

Motion Controller



Q173D(S)CPU/Q172D(S)CPU Motion Controller (SV22) Programming Manual (VIRTUAL MODE)

-Q172DCPU -Q173DCPU -Q172DCPU-S1 -Q173DCPU-S1 -Q172DSCPU -Q173DSCPU



● SAFETY PRECAUTIONS ●

(Please read these instructions before using this equipment.)

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

These precautions apply only to this product. Refer to the Q173D(S)CPU/Q172D(S)CPU Users manual for a description of the Motion controller safety precautions.

In this manual, the safety instructions are ranked as "DANGER" and "CAUTION".



Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.

Indicates that incorrect handling may cause hazardous conditions, resulting in medium or slight personal injury or physical damage.

Depending on circumstances, procedures indicated by A CAUTION may also be linked to serious results.

In any case, it is important to follow the directions for usage.

Please save this manual to make it accessible when required and always forward it to the end user.

For Safe Operations

1. Prevention of electric shocks

▲DANGER

- Never open the front case or terminal covers while the power is ON or the unit is running, as this may lead to electric shocks.
- Never run the unit with the front case or terminal cover removed. The high voltage terminal and charged sections will be exposed and may lead to electric shocks.
- Never open the front case or terminal cover at times other than wiring work or periodic inspections even if the power is OFF. The insides of the Motion controller and servo amplifier are charged and may lead to electric shocks.
- Completely turn off the externally supplied power used in the system before mounting or removing the module, performing wiring work, or inspections. Failing to do so may lead to electric shocks.
- When performing wiring work or inspections, turn the power OFF, wait at least ten minutes, and then check the voltage with a tester, etc. Failing to do so may lead to electric shocks.
- Be sure to ground the Motion controller, servo amplifier and servo motor. (Ground resistance : 100 Ω or less) Do not ground commonly with other devices.
- The wiring work and inspections must be done by a qualified technician.
- Wire the units after installing the Motion controller, servo amplifier and servo motor. Failing to do so may lead to electric shocks or damage.
- Never operate the switches with wet hands, as this may lead to electric shocks.
- Do not damage, apply excessive stress, place heavy things on or sandwich the cables, as this may lead to electric shocks.
- Do not touch the Motion controller, servo amplifier or servo motor terminal blocks while the power is ON, as this may lead to electric shocks.
- Do not touch the built-in power supply, built-in grounding or signal wires of the Motion controller and servo amplifier, as this may lead to electric shocks.

2. For fire prevention

▲CAUTION

- Install the Motion controller, servo amplifier, servo motor and regenerative resistor on incombustible. Installing them directly or close to combustibles will lead to fire.
- If a fault occurs in the Motion controller or servo amplifier, shut the power OFF at the servo amplifier's power source. If a large current continues to flow, fire may occur.
- When using a regenerative resistor, shut the power OFF with an error signal. The regenerative resistor may abnormally overheat due to a fault in the regenerative transistor, etc., and may lead to fire.
- Always take heat measures such as flame proofing for the inside of the control panel where the servo amplifier or regenerative resistor is installed and for the wires used. Failing to do so may lead to fire.
- Do not damage, apply excessive stress, place heavy things on or sandwich the cables, as this may lead to fire.

3. For injury prevention

- Do not apply a voltage other than that specified in the instruction manual on any terminal.
 Doing so may lead to destruction or damage.
- Do not mistake the terminal connections, as this may lead to destruction or damage.
- Do not mistake the polarity (+/-), as this may lead to destruction or damage.
- Do not touch the heat radiating fins of controller or servo amplifier, regenerative resistor and servo motor, etc., while the power is ON and for a short time after the power is turned OFF. In this timing, these parts become very hot and may lead to burns.
- Always turn the power OFF before touching the servo motor shaft or coupled machines, as these parts may lead to injuries.
- Do not go near the machine during test operations or during operations such as teaching. Doing so may lead to injuries.

4. Various precautions

Strictly observe the following precautions.

Mistaken handling of the unit may lead to faults, injuries or electric shocks.

(1) System structure

≜CAUTION

- Always install a leakage breaker on the Motion controller and servo amplifier power source.
- If installation of an electromagnetic contactor for power shut off during an error, etc., is specified in the instruction manual for the servo amplifier, etc., always install the electromagnetic contactor.
- Install the emergency stop circuit externally so that the operation can be stopped immediately and the power shut off.
- Use the Motion controller, servo amplifier, servo motor and regenerative resistor with the correct combinations listed in the instruction manual. Other combinations may lead to fire or faults.
- Use the Motion controller, base unit and motion module with the correct combinations listed in the instruction manual. Other combinations may lead to faults.
- If safety standards (ex., robot safety rules, etc.,) apply to the system using the Motion controller, servo amplifier and servo motor, make sure that the safety standards are satisfied.
- Construct a safety circuit externally of the Motion controller or servo amplifier if the abnormal operation of the Motion controller or servo amplifier differ from the safety directive operation in the system.
- In systems where coasting of the servo motor will be a problem during the forced stop, emergency stop, servo OFF or power supply OFF, use dynamic brakes.
- Make sure that the system considers the coasting amount even when using dynamic brakes.
- In systems where perpendicular shaft dropping may be a problem during the forced stop, emergency stop, servo OFF or power supply OFF, use both dynamic brakes and electromagnetic brakes.

- The dynamic brakes must be used only on errors that cause the forced stop, emergency stop, or servo OFF. These brakes must not be used for normal braking.
- The brakes (electromagnetic brakes) assembled into the servo motor are for holding applications, and must not be used for normal braking.
- The system must have a mechanical allowance so that the machine itself can stop even if the stroke limits switch is passed through at the max. speed.
- Use wires and cables that have a wire diameter, heat resistance and bending resistance compatible with the system.
- Use wires and cables within the length of the range described in the instruction manual.
- The ratings and characteristics of the parts (other than Motion controller, servo amplifier and servo motor) used in a system must be compatible with the Motion controller, servo amplifier and servo motor.
- Install a cover on the shaft so that the rotary parts of the servo motor are not touched during operation.
- There may be some cases where holding by the electromagnetic brakes is not possible due to the life or mechanical structure (when the ball screw and servo motor are connected with a timing belt, etc.). Install a stopping device to ensure safety on the machine side.
- To maintain the safety of the programmable controller system against unauthorized access from external devices via the network, take appropriate measures. To maintain the safety against unauthorized access via the Internet, take measures such as installing a firewall.

(2) Parameter settings and programming

- Set the parameter values to those that are compatible with the Motion controller, servo amplifier, servo motor and regenerative resistor model and the system application. The protective functions may not function if the settings are incorrect.
- The regenerative resistor model and capacity parameters must be set to values that conform to the operation mode, servo amplifier and servo power supply module. The protective functions may not function if the settings are incorrect.
- Set the mechanical brake output and dynamic brake output validity parameters to values that are compatible with the system application. The protective functions may not function if the settings are incorrect.
- Set the stroke limit input validity parameter to a value that is compatible with the system application. The protective functions may not function if the setting is incorrect.
- Set the servo motor encoder type (increment, absolute position type, etc.) parameter to a value that is compatible with the system application. The protective functions may not function if the setting is incorrect.
- Set the servo motor capacity and type (standard, low-inertia, flat, etc.) parameter to values that are compatible with the system application. The protective functions may not function if the settings are incorrect.

- Set the servo amplifier capacity and type parameters to values that are compatible with the system application. The protective functions may not function if the settings are incorrect.
- Use the program commands for the program with the conditions specified in the instruction manual.
- Set the sequence function program capacity setting, device capacity, latch validity range, I/O assignment setting, and validity of continuous operation during error detection to values that are compatible with the system application. The protective functions may not function if the settings are incorrect.
- Some devices used in the program have fixed applications, so use these with the conditions specified in the instruction manual.
- The input devices and data registers assigned to the link will hold the data previous to when communication is terminated by an error, etc. Thus, an error correspondence interlock program specified in the instruction manual must be used.
- Use the interlock program specified in the intelligent function module's instruction manual for the program corresponding to the intelligent function module.

(3) Transportation and installation

- Transport the product with the correct method according to the mass.
- Use the servo motor suspension bolts only for the transportation of the servo motor. Do not transport the servo motor with machine installed on it.
- Do not stack products past the limit.
- When transporting the Motion controller or servo amplifier, never hold the connected wires or cables.
- When transporting the servo motor, never hold the cables, shaft or detector.
- When transporting the Motion controller or servo amplifier, never hold the front case as it may fall off.
- When transporting, installing or removing the Motion controller or servo amplifier, never hold the edges.
- Install the unit according to the instruction manual in a place where the mass can be withstood.
- Do not get on or place heavy objects on the product.
- Always observe the installation direction.
- Keep the designated clearance between the Motion controller or servo amplifier and control panel inner surface or the Motion controller and servo amplifier, Motion controller or servo amplifier and other devices.
- Do not install or operate Motion controller, servo amplifiers or servo motors that are damaged or that have missing parts.
- Do not block the intake/outtake ports of the Motion controller, servo amplifier and servo motor with cooling fan.
- Do not allow conductive matter such as screw or cutting chips or combustible matter such as oil enter the Motion controller, servo amplifier or servo motor.

- The Motion controller, servo amplifier and servo motor are precision machines, so do not drop or apply strong impacts on them.
- Securely fix the Motion controller, servo amplifier and servo motor to the machine according to the instruction manual. If the fixing is insufficient, these may come off during operation.
- Always install the servo motor with reduction gears in the designated direction. Failing to do so may lead to oil leaks.
- Store and use the unit in the following environmental conditions.

F an in an t	Conditions		
Environment	Motion controller/Servo amplifier	Servo motor	
Ambient temperature	According to each instruction manual.	0°C to +40°C (With no freezing) (32°F to +104°F)	
Ambient humidity	According to each instruction manual.	80% RH or less (With no dew condensation)	
Storage temperature	According to each instruction manual.	-20°C to +65°C (-4°F to +149°F)	
Atmosphere	Indoors (where not subject to direct sunlight). No corrosive gases, flammable gases, oil mist or dust must exist		
Altitude	According to each instruction manual		
Vibration	According to each instruction manual		

• When coupling with the synchronous encoder or servo motor shaft end, do not apply impact such as by hitting with a hammer. Doing so may lead to detector damage.

- Do not apply a load larger than the tolerable load onto the synchronous encoder and servo motor shaft. Doing so may lead to shaft breakage.
- When not using the module for a long time, disconnect the power line from the Motion controller or servo amplifier.
- Place the Motion controller and servo amplifier in static electricity preventing vinyl bags and store.
- When storing for a long time, please contact with our sales representative. Also, execute a trial operation.
- 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.

(4) Wiring

- Correctly and securely wire the wires. Reconfirm the connections for mistakes and the terminal screws for tightness after wiring. Failing to do so may lead to run away of the servo motor.
- After wiring, install the protective covers such as the terminal covers to the original positions.
- Do not install a phase advancing capacitor, surge absorber or radio noise filter (option FR-BIF) on the output side of the servo amplifier.
- Correctly connect the output side (terminal U, V, W) and ground. Incorrect connections will lead the servo motor to operate abnormally.
- Do not connect a commercial power supply to the servo motor, as this may lead to trouble.
- Do not mistake the direction of the surge absorbing diode installed on the DC relay for the control signal output of brake signals, etc. Incorrect installation may lead to signals not being output when trouble occurs or the protective functions not functioning.



- Do not connect or disconnect the connection cables between each unit, the encoder cable or PLC expansion cable while the power is ON.
- Securely tighten the cable connector fixing screws and fixing mechanisms. Insufficient fixing may lead to the cables coming off during operation.
- Do not bundle the power line or cables.

(5) Trial operation and adjustment

▲CAUTION

- Confirm and adjust the program and each parameter before operation. Unpredictable movements may occur depending on the machine.
- Extreme adjustments and changes may lead to unstable operation, so never make them.
- When using the absolute position system function, on starting up, and when the Motion controller or absolute position motor has been replaced, always perform a home position return.
- Before starting test operation, set the parameter speed limit value to the slowest value, and make sure that operation can be stopped immediately by the forced stop, etc. if a hazardous state occurs.

(6) Usage methods

≜CAUTION

- Immediately turn OFF the power if smoke, abnormal sounds or odors are emitted from the Motion controller, servo amplifier or servo motor.
- Always execute a test operation before starting actual operations after the program or parameters have been changed or after maintenance and inspection.
- Do not attempt to disassemble and repair the units excluding a qualified technician whom our company recognized.
- Do not make any modifications to the unit.
- Keep the effect or electromagnetic obstacles to a minimum by installing a noise filter or by using wire shields, etc. Electromagnetic obstacles may affect the electronic devices used near the Motion controller or servo amplifier.
- When using the CE Mark-compliant equipment, refer to the User's manual for the Motion controllers and refer to the corresponding EMC guideline information for the servo amplifiers, inverters and other equipment.
- Use the units with the following conditions.

Item	Conditions
Input power	According to each instruction manual.
Input frequency	According to each instruction manual.
Tolerable momentary power failure	According to each instruction manual.

(7) Corrective actions for errors



machine. (Design the machine so that personal safety can be ensured even if the machine restarts suddenly.)

(8) Maintenance, inspection and part replacement

- Perform the daily and periodic inspections according to the instruction manual.
- Perform maintenance and inspection after backing up the program and parameters for the Motion controller and servo amplifier.
- Do not place fingers or hands in the clearance when opening or closing any opening.
- Periodically replace consumable parts such as batteries according to the instruction manual.
- Do not touch the lead sections such as ICs or the connector contacts.
- Before touching the module, always touch grounded metal, etc. to discharge static electricity from human body. Failure to do so may cause the module to fail or malfunction.
- Do not directly touch the module's conductive parts and electronic components. Touching them could cause an operation failure or give damage to the module.
- Do not place the Motion controller or servo amplifier on metal that may cause a power leakage or wood, plastic or vinyl that may cause static electricity buildup.
- Do not perform a megger test (insulation resistance measurement) during inspection.
- When replacing the Motion controller or servo amplifier, always set the new module settings correctly.
- When the Motion controller or absolute value motor has been replaced, carry out a home position return operation using one of the following methods, otherwise position displacement could occur.
 - 1) After writing the servo data to the Motion controller using programming software, switch on the power again, then perform a home position return operation.
 - 2) Using the backup function of the programming software, load the data backed up before replacement.
- After maintenance and inspections are completed, confirm that the position detection of the absolute position detector function is correct.
- Do not drop or impact the battery installed to the module. Doing so may damage the battery, causing battery liquid to leak in the battery. Do not use the dropped or impacted battery, but dispose of it.
- Do not short circuit, charge, overheat, incinerate or disassemble the batteries.
- The electrolytic capacitor will generate gas during a fault, so do not place your face near the Motion controller or servo amplifier.
- The electrolytic capacitor and fan will deteriorate. Periodically replace these to prevent secondary damage from faults. Replacements can be made by our sales representative.
- Lock the control panel and prevent access to those who are not certified to handle or install electric equipment.
- Do not burn or break a module and servo amplifier. Doing so may cause a toxic gas.

(9) About processing of waste

When you discard Motion controller, servo amplifier, a battery (primary battery) and other option articles, please follow the law of each country (area).

▲CAUTION

• This product is not designed or manufactured to be used in equipment or systems in situations that can affect or endanger human life.

When considering this product for operation in special applications such as machinery or systems used in passenger transportation, medical, aerospace, atomic power, electric power, or submarine repeating applications, please contact your nearest Mitsubishi Electric sales representative.

Although this product was manufactured under conditions of strict quality control, you are strongly advised to install safety devices to forestall serious accidents when it is used in facilities where a breakdown in the product is likely to cause a serious accident.

(10) General cautions

All drawings provided in the instruction manual show the state with the covers and safety partitions removed to explain detailed sections. When operating the product, always return the covers and partitions to the designated positions, and operate according to the instruction manual.

REVISIONS

* The manual number is given on the bottom left of the back cover.

Print Date	* Manual Number	Revision
Sep., 2007	IB(NA)-0300137-A	First edition
Nov., 2009	IB(NA)-0300137-B	[Additional model] MR-J3W-□B, MR-J3-□B-RJ080W, MR-J3-□BS [Additional correction/partial correction] Safety precautions, About Manuals, Restrictions by the software's version or serial number, Servo amplifier display servo error code (#8008+20), Amplifier-less operation status flag (SM508), SSCNET control (Status_SD508), SSCNET control (Command_SD803), Advanced S-curve acceleration/deceleration, Error code list, Warranty
Sep., 2011	IB(NA)-0300137-C	[Additional model] Q173DCPU-S1, Q172DCPU-S1, GX Works2, MR Configurator2 [Additional correction/partial correction] Safety precautions, About Manuals, Restrictions by the software's version, Error code list
Mar., 2012	IB(NA)-0300137-D	[Additional model] Q173DSCPU, Q172DSCPU, Q171ENC-W8, MR-J4-□B, MR-J4W-□B [Additional function] Speed-torque control [Additional correction/partial correction] About Manuals, Manual page organization, Restrictions by the software's version, Programming software version, PI-PID switching command (M3217+20n), Parameter error number (#8009+20n), Servo status 1 (#8010+20n), Servo status 2 (#8011+20n), Servo status 3 (#8012+20n), Maximum motion operation cycle (SD524), System setting error information (SD550, SD551), Error code list, Processing time of the Motion CPU
Sep., 2012	IB(NA)-0300137-E	[Additional correction/partial correction] About Manuals, Restrictions by the software's version, Programming software version, External forced stop input ON latch flag (SM506), Operation method (SD560), Error code list, Processing time of the Motion CPU
Apr., 2013	IB(NA)-0300137-F	[Additional correction/partial correction] About Manuals, Restrictions by the software's version, Error code list
Nov., 2013	IB(NA)-0300137-G	[Additional correction/partial correction] Safety precautions, Restrictions by the software's version, Error code list
Dec., 2015	IB(NA)-0300137-H	[Additional correction/partial correction] Restrictions by the software's version, Servo status7 (#8018+20n), Error codes stored using the Motion CPU, Warranty
Mar., 2017	IB(NA)-0300137-J	[Additional correction/partial correction] Safety precautions, Restrictions by the software's version, Error code list, Warranty
Dec., 2019	IB(NA)-0300137-K	[Additional correction/partial correction] Servo status1 (#8010+20n)

Japanese Manual Number IB(NA)-0300129

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INTRODUCTION

Thank you for choosing the Mitsubishi Electric Motion controller Q173D(S)CPU/Q172D(S)CPU. Before using the equipment, please read this manual carefully to develop full familiarity with the functions and performance of the Motion controller you have purchased, so as to ensure correct use.

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About Manuals

The following manuals are also related to this product.

When necessary, order them by quoting the details in the tables below.

Related Manuals

(1) Motion controller

Manual Name	Manual Number (Model Code)
Q173D(S)CPU/Q172D(S)CPU Motion controller User's Manual This manual explains specifications of the Motion CPU modules, Q172DLX Servo external signal interface module, Q172DEX Synchronous encoder interface module, Q173DPX Manual pulse generator interface module, Power supply modules, Servo amplifiers, SSCNETIL cables and Synchronous encoder, and the maintenance/inspection for the system, trouble shooting and others.	IB-0300133 (1XB927)
Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON) This manual explains the Multiple CPU system configuration, performance specifications, common parameters, auxiliary/applied functions, error lists and others.	IB-0300134 (1XB928)
Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (Motion SFC) This manual explains the functions, programming, debugging, error lists for Motion SFC and others.	IB-0300135 (1XB929)
Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE) This manual explains the servo parameters, positioning instructions, device lists, error lists and others.	IB-0300136 (1XB930)
Q173D(S)CPU/Q172D(S)CPU Motion controller (SV22) Programming Manual (VIRTUAL MODE) This manual explains the dedicated instructions to use the synchronous control by virtual main shaft, mechanical system program create mechanical module, servo parameters, positioning instructions, device lists, error lists and others.	IB-0300137 (1XB931)
Q173DSCPU/Q172DSCPU Motion controller (SV22) Programming Manual (Advanced Synchronous Control) This manual explains the dedicated instructions to use the synchronous control by synchronous control parameters, device lists, error lists and others.	IB-0300198 (1XB953)
Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (Safety Observation) This manual explains the details, safety parameters, safety sequence program instructions, device lists and error lists and others for safety observation function by Motion controller.	IB-0300183 (1XB945)
Motion controller Setup Guidance (MT Developer2 Version1) This manual explains the items related to the setup of the Motion controller programming software MT Developer2.	IB-0300142 ()

(2) PLC

Manual Name	Manual Number (Model Code)
QCPU User's Manual (Hardware Design, Maintenance and Inspection) This manual explains the specifications of the QCPU modules, power supply modules, base units, extension cables, memory card battery, and the maintenance/inspection for the system, trouble shooting, error codes and others.	SH-080483ENG (13JR73)
QnUCPU User's Manual (Function Explanation, Program Fundamentals) This manual explains the functions, programming methods and devices and others to create programs with the QCPU.	SH-080807ENG (13JZ27)
QCPU User's Manual (Multiple CPU System) This manual explains the Multiple CPU system overview, system configuration, I/O modules, communication between CPU modules and communication with the I/O modules or intelligent function modules.	SH-080485ENG (13JR75)
QnUCPU User's Manual (Communication via Built-in Ethernet Port) This manual explains functions for the communication via built-in Ethernet port of the CPU module.	SH-080811ENG (13JZ29)
MELSEC-Q/L Programming Manual (Common Instruction) This manual explains how to use the sequence instructions, basic instructions, application instructions and micro computer program.	SH-080809ENG (13JW10)
MELSEC-Q/L/QnA Programming Manual (PID Control Instructions) This manual explains the dedicated instructions used to exercise PID control.	SH-080040 (13JF59)
MELSEC-Q/L/QnA Programming Manual (SFC) This manual explains the system configuration, performance specifications, functions, programming, debugging, error codes and others of MELSAP3.	SH-080041 (13JF60)
I/O Module Type Building Block User's Manual This manual explains the specifications of the I/O modules, connector, connector/terminal block conversion modules and others.	SH-080042 (13JL99)
MELSEC-L SSCNETII/H Head Module User's Manual This manual explains specifications of the head module, procedures before operation, system configuration, installation, wiring, settings, and troubleshooting.	SH-081152ENG (13JZ78)

(3) Servo amplifier

Manual Name	Manual Number (Model Code)
SSCNETII/H Interface AC Servo MR-J4B_(-RJ) Servo amplifier Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for AC Servo MR-J4B_(-RJ) Servo amplifier.	SH-030106 (1CW805)
SSCNETII/H Interface Multi-axis AC Servo MR-J4W2B/MR-J4W3B/MR-J4W2-0303B6 Servo amplifier Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for Multi- axis AC Servo MR-J4W2B/MR-J4W3B/MR-J4W2-0303B6 Servo amplifier.	SH-030105 (1CW806)
SSCNETII interface MR-J3- B Servo amplifier Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for MR-J3- B Servo amplifier.	SH-030051 (1CW202)
SSCNETII interface 2-axis AC Servo Amplifier MR-J3W-0303BN6/MR-J3W-□B Servo amplifier Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for 2-axis AC Servo Amplifier MR-J3W-0303BN6/MR-J3W-□B Servo amplifier.	SH-030073 (1CW604)
SSCNETII Compatible Linear Servo MR-J3-□B-RJ004U□ Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for Linear Servo MR-J3-□B-RJ004U□ Servo amplifier.	SH-030054 (1CW943)
SSCNETII Compatible Fully Closed Loop Control MR-J3-□B-RJ006 Servo amplifier Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for Fully Closed Loop Control MR-J3-□B-RJ006 Servo amplifier.	SH-030056 (1CW304)
SSCNETII Interface Direct Drive Servo MR-J3-□B-RJ080W Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for Direct Drive Servo MR-J3-□B-RJ080W Servo amplifier.	SH-030079 (1CW601)
SSCNETII interface Drive Safety integrated MR-J3- B Safety Servo amplifier Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for safety integrated MR-J3- B Safety Servo amplifier.	SH-030084 (1CW205)

Manual Page Organization

The symbols used in this manual are shown below.

Symbol	Description
QDS	Symbol that indicates correspondence to only Q173DSCPU/Q172DSCPU.
QD	Symbol that indicates correspondence to only Q173DCPU(-S1)/Q172DCPU(-S1).

MEMO

1. OVERVIEW

1.1 Overview

This programming manual describes the dedicated instructions, positioning control parameters and positioning dedicated devices for mechanical system program comprised of a virtual main shaft or mechanical module required to execute the synchronous control in the Motion controller (SV22 virtual mode). The following positioning control is possible in the Motion controller (SV22 virtual mode).

,	
Applicable CPU	Number of positioning control axes
Q173DSCPU	
Q173DCPU (-S1)	Up to 32 axes
Q172DSCPU	Up to 16 axes
Q172DCPU (-S1)	Up to 8 axes

In this manual, the following abbreviations are used.

Generic term/Abbreviation	Description	
Q173D(S)CPU/Q172D(S)CPU or	Q173DSCPU/Q172DSCPU/Q173DCPU/Q172DCPU/Q173DCPU-S1/	
Motion CPU (module)	Q172DCPU-S1 Motion CPU module	
	Q172DLX Servo external signals interface module/	
Q172DLX/Q172DEX/Q173DPX/	Q172DEX Synchronous encoder interface module ^(Note-1) /	
Q173DSXY or Motion module	Q173DPX Manual pulse generator interface module/	
	Q173DSXY Safety signal module	
MR-J4(W)-□B	Servo amplifier model MR-J4-□B/MR-J4W-□B	
MR-J3(W)-□B	Servo amplifier model MR-J3-□B/MR-J3W-□B	
AMP or Servo amplifier	General name for "Servo amplifier model MR-J4-⊡B/MR-J4W-⊡B/MR-J3-⊡B/ MR-J3W-⊡B"	
QCPU, PLC CPU or PLC CPU module	QnUD(E)(H)CPU/QnUDVCPU	
Multiple CPU system or Motion system	Abbreviation for "Multiple PLC system of the Q series"	
CPUn	Abbreviation for "CPU No.n (n= 1 to 4) of the CPU module for the Multiple CPU system"	
Operating system software	General name for "SW7DNC-SV□Q□/SW8DNC-SV□Q□"	
SV13	Operating system software for conveyor assembly use (Motion SFC) : SW8DNC-SV13Q□	
SV22	Operating system software for automatic machinery use (Motion SFC) : SW8DNC-SV22Q□	
Programming software package	General name for MT Developer2/GX Works2/GX Developer/MR Configurator□	
MELSOFT MT Works2	Abbreviation for "Motion controller engineering environment MELSOFT MT Works2"	
MT Developer2 ^(Note-2)	Abbreviation for "Motion controller programming software MT Developer2 (Version 1.00A or later)"	
GX Works2	Abbreviation for "Programmable controller engineering software MELSOFT GX Works2 (Version 1.15R or later)"	
GX Developer	Abbreviation for "MELSEC PLC programming software package GX Developer (Version 8.48A or later)"	
MR Configurator□ ^(Note-2)	General name for "MR Configurator/MR Configurator2"	

Generic term/Abbreviation	Description	
MR Configurator	Abbreviation for "Servo setup software package MR Configurator (Version C0 or later)"	
MR Configurator2	Abbreviation for "Servo setup software package MR Configurator2 (Version 1.01B or later)"	
Manual pulse generator or MR-HDP01	Abbreviation for "Manual pulse generator (MR-HDP01)"	
Serial absolute synchronous encoder or Q171ENC-W8/Q170ENC	Abbreviation for "Serial absolute synchronous encoder (Q171ENC-W8/ Q170ENC)"	
SSCNETⅢ/H ^(Note-3) SSCNETⅢ ^(Note-3)	High speed synchronous network between Motion controller and servo amplifier	
SSCNETII(/H) ^(Note-3)	General name for SSCNETⅢ/H, SSCNETⅢ	
Absolute position system	General name for "system using the servo motor and servo amplifier for absolute position"	
Battery holder unit	Battery holder unit (Q170DBATC)	
Intelligent function module	General name for module that has a function other than input or output such as A/D converter module and D/A converter module.	
SSCNETⅢ/H head module	Abbreviation for "MELSEC-L series SSCNETII/H head module (LJ72MS15)"	
Optical hub unit or MR-MV200	Abbreviation for "SSCNETII/H compatible optical hub unit (MR-MV200)"	

(Note-1): Q172DEX can be used in SV22.

(Note-2): This software is included in Motion controller engineering environment "MELSOFT MT Works2". (Note-3): SSCNET: <u>Servo System Controller NET</u>work REMARK

For information about each module, design method for program and parameter, refer to the following manuals relevant to each module.

Item		Reference Manual	
Motion CPU module/Motion unit		Q173D(S)CPU/Q172D(S)CPU Motion controller User's Manual	
PLC CPU, peripheral devices for sequence program design, I/O modules and intelligent function module		Manual relevant to each module	
Operation method for MT Developer2		Help of each software	
	 Multiple CPU system configuration Performance specification Design method for common parameter Auxiliary and applied functions (common) 	Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)	
	 Design method for Motion SFC program Design method for Motion SFC parameter Motion dedicated PLC instruction 	Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (Motion SFC)	
SV13/SV22	 Design method for positioning control program in the real mode Design method for positioning control parameter 	Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)	
	 Design method for safety observation parameter Design method for user made safety sequence program 	Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (Safety Observation)	
SV22			
(Advanced	 Design method for synchronous control 	Q173DSCPU/Q172DSCPU Motion controller (SV22)	
synchronous control)	parameter	Programming Manual (Advanced Synchronous Control)	

▲CAUTION

- When designing the system, provide external protective and safety circuits to ensure safety in the event of trouble with the Motion controller.
- There are electronic components which are susceptible to the effects of static electricity mounted on the printed circuit board. When handling printed circuit boards with bare hands you must ground your body or the work bench.
- Do not touch current-carrying or electric parts of the equipment with bare hands.
- Make parameter settings within the ranges stated in this manual.
- Use the program instructions that are used in programs in accordance with the conditions stipulated in this manual.
- Some devices for use in programs have fixed applications: they must be used in accordance with the conditions stipulated in this manual.

1.2 Motion Control in SV13/SV22 Real Mode

- System with servo motor is controlled directly using the servo program in (SV13/SV22) real mode.
- (2) Setting of the positioning parameter and creation of the servo program/Motion SFC program are required.
- (3) The procedure of positioning control is shown below:
 - Motion SFC program is requested to start using the D(P). SFCS instruction of the sequence program. (Motion SFC program can also be started automatically by parameter setting.)
 - \downarrow
 - Execute the positioning control using the specified Motion SFC program. (Output to the servo amplifier)
 - \downarrow
 - 3) The servo motor is controlled.

Program structure in SV13/SV22 real mode



1.3 Motion Control in SV22 Virtual Mode

- Synchronous control with software is performed using the mechanical system program comprised by virtual main shaft and mechanical module in (SV22) virtual mode.
- (2) Mechanical system programs is required in addition to the positioning parameter, servo program/Motion SFC program used in real mode.
- (3) The procedure of positioning control in virtual mode is shown below:
 - Motion SFC program for virtual mode is requested to start using the D(P). SFCS instruction of the sequence program. (Motion SFC program can also be started automatically by parameter setting.)
 - 2) The virtual servo motor of the mechanical system program is started.
 - Ļ

 \downarrow

- 3) Output the operation result obtained through the transmission module to the servo amplifier set as the output module.
- \downarrow
- 4) The servo motor is controlled.

Program structure in SV22 virtual mode



1.4 Restrictions by the Software's Version

There are restrictions in the function that can be used by the version of the operating system software and programming software. The combination of each version and a function is shown in Table1.1.

Table 1.1 Restrictions by the So	oftware's Version
----------------------------------	-------------------

	Operating system softw		
Function	Q173DSCPU/Q172DSCPU	Q173DCPU(-S1)/Q172DCPU(-S1)	
Checking Motion controller's serial number and operating			
system software version in GX Developer	_	000	
Advanced S-curve acceleration/deceleration			
(Except constant-speed control (CPSTART) of servo	—	00H	
program.)			
Direct drive servo		00H	
MR-J3-□B-RJ080W	—	UUH	
Servo amplifier display servo error code (#8008+20n)	—	00H	
0.44ms fixed-cycle event task	—	00H	
444µs coasting timer (SD720, SD721)	_	00H	
Synchronous encoder current value monitor in real mode	_	00H	
Display of the past ten times history in current value history	_	00H	
monitor		0011	
Amplifier-less operation	_	00H	
Servo instruction (Home position return (ZERO), high speed			
oscillation (OSC)) and manual pulse generator operation in	—	00H	
mixed function of virtual mode/real mode			
Advanced S-curve acceleration/deceleration in constant-		00K	
speed control (CPSTART) of servo program.			
External input signal (DOG) of servo amplifier in home			
position return of count method and speed-position switching	—	00G	
control			
Communication via PERIPHERAL I/F	_	00H	
Motion SFC operation control instruction		001	
Type conversion (DFLT, SFLT)		002	
Vision system dedicated function (MVOPEN, MVLOAD,		001	
MVTRG, MVPST, MVIN, MVFIN, MVCLOSE, MVCOM)		002	
Home position return of scale home position signal detection	_	001	
method			
Real time display function in digital oscilloscope function	_	00N	
Rapid stop deceleration time setting error invalid function	—	00S	

Programming software version				
MELSOFT MT Works2 (MT Developer2) MR Configurator2 MR Configurator		Section of reference		
Q173DSCPU/Q172DSCPU	Q173DCPU(-S1)/Q172DCPU(-S1)	Wit Conliguratorz	MICCOMIgurator	
—	_	_	_	(Note-2)
1.39R	1.06G	—	—	(Note-4)
1.39R	1.06G	1.01B	C2	
—	_	_	_	Section 4.3
1.39R	1.06G		_	(Note-3)
		_		(Note-5)
_	_	_	_	Section 6.2 Section 6.3
1.39R	1.06G	—	_	(Note-5)
—	_	_	_	(Note-5)
1.39R	1.09K	_	-	Section 10.1
1.39R	1.09K	_		(Note-4)
1.39R	1.15R	-	_	
1.39R	1.15R	_	_	(Note-5)
1.39R	1.15R	—	—	(Note-3)
1.39R	1.15R		_	(Note-3)
1.39R	1.15R			(Note-4)
1.39R	1.17T	_	_	
		_		(Note-4)

-: There is no restriction by the version.

(Note-1): SV13/SV22 is the completely same version.

(Note-2): The operating system software version can be confirmed in the operating system software (CD-ROM), MT Developer2 or

GX Works2/GX Developer. (Refer to "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON) Section 1.3, 1.4".)

(Note-3): Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (Motion SFC)

(Note-4): Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)

(Note-5): Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)

(Note-6): Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (Safety Observation)

(Note-7): Q173DSCPU/Q172DSCPU Motion controller (SV22) Programming Manual (Advanced Synchronous Control)

			<i>, ,</i> , ,
Table 1.1 Restrictions	by the Software	's Version	(continued)

Function		Operating system soft	ware version (Note-1), (Note-2)	
		Q173DSCPU/Q172DSCPU	Q173DCPU(-S1)/Q172DCPU(-S1)	
Vision system dedicated function (MVOU	T)	_	00S	
Motion SFC operation control instruction				
Program control (IF - ELSE - IEND, SELE	CT -CASE - SEND,	—	00R	
FOR -NEXT, BREAK)				
Display format depending on the error set	ting data	_	005	
information of motion error history device	(#8640 to #8735)			
Product information list device (#8736 to	#8751)		00S	
Safety observation function			00S	
Feed current value update command (M3	212+20n) valid in	00B	Not support	
speed control (I)				
External forced stop input ON latch (SM5	06)	00B	00S	
Operation method (SD560)		00B	Not support	
Advanced synchronous control		00B	Not support	
Limit switch output function expansion		00B	Not support	
Driver communication function (SSCNET	Ш)	00C	Not support	
Intelligent function module support		00C	Not support	
SSCNETI/H head module connection		00C	Not support	
Cam auto-generation (CAMMK) easy stro	ke ratio cam	00C	Not support	
Acceleration/deceleration time change fu	nction	00C	Not support	
Home position return of dogless home po	sition signal	00C	Not support	
Setting range expansion of backlash comp	ensation amount	00C	Not support	
Multiple CPU synchronous control		00C	Not support	
Cam axis length per cycle change during	synchronous control	00C	Not support	
Servo driver VCI series manufactured	SSCNET		00L	
by CKD Nikki Denso Co., Ltd.	SSCNETI/H	00D	Not support	
Inverter FR-A700 series	•		_	
Synchronous encoder via servo amplifier		00D	Not support	
Driver communication function (SSCNETI/H)		00D	Not support	
Optical hub unit connection		00F	Not support	
Home position return of driver home position return method		00H	Not support	
Stepping motor module AlphaStep/5-phase manufactured by ORIENTAL MOTOR Co., Ltd.		00H	Not support	
Servo driver VPH series manufactured by CKD Nikki Denso		00H	Not support	
IAI electric actuator controller manufacture	d by IAI Corporation	00H	Not support	
Inverter FR-A800 series		00J	Not support	

1 OVERVIEW

Programming software version				
MELSOFT MT Works2 (MT Developer2) MR Configurator2 MR Configurator		Section of reference		
Q173DSCPU/Q172DSCPU	Q173DCPU(-S1)/Q172DCPU(-S1)	Mix Configurator2 Mix Configurator		
1.39R	1.39R	_	_	(Note-3)
1.39R	1.39R	_	_	(Note-3)
—	_	_	_	(Note-3)
—	—	_	—	Section 4.3
1.39R	1.39R	_	—	(Note-6)
—	Not support	_	_	(Note-4)
_	—	—	—	(Note-5)
	Not support		_	(Note-5)
1.47Z	Not support	—	—	(Note-7)
1.47Z	Not support	_	—	(Note-5)
—	Not support	_	—	(Note-5)
1.56J	Not support	_	—	(Note-5)
1.56J	Not support	_	—	(Note-5)
1.56J	Not support	_	—	(Note-3)
1.56J	Not support			(Note-4)
1.56J	Not support	_	_	(Note-4)
1.56J	Not support	_	_	(Note-4)
1.56J	Not support	_	_	(Note-7)
1.56J	Not support	_	_	(Note-7)
1.34L	1.15R	_	_	(Note-4)
1.56J	Not support	_	_	(Note-4)
1.34L	1.15R	_	_	(Note-4)
1.68W	Not support	1.23Z	Not support	(Note-7)
1.68W	Not support	1.23Z	Not support	(Note-5)
	Not support	_	_	(Note-4)
1.118Y	Not support	_	—	(Note-4)
1.118Y	Not support	_	_	(Note-4)
1.118Y	Not support			(Note-4)
1.118Y	Not support	_	_	(Note-4)
1.120A	Not support		_	(Note-4)

-: There is no restriction by the version.

(Note-1): SV13/SV22 is the completely same version.

(Note-2): The operating system software version can be confirmed in the operating system software (CD-ROM), MT Developer2 or

GX Works2/GX Developer. (Refer to "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON) Section 1.3, 1.4".)

(Note-3): Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (Motion SFC)

(Note-4): Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)

(Note-5): Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)

(Note-6): Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (Safety Observation)

(Note-7): Q173DSCPU/Q172DSCPU Motion controller (SV22) Programming Manual (Advanced Synchronous Control)

	1	/	
	Operating system softwa	are version (Note-1), (Note-2)	
Function	Q173DSCPU/Q172DSCPU	Q173DCPU(-S1)/Q172DCPU(-S1)	
Improvement of absolute positioning operation for servo driver VCII/VPH series manufactured by CKD Nikki Denso Co., Ltd., and stepping motor module AlphaStep/5-phase manufactured by ORIENTAL MOTOR Co., Ltd.	OOL	Not support	

Table 1.1 Restrictions by the Software's Version (continued)

1 OVERVIEW

Programming software version				
MELSOFT MT Work	MD Configurator?	MD Configurator	Section of reference	
Q173DSCPU/Q172DSCPU	Q173DCPU(-S1)/Q172DCPU(-S1)	MR Configurator2 MR Configurator		
_	Not support	_	_	(Note-4)

(Note-1): SV13/SV22 is the completely same version.

—: There is no restriction by the version.

(Note-2): The operating system software version can be confirmed in the operating system software (CD-ROM), MT Developer2 or

GX Works2/GX Developer. (Refer to "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON) Section 1.3, 1.4".)

(Note-3): Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (Motion SFC)

(Note-4): Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)

(Note-5): Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)

(Note-6): Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (Safety Observation)

(Note-7): Q173DSCPU/Q172DSCPU Motion controller (SV22) Programming Manual (Advanced Synchronous Control)

1.5 Programming Software Version

The programming software versions that support Motion CPU are shown below.

-					
Mation ODU	MELSOFT MT Work	ks2 (MT Developer2)			
Motion CPU	SV13/SV22	SV43	MR Conligurator2	MR Conligurator	
Q173DSCPU	1.39R ^(Note-1)		1.10L	Not support	
Q172DSCPU	1.39R ^(Note-1)		1.10L	Not support	
Q173DCPU-S1	1.00A ^(Note-2)	1.03D ^(Note-3)	1.00A	C0 (Note-4)	
Q172DCPU-S1	1.00A ^(Note-2)	1.03D ^(Note-3)	1.00A	C0 (Note-4)	
Q173DCPU	1.00A	1.03D	1.00A	C0 (Note-4)	
Q172DCPU	1.00A	1.03D	1.00A	C0 (Note-4)	

(Note-1): Use version 1.47Z or later to use advanced synchronous control method.

(Note-2): Use version 1.12N or later to communicate via PERIPHERAL I/F.

(Note-3): Use version 1.23Z or later to communicate via PERIPHERAL I/F.

(Note-4): Use version C1 or later to use MR Configurator combination with MT Developer2.

2. STARTING UP THE SYSTEM

The procedure for virtual mode positioning control is shown below.

2.1 Starting Up the Virtual Mode System

The procedure to start up for virtual mode system is shown below.





2.2 Starting Up the Incremental System and Absolute System

When incremental system or absolute system is used, the procedure for virtual mode operation is shown below.

2.2.1 Operation for incremental system

The operation procedure for incremental system is shown below.



2.2.2 Operation for absolute (absolute position) system

The operation procedure for absolute system is shown below.



2.3 Differences Between Real Mode and Virtual Mode

Specifications of the positioning data, positioning devices and servo programs, etc. used in the real mode differ in part in the virtual mode. When using them in the virtual mode, refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)" after checking about a different point in the real mode.

2.3.1 Positioning data

Positioning data used in the virtual mode are shown in Table 2.1 below.

Item	Real mode	Virtual mode	Remark
System settings	0	0	
Fixed parameters	0	Δ	Usable units differ according to the output module.
Servo parameters	0	0	
Parameter blocks	0	\bigtriangleup	Only [pulse] usable.
Home position return data	0	_	
JOG operation data	0		
Limit switch output data	0	\triangle	

 \bigcirc : Used

 \triangle : Used (Restrictions in part)

- : Not used

(Note): Refer to Section 10.1 for the real mode axis at virtual mode.

2.3.2 Positioning devices

The operating ranges of positioning devices used in virtual mode are shown in Table 2.2 below.

Device name	Real mode	Virtual mode
Internal relays	M2000 to M3839	
	M4640 to M4687	M2000 to M5487
	M5440 to M5487	
Special relays	SM0 to SM2255	
Data registers	D0 to D799	D0 to D1559
	D1120 to D1239	
Motion registers	#8000 to #8751	
Special registers	SD0 to SD2255	
2.3.3 Servo programs

- (1) Servo program area
 - (a) The same servo program (Kn) No. cannot be used in both the real mode and virtual modes. The range of servo program (Kn) used in the virtual mode must be set using MT Developer2 in advance.
- (2) Servo instructions
 - (a) The home position return, speed control (II), speed-position switching control, high-speed oscillation control and speed control with fixed position stop among the controls which can be used in the real mode cannot be used in the virtual mode.
 - (b) Control units of the parameter block and the torque limit value among the positioning data which can be set using the servo program are not used.
- (3) Differences of the servo instruction between real mode and virtual mode are shown in Table 2.3 below.

	ltem		Real mode	Virtual mode	Remark
	Speed-position switching control	VPF VPR VPSTART	0	×	
	Speed control (II)	VVF VVR	0	×	
Servo instruction	Home position return	ZERO	0	×	Switch to virtual mode after home position return in the real mode.
	High-speed oscillation	OSC	0	×	
	Speed control with fixed position stop	PVF	0	×	
Desitioning		Control units	0	Fixed as [pulse]	
Positioning data	Parameter block	Torque limit value	0	_	The torque limit value is set with the "output module parameter".

Table 2.3 Differences of Servo Instruction List

 \bigcirc : Used, \times : Unusable, - : Not used

(Note-1): Instruction not listed in the table above are common instructions in real mode and virtual mode.

(Note-2): Refer to Section 10.1 for the real mode axis at virtual mode.

2.3.4 Control change (Current value change/speed change/target position change)

When a control change is executed in the virtual mode, the feed current value/speed of the drive module is changed.

Control changes are not possible for the output module (except for cam).

Differences between control changes in the real mode and virtual modes are shown in Table 2.4 below.

	Real	mode		Virtual mode								
ltere			Drive r	nodule	Output module							
llem	Servo motor	Virtual servo Synchronous		Dellar	Ball	Rotary	0					
		encoder	motor	encoder	Roller	screw	table	Cam				
Current value change	0	⊖ Ver.)	0	0	×	×	×	0				
Speed change	0	×	0	×		imes (Note-1)						
Target position change @DS(0	×	0	×	×							

Table 2.4 Differences List of Control Change

 \bigcirc : Used, \times : Unusable

(Note-1): If the output module is a roller which uses a speed change gear, a speed change can be executed by changing the speed change gear ratio.

REMARK

Refer to the following Chapters for details of the drive and output modules.

- Drive module : Chapter 5 and 6
- Output module : Chapter 5 and 8

Ver. : Refer to Section 1.4 for the software version that supports this function.

2.3.5 Switching of control mode (Speed-torque control)

When a speed-torque control is executed in the virtual mode, the control mode of the output module (except for cam) and real mode axis is switched. Differences between speed-torque control in the real mode and virtual modes are shown in Table 2.5 below.

	Real	mode	Virtual mode									
ltere			Drive	Drive module			Output module					
liem	Servo motor	encoder	Virtual servo motor	Synchronous encoder	Roller	Ball screw	Rotary table	Cam	mode axis			
Speed-torque control	0	×	×	×	0	0	0	×	0			

Table 2.5 Differences List of Control Mode Switching

 \bigcirc : Used, \times : Unusable

REMARK

Refer to the Section 10.2 for details of the speed-torque control in virtual mode.

3. PERFORMANCE SPECIFICATIONS

Performance specifications of the Motion CPU are shown in Table 3.1 below.

Table 3.1 Motion CPU Performance Specifications (Virtual Mode)

-														
		Item	l	Q173E	DSCPU	Q172E	SCPU	Q173D0	CPU(-S1)	Q172D0	CPU(-S1)			
				Up to 3	32 axes	Up to 1	6 axes	Up to 3	32 axes	Up to	8 axes			
Nu	mbe	er of control axe	s	(Simultane	ous: 2 to 4/	(Simultane	ous: 2 to 4/	(Simultane	ous: 2 to 4/	(Simultane	ous: 2 to 4/			
				Independer	nt: 32 axes)	Independer	nt: 16 axes)	Independe	nt: 32 axes)	Independe	ent: 8 axes)			
					Synchrono	ous control,			Synchrono	ous control,				
				PTP (Po	int to Point) o	control. spee	d control.	PTP (Point to Point) control, speed control,						
Co	ntrc	l method		fixed-pit	, tch feed. cor	nstant-speed	control.	fixed-pi	, tch feed. cor	nstant-speed	control.			
					position follo	w-up control	. ,		position follo	w-up control	. ,			
				speed-swi	' tchina contra	ol. speed-tor	ue control		' speed-swite	, hina control	,			
			Virtual servo											
		Drive	motor											
		module	Synchronous	ł			pu	lse						
<u></u>	ntro	1	encoder											
uni	te	л 	Roller											
um	Output		Roll scrow	ł			mm,	inch						
		Dulput	Batany table				Eived ee	"dogroo"						
		module					Fixed as	degree		مهاریس ما				
_			Cam		mm, incn, a	egree, puise	(2		mm, inc	n, puise				
Pro	ogra	im language			Dedicated	Instructions	(Servo prog	ram + mecha	anical systen	n program)				
			Capacity			16	steps (1638	34 steps) (No	16-2)					
Se	Servo program Number of positioning													
				Tot	tal of 3200 p	oints (It chan	iges with pro	grams, indir	ect specificat	tion is possit	ole.)			
		[points			1		1		1				
			Virtual servo	32 8	axes	16 a	axes	32 ;	axes	8 a	xes			
		Drive module	motor											
	_	Bitte medule	Synchronous	12 :	aves	12 :	aves	12 :	aves	8 a	Yes			
	J.Y.		encoder	120		12 0		12 0		00				
	er		Virtual main	3	2	1	6		2	8				
E	et p	Virtual axis	shaft	32		10		52						
gra	e S		Virtual auxiliary	20		16		20		8				
pro	d n		input axis	5	2	16			2	8				
em	о Ч		Gear	6	64	3	2	6	64	1	6			
svst	hic		Clutch (Note-1)	6	4	3	2	6	4	1	6			
cal	S S	-	Speed change				•				•			
anic	dule	Iransmission	gear	6	4	3	2	6	4	1	6			
ech	Õ	module	Differential gear	3	2	1	6	3	2		8			
Σ	rof		Differential gear		-		_	_			_			
	lbe		to main shaft	3	2	1	6	3	2		8			
	Zun		Roller	32		16		32		8				
	_	Output	Ball screw	32		16		32		8				
		module	Rotary table	32	Total 32	16	Total 16	32	Total 32	8	Total 8			
		modulo	Cam	32		16		32		8				
	Tv	nes	Odin	52		10	Lin to 25	6 (Note-3)		0				
	Re	solution per cyc												
am	IVIE	entory capacity												
0	Sto	brage memory f	or cam data			Ĺ	PU Internal		y					
	Str	oke resolution					32	/6/						
	Со	ntrol mode					Two-way ca	am/feed cam						

	I	tem	Q173DSCPU	Q172DSCPU	Q173DCPU(-S1)	Q172DCPU(-S1)					
	Interpolation fu	unctions	Linear	interpolation (2 to 4 axes	s), circular interpolation (2	2 axes)					
	Control metho	ds	PTP (Point to Po	int) control, speed contro position follo	l, fixed-pitch feed, consta w-up control	ant-speed control,					
	Positioning	Method	PTP control Fixed-pitch feed Constant-speed con Position follow-up co	PTP control : Selection of absolute or incremental data method Fixed-pitch feed : Incremental data method Constant-speed control : Both absolute and incremental data method can be used together Position follow-up control : Absolute data method							
		Position command	Addre	ss setting range : –2147	483648 to 2147483647	[pulse]					
		Speed command		Speed setting range : 1	to 2147483647 [pulse/s]						
al servo motor	Acceleration/	Trapezoidal acceleration/ deceleration	Acceleration-fixed acceleration time Deceleration time	celeration/deceleration e : 1 to 65535 [ms] e : 1 to 65535 [ms]	Time-fixed accelera Acceleration/deceleration (Only constant-speed co	tion/deceleration n time: 1 to 5000 [ms] ntrol is possible.)					
Virtua	deceleration control	S-curve acceleration/ deceleration	S-curve ratio: 0 to 100[%]								
		Advanced S-curve acceleration/ deceleration	Acceleration section ratio: 0.0 to 100.0[%] Deceleration section ratio: 0.0 to 100.0[%]								
	JOG operation	1 function		Prov	vided						
	M-code functio	on	M-code out	out function provided, M-	code complete wait funct	ion provided					
	Manual pulse of function (Test mode on	generator operation	M-code output function provided, M-code complete wait function provided Up to 3 units can be connected. Up to 3 axes can be operated simultaneously. Setting of magnification : 1 to 10000 Setting of smoothing magnification provided								

Table 3.1 Motion CPU Performance Specifications (Virtual Mode) (Continued)

(Note-1): When the TREN input signal is used as "external input mode clutch", the high speed reading function cannot be used. (Note-2): Capacity matching the servo program for real mode.

(Note-3): Relation between a resolution per cycle of cam and type are shown below.

Resolution per cycle	256	512	1024	2048		
Туре	256	128	64	32		

4. POSITIONING DEDICATED SIGNALS

The internal signals of the Motion CPU and the external signals to the Motion CPU are used as positioning signals.

(1) Internal signals

The following five devices of the Motion CPU are used as the internal signals of the Motion CPU.

- Internal relay (M) M2000 to M5487 (3488 points)
- Special relay (SM) SM0 to SM2255 (2256 points)
- Data register (D) D0 to D1599 (1600 points)
- Motion register (#) #8000 to #8751 (752 points)
- Special register (SD) SD0 to SD2255 (2256 points)

(2) External signals

The external input signals to the Motion CPU are shown below.

- Upper/lower limit switch input The upper/lower limit of the positioning range is controlled.
- Stop signal This signal makes the starting axis stop.
- Proximity dog signal ON/OFF signal from the proximity dog.
- Speed/position switching signal Signal for switching from speed to position.
- Manual pulse generator input Signal from the manual pulse generator.



Fig.4.1 Flow of the internal signals/external signals

The positioning dedicated devices are shown below.

It indicates the device refresh cycle of the Motion CPU for status signal with the positioning control, and the device fetch cycle of the Motion CPU for command signal with the positioning control.

The operation cycle and main cycle of the Motion CPU are shown below.

(a) Operation cycle

Item		Q173DSCPU	Q172DSCPU	Q173DCPU(-S1)	Q172DCPU(-S1)		
Number of control a	xes	Up to 32 axes	Up to 16 axes	Up to 32 axes	Up to 8 axes		
Operation cycle (Default)	SV22	0.44ms/ 1 to 6 axes 0.88ms/ 7 to 16 axes 1.77ms/ 17 to 32 axes	0.44ms/ 1 to 6 axes 0.88ms/ 7 to 16 axes	0.44ms/ 1 to 4 axes 0.88ms/ 5 to 12 axes 1.77ms/ 13 to 28 axes 3.55ms/ 29 to 32 axes	0.44ms/ 1 to 4 axes 0.88ms/ 5 to 8 axes		

(b) Main cycle is not fixed-cycle as operation cycle. The cycle is dozens[ms] to hundreds[ms].

REMARK

(1) In the positioning dedicated signals, "n" in "M3200+20n", etc. indicates a value corresponding to axis No. such as the following tables.

Axis No.	n	Axis No.	n	Axis No.	n	Axis No.	n
1	0	9	8	17	16	25	24
2	1	10	9	18	17	26	25
3	2	11	10	19	18	27	26
4	3	12	11	20	19	28	27
5	4	13	12	21	20	29	28
6	5	14	13	22	21	30	29
7	6	15	14	23	22	31	30
8	7	16	15	24	23	32	31

Calculate as follows for the device No. corresponding to each axis.

 (Example) For axis 32
 M3200+20n (Stop command)=M3200+20×31=M3820

 M3215+20n (Servo OFF command)=M3215+20×31=M3835

• The following range is valid.

- Q172DSCPU : Axis No.1 to 16 (n=0 to 16)
- Q172DCPU(-S1) : Axis No.1 to 8 (n=0 to 7)
- (2) In the positioning dedicated signals, "n" in "M4640+4n", etc. of the "Synchronous encoder axis status", "Synchronous encoder axis command signal" and "Synchronous encoder axis monitor device" indicates a value corresponding to synchronous encoder No. such as the following tables.

Synchronous encoder No.	n	Synchronous encoder No.	n	Synchronous encoder No.	n
P1	0	P5	4	P9	8
P2	1	P6	5	P10	9
P3	2	P7	6	P11	10
P4	3	P8	7	P12	11

Calculate as follows for the device No. corresponding to each synchronous encoder.

(Example) For synchronous encoder No.12

M4640+4n (Error detection)= M4640+4×11=M4684

D1122+10n (Minor error code)= D1122+10×11= D1232

• The range (n=0 to 7) of synchronous encoder No. P1 to P8 is valid in the Q172DCPU(-S1).

4.1 Internal Relays

(1) Internal relay list

Device No.	Application	Real	Virtual	
MO	User device			
to	(2000 points)			~
M2000	Common device	_	_	
to	(320 points)	0	0	
M2320	Unusable			
to	(80 points)			
M2400	Axis status			
	(20 points $ imes$ 32 axes)	~	0	
to	Real mode : Each axis	0	0	
	Virtual mode : Output module			
M3040	Unusable			
to	(32 points)			Real/virtua
M3072	Common device			community
to	(Command signal)	0	0	
10	(64 points)			
M3136	Unusable			
to	(64 points)		_	
M3200	Axis command signal			
	(20 points $ imes$ 32 axes)	0	0	
to	Real mode : Each axis	0	0	
	Virtual mode : Output module			
M3840	Unusable			
to	(160 points)			Ş
M4000 (Note-1)				
	Virtual servo motor axis status	Backup		
to	(20 points $ imes$ 32 axes) ^(Note-2)	Баскир	0	
M4640 (Note-1)	Synchronous encoder axis			
to	status	0	0	
10	(4 points $ imes$ 12 axes)			
M4688 (Note-1)	Unusable			
to	(112 points)	_		≻ Virtual
M4800 (Note-1)				
			-	
to	$(20 \text{ points} \times 22 \text{ syna})$ (Note-2)	×	0	
	$(20 \text{ points } \times 32 \text{ axes})$			
M5440 (Note-1)				
	Synchronous encoder axis	×		
to	command signal	(Note-4)	0	
	(4 points \times 12 axes)			
M5488	(Note-3)			-
to	User device (Note-5)			
M8191	(2704 points)			
	•	· Valid	∨ · Invalid	

It can be used as a user device.

POINT (1) Total number	er of user device points
(2) (Note-1): Do	not set M4000 to M5487 as the latch range in virtual mode.
(3) (Note-2): Th	This signal occupies only the area of the axis set in the mechanical
sy	stem program. The unused axis areas in the mechanical system
pr	ogram can be used as a user device.
(4) (Note-3): Th	The cam axis command signal and smoothing clutch complete signal
ca	on be set as the optional device at the parameter.
(6) This manua it is required (SV13/SV22	ynchronous encoder current value monitor in real mode". I describes only details for internal relays used in the virtual mode. If d, refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller 2) Programming Manual (REAL MODE)".

Axis No.	Device No.			Signal name									
1	M2400 to M2419												
2	M2420 to M2439	Ν						Virtual					
3	M2440 to M2459	$ \rangle$		Noval a sus s	Deal		Dell	Determ		Real	Refresh	Fetch	Signal
4	M2460 to M2479		\ `	signal name	Real	Roller	Ball	Rotary	Cam	Mode	cycle	cycle	direction
5	M2480 to M2499		\backslash				sciew	lable		axis			
6	M2500 to M2519	C	Positio	ning start complete			0						
7	M2520 to M2539	1	Positio	ning complete			0	FF					
8	M2540 to M2559			ion				-					
9	M2560 to M2579	_	in-posi	In-position		0					Onenetien		
10	M2580 to M2599	3	Comma	and in-position							Operation		
11	M2600 to M2619	4	Speed	controlling			0	cc			cycle		
12	M2620 to M2639	F	Speed	position switching			0	ГГ					
13	M2640 to M2659	Ľ	latch										
14	M2660 to M2679	6	Zero pa	ISS	-								
15	M2680 to M2699	7	Error d	Error detection Servo error detection							Immediately		
16	M2700 to M2719	6	Servo								Operation		Status
17	M2720 to M2739	Ľ								cycle		signal	
18	M2740 to M2759		Home	osition return			0				Main cycle	ain cycle	
19	M2760 to M2779	Ľ	reques								Main Cycle		
20	M2780 to M2799	1	Home	osition return							Operation		
21	M2800 to M2819	Ľ	comple	te			(0			cycle		
22	M2820 to M2839	1	1	FLS									
23	M2840 to M2859	1	2 Externa	I RLS							Main cycle		
24	M2860 to M2879	1	3 signals	STOP							Main Oyolo		
25	M2880 to M2899	1	4	DOG/CHANGE	-								
26	M2900 to M2919	1	5 Servo r	eady	-						Operation		
27	M2920 to M2939	1	6 Torque	limiting							cycle		
28	M2940 to M2959	1	7 Unusal	le	—		-	_				—	
29	M2960 to M2979		Virtual	mode continuation							At virtual	/	
30	M2980 to M2999	1	8 operati	operation disable warning (Note-1)			(C			mode		Statuc
31	M3000 to M3019		(INOTE-1)					0	transition	n Sta	Status signal		
32	M3020 to M3039	1	9 M-code			OFF			Operation				
		Ľ					0				cycle	/	
													\bigcirc : Valid

(2) Axis status list

(Note-1): It is unusable in the SV22 real mode.

POINT

- (1) The following range is valid.
 - Q172DSCPU : Axis No.1 to 16
 - Q172DCPU(-S1): Axis No.1 to 8
- (2) The following device area can be used as a user device.
 - Q172DSCPU : 17 axes or more
 - Q172DCPU(-S1): 9 axes or more
 - However, when the project of Q172DSCPU/Q172DCPU(-S1) is replaced with Q173DSCPU/Q173DCPU(-S1), this area cannot be used as a user device.

1 M3200 to M3219 2 M3220 to M3239 3 M3240 to M3259	Fetch	O. mark
2 M3220 to M3239 Virtual 3 M3240 to M3259 Simplement Duit Duit Real Refresh	Fetch	Oʻrus al
3 M3240 to M3259	Fetch	0.1
		Signai
4 M3260 to M3279	cycle	direction
5 M3280 to M3299 axis axis		
6 M3300 to M3319 0 Stop command / C	Operation	
7 M3320 to M3339 1 Rapid stop command	cycle	
8 M3340 to M3359 Forward rotation JOG start		
9 M3360 to M3379 ² command (
10 M3380 to M3399 Reverse rotation JOG	Main	Command
11 M3400 to M3419 start command	cycle	signal
12 M3420 to M3439 Complete signal OFF		
13 M3440 to M3459 4 command /		
14 M3460 to M3479 Speed/position switching	Operation	
15 M3480 to M3499	cycle	
16 M3500 to M3519 6 Unusable — — — — —	—	—
17 M3520 to M3539 7 Error reset command	Main	
18 M3540 to M3559 Servo error reset O	iviain	Commence
19 M3560 to M3579 Command O	cycle	Command
20 M3580 to M3599 External stop input disable	At start	Signal
21 M3600 to M3619 at start command ×	ALSIAN	
22 M3620 to M3639 10 Upusable		
23 M3640 to M3659 11 Offusable	_	
24 M3660 to M3679 12 Feed current value update	At start	
25 M3680 to M3699	ALSIAN	
26 M3700 to M3719 Address clutch reference	Atvirtual	
27 M3720 to M3739 Setting command (Note-1) × 0	At virtual	
28 M3740 to M3759 14 Cam reference position	transition	
29 M3760 to M3779	uansidon	
30 M3780 to M3799 15 Serve OFE command	Operation	Command
31 M3800 to M3819	cycle	signal
32 M3820 to M3839 16 Gain changing command	Operation	
17 PI-PID switching	cycle	
Command CDSK	(Note-2)	
18 Control loop changing	Operation	
10 FIN signal	cycle	

(3) Axis command signal list

(Note-1): It is unusable in the SV22 real mode.

(Note-2): Operation cycle 7.1[ms] or more: Every 3.5[ms]

POINT
(1) The following range is valid.
Q172DSCPU : Axis No.1 to 16
• Q172DCPU(-S1): Axis No.1 to 8
(2) The following device area can be used as a user device.
Q172DSCPU : 17 axes or more
• Q172DCPU(-S1): 9 axes or more
However, when the project of Q172DSCPU/Q172DCPU(-S1) is replaced with Q173DSCPU/Q173DCPU(-S1), this area cannot be used as a user device.

Axis No.	Device No.				S	Signal n	ame					
1	M4000 to M4019											
2	M4020 to M4039	Ν					Virtual					
3	M4040 to M4059		Signal name	Pool		Dell	Deten		Real	Refresh	Fetch	Signal
4	M4060 to M4079		Signai name	Real	Roller	Dall	w table	Cam	mode	cycle	cycle	direction
5	M4080 to M4099		V			SCIEW	lane		axis			
6	M4100 to M4119	0	Positioning start complete	Bookum			_			Operation		Status
7	M4120 to M4139	1	Positioning complete	Баскир		1	0		×	cycle		signal
8	M4140 to M4159	2	Unusable	—		-	_		—	_	—	_
9	M4160 to M4179	3	Command in-position	Pookun			~			Operation		Status
10	M4180 to M4199	4	Speed controlling	Баскир			0		×	cycle		signal
11	M4200 to M4219	5	Linusable			_						
12	M4220 to M4239	6	Ollusable			-						
13	M4240 to M4259	7	Error detection	Backup			<u> </u>			Immedi-		Status
14	M4260 to M4279	Ľ		Баскар			0		×	ately		signal
15	M4280 to M4299	8	_									
16	M4300 to M4319	9	_									
17	M4320 to M4339	10)									
18	M4340 to M4359	11										
19	M4360 to M4379	12	2									
20	M4380 to M4399	13	Unusable	-		-	_		-		—	—
21	M4400 to M4419	14										
22	M4420 to M4439	15	5									
23	M4440 to M4459	16	5									
24	M4460 to M4479	17	<u>,</u>									
25	M4480 to M4499	18	3									
26	M4500 to M4519	10	M-code outputting	Backup			<u> </u>			Operation		Status
27	M4520 to M4539			Баскар			0		×	cycle		signal
28	M4540 to M4559									0:	Valid,	imes: Invalid
29	M4560 to M4579											
30	M4580 to M4599											
31	M4600 to M4619											
32	M4620 to M4639											

(4) Virtual servo motor axis status list

- (1) The following range is valid.
 - Q172DSCPU : Axis No.1 to 16
 - Q172DCPU(-S1): Axis No.1 to 8
- (2) The unused axis areas in the mechanical system program can be used as a user device.

Axis No.	Device No.					Sign	al name					
1	M4800 to M4819											
2	M4820 to M4839	\backslash					Virtual					
3	M4840 to M4859		Signal name	Deel		Dell	Deterry		Real	Refresh	Fetch	Signal
4	M4860 to M4879		Signal name	Real	Roller	Ball	Rolary	Cam	mode	cycle	cycle	direction
5	M4880 to M4899					Sciew	lable		axis			
6	M4900 to M4919	0	Stop command								Operation	
7	M4920 to M4939	1	Rapid stop command							/	cycle	
8	M4940 to M4959	S	Forward rotation JOG									
9	M4960 to M4979	Z	start command				_					Command
10	M4980 to M4999	2	Reverse rotation JOG	×		()		×		Main	signal
11	M5000 to M5019	3	start command								cycle	
12	M5020 to M5039	1	Complete signal OFF							/		
13	M5040 to M5059	4	command							/		
14	M5060 to M5079	5	Unucabla									
15	M5080 to M5099	6	Onusable	_					_			_
16	M5100 to M5119	7	Error rosot command			,	~				Main	Command
17	M5120 to M5139	'		×		()		×		cycle	signal
18	M5140 to M5159	8	Unusable	_		-	_		—	—	—	—
19	M5160 to M5179		External stop input									Command
20	M5180 to M5199	9	disable at start	×		(С		×		At start	signal
21	M5200 to M5219		command									Signal
22	M5220 to M5239	10										
23	M5240 to M5259	11										
24	M5260 to M5279	12										
25	M5280 to M5299	13										
26	M5300 to M5319	14	Unusable	—		-	_		—	—	—	—
27	M5320 to M5339	15										
28	M5340 to M5359	16										
29	M5360 to M5379	17										
30	M5380 to M5399	18										
31	M5400 to M5419	10					~				Operation	Command
32	M5420 to M5439	19	Fin signal	×		(<u></u>		×		cycle	signal
		_									⊖ : Valio	l, \times : Invalid

(5) Virtual servo motor axis command signal list

POINT

(1) The following range is valid.

• Q172DSCPU : Axis No.1 to 16

- Q172DCPU(-S1): Axis No.1 to 8
- (2) The unused axis areas in the mechanical system program can be used as a user device.

Axis No.	Device No.			Sigr	nal name			
1	M4640 to M4643	-						
2	M4644 to M4647	\setminus	Circul name	Deel) (internet	Refresh cycle	Estable such	Signal
3	M4648 to M4651		Signal name	Real	virtual		Felch cycle	direction
4	M4652 to M4655	0	Error detection			Immediately		
5	M4656 to M4659	1	External signal TREN					Status
6	M4660 to M4663	2	Virtual mode continuation operation	0	0	Main cycle		signal
7	M4664 to M4667	2	disable warning					
8	M4668 to M4671	3	Unusable	_	—	_	—	—
9	M4672 to M4675							\bigcirc : Valid
10	M4676 to M4679							
11	M4680 to M4683							
12	M4684 to M4687							

(6) Synchronous encoder axis status list

POINT

(1) The range of axis No.1 to 8 is valid in the Q172DCPU(-S1).

(2) The device area of 9 axes or more can be used as a user device in the Q172DCPU (-S1).

However, when the project of Q172DCPU(-S1) is replaced with Q173DSCPU/Q172DSCPU/Q173DCPU(-S1), this area cannot be used.

(7) Synchronous encoder axis command signal list

Axis No.	Device No.			Sigr	nal name	•		
1	M5440 to M5443							
2	M5444 to M5447		Signal name	Deel	Virtual	Defrech evele	Fotob avala	Signal
3	M5448 to M5451		Signal name	Real Villuai		Relifesh cycle	Feich cycle	direction
4	M5452 to M5455		Error report	×			Main avala	Status
5	M5456 to M5459	0	Enorreset	(Note-1)	0		Main cycle	signal
6	M5460 to M5463	1						
7	M5464 to M5467	2	Unusable	_	—	—	_	—
8	M5468 to M5471	3						
9	M5472 to M5475						⊖ : Valid	\times : Invalid
10	M5476 to M5479	(No	ote-1): It is valid for the version (Refer to	Sectior	n 1.4) tha	it supports "syncl	nronous encoder ci	urrent
11	M5480 to M5483		value monitor in real mode".					
12	M5484 to M5487							

POINT

(1) The range of axis No.1 to 8 is valid in the Q172DCPU(-S1).

