control | P control is a control method that determines the output value (MV) in proportion to the deviation (E) between the temperature process value (PV) and target value (SV). | ○ | ○ | |
| | PI control | PI control is a control method that adds derivative elements to P control to correct an offset (remaining deviation) that remains when the temperature is stable. By setting the integral time (I) properly, the temperature process value (PV) can be matched with the target value (SV) when the temperature is stable. | ○ | ○ | |
| | PD control | PD control is a control method that sets the derivative time (D) in addition to P control. The control mechanism is the same as P control. | ○ | ○ | |
| | PID control | PID control is a control method that adds derivative elements to PI control so that the state shifts to a stable state in a short period of time even when a drastic change has occurred. By setting the derivative time (D) properly, the control target can be shifted to a stable state in a short period of time. | ○ | ○ | |
| Proportional gain setting function*1 | | Set the proportional bands (P) for heating and cooling individually. Different gradients can be set by using different proportional band (P) values in heating and cooling areas. | × | ○ | Page 618 |
| Control output cycle setting function | | Set the control output cycle, which is a cycle for operating a control device such as a heater and cooler. | ○ | ○ | Page 619 |
| Auto-tuning function | | Automatically set the best PID constants. | ○ | ○ | Page 620 |
| Error display function | | If an error occurs while the PID control function or auto-tuning function is being executed, store the error status and error code into the devices. | ○ | ○ | Page 626 |
| Overlap/dead band function*1 | | The temperature where the cooling control output starts is shifted; therefore, select which of the control stability or energy saving is to be prioritized. | × | ○ | Page 627 |
| Output limiter function | | The upper limit and lower limit for the output value (MV) can be limited. | ○ | ○ | Page 628 |
| Output change ratio limiter function*1 | | The output change ratio limiter limits the amount of change in the output value (MV) per unit time (1s). | ○ | × | Page 628 |
| Temperature rise completion judgment function*1 | | Judge whether the temperature process value (PV) is within the temperature rise completion range. | ○ | ○ | Page 629 |
| Ambient temperature setting function | | For heating-cooling PID control, set the ambient temperature for comparison against the target value (SV) (which value is larger) to determine whether to perform control in the energy saving mode, which executes either heating or cooling only. When a value is set, operation is performed in the energy saving mode. | × | ○ | Page 629 |
| Control response parameter | | Select the response to the target value from the two levels (Normal and Fast). | ○ | ○ | Page 631 |

*1 The function is disabled during auto tuning.

## Usage procedure

This section describes the flow of using the PID control via parameter function as follows. Details are explained per control mode.

1. Configure "Heating/Cooling PID Control Setting" with GX Works3 CPU parameters. (☞ Page 609 Parameter setting)
2. Create a program. (☞ Page 612 Programming)
3. Write the parameters to the CPU module. (☞ Page 612 Operation)
4. Set the CPU module to the STOP state and to the RUN state, and turn the PID control execution command on. (☞ Page 612 Operation)

## Setting example

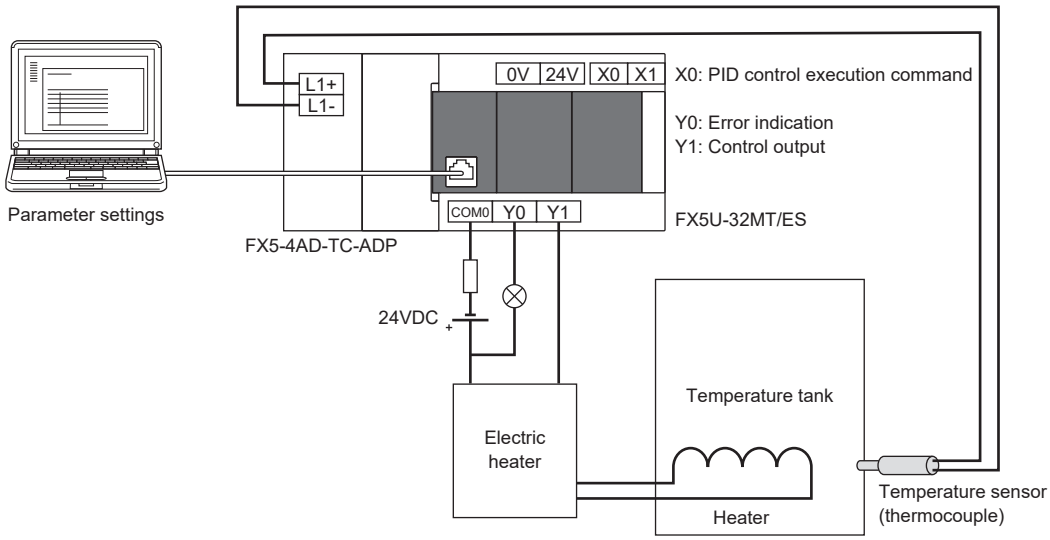
Setting examples of PID control only (setting examples 1 and 4) are shown in this chapter. For details on other program examples, refer to the following.

| Setting example | Control mode | Description | Reference |
|---|---|---|---|
| Setting example 1 | Standard PID control | PID control only | Page 609 Operating procedure |
| Setting example 2 | | Auto tuning + PID control | Page 632 Setting example 2 |
| Setting example 3 | | Analog output using the output value (MV) (Auto tuning + PID control) | Page 634 Setting example 3 |
| Setting example 4 | Heating-cooling PID control | PID control only | Page 609 Operating procedure |
| Setting example 5 | | Auto tuning + PID control | Page 637 Setting example 5 |
| Setting example 6 | | Analog output using the output value (MV) (Auto tuning + PID control) | Page 640 Setting example 6 |

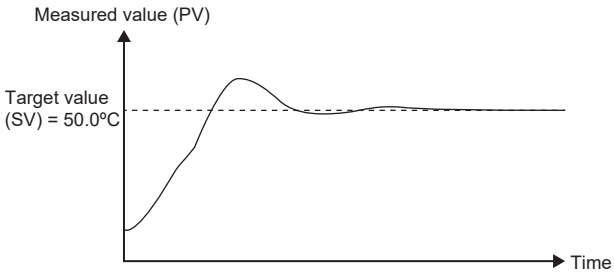


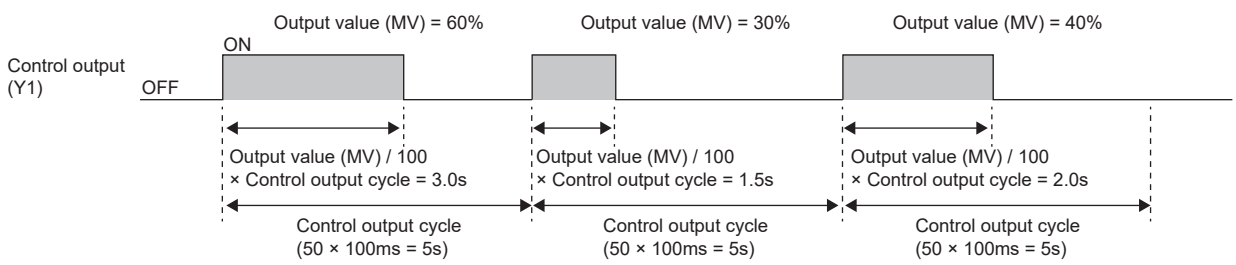
### ■Setting example 1: Standard PID control

When "Control mode" is set to "Standard PID control mode", without performing auto tuning, PID control is performed by using the control parameters set by the user.



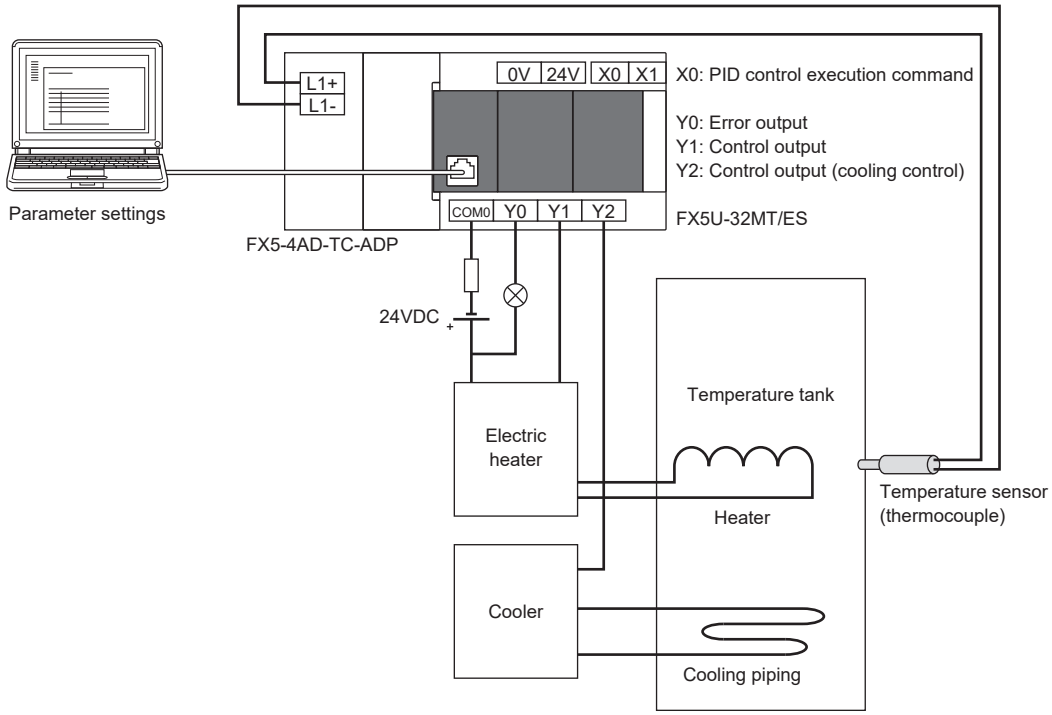

- Operation example



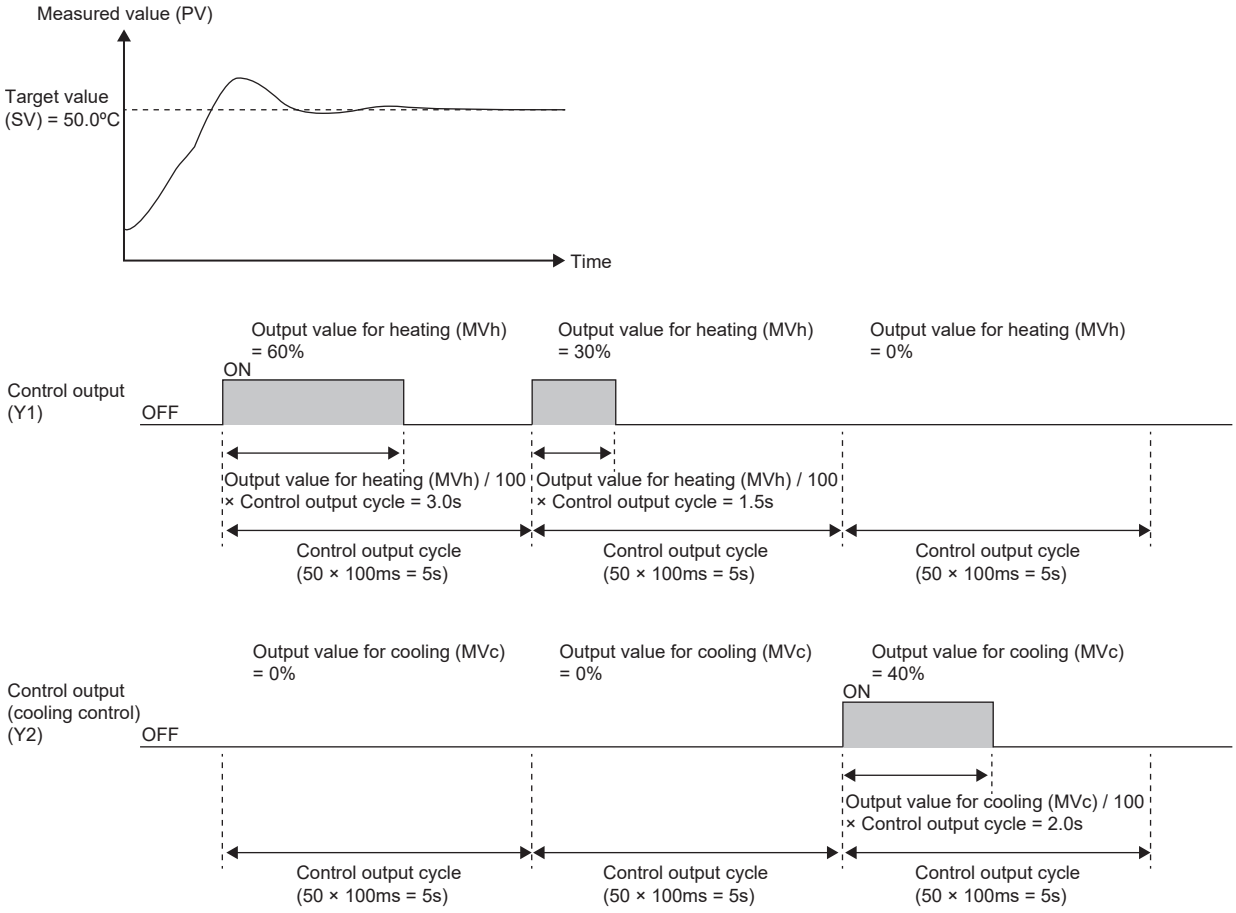



## ■Setting example 4: Heating-cooling PID control

When "Control mode" is set to "Heating-cooling PID control mode", without performing auto tuning, PID control is performed by using the control parameters set by the user.




• Operation example



## Operating procedure

The operation procedures for setting example 1 and setting example 4 are shown below.

### ■Parameter setting

The following describes the parameter settings for executing PID control.

***1.*** Configure the basic settings.

[Navigation window] ⇨ [Parameter]⇨ CPU module model name ⇨ [CPU Parameter] ⇨ [PID Control Setting] ⇨ [Heating/Cooling PID Control Setting] ⇨ [Detailed Setting] ⇨ [Basic Settings]

#### Window

**Setting example 1**

Setting Item

| Item | Setting No.1 | |
|---|---|---|
| | Setting Value | Device Indirect Specification |
| **To Use or Not to Use PID Control Function** | | |
| To Use or Not to Use PID Control Function | Use | |
| **Control Mode Selection** | | |
| Control Mode Selection | Standard PID Control | |
| **Direct Action/Reverse Action Selection** | | |
| Direct Action/Reverse Action Selection | Reverse Action | |
| **Target Value (SV)** | | |
| Target Value (SV) | 500 | D0 |
| **Process Value (PV)** | | |
| Process Value (PV) | | SD6300 |
| **Output Value (MV)** | | |
| Output Value (MV) | | D1 |
| Heating Output Value (MVh) | | |
| Cooling Output Value (MVc) | | |
| **Control Parameter** | | |
| Proportional Gain (KP) | 100 % | D200 |
| Heating Proportional Gain (KPh) | | |
| Cooling Proportional Gain (KPc) | | |
| Integral Time (TI) | 200 ×100ms | D203 |
| Derivative Time (TD) | 300 ×100ms | D204 |
| **Sampling Time (Ts)** | | |
| Sampling Time (Ts) | 10 ×10ms | D300 |
| **Operation Cycle** | | |
| Control Output Cycle | 50 ×100ms | D301 |
| Heating Control Output Cycle | 100 ×100ms | |
| Cooling Control Output Cycle | 100 ×100ms | |
| **Control Output** | | |
| Control Output | | Y1 |
| Control Output (for Cooling Control) | | |
| **PID Control Execution Command** | | |
| PID Control Execution Command | | X0 |
| **To Use or Not to Use Auto-tuning** | | |
| To Use or Not to Use Auto-tuning | | |
| **PID Control Execution Status** | | |
| PID Control Execution Status | | M0 |
| **Auto-tuning Execution Status** | | |
| Auto-tuning Execution Status | | |
| **PID Control Function Error Display** | | |
| PID Control Function Error Display | | Y0 |
| **PID Control Function Error Code** | | |
| ***PID Control Function Error Code*** | | D10 |

**Setting example 4**

Setting Item

| Item | Setting No.1 | |
|---|---|---|
| | Setting Value | Device Indirect Specification |
| **To Use or Not to Use PID Control Function** | | |
| To Use or Not to Use PID Control Function | Use | |
| **Control Mode Selection** | | |
| Control Mode Selection | Heating/Cooling PID ( | |
| **Direct Action/Reverse Action Selection** | | |
| Direct Action/Reverse Action Selection | Reverse Action | |
| **Target Value (SV)** | | |
| Target Value (SV) | 500 | D0 |
| **Process Value (PV)** | | |
| Process Value (PV) | | SD6300 |
| **Output Value (MV)** | | |
| Output Value (MV) | | |
| Heating Output Value (MVh) | | D2 |
| Cooling Output Value (MVc) | | D3 |
| **Control Parameter** | | |
| Proportional Gain (KP) | | |
| Heating Proportional Gain (KPh) | 100 % | D201 |
| Cooling Proportional Gain (KPc) | 200 % | D202 |
| Integral Time (TI) | 200 ×100ms | D203 |
| Derivative Time (TD) | 300 ×100ms | D204 |
| **Sampling Time (Ts)** | | |
| Sampling Time (Ts) | 10 ×10ms | D300 |
| **Operation Cycle** | | |
| Control Output Cycle | 100 ×100ms | |
| Heating Control Output Cycle | 50 ×100ms | D302 |
| Cooling Control Output Cycle | 50 ×100ms | D303 |
| **Control Output** | | |
| Control Output | | Y1 |
| ***Control Output (for Cooling Control)*** | | Y2 |
| **PID Control Execution Command** | | |
| PID Control Execution Command | | X0 |
| **To Use or Not to Use Auto-tuning** | | |
| To Use or Not to Use Auto-tuning | | |
| **PID Control Execution Status** | | |
| PID Control Execution Status | | M0 |
| **Auto-tuning Execution Status** | | |
| Auto-tuning Execution Status | | |
| **PID Control Function Error Display** | | |
| PID Control Function Error Display | | Y0 |
| **PID Control Function Error Code** | | |
| PID Control Function Error Code | | D10 |

#### Setting data

| Setting item | Setting example 1 | Setting example 4 |
|---|---|---|
| To Use or Not to Use PID Control Function | Change the setting to "Use". | Change the setting to "Use". |
| Control Mode Selection | Select "Standard PID Control". | Select "Heating/Cooling PID Control". |
| Direct Action/Reverse Action Selection | Select "Reverse Action". | — |
| Target Value (SV) | Set a value for at least one of the setting value and the device indirect specification.*1<br>• Set 500 for the setting value.<br>• Set D0 for the device. | Set a value for at least one of the setting value and the device indirect specification.*1<br>• Set 500 for the setting value.<br>• Set D0 for the device. |
| Process Value (PV) | Always set a value for this item.<br>Set the measured value (CH1) of the FX5-4AD-TC-ADP.<br>• Set SD6300. | Always set a value for this item.<br>Set the measured value (CH1) of the FX5-4AD-TC-ADP.<br>• Set SD6300. |
| Output Value (MV) | Set a value for at least one of "Output Value (MV)" and "Control Output".<br>• Set D1 for "Output Value (MV)". | Set a value for at least one of "Output Value (MV)" and "Control Output".<br>• Set D2 for "Heating Output Value (MVh)".<br>• Set D3 for "Cooling Output Value (MVc)". |

| Setting item | Setting example 1 | Setting example 4 |
|---|---|---|
| Control Parameter | Set a value for at least one of the setting value and the device indirect specification.*1<br>■Proportional Gain (KP)<br>• Set 100% for the setting value.<br>• Set D200 for the device.<br>■Integral Time (TI)<br>• Set 200 × 100ms for the setting value.<br>• Set D203 for the device.<br>■Derivative Time (TD)<br>• Set 300 × 100ms for the setting value.<br>• Set D204 for the device. | Set a value for at least one of the setting value and the device indirect specification.*1<br>■Heating Proportional Gain (KPh)<br>• Set 100% for the setting value.<br>• Set D201 for the device.<br>■Cooling Proportional Gain (KPc)<br>• Set 200% for the setting value.<br>• Set D202 for the device.<br>■Integral Time (TI)<br>• Set 300% for the setting value.<br>• Set D203 for the device.<br>■Derivative Time (TD)<br>• Set 400 × 100ms for the setting value.<br>• Set D204 for the device. |
| Sampling Time (Ts) | Set a value for at least one of the setting value and the device indirect specification.*1<br>• Set 10 × 10ms for the setting value.*2<br>• Set D300 for the device. | Set a value for at least one of the setting value and the device indirect specification.*1<br>• Set 10 × 10ms for the setting value.<br>• Set D300 for the device. |
| Operation Cycle | Set a value for at least one of the setting value and the device indirect specification.*1<br>■Control Output Cycle<br>• Set 50 × 100ms for the setting value.*2<br>• Set D301 for the device. | Set a value for at least one of the setting value and the device indirect specification.*1<br>■Heating Control Output Cycle<br>• Set 50 × 100ms for the setting value.<br>• Set D302 for the device.<br>■Cooling Control Output Cycle<br>• Set 50 × 100ms for the setting value.<br>• Set D303 for the device. |
| Control Output | Set a value for at least one of "Output Value (MV)" and "Control Output".<br>• Set Y1 for "Control Output". | Set a value for at least one of "Output Value (MV)" and "Control Output".<br>• Set Y1 for "Control Output".<br>• Set Y2 for "Control Output (for Cooling Control)". |
| PID Control Execution Command | Always set a value for this item.<br>• Set X0. | Always set a value for this item.<br>• Set X0. |
| To Use or Not to Use Auto-tuning | When the set device is turned on, auto tuning becomes available. When the set device is turned off, or no value is set for the device, operation is performed without auto tuning.<br>• This item is not set in this example. | When the set device is turned on, auto tuning becomes available. When the set device is turned off, or no value is set for the device, operation is performed without auto tuning.<br>• This item is not set in this example. |
| PID Control Execution Status | Set this item when monitoring the PID control execution status.<br>• Set M0. | Set this item when monitoring the PID control execution status.<br>• Set M0. |
| Auto-tuning Execution Status | Set this item when monitoring the auto tuning execution status.<br>• This item is not set in this example. | Set this item when monitoring the auto tuning execution status.<br>• This item is not set in this example. |
| PID Control Function Error Display | Set this item when monitoring the error status during PID control.<br>• Set Y0. | Set this item when monitoring the error status during PID control.<br>• Set Y0. |
| PID Control Function Error Code | Set this item when monitoring the error code of the error that has occurred during PID control.<br>• Set D10. | Set this item when monitoring the error code of the error that has occurred during PID control.<br>• Set D10. |

*1 To monitor or change during control, set a value for both the setting value and the device indirect specification or only the device indirect specification.

*2 Set a value larger than the scan time. Also set a value so that the sampling time (TS) becomes smaller than the control output cycle.

**2.** Configure application settings.

[Navigation window] ⇨ [Parameter] ⇨ CPU module model name ⇨[CPU Parameter] ⇨ [PID Control Setting] ⇨ [Heating/Cooling PID Control Setting] ⇨ [Detailed Setting] ⇨ [Application Setting]

## Window

| Setting example 1 | Setting example 4 |
|---|---|

Setting example 1

Setting Item

| Item | Setting No.1 | |
|---|---|---|
| | Setting Value | Device Indirect Specification |
| 2-position Control Function | | |
| Adjustment Sensitivity (Dead Band) | 10 | |
| Overlap/Dead Band Setting | | |
| Overlap/Dead Band Setting | 0 | |
| Output Limiter Function | | |
| Upper Limit Output Limiter | 900 ×0.1% | D410 |
| Lower Limit Output Limiter | 0 ×0.1% | D411 |
| Heating Upper Limit Output Limiter | 1000 ×0.1% | |
| Cooling Upper Limit Output Limiter | 1000 ×0.1% | |
| Output Variation Rate Limiter Function | | |
| Output Variation Rate Limiter | 0 ×0.1%/s | D414 |
| Temperature Rise Completion Judgement Function | | |
| Temperature Rise Judgment Flag | | M3 |
| Temperature Rise Completion Range | 50 | D415 |
| Temperature Rise Completion Soak Time | 5 s | D416 |
| Ambient Temperature Setting | | |
| Ambient Temperature Setting | | |
| Control Response Parameter | | |
| Control Response Parameter | Normal | |

Setting example 4

Setting Item

| Item | Setting No.1 | |
|---|---|---|
| | Setting Value | Device Indirect Specification |
| 2-position Control Function | | |
| Adjustment Sensitivity (Dead Band) | 10 | |
| Overlap/Dead Band Setting | | |
| Overlap/Dead Band Setting | 0 | |
| Output Limiter Function | | |
| Upper Limit Output Limiter | 1000 ×0.1% | |
| Lower Limit Output Limiter | 0 ×0.1% | |
| Heating Upper Limit Output Limiter | 1000 ×0.1% | D412 |
| Cooling Upper Limit Output Limiter | 1000 ×0.1% | D413 |
| Output Variation Rate Limiter Function | | |
| Output Variation Rate Limiter | 0 ×0.1%/s | |
| Temperature Rise Completion Judgement Function | | |
| Temperature Rise Judgment Flag | | M3 |
| Temperature Rise Completion Range | 50 | D415 |
| Temperature Rise Completion Soak Time | 5 s | D416 |
| Ambient Temperature Setting | | |
| Ambient Temperature Setting | | |
| Control Response Parameter | | |
| Control Response Parameter | Normal | |

## Setting data

| Setting item | Setting example 1 | Setting example 4 |
|---|---|---|
| 2-position Control Function | Set a value for at least one of the setting value and the device indirect specification.*1*2<br>• Set 10 (default value) for the setting value for "Adjustment Sensitivity (Dead Band)". | Set a value for at least one of the setting value and the device indirect specification.*1*2<br>• Set 10 (default value) for the setting value for "Adjustment Sensitivity (Dead Band)". |
| Overlap/Dead Band Setting | — | Set a value for at least one of the setting value and the device indirect specification.*1<br>Negative setting values are for overlapping, and positive setting values are for the dead band. Setting 0 disables the overlap/dead band settings.<br>• Set D401. |
| Output Limiter Function | Set a value for at least one of the setting value and the device indirect specification.*1*2<br>■Upper Limit Output Limiter<br>• Set 900 × 0.1% for the setting value.<br>• Set D410 for the device.<br>■Lower Limit Output Limiter<br>• Set 0 × 0.1% for the setting value.<br>• Set D411 for the device. | Set a value for at least one of the setting value and the device indirect specification.*1*2<br>■Heating Upper Limit Output Limiter<br>• Set 900 × 0.1% for the setting value.<br>• Set D412 for the device.<br>■Cooling Upper Limit Output Limiter<br>• Set 900 × 0.1% for the setting value.<br>• Set D413 for the device. |
| Output Variation Rate Limiter Function | Set a value for at least one of the setting value and the device indirect specification.*1*2<br>• The setting value must be 0 × 0.1%/s (default value).<br>• Set D414 for the device. | — |
| Temperature Rise Completion Judgement Function | To judge whether the value for "Process Value (PV)" is within the temperature rise completion range, set the device for the temperature rise judgment flag.<br>■Temperature Rise Judgment Flag<br>• Set M3.<br>■Temperature Rise Completion Range*1<br>• Set 50 for the setting value.<br>• Set D415 for the device.<br>■Upper Limit Output Limiter*1<br>• Set 5s for the setting value.<br>• Set D416 for the device. | To judge whether the value for "Process Value (PV)" is within the temperature rise completion range, set the device for the temperature rise judgment flag.<br>■Temperature Rise Judgment Flag<br>• Set M3.<br>■Temperature Rise Completion Range*1<br>• Set 50 for the setting value.<br>• Set D415 for the device.<br>■Upper Limit Output Limiter*1<br>• Set 5s for the setting value.<br>• Set D416 for the device. |
| Ambient Temperature Setting | — | This item is not set in this example.*1 |
| Control Response Parameter | Select the response to the target value from the two levels (Normal and Fast).<br>Select "Normal". | Select the response to the target value from the two levels (Normal and Fast).<br>Select "Normal". |

*1 To monitor or change during control, set a value for both the setting value and the device indirect specification or only the device indirect specification.

*2 When not using the function, the default value need not be changed.

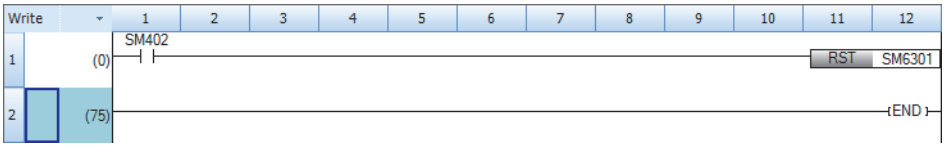
**3.** After setting, click [OK] to complete the heating-cooling PID setting.

### ■Programming

Data other than the data set using parameters is set using a program. The program example is common to setting example 1 and setting example 4.

Set use permission for the FX5-4AD-TC-ADP(CH1), which was set as the process value (SD6300) when the state was changed from STOP to RUN.

| Item | Device indirect specification | Description |
|---|---|---|
| A/D conversion enable/disable setting (CH1) | SM6301 | FX5-4AD-TC-ADP(CH1) A/D conversion enable/disable setting<br>• 0: Enable<br>• 1: Disable |




### ■Operation

1. Write the created project to the CPU module.
2. To use auto tuning, turn on the item Auto tuning used/not used. (This item is not using in this example.)
3. Set the CPU module to the STOP state and to the RUN state, and turn the X0 (PID control execution command) on.

## Heating-cooling PID setting parameter

The following tables show the details of the heating-cooling PID settings configured with GX Works3 CPU parameters.

**Point**

When the operating status of the CPU module is changed from STOP to RUN, for the parameters for which both the setting value and device indirect specification are set, the set values are stored in the devices.

### Basic settings

○: Supported, ×: Not supported

| Setting item | | Setting range | Control mode | | Device type | R/W | |
|---|---|---|---|---|---|---|---|
| | | | Standard PID control | Heating-cooling PID control | | User | System |
| To Use or Not to Use PID Control Function | | • Not use (default)<br>• Use | ○ | ○ | — | W | R |
| Control Mode Selection | | • Standard PID Control (default)<br>• Heating-cooling PID Control | ○ | ○ | — | W | R |
| Direct Action/Reverse Action Selection | | • Direct Action<br>• Reverse Action (default) | ○ | × | — | W | R |
| Target Value (SV) | | -32760 to 32760 | ○ | ○ | D, R | W | R |
| Process Value (PV) | | -32768 to 32767 | ○ | ○ | SD, D, R | W | R |
| Output Value (MV) | | 0 to 1000[×0.1%] | ○ | × | D, R | R/W | R/W |
| Heating Output Value (MVh) | | 0 to 1000[×0.1%] | × | ○ | D, R | R | R/W |
| Cooling Output Value (MVc) | | 0 to 1000[×0.1%] | × | ○ | D, R | R | R/W |
| Control Parameter | Proportional Gain (KP) | 0 to 32767[%] | ○ | × | D, R | R/W | R/W |
| | Heating Proportional Gain (KPh) | 0 to 32767[%] | × | ○ | D, R | R/W | R/W |
| | Cooling Proportional Gain (KPc) | 1 to 32767[%] | × | ○ | D, R | R/W | R/W |
| | Integral Time (TI) | 0 to 32767[×100ms] | ○ | ○ | D, R | R/W | R/W |
| | Derivative Time (TD) | 0 to 32767[×100ms] | ○ | ○ | D, R | R/W | R/W |
| Sampling Time (Ts) | | 1 to 3000[×10ms]<br>(Default: 100) | ○ | ○ | D, R | W | R |

| Setting item | | Setting range | Control mode | | Device type | R/W | |
|---|---|---|---|---|---|---|---|
| | | | Standard PID control | Heating-cooling PID control | | User | System |
| Operation Cycle | Control Output Cycle | 1 to 3000[×100ms] (Default: 100) | ○ | × | D, R | W | R |
| | Heating Control Output Cycle | 1 to 3000[×100ms] (Default: 100) | × | ○ | D, R | W | R |
| | Cooling Control Output Cycle | 1 to 3000[×100ms] (Default: 100) | × | ○ | D, R | W | R |
| Control Output | | ON/OFF | ○ | ○ | Y, M | R | W |
| Control Output (for Cooling Control) | | ON/OFF | × | ○ | Y, M | R | W |
| PID Control Execution Command | | • 0: PID control not executed<br>• 1: PID control executed | ○ | ○ | X, M, SM | W | R |
| To Use or Not to Use Auto-tuning | | • 0: Auto tuning not used<br>• 1: Auto tuning used | ○ | ○ | X, M, SM | W | R |
| PID Control Execution Status | | • 0: PID control stopped<br>• 1: PID control being executed | ○ | ○ | Y, M | R | W |
| Auto-tuning Execution Status | | • 0: Auto tuning stopped<br>• 1: Auto tuning being executed | ○ | ○ | Y, M | R | W |
| PID Control Function Error Display | | • 0: No error occurrence<br>• 1: Error occurrence | ○ | ○ | Y, M | R | W |
| PID Control Function Error Code | | -32768 to 32767 | ○ | ○ | D, R | R | W |

## Application settings

○: Supported, ×: Not supported

| Setting item | | Description/Setting range | Control mode | | Device type | R/W | |
|---|---|---|---|---|---|---|---|
| | | | Standard PID control | Heating-cooling PID control | | User | System |
| 2-position Control Function | Adjustment sensitivity (dead band) | 0 to 32760 | ○ | ○ | D, R | W | R |
| Overlap/Dead Band Setting | | -32768 to 32767 (Default: 0) | × | ○*1 | D, R | W | R |
| Output Limiter Function | Upper Limit Output Limiter | Lower Limit Output Limiter + 1 to 1000[×0.1%] (Default: 1000) | ○ | × | D, R | W | R |
| | Lower Limit Output Limiter | 0 to Upper Limit Output Limiter - 1[×0.1%] (Default: 0) | ○ | × | D, R | W | R |
| | Heating Upper Limit Output Limiter | 0 to 1000[×0.1%] (Default: 1000) | × | ○ | D, R | W | R |
| | Cooling Upper Limit Output Limiter | 0 to 1000[×0.1%] (Default: 1000) | × | ○ | D, R | W | R |
| Output Variation Rate Limiter Function | Output Variation Rate Limiter | 0 to 1000[×0.1%/s] (Default: 0) | ○ | × | D, R | W | R |
| Temperature Rise Completion Judgement Function | Temperature Rise Judgment Flag | • 0: Temperature rise not completed<br>• 1: Temperature rise completed | ○ | ○ | Y, M | R | W |
| | Temperature Rise Completion Range | 0 to 32760 | ○ | ○ | D, R | W | R |
| | Temperature Rise Completion Soak Time | 0 to 32767[s] | ○ | ○ | D, R | W | R |
| Ambient Temperature Setting | | -32768 to 32767 | × | ○ | D, R | W | R |
| Control Response Parameter | | • 0: Normal (Default)<br>• 1: Fast | ○ | ○ | X, M, SM | W | R |

*1 When the firmware version of the FX5U/FX5UC CPU module is "1.290" or later, the settings can be configured. For the firmware version earlier than "1.290", set 0 for the setting value and empty for the device indirect specification.

# Details of specifications

This section describes the details of the specifications of the heating-cooling PID control function.

## Control mode selection

Two types of control modes are available: Standard PID control and heating-cooling PID control.

### ■Standard PID control

Standard PID control is a control method that operates the output for either one of the forward operation (cooling control) system and the backward operation (heating control) system.

In any of the two operations, to make the measured value (PV)*1 closer to the target value (SV), the output value (MV) is calculated from the measured value (PV) by combining P (proportional) action, I (integral) action, and D (derivative) action.

*1 The measured value (PV) used in the control is the mean value of the last 10 measured values (PV) including when PID control is executed.

### ■Heating-cooling PID control

Heating-cooling PID control is a control method that operates the outputs for both the forward operation (cooling control) system and the backward operation (heating control) system.

By operating the outputs for the two systems, to make the measured value (PV)*1 closer to the target value (SV), the output value (MV) is calculated from the measured value (PV) by combining P (proportional) action, I (integral) action, and D (derivative) action.

*1 The measured value (PV) used in the control is the mean value of the last 10 measured values (PV) including when PID control is executed.

## Forward operation/backward operation selection

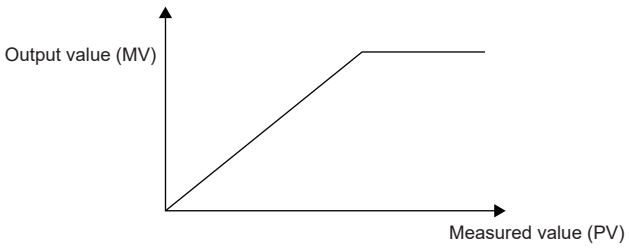
This item is used to select whether to perform forward operation (cooling control) or backward operation (heating control) during standard PID control.

Both forward operation and backward operation can be used in all control methods (two-position control, P control, PI control, PD control, PID control).

### ■Forward operation

Forward operation is operation that increases the output value (MV) when the measured value (PV) becomes larger than the target value (SV). This operation is used when performing cooling control.

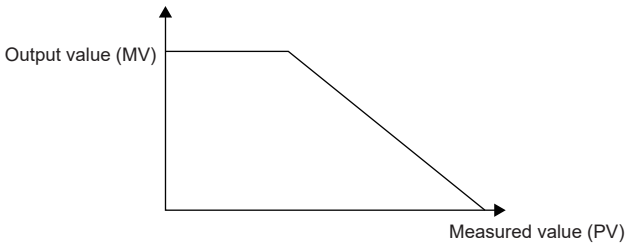
The deviation (E) for forward operation is calculated by subtracting the target value (SV) from the measured value (PV).




### ■Backward operation

Backward operation is operation that increases the output value (MV) when the measured value (PV) becomes smaller than the target value (SV). This operation is used when performing heating control.

The deviation (E) for backward operation is calculated by subtracting the measured value (PV) from the target value (SV).



## Control method

The following control methods can be executed by setting a proportional gain, integral time, and derivative time.

- Two-position control (☞ Page 615 Two-position control)
- P control (☞ Page 617 P control)
- PD control (☞ Page 618 PD control)
- PID control (☞ Page 618 PID control)

### ■Two-position control

Two-position control is a control method that uses the 0% output value (MV) and 100% output value (MV) in each END processing operation. Turning on and off the output value (MV) repeatedly makes the temperature process value come close to the target value (SV), and the temperature is kept constant.

- Two-position control performs control by turning the output value (MV) on or off depending on whether the measured value (PV) is smaller or larger than the target value (SV).
- In two-position control, the value set for the adjustment sensitivity (dead band) becomes valid at the positive side and the negative side each in relation to the target value (SV) as the origin. (When the target value (SV) is 500 and the adjustment sensitivity (dead band) is 100, the upper limit for the adjustment sensitivity (dead band) is 600, and the lower limit is 400.)
- Setting the adjustment sensitivity (dead band) can prevent the control output from being turned on and off repeatedly around the target value (SV).
- In two-position control, the control output cycle setting is ignored.

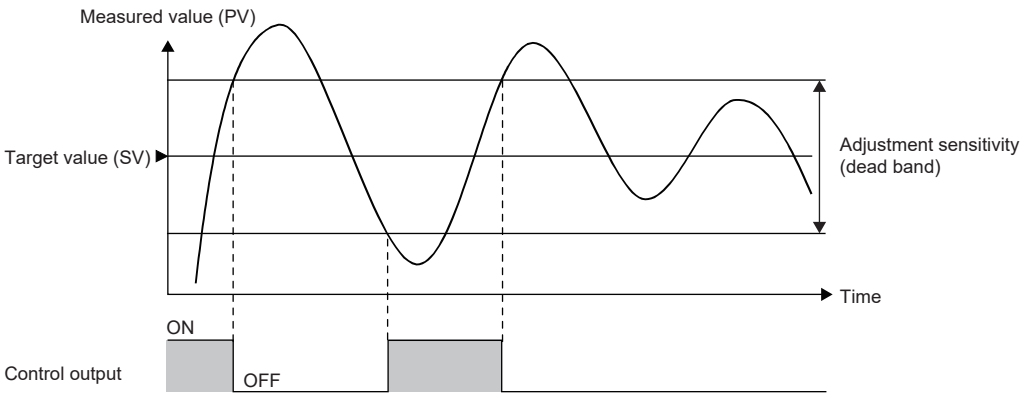
### ■Two-position control (For standard PID control)

When the proportional gain (KP) is set to 0, two-position control is selected.

For standard PID control, heating control and cooling control are available, and the output state of the output value (MV) is not the same.

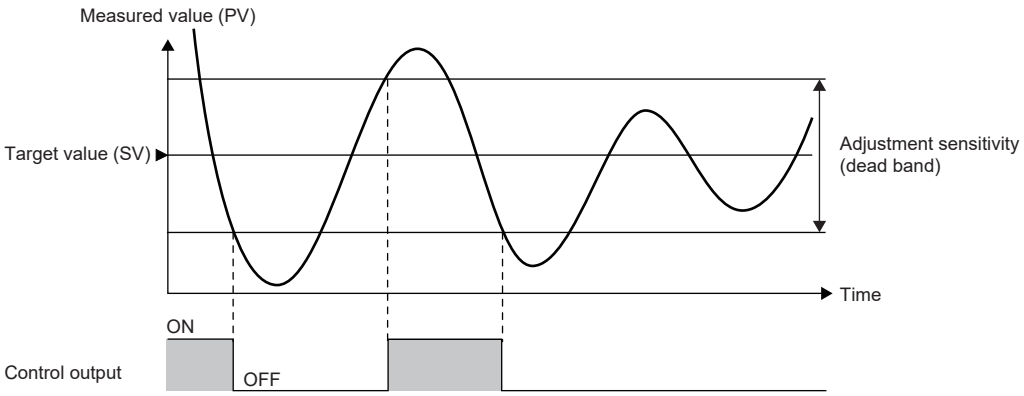
According to the position of the measured value (PV) in relation to the sensitivity (dead band), one of the following operations is performed.

- Heating control (backward operation)




| Condition | Output status |
|---|---|
| Measured value (PV) < Adjustment sensitivity (dead band) lower limit | ON |
| Measurement value (PV) ≥ Adjustment sensitivity (dead band) upper limit | OFF |
| Adjustment sensitivity (dead band) lower limit ≤ Measurement value (PV) < Adjustment sensitivity (dead band) upper limit | The output state of the cycle in the previous cycle is maintained (on during heating, off during cooling) |

• Cooling control (forward operation)




| Condition | Output status |
|---|---|
| Measured value (PV) ≤ Adjustment sensitivity (dead band) lower limit | OFF |
| Measurement value (PV) > Adjustment sensitivity (dead band) upper limit | ON |
| Adjustment sensitivity (dead band) lower limit < Measurement value (PV) ≤ Adjustment sensitivity (dead band) upper limit | The output state of the cycle in the previous cycle is maintained (off during heating, on during cooling) |

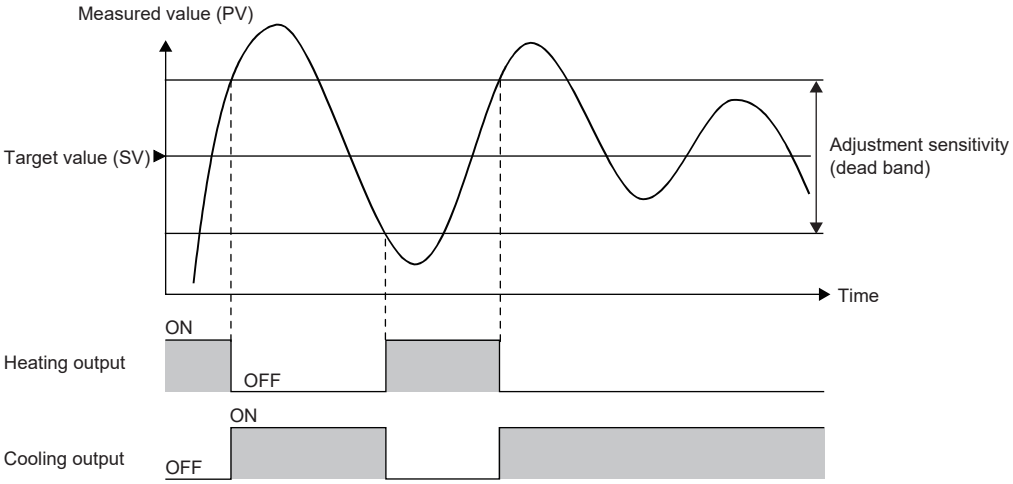
## ■Two-position control (For heating-cooling PID control)

When the heating proportional gain (KPh) is set to 0, two-position control is selected.

The output values are set as either the output value for heating (MVh) turned on/the output value for cooling (MVc) turned off, or the output value for heating (MVh) turned off/the output value for cooling (MVc) turned on.

During two-position control, the value set for the cooling proportional gain (KPc) is ignored.

According to the position of the measured value (PV) in relation to the sensitivity (dead band), one of the following operations is performed.




| Heating control (backward operation) | |
|---|---|
| **Condition** | **Output status** |
| Measured value (PV) < Adjustment sensitivity (dead band) lower limit | ON |
| Measurement value (PV) ≥ Adjustment sensitivity (dead band) upper limit | OFF |
| Adjustment sensitivity (dead band) lower limit ≤ Measurement value (PV) < Adjustment sensitivity (dead band) upper limit | The output state of the cycle in the previous cycle is maintained (on during heating, off during cooling) |

| Cooling control (forward operation) | |
|---|---|
| **Condition** | **Output status** |
| Measured value (PV) < Adjustment sensitivity (dead band) lower limit | OFF |
| Measurement value (PV) ≥ Adjustment sensitivity (dead band) upper limit | ON |
| Adjustment sensitivity (dead band) lower limit ≤ Measurement value (PV) < Adjustment sensitivity (dead band) upper limit | The output state of the cycle in the previous cycle is maintained (off during heating, on during cooling) |

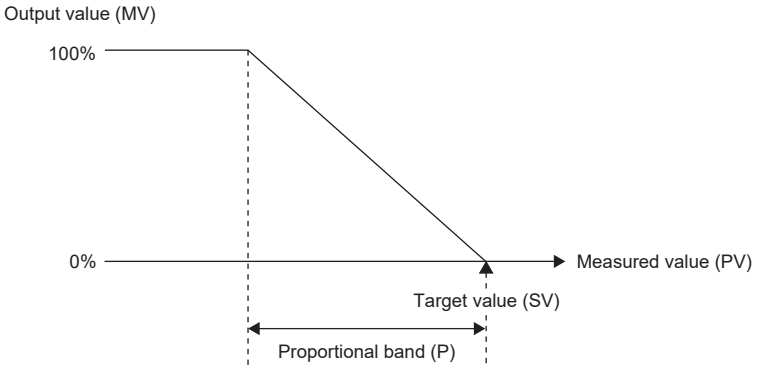
## ■P control

P control is a control method that determines the output value (MV) in proportion to the deviation (E) between the temperature process value (PV) and target value (SV).

When the value for the integral time (TI) and the differential time (TD) each is set to 0, P control is selected.

## ■P control (For standard PID control)

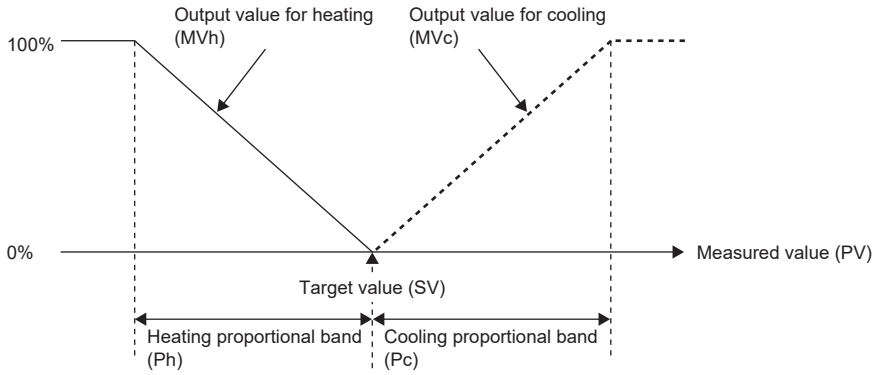
When the measured value (PV) = the target value (SV), the output value (MV) is 0%.




- The value to be actually output is within the output limiter range set by the upper limit output limiter and lower limit output limiter.
- The proportional band (P) is the reciprocal of the proportional gain (KP).

## ■P control (For heating-cooling PID control)

If 0 is set in the overlap/dead band settings when the measured value (PV) is equal to the target value (SV), both the output value for heating (MVh) and the output value for cooling (MVc) are 0%.

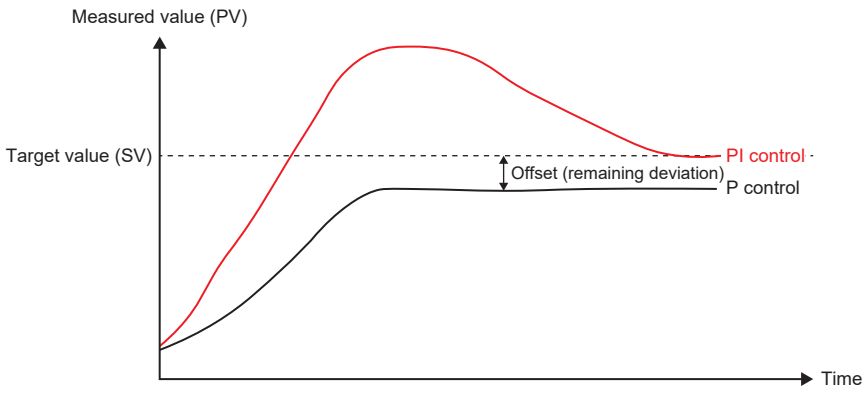



- The value to be actually output is within the output limiter range set by the upper limit output limiter and lower limit output limiter.
- The heating proportional band (Ph) is the reciprocal of the heating proportional gain (KPh), and the cooling proportional band (Pc) is the reciprocal of the cooling proportional gain (KPc).

## ■PI control

PI control is a control method that adds derivative control to P control to correct an offset (remaining deviation) that remains when the temperature is stable. By setting the integral time (TI) properly, the process value (PV) and the target value (SV) can be made to match when the temperature is stable.

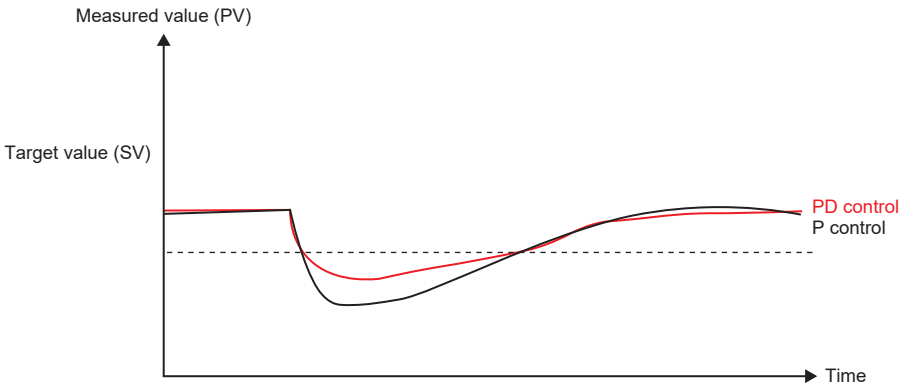
When the value for the differential time (TD) is set to 0, PI control is selected.



### ■PD control

PD control is a control method that prevents large fluctuation in the measured value (PV) due to such a cause as disturbance by adding differential control to P control.

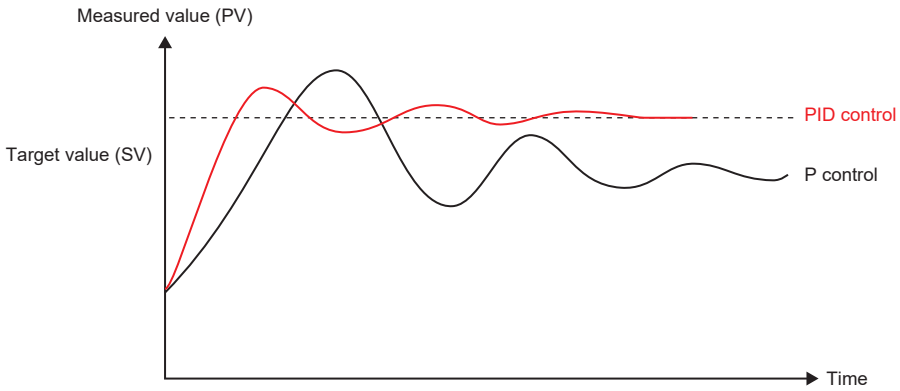
When the value for the integral time (TI) is set to 0, PD control is selected.




### ■PID control

PID control is a control method that adds differential control to PI control so that the state shifts to a stable state in a short period of time even when a drastic change has occurred.

By setting the derivative time (TD) properly, the control target can be shifted to a stable state in a short period of time.




## Proportional gain setting function

The proportional gain (KP) is set separately for heating and for cooling.

By changing the values for the heating proportional gain (KPh) and cooling proportional gain (KPc), different gradients (heating proportional band (Ph), cooling proportional band (Pc)) can be set.

The reciprocal of the proportional gain is called as the proportional band, and their relation is as follows.

$$\frac{100}{\text{Proportional gain (Kp)}} = \text{Proportional band (P)}$$

## Control output cycle setting function

The control output cycle is a cycle of on/off signals being output from the control output to operate a control device such as a heater and cooler.

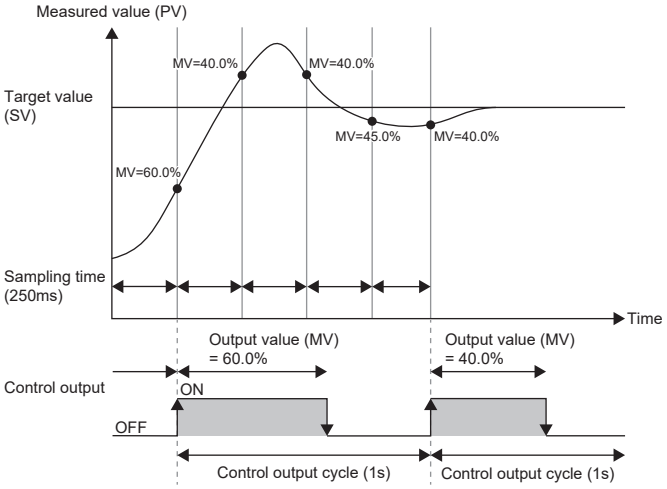
Based on the output value calculated by PID control when the control output cycle starts, on signals are output from the control output. After that, until the control output cycle elapses, the output from the control output is turned off.

When the PID control execution command is turned off, PID control stops. Therefore, the output from the control output is turned off regardless of the output status.

### ■The control output cycle and the sampling time cycle match.

When the control output cycle and the sampling time cycle match, the control output is controlled by using the output value calculated by PID control that is executed at the timing at which the control output cycle time elapses.

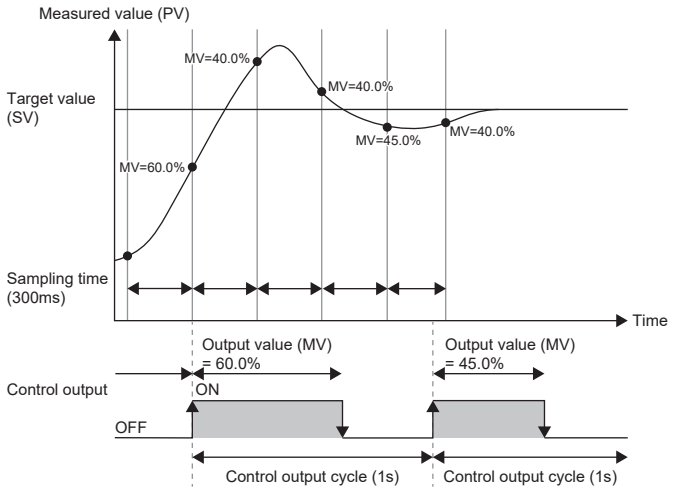





### ■The control output cycle and the sampling time cycle do not match

When the control output cycle and the sampling time cycle do not match, the control output is controlled at the timing of the control output cycle. The output value (MV) used at that time is as follows.

- For the timing applicable when the control output cycle and the sampling time cycle match, in the same way as previously mentioned, use the output value (MV) calculated by PID control that is executed at that timing.
- For the timing applicable when the control output cycle and the sampling time cycle do not match, use the output value (MV) calculated by PID control that has been executed immediately before the said timing.



## Auto-tuning function

The auto-tuning function automatically sets the best PID constants.
In the auto tuning, the control output is turned on and off, and PID constants are calculated depending on the cycle and amplitude of hunting that occurs when overshoots and undershoots of the temperature process value (PV) to the target value (SV) are repeated.
For the on/off operation during auto tuning, in the same way as during PID control, the control output is performed based on the value for the cooling control output cycle setting (heating control output cycle setting, cooling control output cycle setting).
In addition, during auto tuning, when the upper limit/lower limit output limiters (heating upper limit limiter, cooling upper limit limiter) are set, the output value (MV) is limited according to their settings.

### ■Auto-tuning method and cycle

PID control parameters are calculated by the relay feedback method.
Depending on the control mode, the auto tuning cycle is as follows.

- In standard PID control, two cycles of auto tuning are executed.
- In heating-cooling PID control, normally two cycles are executed. When the ambient temperature setting function is enabled, 2.5 cycles are executed.

When auto tuning is executed, standard PID control and heating-cooling PID control each calculate the following by the relay feedback method.

| Standard PID control (forward operation, backward operation) | Heating-cooling PID control |
|---|---|
| • Proportional gain<br>• Integral time<br>• Differential time | • Heating proportional gain<br>• Cooling proportional gain<br>• Integral time<br>• Differential time |

## ■Auto-tuning calculation formula

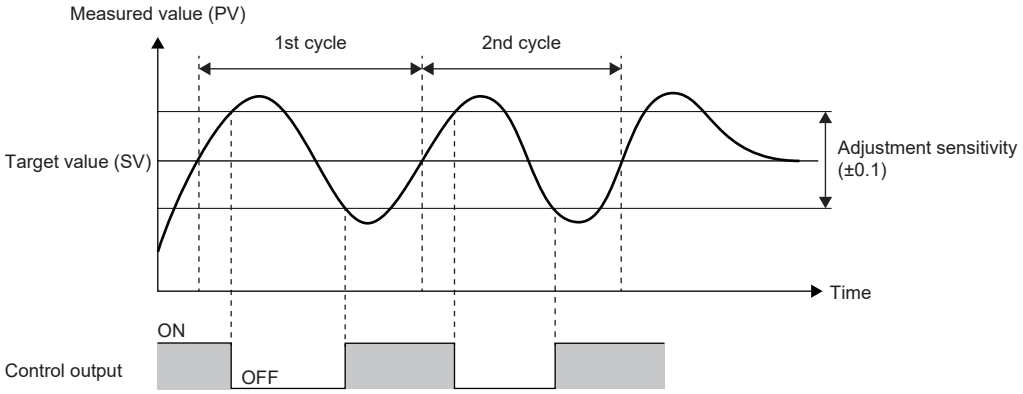
| Operation expression[*1] | Item | Operation expression usage timing |
|---|---|---|
| $K_p=0.588\times\frac{4}{\pi(Y_{max}-Y_{min})}$ | Proportional gain | • Heating control of standard PID control<br>• Cooling control of PID control |
| | Heating proportional gain | • At the 3rd cycle of heating-cooling PID control (when the ambient temperature setting is enabled, target value ≥ ambient temperature) |
| | Cooling proportional gain | • Up to the 3rd cycle of heating-cooling PID control (when the ambient temperature setting is enabled, target value < ambient temperature) |
| $K_{ph}=0.588\times\frac{4}{\pi(Y_{max}-Ymin)}\times\frac{SV-Y_{min}}{((Y_{max}-SV)+(SV-Y_{min}))}$ | Heating proportional gain | • Heating-cooling PID control (when the ambient temperature setting is disabled)<br>• Up to the 2nd cycle of heating-cooling PID control (when the ambient temperature setting is enabled, target value ≥ ambient temperature)<br>• Up to the 2nd cycle of heating-cooling PID control (when the ambient temperature setting is enabled, target value < ambient temperature) |
| $K_{pc}=0.588\times\frac{4}{\pi(Y_{max}-Y_{min})}\times\frac{Y_{max}-SV}{((Y_{max}-SV)+(SV-Y_{min}))}$ | Cooling proportional gain | • Heating-cooling PID control (when the ambient temperature setting is disabled)<br>• Up to the 2nd cycle of heating-cooling PID control (when the ambient temperature setting is enabled, target value ≥ ambient temperature)<br>• Up to the 2nd cycle of heating-cooling PID control (when the ambient temperature setting is enabled, target value < ambient temperature) |
| $T_i=0.5\times(T_{Final}-T_{Init})\div1000$ | Integral time | • Heating control of standard PID control<br>• Cooling control of PID control<br>• Heating-cooling PID control (when the ambient temperature setting is disabled)<br>• Heating-cooling PID control (when the ambient temperature setting is enabled, target value ≥ ambient temperature)<br>• Heating-cooling PID control (when the ambient temperature setting is enabled, target value < ambient temperature) |
| $T_d=0.125\times(T_{Final}-T_{Init})\div1000$ | Differential time | • Heating control of standard PID control<br>• Cooling control of PID control<br>• Heating-cooling PID control (when the ambient temperature setting is disabled)<br>• Heating-cooling PID control (when the ambient temperature setting is enabled, target value ≥ ambient temperature)<br>• Heating-cooling PID control (when the ambient temperature setting is enabled, target value < ambient temperature) |

*1 KP: Proportional gain, KPh: Heating proportional gain, KPc: Cooling proportional gain, π: Ratio of a circle's circumference to its diameter, Ymax: Maximum process value, Ymin: Minimum process value, Ti: Integral time (s), Td: Derivative time (s), $T_{Int}$: Cycle start time (ms), $T_{Final}$: Cycle end time (ms)

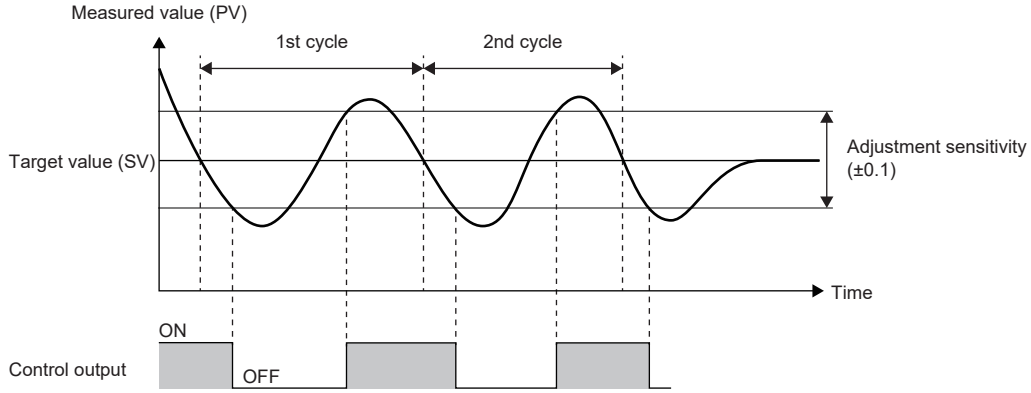
## ■Output value during auto-tuning

The following figures show output values (MVs) during auto tuning in standard PID control and heating-cooling PID control using timing charts.

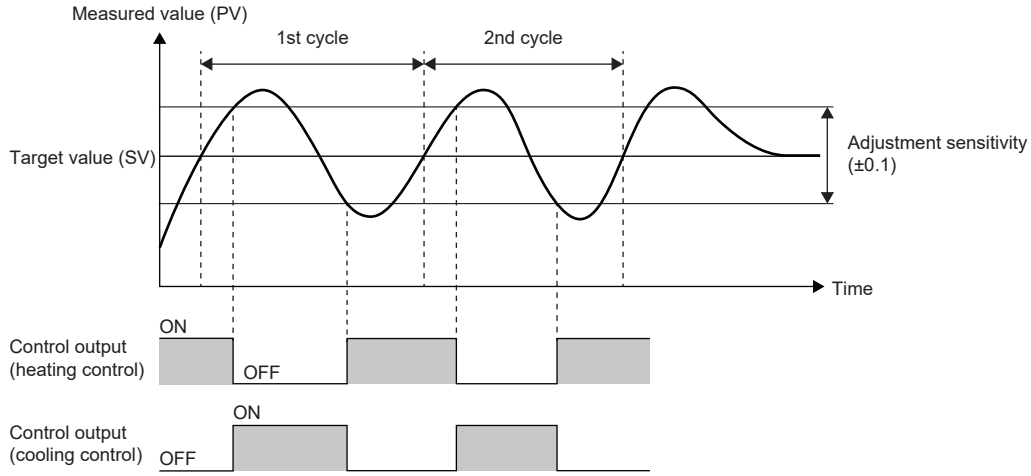
- Heating control (backward operation) of standard PID control



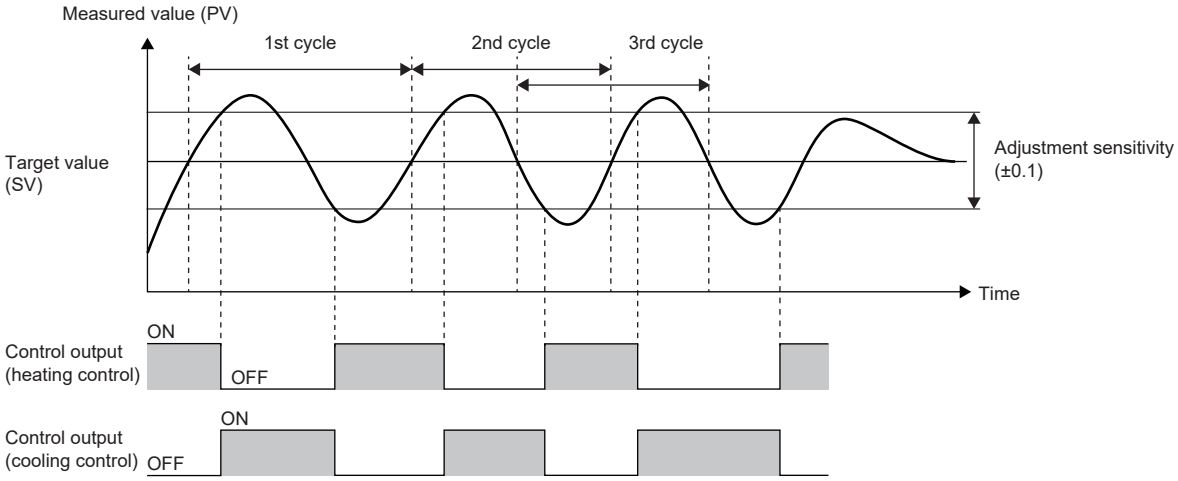

- Cooling control (forward operation) of standard PID control




- Heating-cooling PID control (ambient temperature setting function disabled)

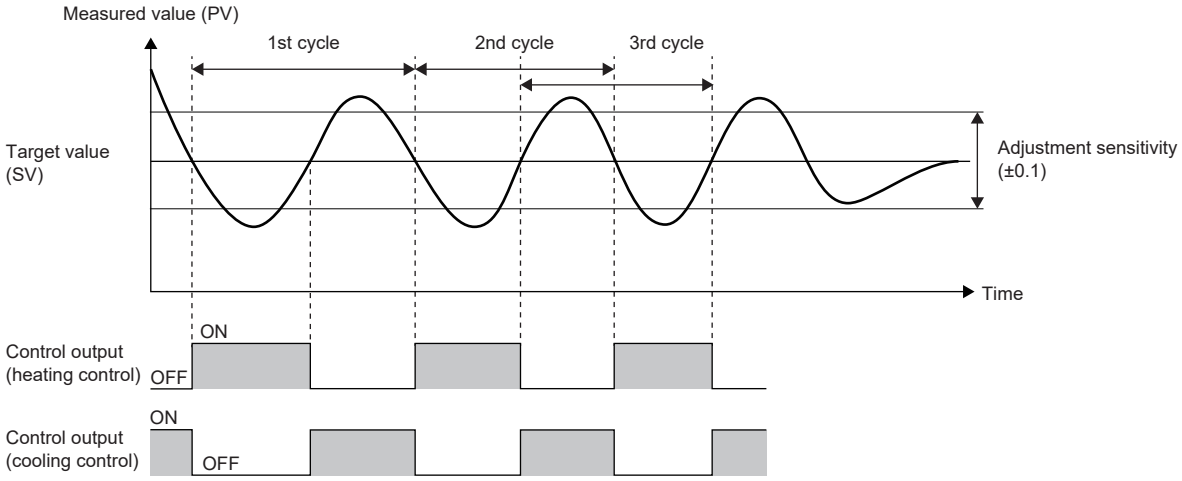


• Heating-cooling PID control (ambient temperature setting function enabled, target value ≥ ambient temperature)




When the ambient temperature setting function is enabled, auto tuning is completed after execution of 2.5 cycles. The third cycle starts in the middle of the second cycle, and ends completely when 2.5 cycles are executed.

• Heating-cooling PID control (ambient temperature setting function enabled, target value < ambient temperature)




When the ambient temperature setting function is enabled, auto tuning is completed after execution of 2.5 cycles. The third cycle starts in the middle of the second cycle, and ends completely when 2.5 cycles are executed.

## ■Execution and stop conditions for auto tuning

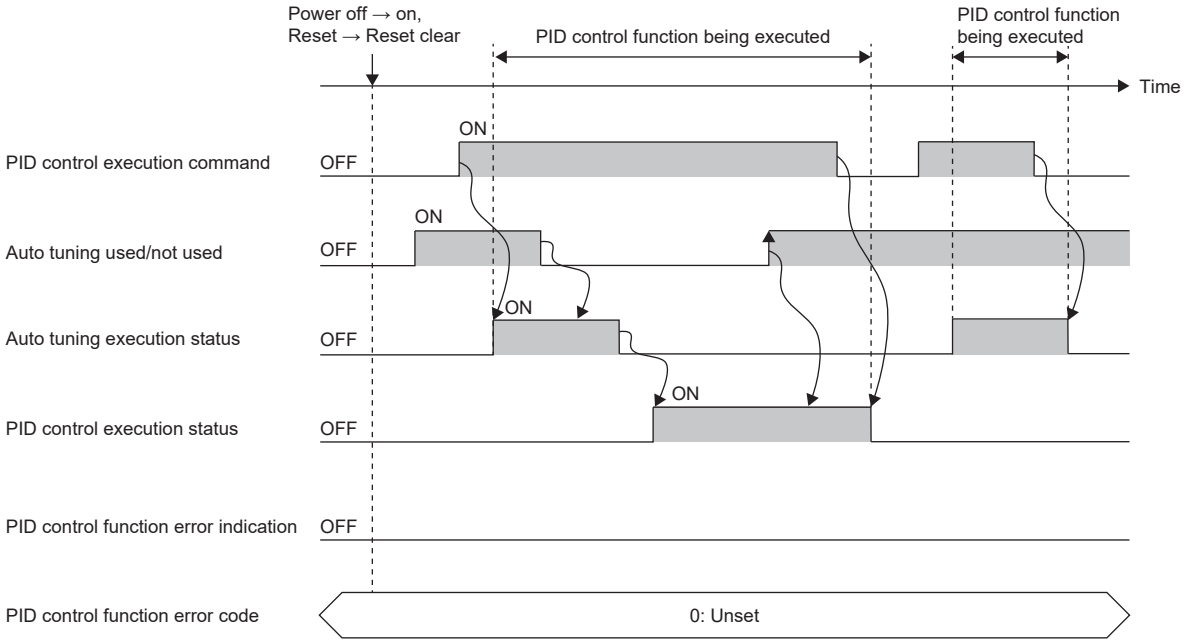
The following table shows the execution and stop conditions for using auto tuning.

| Execution condition | Stop condition |
|---|---|
| • "To Use or Not to Use Auto-tuning" is set to "Auto tuning used".<br>• "PID Control Execution Command" is set to "PID control executed".<br>• The upper limit output limiter/heating upper limit output limiter/cooling upper limit output limiter is set to 1 (0.1%) or larger.<br>• The lower limit output limiter is set to 999 (99.9%) or smaller. | • When "PID Control Execution Command" is set to "PID control not executed" (Stopped)<br>• When the target value (SV) is changed<br>• When the value for the upper limit output limiter/lower limit output limiter is changed<br>• When auto tuning does not end even after approximately two hours have elapsed after its start<br>• When the sampling time is changed<br>• When the cooling control output cycle setting, heating control output cycle setting, or cooling control output cycle setting is changed<br>• When the module operation status turns into the PAUSE state |

## ■Related flag timings

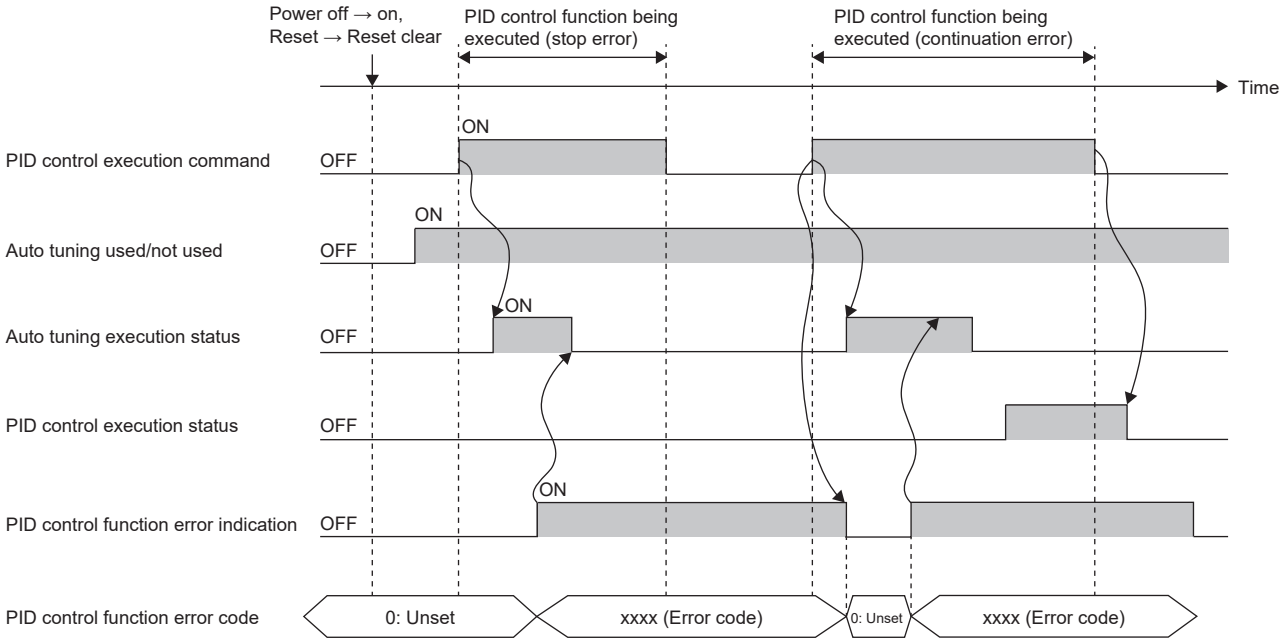
The following figures show the related flag timings based on timing charts.

- For normal execution




(1) When the user writes on to "To Use or Not to Use Auto-tuning" in advance and writes on to "PID Control Execution Command", the system sets on to "Auto-tuning Execution Status".
(2) While auto tuning is being executed, even if the user writes off to "To Use or Not to Use Auto-tuning", "Auto-tuning Execution Status" remains to be on, and the value for "To Use or Not to Use Auto-tuning" is ignored.
(3) When auto tuning is completed successfully, the system sets off to "Auto-tuning Execution Status" and on to "PID Control Execution Status".
(4) While the PID control function is being executed, even if the user writes on, off, and on in sequence to "To Use or Not to Use Auto-tuning", "Auto-tuning Execution Status" remains to be off, and the value for "To Use or Not to Use Auto-tuning" is ignored.
(5) When the user writes off to "PID Control Execution Command", the PID control function ends, and the system sets off to "PID Control Execution Status".
(6) When the user writes off to "PID Control Execution Command" during auto tuning, PID control ends, and the system sets off to "Auto-tuning Execution Status".

• For execution in the event of an error




(1) If a PID control stop error occurs while auto tuning is being executed, the system sets the following and stops auto tuning. (Since auto tuning is not completed, "PID Control Execution Status" is not set to on.)
- Set on to "PID Control Function Error Display".
- Set the corresponding error code to "PID Control Function Error Code".
- Set off to "Auto-tuning Execution Status".

(2) Since the system does not set off to "PID Control Execution Command", the user needs to write off when executing auto tuning again.

(3) When the user writes on to "PID Control Execution Command", the system sets the following and executes auto tuning again.
- Set off to "PID Control Function Error Display".
- Set 0 to "PID Control Function Error Code".

(4) If a PID control continuation error occurs while auto tuning is being executed, the system sets the following, but auto tuning continues without changing "Auto-tuning Execution Status".
- Set on to "PID Control Function Error Display".
- Set the corresponding error code to "PID Control Function Error Code".
- When auto tuning is completed, the system sets off to "Auto-tuning Execution Status" and on to "PID Control Execution Status" to execute the PID control function.

(5) Since the PID control function is executed normally, the user sets off to "PID Control Execution Command" to end the PID control function.

## ■Precautions

- Even when "To Use or Not to Use Auto-tuning" is set to "Auto tuning used" while the PID control function being executed, auto tuning is not executed.
- When the ambient temperature setting is enabled, if the relation (which is higher) between the target value (SV) and the ambient temperature setting at the start of PID control (at the start of auto tuning) is changed after completion of auto tuning, the accuracy of PID control goes down.
- When the ambient temperature setting is enabled, even if the relation (which is higher) between the target value (SV) and the ambient temperature setting is changed during auto tuning, the change is ignored. The change in the ambient temperature setting becomes valid after completion of auto tuning (during PID control).
- When PID control is stopped by setting on and off to the PID control execution command, the devices for the following parameters are cleared.
  - Set off to the control output.
  - Clear the output value (MV), output value for heating (MVh), and output value for cooling (MVc) to 0.
  - Set off to the temperature rise judgment flag.
  - Set off to the PID control execution status.
  - Set off to the auto tuning execution status.

## Error display function

If an error occurs while PID control or auto-tuning is being executed, the error status and error code are stored into the devices. For error code details, refer to the following.

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When an error occurs, "1: Error occurrence" is written to the device set in the "PID Control Function Error Display" parameter, and the error code is written to the device set in the "PID Control Function Error Code" parameter.

An error cannot be checked if no device is set to the parameters.

When an error has already occurred, and another error occurs with the error code written into the device set in "PID Control Function Error Code", the error code already stored into the device will be overwritten.

The error status set to "PID Control Function Error Display" and "PID Control Function Error Code" can be cleared by any of the following methods.

- Set "PID Control Execution Command" to "1: PID control executed".
- Rewrite the values in the devices directly.
- If the device set in each parameter is not a latch device, power off or reset the CPU module.

## Overlap/dead band function

The temperature where the cooling control output starts is shifted; therefore, select which of the control stability or energy saving is to be prioritized.

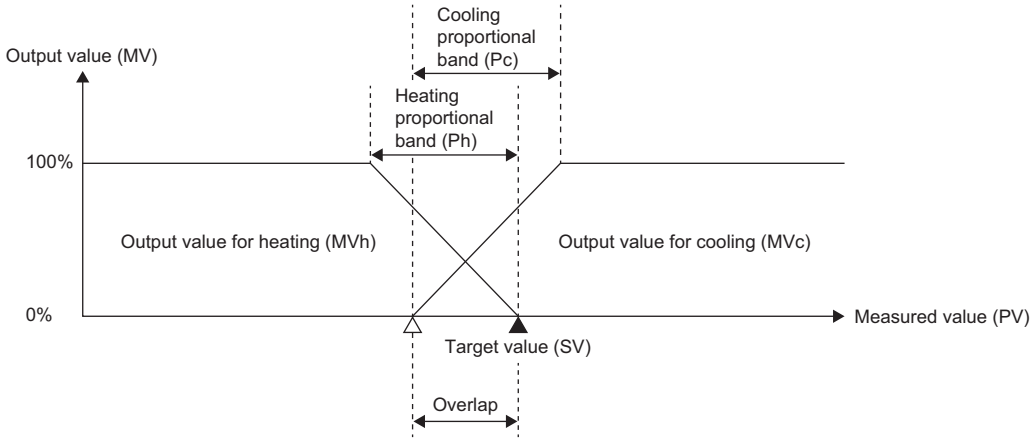
**Point**

In heating-cooling PID control, the temperature process value (PV) significantly changes due to slight heating or cooling control output when the heat produced by a controlled object and natural cooling are being balanced. Consequently, excessive output may be performed.

### ■Overlap

Overlap refers to the temperature area where both heating control and cooling control are performed. In the temperature area where both heating and cooling outputs overlap, both of the output negate each other, thus the control gain becomes moderate. Consequently, the change amount in the temperature process value (PV) for the output becomes small, improving control stability.

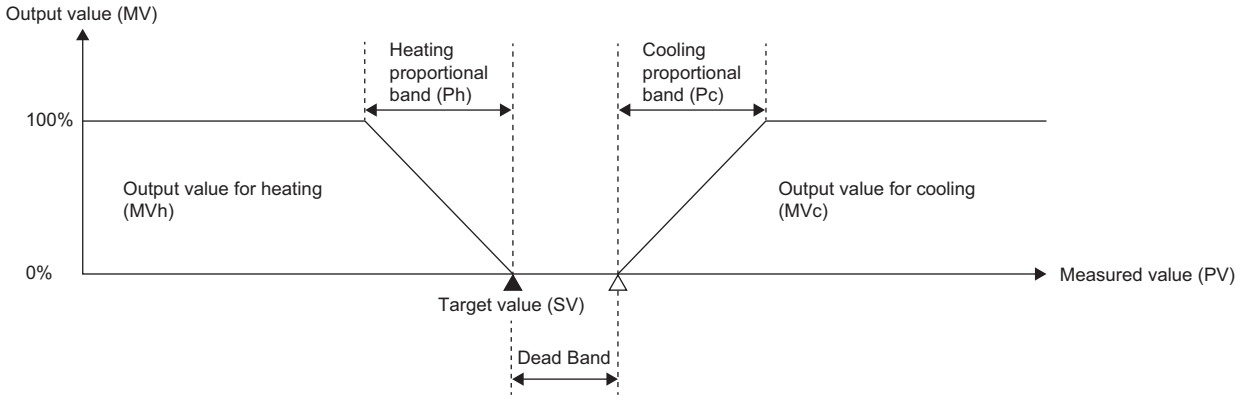
When setting an overlapping area, set a negative value in "Overlap/Dead Band Setting".




### ■Dead band

Dead band refers to the temperature area where neither heating control output nor cooling control output is performed. When the temperature process value (PV) is stable within this area, output is not performed for the slight change in the temperature, contributing to energy saving.

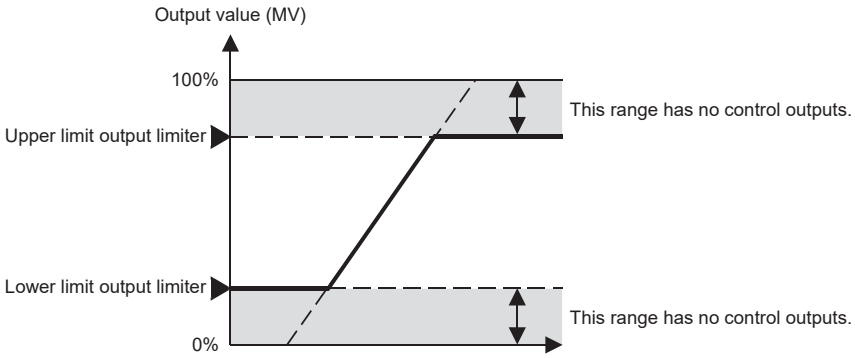
When setting a dead band area, set a positive value in "Overlap/Dead Band Setting".



## Output limiter function

The output limiter is a function that sets the upper and lower limit values if outputting the output value (MV) calculated using PID operations to an external device.

It is disabled only when executing two-position control.




## Output change ratio limiter function

The output change ratio limiter is a function that limits the amount of change in the output value (MV) per unit time (1s). Control outputs are limited using the output change rate that has been set.

For a control target that goes out of control due to a sudden change in the output or a control target in which a large current flows, setting the output variation limiter is effective.

When the target value (SV) is changed, the output value (MV) does not change suddenly, and outputs are made based on the set gradient. When the set value is 0, this function is disabled.

The output value (MV) limited by the output change ratio limiter function can be obtained by the following formula.

Output value (MV) = (Previous output value (MV) ± Output change ratio limiter (%) × (Sampling time (ms) ÷ 1000)

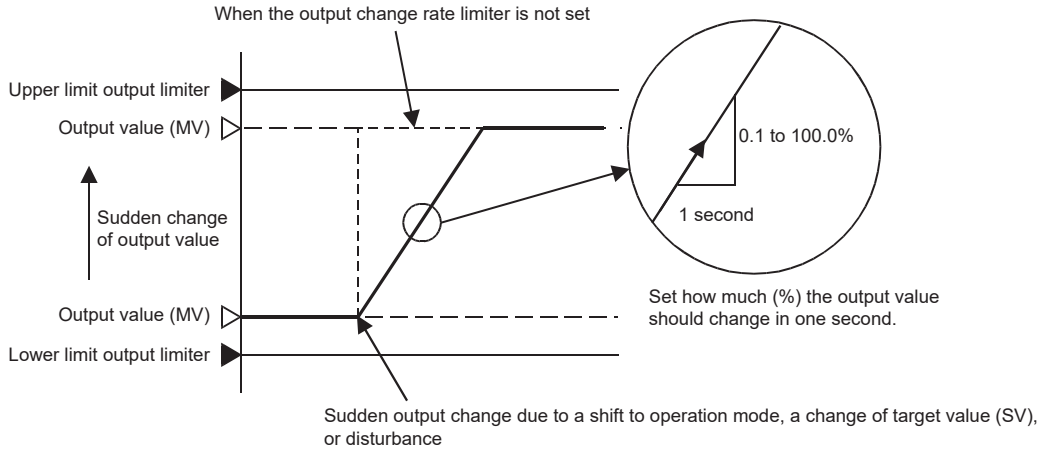
### ■When the output change ratio limiter is effective

The output change ratio limiter is effective in the following cases.

- If the output value (MV) starts from 100% at the start of control (When there is a problem with a 100% sudden change)
- If the output value (MV) changes suddenly due to a change in the target value (SV)

**Ex.**

When the rise of the output change ratio limiter is effective




When the target value (SV) is changed significantly, the output does not change suddenly, and outputs are made based on the set gradient.

### ■Precautions

- Reducing the output change ratio limiter value (reducing the gradient) slows the control response. In addition, the effect of differentiation is lost.
- The output change rate limiter is disabled when executing two-position control.

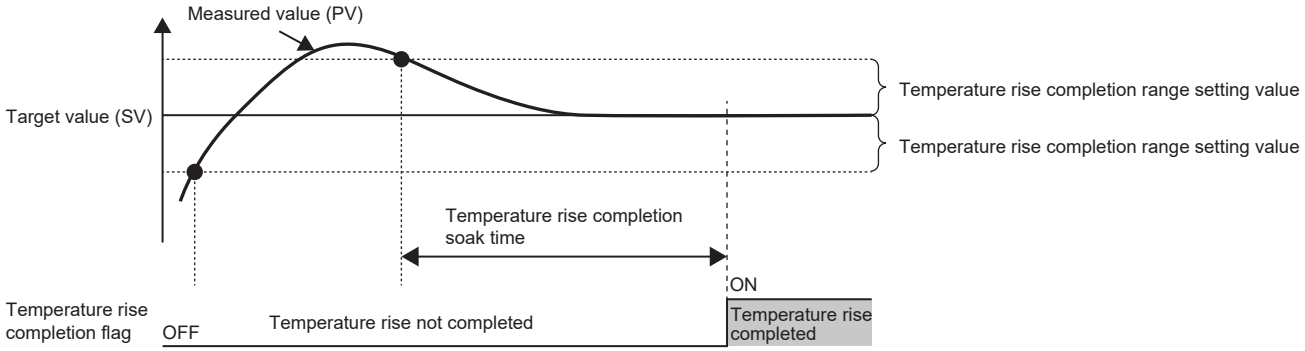
## Temperature rise completion judgment function

The temperature rise completion judgment is a function that judges whether the temperature process value (PV) is within the temperature rise completion range. Judgment is made per sampling time.

The upper limit and lower limit values for the temperature rise completion range can be found by the following formula.

Temperature rise completion range upper value: Target value (SV) + Temperature rise completion range setting value

Temperature rise completion range lower limit: Target value (SV) - Temperature rise completion range setting value




## Ambient temperature setting function

When the ambient temperature setting value is higher than or equal to/lower than the target value (SV), this function prevents unnecessary execution of heating control or cooling control by setting either the output value for heating (MVh) or the output value for cooling (MVc) to 0.

**Point**

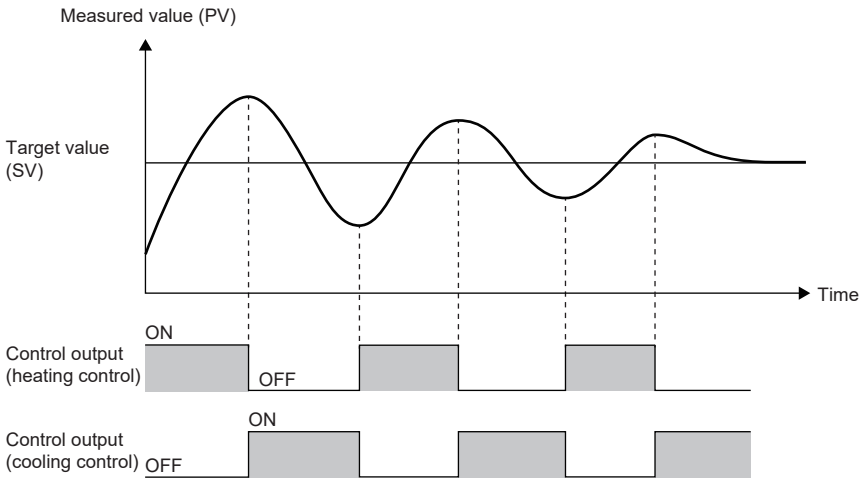
This function prevents heating control and cooling control in the following cases.

- When the ambient temperature (room temperature) is equal to or lower than the target value (SV), without executing cooling control, the measured value (PV) goes down to the target value (SV).
- When the ambient temperature (room temperature) is higher than the target value (SV), without executing heating control, the measured value (PV) goes up to the target value (SV).

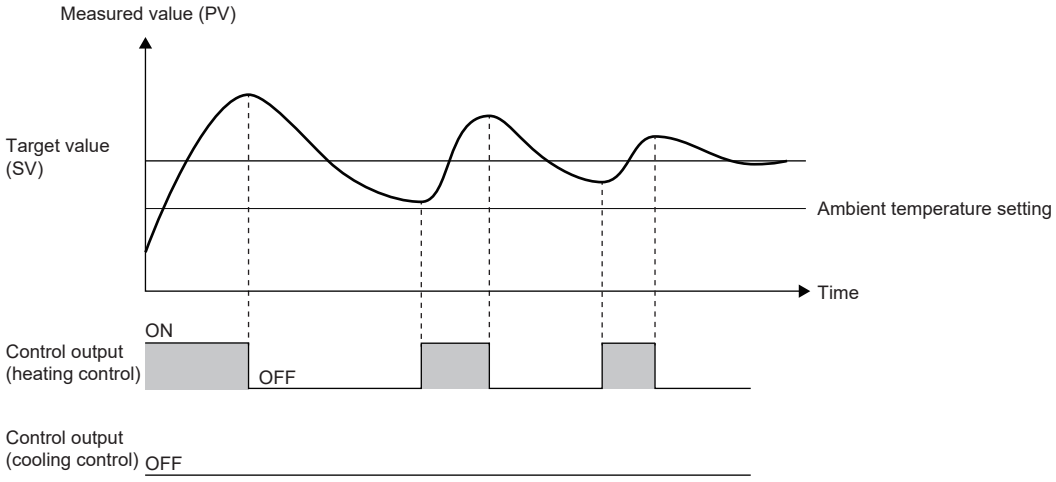
### ■Control output when the ambient temperature setting function is enabled/disabled

The following figures show the control outputs when the ambient temperature setting function is enabled and disabled by using timing charts.

- When the ambient temperature setting function is disabled

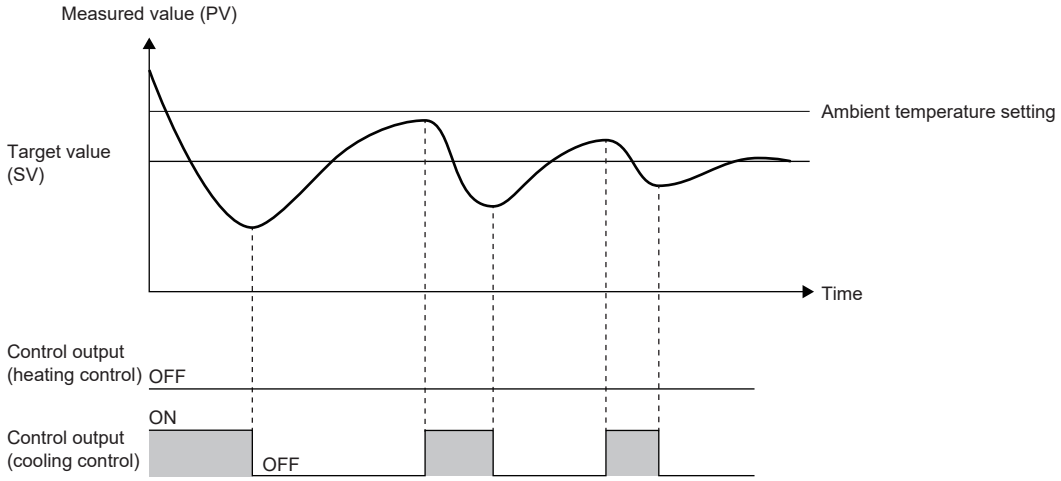


• When the ambient temperature setting function is enabled, and the ambient temperature setting value is equal to or lower than the target value




(1) Cooling control is not executed because the ambient temperature setting value (room temperature) is equal to or lower than the target value (SV) and the measured value (PV) decreases without cooling. (Always off)
(2) Since cooling is not performed, the fall of the measured value (PV) becomes gentler compared to the fall when the ambient temperature setting function is disabled.

• When the ambient temperature setting function is enabled, and the ambient temperature setting value is higher than the target value




(1) Heating control is not executed because the ambient temperature setting value (room temperature) is higher than the target value (SV) and the measured value (PV) increases without heating. (Always off)
(2) Since heating is not performed, the rise of the measured value (PV) becomes gentler compared to the rise when the ambient temperature setting function is disabled.

## ■Precautions

• When the ambient temperature setting function is enabled, the overlap/dead band settings are disabled.
• When the ambient temperature setting function is enabled, if the relation (which is higher) between the target value and the ambient temperature setting is changed after setting "PID Control Execution Command" to "1: PID control executed", the accuracy of PID control goes down.

## Control response parameter

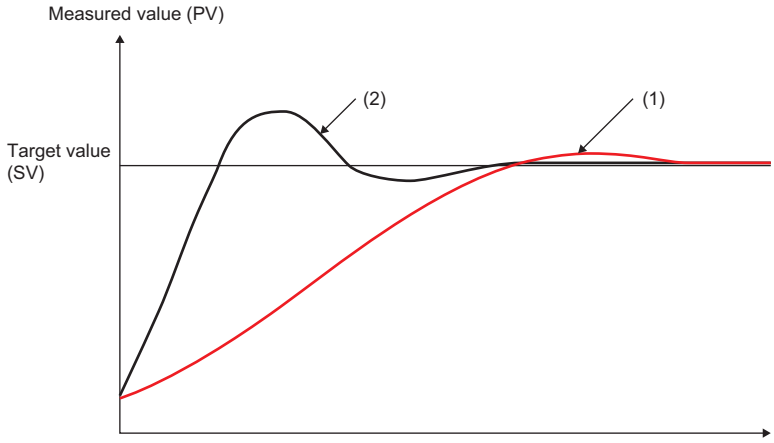
Set the response to the target value (SV) of PID control for either of the two levels (Normal and Fast).

(1): When the response to the target value (SV) is "Normal"

The overshoot and undershoot can be suppressed, but it takes longer to reach the target value (SV).

(2): When the response to the target value (SV) is "Fast"

The target value (SV) is achieved in a shorter period of time, but the overshoot and undershoot increase.




### ■Precautions

- The change using the devices for "Control Response Parameter" is reflected only when "PID Control Execution Command" is set to "0: PID control not executed".
- If a change in "Control Response Parameter" is attempted when "PID Control Execution Command" is set to "1: PID control executed", the change is reflected at the next time when "PID Control Execution Command" is changed from "0: PID control not executed" to "1: PID control executed".

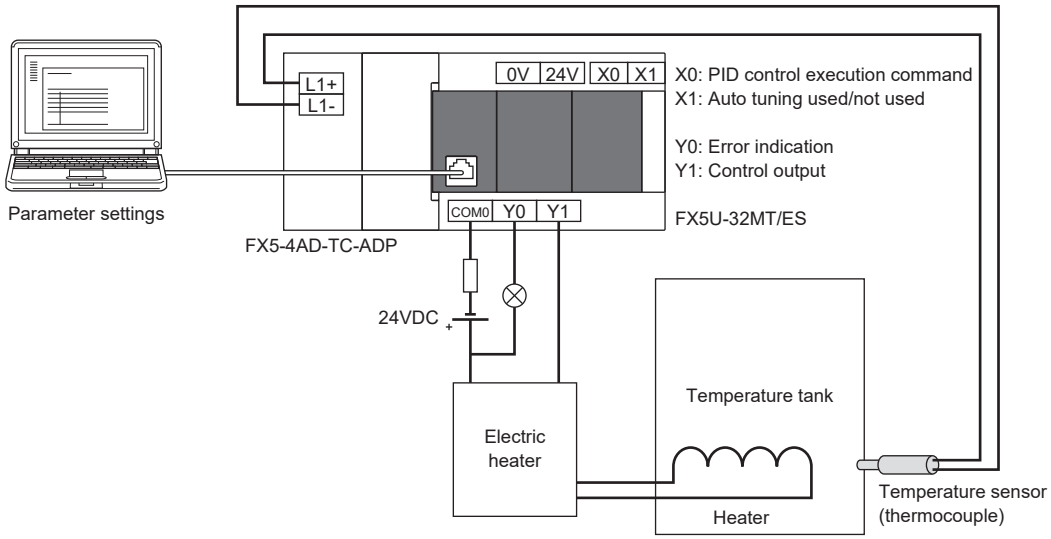
# Setting and program examples

This section shows parameter setting examples and program examples when using the heating-cooling PID control function.

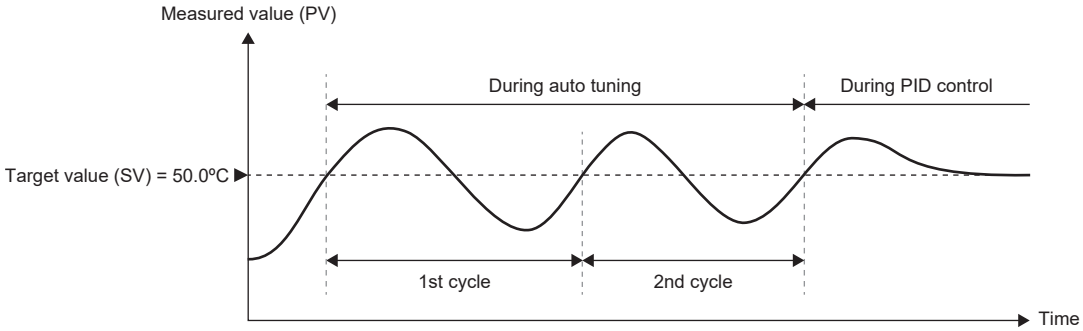
## Setting example 2

When "Control mode" is "Standard PID control mode", after auto tuning starts and ends completely, PID control using the obtained control parameters is performed.

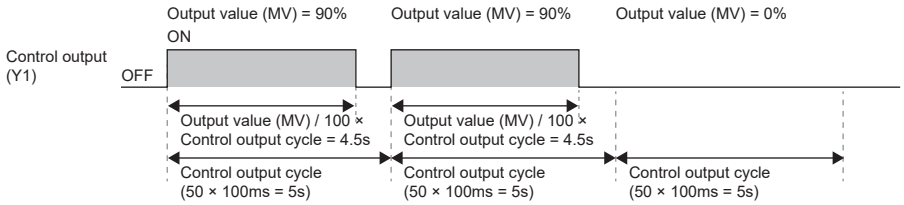
### ■System configuration



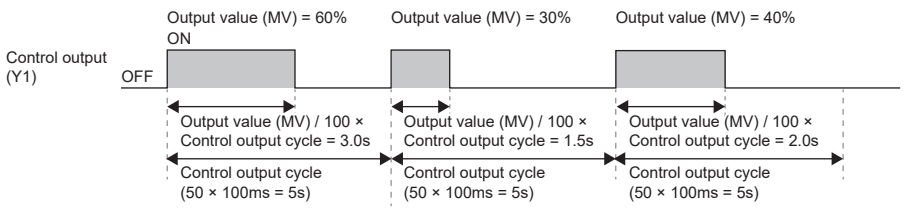

### ■Operation example




■ During auto tuning (when the upper limit output limiter is 90%)




■ During PID control



## ■Parameter setting example

| Setting item | | | Setting value | Device indirect specification |
|---|---|---|---|---|
| Basic Settings | To Use or Not to Use PID Control Function | | Use | — |
| | Control Mode Selection | | Standard PID Control | — |
| | Direct Action/Reverse Action Selection | | Reverse Action | — |
| | Target Value (SV) | | 500 | D0 |
| | Process Value (PV) | | — | SD6300 |
| | Output Value (MV) | | — | D1 |
| | Heating Output Value (MVh) | | — | — |
| | Cooling Output Value (MVc) | | — | — |
| | Control Parameter | Proportional Gain (KP) | Not used | D200 |
| | | Heating Proportional Gain (KPh) | — | — |
| | | Cooling Proportional Gain (KPc) | — | — |
| | | Integral Time (TI) | Not used | D203 |
| | | Derivative Time (TD) | Not used | D204 |
| | Sampling Time (Ts) | | 10[×10ms] | Not used |
| | Operation Cycle | Control Output Cycle | 50[×100ms] | Not used |
| | | Heating Control Output Cycle | — | — |
| | | Cooling Control Output Cycle | — | — |
| | Control Output | | — | Y1 |
| | Control Output (for Cooling Control) | | — | — |
| | PID Control Execution Command | | — | X0 |
| | To Use or Not to Use Auto-tuning | | — | X1 |
| | PID Control Execution Status | | — | M0 |
| | Auto-tuning Execution Status | | — | M1 |
| | PID Control Function Error Display | | — | Y0 |
| | PID Control Function Error Code | | — | D10 |
| Application Settings | 2-position Control Function | Adjustment sensitivity (dead band) | 10 | Not used |
| | Overlap/Dead Band Setting | | — | — |
| | Output Limiter Function | Upper Limit Output Limiter | 900[×0.1%] | Not used |
| | | Lower Limit Output Limiter | 0[×0.1%] | Not used |
| | | Heating Upper Limit Output Limiter | — | — |
| | | Cooling Upper Limit Output Limiter | — | — |
| | Output Variation Rate Limiter Function | Output Variation Rate Limiter | 0[×0.1%/s] | Not used |
| | Temperature Rise Completion Judgement Function | Temperature Rise Judgment Flag | — | M3 |
| | | Temperature Rise Completion Range | 50 | Not used |
| | | Temperature Rise Completion Soak Time | 5[s] | Not used |
| | Ambient Temperature Setting | | — | — |
| | Control Response Parameter | | Normal | — |

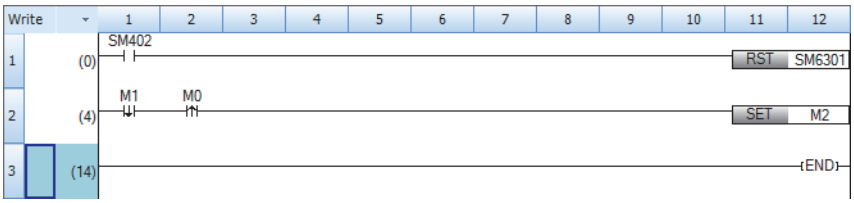
## ■Program examples

• Device setting example

| Item | Device indirect specification | Description |
|---|---|---|
| A/D conversion enable/disable setting (CH1) | SM6301 | FX5-4AD-TC-ADP(CH1) A/D conversion enable/disable setting (0: Enabled, 1: Disabled) |
| Auto tuning completion flag | M2 | Flag that turns on when auto tuning starts and ends completely |

• Program examples

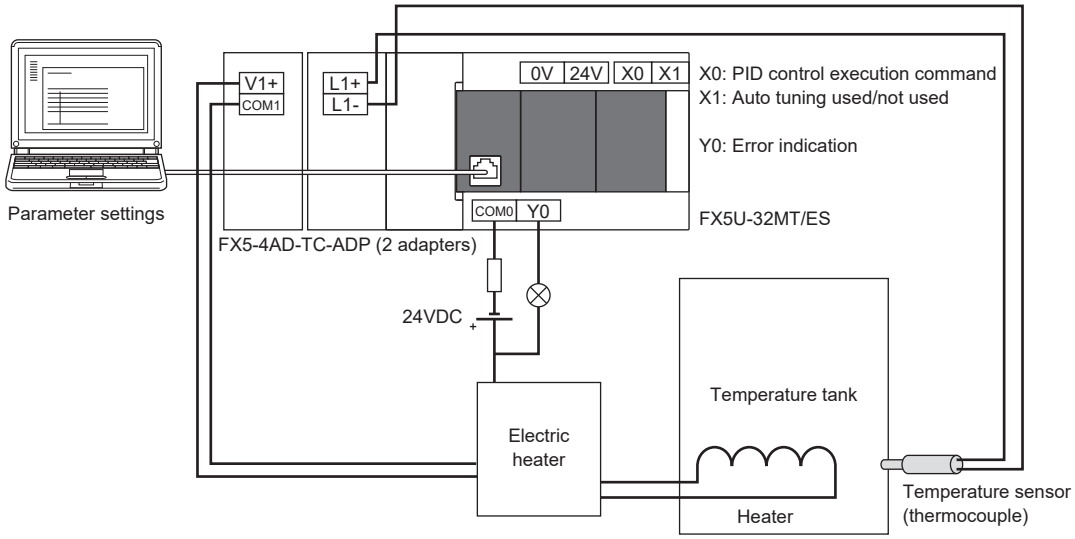
Set use permission for the FX5-4AD-TC-ADP(CH1), which was set as the process value (SD6300) when the state was changed from STOP to RUN. After PID control starts, turn on the auto tuning completion flag when auto tuning is completed. After writing the parameter settings and program to the CPU module, turn X1 (Auto tuning used/not used) on and turn X0 (PID control execution command) on, and auto tuning + PID control can be executed.



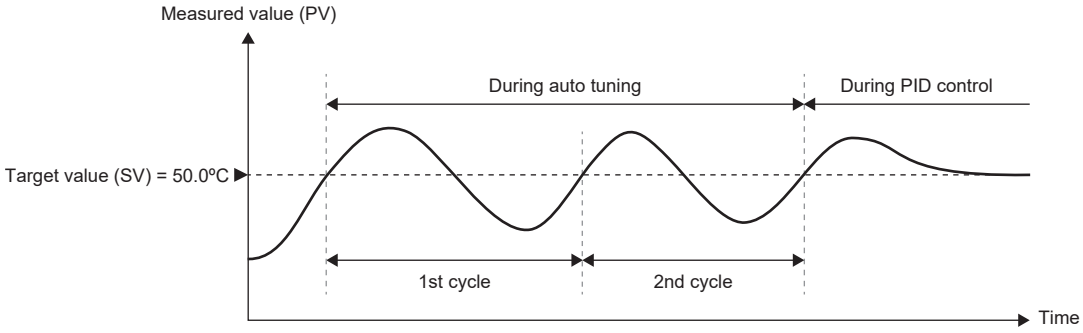

## Setting example 3

When "Control mode" is "Standard PID control mode", after auto tuning starts and ends completely, PID control using the obtained control parameters is performed. After auto tuning is completed, perform conversion to the voltage value (0 to 5V) to be output to the control target by using the output value (MV).

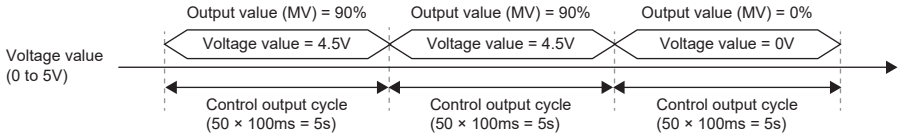
## ■System configuration



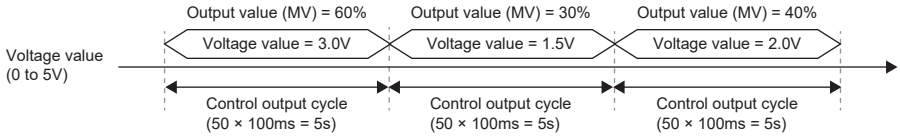
## ■Operation example




■ During auto tuning (when the upper limit output limiter is 90%)




■ During PID control




## ■Parameter setting example

| Setting item | | | Setting value | Device indirect specification |
|---|---|---|---|---|
| Basic Settings | To Use or Not to Use PID Control Function | | Use | — |
| | Control Mode Selection | | Standard PID Control | — |
| | Direct Action/Reverse Action Selection | | Reverse Action | — |
| | Target Value (SV) | | 500 | D0 |
| | Process Value (PV) | | — | SD6300 |
| | Output Value (MV) | | — | D1 |
| | Heating Output Value (MVh) | | — | — |
| | Cooling Output Value (MVc) | | — | — |
| | Control Parameter | Proportional Gain (KP) | Not used | D200 |
| | | Heating Proportional Gain (KPh) | — | — |
| | | Cooling Proportional Gain (KPc) | — | — |
| | | Integral Time (TI) | Not used | D203 |
| | | Derivative Time (TD) | Not used | D204 |
| | Sampling Time (Ts) | | 10[×10ms] | Not used |
| | Operation Cycle | Control Output Cycle | 50[×100ms] | Not used |
| | | Heating Control Output Cycle | — | — |
| | | Cooling Control Output Cycle | — | — |
| | Control Output | | — | Not used |
| | Control Output (for Cooling Control) | | — | — |
| | PID Control Execution Command | | — | X0 |
| | To Use or Not to Use Auto-tuning | | — | X1 |
| | PID Control Execution Status | | — | M0 |
| | Auto-tuning Execution Status | | — | M1 |
| | PID Control Function Error Display | | — | Y0 |
| | PID Control Function Error Code | | — | D10 |

| Setting item | | | Setting value | Device indirect specification |
|---|---|---|---|---|
| Application Settings | 2-position Control Function | Adjustment sensitivity (dead band) | 10 | Not used |
| | Overlap/Dead Band Setting | | — | — |
| | Output Limiter Function | Upper Limit Output Limiter | 900[×0.1%] | D410 |
| | | Lower Limit Output Limiter | 0[×0.1%] | D411 |
| | | Heating Upper Limit Output Limiter | — | — |
| | | Cooling Upper Limit Output Limiter | — | — |
| | Output Variation Rate Limiter Function | Output Variation Rate Limiter | 0[×0.1%/s] | D414 |
| | Temperature Rise Completion Judgement Function | Temperature Rise Judgment Flag | — | M3 |
| | | Temperature Rise Completion Range | 50 | D415 |
| | | Temperature Rise Completion Soak Time | 5[s] | D416 |
| | Ambient Temperature Setting | | — | — |
| | Control Response Parameter | | Normal | — |

## ■Program examples

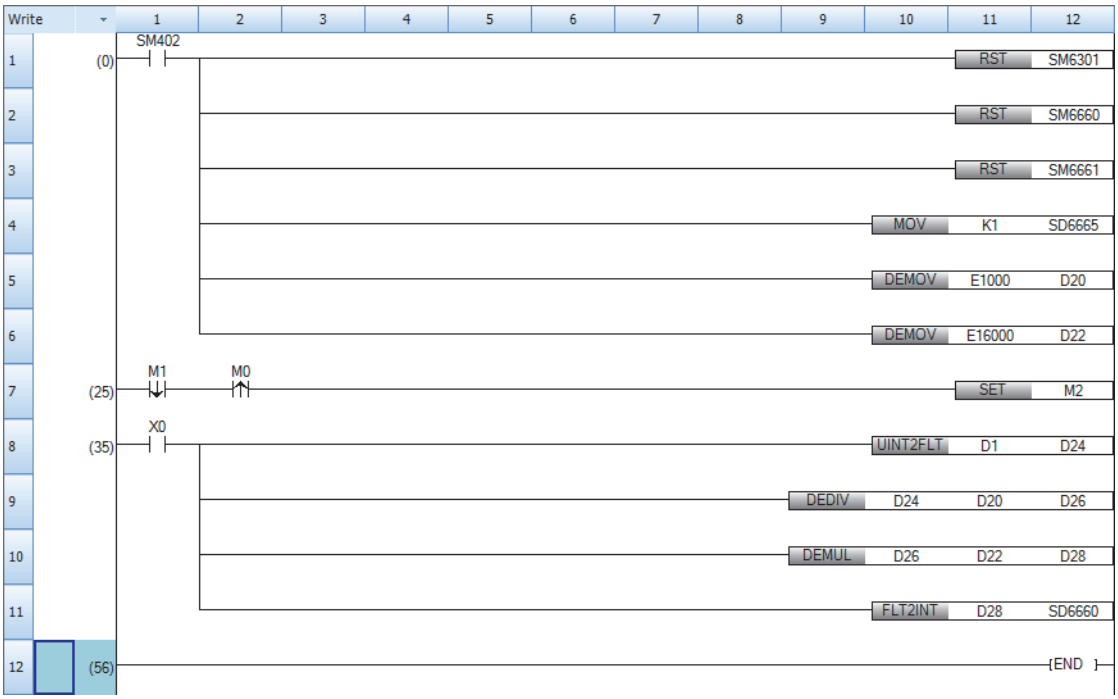
• Device setting example

| Item | Device indirect specification | Description |
|---|---|---|
| A/D conversion enable/disable setting (CH1) | SM6301 | FX5-4AD-TC-ADP(CH1) A/D conversion enable/disable setting (0: Enabled, 1: Disabled) |
| D/A conversion enable/disable setting | SM6660 | FX5-4DA-ADP(CH1) D/ A conversion enable/disable setting (0: Enabled, 1: Disabled) |
| D/A output enable/disable setting | SM6661 | FX5-4DA-ADP(CH1) D/A output enable/disable setting (0: Enabled, 1: Disabled) |
| Output range setting | SD6665 | FX5-4DA-ADP(CH1) output range setting (setting value 1: 0 to 5V) |
| Real number for division of output value (MV) | D20 | Since the unit of the output value (MV) is ×0.1%, store K1000 using a real number value. |
| | D21 | |
| For conversion of output value (MV) into digital value | D22 | Since the voltage value (0 to 5V) is output in this program, store the maximum digital value K16000 using a real number value. |
| | D23 | |
| Auto tuning completion flag | M2 | Flag that turns on when auto tuning starts and ends completely |
| Digital value (CH1) | SD6660 | FX5-4DA-ADP(CH1) digital value |
| Analog output value monitor (CH1) | SD6662 | FX5-4DA-ADP(CH1) analog output value monitor |
| Output value (MV) (real number) | D24 | Store the output value (MV) (after conversion to real number). |
| | D25 | |
| Output value (MV) (0.00 to 1.00) | D26 | Store the value obtained after conversion of the output value (MV) from a value in the range 0 to 1000 to a value in the range 0.00 to 1.00. |
| | D27 | |
| Digital value (real number) | D28 | Store the digital value obtained by calculation using a real number value. |
| | D29 | |

• Program example

Set use permission for the FX5-4AD-TC-ADP(CH1), which was set as the process value (SD6300) when the state was changed from STOP to RUN, and configure settings for the FX5-4DA-ADP(CH1). After PID control starts, perform conversion to the digital value (0 to 16000) to be output to the control target by using the output value (MV), and obtain the analog output value (SD6662). Turn on the auto tuning completion flag when auto tuning is completed.

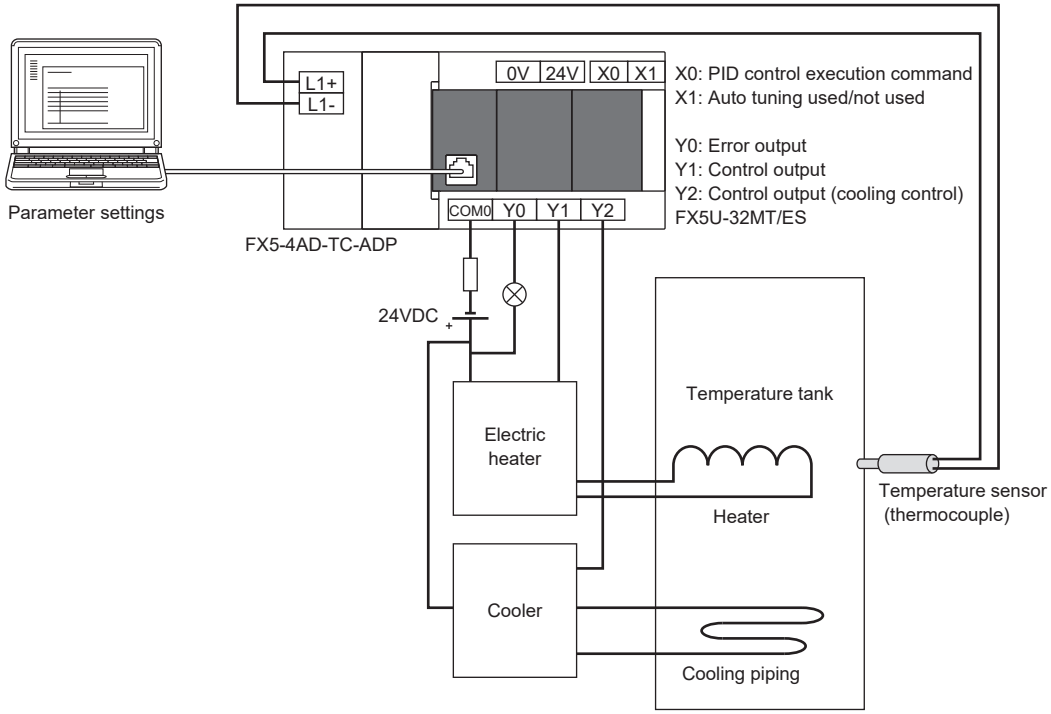
After writing the parameter settings and program to the CPU module, turn X1 (Auto tuning used/not used) on and turn X0 (PID control execution command) on, and auto tuning + PID control can be executed.



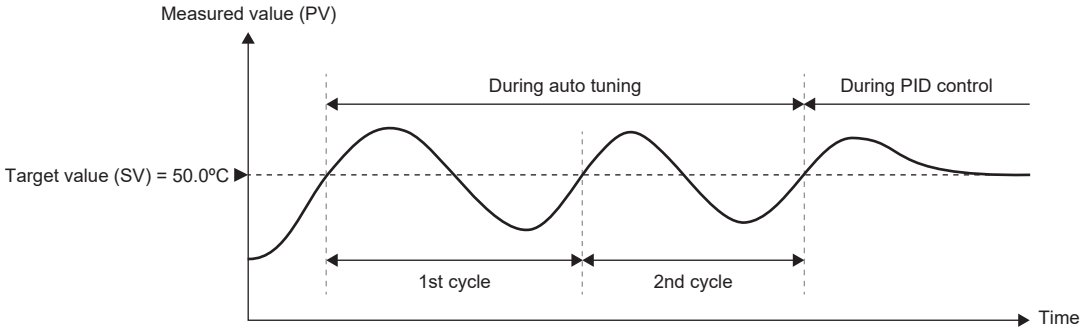

## Setting example 5

When "Control mode" is "Heating-cooling PID control mode", after auto tuning starts and ends completely, perform PID control using the obtained control parameters.

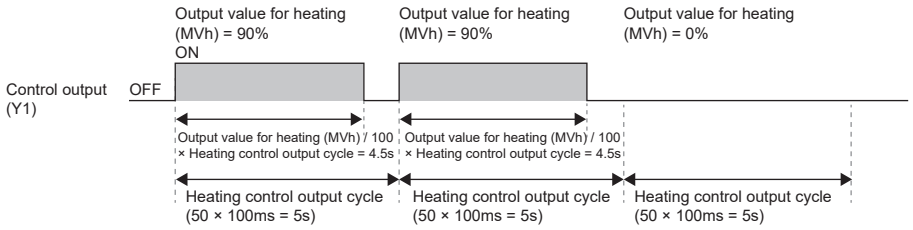
### ■System configuration



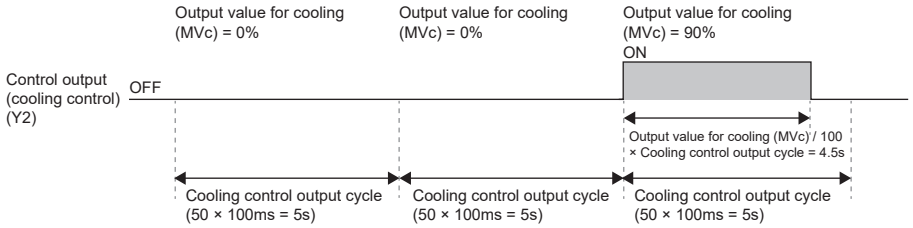
## ■Operation example



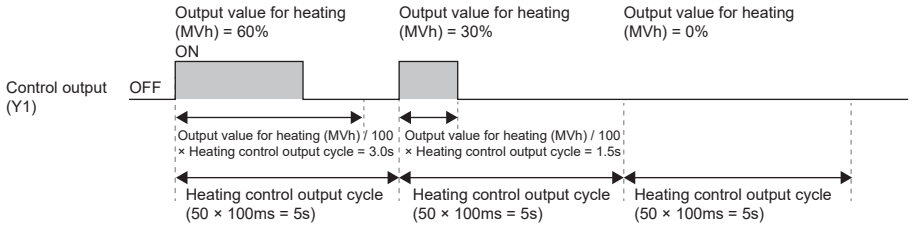

■ During auto tuning (when the heating upper limit output limiter is 90%)



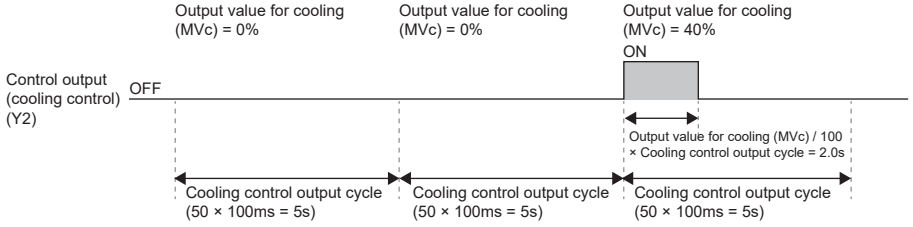

■ During auto tuning (when the cooling upper limit output limiter is 90%)




■ Heating control at PID control




■ Cooling control at PID control



## ■Parameter setting example

| Setting item | | | Setting value | Device indirect specification |
|---|---|---|---|---|
| Basic Settings | To Use or Not to Use PID Control Function | | Use | — |
| | Control Mode Selection | | Heating-cooling PID Control | — |
| | Direct Action/Reverse Action Selection | | — | — |
| | Target Value (SV) | | 500 | D0 |
| | Process Value (PV) | | — | SD6300 |
| | Output Value (MV) | | — | — |
| | Heating Output Value (MVh) | | — | D2 |
| | Cooling Output Value (MVc) | | — | D3 |
| | Control Parameter | Proportional Gain (KP) | Not used | — |
| | | Heating Proportional Gain (KPh) | Not used | D201 |
| | | Cooling Proportional Gain (KPc) | Not used | D202 |
| | | Integral Time (TI) | Not used | D203 |
| | | Derivative Time (TD) | Not used | D204 |
| | Sampling Time (Ts) | | 10[×10ms] | Not used |
| | Operation Cycle | Control Output Cycle | — | — |
| | | Heating Control Output Cycle | 50[×100ms] | Not used |
| | | Cooling Control Output Cycle | 50[×100ms] | Not used |
| | Control Output | | — | Y1 |
| | Control Output (for Cooling Control) | | — | Y2 |
| | PID Control Execution Command | | — | X0 |
| | To Use or Not to Use Auto-tuning | | — | X1 |
| | PID Control Execution Status | | — | M0 |
| | Auto-tuning Execution Status | | — | M1 |
| | PID Control Function Error Display | | — | Y0 |
| | PID Control Function Error Code | | — | D10 |
| Application Settings | 2-position Control Function | Adjustment sensitivity (dead band) | 10 | Not used |
| | Overlap/Dead Band Setting | | 0 | Not used |
| | Output Limiter Function | Upper Limit Output Limiter | — | — |
| | | Lower Limit Output Limiter | — | — |
| | | Heating Upper Limit Output Limiter | 900[×0.1%] | Not used |
| | | Cooling Upper Limit Output Limiter | 900[×0.1%] | Not used |
| | Output Variation Rate Limiter Function | Output Variation Rate Limiter | — | — |
| | Temperature Rise Completion Judgement Function | Temperature Rise Judgment Flag | — | M3 |
| | | Temperature Rise Completion Range | 50 | Not used |
| | | Temperature Rise Completion Soak Time | 5[s] | Not used |
| | Ambient Temperature Setting | | Not used | Not used |
| | Control Response Parameter | | Normal | — |

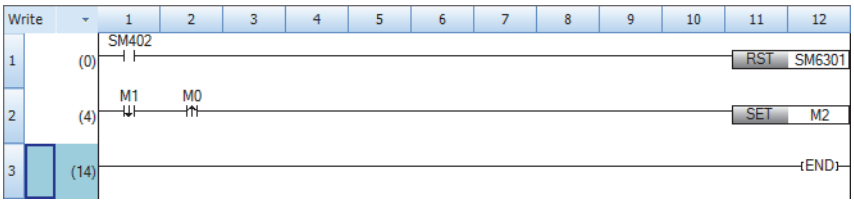
## ■Program example

• Device setting example

| Item | Device indirect specification | Description |
|---|---|---|
| A/D conversion enable/disable setting (CH1) | SM6301 | FX5-4AD-TC-ADP(CH1) A/D conversion enable/disable setting (0: Enabled, 1: Disabled) |
| Auto tuning completion flag | M2 | Flag that turns on when auto tuning starts and ends completely |

• Program example

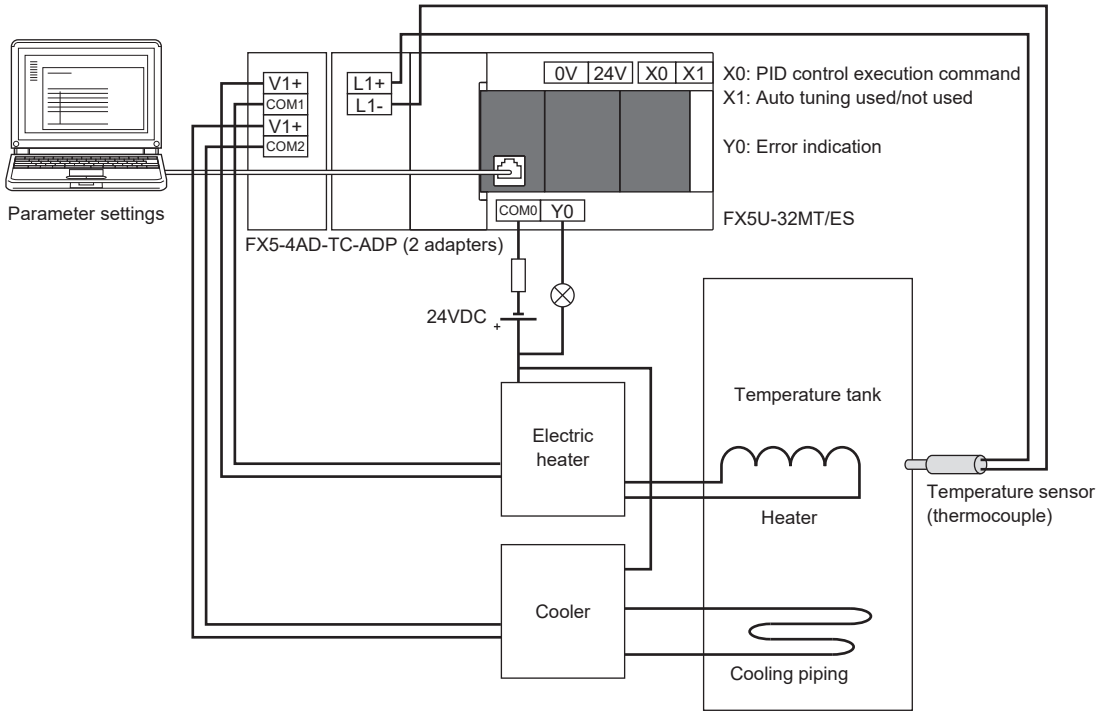
Set use permission for the FX5-4AD-TC-ADP(CH1), which was set as the process value (SD6300) when the state was changed from STOP to RUN. After PID control starts, turn on the auto tuning completion flag when auto tuning is completed. After writing the parameter settings and program to the CPU module, turn X1 (Auto tuning used/not used) on and turn X0 (PID control execution command) on, and auto tuning + PID control can be executed.



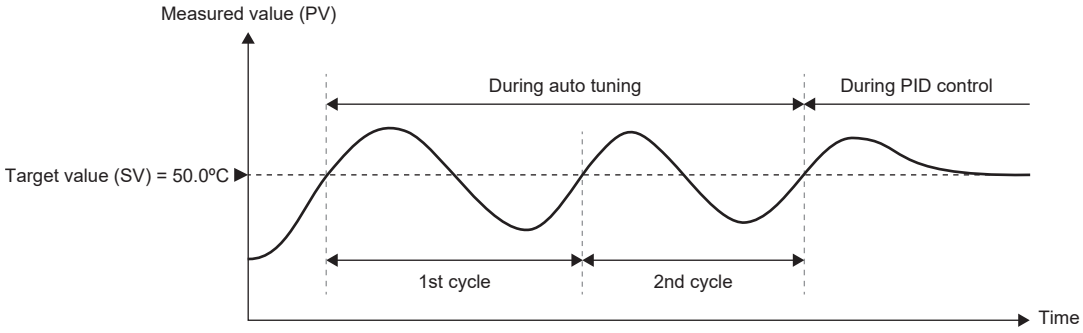

## Setting example 6

When "Control mode" is "Heating-cooling PID control mode", after auto tuning starts and ends completely, perform PID control using the obtained control parameters. After auto tuning is completed, perform conversion to the voltage value (0 to 5V) to be input into the control target by using the output value for heating (MVh) and output value for cooling (MVc).

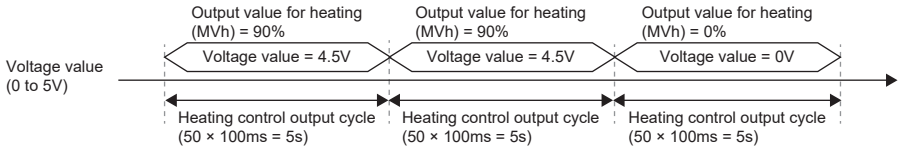
## ■System configuration



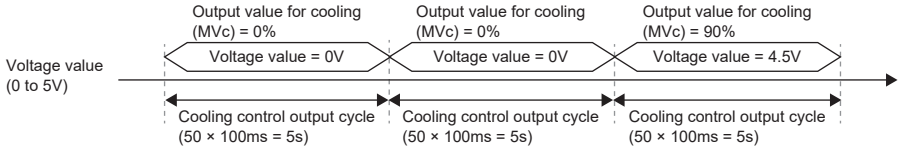
## ■Operation example



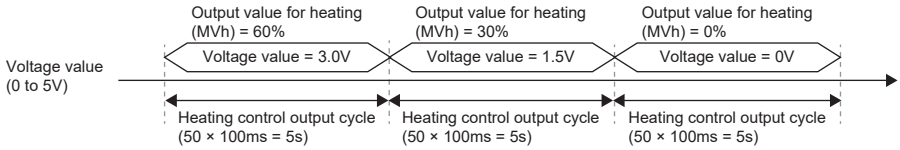

■ During auto tuning (when the heating upper limit output limiter is 90%)



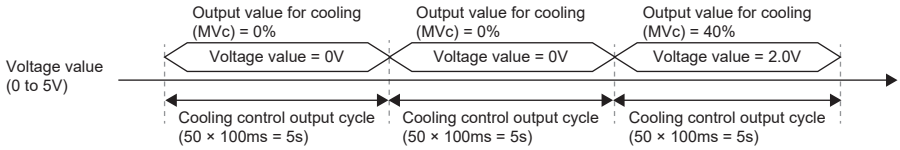

■ During auto tuning (when the cooling upper limit output limiter is 90%)




■ Heating control at PID control




■ Cooling control at PID control



## ■Parameter setting example

| Setting item | | | Setting value | Device indirect specification |
|---|---|---|---|---|
| Basic Settings | To Use or Not to Use PID Control Function | | Use | — |
| | Control Mode Selection | | Heating-cooling PID Control | — |
| | Direct Action/Reverse Action Selection | | — | — |
| | Target Value (SV) | | 500 | D0 |
| | Process Value (PV) | | — | SD6300 |
| | Output Value (MV) | | — | — |
| | Heating Output Value (MVh) | | — | D2 |
| | Cooling Output Value (MVc) | | — | D3 |
| | Control Parameter | Proportional Gain (KP) | Not used | — |
| | | Heating Proportional Gain (KPh) | Not used | D201 |
| | | Cooling Proportional Gain (KPc) | Not used | D202 |
| | | Integral Time (TI) | Not used | D203 |
| | | Derivative Time (TD) | Not used | D204 |
| | Sampling Time (Ts) | | 10[×10ms] | Not used |
| | Operation Cycle | Control Output Cycle | — | — |
| | | Heating Control Output Cycle | 50[×100ms] | Not used |
| | | Cooling Control Output Cycle | 50[×100ms] | Not used |
| | Control Output | | — | Not used |
| | Control Output (for Cooling Control) | | — | Not used |
| | PID Control Execution Command | | — | X0 |
| | To Use or Not to Use Auto-tuning | | — | X1 |
| | PID Control Execution Status | | — | M0 |
| | Auto-tuning Execution Status | | — | M1 |
| | PID Control Function Error Display | | — | Y0 |
| | PID Control Function Error Code | | — | D10 |
| Application Settings | 2-position Control Function | Adjustment sensitivity (dead band) | 10 | Not used |
| | Overlap/Dead Band Setting | | 0 | Not used |
| | Output Limiter Function | Upper Limit Output Limiter | — | — |
| | | Lower Limit Output Limiter | — | — |
| | | Heating Upper Limit Output Limiter | 900[×0.1%] | D412 |
| | | Cooling Upper Limit Output Limiter | 900[×0.1%] | D413 |
| | Output Variation Rate Limiter Function | Output Variation Rate Limiter | — | — |
| | Temperature Rise Completion Judgement Function | Temperature Rise Judgment Flag | — | M3 |
| | | Temperature Rise Completion Range | 50 | D415 |
| | | Temperature Rise Completion Soak Time | 5[s] | D416 |
| | Ambient Temperature Setting | | Not used | Not used |
| | Control Response Parameter | | Normal | — |

## ■Program example

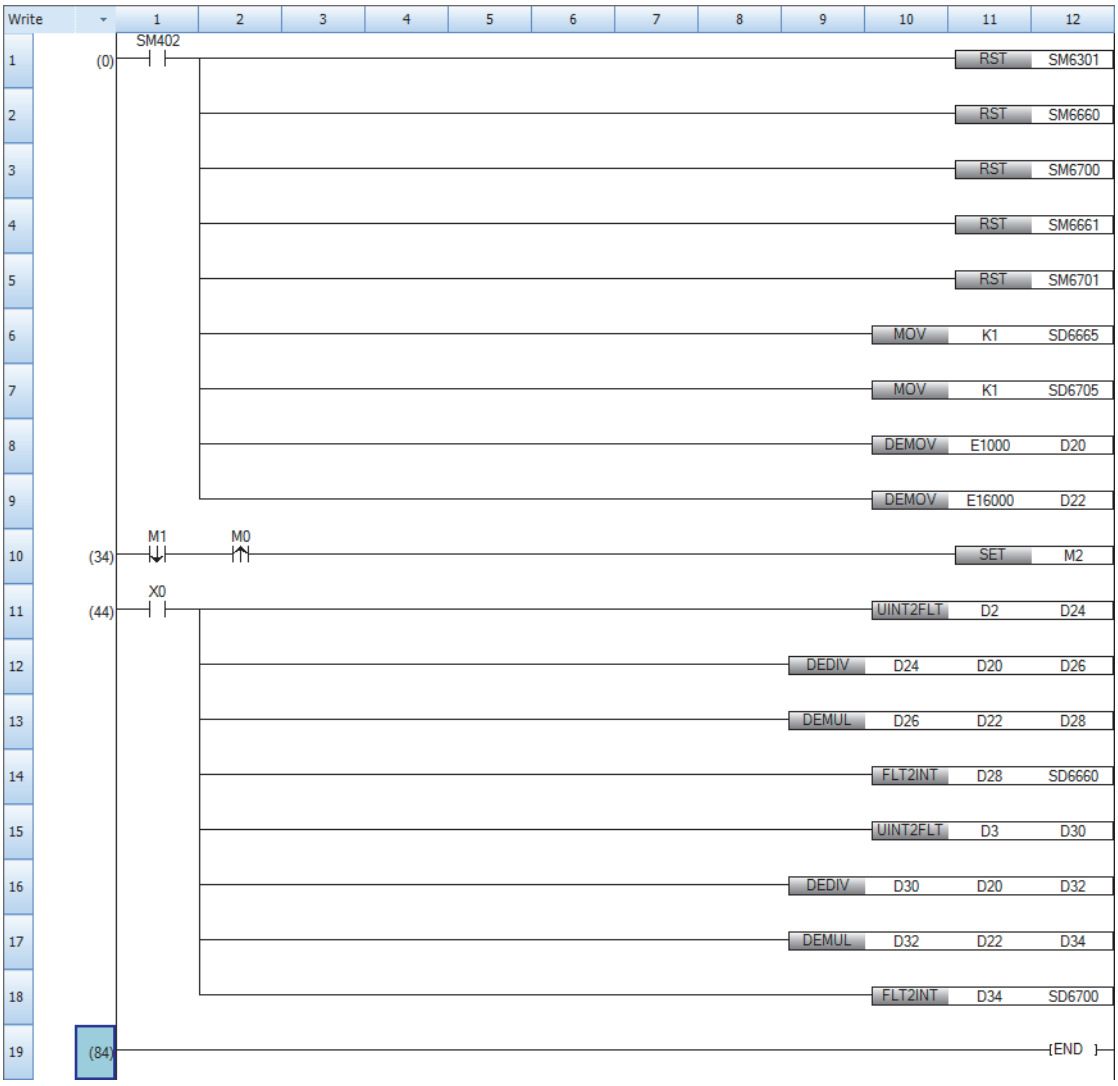
• Device setting example

| Item | Device indirect specification | Description |
|---|---|---|
| A/D conversion enable/disable setting (CH1) | SM6301 | FX5-4AD-TC-ADP(CH1) A/D conversion enable/disable setting (0: Enabled, 1: Disabled) |
| D/A conversion enable/disable setting | SM6660 | FX5-4DA-ADP(CH1) D/A conversion enable/disable setting (0: Enabled, 1: Disabled) |
| | SM6700 | FX5-4DA-ADP(CH2) D/A conversion enable/disable setting (0: Enabled, 1: Disabled) |
| D/A output enable/disable setting | SM6661 | FX5-4DA-ADP(CH1) D/A output enable/disable setting (0: Enabled, 1: Disabled) |
| | SM6701 | FX5-4DA-ADP(CH2) D/A output enable/disable setting (0: Enabled, 1: Disabled) |
| Output range setting | SD6665 | FX5-4DA-ADP(CH1) output range setting (setting value 1: 0 to 5V) |
| | SD6705 | FX5-4DA-ADP(CH2) output range setting (setting value 1: 0 to 5V) |
| Real number for division of output value for heating/cooling (MVh, MVc) | D20 | Since the unit of the output value (MV) is ×0.1%, store K1000 using a real number value. |
| | D21 | |
| Real number for conversion of output value for heating/cooling (MVh, MVc) to digital value | D22 | Since the voltage value (0 to 5V) is output in this program, store the maximum digital value K16000 using a real number value. |
| | D23 | |
| Auto tuning completion flag | M2 | Flag that turns on when auto tuning starts and ends completely |
| Digital value (CH1) | SD6660 | FX5-4DA-ADP(CH1) digital value |
| Analog output value monitor (CH1) | SD6662 | FX5-4DA-ADP(CH1) analog output value monitor |
| Output value for heating (MVh) (real number) | D24 | Store the output value for heating (MVh) (after conversion to real number). |
| | D25 | |
| Output value for heating (MVh) (0.00 to 1.00) | D26 | Store the value obtained after conversion of the output value for heating (MVh) from a value in the range 0 to 1000 to a value the range 0.00 to 1.00. |
| | D27 | |
| Digital value for heating (real number) | D28 | Store the digital value for heating obtained by calculation using a real number value. |
| | D29 | |
| Digital value (CH2) | SD6700 | FX5-4DA-ADP(CH2) digital value |
| Analog output value monitor (CH2) | SD6702 | FX5-4DA-ADP(CH2) analog output value monitor |
| Output value for cooling (MVc) (real number) | D30 | Store the output value for cooling (MVc) (after conversion to real number). |
| | D31 | |
| Output value for cooling (MVc) (0.00 to 1.00) | D32 | Store the value obtained after conversion of the output value for cooling (MVc) from a value in the range 0 to 1000 to a value in the range 0.00 to 1.00. |
| | D33 | |
| Digital value for cooling (real number) | D34 | Store the digital value for cooling obtained by calculation using a real number value. |
| | D35 | |

• Program example

Set use permission for the FX5-4AD-TC-ADP(CH1), which was set as the process value (SD6300) when the state was changed from STOP to RUN, and configure settings for the FX5-4DA-ADP(CH1, 2). After PID control starts, perform conversion to the digital values (0 to 16000) to be output to the control target by using the output values for heating and cooling (MVh, MVc), and obtain the analog output values (SD6662, SD6702). Turn on the auto tuning completion flag when auto tuning is completed.

After writing the parameter settings and program to the CPU module, turn X1 (Auto tuning used/not used) on and turn X0 (PID control execution command) on, and auto tuning + PID control can be executed.



# Troubleshooting

## Troubleshooting with devices

Data on an error detected by the heating-cooling PID control function are stored into the devices set to the parameters "PID control function error indication" and "PID control function error code".
"1: Error occurrence" is written to the device set in "PID Control Function Error Display" when an error occurs, and the corresponding error code is written to the device set in "PID Control Function Error Code".
When an error occurs, either control is stopped, or control continues by rounding values. The execution status of the PID control function can be checked with the device set in the "PID Control Execution Status" parameter.
By monitoring the devices set above using the engineering tool and others, the execution status of PID control, error status, and error details can be checked. (An error cannot be checked if no device is set to the parameters.)



## When a hardware failure occurs

If a hardware failure occurs in a module connected to the programmable controller, check the hardware manual for the connected module.

## Error code overview

The error codes of errors that occur in this function are as follows.

| Error code | Description | Reference |
|---|---|---|
| PID control continuation error (8100H to 8124H) | A PID control continuation error is a minor error, and even if it occurs, PID control can continue; therefore, depending on the content of the error, control is continued by changing the device values for parameters and others. | Page 890 Error codes of errors in PID control via parameter (8100H to 8230H) |
| PID control stop error (8200H to 8230H) | A PID control stop error is a major error, and if it occurs, PID control cannot continue easily; therefore, PID control is stopped immediately when it occurs.<br>If a PID control stop error occurs, the device values for the following parameters are cleared.<br>• Set off to the control output.<br>• Clear the output value (MV), output value for heating (MVh), and output value for cooling (MVc) to 0.<br>• Set off to the temperature rise judgment flag.<br>• Set off to the PID control execution status.<br>• Set off to the auto tuning execution status. | |

# Precautions

## PID control affected by the constant scan setting

Since PID control is executed in END processing, depending on the constant scan setting (0.2 to 2000ms), a delay may occur in the sampling time or the control output cycle (heating control output cycle, cooling control output cycle), preventing stable PID control. If PID control is not stable, check the constant scan time setting.

## Multiple settings for PID control

For PID control, four settings can be configured at the same time. When devices are set in all parameters for which device indirect specification is possible, the number of devices to be used becomes 28 at maximum per one setting, and 112 at maximum for four settings. Ensure that no device duplication occurs in parameter settings.

## When setting parameters

Parameters cannot be written in any of the following cases. Be careful when setting parameters.

- If a device already set elsewhere is set
- If an item required to be set is not set

## Simultaneous use with another function

The scan time may become longer depending on another function. If the setting for the sampling time or control output cycle is not large enough in relation to the scan time, stable PID control may not be possible. Either check and correct the setting for the sampling time or control output cycle, or correct another function to be executed together.

## When the operating status of the CPU module is set to PAUSE

While the PID control execution command is set to on, if the operating status of the CPU module is set to PAUSE, a PID control stop error occurs, and this function stops. If the CPU module is set to PAUSE, set the CPU module to STOP once, and then set it to RUN.

For details on the devices to be cleared when a PID control stop error occurs, refer to the following.

☞ Page 645 Error code overview

## When the setting value of a parameter is changed during control execution

Even if the setting value of a parameter is changed during control execution, the change is not applied to the control immediately. The change will be applied to the control in the sampling time cycle. Also, if the setting value of the sampling time is changed, the change will be applied at the timing of the sampling cycle before the change.

### ■When a setting value is changed during auto tuning execution

If a setting value of the parameter corresponding to the auto tuning stop conditions[*1] is changed during auto tuning execution, a PID control stop error will occur, causing auto tuning to stop (the other setting values will not be changed even if a change is attempted).

*1 For the auto tuning stop conditions, refer to the following.

☞ Page 623 Execution and stop conditions for auto tuning

### ■When the setting value of a parameter is changed during PID control execution

If the setting value of a parameter is changed as shown below during PID control execution, a PID control continuation error will occur. As a result, the parameter will be rounded to a value within the range, and PID control will continue.

- When the setting value of a parameter is changed to a value outside the range
- When the settings are changed to make "Sampling time ≥ Control output cycle (heating control output cycle/cooling control output cycle)"
- When the settings are changed to make "(Sampling time × 10) > Derivative time"
- When the settings are changed to make "Upper limit output limiter ≤ Lower limit output limiter"

If the setting value of a parameter is changed as shown below during PID control execution, a PID control continuation error will occur, and PID control will continue.

- When the magnitude relationship between the target value and the ambient temperature setting is changed
- When the settings are changed so that the "target value ± adjustment sensitivity (dead band)" is the lower limit measurement value or less or the upper limit measurement value or more.
- When the settings are changed to make "Control output cycle (heating control output cycle/cooling control output cycle) < Scan time"

If the setting value of a parameter is changed as shown below during PID control execution, PID control will continue without generating an error. However, the operation is not performed based on the set value.

- When the settings are changed to make "Sampling time < Scan time"



# 36.7 Procedure to Execute the Built-in Analog Function

The procedure to execute the built-in analog function is described below.

***1.*** Confirm the specifications of the built-in analog function.

Confirm the specifications of the built-in analog function. (☞ Page 544 Specifications)

***2.*** Connect the CPU module to the external device.

Wiring to external devices. (☞ Page 647 Wiring)

***3.*** Set the parameters.

Set the parameters to configure the built-in analog function. (☞ Page 648 Parameter Setting)

***4.*** Create the program.

Create the program to use the built-in analog function.

***5.*** Run the program.

## Precautions

Do not write to the special relay/special register in the user interrupt program.

# 36.8 Wiring

For details on the wiring, refer to the following manual.

MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)

# 36.9 Parameter Setting

Set the parameters of each channel.

