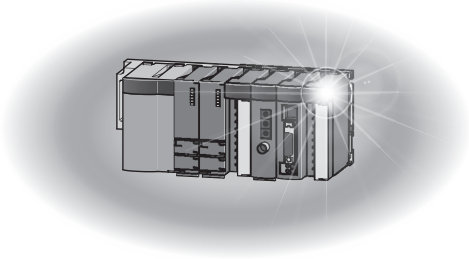
MITSUBISHI ELECTRIC

Programmable Controller

MELSEC Q series

Channel Isolated Analog-Digital Converter Module/ Channel Isolated Analog-Digital Converter Module (With Signal Conditioning Function) User's Manual

-Q68AD-G
-Q66AD-DG
-GX Configurator-AD (SW2D5C-QADU-E)



●SAFETY PRECAUTIONS●

(Read these precautions before using this product.)

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

In this manual, the safety precautions are classified into two levels: "⚠WARNING" and "⚠CAUTION".

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

Under some circumstances, failure to observe the precautions given under "⚠CAUTION" may lead to serious consequences.
Observe the precautions of both levels because they are important for personal and system safety.
Make sure that the end users read this manual and then keep the manual in a safe place for future reference.

[Design Precaution]

⚠WARNING

● Do not write any data to the "system area" or "write-protect area" of the buffer memory areas in the intelligent function module. Also, do not use any "prohibited to use" signals as an output signal to an intelligent function module from the programmable controller CPU.
Doing so may cause malfunction of the programmable controller system.

⚠CAUTION

● Do not bunch the control wires or communication cables with the main circuit or power wires, or install them close to each other.
They should be installed 100mm or more from each other.
Not doing so could result in noise that may cause malfunction.

[Security Precautions]

⚠WARNING

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

[Installation Precautions]

⚠CAUTION

● Use the programmable controller in an environment that meets the general specifications contained in the user's manual of the CPU module to use.
Using this programmable controller in an environment outside the range of the general specifications may cause electric shock, fire, malfunction, and damage to or deterioration of the product.

● While pressing the installation lever located at the bottom of module, insert the module fixing tab into the fixing hole in the base unit until it stops. Then, securely mount the module with the fixing hole as a supporting point.
For the Q66AD-DG, secure the module with fixing brackets after installation to the base unit.
When using the Q68AD-G in an environment where they are frequent vibrations, screw the module to the base unit after installation.

● Tighten the screws within the range of specified torque.
If the screws are loose, it may cause the module to fallout, short circuits, or malfunction.
If the screws are tightened too much, it may cause damage to the screw and/or the module, resulting in fallout, short circuits or malfunction.

● Be sure to shut off all phases of the external power supply used by the system before mounting or removing the module.
Not doing so may cause damage to the module.
In the system where a CPU module supporting the online module change is used and on the MELSECNET/H remote I/O stations, modules can be replaced online (during energizing).
However, there are some restrictions on replaceable modules and the replacement procedures are predetermined for each module.
For details, refer to the chapter of the online module change in this manual.

● Do not directly touch the conductive area or electronic components of the module.
Doing so may cause malfunction or failure in the module.

[Wiring Precautions]

⚠CAUTION

- Individually ground the FG terminal of the programmable controller with a ground resistance of 100Ω or less.
  Not doing so can cause an electric shock or malfunction.

- When turning on the power and operating the module after wiring is completed, always attach the terminal cover that comes with the product.
  There is a risk of electric shock if the terminal cover is not attached.

- Tighten the terminal screws within the range of specified torque.
  If the terminal screws are loose, it may result in short circuits or malfunction.
  If the terminal screws are tightened too much, it may cause damage to the screw and/or the module, resulting in short circuits or malfunction.

- Be careful not to let foreign matter such as sawdust or wire chips get inside the module.
  They may cause fires, failure or malfunction.

- The top surface of the module is covered with protective film to prevent foreign objects such as cable offcuts from entering the module when wiring.
  Do not remove this film until the wiring is complete.
  Before operating the system, be sure to remove the film to provide adequate ventilation.

[Starting and Maintenance Precautions]

⚠CAUTION

- Do not disassemble or modify the modules.
  Doing so could cause failure, malfunction injury or fire.

- Be sure to shut off all phases of the external power supply used by the system before mounting or removing the module.
  Not doing so may cause failure or malfunction of the module.
  In the system where a CPU module supporting the online module change is used and on the MELSECNET/H remote I/O stations, modules can be replaced online (during energizing).
  However, there are some restrictions on replaceable modules and the replacement procedures are predetermined for each module.
  For details, refer to the chapter of the online module change in this manual.

- Do not install/remove the module to/from the base unit more than 50 times after the first use of the product. (IEC 61131-2 compliant)
  Failure to do so may cause malfunction.

- Do not touch the connector while the power is on.
  Doing so may cause malfunction.

- Be sure to shut off all phases of the external power supply before cleaning or retightening the terminal screws or module fixing screws.
  Not doing so may cause failure or malfunction of the module.
  If the screws are loose, it may cause the module to fallout, short circuits, or malfunction.
  If the screws are tightened too much, it may cause damages to the screws and/or the module, resulting in the module falling out, short circuits or malfunction.

- Always make sure to touch the grounded metal to discharge the electricity charged in the body, etc., before touching the module.
  Failure to do so may cause a failure or malfunctions of the module.

[Disposal Precautions]

⚠CAUTION

- When disposing of this product, treat it as industrial waste.

●CONDITIONS OF USE FOR THE PRODUCT●

(1) MELSEC programmable controller ("the PRODUCT") shall be used in conditions;
i) where any problem, fault or failure occurring in the PRODUCT, if any, shall not lead to any major or serious accident; and
ii) where the backup and fail-safe function are systematically or automatically provided outside of the PRODUCT for the case of any problem, fault or failure occurring in the PRODUCT.

(2) The PRODUCT has been designed and manufactured for the purpose of being used in general industries.
MITSUBISHI ELECTRIC SHALL HAVE NO RESPONSIBILITY OR LIABILITY (INCLUDING, BUT NOT LIMITED TO ANY AND ALL RESPONSIBILITY OR LIABILITY BASED ON CONTRACT, WARRANTY, TORT, PRODUCT LIABILITY) FOR ANY INJURY OR DEATH TO PERSONS OR LOSS OR DAMAGE TO PROPERTY CAUSED BY the PRODUCT THAT ARE OPERATED OR USED IN APPLICATION NOT INTENDED OR EXCLUDED BY INSTRUCTIONS, PRECAUTIONS, OR WARNING CONTAINED IN MITSUBISHI ELECTRIC USER'S, INSTRUCTION AND/OR SAFETY MANUALS, TECHNICAL BULLETINS AND GUIDELINES FOR the PRODUCT.
("Prohibited Application")
Prohibited Applications include, but not limited to, the use of the PRODUCT in;
- Nuclear Power Plants and any other power plants operated by Power companies, and/or any other cases in which the public could be affected if any problem or fault occurs in the PRODUCT.
- Railway companies or Public service purposes, and/or any other cases in which establishment of a special quality assurance system is required by the Purchaser or End User.
- Aircraft or Aerospace, Medical applications, Train equipment, transport equipment such as Elevator and Escalator, Incineration and Fuel devices, Vehicles, Manned transportation, Equipment for Recreation and Amusement, and Safety devices, handling of Nuclear or Hazardous Materials or Chemicals, Mining and Drilling, and/or other applications where there is a significant risk of injury to the public or property.

Notwithstanding the above restrictions, Mitsubishi Electric may in its sole discretion, authorize use of the PRODUCT in one or more of the Prohibited Applications, provided that the usage of the PRODUCT is limited only for the specific applications agreed to by Mitsubishi Electric and provided further that no special quality assurance or fail-safe, redundant or other safety features which exceed the general specifications of the PRODUCTs are required. For details, please contact the Mitsubishi Electric representative in your region.

(3) Mitsubishi Electric shall have no responsibility or liability for any problems involving programmable controller trouble and system trouble caused by DoS attacks, unauthorized access, computer viruses, and other cyberattacks.

REVISIONS

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

Print Date	*Manual Number	Revision
Oct., 2006	SH (NA)-080647ENG-A	First edition
Jan., 2007	SH(NA)-080647ENG-B	Correction Section 3.3.2, 3.4.12, 4.6.2, 6.3.1, 6.3.2, 6.5.1, 6.5.2
Jan., 2008	SH(NA)-080647ENG-C	Correction SAFETY PRECAUTIONS, About the Generic Terms and Abbreviations, Section 1.1, Section 2.1, Section 2.3, Section 3.2.1, Section 3.4.1, Section 4.1, Section 4.4.2, Section 4.6.1, Section 4.6.2, Section 5.2.1, Section 5.2.2, Section 5.3.2, Section 5.3.3, Section 5.6.1, Section 5.6.4, Section 5.6.5, Section 7.3.3, Section 7.3.5, Section 8.1, Appendix 1, Appendix 1.1, Appendix 1.2, Appendix 1.3 Addition Section 2.2
May, 2008	SH(NA)-080647ENG-D	Correction SAFETY PRECAUTIONS, Compliance with the EMC and Low Voltage Directives, About the Generic Terms and Abbreviations, Section 2.1, 2.3, Section 3.1.1, 3.2.1, 3.2.4, Section 4.1, 4.3, Section 5.2.1, 5.2.2, 5.3.1, 5.3.2, 5.3.3, Chapter 7, Section 7.1
Oct., 2008	SH(NA)-080647ENG-E	Correction Section 2.1, Section 3.1.1, 3.1.2, 3.2, 3.2.1, 3.2.3, 3.2.6, 3.3.2, 3.4.1, 3.4.2, 3.4.4, 3.4.7, 3.4.9, 3.4.11, 3.4.12, 3.4.13, 3.4.22, Section 4.3, 4.5, Section 5.1, 5.4, Section 8.1, 8.2.4, 8.2.6, Appendix 1.1, 1.2, 1.3 Addition Appendix 2
Sep., 2011	SH(NA)-080647ENG-F	Correction SAFETY PRECAUTIONS, COMPLIANCE WITH THE EMC AND LOW VOLTAGE DIRECTIVES, Section 4.6.1, 4.6.2, 4.6.3, 6.2.1, 6.2.2, 6.2.3, 6.3, 6.3.1, 6.3.2, 6.4, 6.4.1, 6.4.2, 6.4.3, 6.5, 6.5.1, 6.5.2 Addition CONDITIONS OF USE FOR THE PRODUCT
Feb., 2012	SH(NA)-080647ENG-G	Correction SAFETY PRECAUTIONS, COMPLIANCE WITH THE EMC AND LOW VOLTAGE DIRECTIVES, Section 1.1, 2.1 to 2.3, 3.1.1, 3.1.2, 3.2, 3.2.1, 3.2.3, 3.2.4, 3.2.6, 3.3.2, 3.4.1, 3.4.2, 3.4.4, 3.4.5, 3.4.7, 3.4.10, 3.4.15 to 3.4.17, 3.4.19, 3.4.21, 3.4.22, 3.4.25, 4.1, 4.1.1, 4.3, 4.4.2, 4.5, 4.6.1, 4.6.2, 5.2.1, 5.2.2, 5.3.1, 5.3.3, 5.4, 5.5, 5.6.1 to 5.6.3, 6.2.1, 6.2.2, 6.3, 6.3.1, 6.4.1, 6.4.2, 6.5, 6.5.1, Chapter 7, 7.1, 7.2, 7.3.1 to 7.3.6, 7.5, 8.1, 8.2.4, 8.2.6, Appendix 2, Appendix 3

Print Date	*Manual Number	Revision
Dec., 2015	SH(NA)-080647ENG-H	Correction SAFETY PRECAUTIONS, MANUALS, COMPLIANCE WITH THE EMC, LOW VOLTAGE, AND MACHINERY DIRECTIVES, GENERIC TERMS AND ABBREVIATIONS, Section 2.1, 3.1, 3.1.1, 3.2, 3.3.2, 3.4.2, 3.4.4, 4.4.2, 4.6.2, 5.2.1, 5.2.2, 6.3.2, 6.4.2, 6.5.1, 6.5.2, 8.1, 8.2.1, 8.2.4, Appendix 2
Jul., 2017	SH(NA)-080647ENG-I	Correction INTRODUCTION, COMPLIANCE WITH THE EMC, LOW VOLTAGE, AND MACHINERY DIRECTIVES, GENERIC TERMS AND ABBREVIATIONS, Section 2.1, 2.3, 4.3, 4.4.2, 4.4.3, 6.2.1, 6.4.1, Appendix 3
Jul., 2020	SH(NA)-080647ENG-J	Correction Section 4.4.2
Feb., 2021	SH(NA)-080647ENG-K	Correction SAFETY PRECAUTIONS, CONDITIONS OF USE FOR THE PRODUCT, Section 3.1.1

Japanese Manual Version SH-080645-N

This manual confers no industrial property rights or any rights of any other kind, nor does it confer any patent licenses. Mitsubishi Electric Corporation cannot be held responsible for any problems involving industrial property rights which may occur as a result of using the contents noted in this manual.

© 2006 MITSUBISHI ELECTRIC CORPORATION

INTRODUCTION

Thank you for purchasing the Mitsubishi Electric MELSEC-Q series programmable controllers.
Before using the equipment, please read this manual carefully to develop full familiarity with the functions and performance of the Q series programmable controller you have purchased, so as to ensure correct use.
Please forward a copy of this manual to the end user.

CONTENTS

SAFETY PRECAUTIONS ..... A - 1
CONDITIONS OF USE FOR THE PRODUCT ..... A - 5
REVISIONS ..... A - 6
INTRODUCTION ..... A - 8
CONTENTS ..... A - 8
MANUALS ..... A - 12
COMPLIANCE WITH THE EMC, LOW VOLTAGE, AND MACHINERY DIRECTIVES ..... A - 12
GENERIC TERMS AND ABBREVIATIONS ..... A - 13
PACKING LIST ..... A - 14

1 OVERVIEW 1 - 1 to 1 - 3

1.1 Features ..... 1 - 1

2 SYSTEM CONFIGURATION 2 - 1 to 2 - 6

2.1 Applicable Systems ..... 2 - 1
2.2 Precautions on System Configuration ..... 2 - 3
2.3 How to Check the Function Version, Serial No., and Software Version ..... 2 - 4

3 SPECIFICATIONS 3 - 1 to 3 - 75

3.1 Performance Specifications ..... 3 - 1
3.1.1 Performance specifications list ..... 3 - 1
3.1.2 I/O conversion characteristic ..... 3 - 5
3.1.3 Accuracy ..... 3 - 12
3.2 Function List ..... 3 - 13
3.2.1 A/D conversion methods ..... 3 - 15
3.2.2 Maximum and minimum values hold function ..... 3 - 18
3.2.3 Input signal error detection function ..... 3 - 18
3.2.4 Warning output function ..... 3 - 25
3.2.5 Conversion starting time setting function (Q66AD-DG only) ..... 3 - 29
3.2.6 Scaling Function ..... 3 - 30
3.3 I/O Signals for the Programmable Controller CPU ..... 3 - 33
3.3.1 List of I/O signals ..... 3 - 33
3.3.2 Details of I/O signals ..... 3 - 35
3.4 Buffer Memory ..... 3 - 43
3.4.1 Buffer memory assignment ..... 3 - 43

3.4.2 A/D conversion enable/disable setting (Un\G0) ... 3 - 55
3.4.3 CH[ ] average time/average number of times/moving average/time constant settings (Un\G1 to Un\G8) ... 3 - 56
3.4.4 A/D conversion completed flag (Un\G10) ... 3 - 57
3.4.5 CH[ ] digital output value (Un\G11 to Un\G18) ... 3 - 58
3.4.6 Write data error code (Un\G19) ... 3 - 59
3.4.7 Setting range (Un\G20, Un\G21) ... 3 - 59
3.4.8 Offset/gain setting mode offset/gain specification (Un\G22, Un\G23) ... 3 - 60
3.4.9 Averaging process specification (Un\G24, Un\G25)) ... 3 - 61
3.4.10 CH[ ] maximum value/minimum value storage area (Un\G30 to Un\G45) ... 3 - 62
3.4.11 Input signal error detection extended/input signal error detection setting (Un\G47) ... 3 - 62
3.4.12 Warning output settings (Un\G48) ... 3 - 64
3.4.13 Input signal error detection flag (Un\G49) ... 3 - 65
3.4.14 Warning output flag (Un\G50,Un\51) ... 3 - 66
3.4.15 Scaling enable/disable setting (Un\G53) ... 3 - 66
3.4.16 CH[ ] scaling value storage area (Un\G54 to Un\G61) ... 3 - 67
3.4.17 CH[ ] scaling upper / lower limit value (Un\G62 to Un\G77) ... 3 - 67
3.4.18 CH[ ] conversion starting time setting (for 2-wire transmitter) (Un\G78 to Un\G83) (Q66AD-DG only) ... 3 - 67
3.4.19 CH[ ] process alarm upper/lower limit value (Un\G86 to Un\G117) ... 3 - 68
3.4.20 CH[ ] rate alarm warning detection period (Un\G118 to Un\G125) ... 3 - 69
3.4.21 CH[ ] rate alarm upper/lower limit value (Un\G126 to Un\G141) ... 3 - 70
3.4.22 CH[ ] input signal error detection setting value/CH[ ] Input signal error detection lower limit setting value (Un\G142 to Un\G149)
CH[ ] Input signal error detection upper limit setting value (Un\G150 to Un\G157) ... 3 - 71
3.4.23 Mode switching setting (Un\G158, Un\G159) ... 3 - 74
3.4.24 Save data classification setting (Un\G200) (Q68AD-G only) ... 3 - 74
3.4.25 Factory default and User range settings offset/gain value (Un\G202 to Un\G233) ... 3 - 75

4 SETUP AND PROCEDURES BEFORE OPERATION 4 - 1 to 4 - 24

4.1 Handling Precautions ... 4 - 1
4.1.1 Attaching a module fixing bracket (Q66AD-DG only) ... 4 - 2
4.2 Setup and Procedures before Operation ... 4 - 3
4.3 Part Names ... 4 - 4
4.4 Wiring ... 4 - 7
4.4.1 Wiring precautions ... 4 - 7
4.4.2 External wiring ... 4 - 8
4.4.3 Connector/terminal block converter module ... 4 - 11
4.5 Intelligent Function Module Switch Setting ... 4 - 12
4.6 Offset/Gain Settings ... 4 - 14
4.6.1 Offset/gain settings (Q68AD-G) ... 4 - 15
4.6.2 Offset/gain settings (Q66AD-DG) ... 4 - 19
4.6.3 A/D conversion value storage during offset/gain setting ... 4 - 24

5 UTILITY PACKAGE (GX Configurator-AD) 5 - 1 to 5 - 33

5.1 Utility Package Functions ... 5 - 1
5.2 Installing and Uninstalling the Utility Package ... 5 - 2

5.2.1 Handling precautions ..... 5 - 2
5.2.2 Operating environment ..... 5 - 4
5.3 Utility Package Operation ..... 5 - 6
5.3.1 Common utility package operations ..... 5 - 6
5.3.2 Operation overview ..... 5 - 9
5.3.3 Starting the intelligent function module utility ..... 5 - 11
5.4 Initial Setting ..... 5 - 14
5.5 Auto Refresh Setting ..... 5 - 16
5.6 Monitoring/Test ..... 5 - 18
5.6.1 Monitor/test window ..... 5 - 18
5.6.2 Offset/gain setting operation ..... 5 - 21
5.6.3 Confirmation of conversion characteristic ..... 5 - 23
5.6.4 Pass data (Q68AD-G) ..... 5 - 25
5.6.5 Pass data (Q66AD-DG) ..... 5 - 27
5.7 FB Conversion of Initial Setting/Auto Refresh Setting ..... 5 - 28
5.8 Usage of FB ..... 5 - 30
5.8.1 Outline ..... 5 - 30
5.8.2 Paste an FB to a sequence program ..... 5 - 32
5.8.3 Convert (compile) a sequence program ..... 5 - 33

6 PROGRAMMING 6 - 1 to 6 - 38

6.1 Programming Procedure ..... 6 - 1
6.2 For Use in Normal System Configuration (Q68AD-G) ..... 6 - 2
6.2.1 Before creating a program ..... 6 - 3
6.2.2 Programming example using the utility package ..... 6 - 5
6.2.3 Programming example without using the utility package ..... 6 - 8
6.3 For Use in Remote I/O Network (Q68AD-G) ..... 6 - 11
6.3.1 Programming example using the utility package ..... 6 - 14
6.3.2 Programming example without using the utility package ..... 6 - 17
6.4 For Use in Normal System Configuration (Q66AD-DG) ..... 6 - 21
6.4.1 Before creating a program ..... 6 - 22
6.4.2 Programming example using the utility package ..... 6 - 24
6.4.3 Programming example without using the utility package ..... 6 - 27
6.5 For Use in Remote I/O Network (Q66AD-DG) ..... 6 - 30
6.5.1 Programming example using the utility package ..... 6 - 32
6.5.2 Programming example without using the utility package ..... 6 - 35

7 ONLINE MODULE CHANGE 7 - 1 to 7 - 38

7.1 Online Module Change Conditions ..... 7 - 2
7.2 Online Module Change Operations ..... 7 - 3
7.3 Online Module Change Procedure ..... 7 - 4
7.3.1 When industrial shipment setting is used and initial setting was made with GX Configurator-AD ..... 7 - 5
7.3.2 When industrial shipment setting is used and initial setting was made with sequence program ..... 7 - 10

7.3.3 When user range setting is used and initial setting was made with GX Configurator-AD (other system is available) ..... 7 - 15
7.3.4 When user range setting is used and initial setting was made with GX Configurator-AD (other system is unavailable) ..... 7 - 20
7.3.5 When user range setting is used and initial setting was made with sequence program (other system is available) ..... 7 - 26
7.3.6 When user range setting is used and initial setting was made with sequence program (other system is unavailable) ..... 7 - 31
7.4 Range Reference Table ..... 7 - 37
7.5 Precautions for Online Module Change ..... 7 - 38

8 TROUBLESHOOTING 8 - 1 to 8 - 8

8.1 Error Code List ..... 8 - 1
8.2 Troubleshooting ..... 8 - 5
8.2.1 When the "RUN" LED is flashing or turned off ..... 8 - 5
8.2.2 When the "ERR." LED is on or flashing ..... 8 - 5
8.2.3 When the "ALM" LED is on or flashing ..... 8 - 5
8.2.4 When the digital output values cannot be read ..... 8 - 6
8.2.5 When A/D conversion completed flag does not turn ON during use in normal mode ..... 8 - 7
8.2.6 Checking the A/D converter module status using GX Developer system monitor ..... 8 - 7

APPENDIX App - 1 to App - 17

Appendix 1 Dedicated Instruction List and Available Devices ..... App- 1
Appendix 1.1G(P).OFFGAN ..... App- 2
Appendix 1.2G(P).OGLOAD ..... App- 4
Appendix 1.3G(P).OGSTOR ..... App- 8
Appendix 2 Functions Added or Changed Due to Version Upgrade ..... App- 13
Appendix 3 External Dimensions ..... App- 17

INDEX Index - 1 to Index - 2

MANUALS

The manuals related to this product are listed below.
Please place an order as needed.

Relevant Manuals

Manual name	Manual number (model code)
GX Developer Version 8 Operating Manual Operating methods of GX Developer, such as programming, printing, monitoring, and debugging (Sold separately)	SH-080373E (13JU41)
GX Developer Version 8 Operating Manual (Function Block) Operating methods of GX Developer, such as creating and printing function blocks (Sold separately)	SH-080376E (13JU44)
GX Works2 Version1 Operating Manual (Common) System configuration, parameter settings, and online operations (common to Simple project and Structured project) of GX Works2 (Sold separately)	SH-080779ENG (13JU63)
GX Works2 Version1 Operating Manual (Intelligent Function Module) Operating methods of the intelligent function module of GX Works2, such as parameter settings, monitoring, and predefined protocol support function (Sold separately)	SH-080921ENG (13JU69)

Remark

Printed manuals are available separately. Please place an order with the manual number (model code) in the table above.

COMPLIANCE WITH THE EMC, LOW VOLTAGE, AND MACHINERY DIRECTIVES

(1) Method of ensuring compliance

To ensure that Mitsubishi Electric programmable controllers maintain EMC and Low Voltage Directives when incorporated into other machinery or equipment, certain measures may be necessary. Please refer to one of the following manuals.

- QCPU User's Manual (Hardware Design, Maintenance and Inspection)
- Safety Guidelines (This manual is included with the CPU module or head module.)

The CE mark on the side of the programmable controller indicates compliance with EMC and Low Voltage Directives.

(2) Additional measures

No additional measures are necessary for the compliance of this product with EMC and Low Voltage Directives.

GENERIC TERMS AND ABBREVIATIONS

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

General term/Abbreviation	Description
A/D converter module	A generic term for the Q68AD-G and Q66AD-DG
DOS/V personal computer	An IBM PC/AT® or compatible computer with DOS/V
GX Developer	The product name of the software package for the MLSEC programmable controllers
GX Works2	
GX Configurator-AD	The abbreviation for the analog-digital converter module setting and monitor tool GX Configurator-AD (SW2D5C-QADU-E)
QCPU (Q mode)	A generic term for the Q00JCPU, Q00CPU, Q01CPU, Q02CPU, Q02HCPU, Q06HCPU, Q12HCPU, Q25HCPU, Q02PHCPU, Q06PHCPU, Q12PHCPU, Q25PHCPU, Q12PRHCPU, Q25PRHCPU, Q00UJCPU, Q00UCPU, Q01UCPU, Q02UCPU, Q03UDCPU, Q04UDHCPU, Q06UDHCPU, Q10UDHCPU, Q13UDHCPU, Q20UDHCPU, Q26UDHCPU, Q03UDVCPU, Q04UDVCPU, Q06UDVCPU, Q13UDVCPU, Q26UDVCPU, Q03UDECPU, Q04UDEHCPU, Q06UDEHCPU, Q10UDEHCPU, Q13UDEHCPU, Q20UDEHCPU, Q26UDEHCPU, Q50UDEHCPU, and Q100UDEHCPU.
Process CPU	A generic term for the Q02PHCPU, Q06PHCPU, Q12PHCPU and Q25PHCPU
Redundant CPU	Generic term for Q12PRHCPU and Q25PRHCPU.
Personal computer	A generic term for DOS/V personal computers
Industrial shipment setting	A generic term for analog input ranges 0 to 10V, 0 to 5V, 1 to 5V, -10 to 10V, 0 to 20mA, and 4 to 20mA
FB	The abbreviation for function block

PACKING LIST

The following items are included in the package of the A/D converter module.
(GX Configurator-AD is sold separately.)

Model	Product name	Quantity
Q68AD-G	Type Q68AD-G channel isolated analog-digital converter module	1
Q66AD-DG	Type Q66AD-DG channel isolated analog-digital converter module (with signal conditioning function)	1
	FG terminal L-shaped metal fitting	1

The following items are included in the package of GX Configurator-AD.

Model	Product name	Quantity
SW2D5C-QADU-E	GX Configurator-AD version 2 (1-license product)(CD-ROM)	1
SW2D5C-QADU-EA	GX Configurator-AD version 2 (Multiple-license product)(CD-ROM)	1

1 OVERVIEW

This User's Manual describes the specifications, handling and programming methods for the type Q68AD-G channel isolated analog-digital converter module (hereinafter referred to as the Q68AD-G) and type Q66AD-DG channel isolated analog-digital converter module (with signal conditioning function) (hereinafter referred to as the Q66AD-DG), which are used with the MELSEC-Q series CPU modules.
The Q66AD-DG is exclusively used for current input.
In this manual, the Q68AD-G and Q66AD-DG are collectively referred to as the A/D converter modules.

1.1 Features

(1) Channel isolated

The channels are isolated.
The Q66AD-DG is also isolated between the external power supply and channels.

(2) Multi-channel analog input is available.

(a) By using a single Q68AD-G, analog voltage or current inputs of 8 channels are available.

(b) A single Q66AD-DG allows connection of 2-wire transmitters of 6 channels. It has an input range for analog current, in addition to connections to 2-wire transmitters.

(3) Power supply to 2-wire transmitter (Q66AD-DG only)

Supplying power to the 2-wire transmitter, the Q66AD-DG does not require the power supply for the 2-wire transmitter.
Supply power can be switched ON/OFF channel-by-channel by the A/D conversion enable/disable setting.

(4) Module protection provided by short-circuit protection circuit (Q66AD-DG only)

If an excessive current flows into the module due to a short circuit of the wiring, the short-circuit protection circuit limits the current to within 25 to 35mA, protecting the module.

(5) Analog input check by check terminals (Q66AD-DG only)

Measurement of a voltage at the check terminals allows the mA of the 2-wire transmitter output to be checked without the wiring being disconnected.

(6) High accuracy

The reference accuracy *1 is as high as ±0.1% and the temperature coefficient*2 is as high as ±71.4ppm/°C.