(2) The device area of 9 axes or more can be used as a user device in the Q172DCPU (-S1).

However, when the project of Q172DCPU(-S1) is replaced with Q173DSCPU/Q172DSCPU/Q173DCPU(-S1), this area cannot be used.

Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction	Remark (Note-6)	Device No.	S	Signal name	Refresh cycle	Fetch cycle	Signal direction	Remark (Note-6)
M2000	PLC ready flag		Main cycle	Command	M3072	M2055						
M2001 M2002 M2003 M2004 M2005	Axis 1 Axis 2 Axis 3 Axis 4 Axis 5			signal		M2056 M2057 M2058 M2059 M2060	Unusable (6 points)	2	-	-	_	_
M2006 M2007 M2008 M2010 M2011 M2011 M2011 M2011 M2012 M2013 M2014 M2015 M2014 M2015 M2014 M2015 M2014 M2015 M2017 M2018 M2019 M2020 M2021 M2022 M2022 M2022 M2022 M2022 M2022 M2022 M2022 M2022 M2022 M2023 M2028 M2029 M2030 M2031	Axis 6 Axis 7 Axis 8 Axis 9 Axis 10 Axis 11 Axis 12 Axis 12 Axis 13 Axis 14 Axis 15 Axis 16 Axis 17 Axis 18 Axis 19 Axis 20 Axis 21 Axis 22 Axis 22 Axis 25 Axis 24 Axis 25 Axis 22 Axis 22 Axis 22 Axis 23 Axis 24 Axis 25 Axis 27 Axis 28 Axis 27 Axis 28 Axis 20 Axis 30 Axis 30 Axis 30 Axis 30 Axis 32	Operation cycle		Status signal (Note-1), (Note-3), (Note-4)		M2061 M2062 M2063 M2064 M2066 M2066 M2067 M2068 M2069 M2070 M2071 M2072 M2073 M2074 M2075 M2076 M2077 M2078 M2079 M2080 M2081 M2082 M2083 M2084 M2086 M2086	Axis 1 Axis 2 Axis 3 Axis 4 Axis 5 Axis 7 Axis 8 Axis 7 Axis 8 Axis 10 Axis 11 Axis 12 Axis 14 Axis 15 Axis 16 Axis 17 Axis 18 Axis 19 Axis 20 Axis 21 Axis 22 Axis 23 Axis 24 Axis 27 Axis 26	Speed change accepting flag	Operation cycle		Status signal (Note-1), (Note-2), (Note-3), (Note-4)	
M2033 M2034	Unusable (2 points)	_	_	_	_	M2088 M2089	Axis 28 Axis 29					
M2035	Motion error history clear request flag		Main cycle	Command signal	M3080	M2090	Axis 30					
M2036	Unusable	_	_	_	_	M2091	Axis 31			/		
M2037	(2 points)	At debugging mode		Status		M2092	Axis 32					
M2039	Motion error detection flag	transition		signal		M2094						
M2000	Speed switching point specified		At start	Command	M3073	M2095						
M2041	System setting error flag	Operation cycle		Status		M2096						
M2042	All axes servo ON command		Operation cycle	Commond	M3074	M2097	Unusable		—	—	—	—
M2043	Real mode/virtual mode		At virtual mode	signal	M3075	M2098	(0 points)	, 				
	Real mode/virtual mode		transition				-					
M2044 M2045	switching status (SV22) Real mode/virtual mode switching error detection signal (SV22)	At virtual mode transition		Status signal		M2099						
M2046	Out-of-sync warning (SV22)					M2101	Axis 1			/	-	
M2047	Motion slot fault detection flag	Operation cycle	/	0.1		M2102	Axis 2			/		
M2048	JOG operation simultaneous start command		Main cycle	Command signal	M3076	M2103	Axis 3					
M2049	All axes servo ON accept flag	Operation cycle		Status signal		M2104	Axis 4					
M2050	Unusable		_	_	—	M2105	Axis 5	Synchronous encoder current			Status signal	
M2051	Manual pulse generator 1 enable flag				M3077	M2106	Axis 6	value changing flag (Note-5)	Operation cycle		(Note-2), (Note-4)	
M2052	Manual pulse generator 2 enable flag		Main cycle	Command signal	M3078	M2107	Axis 7					
M2053	Manual pulse generator 3 enable flag				M3079	M2108	Axis 8					
M2054	Operation cycle over flag	Operation cycle		Status signal		M2109	Axis 9			/		

(8) Common device list

Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction	Remark (Note-6)	Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction	Remark (Note-6)
M2110	Axis 10 Synchronous			Status		M2179					
M2111	Axis 11 encoder current	Operation cycle		signal (Note-2),		M2180					
M2112	Axis 12 (Note-5)			(Note-4)		M2181					
M2113						M2182					
M2114						M2183					
M2115	-					M2184					
M2117						M2185	,				
M2118						M2187					
M2119	Unusable					M2188					
M2120	(15 points)	_	-	-	-	M2189					
M2121						M2190					
M2123	t i					M2192					
M2124						M2193					
M2125						M2194					
M2126						M2195	,				
M2127	Axis 1					M2190	,				
M2129	Axis 2		/			M2198					
M2130	Axis 3		/			M2199	Unuashla				
M2131	Axis 4		/			M2200	(45 points)	_	_	_	_
M2132	Axis 5 Axis 6		/			M2201	(Note-7)				
M2134	Axis 7		/			M2203					
M2135	Axis 8					M2204					
M2136	Axis 9					M2205					
M2137 M2138	Axis 10 Axis 11					M2206					
M2139	Axis 12		/			M2208	,				
M2140	Axis 13					M2209					
M2141	Axis 14			Status		M2210					
M2142	Axis 15			signal		M2211	,				
M2143	Axis 17 decelerating flag	Operation cycle		(Note-1), (Note-2),		M2212					
M2145	Axis 18			(Note-3),		M2214					
M2146	Axis 19			(Note-4)		M2215					
M2147	Axis 20					M2216					
M2149	Axis 21 Axis 22					M2217	,				
M2150	Axis 23					M2219					
M2151	Axis 24					M2220					
M2152	Axis 25					M2221	,				
M2154	Axis 27					M2223					
M2155	Axis 28		/			M2224					
M2156	Axis 29		/			M2225					
M2157 M2158	Axis 30 Axis 31		/			M2226 M2227					
M2159	Axis 32		/			M2228	,				
M2160						M2229					
M2161						M2230					
M2162						M2231	Unusable	_	_	_	_
M2163						M2232	(16 points)				
M2165						M2234					
M2166						M2235					
M2167						M2236					
M2168	Unusable					M2237					
M2169	(19 points) (Note-7)	-	-	—	-	M2238					
M2170						M2239	Avia 1		/		
M2172						M2240	Axis 2		/		
M2172						M2242	Axis 3			Status	
M2174						M2243	Axis 4 Speed change "0"			Signal (Note-1),	
M2175						M2244	Axis 5 accepting flag	Operation cycle		(Note-2),	
M2176						M2245	Axis 6			(Note-3), (Note 4)	
M2177						M2246	Axis 7		/	(11016-4)	
M2178		1	1			M2247	Axis 8		V		

Common device list (Continued)

Device		Signal name	Refresh cycle	Fetch cycle	Signal	Remark (Note-6)	Device	Signal name	Refresh cycle	Fetch cycle	Signal	Remark (Note-6)
M2248 M2249 M2250	Axis 9 Axis 10 Axis 11				dicotori		M2284 M2285 M2286	Axis 13 Axis 14 Axis 15		/	direction	
M2251	Axis 12						M2287	Axis 16		/		
M2252	Axis 13						M2288	Axis 17		/		
M2253	Axis 14						M2289	Axis 18		/		
M2254	Axis 15						M2290	Axis 19		/		
M2255	Axis 16						M2291	Axis 20			Status	
M2256	Axis 17						M2292	Axis 21		/	signal	
M2257	Axis 18						M2293	Axis 22 Control loop monitor	0	/	(Note-1),	
M2258	Axis 19						M2294	Axis 23 status	Operation cycle	/	(Note-2),	
M2259	Axis 20	Speed change "0"					M2295	Axis 24			(Note-3),	
M2260	Axis 21	accepting flag					M2296	Axis 25			(NOTE-4)	
M2261	Axis 22						M2297	Axis 26				
M2262	Axis 23						M2298	Axis 27				
M2263	Axis 24				Status		M2299	Axis 28				
M2264	Axis 25				signal		M2300	Axis 29				
M2265	Axis 26		On another studie		(Note-1),		M2301	Axis 30		/		
M2266	Axis 27		Operation cycle	1	(Note-2),		M2302	Axis 31		/		
M2267	Axis 28				(Note-3), (Note-4)		M2303	Axis 32		/		
M2268	Axis 29				(NOLE-4)		M2304					
M2269	Axis 30						M2305					
M2270	Axis 31						M2306					
M2271	Axis 32						M2307					
M2272	Axis 1						M2308					
M2273	Axis 2						M2309					
M2274	Axis 3			1			M2310					
M2275	Axis 4						M2311	Unusable	_	_	_	_
M2276	Axis 5						M2312	(16 points)				
M2277	Axis 6	Control loop					M2313					
M2278	AXIS /	monitor status		1			M2314					
M2279	Axis 8						M2315					
IVI2280	AXIS 9			/			M2316					
IVI2201	Axis 10			/			N2210					
IVI2202	Axis 12			/			IVI2318 M2210					
11/12/203	AXIS 12						IVIZ319					

Common device list (Continued)

(Note-1): The range of axis No.1 to 16 is valid in the Q172DSCPU.

(Note-2): The range of axis No.1 to 8 is valid in the Q172DCPU(-S1).

(Note-3): Device area of 17 axes or more is unusable in the Q172DSCPU.

(Note-4): Device area of 9 axes or more is unusable in the Q172DCPU(-S1).

(Note-5): It is unusable in the real mode.

(It can be used in the real mode for the version (Refer to Section 1.4) that supports "synchronous encoder current value monitor in real mode".)

(Note-6): It can also be ordered the device of a remark column.

(Note-7): These devices can be used as the clutch statuses.

The clutch status can also be set as the optional device at the clutch parameter. Refer to Section 7.2.2.

Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction	Remark (Note-1), (Note-2)
M3072	PLC ready flag	/	Main cycle		M2000
M3073	Speed switching point specified flag	/	At start		M2040
M3074	All axes servo ON command		Operation cycle		M2042
M2075	Real mode/virtual mode switching request		At virtual mode		M2042
101075	(SV22)		transition	Commond	11/2043
M3076	JOG operation simultaneous start			signal	M2048
101307 0	command			U U	1012040
M3077	Manual pulse generator 1 enable flag				M2051
M3078	Manual pulse generator 2 enable flag		Main cycle		M2052
M3079	Manual pulse generator 3 enable flag				M2053
M3080	Motion error history clear request flag	/			M2035
M3081	Linux shis (Note-3)				
to		—	_	_	—
M3135	(55 points)				

(9) Common device list (Command signal)

(Note-1): The state of a device is not in agreement when the device of a remark column is turned ON/OFF directly. In addition, when the request from a data register and the request from the above device are performed simultaneously, the request from the above device becomes effective.

(Note-2): It can also be ordered the device of a remark column.

(Note-3): Do not use it as a user device. It can be used as a device that performs automatic refresh because of area for the reserve of command signal.

POINT

The device of a remark column turns ON by OFF to ON of the above device, and turns OFF by ON to OFF of the above device.

The command signal cannot be turned ON/OFF by the PLC CPU in the automatic refresh because the statuses and commands are mixed together in M2000 to M2053. Use the above devices in the case.

And, it can also be turned ON/OFF by the data register. (Refer to Section 4.2.8)

4.1.1 Axis statuses

- (1) In-position signal (M2402+20n) Status signal
 - (a) This signal turns on when the number of droop pulses in the deviation counter becomes below the "in-position range" set in the servo parameters. It turns off at positioning start.



(b) While the control circuit power supply of the servo amplifier is ON, the status of the in-position signal of the servo amplifier (Servo status1 (#8010+20n): b12 (DSK)) is reflected.

However, the state of the signal is always OFF for the following.

- Servo error
- From positioning start until deceleration start (Note-1)
- Current value change
- Home position return (Note-2)
- Speed-torque control
- (Note-1): Except during position follow-up control, high-speed oscillation control, manual pulse generator operation, and synchronous control. (The in-position signal is constantly updated during such controls.)
- (Note-2): The in-position signal may be updated after a proximity dog is turned ON during home position return.
- (2) Zero pass signal (M2406+20n) Status signal This signal turns on when the zero point is passed after the control circuit power supply on of the servo amplifier.

Once the zero point has been passed, it remains on state until the Multiple CPU system has been reset.

However, in the home position return method of proximity dog method, count method, dog cradle method, limit switch combined method, scale home position signal detection method, or dogless home position signal reference method, this signal turns off once at the home position return in real mode start and turns on again at the next zero point passage.

- (3) Error detection signal (M2407+20n) Status signal
 - (a) This signal turns on with detection of a minor error or major error, and it is used as judgement of the error available/not available. The applicable error code ^(Note-1) is stored in the minor error code storage register (D6+20n) with detection of a minor error. The applicable error code ^(Note-1) is stored in the major error code storage register (D7+20n) with detection of a major error.
 - (b) This signal turns off when the error reset command (M3207+20n) turns on.

Error detection ———	ON
Error detection signal <u>OFF</u> (M2407+20n)	
Error reset command OFF (M3207+20n)	/

REMARK

- (Note-1) : Refer to APPENDIX 1 for the error codes with detection of major/minor errors.
- (4) Servo error detection signal (M2408+20n) Status signal
 - (a) This signal turns on when an error occurs at the servo amplifier side (except for errors cause of alarms and emergency stops) ^(Note-1) and it is used as judgement of the servo error available/not available.
 When an error is detected at the servo amplifier side, the applicable error code ^(Note-1) is stored in the servo error code storage register (D8+20n).
 - (b) This signal turns off when the servo error reset command (M3208+20n) turns on or the servo power supply turns on again.
 (Servo error reset is valid in the real mode only.)

Servo error detectionON	
Servo error detection signal <u>OFF</u> (M2408+20n)	
Servo error reset command <u>OFF</u> (M3208+20n)	

REMARK

(Note-1) : Refer to APPENDIX 1.5 for the error codes on errors detected at the servo amplifier side.

(5) Home position return request signal (M2409+20n)

..... Status signal

- This signal turns on when it is necessary to confirm the home position address.
 - (a) When not using an absolute position system
 - 1) This signal turns on in the following cases:
 - Multiple CPU system power supply on or reset
 - · Servo amplifier power supply on
 - Home position return start in the real mode (Unless a home position return is completed normally, the home position return request signal does not turn off.)
 - 2) This signal turns off by the completion of home position return.
 - (b) When using an absolute position system
 - 1) This signal turns on in the following cases:
 - When not executing a home position return once after system start.
 - Home position return start in the real mode (Unless a home position return is completed normally, the home position return request signal does not turn off.)
 - Erase of an absolute data in Motion CPU according to causes, such as battery error
 - Servo error [2025] (absolute position erase) occurrence
 - Servo error [2143] (absolute position counter warning) occurrence
 - Servo error [2913] (encoder counter error) occurrence
 - Major error [1201], [1202], [1203] or [1204] occurrence
 - When the "rotation direction selection" of servo parameter is changed.
 - 2) This signal turns off by the completion of the home position return.

≜CAUTION

When using the absolute position system function, on starting up, and when the Motion controller or absolute value motor has been replaced, always perform a home position return in real mode. In the case of the absolute position system, use the sequence program to check the home position return request before performing the positioning control. Failure to observe this could lead to an accident such as a collision.

(6) Home position return complete signal (M2410+20n)

..... Status signal

- (a) This signal turns on when the home position return operation using the servo program has been completed normally.
- (b) This signal turns off at the positioning start, JOG operation start and manual pulse generator operation start.
- (c) If the home position return of proximity dog, dog cradle or stopper method using the servo program is executed during this signal on, a minor error (error code: 115) occurs and it cannot be start the home position return.

- (7) FLS signal (M2411+20n) ^(Note-1)......Status signal
 - (a) This signal is controlled by the ON/OFF state for the upper stroke limit switch input (FLS) of the Q172DLX/servo amplifier and bit device .
 - Upper stroke limit switch input OFF FLS signal: ON
 - Upper stroke limit switch input ON FLS signal: OFF
 - (b) The state for the upper stroke limit switch input (FLS) when the FLS signal is ON/OFF is shown below.
 - 1) Q172DLX use (Note-2)





2) Servo amplifier input use (Note-3)



3) Bit device use (Note-1) QDS

The set bit device is the FLS signal.

- (Note-1): Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for an external signal and bit device.
- (Note-2): Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller User's Manual" for a pin configuration.

(Note-3): Refer to the "Servo Amplifier Instruction Manual" for a pin configuration.

- (c) "Normally open contact input" and "Normally closed contact input" of the servo data setting can be selected.
- - (a) This signal is controlled by the ON/OFF state for the lower stroke limit switch input (RLS) of the Q172DLX/servo amplifier and bit device as (.
 - · Lower stroke limit switch input OFF RLS signal: ON
 - · Lower stroke limit switch input ON RLS signal: OFF
 - (b) The state of the lower stroke limit switch input (RLS) when the RLS signal is ON/OFF is shown below.
 - 1) Q172DLX use (Note-2)



2) Servo amplifier input use (Note-3)



3) Bit device use (Note-1)

The set bit device is the RLS signal.

- (Note-1): Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for an external signal and bit device.
- (Note-2): Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller User's Manual" for a pin configuration.

(Note-3): Refer to the "Servo Amplifier Instruction Manual" for a pin configuration.

- (c) "Normally open contact input" and "Normally closed contact input" of the servo data setting can be selected.
- - (a) This signal is controlled by the ON/OFF state for the stop signal input (STOP) of the Q172DLX and bit device @st.
 - Stop signal input of the Q172DLX OFF STOP signal: OFF
 - Stop signal input of the Q172DLX ON STOP signal: ON
 - (b) The state of the stop signal input (STOP) when the STOP signal input is ON/OFF is shown below.
 - 1) Q172DLX use (Note-2)



2) Bit device use (Note-1) QDS

The set bit device is the STOP signal.

- (Note-1): Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for an external signal and bit device.
- (Note-2): Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller User's Manual" for a pin configuration.
- (c) "Normally open contact input" and "Normally closed contact input" of the servo data setting can be selected.

- (10) DOG/CHANGE signal (M2414+20n) (Note-1)...... Status signal
 - (a) This signal turns on/off by the proximity dog input (DOG) of the Q172DLX/ servo amplifier/input (DI) of built-in interface in Motion CPU@sk/bit device@sk at the home position return in the real mode. This signal turns on/off by the speed/position switching input (CHANGE) of the Q172DLX/proximity dog input (DOG) of servo amplifier/input (DI) of built-in interface in Motion CPU@sk/bit device@sk at the speed-position switching control in the real mode.

(There is no CHANGE signal in the servo amplifier.)

- (b) The state of the speed/position switching input (CHANGE) when the CHANGE signal is ON/OFF is shown below.
 - 1) Q172DLX use ^(Note-3) DOG/CHANGE signal : ON Q172DLX DOG/CHANGE DOG/CHANGE DOG/CHANGE DOG/CHANGE DOG/CHANGE DOG/CHANGE DOG/CHANGE DOG/CHANGE COM

2) Servo amplifier input use (Note-4)



3) Built-in interface in Motion CPU use (Note-3)



4) Bit device use (Note-1)

The set bit device is the DOG/CHANGE signal.

- (Note-1): Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for an external signal and bit device.
- (Note-2): When using the Q173DCPU(-S1)/Q172DCPU(-S1), the external input signal (DOG) of servo amplifier can also be used in the speed-position switching control. (Refer to Section 1.4 for the software version that supports this function.)
- (Note-3): Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller User's Manual" for a pin configuration.
- (Note-4): Refer to the "Servo Amplifier Instruction Manual" for a pin configuration.

- (c) When using the Q172DLX/built-in interface in Motion CPU, "Normally open contact input" and "Normally closed contact input" of the system setting can be selected.
 When using the proximity dog input (DOG) of servo amplifier/bit device, "Normally open contact input" and "Normally closed contact input" of the servo data setting can be selected.
- (11) Servo ready signal (M2415+20n) Status signal
 - (a) This signal turns on when the servo amplifiers connected to each axis are in the READY state (READY ON and Servo ON).
 - (b) This signal turns off in the following cases.
 - All axes servo ON command (M2042) is off
 - Servo amplifier is not mounted
 - Servo parameter is not set
 - It is received the forced stop input from an external source
 - Servo OFF by the servo OFF command (M3215+20n) ON of each axis
 - Servo error occurs

Refer to "APPENDIX 1.5 Servo errors" for details.



POINT

When the part of multiple servo amplifiers connected to the SSCNETII(/H) becomes a servo error, only an applicable axis becomes the servo OFF state.

(12) Torque limiting signal (M2416+20n) Status signal This signal turns on while torque limit is executed. The signal toward the torque limiting axis turns on. It checks for the following cases.

No.	Check	Remark
1	Servo amplifier power supply ON for absolute axis.	• A minor error (error code: 901 (power supply on in real mode)/9010 (power supply on in virtual mode)) are also set.
2	Anytime during real mode operation.	 It also turns on at the following cases. 1) Home position return 2) Current value change 3) Fixed-pitch feed, speed control (I), (I) or speed-position switching control.

Reset the "Virtual mode continuation operation disable warning signal device" using the Motion SFC program.

4.1.2 Axis command signals

(1) Error reset command (M3207+20n) Command signal This command is used to clear the minor error code storage register (D6+20n), and major error code storage register (D7+20n) of an axis for which the error detection signal has turn on (M2407+20n: ON), and reset the error detection signal (M2407+20n).



(2) Servo error reset command (M3208+20n) Command signal This command is used to clear the servo error code storage register (D8+20) of an axis for which the servo error detection signal has turn on (M2408+20n: ON), and reset the servo error detection signal (M2408+20n).



(3) Address clutch reference setting command (M3213+20n)

..... Command signal

This signal is only effective when the output module is a cam connected an address mode clutch or a rotary table, and it is used to specify the "0" reference position for the current value within 1 virtual axis revolution.

The following processes are executed based on the ON/OFF state of the address clutch reference setting command at the real mode/virtual mode switching request.

(a) M3213+20n : ON

Virtual mode operation starts as "0" for the current value within 1 virtual axis revolution of the main shaft and auxiliary input axis.

- (b) M3213+20n : OFF
 - If the drive module is a virtual servo motor or an incremental synchronous encoder, operation will be continued from the current value within 1 virtual axis revolution for the main shaft and auxiliary input axis in the previous virtual mode.
 - If the drive module is an absolute synchronous encoder, operation will be continued from the current value within 1 virtual axis revolution for the main shaft and auxiliary input axis calculated from the current value of synchronous encoder.
- (4) Cam reference position setting command (M3214+20n)

...... Command signal This signal is only effective when the output module is a cam, and it is used to specify the cam reference position.

The following processes are executed based on the ON/OFF state of the cam reference position setting command at the real mode/virtual mode switching request.

- (a) M3214+20n : ON
 - The current value is cam reference position.
 - The current feed current value is lower stroke limit value (bottom dead point). Moreover, a cam table search is conducted from the beginning of a cycle, and the bottom dead point (0) is specified as the current value within 1 cam shaft revolution.



• After the bottom dead point alignment of cam is completed at the system start-up, it must be turned on at the first real mode to virtual mode switching.

Once the bottom dead point setting is set, operation will be continued with M3214+20n ON by switching from real mode to virtual mode.

(The bottom dead point position is stored in the backup memory.)

	(b)	+20n : OF	FF
--	-----	-----------	----

(b) 10214-2011.011
(Final servo command value in previous virtual mode operation)
$-$ (Current servo current value) \leq (In-position)1)
 For formula 1) Operation will be continued by making the lower stroke limit value and current value within 1 cam shaft revolution into the lower stroke limit value and current value within 1 cam shaft revolution at the previous virtual mode operation.
(Final servo command value in previous virtual mode operation)
— (Current servo current value) > (In-position)
• For formula 2) Current value within 1 cam shaft revolution for current feed current value is calculated and operation will be continued by making the lower stroke limit value into the lower stroke limit value at the previous virtual mode operation.
[Calculation of current value within 1 cam shaft revolution]
(Feed current value) = (Stroke amount) $ imes$ (Stroke ratio) + (Lower stroke limit value)
The stroke ratio(y) used as above formula is calculated, the cam table of the setting cam No. is searched from the beginning of a cycle, and the current value within 1 cam shaft revolution for applicable point is calculated. Because the current value within 1 cam shaft revolution is searched always from the beginning of a cycle, beware of cases where the same stroke ratio appears more than once in the cycle. (Make the necessary position adjustment at the real mode/virtual mode switching.)
32767 In the figure at left, there are 2 relevant points (A and B) for the calculated strok ratio "y", but only point "A" is recognized Lower stroke limit value A B Number of pulses within 1 cycle (1 cam shaft revolution)

- (5) Servo OFF command (M3215+20n) Command signal This command is used to execute the servo OFF state (free run state) when all axes servo ON command (M2042) is ON.
 - OFF Servo ON
 - ON Servo OFF (free run state)

Execute this command after positioning completion because it becomes invalid during positioning.

When the servo OFF command is executed in virtual mode, the clutch will be disengaged first. If it is executed while a "clutch ON" state, a minor error occurs and the servo OFF command becomes invalid.

≜CAUTION

Turn the power supply of the servo amplifier side off before touching a servo motor, such as machine adjustment.

- (6) Gain changing command (M3216+20n) Command signal This signal is used to change the gain of servo amplifier in the Motion controller by the gain changing command ON/OFF.
 - ON Gain changing command ON
 - OFF Gain changing command OFF

Refer to the "Servo amplifier Instruction Manual" for details of gain changing function.

(7) PI-PID switching command (M3217+20n)

..... Command signal

This signal is used to change the PI-PID switching of servo amplifier in the Motion controller by the PI-PID switching command ON/OFF.

- ONPI-PID switching command ON(PID control)
- OFFPI-PID switching command OFF(PI control)

Refer to the "Servo amplifier Instruction Manual" for details of PI-PID switching function.

(8) Control loop changing command (M3218+20n)

..... Command signal

When using the fully closed loop control servo amplifier, this signal is used to change the fully closed loop control/semi closed loop control of servo amplifier in the Motion controller by the control loop changing command ON/OFF.

- ON During fully closed loop control
- OFFDuring semi closed loop control

Fu	ully closed loop ontrol change	ON	Semi closed I	oop e
Control loop changing command (M3218+20n)	<u>OFF</u>	ON		
Control loop monitor status (M2272+n)	OFF		1	

Refer to the "Servo amplifier Instruction Manual" for details of control loop changing function.

POINTS

- (1) When the servo amplifier is not started (LED: "AA", "Ab", "AC", "Ad" or "AE"), if the control loop changing command is turned ON/OFF, the command becomes invalid.
- (2) When the following are operated during the fully closed loop, it returns to the semi closed loop control.
 - (a) Power supply OFF or reset of the Multiple CPU system
 - (b) Wire breakage of the SSCNET**I** cable between the servo amplifier and Motion controller
 - (c) Control circuit power supply OFF of the servo amplifier

4.1.3 Virtual servo motor axis statuses

(1) Positioning start complete signal (M4000+20n)

.....Śtatus signal

- (a) This signal turns on with the start completion for the positioning control of the axis specified with the servo program. It does not turn on at JOG operation.
 It can be used to read an M-code (Note-1) at the positioning start.
- (b) This signal turns off at leading edge of complete signal OFF command (M4804+20n) or positioning completion.



REMARK

(Note-1): Refer to Chapter 7 of the "Q173D(S)CPU/ Q172D(S)CPU Motion controller (SV13/SV22) Programming manual (REAL MODE)".

- (2) Positioning complete signal (M4001+20n) Status signal
 - (a) This signal turns on with the completion for the positioning control of the axis specified with the servo program.
 It does not turn on at the start or stop on the way using JOG operation or speed control.
 It does not turn on at the stop on the way during positioning.
 It can be used to read an M-code at the positioning completion.

(Refer to Chapter 7 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV/13/SV22) Programming Manual (REAL MODE)".)

(b) This signal turns off at leading edge of complete signal OFF command (M4804+20n) or positioning start.



- (3) Command in-positioning signal (M4003+20n) Status signal
 - (a) This signal turns on when the absolute value of the difference between the command position and the feed current value becomes below the "command in-position range" set in the parameters of virtual servo motor (Refer to Section 6.1.2).

This signal turns off in the following cases.

- Positioning control start
- Speed control
- JOG operation
- Speed-torque control
- (b) Command in-position check is continually executed during position control. This check is not executed during speed control.



- (4) Speed controlling signal (M4004+20n) Status signal
 - (a) This signal turns on during speed control, and it is used as judgement of during the speed control or position control.
 The speed controlling signal that turned on with speed control turns off at the positioning control start of following figure.
 - (b) This signal turns off at the power supply on and during position control.



- (5) Error detection signal (M4007+20n) Status signal
 - (a) This signal turns on when a minor error or major error is detected in a virtual servo motor or output module connected to a virtual servo motor.
 It is used as judgement of the error available/not available by turning the error detection signal on/off.
 - (b) When the error detection signal turns on, the applicable error code is stored in the error code storage register.
 - Minor error code (Note-1) ... Stored in the minor error code storage register (D802+20n) (Note-2).
 - Major error code (Note-1) ... Stored in the major error code storage register (D803+20n) (Note-2).

The judgement of the virtual servo motor/output module for detected error can be confirmed by the error code details or turning the error detection signal of output module on/off.

(c) When the error reset command (M4807+20n) turns on in the state where the virtual servo motor or output module connected to the virtual servo motor turns on is normal, the error detection signal turns off.

REMARK

(Note-1) : Refer to APPENDIX 1.4 for details of the virtual servo motor minor/major error codes.

Refer to APPENDIX 1.6 for details of the output module minor/major error codes.

- (Note-2) : Refer to Section 4.2.3 for details of the minor error storage code register (D802+20n) and major error code storage register (D803+20n).
- (6) M-code outputting signal (M4019+20n) Status signal
 - (a) This signal turns during M-code is outputting.
 - (b) This signal turns off when the stop command, cancel signal, skip signal or FIN signal are inputted.



POINT

- (1) The FIN signal (M4819+20n) and M-code outputting signal (M4019+20n) are both signal for the FIN signal wait function.
- (2) The FIN signal (M4819+20n) and M-code outputting signal (M4019+20n) are effective only when FIN acceleration/deceleration is designated in the servo program. Otherwise, the FIN signal wait function is disabled, and the M-code outputting signal (M4019+20n) does not turn on.

4.1.4 Virtual servo motor axis command signals

- (1) Stop command (M4800+20n) Command signal
 - (a) This command stops a starting axis from an external source and becomes effective at leading edge of signal. (An axis for which the stop command is turning on cannot be started.)



- (b) It can also be used as the stop command during the speed control. (Refer to Section "6.13 Speed Control (I)" of the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)" for details of the speed control.
- (c) Stop processing details when the stop command turned on is shown in Table 4.1.

Control details	Processing at the turning stop command on		
during execution	During control	During deceleration stop processing	
Positioning control	The axis decelerates to a stop in	The stop command is ignored and	
Speed control	the deceleration time set in the	deceleration stop processing is	
JOG operation	parameter block or servo program.	continued.	

Table 4.1 Stop Processing at Stop command ON

(d) The stop command in a dwell time is invalid. (After a dwell time, the start accept flag (M2001+n) turns OFF, and the positioning complete signal (M4001+20n) turns ON.)
- (2) Rapid stop command (M4801+20n) Command signal
 - (a) This command stops a starting axis rapidly from an external source and becomes effective at leading edge of signal. (An axis for which the rapid stop command is turning on cannot be started.)



(b) The details of stop processing when the rapid stop command turns on are shown in Table 4.2.

Table 4	.2 Details	of stop pro	ocessing when	the rapid sto	op command turns on
			5		4

Control details	Processing at the turn	ning rapid stop command on			
during execution	During control	During deceleration stop processing			
Positioning control	Rapid stop processing is executed. Parameter (Speed limit value)	Deceleration processing is stopped and rapid stop processing is executed.			
Speed control	k	Setting speed			
JOG operation	Real deceleration time of the parameter block	Contraction stop processing Rapid stop cause Rapid stop deceleration processing Stop			

(c) The rapid stop command in a dwell time is invalid. (After a dwell time, the start accept flag (M2001+n) turns OFF, and the positioning complete signal (M4001+20n) turns ON.)

REMARK

(Note-1) : Rapid stop processing is deceleration stop with deceleration time set in the parameter block or servo program.

- (3) Forward rotation JOG start command (M4802+20n)/Reverse rotation JOG start command (M4803+20n) Command signal
 - (a) JOG operation to the address increase direction is executed while forward rotation JOG start command (M4802+20n) is turning on.
 When M4802+20n is turned off, a deceleration stop is executed in the deceleration time set in the parameter block.
 - (b) JOG operation to the address decrease direction is executed while reverse rotation JOG start command (M4803+20n) is turning on.
 When M4803+20n is turned off, a deceleration stop is executed in the deceleration time set in the parameter block.

POINT

Take an interlock so that the forward rotation JOG start command (M4802+20n) and reverse rotation JOG start command (M4803+20n) may not turn on simultaneously.

(4) Complete signal OFF command (M4804+20n)

..... Command signal

(a) This command is used to turn off the positioning start complete signal (M4000+20n) and positioning complete signal (M4001+20n).



POINT

Do not turn the complete signal OFF command on with a PLS instruction. If it is turned on with a PLS instruction, it cannot be turned off the positioning start complete signal (M4000+20n) and the positioning complete signal (M4001+20n).

- (5) Error reset command (M4807+20n) Command signal
 - (a) This command is used to clear the minor error code storage register (D802+20n) and major error code storage register (D803+20n) of an axis for which the error detection signal has turn on (M4007+20n : ON), and reset the error detection signal (M4007+20n).
 - (b) The following processing is executed when the error reset command turns on.
 - If the virtual servo motor and output module are normal, the minor error code storage register (D802+20n) and major error code storage register (D803+20n) are cleared and the error detection signal (M4007+20n) is reset.
 - If the virtual servo motor and output module error has not been canceled, the error code is again stored in the minor error code storage register (D802+20n) and major error code storage register (D803+20n).
 In this case, the error detection signal (M4007+20n) remains on.
 Reset the output module error by error reset of each axis command signal to the output module.
- (6) External stop input disable at start command (M4809+20n) Command signal

This command is used to set the external stop signal input valid or invalid.

- ON...... External stop input is set as invalid, and even axes which stop input is turning on can be started.
- OFFExternal stop input is set as valid, and axes which stop input is turning on cannot be started.

POINT

When it stops an axis with the external stop input after it starts by turning on the external stop input disable at start command (M4809+20n), switch the external stop input from OFF \rightarrow ON (If the external stop input is turning on at the starting, switch it from ON \rightarrow OFF \rightarrow ON).

(7) FIN signal (M4819+20n) Command signal When a M-code is set in a servo program, transit to the next block does not execute until the FIN signal changes as follows: OFF → ON → OFF. Positioning to the next block begins after the FIN signal changes as above.

It is effective, only when the FIN acceleration/deceleration is set and FIN signal wait function is selected.

	Virtu <k 1000=""> —</k>	al		Point X 1 XWAIT X 2 X						
Point 1	CPSTART2 Axis Axis Speed FIN ABS-2 Axis Axis	1 2 1, 2,	10000 100 200000 200000	M-code 10 11 X M-code outputting signal (M4019+20n) FIN signal (M4819+20n)						
2	ABS-2 Axis Axis	1, 2,	10 300000 250000	Timing Chart for Operation Description						
3	M-code ABS-2 Axis Axis M-code	1, 2,	11 350000 300000 12	 When the positioning of point 1 starts, M-code 10 is output and the M-code outputting signal turns on. FIN signal turns on after performing required processing in the Motion SFC program. Transition to the next point does not 						
4	Axis Axis CPEND	1, 2,	400000 400000	 When the FIN signal turns on, the M-code outputting signal turns off. When the FIN signal turns off after the M-code outputting signal turns off, the positioning to the next point 2 starts. 						

POINT

- (1) The FIN signal (M4819+20n) and M-code outputting signal (M4019+20n) are both signal for the FIN signal wait function.
- (2) The FIN signal (M4819+20n) and M-code outputting signal (M4019+20n) are valid only when FIN acceleration/deceleration is designated in the servo program. Otherwise, the FIN signal wait function is disabled, and the M-code outputting signal does not turn on.

4.1.5 Synchronous encoder axis statuses

- (1) Error detection signal (M4640+4n) Status signal
 - (a) This signal turns on when a minor error or major error is detected in a synchronous encoder or output module connected to the synchronous encoder.

It is used as judgement of the error available/not available by turning the error detection signal on/off.

- (b) When the error detection signal turns on, the applicable error code is stored in the error code storage register.
 - Minor error code (Note-1) ... Stored in the minor error code storage register (D1122+10n) (Note-2)
 - Major error code (Note-1)... Stored in the major error code storage register (D1123+10n) (Note-2)

The judgement of the synchronous encoder/output module for detected error can be confirmed by the error code details or turning the error detection signal of output module on/off.

- (c) When the error reset command (M5440+4n) turns on in the state where the synchronous encoder or output module connected to the synchronous encoder is normal, the error detection signal turns off.
- - Q172DEX does not turn ON regardless of the input status of TREN terminal.
- (3) Virtual mode continuation operation disabled warning signal (M4642+4n)Status signal
 - (a) When the inputted current value at the power supply on of the Multiple CPU system differs from the memorized current value (Final current value in virtual mode operation) at the power supply off of the Multiple CPU system, like the absolute synchronous encoder is moved during the power supply off of the Multiple CPU system, this signal turns on.

The validity of continuation operation in virtual mode can be confirmed at the power supply on or resetting of the Multiple CPU system.

REMARK

- (Note-1): Refer to APPENDIX 1.4 for details of the minor/major error code for the synchronous encoder. Refer to APPENDIX 1.6 for details of the minor/major error code for the output module.
- (Note-2): Refer to Section 4.2.5 for details of the minor error code storage register (D1122+10n) and major error code storage register (D1123+10n).

4.1.6 Synchronous encoder axis command signals

- (1) Error reset command (M5440+4n) Command signal
 - (a) This command is used to clear the minor error code storage register (D1122+10n) and major error code storage register (D1123+10n) of synchronous encoder of an axis for which the error detection signal has turn on (M4640+4n : ON), and reset the error detection signal (M4640+4n).
 - (b) The following processing is executed when the error reset command turns on.
 - If the synchronous encoder and output module are normal, the minor error code storage register (D1122+10n) and major error code storage register (D1123+10n) are cleared and the error detection signal (M4640+4n) is reset.
 - If the synchronous encoder and output module error has not been canceled, the error code is again stored in the minor error code storage register (D1122+10n) and major error code storage register (D1123+10n). In this case, the error detection signal (M4640+4n) remains on. Reset the output module error by error reset of each axis command signal to the output module.

4.1.7 Common devices

POINT

- (1) Internal relays for positioning control are not latched even within the latch range.
- (2) The range devices allocated as internal relays for positioning control cannot be used by the user even if their applications have not been set.
- (1) PLC ready flag (M2000) Command signal
 (a) This signal informs the Motion CPU that the PLC CPU is normal.
 - 1) The positioning control, home position return or JOG operation using the servo program which performs the Motion SFC program when the M2000 is ON.
 - The above 1) control is not performed even if the M2000 is turned on during the test mode [TEST mode ON flag (SM501) : ON] using MT Developer2.
 - (b) The setting data such as the fixed parameters, servo parameters and limit switch output data can be changed using MT Developer2 when the M2000 is OFF only.

The above data using MT Developer2 cannot be written when the M2000 is ON.

- (c) The following processing are performed when the M2000 turns OFF to ON.
 - 1) Processing details
 - Clear the M-code storage area of all axes.
 - Turn the PCPU READY complete flag (SM500) on. (Motion SFC program can be executed.)
 - Start to execute the Motion SFC program of the automatic starting from the first.
 - If there is a starting axis, an error occurs, and the processing in above (c) 1) is not executed.
 - 3) The processing in above (c) 1) is not executed during the test mode. It is executed when the test mode is cancelled and M2000 is ON.



- (d) The following processes are performed when the M2000 turns ON to OFF.1) Processing details
 - - Turn the PCPU READY complete flag (SM500) off.
 - Deceleration stop of the starting axis.
 - Stop to execute the Motion SFC program.
 - Turn all points of the real output PY off.
- (e) Operation at STOP to RUN
 - Set the condition in which the PLC ready flag (M2000) turns ON. Select the following either.
 - M2000 turns ON by switching from STOP to RUN. (Default) Condition in which the M2000 turns from OFF to ON.
 - Move the RUN/STOP switch from STOP to RUN.
 - Turn ON the Multiple CPU system's power supply with the RUN/STOP switch set to RUN.
 - Condition in which the M2000 turns from ON to OFF
 - Move the RUN/STOP switch from RUN to STOP.
 - 2) M2000 turns ON by switching from STOP to RUN and by setting "1" in the setting register.

Condition in which the M2000 turns from OFF to ON

 Set "1" in the setting register (D704) of the PLC ready flag or turn ON the PLC ready flag (M3072) with the RUN/STOP switch set to RUN. (The Motion CPU detects the change from "0" to "1" in the lowest bit of D704).

Condition in which the M2000 turns from ON to OFF

- Set "0" in the setting register (D704) of the PLC ready flag or turn OFF the PLC ready flag (M3072) with the RUN/STOP switch set to RUN. (The Motion CPU detects the change from "1" to "0" in the lowest bit of D704).
- Move the RUN/STOP switch from RUN to STOP.

(2) Virtual servo start accept flag (M2001 to M2032)

..... Status signal

- (a) This flag turns on when the servo program is started. The start accept flag corresponding to an axis specified with the servo program turns on.
- (b) The ON/OFF processing of the start accept flag is shown below.
 - When the servo program is started using the Motion SFC program or Motion dedicated PLC instruction (D(P).SVST), the start accept flag corresponding to an axis specified with the servo program turns on and it turns off at the positioning completion. This flag also turns off when it is made to stopping on the way.

(When it is made to stop on the way by the speed change to speed "0", this flag remains on.)



- 2) This flag turns on at the positioning control by turning on the JOG start command (M4802+20n or M4803+20n), and turns off at the positioning stop by turning off the JOG start command.
- This flag turns on during the manual pulse generator enable (M2051 to M2053: ON), and turns off at the manual pulse generator disable (M2051 to M2053: OFF).
- This flag turns on during a current value change by the CHGA instruction of servo program or Motion dedicated PLC instruction (D(P).CHGA), and turns off at the completion of the current value change.



Axis No.	Device No.						
1	M2001	9	M2009	17	M2017	25	M2025
2	M2002	10	M2010	18	M2018	26	M2026
3	M2003	11	M2011	19	M2019	27	M2027
4	M2004	12	M2012	20	M2020	28	M2028
5	M2005	13	M2013	21	M2021	29	M2029
6	M2006	14	M2014	22	M2022	30	M2030
7	M2007	15	M2015	23	M2023	31	M2031
8	M2008	16	M2016	24	M2024	32	M2032

The start accept flag list is shown below.

(Note): The following range is valid. • Q172DSCPU : Axis No.1 to 16 • Q172DCPU(-S1) : Axis No.1 to 8

- Do not turn the start accept flags ON/OFF in the user side.
 - If the start accept flag is turned off using the Motion SFC program or MT Developer2 while this flag is on, no error will occur but the positioning operation will not be reliable. Depending on the type of machine, it might operate in an unanticipated operation.
 - If the start accept flag is turned on using the Motion SFC program or MT Developer2 while this flag is off, no error will occur but the "start accept on error" will occur at the next starting and cannot be started.
 - (3) Motion error history clear request flag (M2035)
 Command signal
 This flag is used to clear the backed-up Motion error history (#8640 to #8735).
 The Motion error history is cleared at leading edge of M2035.
 After detection of the leading edge of M2035, the Motion error history is cleared, and then the M2035 is automatically turned OFF.
 - (4) Motion SFC debugging flag (M2038) Status signal This flag turns on when it switches to the debug mode of the Motion SFC program using MT Developer2. It turns off with release of the debug mode.

- (6) Speed switching point specified flag (M2040) Command signal This flag is used when the speed change is specified at the pass point of the constant speed control.
 - (a) By turning M2040 on before the starting of the constant speed control (before the servo program is started), control with the change speed can be executed from the first of pass point.
 - OFF Speed is changed to the specified speed from the pass point of the constant speed control.
 - ON Speed has been changed to the specified speed at the pass point of the constant speed control.



- - ON Error
 - OFF Normal
 - (a) When an error occurs, the 7-segment LED at the front side of Motion CPU shows the system setting error.
 - The error contents can be confirmed using the monitor of MT Developer2.
 - (b) When M2041 is ON, positioning cannot be started. Remove an error factor, and turn the Multiple CPU system's power supply on again or reset.

REMARK

Even if the module which is not set as the system setting of MT Developer2 is installed in the slot, it is not set as the object of an adjustment check. And the module which is not set as the system setting cannot be used in the Motion CPU.

(8) All axes servo ON command (M2042) Command signal This command is used to enable servo operation.
 (a) Servo operation enabled M2042 turns on while the servo OFF command

(M3215+20n) is off and there is no servo error.

(b) Servo operation disable • M2042 is off

- The servo OFF command (M3215+20n) is on
- Servo error state
- Forced stop

Execute this command after positioning completion because it becomes invalid in positioning.



(Note): Refer to servo ready signal (M2415+20n) in Section 4.1.1 for details.

POINT When M2042 turns ON, it is not turned off even if the Motion CPU is set in the STOP state. M2042 turns OFF by the forced stop of Motion CPU.

(9) Real mode/virtual mode switching request flag (M2043)

..... Command signal

This flag is used for switching between the real mode and virtual modes.

- (a) Turn the M2043 on after the PCPU READY complete flag (SM500) has turn on for switching from the real mode to virtual mode.
 - An error check is executed when the M2043 is switched from off to on. If no error is detected, switch to the virtual mode, and the real mode/virtual mode status switching status flag (M2044) turns on.
 - If an error is detected, not switch to the virtual mode. In this case, the real mode/virtual mode switching error detection flag (M2045) turns on, and the error code is stored in the real mode/virtual mode switching error code storage register (SD504).
- (b) Turn the M2043 off for switching from the virtual mode to real mode.
 - If all axes of the virtual servo motors stopped, switch to the real mode, and the real mode/virtual mode status switching status flag (M2044) turns off.
 - If the virtual servo motor is operating also with 1 axis, not switch to the real mode. In this case, the real mode/virtual mode switching error detection flag (M2045) turns on, and the error code is stored in the real mode/virtual mode switching error code storage register (SD504).
- (c) Refer to Chapter 9 for switching between the real mode and virtual modes.

(10) Real mode/virtual mode switching status flag (M2044)

..... Status signal

This flag checks the switching completion between the real mode and virtual modes, and the current mode.

- This flag turns off with during the real mode or switching completion from the virtual mode to real mode.
- This flag turns on with switching completion from the real mode to virtual mode.

It can be used as an interlock for the servo program start or control change (speed change, current value change).

(11) Real mode/virtual mode switching error detection flag (M2045)Status signal

This flag is used as judgement of the error available/not available at the mode switching (between the real mode and virtual modes).

- This flag remains off if no error was detected at mode switching.
- This flag turns on if an error was detected at mode switching.

In this case, the error code is stored in the real mode/virtual mode switching error code storage register (SD504).

(12) Out-of-sync warning flag (M2046) Status signal

(a) This signal turns on mode when a discrepancy of synchronized positions between the drive module and output module occurs during the virtual mode.

It is used as judgement for validity of the continuation operation when the drive module has stopped.

- ON.....Continuation operation disabled
- OFFContinuation operation enabled
- (b) This out-of-sync warning flag (M2046) turns on the following cases.
 - Stop by the forced stop.
 - The servo error in the output module.
- (c) When the out-of-sync warning flag (M2046) turns on, resume operation by the following procedure.

1) Return to the real mode and eliminate the error cause.

- 2) Synchronize the axes.
- 3) Turn the out-of-sync warning flag (M2046) off.
- 4) Switch to the virtual mode.

↓ 5) Resume operation.

- (13) Motion slot fault detection flag (M2047) Status signal This flag is used as judgement of which modules installed in the slot of Motion management are "normal" or "abnormal".
 - ON Installed module is abnormal
 - OFF Installed module is normal

The module information at the power supply on and after the power supply on are always checked, and errors are detected.

- (a) When M2047 turns OFF in operation, the operating axis decelerates to a stop.
- (b) When an error occurs, the 7-segment LED at the front side of Motion CPU shows the system setting error.
 The error contents can be confirmed using the monitor of MT Developer2.
- (c) When M2047 is ON, positioning cannot be started. Remove an error factor, and turn the Multiple CPU system's power supply on again or reset.

(14) JOG operation simultaneous start command (M2048)

..... Command signal

- (a) When M2048 turns on, JOG operation simultaneous start based on the JOG operation execution axis set in the JOG operation simultaneous start axis setting register (D710 to D713).
- (b) When M2048 turns OFF, the operating axis decelerates to a stop.
- (15) All axes servo ON accept flag (M2049) Status signal This flag turns on when the Motion CPU accepts the all axes servo ON command (M2042).

Since the servo ready state of each axis is not checked, confirm it in the servo ready signal (M2415+20n).



(Note) : Refer to servo ready signal (M2415+20n) in Section 4.1.1 for details.

(16) Manual pulse generator enable flag (M2051 to M2053)

..... Command signal

This flag set the enabled or disabled state for positioning with the pulse input from the manual pulse generators connected to P1 to P3 ^(Note) of the Q173DPX.

- ON Positioning control is executed by the input from the manual pulse generators.
- OFF Positioning control cannot be executed by the manual pulse generators because of the input from the manual pulse generators is ignored.

Default value is invalid (OFF).

REMARK

(Note) : Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller User's Manual" for P1 to P3 connector of the Q173DPX.

- (17) Operation cycle over flag (M2054)Status signal This flag turns on when the time concerning motion operation exceeds the operation cycle of the Motion CPU setting (SD523). Perform the following operation, in making it turn off.
 - Turn the power supply of the Multiple CPU system on to off
 - Reset the Multiple CPU system
 - Reset using the user program

[Operation cycle over measures]

- 1) Change the operation cycle into a large value in the system setting.
- 2) The number of instruction completions of an event task or NMI task in the Motion SFC program.

(18) Speed change accepting flag (M2061 to M2092)

..... Status signal

This flag turns on at start of speed change by the control change (CHGV) instruction (or Motion dedicated PLC instruction (D(P).CHGV)) of the Motion SFC program.



The speed change accepting flag list is shown below.

Axis No.	Device No.						
1	M2061	9	M2069	17	M2077	25	M2085
2	M2062	10	M2070	18	M2078	26	M2086
3	M2063	11	M2071	19	M2079	27	M2087
4	M2064	12	M2072	20	M2080	28	M2088
5	M2065	13	M2073	21	M2081	29	M2089
6	M2066	14	M2074	22	M2082	30	M2090
7	M2067	15	M2075	23	M2083	31	M2091
8	M2068	16	M2076	24	M2084	32	M2092

(Note): The following range is valid.

• Q172DSCPU : Axis No.1 to 16

• Q172DCPU(-S1) : Axis No.1 to 8

- (19) Automatic decelerating flag (M2128 to M2159) Status signal This signal turns on while automatic deceleration processing is performed during the positioning control or position follow-up control.
 - (a) This flag turns on while automatic deceleration to the command address at the position follow-up control, but it turns off if the command address is changed.
 - (b) This signal turns on while automatic deceleration processing is performed during execution of positioning to final point while in constant speed control.





POINT

Set a travel value in which automatic deceleration processing can be started at the final positioning point, therefore the automatic decelerating flag turns on at the start point of automatic deceleration processing after this final point.

- (c) The signal turns off when all normal start complete commands became achieve.
- (d) The automatic decelerating flag (M2128+n) might be turned ON even during acceleration at advanced S-curve acceleration/deceleration.

- (e) In any of the following cases, the automatic decelerating flag (M2128+20n) does not turn off.
 - During deceleration due to JOG signal off
 - During manual pulse generator operation
 - During deceleration due to stop command or stop cause occurrence
 - When travel value is 0



The automatic decelerating flag list is shown below.

Axis No.	Device No.						
1	M2128	9	M2136	17	M2144	25	M2152
2	M2129	10	M2137	18	M2145	26	M2153
3	M2130	11	M2138	19	M2146	27	M2154
4	M2131	12	M2139	20	M2147	28	M2155
5	M2132	13	M2140	21	M2148	29	M2156
6	M2133	14	M2141	22	M2149	30	M2157
7	M2134	15	M2142	23	M2150	31	M2158
8	M2135	16	M2143	24	M2151	32	M2159

(Note): The following range is valid. • Q172DSCPU : Axis No.1 to 16 • Q172DCPU(-S1) : Axis No.1 to 8

(20) Speed change "0" accepting flag (M2240 to M2271)

..... Status signal

This flag turns on while a speed change request to speed "0" or negative speed change request is being accepted.

It turns on when the speed change request to speed "0" or negative speed change request is accepted during a start. After that, this signal turns off when a speed change is accepted or on completion of a stop due to a stop cause.



Axis No.	Device No.						
1	M2240	9	M2248	17	M2256	25	M2264
2	M2241	10	M2249	18	M2257	26	M2265
3	M2242	11	M2250	19	M2258	27	M2266
4	M2243	12	M2251	20	M2259	28	M2267
5	M2244	13	M2252	21	M2260	29	M2268
6	M2245	14	M2253	22	M2261	30	M2269
7	M2246	15	M2254	23	M2262	31	M2270
8	M2247	16	M2255	24	M2263	32	M2271

The speed change "0" accepting flag list is shown below.

(Note): The following range is valid. • Q172DSCPU : Axis No.1 to 16 • Q172DCPU(-S1) : Axis No.1 to 8

REMARK

- Even if it has stopped, when the start accept flag (M2001+n) is ON state, the state where the request of speed change "0" is accepted is indicated. Confirm by this speed change "0" accepting flag (M2240+n).
- (2) During interpolation, the flags corresponding to the interpolation axes are set.
- (3) In any of the following cases, the speed change "0" request is invalid.
 - After deceleration by the JOG signal off
 - After positioning automatic deceleration start
 - After deceleration due to stop cause
 - (a) The flag turns off if a speed change request occurs during deceleration to a stop due to speed change "0".





(b) The flag turns off if a stop cause occurs after speed change "0" accept.

(c) The speed change "0" accepting flag (M2240+n) does not turn on if a speed change "0" occurs after an automatic deceleration start.



(d) Even if it is speed change "0" after the automatic deceleration start to the "command address", speed change "0" accepting flag (M2240+n) turns on.



REMARK

It does not start, even if the "command address" is changed during speed change "0" accepting.

(21) Control loop monitor status (M2272 to M2303)

..... Command signal

When using the fully closed loop control servo amplifier, this signal is used to check the fully closed loop control/semi closed loop control of servo amplifier.

- ON During fully closed loop control
- OFF During semi closed loop control

It can be changed the fully closed loop control/semi closed loop control of servo amplifier in the Motion controller by the control loop changing command ON/OFF.



The Control loop monitor status list is shown below.

Axis No.	Device No.						
1	M2272	9	M2280	17	M2288	25	M2296
2	M2273	10	M2281	18	M2289	26	M2297
3	M2274	11	M2282	19	M2290	27	M2298
4	M2275	12	M2283	20	M2291	28	M2299
5	M2276	13	M2284	21	M2292	29	M2300
6	M2277	14	M2285	22	M2293	30	M2301
7	M2278	15	M2286	23	M2294	31	M2302
8	M2279	16	M2287	24	M2295	32	M2303

(Note): The following range is valid.

• Q172DSCPU : Axis No.1 to 16

• Q172DCPU(-S1) : Axis No.1 to 8

4.2 Data Registers

(1) Data register list

	SV22]
Device No.	Application	Real	Virtual	_
D0 to	Axis monitor device (20 points × 32 axes) Real mode :Each axis Virtual mode:Output module	0	0	
D640 to	Control change register (2 points × 32 axes)	0	0	Real/virtual community
D704 to	Common device (Command signal) (54 points)	0	0	
D758 to	Unusable (42 points)	_	_	J
D800	Virtual servo motor axis monitor device (6 points \times 32 axes) ^(Note-1) Current value after virtual servo motor axis main shaft's differential gear (4 points \times 32 axes) ^(Note-1)	Backup		
D1120	Synchronous encoder axis monitor device (6 points × 12 axes)	Backup (Note-2)	0	> Virtual
to	Current value after synchronous encoder axis main shaft's differential gear (4 points × 12 axes)	Backup		
D1240 to	Cam axis monitor device (10 points \times 32 axes) ^(Note-1)			
D1560 to D8191	User device (6632 points)			

○ : Valid It can be used as a user device.

POINT								
(1) Total number of points for the user devices 6632 points								
(2) (Note-1) :	This device occupies only the areas of the axes set in the mechanical system program. The unused axis areas in the mechanical system program can be used as a user side.							
(3) (Note-2) :	It is valid for the version (Refer to Section 1.4) that supports "synchronous encoder current value monitor in real mode".							
(4) This manu is required (SV13/SV	al describes only details for data registers used in the virtual mode. If it d, refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller 22) Programming Manual (REAL MODE)".							

Axis No.	Device No.		Signal name									
1	D0 to D19	_										
2	D20 to D39	Ι		Virtual								
3	D40 to D59	$ \rangle$	Signal name	Pool		Dall	Deten		Real	Refresh	Fetch	Signal
4	D60 to D79		Signal name	F	Roller	Ball	table	Cam	mode axis	cycle	cycle	direction
5	D80 to D99					SCIEW	lable					
6	D100 to D119	0	Feed current									
7	D120 to D139	1	value/roller cycle speed									
8	D140 to D159	2	Real current value							Operation		
9	D160 to D179	3								cycle		
10	D180 to D199	4	Deviation counter value			(C		0			
11	D200 to D219	5										
12	D220 to D239	6	Minor error code							Immediately		
13	D240 to D259	7	Major error code		Backup						Monitor	
14	D260 to D279	8	Servo error code	0					Main cycle			
15	D280 to D299	9	Home position return	0				Backup			device	
16	D300 to D319	Ľ	re-travel value						Operation			
17	D320 to D339	10	Travel value after						cycle			
18	D340 to D359	11	proximity dog ON									
19	D360 to D379	12	Execute program No.				<u>_</u>			At start		
20	D380 to D399	13	M-code				~		0	Operation		
21	D400 to D419	14	Torque limit value			()			cycle	/	
22	D420 to D439	15	Data set pointer for				~			At start/	/	
23	D440 to D459		constant-speed control				^			during start		
24	D460 to D479	16	Unusable ^(Note-1)	_		-	_		_	_	_	_
25	D480 to D499	17										
26	D500 to D519	18	Real current value at	0		Bad	ckup		0	Operation		Monitor
27	D520 to D539	19	stop input	0			•		Ŭ	cycle		device
28	D540 to D559										\bigcirc : Valid,	\times : Invalid
29	D560 to D579											
30	D580 to D599											
31	D600 to D619											
32	D620 to D639											

(2) Axis monitor device list

(Note-1): It can be used as the travel value change register. The travel value change register can be set to the device optionally in the servo program.

Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)" for details.

POINT

- (1) The following range is valid.
 - Q172DSCPU : Axis No.1 to 16
 - Q172DCPU(-S1) : Axis No.1 to 8
- (2) The following device area can be used as a user device.
 - Q172DSCPU : 17 axes or more
 - Q172DCPU(-S1): 9 axes or more

However, when the project of Q172DSCPU/Q172DCPU(-S1) is replaced with Q173DSCPU/Q173DCPU(-S1), this area cannot be used as a user device.

4 POSITIONING DEDICATED SIGNALS

Device No.		Signal	name			
D640, D641						-
D642, D643		Deal) (between 1	Refresh	Estable souls	Signal
D644, D645	Signal name	Real	virtual	cycle	Fetch cycle	direction
D646, D647	0				A 4 - 4 - 4	Command
D648, D649	1	0	0		At start	device
D650, D651						\bigcirc : Valid
D652, D653						
D654, D655						
D656, D657						
D658, D659						
D660, D661						
D662, D663						
D664, D665						
D666, D667						
D668, D669						
D670, D671						
D672, D673						
D674, D675						
D676, D677						
D678, D679						
D680, D681						
D682, D683						
D684, D685						
D686, D687						
D688, D689						
D690, D691						
D692, D693						
D694, D695						
D696, D697						
D698, D699						
D700, D701						
D702, D703						

(3) Control change register list

POINT

(1) The following range is valid.

- Q172DSCPU : Axis No.1 to 16
- Q172DCPU(-S1): Axis No.1 to 8
- $\left(2\right)$ The following device area can be used as a user device.
 - Q172DSCPU : 17 axes or more
 - Q172DCPU(-S1): 9 axes or more

However, when the project of Q172DSCPU/Q172DCPU(-S1) is replaced with Q173DSCPU/Q173DCPU(-S1), this area cannot be used as a user device.

Axis No.	Device No.	Signal name											
1	D800 to D809												
2	D810 to D819						-	Virtual					
3	D820 to D829			Signal name	Pool		Dall	Deten		Real	Refresh	Fetch	Signal
4	D830 to D839			Signarhame	Real	Roller	Ball	Ball Rolary	Cam	mode	cycle	cycle	direction
5	D840 to D849						301000	lable		axis			
6	D850 to D859		0	Food current value							Operation		
7	D860 to D869		1								cycle		
8	D870 to D879		2	Minor error code							Immediately		
9	D880 to D889		3	Major error code							Inineciately		
10	D890 to D899		4	Execute program No.							At start		
11	D900 to D909		5	M-code	Backup			_					Monitor
12	D910 to D919		6	Current value after virtual	Баскир			×			device		
13	D920 to D929		7	servo motor axis main					Operation				
14	D930 to D939		'	shaft's differential gear							cycle		
15	D940 to D949		8	Error search output axis No.							e y e l e	/	
16	D950 to D959		a	Data set pointer for							/		
17	D960 to D969	l	5	constant-speed control									
18	D970 to D979										0:	Valid,	imes : Invalid
19	D980 to D989												
20	D990 to D999												
21	D1000 to D1009												
22	D1010 to D1019												
23	D1020 to D1029												
24	D1030 to D1039												
25	D1040 to D1049												
26	D1050 to D1059												
27	D1060 to D1069												
28	D1070 to D1079												
29	D1080 to D1089												
30	D1090 to D1099												
31	D1100 to D1109												
32	D1100 to D1119												

(4) Virtual servo motor axis monitor device list

POINT

(1) The following range is valid.

- Q172DSCPU : Axis No.1 to 16
- Q172DCPU(-S1): Axis No.1 to 8
- (2) The unused axis areas in the mechanical system program can be used as a user device.

Axis No.	Device No.	Signal name						
1	D1120 to D1129	-						-
2	D1130 to D1139		Qiana karana	Deal) (between 1	Refresh	Estable scale	Signal
3	D1140 to D1149		Signal name	Real	virtual	cycle	Fetch cycle	direction
4	D1150 to D1159	0	Current unline	Backup		Operation		
5	D1160 to D1169	1		(Note-1)	~	cycle		Monitor
6	D1170 to D1179	2	Minor error code		0	Immediately		device
7	D1180 to D1189	3	Major error code	Баскир		Inneulately		
8	D1190 to D1199	4	Upusabla					
9	D1200 to D1209	5						_
10	D1210 to D1219	6	Current value after synchronous encoder			Onenation		Manitan
11	D1220 to D1229	7	axis main shaft's differential gear	Backup	0	Operation		Nonitor
12	D1230 to D1239	8	Error search output axis No.			Cycle		device
		9	Unusable	_	_	—	_	_
								\bigcirc : Valid
		(No	ote-1): It is valid for the version (Refer to Se	ection 1.4) that sup	ports "synchr	onous encode	r current
\sim	value monitor in real mode".							

(5) Synchronous encoder axis monitor device list

POINT

(1) It is unusable in the SV22 real mode.

- (2) The range of axis No.1 to 8 is valid in the Q172DCPU(-S1).
- (3) The device area of 9 axes or more can be used as a user device. However, when the project of Q172DCPU(-S1) is replaced with Q173DSCPU/ Q172DSCPU/Q173DCPU(-S1), this area cannot be used.

4 POSITIONING DEDICATED SIGNALS

Axis No.	Device No.				Signal n	ame			
1	D1240 to D1249								
2	D1250 to D1259		\setminus				Refresh		Signal
3	D1260 to D1269		\backslash	Signal name	Real	Virtual	cycle	Fetch cycle	direction
4	D1270 to D1279		0	Unusable	_		_	_	—
5	D1280 to D1289	Í	1	Execute cam No.					
6	D1290 to D1299	ί	2	For a data barrant			o "		
7	D1300 to D1309		3	Execute stroke amount	Backup	0	Operation		Monitor
8	D1310 to D1319		4	Current value within 1 cam shaft			cycle		device
9	D1320 to D1329		5	revolution					
10	D1330 to D1339		6						
11	D1340 to D1349		7	L have a la la					
12	D1350 to D1359	ίΓ	8	Unusable	_		—	—	—
13	D1360 to D1369	ľ	9						
14	D1370 to D1379								◯ : Valid
15	D1380 to D1389								
16	D1390 to D1399								
17	D1400 to D1409								
18	D1410 to D1419								
19	D1420 to D1429								
20	D1430 to D1439								
21	D1440 to D1449								
22	D1450 to D1459								
23	D1460 to D1469								
24	D1470 to D1479								
25	D1480 to D1489								
26	D1490 to D1499								
27	D1500 to D1509								
28	D1510 to D1519								
29	D1520 to D1529								
30	D1530 to D1539								
31	D1540 to D1549								
32	D1550 to D1559								

(6) Cam axis monitor device list

POINT

(1) The following range is valid.

- Q172DSCPU : Axis No.1 to 16
- Q172DCPU(-S1): Axis No.1 to 8
- (2) The unused axis areas in the mechanical system program can be used as a user device.

Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction	Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction
D704	PLC ready flag request				D752	Manual pulse generator 1 smoothing magnification setting register			
D705	Speed switching point specified flag request			Command	D753	Manual pulse generator 2 smoothing magnification setting register		At the manual pulse generator enable flag OFF to ON	
D706	All axes servo ON command request		Main cycle	device	D754	Manual pulse generator 3 smoothing magnification setting register			Command device
D707	Real mode/virtual mode switching request (SV22)				D755	Manual pulse generator 1 enable flag request			
D708	start command request	/			D756	Manual pulse generator 2 enable flag request		Main cycle	
D709	Unusable	—	_	-	D757	Manual pulse generator 3 enable flag request	/		
D710 D711	IOG operation simultaneous				D758 D759				
D712	start axis setting register		At start		D760				
D713		. /			D761				
D714	Manual pulse generator axis				D762				
D716	Manual pulse generator axis	/			D764	•			
D717	2 No. setting register				D765				
D718	Manual pulse generator axis				D766				
D719	3 No. setting register				D767				
D720	Axis 2				D768	•			
D722	Axis 3				D770				
D723	Axis 4				D771				
D724	Axis 5				D772				
D725	Axis 6				D773				
D726	Axis 7				D775				
D728	Axis 9				D776				
D729	Axis 10				D777				
D730	Axis 11			Command	D778	Unusable	_	_	_
D731	Axis 12		At the manual pulse	device	D779	(42 points)			
D732	AXIS 13 Axis 14		generator enable flag		D780				
D734	Axis 15 Manual pulse		OFF to ON		D782				
D735	Axis 16 generators 1 pulse				D783				
D736	Axis 17 setting register				D784				
D737	Axis 18 (Note-1), (Note-2)				D785				
D738	Axis 19 Axis 20				D786				
D740	Axis 20				D788				
D741	Axis 22				D789				
D742	Axis 23				D790				
D743	Axis 24				D791				
D744	Axis 25				D792				
D745	Axis 20	/			D793				
D747	Axis 28				D795				
D748	Axis 29	/			D796				
D749	Axis 30	1/			D797				
D750	Axis 31	V			D798				
D751	Axis 32	1			D799			l	

(7) Common device list

(Note-1): The following range is valid.

• Q172DSCPU : Axis No.1 to 16

• Q172DCPU(-S1) : Axis No.1 to 8

(Note-2): The following device area is unusable.

• Q172DSCPU : 17 axes or more

• Q172DCPU(-S1) : 9 axes or more

4.2.1 Axis monitor devices

The monitoring data area is used by the Motion CPU to store data such as the feed current value during positioning control, the real current value and the deviation counter value.

It can be used to check the positioning control state using the Motion SFC program. The user cannot write data to the monitoring data area.

Refer to "APPENDIX 3 Processing Times of the Motion CPU" for the delay time between a positioning device (input, internal relay and special relay) turning on/off and storage of data in the monitor data area.

- Feed current value/roller cycle speed storage register
 - (D0+20n, D1+20n) Monitor device
 - (a) The target address which is output to the servo amplifier is stored in this register. The target address is based on the command address calculated from the mechanical system program settings.
 - (b) The stroke range check is performed on this feed current value data.
 - (c) Roller cycle speed is stored. The storage range for cycle speed the roller cycle speed storage register is shown below.