Setting parameters here eliminates the need to program them.

**Point**

Parameters are enabled when the CPU module is powered ON or after a reset. In addition, operations different from the parameter settings are possible by transferring values to special relays and special registers while changing these values in the program.

Refer to ☞ Page 776 Special Relay List or ☞ Page 803 Special Register List for details on the special relays and special registers.

## Basic settings (analog input)

### Setting procedure

Open "Basic Settings" of the GX Works3.

***1.*** Start Module parameter.

Navigation window ⇨ [Parameter] ⇨ Module model name ⇨ [Module Parameter] ⇨ [Analog Input] ⇨ [Basic Settings]

#### Window

| Item | CH1 | CH2 |
|---|---|---|
| ⊟ *A/D Conversion Enable/Disable Setting Function* | **Set AD conversion control method.** | |
| A/D Conversion Enable/Disable Setting | Disable | Disable |
| ⊟ **A/D Conversion Method** | **Set AD conversion control method.** | |
| Average Processing Specify | Sampling | Sampling |
| Time Average Counts Average Moving Average | 0 Times | 0 Times |

#### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| A/D Conversion Enable/Disable Setting | Set whether to "enable" or "disable" A/D conversion value output. | • Enable<br>• Disable | Disable |
| Average Processing Specify | Execute whether to set "average process" or "sampling processing". | • Sampling<br>• Time Average<br>• Count Average<br>• Moving average | Sampling |
| Time Average Counts Average Moving average | Set time average, count average, moving average counts during specifying average process for each channel. | User-defined value for the allowable setting range | 0 |

***2.*** Click the item to be changed to enter the setting value.

• Item where a value is selected from the pull-down list

Click [▼] button of the item to be set, and from the pull-down list that appears, select the value.

• Item where a value is entered into the text box

Double-click the item to be set to enter the numeric value.

# Application settings (analog input)

## Setting procedure

Open "Application Settings" of the GX Works3.

**1.** Start Module parameter.

Navigation window ⇨ [Parameter] ⇨ Module model name ⇨ [Module Parameter] ⇨ [Analog Input] ⇨ [Application Settings]

### Window

| Item | CH1 | CH2 |
|---|---|---|
| ***Warning Output Function*** | **Execute the setting related to warning at A/D conversion.** | |
| Process Alarm Warning Setting | Disable | Disable |
| Process Alarm Upper Upper Limit Value | 0 | 0 |
| Process Alarm Upper Lower Limit Value | 0 | 0 |
| Process Alarm Lower Upper Limit Value | 0 | 0 |
| Process Alarm Lower Lower Limit Value | 0 | 0 |
| **Over Scale Detection** | **Execute the setting related to analog input value detection which exceeds the setting ra** | |
| Over Scale Detection Enable/Disable | Enable | Enable |
| **Scaling Setting** | **Execute the setting related to scaling at A/D conversion.** | |
| Scaling Enable/Disable | Disable | Disable |
| Scaling Upper Limit Value | 0 | 0 |
| Scaling Lower Limit Value | 0 | 0 |
| **Shift Function** | **Execute the setting related to shift function at A/D conversion.** | |
| Shifting Amount | 0 | 0 |
| **Digital Clip Setting** | **Execute the setting related to digital clip function at A/D conversion.** | |
| Digital Clip Enable/Disable | Disable | Disable |

### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Process Alarm Warning Setting | Set whether to "enable" or "disable" process alarm warning. | • Enable<br>• Disable | Disable |
| Process Alarm Upper Upper Limit Value | Set the upper upper limit value of the digital output value. | -32768 to +32767 | 0 |
| Process Alarm Upper Lower Limit Value | Set the upper lower limit value of the digital output value. | -32768 to +32767 | 0 |
| Process Alarm Lower Upper Limit Value | Set the lower upper limit value of the digital output value. | -32768 to +32767 | 0 |
| Process Alarm Lower Lower Limit Value | Set the lower lower limit value of the digital output value. | -32768 to +32767 | 0 |
| Over Scale Detection Enable/Disable | Set whether to "enable" or "disable" over scale detection. | • Enable<br>• Disable | Enable |
| Scaling Enable/Disable | Set whether to "enable" or "disable" scaling. | • Enable<br>• Disable | Disable |
| Scaling Upper Limit Value | Set scaling conversion upper limit value. | -32768 to +32767 | 0 |
| Scaling lower limit value | Set scaling conversion lower limit value. | -32768 to +32767 | 0 |
| Shifting Amount | Set shifting amount for shifting function. | -32768 to +32767 | 0 |
| Digital Clip Enable/Disable | Set whether to "enable" or "disable" digital clip. | • Enable<br>• Disable | Disable |

**2.** Click the item to be changed to enter the setting value.

• Item where a value is selected from the pull-down list

Click [▼] button of the item to be set, and from the pull-down list that appears, select the value.

• Item where a value is entered into the text box

Double-click the item to be set to enter the numeric value.

# Basic settings (analog output)

## Setting procedure

Open "Basic Settings" of the GX Works3.

***1.*** Start Module parameter.

Navigation window ⇨ [Parameter] ⇨ Module model name ⇨ [Module Parameter] ⇨ [Analog Output] ⇨ [Basic Settings]

### Window

| Item | CH |
|---|---|
| ***D/A Conversion Enable/Disable Setting Function*** | **Set D/A conversion control method.** |
| D/A Conversion Enable/Disable Setting | Disable |
| **D/A Output Enable/Disable Setting** | **Set D/A output conversion control method.** |
| D/A Output Enable/Disable Setting | Disable |

### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| D/A Conversion Enable/Disable Setting | Set whether to "enable" or "disable" D/A conversion. | • Enable<br>• Disable | Disable |
| D/A Output Enable/Disable Setting | Set whether to "enable" or "disable" D/A output. | • Enable<br>• Disable | Disable |

***2.*** Click the item to be changed to enter the setting value.

• Item where a value is selected from the pull-down list

Click [▼] button of the item to be set, and from the pull-down list that appears, select the value.

• Item where a value is entered into the text box

Double-click the item to be set to enter the numeric value.

# Application settings (analog input)

## Setting procedure

Open "Application Settings" of the GX Works3.

***1.*** Start Module parameter.

Navigation window ⇨ [Parameter] ⇨ Module model name ⇨ [Module Parameter] ⇨ [Analog Output] ⇨ [Application Settings]

### Window

| Item | |
|---|---|
| ***Warning Output Function*** | **Execute the setting related to warning at D/A conversion.** |
| Warning Output Setting | Disable |
| Warning Upper Limit Value | 0 |
| Warning Lower Limit Value | 0 |
| **Scaling Setting** | **Execute the setting related to scaling at D/A conversion.** |
| Scaling Enable/Disable | Disable |
| Scaling Upper Limit Value | 0 |
| Scaling Lower Limit Value | 0 |
| **Shift Function** | **Execute the setting related to shift function at D/A conversion.** |
| Shift Value to Conversion Value | 0 |
| **Analog Output HOLD/CLEAR Setting** | **It can be set whether to HOLD the last value, setting value or C** |
| HOLD/CLEAR Setting | CLEAR |
| HOLD Setting Value | 0 |

### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Warning Output Setting | Set whether to "enable" or "disable" warning output. | • Enable<br>• Disable | Disable |
| Warning Upper Limit value | Set the upper limit value of the digital input value for warning output. | -32768 to +32767 | 0 |
| Warning Lower Limit value | Set the lower limit value of the digital input value for warning output. | -32768 to +32767 | 0 |
| Scaling Enable/Disable | Set whether to "enable" or "disable" scaling. | • Enable<br>• Disable | Disable |
| Scaling Upper Limit Value | Set scaling conversion upper limit value. | -32768 to +32767 | 0 |
| Scaling lower limit value | Set scaling conversion lower limit value. | -32768 to +32767 | 0 |
| Shift Value to Conversion Value | Set shifting amount for shifting function. | -32768 to +32767 | 0 |
| HOLD/CLEAR Setting | Set output status at CLEAR or HOLD. | • CLEAR<br>• Previous Value (Hold)<br>• Setting Value | CLEAR |
| HOLD Setting Value | Set a digital value to be output at HOLD when "Setting Value" is selected in "HOLD/CLEAR Setting". | -32768 to +32767 | 0 |

***2.*** Click the item to be changed to enter the setting value.

• Item where a value is selected from the pull-down list

Click [▼] button of the item to be set, and from the pull-down list that appears, select the value.

• Item where a value is entered into the text box

Double-click the item to be set to enter the numeric value.

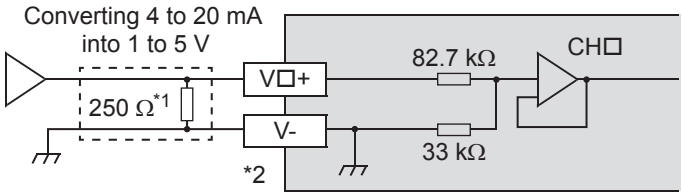
# 36.10 How to Use Analog Inputs Built in CPU Module for Current Inputs

The analog input of the built-in analog can be used as the current input (4 to 20 mA DC) for the FX5U CPU module.

## Method of use with the current input (4 to 20 mA DC)

The FX5U CPU module is designed to handle only voltage inputs. However, the FX5U CPU module can be used for current inputs by connecting a 250 Ω resistor (precise resistance: 0.5%) between the V☐+ terminal and the V- terminal.

### ■Example of wiring




CH No. goes in ☐ of V☐+, CH☐.

*1 Instead of a 250 Ω resistor, a 500 Ω resistor can be connected in parallel. When selecting a resistor, consider the maximum input current.

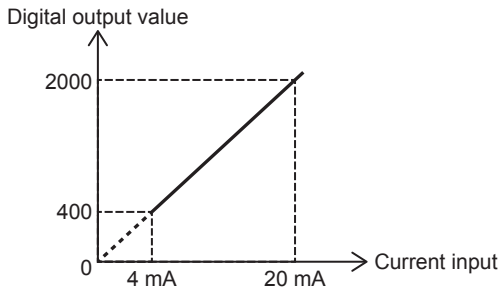
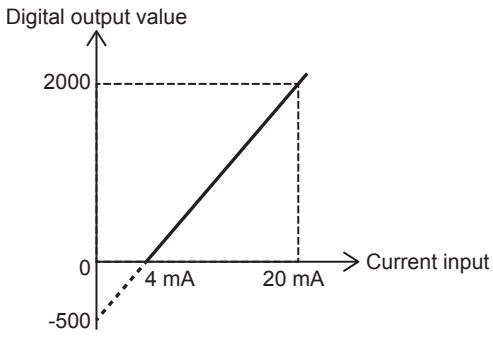
*2 For unused channels, short-circuit the "V☐+" and "V-" terminals.

### ■Specifications

| Item | Specifications |
|---|---|
| Analog input | 4 to 20 mA DC |
| Digital output value | 400 to 2000*1 |
| Resolution | 10 μA |
| Absolute maximum input | -2 mA, +60 mA |

*1 The digital output value can be changed using the scaling function.

### ■Example of using the scaling signal

| Default characteristics (Upper limit value: 4000, lower limit value: 0) | Characteristics converted by the scaling function (When the upper limit value and the lower limit value are set to 4500 and -500 respectively) |
|---|---|
|  |  |





For details of the scaling function, refer to ☞ Page 554 Scaling function.

# 37 ANALOG ADAPTERS

This chapter describes analog adapters.

The following analog adapters are available.

| Product | Model | Function | Description |
|---|---|---|---|
| Analog I/O expansion adapter | FX5-4A-ADP | Analog input<br>Analog output | This analog adapter connects to the CPU module, captures two points of voltage/current, and outputs the two points of voltage/current.<br>A/D-converted values are written to special register areas assigned to each channel.<br>D/A-converted analog data are output when values are set to special register areas assigned to each channel.<br>• System configuration: ☞ Page 654 System Configuration<br>• Power supply specifications: ☞ Page 654 Power supply specifications<br>Performance specifications: ☞ Page 655 Analog input, analog output<br>• Procedures before operation: ☞ Page 663 Procedure to Operate the System<br>• Functions: ☞ Page 664 Analog input<br>☞ Page 666 Analog output<br>☞ Page 669 Others<br>• Parameter settings: ☞ Page 762 Parameter Setting<br>• Troubleshooting: ☞ Page 771 Troubleshooting |
| Analog input expansion adapter | FX5-4AD-ADP | Analog input | This analog adapter connects to the CPU module and captures four points of voltage/current.<br>A/D-converted values are written to special register areas assigned to each channel.<br>• System configuration: ☞ Page 654 System Configuration<br>• Power supply specifications: ☞ Page 654 Power supply specifications<br>Performance specifications: ☞ Page 655 Analog input specifications<br>• Procedures before operation: ☞ Page 663 Procedure to Operate the System<br>• Functions: ☞ Page 664 Analog input<br>☞ Page 669 Others<br>• Parameter settings: ☞ Page 762 Parameter Setting<br>• Troubleshooting: ☞ Page 771 Troubleshooting |
| Analog output expansion adapter | FX5-4DA-ADP | Analog output | This analog adapter connects to the CPU module and outputs four points of voltage/current.<br>D/A-converted analog data are output when values are set to special register areas assigned to each channel.<br>• System configuration: ☞ Page 654 System Configuration<br>• Power supply specifications: ☞ Page 654 Power supply specifications<br>Performance specifications: ☞ Page 655 Analog output specifications<br>• Procedures before operation: ☞ Page 663 Procedure to Operate the System<br>• Functions: ☞ Page 666 Analog output<br>☞ Page 669 Others<br>• Parameter settings: ☞ Page 762 Parameter Setting<br>• Troubleshooting: ☞ Page 771 Troubleshooting |
| RTD temperature sensor input expansion adapter | FX5-4AD-PT-ADP | Temperature sensor input | This analog adapter connects to the CPU module and captures the temperature of four resistance temperature detectors.<br>Temperature converted values are written to special register areas assigned to each channel.<br>• System configuration: ☞ Page 654 System Configuration<br>• Power supply specifications: ☞ Page 654 Power supply specifications<br>Performance specifications: ☞ Page 656 Specifications of temperature sensor input (for resistance temperature detector)<br>• Procedures before operation: ☞ Page 663 Procedure to Operate the System<br>• Functions: ☞ Page 668 Temperature sensor input<br>☞ Page 669 Others<br>• Parameter settings: ☞ Page 762 Parameter Setting<br>• Troubleshooting: ☞ Page 771 Troubleshooting |
| Thermocouple temperature sensor input expansion adapter | FX5-4AD-TC-ADP | Temperature sensor input | This analog adapter connects to the CPU module and captures the temperature of four thermocouples.<br>Temperature converted values are written to special register areas assigned to each channel.<br>• System configuration: ☞ Page 654 System Configuration<br>• Power supply specifications: ☞ Page 654 Power supply specifications<br>Performance specifications: ☞ Page 656 Specifications of temperature sensor input (for thermocouple)<br>• Procedures before operation: ☞ Page 663 Procedure to Operate the System<br>• Functions: ☞ Page 668 Temperature sensor input<br>☞ Page 669 Others<br>• Parameter settings: ☞ Page 762 Parameter Setting<br>• Troubleshooting: ☞ Page 771 Troubleshooting |

# 37.1 System Configuration

This section describes the system configuration including analog adapters.

The maximum number of analog adapters that can be connected is shown below.

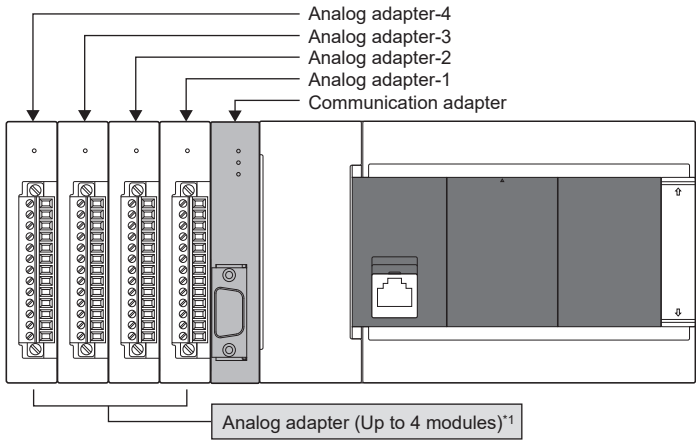
| CPU module | Maximum number of connectable analog adapters |
|---|---|
| FX5S/FX5U/FX5UC CPU module | Four*1 |
| FX5UJ CPU module | Two |

*1 For FX5-4A-ADP with serial number 223**** or earlier, the maximum number of connectable modules is 2.

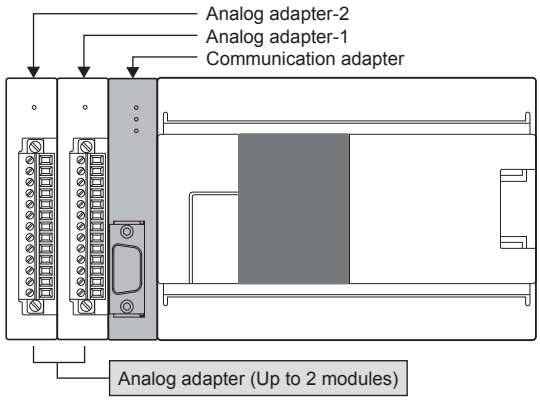
The connection position of the analog adapter connected to each CPU module are counted as the first module, the second module, and so on in order of proximity to the CPU module.

However, communication adapters are not counted towards the number of analog adapters.

**FX5S/FX5U/FX5UC CPU module (The figure shows the FX5U CPU module.)**




**FX5UJ CPU module**




*1 For FX5-4A-ADP with the serial number 223**** or earlier, the maximum number of connectable modules is 2.

# 37.2 Specifications

This section describes the specifications.

## Generic specifications

For general specifications, refer to the following manual.

MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)

## Power supply specifications

Power supply specifications is shown below.

| Item | | Specification | | | | |
|---|---|---|---|---|---|---|
| | | FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP |
| External power supply*1 | Power supply voltage | 24VDC +20%/-15% | — | 24VDC +20%/-15% | — | |
| | Current consumption | 100mA | — | 160mA | — | |
| Internal power supply*2 | Power supply voltage | 5VDC | 5VDC, 24VDC | 5VDC | 5VDC, 24VDC | |
| | Current consumption | 10mA | 5VDC: 10mA<br>24VDC: 20mA | 10mA | 5VDC: 10mA<br>24VDC: 20mA | |

*1 External electric supply is carried out from the power supply connector of an adapter.

*2 Internal electric supply is carried out from the power capacity of the CPU module.

# Performance specifications

Performance specifications is shown below.

## Analog input, analog output

### ■Analog input specifications

| Item | | | Specification | |
|---|---|---|---|---|
| | | | FX5-4A-ADP | FX5-4AD-ADP |
| Number of analog input points | | | 2 points (CH1, CH2) | 4 points (CH1, CH2, CH3, CH4) |
| Analog input voltage | | | -10 to +10VDC (input resistance value 1MΩ) | |
| Analog input current | | | -20 to +20mA DC (input resistance value 250Ω) | |
| Digital output value | | | 14-bit binary value | |
| Input characteristics | Voltage | 0 to 10V | 0 to 16000 | |
| | | 0 to 5V | 0 to 16000 | |
| | | 1 to 5V | 0 to 12800 | |
| | | -10 to +10V | -8000 to +8000 | |
| | Current | 0 to 20mA | 0 to 16000 | |
| | | 4 to 20mA | 0 to 12800 | |
| | | -20 to +20mA | -8000 to +8000 | |
| Resolution | Voltage | 0 to 10V | 625μV | |
| | | 0 to 5V | 312.5μV | |
| | | 1 to 5V | 312.5μV | |
| | | -10 to +10V | 1250μV | |
| | Current | 0 to 20mA | 1.25μA | |
| | | 4 to 20mA | 1.25μA | |
| | | -20 to +20mA | 2.5μA | |
| Accuracy (accuracy for the full scale of the digital output value) | | | Ambient temperature 25±5℃: Within ±0.1% (±16 digits)<br>Ambient temperature 0 to 55℃: Within ±0.2% (±32 digits)<br>Ambient temperature -20 to 0℃*1: Within ±0.3% (±48 digits) | |
| Absolute maximum input | | | Voltage: ±15V, Current: ±30mA | |

*1 This specification does not apply to the FX5-4AD-ADP manufactured before June 2016.

For the input conversion characteristic, refer to the ☞ Page 657 Input conversion characteristics.

### ■Analog output specifications

| Item | | | Specification | |
|---|---|---|---|---|
| | | | FX5-4A-ADP | FX5-4DA-ADP |
| Number of analog output points | | | 2 points (CH3, CH4) | 4 points (CH1, CH2, CH3, CH4) |
| Digital input | | | 14-bit binary value | |
| Analog output voltage | | | -10 to +10V DC (external load resistance value 1k to 1MΩ) | |
| Analog output current | | | 0 to 20mA DC (external load resistance value 0 to 500Ω) | |
| Output characteristics | Voltage | 0 to 10V | 0 to 16000 | |
| | | 0 to 5V | 0 to 16000 | |
| | | 1 to 5V | 0 to 16000 | |
| | | -10 to +10V | -8000 to +8000 | |
| | Current | 0 to 20mA | 0 to 16000 | |
| | | 4 to 20mA | 0 to 16000 | |
| Resolution | Voltage | 0 to 10V | 625μV | |
| | | 0 to 5V | 312.5μV | |
| | | 1 to 5V | 250μV | |
| | | -10 to +10V | 1250μV | |
| | Current | 0 to 20mA | 1.25μA | |
| | | 4 to 20mA | 1μA | |

| Item | Specification | |
|---|---|---|
| | FX5-4A-ADP | FX5-4DA-ADP |
| Accuracy (accuracy for the full scale of the digital output value) | Ambient temperature 25±5℃: Within ±0.1% (voltage ±20mV, current ±20μA)<br>Ambient temperature 0 to 55℃: Within ±0.2% (voltage ±40mV, current ±40μA)<br>Ambient temperature -20 to 0℃: Within ±0.3% (voltage ±60mV, current ±60μA) | Ambient temperature 25±5℃: Within ±0.1% (voltage ±20mV, current ±20μA)<br>Ambient temperature -20 to 55℃*1: Within ±0.2% (voltage ±40mV, current ±40μA) |

*1 The ambient temperature is 0 to 55℃ for products manufactured before June 2016.

For the output conversion characteristic, refer to the ☞ Page 659 Output conversion characteristics.

### ■Common specifications

| Item | Specification | | |
|---|---|---|---|
| | FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP |
| Conversion speed*1*2 | • When the FX5S CPU module is used<br>Maximum 2.2ms<br>• When the FX5UJ/FX5U/FX5UC CPU module is used<br>Maximum 2.0ms | • When the FX5S CPU module is used<br>Maximum 500μs<br>• When the FX5UJ/FX5U/FX5UC CPU module is used<br>Maximum 450μs | • When the FX5S CPU module is used<br>Maximum 1100μs<br>• When the FX5UJ/FX5U/FX5UC CPU module is used<br>Maximum 950μs |
| Number of occupied I/O points | 0 point (This number is not related to the maximum number of I/O points of the programmable controller.) | | |

*1 Data is updated every operation cycle.

*2 The conversion speed is constant regardless of the number of channels being used.

## Temperature sensor input

### ■Specifications of temperature sensor input (for resistance temperature detector)

| Item | | | Specification | |
|---|---|---|---|---|
| | | | Celsius (℃) | Fahrenheit (℉) |
| Number of analog input points | | | 4 points (CH1, CH2, CH3, CH4) | |
| Usable resistance temperature detector*1 | | | Pt100 (JIS C 1604-1997, JIS C 1604-2013)<br>Ni100 (DIN 43760 1987) | |
| Temperature measuring range | | Pt100 | -200 to +850℃ | -328 to +1562℉ |
| | | Ni100 | -60 to +250℃ | -76 to +482℉ |
| Digital output value | | — | 16-bit signed binary | |
| | | Pt100 | -2000 to +8500 | -3280 to +15620 |
| | | Ni100 | -600 to +2500 | -760 to +4820 |
| Accuracy | Ambient temperature 25±5℃ | Pt100 | ±0.8℃ | |
| | | Ni100 | ±0.4℃ | |
| | Ambient temperature -20 to 55℃ | Pt100 | ±2.4℃ | |
| | | Ni100 | ±1.2℃ | |
| Resolution | | | 0.1℃ | 0.1 to 0.2℉ |
| Conversion speed | | | Approx. 85 ms/channel*2 | |
| Number of occupied I/O points | | | 0 point (This number is not related to the maximum number of I/O points of the programmable controller.) | |

*1 An usable resistance temperature detector is 3-wire type only.

*2 For details of the conversion speed, refer to ☞ Page 737 Temperature conversion method.

### ■Specifications of temperature sensor input (for thermocouple)

| Item | Specification | |
|---|---|---|
| | Celsius (℃) | Fahrenheit (℉) |
| Number of analog input points | 4 points (CH1, CH2, CH3, CH4) | |
| Usable thermocouple | K, J, T, B, R, S (JIS C 1602-1995) | |

| Item | | | Specification | |
|---|---|---|---|---|
| | | | Celsius (℃) | Fahrenheit (℉) |
| Temperature measuring range | | K | -200 to +1200℃ | -328 to +2192℉ |
| | | J | -40 to +750℃ | -40 to +1382℉ |
| | | T | -200 to +350℃ | -328 to +662℉ |
| | | B | 600 to 1700℃ | 1112 to 3092℉ |
| | | R | 0 to 1600℃ | 32 to 2912℉ |
| | | S | 0 to 1600℃ | 32 to 2912℉ |
| Digital output value | | — | 16-bit signed binary | |
| | | K | -2000 to +12000 | -3280 to +21920 |
| | | J | -400 to +7500 | -400 to +13820 |
| | | T | -2000 to +3500 | -3280 to +6620 |
| | | B | 6000 to 17000 | 11120 to 30920 |
| | | R | 0 to 16000 | 320 to 29120 |
| | | S | 0 to 16000 | 320 to 29120 |
| Accuracy*1 | Ambient temperature 25±5℃ | K | ±3.7℃ (-100 to +1200℃)*2, ±4.9℃ (-150 to -100℃)*2, ±7.2℃ (-200 to -150℃)*2 | |
| | | J | ±2.8℃ | |
| | | T | ±3.1℃ (0 to 350℃)*2, ±4.1℃ (-100 to 0℃)*2, ±5.0℃ (-150 to -100℃)*2, ±6.7℃ (-200 to -150℃)*2 | |
| | | B | ±3.5℃ | |
| | | R | ±3.7℃ | |
| | | S | ±3.7℃ | |
| | Ambient temperature -20 to 55℃ | K | ±6.5℃ (-100 to +1200℃)*2, ±7.5℃ (-150 to -100℃)*2, ±8.5℃ (-200 to -150℃)*2 | |
| | | J | ±4.5℃ | |
| | | T | ±4.1℃ (0 to 350℃)*2, ±5.1℃ (-100 to 0℃)*2, ±6.0℃ (-150 to -100℃)*2, ±7.7℃ (-200 to -150℃)*2 | |
| | | B | ±6.5℃ | |
| | | R | ±6.5℃ | |
| | | S | ±6.5℃ | |
| Resolution | K, J, T | | 0.1℃ | 0.1 to 0.2℉ |
| | B, R, S | | 0.1 to 0.3℃ | 0.1 to 0.6℉ |
| Conversion speed | | | Approx. 85 ms/channel*3 | |
| Number of occupied I/O points | | | 0 point (This number is not related to the maximum number of I/O points of the programmable controller.) | |

*1 A 45-minute warm-up (energization) is required to satisfy the accuracy condition.
*2 The accuracy differs depending on the ranges of the measured temperature in ().
*3 For details of the conversion speed, refer to ☞ Page 737 Temperature conversion method.

# Input conversion characteristics

• FX5-4A-ADP, FX5-4AD-ADP

The input conversion characteristic of A/D conversion is the slope of a straight line connecting the offset value and gain value when converting analog input (voltage or current) from outside the programmable controller into a digital value.

## Voltage input characteristic

The following shows the list of the analog input ranges and the graphs of each voltage input characteristic, at the voltage input.

| No. | Input range setting | Offset value | Gain value | Digital output value*1 | Resolution |
|---|---|---|---|---|---|
| (1) | 0 to 10V | 0V | 10 V | 0 to 16000 | 625μV |
| (2) | 0 to 5V | 0V | 5 V | 0 to 16000 | 312.5μV |
| (3) | 1 to 5V | 1V | 5 V | 0 to 12800 | 312.5μV |
| (4) | -10 to +10V | 0V | 10 V | -8000 to +8000 | 1250μV |

*1 If the analog input exceeds the digital output value range, the digital output value is fixed at the maximum or minimum value.

| Input range setting | Digital output value | |
|---|---|---|
| | Maximum | Maximum |
| 0 to 10V | -384 | 16383 |

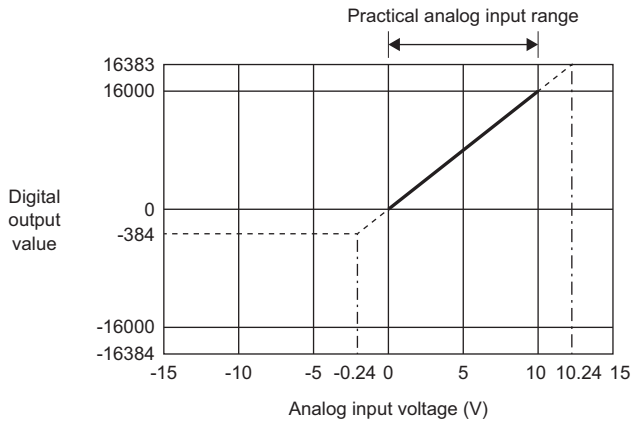
| Input range setting | Digital output value | |
|---|---|---|
| | Maximum | Maximum |
| 0 to 5V | -384 | 16383 |
| 1 to 5V | -3584 | 13183 |
| -10 to +10V | -8192 | 8191 |

**Point**

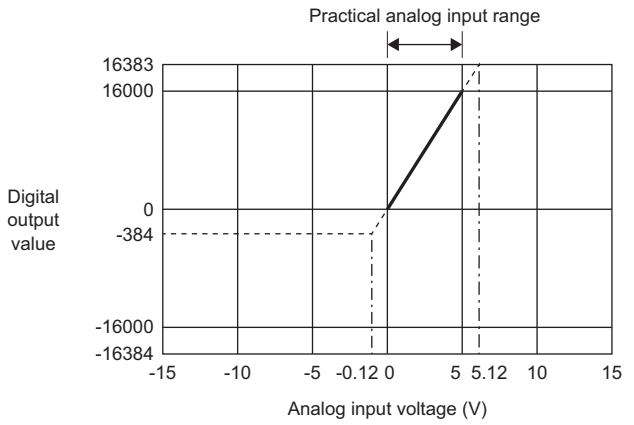
- Use a value within the analog input practical range and digital output practical range of each input range. If the values are out of the range, the resolution and accuracy may not fall within the range of the performance specifications. (Avoid using the dotted line part of the voltage input characteristic graph.)
- Do not set the voltage over ±15 V. Doing so can cause breakdown of the products.

### ■Voltage input characteristic graph

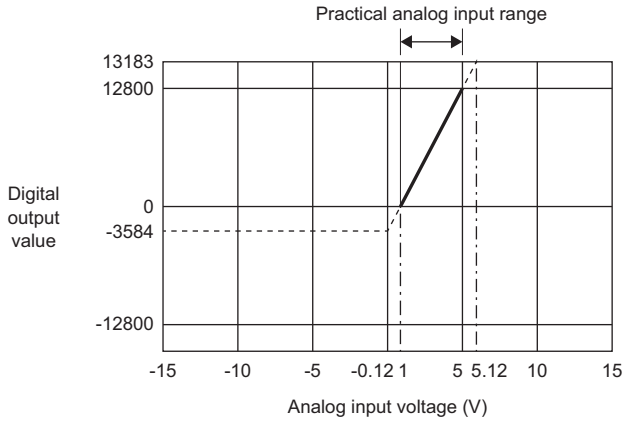
**0 to 10V**



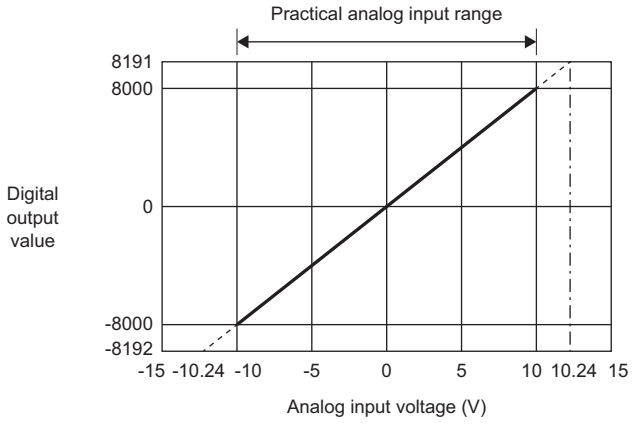

**0 to 5V**




**1 to 5V**




**-10 to +10V**




## Current input characteristic

The following shows the list of the analog input ranges and the graph of each current input characteristic, at the current input.

| No. | Input range setting | Offset value | Gain value | Digital output value*1 | Resolution |
|---|---|---|---|---|---|
| (1) | 0 to 20mA | 0mA | 20 mA | 0 to 16000 | 1.25μA |
| (2) | 4 to 20mA | 4mA | 20 mA | 0 to 12800 | 1.25μA |
| (3) | -20 to +20mA | 0mA | 20 mA | -8000 to +8000 | 2.5μA |

*1 If the analog input exceeds the digital output value range, the digital output value is fixed at the maximum or minimum value.

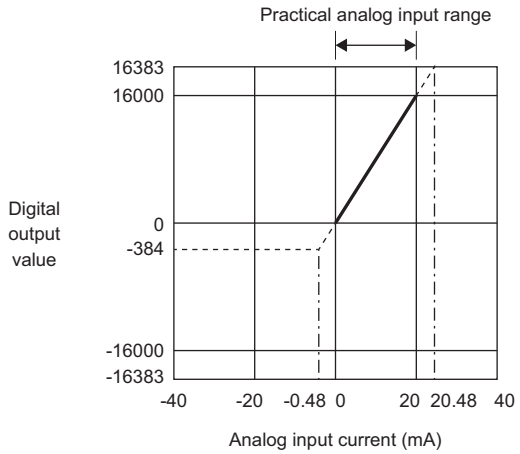
| Input range setting | Digital output value | |
|---|---|---|
| | Maximum | Maximum |
| 0 to 20mA | -384 | 16383 |
| 4 to 20mA | -3584 | 13183 |
| -20 to +20mA | -8192 | 8191 |

**Point**

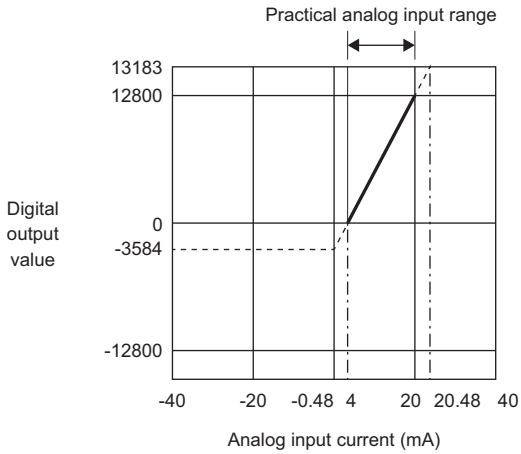
- Use a value within the analog input practical range and digital output practical range of each input range. If the values are out of the range, the resolution and accuracy may not fall within the range of the performance specifications. (Avoid using the dotted line part of the current input characteristic graph.)
- Do not set the voltage over ±30 mA. Doing so can cause breakdown of the products.

### ■Current input characteristic graph

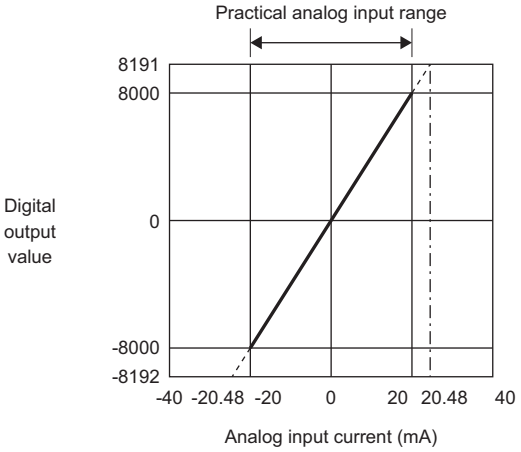
**0 to 20mA**




**4 to 20mA**




**-20 to +20mA**




# Output conversion characteristics

- FX5-4A-ADP, FX5-4DA-ADP

The output conversion characteristic of D/A conversion is the slope of a straight line connecting the offset value and gain value when converting the digital value written from the CPU module to analog output (voltage or current).

## Voltage output characteristic

The following shows the list of the analog output ranges and the graphs of each voltage output characteristic, at the voltage output.

| No. | Output range setting | Offset value | Gain value | Digital value*1 | Resolution |
|---|---|---|---|---|---|
| (1) | 0 to 10V | 0V | 10 V | 0 to 16000 | 625μV |
| (2) | 0 to 5V | 0V | 5 V | 0 to 16000 | 312.5μV |
| (3) | 1 to 5V | 1V | 5 V | 0 to 16000 | 250μV |
| (4) | -10 to +10V | 0V | 10 V | -8000 to +8000 | 1250μV |

*1 If the input exceeds the digital value range, the digital value is fixed at the maximum or minimum value.

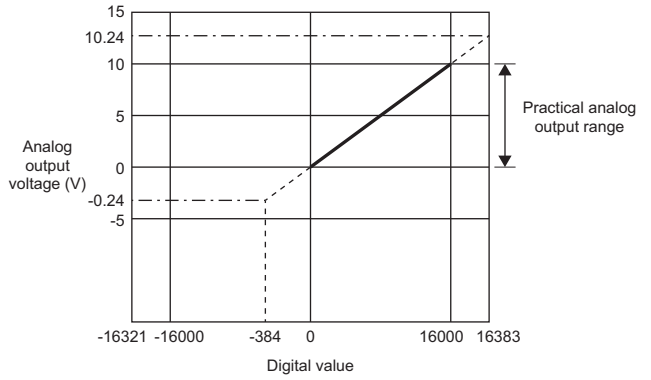
| Output range setting | Digital value | |
|---|---|---|
| | Maximum | Maximum |
| 0 to 10V | -384 | 16383 |
| 0 to 5V | -384 | 16383 |
| 1 to 5V | -384 | 16383 |
| -10 to +10V | -8192 | 8191 |

**Point**

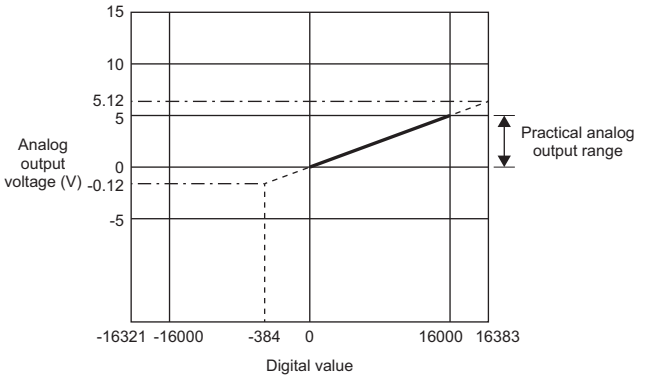
Use a value within the digital input practical range and analog output practical range of each output range. If the values are out of the range, the resolution and accuracy may not fall within the range of the performance specifications. (Avoid using the dotted line part of the voltage output characteristic graph.)

### ■Voltage output characteristic graph

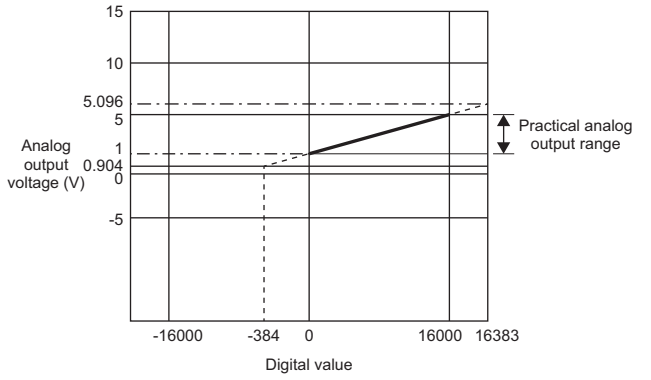
**0 to 10V**



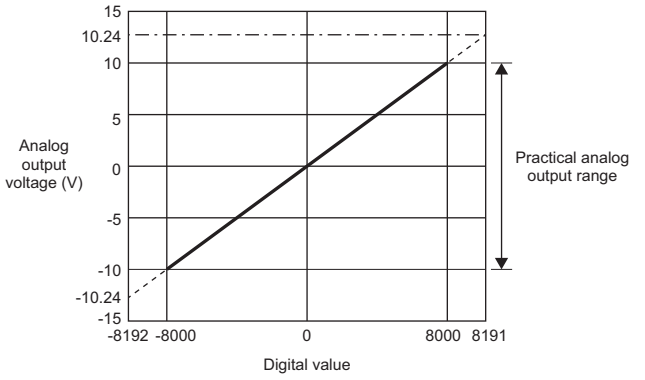

**0 to 5V**




**1 to 5V**




**-10 to +10V**




## Current output characteristic

The following shows the list of the analog output ranges and the graphs of each current output characteristic, at the current output.

| No. | Output range setting | Offset value | Gain value | Digital value*1 | Resolution |
|---|---|---|---|---|---|
| (1) | 0 to 20mA | 0mA | 20 mA | 0 to 16000 | 1.25μA |
| (2) | 4 to 20mA | 4mA | 20 mA | 0 to 16000 | 1μA |

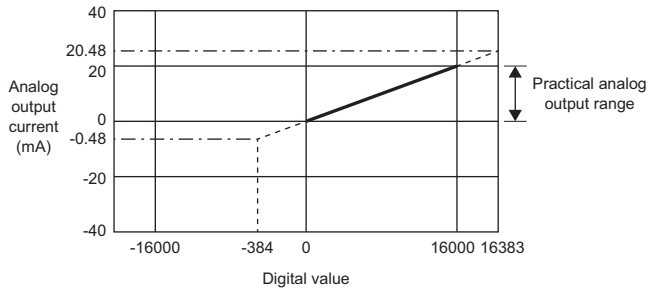
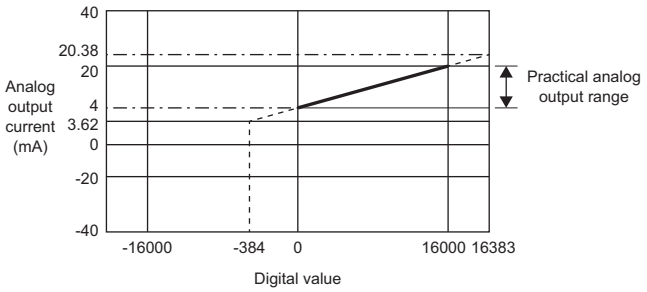
*1 If the input exceeds the digital value range, the digital value is fixed at the maximum or minimum value.

| Output range setting | Digital value | |
|---|---|---|
| | Maximum | Minimum |
| 0 to 20mA | -384 | 16383 |
| 4 to 20mA | -384 | 16383 |

**Point**

Use a value within the digital input practical range and analog output practical range of each output range. If the values are out of the range, the resolution and accuracy may not fall within the range of the performance specifications. (Avoid using the dotted line part of the current output characteristic graph.)

### ■Current output characteristic graph

| 0 to 20mA | 4 to 20mA |
|---|---|
|  |  |







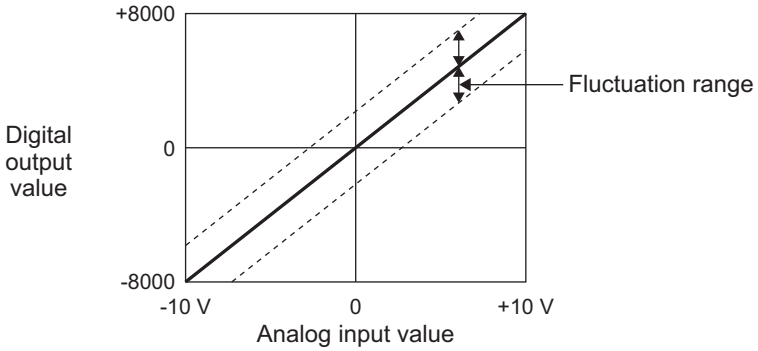
# Accuracy

## Analog input accuracy

Accuracy of A/D conversion is determined by the accuracy for the full scale of digital output value.

An input characteristic change through changes of the offset/gain setting or the input range does not sacrifice the accuracy, which is maintained within the described range of the performance specifications.

The following graph shows the fluctuation range of accuracy when the range of -10V to +10V is selected.





The accuracy will be as shown below depending on the operating ambient temperature. (Except for the conditions under the influence of noise)

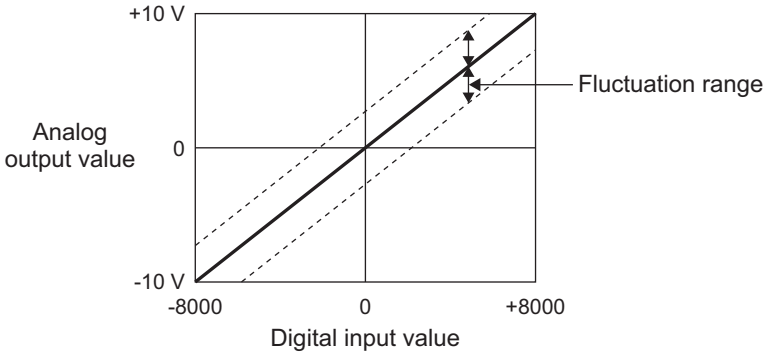
| Item | Specification |
|---|---|
| Ambient temperature 25±5℃ | ±0.1% (±16 digits) |
| Ambient temperature 0 to 55℃ | ±0.2% (±32 digits) |
| Ambient temperature -20 to 0℃ | ±0.3% (±48 digits) |

## Analog output accuracy

Accuracy of D/A conversion is determined by the accuracy for the full scale of analog output value.

An output characteristic change through changes of the offset/gain setting or the output range does not sacrifice the accuracy, which is maintained within the described range of the performance specifications.

The following graph shows the fluctuation range of accuracy when the range of -10V to +10V is selected.




The accuracy will be as shown below depending on the operating ambient temperature. (Except for the conditions under the influence of noise)

| Item | Specification | |
|---|---|---|
| | FX5-4A-ADP | FX5-4DA-ADP |
| Ambient temperature 25±5℃ | ±0.1% (±20mV) | ±0.1% (±20mV) |
| Ambient temperature 0 to 55℃ | ±0.2% (±40mV) | ±0.2% (±40mV) |
| Ambient temperature -20 to 0℃ | ±0.3% (±60mV) | |

## Temperature sensor input accuracy

• FX5-4AD-PT-ADP

Accuracy of resistance temperature detector (including cable) is not included.

The accuracy specifications may not be satisfied temporarily when affected by noise.

| Item | | Specification |
|---|---|---|
| Ambient temperature 25±5℃ | Pt100 | ±0.8% |
| | Ni100 | ±0.4% |
| Ambient temperature -20 to 55℃ | Pt100 | ±2.4% |
| | Ni100 | ±1.2% |

• FX5-4AD-TC-ADP

Does not include the accuracy of the thermocouple and the compensating conductor.

The accuracy specifications may not be satisfied temporarily when affected by noise.

| Item | | Specification |
|---|---|---|
| Ambient temperature 25±5℃ | K | ±3.7℃ (-100 to +1200℃)*1, ±4.9℃ (-150 to -100℃)*1, ±7.2℃ (-200 to -150℃)*1 |
| | J | ±2.8℃ |
| | T | ±3.1℃ (0 to 350℃)*1, ±4.1℃ (-100 to 0℃)*1, ±5.0℃ (-150 to -100℃)*1, ±6.7℃ (-200 to -150℃)*1 |
| | B | ±3.5℃ |
| | R | ±3.7℃ |
| | S | ±3.7℃ |
| Ambient temperature -20 to 55℃ | K | ±6.5℃ (-100 to +1200℃)*1, ±7.5℃ (-150 to -100℃)*1, ±8.5℃ (-200 to -150℃)*1 |
| | J | ±4.5℃ |
| | T | ±4.1℃ (0 to 350℃)*1, ±5.1℃ (-100 to 0℃)*1, ±6.0℃ (-150 to -100℃)*1, ±7.7℃ (-200 to -150℃)*1 |
| | B | ±6.5℃ |
| | R | ±6.5℃ |
| | S | ±6.5℃ |

*1 The accuracy differs depending on the ranges of the measured temperature in ().

# 37.3 Procedure to Operate the System

The procedure to operate the system is described below.

***1.*** Check the specifications of the analog adapter.

Check the specifications of the analog adapter. (☞ Page 654 Specifications)

***2.*** Check the system configuration.

Check the system configuration. (☞ Page 654 System Configuration)

***3.*** Install the analog adapter.

For restrictions on installation with the CPU module, combination of analog adapters, and order of connection, refer to the following manual.

📖MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)

***4.*** Connect the system to the external device.

Wiring to external devices. (☞ Page 663 Wiring)

***5.*** Set the parameters.

Set the parameters such as analog adapter setting. (☞ Page 762 Parameter Setting)

***6.*** Create the program.

Create the program to use the analog adapter.

***7.*** Run the program.

### Precautions

Do not write to the special relay/special register in the user interrupt program.

# 37.4 Wiring

This section describes the wiring.

### European-type terminal block

For wiring to European-type terminal blocks, refer to the following.

📖MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)

### Terminal layout

For the terminal layout, refer to the following.

📖MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)

### Power supply wiring, analog wiring

For the power supply wiring, analog input wiring, analog output wiring, resistance temperature detector wiring, and thermocouple wiring, refer to the following.

📖MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)

### Grounding

For grounding, refer to the following.

📖MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)

# 37.5 List of Functions

The following table lists the functions list.

**Point**

In the following explanation, the icons below indicate whether the corresponding analog adapter can be used in each function. (The functions cannot be used by analog adapters marked with ×.)

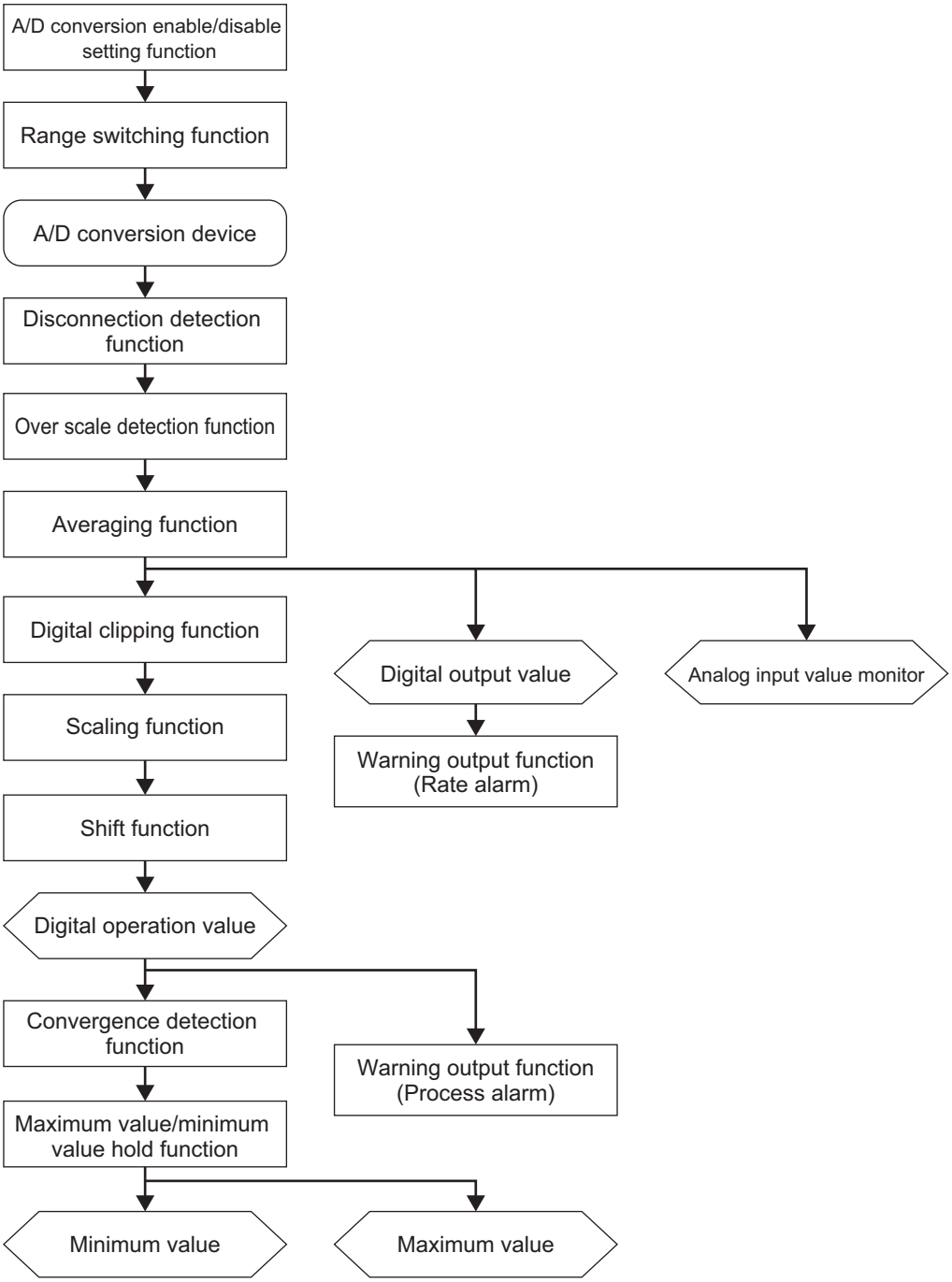

## Analog input

○: Supported, ×: Not supported

| Item | | Description | Availability | | Reference |
|---|---|---|---|---|---|
| | | | FX5-4A-ADP | FX5-4AD-ADP | |
| A/D conversion enable/disable setting function | | Controls whether to enable or disable the A/D conversion for each channel. | ○ | ○ | Page 670 |
| Range switching function | | Allows switching the input range of an analog input for each channel. Switching the range makes it possible to change the input conversion characteristics. | ○ | ○ | Page 671 |
| A/D conversion method | Sampling processing | Sequentially A/D-converts the analog input values and stores the digital output values in a special register. | ○ | ○ | Page 673 |
| | Averaging processing | Averages the digital output values for each channel and stores the average value in a special register. The following three types of averaging processing are provided.<br>• Time average<br>• Count average<br>• Moving average | | | |
| Disconnection detection function | | Disconnection can be detected for each channel. | ○ | ○ | Page 676 |
| Over scale detection function | | Function to detect analog input values that exceed an input range. | ○ | ○ | Page 678 |
| Digital clipping function | | Fixes a digital operation value to the maximum or minimum value of digital operation value output range when an input current or voltage exceeds the input range. | ○ | ○ | Page 680 |
| Scaling function | | Scales the digital output value within a range between the specified scaling upper limit value and scaling lower limit value. This function reduces the time and effort to create a program of the scale conversion. | ○ | ○ | Page 682 |
| Warning output function | Process alarm | Outputs a warning when a digital operation value enters the preset alarm output range. | ○ | ○ | Page 686 |
| | Rate alarm | Outputs a warning when the change rate of a digital output value is equal to or greater than the rate alarm upper limit value, or equal to or smaller than the rate alarm lower limit value. | | | |
| Shift function | | Adds (shifts) the set conversion value shift amount to the digital output value and stores the result in the digital operation value. When the conversion value shift amount is changed, the change will be reflected in the digital operation value in real time, allowing fine adjustments to be easily performed during system startup. | ○ | ○ | Page 693 |
| Convergence detection function | | Detects whether the digital operation value is within a certain range for a specified time. | ○ | ○ | Page 695 |
| Maximum value/minimum value hold function | | Stores the maximum value and minimum value of the digital operation value to the special registers for each channel. | ○ | ○ | Page 697 |

| Item | Description | Availability | | Reference |
|---|---|---|---|---|
| | | FX5-4A-ADP | FX5-4AD-ADP | |
| Deviation detection between channel function | Detects whether there is a difference of more than a certain level in digital operation values between channels. | ○ | ○ | Page 698 |
| Offset/gain setting function | Corrects errors in digital output value. | ○ | ○ | Page 701 |
| Offset/gain initialization function | Initializes the offset and gain values in the built-in memory. | ○ | ○ | Page 706 |

The functions are processed in the order shown below.



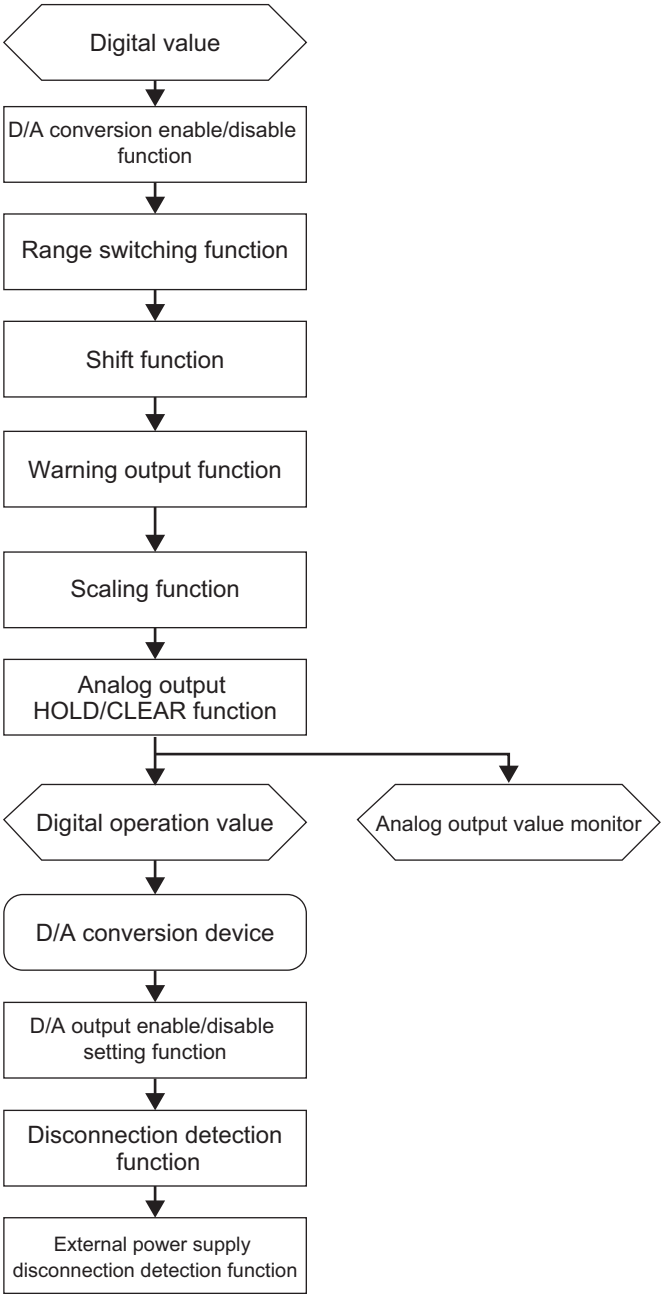

| Item | Description |
|---|---|
| Digital output value | A digital value obtained by applying sampling processing or various types of averaging processing. |
| Digital operation value | A value obtained by operating a digital output value using the digital clipping function, scaling function, or shift function. When any of the functions is not used, the same value as the digital output value is stored. |
| Analog input value monitor | The input analog value is displayed. Voltage and current are displayed in the following units. Voltage: mV, Current: μA |
| Maximum and minimum values | Stores the maximum and minimum values of the digital operation values. |

## Analog output

○: Supported, ×: Not supported

| Item | Description | Availability | | Reference |
|---|---|---|---|---|
| | | FX5-4A-ADP | FX5-4DA-ADP | |
| D/A conversion enable/disable setting function | Controls whether to enable or disable the D/A conversion for each channel. | ○ | ○ | Page 707 |
| Range switching function | Allows switching the output range of an analog output for each channel. Switching the range makes it possible to change the output conversion characteristics. | ○ | ○ | Page 708 |
| Shift function | Adds a set input value shifting amount to a digital value. | ○ | ○ | Page 709 |
| Warning output function | Outputs a warning when the digital value exceeds the warning output upper limit value or becomes less than the warning output lower limit value. | ○ | ○ | Page 711 |
| Scaling function | Performs scale conversion on digital values within a specified range between a scaling upper limit value and a scaling lower limit value. The program for scale conversion can be omitted. | ○ | ○ | Page 713 |
| Analog output HOLD/CLEAR function | Sets whether to hold (HOLD) or clear (CLEAR) the analog output value that was being output when the operation status of the CPU module is RUN, STOP, or a stop error. | ○ | ○ | Page 715 |
| D/A output enable/disable setting function | Specifies whether to output the D/A conversion value or offset value for each channel. The conversion speed is a constant, regardless of the output enable/disable status. | ○ | ○ | Page 716 |
| Disconnection detection function | Monitors the analog output value and detects a disconnection. | ○ | ○ | Page 717 |
| External power supply disconnection detection function | Detects that the external power supply 24 V DC is not supplied or is shut off. | ○ | ○ | Page 720 |
| Offset/gain setting function | Corrects errors in D/A conversion values for each channel. | ○ | ○ | Page 720 |
| Offset/gain initialization function | Initializes the offset and gain values in the built-in memory. | ○ | ○ | Page 725 |
| Analog Output Test when CPU Module is in STOP Status Function | Analog output tests can be carried out when the CPU module is in the STOP status. | ○ | ○ | Page 726 |

The functions are processed in the order shown below.



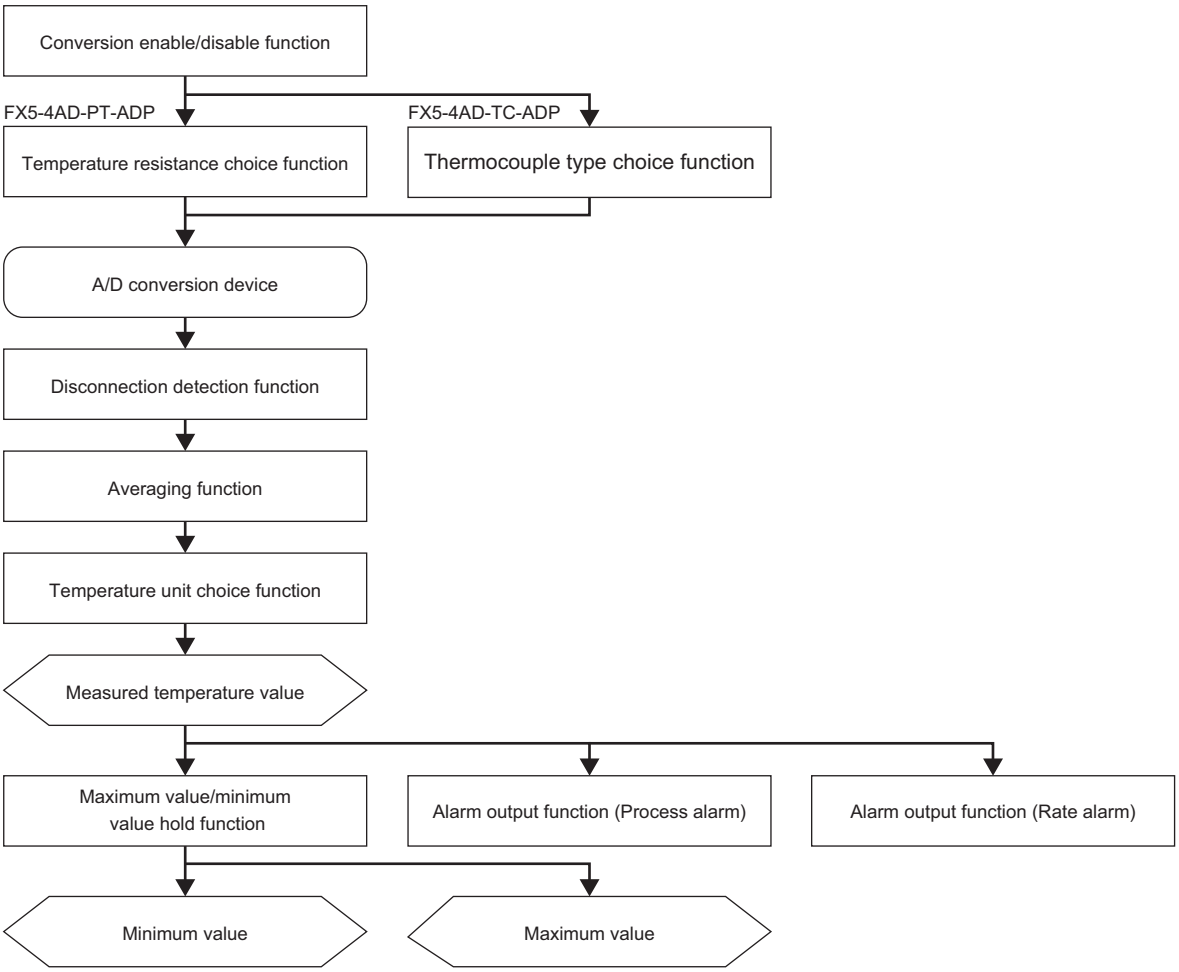

| Item | Description |
|---|---|
| Digital value | Stores the input digital value. |
| Digital operation value | A value obtained by operating a digital value using the scaling function or shift function. When any of the functions is not used, the same value as the digital value is stored. |
| Analog output value monitor | The output analog value is displayed. Voltage and current are displayed in the following units.<br>Voltage: mV, Current: μA |

## Temperature sensor input

○: Supported, ×: Not supported

| Function list | | Description | Availability | | Reference |
|---|---|---|---|---|---|
| | | | FX5-4A-PT-ADP | FX5-4AD-TC-ADP | |
| Conversion enable/disable function | | Sets whether to enable or disable the temperature conversion for each channel. Disabling the conversion on unused channels reduces the conversion cycles. | ○ | ○ | Page 728 |
| Temperature resistance choice function | | Sets a resistance temperature detector type for each channel. Selecting the resistance temperature detector type sets the input conversion characteristics. | ○ | × | Page 729 |
| Thermocouple type choice function | | Sets a thermocouple type for each channel. Selecting the thermocouple type sets the input conversion characteristics. | × | ○ | Page 731 |
| Disconnection detection function | | Performs disconnection detection for each channel. | ○ | ○ | Page 734 |
| Temperature conversion method | Sampling processing | Executes the temperature conversion on analog input every END processing and stores the result as a measured temperature value in the special registers. | ○ | ○ | Page 737 |
| | Averaging processing | Averages measured temperature values for each channel, and stores the average value in a special register. The following three types of averaging processing are provided.<br>• Time average<br>• Count average<br>• Moving average | | | |
| Temperature unit choice function | | Sets the temperature unit (Celsius/ Fahrenheit) for each analog adapter. | ○ | ○ | Page 740 |
| Maximum value/minimum value hold function | | Stores the maximum and minimum values of measured temperature values to the special registers for each channel. | ○ | ○ | Page 741 |
| Warning output function | Process alarm | Outputs an alarm when a measured temperature value enters the preset alarm output range. | ○ | ○ | Page 743 |
| | Rate alarm | Outputs an alert when the change of a measured temperature value is equal to or greater than the rate alarm upper limit value, or equal to or smaller than the rate alarm lower limit value. | | | |
| Offset/gain setting function | | Corrects errors in measured temperature value. | ○ | ○ | Page 750 |
| Offset/gain initialization function | | Initializes the offset and gain values in the built-in memory. | ○ | ○ | Page 756 |

The functions are processed in the order shown below.




| Item | Description |
|---|---|
| Measured temperature value | A digital value obtained by applying sampling processing and various types of averaging processing. |
| Maximum and minimum value | Stores the maximum and minimum values of the digital operation values. |

## Others

○: Supported, ×: Not supported

| Item | Description | Availability | | | | | Reference |
|---|---|---|---|---|---|---|---|
| | | FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP | |
| Event history function | Collects errors from the analog adapter, and stores them as event information in the CPU module. | ○ | ○ | ○ | ○ | ○ | Page 758 |
| Changing the setting value while the CPU module is operating | Changes the parameters set by the engineering tool by using the special device. | ○ | ○ | ○ | ○ | ○ | Page 758 |
| Starting/stopping the analog function in accordance with the CPU module status | The operation of the analog adapter can be checked by the CPU module. | ○ | ○ | ○ | ○ | ○ | Page 759 |
| Alarm clear request | Clears the alarm code. | ○ | ○ | ○ | ○ | ○ | Page 760 |

# 37.6 Functions (Analog Input)

This section describes the A/D conversion functions and the setting procedures for those functions using the GX Works3.

## A/D conversion enable/disable setting function

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

This function controls whether to enable or disable the A/D conversion for each channel.

### Operation

The analog input is converted only for channel(s) whose "A/D conversion enable/disable setting" is set to enable A/D conversion, and the values are stored in the digital output value, digital operation value, and analog input value monitor.
If "A/D conversion enable/disable setting" is changed from A/D conversion enable to A/D conversion disable, the digital value, digital operation value, and analog input value monitor will be cleared.

### Setting procedure

Set "A/D conversion enable/disable setting" to "A/D conversion enable" or "A/D conversion disable".

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Basic Settings" ⇨ "A/D Conversion Enable/Disable Setting Function"

### Corresponding devices

The devices which are used by the A/D conversion enable/disable setting function are listed below.

| Name | Connection part | Special relay | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3*1 | CH4*1 |
| A/D conversion enable/disable setting | 1st adapter | SM6301 | SM6341 | SM6381 | SM6421 |
| | 2nd adapter | SM6661 | SM6701 | SM6741 | SM6781 |
| | 3rd adapter | SM7021 | SM7061 | SM7101 | SM7141 |
| | 4th adapter | SM7381 | SM7421 | SM7461 | SM7501 |

*1 Only used by the FX5-4AD-ADP.

The details of the device used are listed below.

| Name | Description | Setting value | Display description | Default value | R/W |
|---|---|---|---|---|---|
| A/D conversion enable/disable setting | Set whether to enable or disable A/D conversion. | 0: OFF | A/D conversion enable | 1: ON | R/W |
| | | 1: ON | A/D conversion disable | | |

# Range switching function

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

This function allows switching the input range of an analog input for each channel.
Switching the range makes it possible to change the input conversion characteristics.

## Operation

The input range is switched when the "input range setting" is changed while the "A/D conversion enable/disable setting" is set to "disable".
When the input range is switched, the following special devices are initialized:

| Name | Connection part | Special relay/Special register | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3*1 | CH4*1 |
| A/D conversion completed flag | 1st adapter | SM6300 | SM6340 | SM6380 | SM6420 |
| | 2nd adapter | SM6660 | SM6700 | SM6740 | SM6780 |
| | 3rd adapter | SM7020 | SM7060 | SM7100 | SM7140 |
| | 4th adapter | SM7380 | SM7420 | SM7460 | SM7500 |
| Over scale upper limit detection flag | 1st adapter | SM6302 | SM6342 | SM6382 | SM6422 |
| | 2nd adapter | SM6662 | SM6702 | SM6742 | SM6782 |
| | 3rd adapter | SM7022 | SM7062 | SM7102 | SM7142 |
| | 4th adapter | SM7382 | SM7422 | SM7462 | SM7502 |
| Over scale lower limit detection flag | 1st adapter | SM6303 | SM6343 | SM6383 | SM6423 |
| | 2nd adapter | SM6663 | SM6703 | SM6743 | SM6783 |
| | 3rd adapter | SM7023 | SM7063 | SM7103 | SM7143 |
| | 4th adapter | SM7383 | SM7423 | SM7463 | SM7503 |
| Warning output flag (process alarm upper limit) | 1st adapter | SM6311 | SM6351 | SM6391 | SM6431 |
| | 2nd adapter | SM6671 | SM6711 | SM6751 | SM6791 |
| | 3rd adapter | SM7031 | SM7071 | SM7111 | SM7151 |
| | 4th adapter | SM7391 | SM7431 | SM7471 | SM7511 |
| Warning output flag (process alarm lower limit) | 1st adapter | SM6312 | SM6352 | SM6392 | SM6432 |
| | 2nd adapter | SM6672 | SM6712 | SM6752 | SM6792 |
| | 3rd adapter | SM7032 | SM7072 | SM7112 | SM7152 |
| | 4th adapter | SM7392 | SM7432 | SM7472 | SM7512 |
| Warning output flag (rate alarm upper limit) | 1st adapter | SM6315 | SM6355 | SM6395 | SM6435 |
| | 2nd adapter | SM6675 | SM6715 | SM6755 | SM6795 |
| | 3rd adapter | SM7035 | SM7075 | SM7115 | SM7155 |
| | 4th adapter | SM7395 | SM7435 | SM7475 | SM7515 |
| Warning output flag (rate alarm lower) | 1st adapter | SM6316 | SM6356 | SM6396 | SM6436 |
| | 2nd adapter | SM6676 | SM6716 | SM6756 | SM6796 |
| | 3rd adapter | SM7036 | SM7076 | SM7116 | SM7156 |
| | 4th adapter | SM7396 | SM7436 | SM7476 | SM7516 |
| Disconnection detection flag | 1st adapter | SM6318 | SM6358 | SM6398 | SM6438 |
| | 2nd adapter | SM6678 | SM6718 | SM6758 | SM6798 |
| | 3rd adapter | SM7038 | SM7078 | SM7118 | SM7158 |
| | 4th adapter | SM7398 | SM7438 | SM7478 | SM7518 |
| Convergence detection flag | 1st adapter | SM6321 | SM6361 | SM6401 | SM6441 |
| | 2nd adapter | SM6681 | SM6721 | SM6761 | SM6801 |
| | 3rd adapter | SM7041 | SM7081 | SM7121 | SM7161 |
| | 4th adapter | SM7401 | SM7441 | SM7481 | SM7521 |

| Name | Connection part | Special relay/Special register | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3*1 | CH4*1 |
| Deviation detection flag between channel | 1st adapter | SM6325 | SM6365 | SM6405 | SM6445 |
| | 2nd adapter | SM6685 | SM6725 | SM6765 | SM6805 |
| | 3rd adapter | SM7045 | SM7085 | SM7125 | SM7165 |
| | 4th adapter | SM7405 | SM7445 | SM7485 | SM7525 |
| Digital output value | 1st adapter | SD6300 | SD6340 | SD6380 | SD6420 |
| | 2nd adapter | SD6660 | SD6700 | SD6740 | SD6780 |
| | 3rd adapter | SD7020 | SD7060 | SD7100 | SD7140 |
| | 4th adapter | SD7380 | SD7420 | SD7460 | SD7500 |
| Digital operation value | 1st adapter | SD6301 | SD6341 | SD6381 | SD6421 |
| | 2nd adapter | SD6661 | SD6701 | SD6741 | SD6781 |
| | 3rd adapter | SD7021 | SD7061 | SD7101 | SD7141 |
| | 4th adapter | SD7381 | SD7421 | SD7461 | SD7501 |
| Analog input value monitor | 1st adapter | SD6302 | SD6342 | SD6382 | SD6422 |
| | 2nd adapter | SD6662 | SD6702 | SD6742 | SD6782 |
| | 3rd adapter | SD7022 | SD7062 | SD7102 | SD7142 |
| | 4th adapter | SD7382 | SD7422 | SD7462 | SD7502 |
| Maximum value | 1st adapter | SD6306 | SD6346 | SD6386 | SD6426 |
| | 2nd adapter | SD6666 | SD6706 | SD6746 | SD6786 |
| | 3rd adapter | SD7026 | SD7066 | SD7106 | SD7146 |
| | 4th adapter | SD7386 | SD7426 | SD7466 | SD7506 |
| Minimum value | 1st adapter | SD6307 | SD6347 | SD6387 | SD6427 |
| | 2nd adapter | SD6667 | SD6707 | SD6747 | SD6787 |
| | 3rd adapter | SD7027 | SD7067 | SD7107 | SD7147 |
| | 4th adapter | SD7387 | SD7427 | SD7467 | SD7507 |
| Offset setting value*2 | 1st adapter | SD6332 | SD6372 | SD6412 | SD6452 |
| | 2nd adapter | SD6692 | SD6732 | SD6772 | SD6812 |
| | 3rd adapter | SD7052 | SD7092 | SD7132 | SD7172 |
| | 4th adapter | SD7412 | SD7452 | SD7492 | SD7532 |
| Gain setting value*2 | 1st adapter | SD6333 | SD6373 | SD6413 | SD6453 |
| | 2nd adapter | SD6693 | SD6733 | SD6773 | SD6813 |
| | 3rd adapter | SD7053 | SD7093 | SD7133 | SD7173 |
| | 4th adapter | SD7413 | SD7453 | SD7493 | SD7533 |

*1 Only used by the FX5-4AD-ADP.

*2 When the input range setting after change is equivalent to the input range setting set by the offset/gain setting function, the values set by the offset/gain setting function are reflected. In any other case, they are initialized to the initial value.

## Setting procedure

Set the input range to be used in the "Input range setting".

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Basic Settings" ⇨ "Range switching function"

| Input range setting | Digital output value |
|---|---|
| 0 to 10V | 0 to 16000 |
| 0 to 5V | 0 to 16000 |
| 1 to 5V | 0 to 12800 |
| -10 to +10V | -8000 to +8000 |
| 0 to 20mA | 0 to 16000 |
| 4 to 20mA | 0 to 12800 |
| -20 to +20mA | -8000 to +8000 |

## Corresponding devices

The devices which are used by the range switching function are listed below.

| Name | Connection part | Special register | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3*1 | CH4*1 |
| Input range setting | 1st adapter | SD6305 | SD6345 | SD6385 | SD6425 |
| | 2nd adapter | SD6665 | SD6705 | SD6745 | SD6785 |
| | 3rd adapter | SD7025 | SD7065 | SD7105 | SD7145 |
| | 4th adapter | SD7385 | SD7425 | SD7465 | SD7505 |

*1 Only used by the FX5-4AD-ADP.

The details of the device used are listed below.

| Name | Description | Setting value | Description | Default value | R/W |
|---|---|---|---|---|---|
| Input range setting | Set the input range.<br>If a value other than the setting value is set, the range setting range error (error code: 1A8□H) occurs. | 0 | 0 to 10V | 0 | R/W |
| | | 1 | 0 to 5V | | |
| | | 2 | 1 to 5V | | |
| | | 3 | -10 to +10V | | |
| | | 4 | 0 to 20mA | | |
| | | 5 | 4 to 20mA | | |
| | | 6 | -20 to +20mA | | |

# A/D conversion method

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP ✕ | FX5-4AD-PT-ADP ✕ | FX5-4AD-TC-ADP ✕

An A/D conversion method can be set for each channel.

## Sampling processing

The analog input is A/D-converted in each scan of the CPU module, the converted value is output in digital at each time, and values are stored in the digital output value, digital operation value and analog input value monitor.

## Averaging processing

The module averages the digital output values for each channel and stores the average value in a special register.

The following three types of averaging processing are provided.

- Time average
- Count average
- Moving average

### ■Time average

A/D conversion is executed for a set time, the total value is averaged, and values are stored in the digital output value, digital operation value, and analog input value monitor.

The number of times of processing within the set time varies depending on the number of channels for which A/D conversion is enabled.

Number of processing times = Setting time ÷ Scan time

**Point**

If the set time is shorter than the scan time, the averaging processing is not executed, but the sampling value is output. However, only in the first output, the averaged value of the 1st sample and 2nd sample is output.

### ■Count average

A/D conversion is executed for a set number of times of count average, the averaged value excluding the maximum value and minimum value is output in digital, and values are stored in the digital output value, digital operation value, and analog input value monitor.

The time required to store the averaged value obtained by count average in the digital output value, digital operation value, and analog input value monitor varies depending on the scan time.

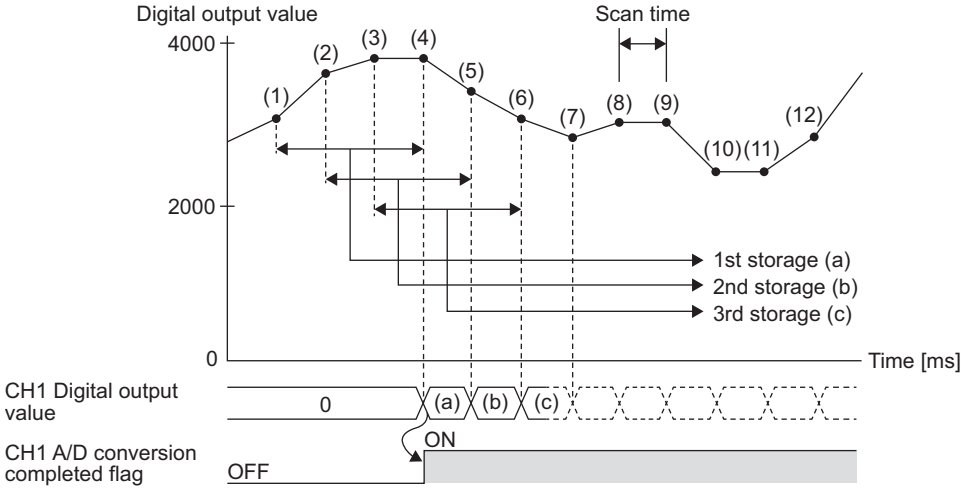
Processing time = Set number of times × Scan time

**Point**

The count average requires a total of at least two values excluding the maximum value and minimum value. Set the number of times to "4" or larger value.

### ■Moving average

The number of times of moving average processing of A/D conversion values can be specified, and the averaged value is output in digital, and values are stored in the digital output value, digital operation value, and analog input value monitor. Because the target range for averaging processing is moved in each scan and the averaging processing is executed using A/D conversion values for the set number of times, the latest digital output value, digital operation value, and analog input value monitor can be obtained. The figure below shows the moving average when the number of times of averaging processing is set to "4".




## Setting procedure

Set "Average Processing Specification".

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ "Basic Settings" ⇨ "A/D conversion method"

| Item | Description | Setting description | Default |
|---|---|---|---|
| Average processing setting | Selects the A/D conversion method. | • Sampling Processing<br>• Time Average<br>• Count Average<br>• Moving Average | Sampling Processing |
| Time Average Counts Average Moving Average*1 | Sets the time average. | 1 to 10000 (ms) | 0 |
| | Sets the count average. | 4 to 32767 (times) | 0 |
| | Sets the moving average. | 2 to 64 (times) | 0 |

*1 Set this item when "Time Average", "Count Average", or "Moving Average" is selected in "Average Processing Specification".

## Corresponding devices

The devices which are used by the A/D conversion method are listed below.

| Name | Connection part | Special register | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3*1 | CH4*1 |
| Digital output value | 1st adapter | SD6300 | SD6340 | SD6380 | SD6420 |
| | 2nd adapter | SD6660 | SD6700 | SD6740 | SD6780 |
| | 3rd adapter | SD7020 | SD7060 | SD7100 | SD7140 |
| | 4th adapter | SD7380 | SD7420 | SD7460 | SD7500 |
| Digital operation value | 1st adapter | SD6301 | SD6341 | SD6381 | SD6421 |
| | 2nd adapter | SD6661 | SD6701 | SD6741 | SD6781 |
| | 3rd adapter | SD7021 | SD7061 | SD7101 | SD7141 |
| | 4th adapter | SD7381 | SD7421 | SD7461 | SD7501 |
| Analog input value monitor | 1st adapter | SD6302 | SD6342 | SD6382 | SD6422 |
| | 2nd adapter | SD6662 | SD6702 | SD6742 | SD6782 |
| | 3rd adapter | SD7022 | SD7062 | SD7102 | SD7142 |
| | 4th adapter | SD7382 | SD7422 | SD7462 | SD7502 |
| Average processing specify | 1st adapter | SD6303 | SD6343 | SD6383 | SD6423 |
| | 2nd adapter | SD6663 | SD6703 | SD6743 | SD6783 |
| | 3rd adapter | SD7023 | SD7063 | SD7103 | SD7143 |
| | 4th adapter | SD7383 | SD7423 | SD7463 | SD7503 |
| Time Average/Count Average/Moving Average setting | 1st adapter | SD6304 | SD6344 | SD6384 | SD6424 |
| | 2nd adapter | SD6664 | SD6704 | SD6744 | SD6784 |
| | 3rd adapter | SD7024 | SD7064 | SD7104 | SD7144 |
| | 4th adapter | SD7384 | SD7424 | SD7464 | SD7504 |

*1 Only used by the FX5-4AD-ADP.

The details of the device used are listed below.

| Name | Description | Range | Default value | R/W |
|---|---|---|---|---|
| Digital output value | The A/D converted digital output value is stored.<br>The value is updated in every averaging processing cycle when the averaging processing is executed, or in every sampling cycle when the averaging processing is not executed. | -8192 to +16383 | 0 | R |
| Digital operation value | The digital operation value operated by the scaling function, shift function, and digital clipping function is stored.<br>The same value as the digital output value is stored when the scaling function, shift function, and digital clipping function are not used. | -32768 to +32767 | 0 | R |
| Analog input value monitor | The input analog value is stored.<br>The unit of analog value is mV for voltage input and μA for current input. | -20480 to +20479 | 0 | R |

| Name | Description | Setting value | Description | Default value | R/W |
|---|---|---|---|---|---|
| Average processing setting | Set which one between the sampling processing and the averaging processing is to be selected.<br>The averaging processing is classified into "time average", "count average" and "moving average".<br>If a value other than the set value is set, the averaging processing setting range error (error code: 1A0□H) occurs. | 0 | Sampling processing | 0 | R/W |
| | | 1 | Time average | | |
| | | 2 | Count average | | |
| | | 3 | Moving average | | |
| Time average/count average/moving average | Set the average time, average counts and moving average counts in the averaging processing for each channel.<br>If a value other than the set value is set, one of the following will occur and A/D conversion processing will be performed with the setting before the error.<br>• Average time setting range error (error code: 1A1□H)<br>• Average count setting range error (error code: 1A2□H)<br>• Moving average count setting range error (error code: 1A3□H) | 1 to 10000 (ms) | Time average | 0 | R/W |
| | | 4 to 32767 (times) | Count average | | |
| | | 2 to 64 (times) | Moving average | | |

# Disconnection detection function

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

Simple disconnection detection is performed.

This function is enabled when the analog input range is 1 to 5 V or 4 to 20 mA.

## Disconnection detection condition

The table below shows the disconnection detection condition and disconnection recovery condition.

| Input range | Disconnection detection condition | Disconnection recovery condition |
|---|---|---|
| 1 to 5V | Analog input value≤0.5 V | Analog input value > 0.5 V |
| 4 to 20mA | Analog input value≤2 mA | Analog input value > 2 mA |

## Operation

When the following conditions are met, a disconnection is determined, an alarm is generated, and the "disconnection detection flag" turns ON. (Alarm code: 0A0□H)

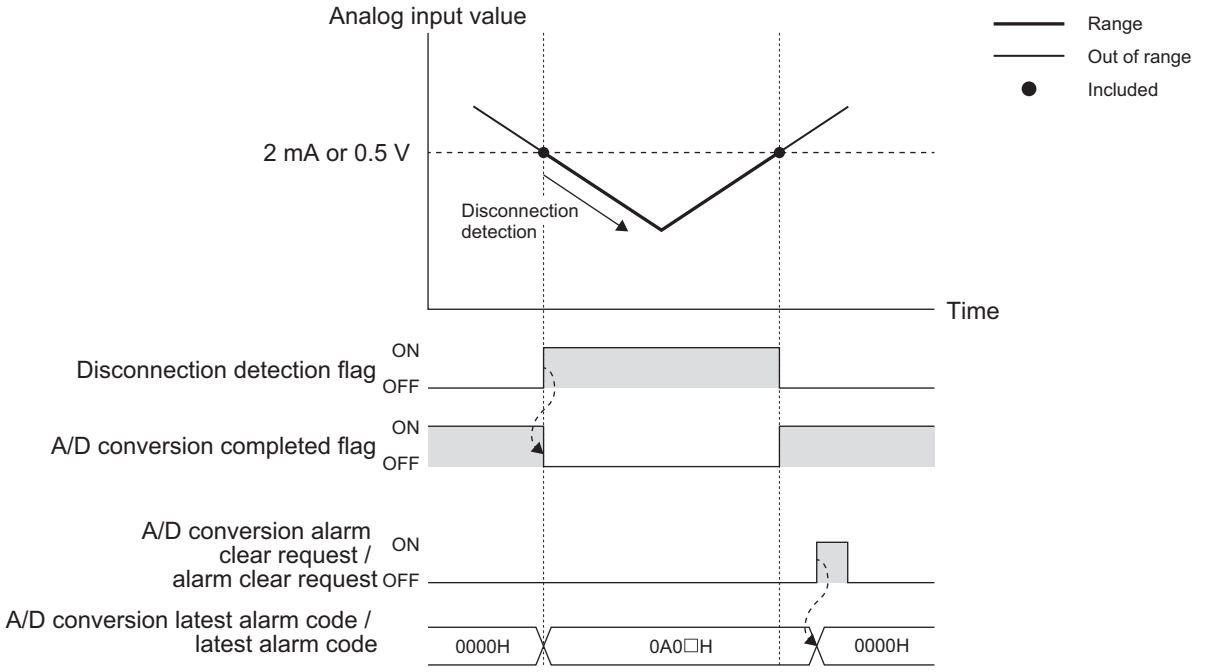
- For channels where A/D conversion is enabled in "A/D conversion enable/disable setting" and "disconnection detection enable/disable setting" is set to "enable", the input voltage or input current reaches their disconnection detection condition.

The A/D conversion completion flag" turns OFF, A/D conversion is interrupted, and the later processing is not executed in the disconnected channel.

- When the "disconnection recovery detection enable/disable setting" is set to "enable", the "disconnection detection flag" turns OFF when the channel is recovered from disconnection. When the channel is recovered from disconnection, A/D conversion is restarted.
- When the "disconnection recovery detection enable/disable setting" is set to "disable", the "disconnection detection flag" remains ON. To turn OFF "disconnection detection flag", it is necessary to turn ON "A/D conversion alarm clear request" ("Alarm clear request" for the FX5-4AD-ADP). The "disconnection detection flag" turns OFF also when the "disconnection detection enable/disable setting" is changed to "disable".

The range setting range error with disconnection detection enabled (Error code: 1AA□H) occurs when the input range of a channel for which the "disconnection detection enable/disable setting" is set to "enable" is set outside "1 to 5V" or "4 to 20mA".

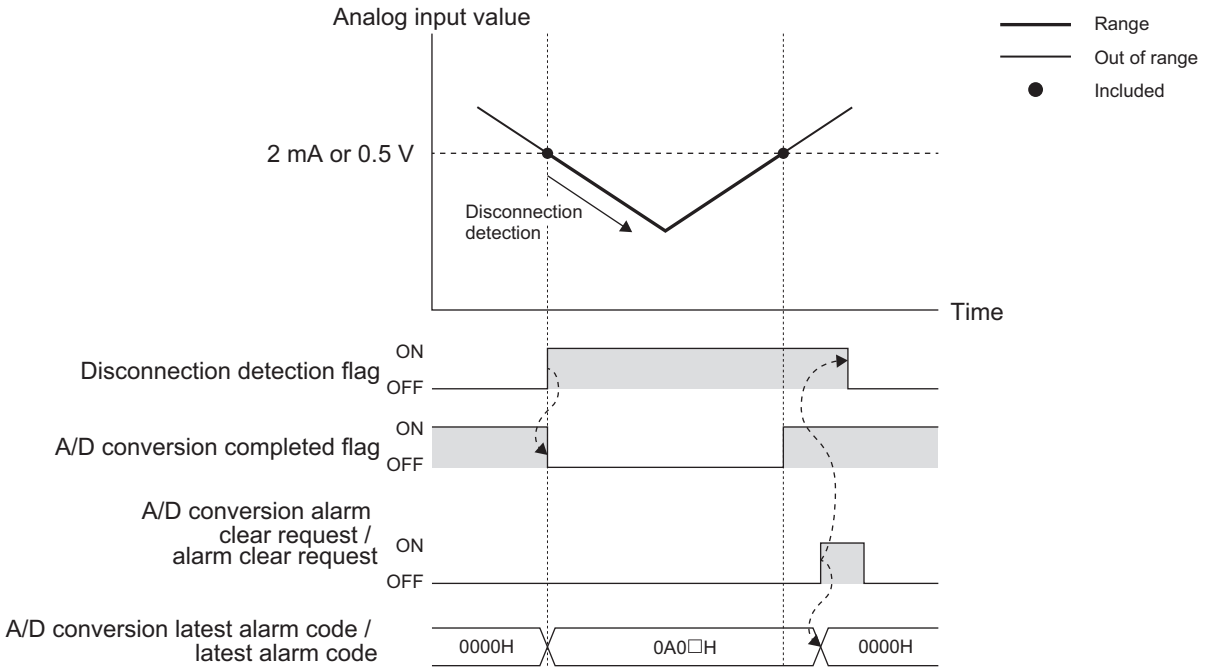
### ■When the "disconnection detection recovery enable/disable setting" is set to "enable"



**Point**

- The "disconnection detection flag" automatically turns OFF.
- To clear "A/D conversion latest alarm code", turn ON "A/D conversion alarm clear request" ("Alarm clear request" for the FX5-4AD-ADP).

### ■When the "disconnection detection recovery enable/disable setting" is set to "disable"




**Point**

- The "disconnection detection flag" does not automatically turns OFF. To turn OFF this flag, turn ON "A/D conversion alarm clear request" ("Alarm clear request" for the FX5-4AD-ADP).
- To clear "A/D conversion latest alarm code", turn ON "A/D conversion alarm clear request" ("Alarm clear request" for the FX5-4AD-ADP).

## Setting procedure

***1.*** Set "Disconnection detection enable/disable setting" to "Enable".

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Application Settings" ⇨ "Disconnection detection enable/disable setting"

***2.*** Set "Disconnection recovery detection enable/disable setting".

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Application Settings" ⇨ "Disconnection recovery detection enable/disable setting"

## Corresponding devices

The devices which are used by the disconnection detection function are listed below.

| Name | Connection part | Special relay | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3*1 | CH4*1 |
| Disconnection detection flag | 1st adapter | SM6318 | SM6358 | SM6398 | SM6438 |
| | 2nd adapter | SM6678 | SM6718 | SM6758 | SM6798 |
| | 3rd adapter | SM7038 | SM7078 | SM7118 | SM7158 |
| | 4th adapter | SM7398 | SM7438 | SM7478 | SM7518 |
| Disconnection detection enable/ disable setting | 1st adapter | SM6319 | SM6359 | SM6399 | SM6439 |
| | 2nd adapter | SM6679 | SM6719 | SM6759 | SM6799 |
| | 3rd adapter | SM7039 | SM7079 | SM7119 | SM7159 |
| | 4th adapter | SM7399 | SM7439 | SM7479 | SM7519 |
| Disconnection recovery detection enable/disable setting | 1st adapter | SM6320 | SM6360 | SM6400 | SM6440 |
| | 2nd adapter | SM6680 | SM6720 | SM6760 | SM6800 |
| | 3rd adapter | SM7040 | SM7080 | SM7120 | SM7160 |
| | 4th adapter | SM7400 | SM7440 | SM7480 | SM7520 |

*1 Only used by the FX5-4AD-ADP.

The details of the device used are listed below.

| Name | Description | Monitor value | Display description | Default value | R/W |
|---|---|---|---|---|---|
| Disconnection detection flag | This flag monitors the disconnection detection. | 0: OFF | Normal | 0: OFF | R |
| | | 1: ON | Disconnection detection | | |
| Disconnection detection enable/ disable setting | Set whether to enable or disable the disconnection detection function. | 0: OFF | Disconnection detection enable | 1: ON | R/W |
| | | 1: ON | Disconnection detection disable | | |
| Disconnection recovery detection enable/disable setting | Set whether to enable or disable the disconnection detection recovery. | 0: OFF | Disconnection recovery detection enable | 1: ON | R/W |
| | | 1: ON | Disconnection recovery detection disable | | |

# Over scale detection function

FX5-4A-ADP FX5-4AD-ADP FX5-4DA-ADP FX5-4AD-PT-ADP FX5-4AD-TC-ADP

This function detects analog input values that exceed an input range.

## Over-scale detection condition

The table below shows the condition for detecting over-scale when the over-scale detection function is enabled.

| Input range | Normal range | Over-scale detection condition | |
|---|---|---|---|
| | | Analog input value lower limit | Analog input value upper limit |
| 0 to 10V | -0.2 to +10.2V | -0.2V > Analog input value | +10.2V < Analog input value |
| 0 to 5V | -0.1 to +5.1V | -0.1V > Analog input value | +5.1V < Analog input value |
| 1 to 5V | -0.1 to +5.1V | -0.1V > Analog input value | +5.1V < Analog input value |
| -10 to +10V | -10.2 to +10.2V | -10.2V > Analog input value | +10.2V < Analog input value |
| 0 to 20mA | -0.4 to +20.4mA | -0.4mA > Analog input value | +20.4mA < Analog input value |
| 4 to 20mA | -0.4 to +20.4mA | -0.4mA > Analog input value | +20.4mA < Analog input value |
| -20 to +20mA | -20.4 to +20.4mA | -20.4mA > Analog input value | +20.4mA < Analog input value |

## Operation

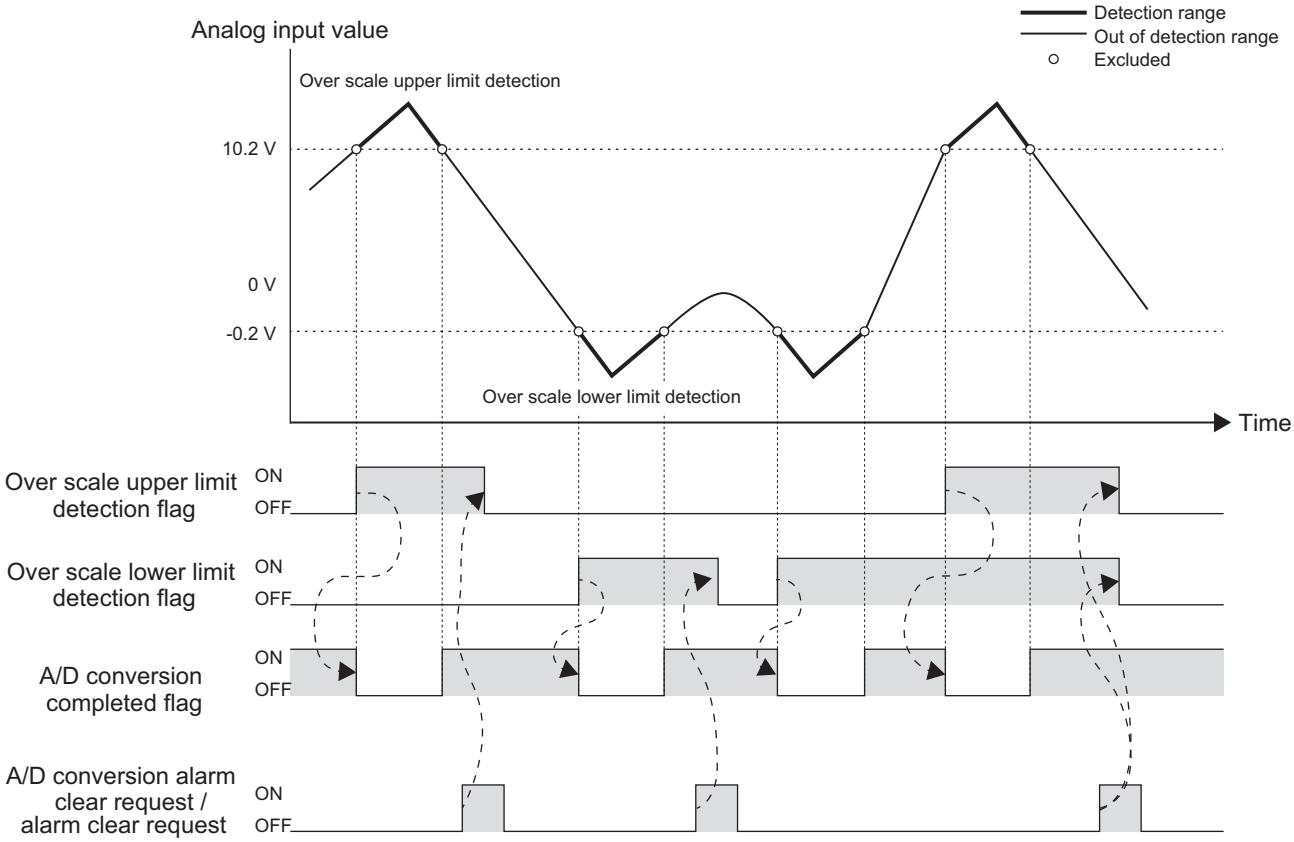
When the analog input value is outside the normal range, it is regarded as over-scale and the corresponding over-scale detection flag turns ON.

- Over-scale upper limit detection flag: Turns ON when the analog input value is above the normal range. (Alarm code: 090☐H)
- Over-scale lower limit detection flag: Turns ON when the analog input value is below the normal range. (Alarm code: 091☐H)

For the channel in which over-limit is detected, the digital output value before over-limit is stored, and "A/D conversion complete flag" turns OFF for this channel.

When the analog input value becomes normal, A/D conversion is restarted. After the first update, the "A/D conversion completion flag" of the corresponding channel turns ON, At this time, the "over-scale upper limit detection flag" and "over-scale lower limit detection flag" do not turn OFF.

To turn OFF "over-scale upper limit detection flag" and "over-scale lower limit detection flag", it is necessary to turn ON "A/D conversion alarm clear request" ("Alarm clear request" for the FX5-4AD-ADP). The "over-scale upper limit detection flag", "over-scale lower limit detection flag" turns OFF also when the "over-scale detection enable/disable" is changed to "disable".




**Point**

- "A/D conversion alarm clear request" ("Alarm clear request" for the FX5-4AD-ADP) does not turn OFF automatically. To perform an alarm clear again, it is necessary to turn it OFF once.
- To clear the alarm code, turn ON "A/D conversion alarm clear request" ("Alarm clear request" for the FX5-4AD-ADP).

## Setting procedure

Set "Over scale detection enable/disable" to "Enable".

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Application Settings" ⇨ "Over Scale Detection"

## Corresponding devices

The devices which are used by the over scale detection function are listed below.

| Name | Connection part | Special relay | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3*1 | CH4*1 |
| Over scale upper limit detection flag | 1st adapter | SM6302 | SM6342 | SM6382 | SM6422 |
| | 2nd adapter | SM6662 | SM6702 | SM6742 | SM6782 |
| | 3rd adapter | SM7022 | SM7062 | SM7102 | SM7142 |
| | 4th adapter | SM7382 | SM7422 | SM7462 | SM7502 |
| Over scale lower limit detection flag | 1st adapter | SM6303 | SM6343 | SM6383 | SM6423 |
| | 2nd adapter | SM6663 | SM6703 | SM6743 | SM6783 |
| | 3rd adapter | SM7023 | SM7063 | SM7103 | SM7143 |
| | 4th adapter | SM7383 | SM7423 | SM7463 | SM7503 |
| Over scale detection enable/disable setting | 1st adapter | SM6304 | SM6344 | SM6384 | SM6424 |
| | 2nd adapter | SM6664 | SM6704 | SM6744 | SM6784 |
| | 3rd adapter | SM7024 | SM7064 | SM7104 | SM7144 |
| | 4th adapter | SM7384 | SM7424 | SM7464 | SM7504 |

*1 Only used by the FX5-4AD-ADP.

The details of the device used are listed below.

| Name | Description | Monitor value | Display description | Default value | R/W |
|---|---|---|---|---|---|
| Over scale upper limit detection flag | This flag monitors the over-scale upper limit detection status in the over-scale detection function. | 0: OFF | Normal | 0: OFF | R |
| | | 1: ON | Over scale upper limit detection | | |
| Over scale lower limit detection flag | This flag monitors the over-scale lower limit detection status in the over-scale detection function. | 0: OFF | Normal | 0: OFF | R |
| | | 1: ON | Over scale lower limit detection | | |
| Over scale detection enable/ disable setting | Set whether to enable or disable over scale detection. | 0: OFF | Over scale detection enable | 1: ON | R/W |
| | | 1: ON | Over scale detection disable | | |

# Digital clipping function

FX5-4A-ADP FX5-4AD-ADP FX5-4DA-ADP FX5-4AD-PT-ADP FX5-4AD-TC-ADP

This function fixes the digital operation value to the maximum or minimum value of the digital operation value output range when the input current or voltage exceeds the input range.

## List of output ranges

In each range below, the output range of digital operation values when the digital clipping function is enabled is shown.

| Input range | Output range of digital operation values | | |
|---|---|---|---|
| | Digital clipping function enabled | Digital clipping function disabled (over scale enabled) | Digital clipping function disabled |
| 0 to 10V | 0 to 16000 | -320 to +16320 | -384 to +16383 |
| 0 to 5V | | | |
| 1 to 5V | 0 to 12800 | -3520 to +13120 | -3584 to +13183 |
| -10 to +10V | -8000 to +8000 | -8160 to +8160 | -8192 to +8191 |
| 0 to 20mA | 0 to 16000 | -320 to +16320 | -384 to +16383 |
| 4 to 20mA | 0 to 12800 | -3520 to +13120 | -3584 to +13183 |
| -20 to +20mA | -8000 to +8000 | -8160 to +8160 | -8192 to +8191 |

## Setting procedure

Set "Digital Clip Enable/Disable" to "enable".

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Application Settings" ⇨ "Digital Clip Setting"

## Setting example

Ex.

When the following values are used for the channel with the input range of 0 to 10V

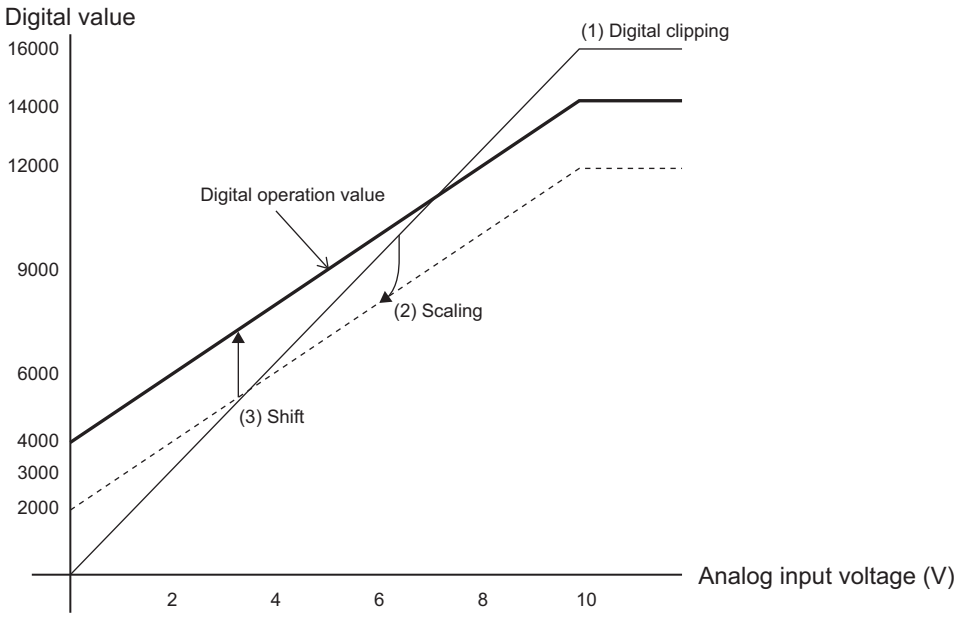
### ■Setting value

- Scaling upper limit value: 12000
- Scaling lower limit value: 2000
- Conversion value shift amount: 2000
- Digital clip enable/disable setting: enable

### ■Setting procedure

1. Set the "A/D conversion enable/disable setting" to "enable".
2. Set "2000" to the scaling lower limit value.
3. Set "12000" to the scaling upper limit value.
4. Set the "scaling enable/disable setting" to "enable".
5. Set "2000" to the conversion value shift amount.
6. Set "Digital clipping enable/disable setting" to "enable".

### ■Operation



## Corresponding devices

The devices which are used by the digital clipping function are listed below.

| Name | Connection part | Special relay | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3*1 | CH4*1 |
| Digital clipping enable/disable setting | 1st adapter | SM6309 | SM6349 | SM6389 | SM6429 |
| | 2nd adapter | SM6669 | SM6709 | SM6749 | SM6789 |
| | 3rd adapter | SM7029 | SM7069 | SM7109 | SM7149 |
| | 4th adapter | SM7389 | SM7429 | SM7469 | SM7509 |

*1 Only used by the FX5-4AD-ADP.

The details of the device used are listed below.

| Name | Description | Setting value | Description | Default value | R/W |
|---|---|---|---|---|---|
| Digital clipping enable/disable setting | Sets whether to enable or disable the digital clipping function. | 0: OFF | Digital clipping function enable | 1: ON | R/W |
| | | 1: ON | Digital clipping function disable | | |

# Scaling function

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

This function performs the scale conversion on digital output values within a specified range between a scaling upper limit value and a scaling lower limit value.

The scaled value is stored in "Digital operation value".

## Operation

### ■Concept of scaling setting

Ex.

When the input range is set to -10 to +10V:

For the scaling lower limit value, set a value corresponding to the lower limit value of the input range (-8000).

For the scaling upper limit value, set a value corresponding to the upper limit value of the input range (+8000).

### ■Calculating the scaling value

The scale conversion is based on the following formula. (The value below the decimal point obtained by scale conversion is rounded off.)

- For current (0 to 20mA, 4 to 20mA), voltage (0 to 10V, 0 to 5V, 1 to 5V)

| Calculation formula | Symbol |
|---|---|
| $D_Y = \frac{D_X \times (S_H - S_L)}{D_{Max}} + S_L$ | $D_X$: Digital output value<br>$D_Y$: Scaling value (digital operation value)<br>$D_{Max}$: Maximum value of digital output for the input range in use<br>$S_H$: Scaling upper limit value<br>$S_L$: Scaling lower limit value |

- For current (-20 to +20mA), voltage (-10 to +10V)

| Calculation formula | Symbol |
|---|---|
| $D_Y = \frac{D_X \times (S_H - S_L)}{D_{Max} - D_{Min}} + \frac{(S_H + S_L)}{2}$ | $D_X$: Digital output value<br>$D_Y$: Scaling value (digital operation value)<br>$D_{Max}$: Maximum value of digital output for the input range in use<br>$D_{Min}$: Minimum value of digital output for the input range in use<br>$S_H$: Scaling upper limit value<br>$S_L$: Scaling lower limit value |

## Setting procedure

**1.** Set "Scaling enable/disable setting" to "Enable".

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Application Settings" ⇨ "Scaling Setting"

**2.** Set values for "Scaling upper limit value" and "Scaling lower limit value".

| Item | Setting range |
|---|---|
| Scaling upper limit value | -32768 to +32767 |
| Scaling lower limit value | -32768 to +32767 |

**Point**

- Even when the scaling upper limit value and the scaling lower limit value are set so that the change is greater than the resolution, the max. resolution will not increase.
- If the relation between the values is scaling lower limit value > scaling upper limit value, the scale conversion can be performed according to a negative slope.
- Set the scaling with the condition "Scaling lower limit value ≠ Scaling upper limit value".

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## Corresponding devices

The devices which are used by the scaling function are listed below.

| Name | Connection part | Special relay/Special register | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3*1 | CH4*1 |
| Scaling enable/disable setting | 1st adapter | SM6308 | SM6348 | SM6388 | SM6428 |
| | 2nd adapter | SM6668 | SM6708 | SM6748 | SM6788 |
| | 3rd adapter | SM7028 | SM7068 | SM7108 | SM7148 |
| | 4th adapter | SM7388 | SM7428 | SM7468 | SM7508 |
| Scaling upper limit value | 1st adapter | SD6308 | SD6348 | SD6388 | SD6428 |
| | 2nd adapter | SD6668 | SD6708 | SD6748 | SD6788 |
| | 3rd adapter | SD7028 | SD7068 | SD7108 | SD7148 |
| | 4th adapter | SD7388 | SD7428 | SD7468 | SD7508 |
| Scaling lower limit value | 1st adapter | SD6309 | SD6349 | SD6389 | SD6429 |
| | 2nd adapter | SD6669 | SD6709 | SD6749 | SD6789 |
| | 3rd adapter | SD7029 | SD7069 | SD7109 | SD7149 |
| | 4th adapter | SD7389 | SD7429 | SD7469 | SD7509 |

*1 Only used by the FX5-4AD-ADP.

The details of the device used are listed below.

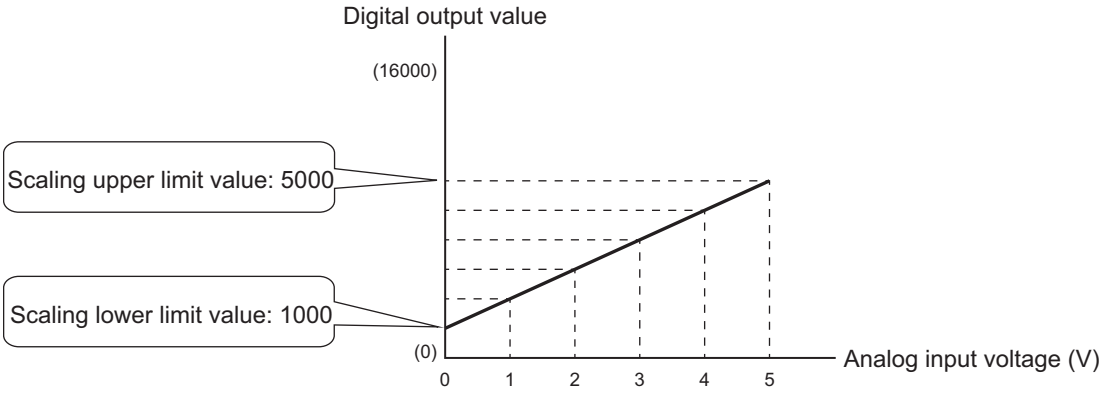
| Name | Description | Setting value | Description | Default value | R/W |
|---|---|---|---|---|---|
| Scaling enable/disable setting | Set whether to enable or disable the scaling function. | 0: OFF | Scaling function enable | 1: ON | R/W |
| | | 1: ON | Scaling function disable | | |

| Name | Description | Range | Default value | R/W |
|---|---|---|---|---|
| Scaling upper limit value<br>Scaling lower limit value | Set the upper and lower limit values of the scaling conversion range. | -32768 to +32767 | 0 | R/W |

## Setting example

Ex.

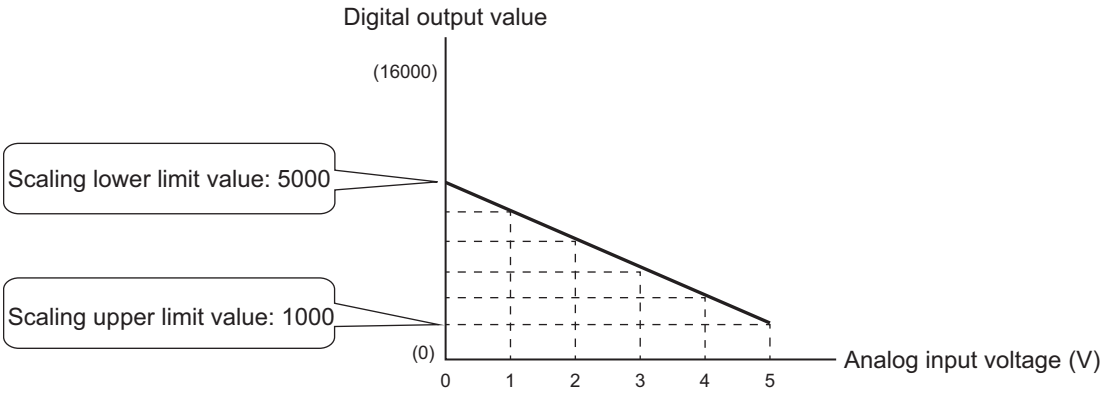
When 5000 is set to the scaling upper limit value and 1000 is set to the scaling lower limit value for the channel with the input range of 0 to 5V




| Voltage input (V) | Digital output value | Digital operation value (scaling value) |
|---|---|---|
| 0 | 0 | 1000 |
| 1 | 3200 | 1800 |
| 2 | 6400 | 2600 |
| 3 | 9600 | 3400 |
| 4 | 12800 | 4200 |
| 5 | 16000 | 5000 |

Ex.

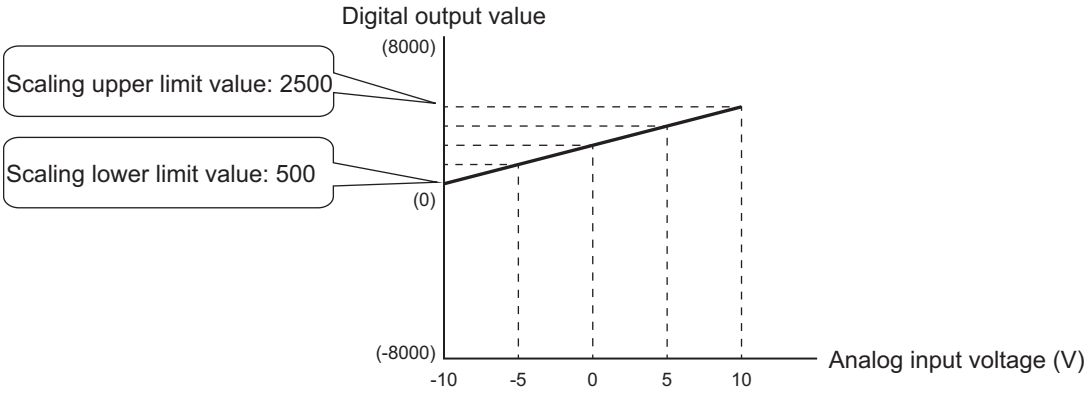
When 1000 is set to the scaling upper limit value and 5000 is set to the scaling lower limit value for the channel with the input range of 0 to 5V




| Voltage input (V) | Digital output value | Digital operation value (scaling value) |
|---|---|---|
| 0 | 0 | 5000 |
| 1 | 3200 | 4200 |
| 2 | 6400 | 3400 |
| 3 | 9600 | 2600 |
| 4 | 12800 | 1800 |
| 5 | 16000 | 1000 |

Ex.

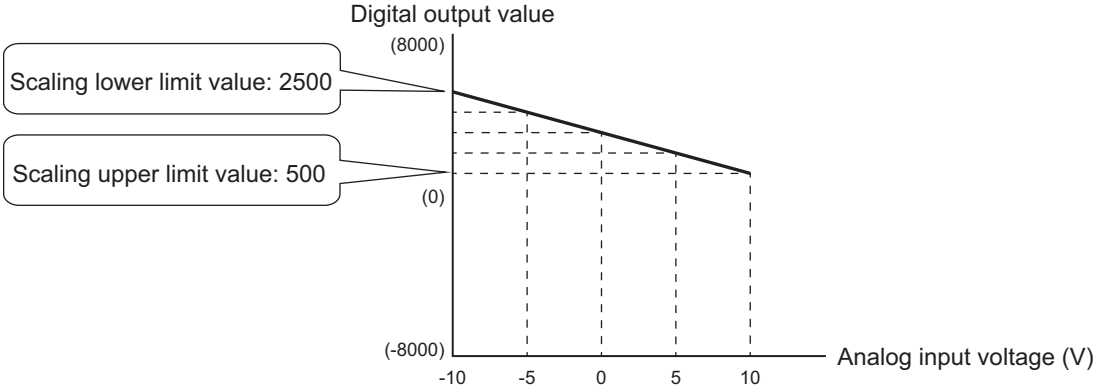
When 2500 is set to the scaling upper limit value and 500 is set to the scaling lower limit value for the channel with the input range of -10 to +10V




| Voltage input (V) | Digital output value | Digital operation value (scaling value) |
|---|---|---|
| -10 | -8000 | 500 |
| -5 | -4000 | 1000 |
| 0 | 0 | 1500 |
| 5 | 4000 | 2000 |
| 10 | 8000 | 2500 |

Ex.

When 500 is set to the scaling upper limit value and 2500 is set to the scaling lower limit value for the channel with the input range of -10 to +10V




| Voltage input (V) | Digital output value | Digital operation value (scaling value) |
|---|---|---|
| -10 | -8000 | 2500 |
| -5 | -4000 | 2000 |
| 0 | 0 | 1500 |
| 5 | 4000 | 1000 |
| 10 | 8000 | 500 |

**Point**

When the scaling function is used with the digital clipping function, the scale conversion is performed on the digital operation values after digital clipping.

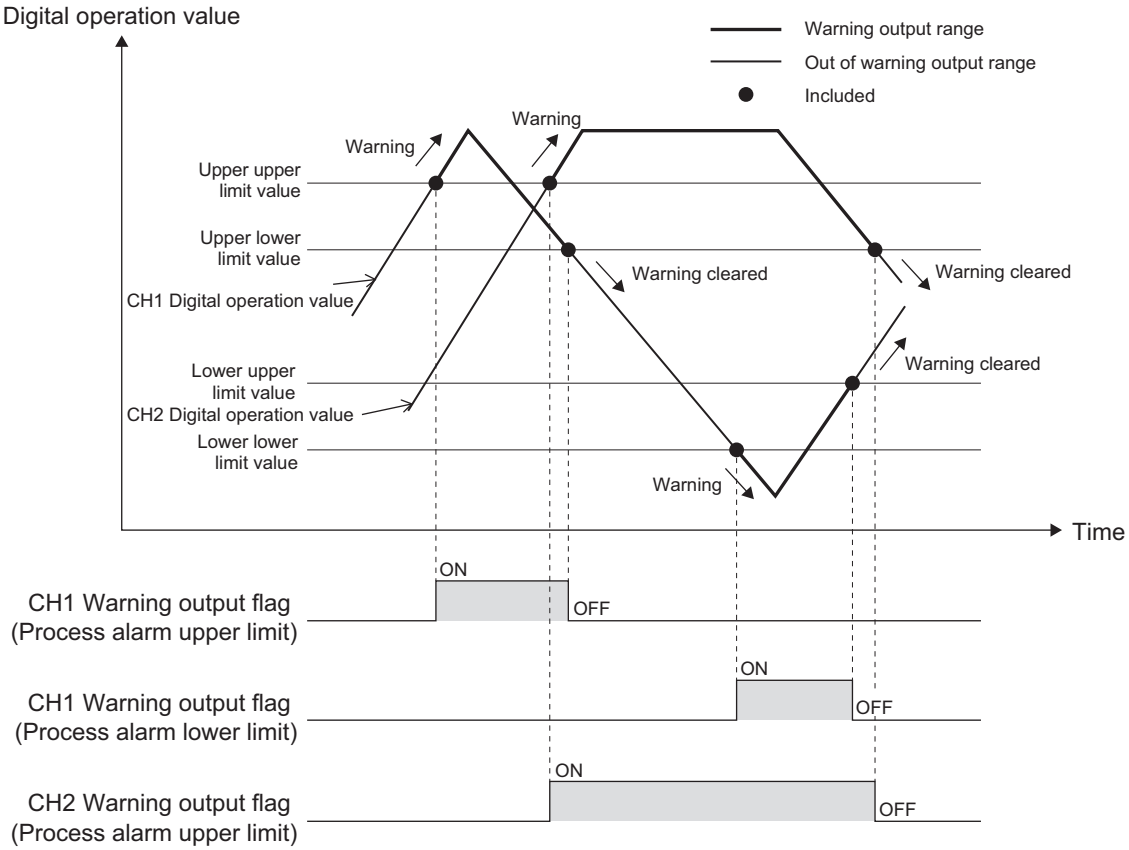
# Warning output function

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

This section describes process alarms and rate alarms used for the warning output function.

## Process alarm

This function outputs an alarm when a digital operation value enters the preset warning output range.




### ■Operation

When the digital operation value is above the process alarm upper upper limit value or below the process alarm lower lower limit value and the warning output condition is satisfied, the "warning output flag (process alarm upper limit)" or "warning output flag (process alarm lower limit)" turns ON.

When the digital operation value changes to a value below the process alarm upper lower limit value or above the process alarm lower upper limit value and the warning output condition is not satisfied after the warning output, the "warning output flag (process alarm upper limit)" or "warning output flag (process alarm lower limit)" turns OFF. The "warning output flag" (process alarm upper limit)" and "warning output flag (process alarm lower limit)" also turn OFF when the "warning output setting" is changed to "disable". However, the alarm code stored in the "A/D conversion latest alarm code" is not cleared.

For clearing the alarm code stored in the "A/D conversion latest alarm code", wait until the "warning output flag (process alarm upper limit)" and "warning output flag (process alarm lower limit)" turn OFF, and then set the "A/D conversion alarm clear request" ("Alarm clear request" for the FX5-4AD-ADP) to OFF, ON, and OFF.

### ■Detection cycle

When time average is specified, the function works at every interval of the time (for averaging). When count average is specified, the function works at every count (for averaging).

When the sampling processing and moving average is specified, this function works at every sampling cycle.

## ■Detection target for outputting a warning

When using the digital clipping function, scaling function, and shift function, the digital operation value resulting from digital clipping, scale conversion, and shift additions becomes the detection target for outputting a warning. Always set the process alarm upper upper limit value, process alarm upper lower limit value, process alarm lower upper limit value, and process alarm lower lower limit value to values that take digital clipping, scale conversion, and shift addition into consideration.

## ■Setting procedure

**1.** Set "Warning output setting (Process alarm)" to "Enable".

Navigation window ⇨ [Parameter] ⇨ [Module Information]⇨ Module model name ⇨ [Module Parameter] ⇨ "Application Settings" ⇨ "Warning output function (Process alarm)"

**2.** Set values for "Process Alarm Upper Upper Limit Value", "Process Alarm Upper Lower Limit Value", "Process Alarm Lower Upper Limit Value", and "Process Alarm Lower Lower Limit Value".

| Item | Setting range |
|---|---|
| Process alarm upper upper limit value | -32768 to +32767 |
| Process alarm upper lower limit value | |
| Process alarm lower upper limit value | |
| Process alarm lower lower limit value | |

**Point**

Set values within the range satisfying the condition "Process alarm upper upper limit value ≥ Process alarm upper lower limit value ≥ Process alarm lower upper limit value ≥ Process alarm lower lower limit value". When not satisfying the above conditions, a process alarm upper lower limit value setting range error occurs. (Error code: 1A4☐H)

## ■Corresponding devices

The devices which are used by the process alarm are listed below.

| Name | Connection part | Special relay/Special register | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3*1 | CH4*1 |
| Warning output flag (process alarm upper limit) | 1st adapter | SM6311 | SM6351 | SM6391 | SM6431 |
| | 2nd adapter | SM6671 | SM6711 | SM6751 | SM6791 |
| | 3rd adapter | SM7031 | SM7071 | SM7111 | SM7151 |
| | 4th adapter | SM7391 | SM7431 | SM7471 | SM7511 |
| Warning output flag (process alarm lower limit) | 1st adapter | SM6312 | SM6352 | SM6392 | SM6432 |
| | 2nd adapter | SM6672 | SM6712 | SM6752 | SM6792 |
| | 3rd adapter | SM7032 | SM7072 | SM7112 | SM7152 |
| | 4th adapter | SM7392 | SM7432 | SM7472 | SM7512 |
| Warning output setting (process alarm) | 1st adapter | SM6313 | SM6353 | SM6393 | SM6433 |
| | 2nd adapter | SM6673 | SM6713 | SM6753 | SM6793 |
| | 3rd adapter | SM7033 | SM7073 | SM7113 | SM7153 |
| | 4th adapter | SM7393 | SM7433 | SM7473 | SM7513 |
| Process alarm upper upper limit value | 1st adapter | SD6311 | SD6351 | SD6391 | SD6431 |
| | 2nd adapter | SD6671 | SD6711 | SD6751 | SD6791 |
| | 3rd adapter | SD7031 | SD7071 | SD7111 | SD7151 |
| | 4th adapter | SD7391 | SD7431 | SD7471 | SD7511 |
| Process alarm upper lower limit value | 1st adapter | SD6312 | SD6352 | SD6392 | SD6432 |
| | 2nd adapter | SD6672 | SD6712 | SD6752 | SD6792 |
| | 3rd adapter | SD7032 | SD7072 | SD7112 | SD7152 |
| | 4th adapter | SD7392 | SD7432 | SD7472 | SD7512 |
| Process alarm lower upper limit value | 1st adapter | SD6313 | SD6353 | SD6393 | SD6433 |
| | 2nd adapter | SD6673 | SD6713 | SD6753 | SD6793 |
| | 3rd adapter | SD7033 | SD7073 | SD7113 | SD7153 |
| | 4th adapter | SD7393 | SD7433 | SD7473 | SD7513 |
| Process alarm lower lower limit value | 1st adapter | SD6314 | SD6354 | SD6394 | SD6434 |
| | 2nd adapter | SD6674 | SD6714 | SD6754 | SD6794 |
| | 3rd adapter | SD7034 | SD7074 | SD7114 | SD7154 |
| | 4th adapter | SD7394 | SD7434 | SD7474 | SD7514 |

*1 Only used by the FX5-4AD-ADP.

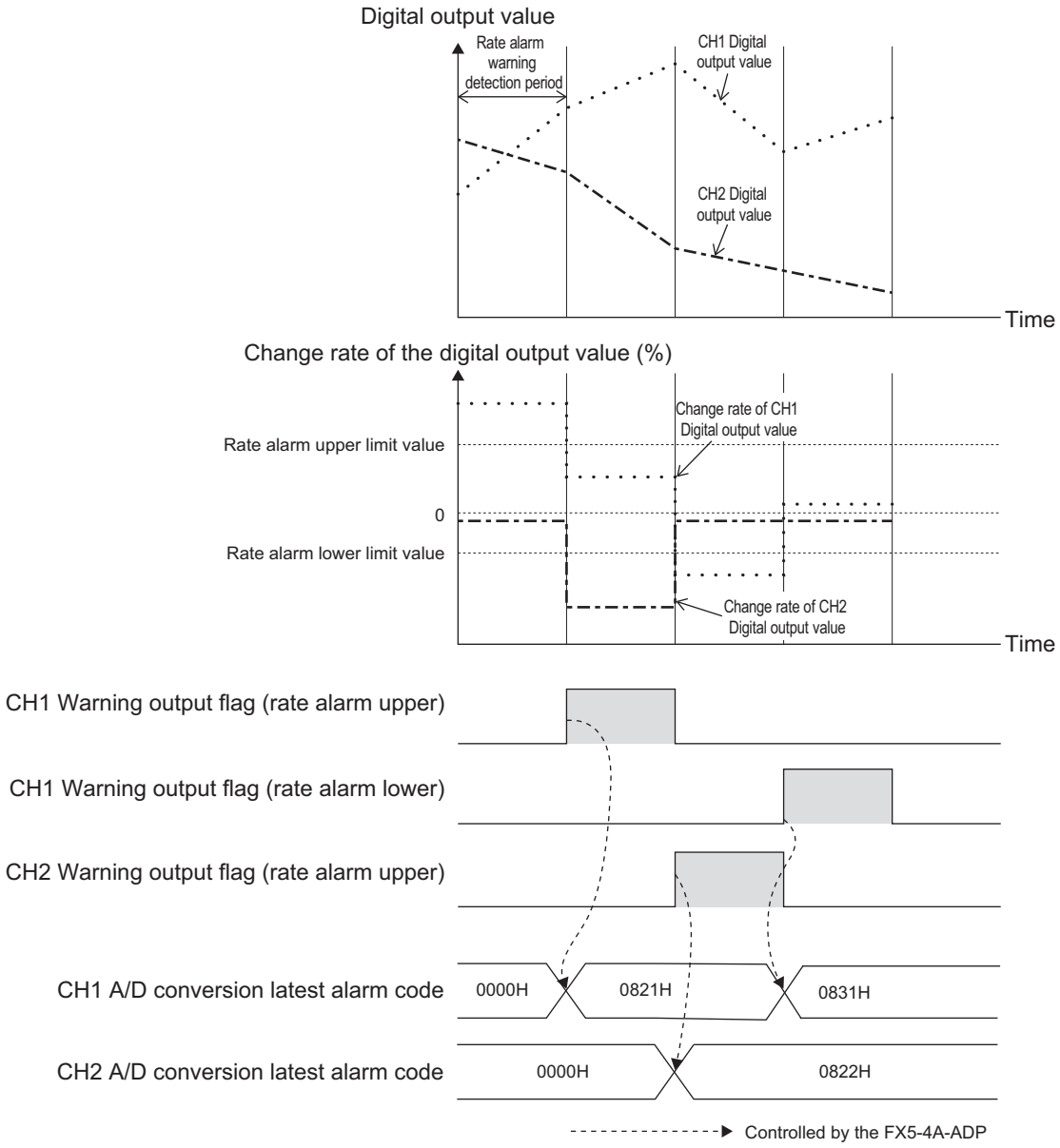
The details of the device used are listed below.

| Name | Description | Monitor value | Display description | Default value | R/W |
|---|---|---|---|---|---|
| Warning output flag (process alarm upper limit)<br>Warning output flag (process alarm lower limit) | Monitors the upper limit value warning and lower limit value warning in the process alarm. | 0: OFF | Normal | 0: OFF | R |
| | | 1: ON | Process alarm upper/lower limit detection | | |
| Warning output setting (process alarm) | Set whether to enable or disable the warning output of process alarm. | 0: OFF | Warning output of process alarm enable | 1: ON | R/W |
| | | 1: ON | Warning output of process alarm disable | | |

| Name | Description | Range | Default value | R/W |
|---|---|---|---|---|
| Process alarm upper upper limit value<br>Process Alarm Upper Lower Limit Value<br>Process alarm lower upper limit value<br>Process alarm lower lower limit value | Set the upper upper limit value, upper lower limit value, lower upper limit value, and lower lower limit value for the warning output function (process alarm).<br>The process alarm upper lower limit value setting range error occurs when the condition "Process alarm upper upper limit value ≥ Process alarm upper lower limit value ≥ Process alarm lower upper limit value ≥ Process alarm lower lower limit value" is not satisfied. (Error code: 1A4□H) | -32768 to +32767 | 0 | R/W |

## Rate alarm

This function outputs a warning when the change rate of a digital output value is equal to or greater than the rate alarm upper limit value, or equal to or smaller than the rate alarm lower limit value.



## ■Operation

The digital output value is monitored every rate alarm warning detection period. When the change from the previous value shows a rate of change that is greater than or equal to the rate alarm upper limit value or less than or equal to the rate alarm lower limit value, the "Warning output flag (rate alarm upper limit)" or the "Warning output flag (rate alarm lower limit)" turns ON.

When the digital output value changes to a value below the rate alarm upper limit value or above the rate alarm upper limit value and the warning output condition is not satisfied after the warning output, the "warning output flag (rate alarm upper limit)" or "warning output flag (rate alarm lower limit)" turns OFF. The "warning output flag (rate alarm upper limit)" and "warning output flag (rate alarm lower limit)" turn OFF also when the "warning output setting (rate alarm)" is set to "disable". However, the alarm code stored in the "A/D conversion latest alarm code" is not cleared.

For clearing the alarm code stored in the "A/D conversion latest alarm code", wait until the "warning output flag (rate alarm upper limit)" and "warning output flag (rate alarm lower limit)" turn OFF, and then set the "A/D conversion alarm clear request" ("Alarm clear request" for the FX5-4AD-ADP) to OFF, ON, and OFF.

## ■Detection cycle

Set the rate alarm warning detection period in "rate alarm warning detection period setting".

## ■Judgment of rate alarm

A change rate is judged with "Rate alarm upper limit value" and "Rate alarm lower limit value" converted to digital values per "rate alarm warning detection period".

The following shows the conversion formula of judgment values used for the rate alarm detection.

Value used for judgment in every rate alarm warning detection period (digit)*1

= (Rate alarm upper limit value (lower limit value)) × 0.1 × 0.01 × Maximum digital output value

Ex.

The judgment value under the following conditions

| Setting item | Description |
|---|---|
| Averaging process specify | Sampling processing |
| Rate alarm warning detection period setting | 10 (ms) |
| Rate alarm upper limit value | 250 (25.0%) |
| Rate alarm lower limit value | 50 (5.0%) |

Upper limit value: 250 × 0.1 × 0.01 × 16000 = 4000 (digit)

Lower limit value: 50 × 0.1 × 0.01 × 16000 = 800 (digit)

The current value is compared with the previous value in every rate alarm warning detection period ("10 ms" in this example). It is checked whether the current digital value is larger by more than 4000 digits (25.0%) or smaller by more than 800 digits (5.0%) compared to the previous value.

The following formula is used to obtain the change rate to be set based on the change amount of the voltage/current to detect warning:

$$\text{Change rate to be set (0.1 \%)} = \left( \frac{\text{Change amount of the voltage (current) to detect warning (V (mA))}}{\text{Gain voltage (current) (V(mA)) - Offset voltage (current) (V (mA))}} \times 1000 \right)^{*1}$$

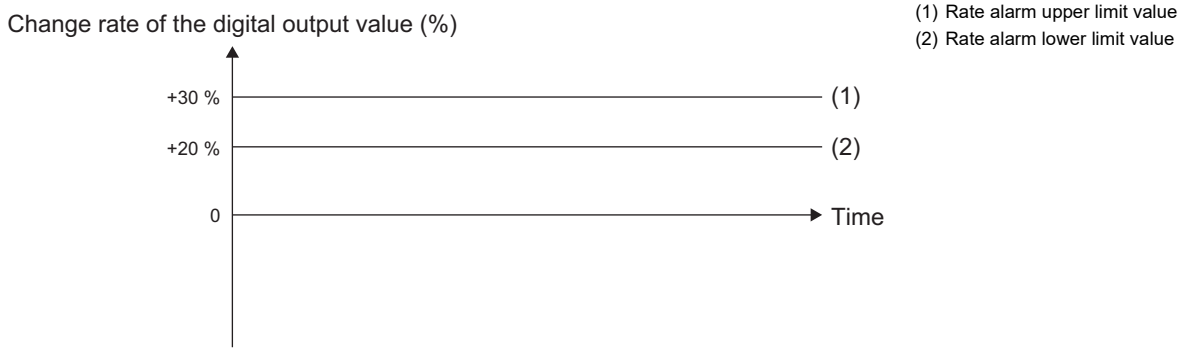
*1 The value below the decimal point obtained by calculation is rounded.

## ■Application examples of rate alarms

A rate alarm serves to monitor that the change rate of a digital output value lies in a limited range as shown below.

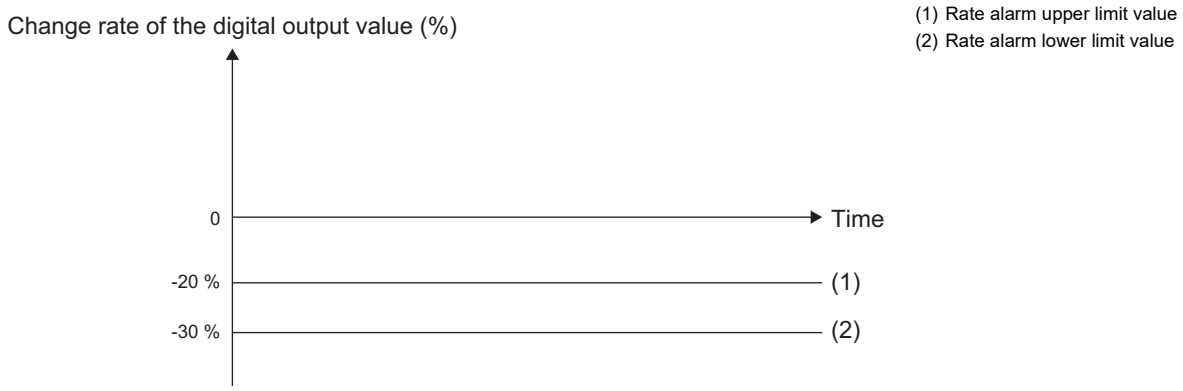
**Ex.**

To monitor that a rising rate of a digital output value is within the specified range



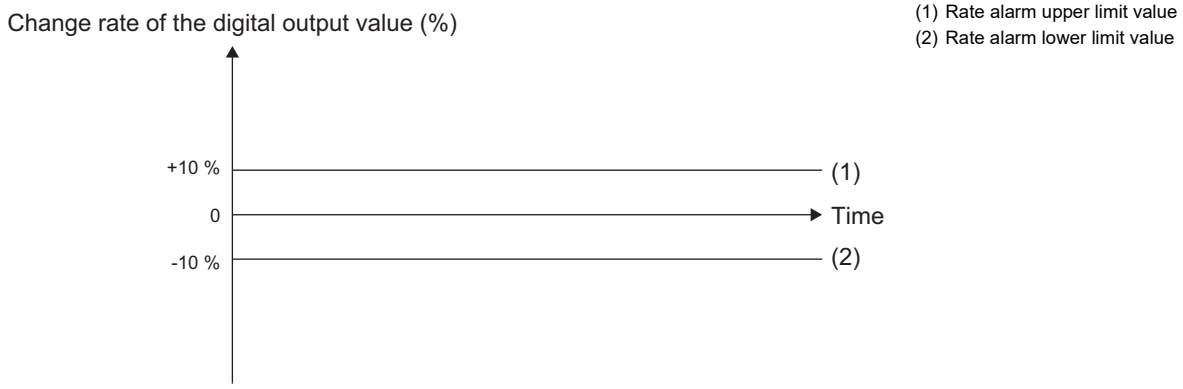

**Ex.**

To monitor that a drop rate of a digital output value is within the specified range




**Ex.**

To monitor that a change rate of a digital output value is within the specified range




## ■Setting procedure

***1.*** Set "Warning output function (Rate alarm)" to "Enable".

Navigation window ⇨ [Parameter] ⇨ [Module Information]⇨ Module model name ⇨ [Module Parameter] ⇨ "Application Settings" ⇨ "Warning output function (Rate alarm)"

**2.** Set a warning detection period of rate alarms.

Set the cycle in "Rate alarm warning detection period setting".

| Item | Setting range |
|---|---|
| Rate alarm warning detection period setting | 1 to 10000 (ms) |

**Point**

When a value outside the setting range is set, the rate alarm warning detection period setting range error occurs. (Error code: 1A6☐H)

**3.** Set values for "Rate alarm upper limit value" and "Rate alarm lower limit value".

Set a value for the maximum value (16000) of the digital output value in increments of 0.1%.

| Item | Setting range |
|---|---|
| Rate alarm upper limit value | -1000 to +1000 (0.1%) |
| Rate alarm lower limit value | |

**Point**

Set values within the range satisfying the condition "Rate alarm upper limit value > Rate alarm lower limit value".

When not satisfying the above conditions, a rate alarm upper/lower limit setting value inversion error occurs. (Error code: 1A5☐H)

## ■Corresponding devices

The devices used by the rate alarm are listed below.

| Name | Connection part | Special relay/Special register | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3*1 | CH4*1 |
| Warning output flag (rate alarm upper limit) | 1st adapter | SM6315 | SM6355 | SM6395 | SM6435 |
| | 2nd adapter | SM6675 | SM6715 | SM6755 | SM6795 |
| | 3rd adapter | SM7035 | SM7075 | SM7115 | SM7155 |
| | 4th adapter | SM7395 | SM7435 | SM7475 | SM7515 |
| Warning output flag (rate alarm lower) | 1st adapter | SM6316 | SM6356 | SM6396 | SM6436 |
| | 2nd adapter | SM6676 | SM6716 | SM6756 | SM6796 |
| | 3rd adapter | SM7036 | SM7076 | SM7116 | SM7156 |
| | 4th adapter | SM7396 | SM7436 | SM7476 | SM7516 |
| Warning output setting (rate alarm) | 1st adapter | SM6317 | SM6357 | SM6397 | SM6437 |
| | 2nd adapter | SM6677 | SM6717 | SM6757 | SM6797 |
| | 3rd adapter | SM7037 | SM7077 | SM7117 | SM7157 |
| | 4th adapter | SM7397 | SM7437 | SM7477 | SM7517 |
| Rate alarm upper limit value | 1st adapter | SD6315 | SD6355 | SD6395 | SD6435 |
| | 2nd adapter | SD6675 | SD6715 | SD6755 | SD6795 |
| | 3rd adapter | SD7035 | SD7075 | SD7115 | SD7155 |
| | 4th adapter | SD7395 | SD7435 | SD7475 | SD7515 |
| Rate alarm lower limit value | 1st adapter | SD6316 | SD6356 | SD6396 | SD6436 |
| | 2nd adapter | SD6676 | SD6716 | SD6756 | SD6796 |
| | 3rd adapter | SD7036 | SD7076 | SD7116 | SD7156 |
| | 4th adapter | SD7396 | SD7436 | SD7476 | SD7516 |
| Rate alarm warning detection period setting | 1st adapter | SD6317 | SD6357 | SD6397 | SD6437 |
| | 2nd adapter | SD6677 | SD6717 | SD6757 | SD6797 |
| | 3rd adapter | SD7037 | SD7077 | SD7117 | SD7157 |
| | 4th adapter | SD7397 | SD7437 | SD7477 | SD7517 |

*1 Only used by the FX5-4AD-ADP.

The details of the device used are listed below.

| Name | Description | Monitor value | Display description | Default value | R/W |
|---|---|---|---|---|---|
| Warning output flag (rate alarm upper limit)<br>Warning output flag (rate alarm lower) | Monitors the upper limit value warning and lower limit value warning in the rate alarm. | 0: OFF | Normal | 0: OFF | R |
| | | 1: ON | Rate alarm upper/lower limit detection | | |
| Warning output setting (rate alarm) | Set whether to enable or disable the warning output of rate alarm. | 0: OFF | Warning output of rate alarm enable | 1: ON | R/W |
| | | 1: ON | Warning output of rate alarm disable | | |

| Name | Description | Range | Default value | R/W |
|---|---|---|---|---|
| Rate alarm upper limit value<br>Rate alarm lower limit value | Set the upper limit of the rate of change of the digital output value for detecting rate alarms.<br>Set the rate alarm upper limit value in the unit "0.1 %".<br>If the condition "rate alarm upper limit value > rate alarm lower limit value" is not satisfied, the rate alarm upper limit value/lower limit value setting inversion error (Error code: 1A5□H) occurs. | -1000 to +1000 | 0 | R/W |
| Rate alarm warning detection period setting | Set the cycle for checking the rate of change of the digital output value. The "rate alarm warning detection period setting" multiplied by the sampling cycle indicates the cycle for detecting rate alarms.<br>If a value other than the setting value is set, the rate alarm warning detection period setting range error (Error code: 1A6□H) occurs. | 1 to 10000 (ms) | 1 | R/W |

# Shift function

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP ✕ | FX5-4AD-PT-ADP ✕ | FX5-4AD-TC-ADP ✕

This function adds (shifts) the set conversion value shift amount to the digital operation value and stores it in "Digital operation value". When the conversion value shift amount is changed, the change will be reflected in the digital operation value in real time, allowing fine adjustments to be easily performed during system startup.

## Operation

The set "Shifting amount to conversion value" is added to the digital operation value. The added digital operation value is stored in "Digital operation value".

When sampling processing is performed, the converted value shift amount is added for each scan. When averaging processing is performed, the converted value shift amount is added for each averaging processing cycle. The results are stored in the "Digital operation value".

When the digital operation value resulting from the shift processing exceeds the range of -32768 to +32767, the value is fixed to the lower limit (-32768) or the upper limit (+32767).

**Point**

- When the scaling function is used together, the shift processing is executed to the value after scale conversion.
- When the digital clipping function and the scaling function are used together, shift processing is performed on the value after digital clipping and scaling.

## Setting procedure

Set a value for "Shifting amount to conversion value".

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Application Settings" ⇨ "Shift Function"

| Item | Setting range |
|---|---|
| Conversion value shift amount | -32768 to +32767 |

## Corresponding devices

The devices which are used by the shift function are listed below.

| Name | Connection part | Special register | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3*1 | CH4*1 |
| Conversion value shift amount | 1st adapter | SD6310 | SD6350 | SD6390 | SD6430 |
| | 2nd adapter | SD6670 | SD6710 | SD6750 | SD6790 |
| | 3rd adapter | SD7030 | SD7070 | SD7110 | SD7150 |
| | 4th adapter | SD7390 | SD7430 | SD7470 | SD7510 |

*1 Only used by the FX5-4AD-ADP.