*1 Accuracy of offset/gain setting at ambient temperature

*2 Accuracy per temperature change of 1°C

Example) Accuracy when the temperature varies from 25 to 30°C
0.1% (reference accuracy) + 0.00714 %/°C (temperature coefficient) × 5°C (temperature variation difference) = 0.1357%

(7) Changing the input range

The input range*3 can easily be set from the GX Developer.

*3 Input range refers to the type of offset/gain settings. The most frequently used range is set as the default but the user can also set the offset/gain.

(8) A/D conversion system*1

There are the following five A/D conversion systems.

(a) Sampling processing
Analog input values are converted into digital values one by one on a channel basis and the digital output value is output at every conversion.

(b) Averaging processing

1) Time averaging
A/D conversion is averaged in terms of time on a channel basis and a digital average value is output.

2) Count averaging
A/D conversion is averaged in terms of count on a channel basis and a digital average value is output.

3) Move averaging
The specified number of digital output values measured per sampling time are averaged.

(c) Primary delay filter
A digital output value is smoothed according to the preset time constant.

*1 Refer to Section 3.2.1 for the details of the A/D conversion system.

(9) Input signal error detection function

The voltage/current outside the setting range is detected.

(10)Warning output*1

There are the following two warning outputs.

(a) Process alarm
A warning is output if a digital output value falls outside the setting range.

(b) Rate alarm
A warning is output if the varying rate of a digital output value falls outside the preset varying rate range.

*1 Refer to Section 3.2.4 for details on warning output.

(11) Scaling function

A/D conversion values can be converted to percentage values (%) in the preset range and be loaded into the buffer memory. This function can reduce the time required for programming. (Refer to Section 3.2.6.)

(12) Online module change

Furthermore, the following operations can be processed by using sequence programs. (Note that these operations are possible for the modules of the same model only.) (Refer to Chapter7.)

- Transferring the offset/gain set values to the replacement A/D converter module
- Transferring the offset/and gain set values to another A/D converter module mounted on the other slot

(13) Offset/gain setting

GX Configurator-AD, dedicated instruction (G(P).OFFGAN) or mode switching setting allows a shift to the offset/gain setting mode easily.

(14) Easy settings using GX Configurator-AD

Using GX Configurator-AD which is sold separately, sequence programs can be reduced since settings of the A/D converter module can be made on the window. Also, the set status or operating status of the module can be checked easily.

A FB*1 can be created automatically from the set intelligent function module parameter, and can be used in sequence programs.

*1 FB is the function for making a circuit block used in a sequence program repeatedly a part (FB) to use it in the sequence program.
This function can improve the efficiency of program development and minimize program bugs to improve program qualities.

For the details of FB, refer to "GX Developer Version 8 Operating Manual (Function Block)."

2 SYSTEM CONFIGURATION

This chapter explains the system configuration of the A/D converter module.

2.1 Applicable Systems

This section describes the applicable systems.

(1) Applicable modules and base units, and No. of modules

(a) When mounted with a CPU module
For the CPU modules, the number of modules, and base units applicable to the A/D converter module, refer to the following.
- User's Manual (Hardware Design, Maintenance and Inspection) for the CPU module used

Remark

To use the A/D converter module with a C Controller module, refer to the user's manual for the C Controller module.

(b) Mounting to a MELSECNET/H remote I/O station
For the number of modules and base units applicable to the A/D converter module, refer to the following.
- Q Corresponding MELSECNET/H Network System Reference Manual (Remote I/O network)

(2) Support of the multiple CPU system

When using the A/D converter in a multiple CPU system, refer to the following manual first.
- QCPU User's Manual (Multiple CPU System)

(a) Applicable A/D converter module
The A/D converter module is of the function version C from the first product, and applicable to a multiple CPU system.

(b) Intelligent function module parameters
Write intelligent function module parameters to only the control CPU of the A/D converter module.

(3) Compatibility with online module change

The A/D converter module is of the function version C from the first product, and online module change is possible.
For the procedure of online module change, refer to Chapter7.

(4) Supported software packages

Relation between the system containing the Q68AD-G and software package is shown in the following table.

GX Developer or GX Works2 is required to use the A/D converter module.

		Software Version		
		GX Developer	GX Configurator-AD	GX Works2
Q00J/Q00/Q01CPU	Single CPU system	Version 7 or later	Version 2.09K or later	Refer to the GX Works2 Version1 Operating Manual (Common)
	Multiple CPU system	Version 8 or later		
Q02/Q02H/Q06H/ Q12H/Q25HCPU	Single CPU system	Version 4 or later		
	Multiple CPU system	Version 6 or later		
Q02PH/Q06PHCPU	Single CPU system	Version 8.68W or later		
	Multiple CPU system			
Q12PH/Q25PHCPU	Single CPU system	Version 7.10L or later		
	Multiple CPU system			
Q12PRH/ Q25PRHCPU	Redundant CPU system	Version 8.45X or later		
Q00UJ/Q00U/ Q01UCPU	Single CPU system	Version 8.76E or later		
	Multiple CPU system			
Q02U/Q03UD/ Q04UDH/ Q06UDHCPU	Single CPU system	Version 8.48A or later		
	Multiple CPU system			
Q10UDH/ Q20UDHCPU	Single CPU system	Version 8.76E or later		
	Multiple CPU system			
Q13UDH/ Q26UDHCPU	Single CPU system	Version 8.62Q or later		
	Multiple CPU system			
Q03UDE/Q04UDEH/ Q06UDEH/Q13UDEH/ Q26UDEHCPU	Single CPU system	Version 8.68W or later		
	Multiple CPU system			
Q10UDEH/ Q20UDEHCPU	Single CPU system	Version 8.76E or later		
	Multiple CPU system			
CPU modules other than the above		unsupported	unsupported	
If installed in a MELSECNET/H remote I/O station		Version 6 or later	Version 2.09K or later	

Point

(1) Depending on the version of GX Configurator-AD, applicable system, CPU module and functions of A/D converter module vary.
Refer to Appendix 2 for details.

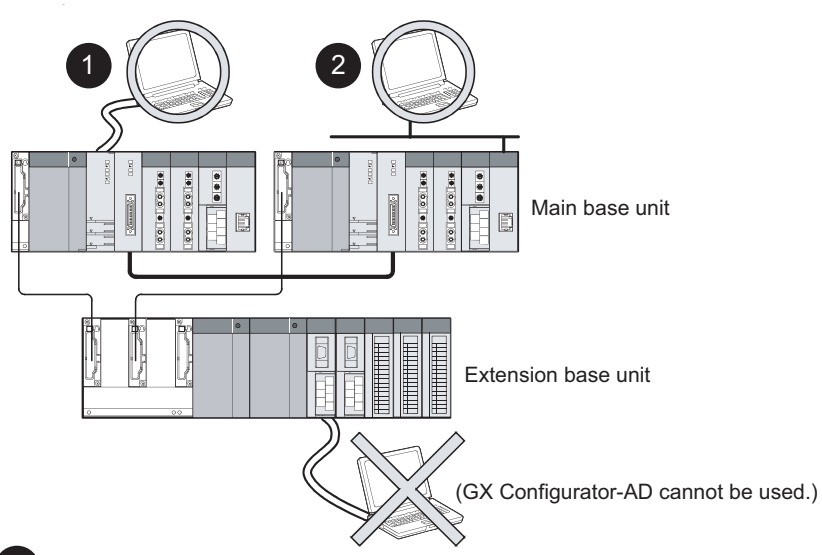
(2) When using GX Works2, refer to the following.
- GX Works2 Version1 Operating Manual (Common)
- GX Works2 Version1 Operating Manual (Intelligent Function Module)

2.2 Precautions on System Configuration

(1) When using the A/D converter module with Redundant CPU

(a) Dedicated instruction
The dedicated instruction cannnot be used.

(b) GX Configurator-AD connection
GX Configurator-AD cannot be used when accessing Redundant CPU via an intelligent function module on an extension base unit from GX Developer.
Connect a personal computer with a communication path indicated below.



1 Direct connection to use the CPU

2 Connection through an intelligent function module on the main base unit
(Through Ethernet module, MELSECNET/H module, or CC-Link module)

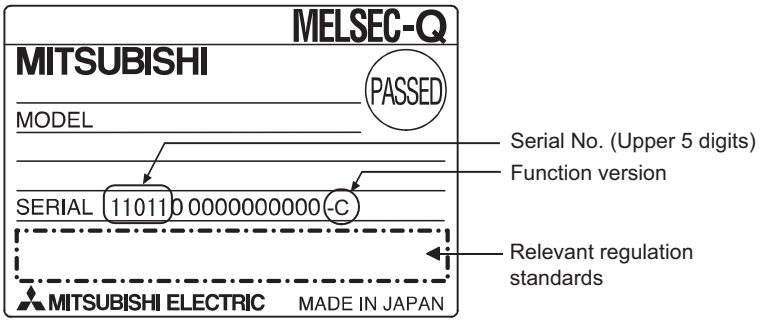
2.3 How to Check the Function Version, Serial No., and Software Version

(1) Checking the function version and serial No.

The serial No. and function version of the A/D converter module can be checked on the rating plate, front of the module, and system monitor of GX developer.

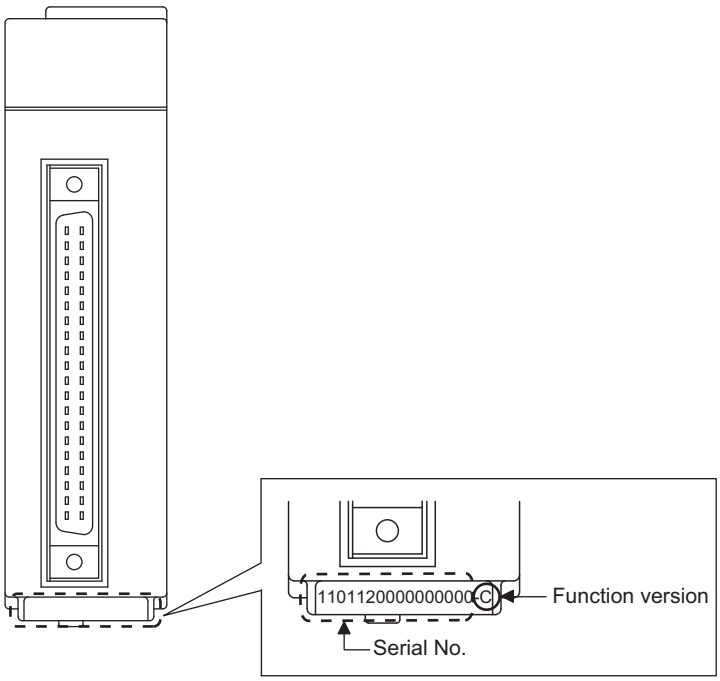
(a) On the rating plate

The rating plate is put on the side of the A/D converter module.



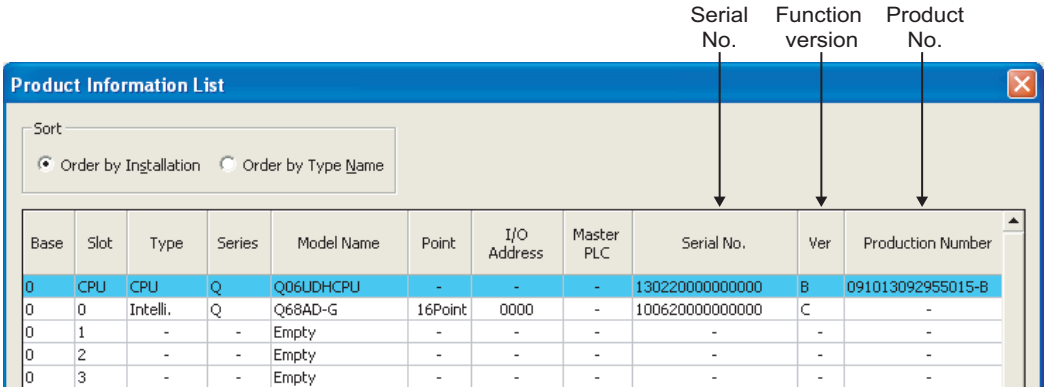
(b) On the front of the module

The function version and serial No. on the rating plate is also indicated on the front of the module (lower part)



(c) On the system monitor (product information list)

To display the system monitor, select [Diagnostics] → [System monitor] → Product Inf. List of GX Developer.



1) Production number

Production number indication is not available for the A/D converter module; "-" is shown.

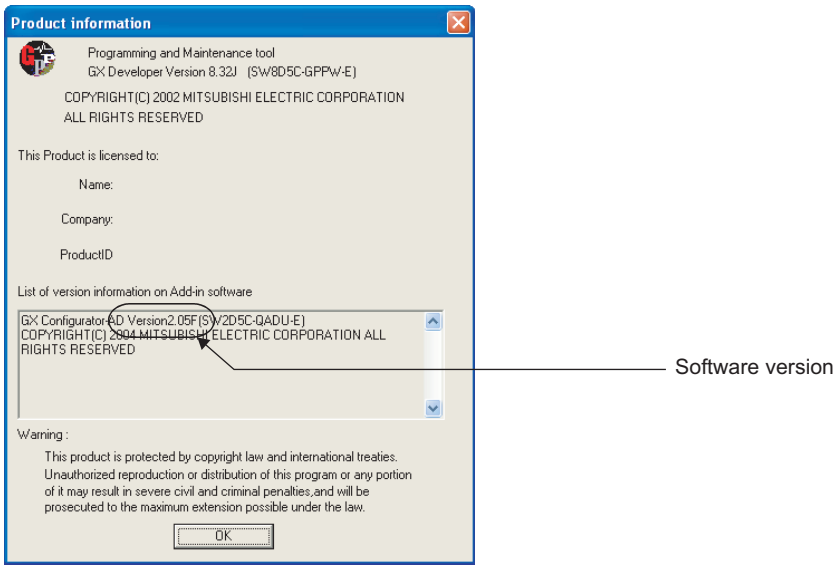
Point

The serial No. on the rating plate and the front of the module may be different from the serial No. displayed on the product information list in GX Developer.

- The serial No. on the rating plate and the front of the module indicates the management information of the product.
- The serial No. displayed on the product information list in GX Developer indicates the function information of the product. The function information of the product is updated when a new function is added.

(2) Checking the software version of GX Configurator-AD

The software version of GX Configurator-AD can be checked on GX Developer by clicking [Help] → [Product information].



(In the case of GX Developer Version 8)

3 SPECIFICATIONS

The description of this chapter and later is based on the Q68AD-G.

3.1 Performance Specifications

3.1.1 Performance specifications list

Table 3.1 shows the performance specifications of the A/D converter modules.

Table3.1 Performance Specifications of Q68AD-G

Item		Specifications
Number of analog input channels		8 channels
Analog input	Voltage	-10 to 10VDC (Input impedance 1 MΩ or more)
	Current	0 to 20mADC (Input resistance 250Ω)
Digital output		16-bit signed binary (normal resolution mode: –4096 to 4095, high resolution mode: –12288 to 12287, –16384 to 16383)
Using scaling function		16-bit signed binary (-32768 to 32767)
I/O characteristics, maximum resolution[*7]		See the table below
Accuracy (Accuracy relative to digital output value)	Reference accuracy [*1]	±0.1% Normal resolution mode : ±4digit[*2] High resolution mode (0 to 10V, -10 to 10V) : ±16digit[*2] High resolution mode (Other than the above ranges) : ±12digit[*2]
	Temperature coefficient [*3]	±71.4ppm/°C (0.00714%/°C)
Common mode characteristic		Common mode voltage, Input-Common ground (input voltage 0V): 500VAC
		Common mode voltage rejection ratio (VCM < 500V): 60Hz 107dB, 50Hz 106dB
Sampling cycle[*4]		10ms/ channel
Response time[*5]		20ms
Absolute maximum input		Voltage: ± 15V Current: ± 30mA[*6]

Input	Analog input range	Normal resolution mode		High resolution mode	
		Digital output value	Maximum resolution	Digital output value	Maximum resolution
Voltage	0 to 10V	0 to 4000	2.5 mV	0 to 16000	0.625 mV
	0 to 5V		1.25 mV	0 to 12000	0.416 mV
	1 to 5V		1.0 mV		0.333 mV
	1 to 5V (Extended mode)	-1000 to 4500	1.0 mV	-3000 to 13500	0.333 mV
	-10 to 10V	-4000 to 4000	2.5 mV	-16000 to 16000	0.625 mV
	Users range setting		0.375 m V[*8]	-12000 to 12000	0.333 mV[*8]
Current	0 to 20mA	0 to 4000	5 μA	0 to 12000	1.66 μA
	4 to 20mA		4 μA		1.33 μA
	4 to 20mA (Extended mode)	-1000 to 4500	4 μA	-3000 to 13500	1.33 μA
	Users range setting	-4000 to 4000	1.37 μA[*8]	-12000 to 12000	1.33 μA[*8]

Table3.1 Performance Specifications of Q68AD-G

<table>
<tr><th>Item</th><th>Specifications</th></tr>
<tr><td>Isolation</td><td>
<table>
<tr><th>Specific isolated area</th><th>Isolation method</th><th>Dielectric withstand voltage</th><th>Insulation resistance</th></tr>
<tr><td>Between input terminal and programmable controller power supply</td><td rowspan="2">Transformer isolation</td><td>500VAC rms, 1min.</td><td rowspan="2">500VDC, 10MΩ or more</td></tr>
<tr><td>Between analog input channels</td><td>1000VAC rms, 1min.</td></tr>
</table>
</td></tr>
<tr><td>Maximum number of writes to flash memory</td><td>Up to 50,000 times</td></tr>
<tr><td>Number of I/O occupied points</td><td>16 points (I/O assignment: Intelligent 16 points)</td></tr>
<tr><td>External wiring connection system</td><td>40-pin connector</td></tr>
<tr><td>Applicable wire size</td><td>0.3mm^2(AWG22) or less (for A6CON1, A6CON4)
0.088mm^2 to 0.24mm^2(AWG28 to 24) (for A6CON2)</td></tr>
<tr><td>External device connection connector</td><td>A6CON1, A6CON2, A6CON4 (sold separately)</td></tr>
<tr><td>Internal current consumption (5VDC)</td><td>0.46A</td></tr>
<tr><td>Weight</td><td>0.16kg</td></tr>
</table>

*1 Accuracy of offset/gain setting at ambient temperature
*2 "digit" indicates a digital value.
*3 Accuracy per temperature change of 1°C

Example) Accuracy when temperature changes from 25 to 30°C
0.1% (reference accuracy) + 0.00714 %/°C (temperature coefficient) × 5°C (temperature change difference) = 0.1357%

*4 The cycle in which A/D conversion values are updated.
*5 The time required for an input signal to reach the A/D converter inside the Q68AD-G.
*6 Current value indicates value of instant input current that does not break module inner electrical resistance.
*7 For details on I/O conversion characteristics, refer to Section3.1.2 (1).
*8 The maximum resolution for the user range setting

Table3.2 Performance Specifications of Q66AD-DG

<table>
<tr><th colspan="2">Item</th><th>Specifications</th></tr>
<tr><td colspan="2">Number of analog input channels (2-wire transmitters)</td><td>6 channels</td></tr>
<tr><td rowspan="2">Input specification</td><td>With 2-wire transmitter</td><td>4 to 20mADC (Input resistance 250Ω)</td></tr>
<tr><td>Without 2-wire transmitter</td><td>0 to 20mADC±1 (Input resistance 250Ω)</td></tr>
<tr><td rowspan="4">Power supply part for 2-wire transmitter</td><td>Supply voltage</td><td>26±2VDC</td></tr>
<tr><td>Maximum supply current</td><td>24mADC</td></tr>
<tr><td>Short-circuit protection</td><td>Available
Limit current: 25 to 35mA</td></tr>
<tr><td>Check terminals</td><td>Available</td></tr>
<tr><td colspan="2">Digital output</td><td>16-bit signed binary (normal resolution mode: –96 to 4095, high resolution mode: –288 to 12287)</td></tr>
<tr><td colspan="2">Using scaling function</td><td>16-bit signed binary (-32768 to 32767)</td></tr>
<tr><td colspan="2">I/O characteristics, maximum resolution[*8]</td><td>
<table>
<tr><th rowspan="2">Analog input range</th><th colspan="2">Normal resolution mode</th><th colspan="2">High resolution mode</th></tr>
<tr><th>Digital output value</th><th>Maximum resolution</th><th>Digital output value</th><th>Maximum resolution</th></tr>
<tr><td>0 to 20mA</td><td rowspan="2">0 to 4000</td><td>5 μA</td><td rowspan="2">0 to 12000</td><td>1.66 μA</td></tr>
<tr><td>4 to 20mA</td><td>4 μA</td><td>1.33 μA</td></tr>
<tr><td>4 to 20mA (Extended mode)</td><td>-1000 to 4500</td><td>4 μA</td><td>-3000 to 13500</td><td>1.33 μA</td></tr>
<tr><td>Users range setting[*4]</td><td>0 to 4000</td><td>1.37 μA[*9]</td><td>0 to 12000</td><td>1.33 μA[*9]</td></tr>
</table>
</td></tr>
<tr><td rowspan="2">Accuracy (Accuracy relative to digital output value)</td><td>Reference accuracy [*1]</td><td>±0.1%
(Normal resolution mode: ±4digit [*2]
High resolution mode: ±12digit [*2])</td></tr>
<tr><td>Temperature coefficient [*3]</td><td>±71.4ppm/°C (0.00714 %/°C)</td></tr>
<tr><td colspan="2">Sampling cycle[*5]</td><td>10ms/ channel</td></tr>
<tr><td colspan="2">Response time[*6]</td><td>20ms</td></tr>
<tr><td colspan="2">Absolute maximum output</td><td>±30mA[*7]</td></tr>
<tr><td colspan="2">Isolation</td><td>
<table>
<tr><th>Specific isolated area</th><th>Isolation method</th><th>Dielectric withstand voltage</th><th>Insulation resistance</th></tr>
<tr><td>Between I/O terminal and programmable controller power supply</td><td rowspan="3">Transformer isolation</td><td>500VAC rms, 1min.</td><td rowspan="3">500VDC 10MΩ or more</td></tr>
<tr><td>Between analog input channels</td><td>1000VAC rms, 1min.</td></tr>
<tr><td>Between external power supply and analog input</td><td>500VAC rms, 1min.</td></tr>
</table>
</td></tr>
<tr><td colspan="2">Maximum number of writes to flash memory</td><td>Up to 50,000 times</td></tr>
<tr><td colspan="2">Number of I/O occupied points</td><td>16 points (I/O assignment: Intelligent 16 points)</td></tr>
<tr><td colspan="2">External wiring connection system</td><td>40-pin connector</td></tr>
<tr><td colspan="2">Applicable wire size</td><td>0.3mm^2(AWG22) or less (for A6CON1, A6CON4)
0.088mm^2 to 0.24mm^2(AWG28 to 24) (for A6CON2)</td></tr>
<tr><td colspan="2">External device connection connector</td><td>A6CON1, A6CON2, A6CON4 (sold separately)</td></tr>
<tr><td colspan="2" rowspan="4">External power supply[*10]</td><td>24VDC +20%, -15%</td></tr>
<tr><td>Ripple, spike within 500mV$_{P-P}$</td></tr>
<tr><td>Inrush current: 5.0A, within 550μs</td></tr>
<tr><td>0.36A</td></tr>
</table>

Table3.2 Performance Specifications of Q66AD-DG

Item	Specifications
Internal current consumption (5VDC)	0.42A
Weight	0.22kg

*1 Accuracy of offset/gain setting at ambient temperature
Q66AD-DG needs to be powered on 30 minutes prior to operation for compliance to the specification (accuracy).

*2 "digit" indicates a digital value.

*3 Accuracy per temperature change of 1°C

Example) Accuracy when temperature changes from 25 to 30°C

0.1% (reference accuracy) + 0.00714 %/°C (temperature coefficient) × 5°C (temperature change difference) = 0.1357%

*4 User range setting is 2 to 24mA

*5 The cycle in which A/D conversion values are updated.

*6 The time required for an input signal to reach the A/D converter inside the Q66AD-DG.

*7 Current value indicates value of instant input current that does not break module inner electrical resistance.

*8 For details on I/O conversion characteristics, refer to Section3.1.2 (2).

*9 The maximum resolution for the user range setting

*10 The external power supply is for a 2-wire transmitter.
When all the channels used are for current input, wiring for 24VDC is not required.
Note that to use the Q66AD-DG with a product number (first five digits) of 15031 or earlier, refer to Appendix 2.

Remark

See the user's manual for the CPU module being used for general specifications of the A/D converter modules.

3.1.2 I/O conversion characteristic

The I/O conversion characteristic represents the angle formed by a straight line connecting the "offset value" and "gain value" when the analog signals (voltage or current input) from outside the programmable controller are converted to digital values.

Offset value

The offset value denotes the analog input value (voltage or current) that makes the digital output value 0.

Gain value

The gain value denotes the analog input value (voltage or current) that makes the digital output value:
4000 (in normal resolution mode)
16000/12000 (in high resolution mode)

(1) Input characteristics of Q68AD-G

(a) Voltage input characteristic

Fig. 3.1 shows a graph of the voltage input characteristic.

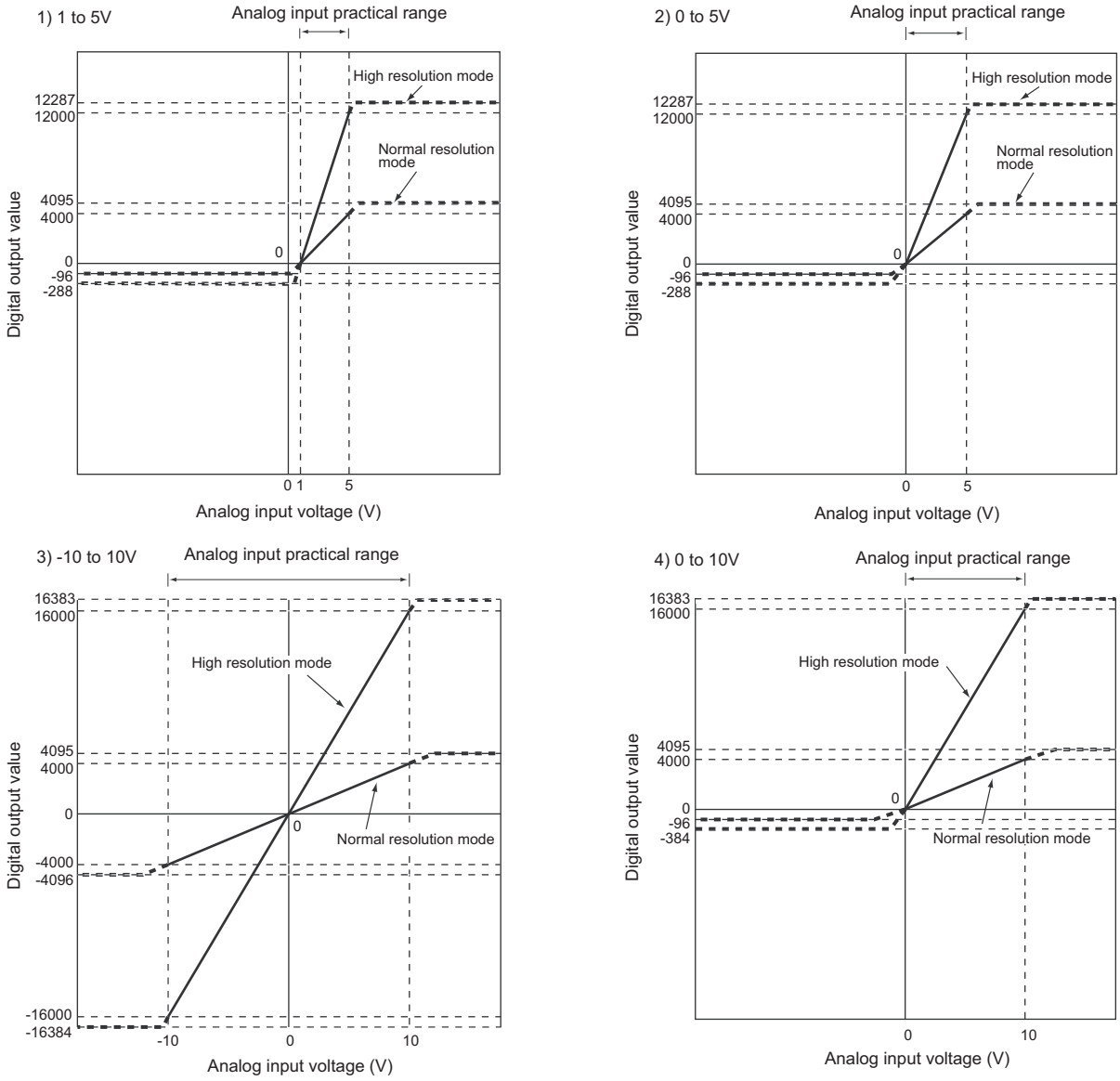


Fig.3.1 Voltage input characteristic of Q68AD-G (1/2)

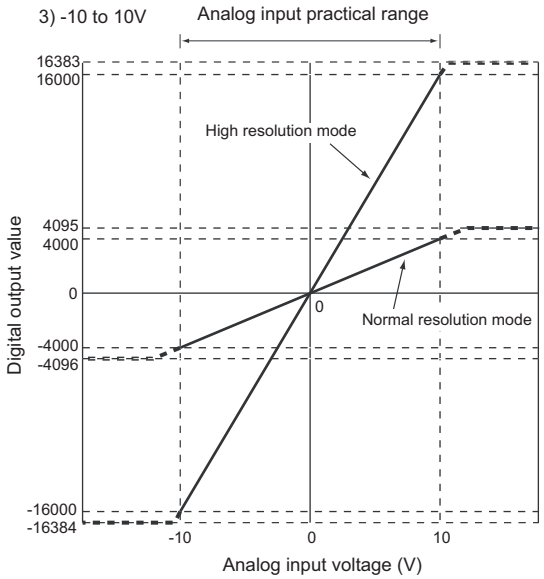


Fig.3.1 Voltage input characteristic of Q68AD-G (2/2)

Point

(1) Set within the analog input range and digital output range for each input range. If these ranges are exceeded, the maximum resolution and accuracy may not fall within the performance specifications. (Avoid use shown by the dotted lines in Fig.3.1.)