Setting Units	Storage Range	Real Roller Cycle Speed			
mm	4.4	0.01 to 6000000.00 [mm/min]			
inch	1 to 600000000	0.001 to 600000.000 [inch/min]			

(2) Real current value storage register (D2+20n, D3+20n)

..... Monitor device

- (a) This device stores the converted value (in an axis control unit) of the feedback position of the motor encoder (in pulse unit).
- (b) The "feed current value" is equal to the "real current value" in the stopped state.

This register stores the droop pulses read from the servo amplifier.

- (4) Minor error code storage register (D6+20n) Monitor device
 - (a) This register stores the corresponding error code (Refer to APPENDIX 1.4 and 1.6) at the minor error occurrence. If another minor error occurs after error code storing, the previous error code is overwritten by the new error code.
 - (b) Minor error codes can be cleared by an error reset command (M3207+20n).

- (5) Major error code storage register (D7+20n) Monitor device
 - (a) This register stores the corresponding error code (Refer to APPENDIX 1.4 and 1.6) at the major error occurrence. If another major error occurs after error code storing, the previous error code is overwritten by the new error code.
 - (b) Major error codes can be cleared by an error reset command (M3207+20n).
- (6) Servo error code storage register (D8+20n) Monitor device
 - (a) This register stores the corresponding error code (Refer to APPENDIX 1.5) at the servo error occurrence. If another servo error occurs after error code storing, the previous error code is overwritten by the new error code.
 - (b) It returns to the real mode by the servo error.
- (7) Torque limit value storage register (D14+20n) Monitor device
 - (a) This register stores the positive direction torque limit value to command the servo amplifier (unit: [%]).
 The default value "300[%]" is stored at the power supply of servo amplifier ON.
 - (b) To monitor the positive/negative direction torque limit value, set "Positive Direction Torque Limit Value Monitor Device" and "Negative Direction Torque Limit Value Monitor Device" with the expansion parameter. (Refer to "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)" for details of expansion parameter.)

4.2.2 Control change registers

This area stores the JOG operation speed data of the virtual servo motor axis.

Name	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8
	D641, D640	D643, D642	D645, D644	D647, D646	D649, D648	D651, D650	D653, D652	D655, D654
	Axis 9	Axis 10	Axis 11	Axis 12	Axis 13	Axis 14	Axis 15	Axis 16
JOG speed	D657, D656	D659, D658	D661, D660	D663, D662	D665, D664	D667, D666	D669, D668	D671, D670
setting	Axis 17	Axis 18	Axis 19	Axis 20	Axis 21	Axis 22	Axis 23	Axis 24
register	D673, D672	D675, D674	D677, D676	D679, D678	D681, D680	D683, D682	D685, D684	D687, D686
	Axis 25	Axis 26	Axis 27	Axis 28	Axis 29	Axis 30	Axis 31	Axis 32
	D689, D688	D691, D690	D693, D692	D695, D694	D697, D696	D699, D698	D701, D700	D703, D702

Table 4.3 Data storage area for control change list

(Note): The following range is valid.

Q172DSCPU : Axis No.1 to 16

• Q172DCPU(-S1) : Axis No.1 to 8

(1) JOG speed setting registers (D640+2n, D641+2n)

..... Command device

- (a) This register stores the JOG speed at the JOG operation.
- (b) Setting range of the JOG speed is shown below.

Unit	pulse					
Item	Setting Range	Unit				
JOG speed	1 to 2147483647	[pulse/s]				

- (c) The JOG speed is the value stored in the JOG speed setting registers (D640+2n, D641+2n) at leading edge of the JOG start signal. Even if data is changed during JOG operation, JOG speed cannot be changed.
- (d) Refer to Section 6.21 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)" for details of the JOG operation.

4.2.3 Virtual servo motor axis monitor devices

(1) Feed current value storage register (D800+10n, D801+10n)

..... Monitor device

- (a) This register stores the target address output to the servo amplifier based on the positioning address/travel value specified with the servo program.
- (b) The stroke range check is performed on this feed current value data.
- (c) Ring address is -2147483648 (-2³¹) [pulse] to 2147483647 (2³¹-1) [pulse] in the infinite operation.



(d) The data of feed current value storage register is also stored in a backup memory at the power supply off or resetting of the Multiple CPU system.

(2) Minor error code storage register (D802+10n)

..... Monitor device

- (a) This register stores the corresponding error code (refer to APPENDIX 1.4 and 1.6) at the minor error occurrence in the virtual servo motor or output module. If another minor error occurs after error code storing, the previous error code is overwritten by the new error code.
- (b) Minor error codes in the virtual servo motor can be cleared by an error reset command ^(Note-1) of the drive module.
 Minor error codes in the output module can be cleared by an error reset command ^(Note-2) of the output module.

REMARK

- (Note-1): Refer to Section 4.1.4 for details of the error reset command for the virtual servo motor axis.
- (Note-2): Refer to Section 4.1.2 for details of the error reset command for the output module.

(3) Major error code storage register (D803+10n)

..... Monitor device

- (a) This register stores the corresponding error code (refer to APPENDIX 1.4 and 1.6) at the major error occurrence in the virtual servo motor or output module. If another major error occurs after error code storing, the previous error code is overwritten by the new error code.
- (b) Major error codes in the virtual servo motor can be cleared by an error reset command ^(Note-1) of the drive module.

Major error codes in the output module can be cleared by an error reset command $^{(Note-2)}$ of the output module.

REMARK

- (Note-1): Refer to Section 4.1.4 for details of the error reset command for the virtual servo motor axis.
- (Note-2): Refer to Section 4.1.2 for details of the error reset command for the output module.

4.2.4 Current value after virtual servo motor axis main shaft's differential gear

(1) Current value after virtual servo motor axis main shaft's differential gear storage register (D806+10n, D807+10n)



- (a) The current value will be the same as the drive module current value of the main shaft side at the virtual mode switching.
- (b) When the current value change is executed toward the drive module current value of the main shaft side, the current value after main shaft's differential gear is also simultaneous changed to the specified current value.
- (c) If the differential gear is not connected with the main shaft, drive module feed current value of the main shaft side is always stored in the current value storage register after main shaft's differential gear.
- (d) In the case of following figure, use "current value after virtual servo motor axis main shaft's differential gear" of axis 1 as "current value after virtual servo motor axis main shaft's differential gear".

(The drive module feed current value of the auxiliary input axis side is stored as "current value after virtual servo motor axis main shaft's differential gear" of axis 2.)



(2) Error search output axis No. storage register (D808+10n)

..... Monitor device

- (a) This register stores the axis No. of the output module in error by the error search function in the virtual mode.
- (b) If there are no errors at the virtual servo motor axes of the main shaft and auxiliary input axis, the error occurrence output axis No. is stored into the error search output axis No. storage register of the corresponding drive module No. when a minor or major error occurs at the connected output axis.
- (c) Error search and error reset
 - 1) Searching the main shaft for error
 - The output axes connected to the main shaft are searched for an error in order of lower to higher numbers. If either a minor or major error has occurred, the corresponding output axis No. is stored into the error search output axis No. storage register.
 Resetting the error of the corresponding output axis stores the other error occurrence output axis No. connected to the same main shaft.
 2) Searching the auxiliary input axis for error
 - 2) Searching the auxiliary input axis for error If either a minor or major error has occurred at the output axis connected to the auxiliary input axis, the corresponding output axis No. is stored into the error search output axis No. storage register. However, when the differential gear (for virtual main shaft connection) is used to provide auxiliary input to the main shaft, the output axis connected to the auxiliary input axis is not searched for an error. Use the main shaft side error search output axis No. storage register to confirm the error occurrence output axis No.
- (d) When error occurs at the drive module axis
 - When an error occurs at the main shaft/auxiliary input axis to which the output axis is connected, "0" (no error) is stored into the error search output axis No. storage device if an error occurred at the output axis.
4.2.5 Synchronous encoder axis monitor devices

(a) This register stores the synchronous encoder current value.

- (b) Ring address is "-2147483648 (-2³¹) to 2147483647 (2³¹-1)" [pulse].
- (c) The current value storage register data is also stored in a backup memory at the power supply off or resetting of the Multiple CPU system.
- (2) Minor error code storage register (D1122+10n) Monitor device
 - (a) This register stores the corresponding error code (refer to APPENDIX 1.4 and 1.6) at the minor error occurrence in the synchronous encoder or output module. If another minor error occurs after error code storing, the previous error code is overwritten by the new error code.
 - (b) Minor error codes in the synchronous encoder can be cleared by an error reset command ^(Note-1) of the synchronous encoder axis.
 Minor error codes in the output module can be cleared by an error reset command ^(Note-2) of the output module.

REMARK

- (Note-1): Refer to Section 4.1.6 for details of the error reset command for the synchronous encoder axis.
- (Note-2): Refer to Section 4.1.2 for details of the error reset command for the output module.
- (3) Major error code storage register (D1123+10n) Monitor device
 - (a) This register stores the corresponding error code (refer to APPENDIX 1.4 and 1.6) at the major error occurrence in the synchronous encoder or output module. If another major error occurs after error code storing, the previous error code is overwritten by the new error code.
 - (b) Major error codes in the synchronous encoder axis can be cleared by an error reset command ^(Note-1) of the synchronous encoder.
 Major error codes in the output module can be cleared by an error reset command ^(Note-2) of the output module.

REMARK

- (Note-1): Refer to Section 4.1.6 for details of the error reset command for the synchronous encoder axis.
- (Note-2): Refer to Section 4.1.2 for details of the error reset command for the output module.

4.2.6 Current value after synchronous encoder axis main shaft's differential gear

 Current value after synchronous encoder axis main shaft's differential gear storage registers (D1126+10n, D1127+10n)





- (a) The current value will be the same as the drive module current value of the main shaft side at the virtual mode switching.
- (b) When the current value change is executed toward the drive module current value of the main shaft side, the current value after main shaft's differential gear is also simultaneous changed to the specified current value.
- (c) If the differential gear is not connected with the main shaft, drive module current value of the main shaft side is always stored in the current value storage register after main shaft's differential gear.
- (d) In the case of following figure, use "current value after synchronous encoder axis main shaft's differential gear" of axis 1 as "current value after synchronous encoder axis main shaft's differential gear".
 (The drive module feed current value of the auxiliary input axis side is stored as "current value after synchronous encoder axis main shaft's differential gear" of axis 2.)



(2) Error search output axis No. storage register (D1128+10n)

..... Monitor device

- (a) This register stores the axis No. of the output module in error by the error search function in the virtual mode.
- (b) If there are no errors at the synchronous encoder axes of the main shaft and auxiliary input axis, the error occurrence output axis No. is stored into the error search output axis No. storage register of the corresponding drive module No. when a minor or major error occurs at the connected output axis.
- (c) Error search and error reset
 - 1) Searching the main shaft for error
 - The output axes connected to the main shaft are searched for an error in order of lower to higher numbers. If either a minor or major error has occurred, the corresponding output axis No. is stored into the error search output axis No. storage register.
 Resetting the error of the corresponding output axis stores the other error occurrence output axis No. connected to the same main shaft.
 2) Searching the auxiliary input axis for error
 - If either a minor or major error has occurred at the output axis connected to the auxiliary input axis, the corresponding output axis No. is stored into the error search output axis No. storage register. However, when the differential gear (for virtual main shaft connection) is used to provide auxiliary input to the main shaft, the output axis connected to the auxiliary input axis is not searched for an error. Use the main shaft side error search output axis No. storage register to confirm the error occurrence output axis No.
- (d) When error occurs at the drive module axis
 - When an error occurs at the main shaft/auxiliary input axis to which the output axis is connected, "0" (no error) is stored into the error search output axis No. storage device if an error occurred at the output axis.

4.2.7 Cam axis monitor devices

- (1) Execute cam No. storage register (D1241+10n) Monitor device
 (a) This register stores the cam No. currently being controlled.
 - (b) Cam No. of the execute cam No. storage register is held until next cam is executed. (Cam No. is not cleared, even if cam control is completed.)
- - (a) This register stores the stroke amount currently being controlled.
- (3) Current value within 1 cam shaft revolution storage register (D1244+10n, D1245+10n) Monitor device
 - (a) This register stores the current value within 1 cam shaft revolution set in the parameter. The current value is a ring address of "0 to [Number of pulses per cam shaft revolution (Nc)-1]".

(Nc-1)- - -

4.2.8 Common devices

(1) Common bit device SET/RST request register (D704 to D708, D755 to D757) Command device Because cannot be turn on/off in every bit from the PLC CPU, the bit device is assigned to data register (D), and each bit device turns on with the lowest rank bit 0 to 1 and each bit device becomes off with 1 to 0. The details of request register are shown below.
(Befar to Section "4.1.7 Common devices" for the bit device M2000 to M2052.)

(Refer to Section "4.1.7 Common devices" for the bit device M2000 to M2053.)

No.	Function	Request register	Bit device	Remark ^(Note-1)
1	PLC ready flag	D704	M2000	M3072
2	Speed switching point specified flag	D705	M2040	M3073
3	All axes servo ON command	D706	M2042	M3074
4	Real mode/virtual mode switching request (SV22)	D707	M2043	M3075
5	JOG operation simultaneous start command	D708	M2048	M3076
6	Manual pulse generator 1 enable flag	D755	M2051	M3077
7	Manual pulse generator 2 enable flag	D756	M2052	M3078
8	Manual pulse generator 3 enable flag	D757	M2053	M3079

Details	of th	ne rec	uest	reaister
Dotano	U 1 U	10100	1000	10910101

(Note-1): It can also be ordered the device of a remark column.

(2) JOG operation simultaneous start axis setting registers

- (D710 to D713) Command device
- (a) These registers set the virtual servo motor axis No. and direction which start simultaneously the JOG operation.



(b) Refer to Section 6.21.3 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)" for details of the JOG operation simultaneous start.

- (3) Manual pulse generator axis No. setting registers (D714 to D719) Command signal
 - (a) These registers store the virtual servo motor axis No. controlled with the manual pulse generator.



(b) Refer to Section 6.22 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)" for details of the manual pulse generator operation.

(4) Manual pulse generator 1-pulse input magnification setting registers (D720 to D751) Command device

(a) These registers set the magnification (1 to 10000) per pulse of number of the input pulses from manual pulse generator at the pulse generator operation.

1-pulse input magnification setting register	Axis No.	Setting range	1-pulse input magnification setting register	Axis No.	Setting range
D720	Axis 1		D736	Axis 17	
D721	Axis 2		D737	Axis 18	
D722	Axis 3		D738	Axis 19	
D723	Axis 4		D739	Axis 20	
D724	Axis 5		D740	Axis 21	
D725	Axis 6		D741	Axis 22	1 += 10000
D726	Axis 7		D742	Axis 23	
D727	Axis 8	4 1 40000	D743	Axis 24	
D728	Axis 9	1 to 10000	D744	Axis 25	1 to 10000
D729	Axis 10		D745	Axis 26	
D730	Axis 11		D746	Axis 27	
D731	Axis 12		D747	Axis 28	
D732	Axis 13		D748	Axis 29	
D733	Axis 14		D749	Axis 30	
D734	Axis 15		D750	Axis 31	
D735	Axis 16		D751	Axis 32	

(Note): The following range is valid.

• Q172DSCPU : Axis No.1 to 16

• Q172DCPU(-S1) : Axis No.1 to 8

- (b) Refer to Section 6.22 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)" for details of the manual pulse generator operation.
- (5) Manual pulse generator smoothing magnification setting registers (D752 to D754) Command device
 - (a) These registers set the smoothing time constants of manual pulse generators.

Manual pulse generator smoothing magnification setting register	Setting range
Manual pulse generator 1 (P1): D752	
Manual pulse generator 2 (P2): D753	0 to 59
Manual pulse generator 3 (P3): D754	

- (b) When the smoothing magnification is set, the smoothing time constant is as indicated by the following expression.
 Smoothing time constant (t) = (Smoothing magnification + 1) × 56.8 [ms]
- (c) Operation



Output speed (V₁) [pulse/s] = (Number of input pulses/s) × (Manual pulse generator 1-pulse input magnification setting)

Travel value (L) = (Number of input pulses) × (Manual pulse generator 1-pulse input magnification setting)

(d) The manual pulse operation in the virtual mode is effective at the only test mode.

REMARK

(1) The smoothing time constant is 56.8[ms] to 3408[ms].

4.3 Motion Registers (#)

There are motion registers (#0 to #12287) in the Motion CPU. #8000 to #8639 are used as the monitor device, #8640 to #8735 are used as the Motion error history device and #8736 to #8751 are used as the product information list device. Refer to the "Q173D(S)CPU/Q172D(S)Motion Controller (SV13/SV22) Programming Manual (Motion SFC)" for details of the motion registers and Motion error history device.

Monitor devices (#8000 to #8639)
 Information for each axis is stored in the monitor devices.
 The details of the storage data are shown below.

Axis No.	Device No.		Signal name							
1	#8000 to #8019									
2	#8020 to #8039		Circul respect	Define have le	Cinnel direction					
3	#8040 to #8059		Signal name	Reiresh cycle	Signal direction					
4	#8060 to #8079	0	Servo amplifier type	When the servo amplifier power-on						
5	#8080 to #8099	1	Motor current value							
6	#8100 to #8119	2	Matar apad	Operation cycle 1.7 [ms] or less : Operation cycle						
7	#8120 to #8139	3	Motor speed							
8	#8140 to #8159	4	Command apood	Operation evalu						
9	#8160 to #8179	5	Command speed							
10	#8180 to #8199	6	Home position return re-	At home position return re-travel	Monitor device					
11	#8200 to #8219	7	travel value							
12	#8220 to #8239	8	Servo amplifier display servo							
13	#8240 to #8259	0	error code	Main cycle						
14	#8260 to #8279	9	Parameter error No. QDS							
15	#8280 to #8299	10	Servo status1	Operation cycle 1 7[ms] or loss Operation cycle						
16	#8300 to #8319	11	Servo status2 QDS	Operation cycle 3.5[ms] or more : 3.5[ms]						
17	#8320 to #8339	12	Servo status3 QDS							
18	#8340 to #8359	13	-							
19	#8360 to #8379	14								
20	#8380 to #8399	15	Unusable	—	—					
21	#8400 to #8419	16								
22	#8420 to #8439	17								
23	#8440 to #8459	10		Operation cycle 1.7[ms] or less : Operation cycle	Manitan daviaa					
24	#8460 to #8479	10		Operation cycle 3.5[ms] or more : 3.5[ms]						
25	#8480 to #8499	19	Unusable	_	_					
26	#8500 to #8519									
27	#8520 to #8539									
28	#8540 to #8559									
29	#8560 to #8579									
30	#8580 to #8599									
31	#8600 to #8619									
32	#8620 to #8639									

Ver.! : Refer to Section 1.4 for the software version that supports this function.

(a)	Servo amplif	ier type (#8000+20n) Monitor device
	This register	stores the servo amplifier type for each axis at the servo
	amplifier pov	ver supply ON.
	• 0	Unused
	• 256	MR-J3-□B
		MR-J3W-⊟B (For 2-axis type)
	• 257	MR-J3-□B-RJ006 (For fully closed loop control)
		MR-J3-□B Safety (For drive safety servo)
	• 258	MR-J3-□B-RJ004 (For Linear servo motor)
	• 263	MR-J3-□B-RJ080W (For direct drive motor)
	• 4096	MR-J4-DB QDS
		MR-J4W-⊟B (For 2-axis type, 3-axis type)
	• 4352	VCII series ^(Note-1) (CKD Nikki Denso Co., Ltd. make)
		Ver.)
	• 4354	VCII series (For Linear stage) ^(Note-2)
		(CKD Nikki Denso Co., Ltd. make) 🕼
	• 4359	VCI series (For direct drive motor) (Note-2)
		(CKD Nikki Denso Co., Ltd. make) 🕼
	• 4864	VPH series ^(Note-1) (CKD Nikki Denso Co., Ltd. make)
		Ver.)
	• 4866	VPH series (For Linear stage) ^(Note-2)
		(CKD Nikki Denso Co., Ltd. make)
	• 4871	VPH series (For direct drive motor) ^(Note-2)
		(CKD Nikki Denso Co., Ltd. make)
	• 8192	FR-A800-1 (Inverter)
	• 8193	FR-A800-2 (Inverter)
	• 8193	IAI electric actuator controller
		(IAI Corporation make)
	• 8233	5-phase stepping motor driver
		(ORIENTAL MOTOR Co., Ltd. make)
	• 8234	Stepping motor driver AlphaStep (AZ series)
		(ORIENTAL MOTOR Co., Ltd. make)
	• 16640	FR-A700 series (Inverter) 🕼
		(Note-1): When connecting SSCNETⅢ/H
		(Note-2): When connecting SSCNETⅢ
	It is not clear	ed even if the servo amplifier power supply turns OFF.
(h)	Motor currer	t value (#8001+20n) Monitor device
(0)	This register	stores the motor current value ($\times 0.1\%$) (signed) read from the
	servo amplif	
	Servo ampin	
(c)	Motor speed	(#8002+20n, #8003+20n) Monitor device
	This register	stores the motor speed (\times 0.1[r/min]) (signed) read from the
	servo amplif	er.
	The motor s	beed ($ imes$ 0.1[mm/s]) (signed) is stored at linear servo use.

Ver. Refer to Section 1.4 for the software version that supports this function.

- (d) Command speed (#8004+20n, #8005+20n)...... Monitor device This register stores the speed (signed) at which command value to the servo amplifier for every operation cycle is converted into [pulse/s].
- (e) Home position return re-travel value (#8006+20n, #8007+20n)

(f) Servo amplifier display servo error code (#8008+20n) Ver

The hexadecimal display is the same as the LED of servo amplifier. Refer to the "Servo amplifier Instruction Manual" for details of the servo error codes.

(g) Parameter error number (#8009+20n) The parameter number of error servo parameter is stored in hexadecimal at the servo error occurrence.



Ver.! : Refer to Section 1.4 for the software version that supports this function.



POINT Servo warning (b15) turns ON during Motion controller forced stop or servo forced stop.



Ver. : Refer to Section 1.4 for the software version that supports this function.

(2) Product information list devices (#8736 to #8751) The operating system software version and serial number of Motion CPU is stored in ASCII code.

The product information list devices are shown below.

Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction
#8736				
to	Operating system software version			
#8743				
#8744		At power on		Monitor device
to	Motion CPU module serial number			
#8751				

(a) Operating system software version (#8736 to #8743) Monitor device The operating system software version of Motion CPU displayed on the system monitor (product information list) of GX Works2/GX Developer is stored in ASCII code.

(Example) Operating system software version: "SV22j VER300A"

								Devic	e No.							
	#87	736	#87	737	#87	738	#87	739	#87	740	#87	741	#87	742	#87	743
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
ASCII code	20H	53H	56H	32H	32H	6AH	20H	20H	56H	45H	52H	33H	30H	30H	41H	20H
Character		S	V	2	2	j			V	Е	R	3	0	0	А	

니 : Space.

(b) Motion CPU module serial number (#8744 to #8751) Monitor device The serial number of Motion CPU displayed on the system monitor (product information list) of GX Works2/GX Developer is stored in ASCII code. (Example) Serial number: "A7Z123015"

		Device No.														
	#8 ⁻	744	#8	745	#8	746	#8	747	#8	748	#8	749	#8	750	#87	751
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
ASCII code	41H	37H	5AH	31H	32H	33H	30H	31H	35H	20H	20H	20H	20H	20H	20H	20H
Character	А	7	Z	1	2	3	0	1	5		Г	Γ	Г	Γ		Ц

□ : Space.

POINT	
Refer to the "C	173D(S)CPU/Q172D(S)CPU Motion Controller User's Manual" or
"Q173D(S)CPI	J/Q172D(S)CPU Motion Controller Programming Manual
(COMMON)" fo	or checking of the operating system software version and serial
number.	

Ver. : Refer to Section 1.4 for the software version that supports this function.

4.4 Special Relays (SM)

There are 2256 special relay points of SM0 to SM2255 in the Motion CPU. Of these, devices in a Table 4.4 are used for the positioning control. The special relay list used for the positioning control is shown below. (Refer to "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for the application of special relays except below.)

Table 4.4 Special relay list

Device No.	Signal name	Refresh cycle	Fetch cycle	Signal type
SM500	PCPU READY complete flag		/	
SM501	TEST mode ON flag	Main cycle	/	
SM502	External forced stop input flag	Operation cycle		
SM503	Digital oscilloscope executing flag	Main cycle		
SM506	External forced stop input ON latch flag ಊ	Operation cycle		Otatus almust
SM508	Amplifier-less operation status flag			Status signal
SM510	TEST mode request error flag			
SM512	Motion CPU WDT error flag	Main cycle		
SM513	Manual pulse generator axis setting error flag		/	
SM516	Servo program setting error flag			

- (1) PCPU READY complete flag (SM500) Status signal This flag is used as judgement of the normal or abnormal in the Motion CPU side using the sequence program.
 - (a) At leading edge of PLC ready flag (M2000), the fixed parameters, servo parameters and limit switch output data are checked, and if error is not detected, this flag turns on.

The servo parameters are written to the servo amplifiers and the M-codes are cleared.

(b) This flag turns off when the PLC ready flag (M2000) turns off.



Ver.! : Refer to Section 1.4 for the software version that supports this function.

- (2) TEST mode ON flag (SM501) Status signal
 - (a) This flag is used as judgement of during the test mode or not using MT Developer2.

Use it for an interlock, etc. at the starting of the servo program using the Motion SFC program.

- OFF.....Except the test mode
- ON.....During the test mode
- (b) If the test mode is not executed in the test mode request from MT Developer2, the TEST mode request error flag (SM510) turns on.
- (3) External forced stop input flag (SM502)Status signal This flag is used to check the external forced stop input signal ON/OFF.
 - OFF External forced stop input ON
 - ON External forced stop input OFF

POINT

- (1) If the forced stop signal is input during positioning, the operation is as follows.When using Q173DSCPU/Q172DSCPU
 - The feed current value becomes the same value as the real current value. • When using Q173DCPU(-S1)/Q172DCPU(-S1)
 - The feed current value is advanced within the rapid stop deceleration time set in the parameter block.

At the same time, the servo OFF state is established because the all axes servo ON command (M2042) turns off.

When the rapid stop deceleration time has elapsed after input of the forced stop signal, the feed current value returns to the value at the point when the emergency stop was initiated.

- (2) If the forced stop is cancelled while the rapid stop deceleration time isn't progressing, an overspeed error or error excessive error may occur.
- (4) Digital oscilloscope executing flag (SM503) Status signal This flag is used to check the state of execution for the digital oscilloscope.
 - OFF Digital oscilloscope has stopped.
 - ON Digital oscilloscope is executing.
- (5) External forced stop input ON latch flag (SM506)

..... Status signal

This flag turns on when an external forced stop input is detected. After that, it remains ON even if the external forced stop input is cancelled. Reset the external forced stop input ON latch flag using the Motion SFC program.

- OFF External forced stop input is not detected.
- ON External forced stop input is detected.

Ver. : Refer to Section 1.4 for the software version that supports this function.

- (6) Amplifier-less operation status flag (SM508) Status signal This flag is used to check the state of amplifier-less operation.
 - OFF During normal operation
 - ON During amplifier-less operation
- (7) TEST mode request error flag (SM510) Status signal
 - (a) This flag turns on when the test mode is not executed in the test mode request using MT Developer2.
 - (b) When SM510 turns on, the error contents are stored in the test mode request error information (SD510, SD511).
- (8) Motion CPU WDT error flag (SM512)...... Status signal This flag turns on when a WDT error (watchdog timer error) is detected of the Motion CPU self-diagnosis function.
 When the Motion CPU detects a WDT error, it executes an immediate stop without deceleration of the operating axes.
 If the Motion CPU WDT error flag has turn on, reset the Multiple CPU system.
 If SM512 remains on after resetting, there is a fault at the Motion CPU side.
 The error cause is stored in the "Motion CPU WDT error cause (SD512)".
 (Refer to Section 4.5(7)).
- (9) Manual pulse generator axis setting error flag (SM513)

..... Status signal

- (a) This flag is use as judgement of normal or abnormal setting of the manual pulse generator axis No. setting registers (D714 to D719).
 - OFFD714 to D719 is normal
 - ON.....D714 to D719 is abnormal
- (b) This flag turns ON by turning ON the manual pulse generator enable flag (M2051 to M2053) with the manual pulse generator axis P1 to P3 unused after setting the manual pulse generator interface module (Q173DPX) in the system setting.
- (c) When SM513 turns on, the error contents are stored in the manual pulse generator axis setting error information (SD513 to SD515).
- (10) Servo program setting error flag (SM516) Status signal This flag is used as judgement of normal or abnormal for the servo program positioning data.
 - OFF.....Normal
 - ON Abnormal

4.5 Special Registers (SD)

There are 2256 special register points of SD0 to SD2255 in the Motion CPU. Of these, devices in a Table 4.5 are used for the positioning control. The special register list used for the positioning control is shown below. (Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for the applications of special registers except below.)

Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction
SD200	State of switch			
SD500		Main cycle	/	
SD501	Real mode axis information register (SV22)		/	
SD502		At power supply on/		
SD503	Servo amplifier loading information	operation cycle	/	
SD504				
SD505	Real mode/virtual mode switching error	At virtual mode transition		
SD506	Information (SV22)		/	
SD508	SSCNET control (status)	Main cycle		
SD510	To at mode we are at a man information			
SD511	rest mode request error information	At test mode request		Monitor device
SD512	Motion CPLLWDT error cause	At Motion CPU		
30312	Motion CFO WD1 endicadse	WDT error occurrence		
SD513		At the manual pulse generator		
SD514				
SD515				
SD516	Error program No.	At stort		
SD517	Error item information	At Start		
SD522	Motion operation cycle	Operation cycle		
SD523	Operation cycle of the Motion CPU setting	At power supply on		
SD524	Maximum Motion operation cycle	Operation cycle		
SD550		At System setting error		
SD551	System setting error information	occurrence]/	
SD560	Operation method QDS(Ver	At power supply on	/	
SD803	SSCNET control (command)		Main cycle	Command device

Table 4.5 Special register list



Ver. : Refer to Section 1.4 for the software version that supports this function.

(2) Real mode axis information register (SD500, SD501)

..... Monitor device

This signal is used to store the information used as a real mode axis at the time of switching from real mode to virtual mode.

The real mode axis information does not change at the time of switching from virtual mode to real mode.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
SD500	Axis 16	Axis 15	Axis 14	Axis 13	Axis 12	Axis 11	Axis 10	Axis 9	Axis 8	Axis 7	Axis 6	Axis 5	Axis 4	Axis 3	Axis 2	Axis 1
SD501	Axis 32	Axis 31	Axis 30	Axis 29	Axis 28	Axis 27	Axis 26	Axis 25	Axis 24	Axis 23	Axis 22	Axis 21	Axis 20	Axis 19	Axis 18	Axis 17
	(Note (Note	-1): Th •Q •Q -2): Re to (e follov 172DS 172DC fer to <i>i</i> each b	wing ra SCPU CPU(-S APPEN it of wo	inge is : Ax 31): Ax NDIX 1 DIX 1 ord dat	valid. is No. is No. .1 for t a.	1 to 16 1 to 8 he exp	ressio	n meth	od of a	axis No	o. corre	espond	ing	→	Real r • 0 : E • 1 : F

(3) Servo amplifier loading information (SD502, SD503)

..... Monitor device

The mounting status of the servo amplifier is checked at the power supply on or reset of the Multiple CPU system and its results are stored in this device. If communication with servo amplifier stops, it is reset.

The mounting status of changed axis after the power supply on is stored.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	
SD502	Axis 16	Axis 15	Axis 14	Axis 13	Axis 12	Axis 11	Axis 10	Axis 9	Axis 8	Axis 7	Axis 6	Axis 5	Axis 4	Axis 3	Axis 2	Axis 1	
SD503	Axis 32	Axis 31	Axis 30	Axis 29	Axis 28	Axis 27	Axis 26	Axis 25	Axis 24	Axis 23	Axis 22	Axis 21	Axis 20	Axis 19	Axis 18	Axis 17	
	(Note- (Note-2	1): The •Q′ •Q′ 2) : Re to e	e follow 172DS 172DC fer to <i>i</i> each b	ving rai CPU PU(-S APPEN it of wo	nge is : Axi 1): Axi IDIX 1 ord dat	valid. s No.1 s No.1 1 for tl a.	to 16 to 8 าe exp	ressior	n meth	od of a	axis Nc	o. corre	spondi	ing		Servo • 0: No • 1: M	amplifier mounting status ot mounted ounted

(a) Servo amplifier mounting status

1) Mounting status

- Mounted The servo amplifier is normal. (Communication with the servo amplifier is normal.)
- Not mounted The servo amplifier is not mounted.

The servo amplifier control circuit power is off. Normal communication with the servo amplifier is

not possible due to a connecting cable fault, etc.

 The system settings and servo amplifier mounting status are shown below.

Queters Qettings	Servo a	amplifier
System Settings	Mounted	Not mounted
Used (axis No. setting)	1 is stored	0 is stored
Unused	0 is s	tored

	b15															b0			
SD504								Error											
SD505	Axis 16	Axis 15	Axis 14	Axis 13	Axis 12	Axis 11	Axis 10	Axis 9	Axis 8	Axis 7	Axis 6	Axis 5	Axis 4	Axis 3	Axis 2	Axis 1			
SD506	Axis 32	Axis 31	Axis 30	Axis 29	Axis 28	Axis 27	Axis 26	Axis 25	Axis 24	Axis 23	Axis 22	Axis 21	Axis 20	Axis 19	Axis 18	Axis 17			
	(Note- (Note-	•1): The •Q •Q •2) : Re to	e follov 172DS 172DC efer to each b	wing ra SCPU CPU(-S APPEI bit of w	nge is : Ax 1): Ax NDIX 1 ord da	valid. is No.1 is No.1 .1 for t ta.	to 16 to 8 he exp	oressio	n meth	<	Examp Decim Decim and the	le> Fo al) "12 al) "0" e error	r 8 axe 8" and and (H code is	es erro (Hexa lexade s store	r decim cimal) d in th	al) "008("0000H e SD504	H" is stor is stored	ed in the in the SI	SD505,)506,

(5) SSCNET control (status) (SD508) Monitor device SSCNET control (status) (SD508) stores the executing state for connect/disconnect of SSCNET communication and start/release of amplifierless operation.

- 0 Command accept waiting
- -1 Execute waiting
- -2 Executing

Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller programming Manual (COMMON)" for details of the SSCNET control function.

(6) Test mode request error information (SD510, SD511)

..... Monitor device

If there are operating axis at a test mode request using MT Developer2, a test mode request error occurs, the test mode request error flag (SM510) turns on, and the during operation/stop data of each axis are stored.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	
SD510	Axis 16	Axis 15	Axis 14	Axis 13	Axis 12	Axis 11	Axis 10	Axis 9	Axis 8	Axis 7	Axis 6	Axis 5	Axis 4	Axis 3	Axis 2	Axis 1	
SD511	Axis 32	Axis 31	Axis 30	Axis 29	Axis 28	Axis 27	Axis 26	Axis 25	Axis 24	Axis 23	Axis 22	Axis 21	Axis 20	Axis 19	Axis 18	Axis 17	
	(Note-	-1): Th •Q •Q -2) : Re to	e follov 172DS 172DC efer to each b	wing ra SCPU CPU(-S APPE oit of w	inge is : Ax 31): Ax NDIX 1 ord da	valid. is No.´ is No.´ I.1 for t ta.	1 to 16 1 to 8 the exp	pressio	n metl	nod of	axis N	o. corr	espono	ding		Stores data o • 0 : D • 1 : D	the during operation/stop f each axis uring stop uring operation

(7) Motion CPU WDT error cause (SD512) Monitor device

The is the state of the state o			1 - f 1			
I DIS FERISTER	is lisen ag	sillaaemen	t of the error	contents i	η της ινιοτιά	IN C.PU
THIS TOGISTOR	13 4304 4	juuuuuiiittiitti		CONCINCING		JII OI U.
		1 0				

Error code	Error cause	Operation when error occurs	Action to take
1	S/W fault 1		Reset the Multiple CPU system.
2	Operation cycle time over	All axes stop immediately, after which operation cannot be started.	 If the an operation cycle time over reoccurs after resetting, or a main cycle is lengthened (more than 1.0[s]), 1) Change the operation cycle into a large value in the system setting. 2) Reduce the number of command execution of the event task or NMI task in the system setting.
4	WDT error		Reset the Multiple CPU system.
300	S/W fault 3		 If the error reoccurs after resetting, explain the error symptom
303	S/W fault 4		and get advice from our sales representative.
304	RIO WDT error		

(8) Manual pulse generator axis setting error information

If there is an unused setting error for the manual pulse generator axis, a correspondence bit of SD513 turns ON.



- (9) Error program No. (SD516) Monitor device
 - (a) When the servo program error occurs at the servo program start, the servo program setting error flag (SM516) turns on and the error servo program No. (0 to 4095).
 - (b) If an error occurs in another servo program when error program No. has been stored, the program No. of the new error is stored.
- (10) Error item information (SD517) Monitor device When the servo program error occurs at the servo program start, the servo program setting error flag (SM516) turns on and the error code corresponds to the error setting item is stored. Refer to APPENDIX 1.3 for details of servo program setting errors.
- (11) Motion operation cycle (SD522) Monitor device The time which motion operation took for every motion operation cycle is stored in [μs] unit.
- (12) Operation cycle of the Motion CPU setting (SD523)

0.8[ms] / 1.7[ms] / 3.5[ms] / 7.1[ms] /14.2[ms] • is set in the system setting, the operation cycle corresponding to each setting.

(Note): If the servo amplifiers of 9 axes or more are connected to one SSCNETI line, it does not support an operation cycle of 0.4[ms].
0.8[ms] is used as the real operation cycle, even if 0.4[ms] is set in the system setting.

(13) Maximum Motion operation cycle (SD524)

..... Monitor device

The maximum time for motion operation is stored every motion operation cycle in $\left[\mu s\right]$ unit.

(14) System setting error information (SD550,SD551)

..... Monitor device

The error code and error individual information are stored at the system setting error occurrence.

Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for details of the system setting errors.

- - 0 Virtual mode switching method
 - 1 Advanced synchronous control method
- (16) SSCNET control (command) (SD803) Command device SSCNET control (command) (SD803) is required for connect/disconnect of SSCNET communication and start/release of amplifier-less operation.
 - 0 No command
 - 1 to 32 Disconnect command of SSCNET communication
 - -10 Re-connect command of SSCNET communication
 - -20 Start command 1 of amplifier-less operation (EMI invalid)
 - -21 Start command 2 of amplifier-less operation (EMI valid)
 - -25 Release command of amplifier-less operation
 - -2 Execute command

Refer to the "Q173DCPU/Q172DCPU Motion controller Programming Manual (COMMON)" for details of the SSCNET control function.

Ver. : Refer to Section 1.4 for the software version that supports this function.

MEMO

5. MECHANICAL SYSTEM PROGRAM

This section describes the mechanical system program in the virtual mode.

In the mechanical system program (Mechanical support language), what was performing synchronous control by hardware using the gear, shaft, belt, pulley, cam or infinitely variable speed changer, etc. is transposed to software, and same operation control is performed.

The mechanical system program is composed with the mechanical module connection diagram and mechanical module parameter.

- The mechanical module connection diagram shows the virtual mechanical system which connected the virtual mechanical modules.
- The mechanical module parameters are used to control of the mechanical modules used at the mechanical module connection diagram.

Refer to the mechanical module parameter lists shown in Chapters 6 to 8 for the mechanical module parameters.

5.1 Mechanical Module Connection Diagram

The mechanical module connection diagram shows a virtual system diagram which arranged the mechanical modules and was composed.

Configuration of the mechanical module connection is shown in Fig. 5.1 below.



Fig. 5.1 Configuration of the Mechanical Module Connection

P	OINT	
(1)	Either a vi	irtual servo motor or a synchronous encoder can be connected in the
	drive mod	Jule.

(2) One of the cam, roller, ball screw or rotary table can be connected in the output module.

(1) Block

The term "block" is one relation from the virtual transmission module (gear) connected to the virtual main shaft to the output module. Refer to Section 5.2 for the number of mechanical modules which can be connected in one block.

(2) System

The term "system" is a generic term of multiple blocks connected to one virtual main shaft.

The number of blocks connectable with one system is up to 32 blocks.

(3) Transmission module connections

There are 3 transmission module connection patterns:

- Pattern 1...... Without a differential gear.
- Pattern 2...... Without a speed change gear at the output side of the differential gear.
- Pattern 3...... With a speed change gear at the output side of the differential gear.



- (a) Transmission modules which can be connected at "A" and "B" above
 - 1) A clutch, speed change gear, and "clutch + speed change gear" can be connected at "A" and "B".
 - 2) If a "clutch + speed change gear" are used, connection constraints have not restrictions.



(b) Transmission module which can be connected at "C" (pattern 3) Only a clutch can be connected at "C".

MEMO

5.2 Mechanical Module List

An overview of the mechanical modules used at the mechanical module connection diagrams in the virtual mode is shown in Tables 5.1. Refer to Chapter 6 to 8 for details of each mechanical module.

							М	aximum Nur	nber c	of Usab	е				
	Mechanica	I Module				Q173E	SCPU					Q1720	SCPU		
Classification			Nu	mber	Nu	mber	Number P	er Block	Nu	mber	Nu	mber	Number P	er Block	<u>c</u>
	Name	Appearance	Per	Motion PU		Per	Connection	Auxiliary Input	Per	Motion PU	- 1	Per	Connection	Auxiliary Input	
			mo	odule	Sy	rstem	Shaft Side	Axis Side	mo	odule	Sy	stem	Axis Side	Axis Side	
	Virtual servo motor		32	Total	32	Total	_		16	Total	16	Total	_	_	
	Synchronous encoder		12	44	12	34	_	_	12	28	12	18	_	_	
	Virtual main shaft	_	32			32	_	_	16			16	_	_	
Virtual axis	Virtual auxiliary input axis	_	32	Total 64		32	_		16	Total 32		16	_	_	
	Gear			64		64	1	1		32		32	1	1	
	Direct clutch														
Transmission module	Smoothing clutch			64		64	1	1		32		32	1	1	
	Speed change gear			64		64	1	1		32		32	1	1	
	Differential gear			32		32	1			16		16	1		
	Differential gear to main shaft			32		1	_			16		1	_		

Table 5.1 Mechanical Module List

				Μ	aximum Nun	nber c	of Usabl	е												
		C	Q173DC	PU(-S1)				(Q172DC	PU(-S1)										
Nu	nber	Nu	mher	Number P	er Block	Nu	mber	Nu	mher	Number P	er Block	Function Description	Section							
Per I	Notion	F	Per	Connection	Auxiliary	Per I	Motion	F	Per	Connection	Auxiliary		000000							
С	PU	Sy	stem	Shaft Side	Input	С	PU	Sy	stem	Axis Side	Input									
mc	dule		1		Axis Side	mo	dule		1		Axis Side									
22		22				0						It is used to drive the virtual axis of	Section							
32	Total	32	Total	_	—	0	Total	0	Total	_	_	servo program or IOG operation	6.1							
	44		34				16	ł	10			It is used to drive the virtual axis by the								
12		12	-	_	_	8		8		_	_	input pulses from the external	Section							
												synchronous encoder.	6.2							
												 This is a virtual "link shaft". 								
32		:	32	—	—	8			8	—	—	 Drive module rotation is transferred to 	—							
		-										the transmission module.								
	Total						Total					This is the auxiliary input axis for input to								
22	64		20			8		0				the differential gear of transmission								
52			52	_	_	0			0	_	_	It is automatically displayed when a	_							
												differential gear and gear are connected.								
												The drive module rotation is transmitted								
												to the output axis.								
												 A setting gear ratio is applied to the 	Section							
(64	(64	1	1		16		16	1	1	travel value (pulse) input from the drive	7.1							
											module, and then transmits to the output									
												axis that it becomes in the setting rotation direction.								
												Transmit or separate the drive module								
												rotation to the output module.								
												There are a direct clutch transmitted								
																			directly and the smoothing clutch which	
													performs the acceleration/deceleration							
												and transmission by the smoothing time	Section							
(64	(64	1	1		16		16	1	1	ON/OFF of the clutch	7.2							
												 It can be selected the ON/OFF mode, 	1.2							
												address mode or the external input								
												mode depending on the application.								
												 Time constant system or slippage 								
												system can be selected as a smoothing								
								<u> </u>				method.								
												module (roller)								
(64	(64	1	1		16		16	1	1	The setting speed change ratio is	Section							
	-											applied to input axis speed, and	7.3							
												transmits to the output axis.								
												Auxiliary input axis rotation is subtracted								
:	32	:	32	1			8		8	1		from virtual main shaft rotation and the								
												result is transmitted to the output axis.	o							
											—	Auvilianzinnut avis rotation is subtracted	Section							
												from virtual main shaft rotation and the	7.4							
	32		1	—			8		1	-		result is transmitted to the output axis.								
												(Connected to the virtual main shaft)								

				Maximum Number of Usable											
Classification	Mechanica				Q173E	SCPU		Q172DSCPU							
			Number Per Motion CPU module		Number Per System		Number P	Number		Numbor		Number P			
	Name	Appearance					Connection Shaft Side	Auxiliary Input Axis Side	Per Motion CPU module		Per System		Connection Axis Side	Auxiliary Input Axis Side	
Output module	Roller		32	32					16		16				
	Ball screw		32	Total	32	Total	1	1	16	Total 16	16	6 Total 16 6	1	1	
	Rotary table		32	32	32	32			16		16				
	Cam		32		32				16		16				

Table 5.1 Mechanical Module List (Continued)

					Ma									
	Q173DCPU(-S1)								C	2172DC	PU(-S1)		Function Description	Section
	Number Per Motion CPU module		Number Per System		Number P	Number		Numbor		Number Per Block				
					Connection Shaft Side	Auxiliary Input Axis Side	 Per Motion CPU module 		Per System		Connection Axis Side	Auxiliary Input Axis Side	r anotori Besonptori	occion
	32		32	Total 32	1	1	8	Total 8 –	8		1	1	 It is used to perform the speed control at the final output. 	Section 8.1
	32	Total 32	32				8		8	Total 8			 It is used to perform the linear positioning control at the final output. 	Section 8.2
	32		32						8				 It is used to perform the angle control at the final output. 	Section 8.3
	32		32				8		8				 It is used to perform the position control based on the cam pattern setting data. There are 2 cam control modes: the two-way cam and feed cam. 	Section 8.4

MEMO

6. DRIVE MODULE

The drive module is the source of drive for the virtual axis (virtual main shaft, virtual auxiliary input axis).

There are following 2 types drive module.

- Virtual servo motor Refer to Section 6.1
- Synchronous encoder Refer to Section 6.2

POINT

Set the travel value of drive module so large as possible to prevent the speed fluctuation of output module in the mechanical system program. If the travel value of drive module is small, the speed fluctuation of output module may occur depending on the setting for transmission module.

6.1 Virtual Servo motor

The virtual servo motor is used to operate the virtual axis (virtual main shaft, virtual auxiliary input axis) using the servo program or JOG operation. Virtual servo motor operation and parameters are shown below.

6.1.1 Operation description

(1) Operation

When the virtual servo motor is started, the pulses are transmitted to the virtual axis (virtual main shaft, virtual auxiliary input axis) by the start conditions (command speed, travel value).

The transmitted pulses are transmitted to the output module connected via the transmission module (gear, differential gear, clutch, speed change gear).

(2) Starting method

The virtual servo motor is started using the servo program or JOG operation.

- (a) Start using the servo program
 - The servo program of Motion SFC program (motion control step) is executed. At this time, the start accept flag ^(Note-1)(M2001 to M2032) of the starting axis turns on.



Example of the Motion SFC program is shown below.

(Note) : Example of the above Motion SFC program is started using the automatic start or sequence program.

REMARK

(Note-1): Refer to Section 4.1.7 (2) for details of the start accept flag.

(b) Start using the JOG operation

An individual start and simultaneous start can be executed in the JOG operation (Note-1).

- 1) Individual start
 -It is started by turning on the forward/reverse JOG command ^(Note-2) of each axis.

Motion SFC program for which executes the JOG operation is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.
2) Simultaneous start

......The simultaneous start axis No. and directions (forward/reverse) are set by the JOG operation simultaneous start axis setting register (D710 to D713) ^(Note-3), and it is started by turning on the JOG operation simultaneous start command flag (M2048) ^(Note-3).



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

REMARK

- (Note-1): Refer to Section "6.21 JOG Operation" of the "Q173D(S)CPU/ Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)" for details of the JOG operation.
- (Note-2): Refer to Section 4.1.4 (3) for details of the forward/reverse rotation JOG start commands.
- (Note-3): Refer to Section 4.2.8 (2) for details of the JOG operation simultaneous start axis setting registers, and Section 4.1.7 (14) for details of the JOG operation simultaneous start command.

(3) Stopping method during operation

When the virtual servo motor is stopped during operation after the start, turn the stop command (M4800+20n)/rapid stop command (M4801+20n) on using the Motion SFC program.

(There are no external stop causes (STOP, FLS, RLS) for the virtual servo motor.)

(4) Control items

- (a) It is controlled as the virtual servo motor backlash compensation amount "0" at the positioning control.
- (b) The deviation counter value and the real current value are not stored, so that the virtual servo motor has no feedback pulse.
- (c) The feed current value of virtual servo motor is recorded in a backup memory, and it is restored at the switching from real mode to virtual mode after the power supply of the Multiple CPU system turned on.
 - When the output module is using the absolute position system, continuation operation is possible. However, if the servo motor of the output module connected to the virtual servo motor is operated while the power supply of the Multiple CPU system turns off, continuation operation is impossible even if the absolute position system is being used.

At this time, the virtual mode continuation operation disabled warning signal (Note-1) turns on.

Set the virtual servo motor or servo motor of output module to the position which synchronous operation is possible.

2) When the output module is not using the absolute position system, correct the feed current value of virtual servo motor by the current value change switching from real mode to virtual mode.

(5) Control change

The following control changes are possible for the virtual servo motor.

- Current value change
- Speed change
- Target position change
 QDS

Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (Motion SFC)" for details of the current value change, speed change or target position change.

REMARK

(Note-1): Refer to Section 4.1.5 (3) for details of the virtual mode continuation operation disabled warning signal.

(6) Error-time operation mode

The processing shown below applies when major errors occur with the output modules per 1 system.

The following control is executed based on the parameter settings (Refer to Section 6.1.2) of the virtual servo motor connected to the virtual main shaft.

(a) Continuation

Even if a major error occurs with the output module, the output module continues operation. At this time, the error detection signal (M2407+20n) turns on, and the applicable error code is stored in the major error code storage register.

Use the Motion SFC program for continue/stop of the system and the output module operation at the major error occurrence.

(b) Clutch OFF

If a major error occurs with the output module, the clutch within 1 system turns off and stops connected output modules. (The smoothing processing is executed by the clutch setting.)

At this time, the clutch ON/OFF command device does not turn off. However, the clutch status storage device turns off regardless of the clutch ON/OFF command device's ON/OFF status.

Operation continues at axes where no clutch is connected.

Use the Motion SFC program to stop the drive module.

Eliminate the error cause, then turn the clutch ON/OFF command device off to on to resume the operation.



(7) Virtual servo motor axis infinite operation

By setting the upper stroke limit value and lower stroke limit value of the virtual servo motor parameters such that the "upper stroke limit value = lower stroke limit value", the stroke limit becomes invalid and infinite operation becomes possible.

When the stroke limit is invalid, it is also possible for the start of the feed current value to take place in a direction that exceeds 32 bits. In this case, the feed current value is converted to a 32 bits ring address.

→ -2147483648......2147483647

Control mode	Control contents		
Positioning (Linear)	$\ensuremath{\cdot}$ When the ABS command is used for the start, it starts in a		
Speed-switching	direction within the 32 bits range. It does not start in a		
Constant-speed (Linear)	 direction that exceeds the 32 bits range. When the INC command is used for the start, it starts in the specified direction, so it also can be start in a direction that exceeds 32 bits. 		
Fixed-pitch feed	 It starts in the specified direction, it also can be start in a direction that exceeds 32 bits. 		
Position follow-up	 The command address is controlled by the absolute method so it does not start in a direction that exceeds the 32 bits range. 		
Speed			
JOG	Stroke is invalid. (It is ignored.) Moves in the specified		
Manual pulse generator (Test mode)	direction.		
Positioning (Circular, Helical)	• A start error (107, 108, 109) accompanies the ABS, ABH,		
Constant-speed (Circular, Helical)	INC or INH command and start is not possible.		

The following operations are possible by the control mode.

(8) Reverse return during positioning

By specifying a negative speed and making a speed change request by the CHGV instruction during the start, allow the axis start deceleration at that point and return in the opposite direction upon completion of deceleration. Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (Motion SFC)" for details.

(9) Target position change

Making a target position change request by the CHGP instruction during the start. Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (Motion SFC)" for details.

6.1.2 Parameter list

The virtual servo motor parameters are shown in Table 6.1 and the parameters shown in this table are explained in items (1) to (4) below.

Refer to the help of MT Developer2 for the parameter setting method of virtual servo motor.

A parameter is requested except for the above for program operation of the virtual servo motor. Refer to the item (5) for precautions of the parameter blocks.

No.	. Setting item		Default value		Setting range			
							Q173DSCPU/Q173DCPU(-S1): 1 to 32	
1	Virtual axis No.		—		Q172DSCPU : 1 to 16	—		
					Q172DCPU(-S1) : 1 to 8			
2	2 Upper stroke limit value		2147483647	pulse	-2147483648 to 2147483647	pulse		
3	3 Lower stroke limit value		0	pulse	-2147483648 to 2147483647	pulse		
		100	Q173DSCPU/Q172DSCPU : 1 to 214748364	7				
4	4 Command in-position range		100	puise	Q173DCPU(-S1)/Q172DCPU(-S1) : 1 to 32767	puise		
5	JOG operation-time	JOG speed restriction	20000	pulse/s	1 to 2147483647	pulse/s		
6	parameter	Parameter block No.	1		1 to 64			
7	7 Operation mode at error occurrence		Continuation		Continuation/Clutch OFF	_		

Table 6.1 Virtual Servo motor Parameter List

(1) Virtual axis No. setting

The virtual axis No. is set in the servo program at the virtual mode operation. The axis No. of the virtual servo motor connected to the virtual main shaft or virtual auxiliary input axis.

(2) Upper/lower stroke limit value settings

- The stroke limit range of the virtual servo motor axis is set.
- (a) When the stroke limit value is made valid:

Set the stroke range of the "Lower stroke limit value < upper stroke limit value".

The stroke limit check and control details at the start/during start are shown below.

Control mode		Error check ^(Note)					
		At start	During start			Remarks	
		106	207	208	220		
.	Linear	0		—	_		
Positioning	Circular	0	0	0	—		
Fixed-pitch feed		0		—	_	Start in the return direction in a stroke limit range from outside the stroke limit range is possible.	
Speed-switching		0	0	0	_		
Constant-speed/Helical		0	0	0	_		
Position follow-u	qu	0	0	—	0		
Speed		_		_	_	Stroke limit is invalid.	
JOG		_	0	_	_	Start in the return direction in a	
Manual pulse g	enerator	_	0	0	_	stroke limit range from outside the stroke limit range is possible.	

(Note): \bigcirc Code detected at the error check.

<Error check at start>

Error code	Contents	Operation
106	Command position is outside the stroke limit range at	Operation does not
	start.	start.

<Error check during start>

Error code	Contents	Operation
207	Feed current value is outside the stroke limit range during start.	
208	Feed current value of another axis is outside the stroke limit range at the circular interpolation start.	Deceleration stop.
220	Command address is outside the stroke limit range during position follow-up control.	

(b) When the stroke limit value is invalid.

Set the stroke range of the "Lower stroke limit value = upper stroke limit value".

When the stroke limit is invalid, feed current value startup in a direction that exceeds 32 bits is possible.

In such a case the feed current value is converted to a 32 bit ring address.

→ -2147483648......2147483647

The following operations are possible by the control mode.

Control mode	Control contents
Positioning (Linear)	• When the ABS command is used at the start, it starts in a
Speed-switching	direction within the 32 bits range. It does not start in a
	direction that exceeds the 32 bits range.
	 When the INC command is used at the start, it starts in
Constant-speed (Linear)	the specified direction, so it also can be start in a direction
	that exceeds 32 bits.
Fixed pitch food	• It starts in the specified direction, it also can be start in a
	direction that exceeds 32 bits.
	 The command address is controlled by the absolute
Position follow-up	method so it does not start in a direction that exceeds the
	32 bits range.
Speed	
JOG	• Stroke is invalid. (It is ignored.) I ravel in the specified
Manual pulse generator	direction.
Positioning (Circular, Helical)	• A start error (107, 108, 109) occurs in the ABS, ABH, INC
Constant-speed (Circular, Helical)	or INH command and start is not possible.

(3) Command in-position range

The command in-position is the difference between the positioning address (command position) and feed current value.

Once the value for the command in-position has been set, the command inposition signal (M2403 + 20n) turns on when the difference between the command position and the feed current value enters the set range [(command position - feed current value) \leq (command in-position range)].

The command in-position check is executed, continuously during position control. (The command in-position range is not checked during the speed control and JOG operation.)



Fig. 6.1 Command in-position range

- (4) Setting of the JOG speed restriction and parameter block No. The JOG speed restriction and parameter block No. used in the JOG operation are shown below.
 - (a) JOG speed restriction

This is the maximum speed setting at the JOG operation for virtual axis. If the JOG speed exceeds the JOG speed restriction, the JOG speed is controlled with the JOG speed restriction.

(b) Parameter block No. setting

This is the parameter block No. setting at the JOG operation.

The following parameter block data items are valid in the JOG operation.

- Acceleration time
- Deceleration time
- · Rapid stop deceleration time



Fig. 6.2 Relationships between the JOG speed restriction, acceleration time, deceleration time and rapid stop time

POINT

- (1) Unit is fixed at [pulse] regardless of the interpolation control unit setting of parameter block in the JOG operation.
- (2) Even if the JOG speed of virtual servo motor is within the JOG speed restriction, when the JOG speed has not satisfied the condition "(Command speed [pulse/s]) × (Operation cycle [ms]) × (Number of input side gear teeth) < 2147483647 × 10³", the speed of output module becomes abnormal. Be sure to use within the range of above conditional expression.



(Example) Relation between an operation cycle, number of input side gear teeth and maximum speed

Operation cycle	Number	Number of input side gear teeth		
[ms]	1	10000	65535	
0.22 QDS		900000000	137331200	
0.44	2147483647	450000000	68665600	
0.88		225000000	34332800	
1.77		112500000	17166400	
3.55		56250000	8583200	
7.11		28125000	4291600	
14.2 QD		14062500	2145800	

REMARK

Regardless of the speed limit value of parameter block for also program start of virtual servo motor, when the command speed has not satisfied the condition "(Command speed [pulse/s]) × (Operation cycle [ms]) × (Number of input side gear teeth) < 2147483647×10^3 ", the speed of output module becomes abnormal. Be sure to use within the range of above conditional expression. (5) The parameter block No. for the program operation of virtual servo motor is set in the servo program for virtual mode. (If the parameter block No. setting is omitted, it is controlled with the contents of parameter block No.1.)

	Item	Control unit
Interpolation control unit		[pulse] only (Note-1)
Speed limit value		[pulse/s] only (Note-1)
Acceleration time		0
Deceleration time		0
Rapid stop decelerat	ion time	0
S-curve ratio		0
	Acceleration/deceleration system	0
Advanced S-curve	Acceleration section 1 ratio	0
acceleration/	Acceleration section 2 ratio	0
deceleration	Deceleration section 1 ratio	0
	Deceleration section 2 ratio	0
Torque limit value		imes (Note-2)
STOP input-time deceleration processing		×
Circular interpolation error permissible range		[pulse] only (Note-1)

The valid parameter block data are shown below.

 \bigcirc : Valid, \times : Invalid

(Note-1): If it is set except for the [pulse] or [pulse/s], the program operation is executed as [pulse] automatically. (Note-2): It is set for every output module with a parameter of output module.

-			
	Item	Specified parameter	Value used for the
		block setting value	program operation
Interpolation control	unit	[mm]	[pulse]
Speed limit value		2000.00[mm/min]	200000[pulse/s]
Acceleration time		1000[ms]	1000[ms]
Deceleration time		1000[ms]	1000[ms]
Rapid stop decelerat	tion time	1000[ms]	1000[ms]
S-curve ratio		0[%]	0[%]
	Acceleration/deceleration system	Trapezoid/S-curve	Trapezoid/S-curve
Advanced S-curve	Acceleration section 1 ratio	20.0[%]	20.0[%]
acceleration/	Acceleration section 2 ratio	20.0[%]	20.0[%]
deceleration	Deceleration section 1 ratio	20.0[%]	20.0[%]
	Deceleration section 2 ratio	20.0[%]	20.0[%]
Torque limit value		300[%]	
STOP input-time dec	celeration processing	Deceleration stop	_
Circular interpolation	error permissible range	0.0100[mm]	100[pulse]

<Example>

6.1.3 Virtual servo motor axis devices (Internal relays, data registers)

- Virtual servo motor axis status Refer to Section 4.1.3 for details of the virtual servo motor axis statuses.
- (2) Virtual servo motor axis command signal Refer to Section 4.1.4 for details of the virtual servo motor axis command signals.
- (3) Virtual servo motor axis monitor device Refer to Section 4.2.3 for details of the virtual servo motor axis monitor devices.
- (4) Current value after virtual servo motor axis main shaft's differential gear

Refer to Section 4.2.4 for details of the current value after virtual servo motor axis main shaft's differential gear.

6.2 Synchronous Encoder

The synchronous encoder is used to operate the virtual axis (virtual main shaft, virtual auxiliary input axis) with the external input pulse.

Synchronous encoder operation and parameters are shown below.

6.2.1 Operation description

(1) Operations

Although a synchronous encoder does not need to start using the servo program etc. in order to operate it by external devices, it needs cautions for the timing which begins to input the input pulse from a synchronous encoder.

(a) Operation start

The input timing of input pulse ^(Note-4) from an external synchronous encoder is shown below.

- · At the switching from real mode to virtual mode
- At the external signal (Note-2) (TREN : Synchronous encoder input start signal) input
- 1) When the input pulse is started to input at the switching from real mode to virtual mode. (Note-4)
 - a) The input pulse is input from the external synchronous encoder at the switching from real mode to virtual mode.



- b) The control mode (Note-3) of a clutch is operation in the case of ON/OFF mode and address mode. It can be used with the synchronous encoder for the incremental/absolute data method.
- c) Operating of the synchronous encoder axis starts when switched to the virtual mode by executing the switching request from real mode to virtual mode (M2043 OFF to ON). It depends on the state of connected clutch whether synchronous encoder operation in virtual mode is transmitted or not to the output module.
 - Clutch ON Transmit to the output module.
 - Clutch OFF Not transmit to the output module.

- If the mode is switched from real mode to virtual mode in the state of clutch ON, use the smoothing clutch. If the direct clutch is used and the mode is switched from real mode to virtual mode in the state of clutch ON, the rapid acceleration occurs at the output module axis, causing a servo error, and the machine will be subjected to a jolt.
 - 2) When the input pulse is inputted from an external synchronous encoder. (Note-4)



a) The input pulse is started to input from the external synchronous encoder, when the clutch is switched on in virtual mode.

b) The control mode (Note-3) of a clutch is operation in the case of external input mode.

Operation of the synchronous encoder and clutch corresponds. It can be used with the synchronous encoder for the incremental data method connected to Q173DPX only.

- (b) Operation end
 - Operation of the synchronous encoder axis is executed the real mode/virtual mode switching request (M2043 : ON → OFF) and ends at the switching to real mode. ^(Note-4)
 - 2) The procedure for ending operation of the synchronous encoder axis is shown below.
 - a) Stop the output module
 - -Stop the external synchronous encoder.
 - b) Switch from the virtual mode to real mode.

If the mode is switched from virtual mode to real mode while the synchronous encoder axis and connected output module are operating, the rapid stop occurs at the output module axis, causing a servo error, and the machine will be subjected to a jolt. (c) Stopping method

Stop the external synchronous encoder for stopping the external synchronous encoder.

There are no external inputs (FLS, RLS, STOP) or stop command/rapid stop command from the Motion SFC program for the synchronous encoder.

- (d) Control items
 - 1) The deviation counter value and the real current value are not stored, so that the synchronous encoder has no feedback pulse.
 - 2) The current value of synchronous encoder is recorded in a backup memory, and it is restored at the switching from real mode to virtual mode after the power supply of the Multiple CPU system turned on.^(Note-4)
 - a) When the output module is using the absolute position system, continuation operation is possible. However, if the servo motor of the output module connected to the synchronous encoder or synchronous encoder for the absolute data method is operated by 180° or more while the power supply of the Multiple CPU system turns off, continuation operation is impossible even if the absolute position system is being used.

At this time, the virtual mode continuation operation disabled warning signal turns on.

Set the servo motor of output module to the position which synchronous operation is possible.

- b) When the output module is not using the absolute position system, correct the feed current value by the current value change switching from real mode to virtual mode.
- (e) Control change

The following current value change is possible for the synchronous encoder. Refer to Section 7.3 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (Motion SFC)" for details of the current value change.

REMARK

- (Note-1): Refer to Section 4.1.7 (9) (10) for details of the real mode/virtual mode switching request flag and real mode/virtual mode switching status flag.
 Refer to Chapter 9 for switching from real mode to virtual mode.
- (Note-2): The synchronous encoder input start signal is inputted to the Q173DPX "TREN" terminal. Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller User's Manual" for details of the Q173DPX "TREN" terminal.
- (Note-3): Refer to Section 7.2.1 for details of the clutch control mode.
- (Note-4): The input pulse is always input after Multiple CPU system's power supply ON in the real mode for the version (Refer to Section 1.4) that supports "synchronous encoder current value monitor in real mode".
 Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)" for details.

(f) Error-time operation mode

The processings are shown below when major errors occurred with the output modules per 1 system.

The following control is executed based on the parameter settings (Refer to Table 6.2) of the synchronous encoder connected to the virtual main shaft.

1) Continuation

Even if a major error occurs with the output module, the output module continues operation. At this time, the error detection signal (M2407+20n) turns on, and the applicable error code is stored in the major error code storage register.

Use the Motion SFC program for continue/stop of the system and the output module operation at the major error occurrence.

2) Clutch OFF

If a major error occurs with the output module, the clutch within 1 system turns off and stops connected output modules.

At this time, the clutch ON/OFF command device does not turn off. However, the clutch status storage device turns off regardless of the clutch ON/OFF command device's ON/OFF status.

Operation continues at axes where no clutch is connected.

Use the Motion SFC program to stop the drive module.

Eliminate the error cause, then turn the clutch ON/OFF command device off to on to resume the operation.



6.2.2 Parameter list

The synchronous encoder parameters are shown in Table 6.2 and the parameters shown in this table are explained in items (1) below.

Refer to the help of MT Developer2 for the parameter setting method of synchronous encoder.

No.	Setting item	Default value	Setting range
1	Synchronous encoder No.	_	Q173DSCPU/Q172DSCPU/Q173DCPU(-S1) : 1 to 12 Q172DCPU(-S1) : 1 to 8
2	Error-time operation mode	Continuation	Continuation/ Clutch OFF

(1) Synchronous encoder No.

The synchronous encoder No. is set connected to the Q172DEX/Q173DPX/builtin interface in Motion CPU (DI)

Connecting position	Synchronous encoder No.
P1	1
P2	2
P3	3
P4	4
P5	5
P6	6
P7	7
P8	8
P9	9
P10	10
P11	11
P12	12

REMARK

(Note-1): The absolute and incremental synchronous encoders can be used (set) together.

6.2.3 Synchronous encoder axis devices (Internal relays, data registers)

- (1) Synchronous encoder axis status Refer to Section 4.1.5 for details of the synchronous encoder axis statuses.
- (2) Synchronous encoder axis command signal Refer to Section 4.1.6 for details of the synchronous encoder axis command signals.
- (3) Synchronous encoder axis monitor device Refer to Section 4.2.5 for details of the synchronous encoder axis monitor devices.
- (4) Current value after synchronous encoder axis main shaft's differential gear
 Refer to Section 4.2.6 for details of the current value after synchronous encoder axis main shaft's differential gear.

6.3 Virtual Servo motor/Synchronous Encoder Control Change

The current value change and JOG speed change of the virtual servo motor and the current value of synchronous encoder. Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (Motion SFC)" for details of the current value change/speed change/target position change

6.3.1 Virtual servo motor control change

Axis No.	Device No.			Signal	name			
1	D640, D641							
2	D642, D643		Signal name	Pool	Virtual	Refresh	Eatab avala	Signal
3	D644, D645		Signal name		virtuai	cycle	Felch cycle	direction
4	D646, D647	0	IOG speed setting	~			At start	Command
5	D648, D649	1	JOG speed setting	0	0		AUStart	device
6	D650, D651							\bigcirc : Valid
7	D652, D653							
8	D654, D655							
9	D656, D657							
10	D658, D659							
11	D660, D661							
12	D662, D663							
13	D664, D665							
14	D666, D667							
15	D668, D669							
16	D670, D671							
17	D672, D673							
18	D674, D675							
19	D676, D677							
20	D678, D679							
21	D680, D681							
22	D682, D683							
23	D684, D685							
24	D686, D687							
25	D688, D689							
26	D690, D691							
27	D692, D693							
28	D694, D695							
29	D696, D697							
30	D698, D699							
31	D700, D701							
32	D702, D703							

(1) Control change registers

POINT

- (1) The following range is valid.
 - Q172DSCPU : Axis No.1 to 16
 - Q172DCPU(-S1): Axis No.1 to 8
- (2) The following device area can be used as a user device.
 - Q172DSCPU : 17 axes or more
 - Q172DCPU(-S1): 9 axes or more

However, when the project of Q172DSCPU/Q172DCPU(-S1) is replaced with Q173DSCPU/Q173DCPU(-S1), this area cannot be used as a user device.