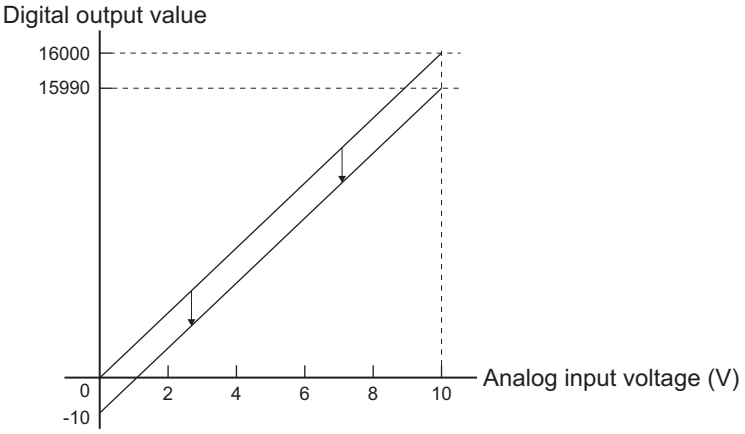
The details of the device used are listed below.

| Name | Description | Range | Default value | R/W |
|---|---|---|---|---|
| Conversion value shift amount | Set the "conversion value shift amount" used in the shift function. The set value is added to the "Digital operation value". | -32768 to +32767 | 0 | R/W |

## Setting example

Ex.

When the input characteristics are adjusted in a channel where the input range of 0 to 10V is set by the shift function




| Voltage input (V) | Digital output value | Digital operation value |
|---|---|---|
| 0 | 0 | -10 |
| 10 | 16000 | 15990 |

# Convergence detection function

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

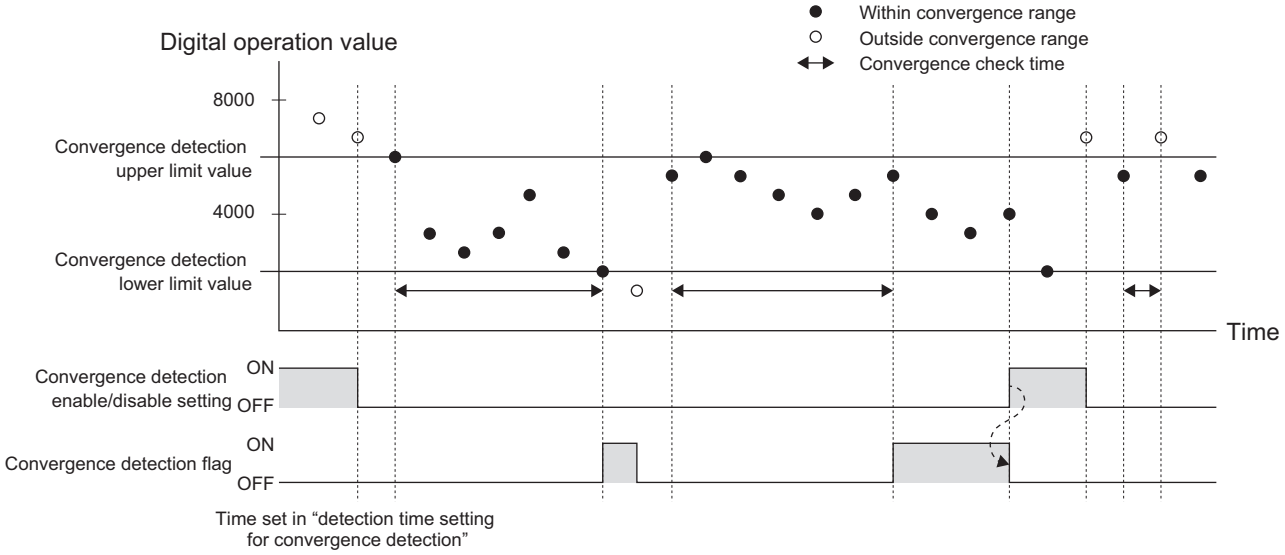
This function detects whether the digital operation value is within a certain range for a specified time.

## Operation

Time is measured when the digital operation value falls within the convergence range.

If the digital operation value falls within the convergence range within the time set in the "Detection time setting for convergence detection", the "convergence detection flag" turns ON. When the digital operation value goes outside the convergence range, the "convergence detection flag" turns OFF. The "convergence detection flag" turns OFF also when the "convergence detection enable/disable setting" is changed to "disable".

The digital operation value is always monitored until the "convergence detection enable/disable setting" is set to "disable".




## Convergence detection condition

The table below shows the convergence detection condition when the "convergence detection enable/disable setting" is set to "enable".

| Within convergence range | Outside convergence range |
|---|---|
| Not less than convergence detection lower limit value and not more than convergence detection upper limit value | Less than convergence detection lower limit value or more than convergence detection upper limit value |

## Setting procedure

***1.*** Set "Convergence detection enable/disable setting" to "Enable".

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Application Settings" ⇨ "Convergence detection enable/disable setting"

***2.*** Set values for "Detection time setting for convergence detection".

| Item | Setting range |
|---|---|
| Detection time setting for convergence detection | 1 to 10000 (ms) |

**Point**

When a value outside the setting range is set, the convergence detection time setting range error occurs. (Error code: 1AC☐H)

**3.** Set values for "Convergence detection upper limit value" and "Convergence detection lower limit value".

| Item | Setting range |
|---|---|
| Convergence detection upper limit value | -32768 to +32767 |
| Convergence detection lower limit value | |

**Point**

Set values so that the condition "Convergence detection upper limit value > Convergence detection lower limit value" is satisfied.
When not satisfying the above conditions, a convergence detection upper limit value/lower limit value setting inversion error occurs. (Error code: 1AD□H)

## Corresponding devices

The devices which are used by the convergence detection function are listed below.

| Name | Connection part | Special relay/Special register | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3*1 | CH4*1 |
| Convergence detection flag | 1st adapter | SM6321 | SM6361 | SM6401 | SM6441 |
| | 2nd adapter | SM6681 | SM6721 | SM6761 | SM6801 |
| | 3rd adapter | SM7041 | SM7081 | SM7121 | SM7161 |
| | 4th adapter | SM7401 | SM7441 | SM7481 | SM7521 |
| Convergence detection enable/disable setting | 1st adapter | SM6322 | SM6362 | SM6402 | SM6442 |
| | 2nd adapter | SM6682 | SM6722 | SM6762 | SM6802 |
| | 3rd adapter | SM7042 | SM7082 | SM7122 | SM7162 |
| | 4th adapter | SM7402 | SM7442 | SM7482 | SM7522 |
| Convergence detection upper limit value | 1st adapter | SD6322 | SD6362 | SD6402 | SD6442 |
| | 2nd adapter | SD6682 | SD6722 | SD6762 | SD6802 |
| | 3rd adapter | SD7042 | SD7082 | SD7122 | SD7162 |
| | 4th adapter | SD7402 | SD7442 | SD7482 | SD7522 |
| Convergence detection lower limit value | 1st adapter | SD6323 | SD6363 | SD6403 | SD6443 |
| | 2nd adapter | SD6683 | SD6723 | SD6763 | SD6803 |
| | 3rd adapter | SD7043 | SD7083 | SD7123 | SD7163 |
| | 4th adapter | SD7403 | SD7443 | SD7483 | SD7523 |
| Detection time setting for convergence detection | 1st adapter | SD6324 | SD6364 | SD6404 | SD6444 |
| | 2nd adapter | SD6684 | SD6724 | SD6764 | SD6804 |
| | 3rd adapter | SD7044 | SD7084 | SD7124 | SD7164 |
| | 4th adapter | SD7404 | SD7444 | SD7484 | SD7524 |

*1 Only used by the FX5-4AD-ADP.

The details of the device used are listed below.

| Name | Description | Monitor value | Display description | Default value | R/W |
|---|---|---|---|---|---|
| Convergence detection flag | This flag monitors the convergence detection. | 0: OFF | Normal | 0: OFF | R |
| | | 1: ON | Convergence detection | | |
| Convergence detection enable/disable setting | Set whether to enable or disable the convergence detection. | 0: OFF | Convergence detection enable | 1: ON | R/W |
| | | 1: ON | Convergence detection disable | | |

| Name | Description | Range | Default value | R/W |
|---|---|---|---|---|
| Convergence detection upper limit value<br>Convergence detection lower limit value | Set the upper and lower limits of the digital output value used in the convergence detection function.<br>If the condition "Convergence detection upper limit value > Convergence detection lower limit value" is not satisfied, the convergence detection upper limit value/lower limit value setting inversion error (Error code: 1AD□H) occurs. | -32768 to +32767 | 0 | R/W |
| Detection time setting for convergence detection | Set the convergence detection time used in the convergence detection function.<br>If a value outside the range is set, the convergence detection time setting range error (Error code: 1AC□H) occurs.<br>The setting value will be ignored when the convergence detection enable/disable setting is set to "disable". | 1 to 10000 (ms) | 1 | R/W |

# Maximum value/minimum value hold function

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

This function stores the maximum value and minimum value of the digital operation value to the special registers for each channel.

This function can be set only with special devices.

## Operation

When the "Maximum value reset request" or "Minimum value reset request" is set from OFF to ON, the maximum value or minimum value of the channel is updated to "Digital operation value". The "maximum value/minimum value reset completion flag" turns ON.

If the range is switched, the "maximum value" and "minimum value" are cleared (0).



## Setting procedure

When the "Maximum value reset request" or "Minimum value reset request" is set from OFF to ON, the maximum value or minimum value is updated to the digital operation value.

| Setting value | Description | Default value |
|---|---|---|
| 0: OFF | With no maximum value or minimum value reset request | 0: OFF |
| 1: ON | With maximum value or minimum value reset request | |

## Corresponding devices

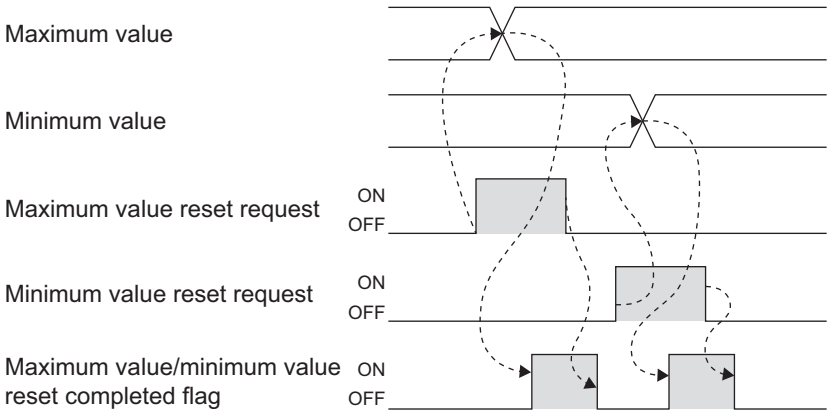
The devices which are used by the function to hold minimum and maximum values are listed below.

| Name | Connection part | Special relay/Special register | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3*1 | CH4*1 |
| Maximum value/minimum value reset completed flag | 1st adapter | SM6305 | SM6345 | SM6385 | SM6425 |
| | 2nd adapter | SM6665 | SM6705 | SM6745 | SM6785 |
| | 3rd adapter | SM7025 | SM7065 | SM7105 | SM7145 |
| | 4th adapter | SM7385 | SM7425 | SM7465 | SM7505 |
| Maximum value reset request | 1st adapter | SM6306 | SM6346 | SM6386 | SM6426 |
| | 2nd adapter | SM6666 | SM6706 | SM6746 | SM6786 |
| | 3rd adapter | SM7026 | SM7066 | SM7106 | SM7146 |
| | 4th adapter | SM7386 | SM7426 | SM7466 | SM7506 |
| Minimum value reset request | 1st adapter | SM6307 | SM6347 | SM6387 | SM6427 |
| | 2nd adapter | SM6667 | SM6707 | SM6747 | SM6787 |
| | 3rd adapter | SM7027 | SM7067 | SM7107 | SM7147 |
| | 4th adapter | SM7387 | SM7427 | SM7467 | SM7507 |
| Maximum value | 1st adapter | SD6306 | SD6346 | SD6386 | SD6426 |
| | 2nd adapter | SD6666 | SD6706 | SD6746 | SD6786 |
| | 3rd adapter | SD7026 | SD7066 | SD7106 | SD7146 |
| | 4th adapter | SD7386 | SD7426 | SD7466 | SD7506 |
| Minimum value | 1st adapter | SD6307 | SD6347 | SD6387 | SD6427 |
| | 2nd adapter | SD6667 | SD6707 | SD6747 | SD6787 |
| | 3rd adapter | SD7027 | SD7067 | SD7107 | SD7147 |
| | 4th adapter | SD7387 | SD7427 | SD7467 | SD7507 |

*1 Only used by the FX5-4AD-ADP.

The details of the device used are listed below.

| Name | Description | Monitor value | Display description | Default value | R/W |
|---|---|---|---|---|---|
| Maximum value/ minimum value reset completed flag | This flag monitors the "maximum value/minimum value" reset status.<br>When the "maximum value reset request" or "minimum value reset request" is set from OFF to ON and then the value stored in the "maximum value" or "minimum value" is reset, the "maximum value/minimum value reset completion flag" turns ON. | 0: OFF | Reset is not completed. | 0: OFF | R |
| | | 1: ON | Reset is completed. | | |




| Name | | Setting value | Description | Default value | R/W |
|---|---|---|---|---|---|
| Maximum value reset request<br>Minimum value reset request | When "Maximum value/Minimum value reset request" is set from OFF to ON, the maximum value and minimum value are updated to "Digital operation value". | 0: OFF | With no maximum value and minimum value reset request | 0: OFF | R/W |
| | | 1: ON | With maximum value and minimum value reset request | | |

| Name | Description | Range | Default value | R/W |
|---|---|---|---|---|
| Maximum value<br>Minimum value | The maximum and minimum values of the digital operation values are stored.<br>When "Maximum value/Minimum value reset request" is set from OFF to ON, the maximum and minimum values of the channel are updated to "Digital operation value". | -32768 to +32767 | 0 | R |

# Deviation detection between channel function

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

This function detects whether there is a difference of more than a certain level in digital operation values between channels.

## Operation

"Digital operation value" of the channel is compared with "Digital operation value" of the channel set for "CH setting for deviation detection between channel".

If the difference between the digital operation value of the channel and the digital operation value of the comparison target channel is equal to or greater than the "Deviation value for deviation detection between channels" for even one channel, the deviation is detected and the "Deviation detection flag between channel" turns ON. (Alarm code: 0B0□H)

If the difference between the digital operation value of the channel and the digital operation value of the comparison target channel is less than the "Deviation value for deviation detection between channels" for all channels, "Deviation detection flag between channel" turns OFF.

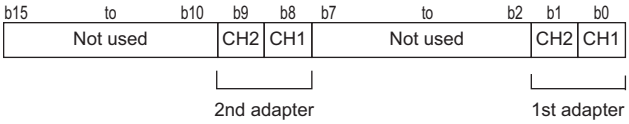
If "Deviation detection trigger between channels" is disabled, the "Deviation detection flag between channel" turns OFF, and "Deviation detection CH1" and "Deviation detection CH2" become 0 (initial value).

## ■Deviation detection CH1

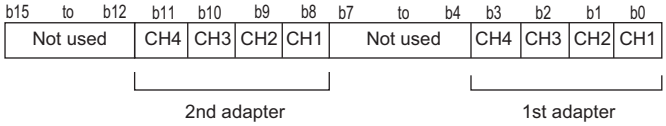
Check the status of the deviation between CH detection flag in the 1st and 2nd FX5-4A-ADP, or FX5-4AD-ADP used in the deviation between CH detection function.

| Monitor value | Display description | Default value | R/W |
|---|---|---|---|
| 0: OFF | Normal | 0: OFF | R |
| 1: ON | Deviation detection | | |

■ When the deviation detection target is FX5-4A-ADP




■ When the deviation detection target is FX5-4AD-ADP



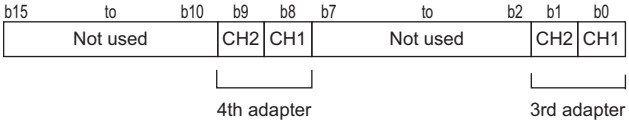

## ■Deviation detection CH2

Check the status of the deviation between CH detection flag in the 3rd and 4th FX5-4A-ADP, or FX5-4AD-ADP used in the deviation between CH detection function.

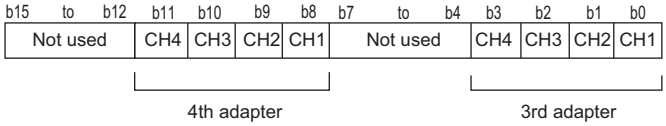
Only used by the FX5S/FX5U/FX5UC CPU module.

| Monitor value | Display description | Default value | R/W |
|---|---|---|---|
| 0: OFF | Normal | 0: OFF | R |
| 1: ON | Deviation detection | | |

■ When the deviation detection target is FX5-4A-ADP




■ When the deviation detection target is FX5-4AD-ADP

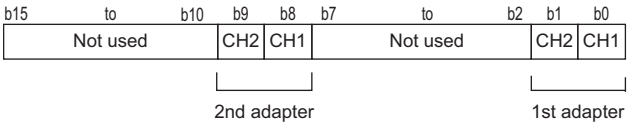



## ■CH setting 1 for deviation detection between channel

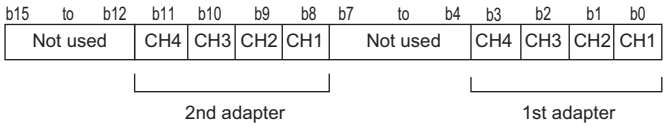
Set the channels whose deviation will be checked in the 1st and 2nd FX5-4A-ADP, or FX5-4AD-ADP used in the deviation detection between channel function.

| Monitor value | Display description | Default value | R/W |
|---|---|---|---|
| 0: OFF | Non target | 0 | R/W |
| 1: ON | Target | | |

■ When the deviation detection target is FX5-4A-ADP




■ When the deviation detection target is FX5-4AD-ADP



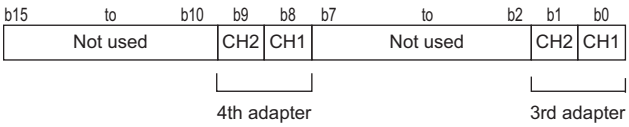

## ■CH setting 2 for deviation detection between channel

Set the channels whose deviation will be checked in the 3rd and 4th FX5-4A-ADP, or FX5-4AD-ADP used in the deviation detection between channel function.

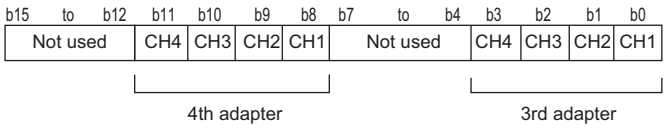
Only used by the FX5S/FX5U/FX5UC CPU module.

| Setting value | Display description | Default value | R/W |
|---|---|---|---|
| 0: OFF | Non target | 0 | R/W |
| 1: ON | Target | | |

■ When the deviation detection target is FX5-4A-ADP




■ When the deviation detection target is FX5-4AD-ADP



## Setting procedure

**1.** Set "Deviation detection trigger between channel" to "Enable".

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Application Settings" ⇨ "Deviation detection trigger between channel"

**2.** Set values for "Deviation value for deviation detection between channel".

| Item | Setting range |
|---|---|
| Deviation value for deviation detection between channel | 0 to 65535 |

**3.** Set whether to perform the deviation check for each channel with "CH setting for deviation detection between channel".

| Item | Setting range |
|---|---|
| CH setting for deviation detection between channel | Non-target |
| | Target |

## Corresponding devices

The devices which are used by the deviation detection between channel function are listed below.

| Name | Connection part | Special relay/Special register | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3*2 | CH4*2 |
| Deviation detection flag between channel | 1st adapter | SM6325 | SM6365 | SM6405 | SM6445 |
| | 2nd adapter | SM6685 | SM6725 | SM6765 | SM6805 |
| | 3rd adapter | SM7045 | SM7085 | SM7125 | SM7165 |
| | 4th adapter | SM7405 | SM7445 | SM7485 | SM7525 |
| Deviation detection trigger between channel | 1st adapter | SM6326 | SM6366 | SM6406 | SM6446 |
| | 2nd adapter | SM6686 | SM6726 | SM6766 | SM6806 |
| | 3rd adapter | SM7046 | SM7086 | SM7126 | SM7166 |
| | 4th adapter | SM7406 | SM7446 | SM7486 | SM7526 |
| Deviation detection CH1*1 | 1st adapter | SD6325 | SD6365 | SD6405 | SD6445 |
| | 2nd adapter | SD6685 | SD6725 | SD6765 | SD6805 |
| | 3rd adapter | SD7045 | SD7085 | SD7125 | SD7165 |
| | 4th adapter | SD7405 | SD7445 | SD7485 | SD7525 |
| Deviation detection CH2 | 1st adapter | SD6326 | SD6366 | SD6406 | SD6446 |
| | 2nd adapter | SD6686 | SD6726 | SD6766 | SD6806 |
| | 3rd adapter | SD7046 | SD7086 | SD7126 | SD7166 |
| | 4th adapter | SD7406 | SD7446 | SD7486 | SD7526 |
| Deviation value for deviation detection between channel | 1st adapter | SD6327 | SD6367 | SD6407 | SD6447 |
| | 2nd adapter | SD6687 | SD6727 | SD6767 | SD6807 |
| | 3rd adapter | SD7047 | SD7087 | SD7127 | SD7167 |
| | 4th adapter | SD7407 | SD7447 | SD7487 | SD7527 |
| CH setting 1 for deviation detection between channel*1 | 1st adapter | SD6328 | SD6368 | SD6408 | SD6448 |
| | 2nd adapter | SD6688 | SD6728 | SD6768 | SD6808 |
| | 3rd adapter | SD7048 | SD7088 | SD7128 | SD7168 |
| | 4th adapter | SD7408 | SD7448 | SD7488 | SD7528 |
| CH setting 2 for deviation detection between channel*1 | 1st adapter | SD6329 | SD6369 | SD6409 | SD6449 |
| | 2nd adapter | SD6689 | SD6729 | SD6769 | SD6809 |
| | 3rd adapter | SD7049 | SD7089 | SD7129 | SD7169 |
| | 4th adapter | SD7409 | SD7449 | SD7489 | SD7529 |

*1 Only used by the FX5S/FX5U/FX5UC CPU module.
*2 Only used by the FX5-4AD-ADP.

The details of the device used are listed below.

| Name | | Setting value | Description | Default value | R/W |
|---|---|---|---|---|---|
| Deviation detection flag between channel | This flag monitors the deviation detection between channels. | 0: OFF | Normal | 0: OFF | R |
| | | 1: ON | Deviation detection | | |
| Deviation detection trigger between channels | Set whether to enable or disable the deviation detection between channels. | 0: OFF | Deviation detection enable | 1: ON | R/W |
| | | 1: ON | Deviation detection disable | | |

| Name | Description | Range | Default value | R/W |
|---|---|---|---|---|
| Deviation value for deviation detection between channels | Set the deviation value between channels used in the deviation detection between channel function. | 0 to 65535 | 0 | R/W |
| Deviation detection CH1<br>Deviation detection CH2<br>CH setting 1 for deviation detection between channel<br>CH setting 2 for deviation detection between channel | ☞ Page 698 Operation | | | |

# Offset/gain setting function

FX5-4A-ADP FX5-4AD-ADP FX5-4DA-ADP FX5-4AD-PT-ADP FX5-4AD-TC-ADP

This function sets any analog value to the offset/gain value without regard to the setting prepared in advance as the analog range. The set value is saved in the built-in memory of the analog adapter.

For changing the offset/gain data, set an analog value to the "offset setting value" or "gain setting value".

The table below shows the available setting range.

| Item | Description | Setting range | |
|---|---|---|---|
| | | Voltage input (mV) | Current input (μA) |
| Offset setting value | Analog input value when the digital value is 0 (offset reference value) | -10000 to +9000 | -20000 to +17000 |
| Gain setting value | Analog input value when the digital value becomes the gain reference value | -9000 to +10000 | -17000 to +30000 |

**Point**

An offset/gain setting value range error occurs when the following condition is not satisfied: (Error code: 1A9□H)

- During voltage input: 1000 ≤ Gain setting value - Offset setting value
- During current input: 3000 ≤ Gain setting value - Offset setting value ≤ 30000

The table below shows the reference value and initial value of the offset/gain setting value.

| Description | | Digital output value | Offset setting value | | Gain setting value | |
|---|---|---|---|---|---|---|
| Voltage/current | Input range | | Reference value | Default value | Reference value | Default value |
| Voltage | 0 to 10V | 0 to 16000 | 0 | 0 mV | 8000 | 5000 mV |
| | 0 to 5V | 0 to 16000 | 0 | 0 mV | 16000 | 5000 mV |
| | 1 to 5V | 0 to 12800 | 0 | 1000 mV | 12800 | 5000 mV |
| | -10 to +10V | -8000 to +8000 | 0 | 0 mV | 4000 | 5000 mV |
| Current | 0 to 20mA | 0 to 16000 | 0 | 0 μA | 16000 | 20000 μA |
| | 4 to 20mA | 0 to 12800 | 0 | 4000 μA | 12800 | 20000 μA |
| | -20 to +20mA | -8000 to +8000 | 0 | 0 μA | 8000 | 20000 μA |

## Operation

### ■Offset/gain writing

For changing the offset/gain data, set "E20FH" to the "offset/gain writing enable code" and set the "offset/gain writing" from OFF to ON to write the "input range setting", "offset setting value" and "gain setting value" to the built-in memory of the analog adapter. Only 1 range can be changed for 1 channel, and the latest contents are valid.

When writing is completed, the "offset/gain writing" automatically turns OFF. Also, the "offset/gain writing enable code" is cleared to 0.

When the "input range setting" is changed, the initial value becomes valid.

For returning the offset/gain data to the initial value, use the offset/gain initialization function (☞ Page 706 Offset/gain initialization function)

**Point**

- The offset/gain value is written when the "offset/gain writing enable code" is set to "E20FH".
- The offset/gain value can be written only while A/D conversion is disabled.
- The "A/D conversion enable/disable setting" cannot be changed to "enable" while the offset/gain value is being written.

### ■Offset/gain reading

For reading the offset/gain data saved in the built-in memory of the analog adapter, set the "offset/gain reading" from OFF to ON to read the "input range setting", "offset setting value" and "gain setting value" from the built-in memory of the analog adapter.

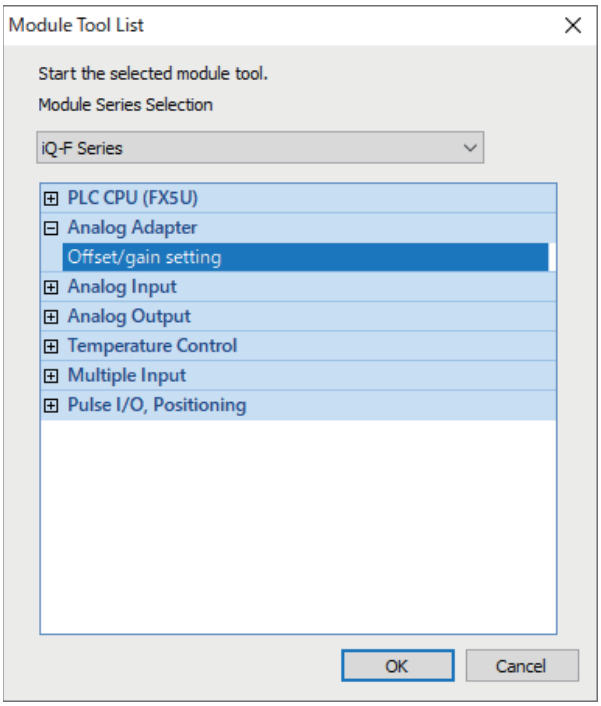
When the input range setting during reading is the same as the input range setting in the built-in memory of the analog adapter, the read values are set to the "offset setting value" and "gain setting value". If the input range setting is different, the initial value of the input range setting selected during reading is valid and set to the "offset setting value" and "gain setting value". In this case, the offset/gain setting input range mismatch alarm occurs (Alarm code: 0C0☐H)

## Setting procedure

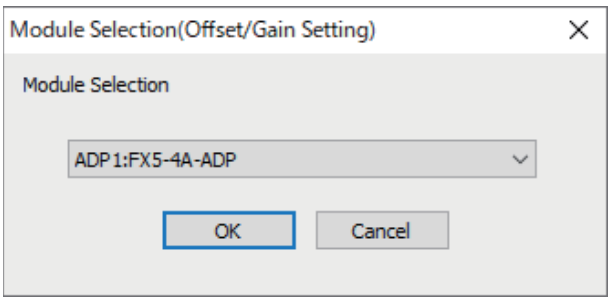
Access to the offset/gain setting window in the GX Works3 to set the offset and gain values.

The setting procedure for the offset/gain setting of the FX5-4A-ADP is as follows:

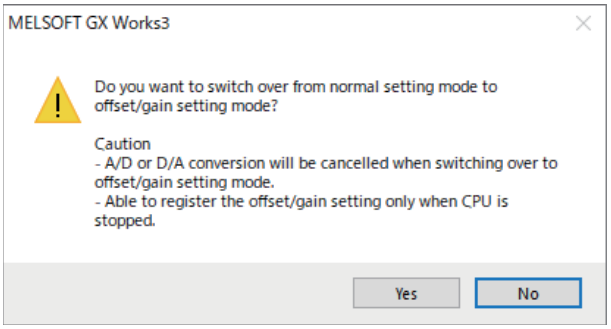
[Tool] ⇨ [Module Tool List]




1. In "Analog Adapter", select "Offset/gain setting" and click [OK] button.



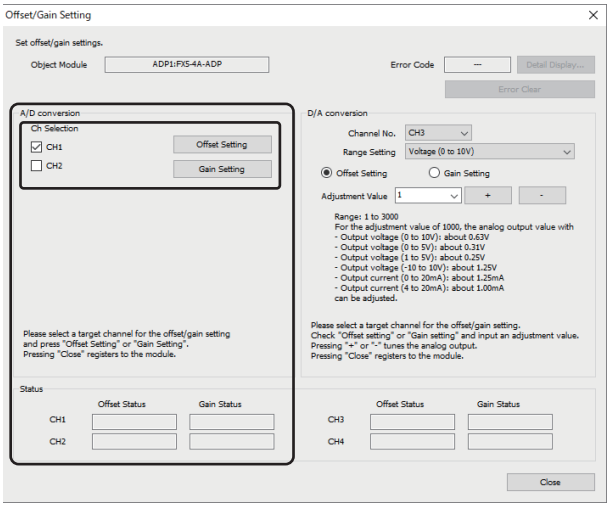

**2.** Select the target module for the offset/gain setting, and click [OK] button.




**3.** Click [Yes] button.

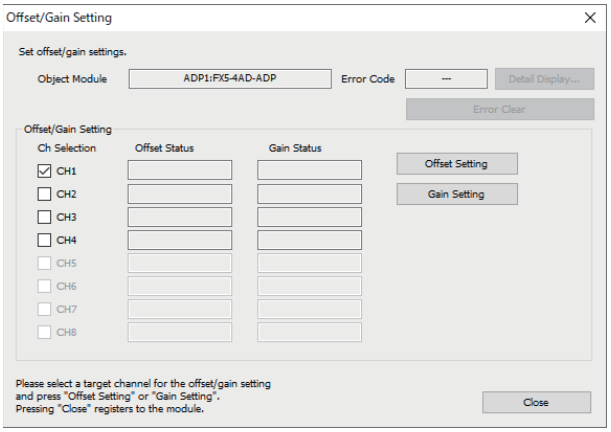


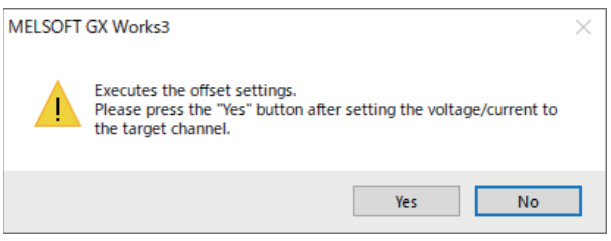
■FX5-4A-ADP



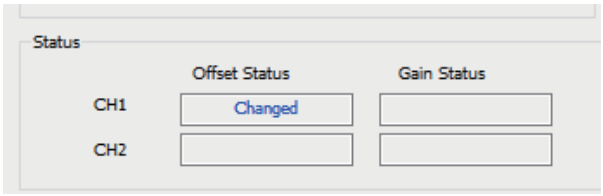

**4.** Execute the settings in A/D conversion. Mark the checkbox of the channel where offset and gain values are to be set, and click [Offset Setting] button.

■FX5-4AD-ADP

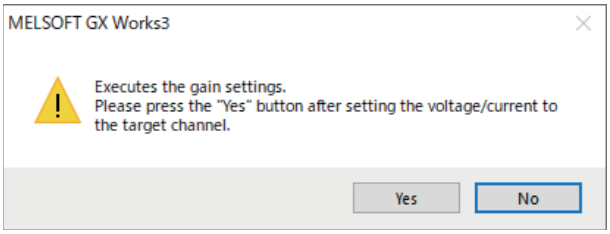


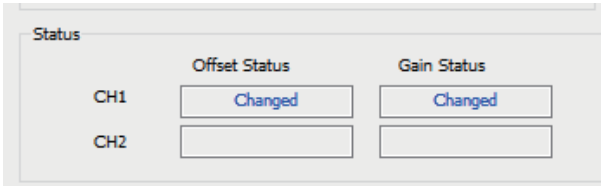

**5.** Apply the offset voltage or current to the terminal of the corresponding channel, and click [Yes] button.



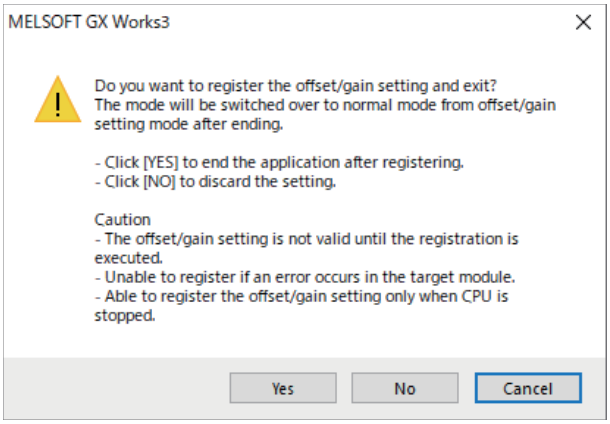

**6.** Check that "Offset Status" has changed to "Changed", and click [Gain Setting] button.




**7.** Apply the gain voltage or current to the terminal of the corresponding channel, and click [Yes] button.




**8.** Check that "Gain Status" has changed to "Changed", and click [Close] button.




**9.** Click [Yes] button.

## Corresponding devices

The devices which are used by the offset/gain setting function are listed below.

| Name | Connection part | Special relay/Special register | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3*1 | CH4*1 |
| Offset/gain reading | 1st adapter | SM6332 | SM6372 | SM6412 | SM6452 |
| | 2nd adapter | SM6692 | SM6732 | SM6772 | SM6812 |
| | 3rd adapter | SM7052 | SM7092 | SM7132 | SM7172 |
| | 4th adapter | SM7412 | SM7452 | SM7492 | SM7532 |
| Offset/gain writing | 1st adapter | SM6333 | SM6373 | SM6413 | SM6453 |
| | 2nd adapter | SM6693 | SM6733 | SM6773 | SM6813 |
| | 3rd adapter | SM7053 | SM7093 | SM7133 | SM7173 |
| | 4th adapter | SM7413 | SM7453 | SM7493 | SM7533 |
| Offset setting value | 1st adapter | SD6332 | SD6372 | SD6412 | SD6452 |
| | 2nd adapter | SD6692 | SD6732 | SD6772 | SD6812 |
| | 3rd adapter | SD7052 | SD7092 | SD7132 | SD7172 |
| | 4th adapter | SD7412 | SD7452 | SD7492 | SD7532 |
| Gain setting value | 1st adapter | SD6333 | SD6373 | SD6413 | SD6453 |
| | 2nd adapter | SD6693 | SD6733 | SD6773 | SD6813 |
| | 3rd adapter | SD7053 | SD7093 | SD7133 | SD7173 |
| | 4th adapter | SD7413 | SD7453 | SD7493 | SD7533 |
| Offset/gain writing enable code | 1st adapter | SD6334 | SD6374 | SD6414 | SD6454 |
| | 2nd adapter | SD6694 | SD6734 | SD6774 | SD6814 |
| | 3rd adapter | SD7054 | SD7094 | SD7134 | SD7174 |
| | 4th adapter | SD7414 | SD7454 | SD7494 | SD7534 |

*1 Only used by the FX5-4AD-ADP.

The details of the device used are listed below.

| Name | Description | Setting value | Description | Default value | R/W |
|---|---|---|---|---|---|
| Offset/gain reading | An offset/gain setting value is read. | 0: OFF | Offset/gain reading is not performed. | 0: OFF | R/W |
| | | 1: ON | Offset/gain reading is performed. | | |
| Offset/gain writing | An offset/gain setting value is written in. | 0: OFF | Offset/gain writing is not performed. | 0: OFF | R/W |
| | | 1: ON | Offset/gain writing is performed. | | |

| Item | Description | Setting range | | Default value | R/W |
|---|---|---|---|---|---|
| | | Voltage input (mV) | Current input (μA) | | |
| Offset setting value | Set the offset data/gain data used in the offset/gain setting function. | -10000 to +9000 | -20000 to +17000 | 0 | R/W |
| Gain setting value | | -9000 to +10000 | -17000 to +30000 | Voltage output: 5000<br>Current output: 20000 | R/W |

| Name | Description | Range | Default value | R/W |
|---|---|---|---|---|
| Offset/gain writing enable code | Set the offset/gain writing enable code used for changing the offset/gain. | Offset/gain writing enable: E20FH<br>Offset/gain writing disable: Other than E20FH | 0 | R/W |

# Offset/gain initialization function

FX5-4A-ADP | FX5-4AD-ADP | ~~FX5-4DA-ADP~~ | ~~FX5-4AD-PT-ADP~~ | ~~FX5-4AD-TC-ADP~~

This function initializes the offset and gain values in the built-in memory of the analog adapter.
This function can be set only with special devices.

## Operation

Set "A/D conversion: E20FH" to "offset/gain writing enable code" and set the "offset/gain initialization" from OFF to ON to initialize the offset value and gain value saved in the built-in memory of the analog adapter. When initialization is completed, the "offset/gain initialization" automatically turns OFF. Also, the "offset/gain writing enable code" is cleared to 0.

**Point**

- Offset/gain initialization is executed when the "offset/gain writing enable code" is set to "E20FH".
- Offset/gain initialization is enabled only while A/D conversion is disabled.
- The "A/D conversion enable/disable setting" cannot be changed to "enable" while offset/gain initialization is being executed.

## Setting procedure

***1.*** Set "E20FH" to the "offset/gain writing enable code".

| Setting value | Description | Default value |
|---|---|---|
| Other than E20FH | Offset/gain writing disable | 0 |
| E20FH | Offset/gain writing enable | |

***2.*** Set the "offset/gain initialization" from OFF to ON.

| Setting value | Description | Default value |
|---|---|---|
| 0: OFF | Offset/gain initialization is not performed. | 0: OFF |
| 1: ON | Offset/gain initialization is performed. | |

## Corresponding devices

The devices which are used by the offset/gain initialization function are listed below.

| Name | Connection part | Special relay/Special register | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3*1 | CH4*1 |
| Offset/gain initialization | 1st adapter | SM6334 | SM6374 | SM6414 | SM6454 |
| | 2nd adapter | SM6694 | SM6734 | SM6774 | SM6814 |
| | 3rd adapter | SM7054 | SM7094 | SM7134 | SM7174 |
| | 4th adapter | SM7414 | SM7454 | SM7494 | SM7534 |
| Offset/gain writing enable code | 1st adapter | SD6334 | SD6374 | SD6414 | SD6454 |
| | 2nd adapter | SD6694 | SD6734 | SD6774 | SD6814 |
| | 3rd adapter | SD7054 | SD7094 | SD7134 | SD7174 |
| | 4th adapter | SD7414 | SD7454 | SD7494 | SD7534 |

*1 Only used by the FX5-4AD-ADP.

The details of the device used are listed below.

| Name | Description | Setting value | Description | Default value | R/W |
|---|---|---|---|---|---|
| Offset/gain initialization | An offset/gain setting value is initialized. | 0: OFF | Offset/gain initialization is not performed. | 0: OFF | R/W |
| | | 1: ON | Offset/gain initialization is performed. | | |

| Name | Description | Range | Default value | R/W |
|---|---|---|---|---|
| Offset/gain writing enable code | Set the offset/gain writing enable code used for changing the offset/gain. | Offset/gain writing enable: E20FH<br>Offset/gain writing disable: Other than E20FH | 0 | R/W |

# 37.7 Functions (Analog Output)

This section describes details of the D/A conversion functions and how to set them using the GX Works3.

## D/A conversion enable/disable function

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

Set whether to enable or disable D/A conversion for each channel.

### Operation

Digital values are D/A-converted only for channels whose "D/A conversion enable/disable setting" is set to "D/A conversion enable". The channels for which the "D/A output enable/disable setting" is set to "enable" output the converted analog value. If "D/A conversion enable/disable setting" is changed from D/A conversion enable to D/A conversion disable, the digital value is held as is, and the digital operation value and analog output value monitor will be cleared.

### Setting methods

Set "D/A conversion enable/disable setting" to "D/A conversion enable" or "D/A conversion disable".

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Basic Settings" ⇨ "D/A Conversion Enable/Disable Setting"

### Corresponding devices

The devices which are used by the D/A conversion enable/disable setting function are listed below.

| Name | Connection part | Special relay | | | |
|---|---|---|---|---|---|
| | | CH1*1 | CH2*1 | CH3 | CH4 |
| D/A conversion enable/disable setting | 1st adapter | SM6300 | SM6340 | SM6380 | SM6420 |
| | 2nd adapter | SM6660 | SM6700 | SM6740 | SM6780 |
| | 3rd adapter | SM7020 | SM7060 | SM7100 | SM7140 |
| | 4th adapter | SM7380 | SM7420 | SM7460 | SM7500 |

*1 Only used by the FX5-4DA-ADP.

The details of the device used are listed below.

| Name | Description | Setting value | Description | Default value | R/W |
|---|---|---|---|---|---|
| D/A conversion enable/disable setting | Set whether to enable or disable D/A conversion. | 0: OFF | D/A conversion enable | 1: ON | R/W |
| | | 1: ON | D/A conversion disable | | |

# Range switching function

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

The output range of the analog output can be switched for each channel.
Switching the range makes it possible to change the output conversion characteristics.

## Operation

The output range is switched when the "output range setting" is changed while the "D/A conversion enable/disable setting" is set to "disable".
When the output range is switched, the following special devices are initialized:

| Name | Connection part | Special relay/Special register | | | |
|---|---|---|---|---|---|
| | | CH1*2 | CH2*2 | CH3 | CH4 |
| Warning output upper limit value flag | 1st adapter | SM6311 | SM6351 | SM6391 | SM6431 |
| | 2nd adapter | SM6671 | SM6711 | SM6751 | SM6791 |
| | 3rd adapter | SM7031 | SM7071 | SM7111 | SM7151 |
| | 4th adapter | SM7391 | SM7431 | SM7471 | SM7511 |
| Warning output lower limit value flag | 1st adapter | SM6312 | SM6352 | SM6392 | SM6432 |
| | 2nd adapter | SM6672 | SM6712 | SM6752 | SM6792 |
| | 3rd adapter | SM7032 | SM7072 | SM7112 | SM7152 |
| | 4th adapter | SM7392 | SM7432 | SM7472 | SM7512 |
| Disconnection detection flag | 1st adapter | SM6318 | SM6358 | SM6398 | SM6438 |
| | 2nd adapter | SM6678 | SM6718 | SM6758 | SM6798 |
| | 3rd adapter | SM7038 | SM7078 | SM7118 | SM7158 |
| | 4th adapter | SM7398 | SM7438 | SM7478 | SM7518 |
| Digital operation value | 1st adapter | SD6301 | SD6341 | SD6381 | SD6421 |
| | 2nd adapter | SD6661 | SD6701 | SD6741 | SD6781 |
| | 3rd adapter | SD7021 | SD7061 | SD7101 | SD7141 |
| | 4th adapter | SD7381 | SD7421 | SD7461 | SD7501 |
| Analog output value monitor | 1st adapter | SD6302 | SD6342 | SD6382 | SD6422 |
| | 2nd adapter | SD6662 | SD6702 | SD6742 | SD6782 |
| | 3rd adapter | SD7022 | SD7062 | SD7102 | SD7142 |
| | 4th adapter | SD7382 | SD7422 | SD7462 | SD7502 |
| Offset setting value*1 | 1st adapter | SD6332 | SD6372 | SD6412 | SD6452 |
| | 2nd adapter | SD6692 | SD6732 | SD6772 | SD6812 |
| | 3rd adapter | SD7052 | SD7092 | SD7132 | SD7172 |
| | 4th adapter | SD7412 | SD7452 | SD7492 | SD7532 |
| Gain setting value*1 | 1st adapter | SD6333 | SD6373 | SD6413 | SD6453 |
| | 2nd adapter | SD6693 | SD6733 | SD6773 | SD6813 |
| | 3rd adapter | SD7053 | SD7093 | SD7133 | SD7173 |
| | 4th adapter | SD7413 | SD7453 | SD7493 | SD7533 |

*1 When the output range setting after change is equivalent to the output range setting set by the offset/gain setting function, the values set by the offset/gain setting function are reflected. In any other case, they are initialized to the initial value.
*2 CH1 and CH2 are only used by the FX5-4DA-ADP.

## Setting procedure

Set the output range to be used in the "output range setting".

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Basic Settings" ⇨ "Range switching function"

| Output range setting | Digital input range |
|---|---|
| 0 to 10V | 0 to 16000 |
| 0 to 5V | 0 to 16000 |
| 1 to 5V | 0 to 16000 |
| -10 to +10V | -8000 to +8000 |
| 0 to 20mA | 0 to 16000 |
| 4 to 20mA | 0 to 16000 |

## Corresponding devices

The devices which are used by the range switching function are listed below.

| Name | Connection part | Special register | | | |
|---|---|---|---|---|---|
| | | CH1*1 | CH2*1 | CH3 | CH4 |
| Output range setting | 1st adapter | SD6305 | SD6345 | SD6385 | SD6425 |
| | 2nd adapter | SD6665 | SD6705 | SD6745 | SD6785 |
| | 3rd adapter | SD7025 | SD7065 | SD7105 | SD7145 |
| | 4th adapter | SD7385 | SD7425 | SD7465 | SD7505 |

*1 Only used by the FX5-4DA-ADP.

The details of the device used are listed below.

| Name | Description | Setting value | Description | Default value | R/W |
|---|---|---|---|---|---|
| Output range setting | Set the output range.<br>If a value other than the setting value is set, the range setting range error (error code: 1B8□H) occurs. | 0 | 0 to 10V | 0 | R/W |
| | | 1 | 0 to 5V | | |
| | | 2 | 1 to 5V | | |
| | | 3 | -10 to +10V | | |
| | | 4 | 0 to 20mA | | |
| | | 5 | 4 to 20mA | | |

# Shift function

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

This function adds (shifts) the set input value shift amount to the digital value and stores it in "Digital operation value". When the input value shift amount is changed, the change will be reflected in the digital operation value in real time, allowing fine adjustments to be easily performed during system startup.

## Operation

The set "Input value shift amount" is added to the digital value. The added digital value is stored in "Digital operation value". When the digital operation value resulting from the shift processing exceeds the range of -32768 to +32767, the value is fixed to the lower limit (-32768) or the upper limit (+32767).

**Point**

When the scaling function is used together, the scaling processing is executed to the value after shifting.

## Setting procedure

Set the shift amount to "Input value shift amount".

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Application Settings" ⇨ "Shift Function"

| Item | Setting range | Default value | R/W |
|---|---|---|---|
| Input value shift amount | -32768 to +32767 | 0 | R/W |

## Corresponding devices

The devices which are used by the shift function are listed below.

| Name | Connection part | Special register | | | |
|---|---|---|---|---|---|
| | | CH1*1 | CH2*1 | CH3 | CH4 |
| Input value shift amount | 1st adapter | SD6310 | SD6350 | SD6390 | SD6430 |
| | 2nd adapter | SD6670 | SD6710 | SD6750 | SD6790 |
| | 3rd adapter | SD7030 | SD7070 | SD7110 | SD7150 |
| | 4th adapter | SD7390 | SD7430 | SD7470 | SD7510 |

*1 Only used by the FX5-4DA-ADP.

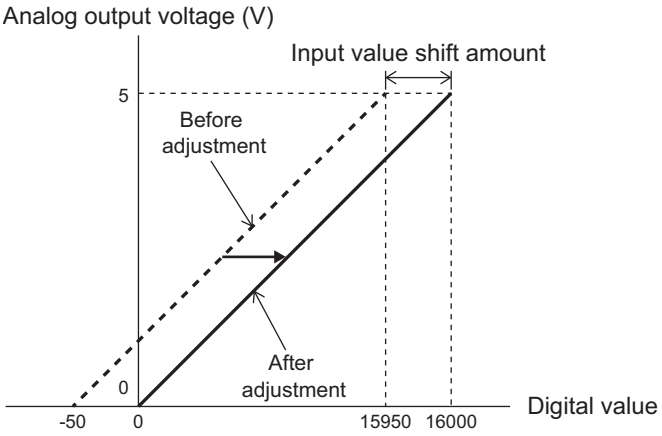
The details of the device used are listed below.

| Name | Description | Range | Default value | R/W |
|---|---|---|---|---|
| Input value shift amount | Set the "input value shift amount" used in the shift function. The set value is added to the "digital value". | -32768 to +32767 | 0 | R/W |

## Setting example

Ex.

When the output range is 0 to 5V and the input value shift amount is +50




| Digital value | Digital operation value | Analog output voltage (V) |
|---|---|---|
| Before adjustment | After adjustment | |
| -50 | 0 | 0 |
| 15950 | 16000 | 5 |

# Warning output function

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

A warning will be output when the digital operation value after shift addition exceeds the warning output upper limit value or is less than the warning output lower limit value.

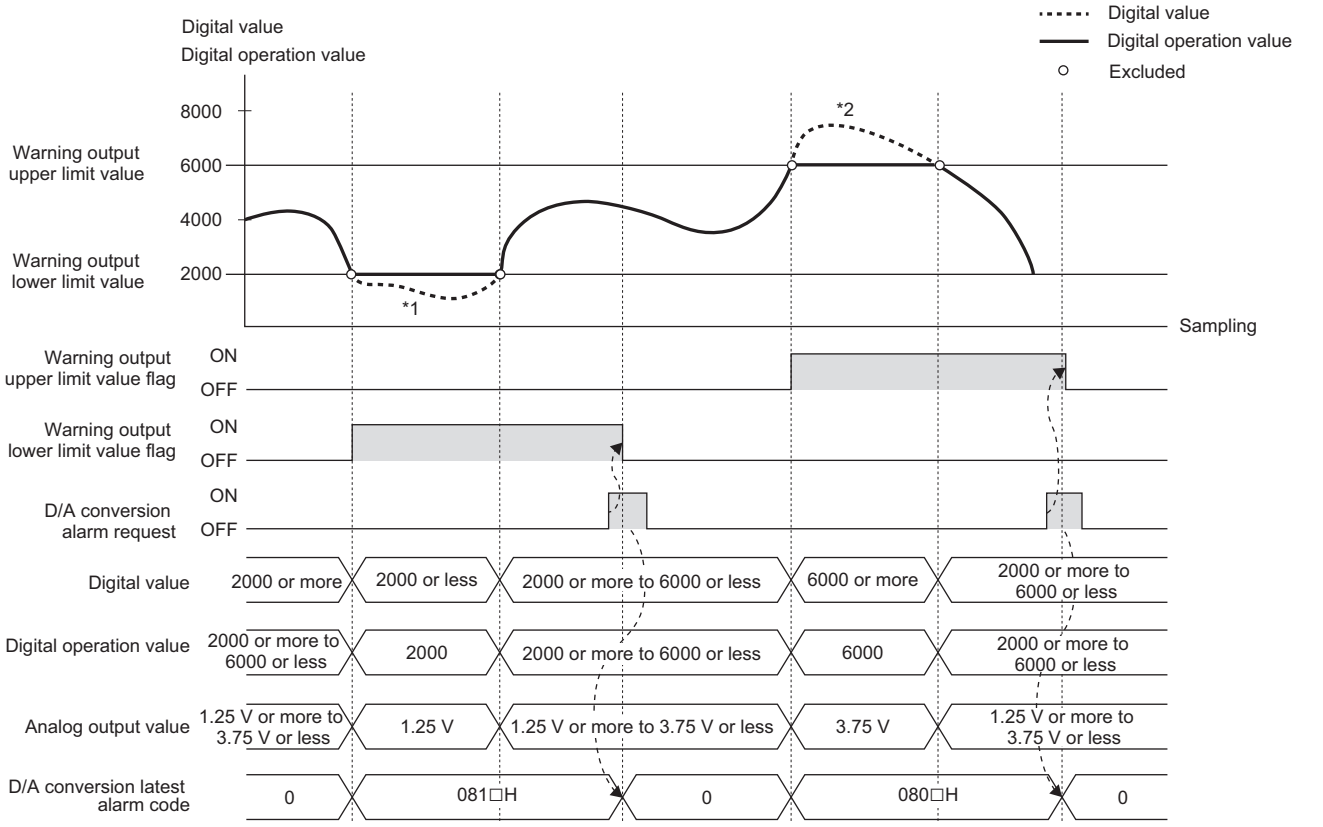
## Operation

When the digital operation value after shift addition is greater than or equal to the warning output upper limit value or less than the warning output lower limit value and satisfies the conditions for warning output, "warning output upper flag" or "warning output lower flag" turns ON.

When a warning is output, the setting value of the warning output upper limit value/warning output lower limit value is regarded as the digital operation value and D/A-converted.

After a warning is output, even if the digital value changes to below the warning output upper limit value and above the warning output lower limit value, the "warning output upper flag" and "warning output lower flag" will not turn OFF. When the alarm clear request is set to OFF, ON and OFF again, the "warning output upper flag" and "warning output lower flag" turn OFF. The "warning output upper flag" and "warning output lower flag" also turn OFF when the "warning output setting" is changed to "disable", but the alarm code stored in the "D/A conversion latest alarm code" is not cleared.

For clearing the alarm code stored in the "D/A conversion latest alarm code", set the alarm clear request to OFF, ON and OFF again.




*1 Analog values below the warning output lower limit value are not output.

*2 Analog values above the warning output upper limit value are not output.

## Setting procedure

**1.** Set "Warning Output Function" to "Enable".

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Application Settings" ⇨ "Warning Output Function"

**2.** Set values for "Warning output upper limit value" and "Warning output lower limit value".

| Item | Setting range |
|---|---|
| Warning output upper limit value | -32768 to +32767 |
| Warning output lower limit value | |

**Point**

Set the warning output upper limit value and warning output lower limit value while satisfying the condition "Warning output upper limit value > Warning output lower limit value".

## Corresponding devices

The devices which are used by the warning output function are listed below.

| Name | Connection part | Special relay/Special register | | | |
|---|---|---|---|---|---|
| | | CH1*1 | CH2*1 | CH3 | CH4 |
| Warning output upper limit value flag | 1st adapter | SM6311 | SM6351 | SM6391 | SM6431 |
| | 2nd adapter | SM6671 | SM6711 | SM6751 | SM6791 |
| | 3rd adapter | SM7031 | SM7071 | SM7111 | SM7151 |
| | 4th adapter | SM7391 | SM7431 | SM7471 | SM7511 |
| Warning output lower limit value flag | 1st adapter | SM6312 | SM6352 | SM6392 | SM6432 |
| | 2nd adapter | SM6672 | SM6712 | SM6752 | SM6792 |
| | 3rd adapter | SM7032 | SM7072 | SM7112 | SM7152 |
| | 4th adapter | SM7392 | SM7432 | SM7472 | SM7512 |
| Warning output setting | 1st adapter | SM6313 | SM6353 | SM6393 | SM6433 |
| | 2nd adapter | SM6673 | SM6713 | SM6753 | SM6793 |
| | 3rd adapter | SM7033 | SM7073 | SM7113 | SM7153 |
| | 4th adapter | SM7393 | SM7433 | SM7473 | SM7513 |
| Warning output upper limit value | 1st adapter | SD6311 | SD6351 | SD6391 | SD6431 |
| | 2nd adapter | SD6671 | SD6711 | SD6751 | SD6791 |
| | 3rd adapter | SD7031 | SD7071 | SD7111 | SD7151 |
| | 4th adapter | SD7391 | SD7431 | SD7471 | SD7511 |
| Warning output lower limit value | 1st adapter | SD6312 | SD6352 | SD6392 | SD6432 |
| | 2nd adapter | SD6672 | SD6712 | SD6752 | SD6792 |
| | 3rd adapter | SD7032 | SD7072 | SD7112 | SD7152 |
| | 4th adapter | SD7392 | SD7432 | SD7472 | SD7512 |

*1 Only used by the FX5-4DA-ADP.

The details of the device used are listed below.

| Name | Description | Monitor value | Display description | Default value | R/W |
|---|---|---|---|---|---|
| Warning output upper limit value flag<br>Warning output lower limit value flag | These flags monitor the upper limit value warning or lower limit value warning of warning output. | 0: OFF | Normal | 0: OFF | R |
| | | 1: ON | Warning output upper limit/ lower limit detection | | |
| Warning output setting | Set whether to enable or disable the warning output. | 0: OFF | Warning output enable | 1: ON | R/W |
| | | 1: ON | Warning output disable | | |

| Name | Description | Range | Default value | R/W |
|---|---|---|---|---|
| Warning output upper limit value<br>Warning output lower limit value | Set the upper and lower limit values of the warning output function. | -32768 to +32767 | 0 | R/W |

# Scaling function

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

This function performs the scale conversion on digital values within a specified range between a scaling upper limit value and a scaling lower limit value.
The program for scale conversion can be omitted.

## Operation

This function performs the scale conversion on digital values within the range between the scaling upper limit value and scaling lower limit value and stores the converted value in "Digital operation value". The value after the scale conversion is used for the D/A conversion. (The value below the decimal point obtained by the conversion is rounded off.)

### ■Concept of scaling setting

Ex.
When the output range is set to -10 to +10V
For the scaling lower limit value, set a value corresponding to the lower limit value of the output range (-8000).
For the scaling upper limit value, set a value corresponding to the upper limit value of the output range (+8000).

### ■Calculating the scaling value

The scale conversion is based on the following formula. (The value below the decimal point obtained by scale conversion is rounded off.)

| Calculation formula | Symbol |
|---|---|
| Digital value used for D/A conversion = $\frac{D_{Max} - D_{Min}}{S_H - S_L} \times (D_X - S_L) + D_{Min}$ | $D_X$: Digital value<br>$D_{Max}$: Maximum value of digital input for the output range in use<br>$D_{Min}$: Minimum value of digital input for the output range in use<br>$S_H$: Scaling upper limit value<br>$S_L$: Scaling lower limit value |

## Setting procedure

1. Set "D/A conversion enable/disable setting" to "D/A conversion enable".

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Basic Settings" ⇨ "D/A Conversion Enable/Disable Setting"

2. Set the "scaling enable/disable setting" to "enable".

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Application Settings" ⇨ "Scaling Setting"

3. Set values for "Scaling upper limit value" and "Scaling lower limit value".

| Item | Setting range |
|---|---|
| Scaling upper limit value | -32768 to +32767 |
| Scaling lower limit value | -32768 to +32767 |

**Point**

- If the relation between the values is scaling lower limit value > scaling upper limit value, the scale conversion can be performed according to a negative slope.
- Set the scaling with the condition "Scaling lower limit value ≠ Scaling upper limit value".

## Corresponding devices

The devices which are used by the scaling function are listed below.

| Name | Connection part | Special relay/Special register | | | |
|---|---|---|---|---|---|
| | | CH1*1 | CH2*1 | CH3 | CH4 |
| Scaling enable/disable setting | 1st adapter | SM6308 | SM6348 | SM6388 | SM6428 |
| | 2nd adapter | SM6668 | SM6708 | SM6748 | SM6788 |
| | 3rd adapter | SM7028 | SM7068 | SM7108 | SM7148 |
| | 4th adapter | SM7388 | SM7428 | SM7468 | SM7508 |
| Scaling upper limit value | 1st adapter | SD6308 | SD6348 | SD6388 | SD6428 |
| | 2nd adapter | SD6668 | SD6708 | SD6748 | SD6788 |
| | 3rd adapter | SD7028 | SD7068 | SD7108 | SD7148 |
| | 4th adapter | SD7388 | SD7428 | SD7468 | SD7508 |
| Scaling lower limit value | 1st adapter | SD6309 | SD6349 | SD6389 | SD6429 |
| | 2nd adapter | SD6669 | SD6709 | SD6749 | SD6789 |
| | 3rd adapter | SD7029 | SD7069 | SD7109 | SD7149 |
| | 4th adapter | SD7389 | SD7429 | SD7469 | SD7509 |

*1 Only used by the FX5-4DA-ADP.

The details of the device used are listed below.

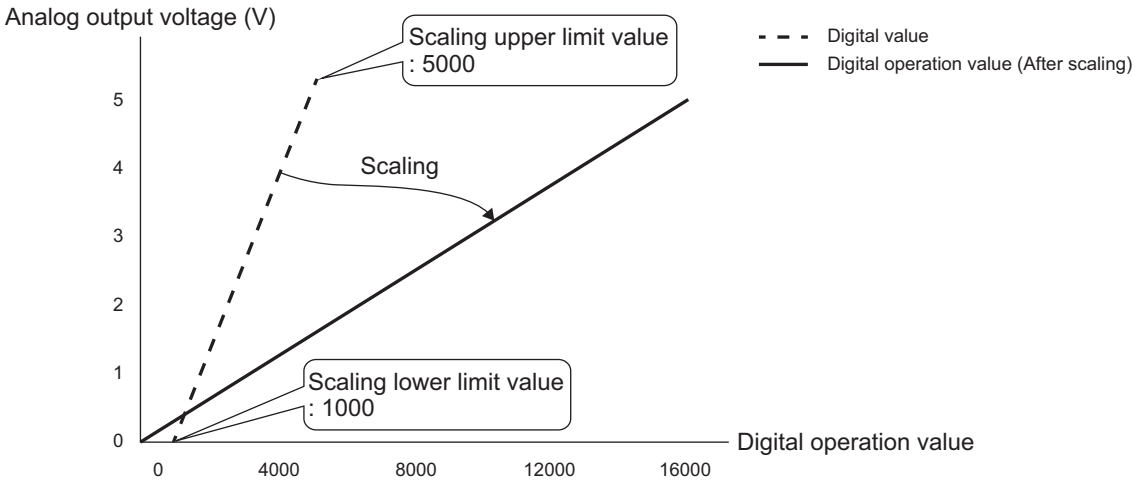
| Name | Description | Setting value | Description | Default value | R/W |
|---|---|---|---|---|---|
| Scaling enable/disable setting | Set whether to enable or disable the scaling function. | 0: OFF | Scaling function enable | 1: ON | R/W |
| | | 1: ON | Scaling function disable | | |

| Name | Description | Range | Default value | R/W |
|---|---|---|---|---|
| Scaling upper limit value<br>Scaling lower limit value | Set the upper and lower limit values of the scaling conversion range. | -32768 to +32767 | 0 | R/W |

## Setting example

**Ex.**

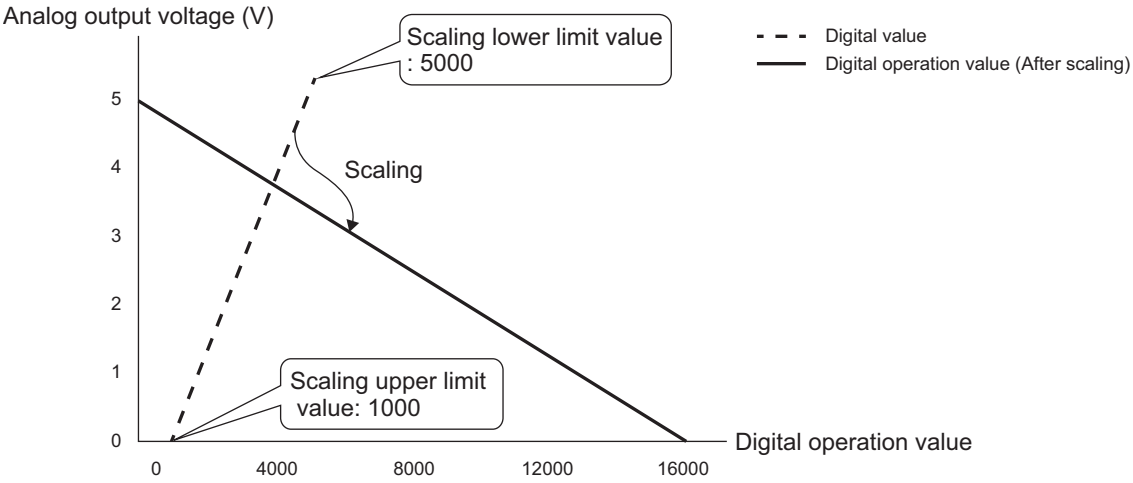
When 5000 is set to the scaling upper limit value and 1000 is set to the scaling lower limit value for the channel with the output range of 0 to 5V




| Digital value | Digital operation value (after scaling) | Output voltage (V) |
|---|---|---|
| 1000 | 0 | 0 |
| 1800 | 3200 | 1 |
| 2600 | 6400 | 2 |
| 3400 | 9600 | 3 |
| 4200 | 12800 | 4 |
| 5000 | 16000 | 5 |

Ex.

When 1000 is set to the scaling upper limit value and 5000 is set to the scaling lower limit value for the channel with the output range of 0 to 5V




| Digital value | Digital operation value (after scaling) | Output voltage (V) |
|---|---|---|
| 1000 | 16000 | 0 |
| 1800 | 12800 | 1 |
| 2600 | 9600 | 2 |
| 3400 | 6400 | 3 |
| 4200 | 3200 | 4 |
| 5000 | 0 | 5 |

# Analog output HOLD/CLEAR function

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

Set whether to clear the output analog output value or to hold the previous value or setting value in accordance with the CPU module operation status (RUN, STOP or STOP (by stop error)).

## Operation

When the CPU module operation status becomes "RUN", "STOP" or "STOP (by stop error)", the FX5-4A-ADP becomes the analog output status shown in the table below in accordance with the combination of "HOLD/CLEAR setting" and "D/A output enable/disable setting".

| CPU module status | D/A conversion enable/disable setting | D/A output enable/ disable setting | Analog output HOLD/ CLEAR setting | Output status |
|---|---|---|---|---|
| RUN | Enabled | Enabled | All settings | The value after a shift and scaling |
| | | Disabled | All settings | Offset value |
| | Disabled | Enabled | All settings | 0 |
| | | Disabled | All settings | 0 |
| STOP (RUN → STOP, PAUSE → STOP, stop error) | Enabled | Enabled | CLEAR | The value with K0 set to the digital value is output. |
| | | | Previous Value (Hold) | The value after a shift and scaling |
| | | | Setting Value | The value set as the HOLD setting value is output. |
| | | Disabled | All settings | Offset value |
| | Disabled | Enabled | All settings | 0 |
| | | Disabled | All settings | 0 |
| PAUSE | Enabled | Enabled | All settings | The value after a shift and scaling |
| | | Disabled | All settings | Offset value |
| | Disabled | Enabled | All settings | 0 |
| | | Disabled | All settings | 0 |

## Setting methods

**1.** Set "HOLD/CLEAR Setting" to "CLEAR", "Previous Value (hold)", or "Setting Value".

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Application Settings" ⇨ "Analog Output HOLD/CLEAR Setting" ⇨ "HOLD/CLEAR Setting"

**2.** It is the above 1, and when "Setting Value" is chosen, a value is set to HOLD setting value.

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Application Settings" ⇨ "Analog Output HOLD/CLEAR Setting"⇨ "HOLD Setting Value"

| Item | Setting range |
|---|---|
| HOLD setting value | -32768 to +32767 |

## Corresponding devices

The devices which are used by the analog output HOLD/CLEAR function are listed below.

| Name | Connection part | Special register | | | |
|---|---|---|---|---|---|
| | | CH1*1 | CH2*1 | CH3 | CH4 |
| HOLD/CLEAR function setting | 1st adapter | SD6303 | SD6343 | SD6383 | SD6423 |
| | 2nd adapter | SD6663 | SD6703 | SD6743 | SD6783 |
| | 3rd adapter | SD7023 | SD7063 | SD7103 | SD7143 |
| | 4th adapter | SD7383 | SD7423 | SD7463 | SD7503 |
| HOLD setting value | 1st adapter | SD6304 | SD6344 | SD6384 | SD6424 |
| | 2nd adapter | SD6664 | SD6704 | SD6744 | SD6784 |
| | 3rd adapter | SD7024 | SD7064 | SD7104 | SD7144 |
| | 4th adapter | SD7384 | SD7424 | SD7464 | SD7504 |

*1 Only used by the FX5-4DA-ADP.

The details of the device used are listed below.

| Name | Description | Setting value | Description | Default value | R/W |
|---|---|---|---|---|---|
| HOLD/CLEAR function setting | Set whether to hold (HOLD) or clear (CLEAR) the analog output value that was being output when the operation status of the CPU module is STOP or a stop error.<br>• If a value other than the setting value is set, the output status setting range error during HOLD (error code: 1B1□H) occurs.<br>• Set a value to the "HOLD setting value" when setting "2" here. | 0 | CLEAR | 1 | R/W |
| | | 1 | Previous Value (Hold) | | |
| | | 2 | HOLD setting value | | |

| Name | Description | Range | Default value | R/W |
|---|---|---|---|---|
| HOLD setting value | Set the output value when "2: HOLD setting value" is set to the HOLD/CLEAR function setting. | -32768 to +32767 | 0 | R/W |

# D/A output enable/disable setting function

FX5-4A-ADP | FX5-4AD-ADP ✕ | FX5-4DA-ADP | FX5-4AD-PT-ADP ✕ | FX5-4AD-TC-ADP ✕

Specify whether to output the D/A conversion value or offset value for each channel.

The conversion speed is a constant, regardless of the output enable/disable state.

## Operation

For channels for which "D/A output enable/disable setting" is set to "D/A output enable", the digital values are D/A-converted and the resultant analog values are output.

The channels for which the "D/A output enable/disable setting" is set to "disable" output the offset value.

## Setting methods

Set "D/A output enable/disable setting" to "D/A output enable" or "D/A output disable".

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Basic Settings" ⇨ "D/A Output Enable/Disable Setting"

## Corresponding devices

The devices which are used by the D/A output enable/disable setting function are listed below.

| Name | Connection part | Special relay | | | |
|---|---|---|---|---|---|
| | | CH1*1 | CH2*1 | CH3 | CH4 |
| D/A output enable/disable setting | 1st adapter | SM6301 | SM6341 | SM6381 | SM6421 |
| | 2nd adapter | SM6661 | SM6701 | SM6741 | SM6781 |
| | 3rd adapter | SM7021 | SM7061 | SM7101 | SM7141 |
| | 4th adapter | SM7381 | SM7421 | SM7461 | SM7501 |

*1 Only used by the FX5-4DA-ADP.

The details of the device used are listed below.

| Name | Description | Setting value | Description | Default value | R/W |
|---|---|---|---|---|---|
| D/A output enable/disable setting | Set whether to output the D/A conversion value or to output the offset value.<br>The setting value will be ignored when the D/A conversion enable/disable setting is set to "disable". | 0: OFF | D/A conversion value | 1: ON | R/W |
| | | 1: ON | Offset value | | |

# Disconnection detection function

FX5-4A-ADP | FX5-4AD-ADP ✕ | FX5-4DA-ADP | FX5-4AD-PT-ADP ✕ | FX5-4AD-TC-ADP ✕

Disconnection can be detected in each channel.

This function is enabled when the analog output range is 4 to 20mA.

## Operation

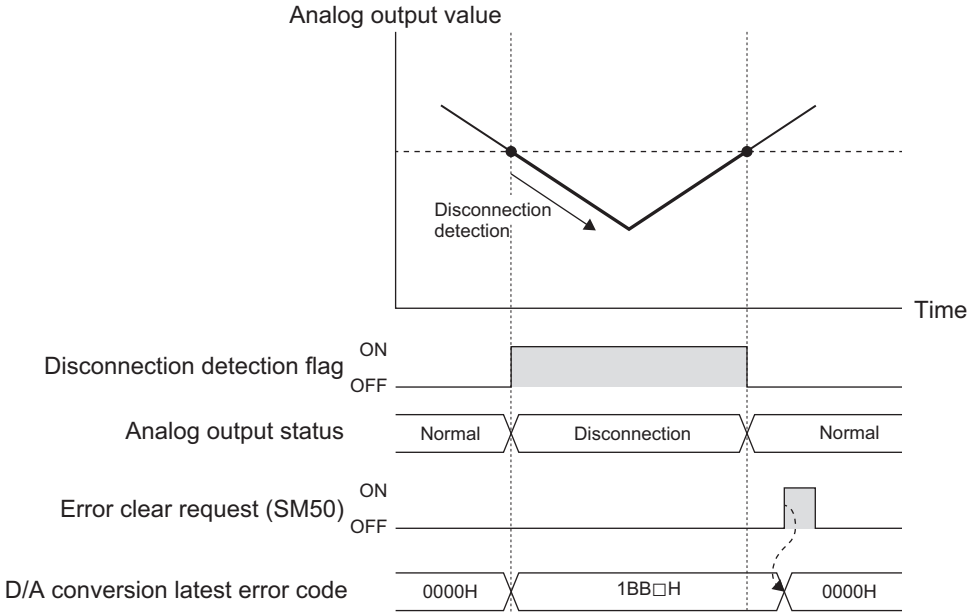
When disconnection is detected in a channel for which the "D/A conversion enable/disable setting" is set to "D/A conversion enable" and the "disconnection detection enable/disable setting" is set to "enable", it is regarded as a disconnection detection error, and the "disconnection detection flag" turns ON. (Error code: 1BB□)

At this time, the digital value, digital operation value, and analog output value monitor will be cleared.

When the "disconnection recovery detection enable/disable setting" is set to "enable", the "disconnection detection flag" turns OFF when the channel is recovered from disconnection.

When the "disconnection recovery detection enable/disable setting" is set to "disable", the "disconnection detection flag" remains ON even if the channel is recovered from disconnection. To turn OFF "disconnection detection flag", it is necessary to set the "error clear request" (SM50) of the CPU module to ON. The "disconnection detection flag" turns OFF also when the "disconnection detection enable/disable setting" is changed to "disable".

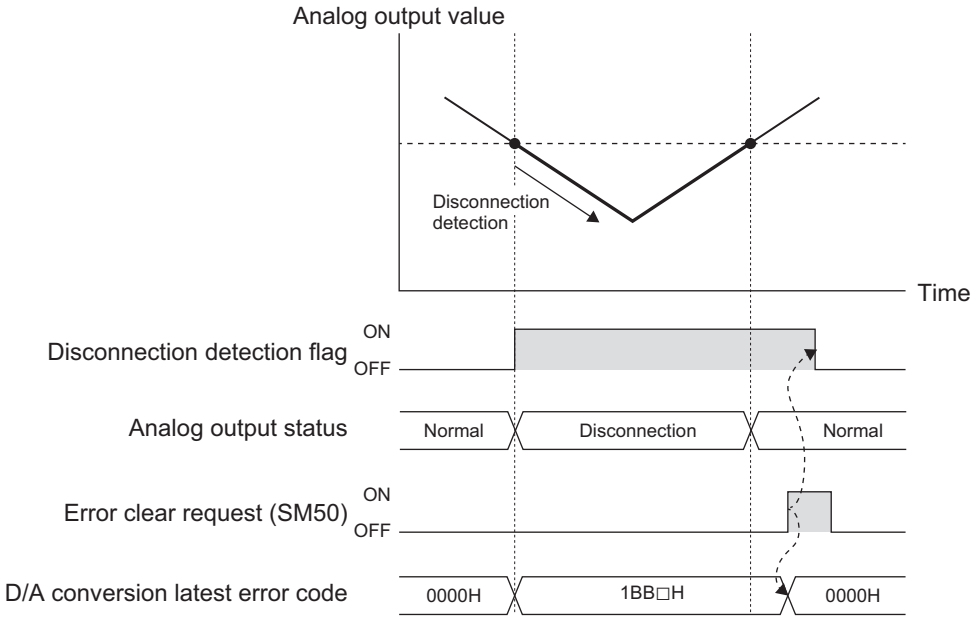
## ■When the "disconnection detection recovery enable/disable setting" is set to "enable"




**Point**

- The "disconnection detection flag" automatically turns OFF.
- To clear "D/A conversion latest error code", set the "error clear request" (SM50) of the CPU module to ON.

## ■When the "disconnection detection recovery enable/disable setting" is set to "disable"




**Point**

- The "disconnection detection flag" does not turn OFF. To turn OFF this flag, set the "error clear request" (SM50) of the CPU module to ON.
- To clear "D/A conversion latest error code", set the "error clear request" (SM50) of the CPU module to ON.

## Setting procedure

**1.** Set "Disconnection detection enable/disable setting" to "Enable".

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Application Settings" ⇨ "Disconnection detection enable/disable setting"

**2.** Set "Disconnection recovery detection enable/disable setting".

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Application Settings" ⇨ "Disconnection recovery detection enable/disable setting"

## Corresponding devices

The devices which are used by the disconnection detection function are listed below.

| Name | Connection part | Special relay | | | |
|---|---|---|---|---|---|
| | | CH1*1 | CH2*1 | CH3 | CH4 |
| Disconnection detection flag | 1st adapter | SM6318 | SM6358 | SM6398 | SM6438 |
| | 2nd adapter | SM6678 | SM6718 | SM6758 | SM6798 |
| | 3rd adapter | SM7038 | SM7078 | SM7118 | SM7158 |
| | 4th adapter | SM7398 | SM7438 | SM7478 | SM7518 |
| Disconnection detection enable/ disable setting | 1st adapter | SM6319 | SM6359 | SM6399 | SM6439 |
| | 2nd adapter | SM6679 | SM6719 | SM6759 | SM6799 |
| | 3rd adapter | SM7039 | SM7079 | SM7119 | SM7159 |
| | 4th adapter | SM7399 | SM7439 | SM7479 | SM7519 |
| Disconnection recovery detection enable/disable setting | 1st adapter | SM6320 | SM6360 | SM6400 | SM6440 |
| | 2nd adapter | SM6680 | SM6720 | SM6760 | SM6800 |
| | 3rd adapter | SM7040 | SM7080 | SM7120 | SM7160 |
| | 4th adapter | SM7400 | SM7440 | SM7480 | SM7520 |

*1 Only used by the FX5-4DA-ADP.

The details of the device used are listed below.

| Name | Description | Monitor value | Display description | Default value | R/W |
|---|---|---|---|---|---|
| Disconnection detection flag | This flag monitors the disconnection detection. | 0: OFF | Normal | 0: OFF | R |
| | | 1: ON | Disconnection detection | | |
| Disconnection detection enable/ disable setting | Set whether to enable or disable the disconnection detection function. | 0: OFF | Disconnection detection enable | 1: ON | R/W |
| | | 1: ON | Disconnection detection disable | | |
| Disconnection recovery detection enable/disable setting | Set whether to enable or disable the disconnection detection recovery. | 0: OFF | Disconnection recovery detection enable | 1: ON | R/W |
| | | 1: ON | Disconnection recovery detection disable | | |

# External power supply disconnection detection function

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

This function detects that the external power supply (24VDC) is not supplied to the analog adapter or that the supply is shut off.

## Operation

The error occurs when the external power is not input. (Error code: 3081H)

### ■FX5-4A-ADP

The error code is stored in "A/D conversion latest error code" of CH1 and "D/A conversion error flag" of CH1 turns ON.
When an error occurs, the analog function performs the following operation.

- A/D conversion function: Stops A/D conversion and holds the digital output value and digital operation value at the previous value.
- D/A conversion function: Stops the D/A conversion and outputs 0V/0mA.

## Setting procedure

The user does not need to configure any settings.

# Offset/gain setting function

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

This function sets any analog value to the offset/gain value without regard to the setting prepared in advance as the analog range. The set value is saved in the built-in memory of the analog adapter.
For changing the offset/gain data, set an analog value to the "offset setting value" or "gain setting value".
The table below shows the available setting range.

| Item | Description | Setting range | |
|---|---|---|---|
| | | Voltage input (mV) | Current input (μA) |
| Offset setting value | Analog output value when the digital value is 0 (offset reference value) | -10000 to +9000 | 0 to 17000 |
| Gain setting value | Analog output value when the digital value becomes the gain reference value | -9000 to +10000 | 3000 to 30000 |

**Point**

An offset/gain setting value range error occurs when the following condition is not satisfied: (Error code: 1A9□H)

- During voltage input: 1000 ≤ Gain setting value - Offset setting value ≤ 10000
- During current input: 3000 ≤ Gain setting value - Offset setting value ≤ 30000

The table below shows the reference value and initial value of the offset/gain setting value.

| Description | | Digital value | Offset setting value | | Gain setting value | |
|---|---|---|---|---|---|---|
| Voltage/current | Output range | | Reference value | Default value | Reference value | Default value |
| Voltage | 0 to 10V | 0 to 16000 | 0 | 0 mV | 8000 | 5000 mV |
| | 0 to 5V | 0 to 16000 | 0 | 0 mV | 16000 | 5000 mV |
| | 1 to 5V | 0 to 16000 | 0 | 1000 mV | 16000 | 5000 mV |
| | -10 to +10V | -8000 to +8000 | 0 | 0 mV | 4000 | 5000 mV |
| Current | 0 to 20mA | 0 to 16000 | 0 | 0 μA | 16000 | 20000 μA |
| | 4 to 20mA | 0 to 16000 | 0 | 4000 μA | 16000 | 20000 μA |

## Operation

### ■Offset/gain writing

For changing the offset/gain data, set "E210H" to the "offset/gain writing enable code" and set the "offset/gain writing" from OFF to ON to write the "output range setting", "offset setting value", and "gain setting value" to the built-in memory of the analog adapter. Only 1 range can be changed for 1 channel, and the latest contents are valid.

When writing is completed, the "offset/gain writing" automatically turns OFF. Also, the "offset/gain writing enable code" is cleared to 0.

When the "output range setting" is changed, the initial value becomes valid.

For returning the offset/gain data to the initial value, use the offset/gain initialization function (☞ Page 706 Offset/gain initialization function)

**Point**

- The offset/gain value is written when the "offset/gain writing enable code" is set to "E210H".
- The offset/gain value can be written only while D/A conversion is disabled.
- The "D/A conversion enable/disable setting" cannot be changed to "enable" while the offset/gain value is being written.

### ■Offset/gain reading

For reading the offset/gain data saved in the built-in memory of the analog adapter, set the "offset/gain reading" from OFF to ON to read the "output range setting", "offset setting value" and "gain setting value" from the built-in memory of the analog adapter.

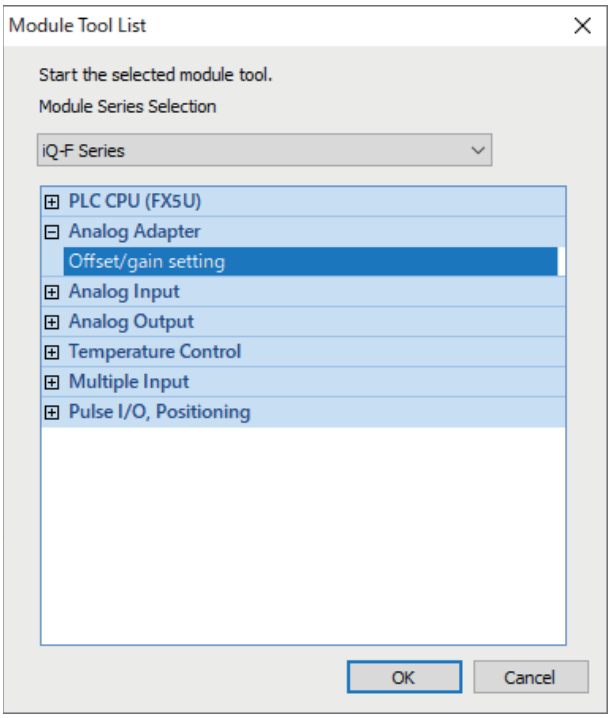
When the output range setting during reading is the same as the output range setting in the built-in memory of the analog adapter, the read values are set to the "offset setting value" and "gain setting value". If the output range setting is different, the initial value of the output range setting selected during reading is valid and set to the "offset setting value" and "gain setting value". In this case, the offset/gain setting input range mismatch alarm occurs (Alarm code: 0C0☐H)

## Setting procedure

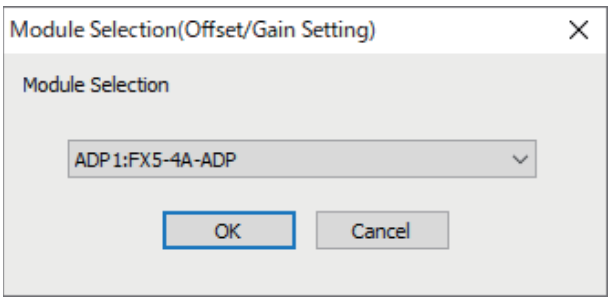
Access to the offset/gain setting window in the GX Works3 to set the offset and gain values.

The setting procedure for the offset/gain setting of the FX5-4A-ADP is as follows:

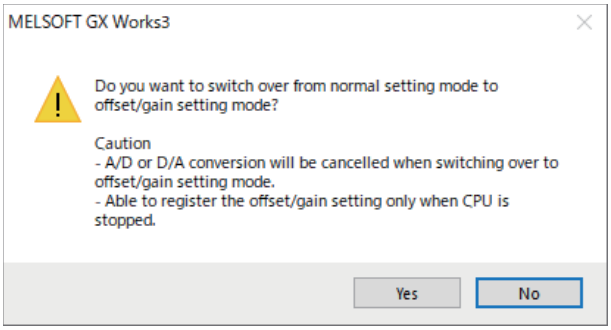
[Tool] ⇨ [Module Tool List]



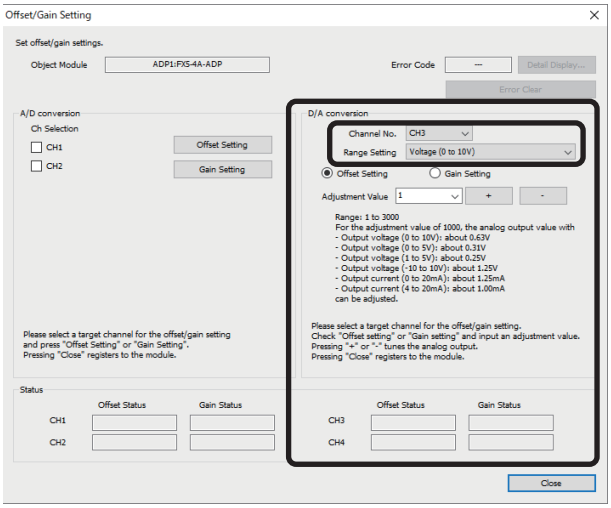

1. In "Analog Adapter", select "Offset/gain setting" and click [OK] button.



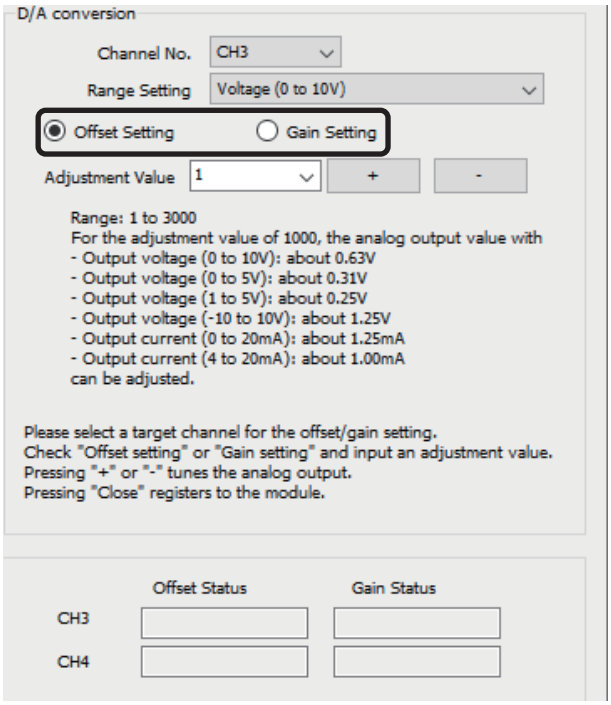

**2.** Select the target module for the offset/gain setting, and click [OK] button.



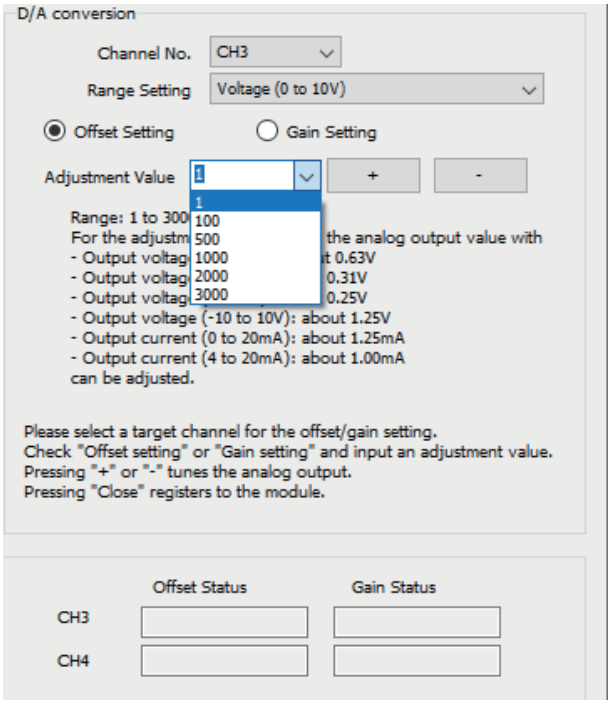

**3.** Click [Yes] button.



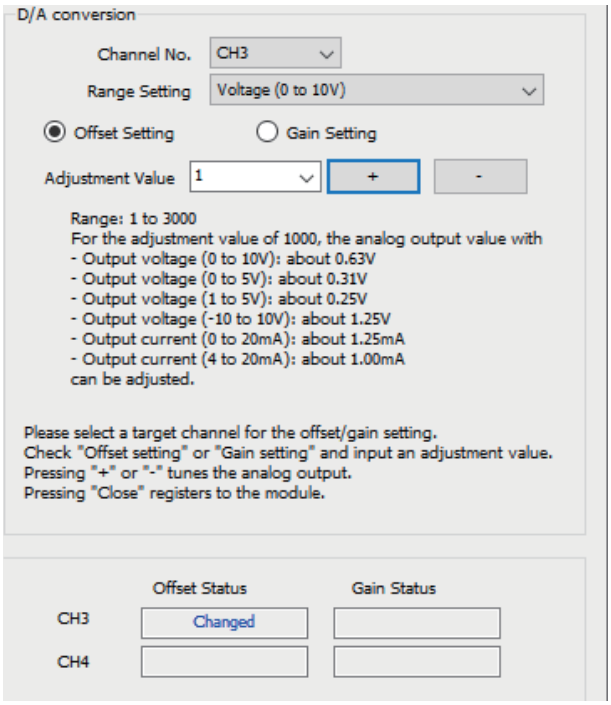

**4.** Execute the settings in D/A conversion. Specify the channel to configure the offset/gain setting and the user range setting.




**5.** Use the radio button to specify whether to perform the offset setting or gain setting. (Step 6 and later steps describe the case where offset setting is specified.)




**6.** The adjustment value of the offset value or gain value can be selected from "1", "100", "500", "1000", "2000", and "3000" or it can be set by inputting any value (1 to 3000).

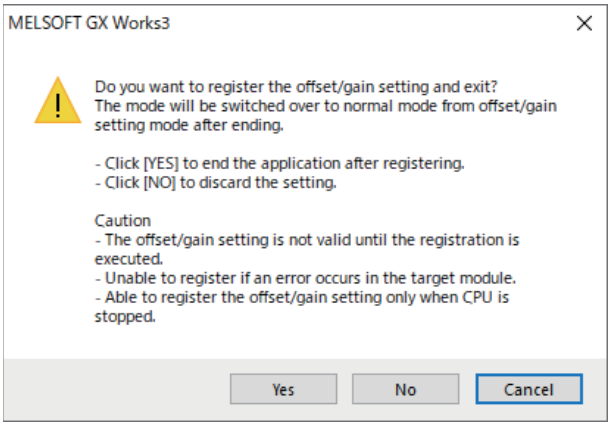



**7.** Clicking the [+(+)] or [-(-)] button fine-tunes the analog output voltage or analog output current value corresponding the set adjustment value.

**8.** Check that the offset setting status in the selected channel has changed to "Changed".

**9.** To perform the gain setting, repeat the procedure from step 5.

**10.** After setting is completed, click the [Close] button.




**11.** Click the [Yes] button.

## Corresponding devices

The devices which are used by the offset/gain setting function are listed below.

| Name | Connection part | Special relay/Special register | | | |
|---|---|---|---|---|---|
| | | CH1*1 | CH2*1 | CH3 | CH4 |
| Offset/gain reading | 1st adapter | SM6332 | SM6372 | SM6412 | SM6452 |
| | 2nd adapter | SM6692 | SM6732 | SM6772 | SM6812 |
| | 3rd adapter | SM7052 | SM7092 | SM7132 | SM7172 |
| | 4th adapter | SM7412 | SM7452 | SM7492 | SM7532 |
| Offset/gain writing | 1st adapter | SM6333 | SM6373 | SM6413 | SM6453 |
| | 2nd adapter | SM6693 | SM6733 | SM6773 | SM6813 |
| | 3rd adapter | SM7053 | SM7093 | SM7133 | SM7173 |
| | 4th adapter | SM7413 | SM7453 | SM7493 | SM7533 |
| Offset setting value | 1st adapter | SD6332 | SD6372 | SD6412 | SD6452 |
| | 2nd adapter | SD6692 | SD6732 | SD6772 | SD6812 |
| | 3rd adapter | SD7052 | SD7092 | SD7132 | SD7172 |
| | 4th adapter | SD7412 | SD7452 | SD7492 | SD7532 |
| Gain setting value | 1st adapter | SD6333 | SD6373 | SD6413 | SD6453 |
| | 2nd adapter | SD6693 | SD6733 | SD6773 | SD6813 |
| | 3rd adapter | SD7053 | SD7093 | SD7133 | SD7173 |
| | 4th adapter | SD7413 | SD7453 | SD7493 | SD7533 |
| Offset/gain writing enable code | 1st adapter | SD6334 | SD6374 | SD6414 | SD6454 |
| | 2nd adapter | SD6694 | SD6734 | SD6774 | SD6814 |
| | 3rd adapter | SD7054 | SD7094 | SD7134 | SD7174 |
| | 4th adapter | SD7414 | SD7454 | SD7494 | SD7534 |

*1 Only used by the FX5-4DA-ADP.

The details of the device used are listed below.

| Name | Description | Setting value | Description | Default value | R/W |
|---|---|---|---|---|---|
| Offset/gain reading | An offset/gain setting value is read. | 0: OFF | Offset/gain reading is not performed. | 0: OFF | R/W |
| | | 1: ON | Offset/gain reading is performed. | | |
| Offset/gain writing | An offset/gain setting value is written in. | 0: OFF | Offset/gain writing is not performed. | 0: OFF | R/W |
| | | 1: ON | Offset/gain writing is performed. | | |

| Item | Description | Setting range | | Default value | R/W |
|---|---|---|---|---|---|
| | | Voltage input (mV) | Current input (μA) | | |
| Offset setting value | Set the offset data/gain data used in the offset/gain setting function. | -10000 to +9000 | 0 to 17000 | 0 | R/W |
| Gain setting value | | -9000 to +10000 | 3000 to 30000 | Voltage output: 5000<br>Current output: 20000 | R/W |

| Name | Description | Range | Default value | R/W |
|---|---|---|---|---|
| Offset/gain writing enable code | Set the offset/gain writing enable code used for changing the offset/gain. | Offset/gain writing enable: E210H<br>Offset/gain writing disable: Other than E210H | 0 | R/W |

# Offset/gain initialization function

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

This function initializes the offset and gain values in the built-in memory of the analog adapter.
This function can be set only with special devices.

## Operation

Set E210H to "offset/gain writing enable code" and set the "offset/gain initialization" from OFF to ON to initialize the offset value and gain value saved in the built-in memory of the analog adapter. When initialization is completed, the "offset/gain initialization" automatically turns OFF. Also, the "offset/gain writing enable code" is cleared to 0.

**Point**

- Offset/gain initialization is executed when the "offset/gain writing enable code" is set to "E210H".
- Offset/gain initialization is enabled only while D/A conversion is disabled.
- The "D/A conversion enable/disable setting" cannot be changed to "enable" while offset/gain initialization is being executed.

## Setting procedure

***1.*** Set "E210H" to the "offset/gain writing enable code".

| Setting value | Description | Default value |
|---|---|---|
| Other than E210H | Offset/gain writing disable | 0 |
| E210H | Offset/gain writing enable | |

***2.*** Set the "offset/gain initialization" from OFF to ON.

| Setting value | Description | Default value |
|---|---|---|
| 0: OFF | Offset/gain initialization is not performed. | 0: OFF |
| 1: ON | Offset/gain initialization is performed. | |

## Corresponding devices

The devices which are used by the offset/gain initialization function are listed below.

| Name | Connection part | Special relay/Special register | | | |
|---|---|---|---|---|---|
| | | CH1*1 | CH2*1 | CH3 | CH4 |
| Offset/gain initialization | 1st adapter | SM6334 | SM6374 | SM6414 | SM6454 |
| | 2nd adapter | SM6694 | SM6734 | SM6774 | SM6814 |
| | 3rd adapter | SM7054 | SM7094 | SM7134 | SM7174 |
| | 4th adapter | SM7414 | SM7454 | SM7494 | SM7534 |
| Offset/gain writing enable code | 1st adapter | SD6334 | SD6374 | SD6414 | SD6454 |
| | 2nd adapter | SD6694 | SD6734 | SD6774 | SD6814 |
| | 3rd adapter | SD7054 | SD7094 | SD7134 | SD7174 |
| | 4th adapter | SD7414 | SD7454 | SD7494 | SD7534 |

*1 Only used by the FX5-4DA-ADP.

The details of the device used are listed below.

| Name | Description | Setting value | Description | Default value | R/W |
|---|---|---|---|---|---|
| Offset/gain initialization | An offset/gain setting value is initialized. | 0: OFF | Offset/gain initialization is not performed. | 0: OFF | R/W |
| | | 1: ON | Offset/gain initialization is performed. | | |

| Name | Description | Range | Default value | R/W |
|---|---|---|---|---|
| Offset/gain writing enable code | Set the offset/gain writing enable code used for changing the offset/gain. | Offset/gain writing enable: E210H<br>Offset/gain writing disable: Other than E210H | 0 | R/W |

# Analog output test when CPU module is in STOP status function

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

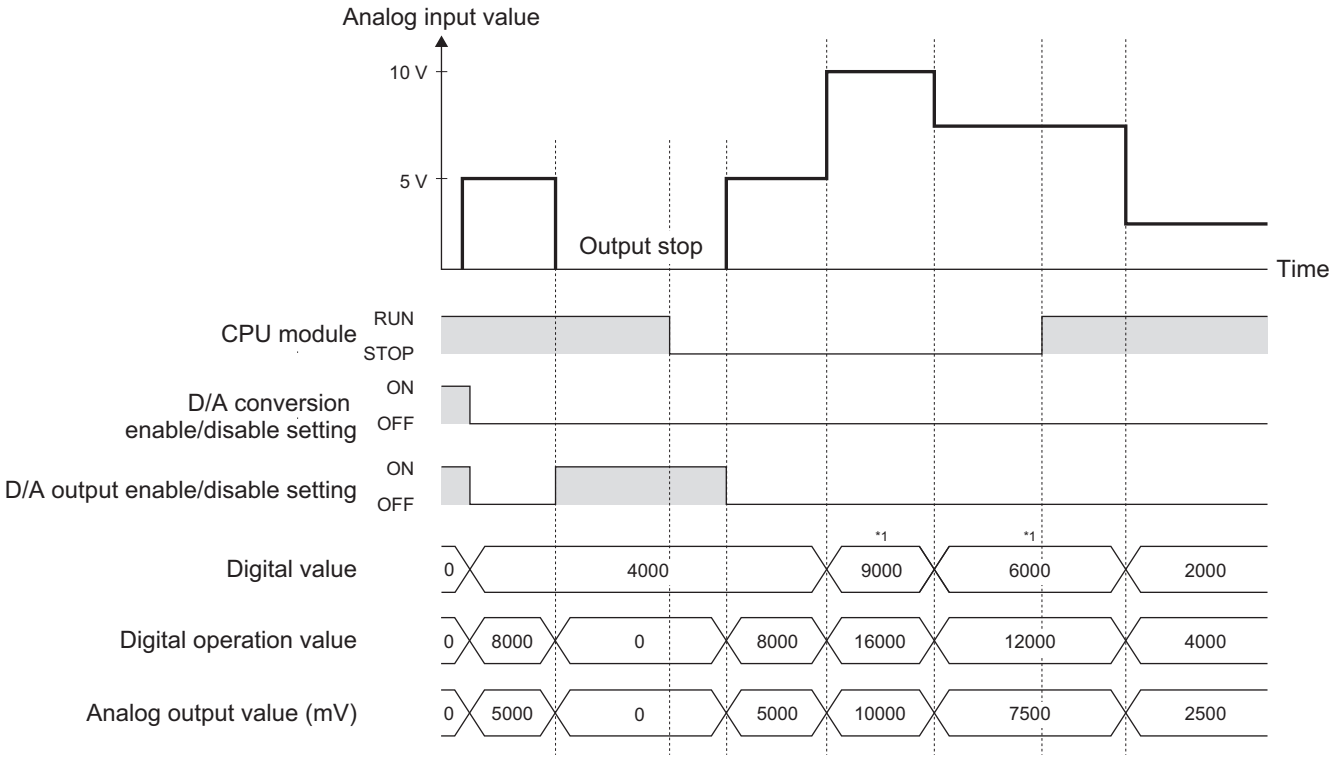
Analog output tests can be carried out when the CPU module is in the STOP status.

The following functions are enabled during the analog output test.

- Scaling function (☞ Page 713 Scaling function)
- Shift function (☞ Page 709 Shift function)
- Warning output function (☞ Page 711 Warning output function)

## Operation

When the "D/A conversion enable/disable setting" is set from ON to OFF and the "D/A output enable/disable setting" is set from ON to OFF, the analog output test is started and analog output is given.




*1 Change the value using the engineering tool.

## Setting methods

To perform an analog output test, configure the settings in the device test of the GX Works3 following the procedure shown below.

1. Set the digital value corresponding to the desired analog value to output in "digital value".
2. Set "D/A conversion enable/disable setting" to OFF (Enable D/A conversion).
3. Set "D/A output enable/disable setting" to OFF (Enable D/A output).

## Corresponding devices

The devices that are used by the analog output test function when the CPU module is stopped are listed below.

| Name | Connection part | Special relay/Special register | | | |
|---|---|---|---|---|---|
| | | CH1*1 | CH2*1 | CH3 | CH4 |
| D/A conversion enable/disable setting | 1st adapter | SM6300 | SM6340 | SM6380 | SM6420 |
| | 2nd adapter | SM6660 | SM6700 | SM6740 | SM6780 |
| | 3rd adapter | SM7020 | SM7060 | SM7100 | SM7140 |
| | 4th adapter | SM7380 | SM7420 | SM7460 | SM7500 |
| D/A output enable/disable setting | 1st adapter | SM6301 | SM6341 | SM6381 | SM6421 |
| | 2nd adapter | SM6661 | SM6701 | SM6741 | SM6781 |
| | 3rd adapter | SM7021 | SM7061 | SM7101 | SM7141 |
| | 4th adapter | SM7381 | SM7421 | SM7461 | SM7501 |
| Digital value | 1st adapter | SD6300 | SD6340 | SD6380 | SD6420 |
| | 2nd adapter | SD6660 | SD6700 | SD6740 | SD6780 |
| | 3rd adapter | SD7020 | SD7060 | SD7100 | SD7140 |
| | 4th adapter | SD7380 | SD7420 | SD7460 | SD7500 |

*1 Only used by the FX5-4DA-ADP.

The details of the device used are listed below.

| Name | Description | Setting value | Description | Default value | R/W |
|---|---|---|---|---|---|
| D/A conversion enable/disable setting | Set whether to enable or disable D/A conversion. | 0: OFF | D/A conversion enable | 1: ON | R/W |
| | | 1: ON | D/A conversion disable | | |
| D/A output enable/disable setting | Set whether to output the D/A conversion value or to output the offset value.<br>The setting value will be ignored when the D/A conversion enable/disable setting is set to "disable". | 0: OFF | D/A conversion value | 1: ON | R/W |
| | | 1: ON | Offset value | | |

| Name | Description | Output range setting | | Digital input range | When the scaling function is enabled | Default value | R/W |
|---|---|---|---|---|---|---|---|
| Digital value | Set the digital value for D/A conversion.<br>When the digital value is set outside the allowable setting range, D/A conversion will be executed within the allowable setting range. | Voltage | 0 to 10V | 0 to 16000 | Scaling lower limit value to Scaling upper limit value | 1: ON | R/W |
| | | | 0 to 5V | 0 to 16000 | | | |
| | | | 1 to 5V | 0 to 16000 | | | |
| | | | -10 to +10V | -8000 to +8000 | | | |
| | | Current | 0 to 20mA | 0 to 16000 | | | |
| | | | 4 to 20mA | 0 to 16000 | | | |

# 37.8 Functions (Temperature Sensor Input)

This section describes details of the functions and how to set them using the GX Works3.

## Conversion enable/disable setting function

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

This function sets whether to enable or disable the temperature conversion for each channel. Disabling the conversion on unused channels reduces the conversion cycles.

### Operation

The analog input is temperature converted only in the channels for which the "conversion enable/disable setting" is set to "enable", and values are stored in the "measured temperature value". Changing "conversion enable/disable setting" from "enable" to "disable" clears the following.

- "Conversion completed flag"
- "Warning output flag (process alarm upper limit)"
- "Warning output flag (process alarm lower limit)"
- "Warning output flag (rate alarm upper limit)"
- "Warning output flag (rate alarm lower limit)"
- "Disconnection detection flag"
- "Measured temperature value"
- "Maximum value"
- "Minimum value"

### Setting procedure

Set "Conversion enable/disable setting" to "conversion enable".

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Basic Settings" ⇨ "Conversion enable/disable setting"

### Corresponding devices

The devices which are used by the conversion enable/disable setting function are listed below.

| Name | Connection part | Special relay | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3 | CH4 |
| Conversion enable/disable setting | 1st adapter | SM6301 | SM6341 | SM6381 | SM6421 |
| | 2nd adapter | SM6661 | SM6701 | SM6741 | SM6781 |
| | 3rd adapter | SM7021 | SM7061 | SM7101 | SM7141 |
| | 4th adapter | SM7381 | SM7421 | SM7461 | SM7501 |

The details of the device used are listed below.

| Name | Description | Setting value | Description | Default value | R/W |
|---|---|---|---|---|---|
| Conversion enable/disable setting | Set whether to enable or disable temperature conversion. | 0: OFF | Temperature conversion enable | 1: ON | R/W |
| | | 1: ON | Temperature conversion disable | | |

# Temperature resistance choice function

FX5-4A-ADP FX5-4AD-ADP FX5-4DA-ADP FX5-4AD-PT-ADP FX5-4AD-TC-ADP

This function sets a resistance temperature detector type for each channel.
Selecting the resistance temperature detector type sets the input conversion characteristics.

## Operation

A resistance temperature detector is switched when the "conversion enable/disable setting" is "disable" and "setting RTD type" has been changed.
When the resistance temperature detector is switched, the following special devices are initialized:

| Name | Connection part | Special relay/Special register | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3 | CH4 |
| Conversion completed flag | 1st adapter | SM6300 | SM6340 | SM6380 | SM6420 |
| | 2nd adapter | SM6660 | SM6700 | SM6740 | SM6780 |
| | 3rd adapter | SM7020 | SM7060 | SM7100 | SM7140 |
| | 4th adapter | SM7380 | SM7420 | SM7460 | SM7500 |
| Warning output flag (process alarm upper limit) | 1st adapter | SM6311 | SM6351 | SM6391 | SM6431 |
| | 2nd adapter | SM6671 | SM6711 | SM6751 | SM6791 |
| | 3rd adapter | SM7031 | SM7071 | SM7111 | SM7151 |
| | 4th adapter | SM7391 | SM7431 | SM7471 | SM7511 |
| Warning output flag (process alarm lower limit) | 1st adapter | SM6312 | SM6352 | SM6392 | SM6432 |
| | 2nd adapter | SM6672 | SM6712 | SM6752 | SM6792 |
| | 3rd adapter | SM7032 | SM7072 | SM7112 | SM7152 |
| | 4th adapter | SM7392 | SM7432 | SM7472 | SM7512 |
| Warning output flag (rate alarm upper limit) | 1st adapter | SM6315 | SM6355 | SM6395 | SM6435 |
| | 2nd adapter | SM6675 | SM6715 | SM6755 | SM6795 |
| | 3rd adapter | SM7035 | SM7075 | SM7115 | SM7155 |
| | 4th adapter | SM7395 | SM7435 | SM7475 | SM7515 |
| Warning output flag (rate alarm lower) | 1st adapter | SM6316 | SM6356 | SM6396 | SM6436 |
| | 2nd adapter | SM6676 | SM6716 | SM6756 | SM6796 |
| | 3rd adapter | SM7036 | SM7076 | SM7116 | SM7156 |
| | 4th adapter | SM7396 | SM7436 | SM7476 | SM7516 |
| Disconnection detection flag | 1st adapter | SM6318 | SM6358 | SM6398 | SM6438 |
| | 2nd adapter | SM6678 | SM6718 | SM6758 | SM6798 |
| | 3rd adapter | SM7038 | SM7078 | SM7118 | SM7158 |
| | 4th adapter | SM7398 | SM7438 | SM7478 | SM7518 |
| Offset/gain setting flag | 1st adapter | SM6331 | SM6371 | SM6411 | SM6451 |
| | 2nd adapter | SM6691 | SM6731 | SM6771 | SM6811 |
| | 3rd adapter | SM7051 | SM7091 | SM7131 | SM7171 |
| | 4th adapter | SM7411 | SM7451 | SM7491 | SM7531 |
| Measured temperature value | 1st adapter | SD6300 | SD6340 | SD6380 | SD6420 |
| | 2nd adapter | SD6660 | SD6700 | SD6740 | SD6780 |
| | 3rd adapter | SD7020 | SD7060 | SD7100 | SD7140 |
| | 4th adapter | SD7380 | SD7420 | SD7460 | SD7500 |
| Maximum value | 1st adapter | SD6306 | SD6346 | SD6386 | SD6426 |
| | 2nd adapter | SD6666 | SD6706 | SD6746 | SD6786 |
| | 3rd adapter | SD7026 | SD7066 | SD7106 | SD7146 |
| | 4th adapter | SD7386 | SD7426 | SD7466 | SD7506 |

| Name | Connection part | Special relay/Special register | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3 | CH4 |
| Minimum value | 1st adapter | SD6307 | SD6347 | SD6387 | SD6427 |
| | 2nd adapter | SD6667 | SD6707 | SD6747 | SD6787 |
| | 3rd adapter | SD7027 | SD7067 | SD7107 | SD7147 |
| | 4th adapter | SD7387 | SD7427 | SD7467 | SD7507 |
| Offset temperature setting value*1 | 1st adapter | SD6327 | SD6367 | SD6407 | SD6447 |
| | 2nd adapter | SD6687 | SD6727 | SD6767 | SD6807 |
| | 3rd adapter | SD7047 | SD7087 | SD7127 | SD7167 |
| | 4th adapter | SD7407 | SD7447 | SD7487 | SD7527 |
| Gain temperature setting value*1 | 1st adapter | SD6328 | SD6368 | SD6408 | SD6448 |
| | 2nd adapter | SD6688 | SD6728 | SD6768 | SD6808 |
| | 3rd adapter | SD7048 | SD7088 | SD7128 | SD7168 |
| | 4th adapter | SD7408 | SD7448 | SD7488 | SD7528 |
| Resistance offset value (L)*1 | 1st adapter | SD6330 | SD6370 | SD6410 | SD6450 |
| | 2nd adapter | SD6690 | SD6730 | SD6770 | SD6810 |
| | 3rd adapter | SD7050 | SD7090 | SD7130 | SD7170 |
| | 4th adapter | SD7410 | SD7450 | SD7490 | SD7530 |
| Resistance offset value (H)*1 | 1st adapter | SD6331 | SD6371 | SD6411 | SD6451 |
| | 2nd adapter | SD6691 | SD6731 | SD6771 | SD6811 |
| | 3rd adapter | SD7051 | SD7091 | SD7131 | SD7171 |
| | 4th adapter | SD7411 | SD7451 | SD7491 | SD7531 |
| Resistance gain value (L)*1 | 1st adapter | SD6332 | SD6372 | SD6412 | SD6452 |
| | 2nd adapter | SD6692 | SD6732 | SD6772 | SD6812 |
| | 3rd adapter | SD7052 | SD7092 | SD7132 | SD7172 |
| | 4th adapter | SD7412 | SD7452 | SD7492 | SD7532 |
| Resistance gain value (H)*1 | 1st adapter | SD6333 | SD6373 | SD6413 | SD6453 |
| | 2nd adapter | SD6693 | SD6733 | SD6773 | SD6813 |
| | 3rd adapter | SD7053 | SD7093 | SD7133 | SD7173 |
| | 4th adapter | SD7413 | SD7453 | SD7493 | SD7533 |
| Input offset value (L)*1 | 1st adapter | SD6334 | SD6374 | SD6414 | SD6454 |
| | 2nd adapter | SD6694 | SD6734 | SD6774 | SD6814 |
| | 3rd adapter | SD7054 | SD7094 | SD7134 | SD7174 |
| | 4th adapter | SD7414 | SD7454 | SD7494 | SD7534 |
| Input offset value (H)*1 | 1st adapter | SD6335 | SD6375 | SD6415 | SD6455 |
| | 2nd adapter | SD6695 | SD6735 | SD6775 | SD6815 |
| | 3rd adapter | SD7055 | SD7095 | SD7135 | SD7175 |
| | 4th adapter | SD7415 | SD7455 | SD7495 | SD7535 |
| Input gain value (L)*1 | 1st adapter | SD6336 | SD6376 | SD6416 | SD6456 |
| | 2nd adapter | SD6696 | SD6736 | SD6776 | SD6816 |
| | 3rd adapter | SD7056 | SD7096 | SD7136 | SD7176 |
| | 4th adapter | SD7416 | SD7456 | SD7496 | SD7536 |
| Input gain value (H)*1 | 1st adapter | SD6337 | SD6377 | SD6417 | SD6457 |
| | 2nd adapter | SD6697 | SD6737 | SD6777 | SD6817 |
| | 3rd adapter | SD7057 | SD7097 | SD7137 | SD7177 |
| | 4th adapter | SD7417 | SD7457 | SD7497 | SD7537 |

*1 If the changed RTD is equal to the RTD set using the offset/gain setting function, the value set using the offset/gain setting function (user range setting) will be reflected. In any other case, the value is initialized to the initial value.

## Setting procedure

Set "Resistance temperature detector type setting" to a desired resistance temperature detector.

Navigation window ⇨ [Parameter] ⇨ [Module Information]⇨ Module model name ⇨ [Module Parameter] ⇨ "Basic Settings" ⇨ "Resistance temperature detector type selection function"

| Item | Temperature unit | Temperature input range | Input characteristics (measured temperature value) |
|---|---|---|---|
| Pt100 | Celsius (℃) | -200 to +850℃ | -2000 to +8500 |
| | Fahrenheit (℉) | -328 to +1562℉ | -3280 to +15620 |
| Ni100 | Celsius (℃) | -60 to +250℃ | -600 to +2500 |
| | Fahrenheit (℉) | -76 to +482℉ | -760 to +4820 |

## Corresponding devices

The devices which are used by the temperature resistance choice function are listed below.

| Name | Connection part | Special register | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3 | CH4 |
| Resistance temperature detector type setting | 1st adapter | SD6305 | SD6345 | SD6385 | SD6425 |
| | 2nd adapter | SD6665 | SD6705 | SD6745 | SD6785 |
| | 3rd adapter | SD7025 | SD7065 | SD7105 | SD7145 |
| | 4th adapter | SD7385 | SD7425 | SD7465 | SD7505 |

The details of the device used are listed below.

| Name | Description | Setting value | Description | Default value | R/W |
|---|---|---|---|---|---|
| Resistance temperature detector type setting | Set the RTD type.<br>If a value other than the setting value is set, the range setting/RTD type range error (error code: 1A8□H) occurs, and the temperature conversion cannot be performed. | 0 | Pt100 | 0 | R/W |
| | | 1 | Ni100 | | |

# Thermocouple type choice function

~~FX5-4A-ADP~~ ~~FX5-4AD-ADP~~ ~~FX5-4DA-ADP~~ ~~FX5-4AD-PT-ADP~~ FX5-4AD-TC-ADP

This function sets a thermocouple type for each channel.

Selecting the thermocouple type sets the input conversion characteristics.

## Operation

Thermocouple type is switched when the "conversion enable/disable setting" is "disable" and "thermocouple type setting" has been changed.

When the thermocouple type is switched, the following special devices are initialized:

| Name | Connection part | Special relay/Special register | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3 | CH4 |
| Conversion completed flag | 1st adapter | SM6300 | SM6340 | SM6380 | SM6420 |
| | 2nd adapter | SM6660 | SM6700 | SM6740 | SM6780 |
| | 3rd adapter | SM7020 | SM7060 | SM7100 | SM7140 |
| | 4th adapter | SM7380 | SM7420 | SM7460 | SM7500 |
| Warning output flag (process alarm upper limit) | 1st adapter | SM6311 | SM6351 | SM6391 | SM6431 |
| | 2nd adapter | SM6671 | SM6711 | SM6751 | SM6791 |
| | 3rd adapter | SM7031 | SM7071 | SM7111 | SM7151 |
| | 4th adapter | SM7391 | SM7431 | SM7471 | SM7511 |

| Name | Connection part | Special relay/Special register | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3 | CH4 |
| Warning output flag (process alarm lower limit) | 1st adapter | SM6312 | SM6352 | SM6392 | SM6432 |
| | 2nd adapter | SM6672 | SM6712 | SM6752 | SM6792 |
| | 3rd adapter | SM7032 | SM7072 | SM7112 | SM7152 |
| | 4th adapter | SM7392 | SM7432 | SM7472 | SM7512 |
| Warning output flag (rate alarm upper limit) | 1st adapter | SM6315 | SM6355 | SM6395 | SM6435 |
| | 2nd adapter | SM6675 | SM6715 | SM6755 | SM6795 |
| | 3rd adapter | SM7035 | SM7075 | SM7115 | SM7155 |
| | 4th adapter | SM7395 | SM7435 | SM7475 | SM7515 |
| Warning output flag (rate alarm lower) | 1st adapter | SM6316 | SM6356 | SM6396 | SM6436 |
| | 2nd adapter | SM6676 | SM6716 | SM6756 | SM6796 |
| | 3rd adapter | SM7036 | SM7076 | SM7116 | SM7156 |
| | 4th adapter | SM7396 | SM7436 | SM7476 | SM7516 |
| Disconnection detection flag | 1st adapter | SM6318 | SM6358 | SM6398 | SM6438 |
| | 2nd adapter | SM6678 | SM6718 | SM6758 | SM6798 |
| | 3rd adapter | SM7038 | SM7078 | SM7118 | SM7158 |
| | 4th adapter | SM7398 | SM7438 | SM7478 | SM7518 |
| Offset/gain setting flag | 1st adapter | SM6331 | SM6371 | SM6411 | SM6451 |
| | 2nd adapter | SM6691 | SM6731 | SM6771 | SM6811 |
| | 3rd adapter | SM7051 | SM7091 | SM7131 | SM7171 |
| | 4th adapter | SM7411 | SM7451 | SM7491 | SM7531 |
| Measured temperature value | 1st adapter | SD6300 | SD6340 | SD6380 | SD6420 |
| | 2nd adapter | SD6660 | SD6700 | SD6740 | SD6780 |
| | 3rd adapter | SD7020 | SD7060 | SD7100 | SD7140 |
| | 4th adapter | SD7380 | SD7420 | SD7460 | SD7500 |
| Maximum value | 1st adapter | SD6306 | SD6346 | SD6386 | SD6426 |
| | 2nd adapter | SD6666 | SD6706 | SD6746 | SD6786 |
| | 3rd adapter | SD7026 | SD7066 | SD7106 | SD7146 |
| | 4th adapter | SD7386 | SD7426 | SD7466 | SD7506 |
| Minimum value | 1st adapter | SD6307 | SD6347 | SD6387 | SD6427 |
| | 2nd adapter | SD6667 | SD6707 | SD6747 | SD6787 |
| | 3rd adapter | SD7027 | SD7067 | SD7107 | SD7147 |
| | 4th adapter | SD7387 | SD7427 | SD7467 | SD7507 |
| Offset temperature setting value*1 | 1st adapter | SD6327 | SD6367 | SD6407 | SD6447 |
| | 2nd adapter | SD6687 | SD6727 | SD6767 | SD6807 |
| | 3rd adapter | SD7047 | SD7087 | SD7127 | SD7167 |
| | 4th adapter | SD7407 | SD7447 | SD7487 | SD7527 |
| Gain temperature setting value*1 | 1st adapter | SD6328 | SD6368 | SD6408 | SD6448 |
| | 2nd adapter | SD6688 | SD6728 | SD6768 | SD6808 |
| | 3rd adapter | SD7048 | SD7088 | SD7128 | SD7168 |
| | 4th adapter | SD7408 | SD7448 | SD7488 | SD7528 |
| Thermal EMF offset value (L)*1 | 1st adapter | SD6330 | SD6370 | SD6410 | SD6450 |
| | 2nd adapter | SD6690 | SD6730 | SD6770 | SD6810 |
| | 3rd adapter | SD7050 | SD7090 | SD7130 | SD7170 |
| | 4th adapter | SD7410 | SD7450 | SD7490 | SD7530 |
| Thermal EMF offset value (H)*1 | 1st adapter | SD6331 | SD6371 | SD6411 | SD6451 |
| | 2nd adapter | SD6691 | SD6731 | SD6771 | SD6811 |
| | 3rd adapter | SD7051 | SD7091 | SD7131 | SD7171 |
| | 4th adapter | SD7411 | SD7451 | SD7491 | SD7531 |
| Thermal EMF gain value (L)*1 | 1st adapter | SD6332 | SD6372 | SD6412 | SD6452 |
| | 2nd adapter | SD6692 | SD6732 | SD6772 | SD6812 |
| | 3rd adapter | SD7052 | SD7092 | SD7132 | SD7172 |
| | 4th adapter | SD7412 | SD7452 | SD7492 | SD7532 |

| Name | Connection part | Special relay/Special register | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3 | CH4 |
| Thermal EMF gain value (H)*1 | 1st adapter | SD6333 | SD6373 | SD6413 | SD6453 |
| | 2nd adapter | SD6693 | SD6733 | SD6773 | SD6813 |
| | 3rd adapter | SD7053 | SD7093 | SD7133 | SD7173 |
| | 4th adapter | SD7413 | SD7453 | SD7493 | SD7533 |
| Input offset value (L)*1 | 1st adapter | SD6334 | SD6374 | SD6414 | SD6454 |
| | 2nd adapter | SD6694 | SD6734 | SD6774 | SD6814 |
| | 3rd adapter | SD7054 | SD7094 | SD7134 | SD7174 |
| | 4th adapter | SD7414 | SD7454 | SD7494 | SD7534 |
| Input offset value (H)*1 | 1st adapter | SD6335 | SD6375 | SD6415 | SD6455 |
| | 2nd adapter | SD6695 | SD6735 | SD6775 | SD6815 |
| | 3rd adapter | SD7055 | SD7095 | SD7135 | SD7175 |
| | 4th adapter | SD7415 | SD7455 | SD7495 | SD7535 |
| Input gain value (L)*1 | 1st adapter | SD6336 | SD6376 | SD6416 | SD6456 |
| | 2nd adapter | SD6696 | SD6736 | SD6776 | SD6816 |
| | 3rd adapter | SD7056 | SD7096 | SD7136 | SD7176 |
| | 4th adapter | SD7416 | SD7456 | SD7496 | SD7536 |
| Input gain value (H)*1 | 1st adapter | SD6337 | SD6377 | SD6417 | SD6457 |
| | 2nd adapter | SD6697 | SD6737 | SD6777 | SD6817 |
| | 3rd adapter | SD7057 | SD7097 | SD7137 | SD7177 |
| | 4th adapter | SD7417 | SD7457 | SD7497 | SD7537 |

*1 If the changed thermocouple is equal to the thermocouple set using the offset/gain setting function, the value set using the offset/gain setting function (user range setting) will be reflected. In any other case, the value is initialized to the initial value.

## Setting procedure

Set "Thermocouple type setting" to the desired thermocouple.

Navigation window ⇨ [Parameter] ⇨ [Module Information]⇨ Module model name ⇨ [Module Parameter] ⇨ "Basic Settings" ⇨ "Thermocouple type selection function"

| Item | Temperature unit | Temperature input range | Input characteristics (measured temperature value) |
|---|---|---|---|
| K | Celsius (℃) | -270 to +1370℃ | -2700 to +13700 |
| | Fahrenheit (℉) | -454 to +2498℉ | -4540 to +24980 |
| J | Celsius (℃) | -210 to +1130℃ | -2100 to +11300 |
| | Fahrenheit (℉) | -346 to +2066℉ | -3460 to +20660 |
| T | Celsius (℃) | -270 to +400℃ | -2700 to +4000 |
| | Fahrenheit (℉) | -454 to +752℉ | -4540 to +7520 |
| B | Celsius (℃) | 0 to 1710℃ | 0 to 17100 |
| | Fahrenheit (℉) | 32 to 3110℉ | 320 to 31100 |
| R | Celsius (℃) | -50 to +1710℃ | -500 to +17100 |
| | Fahrenheit (℉) | -58 to +3110℉ | -580 to +31100 |
| S | Celsius (℃) | -50 to +1710℃ | -500 to +17100 |
| | Fahrenheit (℉) | -58 to +3110℉ | -580 to +31100 |

## Corresponding devices

The devices which are used by the thermocouple type choice function are listed below.

| Name | Connection part | Special register | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3 | CH4 |
| Setting thermocouple type | 1st adapter | SD6305 | SD6345 | SD6385 | SD6425 |
| | 2nd adapter | SD6665 | SD6705 | SD6745 | SD6785 |
| | 3rd adapter | SD7025 | SD7065 | SD7105 | SD7145 |
| | 4th adapter | SD7385 | SD7425 | SD7465 | SD7505 |

The details of the device used are listed below.

| Name | Description | Setting value | Description | Default value | R/W |
|---|---|---|---|---|---|
| Thermocouple type setting | Set the thermocouple type.<br>If a value other than the setting value is set, the range setting/RTD type setting/thermocouple type range error (error code: 1A8□H) occurs, and the temperature conversion cannot be performed. | 0 | K thermocouple | 0 | R/W |
| | | 1 | J thermocouple | | |
| | | 2 | T thermocouple | | |
| | | 3 | B thermocouple | | |
| | | 4 | R thermocouple | | |
| | | 5 | S thermocouple | | |

# Disconnection detection function

FX5-4A-ADP FX5-4AD-ADP FX5-4DA-ADP FX5-4AD-PT-ADP FX5-4AD-TC-ADP

Simple disconnection detection is performed.

### Precautions

The disconnection detection function operates according to the user environment, and thus the detection value varies depending on the difference of wiring resistance.

## Operation

### ■Operations at disconnection

When the analog (temperature) input value reaches the disconnection detection condition in a channel for which the "conversion enable/disable setting" is set to enable and the "disconnection detection enable/disable setting" is set to "enable", the situation is regarded as disconnection. As a result, an alarm occurs and the "disconnection detection flag" turns ON. (Alarm code: 0A0□H)

If disconnection is detected, the temperature conversion is interrupted, and a value (upscale, downscale, any value, or value immediately before disconnection) is stored in the "measured temperature value" according to the setting of "conversion setting for disconnection detection".

### Precautions

While the disconnection detection function is operating, the alarm output function (process alarm), alarm output function (rate alarm), maximum value/minimum value hold function do not operate. In addition, when "conversion enable/disable setting" is "enable", the data related to the disconnection detection function cannot be changed.

### ■Operations when the connection is re-established

The operations when the disconnection cause is eliminated and the connection to an external device is re-established vary depending on the setting of "disconnection detection automatic clear enable/disable setting.

• When "enable" is set

When the connection is re-established, "disconnection detection flag" turns off and the temperature conversion is restarted. "conversion alarm flag" and the alarm code stored in "conversion latest alarm code", however, are not cleared. To clear "conversion alarm flag" and the alarm code stored in "latest alarm code" or "conversion latest alarm code", set the "conversion alarm clear request" to OFF, ON, and OFF.

• When "disable" is set

"disconnection detection flag" remains in the state when the disconnection was detected. To return the flag to the normal state, turn on and off "Conversion alarm clear request" after re-establishing connections for all channels.

Note that when "disconnection detection enable/disable setting" is changed to "disable", "disconnection detection flag" turns off.

## Detection cycle

Disconnection detection is executed every sampling cycle.

## Setting procedure

**1.** Set "Disconnection detection enable/disable setting" to "Enable".

Navigation window ⇨ [Parameter] ⇨ [Module Information]⇨ Module model name ⇨ [Module Parameter] ⇨ "Application Settings" ⇨ "Disconnection detection function"

**2.** Set "Enable/Disable setting for disconnection detection automatic clear" to "Enable" or "Disable".

**3.** Using "Conversion setting for disconnection detection", set what value is to be stored in "Measured temperature value" at the time of the disconnection detection.

| Item | Setting range |
|---|---|
| Conversion setting for disconnection detection | • Upscale<br>• Downscale<br>• Any value<br>• Value before disconnection |

When "upscale" (upper limit value + 5% of measurement range) and "downscale" (lower limit value - 5% of measurement range) are set, the values stored in "measured temperature value" are as follows.

• FX5-4AD-PT-ADP

| RTD | Temperature unit | Downscale | Upscale |
|---|---|---|---|
| Pt100 | Celsius (℃) | -2525 | 9025 |
| | Fahrenheit (℉) | -4225 | 16565 |
| Ni100 | Celsius (℃) | -755 | 2655 |
| | Fahrenheit (℉) | -1039 | 5099 |

• FX5-4AD-TC-ADP

| Thermocouple | Temperature unit | Downscale | Upscale |
|---|---|---|---|
| K | Celsius (℃) | -3520 | 14520 |
| | Fahrenheit (℉) | -6016 | 26456 |
| J | Celsius (℃) | -2770 | 11970 |
| | Fahrenheit (℉) | -4666 | 21866 |
| T | Celsius (℃) | -3035 | 4335 |
| | Fahrenheit (℉) | -5143 | 8123 |
| B | Celsius (℃) | -855 | 17955 |
| | Fahrenheit (℉) | -1219 | 32639 |
| R | Celsius (℃) | -1380 | 17980 |
| | Fahrenheit (℉) | -2164 | 32684 |
| S | Celsius (℃) | -1380 | 17980 |
| | Fahrenheit (℉) | -2164 | 32684 |

**4.** When "Conversion setting for disconnection detection" is set to "Any value", set "Conversion setting function for disconnection detection".

| Item | Setting range |
|---|---|
| Conversion setting function for disconnection detection | -3276.8 to 3276.7[*1] |

*1 If the temperature unit is Fahrenheit (℉), set the value in increments of 2 (0.2℉).

## Corresponding devices

The devices which are used by the disconnection detection function are listed below.

| Name | Connection part | Special relay/Special register | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3 | CH4 |
| Disconnection detection flag | 1st adapter | SM6318 | SM6358 | SM6398 | SM6438 |
| | 2nd adapter | SM6678 | SM6718 | SM6758 | SM6798 |
| | 3rd adapter | SM7038 | SM7078 | SM7118 | SM7158 |
| | 4th adapter | SM7398 | SM7438 | SM7478 | SM7518 |
| Disconnection detection enable/disable setting | 1st adapter | SM6319 | SM6359 | SM6399 | SM6439 |
| | 2nd adapter | SM6679 | SM6719 | SM6759 | SM6799 |
| | 3rd adapter | SM7039 | SM7079 | SM7119 | SM7159 |
| | 4th adapter | SM7399 | SM7439 | SM7479 | SM7519 |
| Disconnection detection automatic clear enable/disable setting | 1st adapter | SM6320 | SM6360 | SM6400 | SM6440 |
| | 2nd adapter | SM6680 | SM6720 | SM6760 | SM6800 |
| | 3rd adapter | SM7040 | SM7080 | SM7120 | SM7160 |
| | 4th adapter | SM7400 | SM7440 | SM7480 | SM7520 |
| Conversion setting for disconnection detection | 1st adapter | SD6318 | SD6358 | SD6398 | SD6438 |
| | 2nd adapter | SD6678 | SD6718 | SD6758 | SD6798 |
| | 3rd adapter | SD7038 | SD7078 | SD7118 | SD7158 |
| | 4th adapter | SD7398 | SD7438 | SD7478 | SD7518 |
| Conversion setting value for disconnection detection | 1st adapter | SD6319 | SD6359 | SD6399 | SD6439 |
| | 2nd adapter | SD6679 | SD6719 | SD6759 | SD6799 |
| | 3rd adapter | SD7039 | SD7079 | SD7119 | SD7159 |
| | 4th adapter | SD7399 | SD7439 | SD7479 | SD7519 |

The details of the device used are listed below.

| Name | Description | Monitor value | Display description | Default value | R/W |
|---|---|---|---|---|---|
| Disconnection detection flag | This flag monitors the disconnection detection. | 0: OFF | Normal | 0: OFF | R |
| | | 1: ON | Disconnection detection | | |
| Disconnection detection enable/disable setting | Set whether to enable or disable the disconnection detection function. | 0: OFF | Disconnection detection enable | 0: OFF | R/W |
| | | 1: ON | Disconnection detection disable | | |
| Disconnection detection automatic clear enable/disable setting | Set whether to enable or disable the disconnection detection automatic clear. | 0: OFF | Disconnection recovery detection enable | 1: ON | R/W |
| | | 1: ON | Disconnection recovery detection disable | | |
| Conversion setting for disconnection detection | Set the value that is to be stored in the "measured temperature value" when a disconnection is detected.<br>If a value other than the setting value is set, the conversion setting range error with disconnection detection enabled (error code: 1AB□H) occurs, and the temperature conversion cannot be performed. | 0 | Upscale | 1 | R/W |
| | | 1 | Downscale | | |
| | | 2 | Any value | | |
| | | 3 | Value immediately before disconnection | | |

When upscale (upper limit value + 5% of measurement range) and downscale (lower limit value - 5% of measurement range) are selected, the values stored in "measured temperature value" are as follows.

| RTD | Temperature unit | Downscale | Upscale |
|---|---|---|---|
| Pt100 | Celsius (℃) | -2525 | 9025 |
| | Fahrenheit (℉) | -4225 | 16565 |
| Ni100 | Celsius (℃) | -755 | 2655 |
| | Fahrenheit (℉) | -1039 | 5099 |

| Thermocouple | Temperature unit | Downscale | Upscale |
|---|---|---|---|
| K | Celsius (℃) | -3520 | 14520 |
| | Fahrenheit (℉) | -6016 | 26456 |
| J | Celsius (℃) | -2770 | 11970 |
| | Fahrenheit (℉) | -4666 | 21866 |
| T | Celsius (℃) | -3035 | 4335 |
| | Fahrenheit (℉) | -5143 | 8123 |
| B | Celsius (℃) | -855 | 17955 |
| | Fahrenheit (℉) | -1219 | 32639 |
| R | Celsius (℃) | -1380 | 17980 |
| | Fahrenheit (℉) | -2164 | 32684 |
| S | Celsius (℃) | -1380 | 17980 |
| | Fahrenheit (℉) | -2164 | 32684 |

| Name | Description | Range | Default value | R/W |
|---|---|---|---|---|
| Conversion setting value for disconnection detection | Set the value that is to be stored in the "measured temperature value" when "conversion setting for disconnection detection" is set to "any value". | -32768 to +32767 (If the temperature unit is Fahrenheit (℉), set the value in increments of 2 (0.2℉).) | 0 | R/W |

# Temperature conversion method

~~FX5-4A-ADP~~ ~~FX5-4AD-ADP~~ ~~FX5-4DA-ADP~~ FX5-4AD-PT-ADP FX5-4AD-TC-ADP

This function sets a temperature conversion method for each channel.

## Sampling processing

Executes the temperature conversion on the analog input approx. 85 ms/channel, and stores the result in the "measured temperature value" each time.

**Point**

Temperature conversion is executed one channel at a time. The time required to convert one channel is approx. 85 ms. Thus, if the conversion is incomplete during the END process, the "measured temperature value" will not be updated until the conversion is completed. The "measured temperature value" is updated during the END process after the conversion is completed, and then conversion of the next channel will be started within the same END process.

## Averaging processing

The FX5-4AD-PT-ADP performs the averaging processing on measured temperature values for each channel and stores the mean values to the "measured temperature value".

The following three types of averaging processing are provided.

- Time average
- Count average
- Moving average

### ■Time average

Temperature conversion is executed for a set time, the total value is averaged, and values are stored in the "measured temperature value".

The number of times of processing within the set time varies depending on the number of channels for which temperature conversion is enabled.

**Point**

If the set time is shorter than the scan time, the averaging processing is not executed, but the sampling value is output. However, only in the first output, the averaged value of the 1st sample and 2nd sample is output.

### ■Count average

Temperature conversion is executed for a set number of times, and the averaged value excluding the maximum value and minimum value is stored in the "measured temperature value".

The time required to store the averaged value obtained by count average in the "measured temperature value" varies depending on the scan time.

**Point**

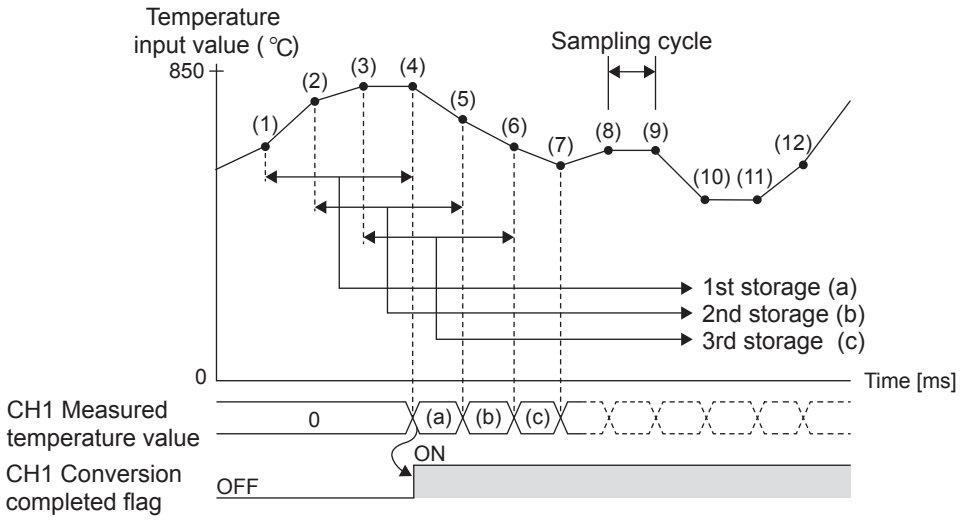
The count average requires a total of at least two values excluding the maximum value and minimum value. Set the number of times to "4" or larger value. Note that only in the first output, sampling values are output until the conversion is executed for a set number of times.

### ■Moving average

The number of moving average processing of the temperature conversion value can be specified, and the average value is digitally output and stored in "measured temperature value".

Because the target range for averaging processing is moved in response to every sampling processing, the latest measured temperature value is constantly obtained.

The following figure shows the moving average processing of when the set number of times to "4".




## Setting procedure

### ■Sampling processing

Set "Average Processing Specification" to "Sampling Processing".

Navigation window ⇨ [Parameter] ⇨ [Module Information]⇨ Module model name ⇨ [Module Parameter] ⇨ "Basic Settings" ⇨ "Temperature Conversion Method"

### ■Averaging processing

**1.** Set "Average Processing Specification" to "Time Average", "Count Average", or "Moving Average".

Navigation window ⇨ [Parameter] ⇨ [Module Information]⇨ Module model name ⇨ [Module Parameter] ⇨ "Basic Settings" ⇨ "Temperature Conversion Method"

**2.** Set a value for "Time Average Counts Average Moving Average".

| Item | Setting range |
|---|---|
| Time Average | 340 to 10000 (ms) |
| Count average | 4 to 4095 (times) |
| Moving average | 2 to 64 (times) |

## Corresponding devices

The devices which are used by the temperature conversion method are listed below.

| Name | Connection part | Special register | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3 | CH4 |
| Measured temperature value | 1st adapter | SD6300 | SD6340 | SD6380 | SD6420 |
| | 2nd adapter | SD6660 | SD6700 | SD6740 | SD6780 |
| | 3rd adapter | SD7020 | SD7060 | SD7100 | SD7140 |
| | 4th adapter | SD7380 | SD7420 | SD7460 | SD7500 |
| Average processing setting | 1st adapter | SD6303 | SD6343 | SD6383 | SD6423 |
| | 2nd adapter | SD6663 | SD6703 | SD6743 | SD6783 |
| | 3rd adapter | SD7023 | SD7063 | SD7103 | SD7143 |
| | 4th adapter | SD7383 | SD7423 | SD7463 | SD7503 |
| Time Average/Count Average/Moving Average setting | 1st adapter | SD6304 | SD6344 | SD6384 | SD6424 |
| | 2nd adapter | SD6664 | SD6704 | SD6744 | SD6784 |
| | 3rd adapter | SD7024 | SD7064 | SD7104 | SD7144 |
| | 4th adapter | SD7384 | SD7424 | SD7464 | SD7504 |

The details of the device used are listed below.

| Name | Description | Range | Default value | R/W |
|---|---|---|---|---|
| Measured temperature value | The temperature converted digital output value is stored. | -32768 to +32767 | 0 | R |

| Name | Description | Setting value | Description | Default value | R/W |
|---|---|---|---|---|---|
| Average processing setting | Set which one between the sampling processing and the averaging processing is to be selected.<br>The averaging processing is classified into "time average", "count average" and "moving average".<br>If a value other than the setting value is set, the averaging process specification setting range error (error code: 1A0☐H) occurs, and temperature conversion cannot be performed. | 0 | Sampling processing | 0 | R/W |
| | | 1 | Time average | | |
| | | 2 | Count average | | |
| | | 3 | Moving average | | |
| Time average/count average/moving average | Set the average time, average counts and moving average counts in the averaging processing for each channel.<br>If a value other than the setting value is set, one of the following will occur and the temperature conversion cannot be performed.<br>• Average time setting range error (error code: 1A1☐H)<br>• Average count setting range error (error code: 1A2☐H)<br>• Moving average count setting range error (error code: 1A3☐H) | 340 to 10000 (ms) | Time average | 0 | R/W |
| | | 4 to 4095 (times) | Count average | | |
| | | 2 to 64 (times) | Moving average | | |

# Temperature unit choice function

FX5-4A-ADP FX5-4AD-ADP FX5-4DA-ADP FX5-4AD-PT-ADP FX5-4AD-TC-ADP

Set whether to use centigrade or fahrenheit as the temperature unit. This setting is for all channels.

## Operation

The "measured temperature value", "maximum value", and "minimum value" are displayed in the temperature unit set by the "temperature unit setting".

The temperature unit can be set only when the "conversion enable/disable setting" is "disable", and the set temperature unit becomes valid after completion of the first temperature conversion.

**Point**

- This function is set for each analog adapter.
- After selecting the temperature unit, reset the warning output function and disconnection detection function settings to values that match the temperature unit.

### Precautions

If the "temperature unit setting" is changed while the warning output function or disconnection detection function is used, the setting values for each function will not be recalculated. If the setting values on which the temperature unit has been changed become out of the setting ranges, a range error for each setting is detected. The error detection is performed at the change timing of "conversion enable/disable setting" from "disable" to "enable".

## Setting procedure

Set temperature unit of the "Temperature unit setting".

- FX5-4AD-PT-ADP

Navigation window ⇨ [Parameter] ⇨ [Module Information]⇨ Module model name ⇨ [Module Parameter] ⇨ "Basic Settings" ⇨ "Temperature unit selection function"

- FX5-4AD-TC-ADP

Navigation window ⇨ [Parameter] ⇨ [Module Information]⇨ Module model name ⇨ [Module Parameter] ⇨ "Basic Settings" ⇨ "Temperature unit setting"

## Corresponding devices

The devices which are used by the temperature unit choice function are listed below.

| Name | Connection part | Special relay | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3 | CH4 |
| Temperature unit setting | 1st adapter | SM6280 | | | |
| | 2nd adapter | SM6640 | | | |
| | 3rd adapter | SM7000 | | | |
| | 4th adapter | SM7360 | | | |

Set the desired temperature unit.

| Name | Description | Monitor value | Display description | Default value | R/W |
|---|---|---|---|---|---|
| Temperature unit setting | Set the desired temperature unit. | 0: OFF | Celsius (℃) | 0: OFF | R/W |
| | | 1: ON | Fahrenheit (℉) | | |

# Maximum value/minimum value hold function

FX5-4A-ADP FX5-4AD-ADP FX5-4DA-ADP FX5-4AD-PT-ADP FX5-4AD-TC-ADP

This function stores the maximum value and minimum value of the measured temperature value to the special registers for each channel.
This function can be set only with special devices.

## Operation

When the "maximum value reset request" or "minimum value reset request" is set from OFF to ON, the maximum value or minimum value of the specified channel is updated to the "measured temperature value" every sampling cycle. In addition, the "maximum value/minimum value reset completed flag" turns ON.
If an RTD or thermocouple is selected, the "maximum value" and "minimum value" are cleared (0).