(2) Do not input an analog input voltage of -15V or less and 15V or more The input elements may be damaged.

(3) Set the offset/gain values for the User range setting marked within a range which satisfies the following conditions.

(a) Offset value, gain value setting range: 10 to 10V

(b) Use one of the following formulas according to the resolution mode to be set.

1) Normal resolution mode

{ (Gain value) - (Offset value) } > 1.5V

2) High resolution mode

{ (Gain value) - (Offset value) } ≧ 4.0V

(4) When an analog value that exceeds the range for the digital output value is entered, the digital output value will be fixed at the maximum or minimum value.

Analog input range setting	Normal resolution mode		High resolution mode	
	Minimum	Maximum	Minimum	Maximum
1 to 5V	-96	4095	-288	12287
0 to 5V				
-10 to 10V	-4096		-16384	16383
0 to 10V	-96		-384	
1 to 5V (Extended mode)	-1096	4595	-3288	13787
User range setting	-4096	4095	-12288	12287

(b) Current input characteristic

Fig. 3.2 shows a graph of the current input characteristic

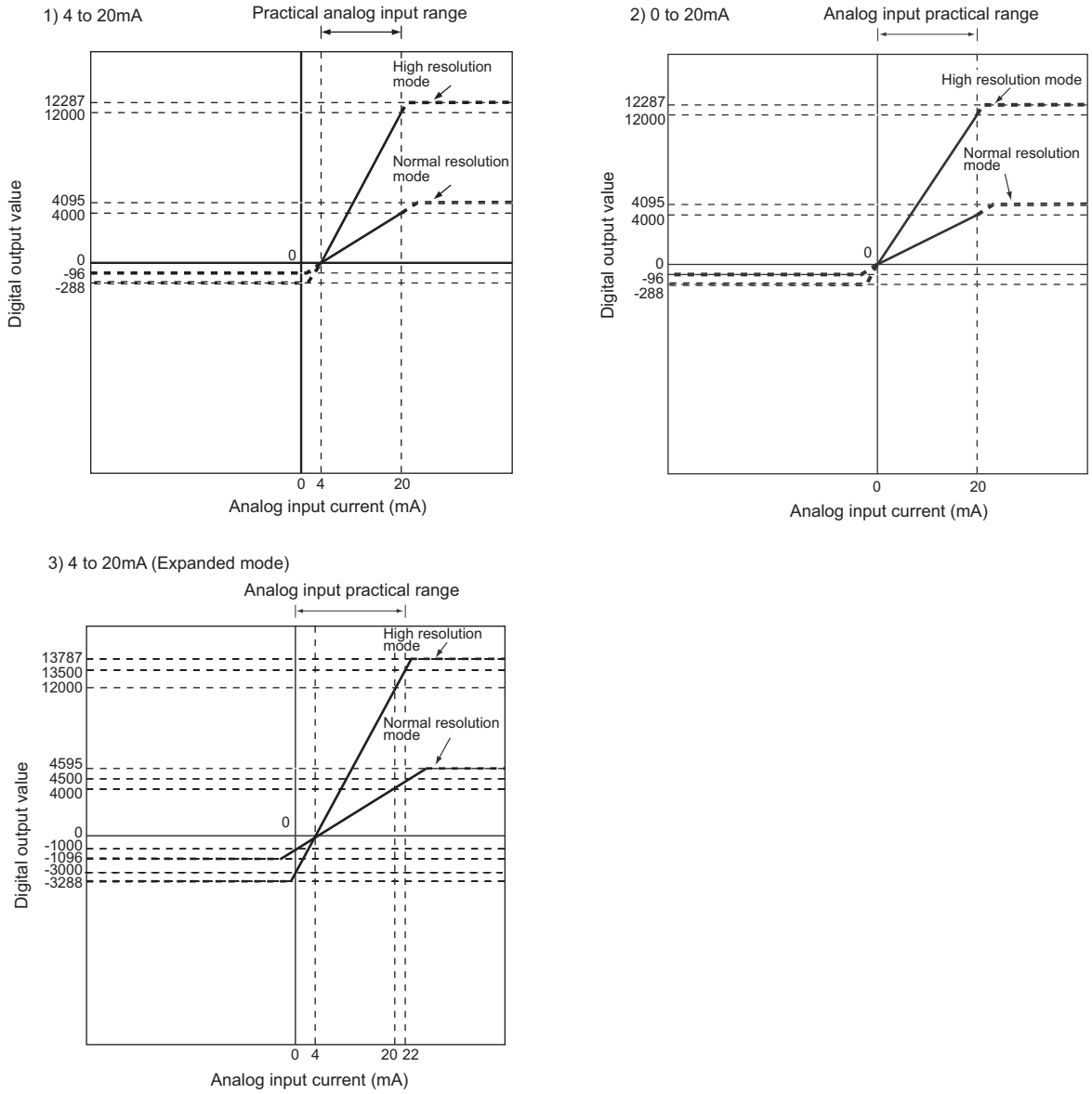


Fig.3.2 Current input characteristic of Q68AD-G

Point

(1) Set within the analog input range and digital output range for each input range.
If these ranges are exceeded, the maximum resolution and accuracy may not fall within the performance specifications. (Avoid use shown by the dotted lines in Fig.3.2.)

(2) Do not input an analog input current of -30mA or less and 30mA or more. The input elements may be damaged.

(3) Set the offset/gain values for the User range setting marked within a range in which satisfies the following conditions.

(a) Gain value ≦ 20mA, offset value ≧ 0mA

(b) Use one of the following formulas according to the resolution mode to be set.

1) Normal resolution mode
{ (Gain value) - (Offset value) } > 5.5mA

2) High resolution mode
{ (Gain value) - (Offset value) } ≧ 16.0mA

(4) When an analog value that exceeds the range of the digital output value is entered, the digital output value will be fixed at the maximum or minimum value.

Analog input range setting	Digital output value (Normal resolution mode)		Digital output value (High resolution mode)	
	Minimum	Maximum	Minimum	Maximum
4 to 20mA	-96	4095	-288	12287
0 to 20mA				
4 to 20mA (Extended mode)	-1096	4595	-3288	13787
User range setting	-4096	4095	-12288	12287

(2) Input characteristic of Q66AD-DG

Fig. 3.3 shows a graph of the Q66AD-DG input characteristic.

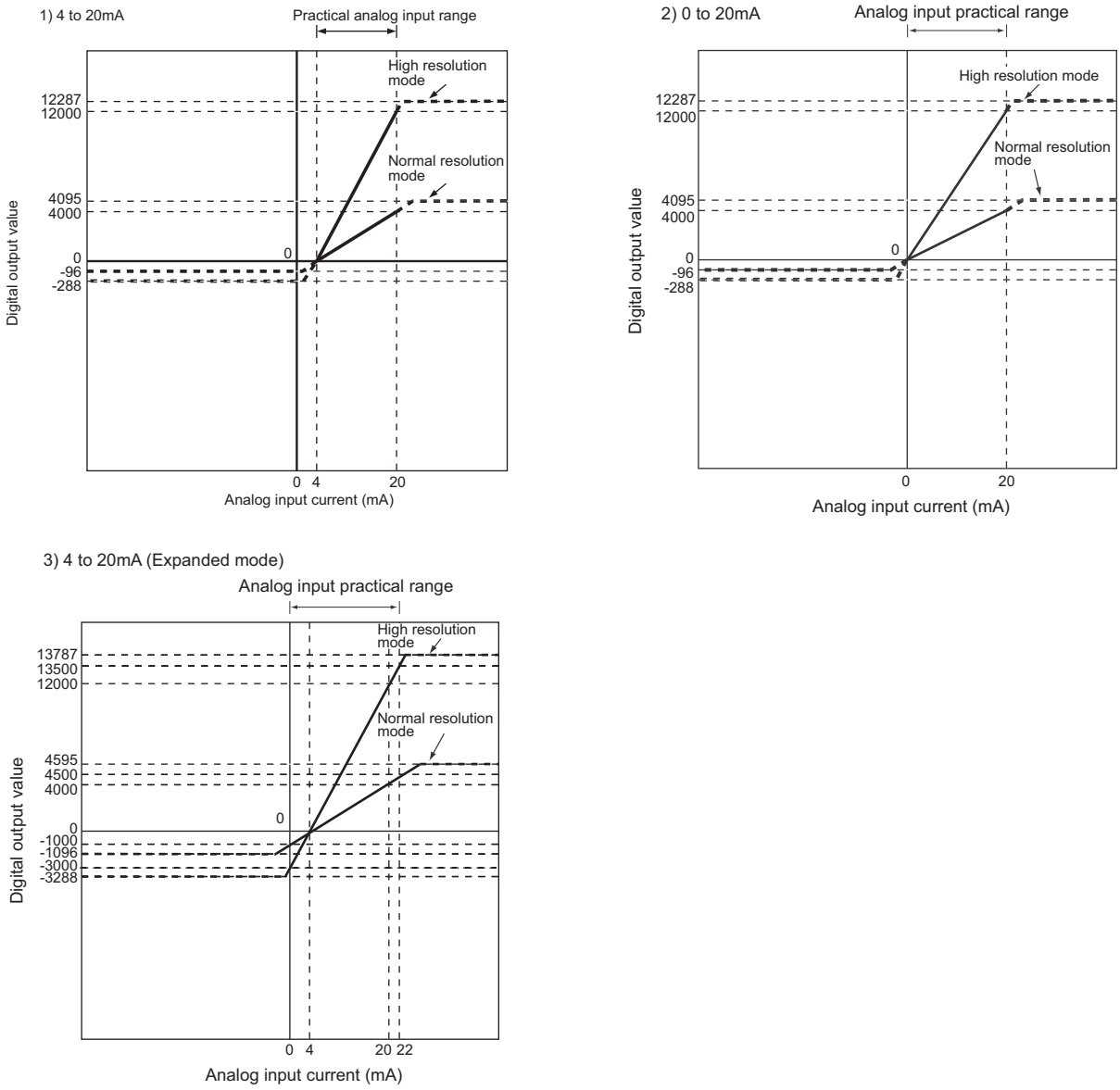


Fig.3.3 Input characteristic of Q66AD-DG

Point

(1) Set within the analog input range and digital output range for each input range.
If these ranges are exceeded, the maximum resolution and accuracy may not fall within the performance specifications. (Avoid use shown by the dotted lines in Fig.3.3.)

(2) Do not input an analog input current of -30mA or less and 30mA or more. The input elements may be damaged.

(3) Set the offset/gain values for the User range setting marked within a range which satisfies the following conditions.

(a) Gain value ≦ 24mA, offset value ≧ 0mA

(b) Use one of the following formulas according to the resolution mode to be set.

1) Normal resolution mode
{ (Gain value) - (Offset value) } > 5.5mA

2) High resolution mode
{ (Gain value) - (Offset value) } ≧ 16.0mA

(4) When an analog value that exceeds the range of the digital output value is entered, the digital output value will be fixed at the maximum or minimum value.

Analog input range setting	Digital output value (Normal resolution mode)		Digital output value (High resolution mode)	
	Minimum	Maximum	Minimum	Maximum
0 to 20mA	-96	4095	-288	12287
4 to 20mA				
4 to 20mA (Extended mode)	-1096	4595	-3288	13787
User range setting	-96	4095	-288	12287

3.1.3 Accuracy

The reference accuracy is the accuracy at the ambient temperature for offset/gain setting.
The temperature coefficient is the accuracy per temperature variation of 1°C.
The reference accuracy is the accuracy relative to the maximum digital output value.
Even if you change the offset/gain setting or input range to change the input characteristic, the reference accuracy and temperature coefficient do not change and are kept within the ranges given in the performance specifications.

[Example] Accuracy when the temperature changed from 25°C to 30°C
0.1% (reference accuracy) + 0.00714%/°C (temperature coefficient) 5°C (temperature variation difference) = 0.1357%

3.2 Function List

Table 3.3 lists the functions of the A/D converter modules.

Table3.3 Function list

Item	Function	Reference section
A/D conversion enable/ disable setting	(1) Specifies whether to enable or disable the A/D conversion for each channel. (2) Since the conversion time is 10ms per channel, disabling A/D conversion of unused channels can reduce the entire conversion time.	Section 3.4.2
A/D conversion method	(1) Sampling processing The A/D conversion for analog input values is performed successively for each channel, and the digital output value is output upon each conversion. (2) Averaging processing (a) Time averaging A/D conversion is averaged in terms of time on a channel basis and a digital average value is output. (b) Count averaging A/D conversion is averaged in terms of count on a channel basis and a digital average value is output. (c) Move averaging The specified number of digital output values measured per sampling time are averaged. (3) Primary delay filter A digital output value is smoothed according to the preset time constant.	Section 3.2.1
Maximum and minimum values hold function	(1) The maximum and minimum values of the digital output values are retained in the module.	Section 3.2.2
Input signal error detection function	(1) A voltage or current input that is equal to or more than the input signal error detection upper limit value, or equal to or less than the input signal error detection lower limit value is detected.	Section 3.2.3
Warning output function	(1) Process alarm A warning is output when a digital output value is equal to or more than the process alarm upper upper limit value, or equal to or less than the process alarm lower lower limit value. (2) Rate alarm A warning is output when the digital output value changes in a rate by which the digital output value reaches the rate alarm upper limit value or more, or the rate alarm lower limit value or less.	Section 3.2.4
Conversion starting time setting function (Q66AD-DG only)	(1) Setting the A/D conversion starting time allows A/D conversion to be started at the point when the output of the 2-wire transmitter stabilizes.	Section 3.2.5
Supply power ON/OFF function (Q66AD-DG only)	(1) The supply power to the 2-wire transmitter can be switched ON/OFF channel by channel. (2) Power is supplied to channels that have input range settings of "4 to 20mA (2-wire transmitter input): 0H", "4 to 20mA (Extended mode) (2-wire transmitter input): AH" or "User range setting (2-wire transmitter input): FH", and that are set to "Enabled" in A/D conversion enable/disable setting (Un\G0).	Section 3.4.2
Scaling function	(1) Conversion of A/D conversion values to preset percentage values and loading into the buffer memory is available. Programming steps for the scaling can be eliminated.	Section 3.2.6
Online module change	(1) The module can be changed without the system being stopped.*1	Chapter 7

*1 If the module is changed online to a module that has no extended mode for analog input range under the following input range settings, an intelligent function module switch error will occur.
Q68AD-G: 4 to 20mA (extended mode): A_H
1 to 5V (extended mode): B_H
Q66AD-DG: 4 to 20mA (extended mode) (2-wire transmitter input): A_H
4 to 20mA (extended mode) (current input): C_H

3.2.1 A/D conversion methods

(1) Sampling processing

A/D conversion is performed successively for analog input values, and the converted digital output values are stored in the buffer memory.
The sampling processing time varies depending on the number of channels used (number of channels set as A/D conversion enable).

Sampling processing time = No. of channels used × 10 (ms)

Example) When setting 6 for the number of channels used
6 ×10 = 60 (ms)

(2) Averaging processing

(a) Time averaging

A/D conversion is made for the preset period of time, the sum of values other than the maximum and minimum values is averaged, and the result is stored into the buffer memory.
The processing count within the set time varies depending on the number of channels used (number of channels set as A/D conversion enable).

Processing count = Set time/(No. of channels used × 10) (times)

Example) When setting 6 for the number of channels used, and 500ms for the set time
500/(6 × 10) = 8.333 (times)···Drop the fractional part.

(b) Count averaging

A/D conversion is made the preset number of times, the sum of values other than the maximum and minimum values is averaged, and the result is stored into the buffer memory.
The time required for the count-based average value to be stored into the buffer memory varies depending on the number of channels used (number of channels set as A/D conversion enable).

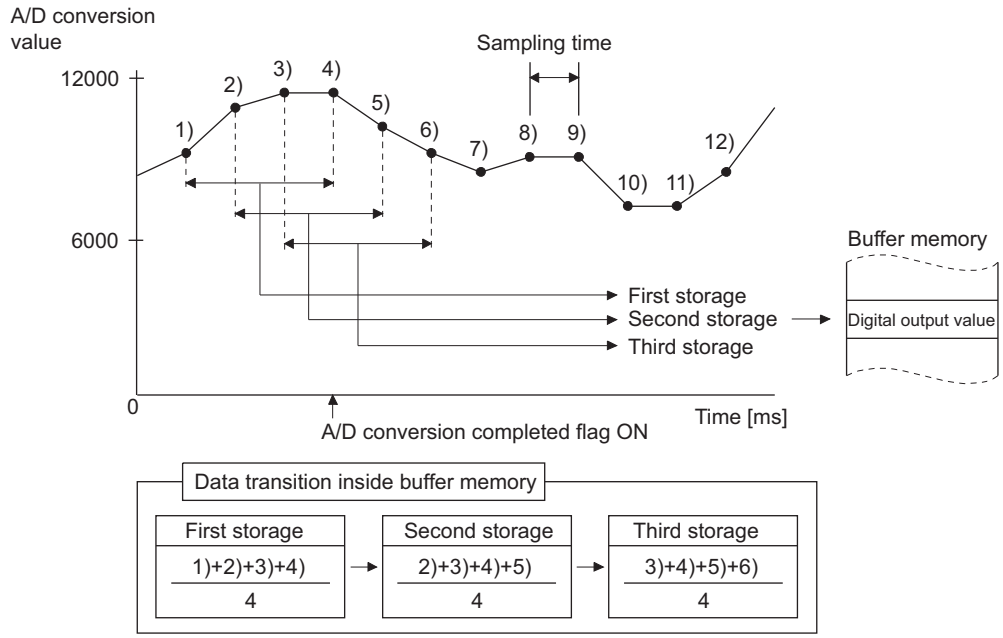
Processing time = Set count × (No. of channels used × 10) (ms)

Example) When setting 5 (times) for the average processing count
5 × 6 × 10 = 50 (ms)

(c) Moving average

The specified count of digital output values imported per sampling time are averaged to find a value, which is then stored into the buffer memory.
Since average processing is performed with data shifted per sampling, the most recent digital output value is obtainable.

Moving average processing at the preset count of 4 times



(3) Primary delay filter

A digital value whose transient noise has been smoothed is output according to the preset time constant.
The degree of smoothing varies with the time constant setting.

The relational expression of the time constant and digital output value is indicated below.

[If n = 1*1]
Yn = 0

[If n = 2]

$$Yn = yn\text{-}1 + \frac{\Delta t}{\Delta t + TA}(yn - yn\text{-}1)$$

[If n ≧ 3]

$$Yn = Yn\text{-}1 + \frac{\Delta t}{\Delta t + TA}(yn - Yn\text{-}1)$$

Yn	:	Current digital output value	yn	:	Pre-smoothing digital output value
Yn-1	:	Immediately preceding digital output value	Yn-1	:	Immediately preceding pre-smoothing digital output value
n	:	Sampling count	Δt	:	A/D conversion time (0.01 × number of conversion enabled channels)(s)
TA	:	Time constant (s)			

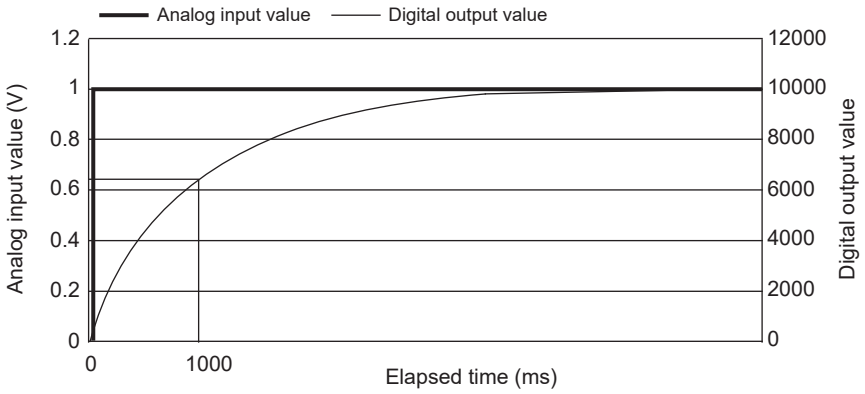
*1 The A/D conversion completed flag turns ON when n ≧ 2.

[Example 1] Digital output value when the analog input value varied from 0 to 1V

When the high resolution mode and the input range of 0 to 10V is specified for the Q68AD-G

The variation of the digital output value at the time constant setting of 1000ms (1s) is as shown below.

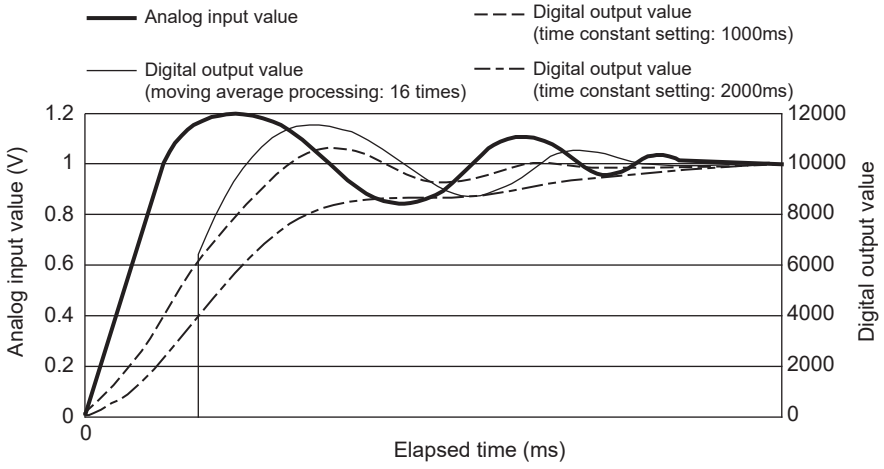
1000ms (1s) after the analog input value has reached 1V, the digital output value reaches 63.2% of the value attained when the sampling processing is selected.



[Example 2] Digital output value when the variation of the analog input value has a ringing waveform

When the high resolution mode and the input range of 0 to 10V is specified for the Q68AD-G

The variations of the digital output values at the time constant setting of 2000ms (2s), at the time constant setting of 1000ms (1s), and at the moving average processing of 16 times are as shown below.



3.2.2 Maximum and minimum values hold function

(1) The maximum and minimum values are held in the buffer memory channel by channel.

(2) The maximum and minimum values are cleared to 0 when the maximum value/ minimum value reset request (YD) or operating condition setting request (Y9) is turned ON, and new maximum and minimum values are stored when conversion is started.

(3) Since the area for storing the maximum and minimum values can be rewritten with the sequence program, the maximum and minimum values within a specific period of time can be checked.

(4) When the scaling function is enabled, values after scaling conversion are stored as the maximum and minimum values.
For the scaling function, refer to Section 3.2.6.

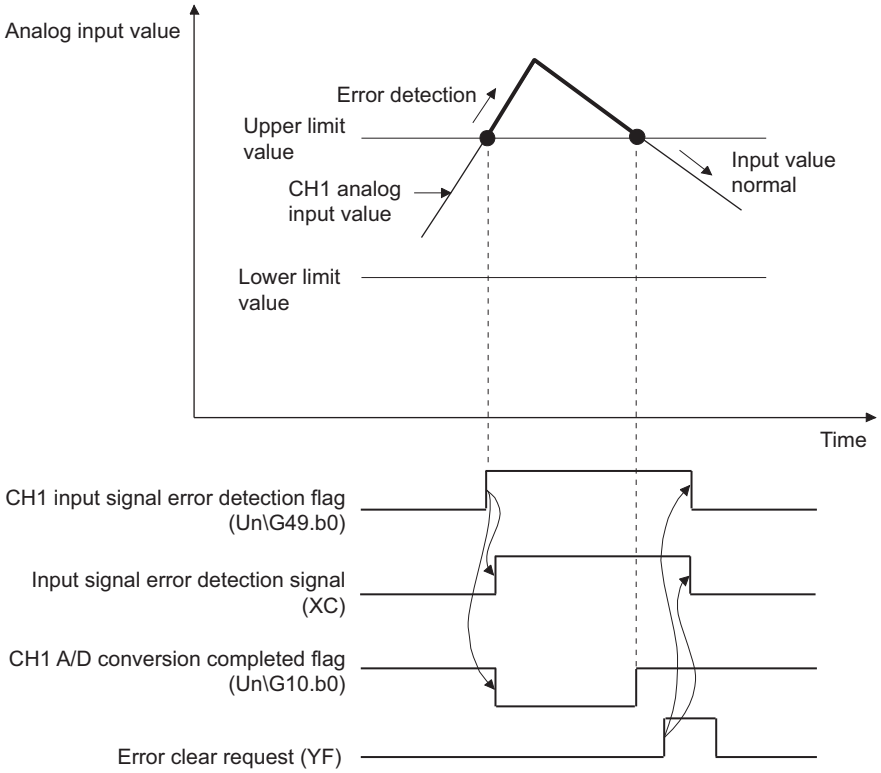
3.2.3 Input signal error detection function

(1) If the input voltage/current rose to or above the input signal error detection upper limit value or fell to or below the lower limit value, the input signal error detection flag (Un\G49) and input signal error detection signal (XC) turn ON and the ALM LED flickers to indicate the error.

(2) When the input signal error detection flag (Un\G49) turns ON for a channel, a digital output value immediately before the error detection is held for the channel, and the A/D conversion completed flag (Un\G10) of the corresponding channel turns OFF.

(3) By bringing the analog input value within the setting range and then turning ON the error clear request (YF), the input signal error detection flag (Un\G49) and input signal error detection signal (XC) turn OFF.

(4) When the analog input value returns to within the setting range, A/D conversion is resumed independently of whether the input signal error detection flag (Un\G49) and input signal error detection signal (XC) are reset or not, the A/D conversion completed flag (Un\G10) of the corresponding channel turns ON again after the first updating. (The ERR. LED remains flickering.)



(5) This function is executed at every sampling processing.

(6) Perform the following procedure to use this function.

1) Set the input signal error detection setting value for the corresponding channel.
2) Enable the A/D conversion of the corresponding channel.
3) Enable the input signal error detection of the corresponding channel.
4) Turn ON the operating condition setting request (Y9).

(7) How to set an input signal error detection upper/lower limit values

Set input signal error detection upper/lower limit values based on the input signal error detection setting value (input signal error detection upper/lower limit setting values). (Set the values in the unit of 1 (0.1%)).

The input signal error detection setting value is reflected to both the input signal error detection upper and lower limit values by default.

To detect input signal errors using only an upper limit value or lower limit value, or to individually set an upper limit value and a lower limit value, refer to (9) in this section.

(a) Input signal error detection upper limit value

This value is calculated as follows:

Gain value + {Full input range (Gain value - Offset value) × Input signal error detection setting value (Input signal error detection upper limit setting value)}

A value equal to or greater than the gain value can be set.

A setting value (%) can be calculated by the following formula.

$$\text{Input signal error detection setting value (Input signal error detection upper limit setting value)} = \frac{\text{Input signal error detection upper limit value} - \text{Gain value of each range}}{\text{Gain value of each range} - \text{Offset value of each range}} \times 1000$$

(b) Input signal error detection lower limit value

This value is calculated as follows:

Lower limit value of the input range - {Full input range (Gain value - Offset value) × Input signal error detection setting value (Input signal error detection lower limit setting value)}

A value equal to or smaller than the lower limit value of the input range can be set.