- (a) JOG speed setting registers (D640+2n, D641+2n)Command device
 1) This register stores the JOG speed at the JOG operation.
 - Setting range of the JOG speed is 1 to 2147483647 [pulse/s].
 - The JOG speed is the value stored in the JOG speed setting registers at leading edge of JOG start signal.
 Even if data is changed during JOG operation, JOG speed cannot be changed.
 - (Note): Refer to Section 6.21 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)" for details of the JOG operation.
- (2) Current value change
 - (a) Current value change by the CHGA instruction
 Motion SFC program for which executes the servo program is shown below.
 Current value change program of the virtual servo motor (When 1 axis feed current value of the virtual servo motor is changed to 1000 pulse.)



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

6.3.2 Synchronous encoder control change

- (1) Current value change by the CHGA-E instruction
 - Example of Motion SFC program for which executes the servo program is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

- (a) The current value to change uses the following devices.
 - Indirect setting...... Data register (D)

 Link register (W)
 Motion register (#)
 Multiple CPU area device (U□\G)

 Direct setting Decimal constant (K)
- (b) Precautions
 - When the synchronous encoder current value is changed in the real mode, an error occurs and the current value change is not executed. ^(Note-1)
 - The synchronous encoder current value change can be executed even during operation in the virtual mode operation (during pulse input from the synchronous encoder). ^(Note-1)

When the current value is changed, the synchronous encoder current value will be continued from the changed value.

- Even if a synchronous encoder current value is changed, it will have no effect on the output module current value.
- (Note-1): The current value change can be executed in real mode for the version (Refer to Section 1.4) that supports "synchronous encoder current value monitor in real mode".

7. TRANSMISSION MODULE

The transmission module transmits the pulse outputted from the drive module to output module.

The following 4 types of transmission modules are available.

- Gear Section 7.1
- Clutch Section 7.2
- Speed change gear Section 7.3
- Differential gear Section 7.4

The device range and setting procedure for indirect setting in the parameter setting of the transmission module are show below.

(1) Device range

The number of device words and device range at the indirect setting are shown below.

Module	ltem	Number of device words		Device setting range		Remark
	Clutch ON/OFF command device			Device	Range	
	Smoothing clutch complete signal			Y	0000 to 1FFF	
		Bit		B	0000 to 1FFF	
Clutch	Clutch status			F U⊡\G	0 to 2047 10000.0 to (10000+p-1).F ^(Note-2)	
	Mode setting device	1	_		_	
	Clutch ON address setting device	2		Device	Range	
	Clutch OFF address setting device	2		D	0 to 8191	
	Slippage setting device	2		W	0000 to 1FFF	
	Slippage in-position range setting	2		#	0 to 7999	
	device			U□\G	10000 to (10000+p_1) (Note-2)	
Gear	Output axis side tooth count	1			(10000+p-1) , ,	
Speed change gear	Speed change ratio setting device	1				

(Note-1): The range of "PXn+4 to PXn+F" cannot be used (fixed at 0) for the input device (PXn+0 to PXn+F) allocated to the built-in interface in Motion CPU (DI). (n: First input No.)

(Note-2): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

POINT

- Be sure to set even-numbered devices of the items set as 2-word.
 Be sure to set as 32-bit integer type when the data is set in these devices using the Motion SFC programs.
- (2) When a 2-word monitor device is read in the Motion SFC program, read it as 32-bit integer type.
- (3) Refer to Chapter 2 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for the user setting area points of the Multiple CPU high speed transmission area.

(2) Device data input

The all device data set indirectly is inputted as "initial value" at the switching from real mode to virtual mode, thereafter the input control for module is executed during the virtual mode operation.

The input timing of each setting device and refresh cycle of setting device are shown below.

Module	ltem	Input device	Refresh device	Real mode/ Virtual mode	During the virtual mode operation	Refresh
				switching		Cycle
	Clutch ON/OFF command device	0	_	0	Input for every operation cycle. (Note)	_
	Smoothing clutch complete signal	_	0	_	_	Operation cycle
	Clutch status	_	0	_	_	(Note)
	Mode setting device	0	_	0		
Clutch	Clutch ON address			0	Input for over a portion ovelo	
Clutch	setting device	0		0	(Note)	
	Clutch OFF address		_	0		
	setting device					
	Slippage setting	0	_	0	Input when switching mode	
	device				setting device.	
	Slippage in-position	0	_	0	Input for every operation cycle. (Note)	_
	Input axis side tooth				Input when the current value	
	count	0	_	0	change of the connection source	
					drive module (virtual servo motor	
Gear	Output axis side tooth	0	_	0	axis/synchronous encoder axis) is	
	count				executed and the gear ratio is	
					changed.	
Speed change	hange Speed change ratio		_	0	Input for every operation cycle.	
gear	setting device	Ŭ		Ŭ		

REMARK

(Note): The operation cycle is set in the "operation cycle setting" of system basic setting.

Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for details of setting contents.

7 TRANSMISSION MODULE

7.1 Gear

This section describes the gear operation and the parameters required to use a gear.

7.1.1 Operation

Relation between the number of pulses outputted from the synchronous encoder or virtual servo motor and the output module is adjusted by parameter setting of the encoder resolution of servo motor, the gear ratio in consideration of the deceleration ratio for machine system etc. and rotation direction. The gear operation is shown below.

(1) The gear transmits the number of pulses which applied the gear ratio set in the gear parameter to the travel value (number of pulses) of drive module (virtual servo motor, synchronous encoder) to the output axis.



(2) The rotation direction of output axis is set in the gear parameters.



REMARK

Refer to Section 7.1.2 for details of the gear parameters.

7.1.2 Parameters

The gear parameters are shown in Table 7.1 and the parameters shown in this table are explained in items (1) to (2) below.

Refer to the help of MT Developer2 for the gear parameter setting method.

 Table 7.1 Gear Parameter List

	Setting Item		Default	Sotting range		
No.						
		5		Direct setting	Indirect setting	
		Input axis side		1 to 65535	D0 to D8191 (Note-1)	
	Gear	tooth count (GI)	1		W0 to W1FFF	
1	ratio	Output axis side			#0 to #7999	
		tooth count (GO)			U□\G10000 to U□\G(10000+p-1) ^(Note-2)	
2	Rotation direction of		Forward rotation	Forward rotation		
	output axis			Reverse rotation	—	

(Note-1): D800 to D1559 are dedicated devices of the virtual servo motor axis, synchronous encoder axis and output module "Cam" in the virtual mode. Unused areas of virtual servo motor axis and cam axis can be used as a user device.

(Note-2): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

- (1) Gear ratio
 - (a) The number of pulses transmitted to the output axis through 1 pulse outputted from the drive module by the gear module is set in the gear ratio.
 - (b) The gear ratio is based on the settings for the input axis side tooth count (GI) and output axis side tooth count (GO).



(2) Rotation direction of output axis

- (a) The rotation direction of the output axis forward the rotation direction of the input axis is set.
- (b) There are two types for rotation directions of the output axis: forward and reverse.
 - 1) Forward

When the input axis rotates to the address increase direction, the output axis also rotates to the address increase direction.



2) Reverse

When the input axis rotates to the address increase direction, the output axis rotates to the address decrease direction.



POINT

If the gear ratio is set indirectly, the timing that the gear ratio set in Motion SFC program becomes valid is shown below.

- (1) When the real mode is switched to virtual mode.
- (2) When the current value of the drive module is changed in the virtual mode.

7.2 Clutch

The clutch is used to transmit/disengage the command pulse from drive module side to output module side, and to control the operation/stop of servo motor.

There are two types for clutch: smoothing clutch and direct clutch. These two clutches operate in the same way, but these have the difference in whether the acceleration/deceleration processing by the smoothing processing is executed or not at the switching of the clutch on/off.

(1) Smoothing clutch and direct clutch

(a) Smoothing clutch

When the clutch is switched on/off, output to the output axis with the acceleration/deceleration processing (smoothing processing) set in the clutch parameters.

There are following three systems for smoothing clutch.

- 1) Time constant system
- 2) Slippage system
 - Exponential function system
 Linear acceleration/deceleration system

(b) Direct clutch

When the clutch is switched on/off, output to the output axis without the acceleration/deceleration processing.



Fig. 7.1 Output to the Output axis by the Smoothing and Direct Clutch

REMARK

(1) Clutch ON/OFF state is shown below.



- Clutch ON state......The state in which pulses inputted to the clutch are output to the output axis.
- Clutch OFF state......The state in which pulses inputted to the clutch are not output to the output axis.
- (2) Smoothing processing
 - (a) Time constant system
 - 1) Since the time constant is fixed, the slippage of clutch changes according to the speed of drive module.





2) If input to clutch (travel value after the main shaft's differential gear) changes after smoothing completion, the smoothing processing is executed at that point.

*t : Smoothing time constant

- (b) Slippage system
 - There are following two systems for slippage system.
 - Exponential function system
 - Linear acceleration/deceleration system
 - 1) Exponential function system
 - a) Set the slippage indicated by the shaded area in the diagram below. Slippage is recommended to be set greater than input to clutch (travel value after the main shaft's differential gear).



b) Since the slippage remains constant even if the drive module speed changes, the clutch ON/OFF position can be controlled without any influence from speed changes.



c) If input to clutch (travel value after the main shaft's differential gear) changes after smoothing completion, the smoothing processing is not executed at that point and output directly.



- d) The smoothing clutch complete signal turns ON after completion of smoothing processing.
 - ON"(Remainder slippage) < (Slippage in-position range)"
 - OFF... Smoothing processing start (Clutch ON/OFF)

The smoothing clutch complete signal is used to check the completion of smoothing processing, etc.

- 2) Linear acceleration/deceleration system
 - a) Set the slippage indicated by the shaded area in the diagram below.
 Slippage is recommended to be set greater than input to clutch (travel value after the main shaft's differential gear).



- b) Execute the smoothing processing so that the slippage may become the shaded area by the linear acceleration/deceleration system at clutch ON/OFF.
- c) Since the slippage remains constant even if the drive module speed changes, the clutch ON/OFF position can be controlled without any influence from speed changes.





 d) If input to clutch (travel value after the main shaft's differential gear) changes after smoothing completion, the smoothing processing is not executed and output directly.

- e) The smoothing clutch complete signal turns ON after completion of smoothing processing.
 - ON"(Remainder slippage) < (Slippage in-position range)"
 - OFF... Smoothing processing start (Clutch ON/OFF)

The smoothing clutch complete signal is used to check the completion of smoothing processing, etc.

7.2.1 Operation

There are following five clutch operation modes.

Operation mode	Description
ON/OFF mode	Clutch ON/OFF control is executed by turning the clutch ON/OFF command device on/off.
Address mode	Clutch ON/OFF control is executed by turning the clutch ON/OFF command device on/off and an address of clutch ON/OFF address setting device.
Address mode 2	After clutch ON/OFF command device turns on, Clutch ON/OFF control by an address of clutch ON/OFF address setting device.
One-shot mode	Clutch ON/OFF control is executed based on the drive module current value, setting travel value before clutch ON and setting travel value after clutch ON after the clutch ON/OFF command device from off to on.
External input mode	Only axis that the incremental synchronous encoder (manual pulse generator) is set as drive module can be set. Clutch ON/OFF control is executed by turning the clutch ON/OFF command device on/off and an external input (TREN signal: Synchronous encoder start signal).

Operations for every clutch mode are shown below.

(1) ON/OFF mode

(a) The clutch ON/OFF control is executed by turning the clutch ON/OFF command device on/off.

Conditions	Clutch operation
Clutch ON/OFF command device: ON	ON
Clutch ON/OFF command device: OFF	OFF

(b) It takes a time for maximum operation cycle until a clutch will be in the ON/OFF state after turning the clutch ON/OFF command device on/off. If greater accuracy is required, use the "address mode".

POINT

- (1) The mode setting device of except "0 to 4" is regarded as an error, and it controls continuously at the previous setting value.
- (2) Clutch operation mode can be changed at any time.
 - (c) The clutch ON/OFF state can be checked by the clutch status signal.



(d) The refresh cycle of clutch status signal is an operation cycle.

Fig. 7.2 Operation Timing for ON/OFF Mode

(2) Address mode

- (a) When the current value of virtual axis reaches an address of clutch ON/OFF address setting device, the clutch ON/OFF is executed. (Mode setting device is "1".)
 - 1) When the clutch ON/OFF command device is ON and the current value of virtual axis reaches an address set in the clutch ON address setting device, the clutch is set to the ON state.
 - 2) When the clutch ON/OFF command device is OFF and the current value of virtual axis reaches an address set in the clutch OFF address setting device, the clutch is set to the OFF state.
- (b) The clutch ON/OFF control differs according to the output module connected as follows.
 - 1) For a ball screw or roller

The ON/OFF control is executed by the current value of virtual axis. When a differential gear is connected to the main shaft, the ON/OFF control is executed by the current value after the main shaft's differential gear.

2) For a rotary table or cam

The ON/OFF control can be executed by setting the current value of virtual axis or current value within 1 virtual axis revolution. (Refer to a rotary table or cam of output module for details.)

- (c) Turn the clutch ON/OFF command device on/off after setting an address of clutch ON/OFF address setting device.
 - 1) When the clutch ON/OFF command device is OFF, even if the current value of virtual axis reaches an address of clutch ON address setting device, the clutch is not set to the ON state.
 - 2) When the clutch ON/OFF command device is ON, even if the current value of virtual axis reaches an address of clutch OFF address setting device, the clutch is not set to the OFF state.
- (d) The clutch ON/OFF state can be checked by clutch status signal.
- (e) The refresh cycle of clutch status signal is an operation cycle.



Fig. 7.3 Operation Timing for Address Mode

POINT (1) The mode setting device of except for "0 to 4" is regarded as an error, and control is continued at the previous setting value.

- (2) Clutch operation mode changes are valid at any time.
- (3) Clutch ON/OFF address setting device changes are valid at any time. Since they have 2-word data, set it as 32-bit integer type data.

- (3) Address mode 2
 - (a) When the current value of virtual axis reaches an address of clutch ON/OFF address setting device, the clutch ON/OFF is executed. (Mode setting device is "2".)
 - (b) When the clutch ON/OFF command device is ON, the following controls are executed according to the current clutch status.
 - 1) When the current clutch status is OFF.

When the current value of virtual axis reaches an address set in the clutch ON address setting device, the clutch is set to the ON state. After that, it is set the state in 2).

- 2) When the current clutch status is ON. When the current value of virtual axis reaches an address set in the clutch OFF address setting device, the clutch is set to the OFF state. After that, it is set the state in 1).
- (c) When the clutch ON/OFF command device is OFF, the clutch is turned off and the above control (b) is not executed. Therefore, the above control is resumed by turning the clutch ON/OFF command device on.



Fig. 7.4 Operation Timing for Address Mode 2

POINT

- (1) The mode setting device of except for "0 to 4" is regarded as an error, and control is continued at the previous setting value.
- (2) Clutch control mode changes are valid at any time.
- (3) Clutch ON/OFF address setting device changes are valid at any time. Since they have 2-word data, set it as 32-bit integer type data.

- (d) The clutch ON/OFF control is executed for every operation cycle. When the current value passes through an address set in the clutch ON/OFF address setting device for 1 operation cycle, the internal control is executed correctly but the clutch status signal does not change.
 - 1) When the clutch status signal is OFF and the current value passes through an address set in the clutch ON/OFF address setting device.



2) When the clutch status signal is ON and the current value passes through an address set in the clutch ON/OFF address setting device.



(e) When the "Clutch OFF" is set in the parameter "Error-time operation mode" of drive module and a major error occurs in the output module, the operating system software turns off the clutch.

The procedure to resume an operation after an error occurrence is shown below.

- 1) Remove a major error factor.
- 2) Turn the clutch ON/OFF command device off.
 - \rightarrow It returns to normal state.
- 3) Turn the clutch ON/OFF command device on.
 - \rightarrow The clutch ON address is monitored and control is resumed.

- (f) The procedure to execute the axis servo OFF or power supply OFF of servo amplifier during operation is shown below.
 - 1) Turn the clutch ON/OFF command device off.
 - → The clutch status is set to the OFF state. After that, the axis servo OFF command becomes valid.
 - 2) Execute the axis servo OFF command or the power supply OFF of servo amplifier.
- (g) The procedure to resume an operation after the axis servo OFF or power supply OFF of servo amplifier during operation is shown below.
 - 1) Turn the power supply of servo amplifier on.
 - 2) Execute the axis servo ON command.
 - 3) Turn the clutch ON/OFF command device on.
 - \rightarrow The clutch ON address is monitored and control is resumed.
- (4) One-shot mode
 - (a) When the mode setting device is "3: One-shot mode clutch ON command is valid" or "4: One-shot mode clutch ON command is invalid", it switches to one-shot mode control.
 - (b) When the mode setting device is "3", the clutch ON/OFF command device becomes valid, and the following controls are executed based on the clutch ON address setting device (setting travel value after clutch ON)/clutch OFF address setting device (setting travel value before clutch ON) by the clutch ON/OFF command device.
 - 1) When the clutch ON/OFF command device switches from OFF to ON. The clutch is set to the ON state after moving the travel value set in the setting travel value before clutch ON, and it is set to the OFF state after moving the travel value set in the setting travel value after clutch ON.
 - 2) When the clutch ON/OFF command device switches from ON to OFF. It has no influence on the clutch processing. The clutch state is held.



Fig. 7.5 Operation Timing for One-shot Mode

(c) When the mode setting device is "4", the clutch ON/OFF command device becomes invalid, and the clutch remains OFF. However, when the mode setting device is changed from "3" to "4" during execution of clutch ON/OFF processing by turning the clutch ON/OFF command device on, the clutch ON/OFF processing in execution is executed till the end and the next clutch ON/OFF command or later becomes invalid.

The clutch ON/OFF command device becomes valid by changing the mode setting device value to "3" again.



(d) The details for setting items are shown below.

Setting items	Description
Clutch ON/OFF command device	The clutch ON/OFF processing of one-shot mode starts at leading edge of this device.
Clutch ON address setting device	The transmitted travel value (setting travel value after clutch ON) of connected drive module from turning on clutch to turning off is set. A positive travel value is stored to indicate a positive direction travel value from the point of clutch ON, and a negative value to indicate a negative travel direction travel value. (Setting range: -2147483648 (-2 ³¹) to 2147483647 (2 ³¹ -1) [pulse])
Clutch OFF address setting device	The travel value (setting travel value before clutch ON) of connected drive module from turning on clutch ON/OFF command device to turning on the clutch actually is set. A positive travel value is stored to indicate a positive direction travel value from the point of clutch ON, and a negative value to indicate a negative travel direction travel value. (Setting range: -2147483648 (-2 ³¹) to 2147483647 (2 ³¹ -1) [pulse])

(Note) : When the setting travel value before clutch ON is "0", the clutch also becomes ON state simultaneously by turning the clutch ON/OFF command device off to on.
POINT

- (1) The mode setting device of except for "0 to 4" is regarded as an error, and control is continued at the previous setting value.
- (2) Clutch control mode changes are valid at any time.
- (3) Clutch ON/OFF address setting device changes are valid at any time. Since they have 2-word data, set it as 32-bit integer type data.
 - (e) The clutch ON/OFF control is executed for every operation cycle. The internal control is executed correctly but the clutch status signal does not change for the setting travel value that the clutch status turns from off to on to off for 1 operation cycle.



(f) When the mode setting device becomes "3", the clutch ON/OFF control starts based on the setting data while the clutch ON/OFF command device is ON.



(g) When the mode setting device becomes "3", the clutch status turns OFF, while the clutch ON/OFF command device is OFF and the clutch status is ON.



- (h) When the mode setting device is changed from "except 3" to "4", the clutch status turns off regardless of the clutch ON/OFF command device.
- (i) When the clutch ON/OFF address setting device data is changed during the clutch processing of one-shot mode, it becomes valid by turning the next clutch ON/OFF command device off to on.
- (j) When the drive module stops during the clutch ON/OFF processing by turning the clutch ON/OFF command device on, or if the clutch ON/OFF command device is turned on though the drive module stops, the one-shot mode clutch does not end until the travel value condition set to the setting travel value before clutch ON or setting travel value after clutch ON is satisfied.
- (k) When the current value change is made to the drive module during the clutch ON/OFF processing by turning the clutch ON/OFF command device on, the clutch turns off at the position where the setting travel value before clutch ON or setting travel value after clutch ON from the clutch ON position is satisfied.

(I) When the travel direction of drive module changes during the clutch ON/OFF processing by turning the clutch ON/OFF command device on, the clutch ON/OFF control is executed at the position in which not the travel value of drive module but the setting travel value before clutch ON/ setting travel value after clutch ON to the position where the clutch ON command is given was added.



- (m) The setting travel value before clutch ON/setting travel value after clutch ON differs according to the output module connected as follows.
 - 1) For a ball screw or roller

The clutch ON/OFF control is executed by the current travel value of virtual axis connected.

When a differential gear is connected to the main shaft, the clutch ON/OFF control is executed by the current travel value after the main shaft's differential gear.

2) For a rotary table or cam

The clutch ON/OFF control is executed by the travel value of current value within 1 virtual axis revolution. The setting travel value can be set outside the range of current value within 1 virtual axis revolution.

(n) When the travel direction set in the setting travel value before clutch ON/ setting travel value after clutch ON does not match the virtual axis or current value within 1 virtual axis revolution, note that the clutch will turn on/off even if the condition is not satisfied when the data found by subtracting the travel value from the specified travel value comes out of the range -2147483648 to 2147483647 [pulse] and changes from "+" to "-" or from "-" to "+". (o) When the "Clutch OFF" is set in the parameter "Error-time operation mode" of drive module and a major error occurs in the output module, the operating system software turns off the clutch.

The procedure to resume an operation after an error occurrence is shown below.

- 1) Remove a major error factor.
- 2) Turn the clutch ON/OFF command device off. \rightarrow It returns to normal state.
- 3) Turn the clutch ON/OFF command device on.
 - \rightarrow The clutch control of one-shot mode is resumed.
- (p) The procedure to execute the axis servo ON/OFF or power supply OFF of servo amplifier during operation is shown below.
 - 1) Turn the clutch revolution OFF command device off, when the clutch status is ON state, wait until the clutch status becomes OFF.
 - → After the clutch status to be set to OFF state, the axis servo OFF command becomes valid.
 - 2) Execute the axis servo OFF command or the power supply OFF of servo amplifier off.
- (q) The procedure to resume an operation after the axis servo OFF or the power supply OFF of servo amplifier during operation is shown below.
 - 1) Turn the power supply of servo amplifier on.
 - 2) Execute the axis servo ON command.
 - 3) Turn the clutch ON/OFF command device on.
 - \rightarrow The clutch control of one-shot mode is resumed.
- (5) External input mode
 - (a) The clutch ON/OFF control is executed by turning the clutch ON/OFF command device on/off and external input (TREN signal: Synchronous encoder start signal).

Since the input pulses from synchronous encoder are counted at leading edge of external input, a high-speed response and high accuracy clutch control is possible.

- 1) The clutch is set to the ON state at leading edge of external input (OFF \rightarrow ON) after the clutch ON/OFF command device turns on.
- 2) When the clutch ON/OFF command device turns off, the clutch is set to the OFF state after maximum 2 operation cycles.
- (b) Turn the external input (TREN signal) on after turning the clutch ON/OFF command device on.

In this mode, a time for maximum 2 operation cycles is required to turn the external input on after the clutch ON/OFF command device turns on.

- 1) If the external input turns from off to on when the clutch ON/OFF command device is OFF, the clutch is not set to the ON state.
- 2) If the clutch ON/OFF device turns on when the external input is ON, the clutch is not set to the ON state.
- 3) If the external input turns off after the clutch is set to the ON state, the clutch state remain ON.

- (c) The clutch status signal ON/OFF is refreshed by the operation cycle.
- (d) The current value of input axis (synchronous encoder) changes at the clutch ON state only.



Fig. 7.6 Operation Timing for External Input Mode

- (e) Only axis that the incremental synchronous encoder (manual pulse generator) is set as drive module can be used in this mode. When an absolute synchronous encoder is set as the drive module, it cannot be used.
- (f) A synchronous encoder, external input and external input mode clutch can be set in only 1:1 ratio.

The relationship between the synchronous encoder and external input is shown in the table below.

Synchronous encoder No.	External input (TREN signal)	Synchronous encoder No.	External input (TREN signal)
P1	TREN 1	P7	TREN 7
P2	TREN 2	P8	TREN 8
P3	TREN 3	P9	TREN 9
P4	TREN 4	P10	TREN 10
P5	TREN 5	P11	TREN 11
P6	TREN 6	P12	TREN 12

(Note): The range of synchronous encoder No. P1 to P8 is valid in the Q172DCPU(-S1).

- (g) Set all clutches connected to the same encoder No. to the external input mode to use the clutch connected to an encoder in the external input mode. However, it is permissible to use a combination of direct clutches and smoothing clutches.
 - < Example 1 > Synchronous encoder is connected to a drive axis

When an external input mode clutch is used, set all clutches connected to the synchronous encoder to the external input mode. (Also set clutch ON/OFF devices to the same setting.)



< Example 2 > Same synchronous encoder is connected to auxiliary input axis

Set all the clutches connected to the same synchronous encoder set to the external input mode. (Also set clutch ON/OFF devices to the same setting.)



< Example 3 > Same synchronous encoder is connected to a drive axis and auxiliary input axis

Set all the connected clutches to the external input mode. (Refer to examples 1 and 2)



Synchronous encoder No.1

7.2.2 Parameters

The clutch parameters are shown in Table 7.2 and the parameters shown in this table are explained in items (1) to (11) below.

Refer to the help of MT Developer2 for the clutch parameter setting method.

No.	Setting item	Default value		Setting ra	ange		Settin	Setting possible	
1	Operation mode	ON/OFF mode	ON/OFF mode	ON/OFF mode Address mode Address mode 2 One-shot mode	combined use	External input mode	Direct clutch	Smoothing clutch	
2	Mode setting device (1 word)			Word de	evice		0	0	
3	Clutch ON/OFF command device			Bit devi	ice		0	0	
4	Clutch status			/Bit device	e (Note-1)		0	0	
5 6	Clutch ON address setting device (2 words) Clutch OFF address setting device (2 words)	_	_	Word de	evice	_	0	0	
7	Smoothing method	Time constant system	Time constant system/slippage system (Exponential function system/Linear acceleration deceleration system)		_	0			
8	Smoothing time constant			1 to 65535	5 [ms]	3 7		0	
9	Slippage setting device (2 words)	_		Word de	vice		_	0	
10	Slippage in-position range setting device (2 words)	_	Word device		_	0			
11	Address mode clutch control system	Current value within 1 virtual axis revolution	Current value within 1 virtual axis revolution/ Current value of virtual axis		Vali cam/ro set as m	O d when a tary table is the output podule.			
12	Smoothing clutch complete signal	_		—/Bit device	e (Note-1)		_	0	

Table 7.2 Clutch Parameter List

(Note-1): The devices set in other clutch parameter cannot be used.

- (1) Operation mode
 - (a) This device is used to set the mode to switch clutch ON/OFF.

The following three modes can be set.

- ON/OFF mode
- ON/OFF mode, address mode, address mode 2 and one-shot mode combined use
- External input mode

Refer to Section "7.2.1 Operation" for each operation modes.

(b) If a synchronous encoder is used as the drive module, the operation modes that can be set differ depending on the encoder interface connected to the Q173DPX/Q172DEX.

	Clutch operation mode			
Encoder interface	ON/OFF mode	Address mode, Address mode 2, One-Shot mode	External input mode	
Manual pulse generator input (Q173DPX)	0	0	0	
Serial encoder input (Q172DEX)	0	0	×	

 \odot : Enable, \times : Disable

- (2) Mode setting device (only ON/OFF mode, address mode, address mode 2 and one-shot mode combined use, 1 word)
 - (a) This device is used to switch the ON/OFF mode and address mode. The mode by mode setting device value are as follows:

Mode setting device No.	Name
0	ON/OFF mode
1	Address mode
2	Address mode 2
3, 4	One-shot mode

The mode setting device of except for "0 to 4" is regarded as an error, and an operation is continued at the previous setting value.

(b) The following devices can be used as the mode setting device.

Name	Setting range	
Data register	D0 to D8191 ^(Note-1)	
Link register	W0 to W1FFF	
Motion register	#0 to #7999	
Multiple CPU area device	U□\G10000 to U□\G(10000+p-1) ^(Note-2)	

(Note-1): D800 to D1559 are dedicated devices of virtual servo motor axis,

synchronous encoder axis and output module "cam" in the virtual mode. Unused areas of virtual servo motor axis and cam axis can be used as a user device.

(Note-2): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

(3) Clutch ON/OFF command device

- (a) This device is used to execute the clutch ON/OFF command.
- (b) The following devices can be used as the clutch ON/OFF command device.

Name	Setting range
Input	X0 to X1FFF ^(Note-1)
Output	Y0 to Y1FFF
Internal relay	M0 to M8191 ^(Note-2)
Link relay	B0 to B1FFF
Annunciator	F0 to F2047
Multiple CPU area device	U□\G10000.0 to U□\G(10000+p-1).F ^(Note-3)

- (Note-1): The range of "PXn+4 to PXn+F" cannot be used (fixed at 0) for the input device (PXn+0 to PXn+F) allocated to the built-in interface in Motion CPU (DI). (n: First input No.)
- (Note-2): "M4000 to M4639 and M4800 to M5439" are the dedicated devices of virtual servo motor axis in the virtual mode.

Unused area of virtual servo motor axis can be used as a user side.

- (Note-3): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.
- (4) Clutch status
 - (a) This device is used to indicate the clutch ON/OFF state.
 - (b) The following devices can be used as the clutch status.

Name	Setting range
Input	X0 to X1FFF (Note-1)
Output	Y0 to Y1FFF
Internal relay	M0 to M8191 ^{(Note-2), (Note-3)}
Link relay	B0 to B1FFF
Annunciator	F0 to F2047
Multiple CPU area device	U□\G10000.0 to U□\G(10000+p-1).F (Note-4), (Note-5)

- (Note-1): The range of "PXn+4 to PXn+F" cannot be used (fixed at 0) for the input device (PXn+0 to PXn+F) allocated to the built-in interface in Motion CPU (DI). (n: First input No.)
- (Note-2): "M4000 to M4639 and M4800 to M5439" are the dedicated devices of virtual servo motor axis in the virtual mode. Unused area of virtual servo motor axis can be used as a user side.
- (Note-3): Use these parameters to use the device (M2160 to M2223) allocated to Q17□CPUN/Q17□HCPU.
- (Note-4): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

(Note-5): Only device of the self CPU can be used.

- (5) Clutch ON/OFF address setting device (only ON/OFF mode, address mode, address mode 2 and one-shot mode combined use, 2 words)
 - (a) This device is used to set an address to turn the clutch on/off in the address mode.
 - (b) The following devices can be used as the clutch ON/OFF address setting devices.

Name	Setting range (Note-1)
Data register	D0 to D8191 (Note-2)
Link register	W0 to W1FFF
Motion register	#0 to #7999
Multiple CPU area device	U□\G10000 to U□\G(10000+p-1) ^(Note-3)

(Note-1): Set an even numbered the first device.

- (Note-2): D800 to D1559 are dedicated devices of virtual servo motor axis, synchronous encoder axis and output module "cam" in the virtual mode. Unused areas of virtual servo motor axis and cam axis can be used as a user device.
- (Note-3): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.
- (c) The clutch ON/OFF address settings range is as follows.
 - The output module is a ball screw/roller, or output module is a cam/rotary table and the address mode clutch control system is current value of virtual axis.
 -2147483648 (-2³¹) to 2147483647 (2³¹-1) [pulse]
 - 2) The output module is a cam/rotary table, and the address mode clutch control system is current value within virtual axis revolution.
 0 to number of pulses within 1 output axis revolution -1 [pulse]

(d) The clutch ON/OFF address setting device value according to the output module is as follows.



Refer to Section 7.2.1 (1) to (5) for details of each mode operation.

- (6) Smoothing method
 - (a) The method for smoothing processing of the clutch is set.
 - The following three methods can be set:
 - Time constant system
 - Slippage system { Exponential function system Linear acceleration/deceleration system
 - (b) Refer to Section 7.2 for each system operation.

(7) Smoothing time constant

This is the time taken to reach 63[%] of the output axis speed.

(8) Slippage setting device (2 words)

- (a) This device is used to set the slippage of clutch.
- (b) The following devices can be used as the slippage setting device.

Name	Setting range ^(Note-1)
Data register	D0 to D8191 ^(Note-2)
Link register	W0 to W1FFF
Motion register	#0 to #7999
Multiple CPU area device	U□\G10000 to U□\G(10000+p-1) ^(Note-3)

(Note-1): Set an even numbered the first device.

- (Note-2): D800 to D1559 are dedicated devices of virtual servo motor axis, synchronous encoder axis and output module "cam" in the virtual mode. Unused areas of virtual servo motor axis and cam axis can be used as a user device.
- (Note-3): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.
- (c) The setting range for slippage is 0 to 2147483647 [pulse].
- (9) Slippage in-position range setting device (2 words)
 - (a) This device is used to set the remainder slippage range for judge as smoothing completion.
 - (b) The following devices can be used as the slippage in-position range setting device.

Name	Setting range ^(Note-1)	
Data register	D0 to D8191 ^(Note-2)	
Link register	W0 to W1FFF	
Motion register	#0 to #7999	
Multiple CPU area device	U□\G10000 to U□\G(10000+p-1) ^(Note-3)	

(Note-1): Set an even numbered the first device.

(Note-2): D800 to D1559 are dedicated devices of virtual servo motor axis, synchronous encoder axis and output module "cam" in the virtual mode. Unused areas of virtual servo motor axis and cam axis can be used as a user device.

- (Note-3): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.
- (c) The setting range for remainder slippage is 0 to 2147483647 [pulse].



- function system and linear acceleration/deceleration system are valid.)
 - ON"(Remainder slippage) < (Slippage in-position range)"
 - OFF.... Smoothing processing start (Clutch ON/OFF)
- 2) Set the slippage in-position range setting device to use the smoothing clutch complete signal.



3) Operation for smoothing clutcha) Exponential function system

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b) Linear acceleration/deceleration system

- (e) When "0" is set in the slippage in-position range setting device, when a clutch is connected/disconnected completely (Remainder slippage=0), the smoothing clutch complete signal turns on.
- (f) Slippage in-position range can be changed at any time.
- (g) When the slippage in-position range setting device is not set, the smoothing clutch complete signal does not turns on.
- (h) When the setting value for slippage in-position range setting device is outside the range, a minor error [5430] of output module will occur at the time of switching from real mode to virtual mode. In this case, it controls as a setting value "0".

Besides, the setting value for slippage in-position range is set outside the range during virtual mode operation, a minor error [6170] of output module will occur, and it controls as a setting value "0".

- (10) Address mode clutch control system
 - (a) When a clutch is turned on by the setting value of ON/OFF address setting device in the address mode/address mode 2, the current value (current value within 1 virtual axis revolution/current value of virtual axis) of virtual axis to be used is selected.
 - 1) Current value within 1 virtual axis revolution
 - The ON/OFF control is executed by the current value within 1 virtual axis revolution system.
 - 2) Current value of virtual axis
 - The ON/OFF control is executed by the current value of virtual axis. When a differential gear is connected to the main shaft, the ON/OFF control is executed by the current value after the main shaft's differential gear.
 - (b) The output module connected to clutch is valid for cam/rotary table
- (11) Smoothing clutch complete signal
 - (a) This device is used to confirm the completion of smoothing processing.
 - (b) The following devices can be used as the smoothing clutch complete signal.

Name	Setting range
Input	X0 to X1FFF ^(Note-1)
Output	Y0 to Y1FFF
Internal relay	M0 to M8191 ^{(Note-2), (Note-3)}
Link relay	B0 to B1FFF
Annunciator	F0 to F2047
Multiple CPU area device	U⊟\G10000.0 to U⊟\G(10000+p-1).F (Note-4), (Note-5)

(Note-1): The range of "PXn+4 to PXn+F" cannot be used (fixed at 0) for the input device (PXn+0 to PXn+F) allocated to the built-in interface in Motion CPU (DI). (n: First input No.)

(Note-2): "M4000 to M4639 and M4800 to M5439" are the dedicated devices of virtual servo motor axis in the virtual mode.

Unused area of virtual servo motor axis can be used as a user side.

- (Note-3): Use these parameters to use the device (M5520 to M5583) allocated to Q17 \Box CPUN/Q17 \Box HCPU.
- (Note-4): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.
- (Note-5): Only device of the self CPU can be used.

7.3 Speed Change Gear

Speed change gear is used to change the rotation speed to output module and travel value during operation.

The operation of speed change gear and parameters required to use it are shown below.

7.3.1 Operation

This section describes the operation of speed change gear.

(1) The speed that the input axis speed multiplied by a speed change ratio set in the speed change ratio setting device is transmitted to output axis.



(2) When a speed change ratio changes, the acceleration/deceleration processing is executed by the smoothing time constant (t) set in the speed change gear parameters.



7.3.2 Parameters

The speed change gear parameters are shown in Table 7.3 and the parameters shown in this table are explained in items (1) to (3) below.

Refer to the help of MT Developer2 for the speed change gear parameter setting method.

No.	Setting Item	Default	Setting range
1	Speed change ratio upper limit value	10000	0 to 65535
2	Speed change ratio lower limit value	1	0 to 65535
	Speed change ratio 3 setting device	_	D0 to D8191
			W0 to W1FFF
3			#0 to #7999
(Tword)		U□\G10000 to U□\G(10000+p-1) ^(Note-1)	
4	Smoothing time constant	0	0 to 65535 [ms]

Table 7.3 Speed Change Gear Parameter List

(Note-1): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

- (1) Speed change ratio upper/lower limit value
 - (a) The validate range (0.00 to 655.35[%]) of speed change ratio set in the speed change ratio setting device is set.
 - (b) When the setting value of speed change ratio setting device is greater than the speed change ratio upper limit value, an operation is executed by a speed change ratio clamped at the upper limit value. When the setting value of speed change ratio setting device is smaller than

the speed change ratio lower limit value, an operation is executed by a speed change ratio clamped at the lower limit value.



- (c) The speed change ratio upper/lower limit value is set in the range of 0 to 65535, i.e. 100 times the settings actually made: 0.00 to 655.35%.
- (d) Set the speed change ratio upper/lower limit value as formula below.

 $0 \le$ (Speed change ratio lower limit value) \le (Speed change ratio upper limit value) \le 65535

- (2) Speed change ratio setting device
 - (a) The device to set a speed change ratio of speed change gear.
 - (b) The following devices can be used as the speed change ratio setting devices.

Name Setting range	
Data register	D0 to D8191 ^(Note-1)
Link register	W0 to W1FFF
Motion register	#0 to #7999
Multiple CPU area device	U□\G10000 to U□\G(10000+p-1) ^(Note-2)

(Note-1): D800 to D1559 are dedicated devices of virtual servo motor axis, synchronous encoder axis and output module "cam" in the virtual mode. Unused areas of virtual servo motor axis and cam axis can be used as a user device.

- (Note-2): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.
- (c) The setting range is "Speed change ratio lower limit value" to "Speed change ratio upper limit value".

(3) Smoothing time constant

This is the time taken to reach 63[%] of the output axis speed.

7.4 Differential Gear

The differential gear is used for the following purposes;

- Output module phase is shifted or alignment of operation start position is executed.
- Individual operation separated from the virtual main shaft is executed.

7.4.1 Operation

- (1) When the output module phase is shifted or alignment of the operation start position is executed.
 - (a) When the input axis clutch is ON.
 - The differential gear subtracts the auxiliary input shaft travel value from the input shaft travel value and transmits this to the output axis.



(b) When the input axis clutch is OFF.

Individual operation is possible using the auxiliary input axis since the differential gear transmits only the travel value from the auxiliary input axis to the output axis.

(2) When the differential gear is used to connect to the virtual main shaft. This is used for operation in which the main shaft is switched or when the same drive module is used as auxiliary input to control all blocks.



Set the different drive modules for virtual main shaft side and auxiliary input axis side.

7.4.2 Parameters

No parameters need to be set for the differential gear.

MEMO

8. OUTPUT MODULE

The command pulse output from drive module is input to output module via the transmission module.

The travel value of servo motor is controlled by the command pulse from output module.

There are following four output modules.

The parameters in accordance with that mechanism is set if necessary.

- Roller..... Section 8.1
- Ball screw..... Section 8.2
- Rotary table..... Section 8.3
- Cam Section 8.4

(1) Output module types

Output module types are shown below.

Module	Details	Applications
Roller	The speed control is executed with the final output (axis).	Roller
Ball screw	The linear position control is executed with the final output (axis).	Ball screw
Rotary table	The angle control is executed with the final output (axis).	Rotary table
Cam	The electronic cam operation is executed with the final output (axis).	Cam (Electronic cam)

- (2) Device range of output module parameters and device data input The device range and setting method of items set in the indirect setting by devices among the output module parameters are shown below.
 - (a) Device range

The number of device words and device range in the indirect setting are shown below.

Module	Item	Number of device words	Device range		Remark
Roller	Torque limit value setting device	1			
Ball screw	Torque limit value setting device	1			
	Torque limit value setting device	1			
Rotary	Current value within 1 virtual axis revolution storage device (Main shaft side)	2			
	Current value within 1 virtual axis revolution storage device (Auxiliary input axis side)	2	Device	Range	
	Number of pulses per cam shaft	0	D	0 to 8191	
	revolution (Nc)	2	W	0 to 1FFF	
	Cam No. setting device	1	#	0 to 7999	
	Stroke amount setting device	2	U□\G	10000 to (10000+p-1) ^(Note-1)	
	Torque limit value setting device	1			
	Lower stroke limit value storage device	2			
	Current value within 1 virtual axis revolution storage device (Main shaft side)	2			
Cam	Current value within 1 virtual axis revolution storage device (Auxiliary input axis side)	2			ļ
			Device	Range	
			Х	0 to 1FFF (Note-2)	
	Com/ball corow owitching		Y	0 to 1FFF	
	command device	Bit	М	0 to 8191	
			В	0 to 1FFF	
			F	0 to 2047	
			U⊟\G	10000.0 to (10000+p-1).F (Note-1)	

(Note-1): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

(Note-2): The range of "PXn+4 to PXn+F" cannot be used (fixed at 0) for the input device (PXn+0 to PXn+F) allocated to the built-in interface in Motion CPU (DI). (n: First input No.)

POINT

(1) Be sure to set even-numbered device of the items set as 2-word.

- Be sure to set as 32-bit integer type when the data is set in these devices using the Motion SFC programs.
- (2) When a 2-word monitor device is read in the Motion SFC program, read it as 32-bit integer type.
- (3) Refer to Chapter 2 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for the user setting area points of the Multiple CPU high speed transmission area.
 - (b) Device data input
 - All indirect setting device data are input as "initial value" at the switching real mode/virtual mode, thereafter the input control for module is executed during the virtual mode operation.

	Device input timing					
Module	Item	Input device	Refresh device	Real mode /Virtual mode switching	During the Virtual mode operation	Refresh cycle
Roller	Torque limit value setting device	0	_	0		
Ball screw	Torque limit value setting device	0	_	0	Input for every	_
	Torque limit value setting device	0	_	0	operation cycle. (1000)	
	Current value within 1 virtual axis					
Rotary table	revolution storage device (Main shaft side)	_	0	_		Operation
	Current value within 1 virtual axis revolution storage device (Auxiliary input axis side)		0	-	_	cycle ^(Note)
	Number of pulses per cam shaft revolution (Nc)	0	_	0	—	
	Cam No. setting device	0	_	0	Input for every operation cycle. ^(Note) However, the cam No.	
	Stroke amount setting device	0	_	0	and stroke amount switching position pass point are valid.	
	Torque limit value setting device	0	_	0	Input for every operation cycle. ^(Note)	
Cam	Lower stroke limit value storage device		0			
	Current value within 1 virtual axis revolution storage device (Main shaft side)	_	0		_	Operation cycle ^(Note)
	Current value within 1 virtual axis revolution storage device (Auxiliary input axis side)	_	0	_		
	Cam/ball screw switching command device	0	_	0	Input for every operation cycle. ^(Note)	_

The input timing and refresh cycle of setting device are shown below.

REMARK

(Note): The operation cycle is set in the "operation cycle setting" of system basic setting.

Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for details.

8.1 Rollers

The rollers are used in the following cases.

- The machine connected to the servo motor is operated continuously.
- The system which does not need position control. (It is used when the speed control (cycle speed/number of rotations) mainly is

controlled without the current value and position data.)

This section describes the roller operation and parameters required to use a roller.

8.1.1 Operation

- (1) Operation
 - (a) The roller is controlled with the speed that the speed/travel value of drive module multiplied by a gear ratio/speed change ratio of transmission module, and it rotates for the travel value.

Roller speed	= (Drive module speed [pulse/s])	imes (Gear ratio)	imes (Speed change ratio) [pulse/s]
Number of roller revolution	= (Drive module travel value [pulse])	imes (Gear ratio)	imes (Speed change ratio) [pulse]

The speed/travel value of drive module transmitted to the roller is commanded to the servo amplifier.



(b) When a clutch is used, the roller is controlled at clutch ON.

- (2) Control details
 - (a) The roller has no current value.
 - However, when it switches from the virtual mode to real mode, it reaches the current value corresponding to the position moved in the virtual mode.
 - The current value is a ring address within the range of -2147483648 (-2³¹) to 2147483647 (2³¹-1) [pulse].



- (b) Backlash compensation processing is continued with the settings value of fixed parameters even if it switches the real mode/virtual mode.
- (c) The roller cycle speed can be monitored using MT Developer2 and the roller cycle speed storage register.

Refer to Section 8.1.2 for the calculation formula of roller cycle speed, and refer to Section 4.2.1 for details of the roller cycle speed storage register.

8.1.2 Parameter list

The roller parameters are shown in Table 8.1 and the parameters shown in this table are explained in items (1) to (6) below.

Refer to the help of MT Developer2 for the roller parameter setting method.

No.	Setting item	Default	Setting range		
			Q173DSCPU/Q173DCPU(-S1): 1 to 32		
1	Output axis No.	0	Q172DSCPU	: 1 to 16	
			Q172DCPU(-S1)	:1 to 8	
2	Output unit	mm	mm	inch	
2	Dellen diemeeten (L)	0	0.1 to 214748364.7	0.00001 to	
3	Roller diameter (L)	0	[µm]	21474.83647 [inch]	
4	Number of pulses per roller revolution (NL)	0	1 to 2147483647 [pulse]		
5	Permissible droop pulse value	6553500	1 to 107374	1824 [pulse]	
<u> </u>	$C_{\text{paradel limit value}}(\lambda t)$	0	0.01 to 6000000.00	0.001 to 600000.000	
6	Speed limit value (VL)	0	[mm/min]	[inch/min]	
7	Torque limit value setting device (1 word)	—	-(300[%]) / word device (D, W, #, U□\G)		
8	Comment	None	32 cha	racters	

Table 8.1 Roller Parameter List

(1) Output unit

- (a) This device is used to set the unit ([mm]/[inch]) of roller.
- (b) The unit (unit in the fixed parameter) for the axis which execute the roller setting in the real mode is permissible to use the any of [mm], [inch], [degree] and [pulse].

- (2) Roller diameter (L)/Number of pulses per roller revolution (NL)
 - (a) The roller diameter connected to servo motor and the number of pulses per roller revolution are displayed.



(b) The roller cycle speed is calculated by the roller diameter and number of pulses per roller revolution as the formula below.1) Unit : [mm]



2) Unit : [inch]

	Number of input	$\pi \times L$	
[Roller cycle speed] =	_pulses per minute	× —[inch/min] N∟	L : [inch]

The value calculated by calculations 1) and 2) is stored with an integer value in the roller cycle speed storage register.

Output unit	t Roller cycle speed storage register				
mm	Calculated value $ imes$ 100				
inch	Calculated value $ imes$ 1000				

(3) Permissible droop pulse value

- (a) This device is used to set the permissible droop pulse value of deviation counter.
- (b) The deviation counter value is continually checked, and if it becomes larger than the permissible droop pulse value, the error detection signal (M2407+20n) turns on.
 However, since the roller axis operation continues, execute the error processing by user side.

(4) Speed control limit (VL)

- (a) This device is used to set the maximum speed of roller axis.
- (b) Set the speed limit value within the following range.

$1 \leq \frac{VL \times NL}{VL \times NL} \leq 2147492647(pulse/s)$	VL : [mm/min] or [inch/min]
$1 \leq 2147483647$ [pulse/s] $60 \times \pi \times L$	L : [mm] or [inch]

(c) When the roller axis speed exceeds the speed limit value, the error detection signal (M2407+20n) turns on.

However, the roller axis speed is not clamped.



(5) Torque limit value setting device (1 word)

(a) This device is used to set the torque limit value of roller axis.
 When the device is set, the torque control is executed with the preset device value.

In the virtual mode, the torque limit setting is always valid. If the device is not set, the torque limit is set at 300[%].

(b) The following devices can be set as the torque limit setting device.

Name	Setting range
Data register	D0 to D8191 ^(Note-1)
Link register	W0 to W1FFF
Motion register	#0 to #7999
Multiple CPU area device	U□\G10000 to U□\G(10000+p-1) ^(Note-2)

(Note-1): D800 to D1559 are dedicated devices of virtual servo motor axis,

synchronous encoder axis and output module "cam" in the virtual mode. Unused areas of virtual servo motor axis and cam axis can be used as a user device.

- (Note-2): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.
- (c) The setting range for torque limit value is 1 to 1000[%].

(6) Comment

- (a) This device is used to create a comment such as purpose of roller axis.
 Made comment can be displayed at monitoring using MT Developer2.
- (b) Comments up to 32 characters long can be created.

POINT

- (1) "Roller diameter" or "number of pulses per roller revolution" set in the roller parameter is used for only the cycle speed monitor of servo motor, and it is not related to the rotation speed/travel value of servo motor.
- (2) The roller cycle speed monitor device is the same for the "feed current value" in the real mode. Therefore, the position address (current value) of roller axis cannot be monitored in the virtual mode.

When it switches from the virtual mode to real mode, the certain value is stored in the position address (current value). The value at this time is an unfixed value.

8.2 Ball Screw

The ball screw is used to make a machine connected to servo motor operate linearly. This section describes the ball screw operation and parameters required to use ball screws.

8.2.1 Operation

- (1) Operation
 - (a) The ball screw is controlled with the speed that the speed/travel value of drive module multiplied by a gear ratio of transmission module, and the travel value is output.

(Ball screw speed)	= (Drive module speed [pulse/s])	×	(Gear ratio)	[pulse/s]
(Ball screw travel value)	= (Drive module travel value [pulse])	×	(Gear ratio)	[pulse]

The speed/travel value of drive module transmitted to the ball screw is commanded to the servo amplifier.



(b) When a clutch is used, the ball screw is controlled at clutch ON.

(2) Control details

- (a) Feed current value is continued, even if it switches from the real mode to virtual mode/from the virtual mode to real mode.
- (b) Backlash compensation processing is continued with the settings value of fixed parameters, even if it switches the real/virtual mode.

8.2.2 Parameter list

The ball screw parameters are shown in Table 8.2 and the parameters shown in this table are explained in items (1) to (7) below.

Refer to the help of MT Developer2 for the ball screw parameter setting method.

Table 8.2 Ball Screw Parameter List

No.	Setting Item	Default	Setting	range
			Q173DSCPU/Q173DCPU(-S1): 1 to 32	
1	Output axis No.	0	Q172DSCPU	: 1 to 16
			Q172DCPU(-S1)	:1 to 8
2	Output unit	mm	mm	inch
3	Ball screw pith (P)			
4	Number of pulses per ball	Must be not set. It is controlled with the fixed parameter.		
	screw revolution (NP)			
5	Permissible droop pulse value	6553500	1 to 1073741824 [pulse]	
6	Upper stroke limit value	214748364.7	-214748364.8 to	-21474.83648 to
7	Lower stroke limit value	0	214748364.7 [µm]	21474.83647 [inch]
8	Speed limit value (VL)	0	0.01 to 6000000.00	0.001 to 600000.000
			[mm/min]	[inch/min]
9	Torque limit value setting			
	device (1 word)	— -(300[%]) / word device (/ice (D, vv, #, U⊔\G)
10	Comment	None	32 characters	

(1) Output unit

- (a) This device is used to set the unit ([mm]/[inch]) of ball screw.
- (b) Set the same unit as used in the real mode (unit in the fixed parameters) for the ball screw unit.

If the ball screw unit differs unit in the real mode, a mode switching error will occur at the switching from real mode to virtual mode.

- (2) Ball screw pitch(P)/Number of pulses per ball screw revolution(NP)
 - (a) The ball screw pitch connected to the servo motor and number of pulses per ball screw revolution are displayed.



(b) The travel value per pulse is calculated by the ball screw pitch and number of pulses per ball screw revolution as the formula below.

POINT

"Ball screw pitch" or "number of pulses per ball screw revolution" is used for only the cycle speed monitor of servo motor, and it is not related to the rotation speed/travel value of servo motor.

- (3) Permissible droop pulse value
 - (a) This device is used to set the permissible droop pulse value of deviation counter.
 - (b) The deviation counter value is continually checked, and if it becomes larger than the permissible droop pulse value, the error detection signal (M2407+20n) turns on.
 However, since the ball screw axis operation continues, execute the error processing by user side.

(4) Upper/lower stroke limit value

- (a) This device is used to set the stroke range in the virtual mode.
- (b) When it exceeds the stroke range during operation, the error detection signal (M2407+20n) turns on.
 However, a stop processing of ball screw axis is not executed.
- (5) Speed limit value (VL)
 - (a) This device is used to set the maximum speed of ball screw axis.
 - (b) Set the speed limit value within the following range.
 - 1) Unit : [mm]

 $1 \leq \frac{V_L \times 10^4 \times N_P}{60 \times P} \leq 2147483647 \quad \text{[pulse/s]}$

2) Unit : [inch]

 $1 \leq \frac{VL \times 10^5 \times NP}{60 \times P} \leq 2147483647 \quad \text{[pulse/s]}$

(c) When the ball screw axis speed exceeds the speed limit value, the error detection signal (M2407+20n) turns on.

However, the ball screw axis speed is not clamped.



(6) Torque limit value setting device (1 word)

(a) This device is used to set the torque limit value of ball screw axis.
 When the device is set, the torque control is executed with the preset device value.

In the virtual mode, the torque limit setting is always valid. If the device is not set, the torque limit is set at 300[%].

(b) The following devices can be set as the torque limit value setting device.

Name	Setting range	
Data register	D0 to D8191 ^(Note-1)	
Link register	W0 to W1FFF	
Motion register	#0 to #7999	
Multiple CPU area device	U□\G10000 to U□\G(10000+p-1) ^(Note-2)	

(Note-1): D800 to D1559 are dedicated devices of virtual servo motor axis,

synchronous encoder axis and output module "Cam" in the virtual mode. Unused areas of virtual servo motor axis and cam axis can be used as a user device.

- (Note-2): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.
- (c) The setting range for the torque limit value is 1 to 1000[%].

(7) Comment

- (a) This device is used to create a comment such as purpose of ball screw axis. Made comment can be displayed at monitoring using MT Developer2.
- (b) Comments up to 32 characters long can be created.

8.3 Rotary Tables

The rotary table is used to make a machine connected to the servo motor gyrate. This section describes the rotary table operation and parameters required to use rotary table.

8.3.1 Operation

- (1) Operation
 - (a) The rotary table is controlled with the speed that the speed/travel value of drive module multiplied by a gear ratio of transmission module, and the travel value is output.

(Rotary table speed)	=(Drive module speed) [pulse/s]	× (Gear ratio) [pulse/s]
(Rotary table travel value)	=(Drive module travel value) [pulse]] × (Gear ratio) [pulse]

The speed/travel value of drive module transmitted to the rotary table is commanded to the servo amplifier.



(b) When a clutch is used, the rotary table is controlled at clutch ON.

(2) Control details

- (a) Feed current value is continued, even if it switches from the real mode to virtual mode/from the virtual mode to real mode.
- (b) Backlash compensation processing is continued with the settings value of fixed parameters, even if it switches the real mode/virtual mode.

8.3.2 Parameter list

The rotary table parameters are shown in Table 8.3 and the parameters shown in this table are explained in items (1) to (8) below.

Refer to the help of MT Developer2 for the rotary table parameter setting method.

No.	Setting Item	Default	Setting range	
1	Output axis No.	0	Q173DSCPU/Q173DCPU(-S1): 1 to 32 Q172DSCPU : 1 to 16 Q172DCPU(-S1) : 1 to 8	
2	Number of pulses per rotary table revolution (ND)	Must be not set. It is controlled with the fixed parameter.		
3	Permissible droop pulse value	6553500	1 to 1073741824 [pulse]	
4	Upper stroke limit value	0	0 to 359.99999 [degree]	
5	Lower stroke limit value	0	0 to 359.99999 [degree]	
6	Speed limit value (VL)	0	0.001 to 2147483.647 [degree/min] ^(Note-1)	
7	Torque limit value setting device (1 word)	_	-(300[%]) / word device (D, W, #, U□\G)	
8	Comment	None	32 characters	
9	Current value within 1 virtual axis revolution storage device (Main shaft side) (2 words)	_	- / word device (D, W, #, U⊡\G)	
10	Current value within 1 virtual axis revolution storage device (Auxiliary input axis side) (2 words)		- / word device (D, W, #, U⊟\G)	

Table 8.3 Rotary Table Parameter List

(Note-1): When the "speed control 10× multiplied speed setting for degree axis" is set to "valid", the setting range is 0.01 to 21474836.47[degree/min].

(1) Number of pulses per rotary table revolution (ND)

(a) The number of pulses per rotary table connected to the servo motor revolution is displayed.



Displayed items	Displayed range		
Number of pulses per rotary table revolution (ND)	Must be not set. It is controlled with the fixed parameter. $N_D = A_P[pulse] \times \frac{360[degree]}{A_L [degree]}$ AP : Number of pulsesl value per revolution of fixed parameter AL : Travel value per revolution of fixed parameter		

(b) The travel value per pulse is calculated from the number of pulses per rotary table revolution in accordance with the following formula:

[Travel value per pulse] =
$$\frac{360}{N_D}$$
 [degree]

POINT

"Number of pulses per rotary table revolution" is used for only the cycle speed monitor of servo motor, and it is not related to the rotation speed/travel value of servo motor.

(2) Permissible droop pulse value

- (a) This device is used to set the permissible droop pulse value of deviation counter.
- (b) The deviation counter value is continually checked, and if it becomes larger than the permissible droop pulse value, the error detection signal (M2407+20n) turns on.

However, since the rotary table axis operation continues, execute the error processing by user side.

(3) Upper/lower stroke limit value

- (a) This device is used to set the stroke range in the virtual mode. The upper/lower stroke limit setting determines whether the stroke limit is valid or not. If the upper stroke limit value is equal to the lower stroke limit value, the stroke limit is invalid.
- (b) When it exceeds the stroke range during operation, the error detection signal (M2407+20n) turns on.
 However, a stop processing of rotary table axis is not executed.
- (4) Speed limit value (VL)
 - (a) This device is used to set the maximum speed of rotary table axis.
 - (b) Set the speed limit value within the following range.

 $1 \leq \frac{V_L \times 10^5 \times N_D}{60 \times 360 \times 10^5} \leq 2147483647[pulse/s]$

(c) When the rotary table axis speed exceeds the speed limit value, the error detection signal (M2407+20n) turns on.
However, the rotary table axis speed is not clamped.





8 - 15
(5) Torque limit value setting device (1 word)

 (a) This device is used to set the torque limit value of rotary table axis. When the device is set, the torque control is executed with the preset device value.

In the virtual mode, the torque limit setting is always valid. If the device is not set, the torque limit is set at 300[%].

(b) The following devices can be set as the torque limit value setting device.

Name	Setting range
Data register	D0 to D8191 ^(Note-1)
Link register	W0 to W1FFF
Motion register	#0 to #7999
Multiple CPU area device	U□\G10000 to U□\G(10000+p-1) ^(Note-2)

(Note-1): D800 to D1559 are dedicated devices of virtual servo motor axis, synchronous encoder axis and output module "Cam" in the virtual mode. Unused areas of virtual servo motor axis and cam axis can be used as a user device.

- (Note-2): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.
- (c) The setting range for torque limit value is 1 to 1000[%].

(6) Comment

(a) This device is used to create a comment such as purpose of rotary table axis.

Made comment can be displayed at monitoring using MT Developer2.

- (b) Comments up to 32 characters long can be created.
- (7) Current value within 1 virtual axis revolution storage device (Main shaft side) (2 words)

This parameter is set when the address mode clutch is set at the rotary table main shaft side.



(a) The current value within 1 virtual axis revolution of rotary table main shaft side is stored in the preset device.

(b) The following devices can be set as the current value within 1 virtual axis revolution storage device.

Name	Setting range ^(Note-1)	
Data register	D0 to D8191 ^(Note-2)	
Link register	W0 to W1FFF	
Motion register	#0 to #7999	
Multiple CPU area device	U□\G10000 to U□\G(10000+p-1) (Note-3), (Note-4)	

(Note-1): Set an even number at the first device.

- (Note-2): D800 to D1559 are dedicated devices of virtual servo motor axis, synchronous encoder axis and output module "Cam" in the virtual mode. Unused areas of virtual servo motor axis and cam axis can be used as a user device.
- (Note-3): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

(Note-4): Only device of the self-CPU can be used.

(c) The current value within 1 virtual axis revolution is the range of 0 to (ND-1) [pulse].

(ND: Number of pulses per rotary table revolution)

- (d) The address mode clutch is turned on/off with the specified address of the current value within 1 virtual axis revolution range of 0 to (ND-1) [pulse]. Therefore, set the address value within the range of 0 to (ND-1) [pulse] in the clutch ON/OFF address setting device.
- (e) The current value within 1 virtual axis revolution reference position "0" is set by turning the address clutch reference setting command (M3213+20n) on and switching to the virtual mode.

The current values within 1 virtual axis revolution for both the main shaft and the auxiliary input axis is set to "0" at this time.

If the address clutch reference setting command (M3213+20n) is turned off and it switches to the virtual mode, the following processing is executed depending on the drive module.

- If the drive module is a virtual servo motor or an incremental synchronous encoder, operation will be continued from the current value within 1 virtual axis revolution for the main shaft and auxiliary input axis in the previous virtual mode.
- If the drive module is an absolute synchronous encoder, operation will be continued from the current value within 1 virtual axis revolution for the main shaft and auxiliary input axis calculated from the current value of synchronous encoder.



(f) An example of an address mode clutch operation is shown below.

(8) Current value within 1 virtual axis revolution storage device (Auxiliary input axis side) (2 words)

This parameter is set when the address mode clutch is set at the rotary table auxiliary input axis side.



(a) By setting the current value within 1 virtual axis revolution of rotary table auxiliary input axis side for the current value within 1 virtual axis revolution is stored in the preset device.

Current value within 1		Drive module travel		Gear ratio
virtual axis revolution of	=	value of auxiliary input	×	Number of pulses per rotary table revolution
auxiliary input axis side		axis side		

(Note): Current value within 1 virtual axis revolution of auxiliary input axis side is updated regardless of clutch ON/OFF.

(b) The following devices can be set as the current value within 1 virtual axis revolution storage device.

Name	Setting range ^(Note-1)	
Data register	D0 to D8191 ^(Note-2)	
Link register	W0 to W1FFF	
Motion register	#0 to #7999	
Multiple CPU area device	U□\G10000 to U□\G(10000+p-1) (Note-3), (Note-4)	

(Note-1): Set an even number at the first device.

- (Note-2): D800 to D1559 are dedicated devices of virtual servo motor axis, synchronous encoder axis and output module "Cam" in the virtual mode. Unused areas of virtual servo motor axis and cam axis can be used as a user device.
- (Note-3): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

(Note-4): Only device of the self CPU can be used.

(c) The current value within 1 virtual axis revolution is the range of 0 to (ND-1) [pulse].

(ND: Number of pulses per rotary table revolution)

- (d) The address mode clutch is turned on/off with the specified address of the current value within 1 virtual axis revolution range of 0 to (ND-1) [pulse]. Therefore, set the address value within the range of 0 to (ND-1) [pulse] in the clutch ON/OFF address setting device.
- (e) The current value within 1 virtual axis revolution reference position "0" is set by turning the address clutch reference setting command (M3213+20n) on and switching to the virtual mode.

The current values within 1 virtual axis revolution for both the main shaft and the auxiliary input axis is set to "0" at this time.

If the address clutch reference setting command (M3213+20n) is turned off and it switches to the virtual mode, the following processing is executed depending on the drive module.

- If the drive module is a virtual servo motor or an incremental synchronous encoder, operation will be continued from the current value within 1 virtual axis revolution for the main shaft and auxiliary input axis in the previous virtual mode.
- If the drive module is an absolute synchronous encoder, operation will be continued from the current value within 1 virtual axis revolution for the main shaft and auxiliary input axis calculated from the current value of synchronous encoder.



(f) An example of an address mode clutch operation is shown below.

POINT

When the number of pulses per virtual axis revolution is not an integer value, a virtual axis revolution may not become a rotary table revolution.

8 OUTPUT MODULE

8.4 Cam

Cam is used to make a machine connected to the servo motor operate according to the preset cam pattern.

(1) For axes at which the cam is set as the output module, the same operation as a cam is executed using a ball screw as shown in the example below.



- (2) The following two types data required to use a cam.
 - Settings item at cam data creation. It is set at cam data (cam curve) creation using the MT Developer2. (Refer to Section 8.4.2)
 - Cam parameters
 These are the parameters used to set to cam in the output module at mechanical system program creation.
 (Refer to Section 8.4.3)

8.4.1 Operation

This section describes the cam operation.

 Procedure for switching from the real mode to virtual mode Set the devices by the following procedure using the Motion SFC program at the switching from real mode to virtual mode.

(a) Set the following details.

- Set the cam No. and stroke amount in the "cam No. setting device" and "stroke amount setting device" set in each cam shaft parameters.
- Turn the cam reference position setting command (M3214+20n) on/off as required.

(Refer to Section 4.1.2 (4))

- \downarrow
- (b) Execute the real mode/virtual mode switching request. (M2043: OFF \rightarrow ON)
- \downarrow
- (c) Start operation based on the cam pattern, stroke amount and cam reference setting command set in each cam shaft.
- (2) Processing at the switching from the real mode to virtual mode The current value within 1 cam shaft revolution is indexed based on the cam reference position setting command (M3214+20n), feed current value, lower stroke limit value, stroke amount and cam No. (cam pattern) at the switching from real mode to virtual mode.
- (3) Operation

A value calculated by the stroke ratio of cam data table based on the current value within 1 cam shaft revolution is output.

[Feed current value] = [Lower stroke limit value] + [Stroke amount] × [Stroke ratio]

The current value within 1 cam shaft revolution is set by the travel value that the travel value of drive module multiplied by a gear ratio of transmission module. Number of pulses per stroke amount is controlled based on the travel value per pulse set in the fixed parameter in the real mode.

- (4) Switching the stroke amount and cam No. during operation
 - (a) The cam stroke amount and execute cam No. can be changed using the Motion SFC program during cam operation.
 - (b) The stroke amount and cam No. are changed by the address set in the "stroke amount, cam No. change point" at the creating cam data. When the "stroke amount, cam No. change point" is passed, the stroke amount/cam No. is changed based on the value of the stroke amount setting device and cam No. setting device set in the cam parameters.



< Example > Switching between cam No.1 and No.2, and switching timing between stroke amount I1 and I2 when the stroke amount/cam No. change point is set as "0".

- (c) Error causes at the changing stroke amount/cam No. during operation
 - The cam No. and stroke amount are always input at the switching from real mode to virtual mode and in the virtual mode.
 A relative check is executed at the time of input. An error occurs in the following cases, the error detection signal (M2407+20n) turns on and the error code is stored in the minor error code storage register.
 - The stroke amount is outside the range of 1 to 2147483647 (2^{31} -1). "Lower stroke limit value + Stroke amount" \leq "2147483647 (2^{31} -1)" is not satisfied in the two-way cam mode.
 - The control mode of cam No. is not same.
 - 2) Processing for the cam No./stroke amount error
 - If the error occurs at switching from the real mode to virtual mode, it does not switch to the virtual mode.
 - If the error occurs at reaching the preset "stroke amount, cam No. change point" (during cam operation), operation continues without switching to the preset stroke amount/cam No.

Reset the error detection signal and minor error code storage register by the error reset command (M3207+20n).

- 3) Processing for the error
 - a) If the error occurs at switching from the real mode to virtual mode, correct by the following procedure.
 - Turn the real mode/virtual mode switching request flag (M2043) off.
 - Correct the cam No. and stroke amount.
 - Turn the real mode/virtual mode switching request flag on, and switch to virtual mode.
 - b) If the error occurs during cam operation, correct the cam No. and stroke amount.

- (5) Control details
 - (a) The cam feed current value is continued at switching from the real mode to virtual mode/from the virtual mode to real mode.
 - (b) Backlash compensation processing is continued with the settings value of fixed parameters, even if switches the real mode/virtual mode.
 - (c) Upper/lower stroke limit value and speed limit value are not checked.

(6) Control change

The current value within 1 cam shaft revolution can be changed to optional value for the cam as the control change during the virtual mode operation. Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (Motion SFC)" for details of current value change.

Motion SFC program for which executes the current value change (CHGA-C) is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.



(7) Program example

[Switching real mode/virtual mode]

Motion SFC program for switching real mode/virtual mode is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

[Switching cam No./stroke amount during operation] Motion SFC program for switching cam No. or stroke amount is shown below.



(Note): Example of the above Motion SFC program is started using the automatic start or sequence program.

8.4.2 Settings items at cam data creating

This section describes the setting items at cam data creating using MT Developer2.