## Setting procedure

When the "maximum value reset request" or "minimum value reset request" is set from OFF to ON, the maximum value or minimum value is updated.

| Setting value | Description | Default value |
|---|---|---|
| 0: OFF | With no maximum value or minimum value reset request | 0: OFF |
| 1: ON | With maximum value or minimum value reset request | |

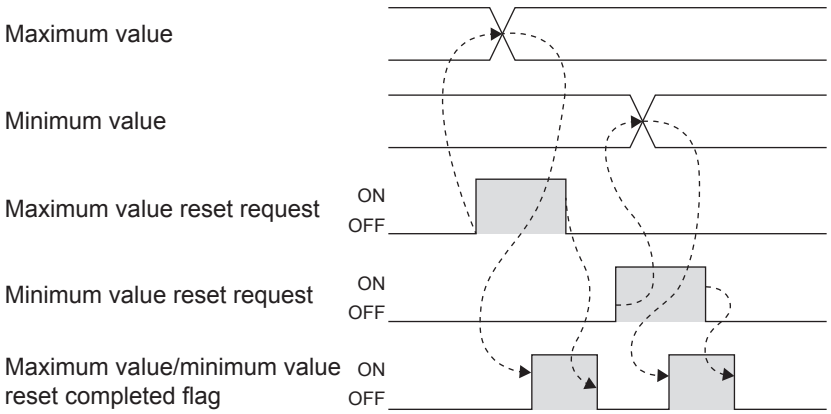
## Corresponding devices

The devices which are used by the maximum value/minimum value hold function are listed below.

| Name | Connection part | Special relay/Special register | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3 | CH4 |
| Maximum value/minimum value reset completed flag | 1st adapter | SM6305 | SM6345 | SM6385 | SM6425 |
| | 2nd adapter | SM6665 | SM6705 | SM6745 | SM6785 |
| | 3rd adapter | SM7025 | SM7065 | SM7105 | SM7145 |
| | 4th adapter | SM7385 | SM7425 | SM7465 | SM7505 |
| Maximum value reset request | 1st adapter | SM6306 | SM6346 | SM6386 | SM6426 |
| | 2nd adapter | SM6666 | SM6706 | SM6746 | SM6786 |
| | 3rd adapter | SM7026 | SM7066 | SM7106 | SM7146 |
| | 4th adapter | SM7386 | SM7426 | SM7466 | SM7506 |
| Minimum value reset request | 1st adapter | SM6307 | SM6347 | SM6387 | SM6427 |
| | 2nd adapter | SM6667 | SM6707 | SM6747 | SM6787 |
| | 3rd adapter | SM7027 | SM7067 | SM7107 | SM7147 |
| | 4th adapter | SM7387 | SM7427 | SM7467 | SM7507 |
| Maximum value | 1st adapter | SD6306 | SD6346 | SD6386 | SD6426 |
| | 2nd adapter | SD6666 | SD6706 | SD6746 | SD6786 |
| | 3rd adapter | SD7026 | SD7066 | SD7106 | SD7146 |
| | 4th adapter | SD7386 | SD7426 | SD7466 | SD7506 |
| Minimum value | 1st adapter | SD6307 | SD6347 | SD6387 | SD6427 |
| | 2nd adapter | SD6667 | SD6707 | SD6747 | SD6787 |
| | 3rd adapter | SD7027 | SD7067 | SD7107 | SD7147 |
| | 4th adapter | SD7387 | SD7427 | SD7467 | SD7507 |

The details of the device used are listed below.

| Name | Description | Monitor value | Display description | Default value | R/W |
|---|---|---|---|---|---|
| Maximum value/minimum value reset completed flag | This flag monitors the "maximum value/minimum value" reset status.<br>When the "maximum value reset request" or "minimum value reset request" is set from OFF to ON and then the value stored in the "maximum value" or "minimum value" is reset, the "maximum value/minimum value reset completion flag" turns ON. | 0: OFF | Reset is not completed. | 0: OFF | R |
| | | 1: ON | Reset is completed. | | |




| Name | Description | Monitor value | Setting description | Default value | R/W |
|---|---|---|---|---|---|
| Maximum value and minimum value reset request | When the "maximum value reset request" and "minimum value reset request" are set from OFF to ON, the maximum value and minimum value are updated to the "measured temperature value". | 0: OFF | With no maximum value and minimum value reset request | 0: OFF | R/W |
| | | 1: ON | With maximum value and minimum value reset request | | |

| Name | Description | Range | Default value | R/W |
|---|---|---|---|---|
| Maximum value and minimum value | The maximum and minimum values of the measured temperature value are stored.<br>When the "maximum value reset request" and "minimum value reset request" are set from OFF to ON, the maximum value and minimum value of the channel are updated to "measured temperature value". | -32768 to +32767 | 0 | R |

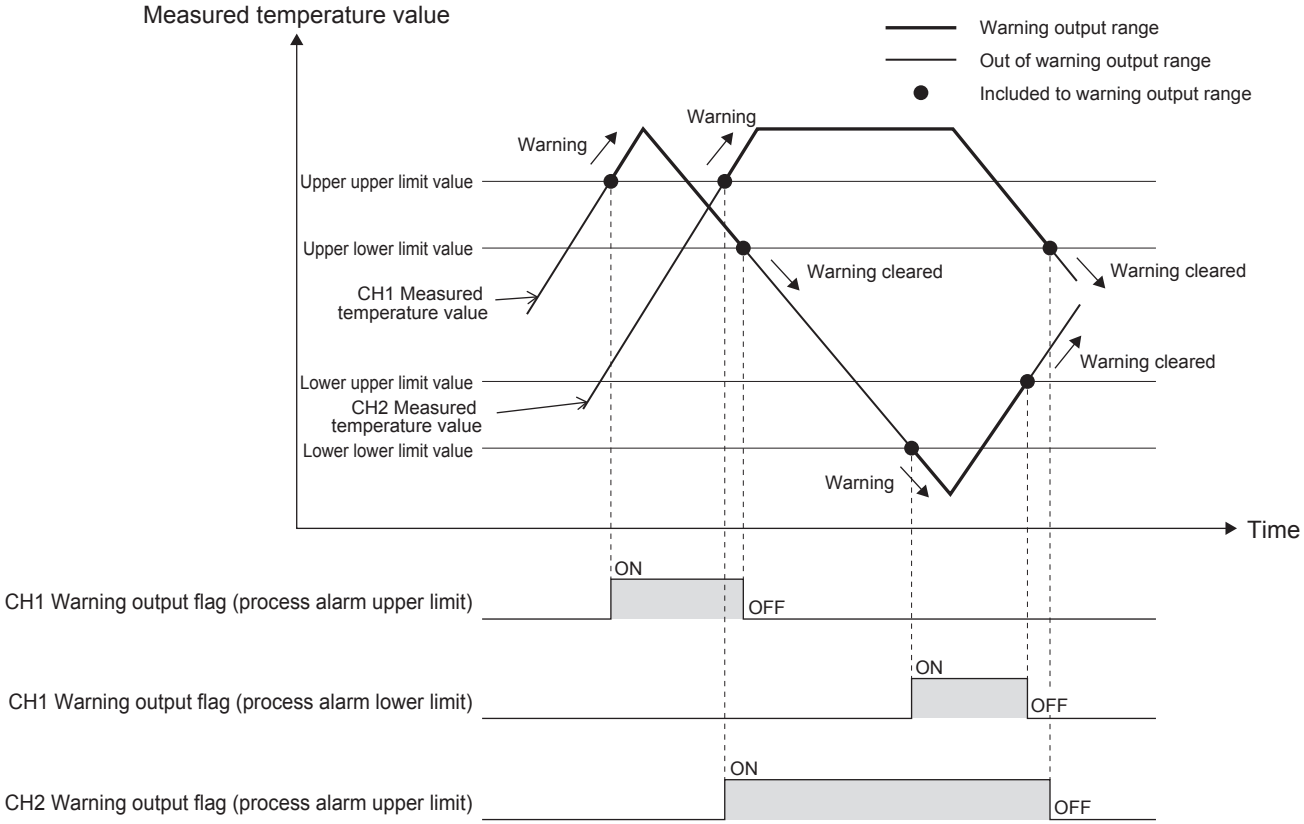
# Warning output function

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

This section describes process alarms and rate alarms used for the warning output function.

## Process alarm

This function outputs an alarm when a measured temperature value enters the preset alarm output range.




### ■Operation

If the measured temperature value satisfies the following conditions where a warning is output, the warning output flag corresponding to "conversion alarm flag" turns on.

- The value is equal to or greater than the process alarm upper upper limit value: "Warning output flag (process alarm upper limit)" turns on. (Alarm code: 080☐H)
- The value is equal to or smaller than the process alarm lower lower limit value: "Warning output flag (process alarm lower limit)" turns on. (Alarm code: 081☐H)

After a warning is output, if the measured temperature value becomes out of the conditions where a warning is output, the corresponding warning output flag turns off.

- The value is smaller than the process alarm upper lower limit value: "Warning output flag (process alarm upper limit)" turns off.
- The value is greater than the process alarm lower upper limit value: "Warning output flag (process alarm lower limit)" turns off.

In addition, when the "warning output setting (process alarm)" is changed to be disabled, "warning output flag (process alarm upper limit)" and "warning output flag (process alarm lower limit)" turn off. "Conversion alarm flag" and the alarm code stored in "conversion latest alarm code", however, are not cleared.

To clear "conversion alarm flag" and the alarm code stored in "conversion latest alarm code", turn on and off "conversion alarm clear request" after all of "warning output flag (process alarm upper limit)" and "warning output flag (process alarm lower limit)" turn off.

## Precautions

When "conversion enable/disable setting" is "enable", the data related to the warning output function (process alarm) cannot be changed.

### ■Detection cycle

The process alarm detection is performed every sampling cycle.

### ■Setting procedure

1. Set "Warning output setting (Process alarm)" to "Enable".

Navigation window ⇨ [Parameter] ⇨ [Module Information]⇨ Module model name ⇨ [Module Parameter] ⇨ "Application Settings" ⇨ "Warning output function (Process alarm)"

2. Set values for "Process Alarm Upper Upper Limit Value", "Process Alarm Upper Lower Limit Value", "Process Alarm Lower Upper Limit Value", and "Process Alarm Lower Lower Limit Value".

• FX5-4AD-PT-ADP

| Item | Resistance temperature detector type setting | | | Setting range |
|---|---|---|---|---|
| | Resistance temperature detector | Temperature unit | Temperature input range | |
| Process Alarm Upper Upper Limit Value<br>Process Alarm Upper Lower Limit Value<br>Process alarm lower upper limit value<br>Process alarm lower lower limit value | Pt100 | Celsius (℃) | -200 to +850℃ | -2000 to +8500 |
| | | Fahrenheit (℉) | -328 to +1562℉ | -3280 to +15620*1 |
| | Ni100 | Celsius (℃) | -60 to +250℃ | -600 to +2500 |
| | | Fahrenheit (℉) | -76 to +482℉ | -760 to +4820*1 |

• FX5-4AD-TC-ADP

| Item | Setting thermocouple type | | | Setting range |
|---|---|---|---|---|
| | Thermocouple | Temperature unit | Temperature input range | |
| Process Alarm Upper Upper Limit Value<br>Process Alarm Upper Lower Limit Value<br>Process alarm lower upper limit value<br>Process alarm lower lower limit value | K | Celsius (℃) | -270 to +1370℃ | -2700 to +13700 |
| | | Fahrenheit (℉) | -454 to +2498℉ | -4540 to +24980*1 |
| | J | Celsius (℃) | -210 to +1130℃ | -2100 to +11300 |
| | | Fahrenheit (℉) | -346 to +2066℉ | -3460 to +20660*1 |
| | T | Celsius (℃) | -270 to +400℃ | -2700 to +4000 |
| | | Fahrenheit (℉) | -454 to +752℉ | -4540 to +7520*1 |
| | B | Celsius (℃) | 0 to 1710℃ | 0 to 17100 |
| | | Fahrenheit (℉) | 32 to 3110℉ | 320 to 31100*1 |
| | R | Celsius (℃) | -50 to +1710℃ | -500 to +17100 |
| | | Fahrenheit (℉) | -58 to +3110℉ | -580 to +31100*1 |
| | S | Celsius (℃) | -50 to +1710℃ | -500 to +17100 |
| | | Fahrenheit (℉) | -58 to +3110℉ | -580 to +31100*1 |

*1 Set the value in increments of 2 (0.2℉).

**Point**

Set values within the range satisfying the condition "Process Alarm Upper Upper Limit Value ≥ Process Alarm Upper Lower Limit Value ≥ Process Alarm Lower Upper Limit Value ≥ Process Alarm Lower Lower Limit Value".

When not satisfying the above conditions, a process alarm upper lower limit value setting range error occurs. (Error code: 1A4□H)

## ■Corresponding devices

The devices which are used by the process alarm are listed below.

| Name | Connection part | Special relay/Special register | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3 | CH4 |
| Warning output flag (process alarm upper limit) | 1st adapter | SM6311 | SM6351 | SM6391 | SM6431 |
| | 2nd adapter | SM6671 | SM6711 | SM6751 | SM6791 |
| | 3rd adapter | SM7031 | SM7071 | SM7111 | SM7151 |
| | 4th adapter | SM7391 | SM7431 | SM7471 | SM7511 |
| Warning output flag (process alarm lower limit) | 1st adapter | SM6312 | SM6352 | SM6392 | SM6432 |
| | 2nd adapter | SM6672 | SM6712 | SM6752 | SM6792 |
| | 3rd adapter | SM7032 | SM7072 | SM7112 | SM7152 |
| | 4th adapter | SM7392 | SM7432 | SM7472 | SM7512 |
| Warning output setting (process alarm) | 1st adapter | SM6313 | SM6353 | SM6393 | SM6433 |
| | 2nd adapter | SM6673 | SM6713 | SM6753 | SM6793 |
| | 3rd adapter | SM7033 | SM7073 | SM7113 | SM7153 |
| | 4th adapter | SM7393 | SM7433 | SM7473 | SM7513 |
| Process alarm upper upper limit value | 1st adapter | SD6311 | SD6351 | SD6391 | SD6431 |
| | 2nd adapter | SD6671 | SD6711 | SD6751 | SD6791 |
| | 3rd adapter | SD7031 | SD7071 | SD7111 | SD7151 |
| | 4th adapter | SD7391 | SD7431 | SD7471 | SD7511 |
| Process alarm upper lower limit value | 1st adapter | SD6312 | SD6352 | SD6392 | SD6432 |
| | 2nd adapter | SD6672 | SD6712 | SD6752 | SD6792 |
| | 3rd adapter | SD7032 | SD7072 | SD7112 | SD7152 |
| | 4th adapter | SD7392 | SD7432 | SD7472 | SD7512 |
| Process alarm lower upper limit value | 1st adapter | SD6313 | SD6353 | SD6393 | SD6433 |
| | 2nd adapter | SD6673 | SD6713 | SD6753 | SD6793 |
| | 3rd adapter | SD7033 | SD7073 | SD7113 | SD7153 |
| | 4th adapter | SD7393 | SD7433 | SD7473 | SD7513 |
| Process alarm lower lower limit value | 1st adapter | SD6314 | SD6354 | SD6394 | SD6434 |
| | 2nd adapter | SD6674 | SD6714 | SD6754 | SD6794 |
| | 3rd adapter | SD7034 | SD7074 | SD7114 | SD7154 |
| | 4th adapter | SD7394 | SD7434 | SD7474 | SD7514 |

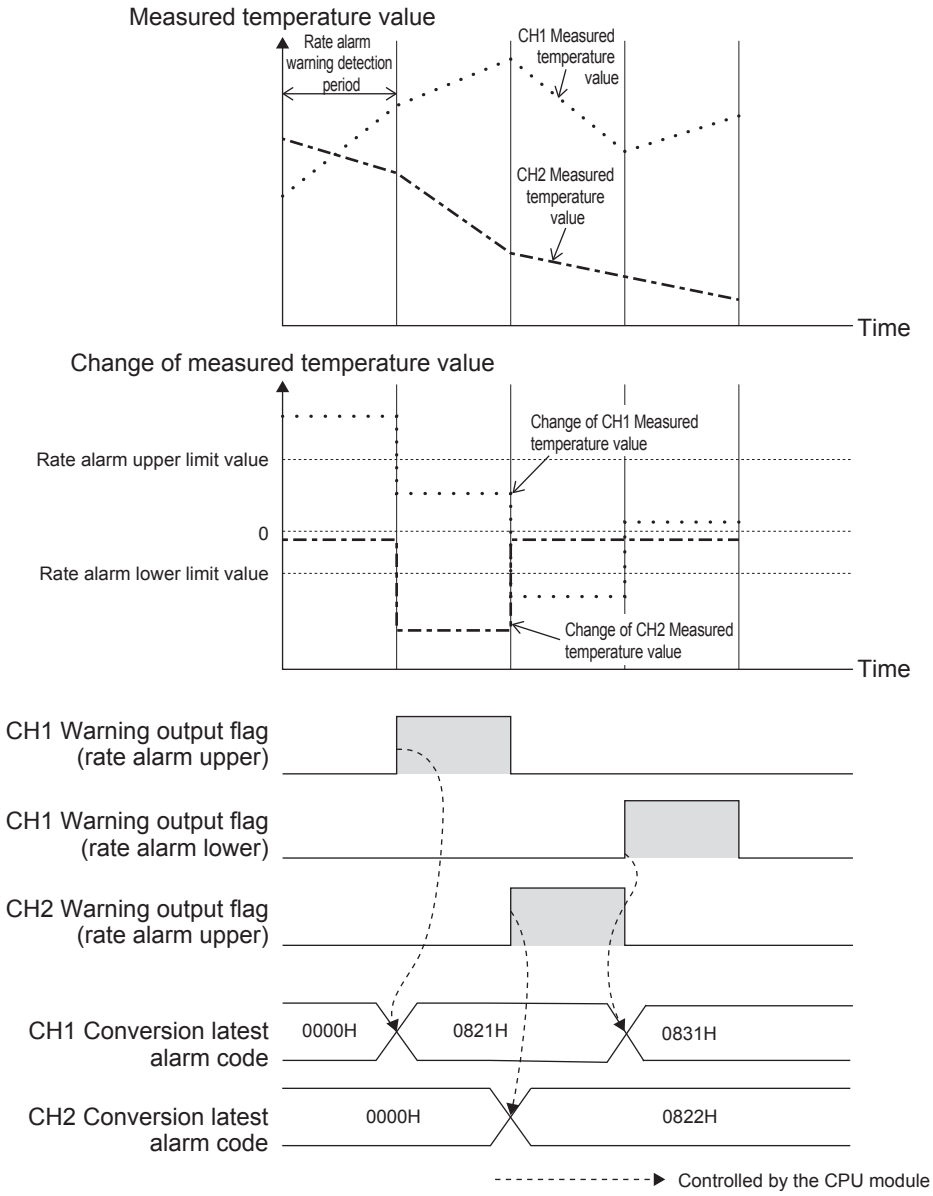
The details of the device used are listed below.

| Name | Description | Setting value | Description | Default value | R/W |
|---|---|---|---|---|---|
| Warning output setting (process alarm) | Set whether to enable or disable the warning output of process alarm. | 0: OFF | Warning output of process alarm enable | 1: ON | R/W |
| | | 1: ON | Warning output of process alarm disable | | |
| Warning output flag (process alarm upper/lower limit) | Monitors the upper limit value warning and lower limit value warning in the process alarm. | 0: OFF | Normal | 0: OFF | R |
| | | 1: ON | Process alarm upper/lower limit detection | | |

| Name | Description | Range | Default value | R/W |
|---|---|---|---|---|
| Process alarm upper upper limit value<br>Process Alarm Upper Lower Limit Value | Set the value of the warning output function (process alarm).<br>• When changing this device, set process alarm upper upper limit value, process alarm upper lower limit value, process alarm lower upper limit value, and process alarm lower lower limit value within the same scan.<br>• If the condition "process alarm upper upper limit value ≥ process alarm upper lower limit value ≥ process alarm lower upper limit value ≥ process alarm lower lower limit value" is not satisfied, the process alarm upper lower limit value setting range error occurs and the temperature conversion cannot be performed. (Error code: 1A4□H) | -32768 to +32767 (If the temperature unit is Fahrenheit (°F), set the value in increments of 2 (0.2°F).) | FX5-4AD-PT-ADP<br>• 8500<br>FX5-4AD-TC-ADP<br>• 12000 | R/W |
| Process alarm lower upper limit value<br>Process alarm lower lower limit value | | | -2000 | R/W |

## Rate alarm

This function outputs an alert when the change of a measured temperature value is equal to or greater than the rate alarm upper limit value, or equal to or smaller than the rate alarm lower limit value.




### ■Operation

The measured temperature value is monitored every rate alarm warning detection period. When the change from the previous value is equal to or greater than the rate alarm upper limit value, or equal to or smaller than the rate alarm lower limit value, a warning output flag corresponding to "conversion alarm flag" turns on.

- The value is equal to or greater than the rate alarm upper limit value: "Warning output flag (rate alarm upper)" turns on. (Alarm code: 082□H)
- The value is equal to or smaller than the rate alarm lower limit value: "Warning output flag (rate alarm lower)" turns on. (Alarm code: 083□H)

After a warning is output, if the measured temperature value becomes out of the conditions where a warning is output, the corresponding warning output flag turns off.

- The value is smaller than the rate alarm upper limit value: "Warning output flag (rate alarm upper)" turns off.
- The value is greater than the rate alarm lower limit value: "Warning output flag (rate alarm lower)" turns off.

In addition, when the "warning output setting (rate alarm)" is changed to be disabled, "warning output flag (rate alarm upper)" and "warning output flag (rate alarm lower)" turn off. "Conversion alarm flag" and the alarm code stored in "conversion latest alarm code", however, are not cleared.

To clear "conversion alarm flag" and the alarm code stored in "conversion latest alarm code", turn on and off "conversion alarm clear request" after all of "warning output flag (rate alarm upper)" and "warning output flag (rate alarm lower)" turn off.

## Precautions

When "conversion enable/disable setting" is "enable", the data related to the warning output function (rate alarm) cannot be changed.

### ■Detection cycle

Set the rate alarm warning detection period in "rate alarm warning detection period setting".

### ■Judgment of rate alarm

A change rate is judged with the following formulae every rate alarm alert detection cycle.

• For alert outputting of rate alarm upper limit

(Current measured temperature value) - (Measured temperature value in the previous detection cycle) ≥ (Rate alarm upper limit value)

• For alert outputting of rate alarm lower limit

(Current measured temperature value) - (Measured temperature value in the previous detection cycle) ≤ (Rate alarm lower limit value)



**Ex.**

Judgment under the following conditions at Pt100 (-200 to +850℃)

• Rate alarm warning detection period setting: 150 (ms)

• Rate alarm upper limit value: 5000 (500.0℃)

• Rate alarm lower limit value: 1000 (100.0℃)

A measured temperature value of this time is compared to the previous value (measured temperature value 150ms before), every rate alarm alert detection cycle of 150ms. From the comparison, whether the increase in the measured temperature value is 5000 (500.0℃) or more, or 1000 (100.0℃) or less is judged.

**Ex.**

Judgment under the following conditions with thermocouple B (600 to 1700℃)

• Rate alarm warning detection period setting: 150 (ms)

• Rate alarm upper limit value: 10000 (1000.0℃)

• Rate alarm lower limit value: 7000 (700.0℃)

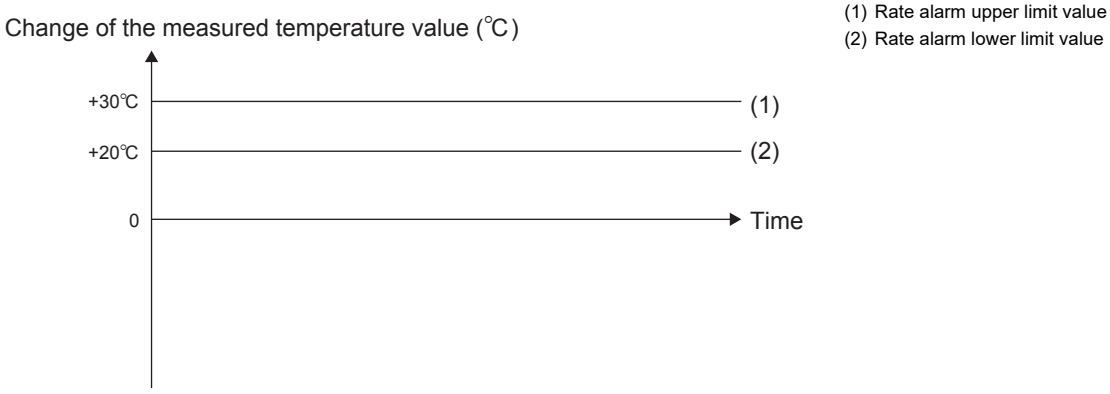
A measured temperature value of this time is compared to the previous value (measured temperature value 150 ms before), every rate alarm alert detection cycle of 150 ms. From the comparison, whether the increase in the measured temperature value is 10000 (1000.0℃) or more, or 7000 (700.0℃) or less is judged.

### ■Application examples of rate alarms

A rate alarm serves to monitor the change of a measured temperature value in a limited range as shown below.

**Ex.**

To monitor that the change of a measured temperature value (temperature unit: Celsius) rises within the specified range

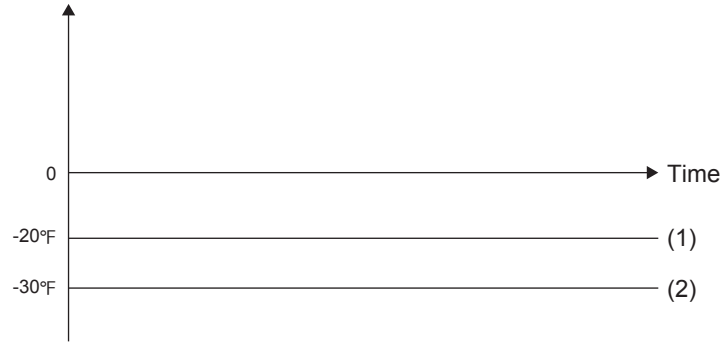


Ex.

To monitor that the change of a measured temperature value (temperature unit: Fahrenheit) falls within the specified range

Change of the measured temperature value (°F)

(1) Rate alarm upper limit value
(2) Rate alarm lower limit value

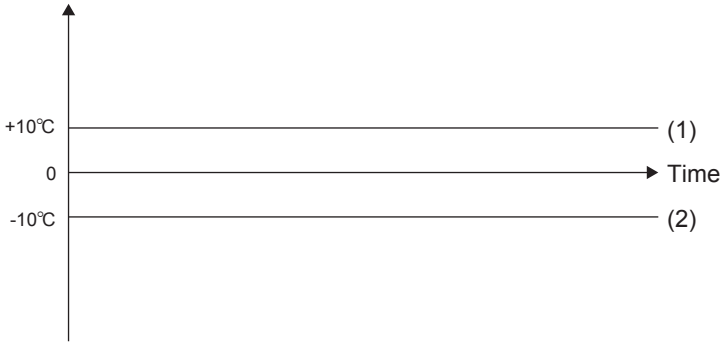



Ex.

To monitor that the change of a measured temperature value (temperature unit: Celsius) is within the specified range

Change of the measured temperature value (°C)

(1) Rate alarm upper limit value
(2) Rate alarm lower limit value




## ■Setting procedure

**1.** Set "Warning output function (Rate alarm)" to "Enable".

Navigation window ⇨ [Parameter] ⇨ [Module Information]⇨ Module model name ⇨ [Module Parameter] ⇨ "Application Settings" ⇨ "Warning output function (Rate alarm)"

**2.** Set a value in "Rate alarm warning detection period setting".

| Item | Setting range |
|---|---|
| Rate alarm warning detection period setting | 85 to 10000 (ms) |

**Point**

- When a value outside the setting range is set, the rate alarm warning detection period setting range error occurs. (Error code: 1A6☐H)
- The rate alarm warning detection period is obtained by Set value + 1 scan time.

**3.** Set values for "Rate alarm upper limit value" and "Rate alarm lower limit value".

| Item | Setting range |
|---|---|
| Rate alarm upper limit value | -3276.8 to 3276.7*1 |
| Rate alarm lower limit value | |

*1 If the temperature unit is Fahrenheit (°F), set the value in increments of 2 (0.2°F).

**Point**

Set values within the range satisfying the condition "Rate alarm upper limit value > Rate alarm lower limit value".

When not satisfying the above conditions, a rate alarm upper/lower limit setting value inversion error occurs. (Error code: 1A5☐H)

## ■Corresponding devices

The devices used by the rate alarm are listed below.

| Name | Connection part | Special relay/Special register | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3 | CH4 |
| Warning output flag (rate alarm upper) | 1st adapter | SM6315 | SM6355 | SM6395 | SM6435 |
| | 2nd adapter | SM6675 | SM6715 | SM6755 | SM6795 |
| | 3rd adapter | SM7035 | SM7075 | SM7115 | SM7155 |
| | 4th adapter | SM7395 | SM7435 | SM7475 | SM7515 |
| Warning output flag (rate alarm lower) | 1st adapter | SM6316 | SM6356 | SM6396 | SM6436 |
| | 2nd adapter | SM6676 | SM6716 | SM6756 | SM6796 |
| | 3rd adapter | SM7036 | SM7076 | SM7116 | SM7156 |
| | 4th adapter | SM7396 | SM7436 | SM7476 | SM7516 |
| Warning output setting (rate alarm) | 1st adapter | SM6317 | SM6357 | SM6397 | SM6437 |
| | 2nd adapter | SM6677 | SM6717 | SM6757 | SM6797 |
| | 3rd adapter | SM7037 | SM7077 | SM7117 | SM7157 |
| | 4th adapter | SM7397 | SM7437 | SM7477 | SM7517 |
| Rate alarm upper limit value | 1st adapter | SD6315 | SD6355 | SD6395 | SD6435 |
| | 2nd adapter | SD6675 | SD6715 | SD6755 | SD6795 |
| | 3rd adapter | SD7035 | SD7075 | SD7115 | SD7155 |
| | 4th adapter | SD7395 | SD7435 | SD7475 | SD7515 |
| Rate alarm lower limit value | 1st adapter | SD6316 | SD6356 | SD6396 | SD6436 |
| | 2nd adapter | SD6676 | SD6716 | SD6756 | SD6796 |
| | 3rd adapter | SD7036 | SD7076 | SD7116 | SD7156 |
| | 4th adapter | SD7396 | SD7436 | SD7476 | SD7516 |
| Rate alarm warning detection period setting | 1st adapter | SD6317 | SD6357 | SD6397 | SD6437 |
| | 2nd adapter | SD6677 | SD6717 | SD6757 | SD6797 |
| | 3rd adapter | SD7037 | SD7077 | SD7117 | SD7157 |
| | 4th adapter | SD7397 | SD7437 | SD7477 | SD7517 |

The details of the device used are listed below.

| Name | Description | Setting value | Description | Default value | R/W |
|---|---|---|---|---|---|
| Warning output setting (rate alarm) | Set whether to enable or disable the warning output of rate alarm. | 0: OFF | Warning output of rate alarm enable | 1: ON | R/W |
| | | 1: ON | Warning output of rate alarm disable | | |
| Warning output flag (rate alarm upper)<br>Warning output flag (rate alarm lower) | Monitors the upper limit value warning and lower limit value warning of the rate alarm. | 0: OFF | Normal | 0: OFF | R |
| | | 1: ON | Rate alarm upper/lower limit detection | | |

| Name | Description | Range | Default value | R/W |
|---|---|---|---|---|
| Rate alarm upper limit value<br>Rate alarm lower limit value | Set the upper/lower limits of the change of a measured temperature value for detecting rate alarms.<br>• When changing this device, set rate alarm upper limit value and rate alarm lower limit value within the same scan.<br>• If the condition "rate alarm upper limit value > rate alarm lower limit value" is not satisfied, the rate alarm upper limit value/lower limit value setting inversion error (Error code: 1A5□H) occurs, and the temperature conversion cannot be performed. | -32768 to +32767 (If the temperature unit is Fahrenheit (°F), set the value in increments of 2 (0.2°F).) | 0 | R/W |
| Rate alarm warning detection period setting | Set the cycle for checking the change amount of the measured temperature value.<br>If a value other than the setting value is set, the rate alarm warning detection period setting range error (Error code: 1A6□H) occurs, and the temperature conversion cannot be performed. | 85 to 10000 (ms) | 85 | R/W |

# Offset/gain setting function

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

This function sets any analog (temperature) input values as offset and gain values (user range setting) instead of the preset settings. The function corrects error of the temperature conversion caused by noise or other factors. Note that the resolution is not changed. The set value is saved in the built-in memory of the analog adapter.

For changing the offset/gain data, set an analog value to the "offset temperature setting value" or "gain temperature setting value".

The table below shows the available setting range.

• FX5-4AD-PT-ADP

| Item | Description | Setting range | | |
|---|---|---|---|---|
| | | Unit/RTD | Pt100 | Ni100 |
| Offset temperature setting value | Temperature setting value corresponding to the input offset value | Celsius (℃) | -200.0 to +850.0℃ | -60.0 to +250.0℃ |
| | | Fahrenheit (℉) | -328.0 to +1562.0℉ | -76.0 to +482.0℉ |
| Gain temperature setting value | Temperature setting value corresponding to the input gain value | Celsius (℃) | -200.0 to +850.0℃ | -60.0 to +250.0℃ |
| | | Fahrenheit (℉) | -328.0 to +1562.0℉ | -76.0 to +482.0℉ |

If the "offset temperature setting value" and the "gain temperature setting value" are set using this function, the following values are also stored.

| Item | Description | Setting range |
|---|---|---|
| Input offset value | Resistance value obtained by temperature conversion averaging processing when the measured temperature value reaches the lower limit value (offset reference value) | 0 to 450000 (mΩ) |
| Input gain value | Resistance value obtained by temperature conversion averaging processing when the measured temperature value reaches the upper limit value (gain reference value) | |

**Point**

The setting value is obtained from the built-in memory of the FX5-4AD-PT-ADP when "offset/gain reading" is set from OFF to ON or the power supply of the FX5-4AD-PT-ADP is turned off and on.

• FX5-4AD-TC-ADP

| Item | Description | Setting range | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Unit/Thermocouple | K | J | T | B | R | S |
| Offset temperature setting value | Temperature setting value corresponding to the input offset value | Celsius (℃) | -270.0 to +1370.0℃ | -210.0 to +1130.0℃ | -270.0 to +400.0℃ | 0 to 710.0℃ | -50.0 to +1710.0℃ | -50.0 to +1710.0℃ |
| | | Fahrenheit (℉) | -454.0 to +2498.0℉ | -346.0 to +2066.0℉ | -454.0 to +752.0℉ | 32.0 to 3110.0℉ | -58.0 to +3110.0℉ | -58.0 to +3110.0℉ |
| Gain temperature setting value | Temperature setting value corresponding to the input gain value | Celsius (℃) | -270.0 to +1370.0℃ | -210.0 to +1130.0℃ | -270.0 to +400.0℃ | 0 to 710.0℃ | -50.0 to +1710.0℃ | -50.0 to +1710.0℃ |
| | | Fahrenheit (℉) | -454.0 to +2498.0℉ | -346.0 to +2066.0℉ | -454.0 to +752.0℉ | 32.0 to 3110.0℉ | -58.0 to +3110.0℉ | -58.0 to +3110.0℉ |

**Point**

When the offset temperature setting value and the gain temperature setting value do not satisfy the following condition, the offset/gain temperature setting value error occurs. (Error code: 1D1□H)

- When the temperature unit is centigrade: Gain temperature setting value - Offset temperature setting value > 0.1℃
- When the temperature unit is Fahrenheit: Gain temperature setting value - Offset temperature setting value > 0.3℉

If the "offset temperature setting value" and the "gain temperature setting value" are set using this function, the following values are also stored.

| Item | Description | Setting range |
|---|---|---|
| Input offset value | Thermal EMF value obtained by temperature conversion averaging processing when the measured temperature value reaches the lower limit value (offset reference value) | 0 to 78125 (μV) |
| Input gain value | Thermal EMF value obtained by temperature conversion averaging processing when the measured temperature value reaches the upper limit value (gain reference value) | |

**Point**

When "offset/gain reading" is set from OFF to ON or the power supply of the FX5-4AD-TC-ADP is turned off and on, the offset temperature setting value obtained from the built-in memory of the FX5-4AD-TC-ADP, the offset thermal EMF value calculated from the thermocouple type setting and the gain thermal EMF value are stored.

## Operation



### ■Offset/gain writing

For changing the offset/gain data, set "E215H" (for the FX5-4AD-PT-ADP) or "E21AH" (for the FX5-4AD-TC-ADP) to the "offset/gain writing enable code", and set the "offset/gain writing" from OFF to ON to write the "setting RTD type" or "setting thermocouple type", "offset temperature setting value", "gain temperature setting value", "input offset value", and "input gain value" to the built-in memory of the analog adapter. This enables the user range setting change for each channel, and the latest contents become valid.

When writing is completed, the "write offset/gain" automatically turns OFF. Also, the "offset/gain writing enable code" is cleared to 0.

When the "setting RTD type" or "setting thermocouple type" is changed, the initial value becomes valid.

For returning the offset/gain data to the initial value, use the offset/gain initialization function. (☞ Page 756 Offset/gain initialization function)

**Point**

- The offset/gain value is written only when the "offset/gain writing enable code" is set to "E215H" (for the FX5-4AD-PT-ADP) or "E21AH" (for the FX5-4AD-TC-ADP).
- The offset/gain value can be written only while temperature conversion is disabled.
- The "conversion enable/disable setting" cannot be changed to "enable" while the offset/gain value is being written.

### ■Offset/gain reading

For reading the offset/gain data saved in the built-in memory of the analog adapter, set the "read offset/gain" from OFF to ON to read the "setting RTD type" or "setting thermocouple type", "offset temperature setting value", "gain temperature setting value", "input offset value" and "input gain value" from the built-in memory of the analog adapter.

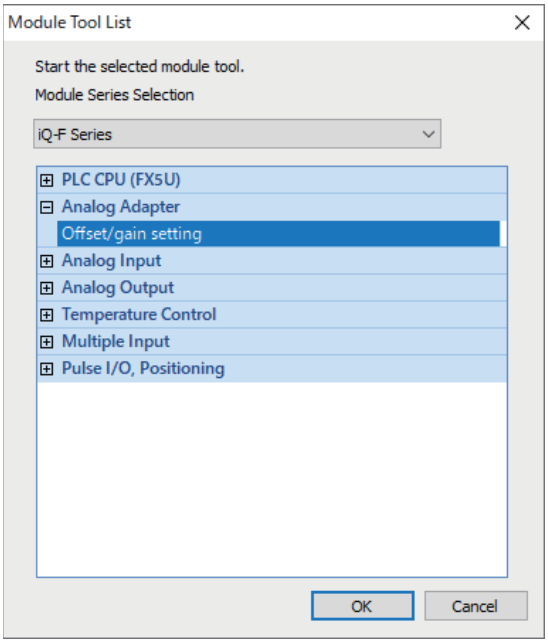
If the RTD type setting or thermocouple type setting at the time of reading is the same as the "setting RTD type" or "setting thermocouple type" in the built-in memory of the analog adapter, the obtained values are stored in the "offset temperature setting value", "gain temperature setting value", "input offset value", and "input gain value". If the RTD type setting or thermocouple type setting is different, the initial value of the RTD type setting or thermocouple type setting at the time of reading is valid and set to the "offset temperature setting value", "gain temperature setting value", "input offset value", and "input gain value". Also, the offset/gain read RTD type or offset/gain read thermocouple type mismatch alarm occurs. (Alarm code: 0C0□H)

## Setting procedure

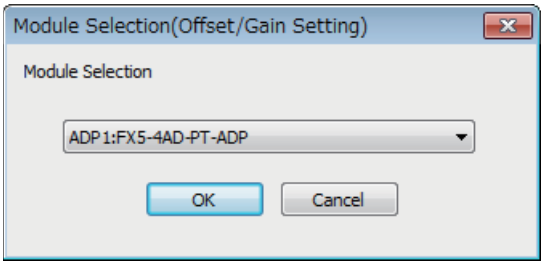
Access to the offset/gain setting window in the GX Works3 to set the offset and gain values.

The setting procedure for the offset/gain setting of the FX5-4A-ADP is as follows:

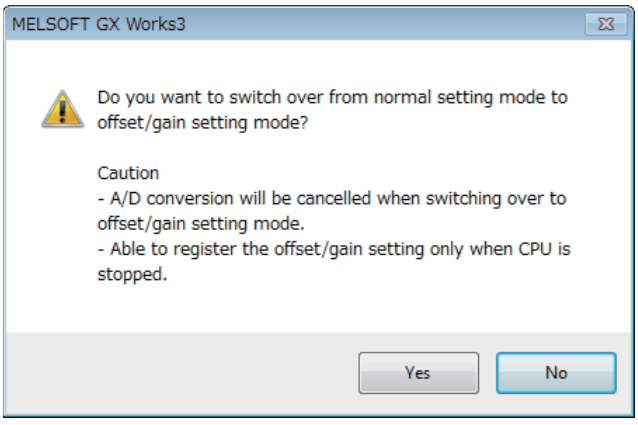
[Tool] ⇨ [Module Tool List]



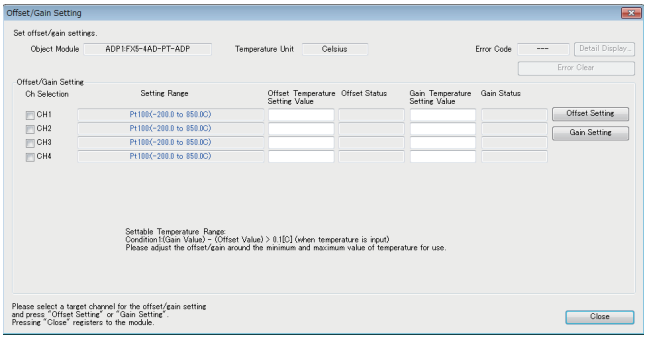

**1.** In "Analog Adapter", select "Offset/gain setting" and click [OK] button.



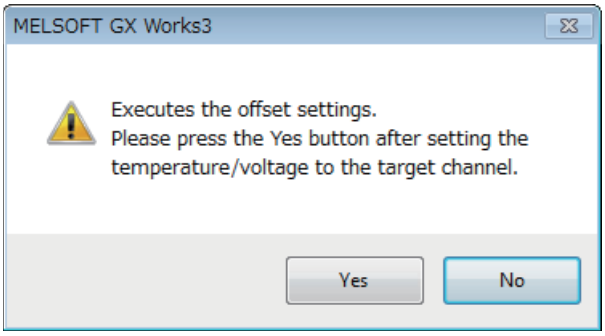

**2.** Select the target module for the offset/gain setting, and click [OK] button.



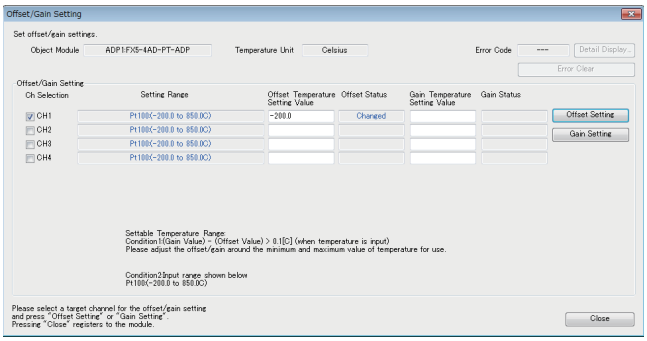

**3.** Click [Yes] button.



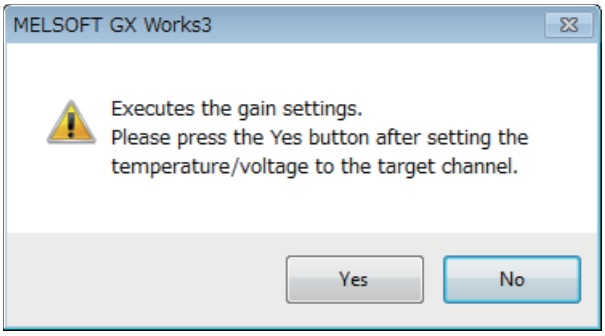

**4.** Mark the checkbox of the channel where offset and gain values are to be set, and click [Offset Setting] button.



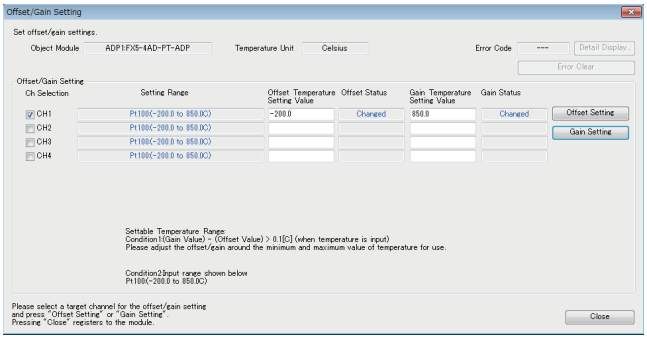

**5.** Apply the offset temperature to the terminal of the corresponding channel, and click [Yes] button.



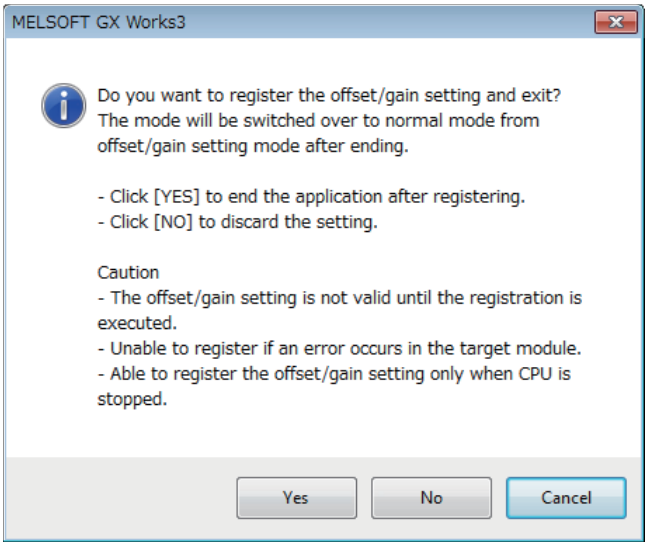

**6.** Check that "Offset Status" has changed to "Changed", and click [Gain Setting] button.




**7.** Apply the gain temperature to the terminal of the corresponding channel, and click [Yes] button.




**8.** Check that "Gain Status" has changed to "Changed", and click [Close] button.




**9.** Click [Yes] button.

## Corresponding devices

The devices which are used by the offset/gain setting function are listed below.

| Name | Connection part | Special relay/Special register | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3 | CH4 |
| Offset/gain setting flag | 1st adapter | SM6331 | SM6371 | SM6411 | SM6451 |
| | 2nd adapter | SM6691 | SM6731 | SM6771 | SM6811 |
| | 3rd adapter | SM7051 | SM7091 | SM7131 | SM7171 |
| | 4th adapter | SM7411 | SM7451 | SM7491 | SM7531 |
| Read offset/gain | 1st adapter | SM6332 | SM6372 | SM6412 | SM6452 |
| | 2nd adapter | SM6692 | SM6732 | SM6772 | SM6812 |
| | 3rd adapter | SM7052 | SM7092 | SM7132 | SM7172 |
| | 4th adapter | SM7412 | SM7452 | SM7492 | SM7532 |
| Offset/gain writing | 1st adapter | SM6333 | SM6373 | SM6413 | SM6453 |
| | 2nd adapter | SM6693 | SM6733 | SM6773 | SM6813 |
| | 3rd adapter | SM7053 | SM7093 | SM7133 | SM7173 |
| | 4th adapter | SM7413 | SM7453 | SM7493 | SM7533 |
| Offset temperature setting value | 1st adapter | SD6327 | SD6367 | SD6407 | SD6447 |
| | 2nd adapter | SD6687 | SD6727 | SD6767 | SD6807 |
| | 3rd adapter | SD7047 | SD7087 | SD7127 | SD7167 |
| | 4th adapter | SD7407 | SD7447 | SD7487 | SD7527 |
| Gain temperature setting value | 1st adapter | SD6328 | SD6368 | SD6408 | SD6448 |
| | 2nd adapter | SD6688 | SD6728 | SD6768 | SD6808 |
| | 3rd adapter | SD7048 | SD7088 | SD7128 | SD7168 |
| | 4th adapter | SD7408 | SD7448 | SD7488 | SD7528 |
| Offset/gain writing enable code | 1st adapter | SD6329 | SD6369 | SD6409 | SD6449 |
| | 2nd adapter | SD6689 | SD6729 | SD6769 | SD6809 |
| | 3rd adapter | SD7049 | SD7089 | SD7129 | SD7169 |
| | 4th adapter | SD7409 | SD7449 | SD7489 | SD7529 |
| Input offset value (L) | 1st adapter | SD6334 | SD6374 | SD6414 | SD6454 |
| | 2nd adapter | SD6694 | SD6734 | SD6774 | SD6814 |
| | 3rd adapter | SD7054 | SD7094 | SD7134 | SD7174 |
| | 4th adapter | SD7414 | SD7454 | SD7494 | SD7534 |
| Input offset value (H) | 1st adapter | SD6335 | SD6375 | SD6415 | SD6455 |
| | 2nd adapter | SD6695 | SD6735 | SD6775 | SD6815 |
| | 3rd adapter | SD7055 | SD7095 | SD7135 | SD7175 |
| | 4th adapter | SD7415 | SD7455 | SD7495 | SD7535 |
| Input gain value (L) | 1st adapter | SD6336 | SD6376 | SD6416 | SD6456 |
| | 2nd adapter | SD6696 | SD6736 | SD6776 | SD6816 |
| | 3rd adapter | SD7056 | SD7096 | SD7136 | SD7176 |
| | 4th adapter | SD7416 | SD7456 | SD7496 | SD7536 |
| Input gain value (H) | 1st adapter | SD6337 | SD6377 | SD6417 | SD6457 |
| | 2nd adapter | SD6697 | SD6737 | SD6777 | SD6817 |
| | 3rd adapter | SD7057 | SD7097 | SD7137 | SD7177 |
| | 4th adapter | SD7417 | SD7457 | SD7497 | SD7537 |

The details of the device used are listed below.

| Name | Description | Setting value | Description | Default value | R/W |
|---|---|---|---|---|---|
| Offset/gain setting flag | The offset/gain setting used for each channel is monitored. | 0: OFF | Initial value | 0: OFF | R |
| | | 1: ON | User range setting | | |
| Offset/gain reading | An offset/gain setting value is read. | 0: OFF | Offset/gain reading is not performed. | 0: OFF | R/W |
| | | 1: ON | Offset/gain reading is performed. | | |
| Offset/gain writing | An offset/gain setting value is written in. | 0: OFF | Offset/gain writing is not performed. | 0: OFF | R/W |
| | | 1: ON | Offset/gain writing is performed. | | |

| Name | Description | Range | Default value | R/W |
|---|---|---|---|---|
| Offset temperature setting value | Set the offset temperature setting value used in the offset/gain setting function. | ■FX5-4AD-PT-ADP<br>Pt100 (Celsius): -2000 to +8500<br>Pt100 (Fahrenheit): -3280 to +15620*1<br>NI100 (Celsius): -600 to +2500<br>NI100 (Fahrenheit): -760 to +4820*1 | 0 | R/W |
| | | ■FX5-4AD-TC-ADP<br>K thermocouple (Celsius): -2700 to +13700<br>K thermocouple (Fahrenheit): -4540 to +24980*1<br>J thermocouple (Celsius): -2100 to +11300<br>J thermocouple (Fahrenheit): -3460 to +20660*1<br>T thermocouple (Celsius): -2700 to +4000<br>T thermocouple (Fahrenheit): -4540 to +7520*1<br>B thermocouple (Celsius): 0 to 17100<br>B thermocouple (Fahrenheit): 320 to 31100*1<br>R thermocouple (Celsius): -500 to +17100<br>R thermocouple (Fahrenheit): -580 to +31100*1<br>S thermocouple (Celsius): -500 to +17100<br>S thermocouple (Fahrenheit): -580 to +31100*1 | | |
| Gain temperature setting value | Set the gain temperature setting value used in the offset/gain setting function.<br>The setting value is obtained from the built-in memory of the analog adapter when "offset/gain reading" is set from OFF to ON or the power supply of the analog adapter is turned off and on. | ■FX5-4AD-PT-ADP<br>Pt100 (Celsius): -2000 to +8500<br>Pt100 (Fahrenheit): -3280 to +15620*1<br>NI100 (Celsius): -600 to +2500<br>NI100 (Fahrenheit): -760 to +4820*1 | 8460 | R/W |
| | | ■FX5-4AD-TC-ADP<br>K thermocouple (Celsius): -2700 to +13700<br>K thermocouple (Fahrenheit): -4540 to +24980*1<br>J thermocouple (Celsius): -2100 to +11300<br>J thermocouple (Fahrenheit): -3460 to +20660*1<br>T thermocouple (Celsius): -2700 to +4000<br>T thermocouple (Fahrenheit): -4540 to +7520*1<br>B thermocouple (Celsius): 0 to 17100<br>B thermocouple (Fahrenheit): 320 to 31100*1<br>R thermocouple (Celsius): -500 to +17100<br>R thermocouple (Fahrenheit): -580 to +31100*1<br>S thermocouple (Celsius): -500 to +17100<br>S thermocouple (Fahrenheit): -580 to +31100*1 | 11300 | |

*1 Set the value in increments of 2 (0.2℉).

| Name | Description | Range | Default value | R/W |
|---|---|---|---|---|
| Offset/gain writing enable code | Set the offset/gain writing enable code used for changing the offset/gain.<br>When "offset/gain writing" is set from OFF to ON while the offset/gain writing is enabled, the "setting RTD type", "offset temperature setting value", "gain temperature setting value", "input offset value", and "input gain value" are written to the built-in memory of the analog adapter. | ■FX5-4AD-PT-ADP<br>Offset/gain writing enable: E215H<br>Offset/gain writing disable: Other than E215H | 0 | R/W |
| | | ■FX5-4AD-TC-ADP<br>Offset/gain writing enable: E21AH<br>Offset/gain writing disable: Other than E21AH | | |
| Input offset value | Set the offset value used in the offset/gain setting function.<br>The setting value is obtained from the built-in memory of the analog adapter when "offset/gain reading" is set from OFF to ON or the power supply of the analog adapter is turned off and on. | ■FX5-4AD-PT-ADP<br>0 to 450000 (mΩ) | 99820 | R/W |
| | | ■FX5-4AD-TC-ADP<br>0 to 78125 (μV) | 2 | |
| Input gain value | Set the gain value used in the offset/gain setting function.<br>The setting value is obtained from the built-in memory of the analog adapter when "offset/gain reading" is set from OFF to ON or the power supply of the analog adapter is turned off and on. | ■FX5-4AD-PT-ADP<br>0 to 450000 (mΩ) | 388610 | R/W |
| | | ■FX5-4AD-TC-ADP<br>0 to 78125 (μV) | 65573 | |

# Offset/gain initialization function

FX5-4A-ADP FX5-4AD-ADP FX5-4DA-ADP FX5-4AD-PT-ADP FX5-4AD-TC-ADP

This function initializes the offset and gain values in the built-in memory of the analog adapter.
This function can be set only with special devices.

## Operation

Set "E215H" (for the FX5-4AD-PT-ADP) or "E21AH" (for the FX5-4AD-TC-ADP) to the "offset/gain writing enable code" and set the "offset/gain initialization" from OFF to ON to initialize the offset temperature setting value, gain temperature setting value, input offset value, and input gain value saved in the built-in memory of the analog adapter. When initialization is completed, the "offset/gain initialization" automatically turns OFF. Also, the "offset/gain writing enable code" is cleared to 0.

**Point**

- Offset/gain initialization is executed when the "offset/gain writing enable code" is set to "E215H" (for the FX5-4AD-PT-ADP) or "E21AH" (for the FX5-4AD-TC-ADP).
- Offset/gain initialization is enabled only while temperature conversion is disabled.
- The "conversion enable/disable setting" cannot be changed to "enable" while offset/gain initialization is being executed.

## Setting procedure

***1.*** Set the following to "offset/gain writing enable code".

| Setting value | | Description | Default value |
|---|---|---|---|
| FX5-4AD-PT-ADP | Other than E215H | Offset/gain writing disable | 0 |
| FX5-4AD-TC-ADP | E215H | Offset/gain writing enable | |

**Point**

When "offset/gain writing" is set from OFF to ON while the offset/gain writing is enabled, the "setting RTD type" or "setting thermocouple type", "offset temperature setting value", "gain temperature setting value", "input offset value", and "input gain value" are written to the built-in memory of the analog adapter.

***2.*** Set "offset/gain initialization" from OFF to ON.

| Setting value | Description | Default value |
|---|---|---|
| 0: OFF | Offset/gain initialization is not performed. | 0: OFF |
| 1: ON | Offset/gain initialization is performed. | |

## Corresponding devices

The devices which are used by the offset/gain initialization function are listed below.

| Name | Connection part | Special relay/Special register | | | |
|---|---|---|---|---|---|
| | | CH1 | CH2 | CH3 | CH4 |
| Offset/gain initialization | 1st adapter | SM6334 | SM6374 | SM6414 | SM6454 |
| | 2nd adapter | SM6694 | SM6734 | SM6774 | SM6814 |
| | 3rd adapter | SM7054 | SM7094 | SM7134 | SM7174 |
| | 4th adapter | SM7414 | SM7454 | SM7494 | SM7534 |
| Offset/gain writing enable code | 1st adapter | SD6329 | SD6369 | SD6409 | SD6449 |
| | 2nd adapter | SD6689 | SD6729 | SD6769 | SD6809 |
| | 3rd adapter | SD7049 | SD7089 | SD7129 | SD7169 |
| | 4th adapter | SD7409 | SD7449 | SD7489 | SD7529 |

The details of the device used are listed below.

| Name | Description | Setting value | Description | Default value | R/W |
|---|---|---|---|---|---|
| Offset/gain initialization | An input offset/gain value is initialized. | 0: OFF | Offset/gain initialization is not performed. | 0: OFF | R/W |
| | | 1: ON | Offset/gain initialization is performed. | | |

| Name | Description | Range | Default value | R/W |
|---|---|---|---|---|
| Offset/gain writing enable code | Set the offset/gain writing enable code used for changing the offset/gain. | ■FX5-4AD-PT-ADP<br>Offset/gain writing enable: E215H<br>Offset/gain writing disable: Other than E215H | 0 | R/W |
| | | ■FX5-4AD-TC-ADP<br>Offset/gain writing enable: E21AH<br>Offset/gain writing disable: Other than E21AH | | |

# 37.9 Other Functions

## Event history function

FX5-4A-ADP FX5-4AD-ADP FX5-4DA-ADP FX5-4AD-PT-ADP FX5-4AD-TC-ADP

This function collects errors from the analog adapter, and keeps them in the SD memory card, and data memory or battery backed built-in RAM of the CPU module.

The event information collected by the CPU module can be displayed on GX Works3 to check the occurrence history in chronological order.

| Event type | Classification | Description |
|---|---|---|
| System | Error | An error detected by the self diagnostics in each module. |

### Setting procedure

The event history function can be set from the event history setting window of GX Works3. For the setting procedure, refer to the following.

☞ Page 131 Event history settings

### Displaying event history

Access the menu of GX Works3. For details on the operating procedure and how to view the contents, refer to the following.

GX Works3 Operating Manual

## Changing the setting value while the CPU module is operating

The following procedure shows how to operate with values other than those set in GX Works3 parameters (values of special relays and special registers).

### Analog input

FX5-4A-ADP FX5-4AD-ADP FX5-4DA-ADP FX5-4AD-PT-ADP FX5-4AD-TC-ADP

***1.*** Disable A/D conversion.

Set "A/D conversion enable/disable setting" to ON. (☞ Page 670 A/D conversion enable/disable setting function)

***2.*** Change the value of a target special relay/device.

Change the value of a target device.

***3.*** Enable A/D conversion.

Set "A/D conversion enable/disable setting" to OFF. (☞ Page 670 A/D conversion enable/disable setting function)

#### Precautions

- An alarm occurs when the value of a special relay/device is changed while A/D conversion is enabled (Alarm code: 0F0□H)
- When the value of a special relay/device related to the scaling, shift, average counts or averaging processing specification was changed in A/D conversion and "count average" or "moving average" was specified as the averaging processing, clear the number of times of sampling and execute sampling again from "0 time".

### Analog output

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

**1.** Disable D/A conversion.

Set "D/A conversion enable/disable setting" to ON. (☞ Page 707 D/A conversion enable/disable function)

**2.** Change the value of a target special relay/device.

Change the value of a target device.

**3.** Enable D/A conversion.

Set "D/A conversion enable/disable setting" to OFF. (☞ Page 707 D/A conversion enable/disable function)

#### Precautions

An alarm occurs when the value of a special relay/device is changed while D/A conversion is enabled (Alarm code: 0F00H)

### Temperature sensor input

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

**1.** Disable temperature conversion.

Set "conversion enable/disable setting" to ON. (☞ Page 728 Conversion enable/disable setting function)

**2.** Change the value of a target special relay/device.

Change the value of a target device.

**3.** Enable temperature conversion.

Set "conversion enable/disable setting" to OFF. (☞ Page 728 Conversion enable/disable setting function)

#### Precautions

- If the value of the special relay or special device has been changed while the temperature conversion is enabled, an alarm occurs and, at the END processing, the value is overwritten with the value used for the current operation. (Alarm code: 0F0□H)
- When the temperature conversion method is count average or moving average, if the temperature conversion is set to be disabled, the values of special relay or special device related to average counts and averaging process setting are changed, and the temperature conversion is set to be enabled again, the number of sampling times is cleared and the sampling is performed from 0 time.

## Starting/stopping the analog function in accordance with the CPU module status

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

This paragraph shows the analog operation in accordance with the CPU module status.

| Item | A/D conversion function | D/A conversion function |
|---|---|---|
| RUN | The module operates in accordance with its parameters. | The module operates in accordance with its parameters. |
| PAUSE | The module operates in accordance with its parameters. | The module operates in accordance with its parameters. |
| STOP | The module continues conversion. | Outputs are enabled even in the STOP status by using the analog output test mode available when the CPU module is in the STOP status. (☞ Page 726 Analog output test when CPU module is in STOP status function) |

# Alarm clear request

## Analog input

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

It is necessary to set the "A/D conversion alarm clear request" from OFF to ON to clear the alarm code.

The table below shows the necessity of the alarm clear request for turning OFF each flag and clearing the alarm code.

○: Alarm clear request required, —: Alarm clear request not required

| Flag name | Alarm clear request required to turn OFF the flag | Alarm clear request required to clear the alarm code |
|---|---|---|
| A/D conversion completed flag | — | — |
| Over scale upper limit detection flag | ○ | ○ |
| Over scale lower limit detection flag | ○ | ○ |
| Maximum value/minimum value reset completed flag | — | — |
| Warning output flag (process alarm upper limit) | — | ○ |
| Warning output flag (process alarm lower limit) | — | ○ |
| Warning output flag (rate alarm upper) | — | ○ |
| Warning output flag (rate alarm lower) | — | ○ |
| Disconnection detection flag | ○*1 | ○ |
| Convergence detection flag | — | — |
| Deviation detection flag between channel | — | ○ |
| A/D conversion alarm flag | ○ | ○ |
| A/D conversion error flag | — | — |

*1 The alarm clear request is required when disconnection recovery is set to "disable".

**Point**

- The "A/D conversion alarm clear request" ("alarm clear request" for the FX5-4AD-ADP) is required for flags which do not turn OFF automatically and flags which cause alarms.
- "A/D conversion alarm clear request" ("alarm clear request" for the FX5-4AD-ADP) does not turn OFF automatically. To perform an alarm clear again, it is necessary to turn it OFF once.
- For A/D conversion error flag and A/D conversion latest error code, use the "error clear request" (SM50) of the CPU module to clear them.

## Analog output

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

It is necessary to set the "D/A conversion alarm clear request" from OFF to ON for clearing the alarm code.

The table below shows the necessity of the alarm clear request for turning OFF each flag and clearing the alarm code.

○: Alarm clear request required, —: Alarm clear request not required

| Flag name | Alarm clear request required to turn OFF the flag | Alarm clear request required to clear the alarm code |
|---|---|---|
| Warning output upper limit value flag | ○ | ○ |
| Warning output lower limit value flag | ○ | ○ |
| Disconnection detection flag | —*1 | —*2 |
| D/A conversion alarm flag | ○ | ○ |
| D/A conversion error flag | — | — |

*1 The "error clear request" (SM50) of the CPU module is required when disconnection recovery is set to "disable".

*2 To clear the error code, the "error clear request" (SM50) of the CPU module is required.

**Point**

- The alarm clear of the CPU module request is required for flags which do not turn OFF automatically and flags which cause alarms.
- For the D/A conversion error flag and D/A conversion latest error code, use the "error clear request" (SM50) of the CPU module to clear them.

## Temperature sensor input

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

It is necessary to set the "conversion alarm clear request" from OFF to ON to clear the alarm code.

The table below shows the necessity of the alarm clear request for turning OFF each flag and clearing the alarm code.

○: Alarm clear request required, —: Alarm clear request not required

| Flag name | Alarm clear request required to turn OFF the flag | Alarm clear request required to clear the alarm code |
|---|---|---|
| Conversion completed flag | — | — |
| Maximum value/minimum value reset completed flag | — | — |
| Warning output flag (process alarm upper limit) | — | ○ |
| Warning output flag (process alarm lower limit) | — | ○ |
| Warning output flag (rate alarm upper) | — | ○ |
| Warning output flag (rate alarm lower) | — | ○ |
| Disconnection detection flag | ○*1 | ○ |

*1 The alarm clear request is required when "disconnection detection automatic clear enable/disable setting" is set to "disable".

**Point**

- The "conversion alarm clear request" is required for flags which do not turn OFF automatically and flags which cause alarms.
- The "conversion alarm clear request" is not turned off automatically. To perform an alarm clear again, it is necessary to turn it OFF once.

# 37.10 Parameter Setting

Set the parameters of each channel.

**Point**

In the explanation for each setting, the icons below indicate the compatible analog adapters. (The functions cannot be used by analog adapters marked with ×.)

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

Setting parameters here eliminates the need to program them.

**Point**

Parameters are enabled when the CPU module is powered ON or after a reset. In addition, operations different from the parameter settings are possible by transferring values to special relays and special registers while changing these values in the program.

For the special relay and the special register, refer to the following.

☞ Page 776 Special Relay List

☞ Page 803 Special Register List

## Basic settings (analog input)

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

### Setting procedure

Open "Basic Settings" of the GX Works3.

**1.** Start Module parameter.

- FX5-4A-ADP

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Basic Settings (Input)"

- FX5-4AD-ADP

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Basic Settings"

#### Window

| Item | CH1 | CH2 | CH3 | CH4 |
|---|---|---|---|---|
| *A/D Conversion Enable/Disable Setting Function* | Set A/D conversion method. | | | |
| A/D Conversion Enable/Disable Setting | Disable | Disable | Disable | Disable |
| A/D Conversion Method | Set A/D conversion method. | | | |
| Average Processing Specify | Sampling Processing | Sampling Processing | Sampling Processing | Sampling Processing |
| Time Average Counts Average Moving Average | 0 Times | 0 Times | 0 Times | 0 Times |
| Range switching function | Able to set the analog input range and to change the input conversion characteristics. | | | |
| Input range setting | Input Voltage (0 to 10V) | Input Voltage (0 to 10V) | Input Voltage (0 to 10V) | Input Voltage (0 to 10V) |

*1 The FX5-4A-ADP uses only CH1 and CH2.

## Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| A/D Conversion Enable/Disable Setting | Set whether to "enable" or "disable" AD conversion value output. | • Disable<br>• Enable | Disable |
| Average Processing Specify | Execute whether to set "average process" or "sampling processing". | • Sampling Processing<br>• Time Average<br>• Count Average<br>• Moving Average | Sampling Processing |
| Time Average Counts Average Moving Average | Set average time, average counts, moving average counts when specifying average process for each channel. | Set range setting for each channel. | — |
| Input range setting | Setting area for input range setting. | • Voltage input (0 to 10V)<br>• Voltage input (0 to 5V)<br>• Voltage input (1 to 5V)<br>• Voltage input (-10 to 10V)<br>• Current input (0 to 20mA)<br>• Current input (4 to 20mA)<br>• Current input (-20 to 20mA) | Voltage input (0 to 10V) |

**2.** Click the item to be changed to enter the setting value.

• Item where a value is selected from the pull-down list

Click [▼] button of the item to be set, and from the pull-down list that appears, select the value.

• Item where a value is entered into the text box

Double-click the item to be set to enter the numeric value.

# Application settings (analog input)

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

## Setting procedure

Open "Application Settings" of the GX Works3.

***1.*** Start Module parameter.

- FX5-4A-ADP

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Application Settings (Input)"

- FX5-4AD-ADP

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Application Settings"

### Window

| Item | CH1 | CH2 | CH3 | CH4 |
|---|---|---|---|---|
| ***Warning output function (Process alarm)*** | **Execute the setting related to warning at A/D conversion.** | | | |
| Warning output setting (Process alarm) | Disable | Disable | Disable | Disable |
| Process Alarm Upper Upper Limit Value | 0 | 0 | 0 | 0 |
| Process Alarm Upper Lower Limit Value | 0 | 0 | 0 | 0 |
| Process Alarm Lower Upper Limit Value | 0 | 0 | 0 | 0 |
| Process Alarm Lower Lower Limit Value | 0 | 0 | 0 | 0 |
| **Warning output function (Rate alarm)** | **Set the value for the warning when A/D conversion is executed.** | | | |
| Warning output setting (Rate alarm) | Disable | Disable | Disable | Disable |
| Rate alarm warning detection period setting | 1 ms | 1 ms | 1 ms | 1 ms |
| Rate alarm upper limit value | 0 | 0 | 0 | 0 |
| Rate alarm lower limit value | 0 | 0 | 0 | 0 |
| **Over Scale Detection** | **Execute the setting related to analog input value detection which exceeds the setting range.** | | | |
| Over Scale Detection Enable/Disable | Disable | Disable | Disable | Disable |
| **Scaling Setting** | **Execute the setting related to scaling at A/D conversion.** | | | |
| Scaling Enable/Disable | Disable | Disable | Disable | Disable |
| Scaling Upper Limit Value | 0 | 0 | 0 | 0 |
| Scaling Lower Limit Value | 0 | 0 | 0 | 0 |
| **Shift Function** | **Execute the setting related to shift function at A/D conversion.** | | | |
| Shifting amount to conversion value | 0 | 0 | 0 | 0 |
| **Digital Clip Setting** | **Execute the setting related to digital clip function at A/D conversion.** | | | |
| Digital Clip Enable/Disable | Disable | Disable | Disable | Disable |
| **Disconnection detection function** | **Set value for Disconnection detection.** | | | |
| Disconnection detection enable/disable setting | Disable | Disable | Disable | Disable |
| Disconnection recovery detection enable/disable setting | Disable | Disable | Disable | Disable |
| **Convergence detection function** | **Set value for Convergence detection.** | | | |
| Convergence detection enable/disable setting | Disable | Disable | Disable | Disable |
| Convergence detection upper limit value | 0 | 0 | 0 | 0 |
| Convergence detection lower limit value | 0 | 0 | 0 | 0 |
| Detection time setting for Convergence detection | 1 ms | 1 ms | 1 ms | 1 ms |
| **Deviation detection function between channels** | **Set value for Deviation detection between channels.** | | | |
| Deviation detection trigger between channels | Disable | Disable | Disable | Disable |
| Deviation value for deviation detection between channels | 0 | 0 | 0 | 0 |
| Target CH setting for deviation detection between channels: No.1 CH1 | Non-target | Non-target | Non-target | Non-target |

*1 The FX5-4A-ADP uses only CH1 and CH2.

## Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Warning output setting (Process alarm) | Set whether to "enable" or "disable" process alarm warning. | • Disable<br>• Enable | Disable |
| Process Alarm Upper Upper Limit Value | Set the upper upper limit value of the digital output value. | -32768 to +32767 | — |
| Process Alarm Upper Lower Limit Value | Set the upper lower limit value of the digital output value. | -32768 to +32767 | — |
| Process Alarm Lower Upper Limit Value | Set the lower upper limit value of the digital output value. | -32768 to +32767 | — |
| Process Alarm Lower Lower Limit Value | Set the lower lower limit value of the digital output value. | -32768 to +32767 | — |
| Warning output setting (Rate alarm) | Set whether to "enable" or "disable" the rate alarm warning. | • Disable<br>• Enable | Disable |
| Rate alarm warning detection period setting | Set the value for the sampling cycle to detect the rate alarm warning. | 1 to 10000 | — |
| Rate alarm upper limit value | Set the upper limit value of the digital output value. | -999 to +1000 | — |
| Rate alarm lower limit value | Set the lower limit value of the digital output value. | -1000 to +999 | — |
| Over Scale Detection Enable/ Disable | Set whether to "enable" or "disable" over scale detection. | • Disable<br>• Enable | Disable |
| Scaling Enable/Disable | Set whether to "enable" or "disable" scaling. | • Disable<br>• Enable | Disable |
| Scaling Upper Limit Value | Set the upper limit value for scaling calculation. | -32768 to +32767 | — |
| Scaling Lower Limit Value | Set the lower limit value for scaling calculation. | -32768 to +32767 | — |
| Conversion value shift amount | Set shifting amount for shifting function. | -32768 to +32767 | 0 |
| Digital Clip Enable/Disable | Set whether to "enable" or "disable" digital clip. | • Disable<br>• Enable | Disable |
| Disconnection detection enable/ disable setting | Set whether to "enable" or "disable" disconnection detection. | • Disable<br>• Enable | Disable |
| Disconnection recovery detection enable/disable setting | Set whether to "enable" or "disable" recovery from the disconnection detected. | • Disable<br>• Enable | Disable |
| Convergence detection enable/ disable setting | Set whether to "enable" or "disable" convergence detection. | • Disable<br>• Enable | Disable |
| Convergence detection upper limit value | Set the upper limit value of the convergence range (range where digital operation values are checked). | -32767 to +32767 | — |
| Convergence detection lower limit value | Set the lower limit value of the convergence range (range where digital operation values are checked). | -32768 to +32766 | — |
| Detection time setting for Convergence detection | Set the detection time (range where digital operation values are checked). | 1 to 10000 | — |
| Deviation detection trigger between channels | Set whether to "enable" or "disable" deviation detection between channels. | • Disable<br>• Enable | Disable |
| Deviation value for deviation detection between channels | Set the deviation value for deviation detection between channels. | 0 to 65535 | — |
| Target CH setting for deviation detection between channels: No.1 to 4, CH1 to CH4*2 | Set whether to target each channel for deviation detection between channels. | • Non-target<br>• Target | Non-target |

*2 For the FX5-4A-ADP, set only CH1 and CH2.

**2.** Click the item to be changed to enter the setting value.

• Item where a value is selected from the pull-down list

Click [▼] button of the item to be set, and from the pull-down list that appears, select the value.

• Item where a value is entered into the text box

Double-click the item to be set to enter the numeric value.

# Basic settings (analog output)

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

## Setting procedure

Open "Basic Settings" of the GX Works3.

***1.*** Start Module parameter.

• FX5-4A-ADP

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Basic Settings (Output)"

• FX5-4DA-ADP

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Basic Settings"

### Window

| Item | CH1 | CH2 | CH3 | CH4 |
|---|---|---|---|---|
| ***D/A Conversion Enable/Disable Setting Function*** | **Set Enable/Disable D/A conversion.** | | | |
| D/A Conversion Enable/Disable Setting | Disable | Disable | Disable | Disable |
| **D/A Output Enable/Disable Setting** | **Set Enable/Disable D/A output.** | | | |
| D/A Output Enable/Disable Setting | Disable | Disable | Disable | Disable |
| **Range switching function** | **Able to set the analog input range and to change the input conversion characteristics.** | | | |
| Output range setting | Output Voltage (0 to 10V) | Output Voltage (0 to 10V) | Output Voltage (0 to 10V) | Output Voltage (0 to 10V) |

*1 The FX5-4A-ADP uses only CH1 and CH2.

### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| D/A Conversion Enable/Disable Setting | Set whether to "enable" or "disable" D/A conversion. | • Disable<br>• Enable | Disable |
| D/A Output Enable/Disable Setting | Set whether to "enable" or "disable" D/A output. | • Disable<br>• Enable | Disable |
| Output range setting | Setting area for output range setting. | • Voltage output (0 to 10V)<br>• Voltage output (0 to 5V)<br>• Voltage output (1 to 5V)<br>• Voltage output (-10 to 10V)<br>• Current output (0 to 20mA)<br>• Current output (4 to 20mA) | Voltage output (0 to 10V) |

***2.*** Click the item to be changed to enter the setting value.

• Item where a value is selected from the pull-down list

Click [▼] button of the item to be set, and from the pull-down list that appears, select the value.

• Item where a value is entered into the text box

Double-click the item to be set to enter the numeric value.

# Application settings (analog output)

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

## Setting procedure

Open "Application Settings" of the GX Works3.

***1.*** Start Module parameter.

- FX5-4A-ADP

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Application Settings (Output)"

- FX5-4DA-ADP

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Application Settings"



### Window

| Item | CH3 | CH4 |
|---|---|---|
| **Warning Output Function** | **Execute the setting related to D/A conversion warning.** | |
| Warning Output Setting | Disable | Disable |
| Warning output upper limit value | 0 | 0 |
| Warning output lower limit value | 0 | 0 |
| **Scaling Setting** | **Execute the setting related to D/A conversion scaling.** | |
| Scaling Enable/Disable | Disable | Disable |
| Scaling Upper Limit Value | 0 | 0 |
| Scaling Lower Limit Value | 0 | 0 |
| **Shift Function** | **Execute the setting related to D/A conversion shift function.** | |
| Shifting amount to conversion value | 0 | 0 |
| **Analog Output HOLD/CLEAR Setting** | **Set whether to HOLD the last value or setting value, or to CLEAR the digital value to be converted to analog value.** | |
| HOLD/CLEAR Setting | Current Value (Hold) | Current Value (Hold) |
| HOLD Setting Value | 0 | 0 |
| **Disconnection detection function** | **Execute the setting related to disconnection detection.** | |
| Disconnection detection enable/disable setting | Disable | Disable |
| Disconnection recovery detection enable/disable setting | Disable | Disable |

### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Warning Output Setting | Set whether to "enable" or "disable" warning output. | • Enable<br>• Disable | Disable |
| Warning output upper limit value | Set the upper limit value of the digital input value for warning output. | -32767 to +32767 | — |
| Warning output lower limit value | Set the lower limit value of the digital input value for warning output. | -32768 to +32766 | — |
| Scaling Enable/Disable | Set whether to "enable" or "disable" scaling. | • Disable<br>• Enable | Disable |
| Scaling Upper Limit Value | Set the upper limit value for scaling calculation. | -32768 to +32767 | — |
| Scaling Lower Limit Value | Set the lower limit value for scaling calculation. | -32768 to +32767 | — |
| Conversion value shift amount | Set shifting amount for shifting function. | -32768 to +32767 | 0 |
| HOLD/CLEAR Setting | Set output status at CLEAR or HOLD. | • CLEAR<br>• Previous Value (Hold)<br>• Setting Value | Previous Value (Hold) |
| HOLD Setting Value | Set a digital value to be output at HOLD when "Setting Value" is selected in "HOLD/CLEAR Setting". | -32768 to +32767 | — |
| Disconnection detection enable/disable setting | Set whether to "enable" or "disable" disconnection detection. | • Disable<br>• Enable | Disable |
| Disconnection recovery detection enable/disable setting | Set whether to "enable" or "disable" recovery from the disconnection detected. | • Disable<br>• Enable | Disable |

**2.** Click the item to be changed to enter the setting value.

• Item where a value is selected from the pull-down list

Click [▼] button of the item to be set, and from the pull-down list that appears, select the value.

• Item where a value is entered into the text box

Double-click the item to be set to enter the numeric value.

# Basic settings (temperature sensor input)

~~FX5-4A-ADP~~ ~~FX5-4AD-ADP~~ ~~FX5-4DA-ADP~~ FX5-4AD-PT-ADP FX5-4AD-TC-ADP

## Setting procedure

Open "Basic Settings" of the GX Works3.

**1.** Start Module parameter.

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Basic Settings"

### Window

• FX5-4A-PT-ADP

| Item | CH1 | CH2 | CH3 | CH4 |
|---|---|---|---|---|
| **Temperature unit selection function** | **Set the temperature unit selection function.** | | | |
| Temperature unit setting | Celsius | | | |
| **Conversion enable/disable setting function** | **Set the Conversion enable/disable function.** | | | |
| Conversion enable/disable setting | Disable | Disable | Disable | Disable |
| **Temperature conversion method** | **Set the temperature conversion method.** | | | |
| Average Processing Specification | Sampling Processing | Sampling Processing | Sampling Processing | Sampling Processing |
| Time Average Counts Average Moving Average | 0 Times | 0 Times | 0 Times | 0 Times |
| **Resistance temperature detector type selection function** | **Set the resistance temperature detector type.** | | | |
| Resistance temperature detector type setting | Pt100 (-200 to 850 C) | Pt100 (-200 to 850 C) | Pt100 (-200 to 850 C) | Pt100 (-200 to 850 C) |

• FX5-4A-TC-ADP

| Item | CH1 | CH2 | CH3 | CH4 |
|---|---|---|---|---|
| **Temperature unit selection function** | **Set the temperature unit selection function.** | | | |
| Temperature unit setting | Celsius | | | |
| **Conversion enable/disable setting function** | **Set the Conversion enable/disable function.** | | | |
| Conversion enable/disable setting | Disable | Disable | Disable | Disable |
| **Temperature conversion method** | **Set the temperature conversion method.** | | | |
| Average Processing Specification | Sampling Processing | Sampling Processing | Sampling Processing | Sampling Processing |
| Time Average Counts Average Moving Average | 0 Times | 0 Times | 0 Times | 0 Times |
| **Thermocouple type selection function** | **Set the thermocouple type.** | | | |
| Thermocouple type setting | K (-270 to 1370 C) | K (-270 to 1370 C) | K (-270 to 1370 C) | K (-270 to 1370 C) |

## Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Temperature unit setting | Set whether to use 'Celsius' or 'Fahrenheit' as the temperature unit. | • Celsius<br>• Fahrenheit | Celsius |
| Conversion enable/disable setting | Set whether to 'Enable' or 'Disable' output of conversion values for each channel. | • Disable<br>• Enabled | Disable |
| Average Processing Specify | Execute whether to set "average process" or "sampling processing". | • Sampling Processing<br>• Time Average<br>• Count Average<br>• Moving Average | Sampling Processing |
| Time Average Counts Average Moving Average | Set average tine, average counts, moving average counts for each channel. | Set range setting for each channel. | — |
| Resistance temperature detector type setting | Set the resistance temperature detector type to connect for each channel. | ■Celsius<br>• Pt100 (-200 to 850℃)<br>• Ni100 (-60 to 250℃)<br>■Fahrenheit<br>• Pt100 (-328 to 1562℉)<br>• Ni100 (-76 to 482℉) | — |
| Thermocouple type setting | Set the thermocouple type to connect for each channel. | ■Celsius<br>• K (-270 to 1370℃)<br>• J (-210 to 1130℃)<br>• T (-270 to 400℃)<br>• B (0 to 1710℃)<br>• R (-50 to 1710℃)<br>• S (-50 to 1710℃)<br>■Fahrenheit<br>• K (-454 to 2498℉)<br>• J (-346 to 2066℉)<br>• T (-454 to 752℉)<br>• B (32 to 3110℉)<br>• R (-58 to 3110℉)<br>• S (-58 to 3110℉) | — |

**2.** Click the item to be changed to enter the setting value.

• Item where a value is selected from the pull-down list

Click [▼] button of the item to be set, and from the pull-down list that appears, select the value.

• Item where a value is entered into the text box

Double-click the item to be set to enter the numeric value.

# Application settings (temperature sensor input)

~~FX5-4A-ADP~~ ~~FX5-4AD-ADP~~ ~~FX5-4DA-ADP~~ FX5-4AD-PT-ADP FX5-4AD-TC-ADP

## Setting procedure

Open "Application Settings" of the GX Works3.

***1.*** Start Module parameter.

Navigation window ⇨ [Parameter] ⇨ [Module Information] ⇨ Module model name ⇨ [Module Parameter] ⇨ "Application Settings"

### Window

| Item | CH1 | CH2 | CH3 | CH4 |
|---|---|---|---|---|
| **Warning output function (Process alarm)** | **Execute the setting related to A/D conversion warning.** | | | |
| Warning output setting (Process alarm) | Disable | Disable | Disable | Disable |
| Process Alarm Upper Upper Limit Value | 850.0 C | 850.0 C | 850.0 C | 850.0 C |
| Process Alarm Upper Lower Limit Value | 850.0 C | 850.0 C | 850.0 C | 850.0 C |
| Process Alarm Lower Upper Limit Value | -200.0 C | -200.0 C | -200.0 C | -200.0 C |
| Process Alarm Lower Lower Limit Value | -200.0 C | -200.0 C | -200.0 C | -200.0 C |
| **Warning output function (Rate alarm)** | **Execute the setting related to A/D conversion warning.** | | | |
| Warning output setting (Rate alarm) | Disable | Disable | Disable | Disable |
| Rate alarm warning detection period setting | 85 ms | 85 ms | 85 ms | 85 ms |
| Rate alarm upper limit value | 0.0 C | 0.0 C | 0.0 C | 0.0 C |
| Rate alarm lower limit value | 0.0 C | 0.0 C | 0.0 C | 0.0 C |
| **Disconnection detection function** | **Execute the setting related to disconnection detection.** | | | |
| Disconnection detection enable/disable setting | Enable | Enable | Enable | Enable |
| Conversion setting for disconnection detection | Downscale | Downscale | Downscale | Downscale |
| Conversion setting function for disconnection detection | 0.0 C | 0.0 C | 0.0 C | 0.0 C |
| Enable/Disable setting for disconnection detection automatic clear | Disable | Disable | Disable | Disable |

### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Warning output setting (Process alarm) | Set whether to "enable" or "disable" process alarm warning. | • Disable<br>• Enabled | Disable |
| Process Alarm Upper Upper Limit Value | Set upper upper limit value of measured temperature value | -3276.8 to +3276.7 | — |
| Process Alarm Upper Lower Limit Value | Set upper lower limit value of measured temperature value. | -3276.8 to +3276.7 | — |
| Process Alarm Lower Upper Limit Value | Set lower upper limit value of measured temperature value. | -3276.8 to +3276.7 | — |
| Process Alarm Lower Lower Limit Value | Set lower lower limit value of measured temperature value. | -3276.8 to +3276.7 | — |
| Warning output setting (rate alarm) | Set whether to "enable" or "disable" the rate alarm warning. | • Disable<br>• Enabled | Disable |
| Rate alarm warning detection period setting | Set the value for the sampling cycle to detect the rate alarm warning. | 85 to 10000 | — |
| Rate alarm upper limit value | Set the upper limit value of the measured temperature value. | -3276.8 to +3276.7 | — |
| Rate alarm lower limit value | Set the lower limit value of the measured temperature value. | -3276.8 to +3276.7 | — |
| Disconnection detection enable/ disable setting | Set whether to "enable" or "disable" disconnection detection. | • Enable<br>• Disable | Enable |
| Conversion setting for disconnection detection | In disconnection detection function, set the value to be converted detecting for each channel. | • Upscale<br>• Downscale<br>• Any value<br>• Value before disconnection | Downscale |
| Conversion setting function for disconnection detection | Set the value to convert when 'Any value' is selected for conversion setting function for disconnection detection. | -3276.8 to +3276.7 | — |
| Enable/Disable setting for disconnection detection automatic clear | Set whether to 'Enable' or 'Disable' the auto-clear of the disconnection detection for disconnection detection function. | • Enable<br>• Disable | Disable |

**2.** Click the item to be changed to enter the setting value.

• Item where a value is selected from the pull-down list

Click [▼] button of the item to be set, and from the pull-down list that appears, select the value.

• Item where a value is entered into the text box

Double-click the item to be set to enter the numeric value.

# 37.11 Troubleshooting

This section describes errors that may occur in the use of the analog adapters, and those troubleshooting.

## Troubleshooting with the LEDs

Check the state of the LED to narrow down the possible causes of the trouble. This step is the first diagnostics.

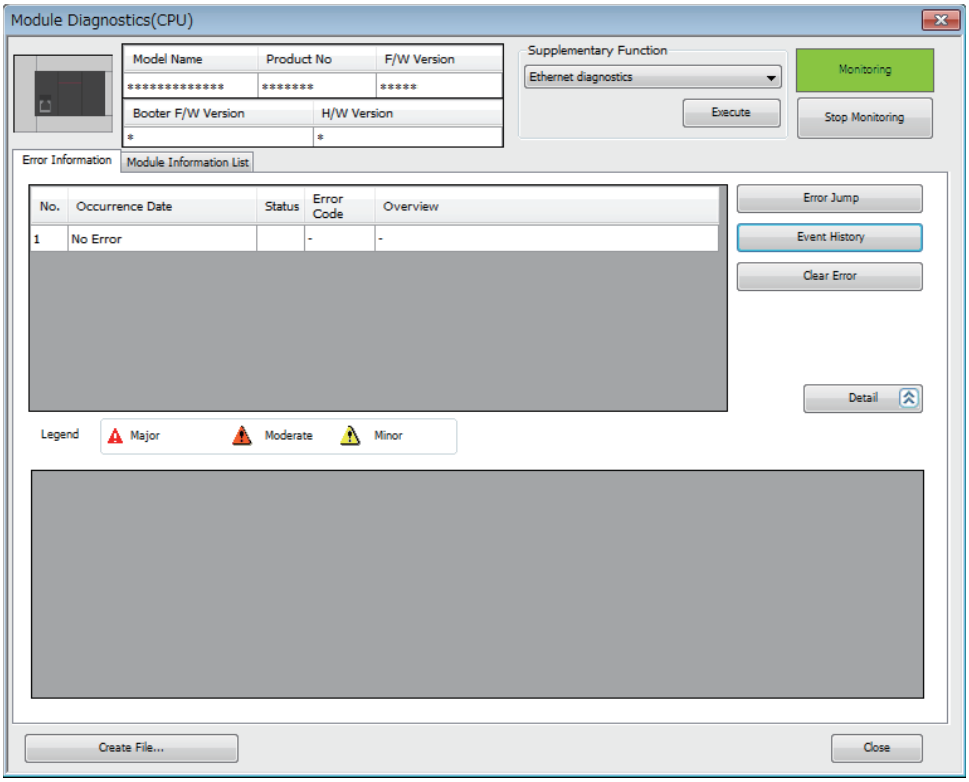
The status of the analog adapter can be checked with the PWR LED. The following table shows the correspondence between the LED and analog adapter status.

| Name | Description |
|---|---|
| PWR LED | Indicates the power supply status of the analog adapter.<br>On: The power supply is supplied.<br>Off: The power supply is not supplied. |

## Checking the state of the module

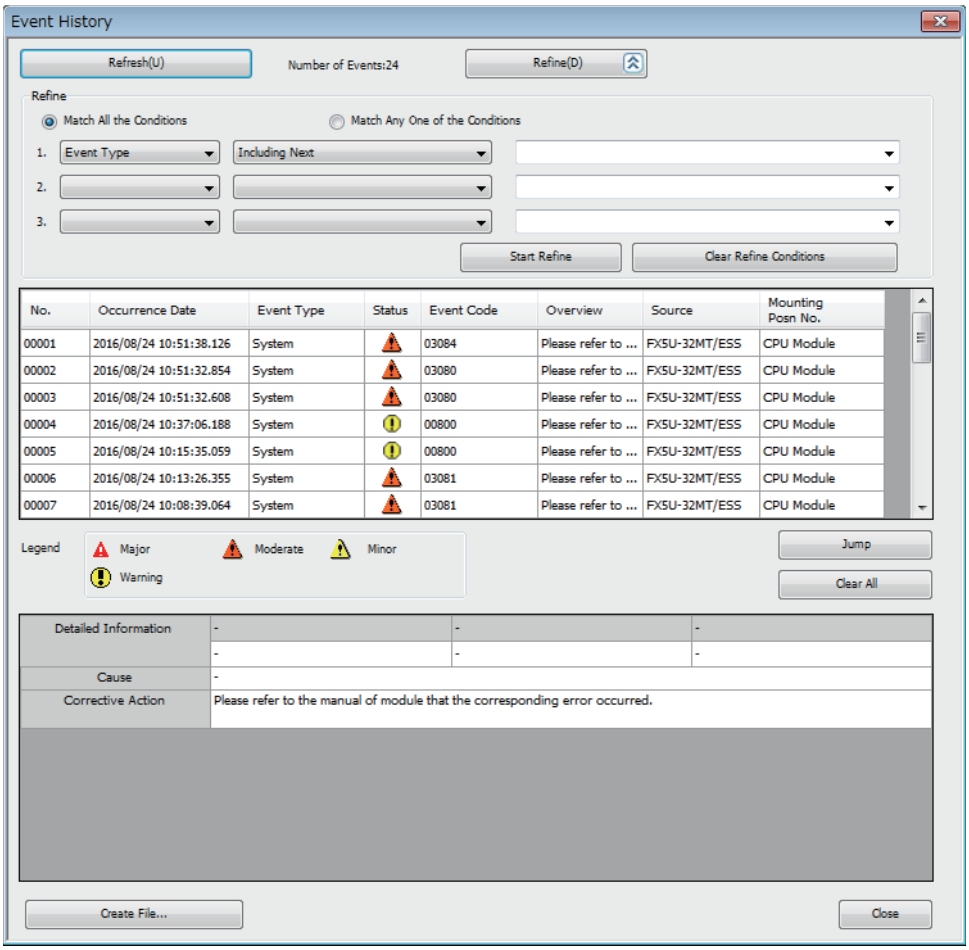
Check the error code (alarm code) and error history of the analog adapter from the module diagnostics window of the GX Works3.

[Diagnostics] ⇨ [Module Diagnostics(CPU Diagnostics)]



Error history, alarm history can be checked with the event history window of the GX Works3.

[Diagnostics] ⇨ [Module Diagnostics (CPU Diagnostics)] ⇨ [Event History] button




# Troubleshooting by Symptom

The following describes troubles classified by symptoms.

**Point**

In the explanation for each item, the icons below indicate the applicable analog adapters. (The explanations do not apply to the analog adapters marked with ×.)

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP × | FX5-4AD-PT-ADP × | FX5-4AD-TC-ADP ×

If the symptom is not improved even after the actions according to each check item are taken, the possible cause is the failure of the analog adapter. Please consult your local Mitsubishi representative.

## When the PWR LED does not turn ON

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

| Check item | Action |
|---|---|
| Whether the power is supplied | FX5-4A-ADP, FX5-4DA-ADP<br>• Check whether the voltage supplied to the analog adapter is within the rated range.<br>FX5-4AD-ADP, FX5-4AD-PT-ADP, FX5-4AD-TC-ADP<br>• Check whether the voltage supplied to the CPU module is within the rated range. |
| Whether the analog adapter is attached normally to the CPU module | Check the analog adapter attached status. |

## Troubleshooting of analog input

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

### ■If the digital output value cannot be read

| Check item | Action |
|---|---|
| Whether the analog signal cable is disconnected from the analog adapter | Check the signal cables visually, and wire the analog signal cable correctly. |
| Whether the external equipment is wired correctly. | Correctly wire the analog adapter and the externally connected device.<br>• Check whether the shield wire of the channel to be used is grounded.<br>• Check whether the V□+ terminal and I□+ terminal are connected to each other when the current is input. |
| Whether 24VDC power is supplied to the external power supply of the analog adapter | Supply the 24VDC power to the analog adapter. |
| Whether the offset/gain is set correctly | Check whether the offset/gain is set correctly.<br>Check whether A/D conversion is executed correctly.<br>When A/D conversion is executed correctly, set the offset/gain again. |
| Whether the input range setting is correct | Check the input range setting in the parameter setting of GX Works3. If the contents of setting are wrong, set the input range again. |
| Whether the "A/D conversion enable/disable setting" is set to "disable" for the channel to be used | Check the "A/D conversion enable/disable setting" for the channel to be used in the parameter setting of GX Works3, and set "enable" in the parameter of GX Works3 or in the program. |

### ■If the digital output value does not change

| Check item | Action |
|---|---|
| Whether disconnection is detected | Remove the cause of the disconnection by replacing the analog signal cable or other means, and then check the digital output value. |
| Whether over-scale is detected. | Remove the cause of over-scale, and then check the digital output value. |
| Whether the shift function is working with a proper setting value | Set the conversion value shift amount suitable for the system. |

### ■When a value is not converted to the expected digital output value

| Check item | Action |
|---|---|
| Whether the input range setting is correct | Check the input range setting in the parameter setting of GX Works3. If the contents of setting are wrong, set the input range again. |
| Whether the offset/gain setting is correct | Check whether the offset/gain is set correctly.<br>Check whether A/D conversion is executed correctly.<br>When A/D conversion is executed correctly, set the offset/gain again. |
| Whether the A/D conversion method is set correctly. | Check the A/D conversion method in the parameter setting of GX Works3. If the contents of setting are wrong, set the A/D conversion method again. |
| Whether the scaling function is set correctly. | When the scaling function is used, check the scaling function setting in the parameter setting of GX Works3. If the contents of setting are wrong, set the scaling function again. |
| Whether the shift function is working with a proper setting value. | Set the conversion value shift amount suitable for the system. |
| Whether the power is supplied | Check whether the voltage supplied to the analog adapter is within the rated range. |

### ■When the digital output value varies

| Check item | Action |
|---|---|
| Whether an A/D conversion method other than sampling processing is set. | Check the A/D conversion method in the parameter setting of GX Works3. Set the averaging processing to the A/D conversion method, and then check again for dispersion of the digital output value. |

### ■When the A/D conversion completed flag does not turn ON

| Check item | Action |
|---|---|
| Whether all channels are set to disable A/D conversion | Check the channels for which A/D conversion is enabled in the parameter setting of GX Works3. If A/D conversion is not enabled in any channel, enable A/D conversion for 1 or more channels in the parameter of GX Works3 or in the program. |
| Whether disconnection is detected | Remove the cause of the disconnection by replacing the analog signal cable or other means, and then check the digital output value. |

## Troubleshooting of analog output

FX5-4A-ADP | FX5-4AD-ADP | FX5-4DA-ADP | FX5-4AD-PT-ADP | FX5-4AD-TC-ADP

### ■When the analog output value is not given

| Check item | Action |
|---|---|
| Whether the analog signal cable is disconnected from the analog adapter | Check the signal cables visually, and wire the analog signal cable correctly. |
| Whether the external equipment is wired correctly. | Correctly wire the analog adapter and the externally connected device. |
| Whether 24VDC power is supplied to the external power supply of the analog adapter | Supply the 24VDC power to the analog adapter. |
| Whether the "D/A conversion enable/disable setting" is set to "disable" for the channel to be used | Check the "D/A conversion enable/disable setting" for the channel to be used in the parameter setting of GX Works3, and set "enable" in the parameter of GX Works3 or in the program. |
| Whether the "D/A output enable/disable setting" is set to "disable" for the channel to be used for output | Check the "D/A output enable/disable setting" for the channel to be used in the parameter setting of GX Works3, and set "enable" in the parameter of GX Works3 or in the program. |
| Whether the digital value written to the desired channel for output | Check the digital value with GX Works3. |

### ■When the analog output value does not change

| Check item | Action |
|---|---|
| Whether the CPU module operation status is "STOP" or "STOP (by stop error)" | The analog output HOLD/CLEAR function is being executed.<br>Set the CPU module to the "RUN" status, and check whether analog output is given normally. When an error causing stop occurs, remove the cause of the error, and then turn OFF and ON the CPU module or reset the CPU module. |

### ■When a value is not converted into the expected analog output value

| Check item | Action |
|---|---|
| Whether the output range is set correctly | Check the output range setting in the parameter setting of GX Works3. If the contents of setting are wrong, set the output range again. |
| Whether the offset/gain is set correctly | Check whether the offset/gain is set correctly.<br>Check whether D/A conversion is executed correctly.<br>When D/A conversion is executed correctly, set the offset/gain again. |
| Whether the scaling function is set correctly | When the scaling function is used, check the scaling function setting in the parameter setting of GX Works3. If the contents of setting are wrong, set the scaling function again. |
| Whether the shift function is working with a proper setting value | Set the input value shift amount suitable for the system. |
| Whether a digital value is set that exceeds the warning output upper/lower limit | When the warning output function is used, check the warning output function setting in the parameter setting of GX Works3. If there is no problem with the settings, check whether the digital value is set to a value outside the warning output range. |
| Whether the power is supplied | Check whether the voltage supplied to the analog adapter is within the rated range. |

### ■When the analog output value cannot be held

| Check item | Action |
|---|---|
| Whether the CPU module operation status is "STOP" or "STOP (by stop error)" | Check the CPU module operation status.<br>The analog output HOLD/CLEAR function is enabled when the CPU module is in the "STOP" or "STOP (by stop error)" status. |
| Whether the analog output HOLD/CLEAR function is set correctly | Check the analog output HOLD/CLEAR function setting in the parameter setting of GX Works3. If the contents of setting are wrong, set the analog output HOLD/CLEAR function again. |
| Whether the PWR LED is off | Reset the CPU module, and check whether the PWR LED turns ON. |

## Troubleshooting of temperature sensor input

FX5-4A-ADP FX5-4AD-ADP FX5-4DA-ADP FX5-4AD-PT-ADP FX5-4AD-TC-ADP

### ■When a measured temperature value cannot be read

| Check item | Action |
|---|---|
| Whether the analog signal cable is disconnected from the analog adapter | Check the signal cables visually, and wire the analog signal cable correctly. |
| Whether the external equipment is wired correctly. | Correctly wire the analog adapter and the externally connected device. |
| Whether the offset/gain is set correctly | Check whether the offset/gain is set correctly.<br>Check whether temperature conversion is executed correctly.<br>When temperature conversion is executed correctly, set the offset/gain again. |
| Whether the setting resistance temperature detector type is correct | Check the setting resistance temperature detector type of GX Works3. If the contents of setting are wrong, set the resistance temperature detector type again. |
| Whether the setting thermocouple type is correct | Check the setting thermocouple type in the parameter setting of GX Works3. If the contents of setting are wrong, set the thermocouple type again. |
| Whether the "conversion enable/disable setting" is set to "disable" for the channel to be used | Check the "Conversion enable/disable setting" for the channel to be used in the parameter setting of GX Works3, and set "enable" in the parameter of GX Works3 or in the program. |

### ■When the Measured temperature value does not change

| Check item | Action |
|---|---|
| Whether a disconnection (outside the measurement temperature range) is detected | Remove the cause of disconnection by replacing the analog signal cable, etc., and then check the Measured temperature value. |

### ■When a value is not converted into the expected digital output value

| Check item | Action |
|---|---|
| Whether the setting RTD type is correct | Check the setting RTD type in the parameter setting of GX Works3. If the contents of setting are wrong, set the RTD type again. |
| Whether the setting thermocouple type is correct | Check the setting thermocouple type in the parameter setting of GX Works3. If the contents of setting are wrong, set the thermocouple type again. |
| Whether the offset/gain setting is correct | Check whether the offset/gain is set correctly.<br>Check whether temperature conversion is executed correctly.<br>When temperature conversion is executed correctly, set the offset/gain again. |
| Whether the temperature conversion method is set correctly. | Check the temperature conversion method in the parameter setting of GX Works3. If the contents of setting are wrong, set the temperature conversion method again. |

### ■When the measured temperature value is dispersed

| Check item | Action |
|---|---|
| Whether a temperature conversion method other than sampling processing is set. | Check the temperature conversion method in the parameter setting of GX Works3. Set the averaging processing to the temperature conversion method, and then check again for dispersion of the measured temperature value. |

### ■When the conversion completed flag does not turn ON

| Check item | Action |
|---|---|
| Whether all channels are set to disable conversion | Check the channels for which conversion is enabled in the parameter setting of GX Works3. If conversion is not enabled in any channel, enable conversion for 1 or more channels in the parameter of GX Works3 or in the program. |
| Whether a disconnection (outside the measurement temperature range) is detected | Remove the cause of disconnection by replacing the analog signal cable, etc., and then check the measured temperature value. |

# APPENDIX

## Appendix 1 Special Relay List

The following table shows items in the list for special relays (SM).

| Item | Description |
|---|---|
| No. | Special relay number |
| Name | Special relay name |
| Description | Data stored in the special relay and its meaning |
| Compatible CPU module | Shows CPU modules that support the special relay. The support status is represented by the following symbols.<br>• ○: Supported<br>• ×: Not supported |
| R/W | The following symbols show whether the special relay can be read/written.<br>• R: Read-only<br>• W: Write-only<br>• R/W: Read/Write |

### Diagnostic information

The special relays for diagnostic information are shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM0 | Latest self diagnostics error (including annunciator ON) | OFF: No error<br>ON: Error | ○ | ○ | ○ | R |
| SM1 | Latest self diagnostics error (not including annunciator On) | OFF: No self-diagnosis errors<br>ON: Self-diagnosis error | ○ | ○ | ○ | R |
| SM50 | Error reset | OFF→ON: Error reset request<br>ON→OFF: Error reset completion | ○ | ○ | ○ | R/W |
| SM51 | Battery low latch | OFF: Normal<br>ON: Battery low | × | × | ○ | R |
| SM52 | Battery low | OFF: Normal<br>ON: Battery low | × | × | ○ | R |
| SM53 | AC/DC DOWN | OFF: No AC/DC down detection<br>ON: AC/DC down is detected | × | ○ | ○ | R |
| SM56 | Operation error | OFF: Normal<br>ON: Operation error | ○ | ○ | ○ | R |
| SM61 | I/O module verify error | OFF: Normal<br>ON: Error | × | ○ | ○ | R |
| SM62 | Annunciator | OFF: Not detected<br>ON: Detected | ○ | ○ | ○ | R |
| SM80 | Detailed information 1: Flag in use | OFF: Not used<br>ON: In use | ○ | ○ | ○ | R |
| SM112 | Detailed information 2: Flag in use | OFF: Not used<br>ON: In use | ○ | ○ | ○ | R |

# System information

The special relays for system information are shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM203 | STOP contact | OFF: Other than STOP state<br>ON: STOP state | ○ | ○ | ○ | R |
| SM204 | PAUSE contact | OFF: Other than PAUSE state<br>ON: PAUSE state | ○ | ○ | ○ | R |
| SM210 | Clock data set request | OFF→ON: Set Request<br>ON→OFF: Set completed | ○ | ○ | ○ | R/W |
| SM211 | Clock data set error | OFF: No error<br>ON: Error | ○ | ○ | ○ | R |
| SM213 | Clock data read request | OFF: Ignored<br>ON: Read request | ○ | ○ | ○ | R/W |

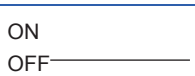
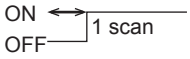
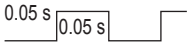
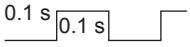
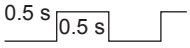
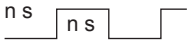
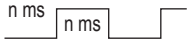
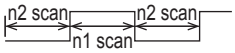
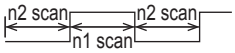
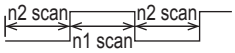
# SFC information

The following is a list of special relay areas relating to SFC information.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM320 | Presence/absence of SFC program | OFF: No SFC program<br>ON: SFC program | ○ | ○ | ○ | R |
| SM321 | Start/stop SFC program | OFF: SFC program not executed (stop)<br>ON: SFC program executed (start) | ○ | ○ | ○ | R/W |
| SM322 | SFC program startup status | OFF: Initial start<br>ON: Resumption | ○ | ○ | ○ | R/W |
| SM323 | Presence/absence of continuous transition for entire block | OFF: No continuous transition<br>ON: Continuous transition | ○ | ○ | ○ | R/W |
| SM324 | Continuous transition prevention flag | OFF: When transition executed<br>ON: When there is no transition | ○ | ○ | ○ | R |
| SM325 | Output mode at block stop | OFF: Coil output turned off<br>ON: Coil output retained | ○ | ○ | ○ | R/W |
| SM327 | Output mode at execution of the END step | OFF: Hold step output off<br>ON: Hold step output retained | ○ | ○ | ○ | R/W |
| SM328 | Clear processing mode when the sequence reaches the END step | OFF: Clear processing performed<br>ON: Clear processing not performed | ○ | ○ | ○ | R |
| SM329 | Online change (SFC block) in-execution flag | OFF: Not being executed<br>ON: Being executed | ○ | ○ | ○ | R |
| SM4301 | FX3 compatible transition operation mode setting status | OFF: Disabled<br>ON: Enabled | ○ | ○ | ○ | R |

# System clock

The special relay about system clock is shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM400 | Always ON |  | ○ | ○ | ○ | R |
| SM401 | Always OFF |  | ○ | ○ | ○ | R |
| SM402 | After RUN, ON for one scan only |  | ○ | ○ | ○ | R |
| SM403 | After RUN, OFF for one scan only |  | ○ | ○ | ○ | R |
| SM409 | 0.01 second clock |  | ○ | ○ | ○ | R |
| SM410 | 0.1 second clock |  | ○ | ○ | ○ | R |
| SM411 | 0.2 second clock |  | ○ | ○ | ○ | R |
| SM412 | 1 second clock |  | ○ | ○ | ○ | R |
| SM413 | 2 second clock |  | ○ | ○ | ○ | R |
| SM414 | 2n second clock |  | ○ | ○ | ○ | R |
| SM415 | 2n millisecond clock |  | ○ | ○ | ○ | R |
| SM420 | Timing clock output 1 |  | ○ | ○ | ○ | R |
| SM421 | Timing clock output 2 |  | ○ | ○ | ○ | R |
| SM422 | Timing clock output 3 |  | ○ | ○ | ○ | R |
| SM423 | Timing clock output 4 |  | ○ | ○ | ○ | R |
| SM424 | Timing clock output 5 |  | ○ | ○ | ○ | R |

# Scan information

The special relay for scan information is shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM522 | Scan time clear request | OFF: Do not clear the scan time.<br>ON: Clear the scan time. | × | ○ | ○ | R/W |

# Drive information

The special relays for drive information are shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM600 | SD memory card usable flag | OFF: Unusable<br>ON: Usable | ○ | ○ | ○ | R |
| SM601 | SD memory card protect flag | OFF: Not protected<br>ON: Protected | ○ | ○ | ○ | R |
| SM603 | SD memory card (drive 2) flag | OFF: No drive 2<br>ON: Drive 2 present | ○ | ○ | ○ | R |
| SM605 | SD memory card remove/insert prohibit flag | OFF: Remove/insert enabled<br>ON: Remove/insert prohibited | ○ | ○ | ○ | R/W |
| SM606 | SD memory card forced disable instruction | OFF: Clear command<br>ON: Command | ○ | ○ | ○ | R/W |
| SM607 | SD memory card forced disable status flag | OFF: Not disabled by SD memory card forced stop request<br>ON: Disabled by SD memory card forced stop request | ○ | ○ | ○ | R |
| SM632 | Data memory write error | OFF: Write not executed/normal<br>ON: Write error | ○ | ○ | ○ | R |
| SM633 | Data memory write flag | OFF: Write not executed<br>ON: Writing | ○ | ○ | ○ | R |
| SM634 | Number of rewriting operations error to data memory flag | OFF: Overwrite count is less than 20,000<br>ON: Overwrite count is 20,000 or more | ○ | ○ | ○ | R |

# Instruction related

The special relays related to instruction execution are shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM699 | Dedicated instruction skip flag | OFF: Intelligent dedicated instruction executed<br>ON: Intelligent dedicated instruction not executed | ○ | ○ | ○ | R/W |
| SM700 | Carry flag | OFF: Carry off<br>ON: Carry on | ○ | ○ | ○ | R |
| SM701 | Output character number switching | OFF: NULL code output<br>ON: No change | ○ | ○ | ○ | R/W |
| SM703 | Sort order | OFF: Ascending order<br>ON: Descending order | ○ | ○ | ○ | R/W |
| SM704 | Block comparison | OFF: Non-match found<br>ON: All match | ○ | ○ | ○ | R |
| SM705 | Number of conversion digits selection | OFF: Set with a specific number of digits (sign + numeric value of 5 digits)<br>ON: Set with any number of digits (maximum: sign + numeric value of 5 digits) | ○ | ○ | ○ | R/W |
| SM709 | DT/TM instruction improper data detection | OFF: Improper data not detected<br>ON: Improper data detected | ○ | ○ | ○ | R/W |
| SM753 | File being accessed | OFF: Not in progress<br>ON: In progress | ○ | ○ | ○ | R |

# Firmware update function

The special relays for firmware update function are shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM912 | Firmware update prohibit state | OFF: Firmware update enable state<br>ON: Firmware update prohibit state (Firmware update prohibited file is present) | ○ | ○ | ○ | R |

# Latch area

The special relays for latch area are shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM953 | Data backup error check flag | OFF: No error<br>ON: Error | ○ | ○ | ○ | R |
| SM959 | Data restoration error check flag | OFF: No error<br>ON: Error | ○ | ○ | ○ | R |
| SM9353 | Clear/keep of latch label during PC write | OFF: Clear<br>ON: Keep | ○ | ○ | ○ | R/W |

# Data logging function

The special relays for data logging function are shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM1201 | SD memory card setting file in use flag | OFF: Not used<br>ON: In use | ○ | ○ | ○ | R |
| SM1202 | Data memory setting file in use flag | OFF: Not used<br>ON: In use | ○ | ○ | ○ | R |
| SM1203 | Data logging file transfer stop request | This special relay stops the logging file transfer with the value specified in SD1203 when this relay is changed from with off to on. It turns off when the logging file transfer is stopped.<br>OFF: Transfer stopped<br>ON: Stop requested | ○ | ○ | ○ | R/W |
| SM1210 | Data logging setting No.1 Data logging preparation | OFF: Not prepared<br>ON: Prepared | ○ | ○ | ○ | R |
| SM1211 | Data logging setting No.1 Data logging start | OFF: Suspended/waiting for start<br>ON: Start | ○ | ○ | ○ | R |
| SM1212 | Data logging setting No.1 Data logging data collection in progress | OFF: Not in progress<br>ON: In progress | ○ | ○ | ○ | R |
| SM1213 | Data logging setting No.1 Data logging completion | OFF: Not completed<br>ON: Completed | ○ | ○ | ○ | R |
| SM1214 | Data logging setting No.1 Data logging triggering | OFF→ON: Triggered | ○ | ○ | ○ | R |
| SM1215 | Data logging setting No.1 Post data logging triggering | OFF: Not post triggering<br>ON: Post triggering | ○ | ○ | ○ | R |
| SM1216 | Data logging setting No.1 Data logging error | OFF: No error<br>ON: Error | ○ | ○ | ○ | R |
| SM1217 | Data logging setting No.1 Data logging data saving into SD memory card in progress | OFF: Not in progress<br>ON: In progress | ○ | ○ | ○ | R |
| SM1218 | Data logging setting No.1 Logging data storage file switching in progress | OFF: Not in progress<br>ON: In progress | ○ | ○ | ○ | R |
| SM1219 | Data logging setting No.1 Logging file transfer function execution status flag | OFF: Not executed<br>ON: Executed | ○ | ○ | ○ | R |
| SM1220 to SM1229 | Data logging setting No.2 | Same configuration as the setting No.1 | ○ | ○ | ○ | R |
| SM1230 to SM1239 | Data logging setting No.3 | Same configuration as the setting No.1 | ○ | ○ | ○ | R |
| SM1240 to SM1249 | Data logging setting No.4 | Same configuration as the setting No.1 | ○ | ○ | ○ | R |
| SM1312 to SM1315 | Data logging setting No.1 to 4 Data logging suspend/resume flag | OFF→ON: Suspend<br>ON→OFF: Resume | ○ | ○ | ○ | R/W |
| SM9300 to SM9303 | Data logging setting No.1 to 4 Data logging register/clear flag | OFF: Clear<br>ON: Register | ○ | ○ | ○ | R/W |

# Data backup/restoration function

The special relays for data backup/restoration function are shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM1350 | Data backup status flag | OFF: Not being executed<br>ON: Being executed | ○ | ○ | ○ | R |
| SM1351 | Data backup execution request | OFF→ON: Backup requested<br>ON→OFF: Backup completed | ○ | ○ | ○ | R/W |
| SM1353 | Data restoration status flag | OFF: Not being executed<br>ON: Being executed | ○ | ○ | ○ | R |
| SM1354 | Data restoration execution request | OFF→ON: Restoration requested<br>ON→OFF: Restoration completed | ○ | ○ | ○ | R/W |
| SM9350 | CPU module auto exchange function enable/ disable flag | OFF: Enable<br>ON: Disable | ○ | ○ | ○ | R/W |

# File transfer function (FTP client)

The special relay for file transfer function (FTP client) is shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM1392 | FTP client connection status | OFF: Not connected (disconnected)<br>ON: Connected | ○ | ○ | ○ | R |

# Memory dump function

The special relays for memory dump function are shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM1472 | Memory dump in progress | OFF: Memory dump not executed<br>ON: Memory dump in progress | ○ | ○ | ○ | R |
| SM1473 | Memory dump completed | OFF: Not completed<br>ON: Completed | ○ | ○ | ○ | R |

# CC-Link IE Field Network Basic function

The special relays for CC-Link IE Field Network Basic function are shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM1536 | Cyclic transmission status | OFF: Not performed<br>ON: Being performed | ○ | ○ | ○ | R |
| SM1540 | Data link status | OFF: All stations normal<br>ON: One or more faulty stations | ○ | ○ | ○ | R |
| SM9400 | CC-Link IE Field Network Basic communication interval setting enable/disable flag (Setting value) | OFF: Disabled<br>ON: Enabled | ○ | ○ | ○ | R/W |
| SM9401 | CC-Link IE Field Network Basic communication interval setting enable/disable flag (Current value) | OFF: Disabled<br>ON: Enabled | ○ | ○ | ○ | R |

# High-speed input/output function

The special relays for the high-speed input/output function are shown below.

## Shared for all channels of the CPU module

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM4210 | All module reset command | OFF: Disabled<br>ON: Enabled (when SD4210 stores F5F5H) | × | ○ | ○ | R/W |
| SM4300 | Event execution type program operation timing switch setting | OFF: Can be executed after initial execution type program operation<br>ON: Can be executed in the same scan as initial execution type program operation | ○ | ○ | ○ | R/W |
| SM4493 | File access adjustment setting | OFF: Disabled<br>ON: Enabled | × | × | ○ | R/W |
| SM4496 | Intelligent module latest error clear request | OFF: Error reset not requested<br>ON: Error reset completion | × | ○ | ○ | R/W |
| SM5000 | High-speed counter multi-point output high-speed comparison table operating | OFF: Stopped<br>ON: Operation | ○ | ○ | ○ | R |
| SM5001 | High-speed counter multi-point output high-speed comparison table completion | OFF: Not completed<br>ON: Completion | ○ | ○ | ○ | R/W |

## CPU module

• High-speed counter

| No. CH1 to CH8 | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM4500 to SM4507 | High-speed counter operating | OFF: Stopped<br>ON: Operation | ○ | ○ | ○ | R |
| SM4516 to SM4523 | High-speed counter pulse density/rotational speed being measured | OFF: Stopped<br>ON: Measurement | ○ | ○ | ○ | R |
| SM4532 to SM4539 | High-speed counter overflow occurrence | OFF: No error<br>ON: Overflow | ○ | ○ | ○ | R/W |
| SM4548 to SM4555 | High-speed counter underflow occurrence | OFF: No error<br>ON: Underflow | ○ | ○ | ○ | R/W |
| SM4564 to SM4571 | High-speed counter count direction monitor | OFF: Up-counting<br>ON: Down-counting | ○ | ○ | ○ | R |
| SM4580 to SM4587 | High-speed counter (1-phase 1-input S/W) count direction switch | OFF: Up-counting<br>ON: Down-counting | ○ | ○ | ○ | R/W |
| SM4596 to SM4603 | High-speed counter preset input logic | OFF: Positive logic<br>ON: Negative logic | ○ | ○ | ○ | R/W |
| SM4612 to SM4619 | High-speed counter preset input comparison enable | OFF: Disabled<br>ON: Enabled | ○ | ○ | ○ | R/W |
| SM4628 to SM4635 | High-speed counter enable input logic | OFF: Positive logic<br>ON: Negative logic | ○ | ○ | ○ | R/W |
| SM4644 to SM4651 | High-speed counter ring length setting | OFF: Disabled<br>ON: Enabled | ○ | ○ | ○ | R/W |
| SM4980 | High-speed counter high-speed comparison table operating | OFF: Stopped<br>ON: Operation | ○ | ○ | ○ | R |
| SM4982 | High-speed counter high-speed comparison table error occurrence | OFF: No error<br>ON: Error | ○ | ○ | ○ | R/W |

• Pulse width measurement

| No. CH1 to CH4 | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM5020 to SM5023 | Pulse width measurement operation | The measurement in progress/measurement stopped status of pulse width measurement on the target channel can be checked by these flags.<br>OFF: Stopped<br>ON: Operation | ○ | ○ | ○ | R |
| SM5036 to SM5039 | Period measurement complete | These flags turn ON at the end of the 1st period measurement on the target channel. (They remain ON during measurement in the always measurement mode.)<br>OFF: Cycle measurement not completed<br>ON: Cycle measurement completion | ○ | ○ | ○ | R |
| SM5052 to SM5055 | Pulse width measurement complete | These flags turn ON at the end of the 1st pulse width measurement on the target channel. (They remain ON during measurement in the always measurement mode.)<br>OFF: Pulse width measurement not completed<br>ON: Pulse width measurement completion | ○ | ○ | ○ | R |
| SM5068 to SM5071 | Pulse width measurement mode | The measurement mode of the target channel can be checked by these flags. (To change the measurement mode during operation, use this special relay.)<br>OFF: Always measurement mode<br>ON: 1 time measurement mode | ○ | ○ | ○ | R/W |

• PWM

| No. CH1 to CH4 | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM5300 to SM5303 | PWM pulse output monitor | The operation/stopped status of PWM output on the target channel can be checked.<br>OFF: Stopped<br>ON: Operation | ○ | ○ | ○ | R |
| SM5316 to SM5319 | PWM output normal end flag | The end status of PWM output on the target channel can be checked.<br>OFF: Other than normally end<br>ON: Normally end | ○ | ○ | ○ | R/W |
| SM5332 to SM5335 | PWM output abnormal end flag | The end status of PWM output on the target channel can be checked.<br>OFF: No error<br>ON: Abnormal end | ○ | ○ | ○ | R/W |

• Positioning

| No. Axis 1 to Axis 4 | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ*1 | FX5U/ FX5UC | |
| SM5500 to SM5503 | Positioning instruction activation | OFF: Stopped<br>ON: Operation | ○ | ○ | ○ | R |
| SM5516 to SM5519 | Positioning pulse output monitor | OFF: Stopped<br>ON: Pulse output | ○ | ○ | ○ | R |
| SM5532 to SM5535 | Positioning error occurrence | OFF: No error<br>ON: Error | ○ | ○ | ○ | R/W |
| SM5580 to SM5583 | Positioning table shift command | OFF: No table shift<br>ON: Table shift start | ○ | ○ | ○ | R/W |
| SM5596 to SM5599 | Positioning remaining distance operation enabled | OFF: Remaining distance operation disabled<br>ON: Remaining distance operation enabled | ○ | ○ | ○ | R/W |
| SM5612 to SM5615 | Positioning remaining distance operation command | OFF: Remaining distance operation standby<br>ON: Remaining distance operation start | ○ | ○ | ○ | R/W |
| SM5628 to SM5631 | Positioning pulse output stop command | OFF: Pulse output is not stopped<br>ON: Pulse output immediate stop | ○ | ○ | ○ | R/W |
| SM5644 to SM5647 | Positioning pulse decelerates stop command (With remaining distance operation) | OFF: Pulse output is not stopped<br>ON: Pulse output decelerates stop | ○ | ○ | ○ | R/W |
| SM5660 to SM5663 | Positioning forward rotation limit | OFF: Forward rotation limit off<br>ON: Forward rotation limit on | ○ | ○ | ○ | R/W |
| SM5676 to SM5679 | Positioning reverse rotation limit | OFF: Reverse rotation limit off<br>ON: Reverse rotation limit on | ○ | ○ | ○ | R/W |
| SM5772 to SM5775 | Positioning rotation direction specification | OFF: Forward rotation (Current address increases)<br>ON: Reverse rotation (Current address increases) | ○ | ○ | ○ | R/W |
| SM5804 to SM5807 | Positioning zero return direction specification | OFF: Zero return start (Reverse rotation direction)<br>ON: Zero return start (Forward rotation direction) | ○ | ○ | ○ | R/W |
| SM5820 to SM5823 | Positioning clear signal output enable | OFF: Clear signal disabled<br>ON: Clear signal enabled | ○ | ○ | ○ | R/W |
| SM5868 to SM5871 | Positioning zero signal count start time | OFF: Near point DOG backward end<br>ON: Near point DOG forward end | ○ | ○ | ○ | R/W |
| SM5916 to SM5919 | Positioning table data initialization disable | OFF: Disabled<br>ON: Enabled | ○ | ○ | ○ | R/W |

*1 Only Axis 1 to Axis 3 are supported.

## High-speed pulse input/output module

• High-speed counter

| No. CH9 to CH16 | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM4508 to SM4515 | High-speed counter operating | OFF: Stopped<br>ON: Operation | × | ○ | ○ | R |
| SM4540 to SM4547 | High-speed counter overflow occurrence | OFF: No error<br>ON: Overflow | × | ○ | ○ | R/W |
| SM4556 to SM4563 | High-speed counter underflow occurrence | OFF: No error<br>ON: Underflow | × | ○ | ○ | R/W |
| SM4572 to SM4579 | High-speed counter count direction monitor | OFF: Up-counting<br>ON: Down-counting | × | ○ | ○ | R |
| SM4588 to SM4595 | High-speed counter (1-phase 1-input S/W) count direction switch | OFF: Up-counting<br>ON: Down-counting | × | ○ | ○ | R/W |
| SM4604 to SM4611 | High-speed counter preset input logic | OFF: Positive logic<br>ON: Negative logic | × | ○ | ○ | R/W |
| SM4620 to SM4627 | High-speed counter preset input comparison enable | OFF: Disabled<br>ON: Enabled | × | ○ | ○ | R/W |
| SM4636 to SM4643 | High-speed counter enable input logic | OFF: Positive logic<br>ON: Negative logic | × | ○ | ○ | R/W |
| SM4652 to SM4659 | High-speed counter ring length setting | OFF: Disabled<br>ON: Enabled | × | ○ | ○ | R/W |
| SM4984, SM4988, SM4992, SM4996 | High-speed counter high-speed comparison table operating | OFF: Stopped<br>ON: Operation | × | ○ | ○ | R |
| SM4986, SM4990, SM4994, SM4998 | High-speed counter high-speed comparison table error occurrence | OFF: No error<br>ON: Error | × | ○ | ○ | R/W |

• Pulse width measurement

| No. CH5 to CH12 | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM5024 to SM5031 | Pulse width measurement operation | The measurement in progress/measurement stopped status of pulse width measurement on the target channel can be checked by these flags.<br>OFF: Stopped<br>ON: Operation | × | ○ | ○ | R |
| SM5040 to SM5047 | Period measurement complete | These flags turn ON at the end of the 1st period measurement on the target channel. (They remain ON during measurement in the always measurement mode.)<br>OFF: Cycle measurement not completed<br>ON: Cycle measurement completion | × | ○ | ○ | R |
| SM5056 to SM5063 | Pulse width measurement complete | These flags turn ON at the end of the 1st pulse width measurement on the target channel. (They remain ON during measurement in the always measurement mode.)<br>OFF: Pulse width measurement not completed<br>ON: Pulse width measurement completion | × | ○ | ○ | R |
| SM5072 to SM5079 | Pulse width measurement mode | The measurement mode of the target channel can be checked by these flags. (To change the measurement mode during operation, use this special relay.)<br>OFF: Always measurement mode<br>ON: 1 time measurement mode | × | ○ | ○ | R/W |

• PWM

| No.<br>CH5 to CH12 | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/<br>FX5UC | |
| SM5304 to SM5311 | PWM pulse output monitor | The operation/stopped status of PWM output on the target channel can be checked.<br>OFF: Stopped<br>ON: Operation | × | ○ | ○ | R |
| SM5320 to SM5327 | PWM output normal end flag | The end status of PWM output on the target channel can be checked.<br>OFF: Other than normally end<br>ON: Normally end | × | ○ | ○ | R/W |
| SM5336 to SM5343 | PWM output abnormal end flag | The end status of PWM output on the target channel can be checked.<br>OFF: No error<br>ON: Abnormal end | × | ○ | ○ | R/W |

• Positioning

| No.<br>Axes 5 to 12 | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/<br>FX5UC | |
| SM5504 to SM5511 | Positioning instruction activation | OFF: Stopped<br>ON: Operation | × | ○ | ○ | R |
| SM5520 to SM5527 | Positioning pulse output monitor | OFF: Stopped<br>ON: Pulse output | × | ○ | ○ | R |
| SM5536 to SM5543 | Positioning error occurrence | OFF: No error<br>ON: Error | × | ○ | ○ | R/W |
| SM5584 to SM5591 | Positioning table shift command | OFF: No table shift<br>ON: Table shift start | × | ○ | ○ | R/W |
| SM5600 to SM5607 | Positioning remaining distance operation enabled | OFF: Remaining distance operation disabled<br>ON: Remaining distance operation enabled | × | ○ | ○ | R/W |
| SM5616 to SM5623 | Positioning remaining distance operation command | OFF: Remaining distance operation standby<br>ON: Remaining distance operation start | × | ○ | ○ | R/W |
| SM5632 to SM5639 | Positioning pulse output stop command | OFF: Pulse output is not stopped<br>ON: Pulse output immediate stop | × | ○ | ○ | R/W |
| SM5648 to SM5655 | Positioning pulse decelerates stop command (With remaining distance operation) | OFF: Pulse output is not stopped<br>ON: Pulse output decelerates stop | × | ○ | ○ | R/W |
| SM5664 to SM5671 | Positioning forward rotation limit | OFF: Forward rotation limit off<br>ON: Forward rotation limit on | × | ○ | ○ | R/W |
| SM5680 to SM5687 | Positioning reverse rotation limit | OFF: Reverse rotation limit off<br>ON: Reverse rotation limit on | × | ○ | ○ | R/W |
| SM5776 to SM5783 | Positioning rotation direction specification | OFF: Forward rotation (Current address increases)<br>ON: Reverse rotation (Current address increases) | × | ○ | ○ | R/W |
| SM5808 to SM5815 | Positioning zero return direction specification | OFF: Zero return start (Reverse rotation direction)<br>ON: Zero return start (Forward rotation direction) | × | ○ | ○ | R/W |
| SM5824 to SM5831 | Positioning clear signal output enable | OFF: Clear signal disabled<br>ON: Clear signal enabled | × | ○ | ○ | R/W |
| SM5872 to SM5879 | Positioning zero signal count start time | OFF: Near point DOG backward end<br>ON: Near point DOG forward end | × | ○ | ○ | R/W |
| SM5920 to SM5927 | Positioning table data initialization disable | OFF: Disabled<br>ON: Enabled | × | ○ | ○ | R/W |

# CPU module built-in analog function

Only FX5U CPU module is supported.

The special relays for the CPU module built-in analog function are shown below.

## Analog input

| No. CH1, CH2 | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC*1 | |
| SM6020, SM6060 | A/D conversion completed flag | OFF: A/D conversion not completed<br>ON: A/D conversion completed | × | × | ○ | R |
| SM6021, SM6061 | A/D conversion enable/disable setting | OFF: A/D conversion enable<br>ON: A/D conversion disable | × | × | ○ | R/W |
| SM6022, SM6062 | Over scale upper limit detection flag | OFF: No over scaling<br>ON: Over scaling | × | × | ○ | R |
| SM6023, SM6063 | Over scale lower limit detection flag | OFF: No over scaling<br>ON: Over scaling | × | × | ○ | R |
| SM6024, SM6064 | Over scale detection setting | OFF: Enabled<br>ON: Disabled | × | × | ○ | R/W |
| SM6025, SM6065 | Maximum value/minimum value reset completed flag | OFF: Reset not completed<br>ON: Reset completed | × | × | ○ | R |
| SM6026, SM6066 | Maximum value reset request | OFF: No reset request<br>ON: Reset request | × | × | ○ | R/W |
| SM6027, SM6067 | Minimum value reset request | OFF: No reset request<br>ON: Reset request | × | × | ○ | R/W |
| SM6028, SM6068 | Scaling enable/disable setting | OFF: Enabled<br>ON: Disabled | × | × | ○ | R/W |
| SM6029, SM6069 | Digital clipping enable/disable setting | OFF: Enabled<br>ON: Disabled | × | × | ○ | R/W |
| SM6031, SM6071 | Warning output flag process alarm upper limit | OFF: No alarm<br>ON: Alarm | × | × | ○ | R |
| SM6032, SM6072 | Warning output flag process alarm lower limit | OFF: No alarm<br>ON: Alarm | × | × | ○ | R |
| SM6033, SM6073 | Warning output setting (process alarm) | OFF: Enabled<br>ON: Disabled | × | × | ○ | R/W |
| SM6057, SM6097 | A/D alarm clear request | OFF: No clear request<br>ON: Clear request | × | × | ○ | R/W |
| SM6058, SM6098 | A/D alarm flag | OFF: No alarm<br>ON: Alarm | × | × | ○ | R |
| SM6059, SM6099 | A/D error flag | OFF: No error<br>ON: Error | × | × | ○ | R |

*1 Only FX5U CPU module is supported.

## Analog output

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC*1 | |
| SM6180 | D/A conversion enable/disable setting | OFF: D/A conversion enable<br>ON: D/A conversion disable | × | × | ○ | R/W |
| SM6181 | D/A output enable/disable setting | OFF: Output enable<br>ON: Output disable | × | × | ○ | R/W |
| SM6188 | Scaling enable/disable setting | OFF: Enabled<br>ON: Disabled | × | × | ○ | R/W |
| SM6191 | Warning output upper limit value flag | OFF: No alarm<br>ON: Alarm | × | × | ○ | R |
| SM6192 | Warning output lower limit value flag | OFF: No alarm<br>ON: Alarm | × | × | ○ | R |
| SM6193 | Warning output setting | OFF: Disabled<br>ON: Enabled | × | × | ○ | R/W |
| SM6217 | D/A alarm clear request | OFF: No clear request<br>ON: Clear request | × | × | ○ | R/W |
| SM6218 | D/A alarm flag | OFF: No alarm<br>ON: Alarm | × | × | ○ | R |
| SM6219 | D/A error flag | OFF: No error<br>ON: Error | × | × | ○ | R |

*1 Only FX5U CPU module is supported.

# Analog adapter

Only the FX5S, FX5U, and FX5UC CPU modules support the 3rd and 4th special relay areas.