A setting value (%) can be calculated by the following formula.

$$\text{Input signal error detection setting value (Input signal error detection lower limit setting value)} = \frac{\text{Lower limit value of each range} - \text{Input signal error detection lower limit value}}{\text{Gain value of each range} - \text{Offset value of each range}} \times 1000$$

Remark

The following table lists the lower limit value, offset value, and gain value for each input range

Table3.4 The lower limit value, offset value, and gain value for each input range (Q68AD-G)

Input	Analog input range	Lower limit value	Offset value	Gain value
Voltage	0 to 10V	0V		10V
	0 to 5V	0V		5V
	1 to 5V	1V		5V
	1 to 5V (extended mode)	1V		5V
	-10 to 10V	-10V	0V	10V
	User range setting	Analog value when the digital value is: • -4000 (normal resolution mode) • -12000 (high resolution mode)	Analog value set as an offset value by the user	Analog value set as a gain value by the user
Current	0 to 20mA	0mA	0mA	20mA
	4 to 20mA	4mA	4mA	20mA
	4 to 20mA (extended mode)	4mA	4mA	20mA
	User range setting	Analog value when the digital value is: • -4000 (normal resolution mode) • -12000 (high resolution mode)	Analog value set as an offset value by the user	Analog value set as a gain value by the user

Table3.5 The lower limit value, offset value, and gain value for each input range (Q66AD-DG)

Input	Analog input range	Lower limit value	Offset value
0 to 20mA	0mA		20mA
4 to 20mA	4mA		20mA
4 to 20mA (extended mode)	4mA		20mA
User range setting	Analog value set as an offset value by the user		Analog value set as a gain value by the user

(8)Setting example of input signal error detection

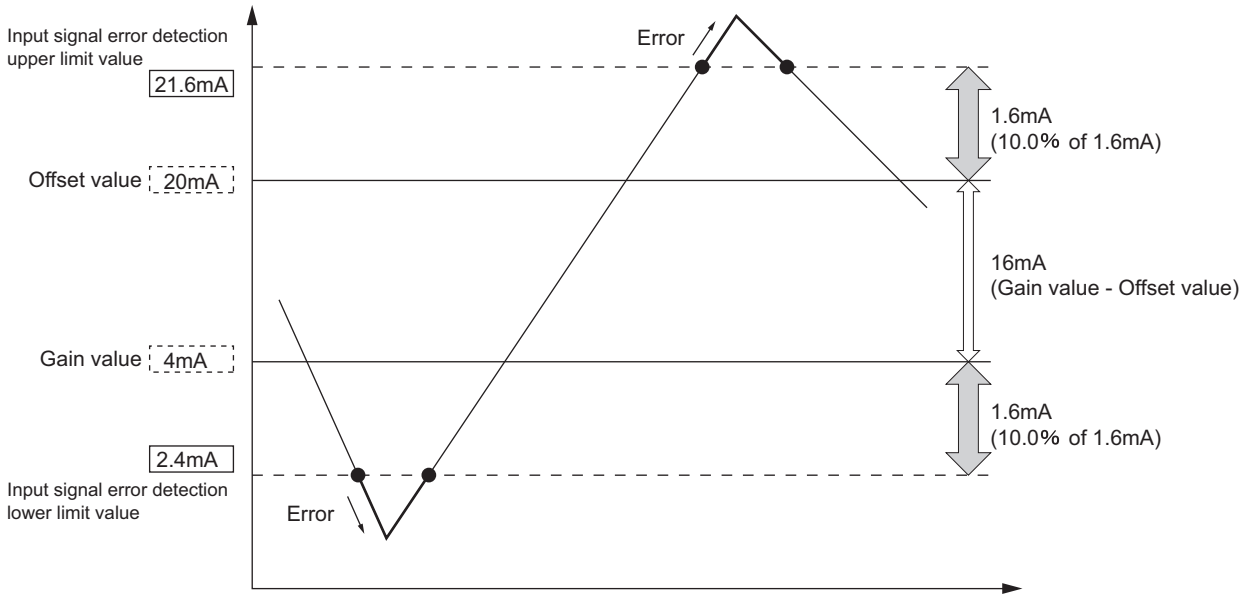
Example) To detect an input signal error when the analog input value falls below 2.4mA in the channel where the input range of 4 to 20mA (extended mode) and the normal resolution mode is set

Apply the following values to the calculation formula for an input signal error detection lower limit value.

- Input signal error detection lower limit value: 2.4mA
- Lower limit value of the input range (offset value): 4.0mA
- Gain value: 20.0mA

$$\text{Input signal error detection setting value} = \frac{\text{Lower limit value of each range} - \text{Input signal error detection upper limit value}}{\text{Gain value of each range} - \text{Offset value of each range}} \times 1000$$

Therefore, Set 100 (10.0%) as an input signal error detection setting value.
The input signal error detection values act as follows in this case. (Because of the setting value of 100 (10%), an error is detected not only at 2.4mA but also at 21.6mA.)



(9)Specifying a condition to detect input signal errors

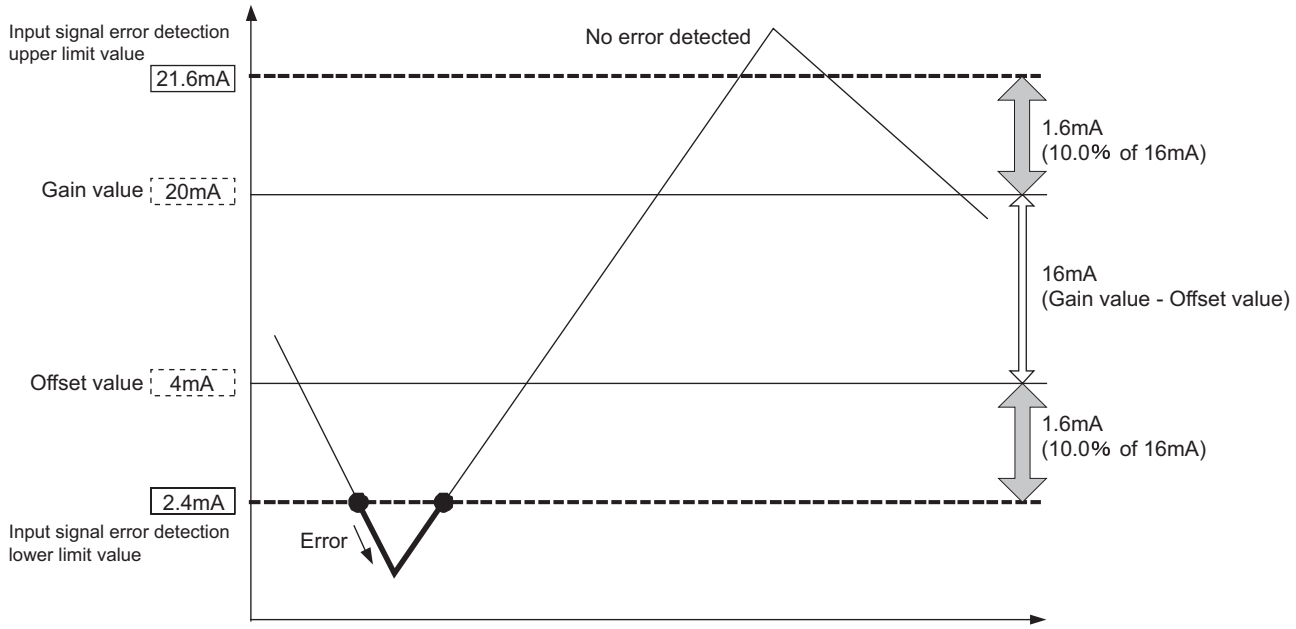
By setting the following buffer memory areas, input signal errors can be detected only at an upper limit value or lower limit value, or at different upper/lower limit values.

- Input signal error detection extended/input signal error detection setting (Un\G47)
- CH□ input signal error detection setting value/CH□ input signal error detection lower limit setting value (Un\G142 to Un\G149)
- CH□ input signal error detection upper limit setting value (Un\G150 to Un\G157)

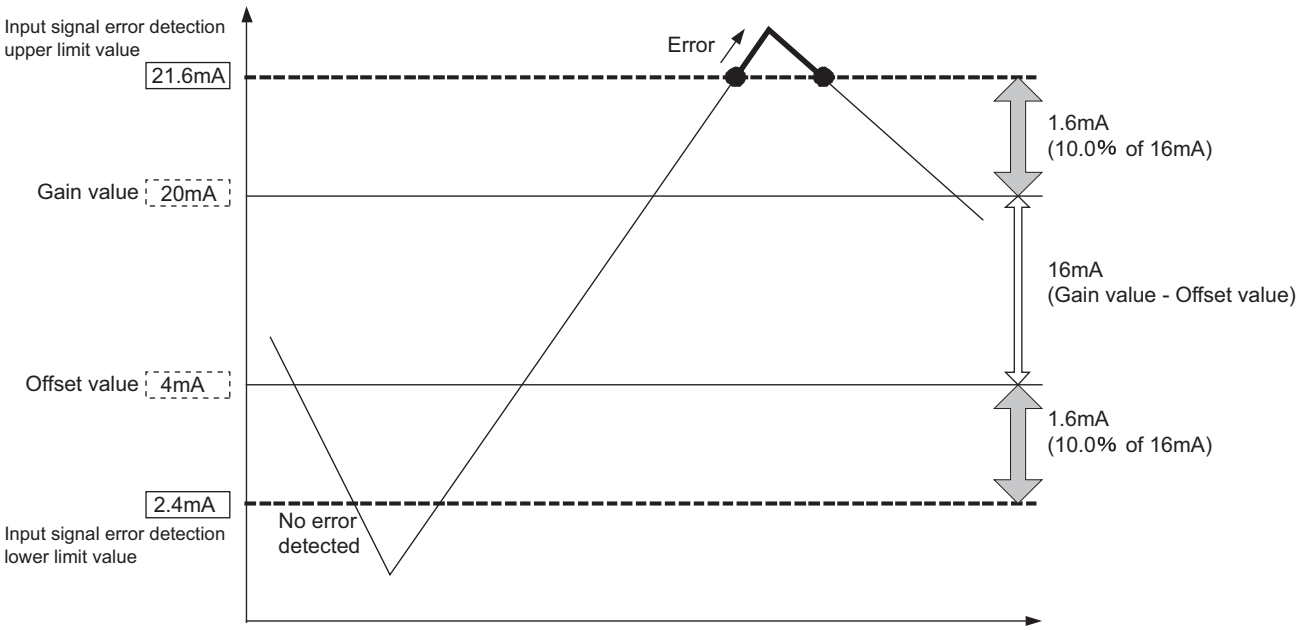
The following is a setting example.

Example) Channel where the input range of 4 to 20mA (extended mode) and the normal resolution mode is set

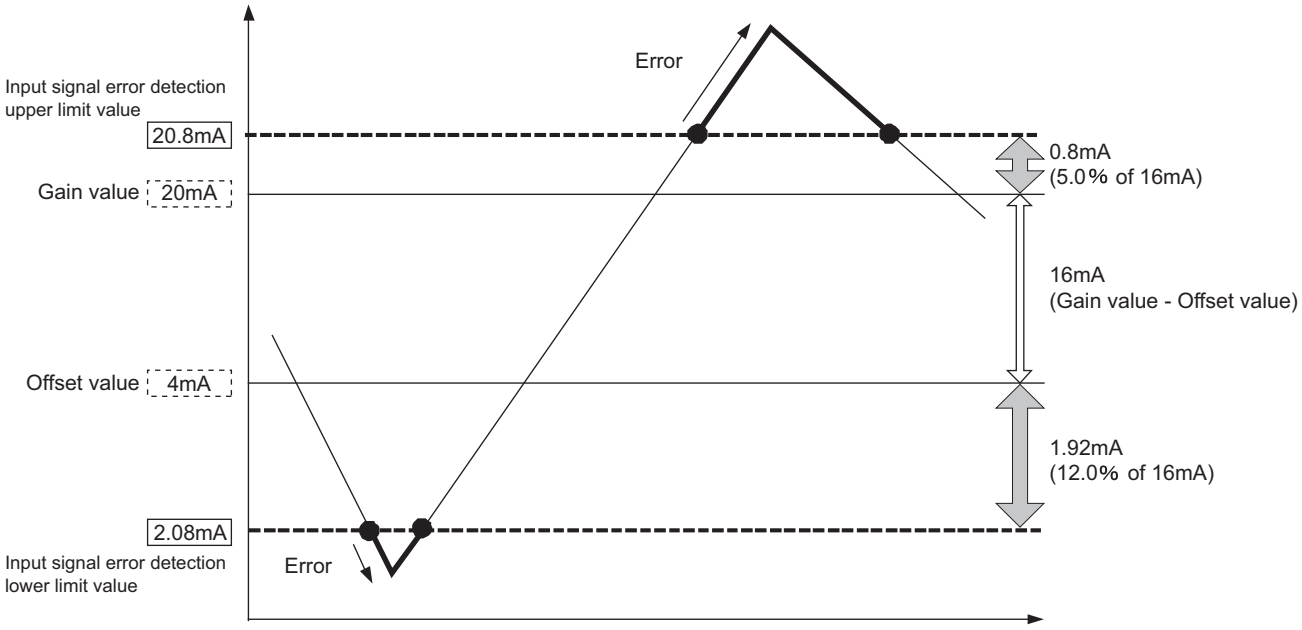
1) To detect input signal errors at a lower limit value only
   - Input signal error detection extended setting: 1 (different upper/lower limit values)
   - Input signal error detection upper limit setting value: 251 (input signal error detection disabled)
   - Input signal error detection lower limit setting value: 100 (10.0%)



2) To detect input signal errors at an upper limit value only
   - Input signal error detection extended setting: 1 (different upper/lower limit values)
   - Input signal error detection upper limit setting value: 100 (10.0%)
   - Input signal error detection lower limit setting value: 251 (input signal error detection disabled)



3) To detect input signal errors at different upper and lower limit values
   - Input signal error detection extended setting: 1 (different upper/lower limit values)
   - Input signal error detection upper limit setting value: 50 (5.0%)
   - Input signal error detection lower limit setting value: 120 (12.0%)



3.2.4 Warning output function

(1) Process alarm

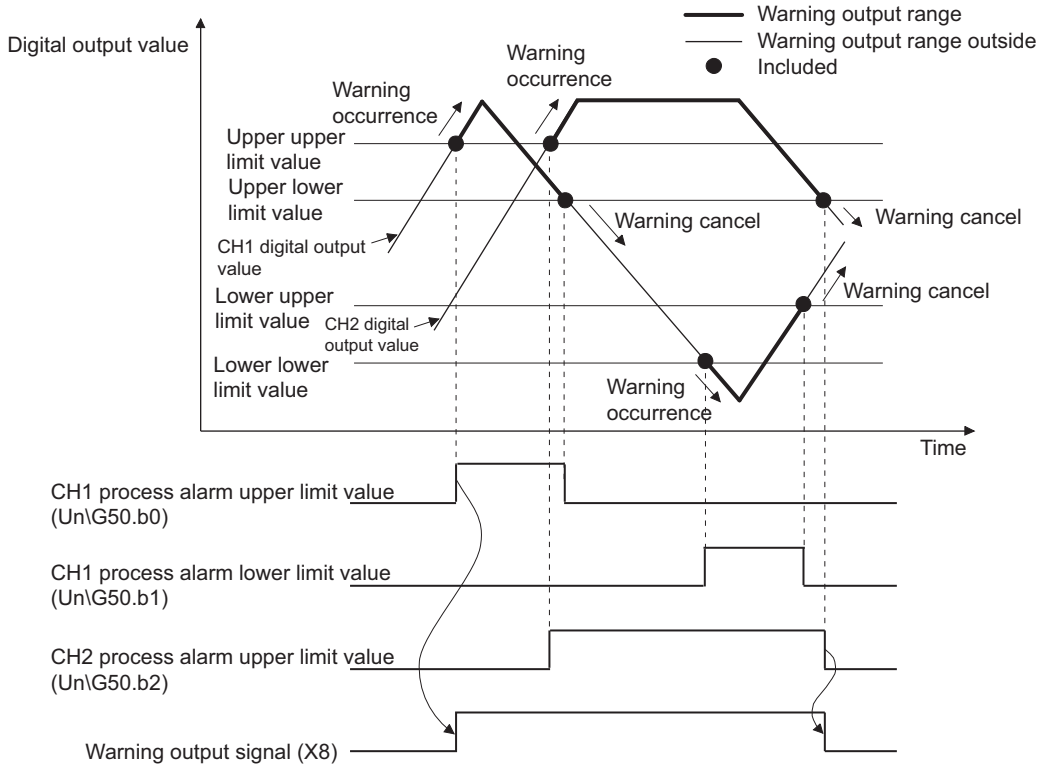
(a) If the detected digital output value rose to or above the process alarm upper upper limit value or fell to or below the process alarm lower lower limit value and entered the warning output range zone, the warning output flag (process alarm)(Un\G50) and warning output signal (X8) turn ON and the ALM LED is lit to indicate the warning.

A warning will be output according to the following digital output values.

Item		Digital value causing warning output
Value set in scaling enable/ disable setting (Un\G53)	0: Disable	CH□ digital output value (Un\G11 to Un\G18)
	1: Enable	CH□ scaling value (Un\G54 to Un\G61)

(b) After a warning was output, when the digital output value reaches a value less than the process alarm upper lower limit value, or a value more than the process alarm lower upper limit value, "0" is stored in the corresponding bit of the warning output flag (Un\G50) for the channel.

The warning output signal (X8) turns OFF, and the ALM LED turns OFF when the digital output values in all channels get out of the warning output range.



(c) When time or count averaging is specified, this function is executed at intervals of the preset averaging time or averaging count.

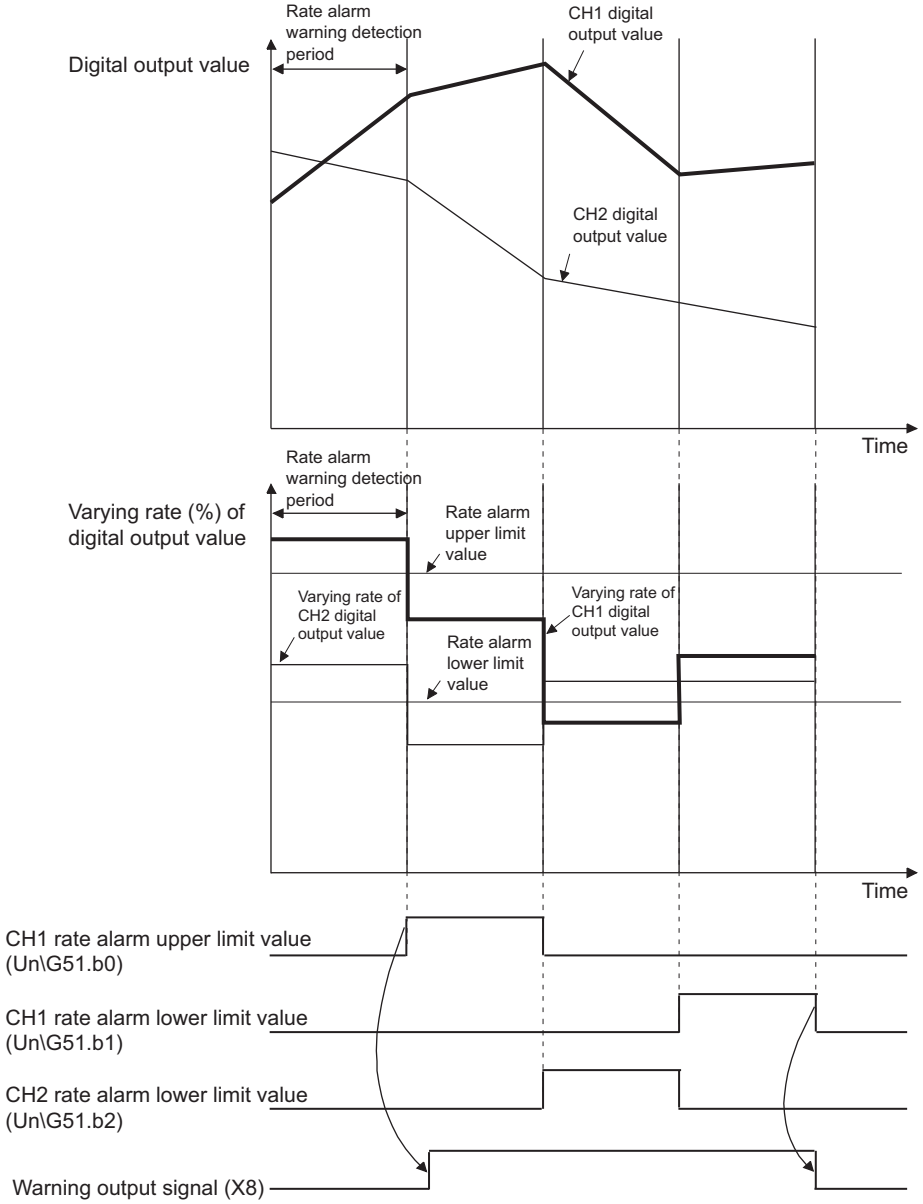
When any other A/D conversion system (sampling processing, moving average, primary delay filter) is specified, this function is executed at intervals of the sampling time.

(d) To use the scaling function, be sure to consider scale conversion before setting the CH□ process alarm upper/lower limit value.

(2) Rate alarm

(a) If the range of change in the digital output value sampled at intervals of the rate alarm warning detection period is equal to or greater than the rate alarm upper limit value or is equal to or less than the rate alarm lower limit value, the warning output flag (rate alarm) (Un\G51) and warning output signal (X8) turn ON and the ALM LED is lit to indicate the warning of the rate alarm.

(b) If, after the output of the warning, the rate fell below the rate alarm upper limit value or rose above the rate alarm lower limit value and returned to within the setting range, "0" is stored into the bit position corresponding to the channel number of the warning output flag (rate alarm) (Un\G51).
The warning output signal (X8) turns OFF only when all channels return to within the setting range.



(c) Set the rate alarm upper limit value/lower limit value in 0.1%/s increments relative to the maximum value (16000/12000/4000) of the digital output value.
The setting range is -32768 to 32767 (-3276.8% to 3276.7%).

(d) The setting range of the rate alarm warning detection period is 10 to 5000ms.
When the period is set to 5000ms, the digital values are compared at intervals of 5 seconds to detect the varying rate.

(e) The rate alarm is judged by converting the rate alarm upper/lower limit value into the digit value per rate alarm warning detection period.
The expression for the value used to make judgment per rate alarm warning detection period is as follows.

Value used to make judgment per rate alarm warning detection period [digit]
=rate alarm upper limit value or lower limit value × 0.001 × maximum value of the digital output value × rate alarm warning detection period ÷ 1000

Example

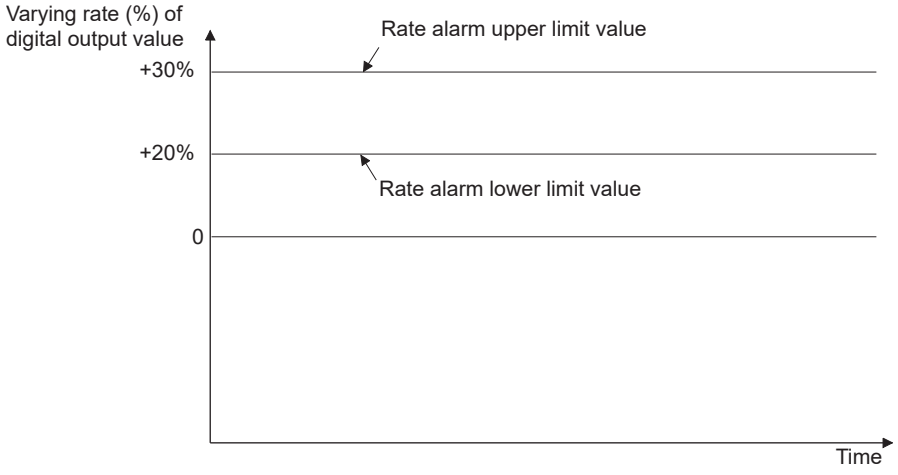
In channel 1, when the following:
- Upper limit value of change rate: 30%/s (300 is stored in buffer memory)
- Maximum digital output value: 16000
- Rate alarm warning detection period: 10ms

are set, a value [digit] used at every rate alarm warning detection period can be calculated as follows:
300 × 0.001 × 16000 × 10 ÷ 1000=48(digit)

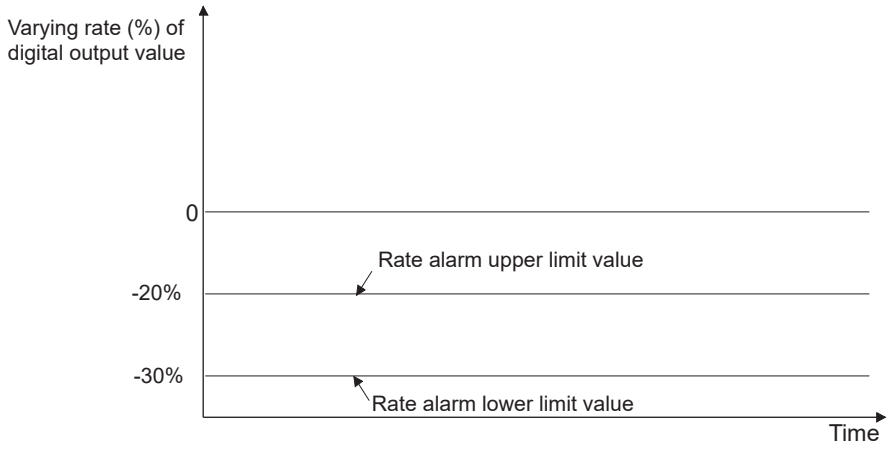
Therefore, the current value is compared with the previous value every 10ms in channel 1, and whether a difference of 48 (digit) or more is identified between them or not is determined.

(f) The rate alarm is useful to watch the varying rate of the digital output value in a limited range.

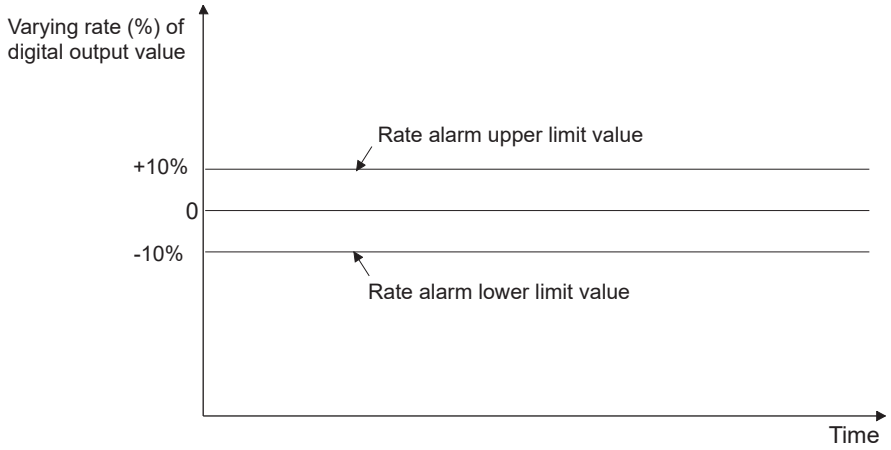
1) Example of setting the rate alarm upper limit value/lower limit value when it is desired to watch that the digital output value increases within the specified range



2) Example of setting the rate alarm upper limit value/lower limit value when it is desired to watch that the digital output value decreases within the specified range



3) Example of setting the rate alarm upper limit value/lower limit value when it is desired to watch that the digital output value increases/decreases within the specified range



3.2.5 Conversion starting time setting function (Q66AD-DG only)

(1) As the A/D conversion starting time, set the "time necessary from when the used 2-wire transmitter powers on until its output stabilizes".
This setting allows A/D conversion processing to be started as soon as the output of the 2-wire transmitter stabilizes.

(2) Set the time to the CH□ Conversion starting time setting (for 2-wire transmitter) (Un\G78 to Un\G83).

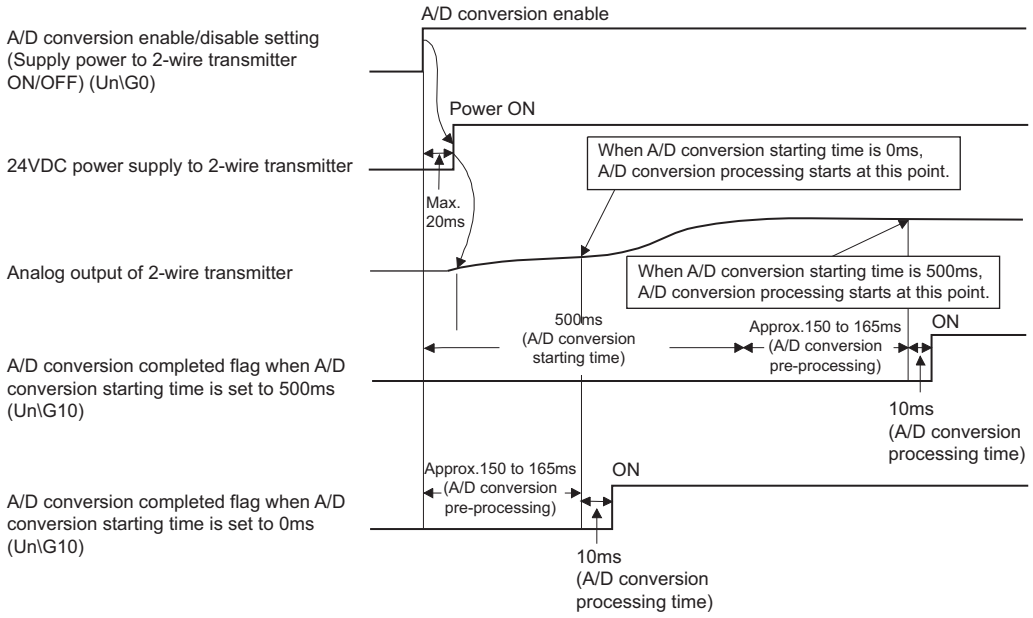
(3) The following indicates the time until the A/D conversion completed flag (Un\G10) turns ON when the A/D conversion starting time has been set.