Table 8.4 Table of Settings Items at cam Data Creating

No.	Setting item	Default	Setting range	
1	Cam No.	—	Refer to (1)	
2	Resolution	256	256, 512, 1024, 2048	
3	Stroke amount/ Cam No. change point	0	0 to (resolution-1)	
4	Operation mode	Two-way cam mode	• Two-way cam mode • Feed cam mode	
5	Cam data table	0	0 to 32767	

(1) Cam No.

This device is used to set the number allocated in created cam data. The number of cam data is set "1 to 64" for each machine.

A cam No. is used with the number which offset value attached by the machine name sequence registered on mechanical system editing screen in the mechanical system program.

Machine name sequence	Setting cam No.
1	1 to 64
2	101 to 164
3	201 to 264
4	301 to 364

(2) Resolution

- (a) This device is used to set the number of index divisions in one cam cycle.
- (b) The following conditions need to be satisfied in order to output the all point data of resolution correctly.
 - Number of pulses per cam revolution (Nc) \geq Resolution
 - Time required per cam revolution \geq Operation cycle × Resolution
- (3) Stroke amount/cam No. change point
 - (a) This device is used to set a position at which the stroke amount/cam No. is switched during operation.
 - (b) When the set switching position [range: 0 to (resolution -1)] is reached, if the stroke amount/cam No. is normal, it is switched to the setting stroke amount and cam No.

(4) Operation mode

- (a) This device is used to set the two-way cam mode/feed cam mode.
 - 1) Two-way cam mode A two-way operation is repeated between the









- (5) Cam data table
 - (a) This device is used to set each point stroke ratio (when the stroke amount is divided into 32767 divisions) in the set resolution.



(b) The cam data table is automatically created by creating the cam curve using MT Developer2.

The cam curves which can be used in the Motion CPU are shown in Section 8.4.4.

8.4.3 Parameter list

The cam parameters are shown in Table 8.5 and the parameters No.2 to No.12 shown in this table are explained in items (1) to (11) below.

Refer to the help of MT Developer2 for the cam parameter setting method.

No.	Setting item	Default value	Setting range			
			Q173DSCPU/Q173DCPU(-S1): 1 to 32			
1	Output axis No.	0	Q172I	DSCPU	: 1 t	o 16
			Q172I	DCPU(-S1)	: 1 t	o 8
2	Number of pulses per cam shaft revolution	0		1 to 107374	1824 [pulse]/	
2	(Nc) (2 words)	0	Word device (D, W, #, U□\G)			
3	Cam No. setting device (1 word)			Word device (D, W, #, U⊡\G)	
4	Permissible droop pulse value	6553500		1 to 107374	1824 [pulse]	
5	Output unit	mm	mm	inch	degree @	pulse
6	Stroke amount setting device (2 words)		Word device (D, W, #, U□\G)			
7	Torque limit value setting device (1 word)	_	-(300[%]) / word device (D, W, #, U□\G)		□\G)	
8	Comment	None	32 characters			
0	Lower stroke limit value storage device			/ward davias		• •
9	(2 words)	_			ı)	
	Current value within 1 virtual axis revolution					
10	storage device	—	-	/ word device	(D, W, #, U□\G	6)
	(Main shaft side, 2 words)					
	Current value within 1 virtual axis revolution					
11 storage device		—	-	/ word device	(D, W, #, U□\G	6)
	(Auxiliary input axis side, 2 words)					
12	Cam/ball screw switching command device	_	- / bit device ^(Note-1)			

Table 8.5 Cam Parameter List

(Note-1): The devices set in other parameter cannot be used.

- (1) Number of pulses per cam shaft revolution (Nc) (2 word)
 - (a) The number of pulses required to rotate the cam one cycle is set.



- (b) The setting for the number of pulses per cam shaft revolution is not related to the travel value per pulse (fixed parameter setting).
- (c) Set cam reference position after setting the number of pulses per cam shaft revolution. If not setting, the positioning is executed at the position before change.

(d) The following devices can be set as the number of pulses per cam shaft revolution.

Name	Setting range ^(Note1)
Data register	D0 to D8191 ^(Note2)
Link register	W0 to W1FFF
Motion register	#0 to #7999
Multiple CPU area device	U□\G10000 to U□\G(10000+p-1) ^(Note-3)

(Note-1): Set an even number at the first device.

- (Note-2): D800 to D1559 are dedicated devices of virtual servo motor axis, synchronous encoder axis and output module "Cam" in the virtual mode. Unused areas of virtual servo motor axis and cam axis can be used as a user device.
- (Note-3): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

(2) Cam No. setting device (1 word)

- (a) This device is used to set the device that sets in the Motion SFC program by which the cam No. to control.
- (b) The following devices can be set as the cam No. setting device.

Name	Setting range
Data register	D0 to D8191 ^(Note-1)
Link register	W0 to W1FFF
Motion register	#0 to #7999
Multiple CPU area device	U□\G10000 to U□\G(10000+p-1) ^(Note-2)

- (Note-1): D800 to D1559 are dedicated devices of virtual servo motor axis, synchronous encoder axis and output module "Cam" in the virtual mode. Unused areas of virtual servo motor axis and cam axis can be used as a user device.
- (Note-2): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.
- (c) When the cam No. setting device value is changed during operation, it changes to the cam No. changed in the "stroke amount/cam No. switching position" set at the cam creating.

(3) Permissible droop pulse value

- (a) This device is used to set the permissible droop pulse value of deviation counter.
- (b) The deviation counter value is continually checked, and if it becomes larger than the permissible droop pulse value, the error detection signal (M2407+20n) turns on.
 However, since the cam shaft operation continues, execute the error processing by user side.
- (4) Output unit
 - (a) This device is used to set the unit ([mm]/[inch]/[degree] [[mst]/[pulse]]) of cam.
 - (b) Set the same unit as used in the real mode (unit in the fixed parameters) for the cam shaft.

(5) Stroke amount setting device (2 words)

- (a) This device is used to set the cam stroke amount.
- (b) The following devices can be set as the stroke amount setting device.

Name Setting range ^(Note1)	
Data register D0 to D8191 ^(Note2)	
Link register W0 to W1FFF	
Motion register #0 to #7999	
Multiple CPU area device U□\G10000 to U□\G(10000+p-1) ^{(Not}	

(Note-1): Set an even number at the first device.

- (Note-2): D800 to D1559 are dedicated devices of virtual servo motor axis, synchronous encoder axis and output module "Cam" in the virtual mode. Unused areas of virtual servo motor axis and cam axis can be used as a user device.
- (Note-3): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.
- (c) Set the stroke amount within the following range.• Setting range in the two-way cam mode

Unit	Setting range
mm	Lower stroke limit value + Stroke amount \leq 2147483647 \times 10 ⁻¹ [µm]
inch	Lower stroke limit value + Stroke amount \leq 2147483647 \times 10 ⁻⁵ [inch]
degree @DSK	Lower stroke limit value + Stroke amount \leq 2147483647 \times 10 ⁻⁵ [degree]
pulse	Lower stroke limit value + Stroke amount ≤ 2147483647 [pulse]

• Setting range in the feed cam mode

Unit	Setting range
mm	0 < Stroke amount \le 2147483647 \times 10 ⁻¹ [µm]
inch	0 < Stroke amount \leq 2147483647 \times 10 ⁻⁵ [inch]
degree @DSK	0 < Stroke amount \leq 2147483647 \times 10 ⁻⁵ [degree]
pulse	0 < Stroke amount ≤ 2147483647 [pulse]

POINT

When the cam reference position setting command (M3214+20n) is OFF, a position of cam axis is restored in the range of 0 to 359.99999[degree]. If the cam stroke amount is lager than 360.00000[degree], the current value within 1 cam shaft revolution different from the previous virtual mode might be restored.
(Example) When cam position is restored by switching to virtual mode in the following conditions, the current value within 1 cam shaft revolution corresponding to "current feed value: 80[degree]" is restored.
• Stroke amount : 720[degree]

- Lower stroke limit value: 0[degree]
- Current value : Lower stroke limit value + 440[degree] (Current feed value: 80[degree])
 - 8 31

(6) Torque limit value setting device (1 word)

(a) This device is used to set the torque limit value for cam shaft.
 When the device is set, the torque control is executed with the preset device value.

In the virtual mode, the torque limit setting is always valid. If the device is not set, the torque limit is set at 300[%].

(b) The following devices can be set as the torque limit value setting device.

Name	Setting range	
Data register	D0 to D8191 ^(Note-1)	
Link register	W0 to W1FFF	
Motion register	#0 to #7999	
Multiple CPU area device	U□\G10000 to U□\G(10000+p-1) ^(Note-2)	

(Note-1): D800 to D1559 are dedicated devices of virtual servo motor axis, synchronous encoder axis and output module "Cam" in the virtual mode. Unused areas of virtual servo motor axis and cam axis can be used as a user device.

- (Note-2): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.
- (c) The setting range for torque limit value is 1 to 1000[%].

(7) Comment

- (a) This device is used to create a comment such as purpose of cam shaft. Made comment can be displayed at monitoring using MT Developer2.
- (b) Comments up to 32 characters long can be created.

(8) Lower stroke limit value storage device (2 words)

- (a) This device is used to store the cam lower stroke limit value. The current lower stroke limit value is stored.
- (b) The following devices can be set as the lower stroke limit value storage device.

Name	Setting range ^(Note-1)	
Data register	D0 to D8191 (Note-2)	
Link register	W0 to W1FFF	
Motion register	#0 to #7999	
Multiple CPU area device	U⊟\G10000 to U⊟\G(10000+p-1) (Note-3), (Note-4)	

(Note-1): Set an even number at the first device.

(Note-2): D800 to D1559 are dedicated devices of the virtual servo motor axis, synchronous encoder axis and output module "Cam" in the virtual mode. The unused areas of the virtual servo motor axis and cam axis can be used as a user device.

- (Note-3): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.
- (Note-4): Only device of the self CPU can be used.

(c) The lower stroke limit value is range of -2147483648 (-2³¹) to 2147483647 (2³¹-1).

Unit	Setting range		
mm	Lower stroke limit value×10 ⁻¹ [µm]		
inch	Lower stroke limit value $ imes$ 10 ⁻⁵ [inch]		
degree	gree @ Lower stroke limit value ×10 ⁻⁵ [degree]		
pulse	Lower stroke limit value $ imes$ 1 [pulse]		

• The lower stroke limit value is determined as follows for each unit setting.

(9) Current value within 1 virtual axis revolution storage device (Main shaft side) (2 words)

This parameter is set when the address mode clutch is set at the cam main shaft side.



- (a) The current value within 1 virtual axis revolution of cam main shaft side is stored in the preset device.
- (b) The following devices can be set as the current value within 1 virtual axis revolution storage device.

Name	Setting range ^(Note-1)	
Data register	D0 to D8191 ^(Note-2)	
Link register	W0 to W1FFF	
Motion register	#0 to #7999	
Multiple CPU area device	U□\G10000 to U□\G(10000+p-1) (Note-3), (Note-4)	

(Note-1): Set an even number at the first device.

- (Note-2): D800 to D1559 are dedicated devices of the virtual servo motor axis, synchronous encoder axis and output module "Cam" in the virtual mode. The unused areas of the virtual servo motor axis and cam axis can be used as a user device.
- (Note-3): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

(Note-4): Only device of the self CPU can be used.

(c) The current value within 1 virtual axis revolution is the range of 0 to (NC-1) [pulse].

(NC: Number of pulses per cam shaft revolution)

(d) The address mode clutch is turned on/off with the specified address of the current value within 1 virtual axis revolution range of 0 to (NC-1) [pulse]. Therefore, set the address value within the range of 0 to (NC-1) [pulse] in the clutch ON/OFF address setting device.

(e) The current value within 1 virtual axis revolution reference position "0" is set by turning the address clutch reference setting command (M3213+20n) on and switching to the virtual mode.

The current values within 1 virtual axis revolution for both the main shaft and the auxiliary input axis is set to "0" at this time.

If the address clutch reference setting command (M3213+20n) is turned off and it switches to the virtual mode, the following processing is executed depending on the drive module.

- If the drive module is a virtual servo motor or an incremental synchronous encoder, operation will be continued from the current value within 1 virtual axis revolution for the main shaft and auxiliary input axis in the previous virtual mode.
- If the drive module is an absolute synchronous encoder, operation will be continued from the current value within 1 virtual axis revolution for the main shaft and auxiliary input axis calculated from the current value of synchronous encoder.



(f) An example of an address mode clutch operation is shown below.

(10) Current value within 1 virtual axis revolution storage device (Auxiliary input axis side) (2 words)

This parameter is set when the address mode clutch is set at the cam auxiliary input axis side.



(a) By setting the current value within 1 virtual axis revolution of auxiliary input axis side, for the current value within 1 virtual axis revolution is stored in the preset device.

Current value within 1 virtual	Drive module travel value	Gear ratio
axis revolution of auxiliary input	= of auxiliary input axis side	\times Number of pulses per cam revolution
axis side		
(Nata). Our mant under a unitation of unitational	and a net cluster of a william include an	is side is undeted remandless of slutch ON/OFF

(Note): Current value within 1 virtual axis revolution of auxiliary input axis side is updated regardless of clutch ON/OFF.

(b) The following devices can be set as the current value within 1 virtual axis revolution storage device.

Name	Setting range ^(Note-1)	
Data register	D0 to D8191 (Note-2)	
Link register	W0 to W1FFF	
Motion register	#0 to #7999	
Multiple CPU area device	U□\G10000 to U□\G(10000+p-1) (Note-3), (Note-4)	

(Note-1): Set an even number at the first device.

- (Note-2): D800 to D1559 are dedicated devices of the virtual servo motor axis, synchronous encoder axis and output module "Cam" in the virtual mode. The unused areas of the virtual servo motor axis and cam axis can be used as a user device.
- (Note-3): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

(Note-4): Only device of the self CPU can be used.

- (c) The current value within 1 virtual axis revolution is the range of 0 to (NC-1) [pulse].
- (d) The address mode clutch is turned on/off with the specified address of the current value within 1 virtual axis revolution range of 0 to (Nc-1) [pulse]. Therefore, set the address value within the range of 0 to (Nc-1) [pulse] in the clutch ON/OFF address setting device.

(e) The current value within 1 virtual axis revolution reference position "0" is set by turning the address clutch reference setting command (M3213+20n) on and switching to the virtual mode.

The current values within 1 virtual axis revolution for both the main shaft and the auxiliary input axis is set to "0" at this time.

If the address clutch reference setting command (M3213+20n) is turned off and it switches to the virtual mode, the following processing is executed depending on the drive module.

- If the drive module is a virtual servo motor or an incremental synchronous encoder, operation will be continued from the current value within 1 virtual axis revolution for the main shaft and auxiliary input axis in the previous virtual mode.
- If the drive module is an absolute synchronous encoder, operation will be continued from the current value within 1 virtual axis revolution for the main shaft and auxiliary input axis calculated from the current value of synchronous encoder.



(f) An example of an address mode clutch operation is shown below.

- (11) Cam/ball screw switching command device
 - (a) This parameter is used to set cam operation.
 - (b) The following devices can be used as the cam/ball screw switching command device.

Name	Setting range	
Input	X0 to X1FFF (Note-1)	
Output	Y0 to Y1FFF	
Internal relay	M0 to M8191 (Note-2), (Note-3)	
Link relay	B0 to B1FFF	
Annunciator	F0 to F2047	
Multiple CPU area device	U□\G10000.0 to U□\G(10000+p-1).F ^(Note-4)	

- (Note-1): The range of "PXn+4 to PXn+F" cannot be used (fixed at 0) for the input device (PXn+0 to PXn+F) allocated to the built-in interface in Motion CPU (DI). (n: First input No.)
- (Note-2): "M4000 to M4639 and M4800 to M5439" are the dedicated devices of virtual servo motor axis in the virtual mode.
 - Unused area of virtual servo motor axis can be used as a user side.
- (Note-3): Use these parameters to use the device (M5488 to M5519) allocated to Q17 \Box CPUN/Q17 \Box HCPU.
- (Note-4): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.
- (c) The following operation is executed depending on the setting unit by turning the cam/ball screw switching command on corresponding to each output axis No.
 - mm : Same operation as ball screw.
 - inch : Same operation as ball screw.
 - degree : Same operation as rotary table.
 - pulse : Same operation as ball screw.
- (d) Operation of output axis by cam/ball screw switching command is shown below.

Items	Operation details		
Cam/ball screw switching command : OFF	Specified cam pattern operation		
Cam/ball screw switching command : ON	 Unit: mm, inch, pulse Same operation as ball screw. Unit: degree OSS Same operation as rotary table. Command to servo amplifier = Preset command to servo amplifier + Drive module travel value[pulse] × Gear ratio (Note): Feed current value is calculated based on the travel value per pulse set in the fixed parameter. 		

- (e) The current value within 1 cam shaft revolution is calculated based on the feed current value, lower stroke limit value, stroke amount and cam No. (cam pattern) by turning off the cam/ball screw switching command. If the cam/ball screw switching command is turned off outside the range of "lower stroke limit value to stroke amount" for cam, a minor error (error code: 5000) will occur.
- (f) "Continue Virtual Mode" is set for operation on servo error, if the feed current value of output axis is outside the range of cam operation ("Lower stroke limit value to Stroke amount") by servo error for two-way cam, return the output axis to within cam operation range.
 - 1) Remove servo error cause.
 - 2) Turn the cam/ball screw switching command ON.
 - \downarrow

- 3) Execute the servo error reset (M3208+20n).
- \downarrow
- 4) Return the output axis position within cam operation range to within stroke range by JOG operation, etc.
- \downarrow

- 5) Turn the cam/ball screw switching command OFF.
- 6) Re-start virtual mode.

8.4.4 Cam curve list

This section describes the cam curves which can be used in the virtual mode.

(1) Cam curve characteristics comparisonThe cam curve characteristics comparison is shown below.

	Class	Cam curve name	Acceleration curve shape	Vm	Am	(A • V)m	(V • V)m	(S•V)m	Remark
Discontinuity curves		Constant - speed	*¥	1.00			1.00	1.00	
		Constant- acceleration		2.00	± 4.00	± 8.00	4.00	1.09	
		5 th curve	\sim	1.88	± 5.77	± 6.69	3.52	1.19	
		Cycloid	\sim	2.00	± 6.28	± 8.16	4.00	1.26	
	Symmetrical curves	Distorted trapezoid		2.00	± 4.89	± 8.09	4.00	1.20	Ta = 1 / 8
Two-		Distorted sine	\sim	1.76	± 5.53	± 5.46	3.10	1.13	Ta = 1 / 8
dwelling curve		Distorted constant- speed	△	1.28	± 8.01	± 5.73	1.63	1.07	Ta = 1 / 16 Ta = 1 / 4
	Asymmetrical	Trapecloid	$\frown \!$	2.18	± 6.17	± 10.84	4.76	1.28	m = 1
	curves	Reverse trapecloid	\frown	2.18	± 6.17	± 10.84	4.76	1.28	m = 1
One-dwellir	ng curve	Double hypotenuse	\langle	2.04	+ 5.55 - 9.87	+ 7.75 - 9.89	4.16	1.39	
Non-dwelling curve		Single hypotenuse	\sum	1.57	± 4.93	± 3.88	2.47	1.02	

Table 8.6 Cam Curve Characteristics	Comparison	Table
-------------------------------------	------------	-------

(2) Free-form curve

The spline interpolation function can be used to create free-form cam curves.

8.5 Phase Compensation Function

When carrying out a position follow-up control (synchronous operation) by synchronous encoder, delays in the progresses, etc. cause the phase to deviate at servo motor shaft end in respect to the synchronous encoder. The phase compensation function compensates in this case so that the phase does not deviate.

(1) Parameter list

Set the following devices for axes to execute the phase compensation function. (Set in the output module parameter.)

No.	Item	Number of device words	Device setting range	Setting range
1	Phase advance time	2	D0 to D8191 ^{(Note-1), (Note-2)} W0 to W1FFF ^(Note-2) U□\G10000 to U□\G(10000+p-1) ^{(Note-2), (Note-3)}	-2147483648 to 2147483647[µs]
2	Phase compensation time constant	1	D0 to D8191 ^(Note-1) W0 to W1FFF U⊡\G10000 to U⊡\G(10000+p-1) ^(Note-3)	0 to 32767[times]
3	Phase compensation processing valid flag	Bit	X0 to X1FFF ^(Note-4) Y0 to Y1FFF M0 to M8191 ^(Note-5) F0 to F2047 B0 to B1FFF U⊡\G10000.0 to U⊡\G(10000+p-1).F ^(Note-3)	_
4	Compensation amount monitor device	2	D0 to D8191 ^{(Note-1), (Note-2)} W0 to W1FFF ^(Note-2) U□\G10000 to U□\G(10000+p-1) ^{(Note-2), (Note-3), (Note-6)}	_

Table 8.7 Phase Compensation Function Parameter List

(Note-1): D800 to D1559 are dedicated devices of virtual servo motor axis, synchronous encoder axis and output module "Cam" in the virtual mode.

Unused areas of virtual servo motor axis and cam axis can be used as a user device.

- (Note-2): Set an even number at the first device.
- (Note-3): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.
- (Note-4): The range of "PXn+4 to PXn+F" cannot be used (fixed at 0) for the input device (PXn+0 to PXn+F) allocated to the built-in interface in Motion CPU (DI). (n: First input No.)
- (Note-5): "M4000 to M4639 and M4800 to M5439" are the dedicated devices of virtual servo motor axis in the virtual mode.

Unused area of virtual servo motor axis can be used as a user side.

(Note-6): Only device of the self CPU can be used.

(a) Phase advance time

It is used to set whether a phase is advanced/delayed. Phase advance time is calculated in the formula below.



"Command speed[pulse/s] × Phase advance time[s]" is added to the servo command value as an amount of compensation.

Operation cycle	Incremental synchronous encoder use	Q171ENC-W8/Q170ENC use
[ms]	[µs]	[µs]
0.22 QDS	681	612
0.44	1088	1271
0.88	2376	2611
1.77	4165	4388
3.55	7715	7943
7.11	18378	18608
14.2 QD	32613	32829

Table 8.8 Delay time peculiar to system

(b) Phase compensation time constant

It is used to set to execute leading edge/trailing edge smoothly so that a servo motor does not make rapid acceleration/deceleration at phase compensation.

Set the number of operation cycles as setting unit.

<Example>

For operation cycle is 0.88[ms] and phase compensation time constant is 50[times].

The phase compensation time constant becomes "0.88 × 50 = 44[ms] "

Phase compensation time constant is input at the phase compensation processing valid flag ON.

(c) Phase compensation processing valid flag

It is used to set whether the phase compensation function is "Valid/Invalid".

- ON.....Phase compensation function "Valid"
- OFF.... Phase compensation function "Invalid"
- (d) Compensation amount monitor

The compensation amount under compensating is stored to the preset register.

- Except cam axis...Compensation amount of servo motor shaft [pulse]
- Cam axis.....Compensation amount of current value within 1 virtual axis revolution [pulse]

(2) Operating method

Operating method for phase compensation function is shown below.

(a) Set a phase advance time.

- \downarrow
- (b) Set a suitable time constant as a phase compensation time constant.
- \downarrow
- (c) Turn the phase compensation processing valid flag on for every axis before the servo motor start.
- \downarrow
- (d) For cam axis, make a gain adjustment in the servo amplifier side to improve the flattery for cam pattern. In this case, advance to the phase of cam axis compared with axis of other roller or rotary table, etc. Therefore, if the phase of cam axis is delayed in the phase advance time

setting, a phase with the axis of a roller or rotation table, etc. can be set.

- (3) Errors at phase compensation
 - (a) When the phase compensation time constant is outside the setting range, a minor error [6300] will occur for applicable axis, a phase compensation is executed without soothing processing.

POINT

- (1) It must be reduced a phase compensation time constant to use for delay compensation of synchronous encoder.
- (2) When driving 2 axes synchronizing with virtual servo motor, even if the position control gains 1 of each axis differ, it can be compensated to eliminate a phase discrepancy by the following setting.

<Example>

For Axis 1: PG1= 50[rad/s] and Axis 2: PG1=100[rad/s],

Phase advance time = 1/50 - 1/100

Therefore, -10000[μ s] is set as a phase advance time of axis 2, a phase of axis 2 can be set with a phase of axis 1.

(3) For cam axis, if it switches from the virtual mode to real mode in compensation amount except "0", it switches to the real mode with a phase shifted to other axes for compensation amount of remainder. In this case, switch to the real mode after setting "0" as a compensation amount.

9. REAL MODE/VIRTUAL MODE SWITCHING AND STOP/RE-START

This section describes the check details and switching method for the real mode/virtual mode switching.

- Real mode/virtual mode switching Real mode/virtual mode switching is executed by turning the real mode/virtual mode switching request flag (M2043) ON/OFF.
 - Real mode Switching request to the real mode by turning the M2043 OFF.
 - Virtual mode Switching request to the virtual mode by turning the M2043 ON.
- (2) Real mode/virtual mode confirmation The current control mode state (real or virtual) can be confirmed by turning the real mode/virtual mode switching status flag (M2044) ON/OFF.
 - M2044 : OFF Real mode state
 - M2044 : ON Virtual mode state

9.1 Switching from the Real Mode to Virtual Mode

When the real mode to virtual mode switching is requested (M2043 OFF \rightarrow ON), the following check is executed. (Confirm the check items in Table 9.1 to 9.3 for switching from real mode to virtual mode, and execute with all normal state.)

- Check to determine if switching to the virtual mode is possible.... Refer to Table 9.1
- Synchronous encoder axis check Refer to Table 9.3

- (1) Check to determine if switching to the virtual mode is possible
 - (a) The items in Table 9.1 are checked to determine if switching to the virtual mode is possible.

When all check items of Table 9.1 are normal, switching to the virtual mode is executed.

(b) If an error of at least one item of Table 9.1, the real mode/virtual mode switching error detection flag (M2045) turns on, and the error code is stored in the real mode/virtual mode switching error information storage register (SD504 to SD506).

Refer to APPENDIX 1.7 for the error codes which are stored in the SD504 to SD506.

		Applicable output module						
Check sequence	Check item	Roller	Ball screw	Rotary table	Cam	Real mode axis (Note-1)	Normal condition	Abnor- mal condition
1	Are PLC ready flag (M2000) and PCPU READY complete flag (SM500) ON ?	0	0	0	0	0	ON	OFF
2	Have all axes stopped ? (M2001 to M2032 : OFF)	0	0	0	0	0	YES	NO
3	Has cam data using the Motion SFC program changed ?	_	_	_	0	_	NO	YES
	• Has the mechanical system program been registered ?	0	0	0	0	0	YES	NO
4	• Does the axis No. set in the system settings match the output axis set in the mechanical system program ?	0	0	0	0	0	YES	NO
5	 Is the all axes servo ON command (M2042) ON ? 	0	0	0	0	0	ON	OFF
6	• Does not the servo start processing by the servo error reset executed at the servo amplifier (axis used) ?	0	0	0	0	0	Comple- tion	During proc- essing
7	 Is the external encoder normal ? 	0	0	0	0	0	YES	NO
8	• Is the external forced stop inputted ?	0	0	0	0	0	NO	YES
9	 Are the all axes servo error detection signal (M2408+20n) ON ? 	0	0	0	0	0	OFF	ON even if 1 axis
10	 Are the home position return request flag (M2409+20n) OFF ? (Excluding roller axis) 		0	0	0		OFF	ON even if 1 axis
11	• Does the units set in the fixed parameters match that set in the output module ?	_	0	0	0	_	YES	NO
12	• Has the cam data been registered?	—	_	_	0	_	YES	NO
13	• Has the cam No. been set at the "cam No. setting device" set in the cam parameter ?		_	_	0	_	YES	NO
14	• Has the stroke amount (1 to 2147483647) been set at the "stroke amount setting device" set in the cam parameter ?	_	_	_	0	_	YES	NO
15	 Is the cam "stroke amount setting device" an even number 2 	_	_	_	0	_	YES	NO

Table 9.1 Check Items List for Real Mode to Virtual Mode Switching

(Note-1): It is not check target for the operating system software version "00H or later".

- (2) Output module check
 - (a) The items in Table 9.2 below are checked to determine the output module state.

If an error is detected, it switches to the virtual mode, but the applicable system cannot be started. Correct the error cause in the real mode, and switch to virtual mode again.

(b) When an error is detected, the error detection signal (M2407+20n) of applicable output module turns on, and the error code is stored in the minor/major error code storage register.

	Check Check item		Applicable output module				
Check sequence			Ball screw	Rotary table	Cam	condition	Abnormal condition
	 Is the feed current value within the stroke limit range ? 	_	0	0	_		
1	 Is the feed current value within the range of "[lower stroke limit value] to [stroke amount]" ? 	_	_		0	YES	NO
2	• Does not "[lower stroke limit value] + [stroke amount]" exceed 2147483647 (2 ³¹ - 1) in the two-way cam mode ?	_	_	_	0	YES	NO
2	• When the clutch connected to between the drive module and synchronous encoder is "external input mode", are the clutch ON/OFF device the same device ?	0	0	0	0	YES	NO
5	• When the clutch connected to between the drive module and synchronous encoder is "external input mode", are the encoder I/F the manual pulse generator input ?	0	0	0	0	YES	NO (Serial encoder (ABS) input)
4	• Is the output module where either a "no clutch" or "clutch ON command" in effect for the virtual main shaft or the virtual auxiliary input axis the servo ready (M2415+20n : ON)?	0	0	0	0	ON	OFF
	 Is the external input signal "STOP" of output module where either a "no clutch" or "clutch ON command" in effect for the main shaft or the auxiliary input axis OFF ? 	0	0	0	0	OFF	ON
5	• Can the current value within 1 cam revolution be calculated in the two-way cam mode ?	_	_	_	0	YES	NO
6	 Is the clutch ON/ OFF address setting device for address mode clutch an even number ? 	0	0	0	0	YES	NO

Table 9.2 Check Items List for Output Module

- (3) Synchronous encoder axis check
 - (a) The items in Table 9.3 below are checked to determine the synchronous encoder state.

If an error is detected, it switches to the virtual mode, but the applicable system cannot be started. Correct the error cause in the real mode, and switch to virtual mode again.

(b) When an error is detected, the error detection signal (M2407+20n) of the applicable output module turns on, and the error code is stored in the minor/major error code storage register.

		-			
	Check item	Applicable sy enco	/nchronous der	Normal condition	Abnormal condition
Check sequence		External synchronous encoder	Output module		
1	Is the synchronous encoder connected	0		Connected	Not connected
I	to the Q172DEX ?	Ŭ			Cable break

Table 9.3 Check Items List for Synchronous Encoder Axis

9.2 Switching from the Virtual Mode to Real Mode

There are following methods for switching from the virtual mode to real mode.

- · Switching by user
- Switching automatically by the operating system software

9.2.1 Switching by user

- When the virtual mode to real mode switching is requested (M2043 ON → OFF), the item in Table 9.4 is checked. If normal, it switches to the real mode. (Confirm the check items in Table 9.4 for the switching from virtual mode to real mode, and execute with all normal state.)
- (2) The real mode/virtual mode switching error detection flag (M2045) turns on at the error detection, and the error code is stored in the real mode/virtual mode switching error information (SD504 to SD506). (Refer to APPENDIX 1.7)

Table 9.4 Check Items for VIRTUAL Mode to REAL Mode Switching

Check item	Normal condition	Abnormal condition	
 Is the virtual axis stopped? (M2001 to M2032 of 	Virtual axis	Virtual axis	
virtual axis: OFF)	OFF	ON even if 1 axis	
• Virtual axis and real mode axis stopped? (M2001 to			
M2032 : OFF)	055		
(Operating system software version "00G" or before	OFF	ON even if 1 axis	
in the Q17⊡DCPU(-S1))			

9.2.2 Switching by the operating system software

- (1) If the following items are detected in the virtual mode operation, the operating system software automatically switches back to the real mode.
 - The forced stop is input.
 - PLC ready flag (M2000) turns off.
 - When "Return to Real Mode" is set as an operation on servo error, the servo error detection signal (M2408+20n) turns on even if 1 axis.
- (2) The error code is stored in the real mode/virtual mode switching error information (SD504 to SD506) at the switching back from virtual mode to real mode. However, the real mode/virtual mode switching error detection flag (M2045) does not turn on.

9 REAL MODE/VIRTUAL MODE SWITCHING AND STOP/RE-START

9.2.3 Continuous operation on servo error in virtual mode

Set the processing on servo error in virtual mode on the mechanical system screen of MT Developer2.

(Default: "Return to real mode")

Refer to the help of MT Developer2 for the setting method.

Mechanical system screen

MELSOFT Series MT Doveloper2 nd Settings/temp/Wy Document/sWorkspace/Project - [Mechanical System page 01] Project Edit End(Relate Yew Ched)Convert Online Debug Tools Window Heb Real Mode And Settings- Project マンド・アンドレーン・ Project マンド・ Project アンド・ Project アンド	
Projekt Chr. Projekt	- 8 ×
P PI名 2 型 字 編集 1 型 字 目 目 型 字 目 目 型 字 目 目 型 字 目 Project P	• •
Project P ス アの アの	• •
Project # X Amechanical Syst Options	4 0 -
Paulica A shall A dematic Astion	
B C Project (SV22)	^
Confirm Memory Size	
Software Security Key Management	Ξ
B (C Servo Program	
Mechanical System Program	
B G Can Data	
🐺 Structured Data Types	
e Covice Memory Axis 6 Axis 16	
	~
	>
Output	Ψ×
	~
4	>
Editing Page 1/32 Q173DS SV22 Host Station No.2	CAP Sg

[Operation on Servo Error] menu

Operation on servo error setting screen



Operation conditions for continuous operation on servo error in virtual mode are shown below.

Operation mode	Dotoilo	Operation on servo	Operation for	Return condition to	
Operation mode	Details	error	other axes	virtual mode	
Return to real mode Motion CPU switches to real mode.		Only axis on servo error is servo OFF,	Rapid stop	After error release in real mode	
Continue virtual mode Virtual mode continues.		and servo motor coasts.	Operation continues	After error release in virtual mode	

POINT

When "Continue virtual mode" is selected, be sure to use a clutch in the mechanical system program. In addition, the drive module connected to output axis on servo error is also continuing operation. Be sure to release a servo error after clutch OFF.

9.3 Precautions at Real Mode/Virtual Mode Switching

This section describes the precautions at real mode/virtual mode switching.

(1) The motion control step and the torque limit value change instruction/speed change instruction during mode switching processing execution impossible The motion control step and the torque limit value change instruction/speed change instruction during the from real mode to virtual mode/from virtual mode to real mode switching processing (part of timing chart (Note-1)) cannot execute. The real mode/virtual mode switching request flag (M2043) and real mode/virtual mode switching status flag (M2044) should be used as an interlock.

[Timing Chart]



Motion SFC program for which executes the motion control step of real mode and virtual mode is shown below.

[Program Example]

- (a) Motion control step in the virtual mode
 - Example of Motion SFC program is shown below.



(Note) : Example of the above Motion SFC program is started using the automatic start or sequence program.

Real mode example	
G10	PX000 turn on real mode/virtual mode
PX000*!M2043*!M2044*!M20	switching request and switching status turn off, and axis 1 start accept flag turn off.
K10	
ABS-1 Axis 1, 20000pulse Speed 2000pulse/s	 1 axis linear control Axis used Axis 1 End address
G20	Positioning speed 2000[pulse/s]
!PX000*!M2001	Wait until PX000 and axis 1 start accept flag turn off.
END	

(b) Motion control step in the real modeExample of Motion SFC program is shown below.

(Note) : Example of the above Motion SFC program is started using the automatic start or sequence program.

(2) M2043 processing during the TEST mode using MT Developer2 M2043 ON/OFF (Real mode/virtual mode switching request) is ignored during the test mode using MT Developer2.

Real mode/virtual mode switching can be executed using MT Developer2, during TEST mode operation using MT Developer2.

The real mode/virtual mode switching status flag (M2044) is turned off/on with the real mode/virtual mode.

REMARK

The same check as the "M2043 (OFF \rightarrow ON/ON \rightarrow OFF)" is also executed at the real mode/virtual mode switching using MT Developer2. (Refer to Sections 9.1 and 9.2)

9.4 Stop and Re-start

The basic method for stopping the system (output module) in the virtual mode operation is to stop the main shaft. If an auxiliary input axis is used, also stop the auxiliary input axis.

(1) Virtual axis stop

The stop operation or causes of virtual axis, the stop processing and re-start after stop are shown below. The following three methods for the virtual servo motor axis stop processing. This processing is also valid for interpolation axes during the interpolation operation.

- Deceleration stop Deceleration stop based on the "stop deceleration time" of parameter block.
- Rapid stop Deceleration stop based on the "rapid stop deceleration time" of parameter block.
- Immediate stop Immediate stop without deceleration.

Because the synchronous encoder axis becomes the input immediate stop, operation should be executed after the synchronous encoder axis has been stopped from the external input, except for abnormal stops such as the forced stop or a servo error occurrence, etc.

(Example : M2000 is OFF, All axes servo OFF command, etc.)

(The servo error occurs by the immediate stop of output module connected to the synchronous encoder axis, and the synchronization discrepancy may occurs.)

When the synchronization discrepancy occurs by the stop cause, the synchronization discrepancy warning (M2046) turns on. In this case, re-align the axes in the real mode, turn M2046 off, then continue the virtual mode operation.

The stop operation/stop causes during operation and re-starting operation after stop are shown in the next page.
9.4.1 Stop operation/stop causes during operation and re-starting operation list

Table 9.5 Stop Operation/stop Causes during Operation and Re-starting Operation List

	Affected virtual axis Stop processing		essing Return to Real mode						
No.	Stop operation or stop causes during operation	Virtual servo motor axis	Synchronous encoder axis	All axes batch	Virtual servo motor axis	Synchronous encoder axis	by operating system software after all virtual axes stop completion	Synchronization discrepancy warning (M2046) set	
1	Stop command ON	O (Applicable axis)	—		Deceleration stop		—	_	
2	Rapid stop command ON	O (Applicable axis)	—		Rapid stop	_	—	—	
3	All-axes servo OFF command (M2042 OFF, Command using MT Developer2 in the TEST mode)	_	_	0	Deceleration stop	Immediate input stop _(Note-1)	_	_	
4	PLC ready flag (M2000) OFF	_	_	0	Deceleration stop	Immediate input stop (Note-1)	0	_	
5	Motion CPU stop	_	_	0	Deceleration stop	Immediate input stop (Note-1)	0	_	
6	All-axes rapid stop from MT Developer2	_	_	0	Rapid stop	Immediate input stop (Note-1)	_	_	
7	Stop from MT Developer2 in the TEST mode	⊖ (All axes)	_	_	Deceleration stop	_	_	_	
8	Forced stop	_	_	0	Rapid stop	Immediate input stop (Note-1)	0	0	
9	Servo error at output module even if 1 axis	_	_	0	Rapid stop	Immediate input stop _(Note-1)	0	0	
10	Motion CPU WDT error	_	_	0	Immediate stop	Immediate input stop	_	_	
11	Multiple CPU system reset	_	_	0	Immediate stop	Immediate input stop	_	_	
12	Multiple CPU system power OFF	_	_	0	Immediate stop	Immediate input stop	_	_	
13	Other errors during virtual axis operation	0	_	_	Deceleration stop		_	_	
14	Error detection at absolute synchronous encoder axis	_	0	_	—	Immediate input stop	—	_	

Error set	Output module operation	Operation continuation enabled (\bigcirc)/ disabled (\times)	Re-start operation after stop
_	Deceleration stop based on the smoothing time constant.	0	 Continuous operation is possible by turning the stop command off (not necessary when on) and starting.
_	 Deceleration stop based on the smoothing time constant. 	0	 Continuous operation is possible by turning the stop command off (not necessary when on) and starting.
_	 Servo OFF state after deceleration stop based on the smoothing time constant. 	0	 Continuous operation is possible by turning the all clutch off → all axes servo on → clutch on. (However, when the servo motor does not operate during the servo OFF. Also, the clutch OFF/ON is switched as required by the user side.) For synchronous encoder axes, switch to the real mode, then back to the virtual mode to resume inputs. ^(Note-1)
Minor error (200) set (virtual axis)	Deceleration stop based on the smoothing time constant.	0	 Operation is possible by executing the real mode to virtual mode switching request (M2043 ON), after turning the PLC ready flag (M2000) on.
Minor error (200) set (virtual axis)	Deceleration stop based on the smoothing time constant.	0	 Operation is possible by executing the real mode to virtual mode switching request (M2043 ON), after starting the Motion CPU.
_	Deceleration stop based on the smoothing time constant.	0	 Continuous operation is possible by starting after stop. For synchronous encoder axes, switch to the real mode, then back to the virtual mode to resume inputs. ^(Note-1)
—	Deceleration stop based on the smoothing time constant.	0	 Continuous operation is possible by starting after stop.
_	• Servo OFF state after immediate stop.	Х	 Continuous operation is not possible due to a synchronization discrepancy between the virtual axis and output module, and stop. After release the forced stop, re-align the output module in the real mode, switch the synchronization discrepancy warning (M2046) OFF, then switch back to the virtual mode to resume operation.
Applicable output module (Servo error, Servo error code set)	 Servo OFF state after immediate stop for error axis only. Operation is different according to the setting at error occurrence. 	Х	 After executing a servo error reset in the real mode, re-align the axes, switch the synchronization discrepancy warning (M2046) OFF, then switch back to the virtual mode to resume operation.
SM512 (Motion CPU WDT error flag) ON	• Servo OFF state after immediate stop.	Х	 Continuous operation is not possible due to a synchronization discrepancy between the virtual axis and output module, and stop. After resetting the Multiple CPU system, re-align the output module, then switch to the virtual mode to resume operation.
_	Servo OFF state after immediate stop.	Х	 Continuous operation is not possible due to a synchronization discrepancy between the virtual axis and output module, and stop. After resetting the Multiple CPU system, re-align the output module, then switch to the virtual mode to resume operation.
_	• Servo OFF state after immediate stop.	×	 Continuous operation is not possible due to a synchronization discrepancy between the virtual axis and output module, and stop. After resetting the Multiple CPU system, re-align the output module, then switch to the virtual mode to resume operation.
Applicable error set	 Deceleration stop based on the smoothing time constant. 	0	Operation is possible by release the error cause.
Applicable error set	 Deceleration stop based on the smoothing time constant. 	×	 Return to the real mode, re-align the axes, then switch to the virtual mode to resume operation.

(Note-1): It is input continuously for the version (Refer to Section 1.4) that supports "synchronous encoder current value monitor in real mode".

MEMO

10. AUXILIARY AND APPLIED FUNCTIONS

This section describes the auxiliary and applied functions for positioning control in the Multiple CPU system.

Items	Details	Applications
	Positioning control for preset axis is	It is used in the system for which
Mixed function of virtual	executed during synchronous	conveys while executing synchronous
mode/real mode	control/cam control in the	control.
	mechanical system program.	

10.1 Mixed Function of Virtual Mode/Real Mode

When the output axis No. to execute positioning control directly is selected in the mixed function of virtual mode/real mode, a positioning control of axis which is not used in the mechanical system program can be executed simultaneously during the mechanical system program.

Example of program is shown below.



10

Set the axis to control as real mode axis on the mechanical system screen of MT Developer2.

Refer to the help of MT Developer2 for the setting method.

Mechanical system screen



[Real Mode Axis Setting] menu

· Real mode axis setting screen

Real Mode	Axis Settin	g	×
Select the a:	is to be cont	rolled as the r	eal mode axis.
Axis 1	∏ Axis 9	│ Axis 17	Axis 25
Axis 2	C Axis 10	F Axis 18	Axis 26
🔽 Axis 3	C Axis 11	F Axis 19	Axis 27
🔽 Axis 4	T Axis 12	🔽 Axis 20	Axis 28
🦳 Axis 5	T Axis 13	☐ Axis 21	Axis 29
F Axis 6	T Axis 14	☐ Axis 22	Axis 30
🕅 Axis 7	C Axis 15	F Axis 23	🔽 Axis 31
🕅 Axis 8	C Axis 16	F Axis 24	🔽 Axis 32
When the Fixed Parameter, or JOG Operation Data for the real mode axis is changed, perform "Mechanical System Program Conversion" again.			
	OK	Canc	el

POINT

- (1) Execute "Mechanical System Program Conversion" after setting "Real mode axis setting" in the mechanical system program editor.
- (2) When a fixed parameter of each axis is changed, be sure to execute "Mechanical System Program Conversion".
- (3) Axis No. set in the "Real mode axis setting" cannot be set as virtual servo motor axis No. And, the output axis No. set in the mechanical system program cannot be also set as real mode axis No.
- (4) Operation cycle over may occur for default operation cycle depending on the number of axes for real mode axis. In this case, change an operation cycle to a large value in the system setting.

	Items	Usable/unusable	Remarks
Servo instructions	Linear positioning control Linear interpolation control Circular interpolation control Helical interpolation control Fixed-pitch feed control Speed control (I) Speed control (I) Speed-position switching control Position follow-up control Constant-speed control Simultaneous start Speed control with fixed position		Positioning control with the torque limit value set in the servo program (parameter block)
	Home position return (ZERO) High-speed oscillation (OSC)	⊖ (Ver.)	
JOG operatio	on	_	Control with JOG operation data
Speed-torque	e control	0	Control with speed-torque control data
Manual pulse	e generator operation	⊖ Ver.!	
Current value change (D(P).CHGA Jn ^(Note) , CHGA)			
Speed change (D(P).CHGV, CHGV)			
Torque limit value change (D(P).CHGT, CHGT)		0	
Torque limit	value individual change		
(D(P).CHGT	2, CHGT2) (2005)		
Target position	on change (CHGP)		

(1) Usable instructions and controls

 $\bigcirc: Usable \quad \times: Unusable \label{eq:stable}$ (Note): "n" shows the numerical value (axis No. 1 to 32) correspond to axis No.

Ver. : Refer to Section 1.4 for the software version that supports this function.

Items	Control method	Remarks
Servo program start	 Use a Motion SFC program start or D(P).SVST instruction Set a real mode axis No. as axis No. 	 When the real mode axis is set to the virtual servo program and it starts, "Servo program setting error" (error code: 906) occurs. When the real mode axis and virtual axis are set together to the interpolation axis if it starts, "Servo program setting error" (error code: 906) occurs.
Stop	 Turn the stop command (M3200+20n) or rapid stop command (M3201+20n) ON in real mode. Turn the external signal (STOP) ON. Use the deceleration stop or all axes rapid stop (Test mode ON) from MT Developer2. Change speed to "0". 	Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)" for details.
JOG operation	Use the forward rotation JOG start command (M3202+20n) or reverse rotation JOG start command (M3203+20n).	Control with parameter JOG operation data.
Speed-torque control	 Set the parameter required at Motion SFC program to switch the mode. Set a real mode axis No. as axis No. for parameter setting. 	Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)" for details.
Current value change	 Use D(P).CHGA Jn ^(Note), CHGA instruction. Set a real mode axis No. as axis No. 	 When the D(P).CHGA Cn ^(Note) instruction is executed, the instruction is ignored. When the CHGA-C instruction is executed to real mode axis, the instruction is ignored.
Speed change	 Use D(P).CHGV, CHGV instruction. Set a real mode axis No. as axis No. 	
• Use D(P).CHGT, CHGT instruction. • hange • Use D(P).CHGT, CHGT instruction. • Set a real mode axis No. as axis No. • Orque limit value • Use D(P).CHGT2, CHGT2 instruction. • Use D(P).CHGT2, CHGT2 instruction. • Set a real mode axis No. as axis No.		Torque limit value of real mode axis at switching from real mode to virtual mode continues the state in real mode.
Target position change	Use CHGP instruction. Set a real mode axis No. as axis No.	

(2) Control methods

(Note): "n" shows the numerical value (axis No. 1 to 32) correspond to axis No.

(3) Error codes in real mode axis

Error codes at positioning control in the mixed function of virtual mode with real mode are shown below.

- (a) Minor error (1 to 999)
- (b) Major error (1000 to 1299)

Minor error (4000 to 9990)/major error (10000 to 12990) code of output module in virtual mode are not set in minor/major error code storage register (D6+20n/D7+20n).

(4) Difference for operation between the output axis of mechanical system program and real mode axis

Operation details for "output axis of mechanical system program" and "real mode axis" on error are shown below.

ltems	Operation for output axis of mechanical system program	Operation for real mode axis
Feed current value exceeds the stroke limit range at switching from real mode to virtual mode.	 Minor error (error code: 5000) occurs. Related system cannot be started. 	• Minor error (error code: 105) occurs at servo program start, and operation does not start.
Feed current value exceeds the stroke limit range during operation.	 Minor error (error code: 6030) occurs. Operation continues. 	 Minor error (error code: 207) occurs, and deceleration stop is executed.
Output speed exceeds the speed limit value.	 Minor error (error code: 6010) occurs. Speed cramp does not process by speed limit value. 	 Servo program setting error or minor error occurs. Speed is controlled by speed limit value.
Stop signal (STOP) is ON.	 Major error (error code: 11020) occurs. Operation continues for axis without clutch. Operation is controlled based on the operation mode on error for axis with clutch. 	 Major error (error code: 1000) occurs by turning the stop signal (STOP) on at start, and operation does not start. Operation stops based on "deceleration processing at stop" of parameter block by turning the stop signal (STOP) on during operation.
External upper LS signal (FLS) turns off during travel to forward direction (address increase direction).	 Major error (error code: 11030) occurs. Operation continues for axis without clutch. Operation is controlled based on the operation mode on error for axis with clutch. 	 Major error (error code: 1001) occurs by turning the external upper LS signal (FLS) off at start to forward direction, and operation does not start. Major error (error code: 1101) occurs by turning the external upper LS signal (FLS) off during start to forward direction, operation stops based on "deceleration processing at stop" of parameter block.
External lower LS signal (RLS) turns off during travel to reverse direction (address decrease direction).	 Major error (error code: 11040) occurs. Operation continues for axis without clutch. Operation is controlled based on the operation mode on error for axis with clutch. 	 Major error (error code: 1002) occurs by turning the external lower LS signal (RLS) off at start to reverse direction, and operation does not start. Major error (error code: 1102) occurs by turning the external lower LS signal (RLS) off during start to reverse direction, operation stops based on "deceleration processing at stop" of parameter block.
Change the torque limit value.	 Any time valid by setting the torque limit value setting device of output axis and changing preset value. Torque limit value individual change request instructions (D(P).CHGT2, CHGT2) are valid. CHGT2) are valid. 	• Torque limit value change request instructions (D(P).CHGT, CHGT) and torque limit value individual change request instructions (D(P).CHGT2, CHGT2) @ are valid.

(5) Difference for operation between the real mode axis in virtual mode and real mode

When the servo OFF command (M3215+20n) turns on at using the mixed function of virtual mode with real mode in virtual mode, positioning control stops.

Items	Operation for real mode axis in virtual mode	Operation for axis in real mode
Servo OFF command (M3215+20n)	Invalid during positioning control. Any time valid. (Operating system software version "00G" or before in the Q17□DCPU(-S1))	Invalid during positioning control.

- (6) Cautions
 - (a) For the operating system software version "00G or before" in the Q17□DCPU(-S1), axis operation, current value, speed and torque limit value cannot be changed for all axes during mode switching.
 - (b) When the feed current value of real mode axis is outside the stroke limit range at virtual mode switching, an error will occur at start of real mode axis. Use the JOG operation to reverse within the stroke limit range.

POINT

For the operating system software version "00G or before" in the Q17□DCPU(-S1), switching from virtual mode to real mode cannot be executed during positioning control of real mode axis. Switch a mode after stop the real mode axis.

10.2 Speed-Torque Control

Control mode can be switched for output axis of mechanical system and real mode axis during virtual mode.

- (1) Speed-torque control in output axis of mechanical system
 - (a) The speed-torque control can be executed for output axis of roller, ball screw and rotary table as output module. When the control mode switching is executed for output axis of cam, a minor error (error code: 6240) will occur, and the control mode is not switched. When switching the mode to speed control mode or torque control mode, the control mode switching is possible during motor stop. When the motor is operating at control mode switching request, a minor error (error code: 6200) will occur, and the control mode is not switched. The mode can be switched to continuous operation to torque control mode even when the motor is operating.
 - (b) In the speed-torque control in output axis of mechanical system, the setting value of "Speed command device" is not referred, and the command speed to output axis is the value of command speed. Command speed acceleration time, command speed deceleration time and initial speed selection at control mode switching are also invalid. (For speed limit value, the value set in each output axis module is valid.)
 - (c) Control the command torque by setting torque command value in the torque command device set in speed-torque control data same as real mode. Torque limit value change request (D(P).CHGT, CHGT) is invalid (no operation), and the torque limit value to servo amplifier can be changed within the range of torque limit value at speed-torque control by the value of torque limit value setting device. (If the value is outside the range, a minor error (error code: 6250) will occur.)

Only when the torque limit value setting device of output module is not set, the torque limit value to servo amplifier can be changed within the range of torque limit value at speed-torque control by the torque limit value individual change request (D(P).CHGT2, CHGT2). If the value exceeds the torque limit value at speed-torque control is set in positive direction torque limit value or negative direction torque limit value, a minor error (error code: 6250) will occur, and the torque limit value is not changed.

(2) Cautions at control mode switching

(a) When using continuous operation to torque control mode, use servo amplifiers that support continuous operation to torque control. When using servo amplifiers that do not support continuous operation to torque control, a major error (error code: 11050) will occur at switching to continuous operation to torque control mode request, and the operation continues based on the parameter settings at major error occurrence, or the clutch is OFF. (b) When the mode is switched from virtual mode to real mode, return all output axes to position control mode. If output axis except position control mode exists when the mode is switched from virtual mode to real mode, an error at real mode/virtual mode switching (error code: 256) will occur, and the mode is not switched to real mode.

(3) Stop causes during virtual mode

Operations of stop causes during "speed-torque control" in the output module during virtual mode are shown below.

Item	Operation during speed-torque control mode
The stop command (M3200+20n) turned ON.	Command is ignored, and operation continues.
The external stop input turned ON.	 A major error (error code: 10030) will occur, and related system cannot be started at virtual servo motor start A major error (error code: 11020) will occur, and operation continues for axis without clutch during command. Operation is controlled based on the operation mode on error for axis with clutch.
The all axes servo ON command (M2042) turned OFF.	During virtual mode, OFF of the all axes servo ON command is not accepted, and the command is ignored. When the mode is returned to position control mode and switched to real mode, command status at the time is valid.
Servo OFF command (M3215+20n) turned ON.	 During no-clutch/clutch ON/clutch status ON, a minor error (error code: 6000) will occur. When the control mode is speed control, torque control or continuous operation to torque control during clutch OFF, servo OFF is not executed. When the mode is switched to position control mode, command status at the time is valid.
The current value reached to software stroke limit.	A minor error (error code: 6030) will occur.
The position of motor reached to hardware stroke limit	A major error (error code: 11030, 11040) will occur, and operation continues for axis without clutch. Operation is controlled based on the operation mode on error for axis with clutch.
The PLC ready flag (M2000) turned OFF.	An error at real mode/virtual mode switching (error code: -4094(F002)) will occur, and the mode is returned to real mode. After that, the control mode is switched to position control mode, and the operation immediately stops.
The forced stop input to Motion CPU.	An error at real mode/virtual mode switching (error code: -4096(F000)) will occur, and the mode is returned to real mode. The control mode switches to position control mode at servo OFF.
The forced stop input to servo amplifier.	 During no-clutch/clutch ON/clutch status ON, a major error (error code: 11010) will occur, and operation continues for axis without clutch. Operation is controlled based on the operation mode on error for axis with clutch. When the control mode is speed control, torque control or continuous operation to torque control during clutch OFF, the mode is switched to position control mode at servo OFF.
The servo error occurred.	An error at real mode/virtual mode switching (error code: -4095(F001)) will occur, and the mode is returned to real mode. The control mode switches to position control mode at servo OFF.
The servo amplifier's power supply turned OFF.	 During no-clutch/clutch ON/clutch status ON, a major error (error code: 11010) will occur, and operation continues for axis without clutch. Operation is controlled based on the operation mode on error for axis with clutch. When the control mode is speed control, torque control, or continuous operation to torque control during clutch OFF, the mode switches to position control mode at the servo amplifier's power supply ON again.

(4) Speed-torque control in the real mode axis
 The speed-torque control can be executed in the real mode axis.
 In this case, the control follows the control during real mode.
 The real mode axis can be switched from virtual to real mode during speed-torque control.
 Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22)
 Programming Manual (REAL MODE)" for details of operation during real mode.

MEMO

APPENDICES

APPENDIX 1 Error Codes Stored Using the Motion CPU

APP.

The following errors are detected in the Motion CPU.

- Servo program setting error
- Positioning error
- Control mode switching error
- Motion SFC error (Note-1)
- Motion SFC parameter error (Note-1)
- Multiple CPU related error (Note-2)
- (Note-1): Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (Motion SFC)" for details.
- (Note-2): Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for details.

(1) Servo program setting errors

These are positioning data errors set in the servo program, and it checks at the start of each servo program.

They are errors that occur when the positioning data is set indirectly.

The operations at the error occurrence are shown below.

- The servo program setting error flag (SM516) turns on.
- The erroneous servo program is stored in the error program No. storage register (SD516).
- The error code is stored in the error item information register (SD517).

(2) Positioning error

(a) Positioning errors occurs at the positioning start or during positioning control. There are minor errors, major errors and servo errors.

1) Minor errors	. These errors occur in the Motion SFC program or servo
	program, and the error codes (drive module : 1 to 999,
	output module : 4000 to 9990) are used.
	Check the error code, and remove the error cause by
	correcting the Motion SFC program or servo program.
2) Major errors	. These errors occur in the external input signals or
	control commands from the Motion SFC program, and
	the error codes (drive module : 1 to 1999, output
	module : 10000 to 11990) are used.
	Check the error code, and remove the error cause of
	the external input signal state or Motion SFC program.
3) Servo errors	. These errors detected in the servo amplifier, and the
	error codes 2000 to 2999 are used.
	Check the error code, and remove the error cause of
	the servo amplifier side.

Error close	Erronoouo ootogon/	Err	or module		
EITOI Class	Enoneous category	Drive module	Output module		
	Setting data	1 to 99	4000 to 4990		
Minor orror	At start	100 to 199	5000 to 5990		
	During operation	200 to 299	6000 to 6990		
	At control change	300 to 399	—		
	At start	1000 to 1099	10000 to 10990		
Major error	During operation	1100 to 1199	11000 to 11990		
	System	_	15000 to 15990		
	Servo amplifier		2000 to 2799 (2100 to 2499 : warning)		
Servo error	Servo amplifier power supply module	_	2800 to 2999 (2900 or later : warning)		

The error applicable range for each error class are shown below.

(b) The error detection signal of the erroneous axis turns on at the error occurrence, and the error codes are stored in the minor error code, major error code or servo error code storage register.

	Device	Error code storage register											
Error class		Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8	Axis 9	Axis10	Axis11	Axis12
Virtual servo	Minor error code	D802	D812	D822	D832	D842	D852	D862	D872	D882	D892	D902	D912
motor	Major error code	D803	D813	D823	D833	D843	D853	D863	D873	D883	D893	D903	D913
Synchronous	Minor error code	D1122	D1132	D1142	D1152	D1162	D1172	D1182	D1192	D1202	D1212	D1222	D1232
encoder	Major error code	D1123	D1133	D1143	D1153	D1163	D1173	D1183	D1193	D1203	D1213	D1223	D1233
	Minor error code	D6	D26	D46	D66	D86	D106	D126	D146	D166	D186	D206	D226
Output module	Major error code	D7	D27	D47	D67	D87	D107	D127	D147	D167	D187	D207	D227
	Servo error code	D8	D28	D48	D68	D88	D108	D128	D148	D168	D188	D208	D228

	Device	Error code storage register											
Error class		Axis13	Axis14	Axis15	Axis16	Axis17	Axis18	Axis19	Axis20	Axis21	Axis22	Axis23	Axis24
Virtual servo	Minor error code	D922	D932	D942	D952	D962	D972	D982	D992	D1002	D1012	D1022	D1032
motor	Major error code	D923	D933	D943	D953	D963	D973	D983	D993	D1003	D1013	D1023	D1033
Synchronous	Minor error code												
encoder	Major error code												
	Minor error code	D246	D266	D286	D306	D326	D346	D366	D386	D406	D426	D446	D466
Output module	Major error code	D247	D267	D287	D307	D327	D347	D367	D387	D407	D427	D447	D467
	Servo error code	D248	D268	D288	D308	D328	D348	D368	D388	D408	D428	D448	D468

	Device			Error	code st	orage ree	gister			Error detection	Error reset
Error class		Axis25	Axis26	Axis27	Axis28	Axis29	Axis30	Axis31	Axis32	signal	command
Virtual servo	Minor error code	D1042	D1052	D1062	D1072	D1082	D1092	D1102	D1112	N44007.00	N4007.00
motor	Major error code	D1043	D1053	D1063	D1073	D1083	D1093	D1103	D1113	M4007+20n	M4807+20n
Synchronous	Minor error code										
encoder	Major error code									M4640+4n	M5440+4n
	Minor error code	D486	D506	D526	D546	D566	D586	D606	D626	10107.00	M0007.00
Output module	Major error code	D487	D507	D527	D547	D567	D587	D607	D627	M2407+20n	M3207+20n
	Servo error code	D488	D508	D528	D548	D568	D588	D608	D628	M2408+20n	M3208+20n

- (c) If another error occurs after an error code has been stored, the existing error code is overwritten, deleting it.
 However, the error history can be checked using MT Developer2.
- (d) Error detection signals and error codes are held until the error reset command (M3207+20n) or servo error reset command (M3208+20n) turns on.

POINT

- (1) Even if the servo error reset (M3208+20n) turns on at the servo error occurrence, the same error code might be stored again.
- (2) Reset the servo error after removing the error cause of the servo amplifier side at the servo error occurrence.
- (3) Error at the real mode/virtual mode switching

These errors are checked when the real mode/virtual mode switching request flag (M2043) turns off to on/on to off.

When the check shown in Section 9.1 and 9.2 is executed, and if error is detected, it is as follows.

- It remains the current mode without the real mode/virtual mode switching.
- The real mode/virtual mode switching error detection flag (M2045) turns on.
- The error codes are stored in the real mode/virtual mode switching error information (SD504 to SD506).



APPENDIX 1.1 Expression method for word data axis No.

The axis No. may be expressed to correspond to each bit of word data for the positioning dedicated signal.

Example of the TEST mode request error information (SD510, SD511) is shown below.



(1) Axis 8 : Test mode request error

	Th	ne co	ntrol	ling s	signa	l "1"	is sto	ored	in SI	D510	"b7	(axis	8)".						
	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	D	ecimal	Hexadecimal
SD510	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	SD510	128	0080H
SD511	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	SD511	0	0000H
-																			

(2) Axis 12, 20 : Test mode request error

	Th	ne co	ntrol	ling s	signa	ıl "1"	is sto	ored	in S[D510	"b1′	1 (ax	is 12)" an	d SE	0511	"b3 (ax	is 20)	".
	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	. D	ecimal	Hexadecimal
SD510	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	SD510	2048	0800H
SD511	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	SD511	8	0008H

(3) Axis 4, 10 : Test mode request error

	Th	e co	ntroll	ing s	signa	"1"	is sto	ored	in SE	0510	"b3	(axis	4)" a	and S	SD51	1 "b	9 (axis	10)".	
	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	D	ecimal	Hexadecimal
SD510	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	SD510	520	0208H
SD511	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	SD511	0	0000H

APPENDIX 1.2 Related systems and error processing

There are following 2 types for the related systems of virtual mode.

- System consisting of a drive module and output module.
- Multiple systems used the same drive module.

The following processing occurs, when the error is detected at an output module.

• If an error is detected at least one output module, a drive module cannot start and that system cannot be operate.

The auxiliary input axis operation for the erroneous output module also cannot operate.

• Other systems which use the drive module which could not start by the output module error also cannot operate.



APPENDIX 1.3 Servo program setting errors (Stored in SD517)

The error codes, error contents and corrective actions for servo program setting errors are shown in Table 1.1.

In the error codes marked with "Note" indicates the axis No. (1 to 32).

Error code stored in SD517	Error name	Error contents	Error processing	Corrective action
1	Parameter block No. setting error	The parameter block No. is outside the range of 1 to 64.	Execute the servo program with the default value "1" of parameter block.	Set the parameter block No. within the range of 1 to 64.
n03 ^(Note)	Address (travel value) setting error (Except the speed control and speed/position control.) (Setting error for linear axis at the belical-interpolation)	 (1) The address is outside the setting range at the positioning start for absolute data method. Unit Address setting range 0 to × 10⁻⁵ degree 35999999 [degree] (2) The travel value is set to 	 Positioning control does not start. (All interpolation control at the interpolation control.) If the error is detected during the speed- switching control or constant-speed control, a deceleration stop is 	 (1) If the control unit is [degree], set the address within the range of 0 to 35999999. (2) Set the travel value within
		-2147483648 (H80000000) at the positioning start for incremental data method.	 (3) If an error occurs in one servo program, all servo programs do not execute during the simultaneous start. 	the range of "0 to $\pm (2^{31}-1)$ ".
4	Command speed error		 Positioning control does not start if the command speed is "0" or less. If the command speed exceeds the speed limit value, control with the speed limit value. 	Set the command speed within the range of 1 to the speed limit value.
5	Dwell time setting error	The dwell time is outside the range of 0 to 5000.	Control with the default value	Set the dwell time within the range of 0 to 5000.
6	M-code setting error	The M-code is outside the range of 0 to 32767.		Set the M-code within the range of 0 to 32767.
7	Torque limit value setting error	The torque limit value is outside the range of 1 to 1000.	Control with the torque limit value of the specified parameter block.	Set the torque limit value within the range of 1 to 1000.

Table 1.1 Servo program setting error list

(Note-1): When the "speed control $10 \times$ multiplier setting for degree axis" is set to "valid", the setting range is 0.01 to 21474836.47 [degree/min].

Error code stored in SD517	Error name	Error contents	Error processing	Corrective action
n08 ^(Note)	Auxiliary point setting error (At the auxiliary point-specified circular interpolation.) (At the auxiliary point-specified helical interpolation.)	 (1) The auxiliary point address is outside the setting range at the positioning start for absolute data method. Unit Address setting range 0 to × 10⁻⁵ degree 35999999 [degree] (2) The auxiliary point address is set to -2147483648 	Positioning control does not start.	 (1) If the control unit is [degree], set the auxiliary point address within the range of 0 to 35999999. (2) Set the auxiliary point address within the range of
		(H80000000) at the positioning start for incremental data method.		0 to ± (2 ³¹ -1).
n09 ^(Note)	Radius setting error (At the radius- specified circular interpolation.) (At the radius- specified helical interpolation.)			(1) If the control unit is [degree], set the radius within the range of 0 to 35999999.
		(2) The radius is set to "0" or negative setting at the positioning start for incremental data method.		(2) Set the radius within the range of 1 to (2 ³¹ -1).
n10 ^(Note)	Central point setting error (At the central point- specified circular interpolation.) (At the central point- specified helical interpolation.)	 (1) The central point address is outside the setting range at the positioning start for absolute data method. Unit Address setting range 0 to × 10⁻⁵ (degree) (degree) (degree) 		(1) If the control unit is [degree], set the central point address within the range of 0 to 35999999.
		(2) The central point is set to -2147483648 (H80000000) at the positioning start for incremental data method.		 (2) Set the central point address within the range of 0 to ± (2³¹-1).
11	Interpolation control unit setting error	The interpolation control unit is set outside the range of 0 to 3.	Control with the default value "3".	Set the interpolation control unit within the range of 0 to 3.
12	Speed limit value setting error	The speed limit value is set outside the setting range.	Control with the default value 200000[pulse/s].	Set the speed limit value within the setting range. [For pulse] 1 to 2147483647[pulse/s]
13	Acceleration time setting error FIN acceleration/ deceleration setting error Fixed position stop acceleration/ deceleration time	The acceleration time is set to "0". The FIN acceleration/deceleration time is set except 1 to 5000. The fixed position stop acceleration/deceleration time is set to "0".	Control with the default value	Set the acceleration time within the range of 1 to 65535. The FIN acceleration/ deceleration time within the range of 1 to 5000. Set the fixed position stop acceleration/deceleration time within the range of 1 to 65535.
14	Deceleration time setting error	The deceleration time is set to "0".		Set the deceleration time within the range of 1 to 65535.

Table 1.1 Servo program setting error list (Continued)

Error code stored in SD517	Error name	Error contents	Error processing	Corrective action
15	Rapid stop deceleration time setting error	The rapid stop deceleration time is set to "0".	Control with the default value "1000".	Set the rapid stop deceleration time within the range of 1 to 65535.
16	Torque limit value setting error	The torque limit value is outside the range of 1 to 1000.	Control with the default value "300[%]".	Set the torque limit value within the range of 1 to 1000.
17	Allowable error range for circular interpolation setting error	The allowable error range for circular interpolation is outside the setting range. $\begin{tabular}{ c c c c c } \hline Unit & Address setting range \\ \hline & & & & \\ \hline & & & & \\ \hline & & & & \\ \hline & & & &$	Control with the default value "100[pulse]".	Set the allowable error range for circular interpolation within the setting range.
18	Repeat count error	The repeat count is outside the range of 1 to 32767.	Control the repeat count with "1".	Set the repeat count within the range of 1 to 32767.
19	START instruction setting error	 The servo program specified with the START instruction does not exist. There is a START instruction in the specified servo program. The starting axis of the specified servo program overlap. The real mode program and virtual mode program are mixed. The real axis program and command generation axis 	Positioning control does not start.	 (1) Create the servo program specified with the START instruction. (2) Delete the servo program specified with the START instruction. (3) Do not overlap the starting axis. (4) Do not allow mixture of the real mode program and virtual mode program. (5) Do not allow mixture of the real axis program and
20	Point setting error	program are mixed. Point is not specified in the instruction at the constant-speed		command generation axis program. Set a point between CPSTART and CPEND.
	Reference axis	control. The axis except interpolation axis		Set one of the interpolation
21	speed setting error	is set as the reference axis at the linear interpolation of the reference axis speed-specified method.		axes as the reference axis.
22	S-curve ratio setting error	S-curve ratio is set outside the range of 0 to 100[%] at the S- curve acceleration/deceleration.	Control the S-curve ratio with 0[%] (Trapezoidal acceleration/deceleration).	Set the S-curve ratio within the range of 0 to 100[%].
23	VSTART setting error	Not even one speed-switching point has been set between a VSTART and VEND instruction, or between FOR and NEXT instruction.	Positioning control does not start.	Set the speed switching point between the VSTART and VEND instructions or the FOR and NEXT instructions.
24	Cancel function start program No. error	The start program No. for the cancel function is set outside the range 0 to 4095.		Start after set the start program No. within the range of 0 to 4095.