The special relay areas for analog adapters are shown below.

| No. CH1, CH2, CH3, CH4 | Connection order | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|---|
| | | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM6280 | 1st adapter | Temperature unit setting | Set the unit of temperature to use. | ○ | ○ | ○ | R/W |
| SM6640 | 2nd adapter | | | | | | |
| SM7000 | 3rd adapter | | | | | | |
| SM7360 | 4th adapter | | | | | | |
| SM6300, SM6340, SM6380, SM6420 | 1st adapter | A/D conversion completed flag | This flag monitors the A/D conversion status.<br>Target:FX5-4A-ADP (CH1, CH2), FX5-4AD-ADP | ○ | ○ | ○ | R |
| SM6660, SM6700, SM6740, SM6780 | 2nd adapter | | | | | | |
| SM7020, SM7060, SM7100, SM7140 | 3rd adapter | | | | | | |
| SM7380, SM7420, SM7460, SM7500 | 4th adapter | | | | | | |
| SM6300, SM6340, SM6380, SM6420 | 1st adapter | D/A conversion enable/disable setting | Set whether to enable or disable D/A conversion.<br>Target:FX5-4A-ADP (CH3, CH4), FX5-4DA-ADP | ○ | ○ | ○ | R |
| SM6660, SM6700, SM6740, SM6780 | 2nd adapter | | | | | | |
| SM7020, SM7060, SM7100, SM7140 | 3rd adapter | | | | | | |
| SM7380, SM7420, SM7460, SM7500 | 4th adapter | | | | | | |
| SM6300, SM6340, SM6380, SM6420 | 1st adapter | Conversion completed flag | This flag monitors the temperature conversion status.<br>Target:FX5-4AD-PT-ADP, FX5-4AD-TC-ADP | ○ | ○ | ○ | R |
| SM6660, SM6700, SM6740, SM6780 | 2nd adapter | | | | | | |
| SM7020, SM7060, SM7100, SM7140 | 3rd adapter | | | | | | |
| SM7380, SM7420, SM7460, SM7500 | 4th adapter | | | | | | |

| No. CH1, CH2, CH3, CH4 | Connection order | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|---|
| | | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM6301, SM6341, SM6381, SM6421 | 1st adapter | A/D conversion enable/disable setting | Set whether to enable or disable A/D conversion.<br>Target:FX5-4A-ADP (CH1, CH2), FX5-4AD-ADP | ○ | ○ | ○ | R/W |
| SM6661, SM6701, SM6741, SM6781 | 2nd adapter | | | | | | |
| SM7021, SM7061, SM7101, SM7141 | 3rd adapter | | | | | | |
| SM7381, SM7421, SM7461, SM7501 | 4th adapter | | | | | | |
| SM6301, SM6341, SM6381, SM6421 | 1st adapter | D/A output enable/ disable setting | Set whether to output the D/A conversion value or to output the offset value.<br>Target:FX5-4A-ADP (CH3, CH4), FX5-4DA-ADP | ○ | ○ | ○ | R/W |
| SM6661, SM6701, SM6741, SM6781 | 2nd adapter | | | | | | |
| SM7021, SM7061, SM7101, SM7141 | 3rd adapter | | | | | | |
| SM7381, SM7421, SM7461, SM7501 | 4th adapter | | | | | | |
| SM6301, SM6341, SM6381, SM6421 | 1st adapter | Conversion enable/ disable setting | Set whether to enable or disable temperature conversion.<br>Target:FX5-4AD-PT-ADP, FX5-4AD-TC-ADP | ○ | ○ | ○ | R/W |
| SM6661, SM6701, SM6741, SM6781 | 2nd adapter | | | | | | |
| SM7021, SM7061, SM7101, SM7141 | 3rd adapter | | | | | | |
| SM7381, SM7421, SM7461, SM7501 | 4th adapter | | | | | | |
| SM6302, SM6342, SM6382, SM6422 | 1st adapter | Over scale upper limit detection flag | This flag monitors the over-scale upper limit detection status in the over-scale detection function. | ○ | ○ | ○ | R |
| SM6662, SM6702, SM6742, SM6782 | 2nd adapter | | | | | | |
| SM7022, SM7062, SM7102, SM7142 | 3rd adapter | | | | | | |
| SM7382, SM7422, SM7462, SM7502 | 4th adapter | | | | | | |
| SM6303, SM6343, SM6383, SM6423 | 1st adapter | Over scale lower limit detection flag | This flag monitors the over-scale lower limit detection status in the over-scale detection function. | ○ | ○ | ○ | R |
| SM6663, SM6703, SM6743, SM6783 | 2nd adapter | | | | | | |
| SM7023, SM7063, SM7103, SM7143 | 3rd adapter | | | | | | |
| SM7383, SM7423, SM7463, SM7503 | 4th adapter | | | | | | |
| SM6304, SM6344, SM6384, SM6424 | 1st adapter | Over scale detection enable/ disable setting | Set whether to enable or disable over scale detection. | ○ | ○ | ○ | R/W |
| SM6664, SM6704, SM6744, SM6784 | 2nd adapter | | | | | | |
| SM7024, SM7064, SM7104, SM7144 | 3rd adapter | | | | | | |
| SM7384, SM7424, SM7464, SM7504 | 4th adapter | | | | | | |
| SM6305, SM6345, SM6385, SM6425 | 1st adapter | Maximum value/ minimum value reset completed flag | This flag monitors the "maximum value/minimum value" reset status. | ○ | ○ | ○ | R |
| SM6665, SM6705, SM6745, SM6785 | 2nd adapter | | | | | | |
| SM7025, SM7065, SM7105, SM7145 | 3rd adapter | | | | | | |
| SM7385, SM7425, SM7465, SM7505 | 4th adapter | | | | | | |

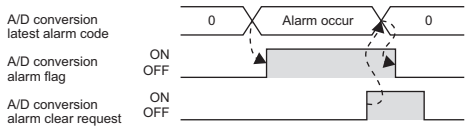
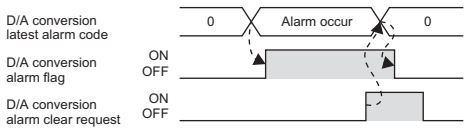
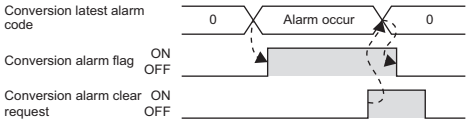
| No. CH1, CH2, CH3, CH4 | Connection order | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|---|
| | | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM6306, SM6346, SM6386, SM6426 | 1st adapter | Maximum value reset request | When "maximum value reset request" is set from OFF to ON, the maximum value is updated to "digital operation value". | ○ | ○ | ○ | R/W |
| SM6666, SM6706, SM6746, SM6786 | 2nd adapter | | | | | | |
| SM7026, SM7066, SM7106, SM7146 | 3rd adapter | | | | | | |
| SM7386, SM7426, SM7466, SM7506 | 4th adapter | | | | | | |
| SM6307, SM6347, SM6387, SM6427 | 1st adapter | Minimum value reset request | When "minimum value reset request" is set from OFF to ON, the minimum value is updated to "digital operation value". | ○ | ○ | ○ | R/W |
| SM6667, SM6707, SM6747, SM6787 | 2nd adapter | | | | | | |
| SM7027, SM7067, SM7107, SM7147 | 3rd adapter | | | | | | |
| SM7387, SM7427, SM7467, SM7507 | 4th adapter | | | | | | |
| SM6308, SM6348, SM6388, SM6428 | 1st adapter | Scaling enable/ disable setting | Set whether to enable or disable the scaling function. | ○ | ○ | ○ | R/W |
| SM6668, SM6708, SM6748, SM6788 | 2nd adapter | | | | | | |
| SM7028, SM7068, SM7108, SM7148 | 3rd adapter | | | | | | |
| SM7388, SM7428, SM7468, SM7508 | 4th adapter | | | | | | |
| SM6309, SM6349, SM6389, SM6429 | 1st adapter | Digital clipping enable/disable setting | Set whether to enable or disable the digital clipping function. | ○ | ○ | ○ | R/W |
| SM6669, SM6709, SM6749, SM6789 | 2nd adapter | | | | | | |
| SM7029, SM7069, SM7109, SM7149 | 3rd adapter | | | | | | |
| SM7389, SM7429, SM7469, SM7509 | 4th adapter | | | | | | |
| SM6311, SM6351, SM6391, SM6431 | 1st adapter | Warning output flag (process alarm upper limit) | This flag monitors the upper limit value warning in the process alarm.<br>Target:FX5-4A-ADP (CH1, CH2), FX5-4AD-ADP, FX5-4AD-PT-ADP, FX5-4AD-TC-ADP | ○ | ○ | ○ | R |
| SM6671, SM6711, SM6751, SM6791 | 2nd adapter | | | | | | |
| SM7031, SM7071, SM7111, SM7151 | 3rd adapter | | | | | | |
| SM7391, SM7431, SM7471, SM7511 | 4th adapter | | | | | | |
| SM6311, SM6351, SM6391, SM6431 | 1st adapter | Warning output upper limit value flag | This flag monitors the upper limit value warning in the warning output.<br>Target:FX5-4A-ADP (CH3, CH4), FX5-4DA-ADP | ○ | ○ | ○ | R |
| SM6671, SM6711, SM6751, SM6791 | 2nd adapter | | | | | | |
| SM7031, SM7071, SM7111, SM7151 | 3rd adapter | | | | | | |
| SM7391, SM7431, SM7471, SM7511 | 4th adapter | | | | | | |
| SM6312, SM6352, SM6392, SM6432 | 1st adapter | Warning output flag (process alarm lower limit) | This flag monitors the lower limit value warning in the process alarm.<br>Target:FX5-4A-ADP (CH1, CH2), FX5-4AD-ADP, FX5-4AD-PT-ADP, FX5-4AD-TC-ADP | ○ | ○ | ○ | R |
| SM6672, SM6712, SM6752, SM6792 | 2nd adapter | | | | | | |
| SM7032, SM7072, SM7112, SM7152 | 3rd adapter | | | | | | |
| SM7392, SM7432, SM7472, SM7512 | 4th adapter | | | | | | |

A

| No. CH1, CH2, CH3, CH4 | Connection order | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|---|
| | | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM6312, SM6352, SM6392, SM6432 | 1st adapter | Warning output lower limit value flag | This flag monitors the lower limit value warning in the warning output.<br>Target:FX5-4A-ADP (CH3, CH4), FX5-4DA-ADP | ○ | ○ | ○ | R |
| SM6672, SM6712, SM6752, SM6792 | 2nd adapter | | | | | | |
| SM7032, SM7072, SM7112, SM7152 | 3rd adapter | | | | | | |
| SM7392, SM7432, SM7472, SM7512 | 4th adapter | | | | | | |
| SM6313, SM6353, SM6393, SM6433 | 1st adapter | Warning output setting (process alarm) | Set whether to enable or disable the warning output of process alarm. | ○ | ○ | ○ | R/W |
| SM6673, SM6713, SM6753, SM6793 | 2nd adapter | | | | | | |
| SM7033, SM7073, SM7113, SM7153 | 3rd adapter | | | | | | |
| SM7393, SM7433, SM7473, SM7513 | 4th adapter | | | | | | |
| SM6313, SM6353, SM6393, SM6433 | 1st adapter | Warning output setting | Set whether to enable or disable the warning output. | ○ | ○ | ○ | R/W |
| SM6673, SM6713, SM6753, SM6793 | 2nd adapter | | | | | | |
| SM7033, SM7073, SM7113, SM7153 | 3rd adapter | | | | | | |
| SM7393, SM7433, SM7473, SM7513 | 4th adapter | | | | | | |
| SM6315, SM6355, SM6395, SM6435 | 1st adapter | Warning output flag (rate alarm upper limit) | This flag monitors the upper limit value warning in the rate alarm. | ○ | ○ | ○ | R |
| SM6675, SM6715, SM6755, SM6795 | 2nd adapter | | | | | | |
| SM7035, SM7075, SM7115, SM7155 | 3rd adapter | | | | | | |
| SM7395, SM7435, SM7475, SM7515 | 4th adapter | | | | | | |
| SM6316, SM6356, SM6396, SM6436 | 1st adapter | Warning output flag (rate alarm lower limit) | This flag monitors the lower limit value warning in the rate alarm. | ○ | ○ | ○ | R |
| SM6676, SM6716, SM6756, SM6796 | 2nd adapter | | | | | | |
| SM7036, SM7076, SM7116, SM7156 | 3rd adapter | | | | | | |
| SM7396, SM7436, SM7476, SM7516 | 4th adapter | | | | | | |
| SM6317, SM6357, SM6397, SM6437 | 1st adapter | Warning output setting (rate alarm) | Set whether to enable or disable the warning output of rate alarm. | ○ | ○ | ○ | R/W |
| SM6677, SM6717, SM6757, SM6797 | 2nd adapter | | | | | | |
| SM7037, SM7077, SM7117, SM7157 | 3rd adapter | | | | | | |
| SM7397, SM7437, SM7477, SM7517 | 4th adapter | | | | | | |
| SM6318, SM6358, SM6398, SM6438 | 1st adapter | Disconnection detection flag | This flag monitors the disconnection detection.<br>Target:FX5-4A-ADP, FX5-4AD-ADP, FX5-4DA-ADP | ○ | ○ | ○ | R |
| SM6678, SM6718, SM6758, SM6798 | 2nd adapter | | | | | | |
| SM7038, SM7078, SM7118, SM7158 | 3rd adapter | | | | | | |
| SM7398, SM7438, SM7478, SM7518 | 4th adapter | | | | | | |

| No. CH1, CH2, CH3, CH4 | Connection order | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|---|
| | | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM6318, SM6358, SM6398, SM6438 | 1st adapter | Disconnection detection flag | This flag monitors the disconnection detection.<br>Target:FX5-4AD-PT-ADP, FX5-4AD-TC-ADP | ○ | ○ | ○ | R |
| SM6678, SM6718, SM6758, SM6798 | 2nd adapter | | | | | | |
| SM7038, SM7078, SM7118, SM7158 | 3rd adapter | | | | | | |
| SM7398, SM7438, SM7478, SM7518 | 4th adapter | | | | | | |
| SM6319, SM6359, SM6399, SM6439 | 1st adapter | Disconnection detection enable/ disable setting | Set whether to enable or disable the disconnection detection function.<br>Target:FX5-4A-ADP, FX5-4AD-ADP, FX5-4DA-ADP | ○ | ○ | ○ | R/W |
| SM6679, SM6719, SM6759, SM6799 | 2nd adapter | | | | | | |
| SM7039, SM7079, SM7119, SM7159 | 3rd adapter | | | | | | |
| SM7399, SM7439, SM7479, SM7519 | 4th adapter | | | | | | |
| SM6319, SM6359, SM6399, SM6439 | 1st adapter | Disconnection detection enable/ disable setting | Set whether to enable or disable the disconnection detection function.<br>Target:FX5-4AD-PT-ADP, FX5-4AD-TC-ADP | ○ | ○ | ○ | R/W |
| SM6679, SM6719, SM6759, SM6799 | 2nd adapter | | | | | | |
| SM7039, SM7079, SM7119, SM7159 | 3rd adapter | | | | | | |
| SM7399, SM7439, SM7479, SM7519 | 4th adapter | | | | | | |
| SM6320, SM6360, SM6400, SM6440 | 1st adapter | Disconnection recovery detection enable/disable setting | Set whether to enable or disable the disconnection detection recovery.<br>Target:FX5-4A-ADP, FX5-4AD-ADP, FX5-4DA-ADP | ○ | ○ | ○ | R/W |
| SM6680, SM6720, SM6760, SM6800 | 2nd adapter | | | | | | |
| SM7040, SM7080, SM7120, SM7160 | 3rd adapter | | | | | | |
| SM7400, SM7440, SM7480, SM7520 | 4th adapter | | | | | | |
| SM6320, SM6360, SM6400, SM6440 | 1st adapter | Disconnection detection automatic clear enable/ disable setting | Set whether to enable or disable the disconnection detection automatic clear.<br>Target:FX5-4AD-PT-ADP, FX5-4AD-TC-ADP | ○ | ○ | ○ | R/W |
| SM6680, SM6720, SM6760, SM6800 | 2nd adapter | | | | | | |
| SM7040, SM7080, SM7120, SM7160 | 3rd adapter | | | | | | |
| SM7400, SM7440, SM7480, SM7520 | 4th adapter | | | | | | |
| SM6321, SM6361, SM6401, SM6441 | 1st adapter | Convergence detection flag | This flag monitors the convergence detection. | ○ | ○ | ○ | R |
| SM6681, SM6721, SM6761, SM6801 | 2nd adapter | | | | | | |
| SM7041, SM7081, SM7121, SM7161 | 3rd adapter | | | | | | |
| SM7401, SM7441, SM7481, SM7521 | 4th adapter | | | | | | |
| SM6322, SM6362, SM6402, SM6442 | 1st adapter | Convergence detection enable/ disable setting | Set whether to enable or disable the convergence detection. | ○ | ○ | ○ | R/W |
| SM6682, SM6722, SM6762, SM6802 | 2nd adapter | | | | | | |
| SM7042, SM7082, SM7122, SM7162 | 3rd adapter | | | | | | |
| SM7402, SM7442, SM7482, SM7522 | 4th adapter | | | | | | |

| No. CH1, CH2, CH3, CH4 | Connection order | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|---|
| | | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM6325, SM6365, SM6405, SM6445 | 1st adapter | Deviation detection flag between channel | This flag monitors the deviation detection flag between channel. | ○ | ○ | ○ | R |
| SM6685, SM6725, SM6765, SM6805 | 2nd adapter | | | | | | |
| SM7045, SM7085, SM7125, SM7165 | 3rd adapter | | | | | | |
| SM7405, SM7445, SM7485, SM7525 | 4th adapter | | | | | | |
| SM6326, SM6366, SM6406, SM6446 | 1st adapter | Deviation detection trigger between channels | Set whether to enable or disable the deviation detection between channels. | ○ | ○ | ○ | R/W |
| SM6686, SM6726, SM6766, SM6806 | 2nd adapter | | | | | | |
| SM7046, SM7086, SM7126, SM7166 | 3rd adapter | | | | | | |
| SM7406, SM7446, SM7486, SM7526 | 4th adapter | | | | | | |
| SM6331, SM6371, SM6411, SM6451 | 1st adapter | Offset/gain setting flag | The offset/gain setting used for each channel is monitored. | ○ | ○ | ○ | R/W |
| SM6691, SM6731, SM6771, SM6811 | 2nd adapter | | | | | | |
| SM7051, SM7091, SM7131, SM7171 | 3rd adapter | | | | | | |
| SM7411, SM7451, SM7491, SM7531 | 4th adapter | | | | | | |
| SM6332, SM6372, SM6412, SM6452 | 1st adapter | Offset/gain reading | An offset/gain setting value is read. | ○ | ○ | ○ | R/W |
| SM6692, SM6732, SM6772, SM6812 | 2nd adapter | | | | | | |
| SM7052, SM7092, SM7132, SM7172 | 3rd adapter | | | | | | |
| SM7412, SM7452, SM7492, SM7532 | 4th adapter | | | | | | |
| SM6333, SM6373, SM6413, SM6453 | 1st adapter | Offset/gain writing | An offset/gain setting value is written in. | ○ | ○ | ○ | R/W |
| SM6693, SM6733, SM6773, SM6813 | 2nd adapter | | | | | | |
| SM7053, SM7093, SM7133, SM7173 | 3rd adapter | | | | | | |
| SM7413, SM7453, SM7493, SM7533 | 4th adapter | | | | | | |
| SM6334, SM6374, SM6414, SM6454 | 1st adapter | Offset/gain initialization | An offset/gain setting value is initialized. | ○ | ○ | ○ | R/W |
| SM6694, SM6734, SM6774, SM6814 | 2nd adapter | | | | | | |
| SM7054, SM7094, SM7134, SM7174 | 3rd adapter | | | | | | |
| SM7414, SM7454, SM7494, SM7534 | 4th adapter | | | | | | |
| SM6337, SM6377, SM6417, SM6457 | 1st adapter | A/D conversion alarm clear request | An A/D conversion alarm clear request is performed.<br>OFF: With no A/D conversion alarm clear request<br>ON: With A/D conversion alarm clear request<br>Default value 0: OFF<br>Target:FX5-4A-ADP (CH1, CH2), FX5-4AD-ADP | ○ | ○ | ○ | R/W |
| SM6697, SM6737, SM6777, SM6817 | 2nd adapter | | | | | | |
| SM7057, SM7097, SM7137, SM7177 | 3rd adapter | | | | | | |
| SM7417, SM7457, SM7497, SM7537 | 4th adapter | | | | | | |

| No. CH1, CH2, CH3, CH4 | Connection order | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|---|
| | | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM6337, SM6377, SM6417, SM6457 | 1st adapter | D/A conversion alarm clear request | A D/A conversion alarm clear request is performed.<br>OFF: With no D/A conversion alarm clear request<br>ON: With D/A conversion alarm clear request<br>Default value 0: OFF<br>Target:FX5-4A-ADP (CH3, CH4), FX5-4DA-ADP | ○ | ○ | ○ | R/W |
| SM6697, SM6737, SM6777, SM6817 | 2nd adapter | | | | | | |
| SM7057, SM7097, SM7137, SM7177 | 3rd adapter | | | | | | |
| SM7417, SM7457, SM7497, SM7537 | 4th adapter | | | | | | |
| SM6337, SM6377, SM6417, SM6457 | 1st adapter | Conversion alarm clear request | A conversion alarm clear request is performed.<br>OFF: With no conversion alarm clear request<br>ON: With conversion alarm clear request<br>Default value 0: OFF<br>Target:FX5-4AD-PT-ADP, FX5-4AD-TC-ADP | ○ | ○ | ○ | R/W |
| SM6697, SM6737, SM6777, SM6817 | 2nd adapter | | | | | | |
| SM7057, SM7097, SM7137, SM7177 | 3rd adapter | | | | | | |
| SM7417, SM7457, SM7497, SM7537 | 4th adapter | | | | | | |
| SM6338, SM6378, SM6418, SM6458 | 1st adapter | A/D conversion alarm flag | "A/D conversion alarm flag" turns on when an alarm occurs.<br>OFF: Normal<br>ON: A/D conversion alarm occur<br>Default value 0: OFF<br>To turn OFF the "A/D conversion alarm flag" and clear the "A/D conversion latest alarm code", set the "A/D conversion alarm clear request" from OFF to ON.<br>  | ○ | ○ | ○ | R |
| SM6698, SM6738, SM6778, SM6818 | 2nd adapter | | | | | | |
| SM7058, SM7098, SM7138, SM7178 | 3rd adapter | | | | | | |
| SM7418, SM7458, SM7498, SM7538 | 4th adapter | | | | | | |
| SM6338, SM6378, SM6418, SM6458 | 1st adapter | D/A conversion alarm flag | "D/A conversion alarm flag" turns on when an alarm occurs.<br>OFF: Normal<br>ON: D/A conversion alarm occur<br>Default value 0: OFF<br>To turn OFF the "D/A conversion alarm flag" and clear the "D/A conversion latest alarm code", set the "D/A conversion alarm clear request" from OFF to ON.<br>  | ○ | ○ | ○ | R |
| SM6698, SM6738, SM6778, SM6818 | 2nd adapter | | | | | | |
| SM7058, SM7098, SM7138, SM7178 | 3rd adapter | | | | | | |
| SM7418, SM7458, SM7498, SM7538 | 4th adapter | | | | | | |
| SM6338, SM6378, SM6418, SM6458 | 1st adapter | Conversion alarm flag | "Conversion error flag" turns on when an alarm occurs.<br>OFF: Normal<br>ON: Conversion alarm occur<br>Default value 0: OFF<br>To clear "Conversion error flag", turn off and on "error clear request" (SM50) of the CPU module.<br>  | ○ | ○ | ○ | R |
| SM6698, SM6738, SM6778, SM6818 | 2nd adapter | | | | | | |
| SM7058, SM7098, SM7138, SM7178 | 3rd adapter | | | | | | |
| SM7418, SM7458, SM7498, SM7538 | 4th adapter | | | | | | |

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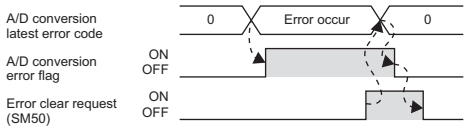
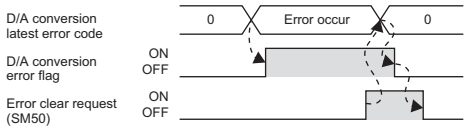
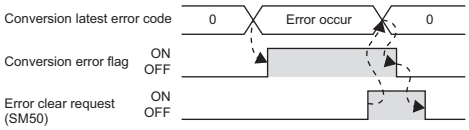
| No. CH1, CH2, CH3, CH4 | Connection order | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|---|
| | | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM6339, SM6379, SM6419, SM6459 | 1st adapter | A/D conversion error flag | "A/D conversion error flag" turns on when an error occurs.<br>OFF: Normal<br>ON: A/D conversion error occur<br>Default value 0: OFF<br>To clear "A/D conversion error flag" and "A/D conversion latest error code", turn off and on "error clear request" (SM50) of the CPU module.<br>  | ○ | ○ | ○ | R |
| SM6699, SM6739, SM6779, SM6819 | 2nd adapter | | | | | | |
| SM7059, SM7099, SM7139, SM7179 | 3rd adapter | | | | | | |
| SM7419, SM7459, SM7499, SM7539 | 4th adapter | | | | | | |
| SM6339, SM6379, SM6419, SM6459 | 1st adapter | D/A conversion error flag | "D/A conversion error flag" turns on when an error occurs.<br>OFF: Normal<br>ON: D/A conversion error occurs.<br>Default value 0: OFF<br>To clear "D/A conversion error flag" and "D/A conversion latest error code", turn off and on "error clear request" (SM50) of the CPU module.<br>  | ○ | ○ | ○ | R |
| SM6699, SM6739, SM6779, SM6819 | 2nd adapter | | | | | | |
| SM7059, SM7099, SM7139, SM7179 | 3rd adapter | | | | | | |
| SM7419, SM7459, SM7499, SM7539 | 4th adapter | | | | | | |
| SM6339, SM6379, SM6419, SM6459 | 1st adapter | Conversion error flag | When an error occurs, the conversion error flag turns on.<br>OFF: Normal<br>ON: Conversion error occur<br>Default value 0: OFF<br>To clear "Conversion error flag", turn off and on "error clear request" (SM50) of the CPU module.<br>  | ○ | ○ | ○ | R |
| SM6699, SM6739, SM6779, SM6819 | 2nd adapter | | | | | | |
| SM7059, SM7099, SM7139, SM7179 | 3rd adapter | | | | | | |
| SM7419, SM7459, SM7499, SM7539 | 4th adapter | | | | | | |

# FX compatible area

The special relays of FX compatible area are shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM8000 | RUN monitor NO contact | OFF: STOP<br>ON: RUN | ○ | ○ | ○ | R |
| SM8001 | RUN monitor NC contact | OFF: RUN<br>ON: STOP | ○ | ○ | ○ | R |
| SM8002 | Initial pulse NO contact | OFF: SM8002 turns off except during 1 scan at the time of RUN<br>ON: SM8002 turns on during 1 scan at the time of RUN | ○ | ○ | ○ | R |
| SM8003 | Initial pulse NC contact | OFF: SM8003 turns on during 1 scan at the time of RUN<br>ON: SM8003 turns off except during 1 scan at the time of RUN | ○ | ○ | ○ | R |
| SM8004 | Error occurrence | OFF: No error<br>ON: Error | ○ | ○ | ○ | R |
| SM8005 | Battery voltage low | OFF: Battery normal<br>ON: Battery voltage low | × | × | ○ | R |
| SM8006 | Battery error latch | OFF: Battery normal<br>ON: Battery voltage low latch | × | × | ○ | R |

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM8007 | Momentary power failure | OFF: No momentary power failure<br>ON: Momentary power failure detected | × | ○ | ○ | R |
| SM8008 | Power failure detected | OFF: No momentary power failure<br>ON: During momentary power failure | × | ○ | ○ | R |
| SM8011 | 10 msec clock pulse | ON and OFF in 10 ms cycles<br>OFF: 5ms<br>ON: 5ms | ○ | ○ | ○ | R |
| SM8012 | 100 msec clock pulse | ON and OFF in 100 ms cycles<br>OFF: 50ms<br>ON: 50ms | ○ | ○ | ○ | R |
| SM8013 | 1 sec clock pulse | ON and OFF in 1 sec cycles<br>OFF: 500ms<br>ON: 500ms | ○ | ○ | ○ | R |
| SM8014 | 1 min clock pulse | ON and OFF in 1 min cycles<br>OFF: 30s<br>ON: 30s | ○ | ○ | ○ | R |
| SM8015 | Clock stop and preset | When SM8015 turns ON, the real time clock is stopped.<br>At the edge from ON to OFF, the time from SD8013 to SD8019 is written to the programmable controller and the clock is started again. | ○ | ○ | ○ | R |
| SM8016 | Time read display is stopped | When SM8016 turns ON, the time display is stopped. | ○ | ○ | ○ | R |
| SM8017 | ±30 seconds correction | At the edge from OFF to ON, the RTC is set to the nearest minute.<br>(When the second data is from 0 to 29, it is set to 0. When the second data is from 30 to 59, it is set to 0 and the minute data is incriminated by "1".) | ○ | ○ | ○ | R |
| SM8019 | Real time clock error | When the data stored in special registers is outside the allowable time setting range, this device turns ON. | ○ | ○ | ○ | R |
| SM8020 | Zero | OFF: Zero flag off<br>ON: Zero flag on | ○ | ○ | ○ | R |
| SM8021 | Borrow | OFF: Borrow flag off<br>ON: Borrow flag on | ○ | ○ | ○ | R |
| SM8022 | Carry | OFF: Carry flag off<br>ON: Carry flag on | ○ | ○ | ○ | R |
| SM8023 | Real time clock access error | SM8023 turns ON at the time of RTC access (reading/writing) error occurrence. | ○ | ○ | ○ | R |
| SM8026 | RAMP mode | OFF: Standard mode<br>ON: RAMP mode | ○ | ○ | ○ | R/W |
| SM8029 | Instruction execution complete | OFF: Instruction execution not complete<br>ON: Instruction execution complete | ○ | ○ | ○ | R |
| SM8031 | Non-latch memory all clear | OFF: Do not clear<br>ON: Non-latch memory all clear | ○ | ○ | ○ | R/W |
| SM8032 | Latch memory all clear | OFF: Do not clear<br>ON: Latch memory all clear | ○ | ○ | ○ | R/W |
| SM8033 | Memory hold stop | OFF: Clear<br>ON: Hold | ○ | ○ | ○ | R/W |
| SM8034 | All output disable | OFF: Normal operation<br>ON: All output disable | ○ | ○ | ○ | R/W |
| SM8039 | Constant scan mode | OFF: Normal operation<br>ON: Constant scan mode | ○ | ○ | ○ | R/W |
| SM8040 | STL: Transfer disable | OFF: Normal operation<br>ON: Transfer disable | ○ | ○ | ○ | R/W |
| SM8041 | STL: Transfer start | Transfer from initial state is enabled in automatic operation mode | ○ | ○ | ○ | R |
| SM8042 | STL: Start pulse | Pulse output is given in response to a start input | ○ | ○ | ○ | R |

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM8043 | STL: Zero return complete | Set this in the last state of zero return mode | ○ | ○ | ○ | R/W |
| SM8044 | STL: Zero point condition | Set this when machine zero return is detected | ○ | ○ | ○ | R/W |
| SM8045 | STL: All output reset disable | Disables the 'all output reset' function when the operation mode is changed | ○ | ○ | ○ | R/W |
| SM8046*1 | STL: STL state ON | ON when SM8047 is ON and any state (S) is active | ○ | ○ | ○ | R |
| SM8047*1 | STL: Enable STL monitoring (SD8040 to SD8047) | SD8040 to SD8047 are enabled when SM8047 is ON | ○ | ○ | ○ | R/W |
| SM8048 | Annunciator ON | ON when SM8049 is ON and any annunciator (F) is ON. | ○ | ○ | ○ | R |
| SM8049 | Enable annunciator monitoring | SD8049 is enabled when SM8049 is ON. | ○ | ○ | ○ | R/W |
| SM8050 to SM8055 | I0 to I5 interrupt disabled (input interrupt) | OFF: Interrupt enabled<br>ON: Interrupt disabled | ○ | ○ | ○ | R/W |
| SM8056 to SM8058 | I28 to I30 interrupt disabled (interrupt from internal timer) | OFF: Interrupt enabled<br>ON: Interrupt disabled | ○ | ○ | ○ | R/W |
| SM8059 | I16 to I23 interrupt disabled (High-speed comparison match interrupt) | OFF: Interrupt enabled<br>ON: Interrupt disabled | ○ | ○ | ○ | R/W |
| SM8063 | Serial communication error 1 (CH1) | OFF: No error<br>ON: Error | ○ | ○ | ○ | R |
| SM8067 | Operation error | OFF: No error<br>ON: Error | ○ | ○ | ○ | R |
| SM8068 | Operation error latch | OFF: No error<br>ON: Error (latch) | ○ | ○ | ○ | R |
| SM8072 | Parallel link operation | OFF: Stopped<br>ON: In normal running state | ○ | ○ | ○ | R |
| SM8090 | Block comparison signal | Block comparison signal ON when all comparison results are ON. | ○ | ○ | ○ | R |
| SM8099 | High-speed ring counter | OFF: High-speed ring counter stop<br>ON: High-speed ring counter start | ○ | ○ | ○ | R/W |
| SM8126 | Global ON (CH1) | Turns ON when the global command is received. | ○ | ○ | ○ | R |
| SM8151 | Inverter communication (CH1) | ON during inverter communication. | ○ | ○ | ○ | R |
| SM8152 | Inverter communication error (CH1) | OFF: No error<br>ON: Error | ○ | ○ | ○ | R |
| SM8153 | Inverter communication error latch (CH1) | OFF: No error<br>ON: Error (latch) | ○ | ○ | ○ | R |
| SM8154 | IVBWR instruction error (CH1) | OFF: No error<br>ON: Error | ○ | ○ | ○ | R |
| SM8156 | Inverter communication (CH2) | ON during inverter communication. | ○ | ○ | ○ | R |
| SM8157 | Inverter communication error (CH2) | OFF: No error<br>ON: Error | ○ | ○ | ○ | R |
| SM8158 | Inverter communication error latch (CH2) | OFF: No error<br>ON: Error (latch) | ○ | ○ | ○ | R |
| SM8159 | IVBWR instruction error (CH2) | OFF: No error<br>ON: Error | ○ | ○ | ○ | R |
| SM8161 | 8 bit operation mode | OFF: 16 bit operation mode<br>ON: 8 bit operation mode | ○ | ○ | ○ | R/W |
| SM8168 | SMOV data mode | BIN→BCD conversion will not be performed, if a SMOV instruction is executed after turning on SM8168. | ○ | ○ | ○ | R/W |
| SM8170 to SM8177 | Input X0 to X7 pulse catch (EI instruction required) | Turns ON when X0 to X7 turn from OFF to ON. | ○ | ○ | ○ | R/W |
| SM8183 | Data communication error (Master station) | OFF: No error<br>ON: Error | ○ | ○ | ○ | R |

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM8184 to SM8190 | Data communication error (Slave station No.1 to No.7) | OFF: No error<br>ON: Error | ○ | ○ | ○ | R |
| SM8191 | Data communication in execution | OFF: Data communication in nonexecution<br>ON: Data communication in execution | ○ | ○ | ○ | R |
| SM8200 to SM8234 | LC0 to LC34 counting direction specification | OFF: Up-counting specification<br>ON: Down-counting specification | ○ | ○ | ○ | R/W |
| SM8246 to SM8255 | LC46 to LC55 counting direction monitoring | OFF: Up-counting specification<br>ON: Down-counting specification | ○ | ○ | ○ | R |
| SM8304 | Zero (MUL, DIV instructions only) | OFF: Zero flag off<br>ON: Zero flag on | ○ | ○ | ○ | R |
| SM8306 | Carry (MUL, DIV instructions only) | OFF: Carry flag off<br>ON: Carry flag on | ○ | ○ | ○ | R |
| SM8312 | RTC clock data loss error | ON when the RTC clock data loss error is occurred. | ○ | ○ | ○ | R |
| SM8328 | Instruction non-execution | Turns ON when the RBFM instruction or WBFM instruction in another step is executed for the same module number. | × | × | ○ | R/W |
| SM8329 | Instruction execution error | OFF: Instruction execution normal<br>ON: Instruction execution error complete | ○ | ○ | ○ | R |
| SM8330 to SM8334 | Timing clock outputs 1 to 5 | DUTY instruction: Timing clock outputs 1 to 5 | ○ | ○ | ○ | R |
| SM8340, SM8350, SM8360 | Axes 1 to 3 pulse output monitor | OFF: Stopped<br>ON: Pulse output | ○ | ○ | ○ | R |
| SM8348, SM8358, SM8368 | Axes 1 to 3 positioning instruction executing | OFF: Positioning instruction not executing<br>ON: Positioning instruction executing | ○ | ○ | ○ | R |
| SM8370 | Axis 4 pulse output monitor | OFF: Stopped<br>ON: Pulse output | ○ | × | ○ | R |
| SM8378 | Axis 4 positioning instruction executing | OFF: Positioning instruction not executing<br>ON: Positioning instruction executing | ○ | × | ○ | R |
| SM8393 | Delay time setting contact | Used for identifying the input interrupt delay function pattern programs. | ○ | ○ | ○ | R/W |
| SM8401, SM8421 | RS2 send wait flag (CH1, CH2)/MODBUS request in process (CH1, CH2) | Turns ON during send wait or MODBUS communication. | ○ | ○ | ○ | R |
| SM8402, SM8422 | MODBUS communication error (CH1, CH2) | OFF: No error<br>ON: Error | ○ | ○ | ○ | R |
| SM8403, SM8423 | MODBUS communication error (latched) (CH1, CH2) | OFF: No error<br>ON: Error (latch) | ○ | ○ | ○ | R |
| SM8404, SM8424 | RS2 carrier detection flag (CH1, CH2)/MODBUS communication mode (CH1, CH2) | Turns ON during carrier detection or listen only mode. | ○ | ○ | ○ | R |
| SM8405, SM8425 | RS2 Data set ready (DSR) flag (CH1, CH2) | OFF: DSR not detected<br>ON: DSR detected | ○ | ○ | ○ | R |
| SM8408, SM8428 | MODBUS retry (CH1, CH2) | OFF: No retry<br>ON: Retry | ○ | ○ | ○ | R |
| SM8409, SM8429 | RS2 time-out check flag (CH1, CH2)/MODBUS timeout (CH1, CH2) | Turns ON when time-out occurs. | ○ | ○ | ○ | R |
| SM8419, SM8439 | Absence/presence of MC protocol (CH1, CH2) | Turns ON when MC protocol is set for serial communication. | ○ | ○ | ○ | R |
| SM8426 | Global ON (CH2) | Turns ON when the global command is received. | ○ | ○ | ○ | R |
| SM8438 | Serial communication error 2 (CH2) | OFF: No error<br>ON: Error | ○ | ○ | ○ | R |
| SM8492 | IP address storage area write request | If OFF to ON, the IP address setting stored in SD8492 to SD8497 will be written in the IP address storage area. | ○ | ○ | ○ | R/W |

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM8493 | IP address storage area write completed | • It turns on, if the write to the IP address storage area is completed. Moreover, it turns on also at the time of the write-in failure.<br>• Turns OFF when IP address storage area write request (SM8492) turns from ON to OFF. | ○ | ○ | ○ | R |
| SM8494 | IP address storage area write error | • Turns ON when writing to IP address storage area is failed.<br>• Turns ON if there is a problem in contents of IP address storage area, when programmable controller power supply is turned from OFF to ON.<br>• Turns OFF when IP address storage area write request (SM8492) turns from ON to OFF. | ○ | ○ | ○ | R |
| SM8495 | IP address storage area clear request | Contents of IP address storage area are cleared when this device turns from OFF to ON. | ○ | ○ | ○ | R/W |
| SM8496 | IP address storage area clear completed | • It turns on, if the clear to the IP address storage area is completed. Moreover, it turns on also at the time of the clear-in failure.<br>• Turns OFF when IP address storage area clear request (SM8495) turns from ON to OFF. | ○ | ○ | ○ | R |
| SM8497 | IP address storage area clear error | • Turns ON when clear to IP address storage area is failed.<br>• Turns OFF when IP address storage area clear request (SM8495) turns from ON to OFF. | ○ | ○ | ○ | R |
| SM8498 | IP address change function enable flag | Turns ON when IP address is changed by IP address change function. | ○ | ○ | ○ | R |

*1 Enabled only when the STL instruction is used.

## LC□ count direction monitor

This is the device to monitor the directions of the counters from LC46 to LC55 when the FX3 compatible high-speed counter is used.

### ■Operation description

The content of the operation when ON and when OFF is as follows.

| Operation when ON | Operation when OFF |
|---|---|
| High-speed counter counting in direction whereby current value is reduced (Down-counting) | High-speed counter counting in direction whereby current value is increased (Up-counting) |

### ■Update timing

The timing of device update is as follows.

| ON | OFF |
|---|---|
| • Down-counting (This is updated with the END processing. When the FX3 compatible high-speed counter function is valid, the updating is made also when UDCNTF instruction is executed ON.) | • Up-counting (This is updated with the END processing. When the FX3 compatible high-speed counter function is valid, the updating is made also when UDCNTF instruction is executed ON.)<br>• Power ON, reset<br>• STOP/PAUSE→RUN |

# Serial communication function

The special relays for the serial communication function are shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC*1 | |
| SM8500 | Serial communication error (CH1) | OFF: No error<br>ON: Error | × | × | ○ | R |
| SM8503 | Absence/presence of MC protocol (CH1) | Turns ON when MC protocol is set for serial communication. | × | × | ○ | R |
| SM8510, SM8520, SM8530 | Serial communication error (CH2 to CH4) | OFF: No error<br>ON: Error | ○ | ○ | ○ | R |
| SM8513, SM8523, SM8533 | Absence/presence of MC protocol (CH2 to CH4) | Turns ON when MC protocol is set for serial communication. | × | × | ○ | R |
| SM8560 | Data transfer delayed (CH1) | This device remains ON while the programmable controller is waiting to send. | × | × | ○ | R |
| SM8561 | Data transfer flag (CH1) | When this device is set to ON, the programmable controller starts to send. | × | × | ○ | R/W |
| SM8562 | Receive completion flag (CH1) | This device turns ON when receiving is completed. | × | × | ○ | R |
| SM8563 | Carrier detection flag (CH1) | This device turns ON in synchronization with the CD (DCD) signal. | × | × | ○ | R |
| SM8564 | Data set ready flag (CH1) | This device turns ON in synchronization with the DR (DSR) signal. | × | × | ○ | R |
| SM8565 | Time-out check flag (CH1) | This device turns ON when data receiving is suspended and the next set of receive data is not given within the time set by the time-out time setting device. | × | × | ○ | R |
| SM8570, SM8580, SM8590 | Data transfer delayed (CH2 to CH4) | This device remains ON while the programmable controller is waiting to send. | ○ | ○ | ○ | R |
| SM8571, SM8581, SM8591 | Data transfer flag (CH2 to CH4) | When this device is set to ON, the programmable controller starts to send. | ○ | ○ | ○ | R/W |
| SM8572, SM8582, SM8592 | Receive completion flag (CH2 to CH4) | This device turns ON when receiving is completed. | ○ | ○ | ○ | R |
| SM8573, SM8583, SM8593 | Carrier detection flag (CH2 to CH4) | This device turns ON in synchronization with the CD (DCD) signal. | ○ | ○ | ○ | R |
| SM8574, SM8584, SM8594 | Data set ready flag (CH2 to CH4) | This device turns ON in synchronization with the DR (DSR) signal. | ○ | ○ | ○ | R |
| SM8575, SM8585, SM8595 | Time-out check flag (CH2 to CH4) | This device turns ON when data receiving is suspended and the next set of receive data is not given within the time set by the time-out time setting device. | ○ | ○ | ○ | R |
| SM8680 | Global ON (CH1) | Turns ON when the global command is received. | × | × | ○ | R |
| SM8690, SM8700, SM8710 | Global ON (CH2 to CH4) | Turns ON when the global command is received. | ○ | ○ | ○ | R |
| SM8740 | Station No. setting SD latch enabled (CH1) | OFF: Latch disabled<br>ON: Latch enabled | × | × | ○ | R |
| SM8750, SM8760, SM8770 | Station No. setting SD latch enabled (CH2 to CH4) | OFF: Latch disabled<br>ON: Latch enabled | ○ | ○ | ○ | R |
| SM8800 | MODBUS RTU communication (CH1) | OFF: Communication stop<br>ON: Communication | × | × | ○ | R |
| SM8801 | Retry (CH1) | OFF: No retry<br>ON: Retry | × | × | ○ | R |
| SM8802 | Timeout (CH1) | OFF: No timeout<br>ON: Timeout | × | × | ○ | R |
| SM8810, SM8820, SM8830 | MODBUS RTU communication (CH2 to CH4) | OFF: Communication stop<br>ON: Communication | ○ | ○ | ○ | R |
| SM8811, SM8821, SM8831 | Retry (CH2 to CH4) | OFF: No retry<br>ON: Retry | ○ | ○ | ○ | R |

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC*1 | |
| SM8812, SM8822, SM8832 | Timeout (CH2 to CH4) | OFF: No timeout<br>ON: Timeout | ○ | ○ | ○ | R |
| SM8861 | Host station No. setting SD latch enabled (CH1) | OFF: Latch disabled<br>ON: Latch enabled | × | × | ○ | *2 |
| SM8871, SM8881, SM8891 | Host station No. setting SD latch enabled (CH2 to CH4) | OFF: Latch disabled<br>ON: Latch enabled | ○ | ○ | ○ | *2 |
| SM8920 | Inverter communication (CH1) | OFF: Communication stop<br>ON: Communication | × | × | ○ | R |
| SM8921 | IVBWR instruction error (CH1) | OFF: No error<br>ON: Error | × | × | ○ | R |
| SM8930, SM8940, SM8950 | Inverter communication (CH2 to CH4) | OFF: Communication stop<br>ON: Communication | ○ | ○ | ○ | R |
| SM8931, SM8941, SM8951 | IVBWR instruction error (CH2 to CH4) | OFF: No error<br>ON: Error | ○ | ○ | ○ | R |
| SM9040 | Data communication error (Master station) | OFF: No error<br>ON: Error | ○ | ○ | ○ | R |
| SM9041 to SM9047 | Data communication error (Slave station No.1 to No.7) | OFF: No error<br>ON: Error | ○ | ○ | ○ | R |
| SM9056 | Data communication in execution | OFF: Data communication in nonexecution<br>ON: Data communication in execution | ○ | ○ | ○ | R |
| SM9080 | Station No. setting SD latch enabled | OFF: Latch disabled<br>ON: Latch enabled | ○ | ○ | ○ | R |
| SM9081 | Slave station total number setting SD latch enabled | OFF: Latch disabled<br>ON: Latch enabled | ○ | ○ | ○ | R |
| SM9090 | Parallel link operation | OFF: Stopped<br>ON: In normal running state | ○ | ○ | ○ | R |

*1 CH2 devices for serial communication are not supported by FX5UC CPU module.

*2 Varies according to the GX Works3 latch setting.
R if the latch setting is disabled because the module operates according to the value set for the GX Works3 parameter.
R/W if the latch setting is enabled.
· The special relay is ON: The module operates according to the value set for the special register.
· The special relay is OFF: The module operates according to the value set for the GX Works3 parameter.

# Extended file register function

The special relays for extended file register function are shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SM9366 | Extended file register (ER) access flag | Turns ON while the extended file register (ER) is being accessed. | ○ | ○ | ○ | R |

# Appendix 2 Special Register List

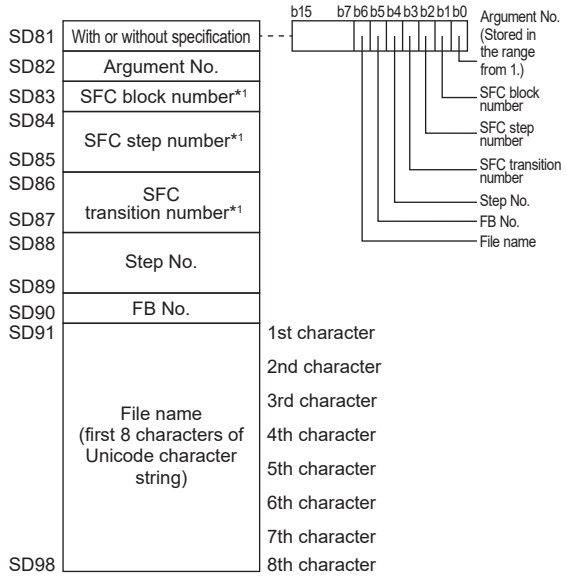
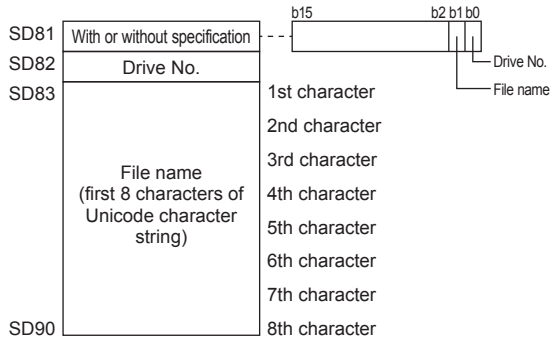
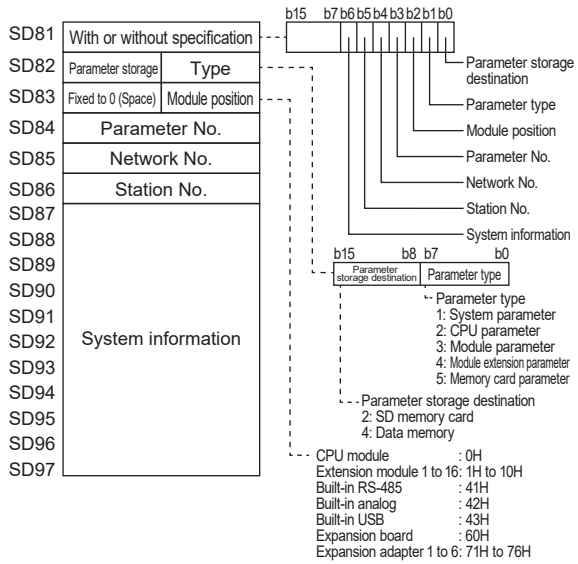
The following table shows items in the list for special registers (SD).

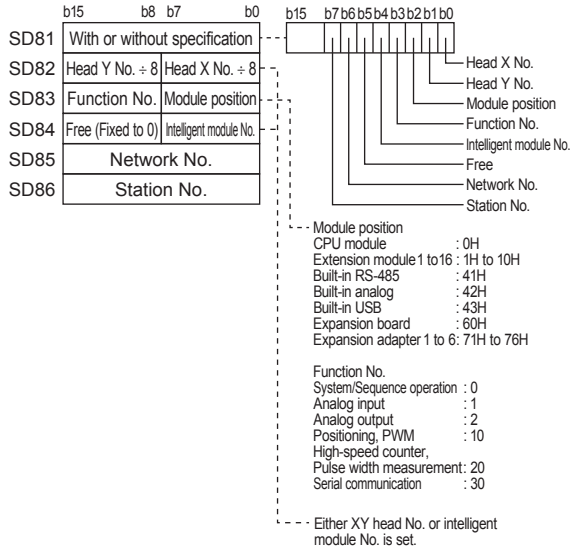
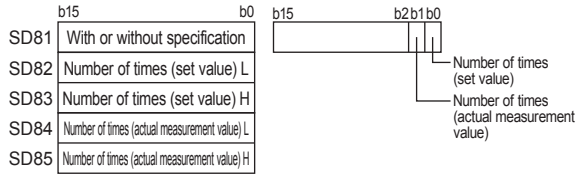
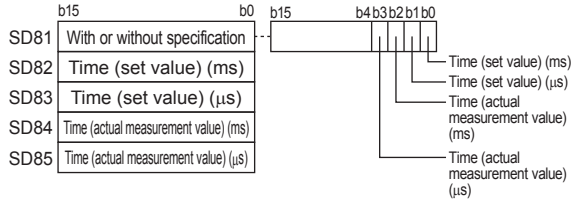
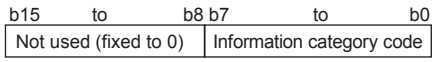
| Item | Description |
|---|---|
| No. | Special register number |
| Name | Special register name |
| Description | Data stored in the special register |
| Compatible CPU module | Shows CPU modules that support the special register. The support status is represented by the following symbols.<br>• ○: Supported<br>• ×: Not supported |
| R/W | The following symbols show whether the special register can be read/written.<br>• R: Read-only<br>• W: Write-only<br>• R/W: Read/Write |

## Diagnostic information

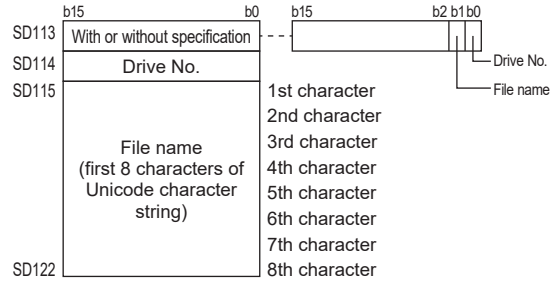
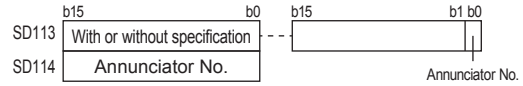
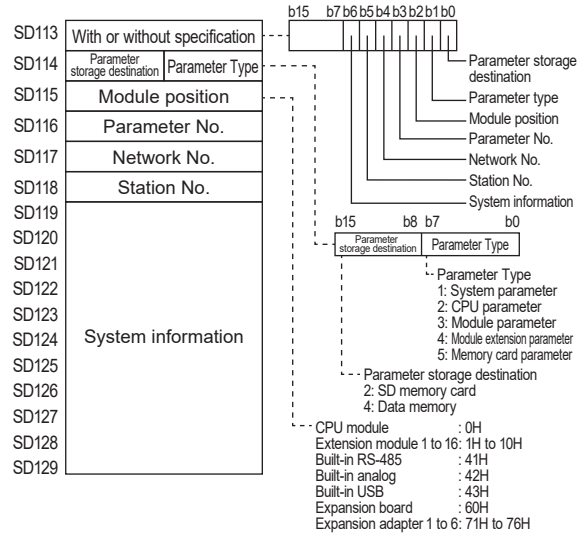
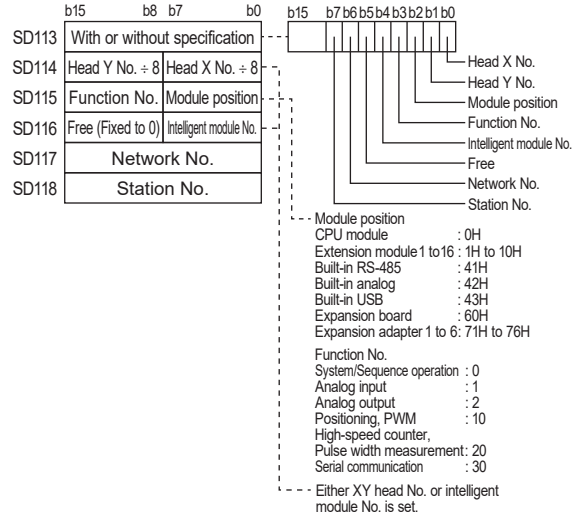
The special registers for diagnostic information are shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD0 | Latest self diagnostics error code | This register stores the latest self-diagnosis error code. | ○ | ○ | ○ | R |
| SD1 | Clock time for self-diagnostics error occurrence (Year) | This register stores the latest self-diagnosis error time (Year). | ○ | ○ | ○ | R |
| SD2 | Clock time for self-diagnostics error occurrence (Month) | This register stores the latest self-diagnosis error time (Month). | ○ | ○ | ○ | R |
| SD3 | Clock time for self-diagnostics error occurrence (Day) | This register stores the latest self-diagnosis error time (Day). | ○ | ○ | ○ | R |
| SD4 | Clock time for self-diagnostics error occurrence (Hour) | This register stores the latest self-diagnosis error time (Hour). | ○ | ○ | ○ | R |
| SD5 | Clock time for self-diagnostics error occurrence (Minute) | This register stores the latest self-diagnosis error time (Minute). | ○ | ○ | ○ | R |
| SD6 | Clock time for self-diagnostics error occurrence (Second) | This register stores the latest self-diagnosis error time (Second). | ○ | ○ | ○ | R |
| SD7 | Clock time for self-diagnostics error occurrence (Day Week) | This register stores the latest self-diagnosis error time (Day Week). | ○ | ○ | ○ | R |
| SD10 to SD25 | Self-diagnostics error code 1 to 16 | These registers store the self-diagnosis error code. | ○ | ○ | ○ | R |
| SD53 | The number of AC/DC DOWN detections | This register stores the number of times of momentary power failure. | × | ○ | ○ | R |
| SD61 | I/O Module Verify Error Module No. | This register stores the I/O module verify error module No. | × | ○ | ○ | R |
| SD62 | Annunciator (F) Detection No. | This register stores the earliest detected annunciator (F) No. | ○ | ○ | ○ | R |
| SD63 | Annunciator (F) Detection Number | This register stores the number of annunciator (F) detections. | ○ | ○ | ○ | R |
| SD64 to SD79 | Annunciator (F) Detection No. table | This register stores the annunciator (F) detection No. | ○ | ○ | ○ | R |
| SD80 | Detailed information 1 information category | • Detailed information 1 information category code is stored.<br>b15 to b8 b7 to b0<br>Not used (fixed to 0) \| Information category code<br>• The following codes are stored into the information category code.<br>0: N/A<br>1: Program position information<br>2: Drive number and file name<br>4: Parameter information<br>5: System configuration information<br>6: Number of times information<br>7: Time information | ○ | ○ | ○ | R |

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD81 to SD111 | Detailed information 1 | • Detailed information 1 corresponding to the error code (SD0) is stored.<br>• There are six types of information to be stored as shown in the following figures.<br>• The type of detailed information 1 can be obtained using SD80 (the value of the "Detailed information 1 information category code" stored in SD80 corresponds to the following figures (1), (2), (4) to (7)).<br>(1) Program location information<br>  <br><br>(2) Drive number and file name<br>  <br><br>(4) Parameter information<br>  <br> | ○ | ○ | ○ | R |

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD81 to SD111 | Detailed information 1 | (5) System configuration information<br>  <br><br>(6) Number of times information<br>  <br><br>(7) Time information<br>  <br> | ○ | ○ | ○ | R |
| SD112 | Detailed information 2 information category | • Detailed information 2 information category code is stored.<br>  <br><br>• The following codes are stored into the information category code.<br>0: N/A<br>2: Drive number and file name<br>3: Annunciator number<br>4: Parameter information<br>5: System configuration information | ○ | ○ | ○ | R |

A

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD113 to SD143 | Detailed information 2 | • Detailed information 2 corresponding to the error code (SD0) is stored.<br>• There are four types of information to be stored as shown in the following figures.<br>• The type of detailed information 2 can be obtained using SD112 (the value of the "Detailed information 2 information category code" stored in SD112 corresponds to the following figures (2) to (5)).<br>(2) Drive number and file name<br>  <br><br>(3) Annunciator number<br>  <br><br>(4) Parameter information<br>  <br><br>(5) System configuration information<br>  <br> | ○ | ○ | ○ | R |

*1 Fixed to 0 if the SFC program is not used.

# System information

The special registers for system information are shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD200 | Switch Status | This register stores the CPU switch status.<br>0: RUN<br>1: STOP | ○ | ○ | ○ | R |
| SD201 | LED Status | This register stores the LED status.<br>b2: ERR lit<br>b3: ERR flashing<br>b4: P.RUN<br>b5: PAUSE<br>b9: BAT flashing<br>b12: SD memory card available or not removable<br>b13: Preparing SD memory card | ○ | ○ | ○ | R |
| SD203 | CPU Status | This register stores the CPU Status.<br>0: RUN<br>2: STOP<br>3: PAUSE | ○ | ○ | ○ | R |
| SD210 | Clock Data (Year) | This register stores the clock data (Year). | ○ | ○ | ○ | R/W |
| SD211 | Clock Data (Month) | This register stores the clock data (Month). | ○ | ○ | ○ | R/W |
| SD212 | Clock Data (Day) | This register stores the clock data (Day). | ○ | ○ | ○ | R/W |
| SD213 | Clock Data (Hour) | This register stores the clock data (Hour). | ○ | ○ | ○ | R/W |
| SD214 | Clock Data (Minute) | This register stores the clock data (Minute). | ○ | ○ | ○ | R/W |
| SD215 | Clock Data (Second) | This register stores the clock data (Second). | ○ | ○ | ○ | R/W |
| SD216 | Clock Data (Day Week) | This register stores the clock data (Day of the Week). | ○ | ○ | ○ | R/W |
| SD218 | Time zone setting value | The time zone setting value specified in the parameter is stored in increments of minutes. | ○ | ○ | ○ | R |
| SD250 | Loaded Max I/O | This register stores high-order 2 digits of the final I/O number of connected modules +1 in 8-bit binary. | ○ | ○ | ○ | R |
| SD260 | X Device Size [Lower] | This register stores the number of X device points used as 32-bit value. | ○ | ○ | ○ | R |
| SD261 | X Device Size [Upper] | | | | | |
| SD262 | Y Device Size [Lower] | This register stores the number of Y device points used as 32-bit value. | ○ | ○ | ○ | R |
| SD263 | Y Device Size [Upper] | | | | | |
| SD264 | M Device Size [Lower] | This register stores the number of M device points used as 32-bit value. | ○ | ○ | ○ | R |
| SD265 | M Device Size [Upper] | | | | | |
| SD266 | B Device Size [Lower] | This register stores the number of B device points used as 32-bit value. | ○ | ○ | ○ | R |
| SD267 | B Device Size [Upper] | | | | | |
| SD268 | SB Device Size [Lower] | This register stores the number of SB device points used as 32-bit value. | ○ | ○ | ○ | R |
| SD269 | SB Device Size [Upper] | | | | | |
| SD270 | F Device Size [Lower] | This register stores the number of F device points used as 32-bit value. | ○ | ○ | ○ | R |
| SD271 | F Device Size [Upper] | | | | | |
| SD274 | L Device Size [Lower] | This register stores the number of L device points used as 32-bit value. | ○ | ○ | ○ | R |
| SD275 | L Device Size [Upper] | | | | | |
| SD280 | D Device Size [Lower] | This register stores the number of D device points used as 32-bit value. | ○ | ○ | ○ | R |
| SD281 | D Device Size [Upper] | | | | | |
| SD282 | W Device Size [Lower] | This register stores the number of W device points used as 32-bit value. | ○ | ○ | ○ | R |
| SD283 | W Device Size [Upper] | | | | | |
| SD284 | SW Device Size [Lower] | This register stores the number of SW device points used as 32-bit value. | ○ | ○ | ○ | R |
| SD285 | SW Device Size [Upper] | | | | | |
| SD288 | T Device Size [Lower] | This register stores the number of T device points used as 32-bit value. | ○ | ○ | ○ | R |
| SD289 | T Device Size [Upper] | | | | | |

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD290 | ST Device Size [Lower] | This register stores the number of ST device points used as 32-bit value. | ○ | ○ | ○ | R |
| SD291 | ST Device Size [Upper] | | | | | |
| SD292 | C Device Size [Lower] | This register stores the number of C device points used as 32-bit value. | ○ | ○ | ○ | R |
| SD293 | C Device Size [Upper] | | | | | |
| SD298 | LC Device Size [Lower] | This register stores the number of LC device points used as 32-bit value. | ○ | ○ | ○ | R |
| SD299 | LC Device Size [Upper] | | | | | |
| SD300 | Z Device Size | This register stores the number of Z device points used. | ○ | ○ | ○ | R |
| SD302 | LZ Device Size | This register stores the number of LZ device points used. | ○ | ○ | ○ | R |
| SD304 | R Device Size [Lower] | This register stores the number of R device points used as 32-bit value. | ○ | ○ | ○ | R |
| SD305 | R Device Size [Upper] | | | | | |

# SFC information

The special register for SFC information is shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD329 | Online change (SFC block) target block No. | • The target SFC block number is stored during online change (SFC block) (SM329=ON).<br>• FFFFH is stored if there is no online change (SFC block). | ○ | ○ | ○ | R |

# System clock

The special registers for system clock are shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD412 | One second counter | • This register is incremented by 1 for each second after the CPU module is set to RUN.<br>• A counting cycle from 0 to 32767 to -32768 to 0 is repeated. | ○ | ○ | ○ | R |
| SD414 | 2n second clock setting | • Stores value n of 2n second clock (Default: 30).<br>• Setting can be made between 1 and 32767. | ○ | ○ | ○ | R/W |
| SD415 | 2nms second clock setting | • Stores value n of 2n ms clock (Default: 30).<br>• Setting can be made between 1 and 32767. | ○ | ○ | ○ | R/W |
| SD420 | Scan counter | • This register is incremented by 1 each scan after the CPU module is set to RUN. (Not incremented for each scan of an initial execution type program.)<br>• A counting cycle from 0 to 32767 to -32768 to 0 is repeated. | ○ | ○ | ○ | R |

# Scan information

The special registers for scan information are shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD518 | Initial scan time (ms) | • The initial scan time is stored into SD518 and SD519 (it is measured in increments of μs).<br>SD518: stores a value in the ms place (storage range: 0 to 65535)<br>SD519: stores a value in the μs place (storage range: 0 to 999)<br>• This register is cleared to 0 when the mode transfers from STOP to RUN mode. | ○ | ○ | ○ | R |
| SD519 | Initial scan time (μs) | | ○ | ○ | ○ | R |
| SD520 | Current scan time (ms) | • The current scan time is stored into SD520 and SD521 (it is measured in increments of μs).<br>SD520: stores a value in the ms place (storage range: 0 to 65535)<br>SD521: stores a value in the μs place (storage range: 0 to 999)<br>Example: If the current scan time is 23.6ms, the following values are stored:<br>SD520 = 23<br>SD521 = 600<br>• This register is cleared to 0 at STOP or PAUSE mode. | ○ | ○ | ○ | R |
| SD521 | Current scan time (μs) | | ○ | ○ | ○ | R |
| SD522 | Minimum scan time (ms) | • The minimum value of the scan time other than that of the initial execution program is stored into SD522 and SD523 (it is measured in increments of μs).<br>SD522: stores a value in the ms place (storage range: 0 to 65535)<br>SD523: stores a value in the μs place (storage range: 0 to 999)<br>• This register is cleared to 0 when the mode transfers from STOP to RUN mode. | ○ | ○ | ○ | R |
| SD523 | Minimum scan time (μs) | | ○ | ○ | ○ | R |
| SD524 | Maximum scan time (ms) | • The maximum value of the scan time other than that of the initial execution program is stored into SD524 and SD525 (it is measured in increments of μs).<br>SD524: stores a value in the ms place (storage range: 0 to 65535)<br>SD525: stores a value in the μs place (storage range: 0 to 999)<br>• This register is cleared to 0 when the mode transfers from STOP to RUN mode. | ○ | ○ | ○ | R |
| SD525 | Maximum scan time (μs) | | ○ | ○ | ○ | R |
| SD526 | END processing time (ms) | • The time period from completion of a scan program until start of the next scan is stored into SD526 to SD527 (it is measured in increments of μs).<br>SD526: stores a value in the ms place (storage range: 0 to 65535)<br>SD527: stores a value in the μs place (storage range: 0 to 999)<br>• This register is cleared to 0 when the mode transfers from STOP to RUN mode. | ○ | ○ | ○ | R |
| SD527 | END processing time (μs) | | ○ | ○ | ○ | R |
| SD528 | Constant scan waiting time (ms) | • The waiting time specified in the constant scan setting process is stored into SD528 and SD529 (it is measured in increments of μs).<br>SD528: stores a value in the ms place (storage range: 0 to 65535)<br>SD529: stores a value in the μs place (storage range: 0 to 999)<br>• This register is cleared to 0 when the mode transfers from STOP to RUN mode. | ○ | ○ | ○ | R |
| SD529 | Constant scan waiting time (μs) | | ○ | ○ | ○ | R |

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| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD530 | Scan program execution time (ms) | • The execution time of the scan program for one scan is stored into SD530 and SD531 (it is measured in increments of μs).<br>SD530: stores a value in the ms place (storage range: 0 to 65535)<br>SD531: stores a value in the μs place (storage range: 0 to 999)<br>• This register is cleared to 0 when the mode transfers from STOP to RUN mode. | ○ | ○ | ○ | R |
| SD531 | Scan program execution time (μs) | | ○ | ○ | ○ | R |

# Drive information

The special registers for drive information are shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD600 | SD memory card mounting status | This register stores the enable/disable classification of the inserted SD card. | ○ | ○ | ○ | R |
| SD604 | SD memory card usage status | The usage status of the SD memory card is stored using the following bit pattern. (On indicates being used.)<br>b0: Event history<br>b1 to b15: Not used | ○ | ○ | ○ | R |
| SD606 | SD memory card capacity: Least significant byte | This register stores the drive 2 storage capacity (unit: 1 K byte). (Free space value after formatting is stored.) | ○ | ○ | ○ | R |
| SD607 | SD memory card capacity: Lower byte | This register stores the drive 2 storage capacity (unit: 1 K byte). (Free space value after formatting is stored.) | ○ | ○ | ○ | R |
| SD608 | SD memory card capacity: Upper byte | This register stores the drive 2 storage capacity (unit: 1 K byte). (Free space value after formatting is stored.) | ○ | ○ | ○ | R |
| SD609 | SD memory card capacity: Most significant byte | This register stores the drive 2 storage capacity (unit: 1 K byte). (Free space value after formatting is stored.) | ○ | ○ | ○ | R |
| SD610 | SD memory card free space capacity: Least significant byte | This register stores the free space value in drive 2 (unit: 1 K byte). | ○ | ○ | ○ | R |
| SD611 | SD memory card free space capacity: Lower byte | This register stores the free space value in drive 2 (unit: 1 K byte). | ○ | ○ | ○ | R |
| SD612 | SD memory card free space capacity: Upper byte | This register stores the free space value in drive 2 (unit: 1 K byte). | ○ | ○ | ○ | R |
| SD613 | SD memory card free space capacity: Most significant byte | This register stores the free space value in drive 2 (unit: 1 K byte). | ○ | ○ | ○ | R |
| SD634 | Index for the number of data memory write operations | Stores an index for the number of write operations to data memory currently. However, the index does not equal the actual number of write operations. | ○ | ○ | ○ | R |
| SD635 | | | | | | |

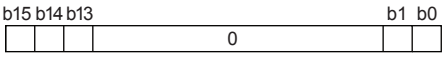
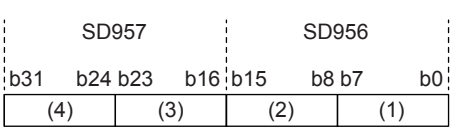
# Instruction related

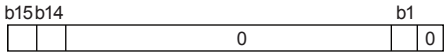
The special registers related to instruction execution are shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD757 | Current interrupt priority | This register stores the interrupt priority of the interrupt program being executed.<br>1 to 3: Priority for the interrupt pointer of the interrupt program currently being executed<br>0: No interrupt operation (default) | ○ | ○ | ○ | R |
| SD758 | Interrupt disabling for each priority setting value | This register stores the disable interrupt priority according to the disable interrupt instruction (DI), disable interrupt after the setting priority instruction (DI), and enable interrupt instruction (EI).<br>1: Disable interrupt priority 1 or less. (Disable interrupts of all priorities) (default value)<br>2: Disable interrupt priority 2 or 3.<br>3: Disable interrupt priority 3.<br>0: No priority. (Enable interrupt of all priority) | ○ | ○ | ○ | R |
| SD771 | Specification of the number of write instruction executions to data memory | This register stores the setting value of limitation in the number of write operations in one day by instruction executions. | ○ | ○ | ○ | R/W |

# Latch area

The special registers for latch area are shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD953 | Backup error cause | The cause of the error that occurred during the data backup is stored.<br>• 0: No error<br>• Other than 0: Error code<br>"0" is set at the start of the data backup. | ○ | ○ | ○ | R |
| SD954 | Restoration target data setting | Set the target data to be restored with the data restoration function.<br>0: All the target data<br>1: Device/label data only<br>2: All target data excluding device/label data | ○ | ○ | ○ | R/W |
| SD955 | Restoration function setting | Set the data restoration function using the following bit pattern. (OFF: Disabled, ON: Enabled)<br>  <br>b0: Auto restoration request<br>b1: Initialization setting at the automatic restoration<br>b13: Restoration target folder<br>b14: Restoration for the special relay and special register<br>b15: Setting of operation after restoration | ○ | ○ | ○ | R/W |
| SD956<br>SD957 | Restoration target date folder setting | Store the target folder (date folder) of the data restoration using BCD code.<br>  <br>(1) Day (1 to 31)<br>(2) Month (1 to 12)<br>(3) Year (last two digits) (0 to 99)<br>(4) Year (first two digits) (0 to 99)<br>[Example] To specify the date folder of June 15 2015, store "20150615H". | ○ | ○ | ○ | R/W |
| SD958 | Restoration target number folder setting | Specify the target folder of the data restoration.<br>1 to 32767: Serial number of the backup folder (*****) in a date folder (00001 to 32767) | ○ | ○ | ○ | R/W |

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD959 | Restoration error cause | The cause of the error that occurred during the data restoration is stored.<br>• 0: No error<br>• Other than 0: Error code<br>"0" is set at the start of the data backup. | ○ | ○ | ○ | R |
| SD9350 | Operation mode setting | Set the operation mode of backup.<br>0: Normal Mode<br>1: CPU module auto exchange mode (Deleting existing data)<br>2: CPU module auto exchange mode (Holding existing data) | ○ | ○ | ○ | R/W |
| SD9351 | CPU module automatic replacement function Restore target data setting | Set the target data restored with the CPU module auto exchange function.<br>0: Device/label data only<br>1: All the target data<br>2: All target data excluding device/label data | ○ | ○ | ○ | R/W |
| SD9352 | CPU module auto exchange function setting | Set the target data restored with the CPU module auto exchange function.<br>  <br><br>b1: Initialize during CPU module auto exchange function<br>b14: Restoration for the special relay and special register (CPU module auto exchange function)<br>b15: Setting of operation after CPU module auto exchange function | ○ | ○ | ○ | R/W |

# Data logging function

The special registers for data logging function are shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD1203 | Data logging file transfer stop information | Use a bit pattern to specify the setting number to stop logging file transfer.<br>b0: Setting No.1<br>b1: Setting No.2<br>b2: Setting No.3<br>b3: Setting No.4 | ○ | ○ | ○ | R/W |
| SD1210 | Data logging setting No.1 Latest storage file number [Low-order] | This register stores the latest storage file number. | ○ | ○ | ○ | R |
| SD1211 | Data logging setting No.1 Latest storage file number [High-order] | | | | | |
| SD1212 | Data logging setting No.1 Oldest storage file number [Low-order] | This register stores the oldest storage file number. | ○ | ○ | ○ | R |
| SD1213 | Data logging setting No.1 Oldest storage file number [High-order] | | | | | |
| SD1214 | Data logging setting No.1 Internal buffer free space | This register stores the free space size of the internal buffer (K bytes). | ○ | ○ | ○ | R |
| SD1215 | Data logging setting No.1 Number of processing overflow occurrences | This register stores the number of processing overflow occurrences. | ○ | ○ | ○ | R |
| SD1216 | Data logging setting No.1 Data logging error cause | This register stores the data logging error cause.<br>0: No error<br>Other than 0: Error code | ○ | ○ | ○ | R |
| SD1220 to SD1226 | Data logging setting No.2 | Same configuration as the setting No.1 | ○ | ○ | ○ | R |
| SD1230 to SD1236 | Data logging setting No.3 | Same configuration as the setting No.1 | ○ | ○ | ○ | R |
| SD1240 to SD1246 | Data logging setting No.4 | Same configuration as the setting No.1 | ○ | ○ | ○ | R |
| SD9300 to SD9303 | Data logging setting No.1 to 4 Data logging register/clear error code | The cause of the error that occurred when SM9300 to SM9303 (Data logging register/clear flag) is ON (register)/OFF (clear) is stored.<br>0: No error<br>Other than 0: Error code | ○ | ○ | ○ | R/W |

# Data backup/restoration function

The special registers for data backup/restoration function are shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD1350 | Number of uncompleted folders/files of CPU module data backup/restoration | This register indicates the number of folders/files where the backup/restoration of the CPU module is not completed. When the backup/ restoration processing is started, the total number of folders and files to be backed up or restored is stored. The number is reduced one each time one folder/file is backed up or restored, and 0 is stored when all the data is backed up or restored. | ○ | ○ | ○ | R |
| SD1351 | Progression status of CPU module data backup/ restoration | This register indicates the progression status of the backup or restoration as a percentage. (Range of the value: 0 to 100 (%)) "0" is set at the start of CPU module data backup/restore. | ○ | ○ | ○ | R |

# Mask pattern of interrupt pointers

The special registers for the mask pattern of interrupt pointers are shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD1400 | IMASK instruction mask pattern | This register stores the IMASK instruction mask pattern. b15 to b0: I15 to I0 | ○ | ○ | ○ | R |
| SD1401 | IMASK instruction mask pattern | This register stores the IMASK instruction mask pattern. b15 to b0: I31 to I16 | ○ | ○ | ○ | R |
| SD1402 | IMASK instruction mask pattern | This register stores the IMASK instruction mask pattern. b15 to b0: I47 to I32 | × | ○ | ○ | R |
| SD1403 | IMASK instruction mask pattern | This register stores the IMASK instruction mask pattern. b15 to b0: I63 to I48 | × | ○ | ○ | R |
| SD1404 | IMASK instruction mask pattern | This register stores the IMASK instruction mask pattern. b15 to b0: I79 to I64 | × | ○ | ○ | R |
| SD1405 | IMASK instruction mask pattern | This register stores the IMASK instruction mask pattern. b15 to b0: I95 to I80 | × | ○ | ○ | R |
| SD1406 | IMASK instruction mask pattern | This register stores the IMASK instruction mask pattern. b15 to b0: I111 to I96 | × | ○ | ○ | R |
| SD1407 | IMASK instruction mask pattern | This register stores the IMASK instruction mask pattern. b15 to b0: I127 to I112 | × | ○ | ○ | R |
| SD1408 | IMASK instruction mask pattern | This register stores the IMASK instruction mask pattern. b15 to b0: I143 to I128 | × | ○ | ○ | R |
| SD1409 | IMASK instruction mask pattern | This register stores the IMASK instruction mask pattern. b15 to b0: I159 to I144 | × | ○ | ○ | R |
| SD1410 | IMASK instruction mask pattern | This register stores the IMASK instruction mask pattern. b15 to b0: I175 to I160 | × | ○ | ○ | R |
| SD1411 | IMASK instruction mask pattern | This register stores the IMASK instruction mask pattern. b15 to b0: I191 to I176 | × | ○ | ○ | R |

# Memory dump function

The special registers for memory dump function are shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD1472 | Memory dump error cause | The cause of the error that occurred during the memory dump function is stored.<br>0: No error<br>Other than 0: Error code | ○ | ○ | ○ | R/W |

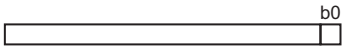
# Real-time monitor function

The special registers for real-time monitor function are shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD1484 | Real-time monitor internal buffer free space | The amount of free space of the internal buffer is stored in K bytes.<br>The smaller the value, the higher the generating ratio of processing overflow. | ○ | ○ | ○ | R |

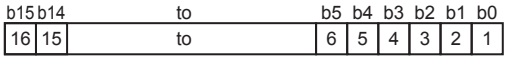
# External input/output forced on/off function

The special registers for the external input/output forced on/off function are shown below.

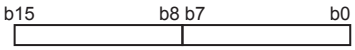
| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD1488 | Debug function usage status | The usage status of the debug function is stored using the following bit pattern.<br>  <br>• b0: External input/output forced on/off function<br>Off: Not used<br>On: In use | ○ | ○ | ○ | R |

# CC-Link IE Field Network Basic function

The special registers for CC-Link IE Field Network Basic function are shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD1536 | Cyclic transmission status of each station | The cyclic transmission status of each station is stored using the following bit pattern. (OFF: Not performed, ON: Being performed)<br>  <br>The numbers in the figure indicate station numbers.*1<br>(Condition)<br>• Only the bit of the start station number turns on.<br>• The status is not stored for the reserved stations and the station numbers after the maximum station number.<br>Use this register as an interlock for cyclic transmission. For details on the interlock program, refer to the following.<br>CC-Link IE Field Network Basic Reference Manual | ○ | ○ | ○ | R |

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD1540 | Data link status for each station | The data link status of each station is stored using the following bit pattern. (Off: Normally operating station[*2], On: Faulty station)<br>b15 b14 to b5 b4 b3 b2 b1 b0<br>16 15 to 6 5 4 3 2 1<br>The numbers in the figure indicate station numbers.[*1]<br>(Condition)<br>• Only the bit of the start station number turns on.<br>• The status is not stored for the reserved stations and the station numbers after the maximum station number.<br>This register can be used to monitor errors in remote stations, connected cables, and a connected hub. | ○ | ○ | ○ | R |
| SD9400 | CC-Link IE Field Network Basic communication interval setting | This register stores CC-Link IE Field Network Basic communication interval setting.<br>Range: 20 to 1000 (ms) | ○ | ○ | ○ | R/W |
| SD11100 | Total number of connected stations | The total number of connected stations set in parameter is stored.<br>Range: 1 to 16[*1] | ○ | ○ | ○ | R |
| SD11101 | Reserved station specification status | The reserved station specification status of the remote station specified in parameter is stored. (0: Not specified, 1: Specified)<br>b0<br>b0: Reserved station specification status<br>b1 to b15: Empty (fixed to 0)<br>The station number that is specified as a reserved station can be checked in 'Reserved station specification status of each station' (SD11102). | ○ | ○ | ○ | R |
| SD11102 | Reserved station specification status of each station | The reserved station specification status is stored using the following bit pattern. (Off: Other than the reserved station, On: Reserved station)<br>b15 b14 to b5 b4 b3 b2 b1 b0<br>16 15 to 6 5 4 3 2 1<br>The numbers in the figure indicate station numbers.[*1]<br>(Condition)<br>• Only the bit of the start station number turns on.<br>• The status is not stored for the station numbers after the maximum station number. | ○ | ○ | ○ | R |
| SD11106 | Maximum link scan (unit: ms) | The maximum link scan time value during cyclic transmission is stored. (Unit: ms) | ○ | ○ | ○ | R |
| SD11107 | Minimum link scan (unit: ms) | The minimum link scan time value during cyclic transmission is stored. (Unit: ms) | ○ | ○ | ○ | R |
| SD11108 | Current link scan (unit: ms) | The current link scan time value during cyclic transmission is stored. (Unit: ms) | ○ | ○ | ○ | R |
| SD11126 | Diagnostic information display request | After the END instruction of the scan where the bit 0 is turned off and on is executed, the diagnostic information of a remote station specified in 'Diagnostic request information' (SD11127) is read to SD11128 to SD11153.<br>When reading of the diagnostic information has completed at END processing, 0 is stored.<br>b0<br>b0: Diagnostic information display request<br>b1 to b15: Empty (fixed to 0) | ○ | ○ | ○ | R/W |
| SD11127 | Diagnosis request information | Specify a remote station number whose diagnostic information is to be displayed.<br>Range: 1 to 16[*1] | ○ | ○ | ○ | R/W |

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD11128 | Diagnostic information status flag | After the END instruction of the scan where the bit 0 of 'Diagnostic information display request' (SD11126) is turned off and on is executed, the status (valid or invalid) of diagnostic information (Diagnostic information 1, Diagnostic information 2) of the remote station specified in 'Diagnostic request information' (SD11127) is stored. (Valid: 1, Invalid: 0)<br>  <br><br>b0 to b7: Diagnostic information 1<br>b8 to b15: Diagnostic information 2<br>• If the station number of the remote station that is specified in 'Diagnostic request information' (SD11127) is the start station number of the occupied stations and the cyclic transmission is performed for the remote station, 1 is stored in b0 to b7 and b8 to b15. (If the specified remote station is a reserved station, 0 is stored in b8 to b15.)<br>• If the station number of the remote station that is specified in 'Diagnostic request information' (SD11127) is other than the start station number of the occupied stations or the cyclic transmission is not performed for the remote station, 0 is stored in b0 to b7 and b8 to b15.<br>• When b0 to b7 are valid, the number of occupied stations, group number, IP address, the accumulated number of timeouts, and the accumulated number of disconnection detection are stored in 'Diagnostic request information 1' (SD11129 to SD11140). When b0 to b7 are invalid, 0 is stored in 'Diagnostic request information 1' (SD11129 to SD11140).<br>• When b8 to b15 are valid, the Manufacturer code, Model code, device version, module information, error code, and detailed module information are stored in 'Diagnostic request information 2' (SD11144 to SD11153). When b8 to b15 are invalid, 0 is stored in 'Diagnostic request information 2' (SD11144 to SD11153). | ○ | ○ | ○ | R |
| SD11129 to SD11140 | Diagnostic information 1 | When 1 (valid) is stored in b0 to b7 of SD11128, the number of occupied stations, group number, IP address, the accumulated number of timeouts, and the accumulated number of disconnection detection are stored. When 0 (invalid) is stored in b0 to b7 of SD11128, 0 is stored.<br>■SD11129: Number of occupied stations<br>■SD11130: Group number<br>■SD11131: IP address (lower)<br>■SD11132: IP address (upper)<br>b15・・・b8 b7・・・b0<br>SD11131: 3 \| 4<br>SD11132: 1 \| 2<br>1 to 4: First octet to fourth octet<br>When the IP address has not been set in the parameter, 0 is stored.<br>■SD11139: Accumulated number of timeouts<br>After the END instruction of the scan where the bit 0 of 'Diagnostic information display request' (SD11126) is turned off and on is executed, the accumulated number of timeouts that occurred in a remote station specified in 'Diagnostic request information' (SD11127) is stored.<br>• 0: No timeouts<br>• 1 to 65535: Number of timeouts (accumulated number)*3<br>■SD11140: Accumulated number of disconnection detections<br>After the END instruction of the scan where the bit 0 of 'Diagnostic information display request' (SD11126) is turned off and on is executed, the accumulated number of disconnections that were detected in a remote station specified in 'Diagnostic request information' (SD11127) is stored.<br>• 0: No disconnections<br>• 1 to 65535: Number of disconnection detection (accumulated number)*3 | ○ | ○ | ○ | R |

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD11144 to SD11153 | Diagnostic information 2 | When Diagnostic information 2 is valid (1 is stored in b8 to b15 of SD11128), the manufacturer code, model code, device version, module information, error code, and detailed module information are stored. When Diagnostic information 2 is invalid (0 is stored in b8 to b15 of SD11128), 0 is stored.<br>■SD11144: Manufacturer code<br>■SD11146: Model code (lower)<br>■SD11147: Model code (upper)<br>■SD11148: Device version<br>■SD11150: Module information<br>■SD11151: Error code<br>■SD11152: Detailed module information (lower)<br>■SD11153: Detailed module information (upper) | ○ | ○ | ○ | R |

*1 The performance specifications differ depending on the versions of the CPU modules. For details, refer to the following.
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*2 This status includes the case where a remote station has not responded to the first request from the master station due to a power-off of the remote station. (The slave station is not judged as a faulty station because the data link status is not determined.)

*3 When the count exceeds 65535, counting is continued from 1 again.

# FX dedicated

The special registers dedicated to FX are shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD4110 to SD4125 | Self-diagnostic error code 1 to 16 details | This register stores the self-diagnosis error code details.<br>• Module position [Low order 8 bit]<br>0H: CPU module<br>1H to 10H: Extension module 1 to 16<br>41H: Built-in RS-485<br>42H: Built-in analog<br>43H: Built-in USB<br>60H: Expansion board<br>71H to 76H: Expansion adapter 1 to 6<br>• Function No. [Higher order 8 bit]<br>0: System/Sequence operation<br>1: Analog input<br>2: Analog output<br>10: Positioning, PWM<br>20: High-speed counter, Pulse width measurement | ○ | ○ | ○ | R |
| SD4150, SD4152, SD4154, SD4156, SD4158, SD4160, SD4162, SD4164 | Modules 1 to 8 status information | These registers store the modules 1 to 8 status information. | × | ○ | ○ | R |
| SD4151, SD4153, SD4155, SD4157, SD4159, SD4161, SD4163, SD4165 | Modules 1 to 8 error information | These registers store the modules 1 to 8 error information. | × | ○ | ○ | R |
| SD4166, SD4168, SD4170, SD4172, SD4174, SD4176, SD4178, SD4180 | Modules 9 to 16 status information | These registers store the modules 9 to 16 status information. | × | × | ○ | R |
| SD4167, SD4169, SD4171, SD4173, SD4175, SD4177, SD4179, SD4181 | Modules 9 to 16 error information | These registers store the modules 9 to 16 error information. | × | × | ○ | R |
| SD4210 | All module reset command permission code | This register stores the code for permission to reset all modules other than the CPU module.<br>0H: Reset disable<br>F5F5H: Reset enable (reset execution by turning ON SM4210) | × | ○ | ○ | R/W |
| SD4462 | Cumulative operating time [Lower] | This register stores the cumulative operating time (unit: second). | ○ | ○ | ○ | R |
| SD4463 | Cumulative operating time [Upper] | | | | | |

# High-speed input/output function

The special registers for the high-speed input/output function are shown below.

## High-speed counter

| No. | Name | Description | Range | Default | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|---|---|
| | | | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD4500, SD4530, SD4560, SD4590, SD4620, SD4650, SD4680, SD4710 | High-speed counter current value [Low-order] (CH1 to CH8) | This register stores the high-speed counter current value. | -2147483648 to +2147483647 | 0 | ○ | ○ | ○ | R/W |
| SD4501, SD4531, SD4561, SD4591, SD4621, SD4651, SD4681, SD4711 | High-speed counter current value [High-order] (CH1 to CH8) | | | | | | | |
| SD4502, SD4532, SD4562, SD4592, SD4622, SD4652, SD4682, SD4712 | High-speed counter maximum value [Low-order] (CH1 to CH8) | This register stores the high-speed counter maximum value. | -2147483648 to +2147483647 | 0 | ○ | ○ | ○ | R/W |
| SD4503, SD4533, SD4563, SD4593, SD4623, SD4653, SD4683, SD4713 | High-speed counter maximum value [High-order] (CH1 to CH8) | | | | | | | |
| SD4504, SD4534, SD4564, SD4594, SD4624, SD4654, SD4684, SD4714 | High-speed counter minimum value [Low-order] (CH1 to CH8) | This register stores the high-speed counter minimum value. | -2147483648 to +2147483647 | 0 | ○ | ○ | ○ | R/W |
| SD4505, SD4535, SD4565, SD4595, SD4625, SD4655, SD4685, SD4715 | High-speed counter minimum value [High-order] (CH1 to CH8) | | | | | | | |
| SD4506, SD4536, SD4566, SD4596, SD4626, SD4656, SD4686, SD4716 | High-speed counter pulse density [Low-order] (CH1 to CH8) | This register stores the high-speed counter pulse density. | 0 to 2147483647 | 0 | ○ | ○ | ○ | R/W |
| SD4507, SD4537, SD4567, SD4597, SD4627, SD4657, SD4687, SD4717 | High-speed counter pulse density [High-order] (CH1 to CH8) | | | | | | | |
| SD4508, SD4538, SD4568, SD4598, SD4628, SD4658, SD4688, SD4718 | High-speed counter rotation speed [Low-order] (CH1 to CH8) | This register stores the high-speed counter rotation speed. | 0 to 2147483647 | 0 | ○ | ○ | ○ | R/W |
| SD4509, SD4539, SD4569, SD4599, SD4629, SD4659, SD4689, SD4719 | High-speed counter rotation speed [High-order] (CH1 to CH8) | | | | | | | |
| SD4510, SD4540, SD4570, SD4600, SD4630, SD4660, SD4690, SD4720 | High-speed counter preset control mode (CH1 to CH8) | This register stores the high-speed counter preset control switch. | 0: Rising edge | 0 | ○ | ○ | ○ | R/W |
| SD4512, SD4542, SD4572, SD4602, SD4632, SD4662, SD4692, SD4722 | High-speed counter preset value [Low-order] (CH1 to CH8) | This register stores the high-speed counter preset value. | -2147483648 to +2147483647 | Parameter set value | ○ | ○ | ○ | R/W |
| SD4513, SD4543, SD4573, SD4603, SD4633, SD4663, SD4693, SD4723 | High-speed counter preset value [High-order] (CH1 to CH8) | | | | | | | |

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| No. | Name | Description | Range | Default | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|---|---|
| | | | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD4514, SD4544, SD4574, SD4604, SD4634, SD4664, SD4694, SD4724 | High-speed counter ring length [Low-order] (CH1 to CH8) | This register stores the high-speed counter ring length. | 2 to 2147483648 | Parameter set value | ○ | ○ | ○ | R/W |
| SD4515, SD4545, SD4575, SD4605, SD4635, SD4665, SD4695, SD4725 | High-speed counter ring length [High-order] (CH1 to CH8) | | | | | | | |
| SD4516, SD4546, SD4576, SD4606, SD4636, SD4666, SD4696, SD4726 | High-speed counter measurement-unit time [Low-order] (CH1 to CH8) | This register stores the high-speed counter measurement-unit time. | 1 to 2147483647 | Parameter set value | ○ | ○ | ○ | R/W |
| SD4517, SD4547, SD4577, SD4607, SD4637, SD4667, SD4697, SD4727 | High-speed counter measurement-unit time [High-order] (CH1 to CH8) | | | | | | | |
| SD4518, SD4548, SD4578, SD4608, SD4638, SD4668, SD4698, SD4728 | High-speed counter number of pulses per rotation [Low-order] (CH1 to CH8) | This register stores the high-speed counter number of pulses per rotation. | 1 to 2147483647 | Parameter set value | ○ | ○ | ○ | R/W |
| SD4519, SD4549, SD4579, SD4609, SD4639, SD4669, SD4699, SD4729 | High-speed counter number of pulses per rotation [High-order] (CH1 to CH8) | | | | | | | |
| SD4740, SD4770, SD4800, SD4830, SD4860, SD4890, SD4920, SD4950 | High-speed counter current value [Low-order] (CH9 to CH16) | This register stores the high-speed counter current value. | -2147483648 to +2147483647 | 0 | × | ○ | ○ | R/W |
| SD4741, SD4771, SD4801, SD4831, SD4861, SD4891, SD4921, SD4951 | High-speed counter current value [High-order] (CH9 to CH16) | | | | | | | |
| SD4742, SD4772, SD4802, SD4832, SD4862, SD4892, SD4922, SD4952 | High-speed counter maximum value [Low-order] (CH9 to CH16) | This register stores the high-speed counter maximum value. | -2147483648 to +2147483647 | -2147483648 | × | ○ | ○ | R/W |
| SD4743, SD4773, SD4803, SD4833, SD4863, SD4893, SD4923, SD4953 | High-speed counter maximum value [High-order] (CH9 to CH16) | | | | | | | |
| SD4744, SD4774, SD4804, SD4834, SD4864, SD4894, SD4924, SD4954 | High-speed counter minimum value [Low-order] (CH9 to CH16) | This register stores the high-speed counter minimum value. | -2147483648 to +2147483647 | 2147483647 | × | ○ | ○ | R/W |
| SD4745, SD4775, SD4805, SD4835, SD4865, SD4895, SD4925, SD4955 | High-speed counter minimum value [High-order] (CH9 to CH16) | | | | | | | |
| SD4750, SD4780, SD4810, SD4840, SD4870, SD4900, SD4930, SD4960 | High-speed counter preset control mode (CH9 to CH16) | This register stores the high-speed counter preset control switch. | 0: Rising edge | 0 | × | ○ | ○ | R/W |
| SD4752, SD4782, SD4812, SD4842, SD4872, SD4902, SD4932, SD4962 | High-speed counter preset value [Low-order] (CH9 to CH16) | This register stores the high-speed counter preset value. | -2147483648 to +2147483647 | Parameter set value | × | ○ | ○ | R/W |
| SD4753, SD4783, SD4813, SD4843, SD4873, SD4903, SD4933, SD4963 | High-speed counter preset value [High-order] (CH9 to CH16) | | | | | | | |

| No. | Name | Description | Range | Default | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|---|---|
| | | | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD4754, SD4784, SD4814, SD4844, SD4874, SD4904, SD4934, SD4964 | High-speed counter ring length [Low-order] (CH9 to CH16) | This register stores the high-speed counter ring length. | 2 to 2147483648 | Parameter set value | × | ○ | ○ | R/W |
| SD4755, SD4785, SD4815, SD4845, SD4875, SD4905, SD4935, SD4965 | High-speed counter ring length [High-order] (CH9 to CH16) | | | | | | | |
| SD4982 | High-speed counter high-speed comparison table error code (CPU module) | This register stores the high-speed comparison table (high-speed compare instruction) error code. | - | - | ○ | ○ | ○ | R/W |
| SD4986 | High-speed counter high-speed comparison table error code (High-speed pulse input/output module first module) | | | | × | ○ | ○ | |
| SD4990 | High-speed counter high-speed comparison table error code (High-speed pulse input/output module second module) | | | | × | ○ | ○ | |
| SD4994 | High-speed counter high-speed comparison table error code (High-speed pulse input/output module third module) | | | | × | ○ | ○ | |
| SD4998 | High-speed counter high-speed comparison table error code (High-speed pulse input/output module fourth module) | | | | × | ○ | ○ | |
| SD5000 | High-speed counter multi-point output high-speed comparison table number | This register stores the multi-point output high-speed comparison table comparison number. | - | - | ○ | ○ | ○ | R |

## Pulse width measurement

| No. | Name | Description | Default | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|---|
| | | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD5020, SD5040, SD5060, SD5080 | Pulse width measurement rising ring counter [Low-order] (CH1 to CH4) | This register stores the pulse width measurement rising ring counter value. | 00000000H | ○ | ○ | ○ | R/W |
| SD5021, SD5041, SD5061, SD5081 | Pulse width measurement rising ring counter [High-order] (CH1 to CH4) | | | | | | |
| SD5022, SD5042, SD5062, SD5082 | Pulse width measurement falling ring counter [Low-order] (CH1 to CH4) | This register stores the pulse width measurement falling ring counter value. | 00000000H | ○ | ○ | ○ | R/W |
| SD5023, SD5043, SD5063, SD5083 | Pulse width measurement falling ring counter [High-order] (CH1 to CH4) | | | | | | |

| No. | Name | Description | Default | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|---|
| | | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD5024, SD5044, SD5064, SD5084 | Pulse width measurement latest value [Low-order] (CH1 to CH4) | This register stores the pulse width measurement latest value. | 00000000H | ○ | ○ | ○ | R/W |
| SD5025, SD5045, SD5065, SD5085 | Pulse width measurement latest value [High-order] (CH1 to CH4) | | | | | | |
| SD5026, SD5046, SD5066, SD5086 | Pulse width measurement maximum value [Low-order] (CH1 to CH4) | This register stores the pulse width measurement maximum value. | 00000000H | ○ | ○ | ○ | R/W |
| SD5027, SD5047, SD5067, SD5087 | Pulse width measurement maximum value [High-order] (CH1 to CH4) | | | | | | |
| SD5028, SD5048, SD5068, SD5088 | Pulse width measurement minimum value [Low-order] (CH1 to CH4) | This register stores the pulse width measurement minimum value. | FFFFFFFFH | ○ | ○ | ○ | R/W |
| SD5029, SD5049, SD5069, SD5089 | Pulse width measurement minimum value [High-order] (CH1 to CH4) | | | | | | |
| SD5030, SD5050, SD5070, SD5090 | Pulse width measurement cycle latest value [Low-order] (CH1 to CH4) | This register stores the pulse width measurement cycle latest value. | 00000000H | ○ | ○ | ○ | R/W |
| SD5031, SD5051, SD5071, SD5091 | Pulse width measurement cycle latest value [High-order] (CH1 to CH4) | | | | | | |
| SD5032, SD5052, SD5072, SD5092 | Pulse width measurement cycle maximum value [Low-order] (CH1 to CH4) | This register stores the pulse width measurement cycle maximum value. | 00000000H | ○ | ○ | ○ | R/W |
| SD5033, SD5053, SD5073, SD5093 | Pulse width measurement cycle maximum value [High-order] (CH1 to CH4) | | | | | | |
| SD5034, SD5054, SD5074, SD5094 | Pulse width measurement cycle minimum value [Low-order] (CH1 to CH4) | This register stores the pulse width measurement cycle minimum value. | FFFFFFFFH | ○ | ○ | ○ | R/W |
| SD5035, SD5055, SD5075, SD5095 | Pulse width measurement cycle minimum value [High-order] (CH1 to CH4) | | | | | | |
| SD5100, SD5120, SD5140, SD5160, SD5180, SD5200, SD5220, SD5240 | Pulse width measurement rising ring counter [Low-order] (CH5 to CH12) | This register stores the pulse width measurement rising ring counter value. | 00000000H | × | ○ | ○ | R/W |
| SD5101, SD5121, SD5141, SD5161, SD5181, SD5201, SD5221, SD5241 | Pulse width measurement rising ring counter [High-order] (CH5 to CH12) | | | | | | |
| SD5102, SD5122, SD5142, SD5162, SD5182, SD5202, SD5222, SD5242 | Pulse width measurement falling ring counter [Low-order] (CH5 to CH12) | This register stores the pulse width measurement falling ring counter value. | 00000000H | × | ○ | ○ | R/W |
| SD5103, SD5123, SD5143, SD5163, SD5183, SD5203, SD5223, SD5243 | Pulse width measurement falling ring counter [High-order] (CH5 to CH12) | | | | | | |
| SD5104, SD5124, SD5144, SD5164, SD5184, SD5204, SD5224, SD5244 | Pulse width measurement latest value [Low-order] (CH5 to CH12) | This register stores the pulse width measurement latest value. | 00000000H | × | ○ | ○ | R/W |
| SD5105, SD5125, SD5145, SD5165, SD5185, SD5205, SD5225, SD5245 | Pulse width measurement latest value [High-order] (CH5 to CH12) | | | | | | |

| No. | Name | Description | Default | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|---|
| | | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD5106, SD5126, SD5146, SD5166, SD5186, SD5206, SD5226, SD5246 | Pulse width measurement maximum value [Low-order] (CH5 to CH12) | This register stores the pulse width measurement maximum value. | 00000000H | × | ○ | ○ | R/W |
| SD5107, SD5127, SD5147, SD5167, SD5187, SD5207, SD5227, SD5247 | Pulse width measurement maximum value [High-order] (CH5 to CH12) | | | | | | |
| SD5108, SD5128, SD5148, SD5168, SD5188, SD5208, SD5228, SD5248 | Pulse width measurement minimum value [Low-order] (CH5 to CH12) | This register stores the pulse width measurement minimum value. | FFFFFFFFH | × | ○ | ○ | R/W |
| SD5109, SD5129, SD5149, SD5169, SD5189, SD5209, SD5229, SD5249 | Pulse width measurement minimum value [High-order] (CH5 to CH12) | | | | | | |
| SD5110, SD5130, SD5150, SD5170, SD5190, SD5210, SD5230, SD5250 | Pulse width measurement cycle latest value [Low-order] (CH5 to CH12) | This register stores the pulse width measurement cycle latest value. | 00000000H | × | ○ | ○ | R/W |
| SD5111, SD5131, SD5151, SD5171, SD5191, SD5211, SD5231, SD5251 | Pulse width measurement cycle latest value [High-order] (CH5 to CH12) | | | | | | |
| SD5112, SD5132, SD5152, SD5172, SD5192, SD5212, SD5232, SD5252 | Pulse width measurement cycle maximum value [Low-order] (CH5 to CH12) | This register stores the pulse width measurement cycle maximum value. | 00000000H | × | ○ | ○ | R/W |
| SD5113, SD5133, SD5153, SD5173, SD5193, SD5213, SD5233, SD5253 | Pulse width measurement cycle maximum value [High-order] (CH5 to CH12) | | | | | | |
| SD5114, SD5134, SD5154, SD5174, SD5194, SD5214, SD5234, SD5254 | Pulse width measurement cycle minimum value [Low-order] (CH5 to CH12) | This register stores the pulse width measurement cycle minimum value. | FFFFFFFFH | × | ○ | ○ | R/W |
| SD5115, SD5135, SD5155, SD5175, SD5195, SD5215, SD5235, SD5255 | Pulse width measurement cycle minimum value [High-order] (CH5 to CH12) | | | | | | |

## PWM

| No. | Name | Description | Default | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|---|
| | | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD5300, SD5316, SD5332, SD5348 | PWM pulse output number [Low-order] (CH1 to CH4) | This register stores the PWM pulse output number. | 0 | ○ | ○ | ○ | R/W |
| SD5301, SD5317, SD5333, SD5349 | PWM pulse output number [High-order] (CH1 to CH4) | | | | | | |
| SD5302, SD5318, SD5334, SD5350 | PWM pulse width [Low-order] (CH1 to CH4) | This register stores the PWM pulse width. | 0 | ○ | ○ | ○ | R/W |
| SD5303, SD5319, SD5335, SD5351 | PWM pulse width [High-order] (CH1 to CH4) | | | | | | |
| SD5304, SD5320, SD5336, SD5352 | PWM cycle [Low-order] (CH1 to CH4) | This register stores the PWM cycle. | 0 | ○ | ○ | ○ | R/W |
| SD5305, SD5321, SD5337, SD5353 | PWM cycle [High-order] (CH1 to CH4) | | | | | | |

| No. | Name | Description | Default | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|---|
| | | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD5306, SD5322, SD5338, SD5354 | PWM pulse output number current value [Low-order] (CH1 to CH4) | This register stores the PWM pulse output number current value. | 0 | ○ | ○ | ○ | R |
| SD5307, SD5323, SD5339, SD5355 | PWM pulse output number current value [High-order] (CH1 to CH4) | | | | | | |
| SD5364, SD5380, SD5396, SD5412, SD5428, SD5444, SD5460, SD5476 | PWM pulse output number [Low-order] (CH5 to CH12) | This register stores the PWM pulse output number. | 0 | × | ○ | ○ | R/W |
| SD5365, SD5381, SD5397, SD5413, SD5429, SD5445, SD5461, SD5477 | PWM pulse output number [High-order] (CH5 to CH12) | | | | | | |
| SD5366, SD5382, SD5398, SD5414, SD5430, SD5446, SD5462, SD5478 | PWM pulse width [Low-order] (CH5 to CH12) | This register stores the PWM pulse width. | 0 | × | ○ | ○ | R/W |
| SD5367, SD5383, SD5399, SD5415, SD5431, SD5447, SD5463, SD5479 | PWM pulse width [High-order] (CH5 to CH12) | | | | | | |
| SD5368, SD5384, SD5400, SD5416, SD5432, SD5448, SD5464, SD5480 | PWM cycle [Low-order] (CH5 to CH12) | This register stores the PWM cycle. | 0 | × | ○ | ○ | R/W |
| SD5369, SD5385, SD5401, SD5417, SD5433, SD5449, SD5465, SD5481 | PWM cycle [High-order] (CH5 to CH12) | | | | | | |

## Positioning

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD5500, SD5540, SD5580, SD5620 | Positioning current address (user unit) [Low-order] (Axis 1 to Axis 4) | This register stores the current address (user unit) of positioning. | ○ | ○*1 | ○ | R/W |
| SD5501, SD5541, SD5581, SD5621 | Positioning current address (user unit) [High-order] (Axis 1 to Axis 4) | | | | | |
| SD5502, SD5542, SD5582, SD5622 | Positioning current address (pulse unit) [Low-order] (Axis 1 to Axis 4) | This register stores the current address (pulse unit) of positioning. | ○ | ○*1 | ○ | R/W |
| SD5503, SD5543, SD5583, SD5623 | Positioning current address (pulse unit) [High-order] (Axis 1 to Axis 4) | | | | | |
| SD5504, SD5544, SD5584, SD5624 | Positioning current speed (user unit) [Low-order] (Axis 1 to Axis 4) | This register stores the current speed (user unit) of positioning. | ○ | ○*1 | ○ | R |
| SD5505, SD5545, SD5585, SD5625 | Positioning current speed (user unit) [High-order] (Axis 1 to Axis 4) | | | | | |
| SD5506, SD5546, SD5586, SD5626 | Positioning execution table number (Axis 1 to Axis 4) | This register stores the execution table number of positioning. | ○ | ○*1 | ○ | R |
| SD5510, SD5550, SD5590, SD5630 | Positioning error code (Axis 1 to Axis 4) | This register stores the error code of positioning. | ○ | ○*1 | ○ | R/W |
| SD5511, SD5551, SD5591, SD5631 | Positioning error table number (Axis 1 to Axis 4) | This register stores the error table number of positioning. | ○ | ○*1 | ○ | R/W |

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD5516, SD5556, SD5596, SD5636 | Positioning maximum speed [Low-order] (Axis 1 to Axis 4) | This register stores the maximum speed of positioning. | ○ | ○*1 | ○ | R/W |
| SD5517, SD5557, SD5597, SD5637 | Positioning maximum speed [High-order] (Axis 1 to Axis 4) | | | | | |
| SD5518, SD5558, SD5598, SD5638 | Positioning bias speed [Low-order] (Axis 1 to Axis 4) | This register stores the bias speed of positioning. | ○ | ○*1 | ○ | R/W |
| SD5519, SD5559, SD5599, SD5639 | Positioning bias speed [High-order] (Axis 1 to Axis 4) | | | | | |
| SD5520, SD5560, SD5600, SD5640 | Positioning acceleration time (Axis 1 to Axis 4) | This register stores the acceleration time of positioning. | ○ | ○*1 | ○ | R/W |
| SD5521, SD5561, SD5601, SD5641 | Positioning deceleration time (Axis 1 to Axis 4) | This register stores the deceleration time of positioning. | ○ | ○*1 | ○ | R/W |
| SD5526, SD5566, SD5606, SD5646 | Positioning zero-return speed [Low-order] (Axis 1 to Axis 4) | This register stores the zero-return speed of positioning. | ○ | ○*1 | ○ | R/W |
| SD5527, SD5567, SD5607, SD5647 | Positioning zero-return speed [High-order] (Axis 1 to Axis 4) | | | | | |
| SD5528, SD5568, SD5608, SD5648 | Positioning creep speed [Low-order] (Axis 1 to Axis 4) | This register stores the creep speed of positioning. | ○ | ○*1 | ○ | R/W |
| SD5529, SD5569, SD5609, SD5649 | Positioning creep speed [High-order] (Axis 1 to Axis 4) | | | | | |
| SD5530, SD5570, SD5610, SD5650 | Positioning zero-point address [Low-order] (Axis 1 to Axis 4) | This register stores the zero-point address of positioning. | ○ | ○*1 | ○ | R/W |
| SD5531, SD5571, SD5611, SD5651 | Positioning zero-point address [High-order] (Axis 1 to Axis 4) | | | | | |
| SD5532, SD5572, SD5612, SD5652 | Positioning number of zero-point signal for zero return (Axis 1 to Axis 4) | This register stores the number of zero-point signal for zero return of positioning. | ○ | ○*1 | ○ | R/W |
| SD5533, SD5573, SD5613, SD5653 | Positioning zero-return dwell time (Axis 1 to Axis 4) | This register stores the zero-return dwell time of positioning. | ○ | ○*1 | ○ | R/W |
| SD5660, SD5700, SD5740, SD5780, SD5820, SD5860, SD5900, SD5940 | Positioning current address (user unit) [Low-order] (Axis 5 to Axis 12) | This register stores the current address (user unit) of positioning. | × | ○ | ○ | R/W |
| SD5661, SD5701, SD5741, SD5781, SD5821, SD5861, SD5901, SD5941 | Positioning current address (user unit) [High-order] (Axis 5 to Axis 12) | | | | | |
| SD5662, SD5702, SD5742, SD5782, SD5822, SD5862, SD5902, SD5942 | Positioning current address (pulse unit) [Low-order] (Axis 5 to Axis 12) | This register stores the current address (pulse unit) of positioning. | × | ○ | ○ | R/W |
| SD5663, SD5703, SD5743, SD5783, SD5823, SD5863, SD5903, SD5943 | Positioning current address (pulse unit) [High-order] (Axis 5 to Axis 12) | | | | | |
| SD5664, SD5704, SD5744, SD5784, SD5824, SD5864, SD5904, SD5944 | Positioning current speed (user unit) [Low-order] (Axis 5 to Axis 12) | This register stores the current speed (user unit) of positioning. | × | ○ | ○ | R |
| SD5665, SD5705, SD5745, SD5785, SD5825, SD5865, SD5905, SD5945 | Positioning current speed (user unit) [High-order] (Axis 5 to Axis 12) | | | | | |
| SD5666, SD5706, SD5746, SD5786, SD5826, SD5866, SD5906, SD5946 | Positioning execution table number (Axis 5 to Axis 12) | This register stores the execution table number of positioning. | × | ○ | ○ | R |

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| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD5668, SD5708, SD5748, SD5788, SD5828, SD5868, SD5908, SD5948 | Composite speed (user unit) [Low-order] (Axis 5 to Axis 12) | This register stores the current speed (composite speed) of positioning. | × | ○ | ○ | R |
| SD5669, SD5709, SD5749, SD5789, SD5829, SD5869, SD5909, SD5949 | Composite speed (user unit) [High-order] (Axis 5 to Axis 12) | | | | | |
| SD5670, SD5710, SD5750, SD5790, SD5830, SD5870, SD5910, SD5950 | Positioning error code (Axis 5 to Axis 12) | This register stores the error code of positioning. | × | ○ | ○ | R/W |
| SD5671, SD5711, SD5751, SD5791, SD5831, SD5871, SD5911, SD5951 | Positioning error table number (Axis 5 to Axis 12) | This register stores the error table number of positioning. | × | ○ | ○ | R/W |
| SD5676, SD5716, SD5756, SD5796, SD5836, SD5876, SD5916, SD5956 | Positioning maximum speed [Low-order] (Axis 5 to Axis 12) | This register stores the maximum speed of positioning. | × | ○ | ○ | R/W |
| SD5677, SD5717, SD5757, SD5797, SD5837, SD5877, SD5917, SD5957 | Positioning maximum speed [High-order] (Axis 5 to Axis 12) | | | | | |
| SD5678, SD5718, SD5758, SD5798, SD5838, SD5878, SD5918, SD5958 | Positioning bias speed [Low-order] (Axis 5 to Axis 12) | This register stores the bias speed of positioning. | × | ○ | ○ | R/W |
| SD5679, SD5719, SD5759, SD5799, SD5839, SD5879, SD5919, SD5959 | Positioning bias speed [High-order] (Axis 5 to Axis 12) | | | | | |
| SD5680, SD5720, SD5760, SD5800, SD5840, SD5880, SD5920, SD5960 | Positioning acceleration time (Axis 5 to Axis 12) | This register stores the acceleration time of positioning. | × | ○ | ○ | R/W |
| SD5681, SD5721, SD5761, SD5801, SD5841, SD5881, SD5921, SD5961 | Positioning deceleration time (Axis 5 to Axis 12) | This register stores the deceleration time of positioning. | × | ○ | ○ | R/W |
| SD5686, SD5726, SD5766, SD5806, SD5846, SD5886, SD5926, SD5966 | Positioning zero-return speed [Low-order] (Axis 5 to Axis 12) | This register stores the zero-return speed of positioning. | × | ○ | ○ | R/W |
| SD5687, SD5727, SD5767, SD5807, SD5847, SD5887, SD5927, SD5967 | Positioning zero-return speed [High-order] (Axis 5 to Axis 12) | | | | | |
| SD5688, SD5728, SD5768, SD5808, SD5848, SD5888, SD5928, SD5968 | Positioning creep speed [Low-order] (Axis 5 to Axis 12) | This register stores the creep speed of positioning. | × | ○ | ○ | R/W |
| SD5689, SD5729, SD5769, SD5809, SD5849, SD5889, SD5929, SD5969 | Positioning creep speed [High-order] (Axis 5 to Axis 12) | | | | | |

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD5690, SD5730, SD5770, SD5810, SD5850, SD5890, SD5930, SD5970 | Positioning zero-point address [Low-order] (Axis 5 to Axis 12) | This register stores the zero-point address of positioning. | × | ○ | ○ | R/W |
| SD5691, SD5731, SD5771, SD5811, SD5851, SD5891, SD5931, SD5971 | Positioning zero-point address [High-order] (Axis 5 to Axis 12) | | | | | |
| SD5692, SD5732, SD5772, SD5812, SD5852, SD5892, SD5932, SD5972 | Positioning number of zero-point signal for zero return (Axis 5 to Axis 12) | This register stores the number of zero-point signal for zero return of positioning. | × | ○ | ○ | R/W |
| SD5693, SD5733, SD5773, SD5813, SD5853, SD5893, SD5933, SD5973 | Positioning zero-return dwell time (Axis 5 to Axis 12) | This register stores the zero-return dwell time of positioning. | × | ○ | ○ | R/W |

*1 Only Axis 1 to Axis 3 are supported.

# CPU module built-in analog function

The special registers for the CPU module built-in analog function are shown below.

| No. CH1, CH2 | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC*1 | |
| SD6020, SD6060 | Digital output value | This register stores the digital output value. | × | × | ○ | R |
| SD6021, SD6061 | Digital operation value | This register stores the digital operation value. | × | × | ○ | R |
| SD6022, SD6062 | Analog input voltage monitor | This register stores the analog input voltage value. | × | × | ○ | R |
| SD6023, SD6063 | Averaging process setting | This register stores the averaging process setting. | × | × | ○ | R/W |
| SD6024, SD6064 | Time average/count average/moving average | This register stores the time average/count average/moving average setting. | × | × | ○ | R/W |
| SD6026, SD6066 | Maximum value | This register stores the maximum value. | × | × | ○ | R |
| SD6027, SD6067 | Minimum value | This register stores the minimum value. | × | × | ○ | R |
| SD6028, SD6068 | Scaling upper limit value | This register stores the scaling upper limit value. | × | × | ○ | R/W |
| SD6029, SD6069 | Scaling lower limit value | This register stores the scaling lower limit value. | × | × | ○ | R/W |
| SD6030, SD6070 | Shifting amount to conversion value | This register stores the shifting amount of conversion value. | × | × | ○ | R/W |
| SD6031, SD6071 | Process alarm upper upper limit value | This register stores the process alarm upper upper limit value. | × | × | ○ | R/W |
| SD6032, SD6072 | Process alarm upper lower limit value | This register stores the process alarm upper lower limit value. | × | × | ○ | R/W |
| SD6033, SD6073 | Process alarm lower upper limit value | This register stores the process alarm lower upper limit value. | × | × | ○ | R/W |
| SD6034, SD6074 | Process alarm lower lower limit value | This register stores the process alarm lower lower limit value. | × | × | ○ | R/W |
| SD6058, SD6098 | A/D latest alarm code | This register stores the latest alarm code. | × | × | ○ | R |
| SD6059, SD6099 | A/D latest error code | This register stores the latest error code. | × | × | ○ | R |
| SD6180 | Digital input value | This register stores the digital input value. | × | × | ○ | R/W |
| SD6181 | Digital operation value | This register stores the digital operation value. | × | × | ○ | R |
| SD6182 | Analog output voltage monitor | This register stores the analog output voltage value. | × | × | ○ | R |
| SD6183 | HOLD/CLEAR function setting | This register stores the HOLD/CLEAR setting. | × | × | ○ | R/W |
| SD6184 | HOLD setting value | This register stores the HOLD setting value. | × | × | ○ | R/W |
| SD6188 | Scaling upper limit value | This register stores the scaling upper limit value. | × | × | ○ | R/W |
| SD6189 | Scaling lower limit value | This register stores the scaling lower limit value. | × | × | ○ | R/W |
| SD6190 | Input value shift amount | This register stores the input value shift amount. | × | × | ○ | R/W |

| No. CH1, CH2 | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC*1 | |
| SD6191 | Warning output upper limit value | This register stores the warning output upper limit value. | × | × | ○ | R/W |
| SD6192 | Warning output lower limit value | This register stores the warning output lower limit value. | × | × | ○ | R/W |
| SD6218 | D/A latest alarm code | This register stores the latest alarm code. | × | × | ○ | R |
| SD6219 | D/A latest error code | This register stores the latest error code. | × | × | ○ | R |

*1 Only FX5U CPU module is supported.

# Analog adapter

The special registers for analog adapters are shown below.

| Special registers CH1, CH2, CH3, CH4 | Connection order | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|---|
| | | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD6280 | 1st adapter | Module information | Module information is stored.<br>■FX5-4A-ADP<br>Stored value: 6180H<br>■FX5-4AD-ADP<br>Stored value: 6141H<br>■FX5-4AD-PT-ADP<br>Stored value: 61A1H<br>■FX5-4AD-TC-ADP<br>Stored value: 61A0H | ○ | ○ | ○ | R |
| SD6640 | 2nd adapter | | | | | | |
| SD7000 | 3rd adapter | | | | | | |
| SD7360 | 4th adapter | | | | | | |
| SD6290 | 1st adapter | Module information | Module information is stored.<br>■FX5-4DA-ADP<br>Stored value: 6161H | ○ | ○ | ○ | R |
| SD6650 | 2nd adapter | | | | | | |
| SD7010 | 3rd adapter | | | | | | |
| SD7370 | 4th adapter | | | | | | |
| SD6300, SD6340, SD6380, SD6420 | 1st adapter | Digital output value | The A/D converted digital output value is stored.<br>Target:FX5-4A-ADP (CH1, CH2), FX5-4AD-ADP | ○ | ○ | ○ | R |
| SD6660, SD6700, SD6740, SD6780 | 2nd adapter | | | | | | |
| SD7020, SD7060, SD7100, SD7140 | 3rd adapter | | | | | | |
| SD7380, SD7420, SD7460, SD7500 | 4th adapter | | | | | | |
| SD6300, SD6340, SD6380, SD6420 | 1st adapter | Digital value | Set the digital value for D/A conversion.<br>Target:FX5-4A-ADP (CH3, CH4), FX5-4DA-ADP | ○ | ○ | ○ | R |
| SD6660, SD6700, SD6740, SD6780 | 2nd adapter | | | | | | |
| SD7020, SD7060, SD7100, SD7140 | 3rd adapter | | | | | | |
| SD7380, SD7420, SD7460, SD7500 | 4th adapter | | | | | | |
| SD6300, SD6340, SD6380, SD6420 | 1st adapter | Measured temperature value | The temperature converted digital output value is stored.<br>Target:FX5-4AD-PT-ADP, FX5-4AD-TC-ADP | ○ | ○ | ○ | R |
| SD6660, SD6700, SD6740, SD6780 | 2nd adapter | | | | | | |
| SD7020, SD7060, SD7100, SD7140 | 3rd adapter | | | | | | |
| SD7380, SD7420, SD7460, SD7500 | 4th adapter | | | | | | |

| Special registers CH1, CH2, CH3, CH4 | Connection order | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|---|
| | | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD6301, SD6341, SD6381, SD6421 | 1st adapter | Digital operation value | The digital operation value operated by the scaling function, shift function, and digital clipping function is stored. | ○ | ○ | ○ | R |
| SD6661, SD6701, SD6741, SD6781 | 2nd adapter | | | | | | |
| SD7021, SD7061, SD7101, SD7141 | 3rd adapter | | | | | | |
| SD7381, SD7421, SD7461, SD7501 | 4th adapter | | | | | | |
| SD6302, SD6342, SD6382, SD6422 | 1st adapter | Analog input value monitor | The input analog value is stored.<br>Target:FX5-4A-ADP (CH1, CH2), FX5-4AD-ADP | ○ | ○ | ○ | R |
| SD6662, SD6702, SD6742, SD6782 | 2nd adapter | | | | | | |
| SD7022, SD7062, SD7102, SD7142 | 3rd adapter | | | | | | |
| SD7382, SD7422, SD7462, SD7502 | 4th adapter | | | | | | |
| SD6302, SD6342, SD6382, SD6422 | 1st adapter | Analog output value monitor | The D/A-converted analog value is stored.<br>• The unit is "1V = 1000mV" for voltage input, and "1mA = 1000mA" for current input.<br>• The upper limit value or lower limit value is stored when the analog value is outside the output range.<br>Range: -10240 to +20479<br>Default value: 0<br>Target:FX5-4A-ADP (CH3, CH4), FX5-4DA-ADP | ○ | ○ | ○ | R |
| SD6662, SD6702, SD6742, SD6782 | 2nd adapter | | | | | | |
| SD7022, SD7062, SD7102, SD7142 | 3rd adapter | | | | | | |
| SD7382, SD7422, SD7462, SD7502 | 4th adapter | | | | | | |
| SD6303, SD6343, SD6383, SD6423 | 1st adapter | Average processing specification | Set which one between the sampling processing and the averaging processing is to be selected.<br>Target:FX5-4A-ADP (CH1, CH2), FX5-4AD-ADP, FX5-4AD-PT-ADP, FX5-4AD-TC-ADP | ○ | ○ | ○ | R/W |
| SD6663, SD6703, SD6743, SD6783 | 2nd adapter | | | | | | |
| SD7023, SD7063, SD7103, SD7143 | 3rd adapter | | | | | | |
| SD7383, SD7423, SD7463, SD7503 | 4th adapter | | | | | | |
| SD6303, SD6343, SD6383, SD6423 | 1st adapter | HOLD/CLEAR function setting | Set whether to hold (HOLD) or clear (CLEAR) the analog output value that was being output when the operation status of the CPU module is STOP or a stop error.<br>Target:FX5-4A-ADP (CH3, CH4), FX5-4DA-ADP | ○ | ○ | ○ | R/W |
| SD6663, SD6703, SD6743, SD6783 | 2nd adapter | | | | | | |
| SD7023, SD7063, SD7103, SD7143 | 3rd adapter | | | | | | |
| SD7383, SD7423, SD7463, SD7503 | 4th adapter | | | | | | |
| SD6304, SD6344, SD6384, SD6424 | 1st adapter | Time average/count average/moving average | Set the average time, average counts and moving average counts in the averaging processing for each channel.<br>Target:FX5-4A-ADP (CH1, CH2), FX5-4AD-ADP, FX5-4AD-PT-ADP, FX5-4AD-TC-ADP | ○ | ○ | ○ | R/W |
| SD6664, SD6704, SD6744, SD6784 | 2nd adapter | | | | | | |
| SD7024, SD7064, SD7104, SD7144 | 3rd adapter | | | | | | |
| SD7384, SD7424, SD7464, SD7504 | 4th adapter | | | | | | |
| SD6304, SD6344, SD6384, SD6424 | 1st adapter | HOLD setting value | Set the output value when "2: HOLD setting value" is set to the HOLD/CLEAR function setting.<br>Target:FX5-4A-ADP (CH3, CH4), FX5-4DA-ADP | ○ | ○ | ○ | R/W |
| SD6664, SD6704, SD6744, SD6784 | 2nd adapter | | | | | | |
| SD7024, SD7064, SD7104, SD7144 | 3rd adapter | | | | | | |
| SD7384, SD7424, SD7464, SD7504 | 4th adapter | | | | | | |

| Special registers CH1, CH2, CH3, CH4 | Connection order | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|---|
| | | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD6305, SD6345, SD6385, SD6425 | 1st adapter | Input range setting | Set the input range.<br>Target:FX5-4A-ADP (CH1, CH2), FX5-4AD-ADP | ○ | ○ | ○ | R/W |
| SD6665, SD6705, SD6745, SD6785 | 2nd adapter | | | | | | |
| SD7025, SD7065, SD7105, SD7145 | 3rd adapter | | | | | | |
| SD7385, SD7425, SD7465, SD7505 | 4th adapter | | | | | | |
| SD6305, SD6345, SD6385, SD6425 | 1st adapter | Output range setting | Set the output range.<br>Target:FX5-4A-ADP (CH3, CH4), FX5-4DA-ADP | ○ | ○ | ○ | R/W |
| SD6665, SD6705, SD6745, SD6785 | 2nd adapter | | | | | | |
| SD7025, SD7065, SD7105, SD7145 | 3rd adapter | | | | | | |
| SD7385, SD7425, SD7465, SD7505 | 4th adapter | | | | | | |
| SD6305, SD6345, SD6385, SD6425 | 1st adapter | Resistance temperature detector type setting | Set the RTD type.<br>Target:FX5-4AD-PT-ADP | ○ | ○ | ○ | R/W |
| SD6665, SD6705, SD6745, SD6785 | 2nd adapter | | | | | | |
| SD7025, SD7065, SD7105, SD7145 | 3rd adapter | | | | | | |
| SD7385, SD7425, SD7465, SD7505 | 4th adapter | | | | | | |
| SD6305, SD6345, SD6385, SD6425 | 1st adapter | Thermocouple type setting | Set the thermocouple type.<br>Target:FX5-4AD-TC-ADP | ○ | ○ | ○ | R/W |
| SD6665, SD6705, SD6745, SD6785 | 2nd adapter | | | | | | |
| SD7025, SD7065, SD7105, SD7145 | 3rd adapter | | | | | | |
| SD7385, SD7425, SD7465, SD7505 | 4th adapter | | | | | | |
| SD6306, SD6346, SD6386, SD6426 | 1st adapter | Maximum value | The maximum value of the digital operation value is stored. | ○ | ○ | ○ | R |
| SD6666, SD6706, SD6746, SD6786 | 2nd adapter | | | | | | |
| SD7026, SD7066, SD7106, SD7146 | 3rd adapter | | | | | | |
| SD7386, SD7426, SD7466, SD7506 | 4th adapter | | | | | | |
| SD6307, SD6347, SD6387, SD6427 | 1st adapter | Minimum value | The minimum value of the digital operation value is stored. | ○ | ○ | ○ | R |
| SD6667, SD6707, SD6747, SD6787 | 2nd adapter | | | | | | |
| SD7027, SD7067, SD7107, SD7147 | 3rd adapter | | | | | | |
| SD7387, SD7427, SD7467, SD7507 | 4th adapter | | | | | | |
| SD6308, SD6348, SD6388, SD6428 | 1st adapter | Scaling upper limit value | Set the upper limit value of the scaling conversion range. | ○ | ○ | ○ | R/W |
| SD6668, SD6708, SD6748, SD6788 | 2nd adapter | | | | | | |
| SD7028, SD7068, SD7108, SD7148 | 3rd adapter | | | | | | |
| SD7388, SD7428, SD7468, SD7508 | 4th adapter | | | | | | |

| Special registers CH1, CH2, CH3, CH4 | Connection order | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|---|
| | | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD6309, SD6349, SD6389, SD6429 | 1st adapter | Scaling lower limit value | Set the lower limit value of the scaling conversion range. | ○ | ○ | ○ | R/W |
| SD6669, SD6709, SD6749, SD6789 | 2nd adapter | | | | | | |
| SD7029, SD7069, SD7109, SD7149 | 3rd adapter | | | | | | |
| SD7389, SD7429, SD7469, SD7509 | 4th adapter | | | | | | |
| SD6310, SD6350, SD6390, SD6430 | 1st adapter | Conversion value shift amount | Set the "conversion value shift amount" used in the shift function.<br>Target:FX5-4A-ADP (CH1, CH2), FX5-4AD-ADP | ○ | ○ | ○ | R/W |
| SD6670, SD6710, SD6750, SD6790 | 2nd adapter | | | | | | |
| SD7030, SD7070, SD7110, SD7150 | 3rd adapter | | | | | | |
| SD7390, SD7430, SD7470, SD7510 | 4th adapter | | | | | | |
| SD6310, SD6350, SD6390, SD6430 | 1st adapter | Input value shift amount | Set the "input value shift amount" used in the shift function.<br>Target:FX5-4A-ADP (CH3, CH4), FX5-4DA-ADP | ○ | ○ | ○ | R/W |
| SD6670, SD6710, SD6750, SD6790 | 2nd adapter | | | | | | |
| SD7030, SD7070, SD7110, SD7150 | 3rd adapter | | | | | | |
| SD7390, SD7430, SD7470, SD7510 | 4th adapter | | | | | | |
| SD6311, SD6351, SD6391, SD6431 | 1st adapter | Process alarm upper upper limit value | Set the upper upper limit value of warning output function (process alarm).<br>Target:FX5-4A-ADP (CH1, CH2), FX5-4AD-ADP, FX5-4AD-PT-ADP, FX5-4AD-TC-ADP | ○ | ○ | ○ | R/W |
| SD6671, SD6711, SD6751, SD6791 | 2nd adapter | | | | | | |
| SD7031, SD7071, SD7111, SD7151 | 3rd adapter | | | | | | |
| SD7391, SD7431, SD7471, SD7511 | 4th adapter | | | | | | |
| SD6311, SD6351, SD6391, SD6431 | 1st adapter | Warning output upper limit value | Set the upper limit value of the warning output function.<br>Target:FX5-4A-ADP (CH3, CH4), FX5-4DA-ADP | ○ | ○ | ○ | R/W |
| SD6671, SD6711, SD6751, SD6791 | 2nd adapter | | | | | | |
| SD7031, SD7071, SD7111, SD7151 | 3rd adapter | | | | | | |
| SD7391, SD7431, SD7471, SD7511 | 4th adapter | | | | | | |
| SD6312, SD6352, SD6392, SD6432 | 1st adapter | Process alarm upper lower limit value | Set the upper lower limit value of warning output function (process alarm).<br>Target:FX5-4A-ADP (CH1, CH2), FX5-4AD-ADP, FX5-4AD-PT-ADP, FX5-4AD-TC-ADP | ○ | ○ | ○ | R/W |
| SD6672, SD6712, SD6752, SD6792 | 2nd adapter | | | | | | |
| SD7032, SD7072, SD7112, SD7152 | 3rd adapter | | | | | | |
| SD7392, SD7432, SD7472, SD7512 | 4th adapter | | | | | | |
| SD6312, SD6352, SD6392, SD6432 | 1st adapter | Warning output lower limit value | Set the lower limit value of the warning output function.<br>Target:FX5-4A-ADP (CH3, CH4), FX5-4DA-ADP | ○ | ○ | ○ | R/W |
| SD6672, SD6712, SD6752, SD6792 | 2nd adapter | | | | | | |
| SD7032, SD7072, SD7112, SD7152 | 3rd adapter | | | | | | |
| SD7392, SD7432, SD7472, SD7512 | 4th adapter | | | | | | |

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| Special registers CH1, CH2, CH3, CH4 | Connection order | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|---|
| | | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD6313, SD6353, SD6393, SD6433 | 1st adapter | Process alarm lower upper limit value | Set the lower upper limit value of warning output function (process alarm). | ○ | ○ | ○ | R/W |
| SD6673, SD6713, SD6753, SD6793 | 2nd adapter | | | | | | |
| SD7033, SD7073, SD7113, SD7153 | 3rd adapter | | | | | | |
| SD7393, SD7433, SD7473, SD7513 | 4th adapter | | | | | | |
| SD6314, SD6354, SD6394, SD6434 | 1st adapter | Process alarm lower lower limit value | Set the lower lower limit value of warning output function (process alarm). | ○ | ○ | ○ | R/W |
| SD6674, SD6714, SD6754, SD6794 | 2nd adapter | | | | | | |
| SD7034, SD7074, SD7114, SD7154 | 3rd adapter | | | | | | |
| SD7394, SD7434, SD7474, SD7514 | 4th adapter | | | | | | |
| SD6315, SD6355, SD6395, SD6435 | 1st adapter | Rate alarm upper limit value | Set the upper limit of the rate of change of the digital output value for detecting rate alarms. | ○ | ○ | ○ | R/W |
| SD6675, SD6715, SD6755, SD6795 | 2nd adapter | | | | | | |
| SD7035, SD7075, SD7115, SD7155 | 3rd adapter | | | | | | |
| SD7395, SD7435, SD7475, SD7515 | 4th adapter | | | | | | |
| SD6316, SD6356, SD6396, SD6436 | 1st adapter | Rate alarm lower limit value | Set the lower limit of the rate of change of the digital output value for detecting rate alarms. | ○ | ○ | ○ | R/W |
| SD6676, SD6716, SD6756, SD6796 | 2nd adapter | | | | | | |
| SD7036, SD7076, SD7116, SD7156 | 3rd adapter | | | | | | |
| SD7396, SD7436, SD7476, SD7516 | 4th adapter | | | | | | |
| SD6317, SD6357, SD6397, SD6437 | 1st adapter | Rate alarm warning detection period setting | Set the cycle for checking the rate of change of the digital output value. | ○ | ○ | ○ | R/W |
| SD6677, SD6717, SD6757, SD6797 | 2nd adapter | | | | | | |
| SD7037, SD7077, SD7117, SD7157 | 3rd adapter | | | | | | |
| SD7397, SD7437, SD7477, SD7517 | 4th adapter | | | | | | |
| SD6318, SD6358, SD6398, SD6438 | 1st adapter | Conversion setting for disconnection detection | Set the value that is to be stored in the "measured temperature value" when a disconnection is detected. | ○ | ○ | ○ | R/W |
| SD6678, SD6718, SD6758, SD6798 | 2nd adapter | | | | | | |
| SD7038, SD7078, SD7118, SD7158 | 3rd adapter | | | | | | |
| SD7398, SD7438, SD7478, SD7518 | 4th adapter | | | | | | |
| SD6319, SD6359, SD6399, SD6439 | 1st adapter | Conversion setting value for disconnection detection | Set the value that is to be stored in the "measured temperature value" when "conversion setting for disconnection detection" is set to "any value". | ○ | ○ | ○ | R/W |
| SD6679, SD6719, SD6759, SD6799 | 2nd adapter | | | | | | |
| SD7039, SD7079, SD7119, SD7159 | 3rd adapter | | | | | | |
| SD7399, SD7439, SD7479, SD7519 | 4th adapter | | | | | | |

| Special registers CH1, CH2, CH3, CH4 | Connection order | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|---|
| | | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD6322, SD6362, SD6402, SD6442 | 1st adapter | Convergence detection upper limit value | Set the upper limit of the digital output value used in the convergence detection function. | ○ | ○ | ○ | R/W |
| SD6682, SD6722, SD6762, SD6802 | 2nd adapter | | | | | | |
| SD7042, SD7082, SD7122, SD7162 | 3rd adapter | | | | | | |
| SD7402, SD7442, SD7482, SD7522 | 4th adapter | | | | | | |
| SD6323, SD6363, SD6403, SD6443 | 1st adapter | Convergence detection lower limit value | Set the lower limit of the digital output value used in the convergence detection function. | ○ | ○ | ○ | R/W |
| SD6683, SD6723, SD6763, SD6803 | 2nd adapter | | | | | | |
| SD7043, SD7083, SD7123, SD7163 | 3rd adapter | | | | | | |
| SD7403, SD7443, SD7483, SD7523 | 4th adapter | | | | | | |
| SD6324, SD6364, SD6404, SD6444 | 1st adapter | Detection time setting for convergence detection | Set the convergence detection time used in the convergence detection function. | ○ | ○ | ○ | R/W |
| SD6684, SD6724, SD6764, SD6804 | 2nd adapter | | | | | | |
| SD7044, SD7084, SD7124, SD7164 | 3rd adapter | | | | | | |
| SD7404, SD7444, SD7484, SD7524 | 4th adapter | | | | | | |
| SD6325, SD6365, SD6405, SD6445 | 1st adapter | Deviation detection CH1 | Check the status of the deviation between CH detection flag in the 1st and 2nd FX5-4A-ADP, or FX5-4AD-ADP used in the deviation between CH detection function. | ○ | ○ | ○ | R |
| SD6685, SD6725, SD6765, SD6805 | 2nd adapter | | | | | | |
| SD7045, SD7085, SD7125, SD7165 | 3rd adapter | | | | | | |
| SD7405, SD7445, SD7485, SD7525 | 4th adapter | | | | | | |
| SD6326, SD6366, SD6406, SD6446 | 1st adapter | Deviation detection CH2 | Check the status of the deviation between CH detection flag in the 3rd and 4th FX5-4A-ADP, or FX5-4AD-ADP used in the deviation between CH detection function. | ○ | ○ | ○ | R |
| SD6686, SD6726, SD6766, SD6806 | 2nd adapter | | | | | | |
| SD7046, SD7086, SD7126, SD7166 | 3rd adapter | | | | | | |
| SD7406, SD7446, SD7486, SD7526 | 4th adapter | | | | | | |
| SD6327, SD6367, SD6407, SD6447 | 1st adapter | Deviation value for deviation detection between channels | Set the deviation value between channels used in the deviation detection between channel function. Target:FX5-4A-ADP (CH1, CH2), FX5-4AD-ADP | ○ | ○ | ○ | R/W |
| SD6687, SD6727, SD6767, SD6807 | 2nd adapter | | | | | | |
| SD7047, SD7087, SD7127, SD7167 | 3rd adapter | | | | | | |
| SD7407, SD7447, SD7487, SD7527 | 4th adapter | | | | | | |
| SD6327, SD6367, SD6407, SD6447 | 1st adapter | Offset temperature setting value | Set the offset temperature setting value used in the offset/gain setting function. Target:FX5-4AD-PT-ADP, FX5-4AD-TC-ADP | ○ | ○ | ○ | R/W |
| SD6687, SD6727, SD6767, SD6807 | 2nd adapter | | | | | | |
| SD7047, SD7087, SD7127, SD7167 | 3rd adapter | | | | | | |
| SD7407, SD7447, SD7487, SD7527 | 4th adapter | | | | | | |

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| Special registers CH1, CH2, CH3, CH4 | Connection order | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|---|
| | | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD6328, SD6368, SD6408, SD6448 | 1st adapter | CH setting 1 for deviation detection between channel | Set the channels whose deviation will be checked in the 1st and 2nd FX5-4A-ADP, or FX5-4AD-ADP used in the deviation detection between channel function. | ○ | ○ | ○ | R/W |
| SD6688, SD6728, SD6768, SD6808 | 2nd adapter | | | | | | |
| SD7048, SD7088, SD7128, SD7168 | 3rd adapter | | | | | | |
| SD7408, SD7448, SD7488, SD7528 | 4th adapter | | | | | | |
| SD6328, SD6368, SD6408, SD6448 | 1st adapter | Gain temperature setting value | Set the gain temperature setting value used in the offset/gain setting function.<br>Target:FX5-4AD-PT-ADP, FX5-4AD-TC-ADP | ○ | ○ | ○ | R/W |
| SD6688, SD6728, SD6768, SD6808 | 2nd adapter | | | | | | |
| SD7048, SD7088, SD7128, SD7168 | 3rd adapter | | | | | | |
| SD7408, SD7448, SD7488, SD7528 | 4th adapter | | | | | | |
| SD6329, SD6369, SD6409, SD6449 | 1st adapter | CH setting 2 for deviation detection between channel | Set the channels whose deviation will be checked in the 3rd and 4th FX5-4A-ADP, or FX5-4AD-ADP used in the deviation detection between channel function.<br>* Only the FX5S/FX5U/FX5UC CPU module is supported. | ○ | ○ | ○ | R/W |
| SD6689, SD6729, SD6769, SD6809 | 2nd adapter | | | | | | |
| SD7049, SD7089, SD7129, SD7169 | 3rd adapter | | | | | | |
| SD7409, SD7449, SD7489, SD7529 | 4th adapter | | | | | | |
| SD6329, SD6369, SD6409, SD6449 | 1st adapter | Offset/gain writing enable code | Set the offset/gain writing enable code used for changing the offset/gain.<br>Target:FX5-4AD-PT-ADP, FX5-4AD-TC-ADP | ○ | ○ | ○ | R/W |
| SD6689, SD6729, SD6769, SD6809 | 2nd adapter | | | | | | |
| SD7049, SD7089, SD7129, SD7169 | 3rd adapter | | | | | | |
| SD7409, SD7449, SD7489, SD7529 | 4th adapter | | | | | | |
| SD6330, SD6370, SD6410, SD6450 | 1st adapter | Resistance offset value (L) | The resistance offset value calculated based on the "offset temperature setting value" and "setting RTD type" is stored.<br>When "offset/gain reading" is set from OFF to ON or the power supply of the FX5-4AD-PT-ADP is turned off and on, the resistance offset value, which is calculated based on the "offset temperature setting value" and "setting RTD type" obtained from the built-in memory of the FX5-4AD-PT-ADP, is stored.<br>Target:FX5-4AD-PT-ADP | ○ | ○ | ○ | R/W |
| SD6690, SD6730, SD6770, SD6810 | 2nd adapter | | | | | | |
| SD7050, SD7090, SD7130, SD7170 | 3rd adapter | | | | | | |
| SD7410, SD7450, SD7490, SD7530 | 4th adapter | | | | | | |
| SD6330, SD6370, SD6410, SD6450 | 1st adapter | Thermal EMF offset value (L) | The thermal EMF offset value calculated based on the "offset temperature setting value" and "setting thermocouple type" is stored.<br>When "offset/gain reading" is set from OFF to ON or the power supply of the FX5-4AD-TC-ADP is turned off and on, the thermal EMF offset value, which is calculated based on the offset temperature setting value and setting thermocouple type obtained from the built-in memory of the FX5-4AD-TC-ADP, is stored.<br>Target:FX5-4AD-TC-ADP | ○ | ○ | ○ | R/W |
| SD6690, SD6730, SD6770, SD6810 | 2nd adapter | | | | | | |
| SD7050, SD7090, SD7130, SD7170 | 3rd adapter | | | | | | |
| SD7410, SD7450, SD7490, SD7530 | 4th adapter | | | | | | |

| Special registers CH1, CH2, CH3, CH4 | Connection order | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|---|
| | | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD6331, SD6371, SD6411, SD6451 | 1st adapter | Resistance offset value (H) | The resistance offset value calculated based on the "offset temperature setting value" and "setting RTD type" is stored.<br>When "offset/gain reading" is set from OFF to ON or the power supply of the FX5-4AD-PT-ADP is turned off and on, the resistance offset value, which is calculated based on the "offset temperature setting value" and "setting RTD type" obtained from the built-in memory of the FX5-4AD-PT-ADP, is stored.<br>Target:FX5-4AD-PT-ADP | ○ | ○ | ○ | R/W |
| SD6691, SD6731, SD6771, SD6811 | 2nd adapter | | | | | | |
| SD7051, SD7091, SD7131, SD7171 | 3rd adapter | | | | | | |
| SD7411, SD7451, SD7491, SD7531 | 4th adapter | | | | | | |
| SD6331, SD6371, SD6411, SD6451 | 1st adapter | Thermal EMF offset value (H) | The thermal EMF offset value calculated based on the "offset temperature setting value" and "setting thermocouple type" is stored.<br>When "offset/gain reading" is set from OFF to ON or the power supply of the FX5-4AD-TC-ADP is turned off and on, the thermal EMF offset value, which is calculated based on the offset temperature setting value and setting thermocouple type obtained from the built-in memory of the FX5-4AD-TC-ADP, is stored.<br>Target:FX5-4AD-TC-ADP | ○ | ○ | ○ | R/W |
| SD6691, SD6731, SD6771, SD6811 | 2nd adapter | | | | | | |
| SD7051, SD7091, SD7131, SD7171 | 3rd adapter | | | | | | |
| SD7411, SD7451, SD7491, SD7531 | 4th adapter | | | | | | |
| SD6332, SD6372, SD6412, SD6452 | 1st adapter | Offset setting value | Set the offset data used in the offset/gain setting function.<br>Target:FX5-4A-ADP, FX5-4AD-ADP, FX5-4DA-ADP | ○ | ○ | ○ | R/W |
| SD6692, SD6732, SD6772, SD6812 | 2nd adapter | | | | | | |
| SD7052, SD7092, SD7132, SD7172 | 3rd adapter | | | | | | |
| SD7412, SD7452, SD7492, SD7532 | 4th adapter | | | | | | |
| SD6332, SD6372, SD6412, SD6452 | 1st adapter | Resistance gain value (L) | The resistance gain value calculated based on the "gain temperature setting value" and "setting RTD type" is stored.<br>When "offset/gain reading" is set from OFF to ON or the power supply of the FX5-4AD-PT-ADP is turned off and on, the resistance gain value, which is calculated based on the "gain temperature setting value" and "setting RTD type" obtained from the built-in memory of the FX5-4AD-PT-ADP, is stored.<br>Target:FX5-4AD-PT-ADP | ○ | ○ | ○ | R/W |
| SD6692, SD6732, SD6772, SD6812 | 2nd adapter | | | | | | |
| SD7052, SD7092, SD7132, SD7172 | 3rd adapter | | | | | | |
| SD7412, SD7452, SD7492, SD7532 | 4th adapter | | | | | | |
| SD6332, SD6372, SD6412, SD6452 | 1st adapter | Thermal EMF gain value (L) | The thermal EMF gain value calculated based on the "gain temperature setting value" and "setting thermocouple type" is stored.<br>When "offset/gain reading" is set from OFF to ON or the power supply of the FX5-4AD-TC-ADP is turned off and on, the thermal EMF gain value, which is calculated based on the gain temperature setting value and setting thermocouple type obtained from the built-in memory of the FX5-4AD-TC-ADP, is stored.<br>Target:FX5-4AD-TC-ADP | ○ | ○ | ○ | R/W |
| SD6692, SD6732, SD6772, SD6812 | 2nd adapter | | | | | | |
| SD7052, SD7092, SD7132, SD7172 | 3rd adapter | | | | | | |
| SD7412, SD7452, SD7492, SD7532 | 4th adapter | | | | | | |
| SD6333, SD6373, SD6413, SD6453 | 1st adapter | Gain setting value | Set the gain data used in the offset/gain setting function.<br>Target:FX5-4A-ADP, FX5-4AD-ADP, FX5-4DA-ADP | ○ | ○ | ○ | R/W |
| SD6693, SD6733, SD6773, SD6813 | 2nd adapter | | | | | | |
| SD7053, SD7093, SD7133, SD7173 | 3rd adapter | | | | | | |
| SD7413, SD7453, SD7493, SD7533 | 4th adapter | | | | | | |

| Special registers CH1, CH2, CH3, CH4 | Connection order | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|---|
| | | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD6333, SD6373, SD6413, SD6453 | 1st adapter | Resistance gain value (H) | The resistance gain value calculated based on the "gain temperature setting value" and "setting RTD type" is stored.<br>When "offset/gain reading" is set from OFF to ON or the power supply of the FX5-4AD-PT-ADP is turned off and on, the resistance gain value, which is calculated based on the "gain temperature setting value" and "setting RTD type" obtained from the built-in memory of the FX5-4AD-PT-ADP, is stored.<br>Target:FX5-4AD-PT-ADP | ○ | ○ | ○ | R/W |
| SD6693, SD6733, SD6773, SD6813 | 2nd adapter | | | | | | |
| SD7053, SD7093, SD7133, SD7173 | 3rd adapter | | | | | | |
| SD7413, SD7453, SD7493, SD7533 | 4th adapter | | | | | | |
| SD6333, SD6373, SD6413, SD6453 | 1st adapter | Thermal EMF gain value (H) | The thermal EMF gain value calculated based on the "gain temperature setting value" and "setting thermocouple type" is stored.<br>When "offset/gain reading" is set from OFF to ON or the power supply of the FX5-4AD-TC-ADP is turned off and on, the thermal EMF gain value, which is calculated based on the gain temperature setting value and setting thermocouple type obtained from the built-in memory of the FX5-4AD-TC-ADP, is stored.<br>Target:FX5-4AD-TC-ADP | ○ | ○ | ○ | R/W |
| SD6693, SD6733, SD6773, SD6813 | 2nd adapter | | | | | | |
| SD7053, SD7093, SD7133, SD7173 | 3rd adapter | | | | | | |
| SD7413, SD7453, SD7493, SD7533 | 4th adapter | | | | | | |
| SD6334, SD6374, SD6414, SD6454 | 1st adapter | Offset/gain writing enable code | Set the offset/gain writing enable code used for changing the offset/gain.<br>Target:FX5-4A-ADP, FX5-4AD-ADP, FX5-4DA-ADP | ○ | ○ | ○ | R |
| SD6694, SD6734, SD6774, SD6814 | 2nd adapter | | | | | | |
| SD7054, SD7094, SD7134, SD7174 | 3rd adapter | | | | | | |
| SD7414, SD7454, SD7494, SD7534 | 4th adapter | | | | | | |
| SD6334, SD6374, SD6414, SD6454 | 1st adapter | Input offset value (L) | Set the offset value used in the offset/gain setting function.<br>Target:FX5-4AD-PT-ADP, FX5-4AD-TC-ADP | ○ | ○ | ○ | R |
| SD6694, SD6734, SD6774, SD6814 | 2nd adapter | | | | | | |
| SD7054, SD7094, SD7134, SD7174 | 3rd adapter | | | | | | |
| SD7414, SD7454, SD7494, SD7534 | 4th adapter | | | | | | |
| SD6335, SD6375, SD6415, SD6455 | 1st adapter | Input offset value (H) | Set the offset value used in the offset/gain setting function. | ○ | ○ | ○ | R/W |
| SD6695, SD6735, SD6775, SD6815 | 2nd adapter | | | | | | |
| SD7055, SD7095, SD7135, SD7175 | 3rd adapter | | | | | | |
| SD7415, SD7455, SD7495, SD7535 | 4th adapter | | | | | | |
| SD6336, SD6376, SD6416, SD6456 | 1st adapter | Input gain value (L) | Set the gain value used in the offset/gain setting function. | ○ | ○ | ○ | R/W |
| SD6696, SD6736, SD6776, SD6816 | 2nd adapter | | | | | | |
| SD7056, SD7096, SD7136, SD7176 | 3rd adapter | | | | | | |
| SD7416, SD7456, SD7496, SD7536 | 4th adapter | | | | | | |

| Special registers CH1, CH2, CH3, CH4 | Connection order | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|---|
| | | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD6337, SD6377, SD6417, SD6457 | 1st adapter | Input gain value (H) | Set the gain value used in the offset/gain setting function. | ○ | ○ | ○ | R/W |
| SD6697, SD6737, SD6777, SD6817 | 2nd adapter | | | | | | |
| SD7057, SD7097, SD7137, SD7177 | 3rd adapter | | | | | | |
| SD7417, SD7457, SD7497, SD7537 | 4th adapter | | | | | | |
| SD6338, SD6378, SD6418, SD6458 | 1st adapter | A/D conversion latest alarm code | The latest alarm code detected by the analog adapter is stored.<br>Default value: 0<br>Set the "A/D conversion alarm clear request" from OFF to ON to clear the alarm code.<br>Target:FX5-4A-ADP (CH1, CH2), FX5-4AD-ADP | ○ | ○ | ○ | R |
| SD6698, SD6738, SD6778, SD6818 | 2nd adapter | | | | | | |
| SD7058, SD7098, SD7138, SD7178 | 3rd adapter | | | | | | |
| SD7418, SD7458, SD7498, SD7538 | 4th adapter | | | | | | |
| SD6338, SD6378, SD6418, SD6458 | 1st adapter | D/A conversion latest alarm code | The latest alarm code detected by the analog adapter is stored.<br>Default value: 0<br>Set the "D/A conversion alarm clear request" from OFF to ON to clear the alarm code.<br>Target:FX5-4A-ADP (CH3, CH4), FX5-4DA-ADP | ○ | ○ | ○ | R |
| SD6698, SD6738, SD6778, SD6818 | 2nd adapter | | | | | | |
| SD7058, SD7098, SD7138, SD7178 | 3rd adapter | | | | | | |
| SD7418, SD7458, SD7498, SD7538 | 4th adapter | | | | | | |
| SD6338, SD6378, SD6418, SD6458 | 1st adapter | Conversion latest alarm code | The latest alarm code detected by the analog adapter is stored.<br>Default value: 0<br>Set the "conversion alarm clear request" from OFF to ON to clear the alarm code.<br>Target:FX5-4AD-PT-ADP, FX5-4AD-TC-ADP | ○ | ○ | ○ | R |
| SD6698, SD6738, SD6778, SD6818 | 2nd adapter | | | | | | |
| SD7058, SD7098, SD7138, SD7178 | 3rd adapter | | | | | | |
| SD7418, SD7458, SD7498, SD7538 | 4th adapter | | | | | | |
| SD6339, SD6379, SD6419, SD6459 | 1st adapter | A/D conversion latest error code | The latest error code detected by the analog adapter is stored.<br>Default value: 0<br>To clear the error code, turn off and on "error clear request" (SM50) of the CPU module.<br>Target:FX5-4A-ADP (CH1, CH2), FX5-4AD-ADP | ○ | ○ | ○ | R |
| SD6699, SD6739, SD6779, SD6819 | 2nd adapter | | | | | | |
| SD7059, SD7099, SD7139, SD7179 | 3rd adapter | | | | | | |
| SD7419, SD7459, SD7499, SD7539 | 4th adapter | | | | | | |
| SD6339, SD6379, SD6419, SD6459 | 1st adapter | D/A conversion latest error code | The latest error code detected by the analog adapter is stored.<br>Default value: 0<br>To clear the error code, turn off and on "error clear request" (SM50) of the CPU module.<br>Target:FX5-4A-ADP (CH3, CH4), FX5-4DA-ADP | ○ | ○ | ○ | R |
| SD6699, SD6739, SD6779, SD6819 | 2nd adapter | | | | | | |
| SD7059, SD7099, SD7139, SD7179 | 3rd adapter | | | | | | |
| SD7419, SD7459, SD7499, SD7539 | 4th adapter | | | | | | |
| SD6339, SD6379, SD6419, SD6459 | 1st adapter | Conversion latest error code | The latest error code detected by the analog adapter is stored.<br>Default value: 0<br>To clear the error code, turn off and on "error clear request" (SM50) of the CPU module.<br>Target:FX5-4AD-PT-ADP, FX5-4AD-TC-ADP | ○ | ○ | ○ | R |
| SD6699, SD6739, SD6779, SD6819 | 2nd adapter | | | | | | |
| SD7059, SD7099, SD7139, SD7179 | 3rd adapter | | | | | | |
| SD7419, SD7459, SD7499, SD7539 | 4th adapter | | | | | | |

# FX compatible area

The special registers for FX compatible area are shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD8000 | Watchdog timer | This register stores the watchdog timer. | ○ | ○ | ○ | R/W |
| SD8001 | Programmable controller type and system version | This register stores the programmable controller type and system version. | ○ | ○ | ○ | R |
| SD8005 | Battery voltage | This register stores the battery voltage. (units: 0.1 V) | × | × | ○ | R |
| SD8006 | Low battery voltage | This register stores the low battery voltage. (units: 0.1 V) | × | × | ○ | R/W |
| SD8007 | Power failure count | This register stores the power failure count. | × | ○ | ○ | R |
| SD8008 | Power failure detection period | This register stores the power failure detection period.<br>When the power supply voltage is 200 V AC, the time can be change to 10 to 100 ms. | × | ○ | ○ | R |
| SD8010 | Current scan time | This register stores the current scan time. (units: 0.1 ms) | ○ | ○ | ○ | R |
| SD8011 | Minimum scan time | This register stores the minimum scan time. (units: 0.1 ms) | ○ | ○ | ○ | R |
| SD8012 | Maximum scan time | This register stores the maximum scan time. (units: 0.1 ms) | ○ | ○ | ○ | R |
| SD8013 | RTC: Seconds | This register stores the seconds data. | ○ | ○ | ○ | R/W |
| SD8014 | RTC: Minute data | This register stores the minute data. | ○ | ○ | ○ | R/W |
| SD8015 | RTC: Hour data | This register stores the hour data. | ○ | ○ | ○ | R/W |
| SD8016 | RTC: Day data | This register stores the day data. | ○ | ○ | ○ | R/W |
| SD8017 | RTC: Month data | This register stores the month data. | ○ | ○ | ○ | R/W |
| SD8018 | RTC: Year data | This register stores the year data. | ○ | ○ | ○ | R/W |
| SD8019 | RTC: Day of week data | This register stores the day of week data. | ○ | ○ | ○ | R/W |
| SD8039 | Constant scan duration | This register stores the constant scan duration. 0 to 2000 (unit: 1 ms) | ○ | ○ | ○ | R/W |
| SD8040 to SD8047[*1] | STL: ON state numbers 1 to 8 | These registers store the ON state numbers 1 to 8. | ○ | ○ | ○ | R/W |
| SD8049 | Lowest active Annunciator | This register stores the lowest active annunciator. | ○ | ○ | ○ | R/W |
| SD8063 | Serial communication error code (CH1) | This register stores the serial communication error code (CH1). | ○ | ○ | ○ | R |
| SD8067 | Operation error | This register stores the error code number of operation error. | ○ | ○ | ○ | R |
| SD8099 | High speed ring counter | This register stores the high speed ring counter count value. (units: 0.1 ms) | ○ | ○ | ○ | R/W |
| SD8136 | PLSY Output number [Low-order] | This register stores the PLSY instruction output pulse number. | ○ | ○ | ○ | R |
| SD8137 | PLSY Output number [High-order] | | | | | |
| SD8140 | PLSY Accumulated number of pulses output [Low-order] (axis 1) | This register stores the PLSY instruction accumulated number of pulses output (to axis 1). | ○ | ○ | ○ | R |
| SD8141 | PLSY Accumulated number of pulses output [High-order] (axis 1) | | | | | |
| SD8142 | PLSY Accumulated number of pulses output [Low-order] (axis 2) | This register stores the PLSY instruction accumulated number of pulses output (to axis 2). | ○ | ○ | ○ | R |
| SD8143 | PLSY Accumulated number of pulses output [High-order] (axis 2) | | | | | |
| SD8152, SD8157 | Inverter communication error codes (CH1, CH2) | These registers store the inverter communication error codes (CH1, CH2). | ○ | ○ | ○ | R |
| SD8154, SD8159 | IVBWR instruction error parameter numbers (CH1, CH2) | These registers store the IVBWR instruction error parameter numbers (CH1, CH2). | ○ | ○ | ○ | R |

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD8166 | Module error occurrence conditions (Module connection position 1 to 15) | b0: No error<br>b1: Module connection No.1<br>b2: Module connection No.2<br>b3: Module connection No.3<br>b4: Module connection No.4<br>b5: Module connection No.5<br>b6: Module connection No.6<br>b7: Module connection No.7<br>b8: Module connection No.8<br>b9: Module connection No.9<br>b10: Module connection No.10*2<br>b11: Module connection No.11*2<br>b12: Module connection No.12*2<br>b13: Module connection No.13*2<br>b14: Module connection No.14*2<br>b15: Module connection No.15*2<br>0: No error<br>1: Error | × | ○ | ○ | R |
| SD8167 | Module error occurrence conditions (Module connection position 16 to 18) | b0: Module connection No.16<br>b1: Module connection No.17<br>b2: Module connection No.18<br>0: No error<br>1: Error | × | × | ○ | R |
| SD8173 | Station number | This register stores the station number. | ○ | ○ | ○ | R/W |
| SD8174 | Total number of slave stations | This register stores the total number of slave stations. | ○ | ○ | ○ | R/W |
| SD8175 | Refresh range | This register stores the refresh range. | ○ | ○ | ○ | R |
| SD8201 | Current link scan time | This register stores the current link scan time. | ○ | ○ | ○ | R |
| SD8202 | Maximum link scan time | This register stores the maximum link scan time. | ○ | ○ | ○ | R |
| SD8203 | Number of communication error at master station | This register stores the number of communication error at master station. | ○ | ○ | ○ | R |
| SD8204 to SD8210 | Number of communication error at slave station No.1 to No.7 | These registers store the number of communication error at slave station No.1 to No.7. | ○ | ○ | ○ | R |
| SD8211 | Code of communication error at master station | This register stores the code of communication error at master station. | ○ | ○ | ○ | R |
| SD8212 to SD8218 | Code of communication error at slave station No.1 to No.7 | These registers store the code of communication error at slave station No.1 to No.7. | ○ | ○ | ○ | R |
| SD8310 | RND Random number generation [Low-order] | This register stores the RND random number generation data. | ○ | ○ | ○ | R |
| SD8311 | RND Random number generation [High-order] | | | | | |
| SD8330 to SD8334 | Counted number of scans for timing clock outputs 1 to 5 | These registers store the scan count for timing clock outputs 1 to 5. | ○ | ○ | ○ | R |
| SD8340, SD8350, SD8360, SD8370 | Current address [Low-order] (axes 1 to 4: pulse units) | These registers store the current address (axes 1 to 4: pulse units). | ○ | ○ | ○ | R |
| SD8341, SD8351, SD8361, SD8371 | Current address [High-order] (axes 1 to 4: pulse units) | | | | | |
| SD8393 | Delay time | The input interrupt delay function for identifying pattern programs | ○ | ○ | ○ | R/W |
| SD8398 | 1 ms ring counter [Low-order] | This register stores the 1 ms ring counter. | ○ | ○ | ○ | R |
| SD8399 | 1 ms ring counter [High-order] | | | | | |
| SD8402, SD8422 | RS2 amount of remaining data (CH1, CH2)/MODBUS communication error code (CH1, CH2) | These registers store the amount of remaining data (CH1, CH2)/MODBUS communication error codes (CH1, CH2). | ○ | ○ | ○ | R |
| SD8403, SD8423 | RS2 receive data points (CH1, CH2)/ MODBUS communication error details (CH1, CH2) | These registers store the receive data points (CH1, CH2)/MODBUS communication error details (CH1, CH2). | ○ | ○ | ○ | R |

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD8405, SD8425 | RS2 communication parameter display (CH1, CH2)/MODBUS communication format display (CH1, CH2) | These registers store the communication parameter display (CH1, CH2)/MODBUS communication format display (CH1, CH2). | ○ | ○ | ○ | R |
| SD8408, SD8428 | MODBUS communication retry times (CH1, CH2) | These registers store the MODBUS communication current retry times (CH1, CH2). | ○ | ○ | ○ | R |
| SD8414, SD8434 | RS2 receive sum (received data) (CH1, CH2) | These registers store the receive sum (received data) (CH1, CH2). | ○ | ○ | ○ | R |
| SD8415, SD8435 | RS2 receive sum (calculated results) (CH1, CH2) | These registers store the receive sum (received results) (CH1, CH2). | ○ | ○ | ○ | R |
| SD8416, SD8436 | RS2 send sum (CH1, CH2) | These registers store the send sum (CH1, CH2). | ○ | ○ | ○ | R |
| SD8419, SD8439 | Operation mode (CH1, CH2) | These registers store the operation mode (CH1, CH2). | ○ | ○ | ○ | R |
| SD8438 | Serial communication error code (CH2) | This register stores the serial communication error code (CH2). | ○ | ○ | ○ | R |
| SD8492 | IP address setting [Low-order] | This register stores the IP address. | ○ | ○ | ○ | R/W |
| SD8493 | IP address setting [High-order] | | | | | |
| SD8494 | Subnet mask setting [Low-order] | This register stores the subnet mask. | ○ | ○ | ○ | R/W |
| SD8495 | Subnet mask setting [High-order] | | | | | |
| SD8496 | Default gateway IP address setting [Low-order] | This register stores the default gateway IP address. | ○ | ○ | ○ | R/W |
| SD8497 | Default gateway IP address setting [High-order] | | | | | |
| SD8498 | IP address storage area write error code | This register stores error codes if writing to IP address storage area is failed. | ○ | ○ | ○ | R |
| SD8499 | IP address storage area clear error code | This register stores error codes if clear to IP address storage area is failed. | ○ | ○ | ○ | R |

*1 Enabled only when the STL instruction is used.