(Conversion starting time) + (A/D conversion pre-processing: Approx. 150 to 165ms) + (A/D conversion processing: number of conversion enabled channels × 10ms)

Point

Set the A/D conversion starting time in consideration of the time necessary from when the 2-wire transmitter powers on until its output stabilizes and the warm-up time of the 2-wire transmitter.

[Example] When the time necessary from when the 2-wire transmitter powers on until its output stabilizes is 500ms



3.2.6 Scaling Function

(1) With this function, A/D conversion values are converted to rate values and loaded into the buffer memory.

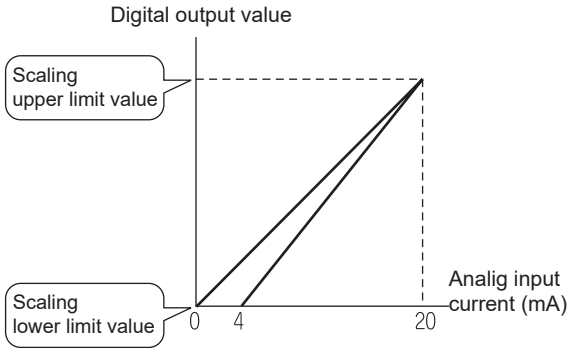
(2) A digital value stored in CH□ digital output value (Un\G11 to Un\G18) is converted to a value in the range set by CH□ scaling upper/lower limit value (Un\G62 to Un\G77). The converted value is stored in CH□ scaling value storage area (Un\G54 to Un\G61).

(3) The scaling function is used for processed values when using the averaging processing or primary delay filter.

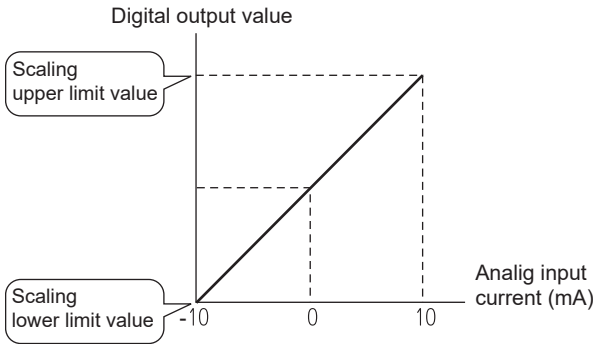
(4) The setting of CH□ scaling upper/lower limit value (Un\G62 to Un\G77) varies depending on whether to use the factory default range setting or the user range setting for the input range.

(a) When using the factory default setting for the input range
Set a value that should correspond to the upper limit of digital output as the scaling upper limit value, and a value that should correspond to the lower limit as the scaling lower limit value.

Example 1) Input range setting: 0 to 20mA, or 4 to 20mA (Q68AD-G, Q66AD-DG)

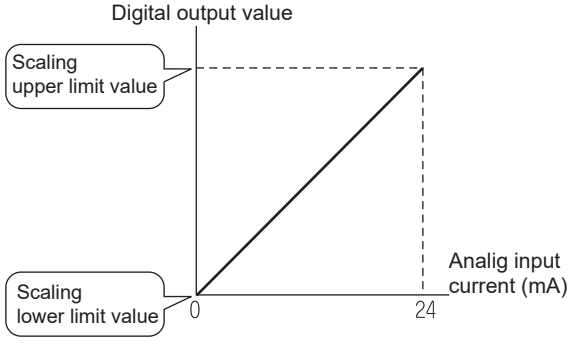


Example 2) Input range setting: -10 to 10V (Q68AD-G)

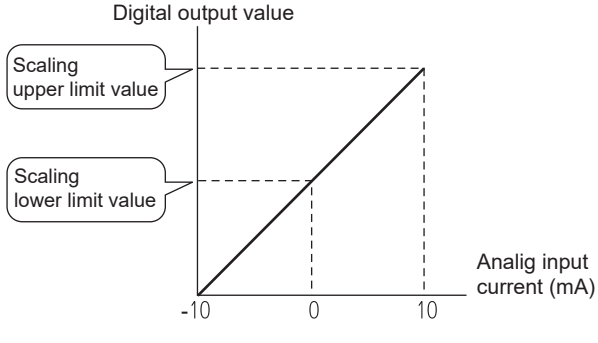


(b) When using the user range setting for the input range
Set a value corresponding to the gain or offset value to the scaling upper or lower limit value respectively.

Example 1) Gain value: 0mA, Offset value: 24mA (Q66AD-DG)



Example 2) Gain value: 0V, Offset value: 10V (Q68AD-G)



(5) How to calculate a scaling value is explained below.

(a) When using the factory default setting for the input range

1) Input range: 0 to10V, 0 to 5V, 1 to 5V, 0 to 20mA, 4 to 20mA, 1 to 5V (Extended mode), or 4 to 20mA (Extended mode)

$$\text{Scaling value} = \frac{D_X \times (S_H - S_L)}{D_{MAX}} + S_L$$

2) Input range: -10 to 10V

$$\text{Scaling value} = \frac{D_X \times (S_H - S_L)}{D_{MAX} - D_{MIN}} + \frac{S_H + S_L}{2}$$

D_X : Digital output value

D_{MAX} : The maximum digital output value in the input range being used

D_{MIN} : The minimum digital output value in the input range being used

S_H : Scaling upper limit value

S_L : Scaling lower limit value

Example) On the Q68AD-G, using the scaling function in High resolution mode and in the input range of -10 to 10V
If the setting is
Scaling upper limit value, S_H: 14000
Scaling lower limit value, S_L : 2000
and the digital output value D_X is 7500,

$$\text{Scaling value} = \frac{7500 \times (14000-2000)}{16000-(-16000)} + \frac{(14000+2000)}{2}$$

$$= 10812.5....$$

$$= 10812$$

It omits digits below the decimal point.

(b) When using the user range setting for the input range

$$\text{Scaling value} = \frac{D_X \times (S_H - S_L)}{D_{MAX}} + S_L$$

D_X : Digital output value

D_{MAX} : The maximum digital output value in the input range being used (A/D conversion value corresponding to the gain value)

S_H : Scaling upper limit value

S_L : Scaling lower limit value

Example) On the Q68AD-G, using the scaling function in High resolution mode and in the user range setting
If the setting is
Scaling upper limit value, S_H: 10000
Scaling lower limit value, S_L : 2000
and the digital output value 4250 is input,

$$\text{Scaling value} = \frac{4250\times(10000-2000)}{12000} + 2000$$

$$= 4833.33....$$

$$= 4833$$

It omits digits below the decimal point.

Point

The setting range allowed for the scaling upper and lower values is -32000 to 32000. Note that the resolution will not change even if a scaling upper/lower limit value is set to change more than the resolution.

3.3 I/O Signals for the Programmable Controller CPU

3.3.1 List of I/O signals

Table 3.4 lists the I/O signals of the Q68AD-G.
Table 3.5 lists the I/O signals of the Q66AD-DG.
Note that I/O numbers (X/Y) shown in this chapter and thereafter are the values when the start I/O number for the A/D converter module is set to 0.

Table3.6 List of I/O signal (Q68AD-G)

Signal direction CPU Module ← Q68AD-G		Signal direction CPU Module → Q68AD-G	
Device No. (Input)	Signal name	Device No. (Output)	Signal name
X0	Module ready	Y0	Use prohibited*1
X1	Use prohibited*1	Y1	
X2		Y2	
X3		Y3	
X4		Y4	
X5		Y5	
X6		Y6	
X7	High resolution mode status flag	Y7	
X8	Warning output signal	Y8	
X9	Operating condition setting completed flag	Y9	Operating condition setting request
XA	Offset/gain setting mode flag	YA	User range writing request
XB	Channel change completed flag	YB	Channel change request
XC	Input signal error detection signal	YC	Use prohibited*1
XD	Maximum value/minimum value reset completed flag	YD	Maximum value/minimum value reset request
XE	A/D conversion completed flag	YE	Use prohibited*1
XF	Error flag	YF	Error clear request

Point

*1 These signals cannot be used by the user since they are for system use only.
If these are turned ON/OFF by the sequence program, the performance of the A/D converter module cannot be guaranteed.

Table3.7 List of I/O signal (Q66AD-DG)

Signal direction CPU Module ← Q66AD-DG		Signal direction CPU Module → Q66AD-DG	
Device No. (Input)	Signal name	Device No. (Output)	Signal name
X0	Module ready	Y0	Use prohibited*1
X1	Use prohibited*1	Y1	
X2		Y2	
X3		Y3	
X4		Y4	
X5		Y5	
X6		Y6	
X7	High resolution mode status flag	Y7	
X8	Warning output signal	Y8	
X9	Operating condition setting completed flag	Y9	Operating condition setting request
XA	Offset/gain setting mode flag	YA	User range writing request
XB	Channel change completed flag	YB	Channel change request
XC	Input signal error detection signal Offset/gain change completed flag	YC	Offset/gain change request
XD	Maximum value/minimum value reset completed flag	YD	Maximum value/minimum value reset request
XE	A/D conversion completed flag	YE	Use prohibited*1
XF	Error flag	YF	Error clear request

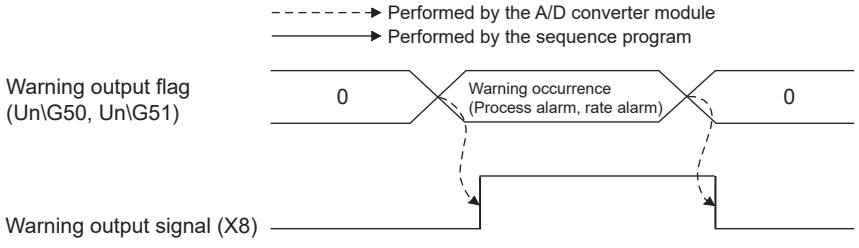
Point

*1 These signals cannot be used by the user since they are for system use only.
If these are turned ON/OFF by the sequence program, the performance of the A/D converter module cannot be guaranteed.

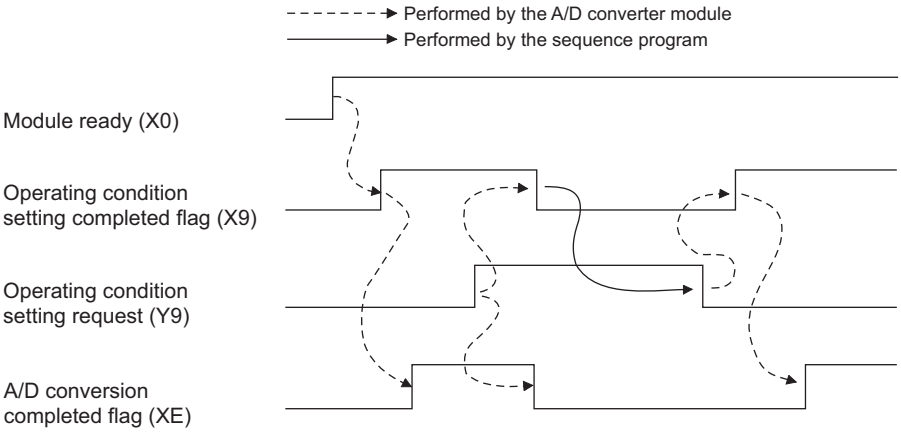
3.3.2 Details of I/O signals

I/O signals for the A/D converter modules are explained in detail below.

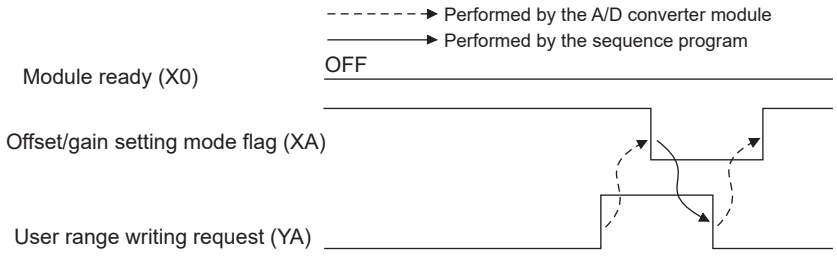
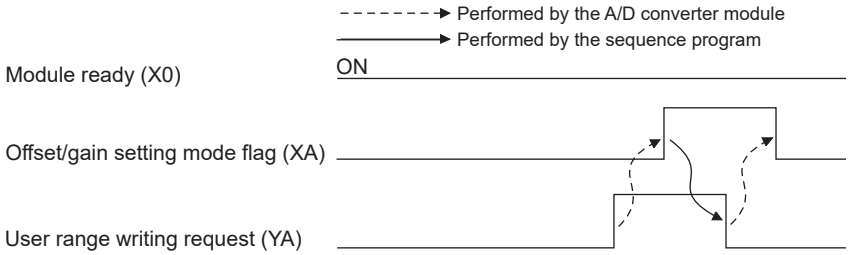
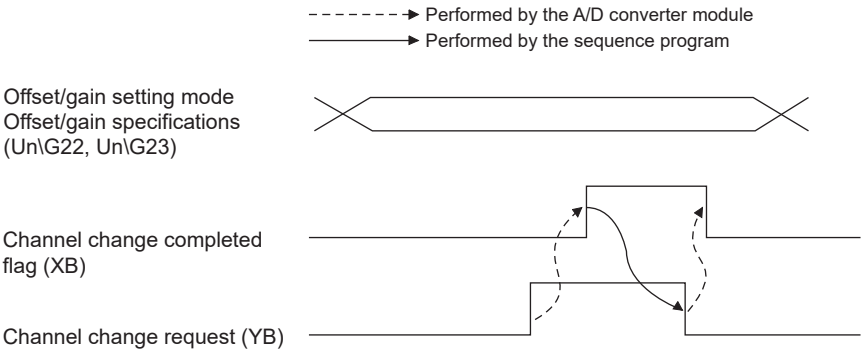
(1) Input signals

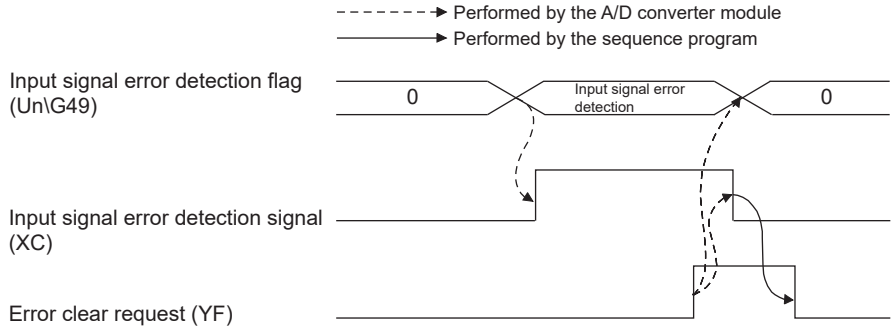
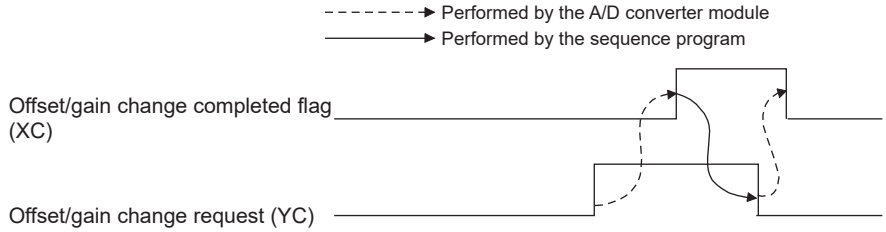
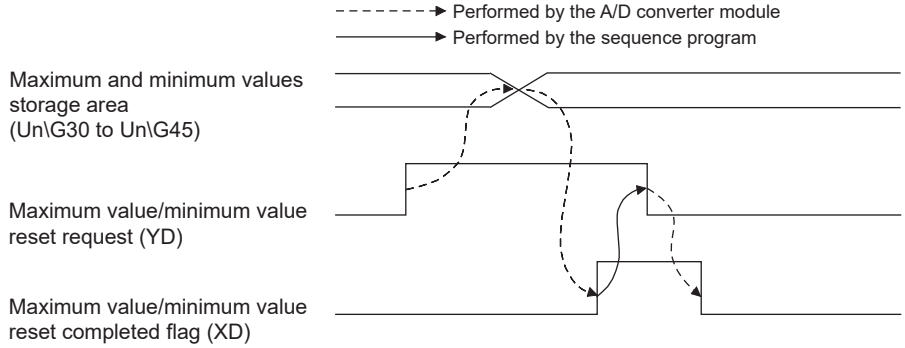
Device No.	Signal Name	Description
X0	Module ready	(1) When the programmable controller CPU is powered on or reset, this signal turns on once the preparation for A/D conversion has been completed, and A/D conversion processing is then performed. (2) In either of the following states, the Module ready (X0) turns OFF. ▪ During offset/gain setting mode (A/D conversion processing is performed.) ▪ When the A/D converter module has a watchdog timer error*1 (A/D conversion processing is not performed.)
X7	High resolution mode status flag	(1) This turns ON when in high resolution mode.
X8	Warning output signal	(1) The Warning output signal (X8) turns ON at detection of a process alarm or rate alarm. (a) Process alarm 1) This signal turns ON when the digital output value falls outside the setting range set to the process alarm upper/lower limit values (Un\G86 to Un\G117) on any of the channels enabled for A/D conversion after the process alarm function has been made valid. 2) As soon as the digital output values return to within the setting ranges on all channels enabled for A/D conversion, this signal turns OFF automatically and the ALM LED is also extinguished. (b) Rate alarm 1) This signal turns ON when the varying rate of the digital output value falls outside the varying rate range set to the rate alarm upper/lower limit values (Un\G122 to Un\G137) on any of the channels enabled for A/D conversion after the rate alarm function has been made valid. 2) As soon as the varying rates of the digital output values return to within the preset varying ranges on all channels enabled for A/D conversion, this signal turns OFF automatically and the ALM LED is also extinguished. 

*1 A watchdog timer error occurs when the program calculations are not completed within the scheduled time due to malfunctions of A/D converter module hardware.
When a watchdog timer error occurs, the RUN LED for the A/D converter module turns off.

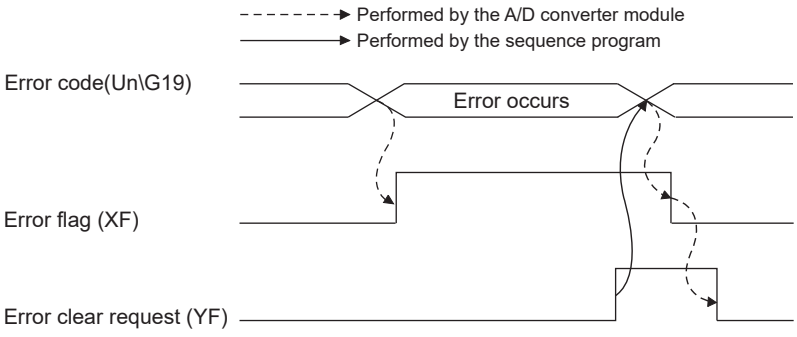
Device No.	Signal Name	Description
X9	Operating condition setting completed flag	(1) This signal is used as an interlock condition to turn ON/OFF the Operating condition setting request (Y9) when any of the following settings has been changed. ▪ A/D conversion enable/disable setting (Un\G0) ▪ CH□Average time/Average number of times/Moving average/Time constant settings (Un\G1 to Un\G8) ▪ Averaging process specification (Un\G24, Un\G25) ▪ Input signal error detection extended/input signal error detection setting (Un\G47) ▪ Warning output settings (Un\G48) ▪ Scaling enable/disable setting(Un\G53) ▪ CH□ scaling upper/lower limit value (Un\G62 to Un\G77) ▪ CH□ conversion starting time setting (for 2-wire transmitter) *1 (Un\G78 to Un\G83) ▪ CH□ process alarm upper/lower limit value (Un\G86 to Un\G117) ▪ CH□ rate alarm warning detection period (Un\G118 to Un\G125) ▪ CH□ rate alarm upper/lower limit value (Un\G126 to Un\G141) ▪ CH□ input signal error detection setting value/CH□ input signal error detection lower limit setting value (Un\G142 to Un\G149) ▪ CH□ input signal error detection upper limit setting value (Un\G150 to Un\G157) (2) When the operating condition setting completed flag (X9) is OFF, A/D conversion processing is not performed. Under the following conditions, the operating condition setting completed flag (X9) turns OFF. ▪ When operating condition setting request (Y9) is ON  (3) Digital outputs are cleared immediately after this Operating condition setting request (Y9) turns ON. Therefore, turn ON the A/D conversion completed flag before reading digital outputs.

*1: For the Q66AD-DG only

Device No.	Signal Name	Description
XA	Offset/gain setting mode flag	[In offset/gain setting mode] (1) This signal is used as an interlock condition to turn ON/OFF the User range writing request (YA) when the value at completion of offset/gain setting adjustment is registered. (2) Refer to Section 4.6 regarding the offset/gain settings.  [In normal mode] (1) This signal is used as an interlock condition to turn ON/OFF the User range writing request (YA) when the user range is restored. (2) Refer to Chapter 7 for the user range restoration. 
XB	Channel change completed flag	(1) This signal is used as an interlock condition for setting the channel change request (YB) to ON/OFF when changing the channel for which the offset/gain settings are to be performed. (2) Refer to Section 4.6 regarding the offset/gain settings. 

Device No.	Signal Name	Description
XC	Input signal error detection signal	(1) This signal turns ON when the analog input value falls outside the setting range set to the Input signal error detection setting value value/input signal error detection lower limit setting value (Un\G142 to Un\G149), Input signal error detection upper limit setting value (Un\G150 to Un\G157) on any of the channels enabled for A/D conversion after the Input signal error detection is made valid. (2) When the Input signal error detection signal turns ON 1) The A/D conversion completed flag (Un\G10) of the corresponding channel turns OFF. 2) The digital output value is held as at the time of error detection. 3) The ALM LED flickers. (3) By bringing the analog input value within the setting range and then turning ON the Error clear request (YF), the Input signal error detection signal (XC) turns OFF and the ALM LED is extinguished. (4) When the analog input value returns to within the setting range, A/D conversion is resumed independently of whether the Input signal error detection signal (XC) is reset or not, and after the first updating, the A/D conversion completed flag (Un\G10) of the corresponding channel turns ON again. The processing, such as averaging processing or primary delay filter, starts from the first time after resumption of A/D conversion. 
	Offset/gain change completed flag*1	(1) This signal is used as an interlock condition to turn ON/OFF the offset/gain change request (YC) when the offset/gain value is changed. (2) Refer to Section 4.6 for the offset/gain setting. 
XD	Maximum value/ minimum value reset completed flag	(1) This signal turns ON when the maximum value/minimum value stored at any of the buffer memory addresses 30 to 45 (Un\G30 to Un\G45) is reset by turning ON the Maximum value/ minimum value reset request (YD). 

<table>
<tr><th>Device No.</th><th>Signal Name</th><th>Description</th></tr>
<tr><td>XE</td><td>A/D conversion completed flag</td><td>
[For the Q68AD-G]
(1) This signal turns ON when all conversion-enabled channels have completed the initial A/D conversion.
(2) This signal or the A/D conversion completed flag (Un\G10) is used as an interlock condition to read out the digital output value.
[For the Q66AD-DG]*1
(1) This signal turns ON when all conversion-enabled channels have completed the initial A/D conversions.
(2) The following table lists the signal status when the external power supply is turned OFF.
<table>
<tr><th colspan="2">Selected range</th><th>When the external power supply is turned OFF</th><th>When the external power supply is turned ON again</th></tr>
<tr><td colspan="2">Analog current input range only without 2-wire transmitter</td><td colspan="2">• Signal remains ON because the A/D conversion continues.</td></tr>
<tr><td colspan="2">2-wire transmitter range only</td><td>• Signal turns OFF because the A/D conversion stops.
• Previous digital output values are held.</td><td>• A/D conversion resumes.
• Signal turns ON again when all conversion-enabled channels have completed the initial A/D conversion.*3</td></tr>
<tr><td rowspan="2">Mix</td><td>Analog current input range without 2-wire transmitter</td><td colspan="2">• A/D conversion continues.*2</td></tr>
<tr><td>2-wire transmitter range</td><td>• A/D conversion stops.*2
• Previous digital output values are held.</td><td>• A/D conversion resumes.
• Signal turns ON again when all conversion-enabled channels have completed the initial A/D conversion.*3</td></tr>
</table>
*1 The specifications are or the Q66AD-DG whose product number (first five digits) is "15032" or later.
For the specifications of the Q66AD-DG whose product number (first five digits) is "15031" or earlier, refer to Appendix 2.
*2 The signal turns OFF because the channels for the 2-wire transmitter range stop the A/D conversion.
*3 The processing such as averaging processing and primary delay filter starts from the initial status after the A/D conversion resumes.
(3) The following table lists the signal status when the A/D conversion is enabled in the off condition of the external power supply.
<table>
<tr><th colspan="2">Selected range</th><th>A/D conversion disable → enable</th></tr>
<tr><td colspan="2">Analog current input range only without 2-wire transmitter</td><td>• A/D conversion starts.
• Signal turns ON when all conversion-enabled channels have completed the initial A/D conversion.</td></tr>
<tr><td colspan="2">2-wire transmitter range only</td><td>• A/D conversion does not start.*4
• Signal remains OFF.</td></tr>
<tr><td rowspan="2">Mix</td><td>Analog current input range without 2-wire transmitter</td><td>• A/D conversion starts.*5</td></tr>
<tr><td>2-wire transmitter range</td><td>• A/D conversion does not start.*4, *5</td></tr>
</table>
*4 The A/D conversion starts if the external power supply is turned on. Then, the signal turns ON when all conversion-enabled channels have completed the initial A/D conversion.
*5 The signal remains OFF because the A/D conversion for the 2-wire transmitter range has not been completed.
(4) This signal or A/D conversion completed flag (Un\G10) is used as an interlock condition to read out the digital output value.
</td></tr>
</table>

Device No.	Signal Name	Description
XF	Error flag	(1) This signal turns ON when a write error occurs. (2) To clear the error code, set the error clear request (YF) to ON. 

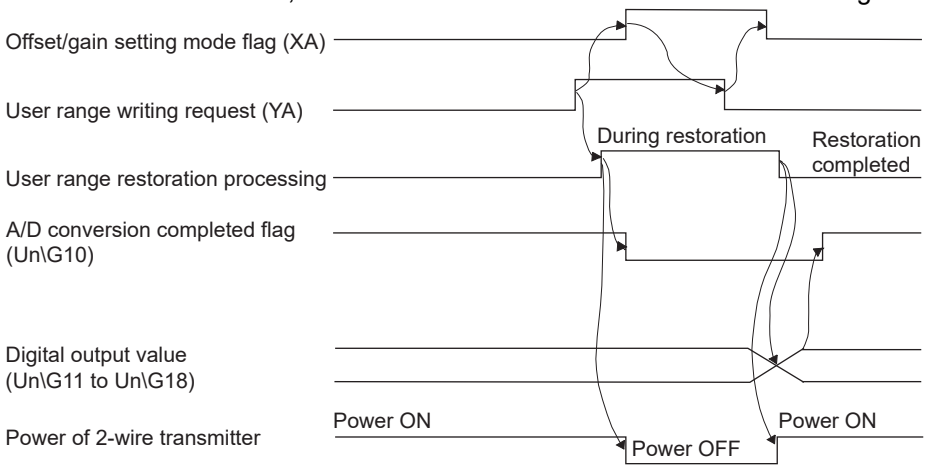
(2) Output signals

Device No.	Signal Name	Description
Y9	Operating condition setting request	(1) Turn this signal ON when making any of the following settings valid. ▪ A/D conversion enable/disable setting (Un\G0) ▪ CH☐ Average time/Average number of times/Moving average/Time constant settings (Un\G1 to Un\G8) ▪ Averaging process specification (Un\G24, Un\G25) ▪ Input signal error detection extended/input signal error detection setting (Un\G47) ▪ Warning output settings (Un\G48) ▪ Scaling enable/disable setting(Un\G53) ▪ CH☐ scaling upper/lower limit value(Un\G62 to Un\G72) ▪ CH☐ conversion starting time setting (for 2-wire transmitter) (Un\G78 to Un\G83) ▪ CH☐ process alarm upper/lower limit value (Un\G86 to Un\G117) ▪ CH☐ rate alarm warning detection period (Un\G118 to Un\G125) ▪ CH☐ rate alarm upper/lower limit value (Un\G126 to Un\G141) ▪ CH☐ input signal error detection setting value/CH input signal error detection lower limit setting value (Un\G142 to Un\G149) ▪ CH☐ input signal error detection upper limit setting value (Un\G150 to Un\G157) (2) Refer to the X9 column for ON/OFF timing.
YA	User range writing request	[In offset/gain setting mode] (1) This turns ON when the value for the adjusted offset/gain settings are registered in the A/D converter module. (2) Refer to the XA column for ON/OFF timing. Refer to Section 4.6 for offset/gain settings. [In normal mode] (1) This signal turns ON when the user range is restored. (2) Refer to the field of XA for the ON/OFF timing. Refer to Chapter 7 for user range restoration.
YB	Channel change request	(1) This turns ON when changing the channel for which offset/gain settings are to be performed. (2) Refer to the XB column for ON/OFF timing. Refer to Section 4.6 for offset/gain settings.
YC	Offset/gain change request*1	(1) Turn this signal ON when changing the offset/gain value. (2) Refer to the field of XC for the ON/OFF timing. Refer to Section 4.6 for the offset/gain setting.
YD	Maximum value/ minimum value reset request	(1) Turning ON the Maximum value/minimum value reset request (YD) clears the maximum value/ minimum value stored at any of the buffer memory addresses 30 to 45 (Un\G30 to Un\G45). (2) Refer to the XD column for ON/OFF timing.
YF	Error clear request	(1) Turn this signal ON when clearing a write error or input signal error. (2) Refer to the field of XF or XC for the ON/OFF timing.