Table 1.1 Servo program setting error list (Continued)

Error code stored in SD517	Error name	Error contents	Error processing	Corrective action
25	High-Speed oscillation command amplitude error	Operation cannot be started because the amplitude specified with the high-speed oscillation function is outside the range 1 to 2147483647.	Positioning control does not start.	Start after set the command amplitude within the range of 1 to 214783647.
26	High-Speed oscillation command starting angle error	Operation cannot be started because the starting angle specified with the high-speed oscillation function is outside the range of 0 to 3599 $(\times 0.1[degree]).$		Start after set the starting angle within the range of 0 to 3599 (×0.1 [degree]).
27	High-Speed oscillation command frequency error	Operation cannot be started because the frequency specified with the high-speed oscillation function is outside the range of 1 to 5000[CPM].		Start after set the frequency within the range of 1 to 5000[CPM].
28	Number of helical interpolation pitches error	The specified number of pitches of helical interpolation is outside the range of 0 to 999.		Set the specified number of pitches within the range of 0 to 999.
41	Device error of the home position return data for indirect setting	Any unauthorized devices are set in the home position return data for indirect setting.	Positioning control does not start.	Review the devices of home position return data for indirect setting.
45	Advanced S-curve acceleration/ deceleration setting	The acceleration section 1 ratio is outside the range of 0.0 to 100.0[%].	Control with acceleration section 1 ratio = 0.0	Set the each ratio within the range of 0.0 to 100.0[%].
46	error	The acceleration section 2 ratio is outside the range of 0.0 to 100.0[%].	acceleration section 2 ratio = 0.0 deceleration section 1 ratio =	
47		The deceleration section 1 ratio is outside the range of 0.0 to 100.0[%].	0.0 deceleration section 2 ratio = 0.0	
48		The deceleration section 2 ratio is outside the range of 0.0 to 100.0[%].		
49		(Acceleration section 1 + Acceleration section 2) > 100.0[%]		
50		(Deceleration section 1 + Deceleration section 2) > 100.0[%]		
51	Rapid stop deceleration time setting error	The rapid stop deceleration time is bigger than the setting value of deceleration time.	Control the rapid stop deceleration time with the setting value of deceleration time.	Set the rapid stop deceleration time within the range of 1 to deceleration time setting value.
900	START instruction setting error	The servo program specified with the servo program start does not exist.	Positioning control does not start.	Set the correct servo program No.
901	START instruction setting error	The axis No. set in the servo program start is different from the axis No. set in the servo program.		Set the correct axis No.
902	Servo program instruction code error	The instruction code cannot be decoded. (A non-existent instruction code has been specified.)		Set the correct instruction code

Table 1.1 Servo program setting error list (Continued)

Error code stored in SD517	Error name	Error contents	Error processing	Corrective action
903	Start error	A virtual mode program was started in the real mode.	Positioning control does not start.	Check the program mode allocation.
905	Start error	 Operation disable instructions (VPF, VPR, VPSTART, PVF, PVR, ZERO, VVF, VVR, OSC) was started in virtual mode. Operation disable instructions (ZERO, OSC, CHGA-C) was started in real mode axis. Operation disable instructions (VPF, VPR, VPSTART, VSTART, ZERO, VVF, VVR, OSC) was started in command generation axis. 		Correct the servo program.
		(4) Operation disable instructions (CHGA-C, CHGA-E) from the D(P).SVST instruction of Motion dedicated instruction was started.		Use the D(P).CHGA instruction of Motion dedicated instruction.
906	Axis No. setting error	 Unused axis of the system setting is set in the servo program start. It was started by setting the real mode axis in the virtual servo program. It was started in the condition that the real mode axis had been mixed with virtual axis in the interpolation axis. 		Set the axis No. set in the system setting or mechanical system program.
		(4) It was started by setting the virtual axis in the real mode program in virtual mode.		
907	Start error	It was started during processing for switching from real mode to virtual mode.		Use M2043 (real mode/virtual mode switching request), M2044 (real mode/virtual
908	Start error	It was stated during processing for switching from virtual mode to real mode.		mode switching status) as interlocks for start.

Table 1.1 Servo program setting error list (Continued)

APPENDIX 1.4 Drive module errors

		Сс	ontro	ol mo	de	of vi	rtual	serv	/o a>	(is				
Error class	Error code	Positioning	Fixed-pitch feed	Speed	Speed switching	Constant-speed	JOG	Manual pulse generator	Synchronous encoder	Position follow-up	Error cause	Error processing	Corrective action	
											The PLC ready flag (M2000) or		Set the Motion CPU to RUN.	
	100	0	0	0	0	0	0	0		0	PCPU READY complete flag (SM500) is OFF.		• Turn the PLC ready flag (M2000) on.	
	101	0	0	0	0	0	0	0		0	• The start accept flag (M2001 to M2032) for applicable axis is ON.		 Take an interlock in the program not to start the starting axis. (Use the start accept flag OFF of the applicable axis as the starting condition). 	
	103	0	0	0	0	0	0	0		0	• The stop command (M4800+20n) for applicable axis is ON.		• Turn the stop command (M4800+20n) off and start.	
	104	0	0	0	0	0	0	0		0	 The rapid stop command (M4801 +20n) for applicable axis is ON. 		• Turn the rapid stop command (M4801+20n) off and start.	
Minor error	105 (Note)	0			0	0				0	 The feed current value is outside the range of stroke limit at the start. 		 Set within the stroke limit range by the JOG operation. Set within the stroke limit range by the home position return or current value change. 	
		06 ote)										 Positioning is outside the range of stroke limit. 		Perform the positioning within the range of stroke limit.
	106 (Note)		0		0	0				0	 When absolute position system is enabled for stepping driver, and software stroke limit is valid with control units as degree, the following instructions were started. (1) Absolute system instructions in constant-speed control (2) Position follow-up control (3) Absolute system instructions in speed-switching control 	Positioning control does not start.	 When absolute position system is enabled for stepping driver, if software stroke limit is valid and control units are degree, do not use the following instructions. (1) Absolute system instructions in constant-speed control (2) Position follow-up control (3) Absolute system instructions in speed-switching control 	
	107 (Note)	0				0					 The address that does not generate an arc is set at auxiliary point- specified circular interpolation or auxiliary point-specified helical interpolation. (Relationship between the start point, auxiliary point and end point.) The auxiliary point-specified circular interpolation or auxiliary point- specified helical interpolation was started in the control unit degree axis which is "stroke limit invalid". The auxiliary point-specified circular interpolation or auxiliary point- specified helical interpolation was started in the control unit degree axis which is "stroke limit invalid". 		 Correct the addresses of the servo program. Make the stroke limit valid for the control unit degree axis starts the auxiliary point-specified circular interpolation or auxiliary point-specified helical interpolation. Make the stroke limit valid for the axis starts the auxiliary point-specified helical interpolation. 	

Table 1.2 Drive module error (100 to 1199) list

(Note): This error code is stored at all relevant interpolation axis storage areas at the interpolation operation.

		Сс	ontro	ol mo	ode o	of vii	rtual	ser	/o a>	kis					
Error class	Error code	Positioning	Fixed-pitch feed	Speed	Speed switching	Constant-speed	JOG	Manual pulse generator	Synchronous encoder	Position follow-up	Error cause	Error processing	Corrective action		
	108 (Note)	8 (e)				0					 The address that does not generate an arc is set at R(radius) specified circular interpolation or R(radius) specified helical interpolation. (Relationship between the start point, radius and end point.) The radius-specified circular interpolation or radius-specified helical interpolation was started in the control unit degree axis which is "stroke limit invalid". The radius-specified circular 		Correct the addresses of the servo program. Make the stroke limit valid for the control unit degree axis starts the radius-specified circular interpolation or radius-specified helical interpolation. Make the stroke limit valid for		
											interpolation or radius-specified helical interpolation was started in the axis which is "stroke limit invalid".		the axis starts the radius- specified circular interpolation or radius-specified helical interpolation.		
	109 (Note)								The address that does not general an arc is set at central point- specified circular interpolation or central point-specified helical interpolation. (Relationship between the start point, central point and end point.)	Positioning control does not start.	Correct the addresses of the servo program.				
Minor error		0	0	0				0					• The central point-specified circular interpolation or central point- specified helical interpolation was started in the control unit degree axis which is "stroke limit invalid".		Make the stroke limit valid for the control unit degree axis starts the central point-specified circular interpolation or central point-specified helical interpolation.
													 The central point-specified circular interpolation or central point- specified helical interpolation was started in the axis which is "stroke limit invalid". 		 Make the stroke limit valid for the axis starts the central point- specified circular interpolation or central point-specified helical interpolation.
	110 (Note)	0				0					 The difference between the end point address and ideal end point is outside the allowable error range for circular interpolation at the circular interpolation. 		Correct the addresses of the servo program.		
											 The setting JOG speed is "0". The setting JOG speed exceeded the JOG speed limit value. 	Control with the JOG speed limit value.	 Set the correct speed (within the setting range). 		
	116						0				 The setting JOG speed limit value exceeded the setting range. 	Control with the maximum setting range of each control unit.	• Set the correct JOG speed limit value (within the setting range).		

Table 1.2 Drive module error (100 to 1199) list (Continued)

(Note): This error code is stored at all relevant interpolation axis storage areas at the interpolation operation.

		Сс	ontro	ol mo	de	of vi	rtual	ser	o ax	kis			
Error class	Error code	Positioning	Fixed-pitch feed	Speed	Speed switching	Constant-speed	JOG	Manual pulse generator	Synchronous encoder	Position follow-up	Error cause	Error processing	Corrective action
	117						0				• Both of forward and reverse rotation were set at the simultaneous start for the JOG operation.	Only the applicable axis set to the forward direction starts.	• Set a correct data.
	119				0						 In the real mode or at the real mode axis, the instruction to specify the end point address by absolute data method in speed switching control was executed for the axis with unit [pulse/mm/inch] where the stroke limit is disabled. 		• When specifying the end point address by absolute data method in speed switching control, make the stroke limit valid.
	136			0							 An unusable instruction (VVF/VVR) was started in an axis that does not support VVF/VVR instruction. 		Cannot start VVF/VVR instruction in an axis that does not support VVF/VVR instruction.
	140	0									• The travel value of the reference axis is set at "0" in the linear interpolation for reference axis specification.	Positioning control does not start	• Do not set axis of travel value "0" as the reference axis.
	141									0	 The position command device of position follow-up control is set the odd number. 		 Set the even number for the position command device of position follow-up control.
Minor error	151	0	0	0	0	0	0	0		0	 Not allowed axis started in the virtual mode. (It cannot be started with error at real mode/virtual mode switching.) 		 Start in the virtual mode again after correct the error cause in the real mode.
	152	0	0	0	0	0	0	0		0	 It started at the virtual mode and during deceleration by all axes servo OFF (M2042 OFF). 		
	153	0	0	0	0	0	0	0		0	 It started at the virtual mode and during deceleration by occurrence of the output module servo error. 		
	200	0	0	0	0	0	0	0		0	 The PLC ready flag (M2000) turned off during the control by the servo program. 	Deceleration stop	• Turn the PLC ready flag (M2000) on after all axes have stopped.
	204	0	0	0	0	0	0	0		0	• The PLC ready flag (M2000) turned off to on again during deceleration by turning off the PLC ready flag (M2000).	No operation	• Turn the PLC ready flag (M2000) off to on after all axes have stopped. (Turn the PLC ready flag (M2000) off to on during deceleration is "no operation".)
	207	0			0	0	0			0	 The feed current value exceeded the stroke limit range during positioning control. Only the axis exceed the stroke limit range is stored at the circular/helical interpolation. All interpolation axes are stored in the linear interpolation. 	Deceleration stop	Correct the stroke limit range or travel value setting so that positioning control is within the range of the stroke limit.

Table 1.2 Drive module error (100 to 1199) list (Continued)

		Сс	ontro	ol mo	ode	of vi	rtual	serv	o a	kis			
Error class	Error code	Positioning	Fixed-pitch feed	Speed	Speed switching	Constant-speed	DOC	Manual pulse generator	Synchronous encoder	Position follow-up	Error cause	Error processing	Corrective action
	208	0			0	0		0			 The feed current value of another axis exceeded the stroke limit value during the circular/helical interpolation control or simultaneous manual pulse generator operation. (For detection of other axis errors). 	Deceleration	• Correct the stroke limit range or travel value setting so that positioning control is within the range of the stroke limit.
	211					0					 During positioning control, an overrun occurred because the deceleration distance for the output speed is not attained at the point where the final positioning address was detected. 	stop	 Set the speed setting so that overrun does not occur. Set the travel value so that overrun does not occur.
	214							0			 The manual pulse generator was enabled during the start of the applicable axis, the manual pulse generator operation was executed. 	Manual pulse generator input is ignored until the axis stops.	Execute the manual pulse generator operation after the applicable axis stopped.
	215				0						 The speed switching point address exceed the end point address. The positioning address in the reverse direction was set during the speed switching control. 	Rapid stop	Set the speed-switching point between the previous speed switching point address and the end point address.
Minor											the same servo program was executed again.		 Correct the Motion SFC program.
error	220									0.	• When the control unit is "degree" during the position follow-up control, the command address exceeded the range of 0 to 35999999. • The command address for the position follow-up control exceeded	Deceleration stop	 When the control unit is "degree", set the command address within the range of 0 to 35999999. Set the address within the stroke limit range.
	225					0					 The stroke limit range. The speed at the pass point exceeded the speed limit value during constant-speed control. The speed at the pass point is 0 or less. 	Control with the speed limit value. Control with the speed of last pass point	• Set the speed command value within the range of 1 to speed limit value.
	230					0					 When the skip is executed in the constant-speed control, the next interpolation instruction is an absolute circular interpolation or absolute helical interpolation. After the skip is executed in the constant-speed control, an absolute circular interpolation or absolute helical interpolation is executed while passing through only the positioning point for incremental method. 	Immediate stop Deceleration stop	 If absolute circular interpolation or absolute helical interpolation is designated at a point after the skip designation point, set an absolute linear interpolation in the interval.

 Table 1.2 Drive module error (100 to 1199) list (Continued)

	_	Сс	ontro	ol mo	de	of vi	rtual	ser	o ax	(is	IS		
Error class	Error code	Positioning	Fixed-pitch feed	Speed	Speed switching	Constant-speed	DOC	Manual pulse generator	Synchronous encoder	Position follow-up	Error cause	Error processing	Corrective action
	260	0	0			0					• The target position change request (CHGP) specifying the address where the target position is outside the range of 0 to 35999999 is executed to the axis whose unit is [degree].		• When executing the target position change request specifying the address to the axis whose unit is [degree], set the target position within the range of 0 to 35999999.
	261	0	0			0					• At the target position change request (CHGP), since the travel to the target position after the change was shorter than the deceleration distance, an overrun occurred.		 Set the speed so that an overrun will not occur. Set the target position so that an overrun will not occur.
Minor error	262	0	0			0					 At the target position change request (CHGP), the target position after the change exceeds the range of the stroke limit. 		 Set the stroke limit range or the target position after the change so that the positioning control is performed within the stroke limit range.
	263	0	0			0					 The target position change request (CHGP) is executed to the program where the following acceleration/deceleration system is set. (1) FIN acceleration/deceleration (2) Advanced S-curve acceleration/ deceleration 	Deceleration	 Do not execute the target position change to the program where the FIN acceleration/deceleration or the advanced S-curve acceleration/deceleration is set. Set the acceleration/deceleration system of the parameter block or the servo program to the trapezoid/S-curve acceleration/deceleration.
	264	0									 In reference axis-specified linear interpolation or the long axis- specified linear interpolation, the travel of the reference axis or the long axis after the target position change request (CHGP) is 0. 		• Set a target position so that the travel of the reference axis or the long axis after the target position change is not 0.
	300	0	0	0	0	0	0	0		0	 The current value was changed during positioning control of the applicable axis. The current value was changed for the axis that had not been started. The current value was changed for the servo OFF axis. 	Current value is not changed.	 Use the following devices as interlocks not to change the current value for the applicable axis. (1) The start accept flag (M2001 to M2032) OFF for applicable axis. (2) The servo READY signal (M2415+20n) ON.
	305				0		0			0	The speed after speed change is set outside the range of 0 to speed limit value. The absolute value of speed after	Control with the speed	Set the speed after speed change within the range of 0 to speed limit value. Set the absolute value of speed
		0	0	0		0					speed change is set outside the range of 0 to speed limit value.	limit value.	after speed change within the range of 0 to speed limit value.

Table 1.2 Drive module error (100 to 1199) list (Continued)

		Сс	ontro	ol mo	ode	of vi	rtua	ser	/o a>	kis				
Error class	Error code	Positioning	Fixed-pitch feed	Speed	Speed switching	Constant-speed	JOG	Manual pulse generator	Synchronous encoder	Position follow-up	Error cause	Error processing	Corrective action	
	310	0	0	0	0	0	0			0	• Change speed to negative speed in the invalid axis of stroke limit.	Speed is not changed.	 Do not change speed to negative speed in the invalid axis of stroke limit. 	
Minor error	330			0	0		0	0			• The target position change request (CHGP) was executed for the axis which was executing a servo instruction which was not compatible with target position change.	Target position is not changed.	 Change the target position for the axes operated by the following servo instructions. (1) Linear interpolation control (2) Fixed-pitch feed operation (3) Constant-speed control 	
												Q172DEX or encoder hardware error.	Immediate	Check (replace) the Q172DEX or encoder.
											Disconnected encoder cable	input stop	 Check the encoder cable 	
Major	1151								0		 A synchronous encoder set in the system setting differs from a synchronous encoder actually connected. 	Input from synchronous encoder does not accept.	 Set a synchronous encoder actually connected in the system setting. 	
error											No battery or disconnected battery at Q172DEX.	Immediate input stop	 Replace the battery and turn ON the Multiple CPU system power supply a few minutes later. 	
	1152								0		Low voltage at Q172DEX.	Operation is	 Replace the battery. 	
	1153								0		No battery or disconnected battery at Q172DEX.	continued.	Replace the battery or check (replace) the Q172DEX.	

Table 1.2 Drive module error (100 to 1199) list (Continued)

APPENDIX 1.5 Servo errors

(1) Servo errors (2000 to 2999)

These errors are detected by the servo amplifier, and the error codes are [2000] to [2999].

The servo error detection signal (M2408+20n) turns on at the servo error occurrence. Eliminate the error cause, reset the servo amplifier error by turning on the servo error reset command (M3208+20n) and perform re-start. (The servo error detection signal does not turn on because the codes [2100] to [2599] are for warnings.)

- (Note-1): As for the regenerative alarm (error code [2030]) or overload 1 or 2 (error codes [2050], [2051]), the state at the operation is held also for after the protection circuit operation in the servo amplifier. The memory contents are cleared with the external power supply off, but are not cleared by the reset signal.
- (Note-2): If resetting by turning off the external power supply is repeated at the occurrence of error code [2030], [2050] or [2051], it may cause devices to be destroyed by overheating. Re-start operation after eliminating the cause of the error certainly.

The hexadecimal display of servo amplifier display servo error code (#8008+20n) is the same as the LED of servo amplifier. $\sqrt{2}$

• If a controller, servo amplifier self-diagnosis error occurs, check the points stated in this manual and clear the error.

List of servo errors are shown in next page or later. Refer to the "Servo amplifier Instruction Manual" for details.

Servo amplifier type	Instruction manual name
MR-J4-⊟B	SSCNETII/H Interface AC Servo MR-J4B_(-RJ) Servo amplifier Instruction Manual (SH-030106)
MR-J4W-⊟B	SSCNETII/H Interface Multi-axis AC Servo MR-J4W2B/MR-J4W3B/ MR-J4W2-0303B6 Servo amplifier Instruction Manual (SH-030105)
MR-J3-⊟B	SSCNETII interface MR-J3-⊡B Servo amplifier Instruction Manual (SH-030051)
MR-J3W-⊟B	SSCNETII interface 2-axis AC Servo Amplifier MR-J3W-0303BN6/MR-J3W-⊡B Servo amplifier Instruction Manual (SH-030073)
MR-J3-□B-RJ004	SSCNETII Compatible Linear Servo MR-J3-⊡B-RJ004U⊡ Instruction Manual (SH-030054)
MR-J3-□B-RJ006	SSCNETII Compatible Fully Closed Loop Control MR-J3-⊡B-RJ006 Servo amplifier Instruction Manual (SH-030056)
MR-J3-□B-RJ080	SSCNETII interface Direct Drive Servo MR-J3-⊡B-RJ080W Instruction Manual (SH-030079)
MR-J3-⊟B Safety	SSCNETII interface Drive Safety integrated MR-J3-⊡B Safety Servo amplifier Instruction Manual (SH-030084)

Ver.! : Refer to Section 1.4 for the software version that supports this function.

(a)	MR-J4((W)-⊟B
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Table 1.3 Servo error (2000 to 2999) list (MR-J4(W)-□B)

Error code	Servo amplifier LED display	Name	Details name	Remarks
0010	10.1	L la democlás as	Voltage drop in the control power	
2010	10.2	Undervoltage	Voltage drop in the main circuit power	
0011	11.1		Axis number setting error/Station number setting error	
2011	11.2	Switch setting error	Disabling control axis setting error	
	12.1		RAM error 1	
	12.2		RAM error 2	
0010	12.3	Memory error 1	RAM error 3	
2012	12.4	(RAM)	RAM error 4	
	12.5		RAM error 5	
	12.6		RAM error 6	
	13.1		Clock error 1	
2013	13.2	Clock error	Clock error 2	
	14.1		Control process error 1	
	14.2		Control process error 2	
	14.3		Control process error 3	
	14.4		Control process error 4	
	14.5		Control process error 5	
2014	14.6	Control process error	Control process error 6	
-	14.7		Control process error 7	
	14.8		Control process error 8	
	14.9		Control process error 9	
	14 A		Control process error 10	
	14.B		Control process error 11	
	15.1		EEP-ROM error at power on	
2015	15.2	Memory error 2 (EEP-	EEP-ROM error during operation	
	15.4	ROM)	Home position information read error	
	16.1		Encoder initial communication - Receive data error 1	
	16.2		Encoder initial communication - Receive data error 2	
	16.3		Encoder initial communication - Receive data error 3	
	16.5		Encoder initial communication - Transmission data	
	16.6		Encoder initial communication - Transmission data	
2016	16.7	Encoder initial communication error 1	Encoder initial communication - Transmission data error 3	
	16.A		Encoder initial communication - Process error 1	
	16.B		Encoder initial communication - Process error 2	
	16 C		Encoder initial communication - Process error 3	
	16.D		Encoder initial communication - Process error 4	
	16.E		Encoder initial communication - Process error 5	
	16.F		Encoder initial communication - Process error 6	
	17.1		Board error 1	
	17.3		Board error 2	
	17.4		Board error 3	
2017	17.5	Board error	Board error 4	
	17.6		Board error 5	
	17.8		Board error 6	
	17.9	1	Board error 8	

19.1 19.2 (Flash-ROM) Flash-ROM error 1 Flash-ROM error 2 Flash-ROM error 3 Image: Comparison of the second secon	Error code	Servo amplifier LED display	Name	Details name	Remarks
2019 19.2 Memory error 3 (Flash-ROM) Flash-ROM error 2 Image: Flash-ROM error 3 2011 20.1 Flash-ROM error 3 Flash-ROM error 3 Flash-ROM error 3 2020 20.3 Flash-ROM error 3 Flash-ROM error 3 Flash-ROM error 3 2020 20.3 Encoder normal communication - Receive data error 3 Encoder normal communication - Receive data error 3 2020 20.6 Encoder normal communication - Transmission data error 3 Encoder normal communication - Transmission data error 3 2020 20.7 Encoder normal communication - Receive data error 4 Encoder normal communication - Transmission data error 3 2021 21.1 Encoder normal communication - Receive data error 4 Encoder normal communication - Receive data error 4 2121 21.2 Encoder normal communication - Receive data error 5 Encoder normal communication - Receive data error 4 2121 21.4 Encoder normal communication - Receive data error 5 Encoder normal communication - Receive data error 4 2121 21.4 Encoder normal communication - Receive data error 4 Encoder normal communication - Receive data error 4 2121 21.6 Encoder normal communication - Transm		19.1		Flash-ROM error 1	
19.3 (Fish-KOW) Flash-ROM error 3 20.1 20.1 Encoder normal communication - Receive data error 2 20.3 20.5 Encoder normal communication - Receive data error 3 20.6 Encoder normal communication - Receive data error 3 20.6 Encoder normal communication - Transmission data error 1 20.7 Encoder normal communication - Transmission data error 1 20.7 Encoder normal communication - Transmission data error 1 20.7 Encoder normal communication - Receive data error 4 20.7 Encoder normal communication - Receive data error 5 20.7 Encoder normal communication - Receive data error 5 20.7 Encoder normal communication - Receive data error 4 20.1 Encoder normal communication - Receive data error 5 21.1 Encoder normal communication - Receive data error 5 21.1 Encoder normal communication - Receive data error 5 21.1 Encoder normal communication - Receive data error 4 21.1 Encoder normal communication - Receive data error 5 21.1 Encoder normal communication error 1 21.1 Encoder normal communication - Receive data error 1 21.1<	2019	19.2	Memory error 3	Flash-ROM error 2	
20.1 20.2 Encoder normal communication - Receive data error 1 20.2 Encoder normal communication - Receive data error 3 20.5 Encoder normal communication - Receive data error 3 20.6 Encoder normal communication - Transmission data error 1 20.7 Encoder normal communication - Transmission data error 3 20.8 Encoder normal communication - Transmission data error 3 20.9 Encoder normal communication - Transmission data error 3 20.9 Encoder normal communication - Transmission data error 3 21.1 Encoder normal communication - Receive data error 4 21.2 Encoder normal communication - Receive data error 4 21.1 Encoder normal communication - Receive data error 4 21.1 Encoder normal communication - Receive data error 5 21.1 Encoder normal communication - Receive data error 4 21.1 Encoder normal communication - Receive data error 4 21.1 Encoder normal communication - Receive data error 4 21.1 Encoder normal communication - Receive data error 4 21.1 Encoder normal communication - Receive data error 4 21.1 Encoder normal communication - Receive data error 4		19.3	(Flash-ROM)	Flash-ROM error 3	
20.3 20.3 Encoder normal communication - Receive data error 2 20.5 Encoder normal communication - Transmission data error 1 20.6 Encoder normal communication - Transmission data error 1 20.7 Encoder normal communication - Transmission data error 1 20.7 Encoder normal communication - Transmission data error 1 20.7 Encoder normal communication - Transmission data error 1 20.7 Encoder normal communication - Transmission data error 1 20.7 Encoder normal communication - Transmission data error 1 20.7 Encoder normal communication - Transmission data error 1 20.7 Encoder normal communication - Transmission data error 1 20.7 Encoder normal communication - Transmission data error 1 20.7 Encoder normal communication - Transmission data error 1 20.7 Encoder normal communication - Transmission data error 1 21.1 Encoder normal error 21.1 Encoder normal		20.1		Encoder normal communication - Receive data error 1	
2020 20.3 20.5 Encoder normal communication - Transmission data error 3 2020 20.6 Encoder normal communication - Transmission data error 1 Encoder normal communication - Transmission data error 3 20.7 20.7 Encoder normal communication - Transmission data error 3 20.9 Encoder normal communication - Transmission data error 3 20.9 Encoder normal communication - Transmission data error 3 20.1 Encoder normal communication - Transmission data error 4 20.1 Encoder normal communication - Receive data error 4 21.1 Encoder normal communication - Receive data error 5 21.1 Encoder normal communication - Receive data error 5 21.1 Encoder normal communication - Receive data error 5 21.1 Encoder normal communication - Receive data error 5 21.1 Encoder normal communication - Receive data error 5 21.1 Encoder normal communication - Receive data error 5 21.1 Encoder normal communication - Receive data error 5 21.1 Encoder normal error 21.1 Encoder normal error 21.1 Encoder normal error 21.1 Encoder normal error </td <td></td> <td>20.2</td> <td></td> <td>Encoder normal communication - Receive data error 2</td> <td></td>		20.2		Encoder normal communication - Receive data error 2	
2020 20.5 Encoder normal communication - Transmission data arror 1 20.6 20.7 Encoder normal communication - Transmission data arror 2 20.9 Encoder normal communication - Transmission data arror 3 20.9 Encoder normal communication - Transmission data arror 4 20.9 Encoder normal communication - Receive data error 4 20.1 Encoder normal communication - Receive data error 5 21.1 Encoder normal communication - Receive data error 4 21.2 Encoder normal communication - Receive data error 5 21.1 Encoder normal communication - Receive data error 5 21.1 Encoder data waveform error 21.1 Encoder romal communication - Receive data error 4 21.1 Encoder arror 1 21.1 Encoder error 1 21.1 Encoder arror 2 21.1 Encoder error 2 21.1 Absolute position ersexed 22.1 Ab		20.3		Encoder normal communication - Receive data error 3	
2020 Image: control interval Encoder normal communication - Transmission data error 2 20.7 Encoder normal communication - Transmission data error 3 20.9 Encoder normal communication - Transmission data error 3 20.9 Encoder normal communication - Transmission data error 3 20.1 Encoder normal communication - Receive data error 4 20.1 Encoder normal communication - Receive data error 4 21.1 Encoder normal communication - Receive data error 4 21.2 Encoder normal communication - Receive data error 4 21.3 Encoder normal communication - Receive data error 4 21.1 Encoder normal communication - Receive data error 4 21.1 Encoder normal communication - Receive data error 4 21.1 Encoder normal communication - Receive data error 4 21.1 Encoder normal communication - Receive data error 4 21.1 Encoder normal communication - Receive data error 4 21.1 Encoder normal communication - Receive data error 4 21.1 Encoder normal communication - Receive data error 4 21.1 Encoder normal communication error 4 21.1 Encoder normal communication error 4 21.1		20.5		Encoder normal communication - Transmission data	
2020 20.6 communication error Encoder normal communication - Transmission data error 3 20.7 20.9 Encoder normal communication - Transmission data error 3 20.8 20.9 Encoder normal communication - Receive data error 4 20.1 21.1 Encoder normal communication - Receive data error 5 21.1 Encoder normal communication - Receive data error 4 21.3 Encoder normal communication - Receive data error 4 21.4 Encoder normal communication - Receive data error 4 21.1 Encoder normal communication - Receive data error 4 21.1 Encoder rormal communication - Receive data error 4 21.1 Encoder rormal communication - Receive data error 4 21.1 Encoder rormal communication error 21.1 Encoder rormal communication - Receive data error 4 21.1 Encoder rormal communication error 21.1 Encoder rormal communication error 21.1 Encoder rormal communication error 2021 24.1 Main circuit error 2025 25.2 Ground fault detected at software detection function 2026 27.3 Initial magnetic pole detectio			Encoder normal	error 1	
20.7 Encoder normal communication - Transmission data error 3 20.9 Encoder normal communication - Receive data error 4 20.1 Encoder normal communication - Receive data error 5 21.1 Encoder normal communication - Receive data error 5 21.3 Encoder error 1 21.4 Encoder error 1 21.5 Encoder error 1 21.6 Encoder error 2 21.6 Encoder error 2 21.9 Encoder error 2 2024 24.1 21.9 Encoder error 2 2025 25.1 205 Absolute position errased 207.1 Serve motor encoder - Absolute position errased 2025 25.2 27.3 Initial magnetic pole detection - Envinomal termination 2026 27.5 2027 27.5 2028 28.1 2029 28.1 2020 27.6 27.6 Magnetic pole detection - Current error 2021 27.6 2022 28.1 2030 30.1 </td <td>2020</td> <td>20.6</td> <td>communication error 1</td> <td>Encoder normal communication - Transmission data error 2</td> <td></td>	2020	20.6	communication error 1	Encoder normal communication - Transmission data error 2	
20.9 Encoder normal communication - Receive data error 4 20.4 Encoder normal communication - Receive data error 5 21.1 Encoder rormal communication - Receive data error 5 21.2 Encoder data update error 21.3 Encoder data update error 21.4 Encoder rormal communication - Receive data error 5 21.4 Encoder data update error 21.5 Encoder rormal error 1 21.6 Encoder error 2 21.9 Encoder error 2 21.4 Main circuit error 2024 24.1 2025 Z5.1 25.1 Absolute position erased 25.1 Absolute position erased 25.2 Encoder error 2 27.1 Servo motor encoder - Absolute position erased 27.2 Absolute position erased 27.1 Magnetic pole detection - Limit switch error 27.1 Magnetic pole detection - Speed deviation error 27.7 Magnetic pole detection - Speed deviation error 27.7 Magnetic pole detection - Current error 27.6 Regenerative error 2 27.7 Magnetic pole detection - Speed deviation e		20.7		Encoder normal communication - Transmission data error 3	
20A Encoder normal communication - Receive data error 5 21.1 21.2 21.3 Encoder error 1 21.4 Encoder data update error 21.5 Encoder data waveform error 21.6 Encoder normalication error 2 21.7 Encoder data waveform error 21.8 Encoder normalication error 2 21.9 Encoder error 2 2024 24.1 2025 25.1 22026 25.2 27.1 Absolute position erased 2027 27.1 27.1 Absolute position erased 27.1 Eracoder error 2 27.1 Magnetic pole detection - Limit switch error 27.1 Eracoder error 2 27.1 Magnetic pole detection - Limit switch error 27.1 Eracoder error 2 27.1 Magnetic pole detection - Limit switch error 27.1 Regenerative error 27.1 Magnetic pole detection - Limit switch		20.9		Encoder normal communication - Receive data error 4	
21.1 21.2 Encoder normal Encoder for afta update error Image: Construction error 2021 21.3 Encoder for afta update error Image: Construction error Image: Constructi error Image: Constructi error		20.A		Encoder normal communication - Receive data error 5	
$ \begin{array}{ c $		21.1		Encoder error 1	
$ \begin{array}{ c c c c } \hline \hline 13.3 \\ \hline 21.4 \\ \hline 21.5 \\ \hline 21.6 \\ \hline 21.5 \\ \hline 21.6 \\ \hline 21.9 \\ \hline 21.9 \\ \hline 2024 \\ \hline 24.1 \\ \hline 2024 \\ \hline 24.1 \\ \hline 20.1 \\ \hline 21.9 \\ \hline 21.9 \\ \hline 21.9 \\ \hline 2024 \\ \hline 24.1 \\ \hline 21.9 \\ \hline 22.2 \\ \hline 2$		21.2		Encoder data update error	
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$		21.3		Encoder data waveform error	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	2021	21.4	Encoder normal	Encoder non-signal error	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		21.5	communication error 2	Encoder hardware error 1	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		21.6		Encoder hardware error 2	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		21.0		Encoder error 2	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		24.1		Ground fault detected at hardware detection circuit	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	2024	24.1	Main circuit error	Ground fault detected at nardware detection function	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		24.2		Serve motor encoder - Absolute position erased	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	2025	23.1	Absolute position	Seelo motor encoder - Absolute position enased	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	2025	25.2	erased	erased	
$ \frac{211}{27.2} $ $ \frac{27.2}{27.3} $ $ \frac{27.3}{27.4} $ $ \frac{27.3}{27.5} $ $ \frac{27.4}{27.5} $ $ \frac{27.6}{27.6} $ $ \frac{27.6}{27.7} $ $ \frac{27.6}{27.7} $ $ \frac{27.6}{27.7} $ $ \frac{27.6}{27.7} $ $ \frac{27.7}{27.7} $ $ \frac{30.1}{27.7} $ $ \frac{30.1}{30.2} $ $ \frac{30.1}{30.2} $ $ \frac{30.1}{30.3} $ $ \frac{30.2}{30.2} $ $ \frac{30.2}{30.3} $ $ \frac{30.2}{30.2} $ $ \frac{30.1}{31.1} $ $ \frac{32.1}{32.2} $ $ \frac{32.1}{32.3} $ $ \frac{32.2}{32.3} $ $ \frac{32.4}{32.4} $ $ \frac{33.1}{31.4} $ $ \frac{2023}{32.4} $ $ \frac{2033}{31.4} $ $ \frac{2033}{31.4} $ $ \frac{2033}{31.4} $ $ \frac{2024}{202} $ $ \frac{2025}{32.4} $ $ \frac{2025}{32.$		27.1		Magnetic pole detection - Abnormal termination	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		27.1		Magnetic pole detection - Time out error	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		27.2	-	Magnetic pole detection - Time out choi	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	2027	27.5	Initial magnetic pole	Magnetic pole detection - Entimated error	
$ \frac{27.3}{27.6} \\ \frac{27.6}{27.7} \\ \frac{27.7}{Magnetic pole detection - Position deviation error}{Magnetic pole detection - Speed deviation error}{Magnetic pole detection - Speed deviation error}{ Magnetic pole detection - Speed deviation error}{ Magnetic pole detection - Current error}{ 2028 28.1 Linear encoder error 2 Linear encoder - Environment error}{ 30.1 \\ 2030 30.2 \\ 30.2 \\ 30.3 \\ 30.4 \\ $	2021	27.4	detection error	Magnetic pole detection - Estimated enor	
$\frac{27.0}{27.7}$ $\frac{27.7}{1}$ $\frac{27.7}{1}$ $\frac{27.7}{1}$ $\frac{27.7}{1}$ $\frac{2028}{28.1}$ $\frac{28.1}{1}$ $\frac{1}{1}$ $\frac{30.1}{30.2}$ $\frac{28.1}{30.2}$ $\frac{30.1}{30.2}$ $\frac{2030}{30.2}$ $\frac{30.2}{30.3}$ $\frac{2031}{31.1}$ $\frac{31.1}{31.1}$ $\frac{32.1}{32.2}$ $\frac{32.2}{32.3}$ $\frac{32.2}{32.3}$ $\frac{32.4}{32.4}$ $\frac{32.1}{32.4}$ \frac		27.5		Magnetic pole detection - Position deviation error	
$\frac{27.7}{2028} = \frac{27.7}{2028} = \frac{28.1}{28.1} = \frac{1}{1000} = \frac{1}{10000} = \frac{1}{10000000000000000000000000000000000$		27.0	-	Magnetic pole detection - Speed deviation error	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	2020	27.7			
$\frac{30.1}{30.2}$ Regenerative error $\frac{30.2}{30.2}$ Regenerative error $\frac{30.2}{30.3}$ Regeneration neat error Regeneration neat error Regeneration neat error Regeneration signal error Regeneration feedback signal error Regeneration	2028	20.1	Linear encoder error 2		
2030 30.2 Regenerative error Regeneration signal error 30.3 30.3 Regeneration feedback signal error 2031 31.1 Overspeed Abnormal motor speed 32.1 32.1 Overcurrent detected at hardware detection circuit (during operation) 32.2 32.2 Overcurrent Overcurrent detected at software detection circuit (during operation) 2032 32.3 Overcurrent Overcurrent detected at hardware detection circuit (during a stop) 32.4 Overcurrent detected at software detection function (during a stop) Overcurrent detected at software detection function (during a stop)	2022	30.1	Degenerative arrest	Regeneration neat error	
30.3 Regeneration feedback signal error 2031 31.1 Overspeed Abnormal motor speed 32.1 32.1 Overcurrent detected at hardware detection circuit (during operation) 2032 32.2 Overcurrent Overcurrent detected at software detection circuit (during operation) 2032 32.3 Overcurrent Overcurrent detected at hardware detection circuit (during a stop) 2033 33.1 Overcurrent Main circuit voltage error	2030	30.2	Regenerative error	Regeneration signal error	
2031 31.1 Overspeed Abnormal motor speed 32.1 32.1 Overcurrent detected at hardware detection circuit (during operation) 2032 32.2 Overcurrent Overcurrent detected at software detection function (during operation) 2032 32.3 Overcurrent Overcurrent detected at hardware detection circuit (during a stop) 2033 33.1 Overcultage Main circuit voltage error		30.3		Regeneration feedback signal error	
32.1 32.1 32.2 32.2 32.3 Overcurrent 32.3 Overcurrent 32.4 Overcurrent Overcurrent Overcurrent Ove	2031	31.1	Overspeed	Abnormal motor speed	
32.2 32.2 Overcurrent Overcurrent detected at software detection function (during operation) 32.3 32.4 Overcurrent detected at hardware detection circuit (during a stop) 2033 33.1 Overcurrent detected at software detection function (during a stop)		32.1		Overcurrent detected at hardware detection circuit	
32.2 32.2 Overcurrent			1	Quaraurrant datacted at asthuara dataction function	
2032 32.3 Overcurrent Overcurrent detected at hardware detection circuit (during a stop) 32.4 32.4 Overcurrent detected at software detection function (during a stop) 2033 33.1 Overcurrent detected at software detection function (during a stop)		32.2		(during operation)	
32.3 32.4 Overcurrent detected at nardware detection circuit (during a stop) 32.4 Overcurrent detected at software detection function (during a stop) 2033 33.1 Overcurrent detected at software detection function	2032		Overcurrent	Quaraurrent detected at hardware detection size	
32.4 (during a stop) Overcurrent detected at software detection function (during a stop) Nain circuit voltage error		32.3			
32.4 Overvoltage Main circuit voltage error			1	Quantity a Stop)	
2033 33.1 Overvoltage Main circuit voltage error		32.4			
	2022	22.1		Main circuit voltage orror	

Table 1.3 Servo error (2000 to 2999) list (MR-J4(W)-□B) (Continued)

Error code	Servo amplifier LED display	Name	Details name	Remarks
	34.1		SSCNET receive data error	
	34.2		SSCNET connector connection error	
	34.3		SSCNET communication data error	
	34.4	SSCNET receive error	Hardware error signal detection	
2034		1	SSCNET receive data error (safety observation	
	34.5		function)	
			SSCNET communication data error (safety	
	34.6		observation function)	
0005	05.4	Command frequency		
2035	35.1	error	Command frequency error	
	36.1		Continuous communication data error	
2036	20.0	SSCINE I receive error	Continuous communication data error (safety	
	30.2	2	observation function)	
	37.1		Parameter setting range error	
2037 (Note-1)	37.2	Parameter error	Parameter combination error	
	37.3		Point table setting error	
	42.1		Servo control error by position deviation	
	42.2	Servo control error	Servo control error by speed deviation	
	42.3		Servo control error by torque/thrust deviation	
2042	42.8		Fully closed loop control error by position deviation	
	42.9	Fully closed loop	Fully closed loop control error by speed deviation	
	40.4	control error	Fully closed loop control error by position deviation	
	42.A		(during command stop)	
2045	45.1	Main circuit device	Main circuit device overheat error 1	
2045	45.2	overheat	Main circuit device overheat error 2	
	46.1		Abnormal temperature of servo motor 1	
	46.2		Abnormal temperature of servo motor 2	
2046	46.3	Sonya matar ayarbaat	Thermistor disconnected error	
2040	46.4	Servo motor overneat	Thermistor circuit error	
	46.5		Abnormal temperature of servo motor 3	
	46.6		Abnormal temperature of servo motor 4	
2047	47.1	Cooling for orror	Cooling fan stop error	
2047	47.2		Cooling fan speed reduction error	
	50.1		Thermal overload error 1 during operation	
	50.2		Thermal overload error 2 during operation	
2050	50.3	Overland 1	Thermal overload error 4 during operation	
2050	50.4	Ovendad I	Thermal overload error 1 during a stop	
	50.5		Thermal overload error 2 during a stop	
	50.6		Thermal overload error 4 during a stop	
2051	51.1	Overland 2	Thermal overload error 3 during operation	
2001	51.2		Thermal overload error 3 during a stop	
	52.1		Excess droop pulse 1	
2052	52.3	Error overenive	Excess droop pulse 2	
2002	52.4		Error excessive during 0 torque limit	
	52.5		Excess droop pulse 3	
2054	54.1	Oscillation detection	Oscillation detection error	
2050	56.2	Foread store store	Over speed during forced stop	
2000	56.3	Forceu stop error	Estimated distance over during forced stop	

Table 1.3 Servo error (2000 to 2999) list (MR-J4(W)-DB) (Continued)

(Note-1): Refer to the parameter No. stored in the parameter error No. (#8009+20n) for details of the erroneous parameter.

Error code	Servo amplifier LED display	Name	Details name	Remarks
	1A.1	_	Servo motor combination error	
2060	1A.2	Servo motor	Servo motor control mode combination error	
	1A.4	combination error	Servo motor combination error 2	
	2A.1		Linear encoder error 1-1	
	2A.2		Linear encoder error 1-2	
	2A.3		Linear encoder error 1-3	
	2A.4		Linear encoder error 1-4	
2061	2A.5	Linear encoder error 1	Linear encoder error 1-5	
	2A.6		Linear encoder error 1-6	
	2A.7		Linear encoder error 1-7	
	2A.8		Linear encoder error 1-8	
	63.1		STO1 off	
	63.2	STO timing error	STO2 off	
2063	63.5	e e e annagene.	STO by functional safety unit	
2000	1F 1	Encoder initial	Encoder malfunction	
	1E.1	communication error 2	Load-side encoder malfunction	
	64.1			
	64.2	Functional safety unit	Compatibility mode setting error	
2064	64.3	setting error	Operation mode setting error	
2004	1F 1	Encodor initial		
	15.2			
	65.1		Functional safety unit communication error 1	
	65.2		Functional safety unit communication error 2	
·	65.3	-	Functional safety unit communication error 2	
·	65.4	-	Functional safety unit communication error 4	
2065	05.4	Functional safety unit	Functional safety unit communication error 4	
2005	65.6	connection error	Functional safety unit communication error 6	
	65.7	-	Functional safety unit communication error 7	
	65.9		Functional safety unit communication error 1	
	05.0	-	Functional safety unit shut-off signal error 2	
	05.9		Functional salety unit situt-oil signal error 2	
	66.1		Encoder Initial communication - Receive data error 1	
		-	Encoder initial communication - Receive data error 2	
	66.2	Encoder initial	(safety observation function)	
		communication error	Encoder initial communication - Receive data error 3	
2066	66.3	(safety observation	(safety observation function)	
		function)	Encoder initial communication - Transmission data	
	66.7	,	error 1 (safety observation function)	
			Encoder initial communication - Process error 1	
	66.9		(safety observation function)	
			Encoder normal communication - Receive data error	
	67.1		1 (safety observation function)	
	07.0		Encoder normal communication - Receive data error	
	67.2	Encoder normal	2 (safety observation function)	
0007		communication error 1	Encoder normal communication - Receive data error	
2067	67.3	(safety observation	3 (safety observation function)	
	07.4	function)	Encoder normal communication - Receive data error	
	07.4	ļ	4 (safety observation function)	
	67 7		Encoder normal communication - Transmission data	
	01.1		error 1 (safety observation function)	

Table 1.3 Servo error (2000 to 2999) list (MR-J4(W)-□B) (Continued)

2068 68.1 STO diagnosis error Mismatched STO signal error 70.1 70.1 Load-side encoder initial communication - Receive data error 1 Load-side encoder initial communication - Receive data error 2 70.5 70.5 Load-side encoder initial communication - Receive data error 3 70.6 70.7 Load-side encoder initial communication - Transmission data error 1 70.7 Load-side encoder initial communication - Transmission data error 2 70.7 Load-side encoder initial communication - Transmission data error 3 70.8 Too.6 70.0 Load-side encoder initial communication - Transmission data error 3 70.8 Too.6 70.0 Load-side encoder initial communication - Process error 1 70.0 Load-side encoder initial communication - Process error 3 70.7 Load-side encoder initial communication - Process error 4 70.7 Load-side encoder initial communication - Process error 4 70.8 Too.6 70.1 Load-side encoder initial communication - Process error 4 70.8 Coad-side encoder initial communication - Process error 4 71.1 Coad-side encoder communication - Receive data error 3 <t< th=""><th>Error code</th><th>Servo amplifier LED display</th><th>Name</th><th>Details name</th><th>Remarks</th></t<>	Error code	Servo amplifier LED display	Name	Details name	Remarks
70.1 Load-side encoder initial communication - Receive data error 1 70.3 70.5 70.6 Load-side encoder initial communication - Receive data error 2 70.6 Load-side encoder initial communication - Receive data error 3 70.7 Load-side encoder initial communication - Transmission data error 1 70.8 Load-side encoder initial communication - Transmission data error 2 70.7 Load-side encoder initial communication - Transmission data error 3 70.8 Transmission data error 3 70.7 Load-side encoder initial communication - Transmission data error 3 70.8 Transmission data error 3 70.8 Load-side encoder initial communication - Transmission data error 3 70.8 Load-side encoder initial communication - Process error 1 70.8 Load-side encoder initial communication - Process error 2 70.0 To.E Load-side encoder initial communication - Process error 5 70.7 Load-side encoder communication - Process error 4 Load-side encoder communication - Process error 5 70.7 Transmission data error 3 Load-side encoder communication - Process error 5 70.7 Transmission data error 3 Load-side encoder communication - Proc	2068	68.1	STO diagnosis error	Mismatched STO signal error	
2070 70.1 Load-side encoder initial communication - Receive data error 2 70.3 70.5 Load-side encoder initial communication - Receive data error 2 70.6 70.7 Load-side encoder initial communication - Transmission data error 3 70.7 Load-side encoder initial communication - Transmission data error 3 70.7 Load-side encoder initial communication - Transmission data error 3 70.7 Load-side encoder initial communication - Transmission data error 3 70.7 Load-side encoder initial communication - Transmission data error 3 70.8 ron.8 70.0 error 1 70.8 Load-side encoder initial communication - Process error 2 70.0 Error 4 70.0 Load-side encoder initial communication - Process error 3 70.0 To.1 70.1 Load-side encoder initial communication - Process error 3 70.2 To.1 70.5 Load-side encoder initial communication - Process error 4 Load-side encoder communication - Process error 5 Error 4 Load-side encoder communication - Process error 6 Load-side encoder communication - Process error 6 71.1 To.1		70.4		Load-side encoder initial communication - Receive	
70.2 Image: constraint of the second se		70.1		data error 1	
2070 70.2 70.3 70.5 70.5 70.6 70.6 10.6 70.7 Load-side encoder initial communication - Transmission data error 2 10.8 10.4 70.7 Load-side encoder initial communication - Transmission data error 2 10.8 10.4 10.9 10.0 10.0 <t< td=""><td>70.0</td><td></td><td>Load-side encoder initial communication - Receive</td><td></td></t<>		70.0		Load-side encoder initial communication - Receive	
70.3 70.3 70.5 70.6 70.6 70.6 70.7 Load-side encoder initial communication - Transmission data error 1 Load-side encoder initial communication - Transmission data error 2 Load-side encoder initial communication - Transmission data error 3 70.8 70.7 70.0 error 1 70.0 error 1 70.0 error 1 70.0 error 1 70.0 Load-side encoder initial communication - Process error 2 70.0 Error 1 70.1 Load-side encoder initial communication - Process error 2 70.0 Error 1 70.1 Load-side encoder initial communication - Process error 2 70.1 Error 1 70.1 Load-side encoder initial communication - Process error 3 10.1 Error 4 Load-side encoder initial communication - Process error 5 10.1 Error 1 10.2 T1.1 71.2 Error 1 71.3 Load-side encoder communication - Receive data error 3 10.2 Error 1 10.2 Error 1 10.2		70.2		data error 2	
2070 70.3 70.5 70.6 70.6 Transmission data error 1 70.7 Load-side encoder initial communication - Transmission data error 3 70.7 Load-side encoder initial communication - Transmission data error 3 70.8 To.7 70.8 To.7 70.7 Load-side encoder initial communication - Transmission data error 3 70.8 To.7 70.0 To.7 70.0 To.7 70.0 To.7 70.0 To.7 70.0 To.7 70.0 To.7 70.1 To.8 70.2 To.7 70.5 Load-side encoder initial communication - Process error 1 Load-side encoder initial communication - Process error 4 Load-side encoder initial communication - Process error 4 Load-side encoder initial communication - Process error 5 Load-side encoder communication - Process error 6 71.1 To.2 Load-side encoder communication - Receive data error 1 71.2 To.1.5 Load-side encoder communication - Receive data error 1 71.7 To.9 Load-side encoder communication - Transmission data error 3 Load-side encoder communication - Transmission data error 3 Load-side encoder communication - Transmission data error 3 2071 <td< td=""><td>70.2</td><td rowspan="7">-</td><td>Load-side encoder initial communication - Receive</td><td></td></td<>		70.2	-	Load-side encoder initial communication - Receive	
2070 70.5 Image: constraint of the second s		70.3		data error 3	
2070 70.5 70.6 70.7 70.7 Load-side encoder initial communication - Transmission data error 2 170.7 Initial communication error 1 170.8 70.7 170.8 10.8 170.8 10.8 170.7 Load-side encoder initial communication - Transmission data error 3 170.8 10.8 170.7 Load-side encoder initial communication - Process error 3 170.7 10.8 170.8 10.8 170.7 Load-side encoder initial communication - Process error 3 170.8 10.8 170.7 10.8 170.8 10.8 170.7 10.8 170.8 10.8 171.1 10.8 171.2 11.1 171.3 11.1 171.4 11.2 171.5 Load-side encoder communication - Receive data error 1 171.6 11.3 171.7 11.4 171.7 11.4 171.8 11.4 171.9 11.4 171.4 11.4		70.5		Load-side encoder initial communication -	
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70.C Load-side encoder initial communication - Process error 3 70.D Load-side encoder initial communication - Process error 4 70.E Load-side encoder initial communication - Process error 5 70.F Load-side encoder initial communication - Process error 6 70.F Load-side encoder initial communication - Process error 6 71.1 71.1 71.2 Load-side encoder communication - Receive data error 1 71.3 Load-side encoder communication - Receive data error 2 71.3 Load-side encoder communication - Receive data error 1 71.6 normal communication error 1 71.7 Load-side encoder communication - Transmission data error 2 71.7 Load-side encoder communication - Transmission data error 3 71.9 71.A		70.8		error 2	
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70.E Load-side encoder initial communication - Process error 5 70.F Load-side encoder initial communication - Process error 6 71.1 T1.1 71.2 T1.3 71.3 Load-side encoder communication - Receive data error 2 71.3 Load-side encoder communication - Receive data error 3 2071 T1.6 71.7 Communication error 1 1 Load-side encoder communication - Transmission data error 2 1 Load-side encoder communication - Transmission data error 3 1 Load-side encoder communication - Transmission data error 3 1 Load-side encoder communication - Transmission data error 4 1 Load-side encoder communication - Transmission data error 4				error 4	
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70.F Load-side encoder initial communication - Process error 6 71.1 71.1 71.2 71.2 71.3 Load-side encoder communication - Receive data error 1 71.3 Load-side encoder normal communication error 1 71.6 Load-side encoder normal communication error 1 71.7 Totad-side encoder normal communication error 1 71.7 Totad-side encoder communication - Transmission data error 2 Load-side encoder communication - Transmission data error 2 Load-side encoder communication - Transmission data error 2 Load-side encoder communication - Transmission data error 3 71.7 71.9 71.A		70.F		error 5	
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71.9 Load-side encoder communication - Transmission data error 4 71.A Load-side encoder communication - Transmission data error 5				data error 3	
71.9 data error 4 71.A Load-side encoder communication - Transmission data error 5 data error 5		71.9		Load-side encoder communication - Transmission	
71.A Load-side encoder communication - Transmission data error 5				data error 4	
71.A data error 5				Load-side encoder communication - Transmission	
		71.A		data error 5	
72.1 Load-side encoder data error 1	2072	72.1	Load-side encoder normal communication error 2	Load-side encoder data error 1	
72.2 Load-side encoder data update error		72.2		Load-side encoder data update error	
72.3 Load-side encoder Load-side encoder data waveform error		72.3		Load-side encoder data waveform error	
2072 72.4 normal Load-side encoder non-signal error		72.4		Load-side encoder non-signal error	
72.5 communication error 2 Load-side encoder hardware error 1		72.5		Load-side encoder hardware error 1	
72 6		72.6		Load-side encoder hardware error 2	
72.9		72.9		L oad-side encoder data error 2	

Table 1.3 Servo error (2000 to 2999) list (MR-J4(W)-□B) (Continued)

Error code	Servo amplifier LED display	Name	Details name	Remarks
2079	79.1		Functional safety unit power voltage error	
	79.2		Functional safety unit internal error	
	79.3		Abnormal temperature of functional safety unit	
	79.4	Functional safety unit	Servo amplifier error	
	79.5	diagnosis error	Input device error	
	79.6		Output device error	
	79.7		Mismatched input signal error	
	79.8		Position feedback fixing error	
2082	82.1	Master-slave operation error 1	Master-slave operation error 1	
2088	888	Watchdog	Watchdog	
2091	91.1	Servo amplifier overheat warning	Main circuit device overheat warning	
	95.1		STO1 off detection	
	95.2		STO2 off detection	
2095	95.3	STO warning	STO warning 1 (safety observation function)	
	95.4		STO warning 2 (safety observation function)	
	95.5		STO warning 3 (safety observation function)	
0400	92.1	Battery cable	Encoder battery cable disconnection warning	
2102	92.3	disconnection warning	Battery degradation	
	96.1		In-position warning at home positioning	
	96.2		Command input warning at home positioning	
2106	96.3	Home position setting	Servo off warning at home positioning	
	00.4	warning	Home positioning warning during magnetic pole	
	90.4		detection	
2116	9F.1	Battery warning	Low battery	
2110	9F.2	Dattery warning	Battery degradation warning	
2140	E0.1	Excessive regeneration warning	Excessive regeneration warning	
2141	E1.1	Overload warning 1	Thermal overload warning 1 during operation	
	E1.2		Thermal overload warning 2 during operation	
	E1.3		Thermal overload warning 3 during operation	
	E1.4		Thermal overload warning 4 during operation	
	E1.5		Thermal overload error 1 during a stop	
	E1.6		Thermal overload error 2 during a stop	
	E1.7		Thermal overload error 3 during a stop	
	E1.8		Thermal overload error 4 during a stop	
2142	E2.1	Servo motor overheat warning	Servo motor temperature warning	
2143	E3.1	Absolute position counter warning	Multi-revolution counter travel distance excess warning	
	E3.2		Absolute position counter warning	
	E3.4		Absolute positioning counter EEP-ROM writing	
	F3 5		Encoder absolute positioning counter warning	
2144 (Note-1)	E4 1	Parameter warning	Parameter setting range error warning	

Table 1.3 Servo error (2000 to 2999) list (MR-J4(W)-DB) (Continued)

(Note-1): Refer to the parameter No. stored in the parameter error No. (#8009+20n) for details of the erroneous parameter.
Error code	Servo amplifier LED display	Name	Details name	Remarks
	E6.1		Forced stop warning	
2146	50.0		SS1 forced stop warning 1 (safety observation	
	E6.2	Servo forced stop	function)	
	50.0	warning	SS1 forced stop warning 2 (safety observation	
	E6.3		function)	
2147	E7.1	Controller forced stop warning	Controller forced stop warning	
0140	E8.1	Cooling fan speed	Decreased cooling fan speed warning	
2148	E8.2	reduction warning	Cooling fan stop	
	E9.1		Servo-on signal on during main circuit off	
	E9.2	Main circuit off	Bus voltage drop during low speed operation	
2149	E9.3	warning	Ready-on signal on during main circuit off	
	E9.4		Converter unit forced stop	
2151	EB.1	The other axis error warning	The other axis error warning	
2152	EC.1	Overload warning 2	Overload warning 2	
2153	ED.1	Output watt excess warning	Output watt excess warning	
0.400	F0.1	Tough drive warning	Instantaneous power failure tough drive warning	
2160	F0.3		Vibration tough drive warning	
	F2.1	Drive recorder -	Drive recorder - Area writing time-out warning	
2162	F2.2	Miswriting warning	Drive recorder - Data miswriting warning	
2163	F3.1	Oscillation detection warning	Oscillation detection warning	
2907	1B.1	Converter error	Converter unit error	
	2B.1		Encoder counter error 1	
2913	2B.2	Encoder counter error	Encoder counter error 2	
2918	3A.1	Inrush current suppression circuit error	Inrush current suppression circuit error	
	3D.1	Parameter setting	Parameter combination error for driver communication on slave	
2921	3D.2	error for driver communication	Parameter combination error for driver	
	3E 1		Operation mode error	
2922	3E 6	Operation mode error	Operation mode switch error	
	02.0		Parameter verification error (safety observation	
	7A.1		function)	
	7A.2	Parameter setting	Parameter setting range error (safety observation function)	
2942		error (safety	Parameter combination error (safety observation	
	7A.3	observation function)	function)	
	7A.4		Functional safety unit combination error (safety observation function)	

Table 1.3 Servo error (2000 to 2999) list (MR-J4(W)-DB) (Continued)

Error code	Servo amplifier LED display	Name	Details name	Remarks
2943	7B.1		Encoder diagnosis error 1 (safety observation function)	
	7B.2	Encoder diagnosis	Encoder diagnosis error 2 (safety observation function)	
	7B.3	observation function)	Encoder diagnosis error 3 (safety observation function)	
	7B.4		Encoder diagnosis error 4 (safety observation function)	
2044	7C.1	Functional safety unit communication	Functional safety unit communication cycle error (safety observation function)	
2044	7C.2	diagnosis error (safety observation function)	Functional safety unit communication data error (safety observation function)	
20.45	7D.1	Safety observation	Stop observation error	
2940	7D.2	error	Speed observation error	
	QA 1	USB communication	USB communication time-out error/serial	
	07.1	time-out error/serial	communication time-out error	
2948	8A.2	communication time- out error/Modbus- RTU communication time-out error	Modbus-RTU communication time-out error	
	8E.1		USB communication receive error/serial communication receive error	
	8E.2		USB communication checksum error/serial communication checksum error	
	8E.3	USB communication error/serial	USB communication character error/serial communication character error	
2952	8E.4	communication error/Modbus-RTU	USB communication command error/serial communication command error	
	8E.5	communication error	USB communication data number error/serial communication data number error	
	8E.6		Modbus-RTU communication receive error	
	8E.7		Modbus-RTU communication message frame error	
	8E.8		Modbus-RTU communication CRC error	
	9B.1		Excess droop pulse 1 warning	
2955	9B.3	Error excessive	Excess droop pulse 2 warning	
	9B.4	warning	Error excessive warning during 0 torque limit	
2956	9C.1	Converter error	Converter unit error	

Table 1.3 Servo error (2000 to 2999) list (MR-J4(W)-DB) (Continued)

(b) MR-J3-□B

Table 1.4 Servo error (2000 to 2999) list (MR-J3-DB)

Error code	Servo amplifier LED display	Name	Remarks
2010	10	Undervoltage	
2012	12	Memory error 1 (RAM)	
2013	13	Clock error	
2015	15	Memory error 2 (EEP-ROM)	
2016	16	Encoder error 1 (At power on)	
2017	17	Board error	
2019	19	Memory error 3 (Flash ROM)	
2020	20	Encoder error 2 (During runtime)	
2021	21	Encoder error 3 (During runtime)	
2024	24	Main circuit error	
2025	25	Absolute position erase	
2030	30	Regenerative error	
2031	31	Overspeed	
2032	32	Overcurrent	
2033	33	Overvoltage	
2034	34	Receive error 1	
2035	35	Command frequency error	
2036	36	Receive error 2	
2045	45	Main circuit device overheat	
2046	46	Servo motor overheat	
2047	47	Cooling fan error	
2050	50	Overload 1	
2051	51	Overload 2	
2052	52	Error excessive	
2060	1A	Motor combination error	
2082	82	Master/slave operation error 1	
2088	888	Watchdog	
2102	92	Battery cable disconnection warning	
2106	96	Home position setting warning	
2116	9F	Battery warning	
2140	E0	Excessive regeneration warning	
2141	E1	Overload warning 1	
2143	E3	Absolute position counter warning	
2146	E6	Servo forced stop warning	
2147	E7	Controller forced stop warning	
2148	E8	Cooling fan speed reduction warning	
2149	E9	Main circuit off warning	
2152	EC	Overload warning 2	
2153	ED	Output watt excess warning	
2301 to 2599	E4	Parameter warning (Refer to the table 1.5)	
2601 to 2899	37	Parameter error (Refer to the table 1.5)	
2907	1B	Converter alarm	
2921	3D	Driver communication parameter setting error	
2948	8A	USB communication time-out error	
2952	8E	USB communication error	
2956	9C	Converter warning	

(Note): The LED display is different when using the servo amplifiers with a large capacity.

Refer to the "Servo amplifier Instruction Manual" for details.

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Error	code	Parameter No.	Name	Error	⁻ code	Parameter No.	Name
2301	2601	PA01	Control mode	2339	2639	PB20	Vibration suppression control resonance frequency setting
2302	2602	PA02	Regenerative option	2340	2640	PB21	
2303	2603	PA03	Absolute position detection system	2341	2641	PB22	For manufacturer setting
2304	2604	PA04	Function selection A-1	2342	2642	PB23	Low-pass filter selection
2305	2605	PA05	-	2343	2643	PB24	Slight vibration suppression control selection
2306	2606	PA06	For manufacturer setting	2344	2644	PB25	For manufacturer setting
2307	2607	PA07		2345	2645	PB26	Gain changing selection
2308	2608	PA08	Auto tuning mode	2346	2646	PB27	Gain changing condition
2309	2609	PA09	Auto tuning response	2347	2647	PB28	Gain changing time constant
2310	2610	PA10	In-position range	2348	2648	PB29	Gain changing ratio of load inertia moment to servo motor inertia moment
2311	2611	PA11		2349	2649	PB30	Gain changing position loop gain
2312	2612	PA12	For monufacturar acting	2350	2650	PB31	Gain changing speed loop gain
2313	2613	PA13	For manufacturer setting	2351	2651	PB32	Gain changing speed integral compensation
2314	2614	PA14	Rotation direction selection	2352	2652	PB33	Gain changing vibration suppression
0045	0045	5445		0050	0050	5504	Gain changing vibration suppression
2315	2615	PA15	Encoder output pulse	2353	2653	PB34	control resonance frequency setting
2316	2616	PA16		2354	2654	PB35	
2317	2617	PA17	For manufacturer setting	2355	2655	PB36	
2318	2618	PA18		2356	2656	PB37	
2319	2619	PA19	Parameter write inhibit	2357	2657	PB38	
2320	2620	PB01	Adaptive tuning mode (adaptive filter I)	2358	2658	PB39	
2321	2621	PB02	Vibration suppression control tuning mode (advanced vibration suppression control)	2359	2659	PB40	For manufacturer setting
2322	2622	PB03	For manufacturer setting	2360	2660	PB41	
2323	2623	PB04	Feed forward gain	2361	2661	PB42	
2324	2624	PB05	For manufacturer setting	2362	2662	PB43	
2325	2625	PB06	Ratio of load inertia moment to servo motor inertia moment	2363	2663	PB44	
2326	2626	PB07	Model loop gain	2364	2664	PB45	Vibration suppression control filter 2
2327	2627	PB08	Position loop gain	2365	2665	PC01	Error excessive alarm level
2328	2628	PB09	Speed loop gain	2366	2666	PC02	Electromagnetic brake sequence output
2329	2629	PB10	Speed integral compensation	2367	2667	PC03	Encoder output pulse selection
2330	2630	PB11	Speed differential compensation	2368	2668	PC04	Function selection C-1
2331	2631	PB12	Overshoot amount compensation	2369	2669	PC05	Function selection C-2
2332	2632	PB13	Machine resonance suppression filter 1	2370	2670	PC06	Function selection C-3
2333	2633	PB14	Notch shape selection 1	2371	2671	PC07	Zero speed
2334	2634	PB15	Machine resonance suppression filter 2	2372	2672	PC08	For manufacturer setting
<u>2335</u>	2635	PB16	Notch shape selection 2	2373	2673	PC09	Analog monitor 1 output
2336	2636	PB17	Automatic setting parameter	2374	2674	PC10	Analog monitor 2 output
2337	2637	PB18	Low-pass filter setting	2375	2675	PC11	Analog monitor 1 offset
2338	2638	PB19	Vibration suppression control vibration	2376	2676	PC12	Analog monitor 2 offset

Table 1.5 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail

(Note): The details are different when using the servo amplifiers with a large capacity. Refer to the "Servo amplifier Instruction Manual" for details.