*2 Only FX5U/FX5UC CPU module is supported.

# Serial communication function

The special registers for the serial communication function are shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC*1 | |
| SD8500 | Serial communication error code (CH1) | This register stores the serial communication error code 1 (CH1). | × | × | ○ | R |
| SD8501 | Serial communication error details (CH1) | This register stores the serial communication error details 1 (CH1). | × | × | ○ | R |
| SD8502 | Serial communication setting (CH1) | This register stores the serial communication setting (CH1). | × | × | ○ | R |
| SD8503 | Serial communication operational mode (CH1) | This register stores the serial communication operational mode 1 (CH1). | × | × | ○ | R |
| SD8510, SD8520, SD8530 | Serial communication error code (CH2 to CH4) | These registers store the serial communication error code 2 (CH2 to CH4). | ○ | ○ | ○ | R |
| SD8511, SD8521, SD8531 | Serial communication error details (CH2 to CH4) | These registers store the serial communication error details 2 (CH2 to CH4). | ○ | ○ | ○ | R |
| SD8512, SD8522, SD8532 | Serial communication setting (CH2 to CH4) | These registers store the serial communication setting (CH2 to CH4). | ○ | ○ | ○ | R |
| SD8513, SD8523, SD8533 | Serial communication operational mode (CH2 to CH4) | These registers store the serial communication operational mode 2 (CH2 to CH4). | ○ | ○ | ○ | R |
| SD8560 | Remaining points of send data (CH1) | This register stores the remaining points of send data (CH1). | × | × | ○ | R |
| SD8561 | Receive data points monitor (CH1) | This register stores the receive data points monitor (CH1). | × | × | ○ | R |
| SD8563 | Receive sum (received data) (CH1) | This register stores the receive sum (received data) (CH1). | × | × | ○ | R |

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC*1 | |
| SD8564 | Receive sum (received result) (CH1) | This register stores the receive sum (received result) (CH1). | × | × | ○ | R |
| SD8565 | Send sum (CH1) | This register stores the send sum (CH1). | × | × | ○ | R |
| SD8570, SD8580, SD8590 | Remaining points of send data (CH2 to CH4) | These registers store the remaining points of send data (CH2 to CH4). | ○ | ○ | ○ | R |
| SD8571, SD8581, SD8591 | Receive data points monitor (CH2 to CH4) | These registers store the receive data points monitor (CH2 to CH4). | ○ | ○ | ○ | R |
| SD8573, SD8583, SD8593 | Receive sum (received data) (CH2 to CH4) | These registers store the receive sum (received data) (CH2 to CH4). | ○ | ○ | ○ | R |
| SD8574, SD8584, SD8594 | Receive sum (received results) (CH2 to CH4) | These registers store the receive sum (received results) (CH2 to CH4). | ○ | ○ | ○ | R |
| SD8575, SD8585, SD8595 | Send sum (CH2 to CH4) | These registers store the send sum (CH2 to CH4). | ○ | ○ | ○ | R |
| SD8621 | Timeout time (CH1) | This register stores the timeout time (CH1). | × | × | ○ | R |
| SD8622 | 8-bit processing mode (CH1) | This register stores the 8-bit processing mode (CH1). | × | × | ○ | R |
| SD8623 | Header 1 and 2 (CH1) | This register stores the header 1 and 2 (CH1). | × | × | ○ | R |
| SD8624 | Header 3 and 4 (CH1) | This register stores the header 3 and 4 (CH1). | × | × | ○ | R |
| SD8625 | Terminator 1 and 2 (CH1) | This register stores the terminator 1 and 2 (CH1). | × | × | ○ | R |
| SD8626 | Terminator 3 and 4 (CH1) | This register stores the terminator 3 and 4 (CH1). | × | × | ○ | R |
| SD8631, SD8641, SD8651 | Timeout time (CH2 to CH4) | These registers store the timeout time (CH2 to CH4). | ○ | ○ | ○ | R |
| SD8632, SD8642, SD8652 | 8-bit processing mode (CH2 to CH4) | These registers store the 8-bit processing mode (CH2 to CH4). | ○ | ○ | ○ | R |
| SD8633, SD8643, SD8653 | Headers 1 and 2 (CH2 to CH4) | These registers store the headers 1 and 2 (CH2 to CH4). | ○ | ○ | ○ | R |
| SD8634, SD8644, SD8654 | Headers 3 and 4 (CH2 to CH4) | These registers store the headers 3 and 4 (CH2 to CH4). | ○ | ○ | ○ | R |
| SD8635, SD8645, SD8655 | Terminators 1 and 2 (CH2 to CH4) | These registers store the terminators 1 and 2 (CH2 to CH4). | ○ | ○ | ○ | R |
| SD8636, SD8646, SD8656 | Terminators 3 and 4 (CH2 to CH4) | These registers store the terminators 3 and 4 (CH2 to CH4). | ○ | ○ | ○ | R |
| SD8740 | Station number setting (CH1) | This register stores the station number setting (CH1). | × | × | ○ | *2 |
| SD8741 | Message frame and form (CH1) | This register stores the message frame and form (CH1). | × | × | ○ | R |
| SD8742 | Timeout time (CH1) | This register stores the timeout time (CH1). | × | × | ○ | R |
| SD8744 | Message waiting time (CH1) | Message waiting time (CH1) is stored. | × | × | ○ | R |
| SD8750, SD8760, SD8770 | Station number setting (CH2 to CH4) | These registers store the station number setting (CH2 to CH4). | ○ | ○ | ○ | *2 |
| SD8751, SD8761, SD8771 | Message frame and form (CH2 to CH4) | These registers store the message frame and form (CH2 to CH4). | ○ | ○ | ○ | R |
| SD8752, SD8762, SD8772 | Timeout time (CH2 to CH4) | These registers store the timeout time (CH2 to CH4). | ○ | ○ | ○ | R |
| SD8754, SD8764, SD8774 | Message waiting time (CH2 to CH4) | These registers store the message waiting time (CH2 to CH4). | ○ | ○ | ○ | R |
| SD8800 | Current retry value (CH1) | This register stores the current retry value (CH1). | × | × | ○ | R |
| SD8810, SD8820, SD8830 | Current retry value (CH2 to CH4) | These registers store the current retry value (CH2 to CH4). | × | × | ○ | R |
| SD8861 | Slave node address (CH1) | This register stores the host station number (CH1). | × | × | ○ | R/W |
| SD8862 | Slave response timeout (CH1) | This register stores the slave response timeout (CH1). | × | × | ○ | R |
| SD8863 | Turn around delay (CH1) | This register stores the broadcast delay (CH1). | × | × | ○ | R |
| SD8864 | Message to message delay (CH1) | This register stores the request to request delay (CH1). | × | × | ○ | R |

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC*1 | |
| SD8865 | Number of retries (CH1) | This register stores the number of retries during timeout (CH1). | × | × | ○ | R |
| SD8871, SD8881, SD8891 | Host station number (CH2 to CH4) | These registers store the host station number (CH2 to CH4). | ○ | ○ | ○ | R/W |
| SD8872, SD8882, SD8892 | Slave response timeout (CH2 to CH4) | These registers store the slave response timeout (CH2 to CH4). | ○ | ○ | ○ | R |
| SD8873, SD8883, SD8893 | Turn around delay (CH2 to CH4) | These registers store the broadcast delay (CH2 to CH4). | ○ | ○ | ○ | R |
| SD8874, SD8884, SD8894 | Message to message delay (CH2 to CH4) | These registers store the request to request delay (CH2 to CH4). | ○ | ○ | ○ | R |
| SD8875, SD8885, SD8895 | Number of retries (CH2 to CH4) | These registers store the number of retries during timeout (CH2 to CH4). | ○ | ○ | ○ | R |
| SD8921 | IVBWR instruction error parameter number (CH1) | This register stores the IVBWR instruction error parameter number (CH1). | × | × | ○ | R |
| SD8931, SD8941, SD8951 | IVBWR instruction error parameter number (CH2 to CH4) | These registers store the IVBWR instruction error parameter numbers (CH2 to CH4). | ○ | ○ | ○ | R |
| SD8981 | Response wait time (CH1) | This register stores the response wait time (CH1). | × | × | ○ | R |
| SD8991, SD9001, SD9011 | Response wait time (CH2 to CH4) | These registers store the response wait time (CH2 to CH4). | ○ | ○ | ○ | R |
| SD9040 | Station number | This register stores the station number. | ○ | ○ | ○ | R |
| SD9041 | Total number of slave stations | This register stores the total number of slave stations. | ○ | ○ | ○ | R |
| SD9043 | Current link scan time | This register stores the current link scan time. | ○ | ○ | ○ | R |
| SD9044 | Maximum link scan time | This register stores the maximum link scan time. | ○ | ○ | ○ | R |
| SD9045 | Number of communication error at master station | This register stores the number of communication error at master station. | ○ | ○ | ○ | R |
| SD9046 to SD9052 | Number of communication error at slave station No.1 to No.7 | These registers store the number of communication error at slave station No.1 to No.7. | ○ | ○ | ○ | R |
| SD9061 | Code of communication error at master station | This register stores the code of communication error at master station. | ○ | ○ | ○ | R |
| SD9062 to SD9068 | Code of communication error at slave station No.1 to No.7 | These registers store the code of communication error at slave station No.1 to No.7. | ○ | ○ | ○ | R |
| SD9080 | Station number setting | This register stores the station number setting. | ○ | ○ | ○ | R/W |
| SD9081 | Total slave station number setting | This register stores the total slave station number setting. | ○ | ○ | ○ | R/W |
| SD9082 | Refresh range setting | This register stores the refresh range setting. | ○ | ○ | ○ | R |
| SD9083 | Retry count setting | This register stores the retry count setting. | ○ | ○ | ○ | R |
| SD9084 | Communication time-out setting | This register stores the communication time-out setting. | ○ | ○ | ○ | R |
| SD9090 | Master station/slave station setting | The master station/slave station settings are stored. | ○ | ○ | ○ | R |
| SD9091 | Link mode setting | The link mode settings are stored. | ○ | ○ | ○ | R |
| SD9092 | Error determination time setting | The error determination time setting is stored. | ○ | ○ | ○ | R |
| SD9102 | Predefined protocol ready | The reflected status after the protocol setting data has been written is stored.<br>0: Faulty<br>1: Normal | ○ | ○ | ○ | R |
| SD9120 | Predefined protocol setting data error information: Protocol No. | When a protocol setting data error was detected, information to identify the error position is stored.<br>0: Normal<br>1 to 64: Protocol No.<br>65535: Specification not allowed | ○ | ○ | ○ | R |
| SD9121 | Predefined protocol setting data error information: Setting type | When a protocol setting data error was detected, information to identify the error position is stored.<br>0: Packet setting or element setting<br>1: Configuring detailed setting of protocols<br>65535: Specification not allowed | ○ | ○ | ○ | R |

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC*1 | |
| SD9122 | Predefined protocol setting data error information: Packet No. | When a protocol setting data error was detected, information to identify the error position is stored.<br>0: Send packet<br>1 to 16: Receive packet<br>65535: Specification not allowed | ○ | ○ | ○ | R |
| SD9123 | Predefined protocol setting data error information: Element No. | When a protocol setting data error was detected, information to identify the error position is stored.<br>1 to 32: Element No.<br>65535: Specification not allowed | ○ | ○ | ○ | R |
| SD9124 | Number of registered predefined protocols | The number of registered protocol setting data is stored.<br>1 to 64 | ○ | ○ | ○ | R |
| SD9132 | Predefined protocol registration (1 to 16) | The ON/OFF state of the bit corresponding to a protocol number indicates whether the protocol setting data has been registered or not.<br>b15 to b0: 16 to 1 | ○ | ○ | ○ | R |
| SD9133 | Predefined protocol registration (17 to 32) | The ON/OFF state of the bit corresponding to a protocol number indicates whether the protocol setting data has been registered or not.<br>b15 to b0: 32 to 17 | ○ | ○ | ○ | R |
| SD9134 | Predefined protocol registration (33 to 48) | The ON/OFF state of the bit corresponding to a protocol number indicates whether the protocol setting data has been registered or not.<br>b15 to b0: 48 to 33 | ○ | ○ | ○ | R |
| SD9135 | Predefined protocol registration (49 to 64) | The ON/OFF state of the bit corresponding to a protocol number indicates whether the protocol setting data has been registered or not.<br>b15 to b0: 64 to 49 | ○ | ○ | ○ | R |
| SD9150 | Protocol execution status (CH1) | The status of a protocol in execution (CH1) is stored.<br>0: Unexecuted<br>1: Waiting for transmission<br>2: Sending<br>3: Waiting for data reception<br>4: Receiving<br>5: Execution completed | × | × | ○ | R |
| SD9168 | Protocol execution count (CH1) | The cumulative number of executions (CH1) of a protocol is stored.<br>0 to 65535 | × | × | ○ | R |
| SD9169 | Protocol cancel specification (CH1) | The protocol (CH1) in execution can be cancelled with a value to be stored in this area.<br>0: Normal operation (do not cancel)<br>1: Cancel request<br>2: Cancel operation completed | × | × | ○ | R/W |
| SD9170, SD9190, SD9210 | Protocol execution status (CH2 to CH4) | These registers store the status of a protocol in execution (CH2 to CH4).<br>0: Unexecuted<br>1: Waiting for transmission<br>2: Sending<br>3: Waiting for data reception<br>4: Receiving<br>5: Execution completed | ○ | ○ | ○ | R |
| SD9188, SD9208, SD9228 | Protocol execution count (CH2 to CH4) | These registers store the cumulative number of executions (CH2 to CH4) of a protocol.<br>0 to 65535 | ○ | ○ | ○ | R |
| SD9189, SD9209, SD9229 | Protocol cancel specification (CH2 to CH4) | The protocol (CH2 to CH4) in execution can be canceled with a value to be stored in these areas.<br>0: Normal operation (do not cancel)<br>1: Cancel request<br>2: Cancel operation completed | ○ | ○ | ○ | R/W |

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC*1 | |
| SD9230 | Send/receive data monitoring function setting (CH1) | The setting (CH1) of the send/receive data monitoring function is stored.<br>0000H: Monitor stop<br>0001H: Monitor start<br>0002H: Monitoring (set by system)<br>1002H: Monitor stop (set by system)<br>100FH: Monitor setting error (set by system) | × | × | ○ | R/W |
| SD9231 | Send/receive data monitoring function option setting (CH1) | The option setting (CH1) of the send/receive data monitoring function is stored.<br>b0: Data area full stop specification<br>b1: Packet stop specification | × | × | ○ | W |
| SD9232 | Monitoring data device specification (CH1) | The type of word device (CH1) used as the monitor data areas is stored.<br>0: D device<br>1: R device<br>2: W device<br>3: SW device | × | × | ○ | W |
| SD9233 | Monitoring data start device No. specification (CH1) | The start device number (CH1) of word devices used as the monitor data areas is stored.<br>0 to 32765 | × | × | ○ | W |
| SD9234 | Monitoring data size specification (CH1) | The size (CH1) of word devices used as the monitor data areas is stored in word units.<br>1 to 32765 | × | × | ○ | W |
| SD9240, SD9250, SD9260 | Send/receive data monitoring function setting (CH2 to CH4) | The setting (CH2 to CH4) of the send/receive data monitoring function is stored.<br>0000H: Monitor stop<br>0001H: Monitor start<br>0002H: Monitoring (set by system)<br>1002H: Monitor stop (set by system)<br>100FH: Monitor setting error (set by system) | ○ | ○ | ○ | R/W |
| SD9241, SD9251, SD9261 | Send/receive data monitoring function option setting (CH2 to CH4) | The option setting (CH2 to CH4) of the send/receive data monitoring function is stored.<br>b0: Data area full stop specification<br>b1: Packet stop specification | ○ | ○ | ○ | W |
| SD9242, SD9252, SD9262 | Monitoring data device specification (CH2 to CH4) | The type of word device (CH2 to CH4) used as the monitor data areas is stored.<br>0: D device<br>1: R device<br>2: W device<br>3: SW device | ○ | ○ | ○ | W |
| SD9243, SD9253, SD9263 | Monitoring data start device No. specification (CH2 to CH4) | The start device number (CH2 to CH4) of word devices used as the monitor data areas is stored.<br>0 to 32765 | ○ | ○ | ○ | W |
| SD9244, SD9254, SD9264 | Monitoring data size specification (CH2 to CH4) | The size (CH2 to CH4) of word devices used as the monitor data areas is stored in word units.<br>1 to 32765 | ○ | ○ | ○ | W |

*1 CH2 devices for serial communication are not supported by FX5UC CPU module.

*2 Varies according to the host station number SD latch setting state.
Latch disabled: R, Latch enabled: R/W

# Built-in Ethernet function

The special registers for built-in Ethernet are shown below.

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD10050 | Local node IP address [Low-order] | This register stores the local node IP address. | ○ | ○ | ○ | R |
| SD10051 | Local node IP address [High-order] | | | | | |
| SD10060 | Subnet mask [Low-order] | This register stores the subnet mask. | ○ | ○ | ○ | R |
| SD10061 | Subnet mask [High-order] | | | | | |

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD10064 | Default gateway IP address [Low-order] | This register stores the default gateway IP address. | ○ | ○ | ○ | R |
| SD10065 | Default gateway IP address [High-order] | | | | | |
| SD10074 | Local node MAC address | This register stores the local node MAC address (5 and 6 bytes). | ○ | ○ | ○ | R |
| SD10075 | Local node MAC address | This register stores the local node MAC address (3 and 4 bytes). | ○ | ○ | ○ | R |
| SD10076 | Local node MAC address | This register stores the local node MAC address (1 and 2 bytes). | ○ | ○ | ○ | R |
| SD10082 | Communication speed setting | This register stores the communication speed setting. | ○ | ○ | ○ | R |
| SD10084 | MELSOFT connection TCP port No. | This register stores the MELSOFT connection TCP port No. | ○ | ○ | ○ | R |
| SD10086 | MELSOFT direct connection port No. | This register stores the MELSOFT direct connection port No. | ○ | ○ | ○ | R |
| SD10130 to SD10137 | Connection No.1 to 8 latest error code | These registers store the connection No.1 to 8 latest error code. | ○ | ○ | ○ | R |
| SD10147 | MELSOFT direct connection latest error code | This register stores the MELSOFT direct connection latest error code. | ○ | ○ | ○ | R |
| SD10251 | Same IP address state storage area | b0: Same IP address detection flag<br>0: No same IP address<br>1: Same IP address | ○ | ○ | ○ | R |
| SD10252 | MAC address of the already connected station | This register stores the MAC address (5 and 6 bytes) of the already connected station. | ○ | ○ | ○ | R |
| SD10253 | MAC address of the already connected station | This register stores the MAC address (3 and 4 bytes) of the already connected station. | ○ | ○ | ○ | R |
| SD10254 | MAC address of the already connected station | This register stores the MAC address (1 and 2 bytes) of the already connected station. | ○ | ○ | ○ | R |
| SD10255 | MAC address of the station connected later | This register stores the MAC address (5 and 6 bytes) of the station connected later. | ○ | ○ | ○ | R |
| SD10256 | MAC address of the station connected later | This register stores the MAC address (3 and 4 bytes) of the station connected later. | ○ | ○ | ○ | R |
| SD10257 | MAC address of the station connected later | This register stores the MAC address (1 and 2 bytes) of the station connected later. | ○ | ○ | ○ | R |
| SD10270 | Remote password lock status connection No.1 to 8 | b0: Connection No.1<br>b1: Connection No.2<br>b2: Connection No.3<br>b3: Connection No.4<br>b4: Connection No.5<br>b5: Connection No.6<br>b6: Connection No.7<br>b7: Connection No.8<br>0: Unlock status/remote password setting none<br>1: Lock status | ○ | ○ | ○ | R |
| SD10271 | Remote password lock status system port | b1: MELSOFT application communication port (UDP)<br>b2: MELSOFT application communication port (TCP)<br>b3: MELSOFT direct connection<br>b4: FTP transmission port<br>0: Unlock status/remote password setting none<br>1: Lock status | ○ | ○ | ○ | R |
| SD10290 | Time setting function operation result | Stores the operation result of the time setting function.<br>0000H: Unexecuted<br>0001H: Success<br>FFFFH: Failure | ○ | ○ | ○ | R |
| SD10291 | Time setting function execution time (Year) | The year (A.D.) which the time setting function is executed is stored in a binary code.<br>When the communication fails, this device is not updated. | ○ | ○ | ○ | R |

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD10292 | Time setting function execution time (Month) | The month which the time setting function is executed is stored in a binary code.<br>When the communication fails, this device is not updated. | ○ | ○ | ○ | R |
| SD10293 | Time setting function execution time (Day) | The day which the time setting function is executed is stored in a binary code.<br>When the communication fails, this device is not updated. | ○ | ○ | ○ | R |
| SD10294 | Time setting function execution time (Hour) | The hour which the time setting function is executed is stored in a binary code.<br>When the communication fails, this device is not updated. | ○ | ○ | ○ | R |
| SD10295 | Time setting function execution time (Minute) | The minute which the time setting function is executed is stored in a binary code.<br>When the communication fails, this device is not updated. | ○ | ○ | ○ | R |
| SD10296 | Time setting function execution time (Second) | The second which the time setting function is executed is stored in a binary code.<br>When the communication fails, this device is not updated. | ○ | ○ | ○ | R |
| SD10297 | Time setting function execution time (Day of the week) | The day of the week which the time setting function is executed is stored in a binary code.<br>0: Sunday<br>1: Monday<br>2: Tuesday<br>3: Wednesday<br>4: Thursday<br>5: Friday<br>6: Saturday<br>When the communication fails, this device is not updated. | ○ | ○ | ○ | R |
| SD10298 | Time setting function required response time | A time required from sending the message to the SNTP server to receiving the response and setting the time to the CPU module is stored.<br>Range: 0000H to FFFEH (Unit: ms)<br>If the value exceeds the above range, all the values are stored as FFFFH.<br>When the communication fails, this device is not updated. | ○ | ○ | ○ | R |
| SD10299 | Time setting function execution | This turns ON when the time setting function is executed.<br>This automatically turns OFF when the time setting is completed or time out occurs in communication.<br>0: No execution request<br>1: Execution requested | ○ | ○ | ○ | R/W |
| SD10320 to SD10327 | Connections 1 to 8 continuous unlock failure number of times | These registers store the connections 1 to 8 continuous unlock failure number of times. | ○ | ○ | ○ | R |
| SD10337 | MELSOFT communication port (UDP/IP) continuous unlock failure number of times | This register stores the MELSOFT communication port (UDP/IP) continuous unlock failure number of times. | ○ | ○ | ○ | R |
| SD10338 | MELSOFT communication port (TCP/IP) continuous unlock failure number of times | This register stores the MELSOFT communication port (TCP/IP) continuous unlock failure number of times. | ○ | ○ | ○ | R |
| SD10339 | FTP transmission port (TCP/IP) continuous unlock failure count | This register stores the FTP transmission port (TCP/IP) continuous unlock failure count. | ○ | ○ | ○ | R |
| SD10340 | MELSOFT direct connection continuous unlock failure number of times | This register stores the MELSOFT direct connection continuous unlock failure number of times. | ○ | ○ | ○ | R |

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD10350 | Request to start communication | Request contact to start data communication when the communication setting for the simple CPU communication is "Request"<br>[b0] to [b15]: Setting No.1 to Setting No.16<br>0 to 1: Requested (start request)<br>To make start request again, first stop the request and then make start request. | ○ | ○ | ○ | R/W |
| SD10351 | | Request contact to start data communication when the communication setting for the simple CPU communication is "Request"<br>[b0] to [b15]: Setting No.17 to Setting No.32<br>0 to 1: Requested (start request)<br>To make start request again, first stop the request and then make start request. | × | × | ○ | R/W |
| SD10352 | Request to stop communication | Request contact to stop data transmission when the communication setting for the simple CPU communication is "Fixed"<br>[b0] to [b15]: Setting No.1 to Setting No.16<br>0 to 1: Requested (stop request)<br>1 to 0: Completed (stop completion) | ○ | ○ | ○ | R/W |
| SD10353 | | Request contact to stop data transmission when the communication setting for the simple CPU communication is "Fixed"<br>[b0] to [b15]: Setting No.17 to Setting No.32<br>0 to 1: Requested (stop request)<br>1 to 0: Completed (stop completion) | × | × | ○ | R/W |
| SD10354 | Request to restart communication | Request contact to restart data transmission when the communication setting for the simple CPU communication is "Fixed"<br>[b0] to [b15]: Setting No.1 to Setting No.16<br>0 to 1: Requested (restart request)<br>1 to 0: Completed (restart completion) | ○ | ○ | ○ | R/W |
| SD10355 | | Request contact to restart data transmission when the communication setting for the simple CPU communication is "Fixed"<br>[b0] to [b15]: Setting No.17 to Setting No.32<br>0 to 1: Requested (restart request)<br>1 to 0: Completed (restart completion) | × | × | ○ | R/W |
| SD10356 | Execution status flag | The data transmission/reception status of the simple CPU communication is stored for each setting number.<br>[b0] to [b15]: Setting No.1 to Setting No.16<br>0: Communication stop (function not used)<br>1: Communicating | ○ | ○ | ○ | R |
| SD10357 | | The data transmission/reception status of the simple CPU communication is stored for each setting number.<br>[b0] to [b15]: Setting No.17 to Setting No.32<br>0: Communication stop (function not used)<br>1: Communicating | × | × | ○ | R |
| SD10358 | Preparation completion flag | The preparation completion status of the simple CPU communication is stored for each setting number.<br>[b0] to [b15]: Setting No.1 to Setting No.16<br>0: Not ready (function not used)<br>1: Ready | ○ | ○ | ○ | R |
| SD10359 | | The preparation completion status of the simple CPU communication is stored for each setting number.<br>[b0] to [b15]: Setting No.17 to Setting No.32<br>0: Not ready (function not used)<br>1: Ready | × | × | ○ | R |

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD10380 to SD10395 | Simple CPU communication status | The simple CPU communication status is stored.<br>SD10380: Setting No.1 to SD10395: Setting No.16<br>0H: Unset<br>1H: Preparing<br>3H: Communicating<br>4H: Communication stop<br>5H: Retry being executed<br>6H: Monitoring at error<br>AH: Communications impossible | ○ | ○ | ○ | R |
| SD10396 to SD10411 | | The simple CPU communication status is stored.<br>SD10396: Setting No.17 to SD10411: Setting No.32<br>0H: Unset<br>1H: Preparing<br>3H: Communicating<br>4H: Communication stop<br>5H: Retry being executed<br>6H: Monitoring at error<br>AH: Communications impossible | × | × | ○ | R |
| SD10412 to SD10427 | Simple CPU communication error code | The cause of the error detected in the simple CPU communication is stored.<br>SD10412: Setting No.1 to SD10427: Setting No.16<br>0: No error (function not used)<br>Other than 0: Error code<br>The value is cleared to 0 with a clear request from the engineering tool. | ○ | ○ | ○ | R |
| SD10428 to SD10443 | | The cause of the error detected in the simple CPU communication is stored.<br>SD10428: Setting No.17 to SD10443: Setting No.32<br>0: No error (function not used)<br>Other than 0: Error code<br>The value is cleared to 0 with a clear request from the engineering tool. | × | × | ○ | R |
| SD10444 to SD10459 | Simple CPU communication execution interval (current value) | If "Fixed" is set for communication setting, the current value of the execution interval is stored.<br>SD10444: Setting No.1 to SD10459: Setting No.16<br>0: Unset (function not used), communications impossible<br>Other than 0: Execution interval (unit: ms) | ○ | ○ | ○ | R |
| SD10460 to SD10475 | | If "Fixed" is set for communication setting, the current value of the execution interval is stored.<br>SD10460: Setting No.17 to SD10475: Setting No.32<br>0: Unset (function not used), communications impossible<br>Other than 0: Execution interval (unit: ms) | × | × | ○ | R |
| SD10476 to SD10491 | Error response code | The error response code detected by simple CPU communication is stored.<br>SD10476: Setting No.1 to SD10491: Setting No.16 | ○ | ○ | ○ | R |
| SD10492 to SD10507 | | The error response code detected by simple CPU communication is stored.<br>SD10492: Setting No.17 to SD10507: Setting No.32 | × | × | ○ | R |

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD10680 | Open completion signal | b0: Connection No.1<br>b1: Connection No.2<br>b2: Connection No.3<br>b3: Connection No.4<br>b4: Connection No.5<br>b5: Connection No.6<br>b6: Connection No.7<br>b7: Connection No.8<br>0: Close/Open not completed<br>1: Open completed | ○ | ○ | ○ | R |
| SD10681 | Open request signal | b0: Connection No.1<br>b1: Connection No.2<br>b2: Connection No.3<br>b3: Connection No.4<br>b4: Connection No.5<br>b5: Connection No.6<br>b6: Connection No.7<br>b7: Connection No.8<br>0: No open request<br>1: Open request exists | ○ | ○ | ○ | R |
| SD10682 | Socket communications receive status signal | b0: Connection No.1<br>b1: Connection No.2<br>b2: Connection No.3<br>b3: Connection No.4<br>b4: Connection No.5<br>b5: Connection No.6<br>b6: Connection No.7<br>b7: Connection No.8<br>0: No data received<br>1: Data receiving completed | ○ | ○ | ○ | R |
| SD10683 | Initial status | b0: Initial normal completion status<br>b1: Initialization abnormal completion<br>0: Not completed<br>1: Completed | ○ | ○ | ○ | R |
| SD10692 | Predefined protocol ready | 0: Not ready<br>1: Ready | ○ | ○ | ○ | R |
| SD10710 | Predefined protocol setting data error information protocol number | When a protocol setting data error is detected, stores the protocol number where the error was detected. | ○ | ○ | ○ | R |
| SD10711 | Predefined protocol setting data error information setting type | 0 is stored if an error is detected in the packet setting or element setting.<br>1 is stored if an error is detected in the protocol detailed setting. | ○ | ○ | ○ | R |
| SD10712 | Predefined protocol setting data error information packet number | When an error is detected in the protocol setting data, stores the packet number that detected the error. | ○ | ○ | ○ | R |
| SD10713 | Predefined protocol setting data error information Element number | When an error is detected in the protocol setting data, stores the element number where the error was detected. | ○ | ○ | ○ | R |
| SD10714 | Number of registered predefined protocols | Stores the protocol number of the registered protocol setting data. | ○ | ○ | ○ | R |
| SD10722 | Predefined protocol registration (1 to 16) | Whether protocol setting data is registered or not is stored. | ○ | ○ | ○ | R |
| SD10723 | Predefined protocol registration (17 to 32) | | | | | |
| SD10724 | Predefined protocol registration (33 to 48) | | | | | |
| SD10725 | Predefined protocol registration (49 to 64) | | | | | |

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD10740 | Connection No.1 protocol execution status | Stores the status of the protocol being executed at connection No.1.<br>0: Unexecuted<br>1: Waiting for transmission<br>2: Sending<br>3: Waiting for data reception<br>4: Receiving<br>5: Execution completed | ○ | ○ | ○ | R |
| SD10742 to SD10757 | Connection No.1 received data verification result (receive packet No.1 to 16) | Stores the verification results of receive packet No.1 to 16.<br>Element No. where the verification result did not match (b0 to b7)<br>The cause of mismatch (verification result code) (b8 to b15) | ○ | ○ | ○ | R |
| SD10758 | Connection No.1 protocol execution count | Stores the number of protocol executions in Connection No.1.<br>0: Protocol not executed<br>1 to 65535: Number of executions | ○ | ○ | ○ | R |
| SD10759 | Connection No.1 protocol cancellation specification | Cancels the protocol executed in connection No.1.<br>0: No cancellation instruction<br>1: Cancel request<br>2: Cancellation completed | ○ | ○ | ○ | R/W |
| SD10760 | Connection No.2 protocol execution status | Stores the status of the protocol being executed at connection No.2.<br>0: Unexecuted<br>1: Waiting for transmission<br>2: Sending<br>3: Waiting for data reception<br>4: Receiving<br>5: Execution completed | ○ | ○ | ○ | R |
| SD10762 to SD10777 | Connection No.2 received data verification result (receive packet No.1 to 16) | Stores the verification results of receive packet No.1 to 16.<br>Element No. where the verification result did not match (b0 to b7)<br>The cause of mismatch (verification result code) (b8 to b15) | ○ | ○ | ○ | R |
| SD10778 | Connection No.2 protocol execution count | Stores the number of protocol executions in connection No.2.<br>0: Protocol not executed<br>1 to 65535: Number of executions | ○ | ○ | ○ | R |
| SD10779 | Connection No.2 protocol cancellation specification | Cancels the protocol executed in connection No.2.<br>0: No cancellation instruction<br>1: Cancel request<br>2: Cancellation completed | ○ | ○ | ○ | R/W |
| SD10780 | Connection No.3 protocol execution status | Stores the status of the protocol being executed at connection No.3.<br>0: Unexecuted<br>1: Waiting for transmission<br>2: Sending<br>3: Waiting for data reception<br>4: Receiving<br>5: Execution completed | ○ | ○ | ○ | R |
| SD10782 to SD10797 | Connection No.3 received data verification result (receive packet No.1 to 16) | Stores the verification results of receive packet No.1 to 16.<br>Element No. where the verification result did not match (b0 to b7)<br>The cause of mismatch (verification result code) (b8 to b15) | ○ | ○ | ○ | R |
| SD10798 | Connection No.3 protocol execution count | Stores the number of protocol executions in connection No.3.<br>0: Protocol not executed<br>1 to 65535: Number of executions | ○ | ○ | ○ | R |

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD10799 | Connection No.3 protocol cancellation specification | Cancels the protocol executed in connection No.3.<br>0: No cancellation instruction<br>1: Cancel request<br>2: Cancellation completed | ○ | ○ | ○ | R/W |
| SD10800 | Connection No.4 protocol execution status | Stores the status of the protocol being executed at connection No.4.<br>0: Unexecuted<br>1: Waiting for transmission<br>2: Sending<br>3: Waiting for data reception<br>4: Receiving<br>5: Execution completed | ○ | ○ | ○ | R |
| SD10802 to SD10817 | Connection No.4 received data verification result (receive packet No.1 to 16) | Stores the verification results of receive packet No.1 to 16.<br>Element No. where the verification result did not match (b0 to b7)<br>The cause of mismatch (verification result code) (b8 to b15) | ○ | ○ | ○ | R |
| SD10818 | Connection No.4 protocol execution count | Stores the number of protocol executions in connection No.4.<br>0: Protocol not executed<br>1 to 65535: Number of executions | ○ | ○ | ○ | R |
| SD10819 | Connection No.4 protocol cancellation specification | Cancels the protocol executed in connection No.4.<br>0: No cancellation instruction<br>1: Cancel request<br>2: Cancellation completed | ○ | ○ | ○ | R/W |
| SD10820 | Connection No.5 protocol execution status | Stores the status of the protocol being executed at connection No.5.<br>0: Unexecuted<br>1: Waiting for transmission<br>2: Sending<br>3: Waiting for data reception<br>4: Receiving<br>5: Execution completed | ○ | ○ | ○ | R |
| SD10822 to SD10837 | Connection No.5 received data verification result (receive packet No.1 to 16) | Stores the verification results of receive packet No.1 to 16.<br>Element No. where the verification result did not match (b0 to b7)<br>The cause of mismatch (verification result code) (b8 to b15) | ○ | ○ | ○ | R |
| SD10838 | Connection No.5 protocol execution count | Stores the number of protocol executions in connection No.5.<br>0: Protocol not executed<br>1 to 65535: Number of executions | ○ | ○ | ○ | R |
| SD10839 | Connection No.5 protocol cancellation specification | Cancels the protocol executed in connection No.5.<br>0: No cancellation instruction<br>1: Cancel request<br>2: Cancellation completed | ○ | ○ | ○ | R/W |
| SD10840 | Connection No.6 protocol execution status | Stores the status of the protocol being executed at connection No.6.<br>0: Unexecuted<br>1: Waiting for transmission<br>2: Sending<br>3: Waiting for data reception<br>4: Receiving<br>5: Execution completed | ○ | ○ | ○ | R |
| SD10842 to SD10857 | Connection No.6 received data verification result (receive packet Nos.1 to 16) | Stores the verification results of receive packet No.1 to 16.<br>Element No. where the verification result did not match (b0 to b7)<br>The cause of mismatch (verification result code) (b8 to b15) | ○ | ○ | ○ | R |

| No. | Name | Description | Compatible CPU module | | | R/W |
|---|---|---|---|---|---|---|
| | | | FX5S | FX5UJ | FX5U/ FX5UC | |
| SD10858 | Connection No.6 protocol execution count | Stores the number of protocol executions in connection No.6.<br>0: Protocol not executed<br>1 to 65535: Number of executions | ○ | ○ | ○ | R |
| SD10859 | Connection No.6 protocol cancellation specification | Cancels the protocol executed in connection No.6.<br>0: No cancellation instruction<br>1: Cancel request<br>2: Cancellation completed | ○ | ○ | ○ | R/W |
| SD10860 | Connection No.7 protocol execution status | Stores the status of the protocol being executed at connection No.7.<br>0: Unexecuted<br>1: Waiting for transmission<br>2: Sending<br>3: Waiting for data reception<br>4: Receiving<br>5: Execution completed | ○ | ○ | ○ | R |
| SD10862 to SD10877 | Connection No.7 received data verification result (receive packet Nos.1 to 16) | Stores the verification results of receive packet No.1 to 16.<br>Element No. where the verification result did not match (b0 to b7)<br>The cause of mismatch (verification result code) (b8 to b15) | ○ | ○ | ○ | R |
| SD10878 | Connection No.7 protocol execution count | Stores the number of protocol executions in connection No.7.<br>0: Protocol not executed<br>1 to 65535: Number of executions | ○ | ○ | ○ | R |
| SD10879 | Connection No.7 protocol cancellation specification | Cancels the protocol executed in connection No.7.<br>0: No cancellation instruction<br>1: Cancel request<br>2: Cancellation completed | ○ | ○ | ○ | R/W |
| SD10880 | Connection No.8 protocol execution status | Stores the status of the protocol being executed at connection No.8.<br>0: Unexecuted<br>1: Waiting for transmission<br>2: Sending<br>3: Waiting for data reception<br>4: Receiving<br>5: Execution completed | ○ | ○ | ○ | R |
| SD10882 to SD10897 | Connection No.8 received data verification result (receive packet Nos.1 to 16) | Stores the verification results of receive packet No.1 to 16.<br>Element No. where the verification result did not match (b0 to b7)<br>The cause of mismatch (verification result code) (b8 to b15) | ○ | ○ | ○ | R |
| SD10898 | Connection No.8 protocol execution count | Stores the number of protocol executions in connection No.8.<br>0: Protocol not executed<br>1 to 65535: Number of executions | ○ | ○ | ○ | R |
| SD10899 | Connection No.8 protocol cancellation specification | Cancels the protocol executed in connection No.8.<br>0: No cancellation instruction<br>1: Cancel request<br>2: Cancellation completed | ○ | ○ | ○ | R/W |

# Appendix 3 Error Code

The CPU module stores error code in special register (SD) upon detection of an error using the self-diagnostics function. The error details and cause can be identified by checking the error code. The error code can be checked in either of the following ways.

• Module diagnostics of the engineering tool (MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware))

This section describes errors that may occur in the CPU module and actions to be taken for the errors.

## Error code system

All error codes are given in hexadecimal format (4 digits) (16-bit unsigned integer). The following table lists the error detection type and the error code ranges.

| Error detection type | | Range | Description |
|---|---|---|---|
| By the self-diagnostic function of each module | Minor error | 1000H to 1FFFH | Error code specific to each module, such as self-diagnostics errors |
| | Moderate error | 2000H to 3BFFH | |
| | Major error | 3C00H to 3FFFH | |
| Detected during communication between CPU modules | | 4000H to 4FFFH | Error in the CPU module |
| | | 7000H to 7FFFH | MELSEC iQ-F FX5 User's Manual (Communication) |
| | | 8100H to 8230H | Error in PID control via parameter |
| | | C000H to CFBFH | MELSEC iQ-F FX5 User's Manual (Communication) |
| | | CFC0H to CFFFH | Error in CC-Link IE Field Network Basic |
| | | D000H to DFFFH | MELSEC iQ-F FX5 CC-Link IE Field Network Module User's Manual |

### Detailed information

Upon detection of error through self-diagnostics function, the detailed information of the error cause is stored all together. The following detailed information is added to each error code (up to two types of information are stored for each error code. The types differ depending on error code.) Detailed information 1 to 2 of the latest error code(s) can be checked with special register (SD).

| Detailed information | Item | Description |
|---|---|---|
| Detailed information 1 | Error location information*1 | Information on the location in a program, such as step No. is indicated. |
| | Drive/file information | Information on drive names and file names |
| | Parameter information | The information for the parameter, such as parameter storage location and parameter type, is indicated. |
| | System configuration information | The information for the system configuration, such as I/O No. is indicated. |
| | Frequency information | This section describes the information for frequency such as the write frequency into memory. |
| | Time information | The information for the time is indicated. |
| Detailed information 2 | Drive/file information | Information on drive names and file names |
| | Annunciator information | Information about annunciators |
| | Parameter information | The information for the parameter, such as parameter storage location and parameter type, is indicated. |
| | System configuration information | The information for the system configuration, such as I/O No. is indicated. |

*1 The step No., which is displayed in the program position information, is the step No. that is counted from the head of the file. It might be sometimes different from the step No. of the program which is displayed in error jump of engineering tool.

A

# Operation when an error occurs

There are two types of errors: continuation errors and stop errors.

## Stop error

If a stop error occurs, the CPU module stops its operation and the operating state will be in STOP. Modules can communicate with the CPU module even after a stop error occurs in the CPU module.

## Continuation error

If a continuation error occurs, the CPU module continues its operation. (The operating state will remain the same.)

# Error check

## Common error

When an error common to the functions other than the positioning function (operation error, parameter error) occurs, the following error flag turns on.

| Latest self-diagnostic error (Including the annunciator ON) | Latest self-diagnostic error (Not including the annunciator ON) | Operation error | |
|---|---|---|---|
| SM0 | SM1 | SM56 | SM8067 |

After the error flag above turns on, an error code is stored in the following device. One error code common to all the axes is stored.

| Latest self diagnostics error code | Operation error |
|---|---|
| SD0 | SD8067 |

When an operation error related to positioning occurs, one of the following error codes is stored.

| Error code (HEX) | Description | Cause |
|---|---|---|
| 1810 | Operation error | Positioning of the axis specified is already in operation. |
| 1811 | Operation error | 17 or more DABS instructions were driven simultaneously. |
| 2221 | Parameter error | The parameter set value is out of range or device specified by the parameter is out of range. |
| 2801 | Instruction execution error | The number of a module that does not exist is specified. |
| 3055 | System bus error | • All module reset was executed.<br>• A stop error occurred in the positioning of high-speed pulse input/output module. |
| 3056 | System bus error | A bus error occurred and a response was not returned during bus access for high-speed pulse input/output module. |
| 3057 | | |
| 3060 | System bus error | A signal error was detected at the time of bus access for high-speed pulse input/output module. |
| 3061 | | |
| 3405 | Operation error | The operand of the instruction is out of range. |
| 3582 | Operation error | The positioning of high-speed pulse input/output module is executed in a user interruption program. |
| 3600 | Operation error | Positioning is attempted on an axis with no parameters specified. A function of the setting not used in parameters (such as interrupt input signal 1 or function related to origin return) is used. |
| 36F0 | ABS sum error | The ABS data sum from the servo amplifier does not match. |

For details on error codes other than the above, refer to the following.

☞ Page 853 Error Code

### Positioning-dedicated error

When an error related to the positioning function occurs, the following special device turns on.

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4*1 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 |
| Positioning error occurrence | SM5532 | SM5533 | SM5534 | SM5535 | SM5536 | SM5537 | SM5538 | SM5539 | SM5540 | SM5541 | SM5542 | SM5543 |

After the device above turns on, an error code is stored in the corresponding special device below.

| Name | CPU module | | | | High-speed pulse input/output module | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | First module | | Second module | | Third module | | Fourth module | |
| | Axis 1 | Axis 2 | Axis 3 | Axis 4*1 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 |
| Positioning error (error code) | SD5510 | SD5550 | SD5590 | SD5630 | SD5670 | SD5710 | SD5750 | SD5790 | SD5830 | SD5870 | SD5910 | SD5950 |

*1 Only FX5S/FX5U/FX5UC CPU module is supported.

The following error codes are stored in the positioning error (error code). Error codes of axis 4 are available only for the FX5S/FX5U/FX5UC CPU module.

## How to clear errors

Continuation errors can be cleared. (☞ Page 129 Error clear)

## List of error codes

### Self-diagnostics error codes of the CPU module (1000H to 3FFFH)

The following table lists the error codes detected by the self-diagnostics function of the CPU module.

| Error code | Error name | Error details and cause | Stop/ continue | Action | Detailed information | Diagnostic timing |
|---|---|---|---|---|---|---|
| 1080H | ROM write count error | • The number of writes to the data memory exceeded 20,000 times. | Continue | • Replace the CPU module. | Frequency information | At write |
| 1090H | Battery error | • Low battery voltage was detected. Or an error was detected in a battery keeping device. | Continue | • Check the connection of the battery.<br>• Replace the battery as soon as possible. | — | At END instruction execution |
| 1100H | Memory card access error | • Writing failed because the write protect switch of the memory card is enabled (writing is prohibited).<br>• An SD memory card was inserted when the SD memory card access control switch was set to OFF (upward). | Continue | • Disable the write protect switch of the memory card.<br>• Set the SD memory card access control switch to ON (downward) and insert an SD memory card. | — | At write |
| 1120H | SNTP time setting error | • Clock setting has failed when the system is powered on or the CPU module is reset.<br>• Clock setting using the time setting function (SNTP client) has failed. | Continue | • Check if the time settings are correctly set in parameter.<br>• Check if the specified SNTP server is operating normally and there is no failure on the network accessing the SNTP server computer. | — | At power-on, at RESET |
| 112EH | Connection establishment failed | • The connection was not established during the open process. | Continue | • Check the operation of the external device.<br>• Use an external device to confirm whether the open process was executed.<br>• Review the port No. of the module with Ethernet, the IP address/port No. of the external device, and the opening method.<br>• If the external device has a firewall set, check whether access is permitted.<br>• Check whether the Ethernet cable is disconnected. | — | At END instruction execution |

| Error code | Error name | Error details and cause | Stop/ continue | Action | Detailed information | Diagnostic timing |
|---|---|---|---|---|---|---|
| 1134H | TCP connection timeout | • A TCP ULP timeout error has occurred in the TCP/IP communication. (The external device does not send an ACK response.) | Continue | • Check the operation of the external device.<br>• Review the TCP ULP timeout value for the module with Ethernet.<br>• Since there may be congestion of packets on the line, send data after a certain period of time.<br>• Check if the connection cable is disconnected. | — | Always |
| 1200H | Module moderate error detected | • Detected a notice of moderate error occurrence from intelligent function module. | Continue/ stop*1 | • Confirm detailed information (system configuration information) from module diagnosis of the engineering tool and remove the error of the abnormal module. | System configuration information | At END instruction execution |
| 1800H | Annunciator ON | • An annunciator that was turned ON by the SET F instruction or OUT F instruction was detected. | Continue | • Check the program of that number (annunciator number). | Error location information and annunciator information | At instruction execution |
| 1810H | Operation error | • The channel specified by instructions using communication functions or high-speed I/O is already used by other instructions. | Continue/ stop*1 | • Verify that the channel specified by instructions using communication functions or high-speed I/O is not used by other instructions. | Error location information | At instruction execution |
| 1811H | Operation error | • The number of times that applied instructions are used in the program exceeded the specified limit. | Continue/ stop*1 | • Verify that the number of times that applied instructions are used in the program does not exceed the specified limit. | Error location information | At instruction execution |
| 1821H to 182CH | Write during RUN error (axes 1 to 12) | • Writing during RUN (change or deletion) is performed on an instruction being executed. | Continue | • Verify that the writing during RUN (change or deletion) is performed on an instruction being executed.<br>• If the writing is executed during an ongoing RUN, after confirming that the pulse output is not occurring, turn OFF → ON the driving contact point to start the operation of the positioning instruction. | Error location information and system configuration information | At END instruction execution |
| 1900H | Constant scan time error | • The scan time exceeded the constant scan setting value. | Continue | • Check and correct the constant scan time setting. | Time information | At END instruction execution |
| 1910H | Update error | • The file for updating is not found. | Continue | • Check the update setting. | Drive/file information | At power-on, at RESET |
| 1911H | Update error | • The module to be updated is not connected to a correct position. | Continue | • Check the update setting and the connection of the module to be updated. | Drive/file information | At power-on, at RESET |
| 1912H | Update error | • Recovery of the project data saved in the SD memory card failed. | Continue | • Recovery of the project data failed, so initialize all data, and then write in the set of project data backed up by the customer. | Drive/file information | At power-on, at RESET |
| 1920H | IP address setting error | • Values such as the IP address setting (SD8492 to SD8497) are outside the set range. | Continue | • Recheck the values such as the IP address setting (SD8492 to SD8497). | — | At END instruction execution |
| 1921H | IP address writing/clear request simultaneous detection | • Write request and clear request (SM8492 and SM8495) turned from OFF to ON simultaneously. | Continue | • Verify that write request and clear request (SM8492 and SM8495) do not turn from OFF to ON simultaneously. | — | At END instruction execution |
| 1930H to 1932H | Online change error | • An error was detected when writing was executed during RUN. | Continue | • Set the CPU module to STOP and write a set of project data. | — | At END instruction execution |
| 1FE0H | Module configuration error | • The number of I/O points specified in the I/O assignment setting of the parameters is different from that of the module connected. | Continue/ stop*1 | • Make sure that the parameters are consistent with the connections. | System configuration information | At power-on, at RESET |

| Error code | Error name | Error details and cause | Stop/ continue | Action | Detailed information | Diagnostic timing |
|---|---|---|---|---|---|---|
| 1FE1H | Module configuration error | • The module position specified in the I/O assignment setting of the parameters is different from that of the module connected. | Continue/ stop*1 | • Make sure that the parameters are consistent with the connections. | System configuration information | At power-on, at RESET |
| 1FE2H | Module configuration error | • No parameters available for the module connected exist. | Continue/ stop*1 | • Make sure that the parameters are consistent with the connections. | System configuration information | At power-on, at RESET |
| 1FE3H | Module configuration error | • The module specified in the I/O assignment setting of the parameters is not connected. | Continue/ stop*1 | • Make sure that the parameters are consistent with the connections. | System configuration information | At power-on, at RESET |
| 1FE4H | Module configuration error | • Parameters for a standard input/output module are set to a high-speed pulse input/ output module. | Continue/ stop*1 | • Make sure that the parameters are consistent with the connections. | System configuration information | At power-on, at RESET |
| 1FE5H | Module configuration error | • The I/O numbers of the reserved module specified in the I/O assignment setting of the parameters overlap those of other modules. | Continue/ stop*1 | • Make sure that the parameters are consistent with the connections. | System configuration information | At power-on, at RESET |
| 1FE6H | Module configuration error | • The I/O method of the input/ output module is different. | Continue/ stop*1 | • Make sure that the parameters are consistent with the connections. | System configuration information | At power-on, at RESET |
| 1FE7H | Module configuration error | • The type of the CPU module is different. | Continue/ stop*1 | • Make sure that the parameters are consistent with the connections. | System configuration information | At power-on, at RESET |
| 1FE8H | Module configuration error | • The remote I/O points required by the system is insufficient. | Continue | • Set the number of I/O points again within the maximum number of points for the entire system.<br>• The maximum number of points differs depending on the firmware version. Confirm the firmware version and update it if necessary. | System configuration information | At power-on, at RESET |
| 2003H | Module configuration error | • The model of the module connected is different from that of the module set in the parameters. | Stop | • Make sure the model of the module to be set is consistent with the parameters of the module connected. | System configuration information | At power-on, at RESET |
| 2008H | Module configuration error | • The total number of I/O points (excluding remote I/O) exceeded the maximum points. | Continue | • Do not use more than the maximum I/O points in programs.<br>• If writing failed, restart or reset the CPU module and then perform write during STOP status. | System configuration information | At power-on, at RESET |

| Error code | Error name | Error details and cause | Stop/ continue | Action | Detailed information | Diagnostic timing |
|---|---|---|---|---|---|---|
| 2042H | CPU module configuration error | ■FX5S CPU module<br>• The number of communication adapters connected is equal to or greater than 3.<br>• The number of analog adapters connected is equal to or greater than 5.<br>• The number of expansion boards connected is equal to or greater than 2.<br>• With a communication board, the number of communication adapters connected is equal to or greater than 2.<br>■FX5UJ CPU module<br>• The number of input, output, input/output, and intelligent function modules connected is equal to or greater than 9.<br>• The number of simple motion modules connected is equal to or greater than 2.<br>• The number of communication adapters connected is equal to or greater than 3.<br>• The number of analog adapters connected is equal to or greater than 3.<br>• The number of extension power supply modules connected is equal to or greater than 2.<br>• The number of expansion boards connected is equal to or greater than 2.<br>• The number of intelligent function modules connected exceeds the limit of available connection.<br>• With a communication board, the number of communication adapters connected is equal to or greater than 2.<br>■FX5U/FX5UC CPU module<br>• The number of input, output, input/output, and intelligent function modules connected is equal to or greater than 17.<br>• The number of communication adapters connected is equal to or greater than 3.<br>• The number of analog adapters connected is equal to or greater than 5.<br>• The number of extension power supply modules connected is equal to or greater than 3.<br>• The number of expansion boards connected is equal to or greater than 2.<br>• The number of intelligent function modules connected exceeds the limit of available connection. | Stop | ■FX5S CPU module<br>• Use up to 2 communication adapters.<br>• Use up to 4 analog adapters.<br>• Use up to 1 expansion board.<br>• When a communication board and a communication adapter are combined, the allowable number of communication adapters is 1 or less.<br>■FX5UJ CPU module<br>• Use up to 8 input, output, input/output, and intelligent function modules.<br>• Use up to 1 simple motion modules.<br>• Use up to 2 communication adapters.<br>• Use up to 2 analog adapters.<br>• Use up to 1 extension power supply module.<br>• Use up to 1 expansion board.<br>• Connect each intelligent function modules within the connectable limit.<br>• When a communication board and a communication adapter are combined, the allowable number of communication adapters is 1 or less.<br>■FX5U/FX5UC CPU module<br>• Use up to 16 input, output, input/output, and intelligent function modules.<br>• Use up to 2 communication adapters.<br>• Use up to 4 analog adapters.<br>• Use up to 2 extension power supply modules.<br>• Use up to 1 expansion board.<br>• Connect each intelligent function modules within the connectable limit. | System configuration information | At power-on, at RESET |

| Error code | Error name | Error details and cause | Stop/ continue | Action | Detailed information | Diagnostic timing |
|---|---|---|---|---|---|---|
| 20E0H | Invalid module detection | • An unsupported module was detected. | Stop | • Verify that the firmware version of the CPU module is compatible with the module where the error was detected.<br>• If the firmware version of the CPU module is correct, there may be a malfunction in the connected module. Replace the connected module. | System configuration information | At power-on, at RESET |
| 2120H | Memory card error | • An SD memory card error was detected.<br>• The SD memory card may have been removed without the SD memory card disabled. | Continue/ stop*1*3 | • Check the connection of the SD memory card. If the problem persists, there may be a malfunction in the SD memory card or CPU module. | Drive/file information | Always |
| 2121H | Memory card error | • An SD memory card error was detected.<br>• The SD memory card may not be correctly formatted. | Continue/ stop*1*3 | • Format the SD memory card. If the problem persists, there may be a malfunction in the SD memory card or CPU module. | Drive/file information | Always |
| 2160H | IP address duplication error | • The IP address is duplicated within the system. | Continue | • Review the setting so that the IP address is not duplicated within the system. | — | Always |
| 2180H | Invalid file detection | • An error was found in the data of the file. | Stop | • Recreate the file. | Drive/file information | At power-on, at RESET, at STOP → RUN state |
| 21A0H | File specification error | • The booted CPU module and the booting CPU module are not of the same model.<br>• The file specified in the parameters does not exist. | Stop | • Boot the CPU module from a CPU module of the same model.<br>• Rewrite the project. If the same error appears, the hardware of the CPU module may be malfunctioning. Initialize the memory, and if the memory still cannot be recovered, consult your local Mitsubishi Electric representative. | Drive/file information<br>Parameter information | At power-on, at RESET, at STOP → RUN state |
| 21A1H | File specification error | • The file specified in parameter cannot be created. | Stop | • Check the detailed information (parameter information) of the error by executing module diagnostics using the engineering tool, and correct the name and size of the file corresponding to the displayed parameter number.<br>• Check the detailed information (drive/file information) of the error by executing module diagnostics using the engineering tool, and take the following actions:<br>(1) Format the corresponding drive.<br>(2) Delete unnecessary files on the corresponding drive to increase free space.<br>(3) Unlock the corresponding drive if it is locked. | Drive/file information | At power-on, at RESET |
| 2200H | Parameter error | • The parameter file is not found. | Stop | • Rewrite the project. | Parameter information | At power-on, at RESET |
| 2220H | Parameter error | • The contents of the parameters are corrupted. | Stop | • Rewrite the project. | Parameter information | At power-on, at RESET |
| 2221H | Parameter error | • The parameter set value is out of range.<br>• A setting has been made to use a function that is not supported. | Stop | • Modify the parameter set value and rewrite the project.<br>• The number of I/O points and supported modules and functions vary depending on the firmware version. Check the firmware version and update it as necessary. | Parameter information | At power-on, at RESET |
| 2222H | Parameter error | • The parameter set value is out of range.<br>• A setting has been made to use a function not supported by the target module. | Stop | • Modify the parameter set value and rewrite the project.<br>• The number of I/O points and supported modules and functions vary depending on the firmware version. Check the firmware version and update it as necessary. | Parameter information | At power-on, at RESET |

| Error code | Error name | Error details and cause | Stop/ continue | Action | Detailed information | Diagnostic timing |
|---|---|---|---|---|---|---|
| 2226H | Parameter error | • The SFC settings in the CPU parameter is incorrect. (Block 0 was set to start automatically, however, block 0 does not exist.) | Stop | • Check the detailed information (parameter information) in the module diagnosis of the engineering tool, and review the parameter setting corresponding to the numerical value (parameter No.). | Parameter information | At power-on, at RESET, at STOP → RUN state, at SFC program execution |
| 2227H | Parameter error | • The execution type of the SFC program set in the CPU parameter program settings is other than the scan execution type. | Stop | • Check the detailed information (parameter information) in the module diagnosis of the engineering tool, and review the parameter setting corresponding to the numerical value (parameter No.). | Parameter information | At power-on, at RESET |
| 2241H | Parameter error (module) | • The module parameter settings and the target module are different. | Stop | • Modify the module parameter set value and rewrite the project. | Parameter information | At power-on, at RESET |
| 2250H | Parameter error (module) | • The module extension parameter for another module is written in the CPU module. | Stop | • Write the protocol setting data for the target module into the CPU module. | Parameter information | At power-on, at RESET |
| 2260H | Network parameter error | • Network No. is duplicated. | Stop | • Check the detailed information (parameter information) in the module diagnosis of the engineering tool, and review the parameter setting corresponding to the numerical value (parameter No.). If the same error is displayed again, there may be a hardware error in the data memory of the CPU module or the intelligent function module. Please contact your local Mitsubishi Electric representative. | Parameter information | At power-on, at RESET |
| 2280H | Parameter error (refresh) | • The refresh setting is set exceeding the device capacity. (Data were refreshed exceeding the file register capacity.) | Stop | • Check the detailed information (parameter information) of the error by executing module diagnosis using the engineering tool, correct the parameter setting corresponding to the displayed value (parameter No.) and set the refresh range within the device setting range. (Take the following actions: increase the number of file register points (capacity) or reduce the refresh device range.)<br>• Rewrite the refresh settings (number of points) of the CPU parameter. | Parameter information | At power-on, at RESET, at STOP → RUN state, at END instruction execution, at instruction execution, at module access |
| 2281H | Parameter error (refresh) | • A device that cannot be used as a refresh device is specified. | Stop | • Check the detailed information (parameter information) in the module diagnosis of the engineering tool, and review the parameter setting corresponding to the numerical value (parameter No.). | Parameter information | At power-on, at RESET, at STOP → RUN state |
| 2282H | Parameter error (refresh) | • The number of specified refresh points is invalid. | Stop | • Check the detailed information (parameter information) in the module diagnosis of the engineering tool, and review the parameter setting corresponding to the numerical value (parameter No.). | Parameter information | At power-on, at RESET, at STOP → RUN state |
| 2283H | Parameter error (refresh) | • The total number of refresh points exceeded the maximum limit. | Stop | • Check the detailed information (parameter information) in the module diagnosis of the engineering tool, and review the parameter setting corresponding to the numerical value (parameter No.). | Parameter information | At power-on, at RESET, at STOP → RUN state |
| 2300H | Security key authentication error | • The security key locking the program does not match the security key written in the CPU module. | Stop | • Write the correct security key to the CPU module. | Drive/file information | At power-on, at RESET, at STOP → RUN state |
| 2301H | Security key authentication error | • The program is locked by the security key, but the security key is not written in the CPU module. | Stop | • Write the security key to the CPU module. | Drive/file information | At power-on, at RESET, at STOP → RUN state |
| 2302H | Security key authentication error | • The security key written in the CPU module is corrupted. | Stop | • Rewrite the security key to the CPU module. | — | At power-on, at RESET, at STOP → RUN state |

| Error code | Error name | Error details and cause | Stop/ continue | Action | Detailed information | Diagnostic timing |
|---|---|---|---|---|---|---|
| 2320H | Remote password setting error | • A module supporting remote passwords is not connected to the module number specified in the remote password parameter. | Stop | • Recheck the remote password parameter setting or module configuration. | System configuration information | At power-on, at RESET |
| 2400H | Module verification error | • The power of a connected module is OFF or a connection error has been detected.<br>• A timeout occurred during internal bus communications. | Stop/ continue*2 | • Verify that the connected module is powered on.<br>• Verify that extension cables are correctly connected.<br>• Implement anti-noise measures.<br>• If there is no problem, there may be a malfunction in the connected module or in the extension cables. Replace the connected module. | System configuration information | Always |
| 2401H | Module verification error | • A module was connected during operation. | Stop/ continue*2 | • Avoid connecting a module during operation. | System configuration information | Always |
| 2440H | Module major error | • The communication procedure with a module failed during initial processing. | Stop | • Verify that extension cables are correctly connected.<br>• Verify that the firmware version of the CPU module is compatible with the module where the error was detected.<br>• If the version of the CPU module is correct, there may be a malfunction in the connected module. Replace the connected module. | System configuration information | At power-on, at RESET |
| 2441H | Module major error | • The communication procedure with a module failed when an instruction was executed. | Continue/ stop*1 | • Review the program and check the contents of the operands used in the applied instructions.<br>• Verify that the specified buffer memory exists in the counterpart equipment.<br>• Verify that extension cables are correctly connected. | Error location information and system configuration information | At instruction execution |
| 2442H | Module major error | • An error has been detected in the I/O module or intelligent function module during the END processing. | Continue/ stop*1 | • Refer to the manuals for the modules, and check the restrictions on the number of connected modules and the number of input/output points.<br>• There may be a hardware error in the faulty module. Consult your local Mitsubishi Electric representative. | System configuration information | At module access |
| 2450H | Module major error detected | • Detected a notice of major error occurrence from intelligent function module. | Stop/ continue*2 | • Take measures against noise.<br>• Verify that extension cables are correctly connected.<br>• Confirm detailed information (system configuration information) in module diagnosis of engineering tool, and please check module corresponding to the numerical value (module No.). In addition, please confirm the details with reference to the manual of target module.<br>• After resetting the CPU unit, please execute RUN. If the same error is displayed again, there might be hardware failure of the module which became abnormal. Please contact the nearest Mitsubishi Electric system service Co., Ltd. or our branch office, agency. | System configuration information | At END instruction execution |
| 2463H | Intelligent module major error | • An error has been detected in intelligent function module. | Stop | • Reset the CPU module, and run it again. If the same error code is displayed again, the possible cause is a hardware failure of the CPU module or intelligent function module where the error has been detected. Consult with your local Mitsubishi Electric representative. | System configuration information | At power-on, at RESET |

| Error code | Error name | Error details and cause | Stop/ continue | Action | Detailed information | Diagnostic timing |
|---|---|---|---|---|---|---|
| 2500H | WDT error | • The initial scan time exceeded the set value of execution monitor time.<br>• The execution time of a fixed-cycle interrupt program exceeds the interrupt execution interval. | Stop | • Recheck the set value of execution monitor time or program. | Time information | Always |
| 2501H | WDT error | • The scan time of the second and subsequent scans exceeded the set value of execution monitor time.<br>• The execution time of a fixed-cycle interrupt program exceeds the interrupt execution interval. | Stop | • Recheck the set value of execution monitor time or program. | Time information | Always |
| 2522H | Invalid interrupt | • An interrupt request was detected from a module that does not have an interrupt pointer specified in the parameters. | Continue | • Correctly set the interrupt pointer for module interrupt. | System configuration information | At interrupt occurrence |
| 2800H | Module specification error | • The specified module number is out of range. | Continue/ stop*1 | • Check the detailed information (error location information) of the error by executing module diagnostics using the engineering tool, display the error program (step) by clicking the [Error Jump] button, and correct the program. | Error location information | At instruction execution |
| 2801H | Module specification error | • The module with the specified module number does not exist.<br>• There are incorrect devices used as an instruction operand. | Continue/ stop*1 | • Specify the correct module number.<br>• Check the range of devices used by each operand and modify the program. | Error location information and system configuration information | At instruction execution |
| 2802H | Module specification error | • The I/O number of the module that does not support the instruction was specified.<br>• The dedicated instruction specified in the program cannot be executed in the specified module or mode. | Continue/ stop*1 | • Check the detailed information (error location information) of the error by executing module diagnostics using the engineering tool, display the error program (step) by clicking the [Error Jump] button, and correct the program.<br>• Check the execution conditions (including support status and execution mode) of the dedicated instruction, referring to the manual for the target module. | Error location information | At instruction execution |
| 2820H | Device specification error | • A device used as an instruction operand is outside the allowable device range. | Continue | • Check the device range and modify the program. | Error location information | At power-on, at RESET, at instruction execution |
| 2821H | Device specification error | • There are incorrect devices used as an instruction operand. | Continue | • Check the range of devices used by each operand and modify the program. | Error location information | At instruction execution |
| 2822H | Device specification error | • A device or modification that cannot be used as an instruction operand is used.<br>• The step relay (S) is used as the operand of an instruction other than the SFC control instruction when the SFC program setting of the CPU parameter is set to "Use". | Stop | • Check the usage of the instruction and modify the program.<br>• Change the step relay (S) used for the instruction to another device. (When the SFC program setting is set to "Use", the step relay (S) cannot be used for commands other than SFC control instructions.) | Error location information | At power-on, at RESET |
| 2823H | Device specification error | • The buffer memory area of the module specified in the instruction has exceeded the specified range. Or the module specified in the instruction does not have buffer memory. | Continue | • Review the program or check the contents of the operands used in applied instructions.<br>• Verify that the specified buffer memory exists in the counterpart equipment. | Error location information | At instruction execution |

| Error code | Error name | Error details and cause | Stop/ continue | Action | Detailed information | Diagnostic timing |
|---|---|---|---|---|---|---|
| 2840H | File name specification error | • The program file specified does not exist. | Stop | • Rewrite the project. | Error location information | At power-on, at RESET |
| 3000H | Boot function execution error | • An error was found in the boot file. | Stop | • Replace the boot file in the SD memory card with the correct file and turn the programmable controller power ON again. | Drive/file information | At power-on, at RESET |
| 3001H | Boot function execution error | • When the boot function was executed, the file format processing failed. | Stop | • Reset the CPU module, and then execute the boot function again. If the same error appears, the hardware of the CPU module may be malfunctioning. Consult your local Mitsubishi Electric representative. | Drive/file information | At power-on, at RESET |
| 3003H | Boot function execution error | • When the boot function was executed, the file passwords did not match. | Stop | • Check and correct the file password settings of the transfer source and transfer destination files.<br>• Delete the boot setting. | Drive/file information | At power-on, at RESET |
| 3004H | Boot function execution error | • When the boot function was executed, the CPU built-in memory capacity was exceeded. | Stop | • Check and correct the boot setting.<br>• Delete unnecessary files in the CPU built-in memory.<br>• Clear the CPU built-in memory by selecting "Clear" to "Operation Setting at CPU Built-in Memory Boot" in the boot settings, and execute the boot function. | Drive/file information | At power-on, at RESET |
| 3005H | Boot function execution error | • A mismatch between the security information of the boot source file and that of the boot destination file was detected during booting. | Stop | • Check and correct the security key setting.<br>• Delete the boot settings from the memory card parameter. | Drive/file information | At power-on, at RESET |
| 3010H | Data restoration function execution error | • The CPU module at the restoration destination does not match the backup source CPU module model. | Stop | • Execute CPU module restoration with the same CPU module model as the backup source CPU module.<br>• Turn off b0 of SD955 (Automatic restoration execution) to disable the automatic data restoration function. | CPU module data backup/ restoration folder information | At power-on, at RESET |
| 3011H | Data restoration function execution error | • Reading of backup data from an SD memory card completed with an error. | Stop | • Replace the SD memory card, and execute the function again.<br>• The backup data may have been corrupted. Execute the data restoration function using another backup data.<br>• Turn off b0 of SD955 (Automatic restoration execution) to disable the automatic data restoration function. | CPU module data backup/ restoration folder information | At power-on, at RESET |
| 3012H | Data restoration function execution error | • Writing of backup data to the CPU built-in memory completed with an error. | Stop | • Possible cause is hardware failure of the restoration target CPU module. Execute the data restoration function to another CPU module. | CPU module data backup/ restoration folder information | At power-on, at RESET |
| 3013H | Data restoration function execution error | • The system file does not exist in the backup data to be restored.<br>• File(s) in the system file information does not exist in the folder of the backed up data.<br>• The CPU module at the restoration destination does not match the backup source CPU module model. | Stop | • The backup data may have been corrupted. Execute the data restoration function using another backup data.<br>• Turn off b0 of SD955 (Automatic restoration execution) to disable the automatic data restoration function.<br>• Execute CPU module restoration with the same CPU module model as the backup source CPU module. | CPU module data backup/ restoration folder information | At power-on, at RESET |
| 3014H | Data restoration function execution error | • Data was restored to the CPU module where the same data with a file password has already been stored. | Stop | • Delete file passwords, and execute the CPU module data backup/restoration function.<br>• Turn off b0 of SD955 (Automatic restoration execution) to disable the automatic data restoration function. | CPU module data backup/ restoration folder information | At power-on, at RESET |

| Error code | Error name | Error details and cause | Stop/ continue | Action | Detailed information | Diagnostic timing |
|---|---|---|---|---|---|---|
| 3015H | Data restoration function execution error | • A folder with a value that matches the restoration target date folder setting value or number folder setting value does not exist in the SD memory card.<br>• The restoration target data setting value is out of range.<br>• The restoration target date folder setting value or number folder setting value is out of range. | Stop | • Check and correct the restoration target date folder setting value or number folder setting value, and execute the function again.<br>• Check and correct the restoration target data setting value, and execute the function again.<br>• Turn off b0 of SD955 (Automatic restoration execution) to disable the automatic data restoration function. | CPU module data backup/ restoration folder information | At power-on, at RESET |
| 3016H | Data restoration function execution error | • The automatic data restoration function was executed with the CPU module where an SD memory card was not inserted. | Stop | • Insert or re-insert an SD memory card, and execute the function again.<br>• Turn off b0 of SD955 (Automatic restoration execution) to disable the automatic data restoration function. | CPU module data backup/ restoration folder information | At power-on, at RESET |
| 3017H | Data restoration function execution error | • The automatic data restoration function was executed exceeding the maximum memory capacity of the CPU module.<br>• The automatic data restoration function was executed exceeding the maximum number of files that can be stored in the CPU module. | Stop | • Execute the function so that the maximum memory capacity will not be exceeded.<br>• Execute the function so that the maximum number of storable files will not be exceeded.<br>• Turn off b0 of SD955 (Automatic restoration execution) to disable the automatic data restoration function. | CPU module data backup/ restoration folder information | At power-on, at RESET |
| 3018H | Data restoration function execution error | • The status (such as programs, parameters, and file structure) of the CPU module differs from that of when the data backup function was executed. | Stop | • Match the CPU module status to the one at the time of backup, and execute the function again.<br>• Set all data as the restoration target data, and execute the data restoration function.<br>• Turn off b0 of SD955 (Automatic restoration execution) to disable the automatic data restoration function. | CPU module data backup/ restoration folder information | At power-on, at RESET |
| 301FH | Data restoration function execution error | • The backup data is broken. | Stop | • Back up the data again, and then execute CPU module auto exchange. | CPU module data backup/ restoration folder information | At power-on, at RESET |
| 3040H | Update error | • The update file which is used for the firmware update is not compatible with the models and serial numbers of the target CPU module and intelligent function module. | Stop | • Check the models, serial numbers, and versions of the target CPU module and intelligent function module. Use the update file compatible with them and update the firmware. | Drive/file information | At power-on, at RESET |
| 3041H | Update error | • An error was found in the update file. | Stop | • Replace the update file with the correct file, and execute the update once again. | Drive/file information | At power-on, at RESET |
| 3042H | Update error | • An error is detected in the update of the extension module. | Stop | • Replace the update file in the SD memory card with the correct file, and execute the update once again. | System configuration information | At power-on, at RESET |
| 3043H | Update error | • Saving the device comment file into the SD memory card failed. | Stop | • Disable the write protect of the SD memory card. | Drive/file information | At power-on, at RESET |
| 3044H | Update error | • Firmware update is prohibited. | Stop | • Review the firmware update prohibit settings. | — | At power-on, at RESET |
| 3045H | Update error | • Recovery of the project data saved in the SD memory card failed. | Stop | • Confirm that the SD memory card used with the firmware update is inserted, and then turn the power OFF and ON again. If the data cannot be recovered, the data stored on the SD memory card may be damaged. After initializing the CPU built-in memory, write in the set of project data backed up by the customer. | Drive/file information | At power-on, at RESET |

| Error code | Error name | Error details and cause | Stop/ continue | Action | Detailed information | Diagnostic timing |
|---|---|---|---|---|---|---|
| 3046H | Update error | • The update file (HVF extension) is not found.<br>• An error was found in the update file (HVF extension). | Stop | • Replace the update file with the correct file (HVF extension), and execute the update once again.<br>• If the same error is displayed again, initialize the memory and reset the CPU module. Then, execute the update once again. | Drive/file information | At power-on, at RESET |
| 3048H | Online change error | • An error was detected when writing was executed during RUN.<br>• The power was restarted in an online change failure state. | Stop | • Set the CPU module to STOP and write a set of project data. | — | At END instruction execution |
| 3049H | Online change error | • An error was detected when writing was executed during RUN. | Stop | • Set the CPU module to STOP and write a set of project data. | — | At END instruction execution |
| 304AH | Online change error | • An error was detected when writing was executed during RUN. | Stop | • Set the CPU module to STOP and write a set of project data. | — | At END instruction execution |
| 304BH | Online change error | • An error was detected when writing was executed during RUN. | Stop | • Set the CPU module to STOP and write a set of project data. | — | At END instruction execution |
| 3050H | System bus error | • Communication with the module failed due to power discontinuity or the like.<br>• Internal bus communication failed. | Stop | • Verify that the connected module is powered on.<br>• Power off and on the connection module and CPU module again.<br>• Verify that extension cables are correctly connected.<br>• Verify that the firmware version of the CPU module is compatible with the module where the error was detected.<br>• Implement anti-noise measures.<br>• If there is no problem, there may be a malfunction in the connected module or in the extension cables. | System configuration information | At power-on, at RESET |
| 3052H | System bus error | • The initial setting of the high-speed pulse input/output module caused an error. | Stop | • Verify that extension cables are correctly connected.<br>• Verify that the firmware version of the CPU module is compatible with the module where the error was detected.<br>• Implement anti-noise measures.<br>• If there is no problem, there may be a malfunction in the connected module or in the extension cables. | System configuration information | At power-on, at RESET |
| 3054H | System bus error | • Detected that the all module reset command was turned on and executed the all module reset. | Stop | • Check that the all module reset command is not turned on. | System configuration information | At END instruction execution, at instruction execution |
| 3055H | System bus error | • All module reset is executed.<br>• The positioning with the high-speed pulse input/output module caused an abnormal stop. | Stop | • Review the program and check the contents of the operands used in the applied instructions.<br>• Verify that the connected module is powered on.<br>• Verify that extension cables are correctly connected.<br>• Verify that the firmware version of the CPU module is compatible with the module where the error was detected.<br>• Implement anti-noise measures.<br>• If there is no problem, there may be a malfunction in the connected module or in the extension cables. | Error location information | At END instruction execution, at instruction execution |

| Error code | Error name | Error details and cause | Stop/ continue | Action | Detailed information | Diagnostic timing |
|---|---|---|---|---|---|---|
| 3056H | System bus error | • A timeout occurred during communication with a connected module when an instruction was executed.<br>• A timeout occurred during internal bus communications.<br>• Detected that the power to the connected module was turned off. | Continue | • Verify that extension cables are correctly connected.<br>• Verify that the firmware version of the CPU module is compatible with the module where the error was detected.<br>• Implement anti-noise measures.<br>• If there is no problem, there may be a malfunction in the connected module or in the extension cables.<br>• When an error occurs alongside positioning function, positioning may not stop at the specified position. After removing the cause of the system bus error, perform zero return and clear error.<br>• Verify that the connected module is powered on. | Error location information and system configuration information | At instruction execution |
| 3057H | System bus error | • A timeout occurred during communication with a connected module during system processing.<br>• A timeout occurred during internal bus communications.<br>• Detected that the power to the connected module was turned off. | Continue | • Verify that extension cables are correctly connected.<br>• Verify that the firmware version of the CPU module is compatible with the module where the error was detected.<br>• Implement anti-noise measures.<br>• If there is no problem, there may be a malfunction in the connected module or in the extension cables.<br>• When an error occurs alongside positioning function, positioning may not stop at the specified position. After removing the cause of the system bus error, perform zero return and clear error.<br>• Verify that the connected module is powered on. | System configuration information | At END instruction execution, at interrupt occurrence, at module access |
| 3060H | System bus error | • A signal error was detected with a connected module when an instruction was executed.<br>• A timeout occurred during internal bus communications. | Continue | • Verify that extension cables are correctly connected.<br>• Verify that the firmware version of the CPU module is compatible with the module where the error was detected.<br>• Implement anti-noise measures.<br>• If there is no problem, there may be a malfunction in the connected module or in the extension cables.<br>• When an error occurs alongside positioning function, positioning may not stop at the specified position. After removing the cause of the system bus error, perform zero return and clear error. | Error location information and system configuration information | At instruction execution |
| 3061H | System bus error | • A signal error was detected during system processing.<br>• A timeout occurred during internal bus communications. | Continue | • Verify that extension cables are correctly connected.<br>• Verify that the firmware version of the CPU module is compatible with the module where the error was detected.<br>• Implement anti-noise measures.<br>• If there is no problem, there may be a malfunction in the connected module or in the extension cables.<br>• When an error occurs alongside positioning function, positioning may not stop at the specified position. After removing the cause of the system bus error, perform zero return and clear error. | System configuration information | At END instruction execution, at interrupt occurrence, at module access |

| Error code | Error name | Error details and cause | Stop/ continue | Action | Detailed information | Diagnostic timing |
|---|---|---|---|---|---|---|
| 3100H | Program error | • The program includes any instruction that cannot be used or decoded in the CPU module.<br>• Unicode strings are used as the input/output arguments of the FB, FUN, and FBD parts.<br>• Unicode strings are used in ST language. | Stop | • Check the detailed information (error location information) of the error by executing module diagnostics using the engineering tool, display the error program (step) by clicking the [Error Jump] button, and check the program.<br>• Implement anti-noise measures.<br>• Re-write the program, and run the program after resetting the CPU module. If the same error appears, the hardware of the CPU module may be malfunctioning. Please consult your local Mitsubishi representative. | Error location information | At power-on, at RESET |
| 3101H | Program error | • The program contains a dedicated SFC program instruction even though it is not an SFC program. | Stop | • Check the detailed information (error location information) of the error by executing module diagnostics using the engineering tool, display the error program (step) by clicking the [Error Jump] button, and check the program.<br>• Take measures to reduce noise.<br>• Write the sequence program(s) and FB program(s) to the CPU module again. Then, reset the CPU module and run it again. If the same error code is displayed again, the possible cause is a hardware failure of the CPU module. Please contact your nearest Mitsubishi Electric System Service Co., Ltd., or our branch or distributor. | Error location information | At power-on, at RESET, at STOP → RUN state |
| 3120H | Program error | • The CPU module does not support the dedicated instruction executed.<br>• The dedicated instructions specified in the program cannot be executed with the specified module. | Stop | • Check the detailed information (error location information) of the error by executing module diagnostics using the engineering tool, display the error program (step) by clicking the [Error Jump] button, and check the program. | Error location information | At power-on, at RESET, at STOP → RUN state, at instruction execution |
| 3121H | Program error | • The number of devices used in the dedicated instruction specified in the program is incorrect. | Stop | • Check the detailed information (error location information) of the error by executing module diagnostics using the engineering tool, display the error program (step) by clicking the [Error Jump] button, and check the program. | Error location information | At instruction execution |
| 3142H | Program structure error | • The temporary area was used incorrectly. | Stop | • Check the detailed information (error location information) of the error by executing module diagnostics using the engineering tool, display the error program (step) by clicking the [Error Jump] button, and check the program. The step number displayed in the error location information is counted from the top of the file. (It may be different from the step number in the program displayed by the jump function.) | Error location information | At instruction execution |
| 3160H to 3163H | SFC program block, step error | • The SFC program configuration is incorrect. | Stop | • Take measures to reduce noise.<br>• Write the SFC program to the CPU module again. Then, reset the CPU module and run it again. If the same error code is displayed again, the possible cause is a hardware failure of the CPU module. Please contact your nearest Mitsubishi Electric System Service Co., Ltd., or our branch or distributor. | Error location information | At power-on, at RESET, at STOP → RUN state, at SFC program execution |
| 3170H | SFC program block, step error | • The number of steps in the SFC program exceeds the total number of step relays (S). | Stop | • Modify the program so that the number of steps in the SFC program does not exceed the total number of step relays. | Error location information | At power-on, at RESET, at STOP → RUN state, at SFC program execution |

| Error code | Error name | Error details and cause | Stop/ continue | Action | Detailed information | Diagnostic timing |
|---|---|---|---|---|---|---|
| 3171H | SFC program block, step error | • The total number of SFC program blocks (max. step No. + 1) exceeds the total number of step relays (S). | Stop | • Correct the program so that the total number of SFC program blocks (max. step No. + 1) does not exceed the total number of step relays (S). | Error location information | At power-on, at RESET, at STOP → RUN state, at SFC program execution |
| 3180H | SFC Program configuration error | • The SFC program configuration is incorrect. | Stop | • Take measures to reduce noise.<br>• Write the SFC program to the CPU module again. Then, reset the CPU module and run it again. If the same error code is displayed again, the possible cause is a hardware failure of the CPU module. Please contact your nearest Mitsubishi Electric System Service Co., Ltd., or our branch or distributor. | Error location information | At power-on, at RESET, at STOP → RUN state, at SFC program execution |
| 3190H, 3191H | SFC Program configuration error | • The SFC program configuration is incorrect. | Stop | • Take measures to reduce noise.<br>• Write the SFC program to the CPU module again. Then, reset the CPU module and run it again. If the same error code is displayed again, the possible cause is a hardware failure of the CPU module. Please contact your nearest Mitsubishi Electric System Service Co., Ltd., or our branch or distributor. | Error location information | At instruction execution, at SFC program execution |
| 3192H | SFC Program configuration error | • A self step number was specified for the specification destination step number for the jump transition. | Stop | • Check the detailed information (error location information) of the error by executing module diagnostics using the engineering tool, display the error program (step) by clicking the [Error Jump] button, and check the program.<br>• Take measures to reduce noise.<br>• Write the SFC program to the CPU module again. Then, reset the CPU module and run it again. If the same error code is displayed again, the possible cause is a hardware failure of the CPU module. Please contact your nearest Mitsubishi Electric System Service Co., Ltd., or our branch or distributor. | Error location information | At instruction execution, at SFC program execution |
| 3193H | SFC Program configuration error | • A self step number was specified for the specification destination step number for the reset step. | Stop | • Check the detailed information (error location information) of the error by executing module diagnostics using the engineering tool, display the error program (step) by clicking the [Error Jump] button, and check the program.<br>• Take measures to reduce noise.<br>• Write the SFC program to the CPU module again. Then, reset the CPU module and run it again. If the same error code is displayed again, the possible cause is a hardware failure of the CPU module. Please contact your nearest Mitsubishi Electric System Service Co., Ltd., or our branch or distributor. | Error location information | At instruction execution, at SFC program execution |
| 31A0H | SFC program block, step specification error | • An attempt was made to start an SFC program block that was already running. | Stop | • Check the detailed information (error location information) of the error by executing module diagnostics using the engineering tool, display the error program (step) by clicking the [Error Jump] button, and check the program.<br>• Turn on SM321 (Start/stop SFC program) if it is off. | Error location information | At instruction execution, at SFC program execution |

| Error code | Error name | Error details and cause | Stop/ continue | Action | Detailed information | Diagnostic timing |
|---|---|---|---|---|---|---|
| 31A1H | SFC program block, step specification error | • A non-existent SFC program block was specified. | Stop | • Check the detailed information (error location information) of the error by executing module diagnostics using the engineering tool, display the error program (step) by clicking the [Error Jump] button, and check the program.<br>• Turn on SM321 (Start/stop SFC program) if it is off.<br>• Check the SFC program has existed.<br>• Check the execution status of the SFC program. | Error location information | At instruction execution, at SFC program execution |
| 31A2H | SFC program block, step specification error | • The specified block exceeds the range that can be used in the SFC program. | Stop | • Check the detailed information (error location information) of the error by executing module diagnostics using the engineering tool, display the error program (step) by clicking the [Error Jump] button, and check the program.<br>• Turn on SM321 (Start/stop SFC program) if it is off. | Error location information | At instruction execution, at SFC program execution |
| 31B1H | SFC program block, step specification error | • A non-existent SFC program step was specified. | Stop | • Check the detailed information (error location information) of the error by executing module diagnostics using the engineering tool, display the error program (step) by clicking the [Error Jump] button, and check the program.<br>• Turn on SM321 (Start/stop SFC program) if it is off.<br>• Check the SFC program has existed.<br>• Check the execution status of the SFC program. | Error location information | At instruction execution, at SFC program execution |
| 31B2H | SFC program block, step specification error | • The specified step exceeds the range that can be used in the SFC program. | Stop | • Check the detailed information (error location information) of the error by executing module diagnostics using the engineering tool, display the error program (step) by clicking the [Error Jump] button, and check the program.<br>• Turn on SM321 (Start/stop SFC program) if it is off. | Error location information | At instruction execution, at SFC program execution |
| 31B3H | SFC program block, step specification error | • The number of simultaneous active block steps that can be specified in the SFC program exceeds the permissible value. | Stop | • Check the detailed information (error location information) of the error by executing module diagnostics using the engineering tool, display the error program (step) by clicking the [Error Jump] button, and check the program. | Error location information | At instruction execution, at SFC program execution |
| 31B4H | SFC program block, step specification error | • The total number of simultaneous active steps that can be specified in the SFC program exceeds the permissible value. | Stop | • Check the detailed information (error location information) of the error by executing module diagnostics using the engineering tool, display the error program (step) by clicking the [Error Jump] button, and check the program. | Error location information | At instruction execution, at SFC program execution |
| 31B5H | SFC program block, step specification error | • SET Sn/BLm\Sn, RST Sn/BLm\Sn, OUT Sn/BLm\Sn instructions were specified for the self step in the step operation output. | Stop | • Check the detailed information (error location information) of the error by executing module diagnostics using the engineering tool, display the error program (step) by clicking the [Error Jump] button, and check the program. | Error location information | At instruction execution, at SFC program execution |
| 3200H | Program execution error | • The device/label assignment does not match the device/label assignment in the program. (After the device assignment was changed, only the parameters were written to the CPU module.) | Stop | • If the index modification setting of the programmable controller parameter is changed, write the parameter and program file to the CPU module at the same time. | Drive/file information | At power-on, at RESET |
| 3201H | Program execution error | • Multiple program files exist although the program setting of the CPU parameter is not set. | Stop | • Set the program in the program setting of the CPU parameter.<br>• Delete the unnecessary program files. | Drive/file information | At power-on, at RESET |

| Error code | Error name | Error details and cause | Stop/ continue | Action | Detailed information | Diagnostic timing |
|---|---|---|---|---|---|---|
| 3202H | Program execution error | • The program file is invalid or the file does not contain a program.<br>• "Yes" is set for the intrinsic property of a subroutine type FB, "Use MC/MCR to control EN".<br>• The SFC program is set for the CPU module that does not support the SFC program.<br>• The SFC program is set, but the CPU parameter program setting is not set to "Use". | Stop | • Write the correct program file.<br>• Change the intrinsic property of the subroutine type FB, "Use MC/MCR to control EN", to "No", and write the program again.<br>• Replace the CPU module with a module of a firmware version that can execute the subroutine type FB whose intrinsic property, "Use MC/MCR to control EN", is changed to "Yes".<br>• Change to a CPU module with a firmware version that supports the SFC program.<br>• Change the SFC program setting of CPU parameter to "Use" and rewrite the parameter. | Drive/file information | At power-on, at RESET |
| 3203H | Program execution error | • No program file exists. | Stop | • Write a program file. | — | At power-on, at RESET |
| 3204H | Program execution error | • Two or more SFC programs were executed. | Stop | • Ensure that only one SFC program is executed. | Drive/file information | At power-on, at RESET |
| 3210H | Program execution error | • A program with a number of steps exceeding the maximum number is written. | Stop | • Reduce the number of steps in the program. | — | At power-on, at RESET |
| 3211H | Program execution error | • An FB program larger than the internal memory capacity was written. | Stop | • Reduce the number of steps in the FB program. | — | At power-on, at RESET |
| 3212H | Program execution error | • No program setting is found in the parameters. | Stop | • Specify the program to execute in the parameters. | — | At power-on, at RESET |
| 3213H | Program execution error | • The parameter set value is out of range. | Stop | • To use this parameter, a new firmware version of the CPU module is required. Replace the CPU module or perform version upgrade. | Parameter information | At power-on, at RESET |
| 3221H, 3222H | SFC program execution error | • The SFC program cannot be executed. | Stop | • Take measures against noise.<br>• Write the SFC program again, reset the CPU module, and then run. If the same error is displayed again, there may be a hardware failure in the CPU module. Please contact your nearest Mitsubishi Electric System Service Co., Ltd., or our branch or distributor. | Drive/file information | At power-on, at RESET, at STOP → RUN state |
| 3302H | Pointer setting error | • Duplicate pointers are programmed. | Stop | • Modify the program to not use duplicate pointers in a program. | Error location information | At power-on, at RESET |
| 3320H | Interrupt pointer setting error | • Duplicate interrupt pointers are programmed. | Stop | • Modify the program to not use duplicate interrupt pointers in a program. | Error location information | At power-on, at RESET |
| 3340H | FOR-NEXT instruction error | • The relationship between FOR and NEXT instructions is invalid. | Stop | • Make sure that FOR and NEXT instructions are each executed the same number of times. In addition, check the FOR syntax for any invalid jump instructions. | Error location information | At END instruction execution |
| 3341H | FOR-NEXT instruction error | • The relationship between FOR and NEXT instructions is invalid. | Stop | • Make sure that FOR and NEXT instructions are each executed the same number of times. In addition, check syntax for any invalid jump instructions. | Error location information | At END instruction execution |
| 3342H | FOR-NEXT instruction error | • A BREAK instruction was executed outside the FOR syntax. | Stop | • The BREAK instruction must be executed inside the FOR syntax. | Error location information | At instruction execution |
| 3360H | Nesting depth error | • The number of nesting levels of subroutine calls is invalid. | Stop | • Make sure that the number of nesting levels is 16 or lower. In addition, check subroutine programs for any invalid jump instructions. | Error location information | At END instruction execution, at instruction execution |
| 3361H | Nesting depth error | • The number of nesting levels of FOR instructions is invalid. | Stop | • Make sure that the number of nesting levels is 16 or lower. In addition, check the FOR syntax for any invalid jump instructions. | Error location information | At END instruction execution, at instruction execution |

| Error code | Error name | Error details and cause | Stop/ continue | Action | Detailed information | Diagnostic timing |
|---|---|---|---|---|---|---|
| 3362H | Nesting depth error | • The number of nesting levels of DI instructions is invalid. | Continue/ stop*1 | • Make sure that the number of nesting levels is 16 or lower. In addition, check the relationship between DI and EI instructions. | Error location information | At END instruction execution, at instruction execution |
| 3380H | Pointer execution error | • There is no pointer to the jump destination. | Stop | • Specify the correct jump destination in the program. | Error location information | At instruction execution |
| 3381H | Pointer execution error | • There is an END, FEND, GOEND, or STOP instruction in a subroutine program. | Stop | • The END, FEND, GOEND, and STOP instructions can be executed only in the main routine program. | Error location information | At END instruction execution |
| 3382H | Pointer execution error | • A RET instruction was executed without a CALL or XCALL instruction executed. | Stop | • Check where there is any invalid jump to subroutine programs. | Error location information | At instruction execution |
| 33A0H | Interrupt pointer execution error | • The interrupt pointer corresponding to the interrupt input does not exist | Stop | • Check if the program corresponding to the interrupt pointer number set in the module parameters exists. | — | At instruction execution |
| 33D0H | Temporary area exceeded | • The size of allocated temporary area exceeds the maximum size. | Stop | • The usage of the temporary area can be reduced by setting the option of the engineering tool, "Collectively allocate temporary area to optimize the number of steps", to "No".<br>• Check the detailed information (error location information) using the module diagnostics of the engineering tool, and, if the program block displayed by Error Jump or the destination of Error Jump is a function block/function, divide the source program block into multiple program blocks.<br>• Change the CPU parameter, program capacity setting, to "128000 steps" to increase the capacity of the temporary area. (Compatible with only firmware version 1.100 or later of FX5U/FX5UC module) | Error location information | At instruction execution |
| 33E0H | Program structure error | • The relationship between LD/ LDI/LDP/LDF/LDPI/LDFI and ANB/ORB instructions is incorrect. | Stop | • Rewrite the program file. | Error location information | At power-on, at RESET |
| 33E1H | Program structure error | • The relationship among MPS, MRD, and MPP is incorrect. | Stop | • Rewrite the program file. | Error location information | At power-on, at RESET |
| 33E2H | Program structure error | • An instruction that should start from the bus line is not connected to the bus line. | Stop | • Rewrite the program file. | Error location information | At power-on, at RESET |
| 33E3H | Program structure error | • The relationship between FOR and NEXT instructions is incorrect. | Stop | • Modify the program so that the mutual relationship between instructions becomes correct. | Error location information | At power-on, at RESET |
| 33E4H | Program structure error | • The relationship between MC and MCR instructions is incorrect. | Stop | • Modify the program so that the mutual relationship between instructions becomes correct. | Error location information | At power-on, at RESET |
| 33E5H | Program structure error | • The relationship between STL and other instructions is incorrect. | Stop | • Revise the program so that relationships between STL instruction and RETSTL instruction are correct.<br>• Revise the program so that the MC/MCR instruction is not used between STL instruction and RETSTL instruction. (Error also occurs when a macro-type FB that specifies "Yes" for "Use MC/MCR to Control EN" from FB property, is placed between STL instruction to RETSTL instruction)<br>• Revise the program not to use STL and RETSTL instructions in interrupt program. | Error location information | At power-on, at RESET |

| Error code | Error name | Error details and cause | Stop/ continue | Action | Detailed information | Diagnostic timing |
|---|---|---|---|---|---|---|
| 33E6H | Program structure error | • An instruction or interrupt pointer that cannot be used in the main routine program is used. | Stop | • Modify the program so that instruction or pointer use becomes correct. | Error location information | At power-on, at RESET |
| 33E7H | Program structure error | • The relationship among a global pointer, interrupt pointer, and return instruction is incorrect. | Stop | • Modify the program so that the mutual relationship between pointer and return instruction becomes correct. | Error location information | At power-on, at RESET |
| 33E8H | Program structure error | • An instruction that cannot be used in an interrupt routine program is used. | Stop | • Modify the program so that no instruction whose use is disabled by the interrupt routine program is used. | Error location information | At power-on, at RESET |
| 33F1H | Program structure error | • The program structure of the ST language, FB, and functions is invalid. | Stop | • Check the syntax of the ST language, FB, and functions. | Error location information | At END instruction execution, at interrupt occurrence |
| 33F2H | Program structure error | • The program structure of the ST language, FB, and functions is invalid. | Stop | • Check the syntax of the ST language, FB, and functions. | Error location information | At instruction execution |
| 33F3H | Program structure error | • More than two STL instructions for the same S number are programmed. | Stop | • Recheck the structure of the step ladder. | Error location information | At power-on, at RESET, at STOP → RUN state |
| 33F4H | Program structure error | • A device used as an instruction operand is outside the allowable device range. | Stop | • Check the device range and modify the program. | Error location information | At power-on, at RESET, at STOP → RUN state |
| 33F5H | Program structure error | • The step ladder instruction is programmed in the project for which the SFC program setting of the CPU parameter is set to "Use". | Stop | • The SFC program cannot be programmed at the same time as the step ladder instruction (STL, RETSTL) or initial state instruction (IST). Delete the instruction, or delete the SFC program and change the SFC program settings. | Error location information | At power-on, at RESET, at STOP → RUN state |
| 3400H | Operation error | • A value of 0 was input as a divisor in an applied instruction. | Continue/ stop*1 | • Review the data specified as the divisor in the applied instruction. | Error location information | At instruction execution |
| 3401H | Operation error | • Data that cannot be converted was input in an applied instruction. | Continue/ stop*1 | • Review the data specified in the applied instruction. | Error location information | At instruction execution |
| 3402H | Operation error | • A value of -0, a denormalized number, a non-number, or ±∞ was input in an applied instruction. | Continue/ stop*1 | • Review the data specified in the applied instruction. | Error location information | At instruction execution |
| 3403H | Operation error | • An overflow occurred in an applied instruction. | Continue/ stop*1 | • Review the data specified in the applied instruction. | Error location information | At instruction execution |
| 3404H | Operation error | • A string that is not supported in the instruction was specified. | Continue/ stop*1 | • Check the detailed information (error location information) of the error by executing module diagnostics using the engineering tool, display the error program (step) by clicking the [Error Jump] button, and correct the program. | Error location information | At instruction execution |
| 3405H | Operation error | • Data that is outside the allowable range was input in an applied instruction. | Continue/ stop*1 | • Review the data specified in the applied instruction. | Error location information | At instruction execution |
| 3406H | Operation error | • The output result is outside the allowable device range in an applied instruction. | Continue/ stop*1 | • Review the data specified in the applied instruction. | Error location information | At instruction execution |
| 3420H | Operation error | • A module access device is specified to both (s) and (d) in a BMOV instruction or BLKMOVB instruction. | Continue/ stop*1 | • Review the device specified in the BMOV instruction or BLKMOVB instruction. | Error location information | At instruction execution |

| Error code | Error name | Error details and cause | Stop/ continue | Action | Detailed information | Diagnostic timing |
|---|---|---|---|---|---|---|
| 3421H | Operation error | • When writing data to the data memory by using the SP.DEVST instruction, the number of writes per day exceeded the number set in SD771.<br>• The value set in SD771 is out of range. | Continue/ stop*1 | • Check if the SP.DEVST instruction is used correctly.<br>• Execute the SP.DEVST instruction again on another day, or change the value in SD771.<br>• Set the value in SD771 within the settable range. | Error location information | At instruction execution |
| 3426H | Operation error | • Two or more "*" are specified in the specified file name (until the period) or in the extension.<br>• "*" and "?" are mixed in the specified file name (until the period) or extension the extension.<br>• A wildcard specification character ("*", "?") is included in a part that cannot be specified.<br>• The specified file name has a file extension that cannot be transferred.<br>• The file name is not specified.<br>• The delimiter of the drive number is specified with symbol other than ":\" or ":/". | Continue/ stop*1 | • Check how to specify wildcard specification characters.<br>• Check the file extensions which can be transferred.<br>• Specify the file name.<br>• Specify the drive number delimiter with ":\" or ":/". | Error location information | At instruction execution |
| 3427H | Operation error | • The combination of execution/ completion type and data type specified in (d1) of the control data for the SP.FREAD instruction and SP.FWRITE instruction is not allowable.<br>• The combination of execution/ completion type, write start position, and file position specified in (d1) of the control data for the SP.FWRITE instruction is not allowable. | Continue/ stop*1 | • Check the detailed information (error location information) of the error by executing module diagnostics using the engineering tool, display the error program (step) by clicking the [Error Jump] button, and check the program that can be specified. | Error location information | At instruction execution |
| 3430H | Operation error | • The instruction was executed without setting the necessary parameters for executing the instruction. | Continue/ stop*1 | • Set the necessary parameters to execute the instruction. | Error location information | At instruction execution |
| 3500H | Operation error | • A value outside the allowable range was set to the sampling time (TS). | Continue/ stop*1 | • Check the contents of the parameters. | Error location information | At instruction execution |
| 3502H | Operation error | • A value outside the allowable range was set to the input filter constant (α). | Continue/ stop*1 | • Check the contents of the parameters. | Error location information | At instruction execution |
| 3503H | Operation error | • A value outside the allowable range was set to the proportional gain (KP). | Continue/ stop*1 | • Check the contents of the parameters. | Error location information | At instruction execution |
| 3504H | Operation error | • A value outside the allowable range was set to the integral time (TI). | Continue/ stop*1 | • Check the contents of the parameters. | Error location information | At instruction execution |
| 3505H | Operation error | • A value outside the allowable range was set to the derivative gain (KD). | Continue/ stop*1 | • Check the contents of the parameters. | Error location information | At instruction execution |
| 3506H | Operation error | • A value outside the allowable range was set to the derivative time (TD). | Continue/ stop*1 | • Check the contents of the parameters. | Error location information | At instruction execution |
| 350AH | Operation error | • The sampling time is shorter than the scan time. | Continue/ stop*1 | • The operation is continued in the condition "sampling time (TS) = cyclic time (scan time)". | Error location information | At instruction execution |

| Error code | Error name | Error details and cause | Stop/ continue | Action | Detailed information | Diagnostic timing |
|---|---|---|---|---|---|---|
| 350CH | Operation error | • The variation of measured value is greater than the maximum value or lower than the minimum value. | Continue/ stop*1 | • The operation is continued with the maximum or minimum value. | Error location information | At instruction execution |
| 350DH | Operation error | • The deviation is greater than the maximum value or lower than the minimum value. | Continue/ stop*1 | • The operation is continued with the maximum or minimum value. | Error location information | At instruction execution |
| 350EH | Operation error | • The integral result is greater than the maximum value or lower than the minimum value. | Continue/ stop*1 | • The operation is continued with the maximum or minimum value. | Error location information | At instruction execution |
| 350FH | Operation error | • The derivative value is greater than the maximum value or lower than the minimum value due to the derivative gain (KD). | Continue/ stop*1 | • The operation is continued with the maximum or minimum value. | Error location information | At instruction execution |
| 3510H | Operation error | • The derivative result is greater than the maximum value or lower than the minimum value. | Continue/ stop*1 | • The operation is continued with the maximum or minimum value. | Error location information | At instruction execution |
| 3511H | Operation error | • The PID operation result is greater than the maximum value or lower than the minimum value. | Continue/ stop*1 | • The operation is continued with the maximum or minimum value. | Error location information | At instruction execution |
| 3512H | Operation error | • The output upper limit value is lower than the output lower limit value. | Continue/ stop*1 | • Calculation is continued with the output upper limit value and output lower limit value transposed. | Error location information | At instruction execution |
| 3513H | Operation error | • The input variation alarm set value or output variation alarm set value is outside the allowable range. | Continue/ stop*1 | • The operation is continued without alarm output. | Error location information | At instruction execution |
| 3514H | Operation error | • The auto tuning result in the step response method is abnormal.<br>• The deviation at end of auto tuning is 1/3 or less of the deviation at start of auto tuning. | Continue/ stop*1 | • Check the measured value and target value, and then execute auto tuning again. | Error location information | At instruction execution |
| 3515H | Operation error | • The operation direction estimated from the measured value at the start of auto tuning in the step response method was different from the actual operation direction of the output during auto tuning. | Continue/ stop*1 | • Correct the relationship among the target value, output value for auto tuning, and the measured value, and then execute auto tuning again. | Error location information | At instruction execution |
| 3516H | Operation error | • Because the set value fluctuated during auto tuning in the step response method, auto tuning was not executed correctly. | Continue/ stop*1 | • Set the sampling time to a value larger than the output change cycle, or set a larger value for the input filter constant. After changing the setting, execute auto tuning again. | Error location information | At instruction execution |
| 3517H | Operation error | • The output set value upper limit for auto tuning is lower than the lower limit. | Continue/ stop*1 | • Verify that the target setting contents are correct. | Error location information | At instruction execution |
| 3518H | Operation error | • A value outside the allowable range was set to the PV threshold for auto tuning. | Continue/ stop*1 | • Verify that the target setting contents are correct. | Error location information | At instruction execution |
| 3519H | Operation error | • Operation is not performed normally because devices occupied by the PID instruction were overwritten. | Continue/ stop*1 | • Ensure that devices occupied by PID instruction are not overwritten in the program. | Error location information | At instruction execution |

| Error code | Error name | Error details and cause | Stop/ continue | Action | Detailed information | Diagnostic timing |
|---|---|---|---|---|---|---|
| 351AH | Operation error | • The auto tuning time is longer than necessary. | Continue/ stop*1 | • Increase the difference (ULV - LLV) between the upper limit and lower limit of the output value for auto tuning, set a smaller value to the input filter constant (α), or set a smaller value to the PV threshold (SHPV) for auto tuning, and then check the result for improvement. | Error location information | At instruction execution |
| 351BH | Operation error | • The variation of the measured value is too small compared with the output value. | Continue/ stop*1 | • Multiply the measured value (PV) by "10" so that the variation of the measured value will increase during auto tuning. The operation is continued with KP = 32767. | Error location information | At instruction execution |
| 351CH | Operation error | • The auto tuning time is longer than necessary. | Continue/ stop*1 | • Increase the difference (ULV - LLV) between the upper limit and lower limit of the output value for auto tuning, set a smaller value to the input filter constant (α), or set a smaller value to the PV threshold (SHPV) for auto tuning, and then check the result for improvement. The operation is continued with TI = 32767. | Error location information | At instruction execution |
| 351DH | Operation error | • The auto tuning time is longer than necessary. | Continue/ stop*1 | • Increase the difference (ULV - LLV) between the upper limit and lower limit of the output value for auto tuning, set a smaller value to the input filter constant (α), or set a smaller value to the PV threshold (SHPV) for auto tuning, and then check the result for improvement. The operation is continued with TD = 32767. | Error location information | At instruction execution |
| 351EH | Operation error | • The set value of the timeout time after maximum ramp for auto tuning is abnormal. | Continue/ stop*1 | • Correct the value so that the timeout time after maximum ramp for auto tuning is within the setting range. | Error location information | At instruction execution |
| 3580H | Operation error | • An instruction that cannot be used in an interrupt routine program is used. | Continue/ stop*1 | • Modify the program so that no instruction whose use is disabled by the interrupt routine program is used. | Error location information | At instruction execution |
| 3581H | Operation error | • Modules subsequent to the bus conversion module are using an operand that cannot be used. | Continue/ stop*1 | • Modify the program so that no operand whose use is disabled for modules subsequent to the bus conversion module is used. | Error location information | At instruction execution |
| 3582H | Operation error | • An instruction that cannot be used in an interrupt routine program is used. | Continue/ stop*1 | • Modify the program so that no instruction whose use is disabled by the interrupt routine program is used. | Error location information | At instruction execution |
| 3583H | Operation error | • A CPU module with a serial No. incompatible with the function was used. | Continue/ stop*1 | • Use a CPU module with a serial No. compatible with the function. For details, refer to the manual. | Error location information | At instruction execution |
| 3584H | Operation error | • The writing failed because the write protect switch of the SD memory card is enabled (the writing is prohibited). | Continue/ stop*1 | • Disable the write protect switch of the SD memory card. | Error location information Drive/file information | At instruction execution |
| 3585H | Operation error | • The data exceeded the maximum data storage capacity. | Continue/ stop*1 | • Increase the SD memory card free space capacity, and execute the function again.<br>• Delete files in the SD memory card, and execute the function again.<br>• Delete the backup data in the SD memory card, and execute the function again. | Error location information Drive/file information | At instruction execution |
| 3586H | Operation error | • The SD memory card has not been inserted.<br>• The SD memory card turned to disable status by SM606 (SD memory card forcibly disable command).<br>• The SD memory card module is not mounted. | Continue/ stop*1 | • Insert or re-insert an SD memory card, and execute the function again.<br>• Release the SD memory card disable status, and execute the function again.<br>• If the SD memory card module is not mounted, power off the programmable controller, mount the SD memory card module, and power on the programmable controller again. | Error location information Drive/file information | At instruction execution |

| Error code | Error name | Error details and cause | Stop/ continue | Action | Detailed information | Diagnostic timing |
|---|---|---|---|---|---|---|
| 3587H | Operation error | • An error was found in the data of the file.<br>• Writing/reading to the SD memory card did not finished correctly.<br>• The SD memory card module is not mounted. | Continue/ stop*1 | • Re-create the file.<br>• Check that the SD memory card is mounted correctly, and execute the function again.<br>• Re-insert the SD memory card, and execute the function again.<br>• If the SD memory card module is not mounted, power off the programmable controller, mount the SD memory card module, and power on the programmable controller again. | Error location information Drive/file information | At instruction execution |
| 3588H | Operation error | • The specified file does not exist. | Continue/ stop*1 | • Check the file, and execute the function again. | Error location information Drive/file information | At instruction execution |
| 3600H | Operation error | • The channel specified by instructions using communication functions or high-speed I/O does not have the appropriate parameter.<br>• The appropriate parameters are set for the specified channel, but the appropriate board, adapter and module are not installed. | Continue/ stop*1 | • Verify that the parameter setting of the channel specified by instructions using communication functions or high-speed I/O is correct.<br>• Verify that the appropriate board, adapter and module are installed on the specified channel. | Error location information | At instruction execution |
| 3611H to 361CH | CH1 to CH12 pulse width, period setting error | • The set value of pulse width, cycle, or number of output pulses is abnormal. | Continue/ stop*1 | • Correct the set value so that the pulse width, cycle, and number of output pulses are within the setting range. | Error location information and system configuration information | At END instruction execution |
| 3621H to 362CH | Axes 1 to 12 limit detection error | • Both the forward and reverse limits were detected at the time of zero return or the limit of the moving direction was detected after the near-point dog was detected. | Continue/ stop*1 | • Recheck the relationship between the near-point dog and limits. | Error location information and system configuration information | At END instruction execution, at instruction execution |
| 3631H to 363CH | Axes 1 to 12 positioning address error | • The 32-bit range was exceeded when the unit of the positioning address was converted.<br>• The 32-bit range was exceeded when the unit of the zero-point address was converted.<br>• The total transfer distance before and after the interrupt of the DVIT/DDVIT instruction or 1-speed positioning with interruption exceeded 7FFFFFFFH. Or, when the operation was started, the positioning address was set to 0.<br>• Pulses of 7FFFFFFFH or greater are needed to specify an absolute address. | Continue/ stop*1 | • Correct values so that the positioning address and starting point address (only if homing) are within the setting range. | Error location information and system configuration information | At interrupt occurrence, at instruction execution |
| 3641H to 364CH | Axes 1 to 12 command speed error | • The 32-bit range was exceeded when the unit of the maximum speed was converted.<br>• When the positioning was started, the speed was set to 0. | Continue/ stop*1 | • Correct values so that the maximum speed and command speed are within the setting range. | Error location information and system configuration information | At instruction execution |

| Error code | Error name | Error details and cause | Stop/ continue | Action | Detailed information | Diagnostic timing |
|---|---|---|---|---|---|---|
| 3651H to 365CH | Axes 1 to 12 error stop (deceleration stop) | • When pulses were being output or positioning was starting, the programmable controller decelerated and stopped the pulse output due to the limit of the moving direction. (The PLSY/DPLSY instruction stops pulse output immediately at both limits.)<br>• When pulses were being output or positioning was starting, the programmable controller decelerated and stopped the pulse output by the pulse decelerate and stop command.<br>• When pulses were being output, the command speed was changed to 0. | Continue/ stop*1 | • Eliminate the error that has caused the stop and restart the positioning. | Error location information and system configuration information | At END instruction execution, at instruction execution |
| 3661H to 366CH | Axes 1 to 12 error stop (immediately stop) | • When pulses were being output or positioning was starting, the programmable controller stopped the pulse output immediately by the pulse stop command or detection of the all outputs disable flag. | Continue/ stop*1 | • Eliminate the error that has caused the stop and restart the positioning. | Error location information and system configuration information | At END instruction execution, at instruction execution |
| 3671H to 367CH | Axes 1 to 12 positioning table operand error | • The value of an operand in the table is abnormal. (Other than the positioning address and command speed) | Continue/ stop*1 | • Set the correct value to the table. | Error location information and system configuration information | At interrupt occurrence, at instruction execution |
| 3681H to 368CH | Axes 1 to 12 positioning table shift error (table specification) | • Tables which cannot be used together were specified for continuous operation.<br>• The counterpart axis for the interpolation operation table was specified. | Continue/ stop*1 | • Correct the table combination so that the continuous operation can be performed.<br>• To drive the interpolation operation, specify the table of the reference axis. | Error location information and system configuration information | At interrupt occurrence, at instruction execution |
| 3691H to 369CH | Axes 1 to 12 positioning table shift error (table shift) | • Table shift processing cannot be completed in time because tables shifted too frequently (one or more tables per 10ms).<br>• A conditional jump was executed 4 times in a row or tables are not executed 4 times in a row. | Continue/ stop*1 | • Set the interval of table shifts to 10 ms or greater.<br>• Correct the table combination so that the condition jumps are executed 3 times or less in a row, or tables are not executed 3 times or less in a row. | Error location information and system configuration information | At interrupt occurrence |
| 36A1H to 36ACH | Axes 1 to 12 interpolation operation error (no counterpart axis) | • The counterpart axis table for the interpolation operation cannot be found. | Continue/ stop*1 | • Set the table of the counterpart axis correctly. | Error location information and system configuration information | At instruction execution |
| 36B1H to 36BCH | Axes 1 to 12 interpolation operation error (reference/ counterpart axis error) | • Errors such as limits occurred, which stopped pulses in the reference axis or counterpart axis.<br>• The reference axis or partner axis is in use. | Continue/ stop*1 | • Verify that the reference axis and partner axis are not in use and the stop conditions are not satisfied. | — | At instruction execution |
| 36F0H | ABS sum error | • There is a sum check error in ABS data read from servo. | Continue/ stop*1 | • Check servo wiring and setting. | Error location information | At instruction execution |
| 3780H | High-speed comparison table maximum excess error | • The number of high-speed comparison tables registered is greater than the upper limit. | Continue/ stop*1 | • Check the total number of tables in the parameters and tables registered in the comparison match instruction. | Error location information and system configuration information | At END instruction execution, at instruction execution |

| Error code | Error name | Error details and cause | Stop/ continue | Action | Detailed information | Diagnostic timing |
|---|---|---|---|---|---|---|
| 3781H | Preset value range outside error | • The preset value is greater than the ring length set value. | Continue/ stop*1 | • Disable the ring length.<br>• Set the preset value within the ring length range. | Error location information and system configuration information | At instruction execution |
| 3A00H | Incompatible function in use error | • A CPU module with a serial No. incompatible with the function was used. | Stop | • Use a CPU module with a serial No. compatible with the function. (Refer to ☞ Page 971 Added and Enhanced Functions.) | Parameter information | At power-on, at function use |
| 3A10H | Memory error | • A memory error was detected. | Continue | • Take measures to reduce noise.<br>• Reset the CPU module, and then execute it again. If the same error is displayed again, there may be a hardware failure in the CPU module. Consult your local Mitsubishi Electric representative. | — | At END instruction execution |
| 3C00H | Hardware failure | • A hardware failure was detected. | Stop | • Reset the CPU module and perform RUN. If the same error appears, the hardware of the CPU module may be malfunctioning. Consult your local Mitsubishi Electric representative. | — | At power-on, at RESET |
| 3C02H | Hardware failure | • A hardware failure was detected. | Stop | • Reset the CPU module and perform RUN. If the same error appears, the hardware of the CPU module may be malfunctioning. Consult your local Mitsubishi Electric representative. | System configuration information | At power-on, at RESET |
| 3C03H | Hardware failure | • A hardware failure was detected. | Stop | • Reset the CPU module and perform RUN. If the same error appears, the hardware of the CPU module may be malfunctioning. Consult your local Mitsubishi Electric representative. | System configuration information | At power-on, at RESET |
| 3C0FH | Hardware failure | • A hardware failure was detected. | Stop | • When an intelligent function module is connected to a CPU module, check that the firmware version of the CPU module is compatible with the intelligent function module, and if not compatible, execute the firmware update.<br>• Reset the CPU module and perform RUN. If the same error appears, the hardware of the CPU module may be malfunctioning. Consult your local Mitsubishi Electric representative. | System configuration information | At power-on, at RESET |
| 3C20H | Memory error | • A memory error was detected. | Stop | • Reset the CPU module and perform RUN. If the same error appears, the hardware of the CPU module may be malfunctioning. Initialize the memory, and if the memory still cannot be recovered, consult your local Mitsubishi Electric representative. | — | At power-on, at RESET |
| 3C22H | Memory error | • A memory error was detected. | Stop | • Reset the CPU module and perform RUN. If the same error appears, the hardware of the CPU module may be malfunctioning. Consult your local Mitsubishi Electric representative. | — | At power-on, at RESET |
| 3C23H | Memory error | • A memory error was detected. | Stop | • The project data or latch data may have errors due to a hardware failure in the CPU module. Initialize the memory. If the memory still cannot be recovered, please consult your local Mitsubishi representative. | — | At power-on, at RESET |
| 3C24H | Memory error | • A memory error was detected. | Stop | • Reset the CPU module and perform RUN. If the same error appears, the hardware of the CPU module may be malfunctioning. Consult your local Mitsubishi Electric representative. | — | At power-on, at RESET |

| Error code | Error name | Error details and cause | Stop/ continue | Action | Detailed information | Diagnostic timing |
|---|---|---|---|---|---|---|
| 3C25H | Memory error | • A memory error was detected. | Stop | • The project data or latch data may have errors. Initialize the memory and then rewrite the project. If the same error is displayed again, there may be a hardware failure in the CPU module. Consult your local Mitsubishi Electric representative. | — | At power-on, at RESET |
| 3C2FH | Memory error | • A memory error was detected. | Stop | • Reset the CPU module and perform RUN.<br>• If this occurs after updating the firmware, update the firmware again.<br>• If the same error is displayed again, there may be a hardware failure in the CPU module. Consult your local Mitsubishi Electric representative. | Drive/file information | At power-on, at RESET |
| 3C32H | Memory error | • An error has been detected in the memory. | Stop | • Reset the CPU module, and run it again. If the same error code is displayed again, possible cause is hardware failure of the CPU module. Please consult your local Mitsubishi representative. | — | At power-on, at RESET |
| 3E20H | Program execution error | • An error has been detected in the memory. | Stop | • Reduce the number of steps in the program. | — | At power-on, at RESET, at STOP → RUN state |

*1 Can be changed by the parameter. (Default: Continue)
*2 Can be changed by the parameter. (Default: Stop)
*3 If the error is detected at startup, the operation stops regardless of the parameter setting.

## Error codes of the CPU module (4000H to 4FFFH)

The following table lists the error codes detected by other causes than the self-diagnostics function of the CPU module.

| Error code | Error name | Error details and cause | Action |
|---|---|---|---|
| 4000H | Common error | • Serial communication sum check error. | • Connect the serial communication cable correctly.<br>• Take measures to reduce noise. |
| 4001H | Common error | • An unsupported request was executed. | • Check the command data of SLMP/MC protocol.<br>• Check the CPU module model name selected in the engineering tool.<br>• Check the target CPU module model name. |
| 4002H | Common error | • An unsupported request was executed. | • Check the command data of SLMP/MC protocol.<br>• Check the CPU module model name selected in the engineering tool.<br>• Use a CPU module with a serial No. compatible with the function. For details, refer to the manual.<br>• Execute the request again.<br>• If the same error code is displayed again, the possible cause is a hardware failure of the CPU module. Please consult your local Mitsubishi representative. |
| 4005H | Common error | • The volume of data handled according to the specified request is too large. | • Check the command data of SLMP/MC protocol. |
| 4006H | Common error | • Initial communication has failed.<br>• Initialization of serial communication has failed. | • When using serial communication, check with the external device manufacturer for support conditions.<br>• When using serial communication, check the CPU module model name selected in the engineering tool.<br>• When using Ethernet communication, shift the communication start timing. |
| 4010H | CPU module operation error | • Since the CPU module is running, the request contents cannot be executed. | • Execute after setting the CPU module to STOP status. |
| 4013H | CPU module operation error | • Since the CPU module is not in a STOP status, the request contents cannot be executed. | • Execute after setting the CPU module to STOP status. |
| 4021H | File related error | • The specified drive (memory) does not exist or there is an error. | • Check the specified drive (memory) status.<br>• Back up data in the CPU module, and then initialize the memory. |
| 4022H | File related error | • The file with the specified file name or file No. does not exist. | • Check the specified file name and file No. |
| 4025H | File related error | • The specified file is processing the request from another engineering tool. | • Forcibly execute the request. Or execute the request again after processing executed from another engineering tool ends. |
| 4027H | File related error | • The specified range is larger than the file size. | • Check the specified range and access within that range. |
| 4029H | File related error | • The specified file capacity cannot be obtained. | • Review the specified file capacity, and execute the request again. |
| 402CH | File related error | • The requested operation cannot be executed currently. | • Execute again after a while. |
| 4030H | Device specification error | • The specified device name cannot be handled.<br>■When CPU Module Logging Configuration Tool is used<br>• The data logging specifying a device that is not supported was started. | • Check the specified device name. |
| 4031H | Device specification error | • The specified device No. is outside the range.<br>• The CPU module cannot handle the specified device.<br>■When CPU Module Logging Configuration Tool is used<br>• The data logging specifying a device number that does not exist was started. | • Check the specified device No.<br>• Check the device assignment of the CPU module.<br>• Check the specified device name. |
| 4032H | Device specification error | • The device modification was incorrectly specified. Or, the unusable device (TS, TC, SS, SC, CS, or CC) was specified in any of the following SLMP/MC protocol commands; Read random, Write random (in units of words), Entry monitor device, or Execute monitor.<br>■When CPU Module Logging Configuration Tool is used<br>• The data logging specifying a device modification that is not supported was started. | • Check the device modification method.<br>• Check the specified device name. |

| Error code | Error name | Error details and cause | Action |
|---|---|---|---|
| 4034H | Device specification error | • The dedicated instruction cannot be executed since the completion device for the dedicated instruction does not turn on. | • Since the completion device for the SREAD or SWRITE instruction does not turn on in the CPU module on the target station, execute the instruction again after setting the operating status of the CPU module on the target station to the RUN status. |
| 4040H | Intelligent function module specification error | • The request contents cannot be executed in the specified intelligent function module. | • Check whether the specified module is the intelligent function module having the buffer memory. |
| 4041H | Intelligent function module specification error | • The access range exceeds the buffer memory range of the specified intelligent function module. | • Check the start address and access number of points and access within the range that exists in the intelligent function module. |
| 4042H | Intelligent function module specification error | • The specified intelligent function module cannot be accessed. | • Check that the specified intelligent function module is operating normally.<br>• Check the specified module for a hardware fault. |
| 4043H | Intelligent function module specification error | • The intelligent function module does not exist in the specified position.<br>■When CPU Module Logging Configuration Tool is used<br>• The data logging specifying a device that does not exist or cannot be accessed was started. | • Check the I/O number of the specified intelligent function module. |
| 4053H | Protect error | • An error occurred when writing data to the specified drive (memory). | • Check the specified drive (memory). Or, write data again after changing the corresponding drive (memory). |
| 4060H | Online registration error | • The online debug function and the data logging function are being executed with another engineering tool.<br>■When CPU Module Logging Configuration Tool is used<br>• An attempt was made to write or delete data logging settings or to execute data logging to the setting registered by another request source. | • Finish the operation of the other engineering tool and then execute the function again.<br>• If the operation of the other engineering tool is on hold, resume and finish the operation of the other engineering tool, and then execute the function again. |
| 4061H | Online registration error | • Settings for the online debug function (such as online change) are incorrect. | • Register an online debug function (external input/output forced on/off function), and then execute the function again.<br>• Execute the function again after checking the communication route such as the communication cable. |
| 4064H | Online registration error | • The specified contents of the online debug function (such as the online program change), data logging function, memory dump function, or real-time monitor function are incorrect.<br>■When CPU Module Logging Configuration Tool is used<br>• The trigger logging was started in a state that the trigger condition has already been satisfied.<br>• The logging was started in a state that the condition of the file switching timing condition specification has already been satisfied. | • Check the set data of the online debug function (such as the online program change), data logging function, memory dump function, and real-time monitor function.<br>• Execute again after checking the communication route such as the communication cable.<br>■When CPU Module Logging Configuration Tool is used<br>• Clear the satisfied trigger condition, and execute the trigger logging again.<br>• Clear the satisfied condition of the file switching timing condition specification, and execute the logging again. |
| 4068H | Online registration error | • Operation is disabled because it is being performed with another engineering tool. | • Execute the request again after processing of the function executed from the other engineering tool ends. |
| 4080H | Other errors | • Request data error.<br>■When CPU Module Logging Configuration Tool is used<br>• Request or setting data error | • Check the request data that has been specified.<br>■When CPU Module Logging Configuration Tool is used<br>• Check the specified data, and write it to the CPU module again. |
| 4081H | Other errors | • The search target data cannot be detected. | • Check the data to be searched. |
| 408BH | Other errors | • The remote request cannot be executed. | • Reexecute after the CPU module is in a status where the remote request can be executed.<br>• For remote operation, set the parameter to "Enable remote reset". |
| 40A0H | SFC device specification error | • A block No. outside the range was specified. | • Check and correct the setting. |
| 40A1H | SFC device specification error | • The number of blocks exceeds the range. | • Check and correct the set number. |
| 40A7H | SFC device specification error | • A block No. that does not exist in the 0 to 31 range was specified. | • Check and correct the setting. |
| 40A8H | SFC device specification error | • A step No. that does not exist in the 0 to 511 range was specified. | • Check and correct the setting. |
| 40B0H | SFC file related error | • The drive (memory) specified with the SFC program file operation is incorrect. | • Check and correct the setting. |

| Error code | Error name | Error details and cause | Action |
|---|---|---|---|
| 40B1H | SFC file related error | • The SFC program specified with the SFC program file operation does not exist. | • Check and correct the specified file name. |
| 40B2H | SFC file related error | • The program specified with the SFC program file operation is not an SFC program. | • Check and correct the specified file name. |
| 40B5H | SFC file related error | • The number of SFC steps after changing the program exceeds the maximum number. | • Reduce the number of SFC steps to be added by online change. |
| 40B6H | SFC file related error | • The specified block does not exist. | • Read from the programmable controller to make the programs of the engineering tool and the CPU module the same, and then execute the online change again. |
| 40B9H | SFC file related error | • The SFC program after change is incorrect. | • Execute again after checking the communication route such as the communication cable. |
| 40BBH | SFC file related error | • Online change is not possible immediately after writing to the programmable controller or because a program execution error has occurred. | • After STOP changes to RUN, execute online change (inactive SFC block).<br>• Execute online change (SFC block) in a state where a program execution error does not occur. |
| 40BEH | SFC file related error | • Online change is not possible because the target includes active (holding) steps. | • Do not include active (holding) steps.<br>• Make any active (holding) step inactive. |
| 4105H | Any other error | • Hardware failure of the CPU module internal memory. | • The possible cause is a hardware failure of the CPU module. Please consult your local Mitsubishi representative. |
| 4121H | File related error | • The specified drive (memory) or file does not exist. | • Execute again after checking the specified drive (memory) or file. |
| 4122H | File related error | • The specified drive (memory) or file does not exist. | • Execute again after checking the specified drive (memory) or file. |
| 4123H | File related error | • The specified drive (memory) is abnormal.<br>■When CPU Module Logging Configuration Tool is used<br>• The data logging was started to the memory having an error. | • Initialize the memory, and restore the drive (memory) to its normal state. |
| 4125H | File related error | • The specified drive (memory) or file is performing processing. | • Execute again after a while. |
| 4126H | File related error | • The specified drive (memory) or file is performing processing. | • Execute again after a while. |
| 4127H | File related error | • File password mismatch. | • Execute again after checking the file password. |
| 4135H | File related error | • The date/time data of the engineering tool (personal computer) is out of range. | • Execute again after checking the clock setting of the engineering tool (personal computer). |
| 4136H | File related error | • The specified file already exists. | • Execute again after checking the specified file name. |
| 4139H | File related error | • The size of the specified file has exceeded that of the existing file. | • Execute again after checking the size of the specified file. |
| 413AH | File related error | • The specified file has exceeded the already existing file size. | • Execute again after checking the size of the specified file. |
| 413BH | File related error | • The same file was simultaneously accessed from different engineering tools.<br>■When CPU Module Logging Configuration Tool is used<br>• An operation was performed to a file being accessed. | • Execute again after a while. |
| 413EH | File related error | • Operation is disabled for the specified drive (memory). | • Execute again after changing the target drive (memory). |
| 4160H | Online registration error | • The registered number of I/O devices of the forced on/off target exceeded the maximum. | • Cancel the registration of I/O devices of the forced on/off target that is not used. |
| 4166H | Online registration error | • The operation cannot be performed because an online change is being executed from the same activation source. | • An online change cannot be executed because the previous online change failed and remains unprocessed due to a reason such as a communication failure during execution. Execute the new online change forcibly. |

| Error code | Error name | Error details and cause | Action |
|---|---|---|---|
| 4181H | CPU module built-in Ethernet port error | • Transmission to the receiving modules is unsuccessful. | • Check the external device operation.<br>• Check the status of the lines, such as cables, hubs and routes, connected to receiving modules.<br>• Some line packets may be engaged. Retry to communicate a little while later.<br>• The receiving module may have no free space in receive area (TCP window size is small). Check whether the receiving module processes receive data, or whether the CPU module does not send unnecessary data.<br>• Check whether the settings of the subnet mask pattern and the default router IP address of the CPU module and the receiving modules are correct, or whether the class of the IP address is correct. |
| 4183H | CPU module built-in Ethernet port error | • Communication with receiving modules was interrupted. | • Check the external device operation.<br>• Check the status of the lines such as cables, hubs and routes connected to receiving modules.<br>• Error may be generated when connection is forcibly canceled during communication. In that case, there is no issue, so clear the error. |
| 419AH | CPU module built-in Ethernet port error | • A system error or setting data error in the OS (Malfunctions caused by noise and others and hardware failure are the possible causes.) | • If the same error is displayed again after checking, there may be a hardware failure in the CPU module. |
| 419EH | CPU module built-in Ethernet port error | • Connection to the module was unsuccessful or interrupted. | • Check the external device operation.<br>• Check the status of the lines such as cables, hubs and routes connected to receiving modules.<br>• Retry to connect a little while later, if the error occurred in communication. |
| 41C5H | File related error | • The specified file does not exist.<br>■When CPU Module Logging Configuration Tool is used<br>• When an attempt was made to re-register the data logging with the previous settings, the corresponding file did not exist. | • Execute again after checking the file. |
| 41C8H | File related error | • The size of the specified file has exceeded that of the existing file. | • Execute again after checking the size of the specified file.<br>• If the error recurs after re-execution, the file information data may be corrupted.<br>• Back up data in the CPU module, and then initialize the memory. |
| 41CCH | File related error | • The specified file does not exist. Or, the specified subdirectory does not exist.<br>■When CPU Module Logging Configuration Tool is used<br>• The data logging was started in a state that sub-folders for storing data logging files (or folders) cannot be created or accessed. Or, sub-folders cannot be created or accessed while the data logging is being performed or the logged data is being saved. | • Execute again after checking the name of the file and subdirectory. |
| 41CDH | File related error | • An access to the file is prohibited in the system.<br>■When CPU Module Logging Configuration Tool is used<br>• The data logging was started in a state that files (or folders) cannot be created or accessed because a file (or folder) with the same name exists. Or, files (folders) cannot be created or accessed while the data logging is being performed or the logged data is being saved. | • Do not access the specified file (folder).<br>• Check the file (folder), and execute the function again. |
| 41D0H | File related error | • The specified drive (memory) has no free space. Or, the number of files in the directory of the specified drive (memory) has exceeded the maximum. | • Execute again after increasing the free space of the drive (memory).<br>• Delete files in the drive (memory), and execute the function again. |
| 41D8H | File related error | • The specified file is being accessed. | • Execute again after a while. |
| 41DFH | File related error | • The specified drive (memory) is write-protected. | • Execute again after canceling the write protect of the specified drive (memory). |
| 41E4H | File related error | • Access to the SD memory card has failed. | • Execute the operation again after checking that the SD memory card has been inserted.<br>• Execute the operation again after replacing the SD memory card.<br>• Back up data, and then initialize the PC memory. |
| 41EBH | File related error | • The file name path is too long. | • Execute again after shortening the file name path. |

| Error code | Error name | Error details and cause | Action |
|---|---|---|---|
| 41FBH | Online module change related error | • The specified file is already being processed by the engineering tool. | • Execute again after the currently performed operation is completed. |
| 41FEH | File related error | • The SD memory card has not been inserted.<br>• The SD memory card is disabled.<br>• The SD memory card turned to disable status by SM606 (SD memory card forcibly disable command).<br>■When CPU Module Logging Configuration Tool is used<br>• The data logging was started when the CPU module is in the following state: no SD memory card is inserted; the CARD LED is not on; or the SD memory card is forcibly disabled. | • Insert the SD memory card.<br>• Remove the SD memory card, and insert it again.<br>• Cancel the SD memory card forced disable instruction.<br>• If the SD memory card module is not mounted, power off the CPU module, mount the SD memory card module, and power on the CPU module again. |
| 4269H | Any other error | • The remote RUN (function) cannot be executed. | • Execute the function again after a while. |
| 4270H | Data logging function error | • Data logging function is being performed (data logging status: Being executed, Saving in progress, End, Pause, Error status) to another memory. | • Register data logging to the memory where the data logging is being performed. Or, stop the data logging being performed and register again.<br>■When CPU Module Logging Configuration Tool is used<br>• Start the data logging to the memory where the data logging is being performed. Or, stop the data logging being performed, and start the data logging. |
| 4271H | Data logging function error | • The specified data logging is already being performed (data logging status: Being executed, Saving in progress, End, Pause, Error status). | • Stop the data logging. Or, write, delete, or register data logging to the setting number where no data logging is being performed. |
| 4276H | Data logging function error | • The specified command cannot be executed because the data logging function is being executed (data logging status: Being executed, Saving in progress, End, Pause, Error status). | • Stop the data logging, and then execute the function. |
| 4277H | Data logging function error | • The number of saved files exceeded the specified number.<br>■When CPU Module Logging Configuration Tool is used<br>• The data logging was started in a state where the number of saved files has exceeded the specified number. (The operation when the number of saved files exceeded is set to "Stop".) Or, the data logging was started in a state where the number of saved files has exceeded the specified number. (The operation when the number of saved files exceeded is set to "Overwrite".) | • The number of files saved in the storage destination memory has exceeded the setting value. Delete files, or change the storage destination and then register.<br>■When CPU Module Logging Configuration Tool is used<br>• The number of files saved in the storage destination memory has exceeded the setting value. Delete files or change the storage destination, and then start the data logging. |
| 4278H | Data logging function error | • The data logging was started in a state where the saved file number has reached its maximum, FFFFFFFF. Or, the number reached to the maximum during the execution.<br>■When CPU Module Logging Configuration Tool is used<br>• The data logging was started in a state where the saved file number has reached its maximum, FFFFFFFF. Or, the number reached to the maximum during the execution. | • The saved file number in the storage target memory has reached its maximum, FFFFFFFF. Delete files, or change the storage destination and then register.<br>■When CPU Module Logging Configuration Tool is used<br>• The saved file number in the storage target memory has reached its maximum, FFFFFFFF. Delete files or change the storage target memory, and then perform the data logging. |
| 4279H | Data logging function error | • Data logging started with the size of the data logging file exceeding the file size set in the storage file switching condition. Or the file size exceeded the set file size while data was saved during execution. | • Set a larger size in the storage file switching condition.<br>• Reduce output information and reduce the header size. (Basically, this occurs when "Output device comment" is selected for "Data name row" in "Data column" and many double quotations are used in the device data.) |
| 427BH | Data logging function error | • The data logging function with the same file storage destination is being performed (data logging status: Being executed, Saving in progress, End, Pause, Error status).<br>■When CPU Module Logging Configuration Tool is used<br>• The data logging with the same file storage destination is being performed (data logging status: RUN waiting (no collection), Start waiting (no collection), Condition waiting (no collection), Pause, Collecting, Trigger waiting (collecting before trigger), Collecting after trigger, or Saving the logging data). | • Stop the data logging destined for the same storage, and then register. Or, change the storage destination of the file, and then register.<br>■When CPU Module Logging Configuration Tool is used<br>• Stop the data logging destined for the same storage, and then perform another data logging. Or, change the storage destination of the file, and then register. |
| 4280H | Data logging function error | • A file transfer test was executed from another CPU Module Logging Configuration Tool during execution of a file transfer test. | • Execute the file transfer test again after the ongoing test is completed. |
| 4281H | Data logging function error | • An attempt was made to register the logging setting for a different PC series. | • Register the logging setting for the same PC series. |
| 4282H | Data logging function error | • The registration was performed with the internal buffer capacity set to 0. | • Check and correct the internal buffer capacity setting. |

| Error code | Error name | Error details and cause | Action |
|---|---|---|---|
| 4283H | Data logging function error | • An attempt was made to register trigger logging in a state that the specified number of records before trigger has exceeded the number of records that can be collected within the internal buffer capacity | • Check and correct the internal buffer capacity setting.<br>• Reduce the number of records before trigger. |
| 4285H | Data logging function error | • A non-executable function has been executed during collection or save in memory dump. | • Execute the function again after the completion of save in memory dump. |
| 4292H | Debug related function error | • Real-time monitor does not begin during the execution of real-time monitor. | • Start real-time monitor after the stopping of the real-time monitor is being executed. |
| 4293H | Debug related function error | • Execution fails because the internal buffer exceeds its maximum capacity. | • Check and correct the settings of internal buffer capacity, and then try again. |
| 433CH | Maintenance and inspection error | • The error was not cleared. | • Execute the request again. |
| 4401H | Security function error | • Read password authentication has failed when required.<br>• The file password format is incorrect. | • Set the correct read password and perform password authentication.<br>• Access the file with the correct method. |
| 4402H | Security function error | • Write password authentication has failed when required.<br>• The file password format is incorrect. | • Set the correct write password and perform password authentication.<br>• Access the file with the correct method. |
| 4403H | Security function error | • Both passwords for reading and for writing do not match the previous passwords when trying to change, authenticate, or delete password. | • Set correct passwords for both reading and writing, and perform password authentication. |
| 4408H | Security function error | • File password authentication has failed when required. | • Set the correct password and perform password authentication again. |
| 440DH | Security function error | • File password authentication failed when access was required. | • Set a correct password and perform password authentication again. |
| 440EH | Security function error | • The security function was activated and password authentication cannot be performed.<br>• Register/cancel file password was attempted on a file set to permanent programmable controller lock. | • Set a correct password and perform password authentication again after a certain period of time.<br>• It is necessary to delete the whole project to delete the file set to permanent programmable controller lock. |
| 440FH | Security function error | • An operation was performed to the firmware update prohibited file with a file password set. | • Disable the file password setting. |
| 4412H | Security function error | • The security key cannot be registered to the CPU module due to failure of the internal memory where the security key is registered. Or, the security key of the CPU module cannot be deleted. | • Hardware failure of the CPU module. Replace the CPU module. |
| 4416H | Security function error | • Since the CPU module is in lock or unlock operation, the requested processing cannot be performed. | • Request the processing after the lock or unlock operation ends. |
| 4422H | Security function error | • The access target CPU module does not support the security key information stored in the engineering tool. | • Change the security key information version of the engineering tool in accordance with the version supported by the target CPU module. |
| 4423H | Security function error | • The specified target of security key operation is inaccurate. | • Set target of security key operation to CPU module. |
| 480CH | iQ Sensor Solution related error | • The specified command cannot be executed because the automatic detection of connected device function of iQ Sensor Solution is being executed. | • Execute the command again after the automatic detection processing ends. |
| 480DH | iQ Sensor Solution related error | • The specified command cannot be executed because the communication setting reflection function of iQ Sensor Solution is being executed. | • Execute the command again after the communication setting reflection processing ends. |
| 480EH | iQ Sensor Solution related error | • The specified command cannot be executed because the monitor function of iQ Sensor Solution is being executed.<br>• The specified command cannot be executed because the sensor parameter read/write function of iQ Sensor Solution is being executed. | • Execute the function again after a while.<br>• Execute the command again after the sensor parameter read/write processing ends. |

| Error code | Error name | Error details and cause | Action |
|---|---|---|---|
| 4A00H | Network error | • Access to the specified station cannot be made since the routing parameters are not set to the start source CPU module and/or relay CPU module.<br>• For routing via a multiple CPU system, the control CPU module of the network module for data routing or the CPU module for data routing has not started.<br>• During configuration of a redundant system, communication via the network module to other station is attempted when the system A/B is not determined.<br>• The third byte of the IP address (network number) specified by the IP communication test and the third byte of the IP address of the CPU module that starts the IP communication test are duplicated. | • Set to the related stations the routing parameters for access to the specified station.<br>• Retry after a while. Or, start communication after checking that the system for data routing has started.<br>• To configure a redundant system, attach a tracking cable and normally startup the system A/B, then execute communication again.<br>• Do not duplicate the third byte of the IP address (network number) specified by the IP communication test and the third byte of the IP address of the CPU module that starts the IP communication test. |
| 4A01H | Network error | • The network of the number set to the routing parameters does not exist.<br>• The specified CPU module cannot be communicated through the network that is not supported by the CPU module.<br>• A communication path which is not compatible with the specified CPU module is specified. | • Check and correct the routing parameters set to the related stations.<br>• Set communication through the network that is supported by the specified CPU module. |
| 4A02H | Network error | • Access to the specified station cannot be made. | • Check the network module/link module for error, or check that the modules are not in offline. |
| 4B00H | Target module error | • An error occurred in the access destination or relay station.<br>• The specified transfer setup (request destination module number) is invalid. | • Take corrective action after checking the error that occurred at the specified access destination or the relay station to the accessed station.<br>• Check the transfer setup (request destination module number or programmable controller number) in the request data of SLMP/MC protocol.<br>• Check the stop error, and take action. |
| 4B02H | Target module error | • The request is not addressed to the CPU module. | • Perform operation to a module that can execute the specified function. |
| 4B03H | Target module error | • The specified route is not supported by the specified CPU module firmware version.<br>• The communication target CPU module is not mounted. | • Check whether the specified route is supported or not.<br>• Check the mounting status of the CPU module.<br>• Check the stop error, and take action. |
| 4C00H | Data logging function error | • There is not enough free space for storing. | • Increase the free space, and create the result file again. |
| 4C01H | Data logging function error | • The result file cannot be written to the target memory because the SD memory card is write-protected or the folder/file structure is incorrect. | • Unlock the write protect switch of the SD memory card, and write the result file again.<br>• Check that the SD memory card is not damaged.<br>• Check that the file/folder to be used in the SD memory card has not been deleted. |
| 4C02H | Data logging function error | • The SD memory card was removed while the data logging function was being executed (data logging status: RUN waiting (no collection), Collecting, Trigger waiting (collecting before trigger), Collecting after trigger, or Saving the logging data). | • Insert the SD memory card, and execute the function again. |
| 4C03H | Data logging function error | • The number of files in the root directory and subdirectory in the target memory exceeded the limit. | • Increase the free space of the drive (memory), and execute the function again.<br>• Delete files in the drive (memory), and execute the function again. |
| 4C04H | Data logging function error | • During auto logging, a data logging was not registered due to a registration failure of the data logging with another setting number. | • Clear the error, and register auto logging. |
| 4C05H | Data logging function error | • The online change function was executed while the data logging function specifying the step number as a sampling or trigger condition was being executed (data logging status: RUN waiting (no collection), Condition waiting (no collection), Start waiting (no collection), Pause, Trigger-wait not collected, Collecting, Trigger waiting (collecting before trigger), Collecting after trigger, or Saving the logging data). | • Do not execute the online change function while the data logging function specifying the step number is being executed (data logging status: RUN waiting (no collection), Condition waiting (no collection), Start waiting (no collection), Pause, Collecting, Trigger waiting (collecting before trigger), Collecting after trigger, or Saving the logging data).<br>• Stop the data logging function specifying the step number. |
| 4C06H | Data logging function error | • System error | • Check the specified data, and write it to the CPU module again. |

| Error code | Error name | Error details and cause | Action |
|---|---|---|---|
| 4C0BH | File transfer error | • A data logging file that is being transferred is deleted.<br>• Reading from (an access to) a data logging file is failed.<br>• The specified file does not exist. Or, the specified subdirectory does not exist. | • Check and correct the number of files to be saved in the file switching setting.<br>• Check if the data logging file is deleted.<br>• Check that an SD memory card is inserted.<br>• Execute the transfer again after checking the name of the file and subdirectory. |
| 4C0CH | Data logging function error | • The data logging file transfer function is executed while the access to the SD memory card is forcibly disabled.<br>• The SD memory card is removed during the data logging file transfer function is executed. | • Clear the forcibly disabled state of the SD memory card, and execute the function again.<br>• Insert the SD memory card, and execute the function again. |
| 4C0DH | Data logging function error | • A data logging is attempted to start during a transfer of a result file. | • Restart the data logging after the completion of the data logging file transfer function. |
| 4C0EH | Data logging function error | • A file transfer is stopped by the data logging file transfer stop request. | • Do not send the data logging file transfer stop request. |
| 4C10H | CPU module backup/restoration function error | • The maximum allowable capacity is exceeded.<br>• The maximum allowable number of files is exceeded.<br>• The upper limit of the backup folder number is exceeded.<br>• The maximum length (255 characters) of the file path is exceeded. | • Increase the free space of the SD memory card and CPU module, and execute the function again.<br>• Delete files in the SD memory card and CPU module, and execute the function again.<br>• Delete backup data in the SD memory card and CPU module, and execute the function again.<br>• Check and correct the folder structure or folder/file names of backup target data, and execute the data backup function again. |
| 4C11H | CPU module backup/restoration function error | • An SD memory card is not inserted.<br>• The SD memory card is disabled.<br>• The SD memory card turned to disable status by SM606 (SD memory card forcibly disable command). | • Insert or re-insert an SD memory card, and execute the function again.<br>• Slide the SD memory card access control switch to ON (downward).<br>• Enable the SD memory card operation, and execute the function again.<br>• If the SD memory card module is not mounted, power off the CPU module, mount the SD memory card module, and power on the CPU module again. |
| 4C12H | CPU module backup/restoration function error | • Reading/writing of data from/to an SD memory card completed with an error. | • Check that an SD memory card is inserted, and execute the function again.<br>• Replace the SD memory card, and execute the function again.<br>• The backup data may have been corrupted. Execute the data restoration function using another backup data. |
| 4C13H | CPU module backup/restoration function error | • Reading/writing of data from/to the CPU built-in memory completed with an error.<br>• The backup target files opened in the CPU built-in memory are duplicated. | • Back up data in the CPU built-in memory, initialize the memory, and write the data back to the original memory. Then, execute the data backup/restoration function.<br>• The possible cause is a hardware failure of the restoration target CPU module. Execute the data restoration function to another CPU module.<br>• Execute the function again after a while. |
| 4C14H | CPU module backup/restoration function error | • The CPU module data backup/restoration function cannot be executed because a file password is set to the data.<br>• Data was restored to the CPU module where the same data with a file password has already been stored. | • Delete file passwords, and execute the CPU module data backup/restoration function. |
| 4C15H | CPU module backup/restoration function error | • The function that cannot be executed simultaneously with such as the file transfer function (FTP) is being executed. | • Execute the function again after a while. |
| 4C17H | CPU module backup/restoration function error | • The backed up CPU module and restoration target destination CPU module models were different when restoration was executed. | • Execute restoration again with the same CPU module model as the backed up CPU module. |
| 4C18H | CPU module backup/restoration function error | • Data was restored while the operating status of the CPU module is in RUN or PAUSE. | • Change the operating status of the CPU module to STOP, and execute the function again. |

| Error code | Error name | Error details and cause | Action |
|---|---|---|---|
| 4C19H | CPU module backup/restoration function error | • The data restoration function was executed with backup files ($BKUP_CPU_INF.BSC and BKUP_CPU.BKD) not structured properly.<br>• Data (file(s)) is missing in the backup file ($BKUP_CPU_INF.BSC) in the backup data folder.<br>• The data restoration function was executed with a folder where no backup files ($BKUP_CPU_INF.BSC, BKUP_CPU.BKD, and BKUP_CPU_DEVLAB.BKD) are stored.<br>• The backed up CPU module and restoration target destination CPU module models were different when restoration was executed. | • The backup data may have been corrupted. Execute the data restoration function using another backup data.<br>• Execute restoration again with the same CPU module model as the backed up CPU module. |
| 4C1AH | CPU module backup/restoration function error | • A value outside the allowable range was set to the operation mode.<br>• A folder with a value that matches the restoration target date folder setting value or number folder setting value does not exist in the SD memory card.<br>• The restoration target data setting value is out of range.<br>• The restoration target date folder setting value or number folder setting value is out of range. | • Check the operation mode setting value, and execute again.<br>• Check and correct the restoration target date folder setting value or number folder setting value, and execute the function again.<br>• Check and correct the restoration target data setting value, and execute the function again. |
| 4C1BH | CPU module backup/restoration function error | • The data restoration function was executed to the CPU module whose status (such as programs, parameters, and file structure) differs from that of when the data backup function was executed. | • Match the CPU module status to the one at the time of backup, and execute the function again.<br>• Store 0 (All target data) to SD954 (Restoration target data setting) and execute the automatic restoration. |
| 4C1CH | CPU module backup/restoration function error | • An SD memory card is not inserted.<br>• The SD memory card turned to disable status by SM606 (SD memory card forcibly disable command).<br>• The SD memory card is write-protected. | • Insert or re-insert an SD memory card, and execute the function again.<br>• Enable the SD memory card operation, and execute the function again.<br>• Cancel the write protection, and execute the function again. |
| 4C1EH | CPU module backup/restoration function error | • When the SFC program specified a continuation start, the status of the SFC program changed during backup execution, such as changing the step active state or establishing transition conditions. | • Do not allow the status of the SFC program to change while the backup is in progress, and then re-execute. |
| 4C1FH | CPU module data backup/restoration function error | • The specified command cannot be executed because the CPU module data backup/restoration function is being executed. | • Execute the command again after the data backup/restoration processing ends. |
| 4C20H | CPU module backup/restoration function error | • The data backup/restoration function was executed while the CPU module is in a state where this function cannot be executed. | • Check that the CPU module's serial No. is compatible with the backup function (16Y**** or later).<br>• Initialize the CPU built-in memory, and execute the data restoration function again. |
| 4C40H | File transfer function (FTP client) error | • When files are specified by using wild card characters for the file transfer function instruction, the number of files matched exceeds the upper limit of the transferable number of files.<br>• When files are specified by using wild card characters for the file transfer function instruction, no files are matched. | • Check and correct the wild card specification. |
| 4C43H | File transfer function (FTP client) error | • The number of processing completed files for sending or acquiring FTP client file is mismatched with the total number of processing files. | • Execute the function again. |
| 4C44H | File transfer function (FTP client) error | • The file transfer function (FTP client) is executed while the backup/restoration function are being executed. | • Execute the File transfer function (FTP client) again after the backup/restoration function is completed. |
| 4D40H | Firmware update function error (Via engineering tool) | • Access to the flash ROM of the module to be updated has failed. | • Perform the firmware update to the target module again. |

| Error code | Error name | Error details and cause | Action |
|---|---|---|---|
| 4D41H | Firmware update function error (Via engineering tool) | • Access to the module to be updated has failed.<br>• The firmware cannot be updated on the target module.<br>• An incorrect firmware update file (a firmware update file not for the module to be updated) has been used.<br>• An invalid firmware update file has been used. | • Check the module to be updated for any hardware failure and perform the firmware update again.<br>• Check that the module to be updated has started up normally and perform the firmware update again.<br>• Check if the firmware can be updated on the target module.<br>• Set the correct firmware update file for the module to be updated in the engineering tool, and perform the firmware update again.<br>• Ensure that the name or contents of the firmware update file is not changed from its original state. |
| 4D44H | Firmware update function error (Via engineering tool) | • A firmware update file of the version that cannot be installed on the module used has been used. | • Use the module with a firmware version that supports the firmware update using the engineering tool. |
| 4D45H | Firmware update function error (Via engineering tool) | • The firmware update is disabled. | • Enable the firmware update and perform the operation again. |
| 4D46H | Firmware update function error (Via engineering tool) | • The engineering tool and the CPU module are connected incorrectly. (The cable connection and/or connection settings in the engineering tool are not correct.) | • Check that the CPU module is connected via USB or built-in Ethernet (Ethernet port direct connection/connection via hub). |
| 4D47H | Firmware update function error (Via engineering tool) | • The operation cannot be performed because the firmware update is being performed.<br>• The operation cannot be performed because the CPU module is not reset after the firmware update.<br>• An error occurred during execution of the previous firmware update. | • After the firmware update completes, perform the operation again.<br>• Manually reset the CPU module and perform the firmware update again. |
| 4D48H | Firmware update function error (Via engineering tool) | • The firmware update cannot be performed due to a CPU module stop error.<br>• The module may be faulty. | • Correct the parameters.<br>• If the same error is displayed again, please consult your local Mitsubishi representative. |
| 4D49H | Firmware update function error (Via engineering tool) | • The CPU module has been powered off or reset during the firmware update processing.<br>• The engineering tool or communication error has occurred during the firmware update processing. | • Update the firmware again. |
| 4D4AH | Firmware update function error (Via engineering tool) | • An invalid firmware update file has been used. | • Ensure that the name or contents of the firmware update file is not changed from its original state. |
| 4D4DH | Firmware update function error (Via engineering tool) | • A firmware data error is detected during the firmware update processing. | • Update the firmware again. |
| 4D4EH | Firmware update function error (Via engineering tool) | • The specified operation cannot be performed because the firmware update is being performed.<br>• A remote operation other than remote RESET was executed. | • Reset the CPU module after the completion of the firmware update and perform the specified operation again. |