*1: Q66AD-DG only

Point

When the User range writing request (YA) is turned ON in the normal mode with A/D conversion enabled, the A/D converter module restores the user range.



During user range restoration : A/D conversion stop, A/D conversion completed flag (Un\G10) OFF, previous digital output value held, power of 2-wire transmitter OFF (Q66AD-DG only)

After user range restoration : A/D conversion resumed (when user range setting is used, A/D conversion is resumed at the restored offset/gain setting value.)

3.4 Buffer Memory

3.4.1 Buffer memory assignment

This section describes the buffer memory assignments of the A/D converter modules.

(1) Buffer memory assignment of Q68AD-G

Point

Do not write data from system area or sequence program to the buffer memory area where writing is disabled.
Doing so may cause malfunction.

Table3.8 Buffer memory assignment of Q68AD-G (1/6)

Address		Description	Default	R/W*1	Reference
Hexadecimal	Decimal				
0H	0	A/D conversion enable/disable setting	0000H	R/W*2	Section 3.4.2
1H	1	CH1 Average time/Average number of times/ Moving average/Time constant settings	0	R/W*2	Section 3.4.3
2H	2	CH2 Average time/Average number of times/ Moving average/Time constant settings	0	R/W*2	
3H	3	CH3 Average time/Average number of times/ Moving average/Time constant settings	0	R/W*2	
4H	4	CH4 Average time/Average number of times/ Moving average/Time constant settings	0	R/W*2	
5H	5	CH5 Average time/Average number of times/ Moving average/Time constant settings	0	R/W*2	
6H	6	CH6 Average time/Average number of times/ Moving average/Time constant settings	0	R/W*2	
7H	7	CH7 Average time/Average number of times/ Moving average/Time constant settings	0	R/W*2	
8H	8	CH8 Average time/Average number of times/ Moving average/Time constant settings	0	R/W*2	
9H	9	System area	—	—	—
AH	10	A/D conversion completed flag	0	R	Section 3.4.4
BH	11	CH1 Digital output value	0	R	Section 3.4.5
CH	12	CH2 Digital output value	0	R	
DH	13	CH3 Digital output value	0	R	
EH	14	CH4 Digital output value	0	R	
FH	15	CH5 Digital output value	0	R	
10H	16	CH6 Digital output value	0	R	
11H	17	CH7 Digital output value	0	R	
12H	18	CH8 Digital output value	0	R	
13H	19	Error code	0	R	Section 3.4.6
14H	20	Setting range(CH1 to CH4)	0	R	Section 3.4.7
15H	21	Setting range(CH5 to CH8)	0	R	
16H	22	Offset/gain setting mode offset specification	0	R/W	Section 3.4.8
17H	23	Offset/gain setting mode gain specification	0	R/W	
18H	24	Averaging process specification (CH1 to CH4)	0	R/W*2	Section 3.4.9
19H	25	Averaging process specification (CH5 to CH8)	0	R/W*2	

*1 Indicates whether reading from and writing to a sequence program are enabled.
R : Read enabled
W : Write enabled

*2 When writing data to the buffer memory, always use the interlock condition (buffer memory write condition) of the following I/O signals.

Table3.8 Buffer memory assignment of Q68AD-G (2/6)

Address		Description	Default	R/W*1	Reference
Hexadecimal	Decimal				
1AH	26	System area	—	—	—
to	to				
1DH	29				
1EH	30	CH1 Maximum value	0	R/W	Section 3.4.10
1FH	31	CH1 Minimum value	0	R/W	
20H	32	CH2 Maximum value	0	R/W	
21H	33	CH2 Minimum value	0	R/W	
22H	34	CH3 Maximum value	0	R/W	
23H	35	CH3 Minimum value	0	R/W	
24H	36	CH4 Maximum value	0	R/W	
25H	37	CH4 Minimum value	0	R/W	
26H	38	CH5 Maximum value	0	R/W	
27H	39	CH5 Minimum value	0	R/W	
28H	40	CH6 Maximum value	0	R/W	
29H	41	CH6 Minimum value	0	R/W	
2AH	42	CH7 Maximum value	0	R/W	
2BH	43	CH7 Minimum value	0	R/W	
2CH	44	CH8 Maximum value	0	R/W	
2DH	45	CH8 Minimum value	0	R/W	
2EH	46	System area	—	—	—
2FH	47	Input signal error detection extended/input signal error detection setting	00FFH	R/W*2	Section 3.4.11
30H	48	Warning output setting	FFFFH	R/W*2	Section 3.4.12
31H	49	Input signal error detection flag	0	R	Section 3.4.13
32H	50	Warning output flag (Process alarm)	0	R	Section 3.4.14
33H	51	Warning output flag (Rate alarm)	0	R	
34H	52	System area	—	—	—
35H	53	Scaling enable/disable setting	00FFH	R/W*2	Section 3.4.15
36H	54	CH1 Scaling value	0	R	Section 3.4.16
37H	55	CH2 Scaling value	0	R	
38H	56	CH3 Scaling value	0	R	
39H	57	CH4 Scaling value	0	R	
3AH	58	CH5 Scaling value	0	R	
3BH	59	CH6 Scaling value	0	R	
3CH	60	CH7 Scaling value	0	R	
3DH	61	CH8 Scaling value	0	R	
3EH	62	CH1 Scaling lower limit value	0	R/W*2	Section 3.4.17
3FH	63	CH1 Scaling upper limit value	0	R/W*2	
40H	64	CH2 Scaling lower limit value	0	R/W*2	
41H	65	CH2 Scaling upper limit value	0	R/W*2	
42H	66	CH3 Scaling lower limit value	0	R/W*2	
43H	67	CH3 Scaling upper limit value	0	R/W*2	

*1 Indicates whether reading from and writing to a sequence program are enabled.
R : Read enabled
W : Write enabled

*2 When writing data to the buffer memory, always use the interlock condition (buffer memory write condition) of the following I/O signals.

Table3.8 Buffer memory assignment of Q68AD-G (3/6)

Address		Description	Default	R/W*1	Reference
Hexadecimal	Decimal				
44H	68	CH4 Scaling lower limit value	0	R/W*2	Section 3.4.17
45H	69	CH4 Scaling upper limit value	0	R/W*2	
46H	70	CH5 Scaling lower limit value	0	R/W*2	
47H	71	CH5 Scaling upper limit value	0	R/W*2	
48H	72	CH6 Scaling lower limit value	0	R/W*2	
49H	73	CH6 Scaling upper limit value	0	R/W*2	
4AH	74	CH7 Scaling lower limit value	0	R/W*2	
4BH	75	CH7 Scaling upper limit value	0	R/W*2	
4CH	76	CH8 Scaling lower limit value	0	R/W*2	
4DH	77	CH8 Scaling upper limit value	0	R/W*2	
4EH	78	System area	—	—	—
to	to				
55H	85				
56H	86	CH1 Process alarm lower lower limit value	0	R/W*2	Section 3.4.19
57H	87	CH1 Process alarm lower upper limit value	0	R/W*2	
58H	88	CH1 Process alarm upper lower limit value	0	R/W*2	
59H	89	CH1 Process alarm upper upper limit value	0	R/W*2	
5AH	90	CH2 Process alarm lower lower limit value	0	R/W*2	
5BH	91	CH2 Process alarm lower upper limit value	0	R/W*2	
5CH	92	CH2 Process alarm upper lower limit value	0	R/W*2	
5DH	93	CH2 Process alarm upper upper limit value	0	R/W*2	
5EH	94	CH3 Process alarm lower lower limit value	0	R/W*2	
5FH	95	CH3 Process alarm lower upper limit value	0	R/W*2	
60H	96	CH3 Process alarm upper lower limit value	0	R/W*2	
61H	97	CH3 Process alarm upper upper limit value	0	R/W*2	
62H	98	CH4 Process alarm lower lower limit value	0	R/W*2	
63H	99	CH4 Process alarm lower upper limit value	0	R/W*2	
64H	100	CH4 Process alarm upper lower limit value	0	R/W*2	
65H	101	CH4 Process alarm upper upper limit value	0	R/W*2	
66H	102	CH5 Process alarm lower lower limit value	0	R/W*2	
67H	103	CH5 Process alarm lower upper limit value	0	R/W*2	
68H	104	CH5 Process alarm upper lower limit value	0	R/W*2	
69H	105	CH5 Process alarm upper upper limit value	0	R/W*2	
6AH	106	CH6 Process alarm lower lower limit value	0	R/W*2	
6BH	107	CH6 Process alarm lower upper limit value	0	R/W*2	
6CH	108	CH6 Process alarm upper lower limit value	0	R/W*2	
6DH	109	CH6 Process alarm upper upper limit value	0	R/W*2	
6EH	110	CH7 Process alarm lower lower limit value	0	R/W*2	
6FH	111	CH7 Process alarm lower upper limit value	0	R/W*2	
70H	112	CH7 Process alarm upper lower limit value	0	R/W*2	
71H	113	CH7 Process alarm upper upper limit value	0	R/W*2	

*1 Indicates whether reading from and writing to a sequence program are enabled.
R : Read enabled
W : Write enabled

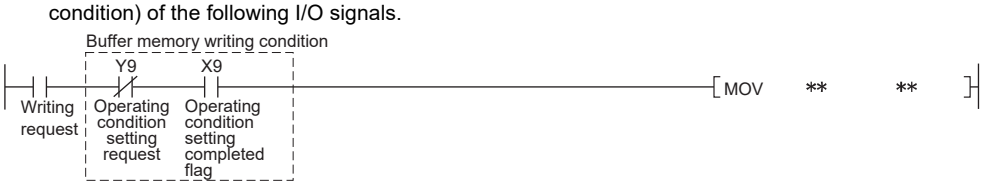
*2 When writing data to the buffer memory, always use the interlock condition (buffer memory write condition) of the following I/O signals.

Table3.8 Buffer memory assignment of Q68AD-G (4/6)

Address		Description	Default	R/W*1	Reference
Hexadecimal	Decimal				
72H	114	CH8 Process alarm lower lower limit value	0	R/W*2	Section 3.4.19
73H	115	CH8 Process alarm lower upper limit value	0	R/W*2	
74H	116	CH8 Process alarm upper lower limit value	0	R/W*2	
75H	117	CH8 Process alarm upper upper limit value	0	R/W*2	
76H	118	CH1 Rate alarm warning detection period	0	R/W*2	Section 3.4.20
77H	119	CH2 Rate alarm warning detection period	0	R/W*2	
78H	120	CH3 Rate alarm warning detection period	0	R/W*2	
79H	121	CH4 Rate alarm warning detection period	0	R/W*2	
7AH	122	CH5 Rate alarm warning detection period	0	R/W*2	
7BH	123	CH6 Rate alarm warning detection period	0	R/W*2	
7CH	124	CH7 Rate alarm warning detection period	0	R/W*2	
7DH	125	CH8 Rate alarm warning detection period	0	R/W*2	
7EH	126	CH1 Rate alarm upper limit value	0	R/W*2	Section 3.4.21
7FH	127	CH1 Rate alarm lower limit value	0	R/W*2	
80H	128	CH2 Rate alarm upper limit value	0	R/W*2	
81H	129	CH2 Rate alarm lower limit value	0	R/W*2	
82H	130	CH3 Rate alarm upper limit value	0	R/W*2	
83H	131	CH3 Rate alarm lower limit value	0	R/W*2	
84H	132	CH4 Rate alarm upper limit value	0	R/W*2	
85H	133	CH4 Rate alarm lower limit value	0	R/W*2	
86H	134	CH5 Rate alarm upper limit value	0	R/W*2	
87H	135	CH5 Rate alarm lower limit value	0	R/W*2	
88H	136	CH6 Rate alarm upper limit value	0	R/W*2	
89H	137	CH6 Rate alarm lower limit value	0	R/W*2	
8AH	138	CH7 Rate alarm upper limit value	0	R/W*2	
8BH	139	CH7 Rate alarm lower limit value	0	R/W*2	
8CH	140	CH8 Rate alarm upper limit value	0	R/W*2	
8DH	141	CH8 Rate alarm lower limit value	0	R/W*2	
8EH	142	CH1 Input signal error detection setting value/CH1 Input signal error detection lower limit setting value	50	R/W*2	Section 3.4.22
8FH	143	CH2 Input signal error detection setting value/CH2 Input signal error detection lower limit setting value	50	R/W*2	
90H	144	CH3 Input signal error detection setting value/CH3 Input signal error detection lower limit setting value	50	R/W*2	
91H	145	CH4 Input signal error detection setting value/CH4 Input signal error detection lower limit setting value	50	R/W*2	
92H	146	CH5 Input signal error detection setting value/CH5 Input signal error detection lower limit setting value	50	R/W*2	
93H	147	CH6 Input signal error detection setting value/CH6 Input signal error detection lower limit setting value	50	R/W*2	

*1 Indicates whether reading from and writing to a sequence program are enabled.
R : Read enabled
W : Write enabled

*2 When writing data to the buffer memory, always use the interlock condition (buffer memory write condition) of the following I/O signals.



*3 Areas used to restore the User range settings offset/gain values when the module is replaced online. Refer to Chapter 7 for details of online module change.

Table3.8 Buffer memory assignment of Q68AD-G (5/6)

Address		Description	Default	R/W*1	Reference
Hexadecimal	Decimal				
94H	148	CH7 Input signal error detection setting value/CH7 Input signal error detection lower limit setting value	50	R/W*2	Section 3.4.22
95H	149	CH8 Input signal error detection setting value/CH8 Input signal error detection lower limit setting value	50	R/W*2	
96H	150	CH1 Input signal error detection upper limit setting value	50	R/W*2	
97H	151	CH2 Input signal error detection upper limit setting value	50	R/W*2	
98H	152	CH3 Input signal error detection upper limit setting value	50	R/W*2	
99H	153	CH4 Input signal error detection upper limit setting value	50	R/W*2	
9AH	154	CH5 Input signal error detection upper limit setting value	50	R/W*2	
9BH	155	CH6 Input signal error detection upper limit setting value	50	R/W*2	
9CH	156	CH7 Input signal error detection upper limit setting value	50	R/W*2	
9DH	157	CH8 Input signal error detection upper limit setting value	50	R/W*2	
9EH	158	Mode switching setting	0	R/W	Section 3.4.23
9FH	159				
A0H	160	System area	—	—	—
to	to				
C7H	199				
C8H	200	Save data classification setting*3	0	R/W	Section 3.4.24
C9H	201	System area	—	—	—
CAH	202	CH1 Factory default offset value*3	0	R/W	Section 3.4.25
CBH	203	CH1 Factory default gain value*3	0	R/W	
CCH	204	CH2 Factory default offset value*3	0	R/W	
CDH	205	CH2 Factory default gain value*3	0	R/W	
CEH	206	CH3 Factory default offset value*3	0	R/W	
CFH	207	CH3 Factory default gain value*3	0	R/W	
D0H	208	CH4 Factory default offset value*3	0	R/W	
D1H	209	CH4 Factory default gain value*3	0	R/W	
D2H	210	CH5 Factory default offset value*3	0	R/W	
D3H	211	CH5 Factory default gain value*3	0	R/W	
D4H	212	CH6 Factory default offset value*3	0	R/W	
D5H	213	CH6 Factory default gain value*3	0	R/W	
D6H	214	CH7 Factory default offset value*3	0	R/W	
D7H	215	CH7 Factory default gain value*3	0	R/W	
D8H	216	CH8 Factory default offset value*3	0	R/W	
D9H	217	CH8 Factory default gain value*3	0	R/W	

*1 Indicates whether reading from and writing to a sequence program are enabled.
R : Read enabled
W : Write enabled

*2 When writing data to the buffer memory, always use the interlock condition (buffer memory write condition) of the following I/O signals.

*3 Areas used to restore the User range settings offset/gain values when the module is replaced online.
Refer to Chapter 7 for details of online module change.

Table3.8 Buffer memory assignment of Q68AD-G (6/6)

Address		Description	Default	R/W*1	Reference
Hexadecimal	Decimal				
DA$_H$	218	CH1 User range settings offset value*3	0	R/W	Section 3.4.25
DB$_H$	219	CH1 User range settings gain value*3	0	R/W	
DC$_H$	220	CH2 User range settings offset value*3	0	R/W	
DD$_H$	221	CH2 User range settings gain value*3	0	R/W	
DE$_H$	222	CH3 User range settings offset value*3	0	R/W	
DF$_H$	223	CH3 User range settings gain value*3	0	R/W	
E0$_H$	224	CH4 User range settings offset value*3	0	R/W	
E1$_H$	225	CH4 User range settings gain value*3	0	R/W	
E2$_H$	226	CH5 User range settings offset value*3	0	R/W	
E3$_H$	227	CH5 User range settings gain value*3	0	R/W	
E4$_H$	228	CH6 User range settings offset value*3	0	R/W	
E5$_H$	229	CH6 User range settings gain value*3	0	R/W	
E6$_H$	230	CH7 User range settings offset value*3	0	R/W	
E7$_H$	231	CH7 User range settings gain value*3	0	R/W	
E8$_H$	232	CH8 User range settings offset value*3	0	R/W	
E9$_H$	233	CH8 User range settings gain value*3	0	R/W	

*1 Indicates whether reading from and writing to a sequence program are enabled.
R : Read enabled
W : Write enabled

*2 When writing data to the buffer memory, always use the interlock condition (buffer memory write condition) of the following I/O signals.

*3 Areas used to restore the User range settings offset/gain values when the module is replaced online. Refer to Chapter 7 for details of online module change.

(2) Buffer memory assignment of Q66AD-DG

Point

Do not write data from system area or sequence program to the buffer memory area where writing is disabled.
Doing so may cause malfunction.

Table3.9 Buffer memory assignment of Q66AD-DG (1/5)

Address		Description	Default	R/W*1	Reference
Hexadecimal	Decimal				
0H	0	A/D conversion enable/disable setting	003FH	R/W*2	Section 3.4.2
1H	1	CH1 Average time/Average number of times/ Moving average/Time constant settings	0	R/W*2	Section 3.4.3
2H	2	CH2 Average time/Average number of times/ Moving average/Time constant settings	0	R/W*2	
3H	3	CH3 Average time/Average number of times/ Moving average/Time constant settings	0	R/W*2	
4H	4	CH4 Average time/Average number of times/ Moving average/Time constant settings	0	R/W*2	
5H	5	CH5 Average time/Average number of times/ Moving average/Time constant settings	0	R/W*2	
6H	6	CH6 Average time/Average number of times/ Moving average/Time constant settings	0	R/W*2	
7H	7	System area	—	—	—
to	to				
9H	9				
AH	10	A/D conversion completed flag	0	R	Section 3.4.4
BH	11	CH1 Digital output value	0	R	Section 3.4.5
CH	12	CH2 Digital output value	0	R	
DH	13	CH3 Digital output value	0	R	
EH	14	CH4 Digital output value	0	R	
FH	15	CH5 Digital output value	0	R	
10H	16	CH6 Digital output value	0	R	
11H	17	System area	—	—	—
12H	18				
13H	19	Error code	0	R	Section 3.4.6
14H	20	Setting range(CH1 to CH4)	0	R	Section 3.4.7
15H	21	Setting range(CH5,CH6)	0	R	
16H	22	Offset/gain setting mode offset specification	0	R/W	Section 3.4.8
17H	23	Offset/gain setting mode gain specification	0	R/W	
18H	24	Averaging process specification (CH1 to CH4)	0	R/W*2	Section 3.4.9
19H	25	Averaging process specification (CH5 to CH6)	0	R/W*2	

*1 Indicates whether reading from and writing to a sequence program are enabled.
R : Read enabled
W : Write enabled

*2 When writing data to the buffer memory, always use the interlock condition (buffer memory write condition) of the following I/O signals.

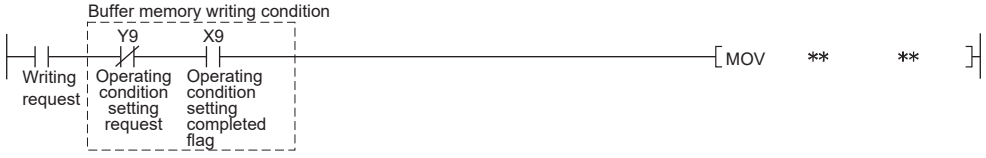


Table3.9 Buffer memory assignment of Q66AD-DG (2/5)

Address		Description	Default	R/W*1	Reference
Hexadecimal	Decimal				
1AH	26	System area	—	—	—
to	to				
1DH	29				
1EH	30	CH1 Maximum value	0	R/W	Section 3.4.10
1FH	31	CH1 Minimum value	0	R/W	
20H	32	CH2 Maximum value	0	R/W	
21H	33	CH2 Minimum value	0	R/W	
22H	34	CH3 Maximum value	0	R/W	
23H	35	CH3 Minimum value	0	R/W	
24H	36	CH4 Maximum value	0	R/W	
25H	37	CH4 Minimum value	0	R/W	
26H	38	CH5 Maximum value	0	R/W	
27H	39	CH5 Minimum value	0	R/W	
28H	40	CH6 Maximum value	0	R/W	
29H	41	CH6 Minimum value	0	R/W	
2AH	42	System area	—	—	—
to	to				
2EH	46				
2FH	47	Input signal error detection extended/input signal error detection setting	003FH	R/W*2	Section 3.4.11
30H	48	Warning output setting	3F3FH	R/W*2	Section 3.4.12
31H	49	Input signal error detection flag	0	R	Section 3.4.13
32H	50	Warning output flag (Process alarm)	0	R	Section 3.4.14
33H	51	Warning output flag (Rate alarm)	0	R	
34H	52	System area	—	—	—
35H	53	Scaling enable/disable setting	003FH	R/W*2	Section 3.4.15
36H	54	CH1 Scaling value	0	R	Section 3.4.16
37H	55	CH2 Scaling value	0	R	
38H	56	CH3 Scaling value	0	R	
39H	57	CH4 Scaling value	0	R	
3AH	58	CH5 Scaling value	0	R	
3BH	59	CH6 Scaling value	0	R	
3CH	60	System area	—	—	—
3DH	61				
3EH	62	CH1 Scaling lower limit value	0	R/W*2	Section 3.4.17
3FH	63	CH1 Scaling upper limit value	0	R/W*2	
40H	64	CH2 Scaling lower limit value	0	R/W*2	
41H	65	CH2 Scaling upper limit value	0	R/W*2	
42H	66	CH3 Scaling lower limit value	0	R/W*2	
43H	67	CH3 Scaling upper limit value	0	R/W*2	
44H	68	CH4 Scaling lower limit value	0	R/W*2	
45H	69	CH4 Scaling upper limit value	0	R/W*2	

*1 Indicates whether reading from and writing to a sequence program are enabled.
R : Read enabled
W : Write enabled

*2 When writing data to the buffer memory, always use the interlock condition (buffer memory write condition) of the following I/O signals.

Table3.9 Buffer memory assignment of Q66AD-DG (3/5)

Address		Description	Default	R/W*1	Reference
Hexadecimal	Decimal				
46H	70	CH5 Scaling lower limit value	0	R/W*2	Section 3.4.17
47H	71	CH5 Scaling upper limit value	0	R/W*2	
48H	72	CH6 Scaling lower limit value	0	R/W*2	
49H	73	CH6 Scaling upper limit value	0	R/W*2	
4AH	74	System area	—	—	—
to	to				
4DH	77				
4EH	78	CH1 Conversion starting time setting (for 2-wire transmitter)	30	R/W*2	Section 3.4.18
4FH	79	CH2 Conversion starting time setting (for 2-wire transmitter)	30	R/W*2	
50H	80	CH3 Conversion starting time setting (for 2-wire transmitter)	30	R/W*2	
51H	81	CH4 Conversion starting time setting (for 2-wire transmitter)	30	R/W*2	
52H	82	CH5 Conversion starting time setting (for 2-wire transmitter)	30	R/W*2	
53H	83	CH6 Conversion starting time setting (for 2-wire transmitter)	30	R/W*2	
54H	84	System area	—	—	—
55H	85				
56H	86	CH1 Process alarm lower lower limit value	0	R/W*2	Section 3.4.19
57H	87	CH1 Process alarm lower upper limit value	0	R/W*2	
58H	88	CH1 Process alarm upper lower limit value	0	R/W*2	
59H	89	CH1 Process alarm upper upper limit value	0	R/W*2	
5AH	90	CH2 Process alarm lower lower limit value	0	R/W*2	
5BH	91	CH2 Process alarm lower upper limit value	0	R/W*2	
5CH	92	CH2 Process alarm upper lower limit value	0	R/W*2	
5DH	93	CH2 Process alarm upper upper limit value	0	R/W*2	
5EH	94	CH3 Process alarm lower lower limit value	0	R/W*2	
5FH	95	CH3 Process alarm lower upper limit value	0	R/W*2	
60H	96	CH3 Process alarm upper lower limit value	0	R/W*2	
61H	97	CH3 Process alarm upper upper limit value	0	R/W*2	
62H	98	CH4 Process alarm lower lower limit value	0	R/W*2	
63H	99	CH4 Process alarm lower upper limit value	0	R/W*2	
64H	100	CH4 Process alarm upper lower limit value	0	R/W*2	
65H	101	CH4 Process alarm upper upper limit value	0	R/W*2	
66H	102	CH5 Process alarm lower lower limit value	0	R/W*2	
67H	103	CH5 Process alarm lower upper limit value	0	R/W*2	
68H	104	CH5 Process alarm upper lower limit value	0	R/W*2	
69H	105	CH5 Process alarm upper upper limit value	0	R/W*2	
6AH	106	CH6 Process alarm lower lower limit value	0	R/W*2	
6BH	107	CH6 Process alarm lower upper limit value	0	R/W*2	
6CH	108	CH6 Process alarm upper lower limit value	0	R/W*2	
6DH	109	CH6 Process alarm upper upper limit value	0	R/W*2	
6EH	110	System area	—	—	—
to	to				
75H	117				

*1 Indicates whether reading from and writing to a sequence program are enabled.
R : Read enabled
W : Write enabled

*2 When writing data to the buffer memory, always use the interlock condition (buffer memory write condition) of the following I/O signals.