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Error	code	Parameter No.	Name	Error	code	Parameter No.	Name
2377	2677	PC13	Analog monitor feedback position output standard data Low	2416	2716	PD20	Driver communication setting Master axis No. selection1 for slave
2378	2678	PC14	Analog monitor feedback position output standard data High	2417	2717	PD21	
2379	2679	PC15	For manufacturer setting	2418	2718	PD22	
2380	2680	PC16	Function selection C-3A	2419	2719	PD23	
2381	2681	PC17	Function selection C-4	2420	2720	PD24	
2382	2682	PC18	For manufacturar actting	2421	2721	PD25	For manufacturer setting
2383	2683	PC19		2422	2722	PD26	
2384	2684	PC20	Function selection C-7	2423	2723	PD27	
2385	2685	PC21	Alarm history clear	2424	2724	PD28	
2386	2686	PC22		2425	2725	PD29	
2387	2687	PC23		2426	2726	PD30	Master-slave operation - Torque comman coefficient on slave
2388	2688	PC24		2427	2727	PD31	Master-slave operation - Speed limit coefficient on slave
2389	2689	PC25		2428	2728	PD32	Master-slave operation - Speed limit adjustment value on slave
2390	2690	PC26		2429	2729	PE01	
2391	2691	PC27		2430	2730	PE02	
2392	2692	PC28		2431	2731	PE03	
2393	2693	PC29	For manufacturer setting	2432	2732	PE04	
2394	2694	PC30		2433	2733	PE05	
2395	2695	PC31		2434	2734	PE06	
2396	2696	PC32		2435	2735	PE07	
2397	2697	PD01		2436	2736	PE08	
2398	2698	PD02		2437	2737	PE09	
2399	2699	PD03		2438	2738	PE10	
2400	2700	PD04		2439	2739	PE11	
2401	2701	PD05		2440	2740	PE12	
2402	2702	PD06		2441	2741	PE13	
2403	2703	PD07	Output signal device selection 1 (CN3-13)	2442	2742	PE14	For manufacturer setting
2404	2704	PD08	Output signal device selection 2 (CN3-9)	2443	2743	PE15	
2405	2705	PD09	Output signal device selection 3 (CN3-15)	2444	2744	PE16	
2406	2706	PD10	For manufacturer setting	2445	2745	PE17	
2407	2707	PD11	Input filter setting	2446	2746	PE18	
2408	2708	PD12	For manufacturar patting	2447	2747	PE19	
2409	2709	PD13	For manufacturer setting	2448	2748	PE20	
2410	2710	PD14	Function selection D-3	2449	2749	PE21	
2411	2711	PD15	Driver communication setting	2450	2750	PE22	
2412	2712	PD16	Driver communication setting Master transmit data selection1	2451	2751	PE23	
2413	2713	PD17	Driver communication setting Master transmit data selection2	2452	2752	PE24	
2414	2714	PD18		2453	2753	PE25	
2415	2715	PD19	For manufacturer setting	2454	2754	PE26	Filter coefficient 2-1

Table 1.5 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail (Continued)

(Note): The details are different when using the servo amplifiers with a large capacity.

Refer to the "Servo amplifier Instruction Manual" for details.

Tabla 1 E	Doromotor worning	10001 to 0500	VDeremeter error	(0C01 to 0000)	orror datail ((Continued)
Table Lo	Parameter warning	12301 10 2399	"Parameter enor i			Conunuear
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Error	r code Parameter Name Error code		Parameter No.	Name			
2455	2755	PE27	Filter coefficient 2-2	2462	2762	PE34	
2456	2756	PE28	Filter coefficient 2-3	2463	2763	PE35	
2457	2757	PE29	Filter coefficient 2-4	2464	2764	PE36	
2458	2758	PE30	Filter coefficient 2-5	2465	2765	PE37	For manufacturer setting
2459	2759	PE31	Filter coefficient 2-6	2466	2766	PE38	
2460	2760	PE32	Filter coefficient 2-7	2467	2767	PE39	
2461	2761	PE33	Filter coefficient 2-8	2468	2768	PE40	

(Note): The details are different when using the servo amplifiers with a large capacity. Refer to the "Servo amplifier Instruction Manual" for details.

(c)	MR-J3W-⊟B
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Table 1.6 Servo error (2000 to 2999) list (MR-J3W-□B)

Error code	Servo amplifier LED display	Name	Details name	Remarks
2010	10.1	Undervoltage	Voltage drop in the control circuit power supply	
-	10.2		Voltage drop in the main circuit power	
	11.1		Rotary switch setting error	
	11.2		DIP switch setting error	
2011	11.3	Switch setting error	Servo motor selection switch setting error	
	11.4		Servo motor selection switch setting error 2	
	12.1		CPU built-in RAM error	
2012	12.2	Memory error 1 (RAM)	CPU data RAM error	
	12.3		Custom IC RAM error	
2013	13.1	Clock error	Clock error	
0015	15.1		EEP-ROM error at power on	
2015	15.2	Memory error 2 (EEP-ROM)	EEP-ROM error during operation	
	16.1		Encoder receive data error 1	
	16.2		Encoder receive data error 2	
2240	16.3	Encoder initial communication	Encoder receive data error 3	
2016	16.5	error 1	Encoder transmission data error 1	
	16.6		Encoder transmission data error 2	
	16.7	1	Encoder transmission data error 3	
	17.1		AD converter error	
	17.2]	Current feedback data error	
0017	17.3	Board error	Custom IC error	
2017	17.4		Amplifier detection signal error	
	17.5		Rotary switch error	
	17.6		DIP switch error	
2010	19.1	Maria and Clock DOM	Flash-ROM error 1	
2019	19.2	Memory error 3 (Flash ROW)	Flash-ROM error 2	
	20.1		Encoder receive data error 1	
	20.2		Encoder receive data error 2	
2020	20.3	Encoder normal	Encoder receive data error 3	
2020	20.5	communication error 1	Encoder transmission data error 1	
	20.6		Encoder transmission data error 2	
	20.7		Encoder transmission data error 3	
	21.1		Encoder data error	
2021	21.2	Encoder normal	Encoder data update error	
	21.3	communication error z	Encoder waveform error	Direct drive motor use
	24.1		Ground fault detected at hardware detection circuit	
2024	24.2	Main circuit error	Ground fault detected at software	
2025	25.1	Absolute position erase	Absolute position data erase	

(Note-1): The name is different when using the linear servo motors. Refer to the "Servo amplifier Instruction Manual" for details.

(Note-2): The name is different when using the direct drive motors.

Refer to the "Servo amplifier Instruction Manual" for details.

Error code	Servo amplifier LED display	Name	Details name	Remarks
	27.1		Magnetic pole detection abnormal termination	
	27.2		Magnetic pole detection time out error	
	27.3		Magnetic pole detection limit switch error	
	27.4	Initial magnetic pole detection	Magnetic pole detection estimated error	Linear servo motor/
2027		error	Magnetic pole detection position deviation	direct drive motor use
	27.5		error	
	27.6		Magnetic pole detection speed deviation	
	27.7		Magnetic pole detection current error	
	21.1			Lipoar convo motor
2028	28.1	Linear encoder error 2	Linear encoder environment error	use
	30.1		Regeneration heat error	
2030	30.2	Regenerative error	Regenerative transistor error	
2000	30.3		Regenerative transistor feedback data	
	00.0		error	
2031	31.1	Overspeed	Abnormal motor speed ^{(Note-1), (Note-2)}	
	32.1		Overcurrent detected at hardware	
	02.1	Overcurrent	detection circuit (during operation).	
	32.2		Overcurrent detected at software	
2032	02.2		detection function (during operation).	
2002	30.3	Overcurrent	Overcurrent detected at hardware	
	02.0		detection circuit (during a stop).	
	32.4		Overcurrent detected at software	
	52.4		detection function (during a stop).	
2033	33.1	Overvoltage	Main circuit voltage error	
	34.1		SSCNET receive data error	
	34.2		SSCNET communication connector	
2034	04.2	SSCNET receive error 1	connection error	
	34.3		Communication data error	
	34.4		Hardware error signal detection	
2035	35.1	Command frequency error	Command frequency error	
2036	36.1	SSCNET receive error 2	Continuous communication data error	
		Lippor sonyo control orror	Linear servo control error on the	Linear servo motor
	12.1		positioning detection	use
	72.1	Servo control error	Servo control error due to position deviation	Direct drive motor use
		Linear servo control error	Linear servo control error on the speed	Linear servo motor
2042	42.2			use
		Servo control error	deviation	Direct drive motor use
		Linear servo control error	Linear servo control error on the thrust detection	Linear servo motor use
	42.3	Servo control error	Servo control error due to torque detection	Direct drive motor use
	45 1		Main circuit abnormal temperature	
2045	45.2	Main circuit device overheat	Board temperature error	

Table 1.6 Servo error (2000 to 2999) list (MR-J3W-□B) (Continued)

(Note-1): The name is different when using the linear servo motors. Refer to the "Servo amplifier Instruction Manual" for details.

Refer to the "Servo amplifier Instruction Manual" for details.

⁽Note-2): The name is different when using the direct drive motors.

Error code	Servo amplifier LED display	Name	Details name	Remarks
	46.1		Abnormal temperature of servo motor	
00.40	46.2	Serve meter everbact (Note-2)	Linear servo motor thermal sensor error	Linear servo motor use
2046		Servo motor overneat (Direct drive motor thermal sensor error	Direct drive motor use
	46.3		Thermistor wires are not connected error	Linear servo motor/ direct drive motor use
2047	47.1	Cooling for orror	Cooling fan stop error	
2047	47.2		Decreased cooling fan speed error	
	50.1		Thermal overload error 1 during operation	
	50.2		Thermal overload error 2 during operation	
2050	50.3	Overland 1	Thermal overload error 4 during operation	
2050	50.4	Overload 1	Thermal overload error 1 during a stop	
	50.5		Thermal overload error 2 during a stop	
	50.6		Thermal overload error 4 during a stop	
0054	51.1		Thermal overload error 3 during operation	
2051	51.2	Overload 2	Thermal overload error 3 during a stop	
	52.3		Excess droop pulse (Note-1), (Note-2)	
2052	52.4	Error excessive	Maximum deviation at 0 torque limit (Note-1), (Note-2)	
2060	1A.1	Motor combination error	Motor combination error	
	2A.1		Linear encoder side error 1	
	2A.2		Linear encoder side error 2	
	2A.3		Linear encoder side error 3	
	2A.4		Linear encoder side error 4	Linear servo motor
2061	2A.5	Linear encoder error 1	Linear encoder side error 5	use
	2A.6		Linear encoder side error 6	
	2A.7		Linear encoder side error 7	
	2A.8		Linear encoder side error 8	
2063	1E.1	Encoder initial communication error 2	Encoder failure	
2064	1F.1	Encoder initial communication error 3	Incompatible encoder	
2088	888	Watchdog	_	
	91.1	Main circuit device overheat	Main circuit device overheat warning	
2101	91.2	warning	Board temperature warning	
2102	92.1	Battery cable disconnection	Encoder battery disconnection warning signal detection	
	96.1		In-position error at home positioning	
2106	96.2	Home position setting warning	Command input error at home positioning	
2116	9F.1	Battery warning	Low battery	
2140	E0.1	Excessive regeneration	Excessive regeneration warning	

Table 1.6 Servo error (2000 to 2999) list (MR-J3W-□B) (Continued)

(Note-1): The name is different when using the linear servo motors.

Refer to the "Servo amplifier Instruction Manual" for details.

(Note-2): The name is different when using the direct drive motors. Refer to the "Servo amplifier Instruction Manual" for details.

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Error code	Servo amplifier LED display	Name	Details name	Remarks
	E1.1		Thermal overload warning 1 during	
			operation	
	E1.2		Thermal overload warning 2 during operation	
	E1.3		Thermal overload warning 3 during	
2141		Overload warning 1	Thermal everland warning 4 during	
	E1.4		operation	
	E1.5		Thermal overload warning 1 during a stop	
	E1.6		Thermal overload warning 2 during a stop	
	E1.7		Thermal overload warning 3 during a stop	
	E1.8		Thermal overload warning 4 during a stop	
		Linear servo motor overheat	Linear servo motor overheat warning	Linear servo motor
2142	E2.1	warning		use
		Direct drive motor overheat warning	Direct drive motor overheat warning	Direct drive motor use
2143	50.4		The multi-revolution counter travel	
	E3.1	Absolute position counter	distance excess warning	
	E3.2 warning		Absolute positioning counter error	
2146	E6.1	Servo forced stop warning	Servo forced stop warning	
2147	E7.1	Controller forced stop warning	Controller forced stop warning	
2148	E8.1	Cooling fan speed reduction warning	Decreased cooling fan speed warning	
	E9.1		Ready-on signal on at main circuit off	
2149	E9.2	Main circuit off warning	Bus voltage drop during low speed	
			operation (Note-1)	
	E9.3		Servo-on signal on at main circuit off	
2151	EB.1	The other axis fault warning	The other axis fault warning	
2152	EC.1	Overload warning 2	Overload warning 2	
2153	ED.1	Output watt excess warning	Output watt excess	
2301 to 2599	E4.1	Parameter warning (Refer to the table 1.7)	Parameter setting range error warning	
	37.1	Parameter error	Parameter setting range error	
2601 to 2899	37.2	(Refer to the table 1.7)	Parameter combination error	
	2B.1		Encoder counter error 1	
2913	2B.2	Encoder counter error	Encoder counter error 2	Direct drive motor use
2948	8A.1	USB communication time-out error	USB communication time-out error	
	8E.1		USB communication receive error	
	8E.2	1	USB communication checksum error	
2952	8E.3	USB communication error	USB communication character error	
	8E.4		USB communication command error	
	8E.5		USB communication data No. error	

Table 1.6 Servo error (2000 to 2999) list (MR-J3W-□B) (Continued)

(Note-1): The name is different when using the linear servo motors. Refer to the "Servo amplifier Instruction Manual" for details.

(Note-2): The name is different when using the direct drive motors. Refer to the "Servo amplifier Instruction Manual" for details.

Error	code	Parameter	Name
2301	2601	PA01	Control mode
2302	2602	PA02	Regenerative option
2303	2603	PA03	Absolute position detection system
2304	2604	PA04	Function selection A-1
2305	2605	PA05	
2306	2606	PA06	For manufacturer setting
2307	2607	PA07	
2308	2608	PA08	Auto tuning mode
2309	2609	PA09	Auto tuning response
2310	2610	PA10	In-position range
2311	2611	PA11	
2312	2612	PA12	For manufacturer setting
2313	2613	PA13	
2314	2614	PA14	Rotation direction selection
2315	2615	PA15	Encoder output pulse
2316	2616	PA16	Encoder output pulse 2
2317	2617	PA17	
2318	2618	PA18	For manufacturer setting
2319	2619	PA19	Parameter write inhibit
2320	2620	PB01	Adaptive tuning mode (adaptive filter I)
2321	2621	PB02	Vibration suppression control tuning mode (advanced vibration suppression control)
2322	2622	PB03	For manufacturer setting
2323	2623	PB04	Feed forward gain
2324	2624	PB05	For manufacturer setting
2325	2625	PB06	Ratio of load inertia moment to servo motor inertia moment
2326	2626	PB07	Model loop gain
2327	2627	PB08	Position loop gain
2328	2628	PB09	Speed loop gain
2329	2629	PB10	Speed integral compensation
<u>2</u> 330	2630	PB11	Speed differential compensation
2331	2631	PB12	For manufacturer setting
2332	2632	PB13	Machine resonance suppression filter 1
2333	2633	PB14	Notch shape selection 1
2334	2634	PB15	Machine resonance suppression filter 2
2335	2635	PB16	Notch shape selection 2
2336	2636	PB17	Automatic setting parameter
2337	2637	PB18	Low-pass filter setting
2338	2638	PB19	Vibration suppression control vibration frequency setting
2339	2639	PB20	Vibration suppression control resonance frequency setting

Table 1.7 Parameter warning (230	1 to 2599)/Parameter erro	r (2601 to 2899) error detail
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Error	code	Parameter No.	Name				
2340	2640	PB21					
2341	2641	PB22	For manufacturer setting				
2342	2642	PB23	Low-pass filter selection				
2343	2643	PB24	Slight vibration suppression control				
2244	0644	DD25	Selection				
2344	2044	PD20					
2345	2045	PD20					
2340	2040	PD27					
2347	2047	PD20	Gain changing time constant				
2348	2648	PB29	to servo motor inertia moment				
2349	2649	PB30	Gain changing position loop gain				
2350	2650	PB31	Gain changing speed loop gain				
2351	2651	PB32	Gain changing speed integral compensation				
00 - 0	0075	0000	Gain changing vibration suppression				
2352	2652	PB33	control vibration frequency setting				
0050	0050	0004	Gain changing vibration suppression				
2353	2653	PB34	control resonance frequency setting				
2354	2654	PB35					
2355	2655	PB36					
2356	2656	PB37					
2357	2657	PB38					
2358	2658	PB39					
2359	2659	PB40					
2360	2660	PB41	For manufacturer setting				
2361	2661	PB42					
2362	2662	PB43					
2363	2663	PB44					
2364	2664	PB45					
2365	2665	PC01	Frror excessive alarm level				
2366	2666	PC02	Electromagnetic brake sequence output				
2367	2667	PC03	Encoder output pulse selection				
2368	2668	PC04	Function selection C-1				
2369	2669	PC05	Function selection C-2				
2370	2670	PC06	Function selection C-3				
2371	2671	PC07	Zero speed				
2372	2672	PC08	For manufacturer setting				
2373	2673	PC09	Analog monitor 1 output				
2374	2674	PC10	Analog monitor 2 output				
2375	2675	PC11	Analog monitor 1 offset				
2376	2676	PC12	Analog monitor 2 offset				
2377	2677	PC13					
2378	2678	PC14	For manufacturer setting				

Error codo		Parameter	Nama	Error code		Parameter	Namo
EII0	coue	No.			No.	Iname	
2379	2679	PC15	Station number selection	2412	2712	PD16	
2380	2680	PC16	For manufacturer setting	2413	2713	PD17	
2381	2681	PC17	Function selection C-4	2414	2714	PD18	
2382	2682	PC18		2415	2715	PD19	
2383	2683	PC19	For manufacturer setting	2416	2716	PD20	
2384	2684	PC20		2417	2717	PD21	
2385	2685	PC21	Alarm history clear	2418	2718	PD22	
2386	2686	PC22		2419	2719	PD23	
2387	2687	PC23		2420	2720	PD24	For manufacturer setting
2388	2688	PC24		2421	2721	PD25	
2389	2689	PC25		2422	2722	PD26	
2390	2690	PC26		2423	2723	PD27	
2391	2691	PC27		2424	2724	PD28	
2392	2692	PC28		2425	2725	PD29	
2393	2693	PC29		2426	2726	PD30	
2394	2694	PC30		2427	2727	PD31	
2395	2695	PC31	For manufacturer setting	2428	2728	PD32	
2396	2696	PC32		2485	2785	Po01	Function selection O-1
2397	2697	PD01		2486	2786	Po02	Axis selection for graphing analog data (MR Configurator)
2398	2698	PD02		2487	2787	Po03	Axis selection for graphing digtal data (MR Configurator)
2399	2699	PD03		2488	2788	Po04	Function selection O-2
2400	2700	PD04		2489	2789	Po05	
2401	2701	PD05		2490	2790	Po06	
2402	2702	PD06		2491	2791	Po07	
2403	2703	PD07	Output signal device selection 1 (CN3-12 for A-axis and CN3-25 for B-axis)	2492	2792	Po08	
2404	2704	PD08	For manufacturer setting	2493	2793	Po09	
2405	2705	PD09	Output signal device selection 3 (CN3-11 for A-axis and CN3-24 for B-axis)	2494	2794	Po10	For manufacturer setting
2406	2706	PD10	For manufacturer setting	2495	2795	Po11	
2407	2707	PD11	Input filter setting	2496	2796	Po12	
2408	2708	PD12		2497	2797	Po13	
2409	2709	PD13	For manufacturer setting	2498	2798	Po14	
2410	2710	PD14	Function selection D-3	2499	2799	Po15	
2411	2711	PD15	For manufacturer setting	2500	2800	Po16	

Table 1.7	Parameter warning	(2301 to 2599)/Par	ameter error (2601	to 2899) error	detail (Continued)
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(d) MR-J3B-RJ004 (For linear servo)

Table 1.8 Servo error (2000 to 2999) list (MR-J3-□B-RJ004)

Error code	Servo amplifier LED display	Name	Remarks
2010	10	Undervoltage	
2012	12	Memory error 1 (RAM)	
2013	13	Clock error	
2015	15	Memory error 2 (EEP-ROM)	
2016	16	Encoder error 1 (At power on)	
2017	17	Board error	
2019	19	Memory error 3 (Flash ROM)	
2020	20	Encoder error 2	
2021	21	Encoder error 3	
2024	24	Main circuit error	
2027	27	Initial magnetic pole detection error	
2028	28	Linear encoder error 2	
2030	30	Regenerative error	
2031	31	Overspeed	
2032	32	Overcurrent	
2033	33	Overvoltage	
2034	34	Receive error 1	
2035	35	Command frequency alarm	
2036	36	Receive error 2	
2042	42	Linear servo control error	
2045	45	Main circuit device overheat	
2046	46	Linear servo motor overheat	
2047	47	Cooling fan alarm	
2050	50	Overload 1	
2051	51	Overload 2	
2052	52	Error excessive	
2061	2A	Linear encoder error 1	
2088	888	Watchdog	
2106	96	Home position setting error	
2140	E0	Excessive regeneration warning	
2141	E1	Overload warning 1	
2142	E2	Linear servo motor overheat warning	
2146	E6	Servo forced stop warning	
2147	E7	Controller emergency stop warning	
2148	E8	Cooling fan speed reduction warning	
2149	E9	Main circuit off warning	
2152	EC	Overload warning 2	
2153	ED	Output watt excess warning	
2301 to 2599	E4	Parameter warning (Refer to the table 1.9)	
2601 to 2899	37	Parameter error (Refer to the table 1.9)	
2948	8A	USB communication time-out error	
2952	8E	USB communication error	

Error code		Parameter	Name	
2301	2601	PA01	For manufacturer setting	
2302	2602	PA02	Regenerative option	
2303	2603	PA03	Absolute position detection system	
2304	2604	PA04	Function selection A-1	
2305	2605	PA05		
2306	2606	PA06	For manufacturer setting	
2307	2607	PA07		
2308	2608	PA08	Auto tuning mode	
2309	2609	PA09	Auto tuning response	
2310	2610	PA10	In-position range	
2311	2611	PA11		
2312	2612	PA12	For manufacturer setting	
2313	2613	PA13		
2314	2614	PA14	Moving direction selection	
2315	2615	PA15	Encoder output pulse	
2316	2616	PA16	Encoder output pulse 2	
2317	2617	PA17		
2318	2618	PA18	For manufacturer setting	
2319	2619	PA19	Parameter write inhibit	
2320	2620	PB01	Adaptive tuning mode (adaptive filter I)	
ac			Vibration suppression control tuning mode	
2321	2621	PB02	(advanced vibration suppression control)	
2322	2622	PB03	For manufacturer setting	
2323	2623	PB04	Feed forward gain	
2324	2624	PB05	For manufacturer setting	
2325	2625	PB06	Load mass ratio to the linear servo motor primary side (coil)	
2326	2626	PB07	Model loop gain	
2327	2627	PB08	Position loop gain	
2328	2628	PB09	Speed loop gain	
2329	2629	PB10	Speed integral compensation	
2330	2630	PB11	Speed differential compensation	
2331	2631	PB12	For manufacturer setting	
2332	2632	PB13	Machine resonance suppression filter 1	
2333	2633	PB14	Notch form selection 1	
2334	2634	PB15	Machine resonance suppression filter 2	
2335	2635	PB16	Notch form selection 2	
2336	2636	PB17	Automatic setting parameter	
2337	2637	PB18	Low-pass filter setting	
2338	2638	PB19	Vibration suppression control vibration	
2339	2639	PB20	Vibration suppression control resonance	
2340	2640	PB21	For manufacturer setting	

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Error	code	Parameter No.	Name					
2341	2641	PB22	For manufacturer setting					
2342	2642	PB23	Low-pass filter selection					
2343	2643	PB24	Slight vibration suppression control					
2344	2644	PB25	For manufacturer setting					
2345	2645	PB26	Gain changing selection					
2346	2646	PB27	Gain changing condition					
2347	2647	PB28	Gain changing time constant					
2348	2648	PB29	Gain load mass ratio to the linear servo					
2349	2649	PB30	Gain changing position loop gain					
2350	2650	PB31	Gain changing peed loop gain					
2000	2000	1 801	Gain changing speed integral					
2351	2651	PB32	compensation					
			Gain changing vibration suppression					
2352	2652	PB33	control vibration frequency setting					
			Gain changing vibration suppression					
2353	2653	PB34	control resonance frequency setting					
2354	2654	PB35						
2355	2655	PB36						
2356	2656	PB37						
2357	2657	PB38						
2358	2658	PB39						
2359	2659	PB40	For manufacturer setting					
2360	2660	PB41						
2361	2661	PB42						
2362	2662	PB43						
2363	2663	PB44						
2364	2664	PB45	Vibration suppression control filter 2					
2365	2665	PC01	Error excessive alarm level					
2366	2666	PC02	Electromagnetic brake sequence output					
2367	2667	PC03	Encoder output pulse selection					
2368	2668	PC04	· · ·					
2369	2669	PC05	For manufacturer setting					
2370	2670	PC06	3					
2371	2671	PC07	Zero speed					
2372	2672	PC08	For manufacturer setting					
2373	2673	PC09	Analog monitor 1 output					
2374	2674	PC10	Analog monitor 2 output					
2375	2675	PC11	Analog monitor 1 offset					
2376	2676	PC12	Analog monitor 2 offset					
2377	2677	PC13						
2378	2678	PC14						
2379	2679	PC15	For manufacturer setting					
2380	2680	PC16						

Error	code	Parameter No.	Name	Erro	code	Parameter No.	Name
2381	2681	PC17	Function selection C-4	2427	2727	PD31	
2382	2682	PC18		2428	2728	PD32	
2383	2683	PC19	For manufacturer setting	2429	2729	PE01	
2384	2684	PC20		2430	2730	PE02	
2385	2685	PC21	Alarm history clear	2431	2731	PE03	
2386	2686	PC22		2432	2732	PE04	
2387	2687	PC23	For monufacturer acting	2433	2733	PE05	
2388	2688	PC24	For manufacturer setting	2434	2734	PE06	
2389	2689	PC25		2435	2735	PE07	
2390	2690	PC26	Function selection C-8	2436	2736	PE08	
2391	2691	PC27	Function selection C-9	2437	2737	PE09	
2392	2692	PC28		2438	2738	PE10	
2393	2693	PC29		2439	2739	PE11	
2394	2694	PC30	For manufacturor sotting	2440	2740	PE12	For manufacturer setting
2395	2695	PC31	i or manufacturer setting	2441	2741	PE13	
2396	2696	PC32		2442	2742	PE14	
2397	2697	PD01		2443	2743	PE15	
2398	2698	PD02	Input signal automatic ON selection	2444	2744	PE16	
2399	2699	PD03		2445	2745	PE17	
2400	2700	PD04	For manufacturer setting	2446	2746	PE18	
2401	2701	PD05	i or manufacturer setting	2447	2747	PE19	
2402	2702	PD06		2448	2748	PE20	
2403	2703	PD07	Output signal device selection 1 (CN3-13)	2449	2749	PE21	
2404	2704	PD08	Output signal device selection 2 (CN3-9)	2450	2750	PE22	
2405	2705	PD09	Output signal device selection 3 (CN3-15)	2451	2751	PE23	
2406	2706	PD10	For manufacturer setting	2452	2752	PE24	
2407	2707	PD11	Input filter setting	2453	2753	PE25	
2408	2708	PD12	For manufacturer setting	2454	2754	PE26	Filter coefficient 2-1
2409	2709	PD13	r or manalaolaror oolling	2455	2755	PE27	Filter coefficient 2-2
2410	2710	PD14	Function selection D-3	2456	2756	PE28	Filter coefficient 2-3
2411	2711	PD15		2457	2757	PE29	Filter coefficient 2-4
2412	2712	PD16		2458	2758	PE30	Filter coefficient 2-5
2413	2713	PD17		2459	2759	PE31	Filter coefficient 2-6
2414	2714	PD18		2460	2760	PE32	Filter coefficient 2-7
2415	2715	PD19		2461	2761	PE33	Filter coefficient 2-8
2416	2716	PD20		2462	2762	PE34	
2417	2717	PD21		2463	2763	PE35	
2418	2718	PD22		2464	2764	PE36	
2419	2719	PD23	For manufacturer setting	2465	2765	PE37	For manufacturer setting
2420	2720	PD24		2466	2766	PE38	
2421	2721 PD25			2467	2767	PE39	
2422	2722	PD26		2468	2768	PE40	
2423	2723	PD27		2501	2801	PS01	Linear function selection 1
2424	2724	PD28		2502	2802	PS02	Linear encoder resolution setting Numerator
2425	2725	PD29		2503	2803	PS03	Linear encoder resolution setting Denominator
2426	2726	PD30		2504	2804	PS04	Linear function selection 2

Table 1.9 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail (Continued)

Error	code	Parameter No.	Name	E	Error code		Parameter No.	Name
2505	2805	PS05	Linear servo motor control position deviation error detection level	2	2519	2819	PS19	
2506	2806	PS06	Linear servo motor control speed deviation error detection level	2	2520	2820	PS20	
2507	2807	PS07	Linear servo motor control thrust deviation error detection level	2	2521	2821	PS21	
2508	2808	PS08	Linear function selection 3	2	2522	2822	PS22	
2509	2809	PS09	Magnetic pole detection voltage level	2	2523	2823	PS23	
2510	2810	PS10	At magnetic pole detection current detection method Identification signal frequency	2	2524	2824	PS24	For manufacturer setting
2511	2811	PS11	At magnetic pole detection current detection method Identification signal amplitude	2	2525	2825	PS25	
2512	2812	PS12		2	2526	2826	PS26	
2513	2813	PS13		2	2527	2827	PS27	
2514	2814	PS14		2	2528	2828	PS28	
2515	2815	PS15	For manufacturer setting	2	2529	2829	PS29	
2516	2816	PS16		2	2530	2830	PS30	
2517	2817	PS17		2	2531	2831	PS31	
2518	2818	PS18		2	2532	2832	PS32	

Table 1.9 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail (Continued)

(e) MR-J3-DB-RJ006 (For fully closed control)

Table 1.10 Servo error (2000 to 2999) list (MR-J3-□B-RJ006)

Error code	Servo amplifier LED display	Name	Remarks
2010	10	Undervoltage	
2012	12	Memory error 1 (RAM)	
2013	13	Clock error	
2015	15	Memory error 2 (EEP-ROM)	
2016	16	Encoder error 1 (At power on)	
2017	17	Board error	
2019	19	Memory error 3 (Flash ROM)	
2020	20	Encoder error 2 (During runtime)	
2021	21	Encoder error 3 (During runtime)	
2024	24	Main circuit error	
2028	28	Linear encoder error 2	
2030	30	Regenerative error	
2031	31	Overspeed	
2032	32	Overcurrent	
2033	33	Overvoltage	
2034	34	Receive error 1	
2035	35	Command frequency alarm	
2036	36	Receive error 2	
2042	42	Fully closed control error detection	
2045	45	Main circuit device overheat	
2046	46	Servo motor overheat	
2047	47	Cooling fan alarm	
2050	50	Overload 1	
2051	51	Overload 2	
2052	52	Error excessive	
2060	1A	Motor combination error	
2061	2A	Linear encoder error 1	
2070	70	Load side encoder error 1	
2071	71	Load side encoder error 2	
2088	888	Watchdog	
2106	96	Home position setting error	
2140	E0	Excessive regeneration warning	
2141	E1	Overload warning 1	
2146	E6	Servo forced stop warning	
2147	E7	Controller emergency stop warning	
2148	E8	Cooling fan speed reduction warning	
2149	E9	Main circuit off warning	
2152	EC	Overload warning 2	
2153	ED	Output watt excess warning	
2301 to 2599	E4	Parameter warning (Refer to the table 1.11)	
2601 to 2899	37	Parameter error (Refer to the table 1.11)	
2948	8A	USB communication time-out error	
2952	8E	USB communication error	

Error	code	Parameter	Name	
LIIU	coue	No.	Indifie	
2301	2601	PA01	Control mode	
2302	2602	PA02	Regenerative option	
2303	2603	PA03	Absolute position detection system	
2304	2604	PA04	Function selection A-1	
2305	2605	PA05		
2306	2606	PA06	For manufacturer setting	
2307	2607	PA07		
2308	2608	PA08	Auto tuning mode	
2309	2609	PA09	Auto tuning response	
2310	2610	PA10	In-position range	
2311	2611	PA11		
2312	2612	PA12	For manufacturer setting	
2313	2613	PA13		
2314	2614	PA14	Rotation direction selection	
2315	2615	PA15	Encoder output pulse	
2316	2616	PA16	Encoder output pulse 2	
2317	2617	PA17	For manufacturer setting	
2318	2618	PA18		
2319	2619	PA19	Parameter write inhibit	
2320	2620	PB01	Adaptive tuning mode (adaptive filter I)	
			Vibration suppression control tuning mode	
2321	2621	PB02	(advanced vibration suppression control)	
2322	2622	PB03	For manufacturer setting	
2323	2623	PB04	Feed forward gain	
2324	2624	PB05	For manufacturer setting	
2325	2625	PB06	Ratio of load inertia moment to servo motor inertia moment	
2326	2626	PB07	Model loop gain	
2327	2627	PB08	Position loop gain	
2328	2628	PB09	Speed loop gain	
2329	2629	PB10	Speed integral compensation	
2330	2630	PB11	Speed differential compensation	
2331	2631	PB12	Overshoot amount compensation	
2332	2632	PB13	Machine resonance suppression filter 1	
2333	2633	PB14	Notch shape selection 1	
2334	2634	PB15	Machine resonance suppression filter 2	
2335	2635	PB16	Notch shape selection 2	
2336	2636	PB17	Automatic setting parameter	
2337	2637	PB18	Low-pass filter setting	
2338	2638	PB19	Vibration suppression control vibration frequency setting	
2339	2639	PB20	Vibration suppression control resonance	
2340	2640	PB21	For manufacturer setting	

Table 1.11 F	Parameter warning	(2301 to 2599)/Parameter e	error (2601 to 2899) error detail
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Error code		Parameter	Name	
		No.		
2341	2641	PB22	For manufacturer setting	
2342	2642	PB23	Low-pass filter selection	
2343	2643	PB24	Slight vibration suppression control selection	
2344	2644	PB25	For manufacturer setting	
2345	2645	PB26	Gain changing selection	
2346	2646	PB27	Gain changing condition	
2347	2647	PB28	Gain changing time constant	
			Gain changing ratio of load inertia moment	
2348	2648	PB29	to servo motor inertia moment	
2349	2649	PB30	Gain changing position loop gain	
2350	2650	PB31	Gain changing speed loop gain	
			Gain changing speed integral	
2351	2651	PB32	compensation	
			Gain changing vibration suppression	
2352	2652	PB33	control vibration frequency setting	
			Gain changing vibration suppression	
2353	2653	PB34	control resonance frequency setting	
2354	2654	PB35		
2355	2655	PB36		
2356	2656	PB37		
2357	2657	PB38		
2358	2658	PB39		
2359	2659	PB40	For manufacturer setting	
2360	2660	PB41	Tor manufacturer setting	
2361	2661	PB42		
2362	2662	PB43		
2363	2663	PB44		
2364	2664	PB45	Vibration suppression control filter 2	
2365	2665	PC01	Error excessive alarm level	
2366	2666	PC02	Electromagnetic brake sequence output	
2367	2667	PC03	Encoder output pulse selection	
2368	2668	PC04	Function selection C-1	
2369	2669	PC05	Function selection C-2	
2370	2670	PC06	Function selection C-3	
2371	2671	PC07	Zero sneed	
2372	2672	PC08	For manufacturer setting	
2373	2673	PC00	Analog monitor 1 output	
2374	2674	PC10	Analog monitor 2 output	
2375	2675	PC11	Analog monitor 1 offset	
2376	2676	PC12	Analog monitor 2 offset	
2377	2677	PC13		
2011	2011	1010		
2378	2678	PC14	For manufacturer setting	
2379	2679	PC15		
2380	2680	PC16	Function selection C-3A	

Error cod	de Parameter	Name	Erro	code	Parameter	Name
2381 26	81 PC17	Eurotion selection C-4	2425	2725		
2382 26	82 PC18		2426	2726	PD30	
2383 26	83 PC19	For manufacturer setting	2427	2727	PD31	For manufacturer setting
2384 26	84 PC20	Function selection C-7	2428	2728	PD32	
2385 26	85 PC21	Alarm history clear	2429	2729	PE01	Fully closed loop selection 1
2386 26	86 PC22		2430	2730	PE02	For manufacturer setting
2387 26	87 PC23		2431	2731	PE03	Fully closed loop selection 2
						Fully closed loop feedback pulse
2388 26	88 PC24	For manufacturer setting	2432	2732	PE04	electronic 1 gear numerator
0000 00			0400	0700	DEOC	Fully closed loop feedback pulse
2389 26	89 PC25		2433	2733	PE05	electronic gear 1 denominator
2390 26	90 PC26	Function selection C-8	2434	2734	PE06	Fully closed loop control speed deviation error detection level
2391 26	91 PC27	Function selection C-9	2435	2735	PE07	Fully closed loop control position deviation error detection level
2392 26	92 PC28		2436	2736	PE08	Fully closed loop dual feedback filter
2393 26	93 PC29		2437	2737	PE09	For manufacturer setting
2394 26	94 PC30		2438	2738	PE10	Fully closed loop selection 3
2395 26	95 PC31	-	2439	2739	PE11	
2396 26	96 PC32	-	2440	2740	PE12	
2397 26	97 PD01	For manufacturer setting	2441	2741	PE13	
2398 26	98 PD02	-	2442	2742	PE14	
2399 26	99 PD03	-	2443	2743	PE15	
2400 27	00 PD04	-	2444	2744	PE16	
2401 27	01 PD05	-	2445	2745	PE17	
2402 27	02 PD06		2446	2746	PE18	For manufacturer setting
2403 27	03 PD07	Output signal device selection 1 (CN3-13)	2447	2747	PE19	
2404 27	04 PD08	Output signal device selection 2 (CN3-9)	2448	2748	PE20	
2405 27	05 PD09	Output signal device selection 3 (CN3-15)	2449	2749	PE21	
2406 27	06 PD10	For manufacturer setting	2450	2750	PE22	
2407 27	07 PD11	Input filter setting	2451	2751	PE23	
2408 27	08 PD12	For manufacturer setting	2452	2752	PE24	
2409 27		Function coloction D 2	2400	2753	PE20	Filter exefficient 2.1
2410 27	10 PD14	Function selection D-3	2404	2755	PE20	Filter coefficient 2-1
2411 27	11 PD15		2455	2755		Filter coefficient 2-3
2412 27	13 PD17		2450	2757	PE20	Filter coefficient 2-3
2410 27			2458	2758	DE30	Filter coefficient 2-5
2414 27	15 PD10		2450	2750	PE31	Filter coefficient 2-6
2416 27	16 PD20		2460	2760	PE32	Filter coefficient 2-7
2417 27	17 PD21		2461	2761	PF33	Filter coefficient 2-8
					. 200	Fully closed loop feedback pulse
2418 27	18 PD22	For manufacturer setting	2462	2762	PE34	electronic gear 2 numerator
						Fully closed loop feedback pulse
2419 27	19 PD23		2463	2763	PE35	electronic gear 2 denominator
2420 27	20 PD24		2464	2764	PE36	
2421 27	21 PD25		2465	2765	PE37	
2422 27	22 PD26		2466	2766	PE38	For manufacturer setting
2423 27	23 PD27		2467	2767	PE39	
2424 27	24 PD28		2468	2768	PE40	

Table 1.11 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail (Continued)

Table 1.12 Servo error (2000 to 2999) list (MR-J3-□B-RJ080W)

Error code	Servo amplifier LED display	Name	Remarks
2010	10	Undervoltage	
2012	12	Memory error 1 (RAM)	
2013	13	Clock error	
2015	15	Memory error 2 (EEP-ROM)	
2016	16	Encoder error 1	
2017	17	Board error	
2019	19	Memory error 3 (Flash ROM)	
2020	20	Encoder error 2	
2021	21	Encoder error 3	
2024	24	Main circuit error	
2025	25	Absolute position erase	
2027	27	Initial magnetic pole detection error	
2030	30	Regenerative error	
2031	31	Overspeed	
2032	32	Overcurrent	
2033	33	Overvoltage	
2034	34	Receive error 1	
2035	35	Command frequency alarm	
2036	36	Receive error 2	
2042	42	Servo control error	
2045	45	Main circuit device overheat	
2046	46	Direct drive motor overheat	
2047	47	Cooling fan alarm	
2050	50	Overload 1	
2051	51	Overload 2	
2052	52	Error excessive	
2060	1A	Motor combination error	
2064	1F	Encoder combination error	
2088	888	Watchdog	
2102	92	Battery cable disconnection warning	
2106	96	Home position setting error	
2116	9F	Battery warning	
2140	E0	Excessive regeneration warning	
2141	E1	Overload warning 1	
2142	E2	Direct drive motor overheat warning	
2143	E3	Absolute position counter warning	
2146	E6	Servo forced stop warning	
2147	E7	Controller emergency stop warning	
2148	E8	Cooling fan speed reduction warning	
2149	E9	Main circuit off warning	
2152	EC	Overload warning 2	
2153	ED	Output watt excess warning	
2301 to 2599	E4	Parameter warning (Refer to the table 1.13)	
2601 to 2899	37	Parameter error (Refer to the table 1.13)	
2913	2B	Encoder counter error	
2948	8A	USB communication time-out error	
2952	8E	USB communication error	

Error	code	Parameter No	Name
2301	2601	PA01	For manufacturer setting
2302	2602	PA02	Regenerative option
2303	2603	PA03	Absolute position detection system
2304	2604	PA04	Function selection A-1
2305	2605	PA05	
2306	2606	PA06	For manufacturer setting
2307	2607	PA07	
2308	2608	PA08	Auto tuning mode
2309	2609	PA09	Auto tuning response
2310	2610	PA10	In-position range
2311	2611	PA11	
2312	2612	PA12	For manufacturer setting
2313	2613	PA13	
2314	2614	PA14	Rotation direction selection
2315	2615	PA15	Encoder output pulse
2316	2616	PA16	
2317	2617	PA17	For manufacturer setting
2318	2618	PA18	
2319	2619	PA19	Parameter write inhibit
2320	2620	PB01	Adaptive tuning mode (adaptive filter I)
2321	2621	PB02	Vibration suppression control tuning mode (advanced vibration suppression control)
2322	2622	PB03	For manufacturer setting
2323	2623	PB04	Feed forward gain
2324	2624	PB05	For manufacturer setting
2325	2625	PB06	Ratio of load inertia moment to direct drive motor inertia moment
2326	2626	PB07	Model loop gain
2327	2627	PB08	Position loop gain
2328	2628	PB09	Speed loop gain
2329	2629	PB10	Speed integral compensation
2330	2630	PB11	Speed differential compensation
2331	2631	PB12	For manufacturer setting
2332	2632	PB13	Machine resonance suppression filter 1
2333	2633	PB14	Notch shape selection 1
2334	2634	PB15	Machine resonance suppression filter 2
2335	2635	PB16	Notch shape selection 2
2336	2636	PB17	Automatic setting parameter
2337	2637	PB18	Low-pass filter setting
2338	2638	PB19	Vibration suppression control vibration frequency setting
2339	2639	PB20	Vibration suppression control resonance frequency setting

Table 1 13	Parameter warning	1 (2301 to 2599)/Param	eter error (2601 to 2899)	error detail
	i arameter manning			enter detail

Error code Parameter No.		Parameter No.	Name	
2340	2640	PB21	For manufacturar satting	
2341	2641	PB22		
2342	2642	PB23	Low-pass filter selection	
2343	2643	PB24	Slight vibration suppression control selection	
2344	2644	PB25	For manufacturer setting	
2345	2645	PB26	Gain changing selection	
2346	2646	PB27	Gain changing condition	
2347	2647	PB28	Gain changing time constant	
2348	2648	PB29	Gain changing ratio of load inertia moment to direct drive motor inertia moment	
2349	2649	PB30	Gain changing position loop gain	
2350	2650	PB31	Gain changing speed loop gain	
2351	2651	PB32	Gain changing speed integral compensation	
2352	2652	PB33	Gain changing vibration suppression control vibration frequency setting	
2353	2653	PB34	Gain changing vibration suppression control resonance frequency setting	
2354	2654	PB35		
2355	2655	PB36		
2356	2656	PB37		
2357	2657	PB38		
2358	2658	PB39		
2359	2659	PB40	For manufacturer setting	
2360	2660	PB41		
2361	2661	PB42		
2362	2662	PB43		
2363	2663	PB44		
2364	2664	PB45	Vibration suppression control filter 2	
2365	2665	PC01	Error excessive alarm level	
2366	2666	PC02	Electromagnetic brake sequence output	
2367	2667	PC03	Encoder output pulse selection	
2368	2668	PC04	Function selection C-1	
2369	2669	PC05	For manufacturer setting	
2370	2670	PC06	Function selection C-3	
2371	2671	PC07	Zero speed	
2372	2672	PC08	For manufacturer setting	
2373	2673	PC09	Analog monitor 1 output	
2374	2674	PC10	Analog monitor 2 output	
2375	2675	PC11	Analog monitor 1 offset	
2376	2676	PC12	Analog monitor 2 offset	
2377	2677	PC13	Analog monitor feedback position output standard data Low	
2378	2678	PC14	Analog monitor feedback position output standard data High	

Error co	ode	Parameter No.	Name	Error	code	Parameter No.	Name
2379 26	679	PC15		2426	2726	PD30	
2380 26	680	PC16		2427	2727	PD31	
2381 26	681	PC17	For manufacturer setting	2428	2728	PD32	
2382 26	682	PC18		2429	2729	PE01	
2383 26	683	PC19		2430	2730	PE02	
2384 26	684	PC20	Function selection C-7	2431	2731	PE03	
2385 26	685	PC21	Alarm history clear	2432	2732	PE04	
2386 26	686	PC22		2433	2733	PE05	
2387 26	687	PC23		2434	2734	PE06	
2388 26	688	PC24		2435	2735	PE07	
2389 26	689	PC25		2436	2736	PE08	
2390 26	690	PC26		2437	2737	PE09	
2391 26	691	PC27		2438	2738	PE10	
2392 26	692	PC28		2439	2739	PE11	For manufacturar sotting
2393 26	693	PC29		2440	2740	PE12	
2394 26	694	PC30	For manufacturer setting	2441	2741	PE13	
2395 26	695	PC31		2442	2742	PE14	
2396 26	696	PC32		2443	2743	PE15	
2397 26	697	PD01		2444	2744	PE16	
2398 26	698	PD02		2445	2745	PE17	
2399 26	699	PD03		2446	2746	PE18	
2400 27	700	PD04		2447	2747	PE19	
2401 27	701	PD05		2448	2748	PE20	
2402 27	702	PD06		2449	2749	PE21	
2403 27	703	PD07	Output signal device selection 1 (CN3-13)	2450	2750	PE22	
2404 27	704	PD08	Output signal device selection 2 (CN3-9)	2451	2751	PE23	
2405 27	705	PD09	Output signal device selection 3 (CN3-15)	2452	2752	PE24	
2406 27	706	PD10	For manufacturer setting	2453	2753	PE25	
2407 27	707	PD11	Input filter setting	2454	2754	PE26	Filter coefficient 2-1
2408 27	708	PD12	For manufacturer setting	2455	2755	PE27	Filter coefficient 2-2
2409 27	709	PD13	-	2456	2756	PE28	Filter coefficient 2-3
2410 27	710	PD14	Function selection D-3	2457	2757	PE29	Filter coefficient 2-4
2411 27	711	PD15		2458	2758	PE30	Filter coefficient 2-5
2412 27	712	PD16		2459	2759	PE31	Filter coefficient 2-6
2413 27	713	PD17		2460	2760	PE32	Filter coefficient 2-7
2414 27	/14	PD18		2461	2761	PE33	Filter coefficient 2-8
2415 27	/15	PD19		2462	2762	PE34	
2416 27	/16	PD20		2463	2/63	PE35	
241/ 27	/1/	PD21		2464	2764	PE36	
2418 27	/18	PD22	For manufacturer setting	2465	2/65	PE37	For manufacturer setting
2419 27	/19	PD23		2466	2/66	PE38	
2420 27	/20 704	PD24		2467	2/6/	PE39	
2421 27	721	PD25		2468	2/68	PE40	On a sial function, a shart's suit
2422 27	722	PD26		2501	2801	PS01	Special function selection 1
2423 27	123	PD27		2502	2802	P502	For manufacturer setting
2424 27	/24	PD28		2503	2803	PS03	
2425 27	/25	PD29		2504	2804	PS04	Special function selection 2

Table 1.13 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail (Continued)

Error	code	Parameter No.	Name	Err	or code	Parameter No.	Name
2505	2805	PS05	Servo control position deviation error detection level	251	2819	PS19	
2506	2806	PS06	Servo control speed deviation error detection level	252	2820	PS20	
2507	2807	PS07	Servo control torque deviation error detection level	252	2821	PS21	
2508	2808	PS08	Special function selection 3	252	2 2822	PS22	
2509	2809	PS09	Magnetic pole detection voltage level	252	3 2823	PS23	
2510	2810	PS10		252	2824	PS24	
2511	2811	PS11		252	5 2825	PS25	For manufacturer setting
2512	2812	PS12		252	3 2826	PS26	
2513	2813	PS13	For manufacturer setting	252	2827	PS27	
2514	2814	PS14		252	3 2828	PS28	
2515	2815	PS15		252	2829	PS29	
2516	2816	PS16		253	2830	PS30	
2517	2817	PS17	Minimal position detection method function selection	253	2831	PS31	
2518	2818	PS18	Minimal position detection method identification signal amplitude	253	2 2832	PS32	

Table 1.13 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail (Continued)

(g) MR-J3B Safety (For safety servo)

Table 1.14 Servo error (2000 to 2999) list (MR-J3-DB Safety)

Error code	Servo amplifier LED display	Name	Remarks
2010	10	Undervoltage	
2012	12	Memory error 1 (RAM)	
2013	13	Clock error	
2015	15	Memory error 2 (EEP-ROM)	
2016	16	Encoder error 1 (At power on)	
2017	17	Board error	
2019	19	Memory error 3 (Flash ROM)	
2020	20	Encoder error 2 (during runtime)	
2021	21	Encoder error 3 (during runtime)	
2024	24	Main circuit error	
2025	25	Absolute position erase	
2028	28	Linear encoder error 2	
2030	30	Regenerative error	
2031	31	Overspeed	
2032	32	Overcurrent	
2033	33	Overvoltage	
2034	34	Receive error 1	
2035	35	Command frequency error	
2036	36	Receive error 2	
2042	42	Fully closed control error detection	
2045	45	Main circuit device overheat	
2046	46	Servo motor overheat	
2047	47	Cooling fan error	
2050	50	Overload 1	
2051	51	Overload 2	
2052	52	Error excessive	
2056	56	Forced stop error	
2070	70	Load side encoder error 1	
2071	71	Load side encoder error 2	
2060	1A	Motor combination error	
2061	2A	Linear encoder error 1	
2063	63	STO timing error	
2088	888	Watchdog	
2095	95	STO warning	
2102	92	Battery cable disconnection warning	
2106	96	Home position setting warning	
2116	9F	Battery warning	
2140	E0	Excessive regeneration warning	
2141	E1	Overload warning 1	
2143	E3	Absolute position counter warning	
2146	E6	Servo forced stop warning	
2147	E7	Controller forced stop warning	
2148	E8	Cooling fan speed reduction warning	
2149	E9	Main circuit off warning	
2152	EC	Overload warning 2	
2153	ED	Output watt excess warning	
2301 to 2599	E4	Parameter warning (Refer to the table 1.15)	

Error code	Servo amplifier LED display	Name	Remarks
2601 to 2899	37	Parameter error (Refer to the table 1.15)	
2948	8A	USB communication time-out error	
2952	8E	USB communication error	

Table 1.14 Servo error (2000 to 2999) list (MR-J3-DB Safety) (Continued)

Error	code	Parameter No.	Name
2301	2601	PA01	Control mode
2302	2602	PA02	Regenerative option
2303	2603	PA03	Absolute position detection system
2304	2604	PA04	Function selection A-1
2305	2605	PA05	
2306	2606	PA06	For manufacturer setting
2307	2607	PA07	
2308	2608	PA08	Auto tuning mode
2309	2609	PA09	Auto tuning response
2310	2610	PA10	In-position range
2311	2611	PA11	
2312	2612	PA12	For manufacturer setting
2313	2613	PA13	
2314	2614	PA14	Rotation direction selection
2315	2615	PA15	Encoder output pulse
2316	2616	PA16	Encoder output pulse 2
2317	2617	PA17	For monufacturer acting
2318	2618	PA18	
2319	2619	PA19	Parameter write inhibit
2320	2620	PB01	Adaptive tuning mode (adaptive filter ${\tt I}$)
2321	2621	PB02	Vibration suppression control tuning mode (advanced vibration suppression control)
2322	2622	PB03	For manufacturer setting
2323	2623	PB04	Feed forward gain
2324	2624	PB05	For manufacturer setting
2325	2625	PB06	Ratio of load inertia moment to servo motor inertia moment
2326	2626	PB07	Model loop gain
2327	2627	PB08	Position loop gain
2328	2628	PB09	Speed loop gain
2329	2629	PB10	Speed integral compensation
2330	2630	PB11	Speed differential compensation
2331	2631	PB12	Overshoot amount compensation
2332	2632	PB13	Machine resonance suppression filter 1
2333	2633	PB14	Notch shape selection 1
2334	2634	PB15	Machine resonance suppression filter 2
2335	2635	PB16	Notch shape selection 2
2336	2636	PB17	Automatic setting parameter
2337	2637	PB18	Low-pass filter setting
2338	2638	PB19	Vibration suppression control vibration frequency setting
2339	2639	PB20	Vibration suppression control resonance frequency setting

Table 1.15	Parameter warning	(2301 to 2599)/Parameter	error (2601 to 2899) error detail

Error code		Parameter	Name					
	couc	No.	Name					
2340	2640	PB21	For manufacturer setting					
2341	2641	PB22						
2342	2642	PB23	Low-pass filter selection					
2343	2643	PB24	Slight vibration suppression control selection					
2344	2644	PB25	For manufacturer setting					
2345	2645	PB26	Gain changing selection					
2346	2646	PB27	Gain changing condition					
2347	2647	PB28	Gain changing time constant					
			Gain changing ratio of load inertia moment					
2348	2648	PB29	to servo motor inertia moment					
2349	2649	PB30	Gain changing position loop gain					
2350	2650	PB31	Gain changing speed loop gain					
2351	2651	PB32	Gain changing speed integral compensation					
0050	0050	0000	Gain changing vibration suppression					
2352	2652	PB33	control vibration frequency setting					
0050	0050	0024	Gain changing vibration suppression					
2353	2003	PB34	control resonance frequency setting					
2354	2654	PB35						
2355	2655	PB36						
2356	2656	PB37						
2357	2657	PB38						
2358	2658	PB39						
2359	2659	PB40	For manufacturer setting					
2360	2660	PB41						
2361	2661	PB42						
2362	2662	PB43						
2363	2663	PB44						
2364	2664	PB45	Vibration suppression control filter 2					
2365	2665	PC01	Error excessive alarm level					
2366	2666	PC02	Electromagnetic brake sequence output					
2367	2667	PC03	Encoder output pulse selection					
2368	2668	PC04	Function selection C-1					
2369	2669	PC05	Function selection C-2					
2370	2670	PC06	Function selection C-3					
2371	2671	PC07	Zero speed					
2372	2672	PC08	For manufacturer setting					
2373	2673	PC09	Analog monitor 1 output					
2374	2674	PC10	Analog monitor 2 output					
2375	2675	PC11	Analog monitor 1 offset					
2376	2676	PC12	Analog monitor 2 offset					
2377	2677	PC13	Analog monitor feedback position output standard data Low					
2378	2678	PC14	Analog monitor feedback position output standard data High					

				-		
Error	code	Parameter No.	Name	Error	code	Pa
2379	2679	PC15	For manufacturer setting	2421	2721	F
2380	2680	PC16	Function selection C-3A	2422	2722	F
2381	2681	PC17	Function selection C-4	2423	2723	F
2382	2682	PC18		2424	2724	F
2383	2683	PC19	For manufacturer setting	2425	2725	F
2384	2684	PC20	Function selection C-7	2426	2726	F
2385	2685	PC21	Alarm history clear	2427	2727	F
2386	2686	PC22		2428	2728	F
2387	2687	PC23	For manufacturer setting	2429	2729	F
2388	2688	PC24	Forced stop deceleration time constant	2430	2730	F
2389	2689	PC25	For manufacturer setting	2431	2731	F
2390	2690	PC26	Function selection C-8	2432	2732	F
2391	2691	PC27	Function selection C-9	2433	2733	F
2392	2692	PC28		2434	2734	F
2393	2693	PC29	For manufacturer setting	2435	2735	F
2394	2694	PC30		2436	2736	F
2395	2695	PC31	Vertical axis freefall prevention compensation amount	2437	2737	F
2396	2696	PC32		2438	2738	F
2397	2697	PD01		2439	2739	F
2398	2698	PD02		2440	2740	F
2399	2699	PD03	For manufacturer setting	2441	2741	F
2400	2700	PD04		2442	2742	F
2401	2701	PD05		2443	2743	F
2402	2702	PD06		2444	2744	F
2403	2703	PD07	Output signal device selection 1 (CN3-13)	2445	2745	F
2404	2704	PD08	Output signal device selection 2 (CN3-9)	2446	2746	F
2405	2705	PD09	Output signal device selection 3 (CN3-15)	2447	2747	F
2406	2706	PD10	For manufacturer setting	2448	2748	F
2407	2707	PD11	Input filter setting	2449	2749	F
2408	2708	PD12		2450	2750	F
2409	2709	PD13	For manufacturer setting	2451	2751	F
2410	2710	PD14	Function selection D-3	2452	2752	F
2411	2711	PD15		2453	2753	F
2412	2712	PD16		2454	2754	F
2413	2713	PD17		2455	2755	F
2414	2714	PD18		2456	2756	F
2415	2715	PD19		2457	2757	F
2416	2716	PD20	For manufacturer setting	2458	2758	F
2417	2717	PD21		2459	2759	F
2418	2718	PD22		2460	2760	, 1
2419	2719	PD23		2461	2761	F
2420	2720	PD24		2462	2762	F

Table 1.15 F	Parameter warning	(2301 to 2599)/F	Parameter error (2	2601 to 2899)	error detail ((Continued)
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Error code		Parameter	Name			
0404	0704					
2421	2721	PD25				
2422	2722	PD26				
2423	2723	PD27				
2424	2724	PD28	For manufacturer setting			
2425	2725	PD29				
2426	2726	PD30				
2427	2727	PD31				
2428	2728	PD32				
2429	2729	PE01	Fully closed loop selection 1			
2430	2730	PE02	For manufacturer setting			
2431	2731	PE03	Fully closed loop selection 2			
2432	2732	PE04	Fully closed loop feedback pulse electronic gear 1 numerator			
2422	2722	DEOF	Fully closed loop feedback pulse			
2433	2133	PE05	electronic gear 1 denominator			
2434	2734	PE06	Fully closed loop speed deviation error detection level			
		L	Fully closed loop position deviation error			
2435	2735	PE07	detection level			
2436	2736	PE08	Fully closed loop dual feedback filter			
2437	2737	PE09	For manufacturer setting			
2438	2738 PE10		Fully closed loop selection 3			
2439	2739	PE11				
2440	2740	PF12				
2441	2741	PF13				
2442	2742	PF14				
2443	2743	PE15				
2444	2744	PE16				
2445	2745	PF17				
2446	2746	PE18	For manufacturer setting			
2447	2747	PE19				
2448	2748	PE20				
2449	2749	PE21				
2450	2750	PF22				
2451	2751	PF23				
2452	2752	PF24				
2453	2753	PE25				
2454	2754	PE26	Filter coefficient 2-1			
2455	2755	PE27	Filter coefficient 2-2			
2456	2756	PE28	Filter coefficient 2-3			
2457	2757	PF29	Filter coefficient 2-4			
2458	2758	PE30	Filter coefficient 2-5			
2450	2759	PE31	Filter coefficient 2-6			
2460	2760	PE32	Filter coefficient 2-7			
2461	2761	PE33	Filter coefficient 2-8			
2701	2101	1 200				
2462	2762	PE34	electronic gear 2 numerator			

Error	code	Parameter No.	Name	Error code Par		Parameter No.	Name
2463	2763	PE35	Fully closed loop feedback pulse electronic gear 2 denominator	2466	2766	PE38	
2464	2764	PE36		2467	2767	PE39	For manufacturer setting
2465	2765	PE37	For manufacturer setting	2468	2768	PE40	

Table 1.15 Parameter warning (2301 to 2599)/Parameter error (2601 to 2899) error detail (Continued)

APPENDIX 1.6 Output module errors

(1) Output module errors at real mode/virtual mode switching (4000 to 5990)

Error	Error		Output	module				
class	code	Roller	Ball screw	Rotary table	Cam	Error cause	Processing	Corrective action
	4050				0	 The "lower stroke limit setting device value + stroke amount setting device value" exceeded "2147483647 (setting unit)". (At the two-way cam mode.) 		 Since the current value within 1 cam shaft revolution cannot be calculated, return to the real mode and set the correct No. in the device.
	4060	0	0	0	0	 When the drive module is the synchronous encoder connected to the manual pulse generator inputs, and the connected clutch is the "external input mode", multiple ON/OFF command bit devices are set. Or, the external input mode clutch setting is fault. 		 Set a one-to-one setting for the external input mode clutch and synchronous encoder. Return to the real mode, turn the PLC ready flag off, then correct and write the clutch setting.
	4070	0	0	0	0	• The clutch of the external input mode is set at the Q173DPX or Q172DEX set for high-speed reading.		• Do not use the clutch of the external input mode at the Q173DPX or Q172DEX set for high-speed reading.
Minor error	5000		0	0	0	 The "feed current value" is outside the stroke limit range. For cam, the feed current value is outside the range of "lower stroke limit value to stroke amount", when the cam/ball screw switching command device is turned ON to OFF at real/virtual mode switching or in virtual mode. (The current value within 1 cam shaft revolution cannot be calculated at the two-way cam mode.) For cam, the feed current value is outside the range of "lower stroke limit value to stroke amount" at the servo amplifier's power supply ON. (In this case, the servo ON status.) 	Related system cannot be started.	Return to the real mode and position within the stroke limit range.
	5060				0	 The "feed current value" is within the stroke limit range, but the current value within 1 cam shaft revolution cannot be calculated. (Cam table fault) 		• Correct the cam table. Set the cam table by the stroke ratio "0 to 7FFFH" of lower stroke value and stroke amount.
	5080	0	0	0	0	Torque limit value setting outside range error.	Control with the default value "300[%]".	 Set the torque limit value within the setting range.
	5200				0	 The first lower stroke limit value storage device is an odd number. 	Operation is possible, but monitoring is impossible.	Set an even numbered the first device.
	5210	0	0	0	0	 The first clutch ON address setting device is an odd number. 	Related system cannot be started	

Table 1.16 Output Module Error List (4000 to 5990)

Error	Error	r Output module						
class	code	Roller	Ball screw	Rotary table	Cam	Error cause	Processing	Corrective action
	5220	0	0	0	0	 The first clutch OFF address setting device is an odd number. 	Related system cannot be started.	Set an even numbered the first device.
	5230			0	0	 The first current value within 1 virtual axis revolution storage device (main shaft side) is an odd number. 	Operation is	
	5240			0	0	 The first current value within 1 virtual axis revolution storage device (auxiliary input shaft side) is an odd number. 	monitoring is impossible.	
	5250	0	0	0	0	• When the amount of slip is set as the clutch smoothing method, the amount of slip setting device value is outside the range (0 to 2147483647).	Amount of slip = 0 (control as the direct clutch).	• Set a value within the range of 0 to 2147483647.
	5260				0	The device set to "Stroke amount setting device" is outside the range.		Correct the device set to "Stroke amount setting device".
	5270				0	The device set to "Cam No. setting device" is outside the range.		Correct the device set to Cam No.
	5280	0	0	0	0	The device set to "Clutch mode setting device" is outside the range.		Correct the device set to clutch mode.
	5290	0	0	0	0	• The device set to "Clutch ON address setting device" is outside the range.	Related system cannot be	• Correct the device set to clutch ON address.
	5300	0	0	0	0	• The device set to "Clutch OFF address setting device" is outside the range.	started.	• Correct the device set to clutch OFF address.
Minor	5310	0	0	0	0	 The device set to "Clutch ON/OFF command setting device" is outside the range. 		• Correct the device set to clutch ON/OFF command.
error	5320	0	0	0	0	• The device set to "Speed change ratio setting device" is outside the range.		 Correct the device set to speed change ratio.
	5330	0	0	0	0	The device set to "Amount of slip setting device" is outside the range.	Amount of slip = 0 (control as the direct clutch).	Correct the device set to amount of slip.
	5340	0	0	0	0	The device set to "Torque limit value setting device" is outside the range.	Related system cannot be started	Correct the device set to torque limit value.
	5350			0	0	The device set to "Current value within 1 virtual axis revolution storage device (main shaft side)" is outside the range.	Current value within 1 virtual axis revolution (main shaft side) cannot be monitored.	Correct the device set to current value within 1 virtual axis revolution (main shaft side).
	5360			0	0	The device set to "Current value within 1 virtual axis revolution storage device (auxiliary input axis side) storage device" is outside the range.	Current value within 1 virtual axis revolution (auxiliary input axis side) cannot be monitored.	• Correct the device set to current value within 1 virtual axis revolution (auxiliary input axis side).
	5370				0	 The device set to "Lower stroke limit value storage device" is outside the range. 	Lower stroke limit value cannot be monitored.	Correct the device set to lower stroke limit value.
	5380	0	0	0	0	 The device set to "Number of input axis side gear tooth count setting device" is outside the range. 	Related system cannot be started.	 Correct the device set to number of input axis side gear tooth count.

Table 1.16 Output Module Error List (4000 to 5990) (Continued)

Error	Error		Output	module					
class	code	Roller	Ball screw	Rotary table	Cam	Error cause	Processing	Corrective action	
	5390	0	0	0	0	 The device set to "Number of output axis side gear tooth count setting device" is outside the range. 		• Correct the device set to number of output axis side gear tooth count.	
	5400	0	0	0	0	 Number of input axis side gear tooth count setting device is set to "0". 	Related system	 Correct the number of input axis side gear tooth count. 	
	5410	0	0	0	0	Number of output axis side gear tooth count setting device is set to "0".	started.	• Correct the number of output axis side gear tooth count.	
	5420	0	0	0	0	• The device set to "Slippage in-position range setting device" is outside the range.		 Correct the device set to slippage in-position range setting device. 	
	5430	0	0	0	0	 Slippage in-position range setting device is outside the range (0 to 2147483647). 	Control with the setting value "0".		
	5440	0	0	0	0	• Either of "phase advance time" of "phase compensation processing valid flag" or "phase compensation time constant" of the phase compensation setting devices is outside the setting range.	Control as the phase compensation processing invalid.	 Correct the phase advance time. Correct the phase compensation processing valid flag. Correct the phase compensation time constant. 	
	5450	0	0	0	0	 The device set to "Smoothing clutch complete signal device" is outside the range. 		Correct the device set to "Smoothing clutch complete signal device".	
Minor error	5460	0	0	0	0	The device set to "Clutch status device" is outside the range.		Correct the device set to "Clutch status device".	
	5480				0	• The device set to "Cam/ball screw switching command device" is outside the range.		Correct the device set to "Cam/ball screw switching command device".	
	5490			0	0	 When the address mode clutch control system is the current value within 1 virtual axis revolution, the setting value set to "Clutch ON address setting device" is outside the range of "0 to number of pulses within 1 output axis revolution –1[pulse]". 	Related system cannot be	• Correct the setting value set to "Clutch ON address setting device" with in the range of "0 to number of pulses within 1 output axis revolution – 1[pulse]".	
	5500			0	0	 When the address mode clutch control system is the current value within 1 virtual axis revolution, the setting value set to "Clutch OFF address setting device" is outside the range of "0 to number of pulses within 1 output axis revolution –1[pulse]". 		 Correct the setting value set to "Clutch OFF address setting device" with in the range of "0 to number of pulses within 1 output axis revolution – 1[pulse]". 	
	5510				0	• The device set to "Number of pulses per cam shaft revolution" is outside the range.		Correct the device set to "Number of pulses per cam shaft revolution".	
	5520				0	 I he value of "Number of pulses per cam shaft revolution" is outside the range. 		 Correct the setting of "Number of pulses per cam shaft revolution". 	

 Table 1.16 Output Module Error List (4000 to 5990) (Continued)

(2) Output module errors (6000 to 6990)

Table 1.17 Output Module Error List (6000 to 6990)

Error	Error		Output	module				
class	code	Roller	Ball screw	Rotary table	Cam	Error cause	Processing	Corrective action
	6000	0	0	0	0	 The servo OFF command (M3215+20n) turned ON during operation. The servo amplifier's power supply is turned ON during operation. 		Execute the servo OFF after clutch OFF command.
	6010	0	0	0		• The output speed exceeded the speed limit value during operation. (Speed clamp processing by the speed limit value is not executed.)		• Correct the speed, gear ratio and speed change ratio of drive module within the speed limit value.
	6020	0	0	0	0	The deviation counter value exceeded the permissible droop pulse value during operation.	Operation continues.	 Correct the speed, gear ratio and speed change ratio of drive module within the permissible droop pulse value after stopping the drive module.
	6030		0	0		 The feed current value exceeded the stroke limit range during operation. 		 Control within the stroke limit value.
	6040				0	• The cam No. setting device value is outside the "used cam No." range. (Operation continues with the current cam No.)		Correct the cam No. setting.
Minor error	6050				0	 The stroke amount setting device value is outside the range of "1 to 2147483647". "Lower stroke limit value + stroke amount ≤ 2147483647" is outside the range. (Operation continues with the current stroke amount.) 	Operation continues with the current cam No. and stroke amount.	Correct the stroke amount setting.
	6060				0	A control mode (feed/two-way) does not match at cam No. switching.	Operation continues.	 Correct the control mode after stopping the drive module.
	6080	0	0	0	0	The torque limit value setting device is outside the range.	Control with the default value "300[%]".	• Set the torque limit value within the setting range.
	6090	0	0	0	0	 The servo OFF command (M3215+20n) turned on at servo OFF in operation. The servo ON is executed by turning ON the servo amplifier's power supply in operation. 	Servo ON is not executed.	Execute the servo ON after clutch OFF command.
	6120				0	 The current value within 1 cam axis revolution was changed to the outside the range. 	The current value is not changed.	 Set a value within the range of 1 to "number of pulses 1 cam shaft revolution – 1".
	6130	0	0	0	0	 Number of input axis side gear tooth count is set by indirect device setting, and the current value for the drive module was changed to the device value "0". 	The gear ratio of	• Set the value within the range of 1 to 65535.
	6140	0	0	0	0	 Number of output axis side gear tooth count is set by indirect device setting, and the current value for the drive module was changed to the device value "0". 	is not changed.	