## Error codes of errors in PID control via parameter (8100H to 8230H)

The following table lists error codes of errors in the PID control via parameter function.

| Error code | Error name | Error details and cause | Stop/ continue | Action |
|---|---|---|---|---|
| 8100H | Auto-tuning malfunction | The difference between the maximum and minimum values for the measured value (PV) during auto tuning is too small. | Continue | Multiply the measured value (PV) by "10" so that the variation of the measured value will increase during auto tuning.<br>(If an error occurs, set the measured value (PV) to 32767.) |
| 8101H | Auto-tuning malfunction | | Continue | |
| 8102H | Auto-tuning malfunction | The auto tuning time is longer than necessary. | Continue | ■For standard PID control<br>• Check the value for the upper limit output limiter and correct the value if it is smaller than 100%.<br>• Check the value for the lower limit output limiter and correct the value if it is larger than 0%.<br>■For heating-cooling PID control<br>• Check the value for the heating upper limit output limiter and correct the value if it is smaller than 100%.<br>• Check the value for the cooling upper limit output limiter and correct the value if it is smaller than 100%.<br>■Common to PID control<br>• Due to the influence of the environment, the temperature of the control target may be unable to fall or rise. Stop controlling the adjacent control targets and execute auto tuning for the control target individually.<br>(If an error occurs, set the value for the upper limit output limiter/lower limit output limiter/heating upper limit output limiter/cooling upper limit output limiter to 32767.) |
| 8103H | Auto-tuning malfunction | | Continue | |
| 8110H | Out of parameter setting range | During PID control, a value outside the allowable range was set to the proportional gain (KP) or heating proportional gain (KPh). | Continue | Set a value in the range 0 to 32767 to the proportional gain (KP) or heating proportional gain (KPh).<br>(If an error occurs, set the proportional gain (KP) or heating proportional gain (KPh) to 0.) |
| 8111H | Out of parameter setting range | A value outside the allowable range was set to the cooling proportional gain (KPc) during PID control. | Continue | Set a value in the range 1 to 32767 to the cooling proportional gain (KPc).<br>(If an error occurs, set the cooling proportional gain (KPc) to 1.) |
| 8112H | Out of parameter setting range | A value outside the allowable range was set to the integral time (TI) during PID control. | Continue | Set a value for the integral time (TI) in the range 0 to 32767.<br>(If an error occurs, set the value for the integral time (TI) to 0.) |
| 8113H | Out of parameter setting range | A value outside the allowable range was set to the differential time (TD) during PID control. | Continue | Set a value for the differential time (TD) in the range 0 to 32767.<br>(If an error occurs, set the value for the differential time (TD) to 0.) |
| 8114H | Out of parameter setting range | Values were set so that the sampling time (Ts)≥the control output cycle (heating control output cycle, cooling control output cycle) during PID control. | Continue | The values for the sampling time and control output cycle (heating control output cycle, cooling output cycle) cannot be changed.<br>Set values so that the control output cycle (heating control output cycle, cooling output cycle) becomes larger than the sampling time.<br>(If an error occurs, write back the value for the control output cycle to the value before change. When the mode is changed from two-position control to PID control, set a value obtained by following equation: A value obtained by discarding any fraction less than 100ms from the sampling time + 100ms. |
| 8115H | Out of parameter setting range | A value outside the allowable range was set to the sampling time (Ts) during PID control. | Continue | Set a value for the sampling time (Ts) in the range 1 to 3000. Alternatively, set a value so that a value 10 times the sampling time is equal to or smaller than the differential time. Alternatively, make adjustment so that the scan time does not exceed the sampling time.<br>(If an error occurs, set the scan time to the minimum/ maximum value.) |

| Error code | Error name | Error details and cause | Stop/ continue | Action |
|---|---|---|---|---|
| 8116H | Out of parameter setting range | A value outside the allowable range was set to the control output cycle, heating control output cycle, or cooling control output cycle during PID control. | Continue | Set a value in the range 1 to 3000 for the control output cycle, heating control output cycle, or cooling control output cycle.<br>(If an error occurs, the value for the control output cycle, heating control output cycle, or cooling control output cycle to the minimum value/maximum value.) |
| 8117H | Out of parameter setting range | A value outside the allowable range was set to the adjustment sensitivity (dead band) PID control. | Continue | Set a value for the adjustment sensitivity (dead band) in the range 0 to 32760.<br>(If an error occurs, set the adjustment sensitivity (dead band) to the minimum/maximum value.) |
| 8118H | Out of parameter setting range | A value outside the allowable range was set to the upper limit output limiter during PID control. | Continue | Set a value for the upper limit output limiter in the range 1 to 1000.<br>(If an error occurs, set the value for the upper limit output limiter to the minimum/maximum value.) |
| 8119H | Out of parameter setting range | A value outside the allowable range was set to the upper limit output limiter during PID control. | Continue | Set a value for the upper limit output limiter in the range 1 to 1000.<br>(If an error occurs, set the value for the upper limit output limiter to the minimum/maximum value.) |
| 811AH | Out of parameter setting range | A value outside the allowable range was set to the heating upper limit output limiter during PID control. | Continue | Set a value for the heating upper limit output limiter in the range 0 to 1000.<br>(If an error occurs, set the value for the heating upper limit output limiter to the minimum/maximum value.) |
| 811BH | Out of parameter setting range | A value outside the allowable range was set to the cooling upper limit output limiter during PID control. | Continue | Set a value for the cooling upper limit output limiter in the range 0 to 1000.<br>(If an error occurs, set the value for the cooling upper limit output limiter to the minimum/maximum value.) |
| 811CH | Out of parameter setting range | A value outside the allowable range was set to the output change ratio limiter during PID control. | Continue | Set a value for the output change ratio limiter in the range 0 to 1000.<br>(If an error occurs, set the value for the output change ratio limiter to the minimum/maximum value.) |
| 811DH | Out of parameter setting range | A value outside the allowable range was set to the temperature rise completion range setting during PID control. | Continue | Set a value for the temperature rise completion range setting in the range 0 to 32760.<br>(If an error occurs, set the value for the temperature rise completion range setting to the minimum/maximum value.) |
| 811EH | Out of parameter setting range | A value outside the allowable range was set to the temperature rise completion soak time setting during PID control. | Continue | Set a value for temperature rise completion soak time setting in the range 0 to 32767.<br>(If an error occurs, set the value for the temperature rise completion soak time setting to 0.) |
| 811FH | PID control malfunction | The value for the upper limit output limiter was changed to a value equal to or smaller than the value for the lower limit output limiter during PID control. | Continue | The values for the upper limit output limiter and lower limit output limiter cannot be changed as upper limit output limiter≤lower limit output limiter.<br>Set values so that the value for the upper limit output limiter is larger than the value for the lower limit output limiter.<br>When an error occurs, write back the values for the upper limit output limiter and lower limit output limiter to the values before change.) When the mode is changed from two-position control to PID control, set the values to the default values (upper limit output limiter = 1000, lower limit output limiter = 0). |
| 8120H | PID control malfunction | Correct control was not performed because the relation (which is larger) between the measured value (PV) and the ambient temperature setting was changed from the relation when PID control started. | Continue | Ensure that the relation (which is larger) between the measured value (PV) and the ambient temperature setting is not changed from the relation when PID control started. |
| 8122H | Out of parameter setting range | A value outside the allowable range was set to the target value (SV) during PID control. | Continue | Set a value for the target value (SV) in the range -32760 to 32760.<br>(If an error occurs, set the value for the target value (SV) to the minimum/maximum value.) |
| 8124H | PID control malfunction | During PID control, the value for "Target value (SV)±Adjustment sensitivity (dead band)" was set to that which was outside the range of the measured value (PV) (any value outside the range of -32767 to 32766). | Continue | Set a value larger than the lower limit or smaller than the upper limit of the range of the measured value (PV) (-32767~32766) for the value for "Target value (SV)±Sensitivity (dead band)". |

| Error code | Error name | Error details and cause | Stop/ continue | Action |
|---|---|---|---|---|
| 8125H | Out of parameter setting range | The lower value than the operation cycle value of the programmable controller was set to the control output cycle setting, heating control output cycle setting, or cooling control output cycle setting. | Continue | Set a value larger enough than the scan time for the control output cycle setting, heating control output cycle setting, or cooling output cycle setting. |
| 8200H | Auto-tuning measurement time error | ■For standard PID control<br>• The value for the upper limit output limiter is small.<br>• The value for the lower limit output limiter is large.<br>■For heating-cooling PID control<br>• The value for the heating upper limit output limiter is small.<br>• The value for the cooling upper limit output limiter is small.<br>■Common to PID control<br>• The heater power supply or cooling device power supply may not be turned ON.<br>• Due to the influence of the environment, the temperature of the control target may be unable to fall or rise.<br>• The operation direction estimated from the measured value at the start of auto tuning was different from the actual operation direction of the output during auto tuning. | Stop | ■For standard PID control<br>• Check the value for the upper limit output limiter and correct the value if it is smaller than 100%.<br>• Check the value for the lower limit output limiter and correct the value if it is larger than 0%.<br>■For heating-cooling PID control<br>• Check the value for the heating upper limit output limiter and correct the value if it is smaller than 100%.<br>• Check the value for the cooling upper limit output limiter and correct the value if it is smaller than 100%.<br>■Common to PID control<br>• Check that the heater power supply or cooling device power supply is turned ON.<br>• Due to the influence of the environment, the temperature of the control target may be unable to fall or rise. Stop controlling the adjacent control targets and execute auto tuning for the control target individually.<br>• Correct the relationship between the target value and the measured value, and then execute auto tuning again. |
| 8201H | Out of parameter setting range | Correct PID control constants could not be found because the target value (SV) was changed during auto tuning. | Stop | Do not change the target value (SV) during auto tuning.<br>Execute auto tuning again. |
| 8202H | Out of parameter setting range | Correct PID control constants could not be found because the sampling time (Ts) was changed during auto tuning. | Stop | Do not change the sampling time (Ts) during auto tuning.<br>Execute auto tuning again. |
| 8203H | Out of parameter setting range | Correct PID control constants could not be found because the value for the upper limit output limiter was changed during auto tuning. | Stop | Do not change the value for the upper limit output limiter during auto tuning.<br>Execute auto tuning again. |
| 8204H | Out of parameter setting range | Correct PID control constants could not be found because the value for the lower limit output limiter was changed during auto tuning. | Stop | Do not change the value for the lower limit output limiter during auto tuning.<br>Execute auto tuning again. |
| 8205H | Out of parameter setting range | Correct PID control constants could not be found because the value for the heating upper limit output limiter was changed during auto tuning. | Stop | Do not change the value for the heating upper limit output limiter during auto tuning.<br>Execute auto tuning again. |
| 8206H | Out of parameter setting range | Correct PID control constants could not be found because the value for the cooling upper limit output limiter was changed during auto tuning. | Stop | Do not change the value for the cooling upper limit output limiter during auto tuning.<br>Execute auto tuning again. |
| 8207H | Out of parameter setting range | Correct PID control constants could not be found because the value for the control output cycle, heating control output cycle, or cooling control output cycle was changed during auto tuning. | Stop | Do not change the control output cycle, heating control output cycle, or cooling control output cycle during auto-tuning.<br>Execute auto tuning again. |
| 8208H | Out of parameter setting range | Auto tuning could not be executed because the value for the upper limit output limiter, heating upper limit output limiter, or cooling upper limit output limiter was smaller than 1 (0.1%). | Stop | To execute auto tuning, set the value for the upper limit output limiter, heating upper limit output limiter, or cooling upper limit output limiter equal to or larger than 1 (0.1%).<br>Execute auto tuning again. |
| 8209H | Out of parameter setting range | Auto tuning could not be executed because the value for the lower limit output limiter was equal to or larger than 1000 (100.0%). | Stop | To execute auto tuning, set the value for the lower limit output limiter smaller than 999 (99.9%).<br>Execute auto tuning again. |
| 8210H | PID control malfunction | The value for the control output cycle (heating control output cycle, cooling output cycle) was set to equal to or smaller than the sampling time (Ts) when PID control started. | Stop | Set values so that the control output cycle (heating control output cycle, cooling output cycle) becomes larger than the sampling time. |
| 8211H | PID control malfunction | The value for the upper limit output limiter was equal to or smaller than the value for the lower limit output limiter when PID control started. | Stop | Set values so that the value for the upper limit output limiter is larger than the value for the lower limit output limiter. |

| Error code | Error name | Error details and cause | Stop/ continue | Action |
|---|---|---|---|---|
| 8213H | PID control malfunction | A PID operation result overflow occurred. | Stop | PID control was not executed correctly. Check and correct the values for the proportional gain (Kp), heating proportional gain (Kph), cooling proportional gain (Kpc), integral time (TI), differential time (TD), and sampling time (Ts). |
| 8214H | Parameter error | An incorrect parameter was detected at starting of PID control. | Stop | If the firmware version of the FX5U/FX5UC CPU module is less than 1.290, set the overlap/dead band settings as follows.<br>• Setting value: 0<br>• Device indirect specification: Empty |
| 8230H | PAUSE detection | The status changed to PAUSE during auto tuning or PID control. | Stop | Do not change the status into PAUSE during auto tuning or PID control. |

## Error codes of the file transfer function (C616H to C622H)

The following table lists the error codes of completion status errors that occur in the file transfer function (FTP client).

| Error code | Error name | Error details and cause | Action |
|---|---|---|---|
| C616H to C622H | ☞ MELSEC iQ-F FX5 User's Manual (Communication) | | |

## Error codes of the CC-Link IE Field Network Basic (CFC0H to CFFFH)

The following table lists the error codes detected by the CC-Link IE Field Network Basic function.

| Error code | Error name | Error details and cause | Action |
|---|---|---|---|
| CFC0H | Cyclic transmission error (master station) | • Unable to execute cyclic transmission because multiple master stations exist in the same network address. | • Check the existence status of master station in network. |
| CFC1H | Cyclic transmission error (master station) | • Unable to execute cyclic transmission because the error occurred in cyclic transmission. | • Take measures to reduce noise.<br>• If the same error is displayed again, please contact your local Mitsubishi representative. |
| CFC8H | Cyclic transmission error (master station) | • Unable to execute cyclic transmission because the remote station controlled by other master station exists. | • Check the existence status of master station in network.<br>• Check the remote station where the error occurred. |
| CFC9H | Cyclic transmission error (master station) | • Unable to execute cyclic transmission because the remote station of the same IP address exists in the same network address. | • Check the existence status of the remote station in network.<br>• Check the remote station where the error occurred. |
| CFD0H | Master station error | • The port No. (61450) used in CC-Link IE Field Network Basic has already been used. | • Check the port No. used in Ethernet function. |
| CFD1H | Master station error | • Invalid value has been set in subnet mask. | • Check the parameter setting. |
| CFE0H | Cyclic transmission error (remote station) | • The cyclic transmission was executed for the remote station controlled by other master station. | • Check the existence status of master station in network.<br>• Check the remote station where the error occurred. |
| CFE1H | Cyclic transmission error (remote station) | • The unusable number of occupied stations has been specified from master station. | • Check the number of occupied stations setting in master station parameter (Network Configuration Settings). |
| CFE8H | Cyclic transmission error (remote station) | • There is no response from the remote station. | • Check the remote station disconnection detection setting in master station parameter (Network Configuration Settings).<br>• Check the existence status of the remote station in network.<br>• Check the remote station where the disconnection occurred.<br>• Take measures to reduce noise. |
| CFE9H | Cyclic transmission error (remote station) | • The remote station of the same IP address has existed in the same network address. | • Check the remote station where the error occurred. |
| CFF0H | Remote station error | • An error occurred in the remote station. | • Check the remote station where the error occurred. |

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## Error codes of the analog function (0000H to 3084H)

The following table lists the error codes that may be stored.

☐: Indicates the channel number where the error occurred. The square represents a number between 1 and 4, which corresponds to the channel numbers from CH1 to CH4.

(CH1: 1, CH2: 2, CH3: 3, CH4: 4)

### ■For the CPU module built-in analog function

• Analog input

| Error code | Error name | Error details and cause | Action |
|---|---|---|---|
| 0000H | — | There is no error. | — |
| 1A0☐H | Averaging process specification setting range error | A value other than 0 to 3 was set in CH☐ average processing setting. | Reset CH☐ the average processing setting to 0 to 3. |
| 1A1☐H | Average time setting range error | When the time average is set to CH☐ averaging processing setting, a value other than 1 to 10000 was set to CH☐ time average/count average/moving average settings. | Reset CH☐ time average/count average/moving average settings to the following value.<br>1 to 10000 |
| 1A2☐H | Average count setting range error | When the count average is set to CH☐ averaging processing setting, a value other than 4 to 32767 was set to CH☐ time average/count average/moving average settings. | Reset CH☐ time average/count average/moving average settings to the following value.<br>4 to 32767 |
| 1A3☐H | Moving average count setting range error | When the moving average is set to CH☐ average processing setting, a value other than the following was set to CH☐ time average/count average/moving average settings.<br>2 to 64 | Reset CH☐ time average/count average/moving average settings to the following value.<br>2 to 64 |
| 1A4☐H | Process alarm upper-lower limit value setting range error | The value not meeting the following conditions was set to CH☐process alarm upper-upper limit value to CH☐ process alarm lower-lower limit value.<br>Upper-upper limit value≥Upper-lower limit value≥Lower-upper limit value≥Lower-lower limit value | Reset CH☐ process alarm upper-upper limit value to CH☐ process alarm lower-lower limit value to the value meeting the following conditions.<br>Upper-upper limit value≥Upper-lower limit value≥Lower-upper limit value≥Lower-lower limit value |
| 1A7☐H | Scaling upper and lower limit value setting error | CH☐ scaling upper limit value and CH☐ scaling lower limit value are equal. | Reset CH☐ scaling upper limit value or CH☐ scaling lower limit value such that Scaling upper limit value≠Scaling lower limit value. |

• Analog output

| Error code | Error name | Error details and cause | Action |
|---|---|---|---|
| 0000H | — | There is no error. | — |
| 1B01H | Warning output upper and lower limit value inversion error | Values that do not satisfy the following relation are set in warning output upper limit value and warning output lower limit value:<br>Upper limit value > Lower limit value | Set the warning output upper limit value and warning output lower limit value so that upper limit value > lower limit value. |
| 1B11H | HOLD output state setting range error | A value other than 0, 1 or, 2 was set in the HOLD/CLEAR function setting. | Set a value between 0 and 2 to the HOLD/CLEAR function setting. |
| 1B21H | HOLD output set value range error | The HOLD output set value is outside the range between the scaling lower limit value and scaling upper limit value. | Specify the HOLD output set value to fall within the range between the scaling lower limit value and scaling upper limit value. |
| 1B71H | Scaling upper and lower limit value setting error | Scaling upper limit value and CH☐ scaling lower limit value are equal. | Reset Scaling upper limit value or CH☐ scaling lower limit value such that Scaling upper limit value≠Scaling lower limit value. |

## ■For the analog adapter

• Analog input

| Error code | Error name | Error details and cause | Action |
|---|---|---|---|
| 0000H | — | There is no error. | — |
| 1A0□H | Averaging process specification setting range error | A value other than 0 to 3 was set in CH□ average processing setting. | Reset CH□ the average processing setting to 0 to 3. |
| 1A1□H | Average time setting range error | When the time average is set to CH□ averaging processing setting, a value other than 1 to 10000 was set to CH□ time average/count average/moving average settings. | Reset CH□ time average/count average/moving average settings to the following value.<br>1 to 10000 |
| 1A2□H | Average count setting range error | When the count average is set to CH□ averaging processing setting, a value other than 4 to 32767 was set to CH□ time average/count average/moving average settings. | Reset CH□ time average/count average/moving average settings to the following value.<br>4 to 32767 |
| 1A3□H | Moving average count setting range error | When the moving average is set to CH□ Averaging process specification, a value other than the following was set to CH□ Time average/count average/moving average settings.<br>2 to 64 | Reset CH□ time average/count average/moving average settings to the following value.<br>2 to 64 |
| 1A4□H | Process alarm upper-lower limit value setting range error | The value not meeting the following conditions was set to CH□ process alarm upper-upper limit value to CH□ process alarm lower-lower limit value.<br>Upper-upper limit value≥Upper-lower limit value≥Lower-upper limit value≥Lower-lower limit value | Reset CH□ process alarm upper-upper limit value to CH□ process alarm lower-lower limit value to the value meeting the following conditions.<br>Upper-upper limit value≥Upper-lower limit value≥Lower-upper limit value≥Lower-lower limit value |
| 1A5□H | Rate alarm upper limit value/ lower limit value setting inversion error | A value satisfying "lower limit value≥upper limit value" was set to CH□ rate alarm upper limit value and CH□ rate alarm lower limit value. | Reset CH□ rate alarm upper limit value and CH□ rate alarm lower limit value to lower limit value<upper limit value. |
| 1A6□H | Rate alarm warning detection period setting range error | A value other than 1 to 10000 was set to CH□ rate alarm warning detection period setting. | Reset the CH□ rate alarm warning detection period setting to the value within 1 to 10000. |
| 1A7□H | Scaling upper and lower limit value setting error | CH□ scaling upper limit value and CH□ scaling lower limit value are equal. | Reset CH□ scaling upper limit value or CH□ scaling lower limit value such that Scaling upper limit value≠Scaling lower limit value. |
| 1A8□H | Range setting range error | A value outside the range was set to the CH□ range setting. | Reset the CH□ range setting to the following value.<br>0 to 6 |
| 1A9□H | Offset/Gain setting value range error | A value outside the range was set to CH□ Offset setting value or CH□ Gain setting value. | Reset CH□ Offset setting value or CH□ Gain setting value to the following value.<br>■Voltage<br>Offset value: -10000 to +9000<br>Gain value: -9000 to +10000<br>■Current<br>Offset value: -20000 to +17000<br>Gain value: -17000 to +30000 |
| 1AA□H | Range setting range error with disconnection detection enabled | CH□ Disconnection detection functions were set to Enable and CH□ Input range is set to those other than the following.<br>• 1 to 5V<br>• 4 to 20mA | For the channel detecting simple disconnection using the disconnection detection function, reset CH□ Input range to any of the following.<br>• 1 to 5V<br>• 4 to 20mA |
| 1AC□H | Convergence detection time setting range error | A value other than 1 to 10000 was set to CH□ Convergence detection time setting. | Reset CH□ Convergence detection time setting to the value within 1 to 10000. |
| 1AD□H | Convergence detection upper limit value/lower limit value setting inversion error | A value satisfying "lower limit value≥upper limit value" was set to CH□ Convergence detection upper limit value and CH□ Convergence detection lower limit value. | Reset CH□ Convergence detection upper limit value and CH□ Convergence detection lower limit value so that upper limit value is larger than lower limit value. |
| 1AF□H | Offset/Gain setting write error | During CH□ Offset/Gain setting write or CH□ Offset/ Gain setting initialization, "CH□ A/D conversion enable/ disable setting" was set to conversion enable. | Set "CH□ A/D conversion enable/disable setting" to conversion disable, and write CH□ Offset/Gain setting or initialize CH□ Offset/Gain setting. |
| 1D7□H | Offset/Gain computed value range error | CH□ Offset/Gain computed value became out of range. | Reset CH□ Offset value and CH□ Gain setting value. |
| 3080H | Analog ADP Hardware error | Hardware error of analog ADP was detected. | After resetting the CPU module, carry out RUN. If the same error is displayed again, there is a possibility of hardware error of the analog ADP. Consult the nearest Mitsubishi Electric representative. |

| Error code | Error name | Error details and cause | Action |
|---|---|---|---|
| 3081H | Analog ADP Power failure | The power is not supplied to the analog ADP normally. | Confirm if the power is supplied to the analog ADP properly. |
| 3082H | Analog ADP Memory Error | An analog ADP memory error was detected. | After resetting the CPU module, carry out RUN. If the same error is displayed again, there is a possibility of analog ADP hardware failure. Consult the nearest Mitsubishi Electric representative. |
| 3083H | Analog ADP Memory Error | An error was detected in offset/gain setting data of the analog ADP. | After offset/gain initialization of the analog ADP is finished, set the data by offset/gain settings again. |
| 3084H | Analog ADP Communication error | Communication error occurred between the analog ADP and the CPU module. | Confirm if ADP is connected properly to the CPU module. If not improved, consult the nearest Mitsubishi Electric representative. |

• Analog output

| Error code | Error name | Error details and cause | Action |
|---|---|---|---|
| 0000H | — | There is no error. | — |
| 1B0□H | Warning output upper and lower limit value inversion error | The value not meeting the following condition was set to CH□ Warning output upper limit value and CH□ Warning output lower limit value.<br>Upper limit value>Lower limit value | Reset CH□ Warning output upper limit value and CH□ Warning output lower limit value such that upper limit value>lower limit value. |
| 1B1□H | HOLD output state setting range error | A value other than 0 to 2 was set in the CH□ HOLD/CLEAR function setting. | Set a value between 0 and 2 to the CH□ HOLD/CLEAR function setting. |
| 1B2□H | HOLD output set value range error | CH□ Output setting value during HOLD is set outside the range of scaling upper and lower limit value. | Set CH□ Output setting value during HOLD within the range of scaling upper and lower limit value. |
| 1B7□H | Scaling upper and lower limit value setting error | CH□ Scaling upper limit value and CH□ Scaling lower limit value are equal. | Reset CH□ Scaling upper limit value or CH□ scaling lower limit value such that Scaling upper limit value≠Scaling lower limit value. |
| 1B8□H | Range setting range error | A value outside the range was set to the CH□ range setting. | Reset the CH□ range setting to the following value.<br>0 to 5 |
| 1B9□H | Offset/Gain setting value range error | A value outside the range was set to CH□ Offset setting value or CH□ Gain setting value. | Reset CH□ Offset setting value or CH□ Gain setting value to the following value.<br>■Voltage<br>Offset value: -10000 to +9000<br>Gain value: -9000 to +10000<br>■Current<br>Offset value: 0 to 17000<br>Gain value: 3000 to 30000 |
| 1BA□H | Range setting range error with disconnection detection enabled | CH□ Disconnection detection functions were set to Enable and CH□ Output range is set to other than the following.<br>• 4 to 20mA | For the channel detecting disconnection using the disconnection detection function, reset CH□ Output range to any of the following.<br>• 4 to 20mA |
| 1BB□H | Disconnection detection error | In CH□, disconnection was detected. | Eliminate the cause of the disconnection in the channel and turn on the "error clear request" (SM50). |
| 1BF□H | Offset/Gain setting write error | During CH□ Offset/Gain setting write or CH□ Offset/Gain setting initialization, 'CH□ D/A conversion enable/disable setting' was set to conversion enable. | Set 'CH□ D/A conversion enable/disable setting' to conversion disable and write CH□ Offset /Gain setting or initialize CH□ Offset/Gain setting. |
| 1D7□H | Offset/Gain computed value range error | CH□ Offset/Gain computed value became out of range. | Reset CH□ Offset value and CH□ Gain setting value. |
| 3080H | Analog ADP Hardware error | Hardware error of analog ADP was detected. | After resetting the CPU module, carry out RUN. If the same error is displayed again, there is a possibility of hardware error of the analog ADP. Consult the nearest Mitsubishi Electric representative. |
| 3081H | Analog ADP Power failure | The power is not supplied to the analog ADP normally. | Confirm if the power is supplied to the analog ADP properly. |
| 3082H | Analog ADP Memory Error | An analog ADP memory error was detected. | After resetting the CPU module, carry out RUN. If the same error is displayed again, there is a possibility of analog ADP hardware failure. Consult the nearest Mitsubishi Electric representative. |
| 3083H | Analog ADP Memory Error | An error was detected in offset/gain setting data of the analog ADP. | After offset/gain initialization of the analog ADP is finished, set the data by offset/gain settings again. |
| 3084H | Analog ADP Communication error | Communication error occurred between the analog ADP and the CPU module. | Confirm if ADP is connected properly to the CPU module. If not improved, consult the nearest Mitsubishi Electric representative. |

• Temperature sensor input

| Error code | Error name | Error details and cause | Action |
|---|---|---|---|
| 0000H | — | There is no error. | — |
| 1A0☐H | Averaging process specification setting range error | A value other than 0 to 3 was set in CH☐ average processing setting. | Reset CH☐ the average processing setting to 0 to 3. |
| 1A1☐H | Average time setting range error | When the time average is set to CH☐ averaging processing setting, a value other than 340 to 10000 was set to CH☐ time average/count average/moving average settings. | Reset CH☐ time average/count average/moving average settings to the following value.<br>340 to 10000 |
| 1A2☐H | Average count setting range error | When the count average is set to CH☐ averaging processing setting, a value other than 4 to 4095 was set to CH☐ time average/count average/moving average settings. | Reset CH☐ time average/count average/moving average settings to the following value.<br>4 to 4095 |
| 1A3☐H | Moving average count setting range error | When the moving average is set to CH☐ Averaging process specification, a value other than the following was set to CH☐ Time average/count average/moving average settings.<br>2 to 64 | Reset CH☐ time average/count average/moving average settings to the following value.<br>2 to 64 |
| 1A4☐H | Process alarm upper-lower limit value setting range error | The value not meeting the following conditions was set to CH☐ process alarm upper-upper limit value to CH☐ process alarm lower-lower limit value.<br>Upper-upper limit value≥Upper-lower limit value≥Lower-upper limit value≥Lower-lower limit value | Reset CH☐ process alarm upper-upper limit value to CH☐ process alarm lower-lower limit value to the value meeting the following conditions.<br>Upper-upper limit value≥Upper-lower limit value≥Lower-upper limit value≥Lower-lower limit value |
| 1A5☐H | Rate alarm upper limit value/ lower limit value setting inversion error | A value satisfying "lower limit value≥upper limit value" was set to CH☐ rate alarm upper limit value and CH☐ rate alarm lower limit value. | Reset CH☐ rate alarm upper limit value and CH☐ rate alarm lower limit value to lower limit value<upper limit value. |
| 1A6☐H | Rate alarm warning detection period setting range error | A value other than 85 to 10000 was set to CH☐ rate alarm warning detection period setting. | Reset the CH☐ rate alarm warning detection period setting to the value within 85 to 10000. |
| 1A8☐H | • Range setting/resistance temperature detector type error<br>• Range setting/resistance temperature detector type setting/thermocouple type range error | A value outside the range was set. | Reset the CH☐ range setting to the following value.<br>0 to 1 |
| 1AB☐H | Conversion setting range error with disconnection detection enabled | A value outside the range was set to CH☐ conversion setting for disconnection detection. | Set CH☐ conversion setting for disconnection detection to the following value.<br>0 to 3 |
| 1AF☐H | Offset/Gain setting write error | During CH☐ Offset/Gain setting write or CH☐ Offset/Gain setting initialization, "CH☐ conversion enable/disable setting" was set to conversion enable. | Set "CH☐ conversion enable/disable setting" to conversion disable, and write CH☐ Offset/Gain setting or initialize CH☐ Offset/Gain setting. |
| 1D0☐H | Offset/Gain input value error | At the temperature conversion, the input offset value and input gain value do not satisfy the following condition.<br>• Centigrade: Input gain value - input offset value > 0.1℃<br>• Fahrenheit: Input gain value - input offset value > 0.3℉ | At the temperature conversion, correct values so that the input offset value and input gain value satisfy the following condition.<br>• Centigrade: Input gain value - input offset value > 0.1℃<br>• Fahrenheit: Input gain value - input offset value > 0.3℉ |
| 1D1☐H | Offset/Gain temperature setting value error | The set offset/gain temperature setting values are outside the ranges. Or the set offset/gain temperature setting values do not satisfy the following condition.<br>• Centigrade: Gain temperature setting value - offset temperature setting value > 0.1℃<br>• Fahrenheit: Gain temperature setting value - offset temperature setting value > 0.3℉ | Correct values so that the offset/gain temperature setting values satisfy the following condition.<br>• Centigrade: Gain temperature setting value - offset temperature setting value > 0.1℃<br>• Fahrenheit: Gain temperature setting value - offset temperature setting value > 0.3℉ |
| 3080H | Analog ADP Hardware error | Hardware error of analog ADP was detected. | After resetting the CPU module, carry out RUN. If the same error is displayed again, there is a possibility of hardware error of the analog ADP. Consult the nearest Mitsubishi Electric representative. |
| 3081H | Analog ADP Power failure | The power is not supplied to the analog ADP normally. | Confirm if the power is supplied to the analog ADP properly. |

| Error code | Error name | Error details and cause | Action |
|---|---|---|---|
| 3082H | Analog ADP Memory Error | An analog ADP memory error was detected. | After resetting the CPU module, carry out RUN. If the same error is displayed again, there is a possibility of analog ADP hardware failure. Consult the nearest Mitsubishi Electric representative. |
| 3083H | Analog ADP Memory Error | An error was detected in offset/gain setting data of the analog ADP. | After offset/gain initialization of the analog ADP is finished, set the data by offset/gain settings again. |
| 3084H | Analog ADP Communication error | Communication error occurred between the analog ADP and the CPU module. | Confirm if ADP is connected properly to the CPU module. If not improved, consult the nearest Mitsubishi Electric representative. |

# Appendix 4 Alarm Code

The following table shows the list of the alarm codes stored.

☐: Indicates the channel number where the error occurred. The square represents a number between 1 and 4, which corresponds to the channel numbers from CH1 to CH4.

(CH1: 1, CH2: 2, CH3: 3, CH4: 4)

## For the CPU module built-in analog function

• Analog input

| Alarm code | Alarm name | Description and cause | Action |
|---|---|---|---|
| 080☐H | Process alarm (upper limit) | The process alarm (upper limit) has occurred in CH☐. | When the CH☐ digital operation value returns from the warning output range, the alarm code automatically changes to "0: Normal". |
| 081☐H | Process alarm (lower limit) | The process alarm (lower limit) has occurred in CH☐. | |
| 090☐H | Over-limit detection | The over-limit (upper limit) has occurred in CH☐. | If the alarm clear request is turned ON after the analog input value falls within the set range, all the over-limit detection flags are set to "0: Normal" and the alarm code in the A/D conversion latest alarm code is cleared. |
| 0F0☐H | Changing the setting with setting change not allowed | The setting was changed when setting change was not allowed. | Change the setting with setting change allowed. |

• Analog output

| Alarm code | Alarm name | Description and cause | Action |
|---|---|---|---|
| 0801H | Warning output alarm (upper limit) | The warning output alarm (upper limit side) has occurred. | If the alarm clear request is turned ON after the digital operation value returns from the warning output range, the warning output flag changes to "0: Normal". |
| 0811H | Warning output alarm (lower limit) | The warning output alarm (lower limit side) has occurred. | |
| 0F01H | Changing the setting with setting change not allowed | The setting was changed when setting change was not allowed. | Change the setting with setting change allowed. |

## For the analog adapter

• Analog input

| Alarm code | Alarm name | Description and cause | Action |
|---|---|---|---|
| 0000H | — | There is no error. | — |
| 080☐H | Process alarm (upper limit) | The process alarm (upper limit) has occurred in CH☐. | When the CH☐ digital operation value returns from the warning output range, the alarm code automatically changes to "0: Normal". |
| 081☐H | Process alarm (lower limit) | The process alarm (lower limit) has occurred in CH☐. | |
| 082☐H | Rate alarm (upper limit) | The rate alarm (upper limit) has occurred in CH☐. | When the change ratio of the CH☐ digital operation value returns to the setting range, the alarm code automatically changes to "0: Normal". |
| 083☐H | Rate alarm (lower limit) | The rate alarm (lower limit) has occurred in CH☐. | |
| 090☐H | Over scale (upper limit) | The over-limit (upper limit) has occurred in CH☐. | If the alarm clear request is turned ON after the analog input value falls within the set range, all the over-limit detection flags are set to "0: Normal" and the alarm code in the A/D conversion latest alarm code is cleared. |
| 091☐H | Over scale (lower limit) | The over-limit (lower limit) has occurred in CH☐. | |
| 0A0☐H | Disconnection detection | Disconnection is detected in the CH☐. | When the alarm clear request is set to ON after the CH☐ is recovered from disconnection, all CH disconnection detection flags become "0: Normal", and the alarm code stored in the "A/D conversion latest alarm code" is cleared. |
| 0B0☐H | Deviation detection between channels | Deviation is detected in the CH☐. | When the deviation between the CH☐ becomes less than the deviation value for deviation between CH detection, the deviation between CH detection flag automatically becomes "0: Normal". |
| 0C0☐H | Offset/gain reading input range mismatch | The saved offset/gain input range is different from the currently set input range. | Change the currently set input range to the input range selected when the offset/gain was written, and then read the offset/gain. |

| Alarm code | Alarm name | Description and cause | Action |
|---|---|---|---|
| 0E0□H | Range change alarm during offset/gain writing or offset/gain initialization | The range was changed during offset/gain writing or offset/gain initialization. | Wait until offset/gain writing or offset/gain initialization is finished, and then change the range. |
| 0E1□H | Offset/gain initialization execution alarm | Offset/gain initialization was executed during offset/gain writing. | Wait until offset/gain writing is finished, and then initialize the offset/gain. |
| 0E2□H | Offset/gain writing execution alarm | Offset/gain writing was executed during offset/gain initialization. | Wait until offset/gain initialization is finished, and then write the offset/gain. |
| 0E3□H | Analog ADP memory access alarm | Offset/gain writing, offset/gain reading, or offset/gain initialization was executed while the analog ADP memory error (Error code: 3082H) occurred. Or, offset reading was performed while an analog ADP memory error (Error code: 3083H) occurred. | Reset the CPU module. |
| 0F0□H | Setting change alarm | Special relays/registers for analog are changed while conversion is enabled. | Change the setting of special relays/registers while conversion is disabled. |

• Analog output

| Alarm code | Alarm name | Description and cause | Action |
|---|---|---|---|
| 0000H | — | There is no error. | — |
| 080□H | Warning output alarm (upper limit) | The warning output alarm (upper limit side) has occurred in CH□. | When the CH□ digital operation value returns from the warning output range, the alarm code automatically changes to "0: Normal". |
| 081□H | Warning output alarm (lower limit) | The warning output alarm (lower limit side) has occurred in CH□. | |
| 0C0□H | Offset gain reading output range mismatch | The saved offset/gain output range is different from the currently set output range. | Change the currently set output range to the output range selected when the offset/gain was written, and then read the offset/gain. |
| 0E0□H | Range change alarm during offset/gain writing or offset/gain initialization | The range was changed during offset/gain writing or offset/gain initialization. | Wait until offset/gain writing or offset/gain initialization is finished, and then change the range. |
| 0E1□H | Offset/gain initialization execution alarm | Offset/gain initialization was executed during offset/gain writing. | Wait until offset/gain writing is finished, and then initialize the offset/gain. |
| 0E2□H | Offset/gain writing execution alarm | Offset/gain writing was executed during offset/gain initialization. | Wait until offset/gain initialization is finished, and then write the offset/gain. |
| 0E3□H | Analog ADP memory access alarm | Offset/gain writing, offset/gain reading, or offset/gain initialization was executed while the analog ADP memory error (Error code: 3082H) occurred. Or, offset reading was performed while an analog ADP memory error (Error code: 3083H) occurred. | Reset the CPU module. |
| 0F0□H | Setting change alarm | Special relays/registers for analog are changed while conversion is enabled. | Change the setting of special relays/registers while conversion is disabled. |

• Temperature sensor input

| Alarm code | Alarm name | Description and cause | Action |
|---|---|---|---|
| 0000H | — | There is no error. | — |
| 080□H | Process alarm (upper limit) | The process alarm (upper limit) has occurred in CH□. | When CH□ measured temperature value returns from the warning output range, the alarm code automatically changes to "0: Normal". |
| 081□H | Process alarm (lower limit) | The process alarm (lower limit) has occurred in CH□. | |
| 082□H | Rate alarm (upper limit) | The rate alarm (upper limit) has occurred in CH□. | When the change of CH□ measured temperature value from the previous value returns to the setting range, the alarm code automatically changes to "0: Normal". |
| 083□H | Rate alarm (lower limit) | The rate alarm (lower limit) has occurred in CH□. | |
| 0A0□H | Disconnection detection | Disconnection is detected in the CH□. | When the conversion alarm clear request is set to ON after the CH□ is recovered from disconnection, all CH disconnection detection flag become "0: Normal", and the alarm code stored in the "conversion latest alarm code" is cleared. |
| 0C0□H | Offset/gain reading RTD type mismatch | The saved offset/gain RTD type is different from the currently set RTD type. | Change the currently set RTD type to the RTD type selected when the offset/gain was written, and then read the offset/gain. |
| | Offset/gain reading thermocouple type mismatch | The saved offset/gain thermocouple type is different from the currently set thermocouple type. | Change the currently set thermocouple type to the thermocouple type selected when the offset/gain was written, and then read the offset/gain. |

| Alarm code | Alarm name | Description and cause | Action |
|---|---|---|---|
| 0E0□H | RTD type change alarm during offset/gain writing or offset/gain initialization | The RTD type was changed during offset/gain writing or offset/gain initialization. | Wait until offset/gain writing or offset/gain initialization is finished, and then change the RTD type. |
| | Thermocouple type change alarm during offset/gain writing or offset/gain initialization | The thermocouple type was changed during offset/gain writing or offset/gain initialization. | Wait until offset/gain writing or offset/gain initialization is finished, and then change the thermocouple type. |
| 0E1□H | Offset/gain initialization execution alarm | Offset/gain initialization was executed during offset/gain writing. | Wait until offset/gain writing is finished, and then initialize the offset/gain. |
| 0E2□H | Offset/gain writing execution alarm | Offset/gain writing was executed during offset/gain initialization. | Wait until offset/gain initialization is finished, and then write the offset/gain. |
| 0E3□H | Analog ADP memory access alarm | Offset/gain writing, offset/gain reading, or offset/gain initialization was executed while the analog ADP memory error (Error code: 3082H) occurred. Or, offset reading was performed while an analog ADP memory error (Error code: 3083H) occurred. | Reset the CPU module. |
| 0F0□H | Setting change alarm | Special relays/registers for analog are changed while conversion is enabled. | Change the setting of special relays/registers while conversion is disabled. |

# Appendix 5 Parameter List

A parameter list is shown below.

## System parameters

| Item | | | Parameter No. |
|---|---|---|---|
| I/O Assignment Setting | Model Name | — | 0203H |
| | Intelligent Module No. | — | 0200H |
| | Serial Communication ch | — | 0200H |
| | Number of Input Points | — | 0200H |
| | Number of Output Points | — | 0200H |
| | CPU Module Operation at Error Detection | — | 0200H |

## CPU parameters

| Item | | | Parameter No. |
|---|---|---|---|
| Name Setting | Title Setting | Title | 3100H |
| | Comment Setting | Comment | 3101H |
| Operation Related Setting | RUN Contact Setting | RUN Contact Operation | 3201H |
| | Remote Reset Setting | Remote Reset | 3202H |
| | Clock Related Setting | Time Zone | 3209H |
| | | Comment | 3209H |
| Interrupt Settings | Fixed Scan Interval Setting | Interrupt Setting from Internal Timer | 3A00H |
| | Fixed Scan Execution Mode Setting | Fixed Scan Execution Mode | 3A00H |
| | Interrupt Priority Setting from Module | Multiple Interrupt | 3A01H |
| | | Interrupt Priority | 3A01H |
| | | Index Register Save/Restoration | 3A00H |
| Service Processing Setting | Device/Label Access Service Processing Setting | Specifying Method | 3B00H |
| File Setting | Initial Value Setting | Setting of Device Initial Value Use Or Not | 3301H |
| | | Target Memory | 3301H |
| | | Global Device Initial Value File Name | 3301H |
| Memory/Device Setting | Device/Label Memory Area Setting | Option Battery Setting | 320AH |
| | | Device/Label Memory Area Capacity Setting | 3400H |
| | | Device/Label Memory Area Detailed Setting | 3401H |
| | Index Register Setting | Points Setting | 3402H |
| | Pointer Setting | Total Points | 340BH |
| | Internal Buffer Capacity Setting | Total Capacity | 340AH |
| RAS Setting | Scan Time Monitoring Time (WDT) Setting | Initial Scan | 3500H |
| | | After 2nd Scan | 3500H |
| | Constant Scan Setting | Constant Scan | 3503H |
| | Error Detections Setting | Battery Error | 3501H |
| | | Module Verify Error | 3501H |
| | CPU Module Operation Setting at Error Detected | Instruction Execution Error | 3501H |
| | | Memory Card Error | 3501H |
| | | Module Verify Error | 3501H |
| | | System Configuration Error | 3501H |
| | LED Display Setting | ERROR LED | 3502H |
| | | BATTERY LED | 3502H |
| | Event History Setting | Save Destination | 3504H |
| | | Storage Capacity Setting per File | 3504H |
| Program Setting | Program Setting | Program Setting | 3700H |
| | FB/FUN File Setting | FB/FUN File Setting | 3702H |
| | Program Capacity Setting | Program Capacity Setting | 3703H |

| Item | | | Parameter No. |
|---|---|---|---|
| SFC Setting | SFC Program Setting | To Use or Not to Use SFC | 3C10H |
| | SFC Program Start Mode Setting | SFC Program Start Mode | 3C00H |
| | Start Conditions Setting | Start Conditions | 3C00H |
| | FX3 Compatible Transition Operation Mode Setting | FX3 Compatible Transition Operation Mode | 3C10H |

# Module parameters

## Ethernet Port

| Item | | | Parameter No. |
|---|---|---|---|
| Basic Settings | Own Node Settings | IP Address | A012H |
| | | Communication Data Code | A030H |
| | | Required I/O points | AD0H |
| | CC-Link IEF Basic Setting | To Use or Not to Use CC-Link IEF Basic Setting | 7A00H |
| | | Network Configuration Settings | 7A00H |
| | | Refresh Settings | 7420H |
| | MODBUS/TCP Settings | To Use or Not to Use MODBUS/TCP Setting | A031H |
| | | Device Assigned | A0B2H |
| | External Device Configuration | External Device Configuration | A031H |
| Application Settings | FTP Server Settings | FTP Server | A037H |
| | | Login Name | A037H |
| | | Advanced Settings | A037H |
| | Web Server Settings | To Use or Not to USE Web Server Settings | A035H |
| | | HTTP Port No. | A035H |
| | | Account Settings | A035H |
| | Security | IP Filter Settings | A03AH |
| | | Disable Direct Connection with MELSOFT | A034H |
| | | Do Not Respond to CPU Module Search | A024H |
| | Time Setting | Time Setting (SNTP client) | A039H |
| | Simple PLC Communication Setting | Simple PLC Communication Setting | 7A10H |
| | FTP Client Settings | To Use or Not to Use FTP Client Settings | A03DH |
| | | FTP Server Specification | A03DH |
| | | Login Name | A03DH |
| | | Password | A03DH |
| | | Connection Method | A03DH |
| | | Port No. | A03DH |

## 485 Serial Port

### ■MELSOFT Connection

| Item | | | Parameter No. |
|---|---|---|---|
| Basic Settings | Communication Protocol Type | Communication Protocol Type | 8000H |

### ■Non-Protocol Communication

| Item | | | Parameter No. |
|---|---|---|---|
| Basic Settings | Communication Protocol Type | Communication Protocol Type | 8001H |
| | Advanced Settings | Data Length | 8001H |
| | | Parity Bit | 8001H |
| | | Stop Bit | 8001H |
| | | Baud Rate | 8001H |
| | | Header | 8001H |
| | | Header Setting Value | 8001H |
| | | Terminator | 8001H |
| | | Terminator Setting Value | 8001H |
| | | Control Mode (RS-232C) | 8001H |
| | | Control Mode (RS-485) | 8001H |
| | | Sum Check Code | 8001H |
| | | Control Procedure | 8001H |
| Fixed Setting | 8 bit Process Mode | 8 Bit Processing Mode | 8001H |
| | Time-out Period | Time-out Period | 8001H |
| SM/SD Setting | Latch Setting | Advanced Settings | 8001H |
| | | 8 Bit Process Mode | 8001H |
| | | Time-out Period | 8001H |
| | | Header Setting Value | 8001H |
| | | Terminator Setting Value | 8001H |
| | FX3 Series Compatibility | SM/SD for Compatible | 8001H |

### ■MC Protocol

| Item | | | Parameter No. |
|---|---|---|---|
| Basic Settings | Communication Protocol Type | Communication Protocol Type | 8002H |
| | Advanced Settings | Data Length | 8002H |
| | | Parity Bit | 8002H |
| | | Stop Bit | 8002H |
| | | Baud Rate | 8002H |
| | | Sum Check Code | 8002H |
| Fixed Setting | Station Number | Station Number | 8002H |
| | Message Pattern | Message Pattern | 8002H |
| | Time-out Period | Time-out Period | 8002H |
| | Message waiting time | Message waiting time | 8002H |
| SM/SD Setting | Latch Setting | Advanced Settings | 8002H |
| | | Station Number | 8002H |
| | | Message Pattern | 8002H |
| | | Time-out Period | 8002H |
| | | Message waiting time | 8002H |
| | FX3 Series Compatibility | SM/SD for Compatible | 8002H |

## ■MODBUS_RTU Communication

| Item | | | Parameter No. |
|---|---|---|---|
| Basic Settings | Communication Protocol Type | Communication Protocol Type | 8003H |
| | Advanced Settings | Parity Bit | 8003H |
| | | Stop Bit | 8003H |
| | | Baud Rate | 8003H |
| Fixed Setting | Host Station No. | Host Station No. | 8003H |
| | Slave Response Timeout | Slave Response Timeout | 8003H |
| | Broadcast Delay | Broadcast Delay | 8003H |
| | Message to Message Delay | Message to Message Delay | 8003H |
| | Timeout Retry Count Setting | Timeout Retry Count Setting | 8003H |
| Modbus Device Assigned | Modbus Device Assigned | Device Assigned | 8003H |
| SM/SD Setting | Latch Setting | Advanced Settings | 8003H |
| | | Host Station No. | 8003H |
| | | Slave Response Timeout | 8003H |
| | | Broadcast Delay | 8003H |
| | | Message to Message Delay | 8003H |
| | | Timeout Retry Count Setting | 8003H |
| | FX3 Series Compatibility | SM/SD for Compatible | 8003H |

## ■Predefined Protocol Support Function

| Item | | | Parameter No. |
|---|---|---|---|
| Basic Settings | Communication Protocol Type | Communication Protocol Type | 8004H |
| | Advanced Settings | Data Length | 8004H |
| | | Parity Bit | 8004H |
| | | Stop Bit | 8004H |
| | | Baud Rate | 8004H |

## ■Inverter Communication

| Item | | | Parameter No. |
|---|---|---|---|
| Basic Settings | Communication Protocol Type | Communication Protocol Type | 8005H |
| | Advanced Settings | Data Length | 8005H |
| | | Parity Bit | 8005H |
| | | Stop Bit | 8005H |
| | | Baud Rate | 8005H |
| Fixed Setting | Response Waiting Time | Response Waiting Time | 8005H |
| SM/SD Setting | Latch Setting | Advanced Settings | 8005H |
| | | Response Waiting Time | 8005H |
| | FX3 Series Compatibility | SM/SD for Compatible | 8005H |

## ■N:N Network

| Item | | | Parameter No. |
|---|---|---|---|
| Basic Settings | Communication Protocol Type | Communication Protocol Type | 8006H |
| Fixed Setting | Host Station No. | Host Station No. | 8006H |
| | Total Number of Local Station | Total Number of Local Station | 8006H |
| | Refresh Range | Refresh Range | 8006H |
| | Timeout Retry Count Setting | Timeout Retry Count Setting | 8006H |
| | Monitoring Time | Monitoring Time | 8006H |
| Link Device | Link Device Bit | Device | 8006H |
| | Link Device Word | Device | 8006H |
| SM/SD Setting | Latch Setting | Host Station No. | 8006H |
| | | Total Number of Local Station | 8006H |
| | | Refresh Range | 8006H |
| | | Timeout Retry Count Setting | 8006H |
| | | Monitoring Time | 8006H |
| | FX3 Series Compatibility | SM/SD for Compatible | 8006H |

## ■Parallel Link

| Item | | | Parameter No. |
|---|---|---|---|
| Basic Settings | Communication Protocol Type | Communication Protocol Type | 8007H |
| Fixed Setting | Station Setting | Station Setting | 8007H |
| | Link Mode | Link Mode | 8007H |
| | Error Judgement Time | Error Judgement Time | 8007H |
| Link Device | Link Device Bit | Device | 8007H |
| | Link Device Word | Device | 8007H |
| SM/SD Setting | Latch Setting | Station Setting | 8007H |
| | | Link Mode | 8007H |
| | | Error Judgement Time | 8007H |
| | FX3 Series Compatibility | SM/SD for Compatible | 8007H |

## High Speed I/O Settings

| Item | | | Parameter No. |
|---|---|---|---|
| Input Function | General/Interrupt/Pulse catch | General/Interrupt/Pulse catch | 8010H |
| | High Speed Counter | High Speed Counter | 8010H |
| | Pulse Width Measurement | Pulse Width Measurement | 8010H |
| Output Function | Positioning | Positioning | 8010H |
| | PWM | PWM | 8010H |
| Input Check | Input Response Time | Input Response Time | 8010H |
| | Input Interrupt | Rising | 8010H |
| | | Falling | 8010H |
| | | Rising+Falling | 8010H |
| | Pulse Catch | Pulse Catch | 8010H |
| | High Speed Counter | CH1 to 8 | 8010H |
| | Pulse Width Measurement | CH1 to 4 | 8010H |
| | Positioning | External Start Signal Positive Logic (Axis 1 to 4) | 8010H |
| | | External Start Signal Negative Logic (Axis 1 to 4) | 8010H |
| | | Interrupt Input Signal 1 High Speed (Axis 1 to 4) | 8010H |
| | | Interrupt Input Signal 1 Standard Positive Logic (Axis 1 to 4) | 8010H |
| | | Interrupt Input Signal 1 Standard Negative Logic (Axis 1 to 4) | 8010H |
| | | Near-point Dog Signal (Axis 1 to 4) | 8010H |
| | | Zero Signal Positive Logic (Axis 1 to 4) | 8010H |
| | | Zero Signal Negative Logic (Axis 1 to 4) | 8010H |
| | | Interrupt Input Signal 2 (Axis 1 to 4) | 8010H |
| Output Confirmation | Positioning | Pulse Output (PULSE) (Axis 1 to 4) | 8010H |
| | | Pulse Output (SIGN) (Axis 1 to 4) | 8010H |
| | | Pulse Output (CW) (Axis 1 to 4) | 8010H |
| | | Pulse Output (CCW) (Axis 1 to 4) | 8010H |
| | | Clear Signal (Axis 1 to 4) | 8010H |
| | PWM | CH1 to 4 | 8010H |

### ■General/Interrupt/Pulse catch

| Item | | | Parameter No. |
|---|---|---|---|
| General/Interrupt/Pulse Catch | General/Interrupt/Pulse Catch Setting | X0 to X17 | 8010H |

## ■High Speed Counter

| Item | | | Parameter No. |
|---|---|---|---|
| Basic Settings | Use/Do Not Use Counter | Use/Not Use | 8010H |
| | Operation Mode | Operation Mode | 8010H |
| | Pulse Input Mode | Pulse Input Mode | 8010H |
| | Preset Input | Preset Input Enable/Disable | 8010H |
| | | Input Logic | 8010H |
| | | Preset Value | 8010H |
| | | Input Comparison Enable/Disable | 8010H |
| | | Control Switch | 8010H |
| | Enable Input | Enable Input Enable/Disable | 8010H |
| | | Input logic | 8010H |
| | Ring Length Setting | Ring Length Enable/Disable | 8010H |
| | | Ring Length | 8010H |
| | Measurement Unit Time | Measurement Unit Time | 8010H |
| | Pulse No. of per Rotation | Pulse No. of per Rotation | 8010H |
| High Speed Compare Table | Counter CH | — | 8010H |
| | Comparison Type | — | 8010H |
| | Output Destination Device | — | 8010H |
| | Comparison Value 1 Specification Method | — | 8010H |
| | Comparison Value 1 Direct | — | 8010H |
| | Comparison Value 1 Indirect | — | 8010H |
| | Comparison Value 2 Specification Method | — | 8010H |
| | Comparison Value 2 Direct | — | 8010H |
| | Comparison Value 2 Indirect | — | 8010H |
| Multi-point Output High Speed Compare Table | Enable/Disable | — | 8010H |
| | Device | — | 8010H |
| | Comparison Value | — | 8010H |
| | Output Device | — | 8010H |
| | Output Data (HEX) | — | 8010H |
| | Table Data/Counter CH/Output Data/Points | — | 8010H |
| Occupied input (X) Explanation | 1-Phase 1 Count (S/W Updown Switch) | CH1 to 8 | 8010H |
| | 1-Phase 1 Count (H/W Updown Switch) | CH1 to 8 | 8010H |
| | 1-Phase 2 Input | CH1 to 8 | 8010H |
| | 2-Phase 2 Counts | CH1 to 8 | 8010H |
| Other | Specification method for high speed counter | Specification method for high speed counter | 8010H |

## ■Pulse Width Measurement

| Item | | | Parameter No. |
|---|---|---|---|
| Basic Settings | Use Pulse Width Measurement | Use/Not Use | 8010H |
| | Input Signal | Input Signal | 8010H |
| | Logical Switch | Logical Switch | 8010H |
| | Measurement Mode | Measurement Mode | 8010H |

## ■Positioning

| Item | | | Parameter No. |
|---|---|---|---|
| Basic Settings | Basic Parameters 1 | Pulse Output Mode | 8010H |
| | | Output Device (PULSE/CW) | 8010H |
| | | Output Device (SIGN/CCW) | 8010H |
| | | Rotation Direction Setting | 8010H |
| | | Unit Setting | 8010H |
| | | Pulse No. of per Rotation | 8010H |
| | | Movement Amount per Rotation | 8010H |
| | | Position Data Magnification | 8010H |
| | Basic Parameters 2 | Interpolation Speed Specified Method | 8010H |
| | | Max. Speed | 8010H |
| | | Bias Speed | 8010H |
| | | Acceleration Time | 8010H |
| | | Deceleration Time | 8010H |
| | Detailed Setting Parameter | External Start Signal Enable/Disable | 8010H |
| | | External Start Signal Device No. | 8010H |
| | | External Start Signal Logic | 8010H |
| | | Interrupt Input Signal 1 Enable/Disable | 8010H |
| | | Interrupt Input Signal 1 Mode | 8010H |
| | | Interrupt Input Signal 1 Device No. | 8010H |
| | | Interrupt Input Signal 1 Logic | 8010H |
| | | Interrupt Input Signal 2 Logic | 8010H |
| | OPR Parameters | OPR Enable/Disable | 8010H |
| | | OPR Direction | 8010H |
| | | Starting Point Address | 8010H |
| | | Clear Signal Output Enable/Disable | 8010H |
| | | Clear Signal Output Device No. | 8010H |
| | | OPR Dwell Time | 8010H |
| | | Near-point Dog Signal Device No. | 8010H |
| | | Near-point Dog Signal Logic | 8010H |
| | | Zero Signal Device No. | 8010H |
| | | Zero Signal Logic | 8010H |
| | | Zero Signal OPR Zero Signal Counts | 8010H |
| | | Zero Signal Count Start Time | 8010H |
| | Axis Common Parameter | When Stop Error Occurs, All Module Reset Enabled/Disabled | 8010H |
| Positioning Data | Device | — | 8010H |
| | Control Method | — | 8010H |
| | Axis to be Interpolated | — | 8010H |
| | Positioning Address | — | 8010H |
| | Command Speed | — | 8010H |
| | Dwell Time | — | 8010H |
| | Interrupt Counts | — | 8010H |
| | Interrupt Input Signal 2 Device No. | — | 8010H |
| | Jump Destination Table No. | — | 8010H |
| | M No. for Jump Condition | — | 8010H |
| | Table Data | — | 8010H |

### ■PWM

| Item | | | Parameter No. |
|---|---|---|---|
| Basic Settings | Use PWM Output | Use/Not Use | 8010H |
| | Output Signal | Output Signal | 8010H |
| | Pulse Width/Cycle Unit | Pulse Width/Cycle Unit | 8010H |
| | Output Pulse Logic | Output Pulse Logic | 8010H |
| | Pulse Width | Pulse Width | 8010H |
| | Cycle | Cycle | 8010H |

## Input Response Time Setting

| Item | | | Parameter No. |
|---|---|---|---|
| Input Response Time | X0 to X577 | — | 8011H |

## Analog Input Setting

| Item | | | Parameter No. |
|---|---|---|---|
| Basic Settings | A/D Conversion Enable/Disable Setting Function | A/D Conversion Enable/Disable Setting | 8014H |
| | A/D Conversion Method | Average Processing Specify | 8014H |
| | | Time Average Counts Average Moving Average | 8014H |
| Application Settings | Warning Output Function | Process Alarm Warning Setting | 8014H |
| | | Process Alarm Upper Upper Limit Value | 8014H |
| | | Process Alarm Upper Lower Limit Value | 8014H |
| | | Process Alarm Lower Upper Limit Value | 8014H |
| | | Process Alarm Lower Lower Limit Value | 8014H |
| | Over Scale Detection | Over Scale Detection Enable/Disable | 8014H |
| | Scaling Setting | Scaling Enable/Disable | 8014H |
| | | Scaling Upper Limit Value | 8014H |
| | | Scaling Lower Limit Value | 8014H |
| | Shift Function | Shift Amount | 8014H |
| | Digital Clip Setting | Digital Clip Enable/Disable | 8014H |

## Analog Output Setting

| Item | | | Parameter No. |
|---|---|---|---|
| Basic Settings | D/A Conversion Enable/Disable Setting Function | D/A Conversion Enable/Disable Setting | 8015H |
| | D/A Output Enable/Disable Setting | D/A Output Enable/Disable Setting | 8015H |
| Application Settings | Warning Output Function | Warning Output Setting | 8015H |
| | | Warning Upper Limit Value | 8015H |
| | | Warning Lower Limit Value | 8015H |
| | Scaling Setting | Scaling Enable/Disable | 8015H |
| | | Scaling Upper Limit Value | 8015H |
| | | Scaling Lower Limit Value | 8015H |
| | Shift Function | Shifting Amount | 8015H |
| | Analog Output HOLD/CLEAR Setting | HOLD/CLEAR Setting | 8015H |
| | | HOLD Setting Value | 8015H |

## Extended Board Setting

| Item | | | Parameter No. |
|---|---|---|---|
| Basic Settings | Extended Board | — | 7000H |
| | Communication Protocol Type | — | *1 |

*1 The parameter No. varies according to the communication protocol type. For details, refer to ☞ Page 904 485 Serial Port.

# Memory card parameters

| Item | | | Parameter No. |
|---|---|---|---|
| Boot Setting | Boot Setting | Clear the CPU built-in memory before boot | 2000H |
| | | Boot File Setting | 2000H |
| | Setting of File/Data Use or Not in Memory Card | Module Extended Parameter | 2010H |
| | | Device Station Parameter | 2010H |

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# Appendix 6 Event List

Information including errors detected in the CPU module, expansion board, expansion adapter and intelligent module, and errors that occur in the network are collected and saved in the CPU built-in memory or SD memory card by the CPU module. (☞ Page 130 Event History Function) When an event occurs, its event code and details can be read by using an engineering tool.

Check the User's Manual of each module for a list of events related to the intelligent function module.

## How to read the event list

The event list contains the following information.

| Item | Description |
|---|---|
| Event code | ID number assigned to an event |
| Event type | Type of an event |
| Event category | Category of an event |
| Detected event | Description of a detected event |
| Detailed information 1 to 3 | Details of a detected event |

### Detailed information

The following table lists the details of information displayed in the detailed information 1 to 3.

| Detailed information | Item | Description |
|---|---|---|
| Detailed information 1 | Operation source information | Information on the operation source<br>• Connection port (Connection information such as Ethernet)<br>• Module number<br>• Network number<br>• Station number<br>• IP address |
| | Event history file information | Information on the event history file |
| Detailed information 2 | Communication speed and communication mode | Information on the communication speed and the communication mode |
| | Drive/file information | Information on the corresponding drive name and file name |
| | Device/label information | Information on the corresponding device and label |
| Detailed information 3 | — | — |

# Event list

The following table lists events related to the CPU module.

| Event code | Event type | Event category | Detected event | Description | Detailed information | | |
|---|---|---|---|---|---|---|---|
| | | | | | Detailed information 1 | Detailed information 2 | Detailed information 3 |
| 00430 | System | Info | SFC program continue start not possible | An SFC program could not be resumed, and an initial start was performed. | — | — | — |
| 00800 | | Warning | Link-down | The CPU module has entered into the link-down state as a result of an operation such as disconnecting a network cable between the CPU module and an external device. | Operation source information | Communication speed and communication mode | |
| 00904 | | | Socket communication send error | Sending a message over socket communication failed. | | — | |
| 01000 and after | | Error | When a self-diagnostic error occurs, the error is stored as an event. | | | | |
| 10100 | Security | Info | Security key registration/deletion | A security key was registered or deleted. | Operation source information | Security key operation information | — |
| 10200 | | | Remote password lock | The remote password was set. | | Remote password information | |
| 10201 | | | Remote password unlock | The remote password unlock processing was successfully completed. | | | |
| 10202 | | | Remote password unlock failed | The remote password unlock processing failed. | | | |
| 10300 | | | Access from an IP address blocked by the IP filter setting | An access from an IP address blocked by the IP filer setting was accepted. | | Blocked IP address information | |
| 10400 | | | File password registration/change/deletion | A file password was successfully registered, changed, or deleted. | | File password information | |
| 10401 | | | File password registration/change/deletion failed | Registration, change, or deletion of a file password failed. | | | |
| 10402 | | | File password unlock | A file password was successfully unlocked. | | | |
| 10403 | | | File password unlock failed | Unlock of a file password failed. | | | |
| 20100 | Operation | Info | Error clear | The error was cleared. | Operation source information | — | — |
| 20200 | | | Event history clear | The event history was cleared. | | | |
| 20210 | | | Scan time clear | The scan time was cleared. | | | |
| 20400 | | | Firmware update successful via SD memory card | CPU module firmware update using the SD memory card was performed and completed successfully. | CPU module firmware update information | | |
| 20401 | | | Firmware update failed via SD memory card | CPU module firmware update using the SD memory card was performed and was not completed successfully. | | | |
| 24000 | | | Clock setting | The clock data was set. | Operation source information | | |
| 24001 | | | Remote operation request accepted | A remote request (RUN, STOP, or PAUSE) was accepted. | | Remote operation type information | |
| 24200 | | | Creation of new folders, writes to files/folders | A new folder was created.<br>A new file was created or data was written to a file. | | Drive/file information | |
| 2A200 | | Warning | Memory initialization | The memory was initialized. | | Drive/file information | |
| 2A201 | | | Device/label zero clear | Values in a device or label were cleared to zero. | | Device/label information | |
| 2A202 | | | Folder/file deletion | A folder or file was deleted. | | Drive/file information | |

# Appendix 7 Processing Time

Each of the processing time that constitutes the scan time is as follows.

## SFC program processing time

This section describes the time required for SFC program processing. For details on the SFC program, refer to the following.

MELSEC iQ-F FX5 Programming Manual (Program Design)

### SFC program processing performance

The SFC program execution time can be calculated with the following formula.

- SFC program execution time = (A) + (B) + (C)

| Item | | Description |
|---|---|---|
| (A) | SFC processing time | Page 914 SFC processing time |
| (B) | Operation output processing time for all steps | This is the total processing time for each instruction used for operation output for all steps in the active status. |
| (C) | Processing time for all transition conditions | This is the total processing time for each instruction used for transition conditions associated with each step in the active status. |

For the processing time for the SFC control instruction, refer to the following.

MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks)

#### ■SFC processing time

The following table lists the details of the types of the SFC processing time (A).

- The SFC processing time (A) = (a) + (b) + (c) + (d) + (e) + (f) + (g) + (h)

| Item | | Processing time calculation (unit: μs) | Description |
|---|---|---|---|
| (a) | Active block processing time | Active block processing time coefficient × Number of active blocks | This is the system processing time required to execute active blocks. |
| (b) | Inactive block processing time | Inactive block processing time coefficient × Number of inactive blocks | This is the processing time required to execute inactive blocks. |
| (c) | Nonexistent block processing time | Nonexistent block processing time coefficient × Number of nonexistent blocks | This is the system processing time required to execute blocks that have not been created. |
| (d) | Active step processing time | Active step processing time coefficient × Number of active steps | This is the time required to execute active steps. |
| (e) | Active transition processing time | Active transition processing time coefficient × Number of active transitions | This is the system processing time required to execute active transitions. |
| (f) | Transition establishment step processing time | Transition establishment step processing time coefficient × Number of transitions | This is the time required to turn off active steps when transitions are established. |
| (g) | SFC END processing time | SFC END processing time | This is the system processing time required for SFC END processing. |
| (h) | Operation output processing time | Action processing time coefficient × Number of actions | This is the system processing time required to process operation outputs. |

The following table lists the coefficient values for each processing time.

| Item | | | | Coefficient value | |
|---|---|---|---|---|---|
| | | | | FX5U/FX5UC CPU module | |
| | | | | Program capacity setting: 64000 steps | Program capacity setting: 128000 steps |
| (a) | Active block processing time coefficient | | | 2.6 μs | 2.6 μs |
| (b) | Inactive block processing time coefficient | | | 1.2 μs | 1.2 μs |
| (c) | Nonexistent block processing time coefficient | | | 0.5 μs | 0.5 μs |
| (d) | Active step processing time coefficient | | FX3 Compatible Transition Operation Mode Enable | 5.8 μs | 8.2 μs |
| | | | FX3 Compatible Transition Operation Mode Disable | 5.4 μs | 7.7 μs |
| (e) | Active transition processing time coefficient | | | 2.5 μs | 5.6 μs |
| (f) | Transition establishment step processing time coefficient | Hold step | FX3 Compatible Transition Operation Mode Enable | 21.9 μs | 28.1 μs |
| | | | FX3 Compatible Transition Operation Mode Disable | 12.3 μs | 13.1 μs |
| | | Normal step | FX3 Compatible Transition Operation Mode Enable | 22.9 μs | 29.2 μs |
| | | | FX3 Compatible Transition Operation Mode Disable | 17.6 μs | 22.1 μs |
| (g) | SFC END processing time | | | 2.4 μs | 2.4 μs |
| (h) | Operation output processing time coefficient | | | — | — |

# Processing time until the file operation is completed

This section describes the processing time from the start of the file operation instruction until the completion of the file operation.

## Changes in the processing time according to the number of files

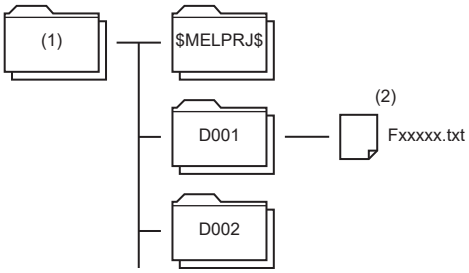
The processing time changes according to the number of files stored in folders. The table below lists the processing time under the following conditions.

### ■Condition

- Folder/file structure (drive 2: SD memory card)
- SD memory card: NZ1MEM-2GBSD used
- Size of each file to be operated: 1K byte
- The following table lists the instruction arguments of each file operation instruction.

| Instruction name | First argument | Second argument | Third argument | Fourth argument | Fifth argument | Sixth argument | Seventh argument |
|---|---|---|---|---|---|---|---|
| SP.FDELETE | U1 | K2 | D0 | "D001" | M0 | — | — |
| SP.FCOPY | U1 | D40 | K2 | "D001" | K2 | "D002" | M40 |
| SP.FMOVE | U1 | D40 | K2 | "D001" | K2 | "D002" | M40 |
| SP.FRENAME | U1 | K2 | D0 | "D001" | "D002" | M0 | — |
| SP.FSTATUS | U1 | K2 | D0 | "D001" | D10 | M0 | — |

- File/folder structures except those shown below do not exist.




(1) Root directory (root folder)
(2) All file names are Fxxxxx.txt (xxxxx: serial numbers starting from 00001).

- Overwriting setting: Not overwrite (SP.FCOPY, SP.FMOVE only)
- Target type setting (b0): Folder specification
- Target type setting (b2): Move the specified folder (SP.FMOVE only)
- Empty folder deletion setting: Delete folders even when they are not empty (SP.FDELETE only)

### ■Processing time (Constant scan: None)

| Instruction name | Number of operated files in the folder (D001) | | |
|---|---|---|---|
| | 1 | 10 | 100 |
| SP.FDELETE | 261ms | 1600ms | 14380ms |
| SP.FCOPY | 1614ms | 15173ms | 138573ms |
| SP.FMOVE | 115ms | 162ms | 119ms |
| SP.FRENAME | 34ms | 35ms | 37ms |
| SP.FSTATUS | 3ms | 4ms | 6ms |

## Changes in the processing time according to the file size

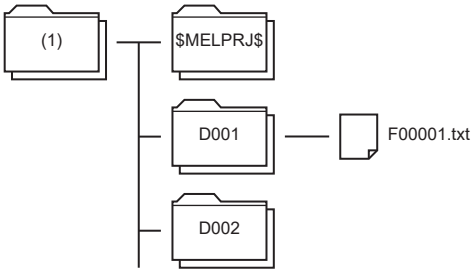
The processing time changes according to the size of the files stored in the folder. The table below lists the processing time under the following conditions.

### ■Condition

- Folder/file structure (drive 2: SD memory card)
- SD memory card: NZ1MEM-2GBSD used
- Number of files in the folder: 1
- The following table lists the instruction argument of each file operation instruction.

| Instruction name | First argument | Second argument | Third argument | Fourth argument | Fifth argument | Sixth argument | Seventh argument |
|---|---|---|---|---|---|---|---|
| SP.FDELETE | U1 | K2 | D0 | "D001\F00001.txt" | M0 | — | — |
| SP.FCOPY | U1 | D40 | K2 | "D001\F00001.txt" | K2 | "D002" | M40 |
| SP.FMOVE | U1 | D40 | K2 | "D001\F00001.txt" | K2 | "D002" | M40 |
| SP.FRENAME | U1 | K2 | D0 | "D001\F00001.txt" | "F00002.txt" | M0 | — |
| SP.FSTATUS | U1 | K2 | D0 | "D001\F00001.txt" | D10 | M0 | — |

- File/folder structures except those shown below do not exist.




(1) Root directory (root folder)

- Overwriting setting: Not overwrite (SP.FCOPY, SP.FMOVE only)
- Target type setting: Folder specification

### ■Processing time (Constant scan: None)

| Instruction name | Number of operated files in the folder (D001) | | |
|---|---|---|---|
| | 100KB | 1MB | 16MB |
| SP.FDELETE | 80ms | 81ms | 780ms |
| SP.FCOPY | 2802ms | 16289ms | 285671ms |
| SP.FMOVE | 216ms | 216ms | 216ms |
| SP.FRENAME | 26ms | 26ms | 28ms |
| SP.FSTATUS | 13ms | 13ms | 13ms |

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# Appendix 8 How to Use CPU Module Logging Configuration Tool

This appendix describes how to operate the CPU Module Logging Configuration Tool and configure the logging function.

**Point**

For the system configuration and procedure for using the data logging function, refer to the following.

☞ Page 150 Procedure for Using

## Operating environment

For details on the operating environment for CPU Module Logging Configuration Tool, refer to following manual which is stored in the installer.

📖CPU Module Logging Configuration Tool/GX LogViewer Installation Instructions (BCN-P5999-0506)

## Installation/uninstallation

For the procedures for installing and uninstalling the CPU Module Logging Configuration Tool, refer to the following.

📖CPU Module Logging Configuration Tool/GX LogViewer Installation Instructions (BCN-P5999-0506)

## Starting the CPU Module Logging Configuration Tool

The CPU Module Logging Configuration Tool can be started by the following three methods.

### ■Starting from the Start menu

After installing the CPU Module Logging Configuration Tool, you can start the tool by the following operation.

[Start] ⇨ [All Programs] ⇨ [MELSOFT] ⇨ [Logging Function] ⇨ [CPU Module Logging Configuration Tool]

### ■Starting from GX Works3

After starting GX Works3, you can start the tool by the following operation.

[Tool] ⇨ [Logging Configuration Tool]

When the tool is started, the project information (connected device, transfer setup/setting, and display language) of GX Works3 is handed off.

### ■Starting from GX LogViewer

Refer to the following manual.

📖GX LogViewer Version 1 Operating Manual

**Point**

If an error message is displayed when the CPU Module Logging Configuration Tool is started, start it with administrator privileges.

## Communication route

To connect the CPU module to a personal computer, use the following methods. (☞ Page 925 Transfer setup)

### ■Connection through an RS-232C communication port

Connect the CPU module that is hooked up with an FX5-232-BD or FX5-232ADP with an RS-232C cable.

### ■Connection through an USB port

Connect the FX5S/FX5UJ CPU module with a USB cable.

### ■Connection through an Ethernet port

• Connection via a hub

Connect the CPU module via a hub to a personal computer on the same local network. Note that IP address of the CPU module must be specified. Also the personal computer should have the same network address as the CPU module.

**Restriction**

Only local area network can be used for connections. Connections via the Internet are not allowed.

• Direct connection

One-to-one direct connection with an Ethernet cable is possible. This method requires no hub. Note that IP address of the CPU module need not be specified with this method.

### Precautions

- Do not directly connect to a personal computer via LAN line. Load imposed on the LAN line adversely affect communications of other devices.
- Do not configure the direct connection setting when using one-to-one connection via a hub between the CPU module and a personal computer.
- If the following conditions are met, the direct connection communication may be disabled. If the communication is disabled, review the settings of the CPU module and personal computer.

Ex.

When all the bits of the CPU module-side IP address that correspond to 0 part of the personal computer-side subnet mask are ON or OFF:

CPU module-side IP address: 64.64.255.255

Personal computer-side IP address: 64.64.1.1

Personal computer-side subnet mask: 255.255.0.0

Ex.

In the CPU module IP address bits, if the bits corresponding to the host address of the class of the personal computer IP address are all ON or all OFF:

Personal computer IP address: 192.168.0.1 ← 192.x.x.x., class C and the host address is the fourth octet.

Personal computer subnet mask: 255.0.0.0

CPU module IP address: 64.64.255.255 ← each bit turns on because of the fourth octet is 255

**Point**

The IP address for each class is as follows.

- Class A: 0.x.x.x to 127.x.x.x
- Class B: 128.x.x.x to 191.x.x.x
- Class C: 192.x.x.x to 223.x.x.x

The host address for each class is the portion including "0" as shown below.

- Class A: 255.0.0.0
- Class B: 255.255.0.0
- Class C: 255.255.255.0

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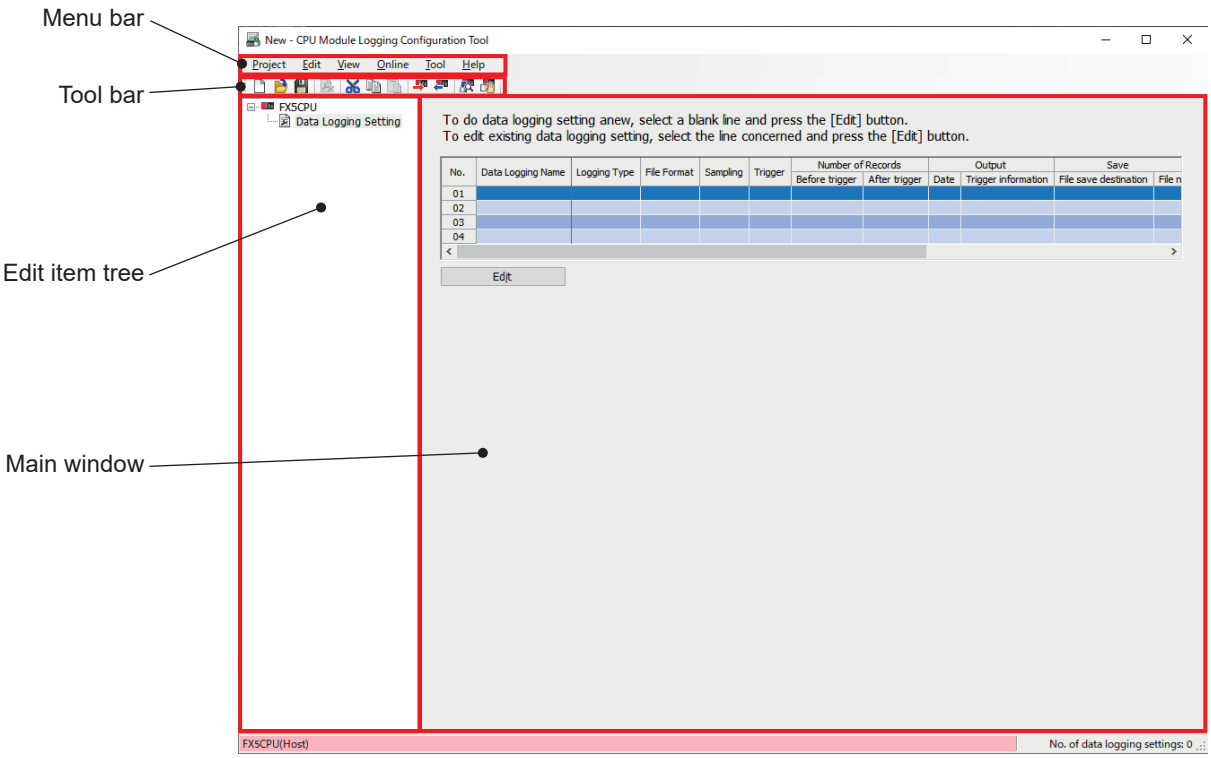
# Screen configuration

## Entire screen

The entire screen configuration is shown below.




| Name | Description | Reference |
|---|---|---|
| Menu bar | The menu is displayed. | Page 921 Menu structure |
| Tool bar | The tool icons are displayed. | — |
| Edit item tree | The setting items are displayed in tree format. | — |
| Main window | Set the items necessary for using the data logging function in the wizard window. | Page 932 Setting data logging |

# Menu structure

The following table describes the menu structure of CPU Module Logging Configuration Tool.

| Menu item | | Description | Reference |
|---|---|---|---|
| Project | New | Create a new project. | Page 922 |
| | Open | Open a stored project file. | Page 922 |
| | Save | Overwrite an edited project to the file and saves it. | Page 922 |
| | Save As | Save an edited project with a new file name. | Page 922 |
| | Read Logging Setting from Memory Card (SD) | Read the data logging setting written in the SD memory card attached to the personal computer. | Page 923 |
| | Write Logging Setting into Memory Card (SD) | Write the settings being edited in a format with which the CPU module can operate. The settings are directly written into an SD memory card attached to the personal computer. | Page 924 |
| | Recent Files | Open a recently used file. | — |
| | Exit | Exit CPU Module Logging Configuration Tool. | — |
| Edit | Delete Data Logging Setting | Remove the data logging setting selected in the Edit item tree. | — |
| | Copy and Add Data Logging Setting | Copy and add the data logging setting selected in the Edit item tree. | — |
| | Batch Data Insertion | Configure the multiple setting items at once. | — |
| | Cut Setting Item | Delete the data in the selected row and copy the setting items to the clip board.*1 | — |
| | Copy Setting Item | Copy the setting items in the selected row to the clip board.*1 | — |
| | Paste Setting Item | Paste the copied setting items to the selected row.*2 | — |
| | Insert and Paste Setting Items*3 | If "Insert and Paste Setting Items" is executed in the state where the setting items are copied/cut, the setting items in the clip board will be inserted above the selected row.*2 | — |
| | Delete Setting Item | Delete the setting items in the selected row. | — |
| | Move Setting Item Upward | Move the setting items in the selected row upward. | — |
| | Move Setting Item Downward | Move the setting items in the selected row downward. | — |
| | Device Batch Replacement | Replace devices for all the settings. | — |
| View | Switch Display Language (Display Language) | Change the display language for menus and so on. | Page 925 |
| Online | Transfer Setup | Configure the communication setting used for connection to the CPU module. | Page 925 |
| | Read Logging Setting | Read the setting from the CPU module. | Page 926 |
| | Write Logging Setting | Write the setting to the CPU module. | Page 927 |
| | Delete Logging Setting | Remove the setting data from the CPU module. | Page 928 |
| | Logging Status and Operation | Check the data logging status. | Page 929 |
| | Logging File Operation | Connect to the CPU module and reads or removes the files on the attached SD memory card. | Page 931 |
| Tool | Start GX LogViewer | Launch GX LogViewer. | Page 918 |
| Help | Open Manual | E-Manual Viewer opens and its manual is displayed. | Page 932 |
| | Connection to MITSUBISHI ELECTRIC FA Global Website | The Mitsubishi Electric Corporation FA website is displayed. | Page 932 |
| | About Configuration tool | The product information is displayed. | Page 932 |

*1 Even if the copied/cut setting items are edited or the screen is switched, the items are still in a copied state. They can be pasted while the copied data is in the clip board.

*2 The setting items copied by using the watch window of GX Works3 or GX Works2, spreadsheet software or text editor can be pasted.

*3 "Insert Copied Setting Item" and "Insert Cut Setting Item" were changed to "Insert and Paste Setting Items". The version of the CPU Module Logging Configuration Tool with the updated menu is 1.118X.

## Project management

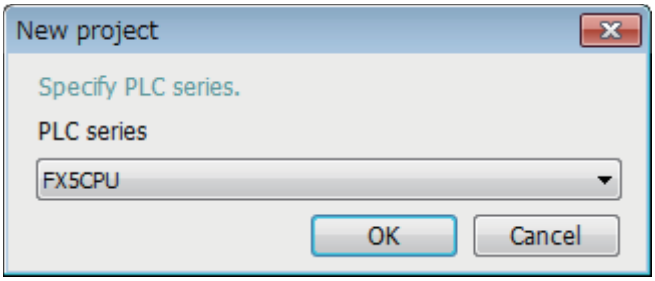
This function creates and saves the project, and reads/writes it from/to an SD memory card.

### ■New

Create a new project.

[Project] ⇨ [New]

#### Window




#### Displayed items

| Item | Description |
|---|---|
| PLC series | Select "FX5CPU". |

### ■Open

Open a stored project file.

[Project] ⇨ [Open]

### ■Save

Overwrite an edited project to the file and saves it.

[Project] ⇨ [Save]

### ■Save as

Save an edited project with a new file name.

[Project] ⇨ [Save as]

## ■Read logging setting from memory card (SD)

The following procedure is to read the data logging setting written in an SD memory card attached to the personal computer.

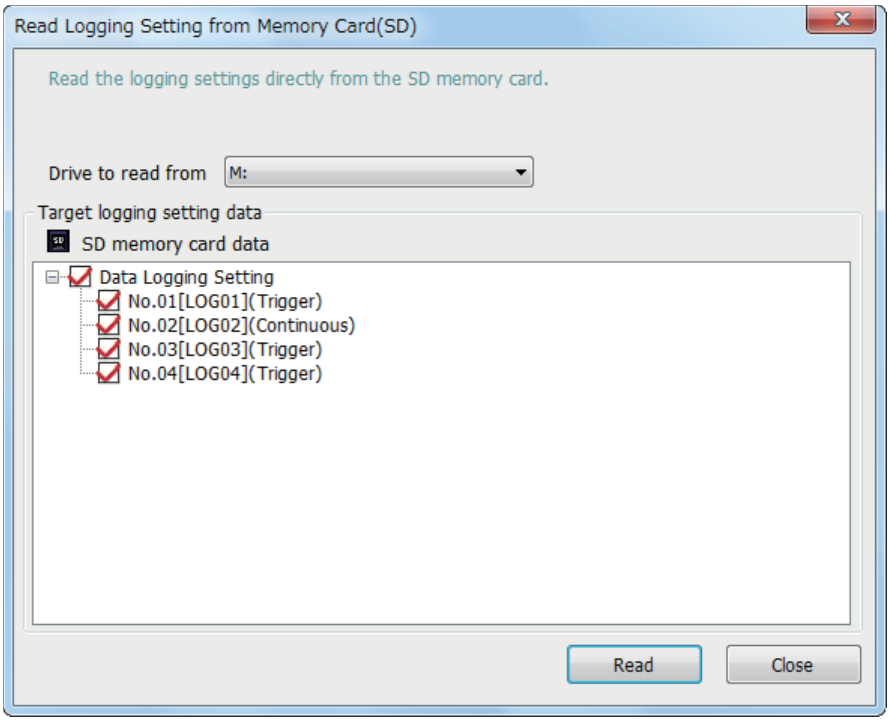
### Operating procedure

1. Attach an SD memory card to the personal computer.
2. Open the following window.

[Project] ⇨ [Read Logging Setting from Memory Card (SD)]

3. Select the drive from which data is read and data to be read.
4. Click the [Read] button.

### Window




### Displayed items

| Item | Description |
|---|---|
| Drive to read from | Select the drive where the data to be read is stored. |
| Target logging setting data | Select the data item to be read. |

**Point**

Any existing data (data logging setting with the same setting number or common setting) on the target is overwritten.

## ■Write logging setting into memory card (SD)

The following procedure is to write the settings being edited in a format with which the CPU module can operate. Once writing the settings directly into an SD memory card attached to the personal computer and attaching the card to the CPU module, the data logging starts.

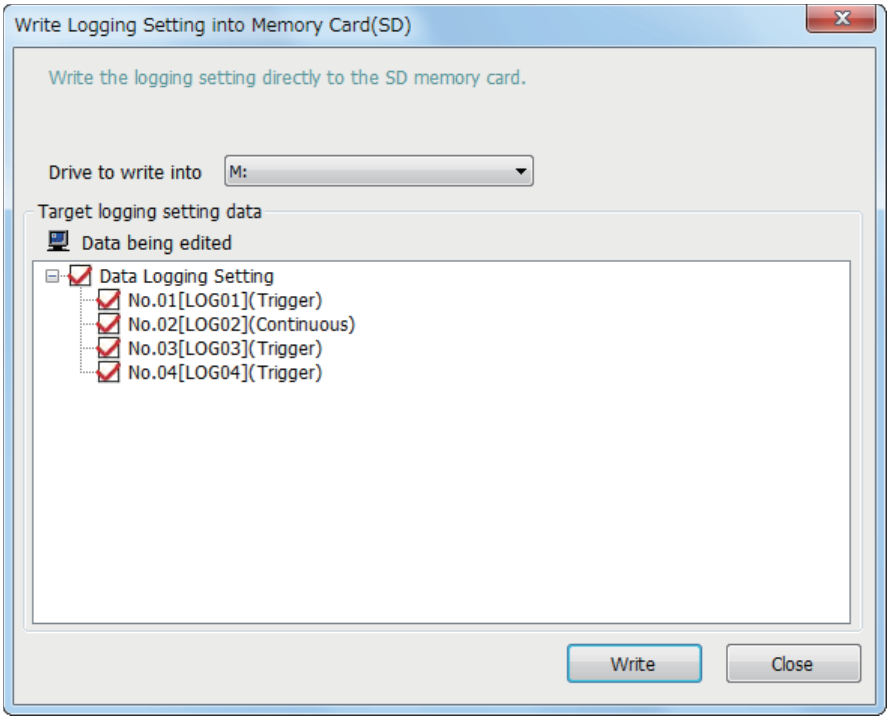
### Operating procedure

1. Attach an SD memory card to the personal computer.
2. Open the following window.

[Project] ⇨ [Write Logging Setting into Memory Card (SD)]

3. Select the drive to which data is written and data to be written.
4. Click the [Write] button.

### Window




### Displayed items

| Item | Description |
|---|---|
| Drive to write into | Select the drive where the data to be written is stored. |
| Target logging setting data | Select the data to be written. |

**Point**

Any existing data (data logging setting with the same setting number or common setting) on the target is overwritten.

# View

## ■Display language change

The CPU Module Logging Configuration Tool supports multiple languages, and can be used by changing the display language for menus and so on at the same computer.

### Operating procedure

[View] ⇨ [Switch Display Language (Display Language)]

### Precautions

Text may be cut off if the OS and set display language differ.

# Online

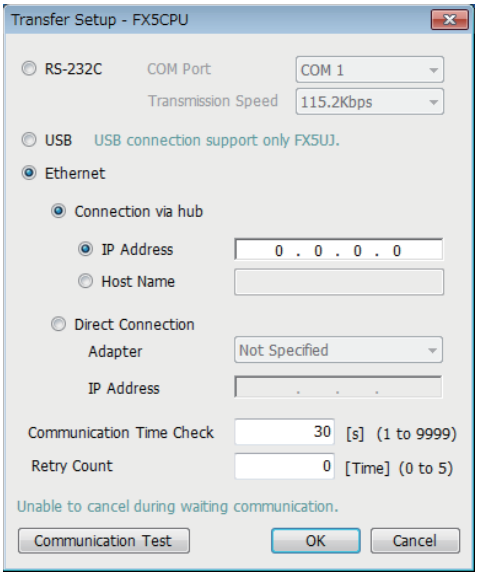
The online operation enables users to read/write/remove the data logging settings, view the data logging status, and operate the data logging file.

## ■Transfer setup

The following window specifies the communication route between the CPU module and a personal computer.

[Online] ⇨ [Transfer Setup]

### Window




### Displayed items

| Item | | | Description |
|---|---|---|---|
| RS-232C | COM Port | | Configure the COM port and transmission speed used for connection with an RS-232C communication cable.<br>• COM Port: COM1 to COM63<br>• Transmission Speed: 9.6kbps / 19.2kbps / 38.4kbps / 57.6kbps / 115.2kbps |
| | Transmission Speed | | |
| USB*1 | | | Configure when connecting with a USB cable. |
| Ethernet | Connection via hub | IP Address | Configure the IP address and host name used for connection via a hub with an Ethernet cable. |
| | | Host Name | |
| | Direct Connection | Adapter | For direct connection with the Ethernet cable, select the Ethernet adapter that is connected directly to the CPU module. The IP address of the selected Ethernet adapter is displayed as the IP address. |
| | | IP Address | |
| Communication Time Check | | | Specify the communication time. |
| Retry Count | | | Specify the number of retries. |
| [Communication Test] button | | | This button checks the communication status. |

*1 Only FX5UJ CPU module is supported.

## ■Read logging setting

The following procedure reads the data logging setting from the target memory.

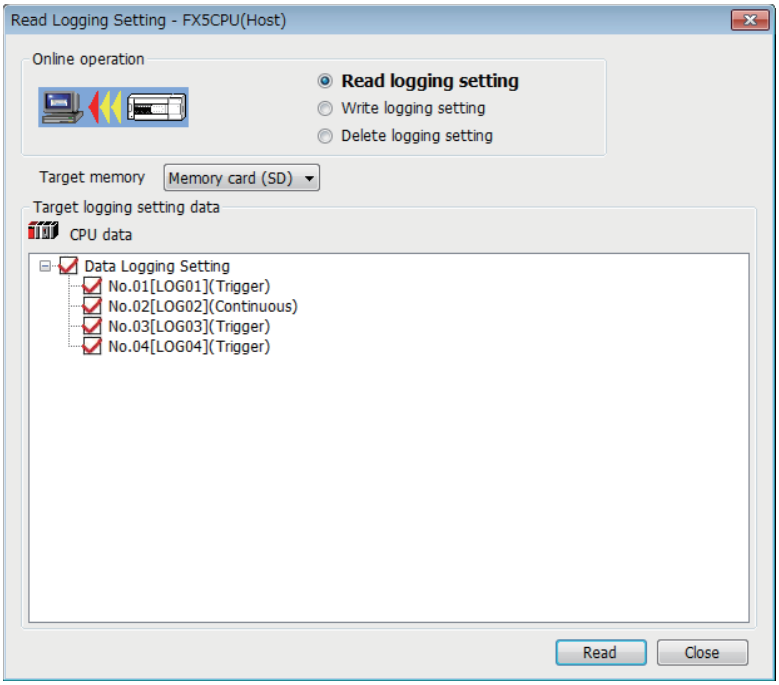
### Operating procedure

1. Open the "Read Logging Setting" window.

[Online] ⇨ [Read Logging Setting]

2. Select the memory where the data to be read is stored from the "Target memory" list.
3. Select the checkbox corresponding to the data item to be read in the "Target logging setting data" list, and click the [Read] button.

### Window




### Displayed items

| Item | Description |
|---|---|
| Target memory | Select the memory where the data to be read is stored. |
| Target logging setting data | Select the data item to be read. |

**Point**

Any existing data (data logging setting with the same setting number or common setting) on the target is overwritten.

## ■Write logging setting

The following procedure is to write the data logging setting to the target memory.

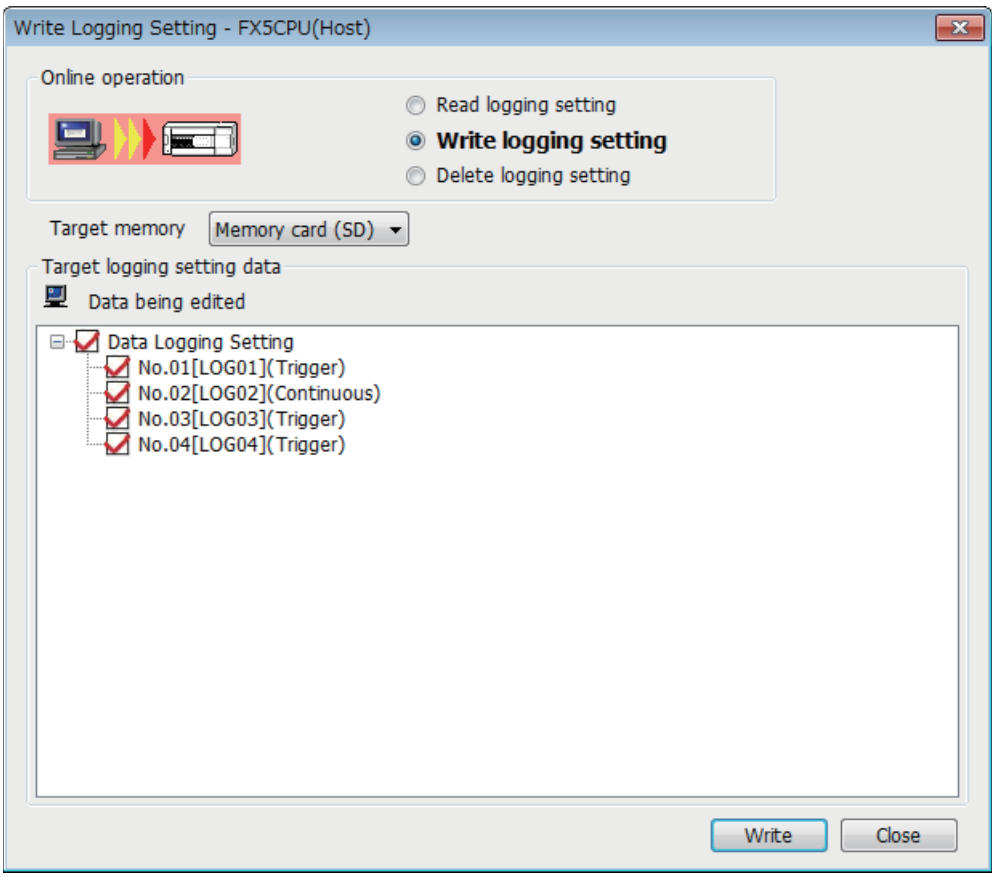
### Operating procedure

1. Open the "Write Logging Setting" window.

[Online] ⇨ [Write Logging Setting]

2. Select the memory where the data to be written is stored from "Target memory" list.
3. Select the checkbox in the "Target logging setting data" list corresponding to the data item to be written, and click the [Write] button.

### Setting data




### Displayed items

| Item | Description |
|---|---|
| Target memory | Select the memory where the data to be written is stored. |
| Target logging setting data | Select the data to be written. |

**Point**

Any existing data (data logging setting with the same setting number or common setting) on the target is overwritten.

## ■Delete logging setting

The following procedure removes the data logging setting on the target memory.

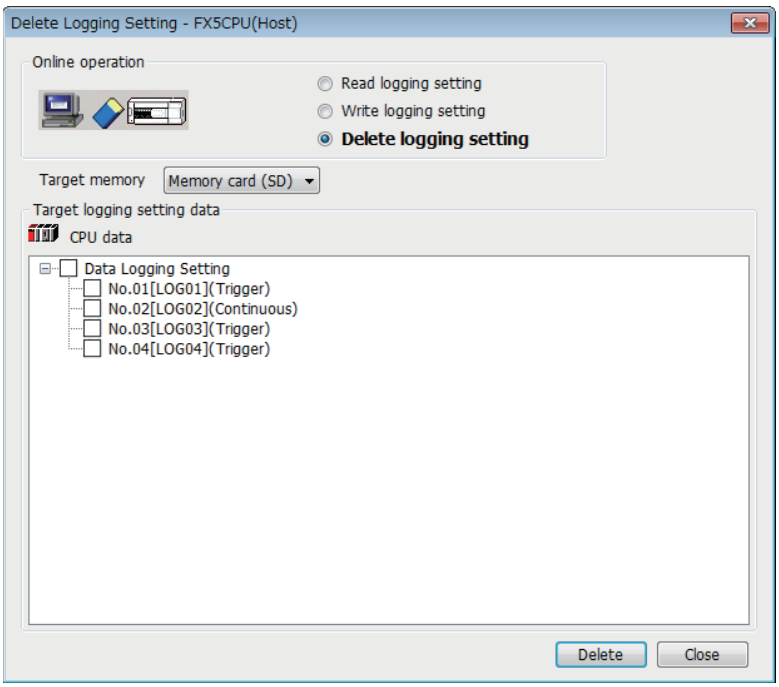
### Operating procedure

1. Open the "Delete Logging Setting" window.

[Online] ⇨ [Delete Logging Setting]

2. Select the memory where the data to be removed is stored from the "Target memory" list.
3. Select the checkbox corresponding to the data item to be removed in the "Target logging setting data" list, and click the [Delete] button.

### Window




### Displayed items

| Item | Description |
|---|---|
| Target memory | Select the memory where the data to be removed is stored. |
| Target logging setting data | Select the data to be removed. |

## ■Logging status and operation

The following procedure is to execute or stop the data logging. Also the data logging status can be checked through this procedure.

### Operating procedure

1. Open the "Logging Status and Operation" window.

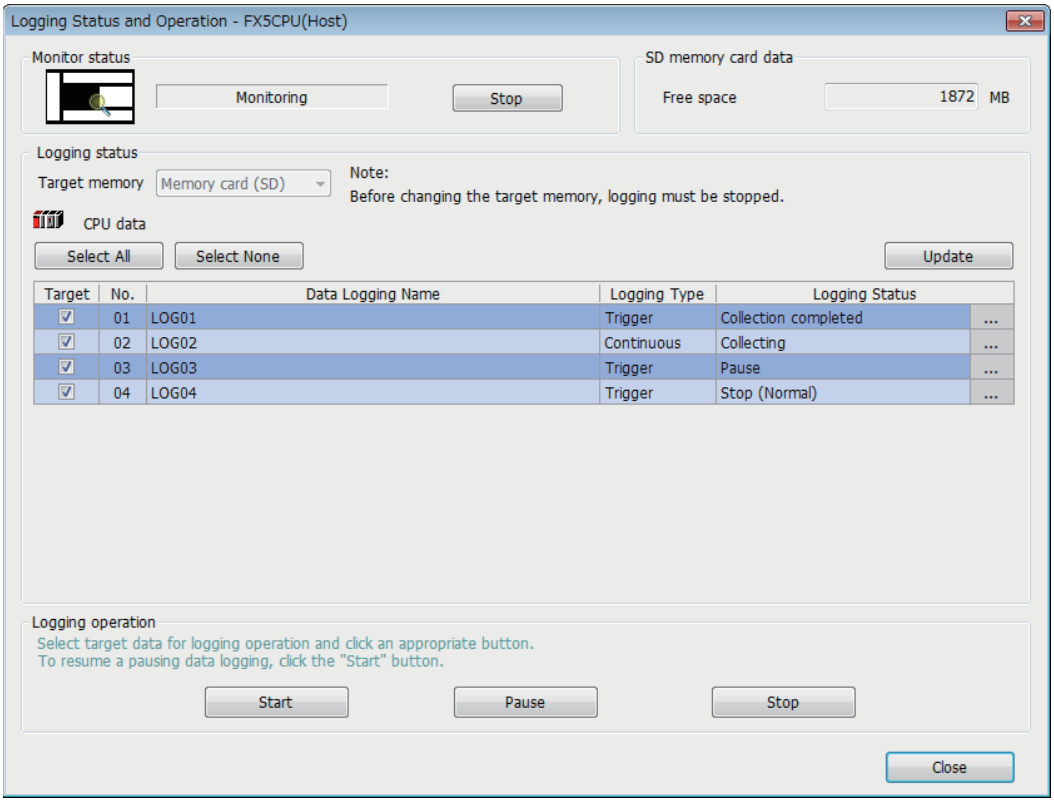
[Online] ⇨ [Logging Status and Operation]

2. Specify the target memory (either data memory or SD memory card) where the effective setting data is stored.
3. Select the checkbox corresponding to the setting number to be executed (Multiple selection possible)
4. Start the data logging by clicking the [Start] button. (When multiple items are selected, they are executed simultaneously.)
5. To suspend data logging, click the [Pause] button. To stop data logging, click the [Stop] button. (When multiple items are selected, they are executed simultaneously.)

**Point**

- The data logging cannot be started even when writing the setting and turning power off and on or resetting. Be sure to click the [Start] button to start data logging.
- With regards to the trigger logging, the data logging setting registration attempt fails if the trigger condition is satisfied.
- It takes a certain time to stop or suspend the data logging after either of these commands is issued by CPU Module Logging Configuration Tool (because the data logging is not stopped or suspended unless the data stored in the internal buffer data has been transferred into the SD memory card in response to these commands).
- There may be a case where a time-out error occurs and the data logging is suspended after CPU Module Logging Configuration Tool starts the logging.

### Window



## Displayed items

| Item | | Description |
|---|---|---|
| Monitor status | [Start (Stop)] button | Start or stop monitoring. |
| SD memory card data | Free space | View the amount of free space of the SD memory card. |
| Logging status | Target memory | Select the memory used for this operation.*1 |
| | [Select All] button | Select all the checkboxes in the setting data list. |
| | [Select None] button | Clear all the checkboxes in the setting data list. |
| | [Update] button | Update monitoring status. |
| | Target | Select the target setting data for this operation (Multiple selection possible) |
| | [...] button | Clicking this button when an error occurs displays the error details window. |
| Logging operation | [Start] button | Execute the logging of the selected setting data. |
| | [Pause] button | Suspend the logging of the selected setting data. |
| | [Stop] button | Stop the logging of the selected setting data. |

*1 This menu item can be selected only when all the data logging statuses are "Stop".

The data logging function has various states that can be classified into data logging and storage.

- Data logging states

| Data logging states | Description |
|---|---|
| Stop | No data logging settings are registered and data collection is inactive. |
| Waiting RUN Not collected | Data collection has not yet begun because the CPU module is not in the RUN mode. |
| Waiting start Not collected | Data collection has not yet begun because waiting for the start command. |
| Pause | Data logging is suspended and data collection is inactive. |
| Waiting to establish collection conditions Not collected | Waiting for the first collection timing after the start command. |
| Collecting | Continuous logging is active and collecting data. |
| Waiting trigger Collecting before trigger | Trigger logging is active and collecting data, waiting until the trigger condition is met. |
| Collecting after trigger | Trigger logging is active and collecting data after the trigger condition is met. |
| Collection completed | Continuous logging: Data collection has finished upon reaching "Number of files to be saved" specified as part of the "Stop" setting configured in "Operation when exceeds the number of files".<br>Trigger logging: Has finished collecting as much data as the specified number of records. |
| Error | Data logging has failed due to the occurrence of an error. |

- Storage states

| Storage states | Description |
|---|---|
| Unsaved | Has not yet stored the collected data into the SD memory card. |
| Saving in progress | Has begun but not yet finished storing the collected data into the SD memory card. |
| Save completed | Has finished storing the collected data as much as the specified number of records into the SD memory card.*1 |

*1 If the data logging function has not yet collected and stored as much data as the specified number of records (i.e., either data logging has been stopped or suspended before collecting or storing the specified number of records or the CPU module has been stopped), it completes the storage operation by storing all the data that has been collected into the internal buffer. It does not store data, however, before the trigger condition is met.

## ■Logging file operation

The following procedure is to save or remove data logging files on an SD memory card from/to the personal computer.

### Operating procedure

1. Open the "Logging File Operation" window.

[Online] ⇨ [Logging File Operation]

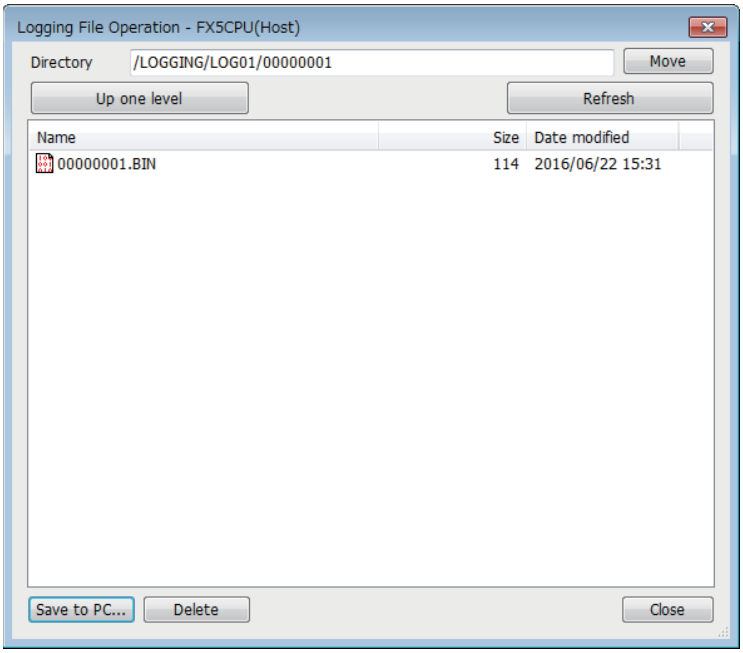
2. Specify the directory and select the targeted file.
3. To save, click the [Save to PC] button. To delete, click the [Delete] button.

**Point**

Attempting the following operations may result in delay of other monitor update because a certain time period is required for saving data logging files.

- When saving data logging files during the data logging execution.
- When saving a large data logging file.

### Window




### Displayed items

| Item | Description |
|---|---|
| Directory | View the path to the displayed folder. To change the folder, specify the target folder path. |
| [Move] button | Move to the specified folder. |
| [Up one level] button | Move up to a higher level in the folder hierarchy. |
| [Refresh] button | Update the displayed content. |
| [Save to PC] button | Display the "Save As" window and save the selected file to the personal computer. |
| [Delete] button | Remove the selected file or folder. |

## Help

The following procedures allow to view or use the help function of CPU Module Logging Configuration Tool.

### ■Opening user's manual

E-Manual Viewer opens and its manual is displayed.

#### Operating procedure

[Help] ⇨ [Open Manual]

### ■Connection to MITSUBISHI ELECTRIC FA Global Website

Access Mitsubishi Electric Corporation FA site home page.

#### Operating procedure

[Help] ⇨ [Connection to MITSUBISHI ELECTRIC FA Global Website]

### ■Checking version information

Check the version of CPU Module Logging Configuration Tool.

#### Operating procedure

[Help] ⇨ [Version Information]

# Setting data logging

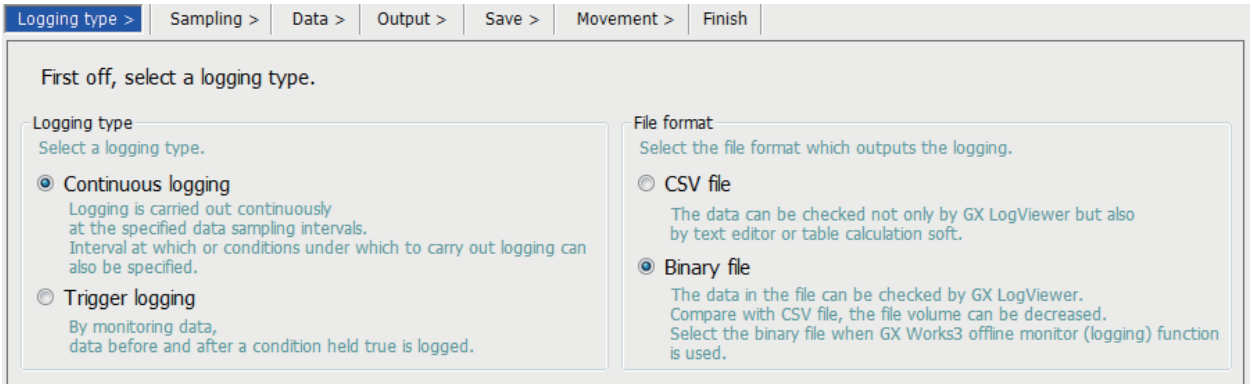
This menu item launches a wizard that helps users to configure the required settings for using the data logging function.

Edit item tree ⇨ [FX5CPU] ⇨ [Data Logging Setting] ⇨ [Edit] button

## Logging type

The following window configures the data logging type (☞ Page 163 Logging type, ☞ Page 169 Data output specifications).

#### Window



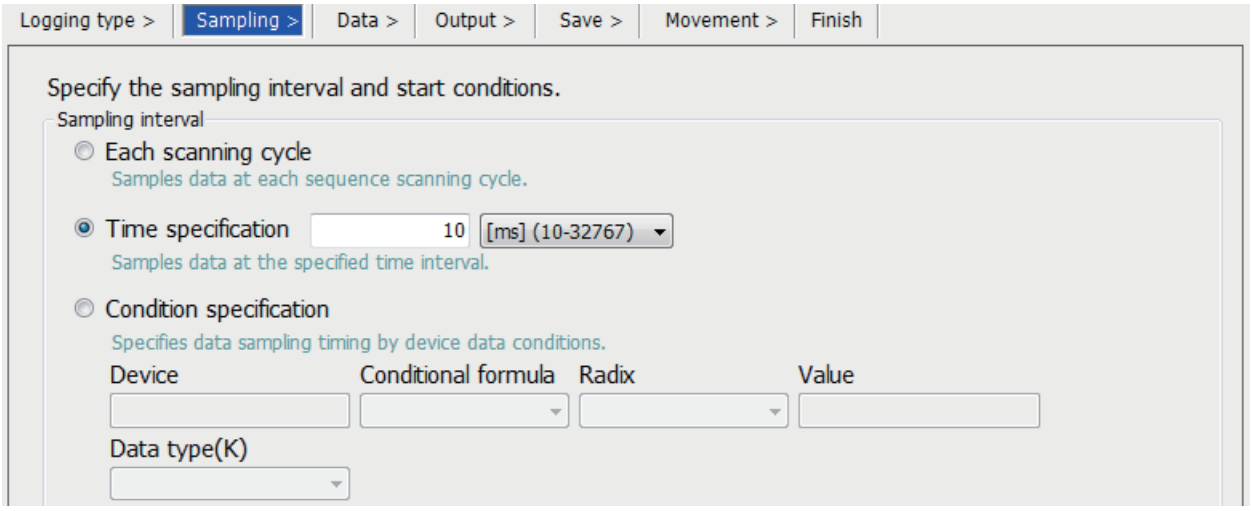

#### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Logging type | Select the logging type. | • Continuous logging<br>• Trigger logging | Continuous logging |
| File format | Select the output file format. (☞ Page 169 Data logging file) | • CSV file<br>• Binary file | Binary file |

## Collection

The following window configures the collection interval and/or collection start conditions (☞ Page 165 Data collection conditions)

### Window



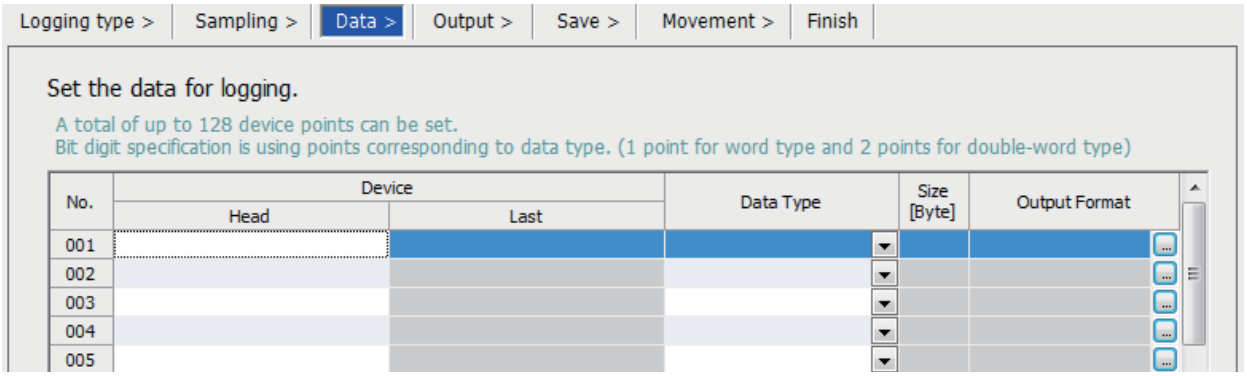

### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Each scanning cycle | Select this item to collect scan data obtained for each scan operation. | — | — |
| Time specification | Select this checkbox to collect data at a timing when the first END processing is done after the specified time interval is elapsed. | ms: 10 to 32767<br>s: 1 to 86400 | 10 ms |
| Condition specification | Specify the data collection timing according to the device data conditions. | ☞ Page 166 Condition specification | — |

## Data

The following window configures the various items such as data format of the target collection device.

### Window



### Displayed items

| Item | | Description | Setting range | Default |
|---|---|---|---|---|
| No. | | In this column, the data setting numbers from 001 to 128 are displayed. | — | — |
| Device | Head | Specify the start device number. | ☞ Page 168 Data to be collected | |
| | Last | In this column, the end device number calculated based on the data type and size is displayed. | | |
| Data Type | | Select the type of target data. | ☞ Page 168 Data type | |
| Size [Byte] | | Specify the data size when the data type is set to "String" or "Raw". | 1 to 256 bytes | |
| Output Format | | Clicking the [...] button at the rightmost part of each row displays the "Output Format (integer·float)" list. Select the format to be used when data is output to the file. | ☞ Page 169 Data output specifications | |

## Batch insertion of data

The following window is to insert data items into the data list at once. Data is inserted into blank rows in the list of the "Data" setting window in order from the top (when a setting already exists in the target insertion row, the row is skipped without overwriting it).

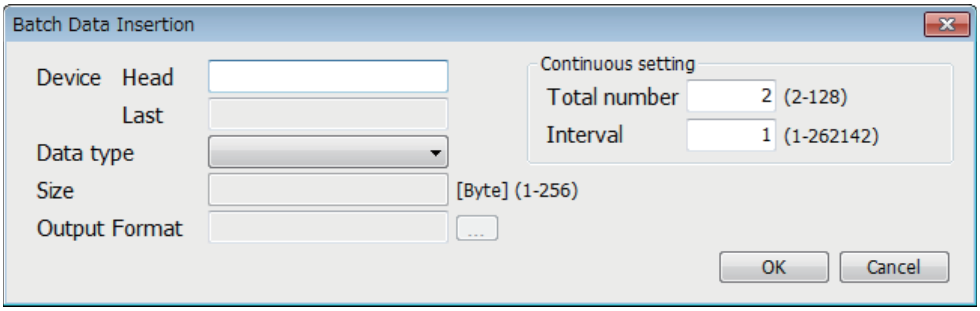
### Operating procedure

1. Open the following window.

[Edit] ⇨ [Batch Data Insertion]

2. Configure the setting items and continuous settings, and click the [OK] button.

### Window



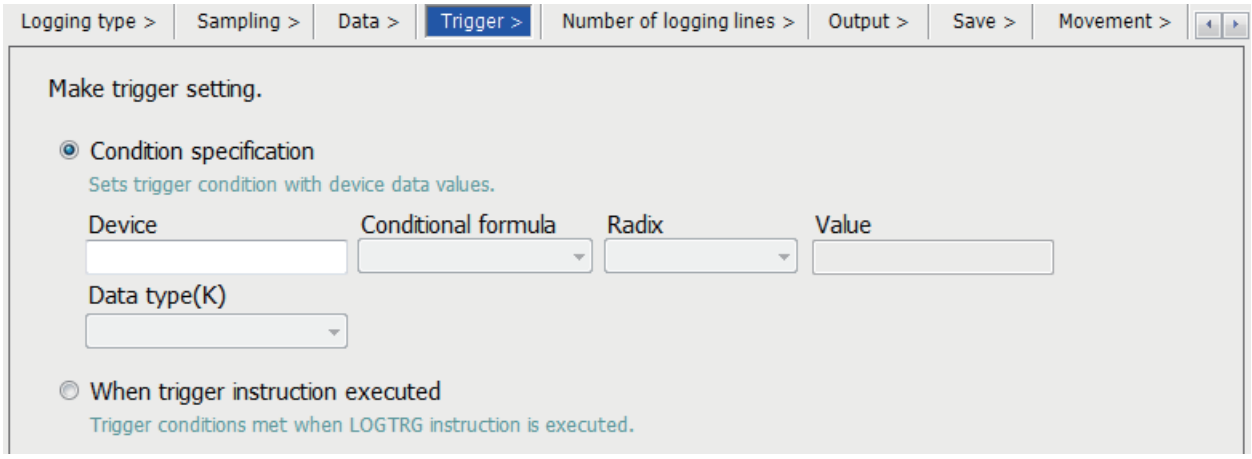

### Displayed items

| Item | | Description | Setting range | Default |
|---|---|---|---|---|
| Device | Head | Same as the data setting (☞ Page 933 Data) | Same as the data setting (☞ Page 933 Data) | — |
| | Last | | | |
| Data type | | | | |
| Size | | | | |
| Output Format | | | | |
| Continuous setting | Total number | Specify the total number of data items to be inserted at once. | 2 to 128 | 2 |
| | Interval | Specify the device interval of data to be inserted at once. | 1 to 262142 | 1 |

## Trigger

The following window specifies the trigger condition when the trigger logging is selected (☞ Page 168 Trigger condition)

### Window



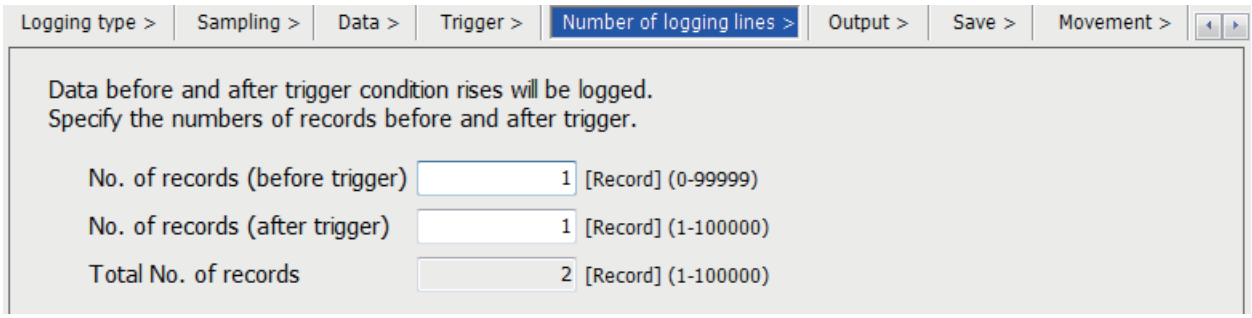

### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Condition specification | Configure the trigger condition based on the device data condition. | ☞ Page 169 Condition specification | Checked |
| When trigger instruction executed | Trigger condition is established when the LOGTRG instruction is executed. | — | — |

## Number of records

The following window specifies the number of records to be output before and after trigger occurrences when the trigger logging is selected (☞ Page 165 Number of records)

### Window



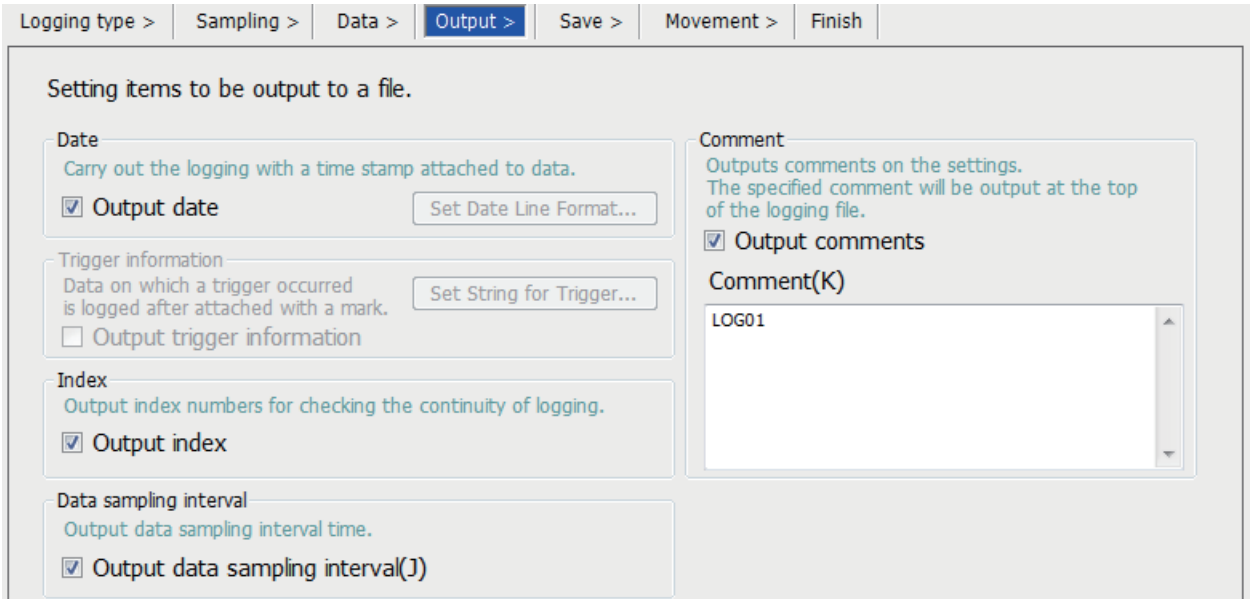

### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| No. of records (before trigger) | Specify the number of records to be output as pre-trigger record. | 0 to 99999 | 1 |
| No. of records (after trigger) | Specify the number of records to be logged during and after a trigger occurrence. | 1 to 100000 | 1 |
| Total No. of records | View the total number of pre-trigger and post-trigger records. | — | 2 |

## Output

The following window specifies the items to be output into the file. (☞ Page 169 Data output specifications)

### Window




### Displayed items

| Item | | Description | Setting range | Default |
|---|---|---|---|---|
| Date | Output date | Add a time stamp to data for the data logging. | *2*3 | Checked (YYYY/MM/DD hh:mm:ss.sss) |
| | Set Date Line Format*1 | The date/time format to be output can be specified. | | |
| Trigger information | Output trigger information | Add a mark to data items that are associated with a trigger occurrence for the data logging. | 256 characters or less | — (*) |
| | String for Indicating Trigger Occurrence*1 | A character string to be added to the data where a trigger has occurred can be specified.*4 | | |
| Index | Output index | Output the index number used for checking the logging continuity. | — | Checked |
| Data sampling interval | Output data sampling interval | Output the data collection interval. | | |
| Comment | Output comments | Output the comment at the top of the file. | | |
| | Comment*5 | Input the comment in this box. *4 | 256 characters or less (No line feed can be used.) | LOG [Logging setting No.] |

*1 Only CSV file is supported for the file format.

*2 Data output format can be created by combining the following formats.
- Year: YYYY for four-digit expression; YY for two-digit expression
- Month: MM
- Day: DD
- Hour: hh
- Minute: mm
- Second: ss
- Millisecond: ms (three-digit expression), or s, ss, sss, ssss, sssss, ssssss, or sssssss (second unit after the decimal point, maximum of seven digits)

Example: YYYY/MM/DD hh:mm:ss.sss → 2016/10/13 09:44:35.241

*3 When either of "Year", "Month", "Day", "Hour", "Minute", or "Second" is omitted, if opening the data logging file by GX LogViewer, the index expression is used rather than the time expression.
📖GX LogViewer Version 1 Operating Manual

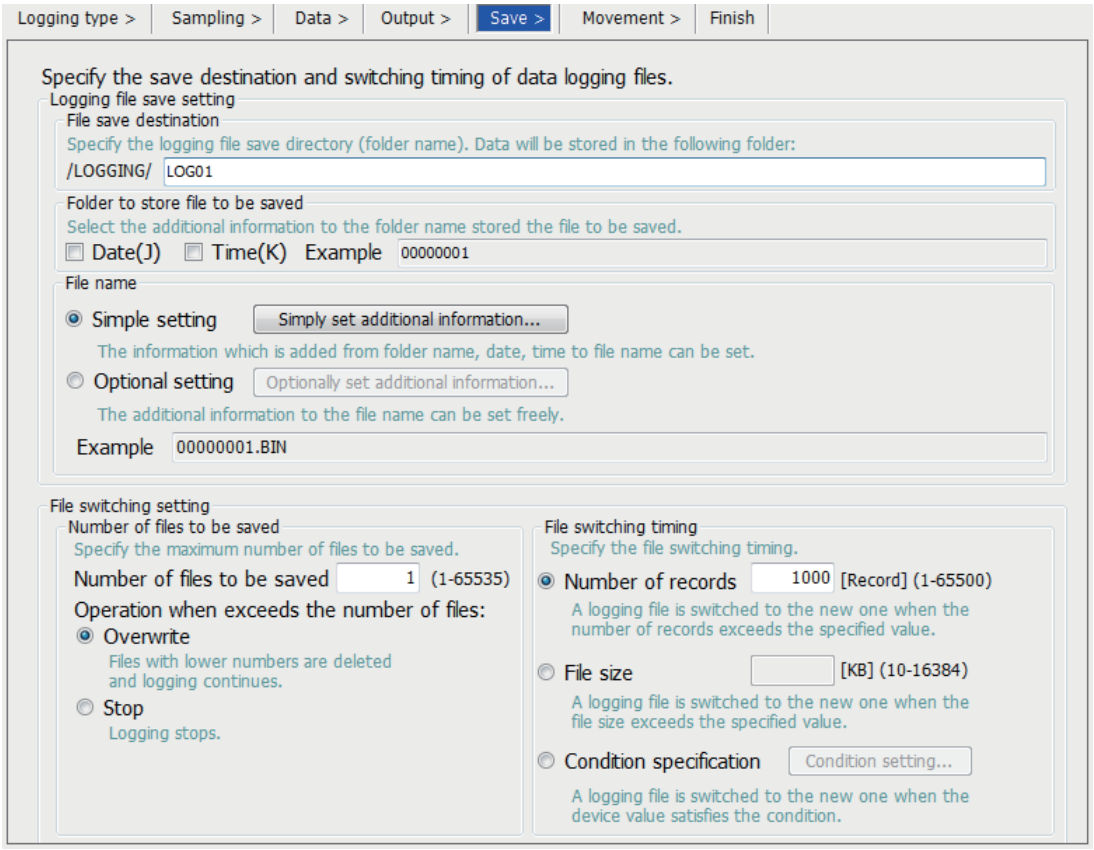
*4 If characters other than a single-byte character are used, the scan time can be long when the logging is started.

*5 You can use any characters as long as Unicode can describe them. Note, however, that you cannot use ["] (double quotation), [,] (comma) or [;] (semi colon).

## Save

The following window configures the target storage for data logging file and switching timing of storage files. (☞ Page 177 Switching to a storage file)

### Window




### Displayed items

| Item | | | Description | Setting range | Default |
|---|---|---|---|---|---|
| Logging file save setting | File save destination | | Specify the storage folder for the data logging file. | 60 characters or less (double-byte character not allowed) | LOG [Logging setting No.] |
| | Folder to store file to be saved | | Select information to be added to the name of the folder which stores the storage file. | — | Not checked |
| | File name | Simple setting | Specify information to be added to the name of the storage file (the name of the storage folder, date, time) by using the [Simply set additional information] button. | — | Checked |
| | | Optional setting | Specify the format of information to be added to the name of the storage file (the name of the storage folder, date, time) by using the [Optionally set additional information] button. The device data value can be added.*3 | *1*2 | — |
| | | Add date type | Add date/time when the file switching condition is satisfied and when the file is created if the simple setting or optional setting is selected. | — | — |
| File switching setting | Number of files to be saved | Number of files to be saved | Specify the maximum number of storage files. | 1 to 65535 | 1 |
| | | Operation when exceeds the number of files | Select the operation when the number of files exceeds the maximum number of files to be saved. (☞ Page 179 Action to take when the maximum number of storage files is exceeded) | • Overwrite<br>• Stop | Overwrite |
| | File switch timing*4 | | Select the timing at which the file is replaced with new one (☞ Page 177 File switching condition) | • Number of records: 1 to 65500<br>• File size: 10 to 16384K bytes<br>• Condition specification | Number of records (1000) |

*1 Date and/or time can be added in any format by using the following character strings.
· Year: YYYY for four-digit expression; YY for two-digit expression
· Month: MM
· Day: DD
· Day of the week: ddd (Sunday: Sun, Monday: Mon, Tuesday: Tue, Wednesday: Wed, Thursday: Thu, Friday: Fri, Saturday: Sat)
· Hour: hh
· Minute: mm
· Second: ss
Example: for June 18, 2014 (Wednesday), 09:30:15, YYYYMMDDdddhhmmss → 20140618Wed093015_00000001.BIN
Also when using the additional information simply as a character string rather than the above format, any character string can be added by enclosing it with double-quotation marks (" ").
Example: when adding the character string "address" to the file name, "address" → address_00000001.BIN can be used.

*2 Maximum of 64 characters (including underscore (_), serial number (eight digits), period, and extension) can be used. However, when specifying a character string that contains double quotation marks (" "), the maximum number reduces by the number of the double quotation marks.

*3 When the device data is used for the saved file name, it is recommended that the latch device is used because the saved file may be created after the programmable controller stops.

*4 Reducing the setting value results in frequent file switching, so that it is possible that the scan time and/or the device processing time can be extended.

## Logging operation

The following window specifies the data logging operation when the mode transfers to RUN mode (☞ Page 188 Setting the operation at the time of transition to RUN)

### Window

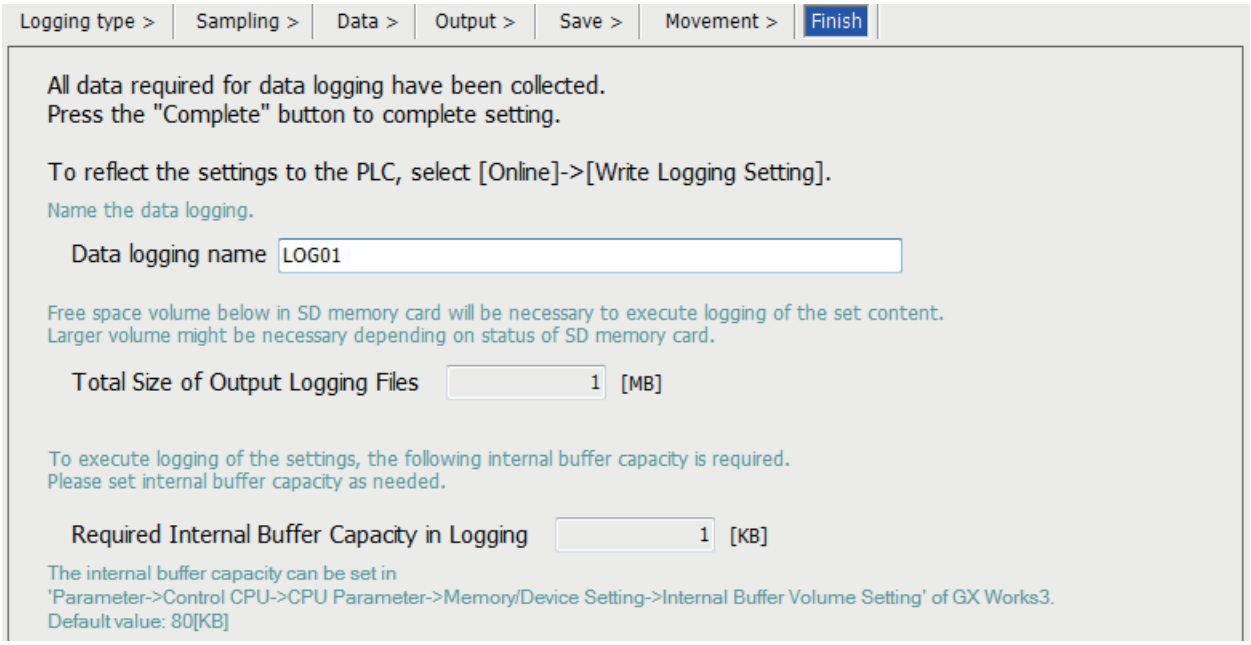

### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Operation at transition to RUN | Select the operation when the mode transfers to RUN mode. | • Auto Start<br>• Start by User Operation | Auto Start |

## Finish

The following window is to give the data logging setting a name.

### Window




### Displayed items

| Item | Description | Setting range | Default |
|---|---|---|---|
| Data logging name*1 | Give the data logging setting being configured a name. | 32 characters or less | LOG [Logging setting No.] |
| Total Size of Output Logging Files | View the total capacity of the data logging file which is output based on the specified settings. The total capacity can be increased/decreased by adding/removing the items to be output to the file. | — | 1 |
| Required Internal Buffer Capacity in Logging | View the internal buffer capacity required to execute the data logging based on the specified settings. This value can be specified with the internal buffer capacity setting of engineering tool (☞ Page 206 INTERNAL BUFFER CAPACITY SETTING) | — | 1 |

*1 When the following user action is detected, character entry will be disabled
· Entered a character which cannot be handled by the OS language character code.
· Entered a character whose language code is different from the one for characters already input in the same data logging setting.