Table3.9 Buffer memory assignment of Q66AD-DG (4/5)

Address		Description	Default	R/W*1	Reference
Hexadecimal	Decimal				
76H	118	CH1 Rate alarm warning detection period	0	R/W*2	Section 3.4.20
77H	119	CH2 Rate alarm warning detection period	0	R/W*2	
78H	120	CH3 Rate alarm warning detection period	0	R/W*2	
79H	121	CH4 Rate alarm warning detection period	0	R/W*2	
7AH	122	CH5 Rate alarm warning detection period	0	R/W*2	
7BH	123	CH6 Rate alarm warning detection period	0	R/W*2	
7CH	124	System area	—	—	—
7DH	125				
7EH	126	CH1 Rate alarm upper limit value	0	R/W*2	Section 3.4.21
7FH	127	CH1 Rate alarm lower limit value	0	R/W*2	
80H	128	CH2 Rate alarm upper limit value	0	R/W*2	
81H	129	CH2 Rate alarm lower limit value	0	R/W*2	
82H	130	CH3 Rate alarm upper limit value	0	R/W*2	
83H	131	CH3 Rate alarm lower limit value	0	R/W*2	
84H	132	CH4 Rate alarm upper limit value	0	R/W*2	
85H	133	CH4 Rate alarm lower limit value	0	R/W*2	
86H	134	CH5 Rate alarm upper limit value	0	R/W*2	
87H	135	CH5 Rate alarm lower limit value	0	R/W*2	
88H	136	CH6 Rate alarm upper limit value	0	R/W*2	
89H	137	CH6 Rate alarm lower limit value	0	R/W*2	
8AH	138	System area	—	—	—
to	to				
8DH	141				
8EH	142	CH1 Input signal error detection setting value/CH1 Input signal error detection lower limit setting value	50	R/W*2	Section 3.4.22
8FH	143	CH2 Input signal error detection setting value/CH2 Input signal error detection lower limit setting value	50	R/W*2	
90H	144	CH3 Input signal error detection setting value/CH3 Input signal error detection lower limit setting value	50	R/W*2	
91H	145	CH4 Input signal error detection setting value/CH4 Input signal error detection lower limit setting value	50	R/W*2	
92H	146	CH5 Input signal error detection setting value/CH5 Input signal error detection lower limit setting value	50	R/W*2	
93H	147	CH6 Input signal error detection setting value/CH6 Input signal error detection lower limit setting value	50	R/W*2	
94H	148	System area	—	—	—
95H	149				
96H	150	CH1 Input signal error detection upper limit setting value	50	R/W*2	Section 3.4.22
97H	151	CH2 Input signal error detection upper limit setting value	50	R/W*2	
98H	152	CH3 Input signal error detection upper limit setting value	50	R/W*2	

*1 Indicates whether reading from and writing to a sequence program are enabled.
R : Read enabled
W : Write enabled

*2 When writing data to the buffer memory, always use the interlock condition (buffer memory write condition) of the following I/O signals

Table3.9 Buffer memory assignment of Q66AD-DG (5/5)

Address		Description	Default	R/W*1	Reference
Hexadecimal	Decimal				
99H	153	CH4 Input signal error detection upper limit setting value	50	R/W*2	Section 3.4.22
9AH	154	CH5 Input signal error detection upper limit setting value	50	R/W*2	
9BH	155	CH6 Input signal error detection upper limit setting value	50	R/W*2	
9CH	156	System area	—	—	—
9DH	157				
9EH	158	Mode switching setting	0	R/W	Section 3.4.23
9FH	159				
A0H	160	System area	—	—	—
to	to				
C9H	201				
CAH	202	CH1 Factory default offset value*3	0	R/W	Section 3.4.25
CBH	203	CH1 Factory default gain value*3	0	R/W	
CCH	204	CH2 Factory default offset value*3	0	R/W	
CDH	205	CH2 Factory default gain value*3	0	R/W	
CEH	206	CH3 Factory default offset value*3	0	R/W	
CFH	207	CH3 Factory default gain value*3	0	R/W	
D0H	208	CH4 Factory default offset value*3	0	R/W	
D1H	209	CH4 Factory default gain value*3	0	R/W	
D2H	210	CH5 Factory default offset value*3	0	R/W	
D3H	211	CH5 Factory default gain value*3	0	R/W	
D4H	212	CH6 Factory default offset value*3	0	R/W	
D5H	213	CH6 Factory default gain value*3	0	R/W	
D6H	214	System area	—	—	—
to	to				
D9H	217				
DAH	218	CH1 User range settings offset value*3	0	R/W	Section 3.4.25
DBH	219	CH1 User range settings gain value*3	0	R/W	
DCH	220	CH2 User range settings offset value*3	0	R/W	
DDH	221	CH2 User range settings gain value*3	0	R/W	
DEH	222	CH3 User range settings offset value*3	0	R/W	
DFH	223	CH3 User range settings gain value*3	0	R/W	
E0H	224	CH4 User range settings offset value*3	0	R/W	
E1H	225	CH4 User range settings gain value*3	0	R/W	
E2H	226	CH5 User range settings offset value*3	0	R/W	
E3H	227	CH5 User range settings gain value*3	0	R/W	
E4H	228	CH6 User range settings offset value*3	0	R/W	
E5H	229	CH6 User range settings gain value*3	0	R/W	

*1 Indicates whether reading from and writing to a sequence program are enabled.
R : Read enabled
W : Write enabled

*2 When writing data to the buffer memory, always use the interlock condition (buffer memory write condition) of the following I/O signals.

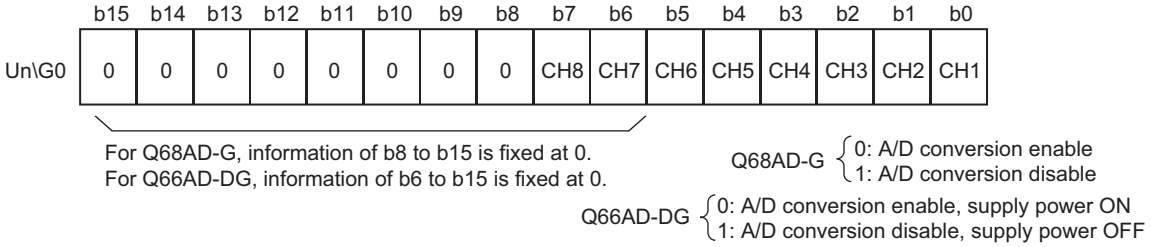
*3 Areas used to restore the User range settings offset/gain values when the module is replaced online.
Refer to Chapter 7 for details of online module change.

3.4.2 A/D conversion enable/disable setting (Un\G0)

(1) Set whether to enable or disable A/D conversion for each channel.
For the Q66AD-DG, the A/D conversion enable/disable setting also acts as the ON/OFF setting of the supply power to the 2-wire transmitter.
Note that power is supplied to only the 2-wire transmitters whose channels use input ranges of "4 to 20mA (2-wire transmitter input): 0H", "4 to 20mA (Extended mode) (2-wire transmitter input): AH" or "User range setting (2-wire transmitter input): FH".
No power is supplied when any other input range is used.

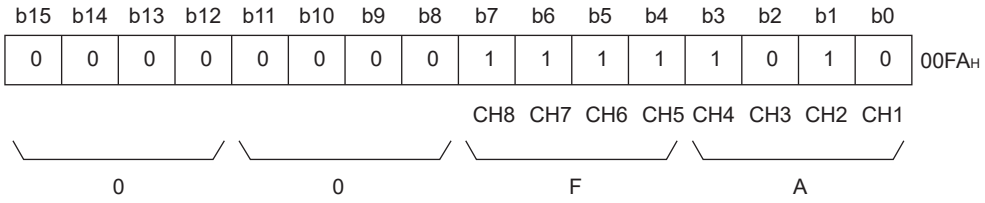
(2) It is necessary to set the operating condition setting request (Y9) to ON/OFF in order to validate the A/D conversion enable/disable setting. (Refer to Section 3.3.2.)

(3) The Q68AD-G is preset to enable A/D conversion on all channels.
The Q66AD-DG is preset to disable A/D conversion on all channels.



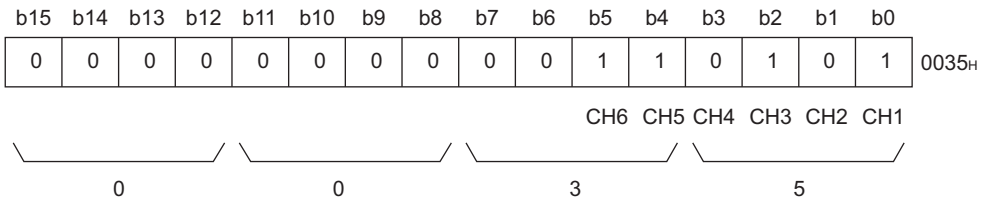
[Setting example of Q68AD-G]

When channel 1 and 3 are set to enable A/D conversion, 00FAH is stored.



[Setting example of Q66AD-DG]

When channel 2 and 4 are set to enable A/D conversion, 0035H is stored.



3.4.3 CH □ average time/average number of times/moving average/ time constant settings (Un\G1 to Un\G8)

(1) Set the average time, average count, moving average count or primary delay filter time constant for each channel for which averaging processing is specified.

(2) To validate the setting, the operating condition setting request (Y9) must be turned ON/OFF. (Refer to Section 3.3.2.)

(3) 0 is set as the default.

(4) The setting ranges are as follows.

Processing method	Setting value
Time averaging	40 to 5000 (ms)*1
Count averaging	4 to 500 (times)
Moving average	2 to 60 (times)
Primary delay filter	10 to 5000 (ms)*2

Point

(1) For the time averaging marked*1, set a value equal to or greater than (4 times x 10ms x number of channels used). If any insufficient value is set, an error occurs and 0 is stored as a digital output value.

(2) For the primary delay filter marked*2, set a value equal to or greater than (10ms x number of channels used). If any insufficient value is set, an error occurs and 0 is stored as a digital output value.

(3) Writing a value outside the range to a channel will cause an error, storing an error code in Error code (Un\G19) and turning ON the Error flag (XF). If this occurs, A/D conversion is performed based on the setting before the error detection.

(4) Since the default setting is 0, change it for the selected processing method.

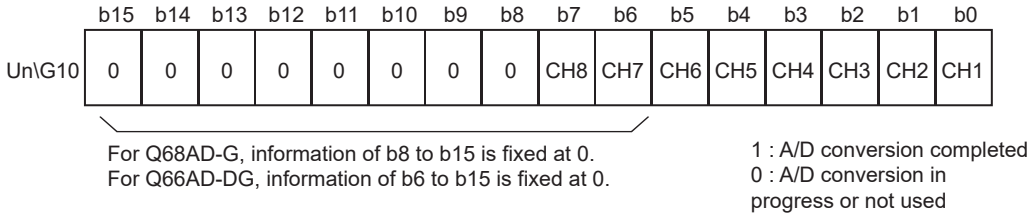
(5) If a value is set to a sampling-processing channel, the value is ignored.

3.4.4 A/D conversion completed flag (Un\G10)

(1) When the A/D conversion-enabled channel has completed the initial A/D conversion, A/D conversion completed flag is set to 1.
A/D conversion completed flag (XE) turns ON when all A/D conversion-enabled channels have completed the initial A/D conversion.
[For the Q66AD-DG]*1
- When the A/D conversion is enabled in the off condition of the external power supply and the initial A/D conversion is completed, the channels for the analog current input range without a 2-wire transmitter are set to 1. Also, the channels for the 2-wire transmitter range remain 0. If the external power supply is turned on and the initial A/D conversion is completed, the channels are set to 1.
- When the external power supply is turned off, the channels for the 2-wire transmitter range only are set to 0. The channels for the analog current input range without a 2-wire transmitter remain 1.

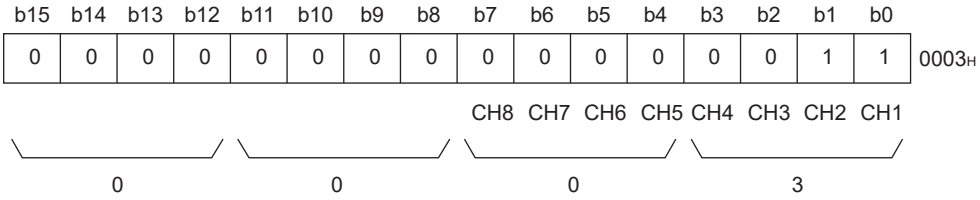
*1 The specifications are for product number 15032 or later of the Q66AD-DG.
For the specifications for product number 15031 or earlier, refer to Appendix 2.

(2) When operating condition setting request (Y9) is set to ON, A/D conversion completed flag on all channels returns to the default setting of 0.
If operating condition setting request (Y9) is set to OFF and the initial A/D conversion is completed, the flag is set to 1.



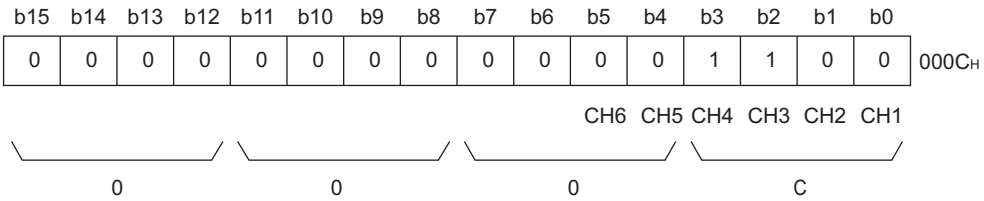
[Setting example of Q68AD-G]

When all A/D conversions of conversion-enabled channels 1 and 2 are completed, 0003H is stored into the buffer memory address 10 (Un\G10).



[Setting example of Q66AD-DG]

When all A/D conversions of conversion-enabled channels 3 and 4 are completed, 000CH is stored into the buffer memory address 10 (Un\G10).

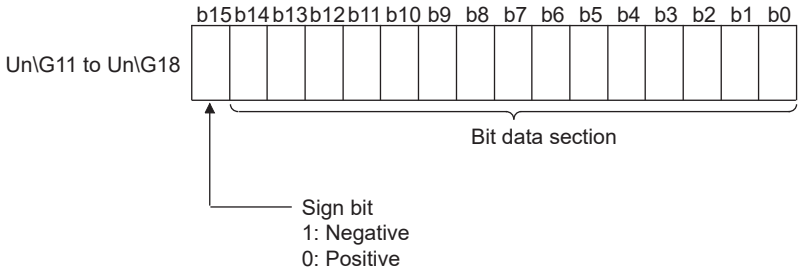


(3) Use this area or the A/D conversion competed flag (XE) as an interlock to read out the digital output value.

3.4.5 CH □ digital output value (Un\G11 to Un\G18)

(1) Digital values converted from analog values are stored for respective channels.

(2) Digital values are stored in 16-bit signed binary format.



(3) While the operating condition setting request (Y9) is ON, 0 is stored in this area.

(4) Use the A/D conversion competed flag (XE) or the A/D conversion completed flag (Un\G10) as an interlock to read out the digital output value.

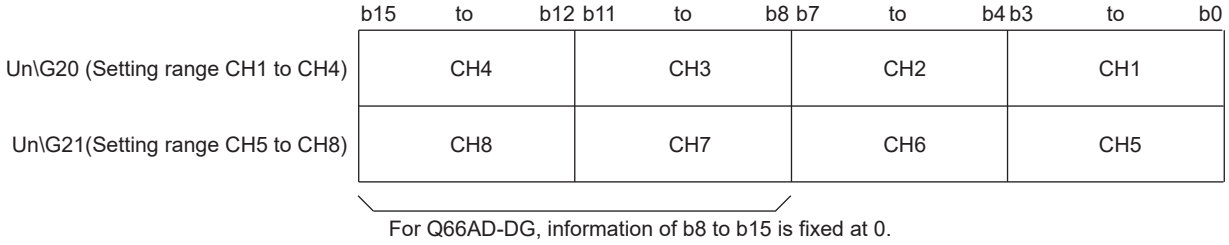
3.4.6 Write data error code (Un\G19)

(1) An error code generated by the A/D converter module is stored here.

(2) Refer to Section 8.1 for details of the error codes.

3.4.7 Setting range (Un\G20, Un\G21)

(1) These areas are used to confirm the input ranges of respective channels.
A value set in the input range setting is stored in the corresponding channel area as shown below.



Setting ranges of Q68AD-G

Input range	Setting value
4 to 20 mA	0H
0 to 20 mA	1H
1 to 5 V	2H
0 to 5 V	3H
-10 to 10V	4H
0 to 10 V	5H
4 to 20 mA (Extended mode)	AH
1 to 5 V (Extended mode)	BH
User range setting	FH

Setting ranges of Q66AD-DG

Input range	Setting value
4 to 20 mA (For 2-wire transmitter input)	0H
4 to 20 mA (For current input)	6H
0 to 20 mA (For current input)	7H
4 to 20 mA (Expanded mode) (For 2-wire transmitter input)	AH
4 to 20 mA (Expanded mode) (For current input)	CH
User range setting (For current input)	EH
User range setting (For 2-wire transmitter input)	FH

Point

The input range setting cannot be changed in this area.
Change the input range setting in the intelligent function module switch setting. (Refer to Section 4.5.)

3.4.8 Offset/gain setting mode offset/gain specification (Un\G22, Un\G23)

(1) Specify the channel to be adjusted for the offset/gain settings.

(2) Specify the channel to be adjusted with an offset value in Un\G22 and the channel to be adjusted with a gain value in Un\G23.

(3) Set the offset and gain separately (Set either Un\G22 or Un\G23 to 0). If both are set at the same time, an offset/gain setting mode error (error code 500) occurs.

(4) Refer to Section 4.6 for the details of the offset/gain settings.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Un\G22 (Offset specification)	0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1
Un\G23 (Gain specification)	0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

For Q68AD-G, information of b8 to b15 is fixed at 0.
For Q66AD-DG, information of b6 to b15 is fixed at 0.

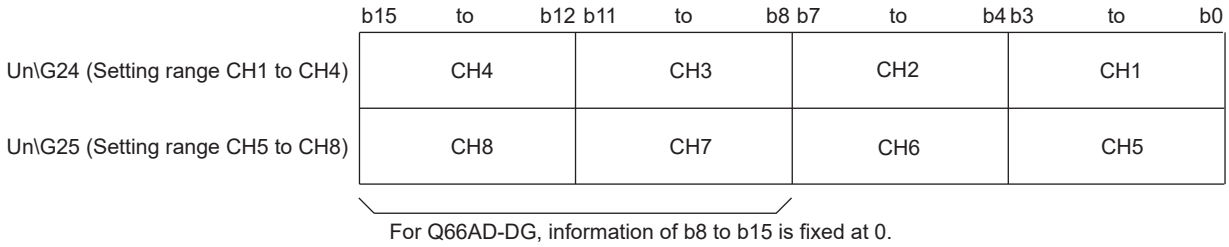
1 : Channel set
0 : Invalid

3.4.9 Averaging process specification (Un\G24, Un\G25))

(1) Specify whether to perform sampling processing or averaging processing (time averaging, count averaging, moving average, or primary delay filter) for each channel.

(2) To validare the setting, the operating condition setting request (Y9) must be turned ON/OFF. (Refer to Section 3.3.2.)

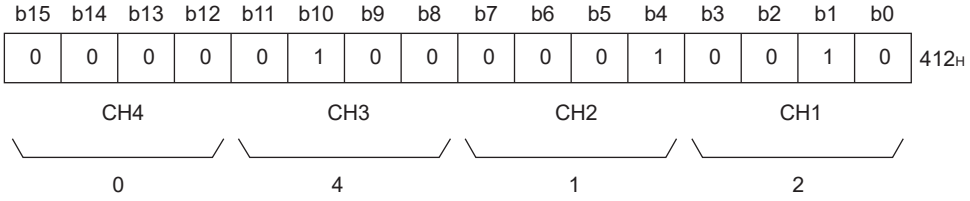
(3) By default, sampling processing(0_H) is set for all channels.



Processing method	Setting value
Sampling processing	0_H
Time averaging	1_H
Count averaging	2_H
Moving average	3_H
Primary delay filter	4_H

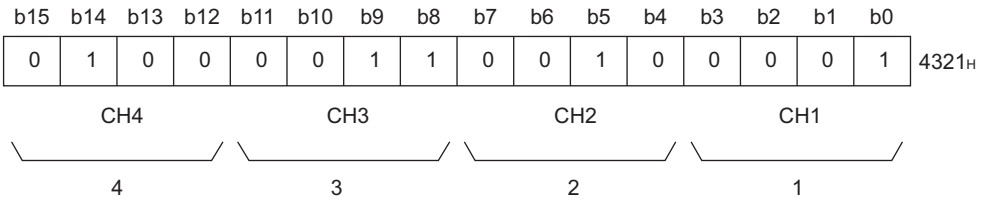
[Setting example of Q68AD-G]

When setting channel 1 to count averaging, channel 2 to time averaging, channel 3 to primary delay filter, and channel 4 to sampling processing, store 412_H into Un\G24.



[Setting example of Q66AD-DG]

When setting channel 1 to time averaging, channel 2 to count averaging, channel 3 to moving average, and channel 4 to primary delay filter, store 4321_H into Un\G24.



Point

When a value outside the above setting range has been written to a channel, sampling processing is applied to the channel.

3.4.10 CH □ maximum value/minimum value storage area (Un\G30 to Un\G45)

(1) For each channel, the maximum and minimum values of the converted digital values are stored in this area every sampling time in 16-bit signed binary.

(2) The stored values for all channels will be cleared to 0 when the operating condition setting request (Y9) is set to ON and the setting is changed or when the maximum value/minimum value reset request (YD) is set to ON.

(3) For the channel where averaging processing is specified also, the maximum and minimum values of the digital values from sampling processing are stored in this area.

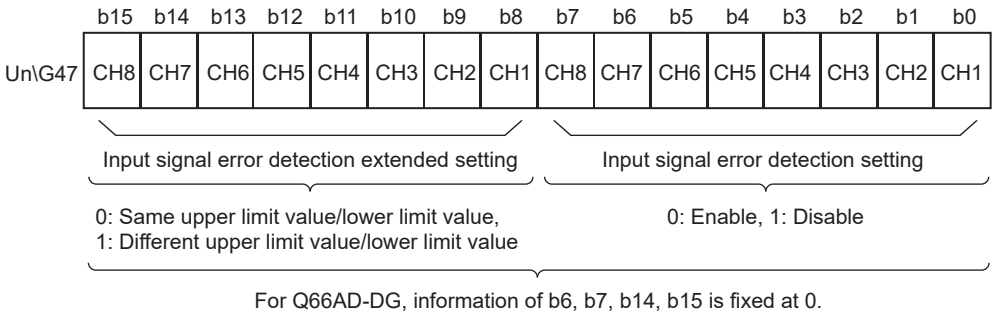
(4) When the scaling function is enabled, maximum/minimum values after scaling conversion are stored.

3.4.11 Input signal error detection extended/input signal error detection setting (Un\G47)

(1) This area is used to set whether the input signal error detection, process alarm, or rate alarm will be enabled or disabled for each channel.
If the warning of input signal error detection is enabled, the input signal error detection can be performed by setting the same value of upper and lower limit or different value of upper and lower limit.

(2) To validate the input signal error detection extended/input signal error detection setting, the operating condition setting request (Y9) must be turned ON/OFF. (Refer to Section 3.3.2.)

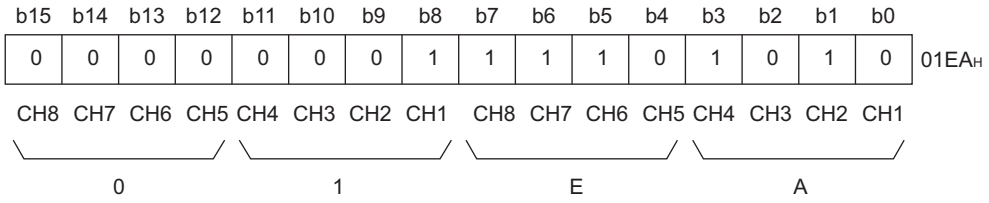
(3) All channels for the input signal error detection and all channels for the input signal error detection extended setting are set to the same value of upper limit and lower limit as the default setting.



[Setting example of Q68AD-G]

If the following setting is performed, store 01EA$_H$ into Un\G47.

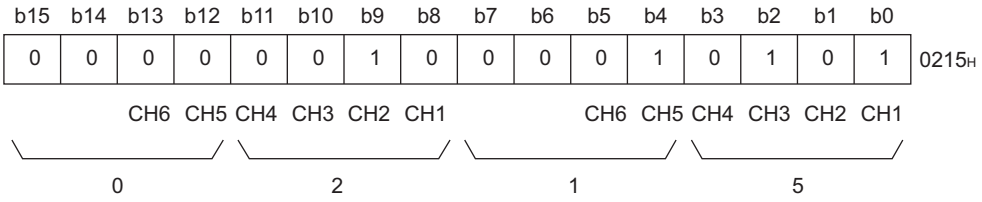
- The channel 1, 3 and 5 specified for input signal error detection are set to 0 (enabled).
- The channel 1 specified for input signal error detection extended setting is set to 1 (different value of lower and upper limit).



[Setting example of Q66AD-DG]

If the following setting is performed, store 0215$_H$ into Un\G47.

- The channel 2, 4 and 6 specified for input signal error detection are set to 0 (enabled).
- The channel 2 specified for input signal error detection extended setting is set to 1 (different value of lower and upper limit).

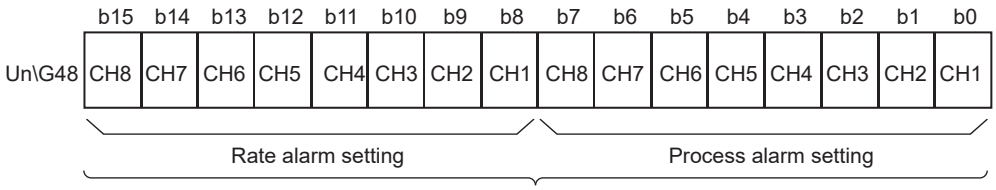


3.4.12 Warning output settings (Un\G48)

(1) This area is used to set whether the process alarm/rate alarm warning is to be output or stopped on a channel basis.

(2) To validate the warning output setting, the operating condition setting request (Y9) must be turned ON/OFF. (Refer to Section 3.3.2.)

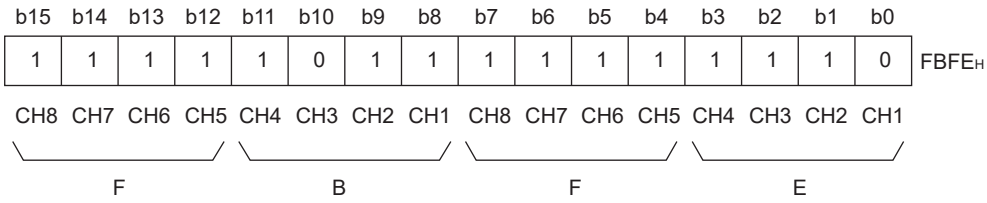
(3) By default, all channels are set to disable.



0: Enable, 1: Disable
For Q66AD-DG, information of b6, b7, b14, b15 is fixed at 0.

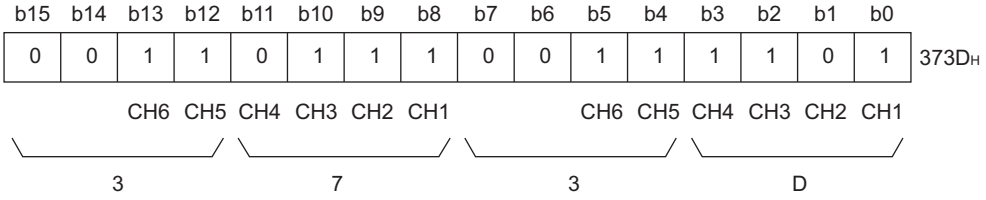
[Setting example of Q68AD-G]

When process alarm warning output is enabled for channel 1 and rate alarm warning output is enabled for channel 3, FBFEH is stored into Un\G48.



[Setting example of Q66AD-DG]

When process alarm warning output is enabled for channel 2 and rate alarm warning output is enabled for channel 4, 373DH is stored into Un\G48.



3.4.13 Input signal error detection flag (Un\G49)

(1) If the analog input value detected falls outside the setting range sets to the CH☐ input signal error detection setting value/CH☐ Input signal error detection lower limit setting value (Un\G142 to Un\G149), or CH☐ input signal error detection upper limit setting value (Un\G150 to Un\G157), the Input signal error detection flag for the corresponding channel turns to 1.

(2) By bringing the analog input value within the setting range and turning ON the Error clear request (YF), the Input signal error detection flag turns OFF.

(3) If an error is detected on any one of the channels for which input signal error detection is enabled, the Input signal error detection signal (XC) also turns ON.

(4) When the operating condition setting request (Y9) is turned ON, the Input signal error detection flag is cleared.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Un\G49	0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

For Q68AD-G, information of b8 to b15 is fixed at 0.
For Q66AD-DG, information of b6 to b15 is fixed at 0.

0: Normal
1: Input signal error

3.4.14 Warning output flag (Un\G50,Un\51)

(1) If the digital output value or its varying rate falls outside the setting range set to the CH□ process alarm upper/lower limit value (Un\G86 to Un\G117) or CH□ rate alarm upper/lower limit value (Un\G126 to Un\G141), the warning output flag for the corresponding channel turns to 1.

(2) For both the process alarm and rate alarm, whether the warning is for the upper or lower limit value can be checked on a channel basis.

(3) When the digital output value or its varying rate returns to within the setting range, the warning output flag is automatically reset.

(4) If a warning is detected on any one of the channels for which A/D conversion and process alarm or rate alarm warning output are enabled, the Warning output signal (X8) also turns ON.

(5) When the operating condition setting request (Y9) is turned ON, the warning output flag is cleared.

Un\G50(Process alarm)

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
CH8 Upper limit value	CH8 Lower limit value	CH7 Lower limit value	CH7 Upper limit value	CH6 Lower limit value	CH6 Upper limit value	CH5 Lower limit value	CH5 Upper limit value	CH4 Lower limit value	CH4 Upper limit value	CH3 Lower limit value	CH3 Upper limit value	CH2 Lower limit value	CH2 Upper limit value	CH1 Lower limit value	CH1 Upper limit value

For Q66AD-DG, information of b12 to b15 is fixed at 0.

0: Normal,
1: Alarm ON

Un\G51(Rate alarm)

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
CH8 Upper limit value	CH8 Lower limit value	CH7 Lower limit value	CH7 Upper limit value	CH6 Lower limit value	CH6 Upper limit value	CH5 Lower limit value	CH5 Upper limit value	CH4 Lower limit value	CH4 Upper limit value	CH3 Lower limit value	CH3 Upper limit value	CH2 Lower limit value	CH2 Upper limit value	CH1 Lower limit value	CH1 Upper limit value

For Q66AD-DG, information of b12 to b15 is fixed at 0.