Error	Error		Output	module				
class	code	Roller	Ball screw	Rotary table	Cam	Error cause	Processing	Corrective action
	6160				0	 Current value was changed for the axis that had not been started. Or, the current value within 1 cam shaft revolution was changed for the servo OFF axis. The current value within 1 cam shaft revolution was changed during cam/ball screw switching processing. 	Do not change the current value within 1 cam shaft revolution.	 Use the following device as interlock not to change the current value within 1 cam shaft revolution for applicable axis. (Servo READY signal (M2415+20) ON) Do not change the current value within 1 cam shaft revolution during cam/ball screw switching or cam/ball screw switching command ON.
	6170	0	0	0	0	 Slippage in-position range setting device value is outside the range (0 to 2147483647). 	Control with the setting value "0".	• Set the device value within the range of 0 to 2147483647.
	6180	0	0	0		 One of the devices set in the speed- torque control operation data is outside the range. 		Correct the speed-torque control operation data device.
Minor error	6190	0	0	0		 The control mode switching was executed with an invalid value specified in the control mode setting device. 	Operation continues without switching	 Correct the value of the control mode setting device. When switching the mode from the continuous operation to torque control mode to another, return the mode to the previous one.
	6200	0	0	0		 The control mode switching request was executed during the zero speed was OFF. 	mode.	 Switch the control mode while the output axis is stopped and the zero speed is turned on. Make "Invalid selection during zero speed at control mode switching" valid when not waiting for the stop of the servo motor.
	6210	0	0	0		• At the control mode switching, a value set to the torque limit value at speed- torque control is outside the range.	Control with the default value "300[%]".	• Set the torque limit value to 0.1 to 1000.0[%].
	6220	0	0	0		• During torque control or continuous operation to torque control, the absolute value of the command torque is outside the range of 0 to the torque limit value at speed-torque control.	Control with the torque limit value at speed-torque control.	 Set the torque after torque change within the range of 0 to the torque limit value at speed- torque control.
	6230	0	0	0		• The control mode switching request of speed/torque control was executed for the axis that connects to the stepping driver which do not support the control mode switching.	The control mode is not switched.	 Do not switch the control mode switching request of speed/torque control for the axis that connects to the stepping driver which does not support the control mode switching.
	6240				0	• The control mode switching request of speed-torque control was executed to the cam axis.		 Do not execute the speed- torque control mode switching request to the cam axis.

 Table 1.17 Output Module Error List (6000 to 6990) (Continued)

Error	Error		Output	module				
class	code	Roller	Ball screw	Rotary table	Cam	Error cause	Processing	Corrective action
	6250	0	0	0		 During the speed-torque control, the change value by the torque limit value setting device exceeds the torque limit value at speed-torque control. During the speed-torque control, the change value by the torque limit value individual change request (D(P).CHGT2, CHGT2) exceeds the torque limit value at speed-torque control. 	 Control with the torque limit value at speed- torque control. The torque limit value by the torque limit value individual change request (D(P).CHGT2, CHGT2) is not changed. 	Set the torque limit value after torque change within the range of 1 to the torque limit value at speed-torque control.
	6260	0	0	0	0	 The torque limit value individual change request (D(P).CHGT2, CHGT2) was executed with the setting of the torque limit value setting device of the mechanical system output module. 		• When executing the torque limit value individual change request (D(P).CHGT2, CHGT2), do not set the torque limit value setting device of the mechanical system output module.
Minor error	6270	0	0	0	0	• The positive direction torque limit value or the negative direction torque limit value outside the range of 0.1 to 1000.0[%] was set in the torque limit value individual change request (CHGT2).	The torque limit value is not changed.	• Set the change request within the range of 0.1 to 1000.0[%] for the positive direction torque limit value or the negative direction torque limit value.
	6280	0	0	0	0	• The torque limit value individual change request (D(P).CHGT2, CHGT2) was made for the axis that had not been started.		 Request the torque limit value individual change for the starting axis.
	6300	0	0	0	0	 Phase compensation time constant is outside the range. 	Control with the phase compensation time constant "0".	• Set the phase compensation time constant within the range of 0 to 32767 (times).
	6500	0	0	0	0	A servo OFF state at a clutch ON command.	Clutch romaina	 Return to the clutch OFF command, and repeat the clutch ON command after executing a servo ON command.
	6530		0	0	0	• The home position return request signal (M2409+20n) is turning on at a clutch ON command. (Incremental axis servo amplifier power from off to ON.)	OFF.	 Return to the real mode, back to the virtual mode after home position return.
	6540				0	 Although the feed current value is within the stroke limit value, the current value within 1 cam shaft revolution cannot be calculated. (Cam table error) 	Servo remains ON.	 Return to the real mode, correct the cam data settings. Set the cam table by the stroke ratio "0 to 7FFFH" of lower stroke value and stroke amount.

 Table 1.17 Output Module Error List (6000 to 6990) (Continued)

(3) System errors (9000 to 9990)

Table 1.18 Output Module Error List (9000 to 9990)

Error class	Error code	Output module						
		Roller	Ball screw	Rotary table	Cam	Error cause	Processing	Corrective action
Minor error	9010	0	0	0	0	• The motor travel value while the power is off exceeded the "System setting mode-allowable travel value during power off" set in the system settings at the turning on of the servo amplifier.	Virtual mode continuation operation disable warning signal turns on. Further operation is possible.	 Check the position. Check the battery of encoder.

(4) Output module errors at virtual servo motor axis start (10000 to 10990)

Error	Error code		Output	module		Error cause	Processing	Corrective action
class		Roller	Ball screw	Rotary table	Cam			
Major error	10000		0	0	0	• The home position return request signal (M2409+20n) is ON.		 Return to the real mode and execute a home position return. If position is not established after executing a home position return at all axes, the virtual mode operation cannot be executed.
	10010	0	0	0	0	 The servo error detection signal (M2408+20n) is ON. 	Deleted evetere	• Execute a servo error reset in the real mode.
	10020	0	0	0	0	• A servo OFF (M2415+20n OFF) status exists at an output module where a "clutch ON" or "no clutch" setting is set at either the main shaft or auxiliary input axis.	cannot be start.	Turn the servo on after clutch OFF command.
	10030	0	0	0	0	• An external input signal (STOP) is turning on at an output module where a "clutch ON" or "no clutch" setting is set at either the main shaft or auxiliary input axis.		• Turn the stop signal (STOP) off.

Table 1.19 Output Module Error List (10000 to 10990)

(5) "No-clutch/clutch ON/clutch status ON" output module errors (11000 to 11990)

Free	Error code		Output	module		Error cause Processing		Corrective action
class		Roller	Ball screw	Rotary table	Cam		Processing	
	11000	0	0	0	0	The servo error detection signal (M2408+20n) turned on during operation.	After an immediate stop at the applicable output module, and the servo OFF state.	Release the servo error causes. (Refer to APPENDIX 1.5).
	11010	0	0	0	0	 A servo OFF state (M2415+20n OFF) during operation. Servo amplifier power supply was OFF. 	 Operation continues at "no-clutch" axes. At axes with clutches, control is executed based on the operation mode at the time of the error. Operation continues. All clutches turns off at the applicable systems. 	• When the "operation continuation" setting is set, execute the stop processing using the user's Motion SFC program.
	11020	0	0	0	0	 The stop signal (STOP) turned on. 		
Major error	11030	0	0	0	0	• The upper limit switch signal (FLS) turned off during forward (address increase direction) travel.		
	11040	0	0	0	0	 The lower limit switch signal (RLS) turned off during reverse (address decrease direction) travel. 		
	11050	0	0	0		At the switching request to the continuous operation to torque control, the servo amplifier is not compatible with the continuous operation to torque control.		

Table 1.20 Output Module Error List (11000 to 11990)
(6) Errors when using an absolute position system (12000 to 12990)

Error	Error	Output module							
class	code	Roller	Ball	Rotary	Cam	Error cause	Processing	Corrective action	
	12010	0	O	G	0	 The error causes why the home position return is required in the absolute position system are as follows: (1) The home position return has never been executed after the system start. (2) The home position return is started, but not completed correctly. (3) Absolute data in the Motion CPU is erased due to causes such as a battery error. (4) Servo error [2025], [2143], or [2913] occurred. (5) Major error [1202], [1203], [1204], [12020], [12030] or [12040] occurred. (6) "Rotation direction selection" of the servo parameter is changed. 	Home position return signal turns ON.	• Execute the home position return in real mode after checking the batteries of the Motion CPU module and servo amplifier.	
Major error	12020	0	0	0	0	 A communication error between the servo amplifier and encoder occurred at the servo amplifier power supply on. 	Depending on the version of operating system and servo amplifier, home position return signal turns ON.	 Check the motor and encoder cables. If the home position return request signal is turning ON, execute a home position return in the real mode. 	
	12030	0	0	0	0	 The amount of change in encoder current value during operation holds the following expression: "Amount of change in encoder current value / 3.5[ms] >180° of motor revolution" It is always checked after the servo amplifier power supply on (in both servo ON and OFF states). (Q17□DCPU(-S1) use) 	Home position	Check the motor and encoder cables.	
	12040	0	0	0	0	 During operation, the following expression holds: "Encoder current value [pulse] ≠ feedback current value [pulse] (number of bits in encoder enable range)". It is always checked after the servo amplifier power supply on (in both servo ON and OFF states). (Q17□DCPU(-S1) use) 	turns ON.		

Table 1.21 Output Module Error List (12000 to 12990)

Free	Free		Output module						
class	code	Roller	table Ball Rotary Car		Cam	Error cause	Processing	Corrective action	
Major error	12050	0	0	0	0	 During operation, the following expression holds: "Encoder current value [pulse] ≠ feedback current value [pulse] (number of bits in encoder enable range)". It is always checked after the servo amplifier power supply on (in both servo ON and OFF states). 	Operation continues. (Home position return signal does not turn ON.)	Check the motor and encoder cables.	

Table 1.21 Output Module Error List (12000 to 12990) (Continued)

APPENDIX 1.7 Errors at real mode/virtual mode switching

Error codes st	ored in SD504		
Decimal	Hexadecimal	Error description	Corrective action
display	display		
		 Real mode/virtual mode switching request flag (M2043) turned OFF → ON in the state which all axes have not stopped. (Operation system software version "00G" or before) 	 Turn real mode/virtual mode switching request flag (M2043) OFF → ON when start accept flag (M2001 to M2032) are all OFF. (Operation system software version "00G" or before)
1	0001	 Real mode/virtual mode switching request flag (M2043) turned OFF → ON in the state which output axis set in the mechanical system program has not stopped. (Operation system software version "00H" or later) 	 Turn real mode/virtual mode switching request flag (M2043) OFF → ON when start accept flag (M2001 to M2032) of output axis set in the mechanical system program are all OFF. (The real mode axis can be switched in even operation.) (Operation system software version "00H" or later)
		 Real mode/virtual mode switching request flag (M2043) turned ON → OFF in the state which all axes have not stopped. (Operation system software version "00G" or before) 	 Turn real mode/virtual mode switching request flag (M2043) ON → OFF when start accept flag (M2001 to M2032) are all OFF. (Operation system software version "00G" or before)
256	0100	 Real mode/virtual mode switching request flag (M2043) turned ON → OFF in the state which virtual axis has not stopped. (Operation system software version "00H" or later) 	 Turn real mode/virtual mode switching request flag (M2043) ON → OFF when start accept flag (M2001 to M2032) of virtual axis are all OFF. (The real mode axis can be switched in even operation.) (Operation system software version "00H" or later)
		 Real mode/virtual mode switching request flag (M2043) turned ON → OFF in the state which virtual axis has not stopped. Real mode/virtual mode switching request flag (M2043) turned ON → OFF in the state which output module is speed-torque control". 	 Turn real mode/virtual mode switching request flag (M2043) ON → OFF when start accept flag (M2001 to M2032) of output axis set in the mechanical system program are all OFF. (The real mode axis can be switched in even operation.) Turn real/virtual mode switching request flag (M2043) ON → OFF when all output modules are in the position control.
512	0200	 Real mode/virtual mode switching request flag (M2043) turned OFF → ON in the state which mechanical system program has not registered. Real mode/virtual mode switching request flag (M2043) 	Write the mechanical system program to the Motion CPU. Set the same axis No. at both the system
		turned OFF \rightarrow ON in the state which the axis No. set in the system setting does not match the output axis No. set in the mechanical system program.	settings and mechanical system program, then write the data to the Motion CPU.
513 ^(Note)	0201	 Real mode/virtual mode switching request flag (M2043) turned OFF → ON in the state which the PLC ready flag (M2000) or PCPU READY complete flag (SM500) is OFF. 	 After turning the PLC ready flag and PCPU READY flags on, turn real mode/virtual mode switching request flag (M2043) OFF → ON.
514 ^(Note)	0202	• Real mode/virtual mode switching request flag (M2043) turned OFF \rightarrow ON in the state which the all-axes servo ON command (M2042) is OFF.	• Turn all axes servo ON command (M2042) on, turn the all-axes servo ON accept flag on, then turn real mode/virtual mode switching request flag (M2043) OFF \rightarrow ON.

Table 1.22 Real Mode/Virtual Mode Switching Error Code List

(Note): Error axis No. information is not set to SD505, SD506 in this error.

Error codes st	ored in SD504		
Decimal	Hexadecimal	Error description	Corrective action
display	display		
515 ^(Note)	0203	 Real mode/virtual mode switching request flag (M2043) turned OFF → ON in the state which the external forced stop input signal (EMG) is ON. 	• Turn the external forced stop signal off, then turn real mode/virtual mode switching request flag (M2043) OFF \rightarrow ON switching.
516 ^(Note)	0204	 Real mode/virtual mode switching request flag (M2043) turned OFF → ON during the servo start processing by the servo error reset command (M3208+20n). 	 When the servo error reset is executed by turning servo error reset command (M3208+20n) on, turn the servo error detection signal (M2408+20n) off, then turn real mode/virtual mode switching request flag (M2043) OFF → ON.
768	0300	 Real mode/virtual mode switching request flag (M2043) turned OFF → ON in the state which the home position return signal is turning on for the output module is other than the roller. 	 Execute the home position return (execute ZERO in the servo program), and turn real mode/virtual mode switching request flag (M2043) OFF → ON after home position return request signal (M2409+20n) has turned OFF.
1024	0400	 Real mode/virtual mode switching request flag (M2043) turned OFF → ON in the state (M2408+20n ON) of the servo error. 	 Check the servo amplifier, servo motor and wiring, etc.
1280	0500	 Real mode/virtual mode switching request flag (M2043) turned OFF → ON in the state which the units set in the fixed parameter and output module are different for the output module is other than the roller. 	 Correct the setting unit of the fixed parameter or output module, and write to the Motion CPU.
1536	0600	• Real mode/virtual mode switching request flag (M2043) turned OFF \rightarrow ON in the state which cam data has not registered although the cam is set to the output module.	 Write the cam data to the Motion CPU.
2048	0800	 Real mode/virtual mode switching request flag (M2043) turned OFF → ON without the cam No. setting to the cam No. setting device. (Cam No. setting device is "0"). 	 Turn real mode/virtual mode switching request flag (M2043) OFF → ON after writing the cam No. set in the cam No. used of cam parameter to the cam No. setting device.
2304	0900	• The setting value of cam stroke amount setting device is outside the range of 1 to (2 ³¹ -1).	• Turn real mode/virtual mode switching request flag (M2043) OFF \rightarrow ON after setting the value within the range of 1 to (2 ³¹ -1) to the cam stroke amount setting device.
2816	0B00	 The cam stroke amount setting device is not an even number. 	• Set an even number to the cam stroke amount setting device.
3072	0C00	 Setting for real mode axis is not correct. 	 Execute "conversion and save" after setting real mode axis setting in the mechanical system program editor.
3328	0D00	• The number of pulses per revolution of the rotary table is outside the range of 1 to 1073741824.	• Correct the number of pulses per revolution and the travel value per revolution in the fixed parameter within the range of 1 to 1073741824 to the number of pulses per revolution of the rotary table.
-4094 ^(Note)	F002	 The PLC ready flag (M2000) turned off, and the system returned to the real mode during virtual mode operation. The Motion CPU stopped during virtual mode operation. 	Turn PLC ready flag (M2000) on. Set the Motion CPU "RUN" state.
-4095 ^(Note)	F001	• The servo error detection signal (M2408+20n) turned off, and the system returned to the real mode during virtual mode operation.	 Check the servo error code register to determine the error cause at the axis in question, then release the error cause (Refer to APPENDIX 1.5).
-4096 (Note)	F000	The forced stop signal (EMG) turned on, and the system returned to the real mode	Turn the forced stop signal off.

Table 1.22 Real Mode/Virtual Mode Switching Error Code List (Continued)

(Note): Error axis No. information is not set to SD505, SD506 in this error.

APPENDIX 2 Setting Range for Indirect Setting Devices

Positioning address, command speed or M-code, etc. (excluding the axis No.) set in the servo program can be set indirectly by the word.

(1) Device range

The number of device words and device range at indirect setting are shown below.

\setminus		Item	Number of device words			Device setting range	Remarks
	Parameter bloo	xk No.	1				
_	Address (trave	l value)	2	-			
Б Ш	Command spe	ed	2	Devic	е	Range	
с С	Dwell time		1	D		0 to 8191 ^(Note-1)	
0	M-code		1	W		0000 to 1FFF	
	Torque limit va	lue	1	#		0 to 7999	
	Auxiliary point		2	U□\G	;	10000 to (10000+p-1) ^(Note-2)	
ę	Radius		2				
₹	Central point		2				
	Pitch		1				
	Control unit		1				
	Speed limit val	ue	2				
	Acceleration tir	ne	1				
	Deceleration til	ne	1				
	Rapid stop dec	eleration time	1				
성	S-curve ratio		1				
r blo		Acceleration/deceleration	4				
lete	Advanced	system	1				
ram	S-curve	Acceleration section 1 ratio	1				
Ра	acceleration/	Acceleration section 2 ratio	1				
	deceleration	Deceleration section 1 ratio	1				
		Deceleration section 2 ratio	1				
	Torque limit va	lue	1				
	Deceleration p	rocessing on STOP input	1				
	Allowable error	range for circular interpolation	2				
	Command spee	ed (Constant speed)	2				
	FIN acceleration	on/deceleration	1				
	Fixed position s	stop acceleration/deceleration	1				
	time		1				
	Repetition con	dition (Number of repetitions)	1				
	Repetition con	dition (ON/OFF)					
lers	Cancel			Devic	е	Range	
Oth	Skip			Х		0000 to 1FFF (Note-3)	
	WAIT ON/OFF			Y		0000 to 1FFF	
	Fixed position	stop	Bit	М		0 to 8191 ^(Note-1)	
				В		0000 to 1FFF	
				F		0 to 2047	
				U 🗆 \C	6	10000.0 to (10000+p-1).F (Note-2)	

(Note-1): Synchronous encoder axis area cannot be set.

(Note-2): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU. (Note-3): The range of "PXn+4 to PXn+F" cannot be used (fixed at 0) for the input device (PXn+0 to PXn+F)

allocated to the built-in interface in Motion CPU (DI). (n: First input No.)

POINT

- (1) Be sure to set even-numbered devices of the items set as 2-word.Be sure to set as 32-bit integer type when the data is set in these devices using the Motion SFC programs. (Example : #0L, D0L)
- (2) Refer to Chapter 2 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for the user setting area points of the Multiple CPU high speed transmission area.

(2) Inputting device data

Indirect setting device data is inputted by the Motion CPU at the servo program start.

Do not change the applicable device before setting to device and start completion.

The procedures by start method for setting data to devices and cautions are shown below.

Start method	Setting method	Notes
Start by the servo program	Set data in indirect setting devices. ↓ Start the servo program.	Do not change the indirect setting device before the "positioning start complete signal" of the starting axis turns on.
Set the loop (FOR - NEXT) point data for CPSTART instruction indirectly	Set initial command data in the indirect setting device. Start using the servo program (or turn the cancel command device on). Read the value of "data set pointer for constant-speed control" of the start axis, and update the data input by Motion CPU.	Refer to the positioning signal data register "Monitoring data area" for details.

APPENDIX 3 Processing Times of the Motion CPU

The processing time of each signal and each instruction for positioning control in the Multiple CPU system is shown below.

(1) Motion operation cycle [ms] (Default)

(a) Q173DSCPU/Q172DSCPU

	(Q173DSCPL	Q172DSCPU		
Number of setting axes (SV22)	1 to 6	7 to 16	17 to 32	1 to 6	7 to 16
Operation cycle [ms]	0.44	0.88	1.77	0.44	0.88

(b) Q173DCPU(-S1)/Q172DCPU(-S1)

		Q173DC	Q172DCPU(-S1)			
Number of setting axes (SV22)	1 to 4	5 to 12	13 to 28	29 to 32	1 to 4	5 to 8
Operation cycle [ms]	0.44	0.88	1.77	3.55	0.44	0.88

(2) CPU processing time [ms]

The instruction processing time means the time until the content is reflected to servo amplifier side after each instruction is executed.

(Including the transmission time between Motion controller and servo amplifier.)(a) Q173DSCPU/Q172DSCPU

		Q173DSCPU/Q172DSCPU					
Ор	eration cycle [ms]	0.22	0.44	0.88	1.77	3.55	7.11
Servo program	"WAIT ON/OFF" + Motion control step	0.44	0.88	1.77	2.66	4.44	7.99
start processing	Only Motion control step	0.6 to 0.9	1.0 to 1.4	1.9 to 2.8	2.8 to 4.6	4.6 to 8.2	8.1 to 15.2
time ^(Note-1)	Dedicated instruction (D(P).SVST) from the PLC CPU	1.4 to 2.3	2.2 to 3.1	3.5 to 4.4	5.3 to 6.2	8.8 to 9.7	16.0 to 16.9
Speed change	Instruction (CHGV) from the Motion SFC	0.4 to 0.9	0.8 to 1.3	1.7 to 2.6	2.6 to 4.4	4.4 to 8.0	8.0 to 15.1
response time	Dedicated instruction (D(P).CHGV) from the PLC CPU	1.4 to 2.3	1.7 to 2.6	2.6 to 3.5	3.5 to 4.4	5.3 to 6.2	8.9 to 9.8
Torque limit value	Instruction (CHGT) from the Motion SFC	0.4 to 0.9	0.8 to 1.3	1.7 to 2.6	2.6 to 4.4	4.4 to 8.0	4.4 to 11.5
time	Dedicated instruction (D(P).CHGT) from the PLC CPU	1.4 to 2.3	1.7 to 2.6	2.6 to 3.5	3.5 to 4.4	5.3 to 6.2	5.3 to 9.7
Torque limit value	Instruction (CHGT2) from the Motion SFC	0.4 to 0.9	0.8 to 1.3	1.7 to 2.6	2.6 to 4.4	4.4 to 8.0	4.4 to 11.5
individual change response time	Dedicated instruction (D(P).CHGT2) from the PLC CPU	1.4 to 2.3	1.7 to 2.6	2.6 to 3.5	3.5 to 4.4	5.3 to 6.2	5.3 to 9.7
Target position change response time	Instruction (CHGP) from the Motion SFC	0.4 to 0.9	0.8 to 1.3	1.7 to 2.6	2.6 to 4.4	4.4 to 8.0	8.0 to 15.1
Time from PLC ready flag (M2000) ON to PCPU READY complete flag (SM500) ON		44 to 60					

(Note-1): FEED instruction varies greatly depending on the condition (whether other axes are operating).

		Q173DCPU(-S1)/Q172DCPU(-S1)						
Ор	eration cycle [ms]	0.44	0.88	1.77	3.55	7.11	14.2	
Servo program	"WAIT ON/OFF" + Motion control step	0.88	1.77	2.66	4.44	7.99	15.11	
start processing	Only Motion control step	1.0 to 1.4	1.9 to 2.8	2.8 to 4.6	4.6 to 8.2	8.1 to 15.2	15.2 to 29.4	
time ^(Note-1)	Dedicated instruction (D(P).SVST) from the PLC CPU	2.2 to 3.1	3.5 to 4.4	5.3 to 6.2	8.8 to 9.7	16.0 to 16.9	30.2 to 31.1	
Speed change	Instruction (CHGV) from the Motion SFC	0.8 to 1.3	1.7 to 2.6	2.6 to 4.4	4.4 to 8.0	8.0 to 15.1	15.1 to 29.3	
response time	Dedicated instruction (D(P).CHGV) from the PLC CPU	1.7 to 2.6	2.6 to 3.5	3.5 to 4.4	5.3 to 6.2	8.9 to 9.8	16.0 to 16.9	
Torque limit value	Instruction (CHGT) from the Motion SFC	0.8 to 1.3	1.7 to 2.6	2.6 to 4.4	4.4 to 8.0	4.4 to 11.5	4.4 to 18.6	
time	Dedicated instruction (D(P).CHGT) from the PLC CPU	1.7 to 2.6	2.6 to 3.5	3.5 to 4.4	5.3 to 6.2	5.3 to 9.7	5.3 to 16.0	
Time from PLC ready flag (M2000) ON to PCPU READY complete flag (SM500) ON		22 to 28						

(b) Q173DCPU(-S1)/Q172DCPU(-S1)

(Note-1): FEED instruction varies greatly depending on the condition (whether other axes are operating).

(3) Virtual servo motor axis/synchronous encoder axis operation cycle [ms] (Default)

(a) Q173DSCPU/Q172DSCPU

	(Q173DSCPL	Q172DSCPU		
Number of setting axes (SV22)	1 to 6	7 to 16	17 to 32	1 to 6	7 to 16
Virtual servo motor [ms]	0.44	0.88	1.77	0.44	0.88
Synchronous encoder [ms]	0.44	0.88	1.77	0.44	0.88

(b) Q173DCPU(-S1)/Q172DCPU(-S1)

		Q173D0	Q172DCPU(-S1)			
Number of setting axes (SV22)	1 to 4	5 to 12	13 to 28	29 to 32	1 to 4	5 to 8
Virtual servo motor [ms]	0.44	0.88	1.77	3.55	0.44	0.88
Synchronous encoder [ms]	0.44	0.88	1.77	3.55	0.44	0.88

APPENDIX 4 Device List

Axis No.	Device No.						Signa	l name					
1	M2400 to M2419												
2	M2420 to M2439	\setminus						Virtual					
3	M2440 to M2459	$\left \right\rangle$	Ci		Deel			Determ		Real	Refresh	Fetch	Signal
4	M2460 to M2479	1		gnai name	Real	Roller	Ball	Rotary	Cam	Mode	cycle	cycle	direction
5	M2480 to M2499						screw	lable		axis			
6	M2500 to M2519	0	Positioni	ng start complete			0						
7	M2520 to M2539	1	Positioni	ng complete			0	FF					
8	M2540 to M2559	2	In positio	2				~					
9	M2560 to M2579	2	in-positio	r 1			(5			Operation		
10	M2580 to M2599	3	Comman	d in-position							cycle		
11	M2600 to M2619	4	Speed co	ontrolling			0				Cycle		
12	M2620 to M2639	5	Speed / p	position switching			0						
13	M2640 to M2659	5	latch										
14	M2660 to M2679	6	Zero pas	s									
15	M2680 to M2699	7	Error det	ection							Immediately		
16	M2700 to M2719	8	Servo en	or detection	0					0	Operation		Status
17	M2720 to M2739	_			0					0	cycle		signal
18	M2740 to M2759	9	Home po	sition return							Main cycle		
19	M2760 to M2779	Ŭ	request								Main Oyolo		
20	M2780 to M2799	10	Home po	sition return			(~			Operation		
21	M2800 to M2819		complete	۱ ۱)			cycle		
22	M2820 to M2839	11	1	FLS									
23	M2840 to M2859	12	2 External	RLS							Main cycle		
24	M2860 to M2879	13	3 signals	STOP							Main eyele	1/	
25	M2880 to M2899	14	1	DOG/CHANGE								-//	
26	M2900 to M2919	15	5 Servo rea	ady							Operation		
27	M2920 to M2939	16	3 Torque li	miting							cycle		
28	M2940 to M2959	17	7 Unusable)	_			_			—		
29	M2960 to M2979		Virtual mode continuation								At virtual	/	
30	M2980 to M2999	18 operation disable warning					(C			mode		Status
31	M3000 to M3019	(Note-1)						0	transition	/	signal		
32	M3020 to M3039	19 M-code outputting OFF								Operation	/		
		Ľ									cycle	/	
													\bigcirc : Valid

(1) Axis status list

(Note-1): It is unusable in the SV22 real mode.

POINT

(1) The following range is valid.

- Q172DSCPU : Axis No.1 to 16
- Q172DCPU(-S1): Axis No.1 to 8
- (2) The following device area can be used as a user device.
 - Q172DSCPU : 17 axes or more
 - Q172DCPU(-S1): 9 axes or more

However, when the project of Q172DSCPU/Q172DCPU(-S1) is replaced with Q173DSCPU/Q173DCPU(-S1), this area cannot be used as a user device.

Axis No.	Device No.				Signal name								
1	M3200 to M3219												
2	M3220 to M3239	Ν	1					Virtual					
3	M3240 to M3259	ľ	\	0:			D - II	_		Real	Refresh	Fetch	Signal
4	M3260 to M3279			Signai name	Rea	Roller	Ball	Rotary	Cam	mode	cycle	cycle	direction
5	M3280 to M3299		/				screw	table		axis			
6	M3300 to M3319		0	Stop command								Operation	
7	M3320 to M3339		1	Rapid stop command								cycle	
8	M3340 to M3359		2	Forward rotation JOG start	t								
9	M3360 to M3379		Z	command									
10	M3380 to M3399		2	Reverse rotation JOG]							Main	Command
11	M3400 to M3419		3	start command	0)	×		0		cycle	signal
12	M3420 to M3439		1	Complete signal OFF									
13	M3440 to M3459		4	command							/		
14	M3460 to M3479		5	Speed/position switching							/	Operation	
15	M3480 to M3499		5	enable command							/	cycle	
16	M3500 to M3519	L	6	Unusable					—				
17	M3520 to M3539	ŀ	7	Error reset command							/	Main	
18	M3540 to M3559		8	Servo error reset		0					cycle	Command	
19	M3560 to M3579	ŀ	0	command	0				0		Cycle	signal	
20	M3580 to M3599		9	External stop input disable							/	At start	Signal
21	M3600 to M3619	╷┟		at start command		<u> </u>		×			/	AUSIAN	
22	M3620 to M3639	Ľ	10	Unusable			-	_				_	_
23	M3640 to M3659	Ľ	11			Ļ							
24	M3660 to M3679		12	Feed current value update								At start	
25	M3680 to M3699	╞		command		Ļ		× 1		0		/ it otart	
26	M3700 to M3719		13	Address clutch reference					`			∆t virtual	
27	M3720 to M3739	╞		setting command (Note-1)			×			·		mode	
28	M3740 to M3759		14	Cam reference position	~		\checkmark			X		transition	
29	M3760 to M3779	╞		setting command (Note-1)	<u> </u>	ļ	^		0			•	
30	M3780 to M3799		15	Servo OFF command								Operation	Command
31	M3800 to M3819	╷┝			4					cycle	signal		
32	M3820 to M3839	ľ	16	Gain changing command	4					Operation			
			17	PI-PID switching	0	0		0		cycle			
		┢			-					(11010-2)			
		•	18								/	Operation	
		F	10	EIN signal	-			~			/	cycle	
		L	10			<u> </u>		~		l		⊖ · Valio	l ∨ · Invalid

(2) Axis command signal list

(Note-1): It is unusable in the SV22 real mode.

(Note-2): Operation cycle 7.1[ms] or more: Every 3.5[ms]

POINT
(1) The following range is valid.
Q172DSCPU : Axis No.1 to 16
• Q172DCPU(-S1): Axis No.1 to 8
(2) The following device area can be used as a user device.
Q172DSCPU : 17 axes or more
Q172DCPU(-S1): 9 axes or more
However, when the project of Q172DSCPU/Q172DCPU(-S1) is replaced with
Q173DSCPU/Q173DCPU(-S1), this area cannot be used as a user device.

Axis No.	Device No.					5	Signal n	ame						
1	M4000 to M4019	_												
2	M4020 to M4039	Ν						Virtual						
3	M4040 to M4059			Signal name	Deel		Dell	Datawa		Real	Refresh	Fetch	Signal	
4	M4060 to M4079		\setminus	Signal hame	Real	Roller	Ball	Rolary	Cam	mode	cycle	cycle	direction	
5	M4080 to M4099						SCIEW	lable		axis				
6	M4100 to M4119	C)	Positioning start complete	Bookup			0			Operation		Status	
7	M4120 to M4139	1	1	Positioning complete	Баскир		(0		×	cycle		signal	
8	M4140 to M4159	2	2	Unusable	_		_	_		—	_	_	—	
9	M4160 to M4179	3	3	Command in-position	Bookup			0			Operation		Status	
10	M4180 to M4199	4	1	Speed controlling	Баскир		()		×	cycle		signal	
11	M4200 to M4219	5	5	Linucabla										
12	M4220 to M4239	6	3	Ullusable	_									
13	M4240 to M4259	-	,	Error detection	Backup			~			Immedi-		Status	
14	M4260 to M4279	Ľ	'		Баскир		(5		×	ately		signal	
15	M4280 to M4299	8	3											
16	M4300 to M4319	ę	9											
17	M4320 to M4339	1	0											
18	M4340 to M4359	1	1											
19	M4360 to M4379	1	2											
20	M4380 to M4399	1	3	Unusable	—		-	_		-		—	—	
21	M4400 to M4419	1	4											
22	M4420 to M4439	1	5											
23	M4440 to M4459	1	6											
24	M4460 to M4479	1	7											
25	M4480 to M4499	1	8											
26	M4500 to M4519	1	q	M-code outputting	Backup						Operation		Status	
27	M4520 to M4539	Ľ	Ŭ	W code outputting	Buokup		(5		X	cycle		signal	
28	M4540 to M4559										0:	Valid,	\times : Invalid	
29	M4560 to M4579													
30	M4580 to M4599													
31	M4600 to M4619													
32	M4620 to M4639													

(3) Virtual servo motor axis status list

POINT

- (1) The following range is valid.
 - Q172DSCPU : Axis No.1 to 16
 - Q172DCPU(-S1): Axis No.1 to 8
- (2) The unused axis areas in the mechanical system program can be used as a user device.

Axis No.	Device No.						Sign	al name	•				
1	M4800 to M4819												
2	M4820 to M4839	Ν	1					Virtual					
3	M4840 to M4859		\setminus	Cirra el recorre e	Deel		Dell	Determ		Real	Refresh	Fetch	Signal
4	M4860 to M4879			Signal name	Real	Roller	Ball	Rolary	Cam	mode	cycle	cycle	direction
5	M4880 to M4899						sciew	lable		axis			
6	M4900 to M4919		0	Stop command								Operation	
7	M4920 to M4939		1	Rapid stop command							/	cycle	
8	M4940 to M4959		S	Forward rotation JOG									
9	M4960 to M4979		2	start command			,	~					Command
10	M4980 to M4999		2	Reverse rotation JOG	×		()		×		Main	signal
11	M5000 to M5019		5	start command							/	cycle	
12	M5020 to M5039		٨	Complete signal OFF							/		
13	M5040 to M5059		4	command							/		
14	M5060 to M5079		5	Linusable			_						_
15	M5080 to M5099		6	Ondsable									
16	M5100 to M5119		7	Error reset command			,	~				Main	Command
17	M5120 to M5139		'		X		()		X		cycle	signal
18	M5140 to M5159		8	Unusable	_		-	_		—	—		—
19	M5160 to M5179			External stop input									Command
20	M5180 to M5199		9	disable at start	×		(C		×		At start	signal
21	M5200 to M5219			command							/		olghai
22	M5220 to M5239	Ŀ	10										
23	M5240 to M5259		11										
24	M5260 to M5279		12										
25	M5280 to M5299		13										
26	M5300 to M5319		14	Unusable	—		-	_		—		—	—
27	M5320 to M5339	Ŀ	15										
28	M5340 to M5359	Ŀ	16										
29	M5360 to M5379	Ŀ	17										
30	M5380 to M5399	Ŀ	18										
31	M5400 to M5419		10	FIN signal			,	~				Operation	Command
32	M5420 to M5439	L	19		×		(J		×	\checkmark	cycle	signal
												⊖ : Valic	l, $ imes$: Invalid

(4) Virtual servo motor axis command signal list

POINT

(1) The following range is valid.

• Q172DSCPU : Axis No.1 to 16

- Q172DCPU(-S1): Axis No.1 to 8
- (2) The unused axis areas in the mechanical system program can be used as a user device.

Axis No.	Device No.				Sigr	nal name			
1	M4640 to M4643	_							
2	M4644 to M4647		/	Circuit name	Deel	ا من الله ال	Defrech evelo		Signal
3	M4648 to M4651			Signal name	Real	virtuai	Refresh cycle	Fetch cycle	direction
4	M4652 to M4655		0	Error detection			Immediately		
5	M4656 to M4659		1	External signal TREN					Status
6	M4660 to M4663		S	Virtual mode continuation operation	0	0	Main cycle		signal
7	M4664 to M4667		2	disable warning					
8	M4668 to M4671		3	Unusable	—	—	_	—	—
9	M4672 to M4675								\bigcirc : Valid
10	M4676 to M4679								
11	M4680 to M4683								
12	M4684 to M4687								

(5) Synchronous encoder axis status list

POINT

(1) The range of axis No.1 to 8 is valid in the Q172DCPU(-S1).

(2) The device area of 9 axes or more can be used as a user device in the Q172DCPU(-S1).

However, when the project of Q172DCPU(-S1) is replaced with

Q173DSCPU/Q172DSCPU/Q173DCPU(-S1), this area cannot be used.

(6) Synchronous encoder axis command signal list

Axis No.	Device No.			Sigr	nal name	9		
1	M5440 to M5443							
2	M5444 to M5447			Deel	Virtual	Defrech evele	Fotob ovolo	Signal
3	M5448 to M5451		Signal name	Real	virtual	Relifesh cycle	Feich cycle	direction
4	M5452 to M5455		Error react	×	-		Main avala	Status
5	M5456 to M5459	0		(Note-1)	0		Main cycle	signal
6	M5460 to M5463	1						
7	M5464 to M5467	2	Unusable	_	_	—	_	—
8	M5468 to M5471	3						
9	M5472 to M5475						\odot : Valid,	, \times : Invalid
10	M5476 to M5479	(No	ote-1): It is valid for the version (Refer to	Sectior	n 1.4) tha	t supports "synch	nronous encoder cu	urrent
11	M5480 to M5483		value monitor in real mode".					
12	M5484 to M5487							

POINT

(1) The range of axis No.1 to 8 is valid in the Q172DCPU(-S1).

(2) The device area of 9 axes or more can be used as a user device in the Q172DCPU(-S1).

However, when the project of Q172DCPU(-S1) is replaced with Q173DSCPU/Q172DSCPU/Q173DCPU(-S1), this area cannot be used.

Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction	Remark (Note-6)	Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction	Remark (Note-6)
M2000	PLC ready flag		Main cycle	Command	M3072	M2055					
M2001 M2002 M2003 M2004 M2005	Axis 1 Axis 2 Axis 3 Axis 4 Axis 5	~		Jignai		M2056 M2057 M2058 M2059 M2060	Unusable (6 points)	-	-	_	_
M2006 M2007 M2008 M2009 M2010 M2011 M2012 M2021 M2022 M20 M20	Axis 5 Axis 7 Axis 8 Axis 9 Axis 10 Axis 11 Axis 13 Axis 13 Axis 13 Axis 13 Axis 14 Axis 15 Axis 16 Axis 17 Axis 18 Axis 20 Axis 21 Axis 22 Axis 23 Axis 24 Axis 25 Axis 26 Axis 27 Axis 28 Axis 29 Axis 30 Axis 30 Axis 31 Axis 31	Operation cycle		Status signal (Note-1), (Note-2), (Note-4)		M2000 M2061 M2062 M2063 M2064 M2065 M2066 M2067 M2069 M2070 M2071 M2072 M2073 M2074 M2075 M2076 M2077 M2078 M2079 M2080 M2081 M2084 M2085 M2084 M2085 M2084 M2085 M2084	Axis 1 Axis 2 Axis 3 Axis 4 Axis 5 Axis 6 Axis 7 Axis 8 Axis 7 Axis 8 Axis 9 Axis 10 Axis 11 Axis 12 Axis 13 Axis 14 Axis 15 Axis 15 Axis 16 Axis 17 Axis 18 Axis 20 Axis 21 Axis 22 Axis 22 Axis 22 Axis 22 Axis 25 Axis 26 Axis 7	Operation cycle		Status signal (Note-1), (Note-2), (Note-3), (Note-4)	
M2032	Unusable	_	_	_	_	M2087	Axis 28 Axis 28				
M2034	Motion error history clear		Main cycle	Command	M3080	M2089	Axis 29 Axis 30		/		
M2036	Unusable			signai		M2091	Axis 31				
M2037	(2 points)	At debugging mode				M2092	Axis 32		/		
M2038	Motion SFC debugging flag	transition		status signal		M2093					
M2040	Speed switching point specified		At start	Command	M3073	M2095	•				
M2041	Tag System setting error flag	Operation cycle		signal Status signal		M2096					
M2042	All axes servo ON command		Operation cycle	Command	M3074	M2097	(8 points)	-	-	-	-
M2043	switching request (SV22) Real mode/virtual mode		transition	signal	M3075	M2098					
M2044	switching status (SV22) Real mode/virtual mode switching error detection signal (SV22)	At virtual mode transition		Status signal		M2000					
M2046	Out-of-sync warning (SV22)					M2101	Axis 1		/		
M2047	Motion slot fault detection flag JOG operation simultaneous	Operation cycle	Main surls	Command	M2076	M2102	Axis 2		/		
M2048	start command	Operation cycle	Main cycle	signal Status	M3076	M2103	Axis 3				
M2050	Unusable		_	signal	_	M2105	Axis 5 Synchronous		/	Status	
M2051	Manual pulse generator 1	/			M3077	M2106	Axis 6 value changing flag	Operation cycle		signal (Note-2),	
M2052	enable flag Manual pulse generator 2 enable flag		Main cycle	Command signal	M3078	M2107	(Note-5) Axis 7			(Note-4)	
M2053	Manual pulse generator 3			-	M3079	M2108	Axis 8		/		
M2054	Operation cycle over flag	Operation cycle		Status signal		M2109	Axis 9		/		

(7) Common device list

Device No.		Signal name	Refresh cycle	Fetch cycle	Signal direction	Remark (Note-6)	Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction	Remark (Note-6)
M2110	Axis 10	Synchronous			Status		M2179					
M2111	Axis 11	encoder current			signal		M2180					
M2112	Axis 12	value changing flag	operation cycle		(Note-2), (Note-4)		M2181					
	7000 12	(14018-3)		/	(14018-4)							
M2113							M2182					
M2114	-						M2183					
M2115	-						M2184					
M2116	-						M2185					
M2117	-						M2186					
M2110	-						IVIZ107					
M2120	Unusabl	e					M2190					
M2121	(15 poin	ts)	—	_	_	_	M2100					
M2122							M2191					
M2123	-						M2192					
M2124							M2193					
M2125							M2194					
M2126							M2195					
M2127							M2196					
M2128	Axis 1						M2197					
M2129	Axis 2]		/			M2198					
M2130	Axis 3]		/			M2199					
M2131	Axis 4			/			M2200	Unusable				
M2132	Axis 5			/			M2201	(45 points) (Note-7)	-	-	—	—
M2133	Axis 6			/			M2202					
M2134	Axis 7			/			M2203					
M2135	Axis 8			/			M2204					
M2136	Axis 9						M2205					
M2137	Axis 10						M2206					
M2138	Axis 11						M2207					
M2139	Axis 12						M2208					
M2140	Axis 13						M2209					
M2141	Axis 14				Status		M2210					
M2142	Axis 15				signal		M2211					
M2143	Axis 16	Automatic	Operation cycle		(Note-1),		M2212					
M2144	Axis 17	decelerating flag			(Note-2),		M2213					
M2145	Axis 18				(Note-3), (Note 4)		M2214					
M2146	Axis 19				(NOLE-4)		M2215					
M2147	Axis 20						M2216					
M2148	Axis 21						M2217					
M2149	Axis 22						M2218					
M2150	Axis 23						M2219					
M2151	Axis 24						M2221					
M2152	Axis 20						M22221					
M2154	Axis 27			/			M2223					
M2155	Axis 28			/			M2224		-			
M2156	Axis 29			/			M2225					
M2157	Axis 30			/			M2226					
M2158	Axis 31			/			M2227					
M2159	Axis 32			/			M2228					
M2160							M2229					
M2161							M2230					
M2162							M2231	Linunabla				
M2163							M2232	(16 points)	-	-	-	-
M2164							M2233	()				
M2165							M2234					
M2166							M2235					
M2167	-						M2236					
M2168							M2237					
M2160	Unusabl	e ta)					M22207					
1012109	(Note-7)	us)	_	_	_	_	1012230					
M2170							M2239	A-1-4		· · · · · ·		
M2171	-						M2240	Axis 1				
M2172							M2241	Axis 2			Status	
M2173							M2242	Axis 3			signal	
M2174							M2243	Axis 4 Speed change "0"	Operation cvcle		(Note-1),	
M2175							M2244	Axis 5 accepting flag	,		(Note-2),	
M2176							M2245	Axis 6			(Note-3),	
M2177							M2246	Axis 7		/	(11016-4)	
M2178							M2247	Axis 8		V		

Common device list (Continued)

Device No	Signal name	Refresh cycle	Fetch cycle	Signal	Remark (Note-6)	Device No	Signal name	Refresh cycle	Fetch cycle	Signal	Remark (Note-6)
No. M2248 M2249 M2250 M2251 M2252 M2253 M2254 M2255 M2256 M2257 M2258 M2259 M2259 M2259	Axis 9 Axis 10 Axis 11 Axis 12 Axis 13 Axis 14 Axis 14 Axis 15 Axis 16 Axis 17 Axis 18 Axis 19 Axis 20 Speed change "0" Axis 21 accepting flag	Refresh cycle	Fetch cycle	direction	(Note-6)	No. M2284 M2285 M2286 M2287 M2288 M2290 M2291 M2292 M2293 M2294 M2295 M2294 M2295 M2294	Axis 13 Axis 14 Axis 15 Axis 16 Axis 17 Axis 17 Axis 18 Axis 18 Axis 19 Axis 20 Axis 21 Axis 22 Control loop monitor Axis 23 status Axis 24 Axis 25	Refresh cycle Operation cycle	Fetch cycle	direction Status signal (Note-1), (Note-2), (Note-3), (Note-4)	(Note-6)
M2263 M2261 M2262 M2263 M2264 M2265 M2266 M2266 M2267 M2268 M2269 M2270 M2271	Axis 22 Axis 23 Axis 24 Axis 25 Axis 25 Axis 26 Axis 27 Axis 28 Axis 29 Axis 30 Axis 31 Axis 32	Operation cycle		Status signal (Note-1), (Note-2), (Note-3), (Note-4)		M2297 M2297 M2298 M2299 M2300 M2301 M2302 M2303 M2304 M2305 M2306 M2307	Axis 26 Axis 27 Axis 27 Axis 28 Axis 29 Axis 30 Axis 31 Axis 32				
M2272 M2273 M2274 M2275 M2276 M2277 M2278 M2279 M2280 M2281 M2282 M2283	Axis 1 Axis 2 Axis 3 Axis 4 Axis 5 Axis 6 Control loop Axis 7 monitor status Axis 8 Axis 10 Axis 11 Axis 12					M2308 M2309 M2310 M2311 M2312 M2313 M2314 M2315 M2316 M2316 M2317 M2318 M2319	Unusable (16 points)	_	_	_	-

Common device list (Continued)

(Note-1): The range of axis No.1 to 16 is valid in the Q172DSCPU.

(Note-2): The range of axis No.1 to 8 is valid in the Q172DCPU(-S1).

(Note-3): Device area of 17 axes or more is unusable in the Q172DSCPU.

(Note-4): Device area of 9 axes or more is unusable in the Q172DCPU(-S1).

(Note-5): It is unusable in the real mode.

(It can be used in the real mode for the version (Refer to Section 1.4) that supports "synchronous encoder current value monitor in real mode".)

(Note-6): It can also be ordered the device of a remark column.

(Note-7): These devices can be used as the clutch statuses.

The clutch status can also be set as the optional device at the clutch parameter. Refer to Section 7.2.2.

Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction	Remark (Note-1), (Note-2)
M3072	PLC ready flag		Main cycle		M2000
M3073	Speed switching point specified flag		At start		M2040
M3074	All axes servo ON command		Operation cycle		M2042
M0075	Real mode/virtual mode switching request		At virtual mode		M2042
M3075	(SV22)		transition	Commond	WI2043
M2076	JOG operation simultaneous start			signal	M2049
M3076	command			5	1012040
M3077	Manual pulse generator 1 enable flag				M2051
M3078	Manual pulse generator 2 enable flag		Main cycle		M2052
M3079	Manual pulse generator 3 enable flag				M2053
M3080	Motion error history clear request flag	/			M2035
M3081	Linux shis (Note-3)				
to		_	_	_	_
M3135	(55 points)				

(8) Common device list (Command signal)

(Note-1): The state of a device is not in agreement when the device of a remark column is turned ON/OFF directly. In addition, when the request from a data register and the request from the above device are performed simultaneously, the request from the above device becomes effective.

(Note-2): It can also be ordered the device of a remark column.

(Note-3): Do not use it as a user device. It can be used as a device that performs automatic refresh because of area for the reserve of command signal.

POINT

The device of a remark column turns ON by OFF to ON of the above device, and turns OFF by ON to OFF of the above device.

The command signal cannot be turned ON/OFF by the PLC CPU in the automatic refresh because the statuses and commands are mixed together in M2000 to M2053. Use the above devices in the case.

And, it can also be turned ON/OFF by the data register. (Refer to Section 4.2.8)

Axis No.	Device No.	No. Signal name											
1	D0 to D19	_											
2	D20 to D39	Ν					Virtua	l					
3	D40 to D59	$ \rangle$	0	Deal					Real	Refresh	Fetch	Signal	
4	D60 to D79	$ \rangle$	Signal name	Real	Roller	Ball	Rotary	Cam	mode	cycle	cycle	direction	
5	D80 to D99					screw	lable		axis				
6	D100 to D119	0	Feed current										
7	D120 to D139	1	value/roller cycle speed										
8	D140 to D159	2								Operation			
9	D160 to D179	3	Real current value							cycle			
10	D180 to D199	4	Doviation counter value			(С		0				
11	D200 to D219	5	Deviation counter value										
12	D220 to D239	6	Minor error code							Immodiately			
13	D240 to D259	7	Major error code							immediately			
14	D260 to D279	8	Servo error code	~	0					Main cycle		Monitor	
15	D280 to D299	0	Home position return	0					Backup			device	
16	D300 to D319	9	re-travel value		Backup				Баскир	Operation			
17	D320 to D339	10	Travel value after			Dav	жир			cycle			
18	D340 to D359	11	proximity dog ON										
19	D360 to D379	12	Execute program No.				. ,			At start			
20	D380 to D399	13	M-code				×		0	Operation			
21	D400 to D419	14	Torque limit value			(C			cycle	/		
22	D420 to D439	15	Data set pointer for				. ,			At start/	/		
23	D440 to D459	10	constant-speed control				X			during start			
24	D460 to D479	16	Unusable ^(Note-1)	_		_	_			_	_		
25	D480 to D499	17											
26	D500 to D519	18	Real current value at	0	Backup				0	Operation		Monitor	
27	D520 to D539	19	stop input					0	cycle		device		
28	D540 to D559									\bigcirc : Valid,	\times : Invalid		
29	D560 to D579												
30	D580 to D599												
31	D600 to D619												
32	D620 to D639												

(9) Axis monitor device list

(Note-1): It can be used as the travel value change register. The travel value change register can be set to the device optionally in the servo program.

Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)" for details.

POINT

- (1) The following range is valid.
 - Q172DSCPU : Axis No.1 to 16
 - Q172DCPU(-S1): Axis No.1 to 8
- (2) The following device area can be used as a user device.
 - Q172DSCPU : 17 axes or more
 - Q172DCPU(-S1): 9 axes or more

However, when the project of Q172DSCPU/Q172DCPU(-S1) is replaced with Q173DSCPU/Q173DCPU(-S1), this area cannot be used as a user device.

Axis No.	Device No.			Signal	name			
1	D640, D641	_						
2	D642, D643		Signal name	Deel	Virtual	Refresh	Fotob avala	Signal
3	D644, D645		Signarhame	Real	viituai	cycle	Felch cycle	direction
4	D646, D647	0	IOG speed setting	0	(At start	Command
5	D648, D649	1	JOG speed setting	0	0		Al statt	device
6	D650, D651							\bigcirc : Valid
7	D652, D653							
8	D654, D655							
9	D656, D657							
10	D658, D659							
11	D660, D661							
12	D662, D663							
13	D664, D665							
14	D666, D667							
15	D668, D669							
16	D670, D671							
17	D672, D673							
18	D674, D675							
19	D676, D677							
20	D678, D679							
21	D680, D681							
22	D682, D683							
23	D684, D685							
24	D686, D687							
25	D688, D689							
26	D690, D691							
27	D692, D693							
28	D694, D695							
29	D696, D697							
30	D698, D699							
31	D700, D701							
32	D702, D703							

(10) Control change register list

POINT

(1) The following range is valid.

- Q172DSCPU : Axis No.1 to 16
- Q172DCPU(-S1): Axis No.1 to 8
- $\ensuremath{\left(2\right)}$ The following device area can be used as a user device.
 - Q172DSCPU : 17 axes or more
 - Q172DCPU(-S1): 9 axes or more

However, when the project of Q172DSCPU/Q172DCPU(-S1) is replaced with Q173DSCPU/Q173DCPU(-S1), this area cannot be used as a user device.

Axis No.	Device No.		Signal name										
1	D800 to D809	_											_
2	D810 to D819	Ν						Virtual					
3	D820 to D829	$ \rangle$	۱.	0:	Deal					Real	Refresh	Fetch	Signal
4	D830 to D839		\backslash	Signal name	Real	Roller	Ball	Rotary	Cam	mode	cycle	cycle	direction
5	D840 to D849						screw	lable		axis			
6	D850 to D859	(C								Operation		
7	D860 to D869	-	1	Feed current value							cycle		
8	D870 to D879	2	2	Minor error code							Immodiately		
9	D880 to D889	3	3	Major error code							immediately		
10	D890 to D899	4	4	Execute program No.							At start		
11	D900 to D909	Ę	5	M-code	Bookup			_					Monitor
12	D910 to D919	6	6	Current value after virtual	Баскир		()		×			device
13	D920 to D929		7	servo motor axis main							Operation		
14	D930 to D939	'	(shaft's differential gear							operation		
15	D940 to D949	8	8	Error search output axis No.							Cycle	/	
16	D950 to D959		2	Data set pointer for								/	
17	D960 to D969		9	constant-speed control									
18	D970 to D979										0:	Valid,	imes : Invalid
19	D980 to D989												
20	D990 to D999												
21	D1000 to D1009												
22	D1010 to D1019												
23	D1020 to D1029												
24	D1030 to D1039												
25	D1040 to D1049												
26	D1050 to D1059												
27	D1060 to D1069												
28	D1070 to D1079												
29	D1080 to D1089												
30	D1090 to D1099												
31	D1100 to D1109												
32	D1100 to D1119												

(11) Virtual servo motor axis monitor device list

POINT

(1) The following range is valid.

- Q172DSCPU : Axis No.1 to 16
- Q172DCPU(-S1): Axis No.1 to 8
- (2) The unused axis areas in the mechanical system program can be used as a user device.

Axis No.	Device No.			Signal n	ame			
1	D1120 to D1129							
2	D1130 to D1139			Deal) (between 1	Refresh	Estable souls	Signal
3	D1140 to D1149		Signal name	Real	Virtual	cycle	Fetch cycle	direction
4	D1150 to D1159	0		Backup		Operation		
5	D1160 to D1169	1	Current value	(Note-1)	~	cycle		Monitor
6	D1170 to D1179	2	Minor error code	Bookup	0	Immediately		device
7	D1180 to D1189	3	Major error code	Баскир		Inimediately		
8	D1190 to D1199	4	Linuaghia					
9	D1200 to D1209	5	Onusable					
10	D1210 to D1219	6	Current value after synchronous encoder			Onesting		N. d. a. with a m
11	D1220 to D1229	7	axis main shaft's differential gear	Backup	0	Operation cycle		Nonitor
12	D1230 to D1239	8	Error search output axis No.					device
		9	Unusable	_		_	_	_
								\bigcirc : Valid
	(Note-1): It is valid for the version (Refer to Section 1.4) that supports "synchronous encoder current						er current	
\sim			value monitor in real mode".					

(12) Synchronous encoder axis monitor device list

POINT

(1) It is unusable in the SV22 real mode.

- (2) The range of axis No.1 to 8 is valid in the Q172DCPU(-S1).
- (3) The device area of 9 axes or more can be used as a user device. However, when the project of Q172DCPU(-S1) is replaced with Q173DSCPU/ Q172DSCPU/Q173DCPU(-S1), this area cannot be used.

Axis No.	Device No.				Signal n	ame				
1	D1240 to D1249									
2	D1250 to D1259		\setminus				Refresh	- ()	Signal	
3	D1260 to D1269			Signal name	Real	Virtual	cycle	Fetch cycle	direction	
4	D1270 to D1279		0	Unusable	_		_	_	_	
5	D1280 to D1289		1	Execute cam No.						
6	D1290 to D1299		2				Onerting		Manitan	
7	D1300 to D1309		3	Execute stroke amount	Backup	0	Operation		Ivionitor	
8	D1310 to D1319		4	Current value within 1 cam shaft			cycle		device	
9	D1320 to D1329		5	revolution						
10	D1330 to D1339		6							
11	D1340 to D1349		7	l leve able						
12	D1350 to D1359		8	Unusable	-	_	_	—	—	
13	D1360 to D1369		9							
14	D1370 to D1379	_							\bigcirc : Valid	
15	D1380 to D1389									
16	D1390 to D1399									
17	D1400 to D1409									
18	D1410 to D1419									
19	D1420 to D1429									
20	D1430 to D1439									
21	D1440 to D1449									
22	D1450 to D1459									
23	D1460 to D1469									
24	D1470 to D1479									
25	D1480 to D1489									
26	D1490 to D1499									
27	D1500 to D1509									
28	D1510 to D1519									
29	D1520 to D1529									
30	D1530 to D1539									
31	D1540 to D1549									
32	D1550 to D1559									

(13) Cam axis monitor device list

POINT

(1) The following range is valid.

- Q172DSCPU : Axis No.1 to 16
- Q172DCPU(-S1): Axis No.1 to 8
- (2) The unused axis areas in the mechanical system program can be used as a user device.

Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction	Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction	
D704	PLC ready flag request				D752	Manual pulse generator 1 smoothing magnification setting register				
D705	Speed switching point specified flag request			Command	D753	Manual pulse generator 2 smoothing magnification setting register		At the manual pulse generator enable flag OFF to ON		
D706	All axes servo ON command request		Main cycle	device	D754	Manual pulse generator 3 smoothing magnification setting register			Command device	
D707	Real mode/virtual mode switching request (SV22)				D755	Manual pulse generator 1 enable flag request				
D708	start command request	/			D756	enable flag request		Main cycle		
D709	Unusable	_	_	-	D757	Manual pulse generator 3 enable flag request	/			
D710 D711 D712 D713	JOG operation simultaneous start axis setting register		At start		D758 D759 D760 D761					
D714 D715	Manual pulse generator axis 1 No. setting register				D762 D763					
D716 D717	Manual pulse generator axis 2 No. setting register				D764 D765					
D718	Manual pulse generator axis				D766					
D719 D720	Axis 1				D767 D768					
D721	Axis 2				D769					
D722	Axis 3 Axis 4					D771				
D724	Axis 5				D772					
D725	Axis 6				D773					
D726 D727	Axis 7 Axis 8				D774					
D728	Axis 9				D776					
D729	Axis 10				D777					
D730	Axis 11			Command	D778	Unusable	_	_	_	
D731	Axis 12		At the manual pulse	device	D779	(42 points)				
D732	Axis 13		generator enable flag		D780					
D734	Axis 15 Manual pulse		OFF to ON		D782					
D735	Axis 16 generators 1 pulse				D783					
D736	Axis 17 setting register				D784					
D737	Axis 18 (Note-1), (Note-2)				D785					
D738	Axis 19				D786					
D739	Axis 20 Axis 21				D787					
D741	Axis 22				D789					
D742	Axis 23				D790					
D743	Axis 24				D791					
D744	Axis 25				D792					
D745	Axis 26				D793					
D746	Axis 27				D794					
D748	Axis 20 Axis 29	/			D795					
D749	Axis 30	1			D797					
D750	Axis 31	/			D798					
D751	Axis 32	/			D799					

(14) Common device list

(Note-1): The following range is valid.

• Q172DSCPU : Axis No.1 to 16

• Q172DCPU(-S1) : Axis No.1 to 8

(Note-2): The following device area is unusable. • Q172DSCPU : 17 axes or more

• Q172DCPU(-S1) : 9 axes or more

Axis No.	Device No.	Signal name						
1	#8000 to #8019	_						
2	#8020 to #8039		Signal name	Defrech evelo	Signal direction			
3	#8040 to #8059		Signai name Reliesh cycle		Signal direction			
4	#8060 to #8079	0	Servo amplifier type	When the servo amplifier power-on				
5	#8080 to #8099	1	Motor current value	Operation such 1.7[ma] or loss				
6	#8100 to #8119	2	Motor spood	Operation cycle 3.5[ms] or more : 3.5[ms]				
7	#8120 to #8139	3	Motor speed					
8	#8140 to #8159	4	Command speed	Command speed Operation cycle				
9	#8160 to #8179	5						
10	#8180 to #8199	6	Home position return re-	Home position return re- travel value At home position return re-travel				
11	#8200 to #8219	7	travel value					
12	#8220 to #8239	8	Servo amplifier display servo					
13	#8240 to #8259	0	error code	Main cycle				
14	#8260 to #8279	9	Parameter error No. QDS					
15	#8280 to #8299	10	Servo status1 QDS	Operation cycle 1 7[ms] or less . Operation cycle				
16	#8300 to #8319	11	Servo status2	Operation cycle 3.5[ms] or more : 3.5[ms]				
17	#8320 to #8339	12	Servo status3					
18	#8340 to #8359	13	_					
19	#8360 to #8379	14						
20	#8380 to #8399	15	Unusable	—	—			
21	#8400 to #8419	16						
22	#8420 to #8439	17						
23	#8440 to #8459	40	Ourse status 7 ODS/ Ver	Operation cycle 1.7[ms] or less : Operation cycle	Manifest devices			
24	#8460 to #8479	18	Servo status/	Operation cycle 3.5[ms] or more : 3.5[ms]	Monitor device			
25	#8480 to #8499	19	Unusable	_	_			
26	#8500 to #8519							
27	#8520 to #8539							
28	#8540 to #8559							
29	#8560 to #8579							
30	#8580 to #8599							
31	#8600 to #8619							
32	#8620 to #8639							

(15) Motion register list (#)

(16) Product information list devices (#8736 to #8751)

Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction
#8736				
to	Operating system software version			
#8743		At power supply		Manitan daviaa
#8744		ON		Monitor device
to	Motion CPU module serial number			
#8751				

Ver. Refer to Section 1.4 for the software version that supports this function.

(17) Special relay list

Device No.	Signal name	Refresh cycle	Fetch cycle	Signal type
SM500	PCPU READY complete flag	Main mala	/	
SM501	TEST mode ON flag	Main cycle		
SM502	External forced stop input flag	Operation cycle		
SM503	Digital oscilloscope executing flag	Main cycle		
SM506	External forced stop input ON latch flag 🕬	Operation cycle		Otatus simul
SM508	Amplifier-less operation status flag			Status signal
SM510	TEST mode request error flag			
SM512	Motion CPU WDT error flag	Main cycle		
SM513	Manual pulse generator axis setting error flag		/	
SM516	Servo program setting error flag		/	

(18) Special register list

Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction	
SD200	State of switch		/		
SD500	De el me de evie information register (C) (22)	Main cycle	/		
SD501	Real mode axis information register (SV22)		/		
SD502	Convo emplifier leading information	At power supply on/			
SD503		operation cycle			
SD504	De el mondo (rintro el mondo escritorio el encor		/		
SD505	Real mode/virtual mode switching error	At virtual mode transition			
SD506			/		
SD508	SSCNET control (status)	Main cycle			
SD510	Test mode request error information	At test made request		Monitor device	
SD511		At test mode request			
SD512	Motion CPU WDT error cause	At Motion CPU			
		WDT error occurrence	/		
SD513	Manual nulse generator axis setting error	At the manual nulse generator			
SD514	information	enable flag OFF to ON			
SD515					
SD516	Error program No.	At start			
SD517	Error item information		/		
SD522	Motion operation cycle	Operation cycle			
SD523	Operation cycle of the Motion CPU setting	At power supply on			
SD524	Maximum Motion operation cycle	Operation cycle			
SD550		At System setting error			
SD551	System setting error information	occurrence]/		
SD560	Operation method QDS(Ver	At power supply on	V		
SD803	SSCNET control (command)		Main cycle	Command device	

Ver. Refer to Section 1.4 for the software version that supports this function.

WARRANTY

Please confirm the following product warranty details before using this product.

1. Gratis Warranty Term and Gratis Warranty Range

We will repair any failure or defect hereinafter referred to as "failure" in our FA equipment hereinafter referred to as the "Product" arisen during warranty period at no charge due to causes for which we are responsible through the distributor from which you purchased the Product or our service provider. However, we will charge the actual cost of dispatching our engineer for an on-site repair work on request by customer in Japan or overseas countries. We are not responsible for any on-site readjustment and/or trial run that may be required after a defective unit is repaired or replaced.

[Gratis Warranty Term]

The term of warranty for Product is thirty six (36) months after your purchase or delivery of the Product to a place designated by you or forty two (42) months from the date of manufacture whichever comes first "Warranty Period". Warranty period for repaired Product cannot exceed beyond the original warranty period before any repair work.

[Gratis Warranty Range]

- (1) You are requested to conduct an initial failure diagnosis by yourself, as a general rule.
 - It can also be carried out by us or our service company upon your request and the actual cost will be charged. However, it will not be charged if we are responsible for the cause of the failure.
- (2) This limited warranty applies only when the condition, method, environment, etc. of use are in compliance with the terms and conditions and instructions that are set forth in the instruction manual and user manual for the Product and the caution label affixed to the Product.
- (3) Even during the term of warranty, the repair cost will be charged on you in the following cases;
 - 1) A failure caused by your improper storing or handling, carelessness or negligence, etc., and a failure caused by your hardware or software problem
 - 2) A failure caused by any alteration, etc. to the Product made on your side without our approval
 - 3) A failure which may be regarded as avoidable, if your equipment in which the Product is incorporated is equipped with a safety device required by applicable laws and has any function or structure considered to be indispensable according to a common sense in the industry
 - 4) A failure which may be regarded as avoidable if consumable parts designated in the instruction manual, etc. are duly maintained and replaced
 - 5) Any replacement of consumable parts (battery, fan, etc.)
 - 6) A failure caused by external factors such as inevitable accidents, including without limitation fire and abnormal fluctuation of voltage, and acts of God, including without limitation earthquake, lightning and natural disasters
 - 7) A failure generated by an unforeseeable cause with a scientific technology that was not available at the time of the shipment of the Product from our company
 - 8) Any other failures which we are not responsible for or which you acknowledge we are not responsible for

2. Onerous Repair Term after Discontinuation of Production

- (1) We may accept the repair at charge for another seven (7) years after the production of the product is discontinued.
- The announcement of the stop of production for each model can be seen in our Sales and Service, etc.
- (2) Please note that the Product (including its spare parts) cannot be ordered after its stop of production.

3. Service in overseas countries

Our regional FA Center in overseas countries will accept the repair work of the Product; However, the terms and conditions of the repair work may differ depending on each FA Center. Please ask your local FA center for details.

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. Change of Product specifications

Specifications listed in our catalogs, manuals or technical documents may be changed without notice.

6. Precautions for Choosing the Products

- (1) For the use of our Motion controller, its applications should be those that may not result in a serious damage even if any failure or malfunction occurs in Motion controller, and a backup or fail-safe function should operate on an external system to Motion controller when any failure or malfunction occurs.
- (2) Our Motion controller is designed and manufactured as a general purpose product for use at general industries. Therefore, applications substantially influential on the public interest for such as atomic power plants and other power plants of electric power companies, and also which require a special quality assurance system, including applications for railway companies and government or public offices are not recommended, and we assume no responsibility for any failure caused by these applications when used.

In addition, applications which may be substantially influential to human lives or properties for such as airlines, medical treatments, railway service, incineration and fuel systems, man-operated material handling equipment, entertainment machines, safety machines, etc. are not recommended, and we assume no responsibility for any failure caused by these applications when used.

We will review the acceptability of the abovementioned applications, if you agree not to require a specific quality for a specific application. Please contact us for consultation.

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<u>IB(NA)-0300137-K(1912)MEE</u> MODEL: Q173D-P-SV22-KASO-E MODEL CODE: 1XB931

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Specifications subject to change without notice.