A

# Data Logging File Transfer Status

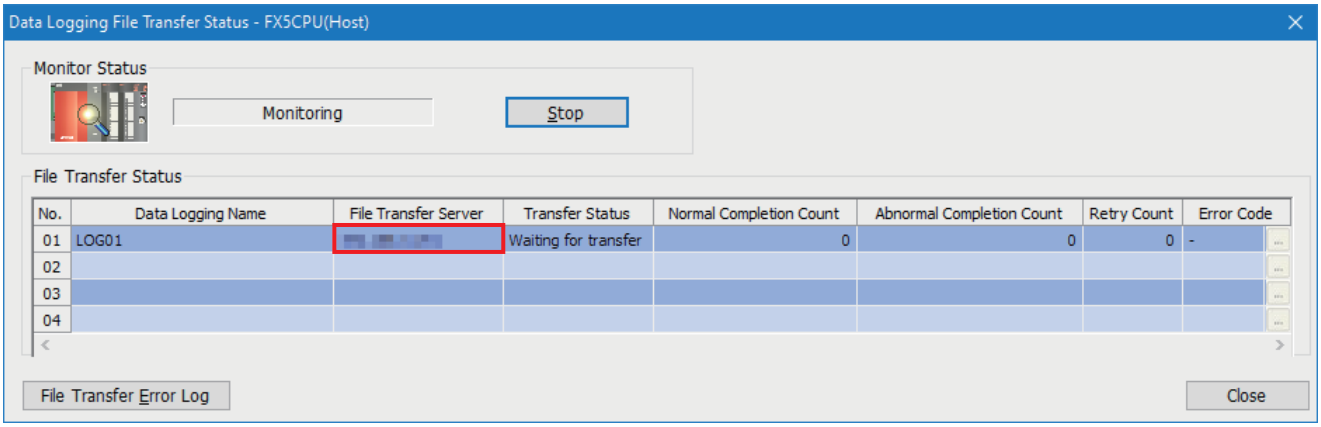
The following window is used to check the file transfer status of data logging files.

## Operating procedure

The file transfer status can be checked on the "Data Logging File Transfer Status" window.

[Online]⇨[Data Logging File Transfer Status]

## Window



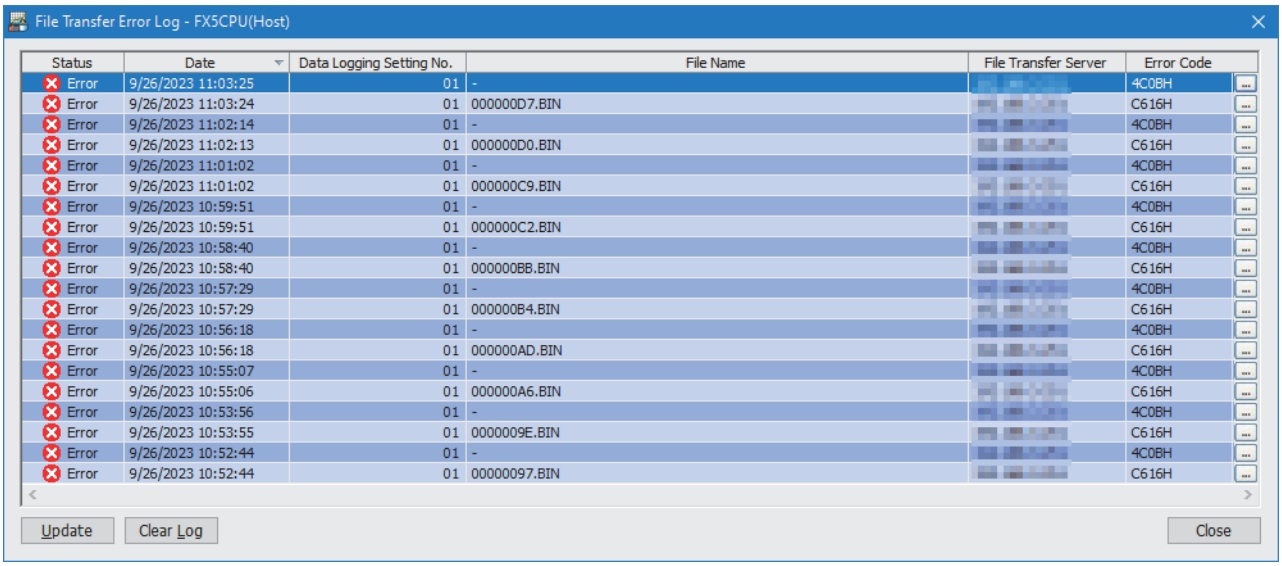

## Displayed items

| Item | Description |
|---|---|
| Data logging setting No. | The data logging setting No. is displayed. |
| Data Logging Name | The data logging name is displayed. |
| File Transfer Server | The IP address specified in the server setting is displayed.<br>• Range: 0.0.0.1 to 223.255.255.254 |
| Transfer Status | The transfer status of the data logging file is displayed.<br>• —: The data logging file transfer setting is not set.<br>• Stopped: File transfer is stopped.<br>• Retrying: The file whose transfer failed is being transferred again.<br>• Transferring: Files are being transferred.<br>• Waiting for transfer: Files are waiting to be transferred, or there is no file to be transferred. |
| Normal Completion Count | The number of data logging files that have been transferred to the FTP server is displayed.<br>• Range: 0 to 4294967295 |
| Abnormal Completion Count | The number of data logging files that have not been transferred to the FTP server is displayed.<br>• Range: 0 to 4294967295 |
| Retry Count | The number of retries is displayed.<br>• Range: 0 to 4294967295 |
| Error Code | The error code of the latest data logging file transfer function error is displayed.<br>• Range: 4000H to 4FFFH, C000H to CFFFH |
| [...] button | This button is displayed when an error has occurred. Clicking this button displays the error details window. |
| [File Transfer Error Log] button | Clicking this button displays the error history window.(☞ Page 941 File Transfer Error Log) |

## File Transfer Error Log

The following window displays the error history of the data logging file transfer function. Up to 20 errors are displayed. When the number of errors exceeds 20, records are deleted in order from the oldest one. The error history is cleared after the power is off and on or the reset operation is performed.

### Window




### Displayed items

| Item | Description |
|---|---|
| Status | The file transfer status is displayed.<br>• Error |
| Date | The date when the data logging file transfer function error occurred is displayed.<br>Format: For the Japanese version, the format is as follows.<br>• "YYYY/MM/DD hh:mm:ss"<br>YYYY: Year (4 digits), MM: Month (2 digits), DD: Day (2 digits), hh: Hour (2 digits), mm: Minutes (2 digits), ss: Seconds (2 digits) |
| Data Logging Setting No. | The data logging setting No. where the data logging file transfer function error has occurred is displayed.<br>• Range: 1 to 4 |
| File Name | The data logging file name where the data logging file transfer function error has occurred is displayed.*1<br>• Range: 12 to 64 characters |
| File Transfer Server | The IP address of the transfer destination server where the data logging file transfer function error has occurred is displayed.*2<br>• Range: 0.0.0.1 to 223.255.255.254 |
| Error Code | The data logging file transfer function error that has occurred is displayed.<br>• Range: 4000H to 4FFFH, C000H to CFFFH |
| [...] button | This button is displayed when an error has occurred. Clicking this button displays the error details window. |
| [Update] button | Clicking this button obtains the error history in the CPU module again and displays it. |
| [Clear Log] button | Clicking this button clears the error history in the CPU module. |

*1 When the data logging file transfer is stopped or there is no file to be transferred, "—" is displayed.

*2 Even when the FTP server is specified with the server name in the server setting, the IP address is displayed. However, when the server is not connected, "—" is displayed.

## Supported characters

This section describes the supported characters.

### ■Supported characters for CPU Module Logging Configuration Tool

Any characters that can be expressed by Unicode are supported. However, the supported characters vary for each position as shown in the following table. Note that if attempting to input an unsupported character, the entry is rejected or a message window appears in response to the improper entry.

| Place where character is used | | Support status of the target character | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (SP)*1 | " | ' | * | + | , | / | : | ; | < | > | ? | [ | \ | ] | \| | . | Two-byte characters |
| Data Logging Setting | • Data logging name<br>• String for Indicating Trigger Occurrence<br>• Comment | ○ | × | ○ | ○ | ○ | × | ○ | ○ | × | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | Date Line Output Format | ○ | × | ○ | ○ | ○ | × | ○ | ○ | × | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | × |
| Logging File Operation | Directory | × | × | ○ | × | ○ | × | ○ | × | × | × | × | × | ○ | × | ○ | × | × | × |

*1 (SP) means a space.

**Point**

Surrogate pair characters cannot be used.

### ■Supported characters for file and/or folder (directory) name

Characters in the shaded area can be used.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | NULL | | (SP) | 0 | @ | P | ` | p | | | | - | タ | ミ | | |
| 1 | | | ! | 1 | A | Q | a | q | | | 。 | ア | チ | ム | | |
| 2 | | | " | 2 | B | R | b | r | | | 「 | イ | ツ | メ | | |
| 3 | | | # | 3 | C | S | c | s | | | 」 | ウ | テ | モ | | |
| 4 | | | $ | 4 | D | T | d | t | | | | エ | ト | ヤ | | |
| 5 | | | % | 5 | E | U | e | u | | | 、 | オ | ナ | ユ | | |
| 6 | | | & | 6 | F | V | f | v | | | ・ | カ | ニ | ヨ | | |
| 7 | | | ' | 7 | G | W | g | w | | | ヲ | キ | ヌ | ラ | | |
| 8 | | | ( | 8 | H | X | h | x | | | ァ | ク | ネ | リ | | |
| 9 | | | ) | 9 | I | Y | i | y | | | ィ | ケ | ノ | ル | | |
| A | | | * | : | J | Z | j | z | | | ゥ | コ | ハ | レ | | |
| B | | | + | ; | K | [ | k | { | | | ェ | サ | ヒ | ロ | | |
| C | | | , | < | L | ¥ | l | \| | | | ォ | シ | フ | ワ | | |
| D | | | - | = | M | ] | m | } | | | ャ | ス | ヘ | ン | | |
| E | | | . | > | N | ^ | n | ~ | | | ュ | セ | ホ | ゛ | | |
| F | | | / | ? | O | _ | o | | | | ョ | ソ | マ | ° | | |

## Procedure for installing the built-in USB driver of the FX5S/FX5UJ CPU modules

To communicate with the FX5S/FX5UJ CPU module via USB, a USB driver needs to be installed.
This section describes the installation procedure of a USB driver.
If multiple MELSOFT products are installed, refer to their installed location.

### ■Windows® XP

#### Operating procedure

1. Connect a personal computer to the CPU module with a USB cable, and power on the CPU module.
2. Select "Install from a list or specific location (Advanced)" on the "Found New Hardware Wizard" window.
3. On the next window, select "Search for the best driver in these locations". Check the "Include this location in the search" checkbox, and specify the "Easysocket\USBDrivers" folder where the CPU Module Logging Configuration Tool has been installed.

#### Precautions

If the driver cannot be installed, check the following setting on Windows®.
Select [Control Panel] ⇨ [System] ⇨ [Hardware], and click the [Driver Signing] button. If "Block - Never install unsigned driver software" is selected, the USB driver may not be installed. Select "Ignore - Install the software anyway and don't ask for my approval" or "Warn - Prompt me each time to choose an action", and then install the USB driver.

### ■Windows Vista®

#### Operating procedure

1. Connect a personal computer to the CPU module with a USB cable, and power on the CPU module.
2. Select "Locate and install driver software (recommended)" on the "Found New Hardware" window.
3. On the next window, select "Browse my computer for driver software (advanced)".
4. On the next window, select "Search for the best driver in these locations". Check the "Include subfolders" checkbox, and specify the "Easysocket\USBDrivers" folder where the CPU Module Logging Configuration Tool has been installed.

#### Precautions

If "Windows can't verify the publisher of this driver software" appears on the "Windows Security" window, select "Install this driver software anyway".

### ■Windows® 7 and later

#### Operating procedure

1. Connect a personal computer to the CPU module with a USB cable, and power on the CPU module.
2. Select [Start] ⇨ [Control Panel] ⇨ [System and Security] ⇨ [Administrative Tools] ⇨ [Computer Management] ⇨ [Device Manager]. Right-click "Unknown device", and click "Update Driver Software".
3. On the "Update Driver Software" window, select "Browse my computer for driver software" and specify the "Easysocket\USBDrivers" folder where the CPU Module Logging Configuration Tool has been installed on the next window.

# Appendix 9 Connection Example of Servo Amplifier

Examples (sink input/sink output) of connecting a CPU module and high-speed pulse input/output module to a MELSERVO MR-J5□A, MR-J4□A, MR-J3□A or MR-JN□A series servo amplifier are shown.

For pulse output mode, refer to ☞ Page 372 Pulse Output Mode.

For DABS instruction, refer to ☞ Page 485 Absolute Position Detection System.

For input/output of the CPU module and high-speed pulse input/output module assigned, refer to the following.

☞ Page 343 Input assignment

☞ Page 348 Assignment of output numbers

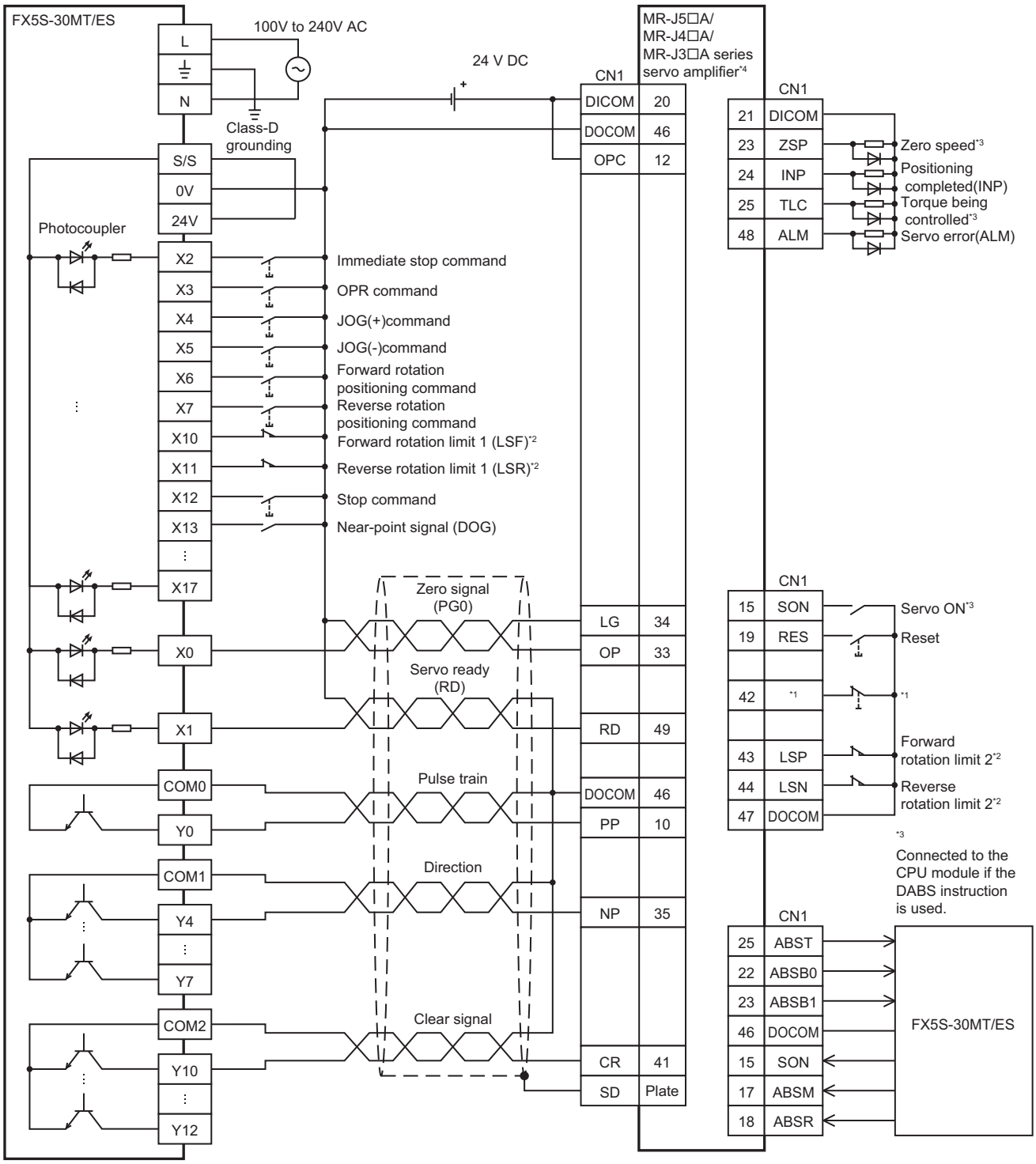
For details of the I/O module, refer to the following manuals.

MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)

For details of the servo amplifier, refer to the manual for each servo amplifier.

## FX5S CPU module

### ■PULSE/SIGN mode



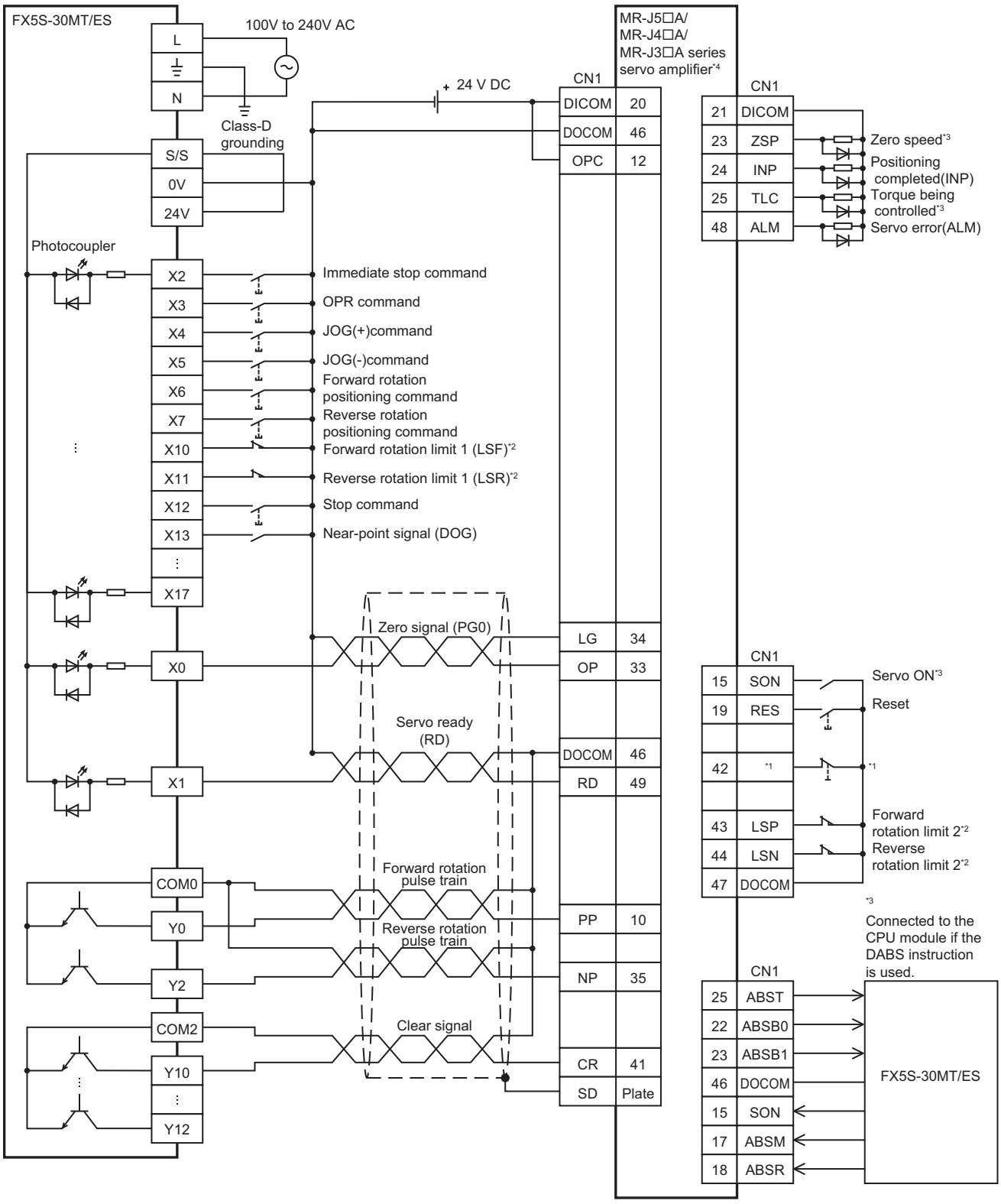

*1 EM2 (forced stop 2) for MR-J5□A type/MR-J4□A type servo amplifier, and EMG (emergency stop) for MR-J3□A type servo amplifier

*2 For details, refer to ☞ Page 947 Precautions.

*3 To detect absolute positions, connect this line to the CPU module.
For details, refer to ☞ Page 947 Precautions.

*4 Set the command pulse input form PA13 as below.
· MR-J5□A type/MR-J4□A type servo amplifier: "0211" (negative logic, signed pulse train, command input pulse train filter 500kpps or less)
· MR-J3□A type servo amplifier: "0011" (negative logic, signed pulse train)

## ■CW/CCW mode




*1 EM2 (forced stop 2) for MR-J5□A type/MR-J4□A type servo amplifier, and EMG (emergency stop) for MR-J3□A type servo amplifier

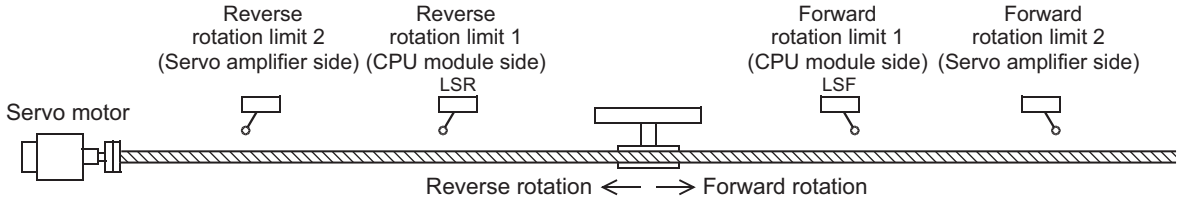
*2 For details, refer to ☞ Page 947 Precautions.

*3 To detect absolute positions, connect this line to the CPU module.
For details, refer to ☞ Page 947 Precautions.

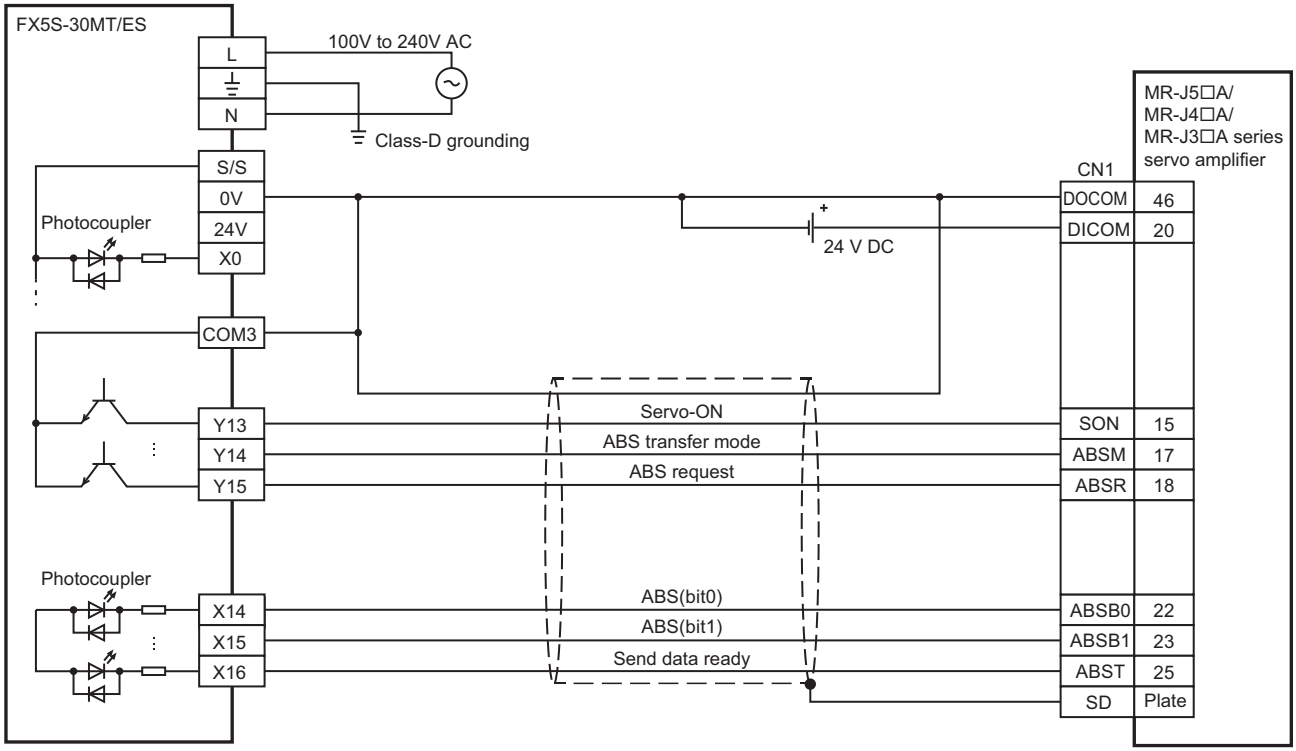
*4 Set the command pulse input form PA13 as below.
· MR-J5□A type/MR-J4□A type servo amplifier: "0210" (negative logic, forward pulse train, reverse pulse train, command input pulse train filter 500kpps or less)
· MR-J3□A type servo amplifier: "0010" (negative logic, forward pulse train, reverse pulse train)

## ■Precautions

- Use a CPU module and I/O module with transistor output.
- Be sure to use the class-D grounding method (grounding resistance: 100 Ω or less).
- To ensure safety, use the forward rotation limit switch and the reverse rotation limit switch on both sides: the CPU module side and the servo amplifier side.
  Note that the limit switches on the CPU module side should be activated slightly earlier than the limit switches on the servo amplifier side.

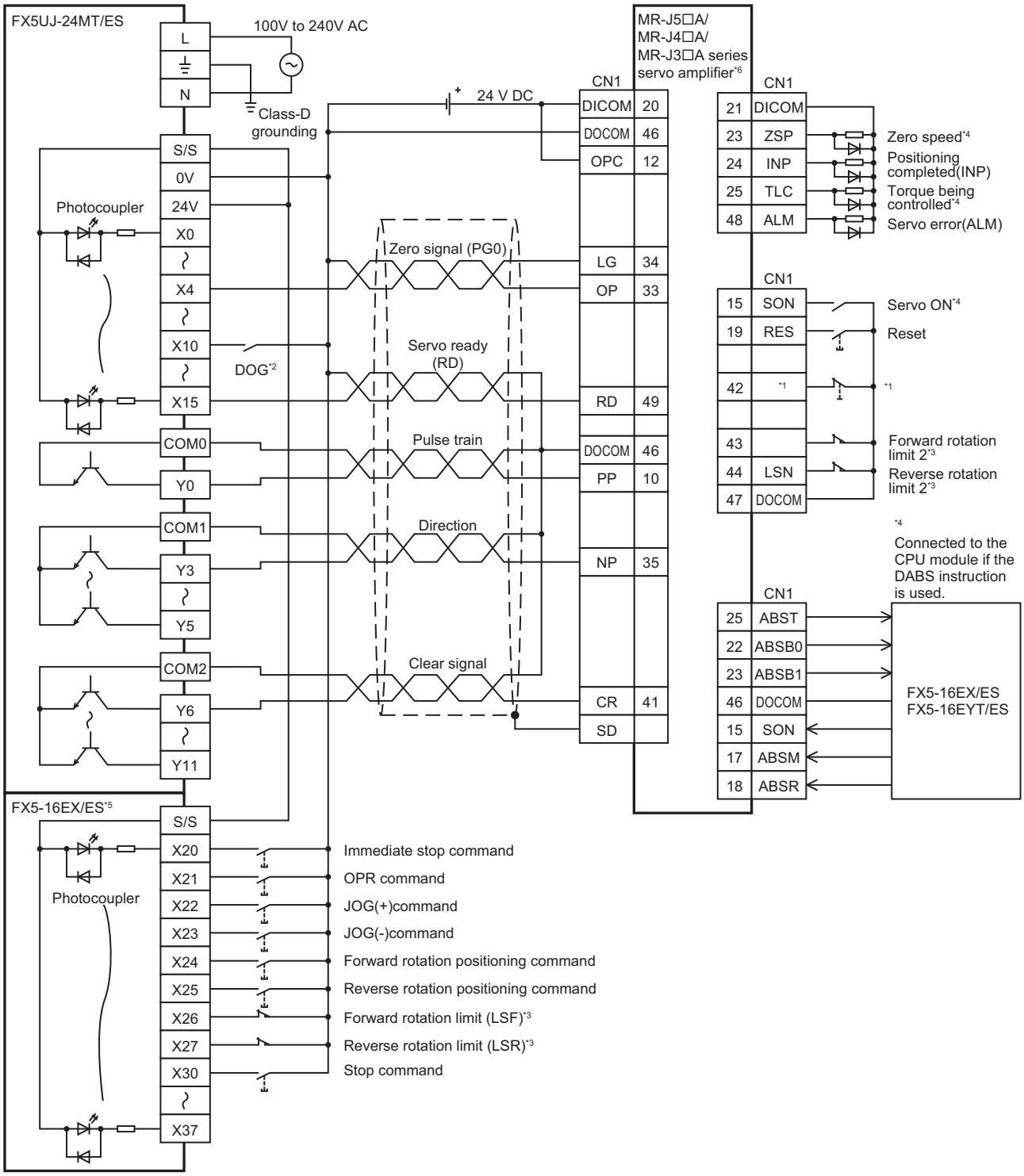



- An example of connection with the CPU module during absolute position detection is shown below.



## FX5UJ CPU module

### ■PULSE/SIGN mode




*1 EM2 (forced stop 2) for MR-J5□A type/MR-J4□A type servo amplifier, and EMG (emergency stop) for MR-J3□A type servo amplifier

*2 Near-point signal (DOG)

*3 For details, refer to ☞ Page 949 Precautions.

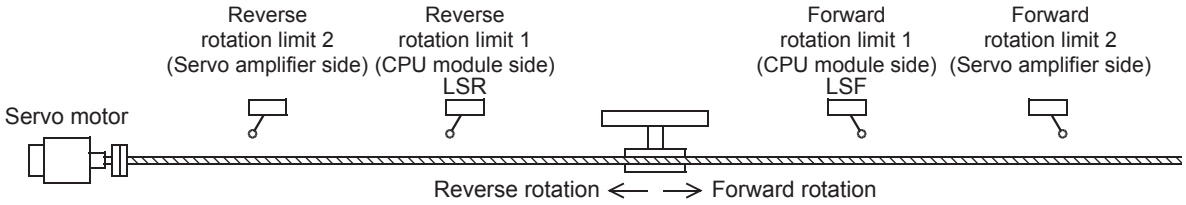
*4 To detect absolute positions, connect this line to the CPU module.
For details, refer to ☞ Page 949 Precautions.

*5 I/O module are used in the connection example. Inputs and outputs built into the CPU module are available in place of I/O module.

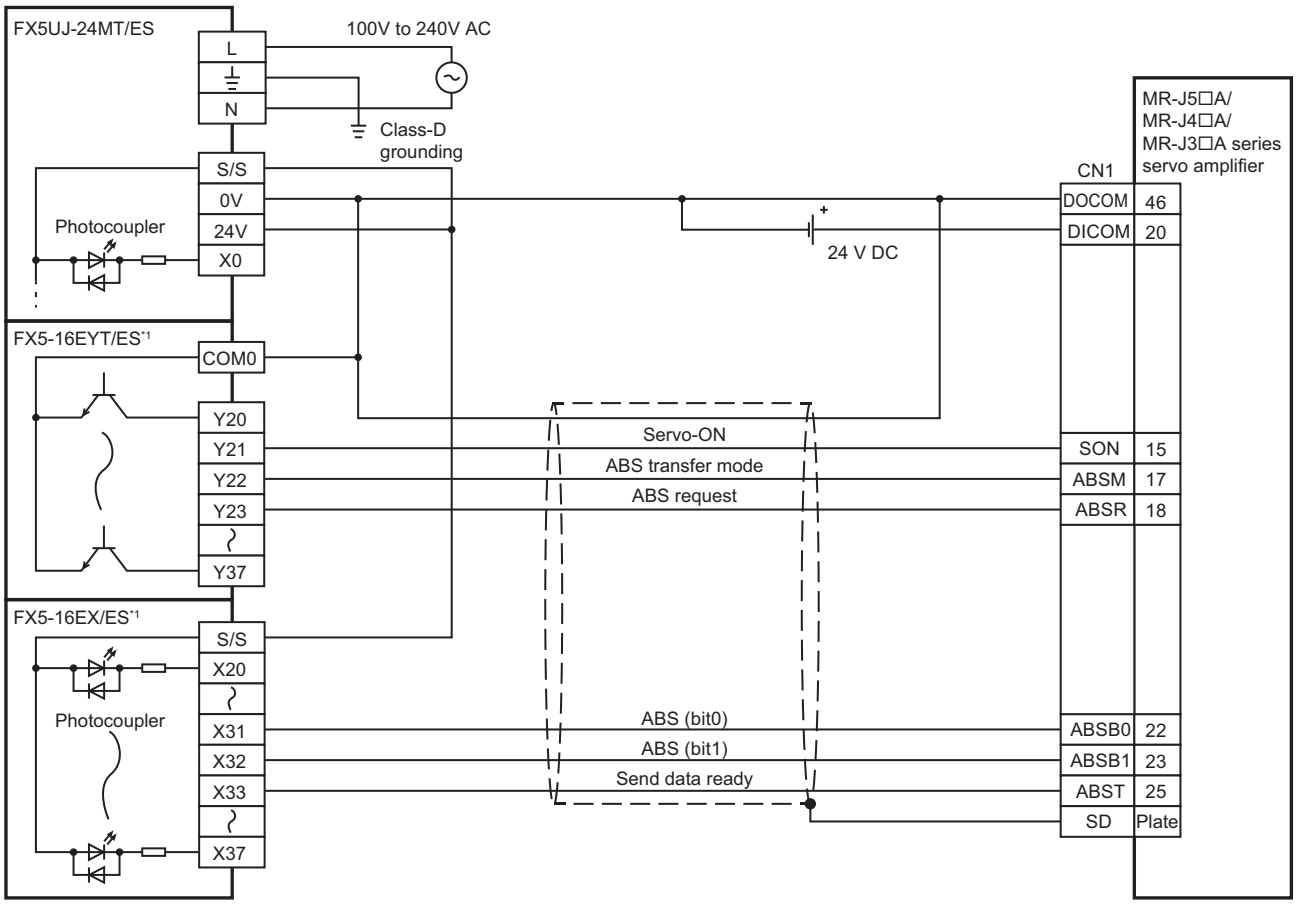
*6 Set the command pulse input form PA13 as below.
· MR-J5□A type/MR-J4□A type servo amplifier: "0211" (negative logic, signed pulse train, command input pulse train filter 500kpps or less)
· MR-J3□A type servo amplifier: "0011" (negative logic, signed pulse train)

## ■Precautions

- Use a CPU module and I/O module with transistor output.
- Be sure to use the class-D grounding method (grounding resistance: 100 Ω or less).
- To ensure safety, use the forward rotation limit switch and the reverse rotation limit switch on both sides: the CPU module side and the servo amplifier side.
  Note that the limit switches on the CPU module side should be activated slightly earlier than the limit switches on the servo amplifier side.




- An example of connection with the CPU module during absolute position detection is shown below.




*1 I/O module are used in the connection example. Inputs and outputs built into the CPU module are available in place of I/O module.

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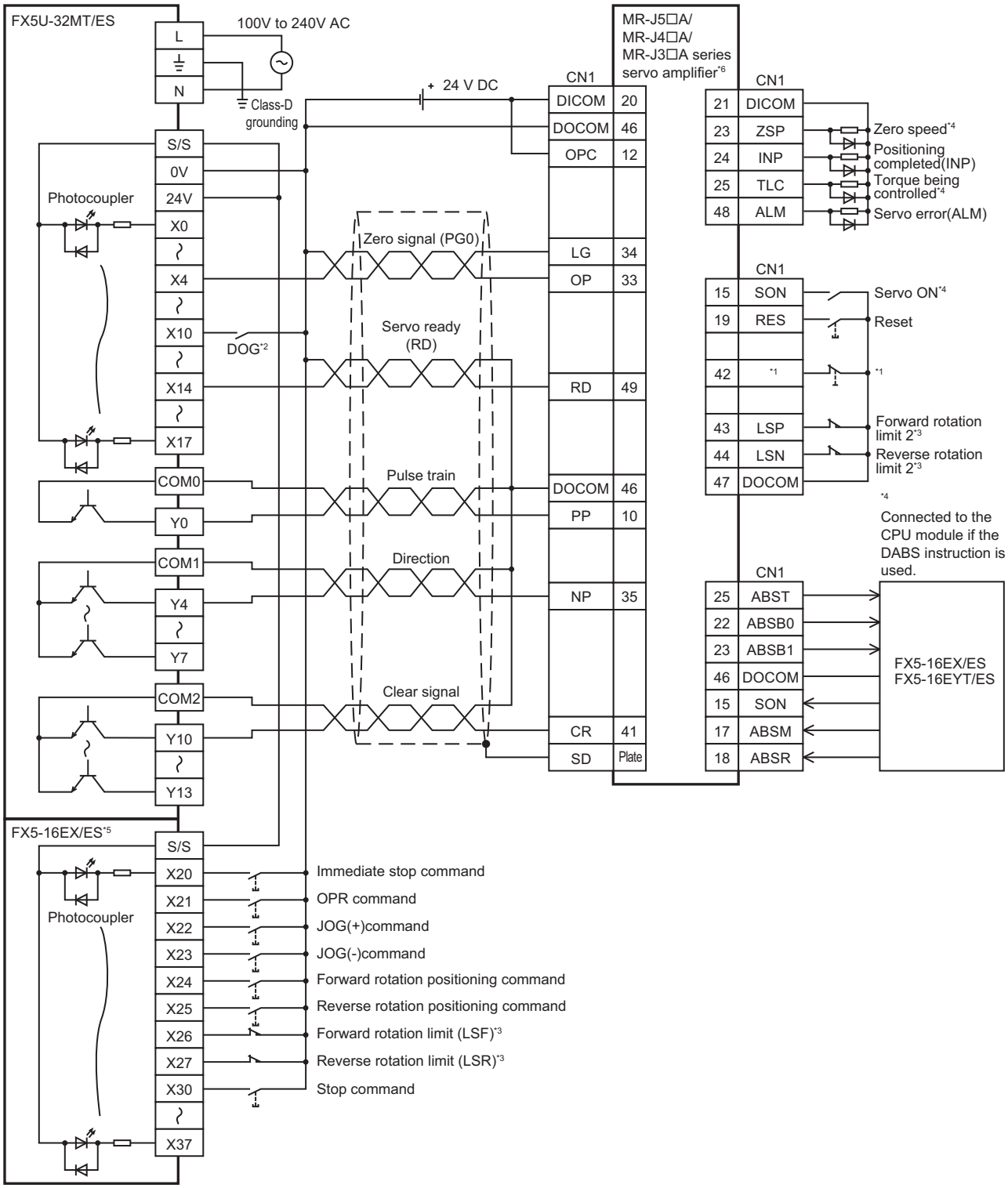
## FX5U CPU module

### ■PULSE/SIGN mode




*1 EM2 (forced stop 2) for MR-J5□A type/MR-J4□A type servo amplifier, and EMG (emergency stop) for MR-J3□A type servo amplifier

*2 Near-point signal (DOG)

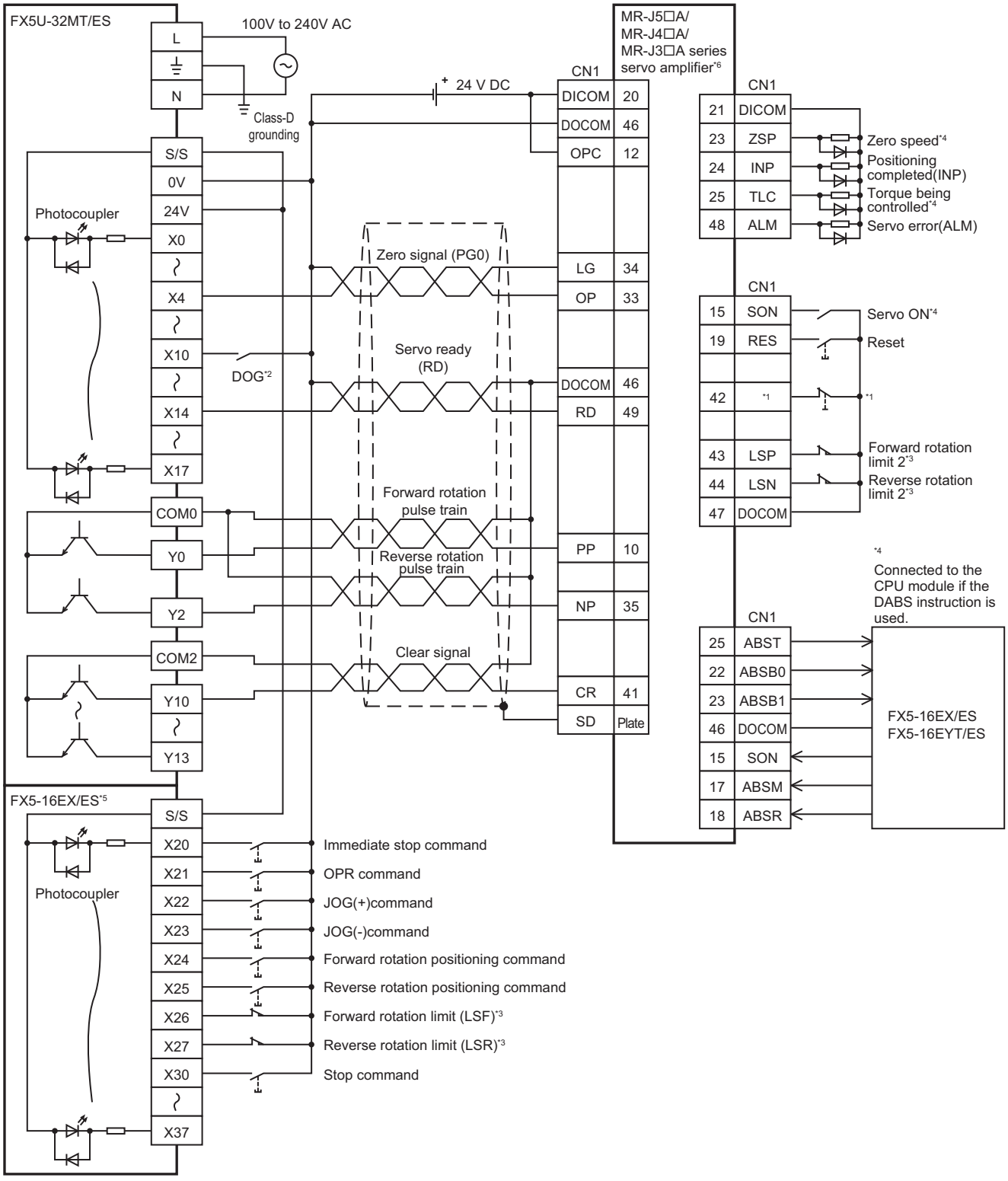
*3 For details, refer to ☞ Page 952 Precautions.

*4 To detect absolute positions, connect this line to the CPU module.
For details, refer to ☞ Page 952 Precautions.

*5 I/O module are used in the connection example. Inputs and outputs built into the CPU module are available in place of I/O module.

*6 Set the command pulse input form PA13 as below.
· MR-J5□A type/MR-J4□A type servo amplifier: "0211" (negative logic, signed pulse train, command input pulse train filter 500kpps or less)
· MR-J3□A type servo amplifier: "0011" (negative logic, signed pulse train)

## ■CW/CCW mode




*1 EM2 (forced stop 2) for MR-J5□A type/MR-J4□A type servo amplifier, and EMG (emergency stop) for MR-J3□A type servo amplifier

*2 Near-point signal (DOG)

*3 For details, refer to ☞ Page 952 Precautions.

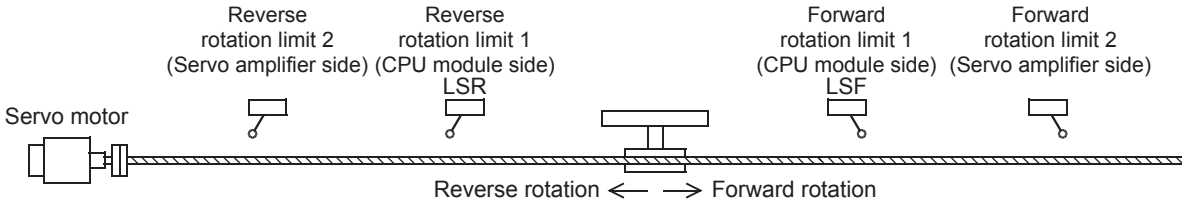
*4 To detect absolute positions, connect this line to the CPU module.
For details, refer to ☞ Page 952 Precautions.

*5 I/O module are used in the connection example. Inputs and outputs built into the CPU module are available in place of I/O module.

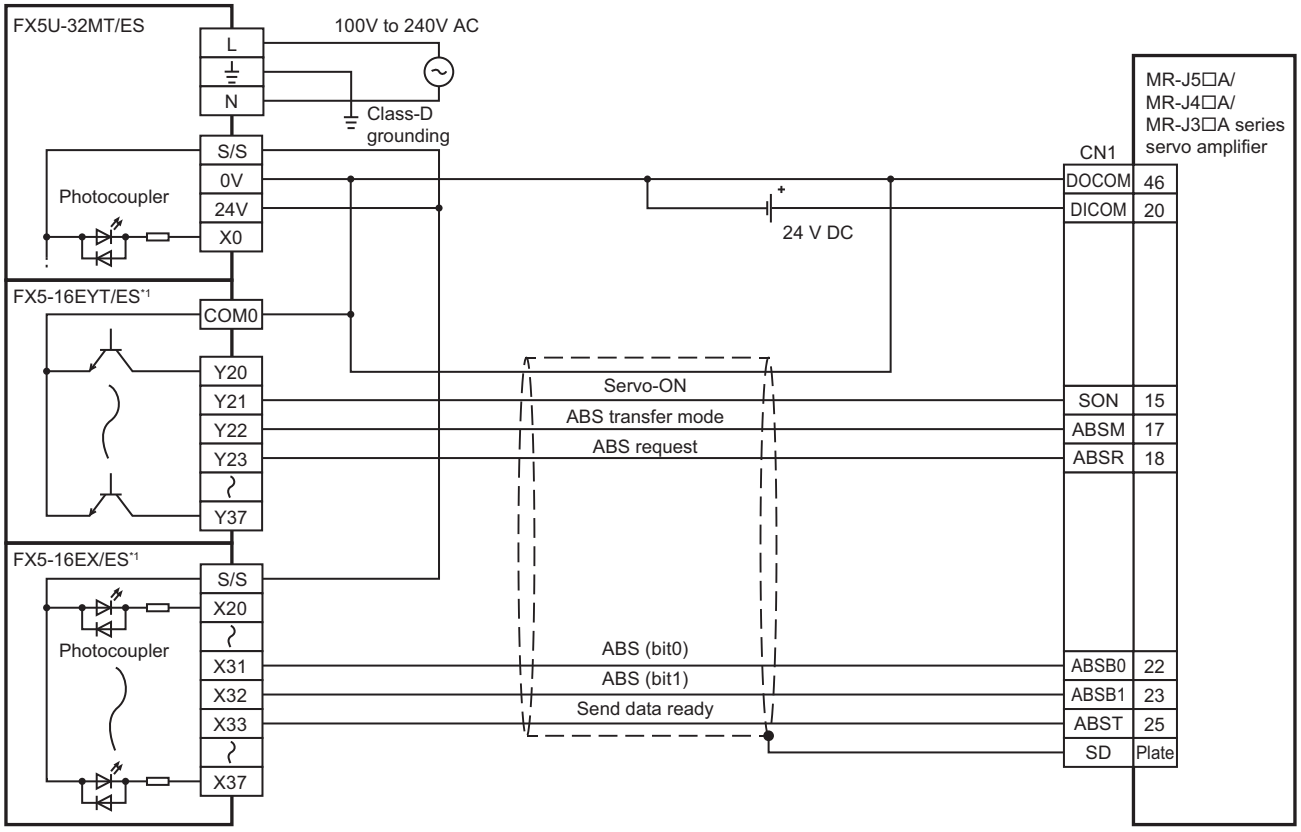
*6 Set the command pulse input form PA13 as below.
· MR-J5□A type/MR-J4□A type servo amplifier: "0210" (negative logic, forward pulse train, reverse pulse train, command input pulse train filter 500kpps or less)
· MR-J3□A type servo amplifier: "0010" (negative logic, forward pulse train, reverse pulse train)

## ■Precautions

- Use a CPU module and I/O module with transistor output.
- Be sure to use the class-D grounding method (grounding resistance: 100 Ω or less).
- To ensure safety, use the forward rotation limit switch and the reverse rotation limit switch on both sides: the CPU module side and the servo amplifier side.
  Note that the limit switches on the CPU module side should be activated slightly earlier than the limit switches on the servo amplifier side.

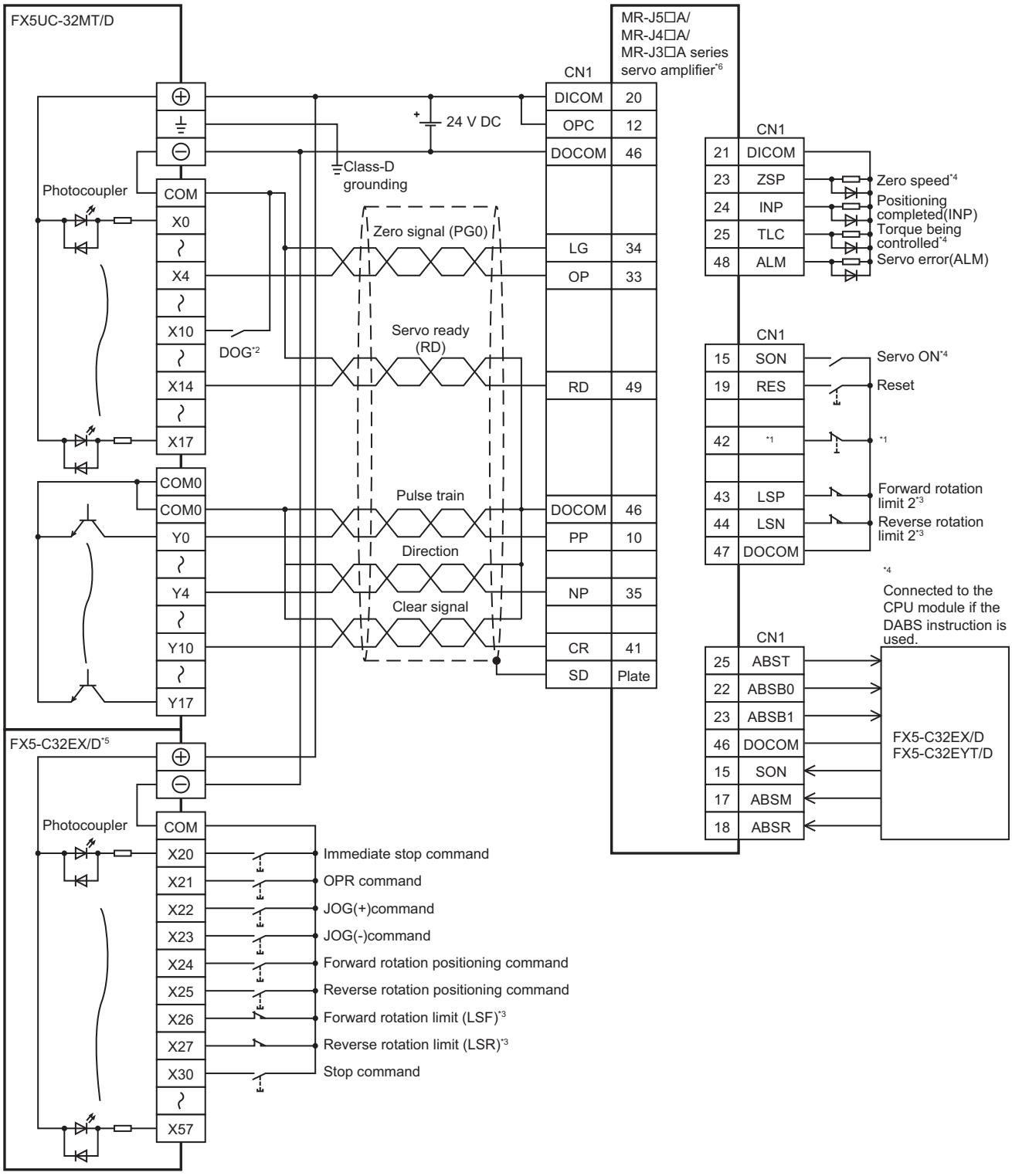



- An example of connection with the CPU module during absolute position detection is shown below.




*1 I/O module are used in the connection example. Inputs and outputs built into the CPU module are available in place of I/O module.

## ■PULSE/SIGN mode




*1 EM2 (forced stop 2) for MR-J5□A type/MR-J4□A type servo amplifier, and EMG (emergency stop) for MR-J3□A type servo amplifier

*2 Near-point signal (DOG)

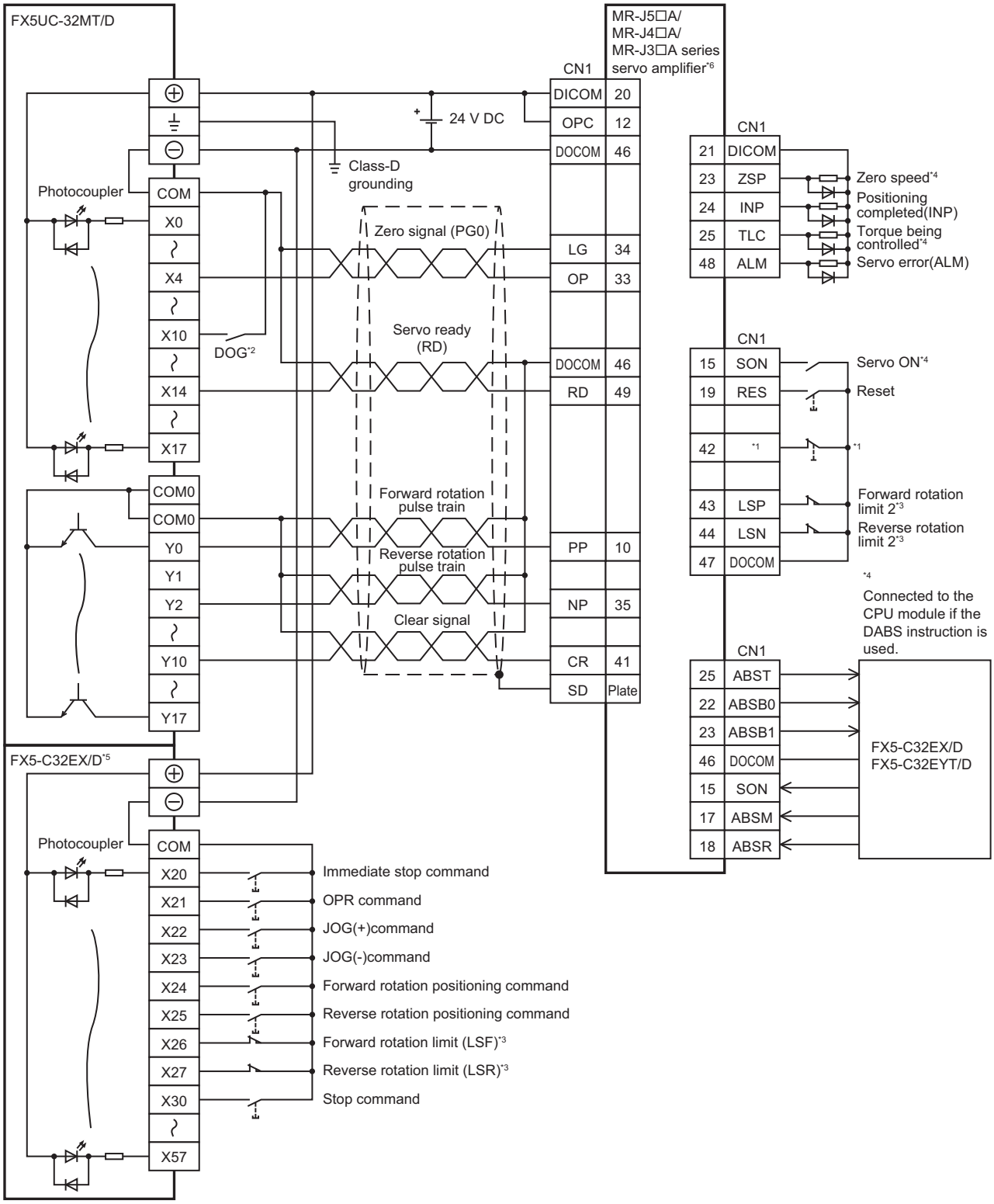
*3 For details, refer to ☞ Page 955 Precautions.

*4 To detect absolute positions, connect this line to the CPU module.
For details, refer to ☞ Page 955 Precautions.

*5 I/O module are used in the connection example. Inputs and outputs built into the CPU module are available in place of I/O module.

*6 Set the command pulse input form PA13 as below.
· MR-J5□A type/MR-J4□A type servo amplifier: "0211" (negative logic, signed pulse train, command input pulse train filter 500kpps or less)
· MR-J3□A type servo amplifier: "0011" (negative logic, signed pulse train)

## ■CW/CCW mode




*1 EM2 (forced stop 2) for MR-J5□A type/MR-J4□A type servo amplifier, and EMG (emergency stop) for MR-J3□A type servo amplifier

*2 Near-point signal (DOG)

*3 For details, refer to ☞ Page 955 Precautions.

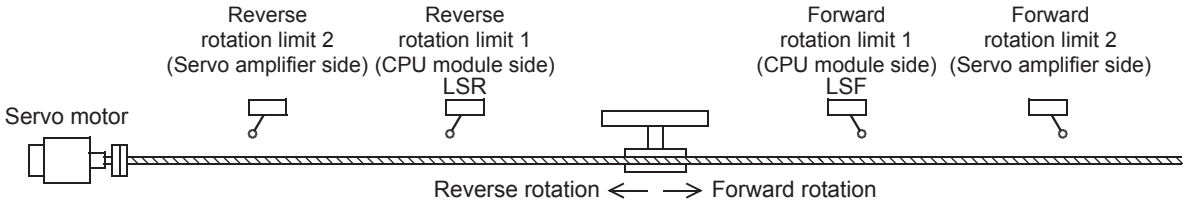
*4 To detect absolute positions, connect this line to the CPU module.
For details, refer to ☞ Page 955 Precautions.

*5 I/O module are used in the connection example. Inputs and outputs built into the CPU module are available in place of I/O module.

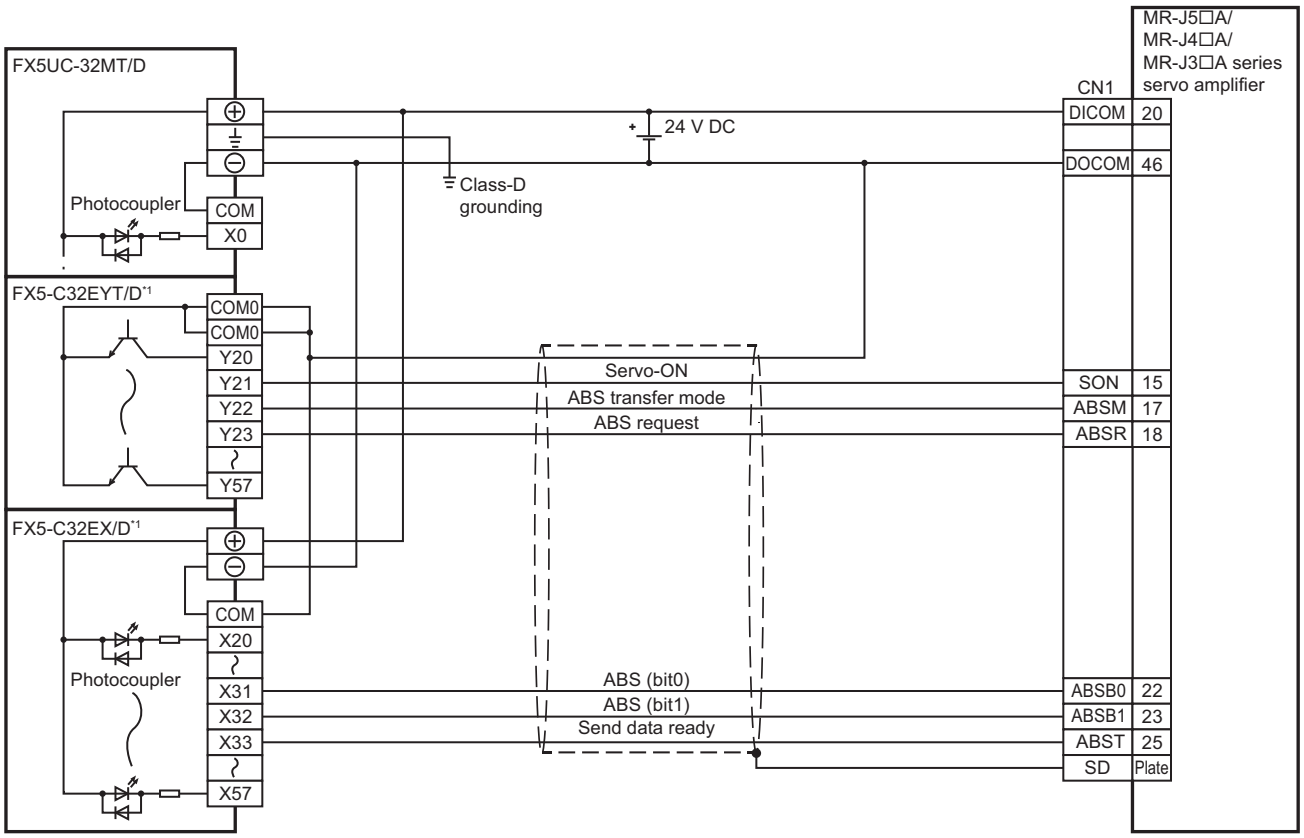
*6 Set the command pulse input form PA13 as below.
· MR-J5□A type/MR-J4□A type servo amplifier: "0210" (negative logic, forward pulse train, reverse pulse train, command input pulse train filter 500kpps or less)
· MR-J3□A type servo amplifier: "0010" (negative logic, forward pulse train, reverse pulse train)

## ■Precautions

- Use a CPU module and I/O module with transistor output.
- Be sure to use the class-D grounding method (grounding resistance: 100 Ω or less).
- To ensure safety, use the forward rotation limit switch and the reverse rotation limit switch on both sides: the CPU module side and the servo amplifier side.
  Note that the limit switches on the CPU module side should be activated slightly earlier than the limit switches on the servo amplifier side.




- An example of connection with the CPU module during absolute position detection is shown below.

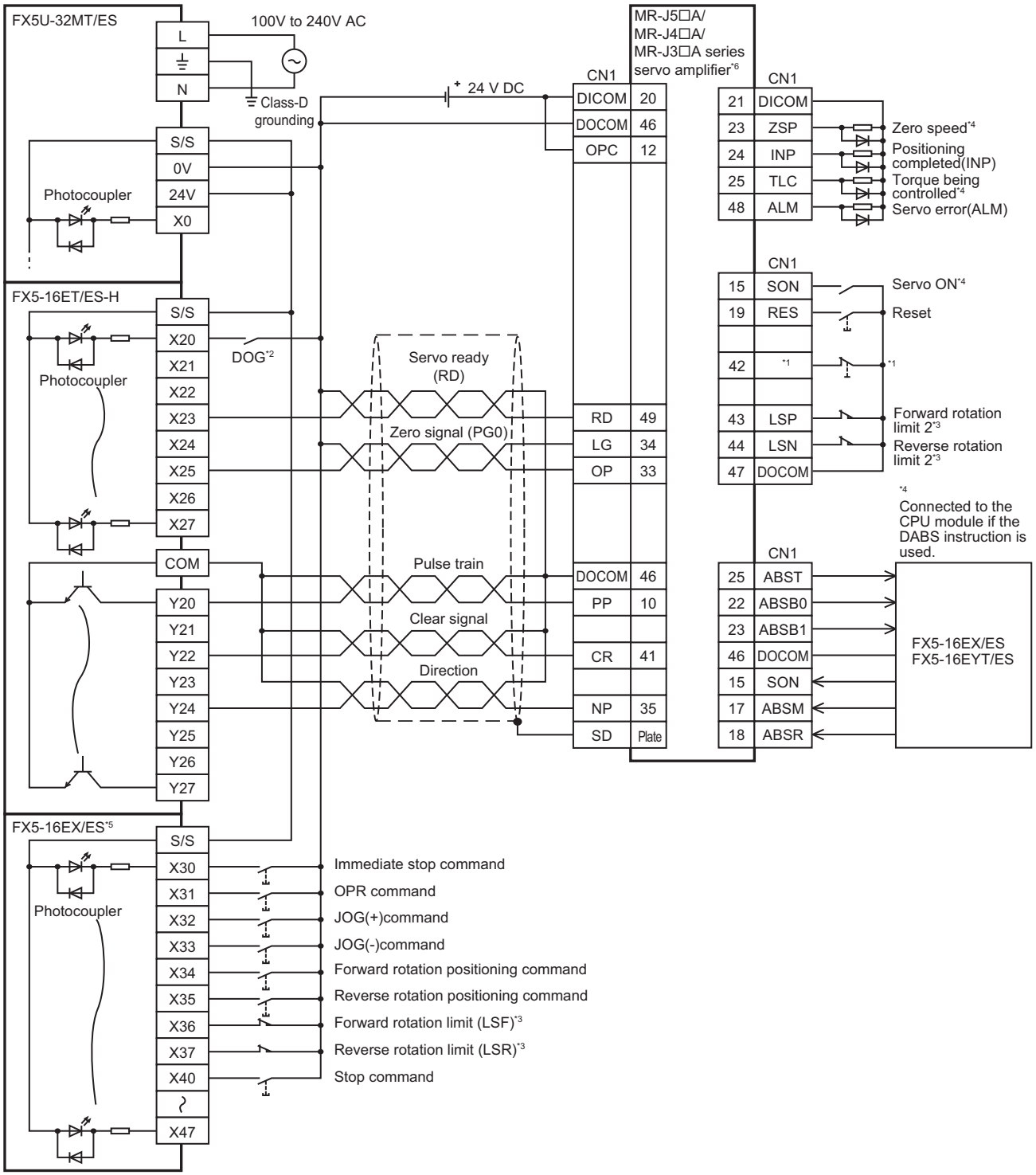



*1 I/O module are used in the connection example. Inputs and outputs built into the CPU module are available in place of I/O module.

A

## High-speed pulse input/output module

### ■PULSE/SIGN mode




*1 EM2 (forced stop 2) for MR-J5□A type/MR-J4□A type servo amplifier, and EMG (emergency stop) for MR-J3□A type servo amplifier

*2 Near-point signal (DOG)
Any input other than high-speed pulse input/output module can also be used.

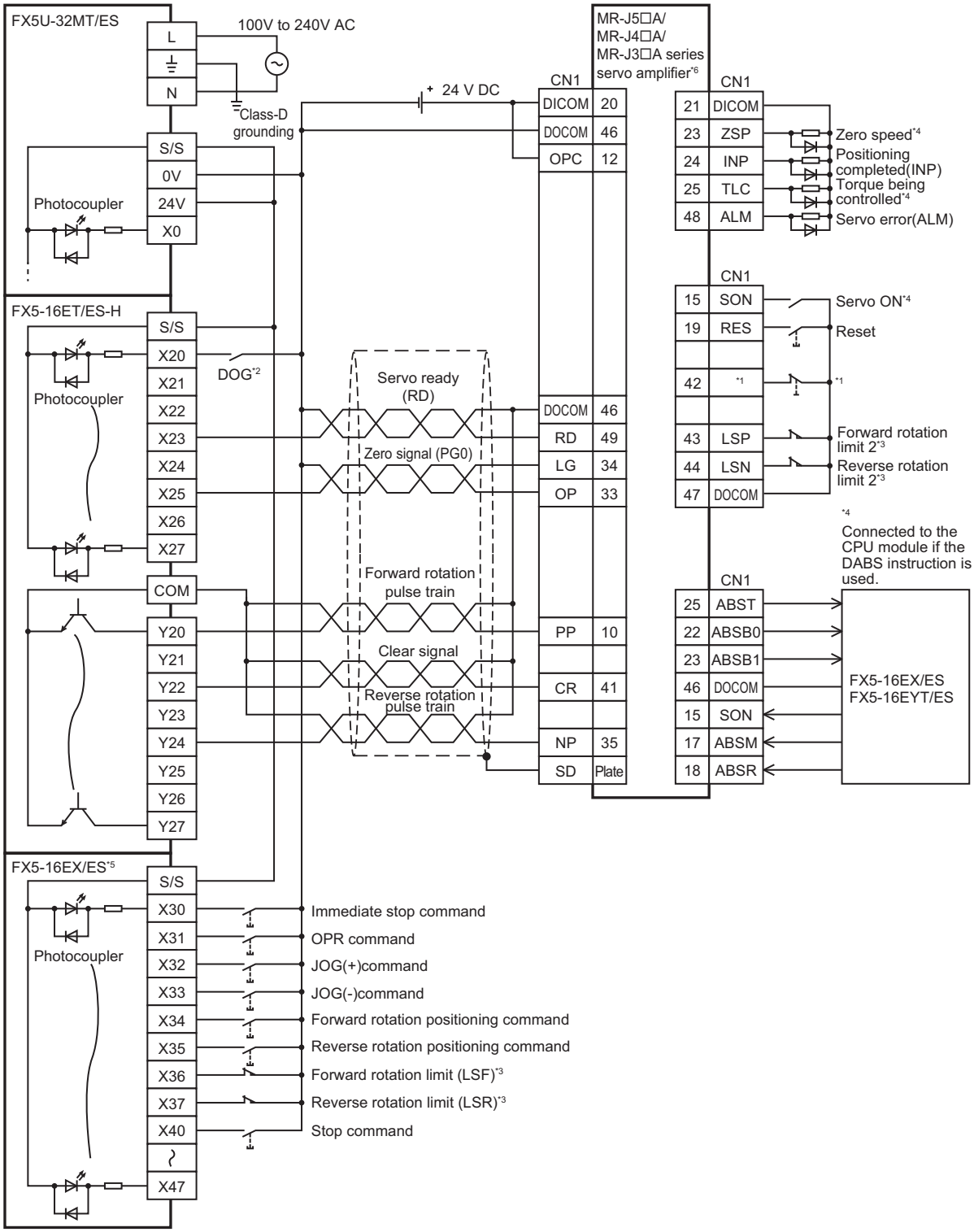
*3 For details, refer to ☞ Page 958 Precautions.

*4 To detect absolute positions, connect this line to the CPU module.
For details, refer to ☞ Page 958 Precautions.

*5 I/O module are used in the connection example. Inputs built into the CPU module are available in place of I/O module.

*6 Set the command pulse input form PA13 as below.
· MR-J5□A type/MR-J4□A type servo amplifier: "0211" (negative logic, signed pulse train, command input pulse train filter 500kpps or less)
· MR-J3□A type servo amplifier: "0011" (negative logic, signed pulse train)

## ■CW/CCW mode




*1 EM2 (forced stop 2) for MR-J5□A type/MR-J4□A type servo amplifier, and EMG (emergency stop) for MR-J3□A type servo amplifier

*2 Near-point signal (DOG)
Any input other than high-speed pulse input/output module can also be used.

*3 For details, refer to ☞ Page 958 Precautions.

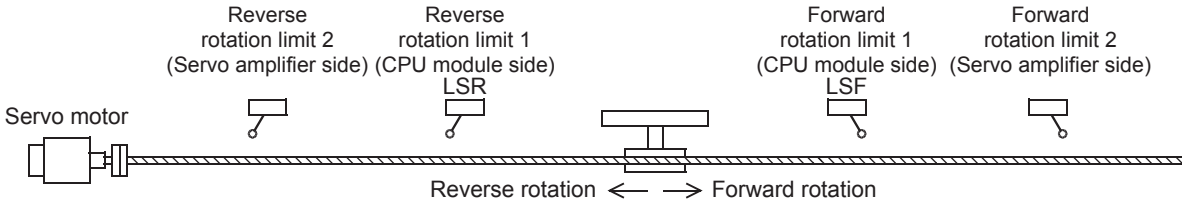
*4 To detect absolute positions, connect this line to the CPU module.
For details, refer to ☞ Page 958 Precautions.

*5 I/O module are used in the connection example. Inputs built into the CPU module are available in place of I/O module.

*6 Set the command pulse input form PA13 as below.
· MR-J5□A type/MR-J4□A type servo amplifier: "0210" (negative logic, forward pulse train, reverse pulse train, command input pulse train filter 500kpps or less)
· MR-J3□A type servo amplifier: "0010" (negative logic, forward pulse train, reverse pulse train)

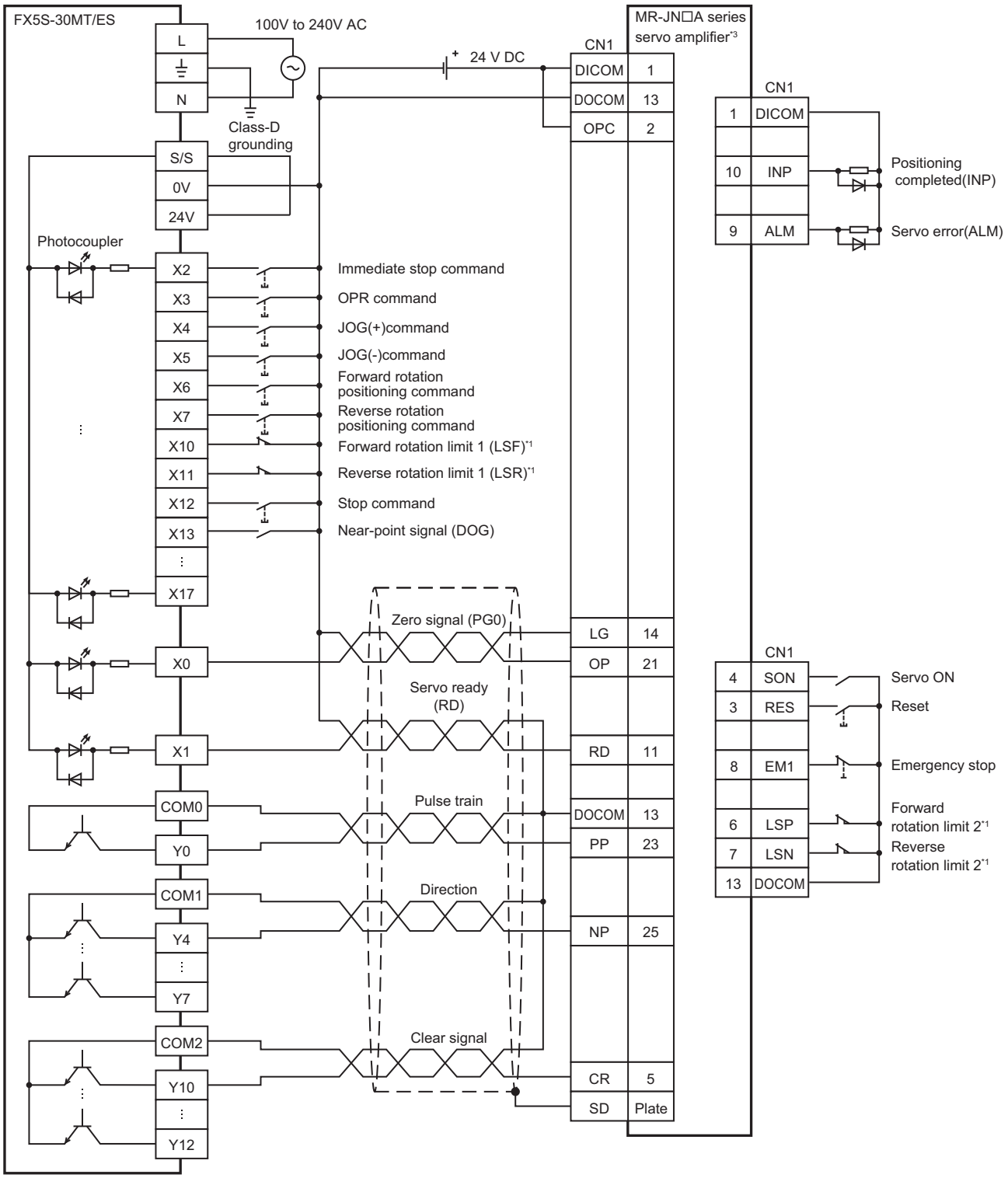
## ■Precautions

- Use a CPU module and I/O module with transistor output.
- Be sure to use the class-D grounding method (grounding resistance: 100 Ω or less).
- To ensure safety, use the forward rotation limit switch and the reverse rotation limit switch on both sides: the CPU module side and the servo amplifier side.
  Note that the limit switches on the CPU module side should be activated slightly earlier than the limit switches on the servo amplifier side.



## FX5S CPU module

### ■PULSE/SIGN mode



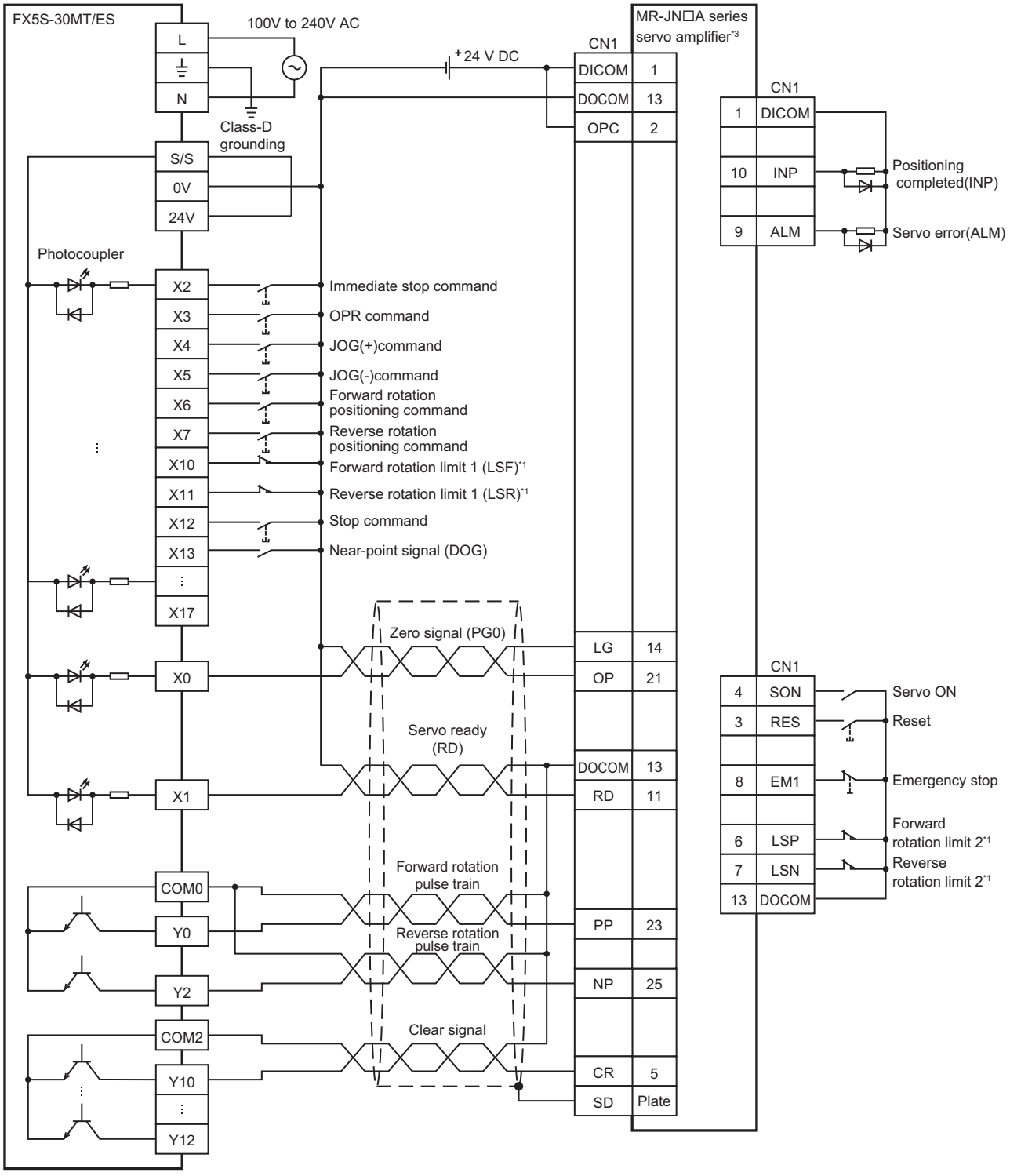

*1 For details, refer to ☞ Page 968 Precautions.

*2 I/O module are used in the connection example. Inputs and outputs built into the CPU module are available in place of I/O module.

*3 Set the command pulse input form (PA13) of the MR-JN□A type servo amplifier to "211" (negative logic, signed pulse train, command input pulse train filter: 100kpps or less).

A

## ■CW/CCW mode



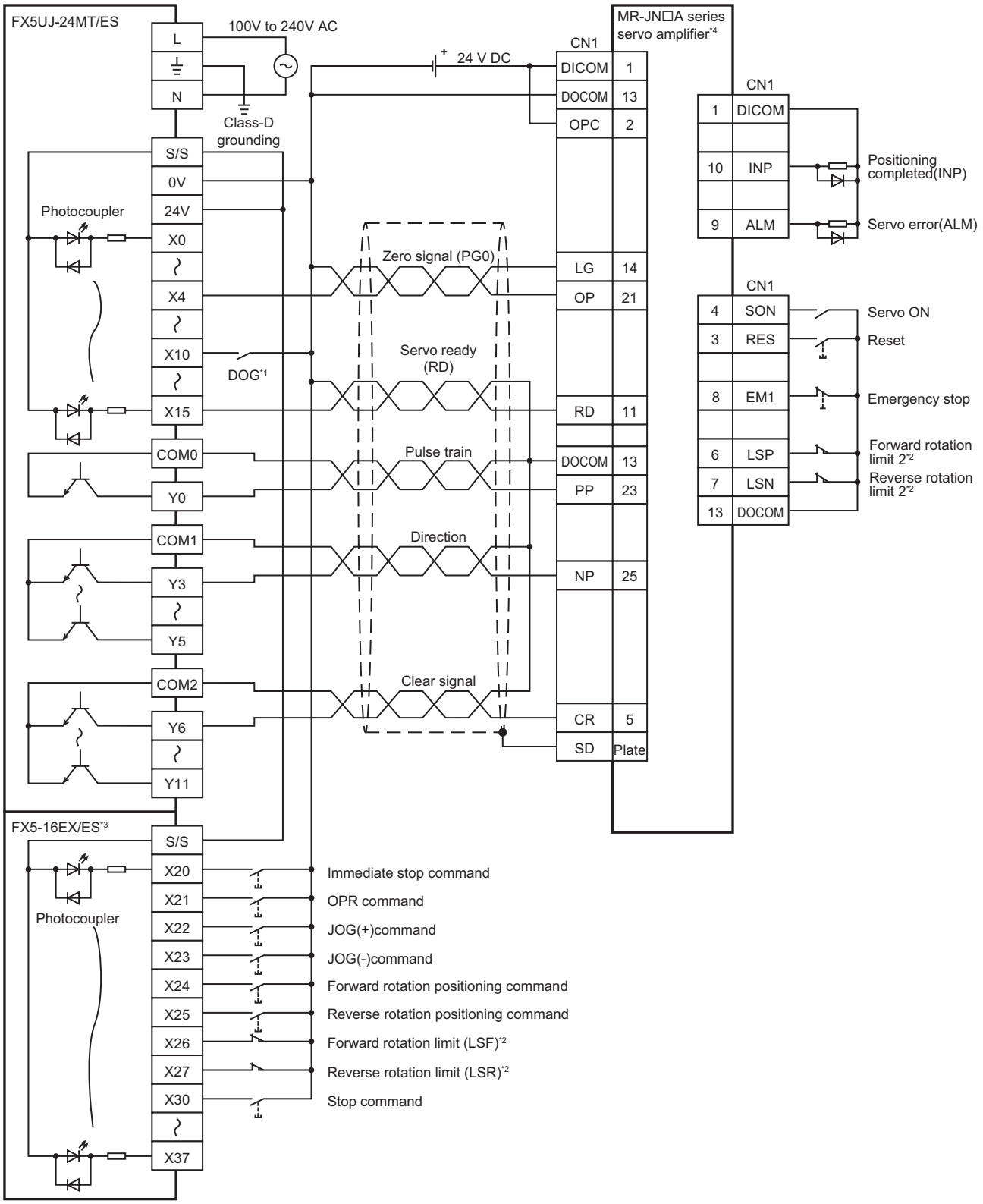

*1 For details, refer to ☞ Page 968 Precautions.

*2 I/O module are used in the connection example. Inputs and outputs built into the CPU module are available in place of I/O module.

*3 Set the command pulse input form (PA13) of the MR-JN□A type servo amplifier to "211" (negative logic, forward rotation pulse train, reverse rotation pulse train, command input pulse train filter: 100kpps or less).

## FX5UJ CPU module

### ■PULSE/SIGN mode




*1 Near-point signal (DOG)

*2 For details, refer to ☞ Page 968 Precautions.

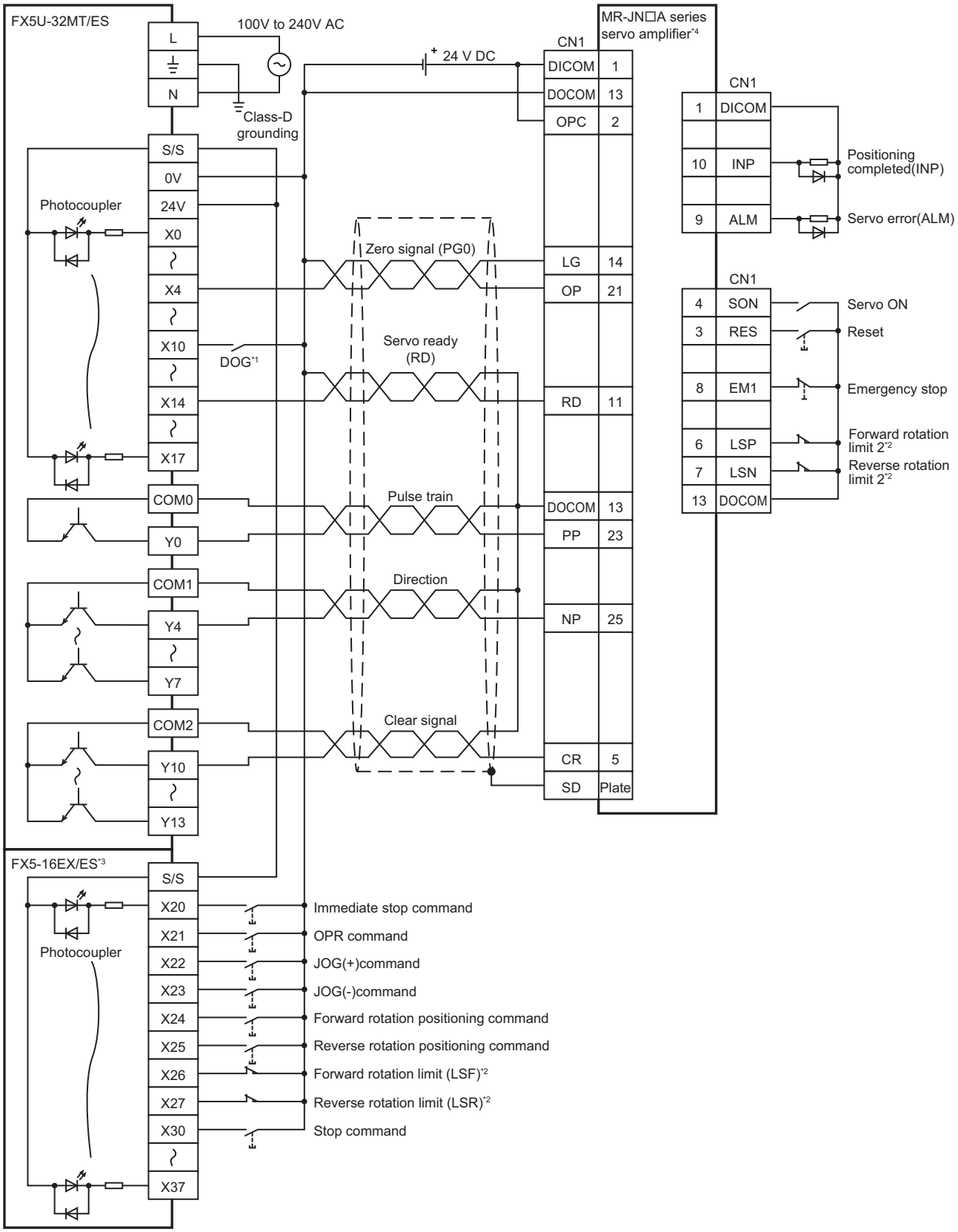
*3 I/O module are used in the connection example. Inputs and outputs built into the CPU module are available in place of I/O module.

*4 Set the command pulse input form (PA13) of the MR-JN□A type servo amplifier to "211" (negative logic, signed pulse train, command input pulse train filter: 200kpps or less).

A

## FX5U CPU module

### ■PULSE/SIGN mode



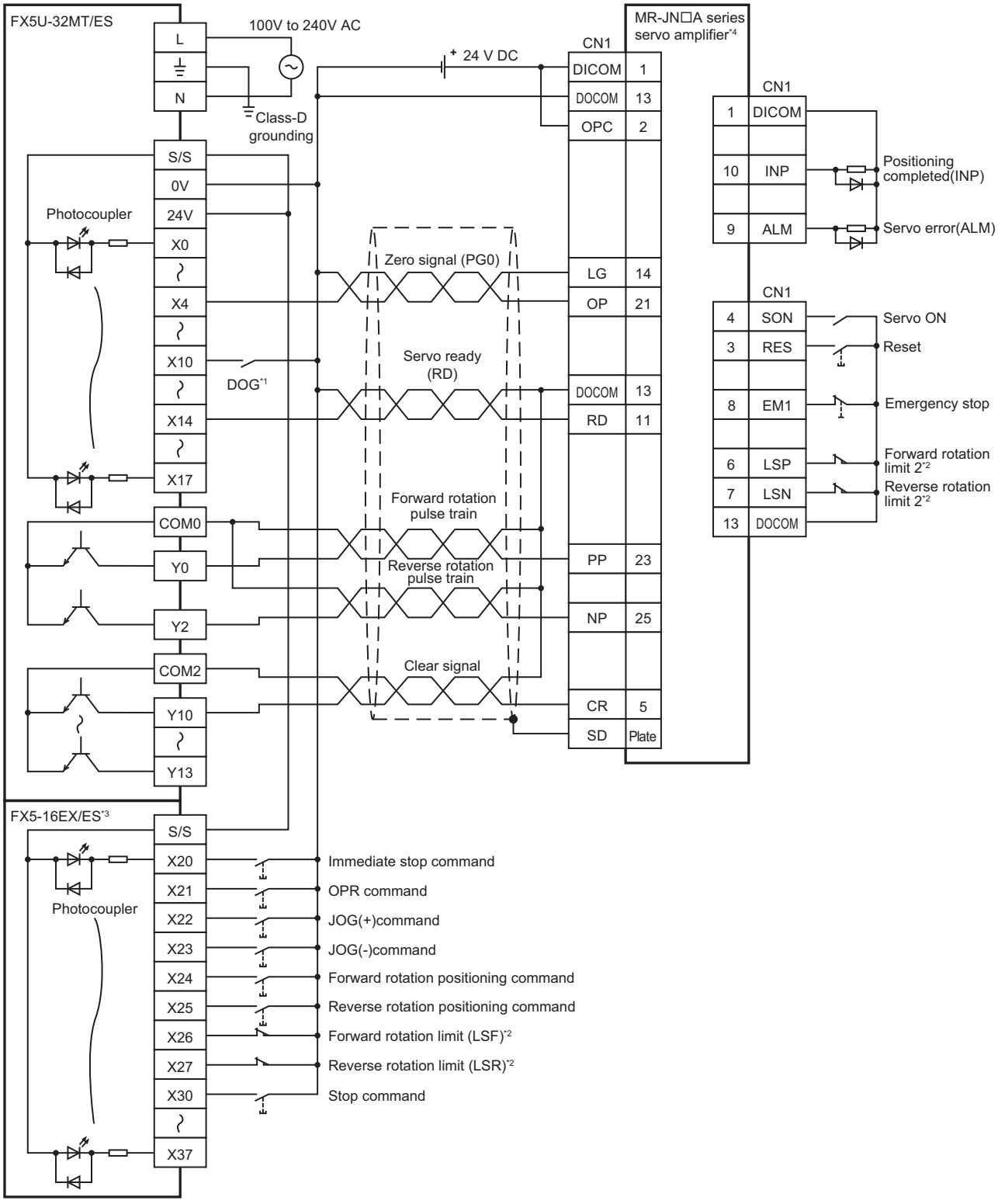

*1 Near-point signal (DOG)

*2 For details, refer to ☞ Page 968 Precautions.

*3 I/O module are used in the connection example. Inputs and outputs built into the CPU module are available in place of I/O module.

*4 Set the command pulse input form (PA13) of the MR-JN□A type servo amplifier to "211" (negative logic, signed pulse train, command input pulse train filter: 200kpps or less).

## ■CW/CCW mode




*1 Near-point signal (DOG)

*2 For details, refer to ☞ Page 968 Precautions.

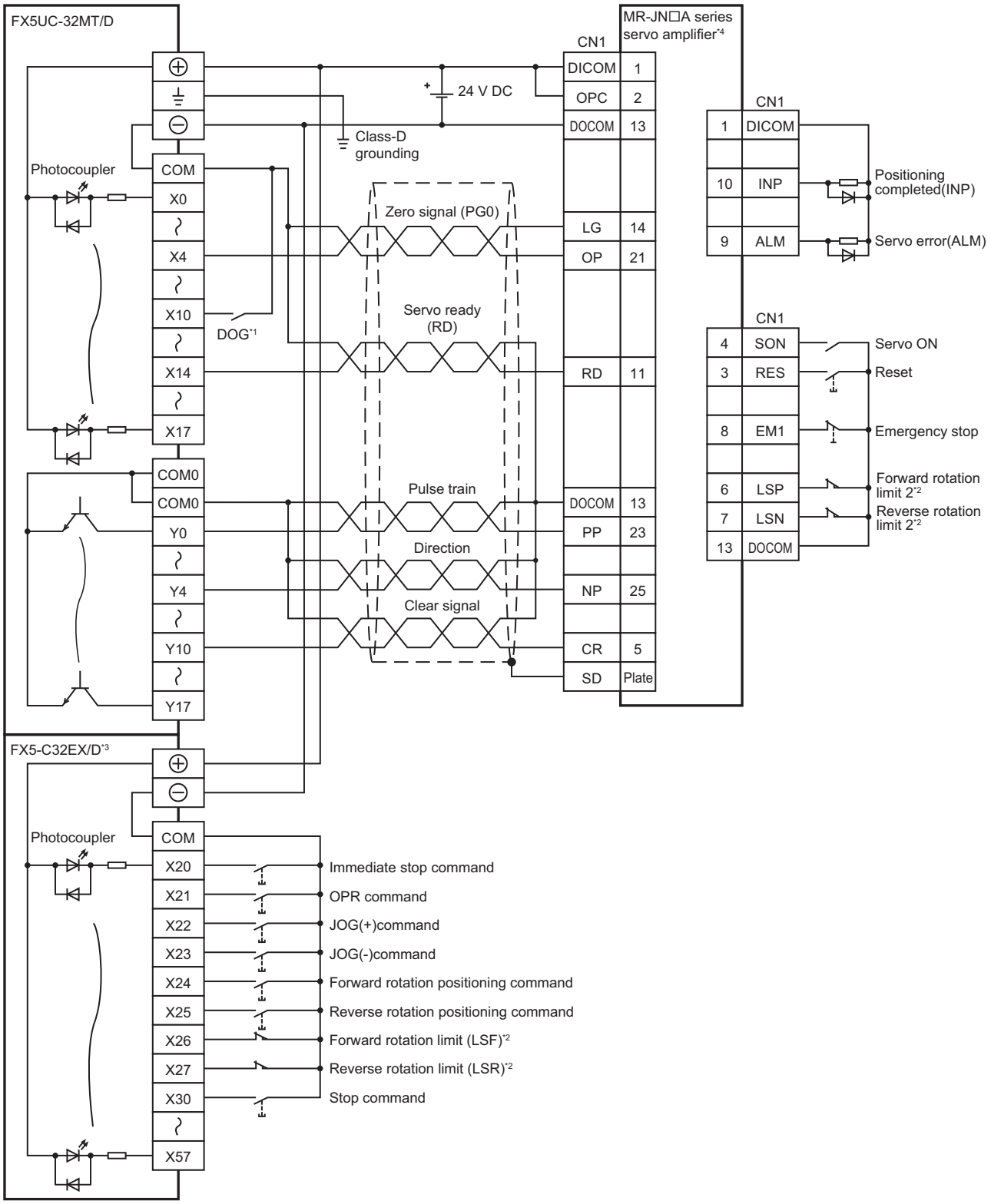
*3 I/O module are used in the connection example. Inputs and outputs built into the CPU module are available in place of I/O module.

*4 Set the command pulse input form (PA13) of the MR-JN□A type servo amplifier to "210" (negative logic, forward rotation pulse train, reverse rotation pulse train, command input pulse train filter: 200kpps or less).

A

## FX5UC CPU module

### ■PULSE/SIGN mode



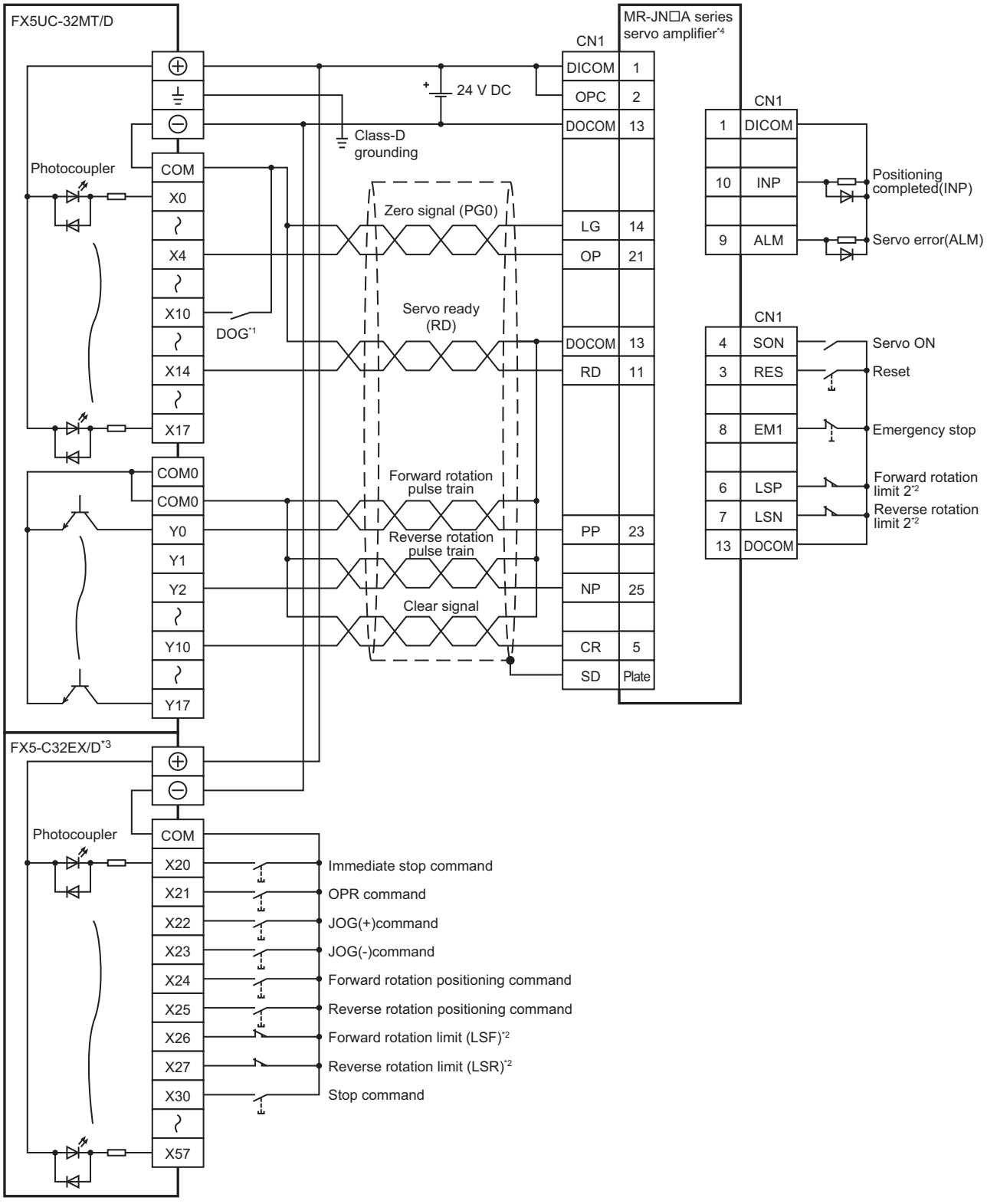

*1 Near-point signal (DOG)

*2 For details, refer to ☞ Page 968 Precautions.

*3 I/O module are used in the connection example. Inputs and outputs built into the CPU module are available in place of I/O module.

*4 Set the command pulse input form (PA13) of the MR-JN□A type servo amplifier to "211" (negative logic, signed pulse train, command input pulse train filter: 200kpps or less).

## ■CW/CCW mode




*1 Near-point signal (DOG)

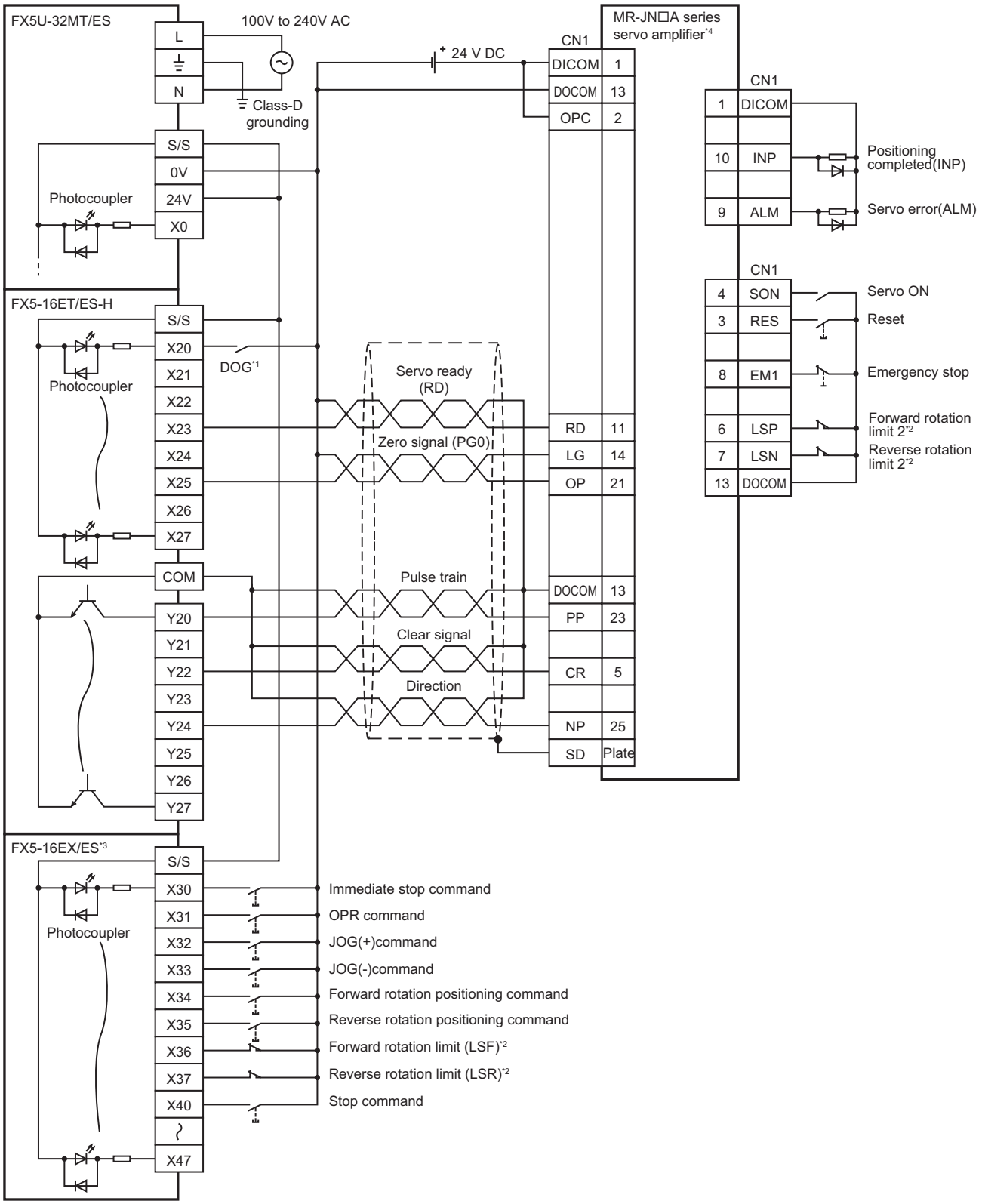
*2 For details, refer to ☞ Page 968 Precautions.

*3 I/O module are used in the connection example. Inputs and outputs built into the CPU module are available in place of I/O module.

*4 Set the command pulse input form (PA13) of the MR-JN□A type servo amplifier to "210" (negative logic, forward rotation pulse train, reverse rotation pulse train, command input pulse train filter: 200kpps or less).

## High-speed pulse input/output module

### ■PULSE/SIGN mode



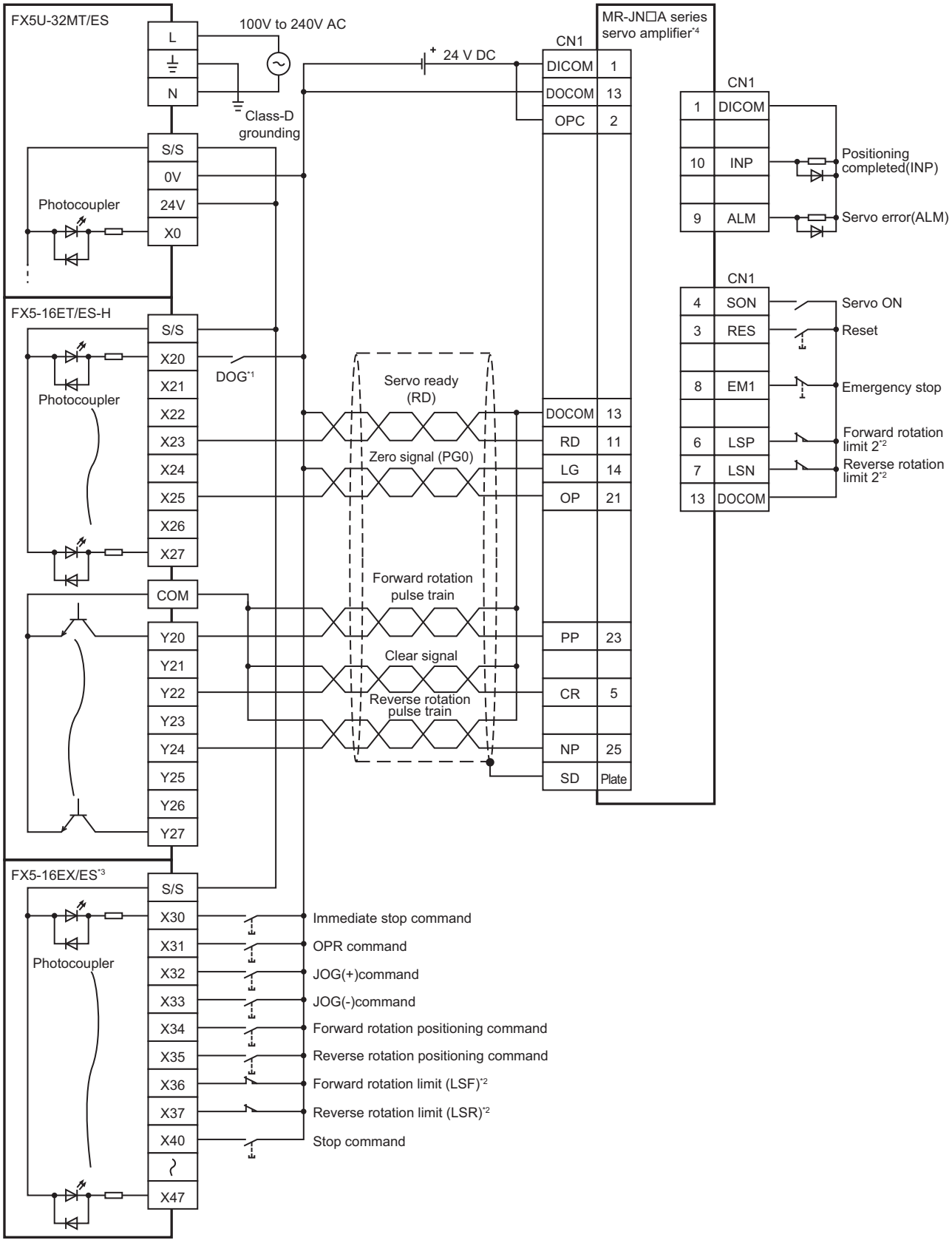

*1 Near-point signal (DOG)
Any input other than high-speed pulse input/output module can also be used.

*2 For details, refer to ☞ Page 968 Precautions.

*3 I/O module are used in the connection example. Inputs built into the CPU module are available in place of I/O module.

*4 Set the command pulse input form (PA13) of the MR-JN□A type servo amplifier to "211" (negative logic, signed pulse train, command input pulse train filter: 200kpps or less).

## ■CW/CCW mode




*1 Near-point signal (DOG)
Any input other than high-speed pulse input/output module can also be used.

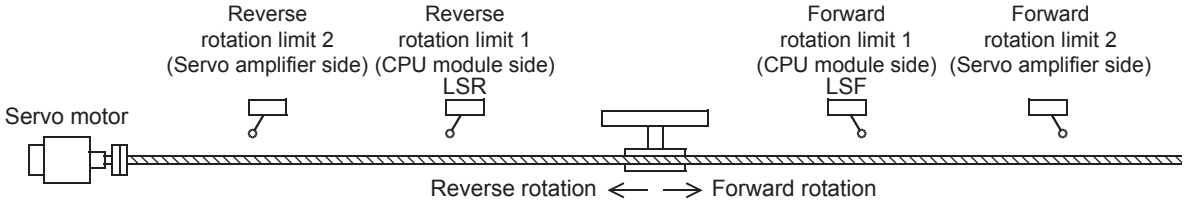
*2 For details, refer to ☞ Page 968 Precautions.

*3 I/O module are used in the connection example. Inputs built into the CPU module are available in place of I/O module.

*4 Set the command pulse input form (PA13) of the MR-JN□A type servo amplifier to "210" (negative logic, forward rotation pulse train, reverse rotation pulse train, command input pulse train filter: 200kpps or less).

## Precautions

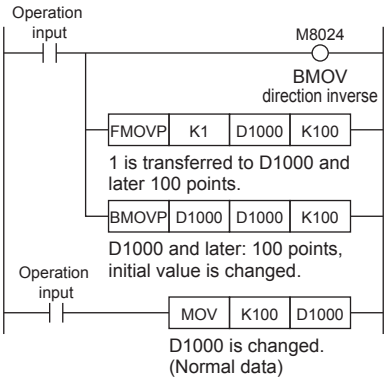
- Use a CPU module and I/O module with transistor output.
- Be sure to use the class-D grounding method (grounding resistance: 100 Ω or less).
- To ensure safety, use the forward rotation limit switch and the reverse rotation limit switch on both sides: the CPU module side and the servo amplifier side.
  Note that the limit switches on the CPU module side should be activated slightly earlier than the limit switches on the servo amplifier side.

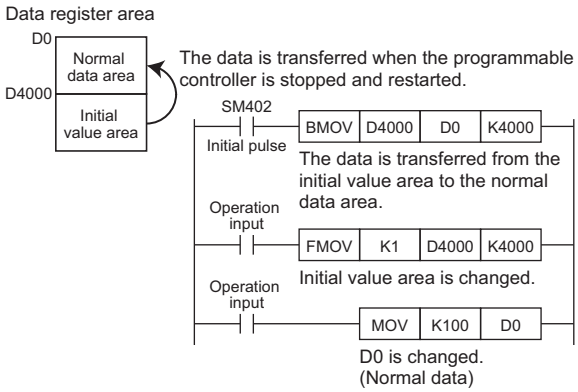


# Appendix 10 Substitute Functions

## File registers

To use a file register of the FX3 programmable controller, use functions of the FX5 programmable controller.
A file register is a device that sets an initial value to a data register that has the same device number. The values of the file registers set in the built-in memory or memory cassette are transferred collectively to the data registers when the power of the FX3 programmable controller is OFF→ON or the programmable controller is STOP→RUN.

<table>
<tr><th>File registers function of FX3 programmable controller</th><th>Substitute function of FX5 programmable controller</th><th>Reference</th></tr>
<tr><td>• The initial value setting of the data register<br>• When the power is OFF→ON or the programmable controller is STOP→RUN, the data register is initialized.</td><td>The setting is possible with the device initial value setting. If the initial value is set, the data register is initialized when the power is OFF→ON, reset, or the programmable controller is STOP→RUN.</td><td>Page 76</td></tr>
<tr><td>The initial value of the data register (FX3 file register) can be changed by the BMOV instruction. When changed by something other than the BMOV instruction, it is treated as a normal data register. When the power is OFF→ON or the programmable controller is STOP→RUN, the value that is changed by the BMOV instruction is the initial value.<br>■Program example<br>When D1000 and later are used as FX3 file registers<br> 

When the above program is executed, the value of D1000 becomes 100. When the programmable controller is stopped and restarted, the initial value "1" specified by the BMOVP instruction is stored in D1000 to D1099.</td><td>Divide data register area into initial value area and normal data area. When the programmable controller is STOP→RUN, transfer the data in the initial value area to the normal data area to use the initial value area as file registers. Use the latch function in the initial value area.<br>■Data register area and program example<br>When D4000 and later are the initial value area<br> 

When the above program is executed, the value of D0 becomes 100. When the programmable controller is stopped and restarted, the initial value "1" that is stored in the initial value area, D4000 to D7999, is transferred to the normal data area, D0 to D3999.</td><td>Page 123</td></tr>
</table>

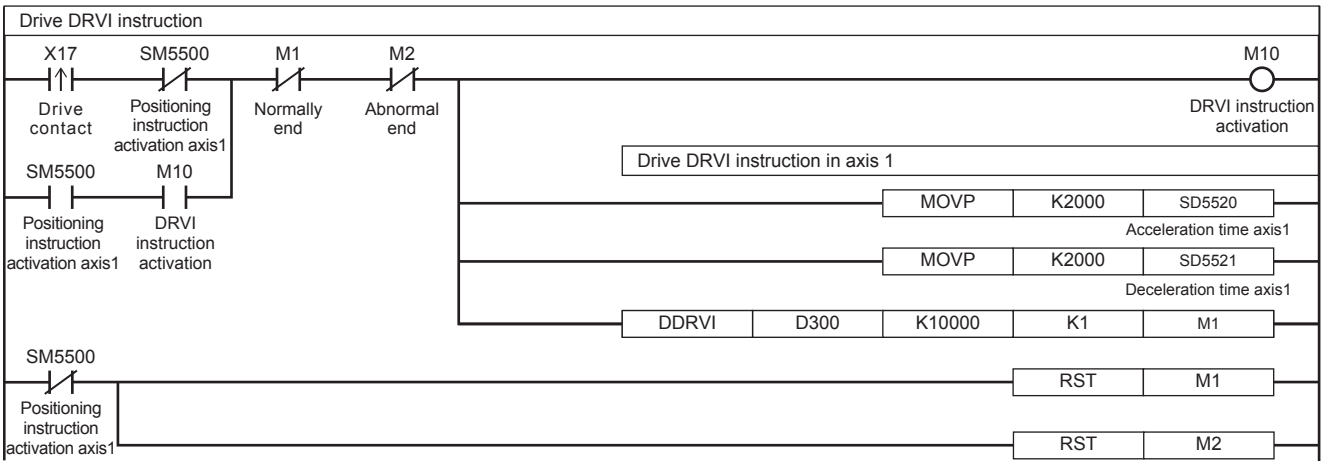
A

# Replacing PLSR/DPLSR instruction to DRVI/DDRVI instruction

The PLSR/DPLSR (pulse output with acceleration and deceleration control) instruction of FX3 can be replaced to the DRVI/DDRVI instruction.

The PLSR/DPLSR instruction can set the duration of time for acceleration and deceleration. Setting the duration of time for acceleration or deceleration before executing the DRVI/DDRVI instruction enables the DRVI/DDRVI instruction to substitute the PLSR/DPLSR instruction.

## Program example




For the stop event, refer to ☞ Page 431 Program example.

# Replacing ZRN/DZRN instruction to DSZR/DDSZR instruction

The ZRN/DZRN (OPR) instruction of FX3 can be replaced to the DSZR/DDSZR instruction.

With the OPR parameters as below, the operation of the DSZR/DDSZR instruction is the same as that of the ZRN/DZRN instruction. Other parameters can be set as desired. For each parameter, refer to ☞ Page 366 POSITIONING PARAMETER.

| OPR Parameter | | Setting value | Reference |
|---|---|---|---|
| Near-point Dog Signal Device No. | | Same device | Page 392 |
| Zero Signal | Device No. | | Page 393 |
| | OPR Zero Signal Counts | 1 | |
| | Count Start Time | 0: Near-point Dog Latter Part | |

# Appendix 11 Added and Enhanced Functions

This section describes added and enhanced functions of the CPU module and the engineering tool, as well as the firmware versions of the CPU module and software versions of the engineering tool corresponding to the functions.
The firmware version can be confirmed with module diagnosis (CPU diagnosis). Refer to the following manuals for details on diagnosing the module (CPU diagnosis).
MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)
Refer to the GX Works3 Operating Manual for details on the software version.

## FX5S CPU module

| Add/Change Function | Supported CPU module firmware version | Supported engineering tool software version | Reference |
|---|---|---|---|
| FX5S CPU module is supported. | From the first | "1.080J" or later | — |
| Number of conversion digits selection by SM705 is supported. | "1.010" or later | "1.095Z" or later | Page 780 |
| SFC function is supported. | "1.010" or later | "1.095Z" or later | MELSEC iQ-F FX5 Programming Manual (Program Design) |
| Input interrupt delay function | "1.010" or later | "1.095Z" or later | Page 111 |
| External input/output forced on/off function | "1.020" or later | "1.100E" or later | Page 135 |
| Data logging file transfer function | "1.020" or later | "1.100E" or later | Page 181 |
| The maximum number of connectable stations in CC-Link IE Field Network Basic was expanded to 16. | "1.040" or later | "1.110Q" or later | CC-Link IE Field Network Basic Reference Manual |
| Heating-cooling PID control function | "1.040" or later | "1.110Q" or later | Page 614 |

## FX5UJ CPU module

| Add/Change Function | Supported CPU module firmware version | Supported engineering tool software version | Reference |
|---|---|---|---|
| FX5UJ CPU module is supported. | From the first | "1.060N" or later | — |
| The following modules are supported.<br>• FX5-SF-MU4T5<br>• FX5-SF-8DI4 | "1.010" or later | "1.075D" or later | MELSEC iQ-F FX5 Safety Extension Module User's Manual |
| The following modules are supported.<br>• FX5-4A-ADP | "1.010" or later | "1.075D" or later | Page 653 |
| User Web page is supported. | "1.020" or later | "1.080J" or later | MELSEC iQ-F FX5 User's Manual (Communication)<br>MELSEC iQ-R/MELSEC iQ-F Web Server Function Guide Book |
| Firmware update function | "1.030" or later | "1.075D" or later | Page 89 |
| Data logging function supports a CSV file format. | "1.030" or later | "1.085P" or later | Page 147<br>Page 918 |
| 1E frame of SLMP is supported. | "1.030" or later | "1.085P" or later | MELSEC iQ-F FX5 User's Manual (Communication) |
| File transfer function instruction (Sending FTP client files) is supported. | "1.030" or later | "1.085P" or later | MELSEC iQ-F FX5 User's Manual (Communication) |
| Supported models for the simple CPU communication function are added. | "1.030" or later | "1.085P" or later | MELSEC iQ-F FX5 User's Manual (Communication) |
| File operation instructions is supported. | "1.030" or later | "1.085P" or later | MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks) |
| Unicode string data transfer instruction is supported. | "1.030" or later | "1.085P" or later | MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks) |

| Add/Change Function | Supported CPU module firmware version | Supported engineering tool software version | Reference |
|---|---|---|---|
| Unicode character string to Shift JIS character string convert instruction is supported. | "1.030" or later | "1.085P" or later | MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks) |
| Shift JIS character string to Unicode character string convert instruction (without byte order mark) is supported. | "1.030" or later | "1.085P" or later | MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks) |
| Shift JIS character string to Unicode convert instruction (with byte order mark) is supported. | "1.030" or later | "1.085P" or later | MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks) |
| The high-speed pulse I/O module is supported. | "1.030" or later | "1.085P" or later | Page 333 |
| Scan time clear function | "1.030" or later | "1.085P" or later | Page 779 |
| Number of conversion digits selection by SM705 is supported. | "1.040" or later | "1.090U" or later | Page 780 |
| SFC function is supported. | "1.050" or later | "1.095Z" or later | MELSEC iQ-F FX5 Programming Manual (Program Design) |
| Input interrupt delay function | "1.050" or later | "1.095Z" or later | Page 111 |
| External input/output forced on/off function | "1.060" or later | "1.100E" or later | Page 135 |
| Data logging file transfer function | "1.060" or later | "1.100E" or later | Page 181 |
| The maximum number of connectable stations in CC-Link IE Field Network Basic was expanded to 16. | "1.080" or later | "1.110Q" or later | CC-Link IE Field Network Basic Reference Manual |
| Heating-cooling PID control function | "1.080" or later | "1.110Q" or later | Page 614 |

## FX5U/FX5UC CPU module

| Add/Change Function | Supported CPU module firmware version | Supported engineering tool software version | Reference |
|---|---|---|---|
| The following module is supported.<br>• FX5-4AD-ADP | From the first version | "1.007H" or later | Page 653 |
| The number of settable high-speed comparison tables was changed from maximum 4 to 32. | "1.015" or later*1 | "1.015R" or later | Page 254 |
| The number of high-speed comparisons was changed from 4 to 32. | "1.015" or later*1 | "1.015R" or later | Page 286 |
| The following modules are supported.<br>• FX5-16ET/ES-H<br>• FX5-16ET/ESS-H | "1.030" or later | "1.025B" or later | Page 232 |
| Interrupt input signal 1 high-speed mode is added | "1.030" or later | "1.025B" or later | Page 383 |
| All module reset when a stop error occurs is added | "1.030" or later | "1.025B" or later | Page 385 |
| Positioning table data retaining function is added | "1.030" or later | "1.025B" or later | Page 492 |
| Firmware update function | From the first version*2 | —*3 | Page 89 |
| Data logging function | "1.040" or later*4 | "1.64S" or later*5 | Page 147 |
| Event history function | "1.040" or later*6 | "1.030G" or later | Page 130 |
| Internal buffer capacity setting | "1.040" or later*4 | "1.030G" or later | Page 206 |
| PID control operation setting (ACT)<br>• Overshoot suppression setting<br>• Hunting suppression setting | "1.040" or later | "1.030G" or later | Page 574 |
| The following modules are supported.<br>• FX5-4AD-PT-ADP<br>• FX5-4AD-TC-ADP | "1.040" or later | "1.030G" or later | Page 653 |
| File transfer function (FTP server) | "1.040" or later*4*7 | "1.030G" or later | MELSEC iQ-F FX5 User's Manual (Communication) |

| Add/Change Function | Supported CPU module firmware version | Supported engineering tool software version | Reference |
|---|---|---|---|
| iQ Sensor Solution<br>• Automatic detection of connected devices<br>• Communication setting reflection of Ethernet device<br>• Sensor parameter read/write | "1.040" or later | "1.030G" or later | iQ Sensor Solution Reference Manual |
| CC-Link IE Field Network Basic function | "1.040" or later | "1.030G" or later | CC-Link IE Field Network Basic Reference Manual |
| Data backup/restoration function | "1.045" or later*8 | — | Page 206 |
| Memory dump function | "1.050" or later*4 | "1.035M" or later | Page 197 |
| IP filter function | "1.050" or later | "1.035M" or later | MELSEC iQ-F FX5 User's Manual (Communication) |
| Parallel link function | "1.050" or later | "1.035M" or later | MELSEC iQ-F FX5 User's Manual (Communication) |
| The following module is supported.<br>• FX5-CCL-MS | "1.050" or later | "1.035M" or later | MELSEC iQ-F FX5 CC-Link System Master/Intelligent Device Module User's Manual |
| The following module is supported.<br>• FX5-20PG-P | "1.050" or later | "1.035M" or later | Page 333 |
| The following modules are supported.<br>• FX5-8AD | "1.050" or later | "1.035M" or later | MELSEC iQ-F FX5 Analog Module User's Manual |
| The following modules are supported.<br>• FX5-4LC | "1.050" or later | "1.035M" or later | MELSEC iQ-F FX5 Temperature Control Module User's Manual |
| The following module is supported.<br>• FX5-ASL-M | "1.050" or later | "1.035M" or later | MELSEC iQ-F FX5 AnyWireASLINK System Master Module User's Manual |
| Real-time monitor function | "1.060" or later | *9 | Page 208 |
| Support extended file register function | "1.060" or later*4 | "1.040S" or later | Page 65 |
| MODBUS/TCP communication function | "1.060" or later | "1.040S" or later | MELSEC iQ-F FX5 User's Manual (Communication) |
| Time setting function (SNTP client) | "1.060" or later | "1.040S" or later | MELSEC iQ-F FX5 User's Manual (Communication) |
| Web server function | "1.060" or later | "1.040S" or later | MELSEC iQ-F FX5 User's Manual (Communication)<br>MELSEC iQ-R/MELSEC iQ-F Web Server Function Guide Book |
| Support S(P).DEVLD, SP.DEVST, ERREAD, ERWRITE, ERINIT and RTM instruction | "1.060" or later*10 | "1.040S" or later | MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks) |
| Support "Use MC/MCR for control of EN" of the subroutine type FB | "1.060" or later | "1.040S" or later | GX Works3 Operating Manual |
| The following modules are supported.<br>• FX5-4AD<br>• FX5-4DA | "1.050" or later | "1.040S" or later | MELSEC iQ-F FX5 Analog Module User's Manual |
| During IP address duplication with the device on the same network, the operation was improved to output the information of the external device with duplicated IP address. | "1.061" or later | — | MELSEC iQ-F FX5 User's Manual (Communication) |
| Keep of latch label during PC write by SM9353 | "1.065" or later | — | Page 126 |
| Expanding the number of input/output points to 384 points. | "1.100" or later | "1.047Z" or later | MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware) |
| Removing the limitation on the number of remote I/O points. (384 points)<br>(However, the total number of remote I/O points and input/output points is 512 points or less.) | "1.100" or later | "1.047Z" or later | MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware) |
| Expanding the program capacity up to 128000 steps. | "1.100" or later | "1.047Z" or later | MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware) |

| Add/Change Function | Supported CPU module firmware version | Supported engineering tool software version | Reference |
|---|---|---|---|
| Divided writing of the program and program restoration information of online change | "1.100" or later | "1.047Z" or later | Page 107 |
| User Web page is supported. | "1.100" or later | "1.047Z" or later | MELSEC iQ-F FX5 User's Manual (Communication)<br>MELSEC iQ-R/MELSEC iQ-F Web Server Function Guide Book |
| The following module is supported.<br>• FX5-20PG-D | "1.050" or later | "1.050C" or later | MELSEC iQ-F FX5 Positioning Module User's Manual |
| The following module is supported.<br>• FX5-ENET | "1.110" or later | "1.050C" or later | MELSEC iQ-F FX5 Ethernet Module User's Manual |
| The following module is supported.<br>• FX5-DP-M | "1.110" or later | "1.050C" or later | MELSEC iQ-F FX5 PROFIBUS-DP Master Module User's Manual |
| Expanding the number of remote I/O station of CC-Link IE field network Basic from 6 to 16 stations. | "1.110" or later | "1.050C" or later | MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware) |
| 1C frame of MC protocol | "1.110" or later | "1.050C" or later | MELSEC iQ-F FX5 User's Manual (Communication) |
| The following modules support the module diagnostics and event history function.<br>• FX5-20PG-P[*11]<br>• FX5-20PG-D[*11]<br>• FX5-ENET | "1.110" or later | "1.050C" or later | Page 130 |
| Simple CPU communication function | "1.110" or later | "1.050C" or later | MELSEC iQ-F FX5 User's Manual (Communication) |
| The following modules are supported.<br>• FX5-SF-MU4T5<br>• FX5-SF-8DI4 | "1.200" or later | "1.060N" or later | MELSEC iQ-F FX5 Safety Extension Module User's Manual |
| Down counting for LC0 to LC34 is supported. | "1.201" or later | "1.060N" or later | MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks) |
| The area capacity in the device/label memory area setting (standard area) increased from 48K to 63K. | "1.210" or later | "1.065T" or later | Page 79 |
| Data logging function supports a CSV file format. | "1.210" or later[*12] | "1.106K" or later[*5] | Page 147<br>Page 918 |
| The following modules are supported.<br>• FX5-CCLGN-MS | "1.210" or later | "1.065T" or later | MELSEC iQ-F FX5 CC-Link IE TSN Master/Local Module User's Manual |
| The following modules support the parameter setting function by the program.<br>• FX5-CCL-MS | "1.210" or later | "1.065T" or later | MELSEC iQ-F FX5 CC-Link System Master/Intelligent Device Module User's Manual |
| 1E frame of SLMP is supported. | "1.210" or later | — | MELSEC iQ-F FX5 User's Manual (Communication) |
| File transfer function instruction (Sending FTP client files) is supported. | "1.210" or later | "1.065T" or later | MELSEC iQ-F FX5 User's Manual (Communication) |
| Supported models for the simple CPU communication function are added. | "1.210" or later | "1.065T" or later | MELSEC iQ-F FX5 User's Manual (Communication) |
| SFC programs are supported. | "1.220" or later | "1.070Y" or later | MELSEC iQ-F FX5 Programming Manual (Program Design) |
| Instructions for SFC programs are supported. | "1.220" or later | "1.070Y" or later | MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks) |
| The following modules are supported.<br>• FX5-40SSC-G<br>• FX5-80SSC-G | "1.230" or later | "1.072A" or later | MELSEC iQ-F FX5 Motion Module/Simple Motion Module User's Manual (Startup) |
| Firmware update function using engineering tool. | "1.240" or later | "1.075D" or later | Page 95 |

| Add/Change Function | Supported CPU module firmware version | Supported engineering tool software version | Reference |
|---|---|---|---|
| File operation instructions is supported. | "1.240" or later | "1.075D" or later | MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks) |
| Unicode string data transfer instruction is supported. | "1.240" or later | "1.075D" or later | MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks) |
| Unicode character string to Shift JIS character string convert instruction is supported. | "1.240" or later | "1.075D" or later | MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks) |
| Shift JIS character string to Unicode character string convert instruction (without byte order mark) is supported. | "1.240" or later | "1.075D" or later | MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks) |
| Shift JIS character string to Unicode convert instruction (with byte order mark) is supported. | "1.240" or later | "1.075D" or later | MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks) |
| Retrieving FTP client files instruction is supported. | "1.240" or later | "1.075D" or later | MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks) |
| The following module is supported.<br>• FX5-4A-ADP | "1.240" or later | "1.075D" or later | Page 653 |
| The following modules are supported.<br>• FX5-40SSC-G Ver.1.001<br>• FX5-80SSC-G Ver.1.001 | "1.250" or later | "1.080J" or later | MELSEC iQ-F FX5 Motion Module User's Manual (CC-Link IE TSN) |
| The processing time when a file is specified for the SP.FMOVE file operation instruction was improved. | "1.250" or later | "1.080J" or later | Page 917 |
| Scan time clear function | "1.270" or later | "1.085P" or later | Page 779 |
| Heating-cooling PID control function | "1.280" or later | "1.090U" or later | Page 614 |
| Number of conversion digits selection by SM705 is supported. | "1.280" or later | "1.090U" or later | Page 780 |
| Heating-cooling PID control function supports the overlap/dead band function. | "1.290" or later | "1.095Z" or later | Page 604 |
| Input interrupt delay function | "1.290" or later | "1.095Z" or later | Page 111 |
| External input/output forced on/off function | "1.300" or later | "1.100E" or later | Page 135 |
| Data logging file transfer function | "1.300" or later | "1.100E" or later | Page 181 |
| Heating-cooling PID control function supports the control response parameter. | "1.320" or later | "1.110Q" or later | Page 631 |

*1 Supported with CPU module serial No. 158**** or later.
*2 Data memory (device comment file) save/recovery is supported with "1.030" or later.
Data memory (device comment file) recovery retry is supported with "1.045" or later.
File password setting for the firmware update prohibited file is supported with "1.045" or later.
Data memory (restored information files, parameter files) save/recovery/recovery retry is supported with "1.060" or later.
*3 Writing firmware update prohibited files is supported with "1.030G" or later.
*4 Supported with CPU module serial No. 16Y**** or later.
*5 Indicates the compatible software version of CPU Module Logging Configuration Tool and GX LogViewer.
*6 Saving the event history file to the SD memory card is supported from CPU module serial No. 16Y**** or later.
*7 Write the file, delete the file, remote password and file password is supported with "1.050" or later.
*8 Data backup function is supported from CPU module serial No. 16Y**** or later.
The data memory for the backup/restoration target data is supported from "1.050" or later.
*9 GX Works3: "1.040S" or later
GX LogViewer: "1.76E" or later
*10 ERREAD, ERWRITE, ERINIT instruction is supported from CPU module serial No. 16Y**** or later.
*11 Supported from the firmware version 1.010 or later of FX5-20PG-P and FX5-20PG-D.
*12 Supported with CPU module serial No. 17X**** or later.

Restriction

- To update the firmware of the FX5U/FX5UC CPU module to version "1.100" or later, use the CPU module with serial No. as follows.

- FX5UC-32MT/DS-TS and FX5UC-32MT/DSS-TS: Serial No.178****
- FX5U/FX5UC CPU module other than the above: Serial No.17X****

- For the FX5U/FX5UC CPU module with the serial No. 2114001 or later, downgrading to previous firmware version "1.220" or earlier cannot be performed. Update error (3040H) will occur and the firmware will not be updated.
- For the FX5UJ CPU module with the serial No. 2154001 or later, downgrading to previous firmware version "1.010" or earlier cannot be performed. Update error (3040H) will occur and the firmware will not be updated.
- For the FX5UJ-□MT/D□ and the FX5UJ-□MR/D□, downgrading to previous firmware version "1.050" or earlier cannot be performed. Update error (3040H) will occur and the firmware will not be updated.

# INDEX



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# REVISIONS

*The manual number is given on the bottom left of the back cover.

| Revision date | Revision | Description |
|---|---|---|
| October 2014 | A | First Edition |
| January 2015 | B | ■Added functions<br>Fixed scan execution type program, Online change, PID control function, FX3-compatible high-speed counter function, Routine timer<br>■Added or modified parts<br>Section 1.3, 3.1, 3.2, Chapter 4, 7, 8, 9, 12, 13, 17, Section 19.2, Chapter 20, Section 21.2, Appendix 1, 2, 3, 4 |
| April 2015 | C | A part of the cover design is changed. |
| May 2016 | D | ■Added modules<br>FX5U-32MR/DS, FX5U-32MT/DS, FX5U-32MT/DSS, FX5UC-64MT/D, FX5UC-64MT/DSS, FX5UC-96MT/D, FX5UC-96MT/DSS, FX5-16ET/ES-H, FX5-16ET/ESS-H<br>■Added or modified parts<br>RELEVANT MANUALS, TERMS, Section 1.1, 1.5, Chapter 4, Section 7.1, Section 9.3, 9.6, 9.8, 11.1, Chapter 12, Section 14.2, 15.1, Chapter 18, 19, Section 21.2, 21.4, 21.7, 21.9, 21.10, Chapter 22, Appendix, WARRANTY |
| October 2016 | E | ■Added modules<br>FX5U-64MR/DS, FX5U-64MT/DS, FX5U-64MT/DSS, FX5U-80MR/DS, FX5U-80MT/DS, FX5U-80MT/DSS<br>■Added functions<br>Firmware update function, Data logging function, Event history function, Internal buffer capacity setting<br>■Added or modified parts<br>Terms, Section 1.1, 1.4, 1.5, 3.1, 3.2, Chapter 4, 5, 7, Section 10.3, 10.5, 10.6, 10.7, 10.8, 12.1, 13.2, Chapter 14, Section 17.1, Chapter 19, 20, Section 22.1, 23.2, 24.2, Appendix 1, 2, 3, 4, 5, 6, 7, 9 |
| October 2016 | F | ■Added or modified parts<br>Chapter 5, Section 19.2 |
| January 2017 | G | ■Added functions<br>Data backup/restoration function<br>■Added or modified parts<br>Section 3.2, Chapter 4, 5, Section 7.1, 8.1, 17.1, Chapter 19, Section 20.2, Chapter 21, Section 23.1, Appendix 1, 2, 3, 9 |
| April 2017 | H | ■Added functions<br>Memory dump function<br>■Added or modified parts<br>RELEVANT MANUALS, TERMS, Chapter 3, 4, 14, Section 17.1, Chapter 19, 20, 22, Appendix 1, 2, 3, 4, 9 |
| October 2017 | J | ■Added functions<br>Real-time monitor function, extended file register<br>■Added or modified parts<br>RELEVANT MANUALS, TERMS, Chapter 3, 4, 5, 14, Section 17.1, 20.4, Chapter 21, 23, Section 25.1, 27.1, 27.6, Appendix 1, 2, 3, 4, 9 |
| April 2018 | K | ■Added functions<br>Keep of latch label during PC write<br>■Added or modified parts<br>Section 10.8, 16.5, 22.1, Appendix 1, 2, 3, 4, 8, 9 |
| July 2018 | L | ■Added or modified parts<br>TERMS, Chapter 4, 5, Section 8.1, Chapter 14, Section 18.2, 24.2, 26.1, 26.2, 26.3, 26.6, 28.2, 28.9, Appendix 1, 3, 4, 9 |
| November 2018 | M | ■Added or modified parts<br>RELEVANT MANUALS, TERMS, Section 3.1, 3.3, Chapter 4, 5, Section 12.1, 12.2, 12.3, Chapter 13, 19, Section 23.2, 24.2, Appendix 1, 2, 3, 4, 5, 9 |
| October 2019 | N | ■Added modules<br>FX5UJ-24MR/ES, FX5UJ-24MT/ES, FX5UJ-24MT/ESS, FX5UJ-40MR/ES, FX5UJ-40MT/ES, FX5UJ-40MT/ESS, FX5UJ-60MR/ES, FX5UJ-60MT/ES, FX5UJ-60MT/ESS, FX5UC-32MT/DS-TS, FX5UC-32MT/DSS-TS, FX5UC-32MR/DS-TS<br>■Added or modified parts<br>RELEVANT MANUALS, TERMS, Section 1.1, 1.4, 1.5, 3.1, 3.2, 3.3, Chapter 4, 5, Section 6.1, 7.1, 7.2, Chapter 9, Section 10.8, Chapter 11, Section 12.3, Chapter 13, 14, 15, Section 16.1, 17.2, 17.3, 18.2, Chapter 19, Section 20.1, 20.2, 20.13, 21.4, 21.7, 21.9, 23.1, 23.2, Chapter 24, 25, 26, Section 27.2, 28.2, 28.5, 28.9, Appendix 1, 2, 3, 7, 9, TRADEMARKS |

| Revision date | Revision | Description |
|---|---|---|
| May 2020 | P | ■Added functions<br>Data logging function (CSV file output format)<br>■Added or modified parts<br>RELEVANT MANUALS, TERMS, Section 3.2, Chapter 4, Section 10.2, Chapter 13, 20, Section 24.1, 24.2, 26.6, Appendix 1, 2, 3, 4, 6, 7, 9, TRADEMARKS |
| August 2020 | Q | ■Added or modified parts<br>SAFETY PRECAUTIONS, WARRANTY |
| October 2020 | R | ■Added or modified parts<br>RELEVANT MANUALS, Section 1.4, 1.5, Chapter 2, Section 3.2, Chapter 4, 5, Section 8.1, Chapter 21, Section 23.1, Chapter 24, Section 26.1, 26.2, 28.1, 28.2, 28.10, 28.11, Appendix 1, 2, 3, 4, 5, 6, 9 |
| January 2021 | S | ■Added or modified parts<br>Section 3.1, Chapter 5, Section 21.4, 28.5, 28.12, Appendix 9 |
| April 2021 | T | ■Added functions<br>Firmware update function using engineering tool<br>■Added or modified parts<br>RELEVANT MANUALS, TERMS, Section 3.2, Chapter 5, 20, Section 28.13, Appendix 1, 2, 3, 7, 9 |
| October 2021 | U | ■Added or modified parts<br>RELEVANT MANUALS, TERMS, GENERIC TERMS AND ABBREVIATIONS, Section 5.1, 5.2, 10.8, Appendix 2 |
| April 2022 | V | ■Added modules<br>FX5S-30MR/ES, FX5S-40MR/ES, FX5S-60MR/ES, FX5S-80MR/ES, FX5S-30MT/ES, FX5S-40MT/ES, FX5S-60MT/ES, FX5S-80MT/ES, FX5S-30MT/ESS, FX5S-40MT/ESS, FX5S-60MT/ESS, FX5S-80MT/ESS<br>■Added functions<br>Scan time clear function<br>■Added or modified parts<br>INTRODUCTION, RELEVANT MANUALS, GENERIC TERMS AND ABBREVIATIONS, Section 1.1, 1.4, 3.1, 3.2, Chapter 4, 5, Section 6.1, 11.1, 13.2, 13.3, 13.4, Chapter 15, Section 17.2, 17.3, Chapter 18, 19, 20, 21, Section 23.1, 23.2, Chapter 24, 26, Section 28.1, 28.2, 28.4, 28.5, 28.10, 28.11, Appendix 1, 2, 3, 4, 6, 7, 9 |
| October 2022 | W | ■Added functions<br>Heating-cooling PID control function<br>■Added or modified parts<br>GENERIC TERMS AND ABBREVIATIONS, Chapter 4, Section 5.2, Chapter 11, 21, Section 29.2, Appendix 1, 2, 3, 4, 5, 9 |
| April 2023 | X | ■Added function<br>Input interrupt delay function<br>■Added or modified parts<br>Overall revision according to the manual composition change |
| July 2023 | Y | ■Added modules<br>FX5UJ-24MR/DS, FX5UJ-24MT/DS, FX5UJ-24MT/DSS, FX5UJ-40MR/DS, FX5UJ-40MT/DS, FX5UJ-40MT/DSS, FX5UJ-60MR/DS, FX5UJ-60MT/DS, FX5UJ-60MT/DSS<br>■Added or modified parts<br>INTRODUCTION, GENERIC TERMS AND ABBREVIATIONS, Chapter 8, Section 9.1, 9.2, 14.1, 14.2, 14.3, Chapter 18, Appendix 3, 11 |
| October 2023 | Z | ■Added functions<br>External input/output forced on/off function, data logging file transfer function<br>■Added or modified parts<br>Overall revision according to the manual composition change<br>RELEVANT MANUALS, Chapter 8, Section 10.1, Chapter 17, Section 20.5, 20.6, Chapter 37, Appendix 1, 2, 3, 4, 8, 9, 11 |
| December 2023 | AA | ■Added or modified parts<br>Section 37.6, 37.8 |
| April 2024 | AB | ■Added or modified parts<br>Section 15.2, 15.3, 26.1, 37.6, 37.7, 37.8 |
| July 2024 | AC | ■Added modules<br>FX5S-30MR/DS, FX5S-30MT/DS, FX5S-30MT/DSS, FX5S-40MR/DS, FX5S-40MT/DS, FX5S-40MT/DSS, FX5S-60MR/DS, FX5S-60MT/DS, FX5S-60MT/DSS, FX5S-80MR/DS, FX5S-80MT/DS, FX5S-80MT/DSS<br>■Added or modified parts<br>INTRODUCTION, GENERIC TERMS AND ABBREVIATIONS, Chapter 9 |
| October 2024 | AD | ■Added or modified parts<br>Chapter 8, Section 36.6, Section 37.2, Appendix 2, 3, 4, 11 |

Japanese manual number: JY997D54301AB

# WARRANTY

Please confirm the following product warranty details before using this product.

## 1. Gratis Warranty Term and Gratis Warranty Range

If any faults or defects (hereinafter "Failure") found to be the responsibility of Mitsubishi occurs during use of the product within the gratis warranty term, the product shall be repaired at no cost via the sales representative or Mitsubishi Service Company. However, if repairs are required onsite at domestic or overseas location, expenses to send an engineer will be solely at the customer's discretion. Mitsubishi shall not be held responsible for any re-commissioning, maintenance, or testing on-site that involves replacement of the failed module.

**[Gratis Warranty Term]**

The gratis warranty term of the product shall be for one year after the date of purchase or delivery to a designated place. Note that after manufacture and shipment from Mitsubishi, the maximum distribution period shall be six (6) months, and the longest gratis warranty term after manufacturing shall be eighteen (18) months. The gratis warranty term of repair parts shall not exceed the gratis warranty term before repairs.

**[Gratis Warranty Range]**

(1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.

(2) Even within the gratis warranty term, repairs shall be charged for in the following cases.
   1. Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
   2. Failure caused by unapproved modifications, etc., to the product by the user.
   3. When the Mitsubishi product is assembled into a user's device, Failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.
   4. Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.
   5. Relay failure or output contact failure caused by usage beyond the specified life of contact (cycles).
   6. Failure caused by external irresistible forces such as fires or abnormal voltages, and failure caused by force majeure such as earthquakes, lightning, wind and water damage.
   7. Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
   8. Any other failure found not to be the responsibility of Mitsubishi or that admitted not to be so by the user.

## 2. Onerous repair term after discontinuation of production

(1) Mitsubishi shall accept onerous product repairs for seven (7) years after production of the product is discontinued.
Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.

(2) Product supply (including repair parts) is not available after production is discontinued.

## 3. Overseas service

Overseas, repairs shall be accepted by Mitsubishi's local overseas FA Center. Note that the repair conditions at each FA Center may differ.

## 4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to:

(1) Damages caused by any cause found not to be the responsibility of Mitsubishi.

(2) Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products.

(3) Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products.

(4) Replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

## 5. Changes in product specifications

The specifications given in the catalogs, manuals or technical documents are subject to change without prior notice.

## 6. Product application

(1) In using the Mitsubishi MELSEC programmable controller, the usage conditions shall be that the application will not lead to a major accident even if any problem or fault should occur in the programmable controller device, and that backup and fail-safe functions are systematically provided outside of the device for any problem or fault.

(2) The Mitsubishi programmable controller has been designed and manufactured for applications in general industries, etc. Thus, applications in which the public could be affected such as in nuclear power plants and other power plants operated by respective power companies, and applications in which a special quality assurance system is required, such as for railway companies or public service purposes shall be excluded from the programmable controller applications.
In addition, applications in which human life or property that could be greatly affected, such as in aircraft, medical applications, incineration and fuel devices, manned transportation, equipment for recreation and amusement, and safety devices, shall also be excluded from the programmable controller range of applications.
However, in certain cases, some applications may be possible, providing the user consults their local Mitsubishi representative outlining the special requirements of the project, and providing that all parties concerned agree to the special circumstances, solely at the user's discretion.

(3) Mitsubishi shall have no responsibility or liability for any problems involving programmable controller trouble and system trouble caused by DoS attacks, unauthorized access, computer viruses, and other cyberattacks.

# INFORMATION AND SERVICES

For further information and services, please contact your local Mitsubishi Electric sales office or representative.
Visit our website to find our locations worldwide.

MITSUBISHI ELECTRIC Factory Automation Global Website
Locations Worldwide
www.MitsubishiElectric.com/fa/about-us/overseas/

# TRADEMARKS

Manual number: JY997D55401AD
MODEL: FX5-U-OU-E
MODEL CODE: 09R537

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