0: Normal,
1: Alarm ON

3.4.15 Scaling enable/disable setting (Un\G53)

(1) Whether to enable or disable the scaling function for each channel is set in this area.

(2) To validate the scaling function, the operating condition setting request (Y9) must be turned ON/OFF. (Refer to Section 3.3.2.)

(3) All channels are defaulted to "Disable".

Un\G53

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

For Q68AD-G, information of b8 to b15 is fixed at 0.
For Q66AD-DG, information of b6 to b15 is fixed at 0.

0: Active
1: Inactive

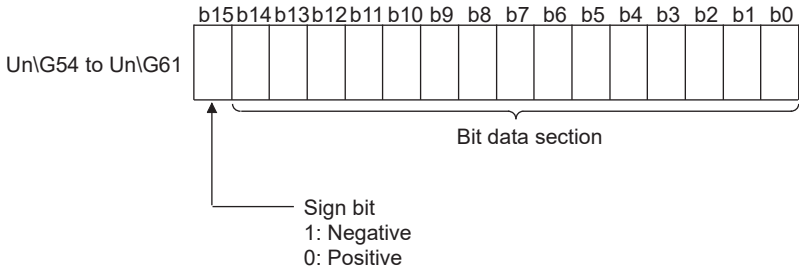
Point

When the Scaling enable/disable setting (Un\G53) is set to "Disable", 0s are stored in the CH□ scaling value storage area (Un\G54 to Un\G61).

3.4.16 CH □ scaling value storage area (Un\G54 to Un\G61)

(1) Digital output values after scaling are stored for respective channels.

(2) Scaling values are stored as 16-bit signed binaries.



3.4.17 CH □ scaling upper / lower limit value (Un\G62 to Un\G77)

(1) For each channel, set a scaling range.

(2) To validate the setting, the operating condition setting request (Y9) must be turned ON/OFF. (Refer to Section 3.3.2.)

(3) The setting range is -32000 to 32000.

(4) Refer to Section 3.2.6 for details of the scaling function.

Point

(1) Setting a value outside the above setting range or a value that does not meet the inequality "Upper limit > Lower limit" will cause an error. If this occurs, an error code is stored in Error code (Un\G19) followed by ON of the Error flag (XF), and the module will operate under the setting before the error.
(2) Since the default setting is 0, change the setting.
(3) When the Scaling enable/disable setting (Un\G53) is set to "Disable", scaling upper/lower limit values are ignored.

3.4.18 CH □ conversion starting time setting (for 2-wire transmitter) (Un\G78 to Un\G83) (Q66AD-DG only)

(1) This area is used to set the "time necessary from when the used 2-wire transmitter powers on until its output stabilizes" on a channel basis.
This setting is valid only for the channels that use input ranges of "4 to 20mA (2-wire transmitter): 0_H" or "User range setting (2-wire transmitter): F_H", and that are set as conversion-enabled in the A/D conversion enable/disable setting (Un\G0). It is ignored in the case of any other setting.

(2) To validate the setting, the operating condition setting request (Y9) must be turned ON/OFF. (Refer to Section 3.3.2.)

(3) The setting range is 0 to 3276.7 seconds (0 to 54 minutes and 36.7 seconds) [0 to 32767].
Set the time in 100ms increments.
Example) When setting the A/D conversion starting time to 5 seconds, store 50 into the buffer memory.

(4) The default is set to 3 seconds [30].

(5) Refer to Section 3.2.5 for details of the conversion starting time setting function.

Point

If a value outside the above setting range is written to a channel, an error occurs, and an error code is stored into the Error code (Un\G19). In this case, the operation is performed based on the setting before the error detection.

3.4.19 CH □ process alarm upper/lower limit value (Un\G86 to Un\G117)

(1) For each channel, set a range of digital output values.

(2) To validate the setting, the operating condition setting request (Y9) must be turned ON/OFF. (Refer to Section 3.3.2.)

(3) The setting range is -32768 to 32767.

(4) Make four kinds of settings: process alarm upper upper limit value, upper lower limit value, lower upper limit value and lower lower limit value.

(5) Refer to Section 3.2.4 for details of the process alarm.

Point

(1) If a value outside the above setting range is set or if a value that does not satisfy the condition of "lower lower limit value ≦ lower upper limit value ≦ upper lower limit value ≦ upper upper limit value" is set, it results in an error. An error code is stored into the Error code (Un\G19), the Error flag (XF) turns ON, and operation is performed based on the setting before the error detection.
(2) Since the default setting is 0, change the setting.
(3) When "Enable" is set in the Scaling enable/disable setting (Un\G53), always take into account the scaling conversion before setting values.

3.4.20 CH □ rate alarm warning detection period (Un\G118 to Un\G125)

(1) Set a period, with which the varying rate of the digital output value will be checked, on a channel basis.

(2) To validate the setting, the operating condition setting request (Y9) must be turned ON/OFF. (Refer to Section 3.3.2.)

(3) The setting range is 10 to 5000ms.
The value can be set in 1ms increments, but the first digit is rounded down and the value is processed in 10ms increments.

(4) When time averaging or count averaging has been specified for averaging process specification, set the rate alarm warning detection period as a multiple of the time averaging or count averaging conversion period.

Example) When the number of channels is 5, and if the count value set for the count averaging is 10, the conversion cycle for count averaging is:
10 (times) × 5 (CH) × 10 (ms) = 500 (ms)
Therefore, set a multiple of 500, such as 1500 or 3000, to the rate alarm warning detection period.

(5) The default setting is 0ms.

(6) Refer to Section 3.2.4 for details of the rate alarm.

Point

(1) If a value outside the above setting range is written to a channel, an error occurs, and an error code is stored into the Error code (Un\G19). The Error flag (XF) turns ON, and the time or count averaging or rate alarm processing is performed based on the setting before the error detection.
(2) Since the default setting is 0, change the setting.
(3) If the upper limit value and lower limit value settings of the rate alarm are small, the warning output may turn ON due to overreaction to disturbance or like. This overreaction can be avoided by increasing the setting of the rate alarm warning detection period.

3.4.21 CH □ rate alarm upper/lower limit value (Un\G126 to Un\G141)

(1) For each channel, set the range of change rate of digital output values.

(2) To validate the setting, the operating condition setting request (Y9) must be turned ON/OFF. (Refer to Section 3.3.2.)

(3) The setting range is -32768 to 32767 (-3276.8 to 3276.7%). Set the value in 0.1%/s increments.

Example) When setting the rate alarm upper limit value to 30%/s, store 300 into the buffer memory.

(4) Refer to Section 3.2.4 for details of the rate alarm.

3.4.22 CH □ input signal error detection setting value/CH □ Input signal error detection lower limit setting value (Un\G142 to Un\G149)
CH □ Input signal error detection upper limit setting value (Un\G150 to Un\G157)

(1) Set the value (upper limit setting value and lower limit setting value), by which an error of the input analog value will be detected, on a channel basis.
The setting value (upper limit value and lower limit value) depends on the input signal error detection extended setting.

(a) When Same upper limit value/lower limit value is selected.
- Set the value of the input signal error detection setting for CH□ input signal error detection setting (Un\G142 to Un\G149).

(b) When Different upper limit value/lower limit value is selected.
- Set the value of the input signal error detection lower limit for CH□ Input signal error detection lower limit setting value (Un\G142 to Un\G149).
- Set the value of the input signal error detection upper limit for CH□ Input signal error detection upper limit setting value (Un\G150 to Un\G157).

(2) To validate the setting, the Operating condition setting request (Y9) must be turned ON/OFF. (Refer to Section 3.3.2.)

(3) The setting range is 0 to 250 (0 to 25.0%). Set the value in 0.1% increments.
Example) When setting the input signal error detection setting value to 15%,
store 150 into the buffer memory.

If 251 is entered in the CH□ Input signal error detection upper limit setting value and CH□ Input signal error detection lower limit setting value boxes after Different upper limit value/lower limit value is selected for the input signal error detection extended setting, the detection function for the upper and lower limits can be disabled.

(4) Based on an input signal error detection setting value (input signal error upper and lower limit setting values), an input signal upper and lower limit values are calculated as shown below.

The calculated values vary depending on the input range.*1

(a) Input signal error detection upper limit value
= gain value of corresponding range + (gain value of corresponding range - offset value of corresponding range) × {input signal error detection setting value (Input signal error detection upper limit setting value) /1000}

(b) Input signal error detection lower limit value
= lower limit value of corresponding range + (gain value of corresponding range - offset value of corresponding range) × {input signal error detection setting value (Input signal error detection lower limit setting value) /1000}

*1 For the lower limit value, offset value, and gain value for each input range, refer to Point (3) in this section.

[Example When same upper limit value/lower limit value is selected for the input signal error detection extended setting, setting 15% (150) to the input signal error detection setting value in the Q68AD-G]
Resolution mode : High resolution mode
Used range : User range setting (Offset value: 5mA, Gain value: 18mA)
In this setting, because the lower limit value is an analog value at the time the digital value is -12000, it is -8mA.
Therefore, the input signal error detection upper and lower limit values are as follows:
Input signal error detection upper limit value = 18 + (18-5) x 150/1000 = 19.95mA
Input signal error detection lower limit value = -8 - (18-5) x 150/1000 = -9.95mA

(5) Refer to Section 3.2.3 for details of the input signal error detection function.

Point

(1) Set the input signal error detection upper limit value to less than 25mA. If the setting is 25mA or more, the error may not be detected.

(2) If a value outside the setting range is set, an error occurs and an error code is stored in the Error code (Un\G19). In this case, the operation is performed based on the setting before the error detection.

(3) The following table lists the lower limit value, offset value, and gain value for each input range.

Table3.10 The lower limit value, offset value, and gain value for each input range (Q68AD-G)

Input	Analog input range	Lower limit value	Offset value	Gain value
Voltage	0 to 10V	0V		10V
	0 to 5V	0V		5V
	1 to 5V	1V		5V
	1 to 5V (extended mode)	1V		5V
	-10 to 10V	-10V	0V	10V
	User range setting	Analog value when the digital value is: • -4000 (normal resolution mode) • -12000 (high resolution mode)	Analog value set as an offset value by the user	Analog value set as a gain value by the user
Current	0 to 20mA	0mA	0mA	20mA
	4 to 20mA	4mA	4mA	20mA
	4 to 20mA (extended mode)	4mA	4mA	20mA
	User range setting	Analog value when the digital value is: • -4000 (normal resolution mode) • -12000 (high resolution mode)	Analog value set as an offset value by the user	Analog value set as a gain value by the user

Table3.11 The lower limit value, offset value, and gain value for each input range (Q66AD-DG)

Input	Analog input range	Lower limit value	Offset value
0 to 20mA	0mA		20mA
4 to 20mA	4mA		20mA
4 to 20mA (extended mode)	4mA		20mA
User range setting	Analog value set as an offset value by the user		Analog value set as a gain value by the user

3.4.23 Mode switching setting (Un\G158, Un\G159)

(1) Set values for the mode desired to be switched to.

(2) After setting the values, turning the operating condition setting request (Y9) from OFF to ON switches to that mode.

(3) When mode switching is performed, this area is cleared to zero and the operating condition setting completed flag (X9) turns OFF.

(4) After confirming that the operating condition setting completed flag (X9) has turned OFF, turn OFF the operating condition setting request (Y9).

Mode to be switched to	Set value	
	Buffer memory address 158	Buffer memory address 159
Normal mode	0964H	4144H
Offset/gain setting mode	4144H	0964H

Point

If any value other than the above is written, mode switching is not performed and only the operating condition is changed.

3.4.24 Save data classification setting (Un\G200) (Q68AD-G only)

(1) This area is used to restore the User range settings offset/gain values when the module is replaced online.
Refer to Chapter 7 for details of online module change.

(2) Specify whether the offset/gain values to be saved/restored are voltages or currents when saving/restoring the offset/gain values of the user range setting.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Un\G200	0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

Information of b8 to b15 is fixed to 0.

1: Current
0: Voltage

Point

Refer to Section 4.6 for the offset/gain value setting method.

3.4.25 Factory default and User range settings offset/gain value (Un\G202 to Un\G233)

(1) The areas are used to restore the User range settings offset/gain values when the module is replaced online.
Refer to Chapter 7 for details of online module change.

(2) When the offset/gain values of the user range setting are restored, the used data are stored.
The data are stored (saved) when:
- Initial setting is written by the utility;
- The operating condition is set (Y9 turns from OFF to ON ∗1); or
- The offset/gain values are written in the offset/gain setting mode (YA turns from OFF to ON).

*1: The data are not saved when values have been written to the mode switching setting area (Un\G158, Un\G159).

(3) When restoring the offset/gain values of the user range setting, set the data saved here into the corresponding area of the module where the data will be restored.

(4) Buffer memory saving recording procedure for online module change

1) Set the save data classification setting*1 (Un\G200).
2) Turn the operating condition setting request (Y9) from OFF to ON.
3) Compare the offset/gain values of the Factory default and User range settings (Un\G202 to Un\G233) with the range reference values. Refer to Section 7.4 for the range reference values.
4) If the values are proper, record the values of the save data classification setting*1, Factory default and User range settings offset/gain value.

*1: The Q66AD-DG does not require the setting and recording of the save data classification setting.

Point

Refer to Section 4.6 for the offset/gain value setting method.

4 SETUP AND PROCEDURES BEFORE OPERATION

4.1 Handling Precautions

(1) Do not drop the module or subject it to heavy impact.

(2) Do not remove the PCB of the module from its case.
Doing so may cause the module to fail.

(3) Be careful not to let foreign particles such as swarf or wire chips enter the module.
They may cause a fire, mechanical failure or malfunction.

(4) The top surface of the module is covered with a protective film to prevent foreign objects such as wire burrs from entering the module during wiring.
Do not remove this film until the wiring is complete.
Before operating the system, be sure to remove the film to provide adequate ventilation.

(5) Tighten the screws such as module fixing screws within the following ranges.
Loose screws may cause short circuits, failures, or malfunctions.

Screw location	Tightening torque range
Module fixing screw (M3 screw)	0.36 to 0.48 N·m
Connector screw (M2.6 screw)	0.20 to 0.29 N·m
FG terminal screw (M3 screw)	0.42 to 0.58 N·m

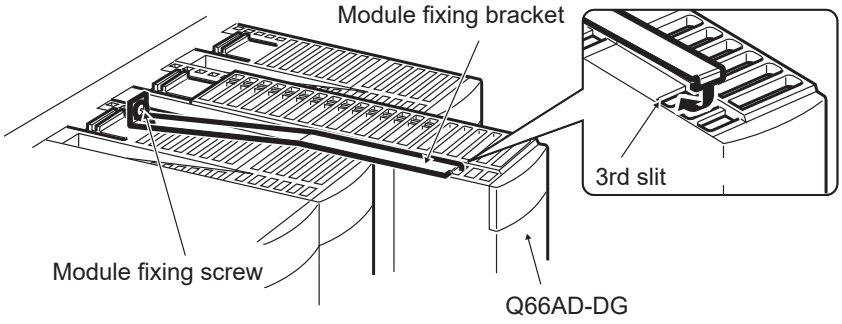
(6) To mount the module, while pressing the module mounting lever located in the lower part of the module, fully insert the module fixing projection into the hole in the base unit and press the module until it snaps into place.
Improper installation may result in a module malfunction, or may cause the module to fall off.

4.1.1 Attaching a module fixing bracket (Q66AD-DG only)

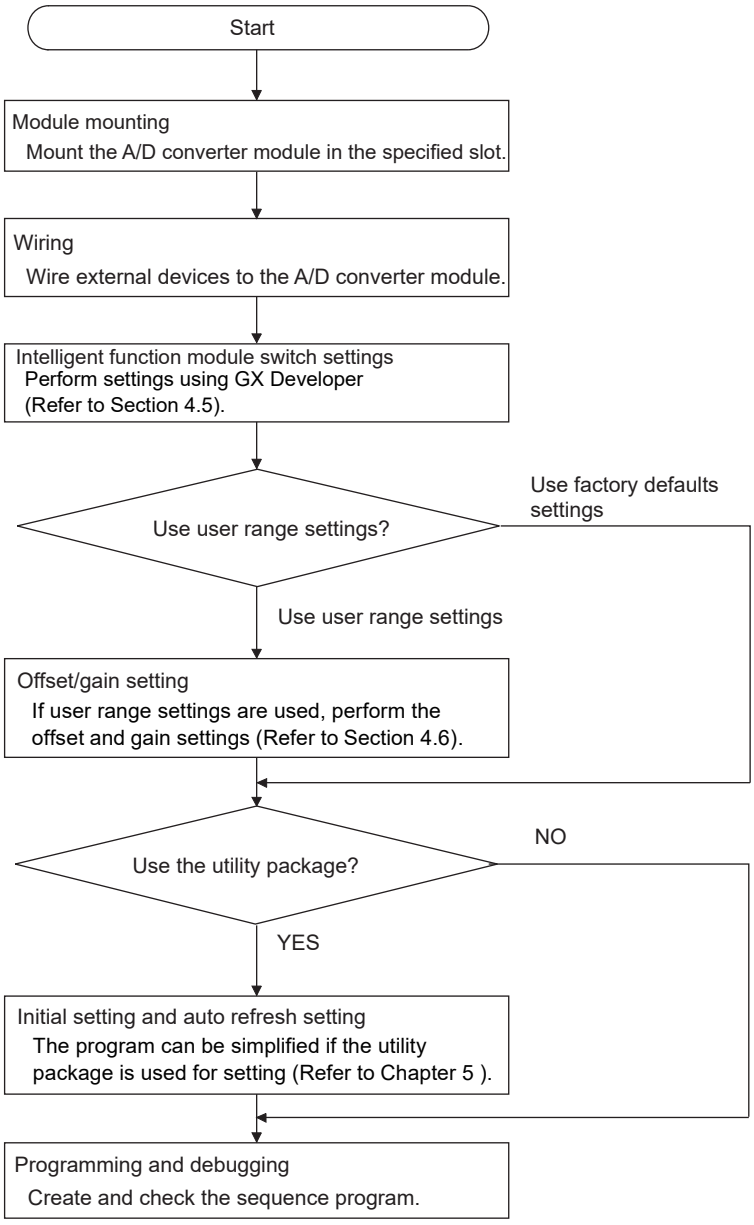
After mounting the Q66AD-DG on the base unit, fix the module with a module fixing bracket.

Point

Make sure that the module fixing bracket is hooked on the 3rd slit viewed from the front of Q66AD-DG.
And tighten the module fixing screw at the specified torque.



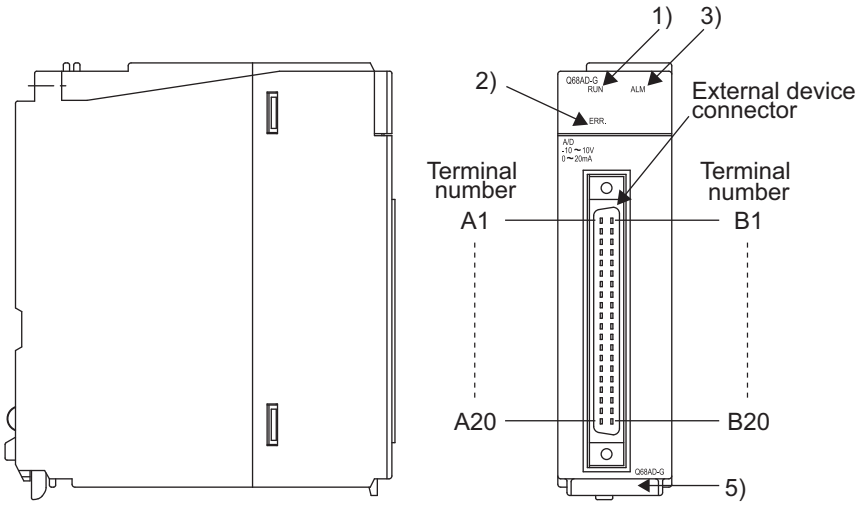
4.2 Setup and Procedures before Operation



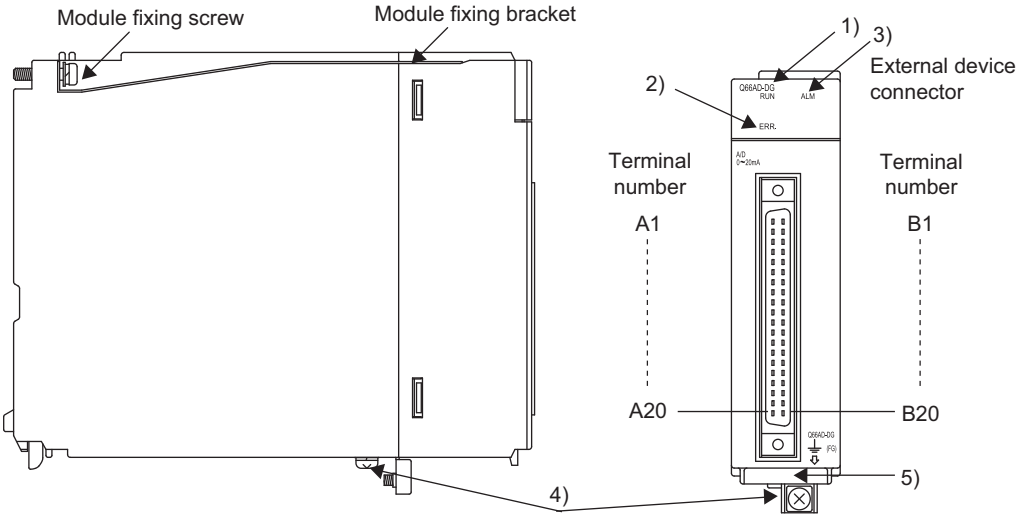
4.3 Part Names

The name of each part of the A/D converter module is shown below.

(1) Q68AD-G



(2) Q66AD-DG

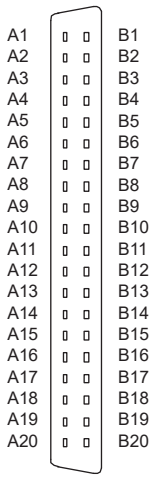


Number	Name and appearance	Description
1)	RUN LED*2	Displays the operating status of the A/D converter module. On : Normal operation Flashing : During offset/gain setting mode Off : 5V power supply interrupted, watchdog timer error occurred, or online module change enabled.
2)	ERR. LED	Displays the error status of the A/D converter module. On : Error*1 Flashing : Error in switch settings. Switch No. 5 of the intelligent function module has been set to a value other than zero. Off : Normal operation
3)	ALM LED	Displays the alarm status of the A/D converter module. On : An alarm (process alarm, rate alarm) occurred. Flashing : An input signal error occurred. Off : Normal operation
4)	FG terminal L-Shaped metal fitting (Q66AD-DG only)	Metal fitting to wire for FG of the Q66AD-DG.
5)	Serial No. display	Displays the serial No. of the A/D converter module.

* 1 Check the error code for details.
* 2 When the module is mounted on a MELSECNET/H remote I/O station, the RUN LED stays off until a data link starts normally, even after the power is turned on. The RUN LED turns on once a data link starts.

Point

When two or more errors have occurred, the latest error found by the A/D converter module is indicated with the LED.



Seen from the front of the module

(1) Q68AD-G

Terminal number	Signal name	Terminal number	Signal name
A1	CH1 V +	B1	CH1 V -/I -
A2	CH1 I +	B2	-
A3	-	B3	CH2 V +
A4	CH2 V -/I -	B4	CH2 I +
A5	-	B5	-
A6	CH3 V +	B6	CH3 V -/I -
A7	CH3 I +	B7	-
A8	-	B8	CH4 V +
A9	CH4 V -/I -	B9	CH4 I +
A10	-	B10	-
A11	CH5 V +	B11	CH5 V -/I -
A12	CH5 I +	B12	-
A13	-	B13	CH6 V +
A14	CH6 V -/I -	B14	CH6 I +
A15	-	B15	-
A16	CH7 V +	B16	CH7 V -/I -
A17	CH7 I +	B17	-
A18	-	B18	CH8 V +
A19	CH8V -/I -	B19	CH8 I +
A20	-	B20	-

(2) Q66AD-DG

Terminal number	Signal name	Terminal number	Signal name
A1	CH1 P	B1	CH1 I +/CHK +
A2	-	B2	CH1 I -/CHK -
A3	-	B3	-
A4	CH2 P	B4	CH2 I +/CHK +
A5	-	B5	CH2 I -/CHK -
A6	-	B6	-
A7	CH3 P	B7	CH3 I +/CHK +
A8	-	B8	CH3 I -/CHK -
A9	-	B9	-
A10	CH4 P	B10	CH4 I +/CHK +
A11	-	B11	CH4 I -/CHK -
A12	-	B12	-
A13	CH5 P	B13	CH5 I +/CHK +
A14	-	B14	CH5 I -/CHK -
A15	-	B15	-
A16	CH6 P	B16	CH6 I +/CHK +
A17	-	B17	CH6 I -/CHK -
A18	-	B18	-
A19	24VDC	B19	24VDC
A20	24GDC	B20	24GDC

P : Power supply for 2-wire transmitter
I+/CHK+ : 2-wire transmitter current input, Current(+) input / check (+) terminal
I-/CHK- : Current(-) input / check (-) terminal

(3) Connector for external wiring

The connectors for use with the A/D converter module should be purchased separately by the user.
The following tables show the connector types and the crimp-contact tool.

(a) Connector types*1

Type	Model name	Applicable wire size
Soldering type (straight out)	A6CON1	0.3mm^2 (AWG22) (stranded)
Crimp-contact type (straight out)	A6CON2	0.088mm^2 to 0.24mm^2 (AWG28 to 24) (stranded)
Soldering type (straight out/diagonal out)	A6CON4	0.3mm^2(AWG22) (stranded)

*1: The A6CON3 (pressure-displacement type, straight out) connector cannot be used for the A/D converter module.

(b) Crimp-contact tool

Type	Model name	Applicable wire size	Contact
Crimp-contact tool	FCN-363T-T005/H	0.088mm^2 to 0.24mm^2(AWG26 to 24)	FUJITSU COMPONENT LIMITED www.fujitsu.com/jp/group/fcl/en

4.4 Wiring

The wiring precautions and examples of module connection are provided below.

4.4.1 Wiring precautions

In order to optimize the functions of the A/D converter module and ensure system reliability, external wiring that is protected from noise is required.
Please observe the following precautions for external wiring:

(1) Use separate cables for the AC control circuit and the external input signals of the Q68AD-G to prevent influences of AC surge or induction.

(2) Use separate cables for the AC control circuit, the external input signals and external power supply of the Q66AD-DG to avoid influences of AC side surge or induction.

(3) Keep a distance among the main circuit line, a high-voltage cable and a load cable from other than the programmable controller.
Failure to do so may increase the effects of noise, surges and induction.

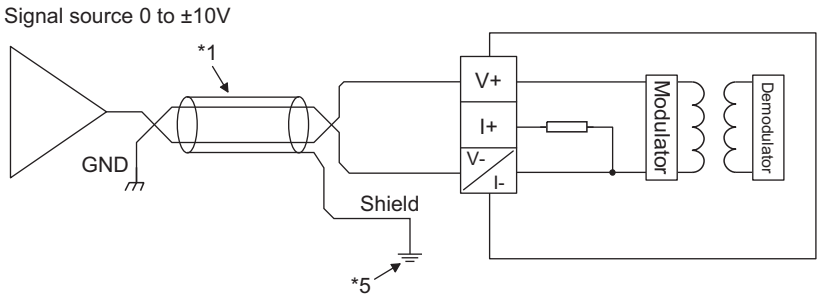
(4) The shield wire or the shield of the shielded cable must be grounded at one end.

(5) When wiring to the module placed on the right side of the Q66AD-DG is difficult, remove the Q66AD-DG before wiring.

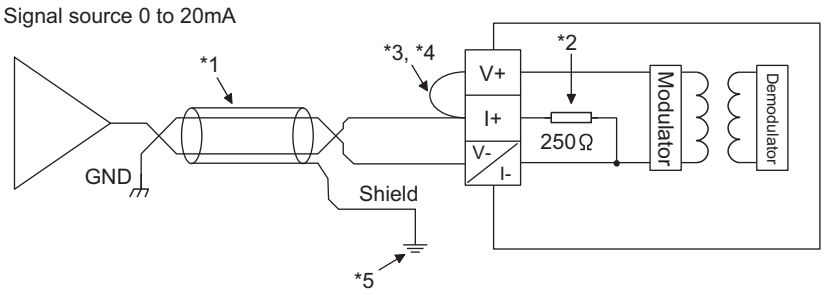
4.4.2 External wiring

(1) Q68AD-G

(a) For voltage input



(b) For current input



*1: Use a 2-core twisted shielded wire for the power wire.
*2: Shows input resistance.
*3: For current input, be sure to connect (V+) and (I+) terminals.
*4: Connect (V+) terminal to (I+) terminal in the external device connection connector to reduce resistance of the connection conductor.
*5: Always ground the shield of the wire of each channel.

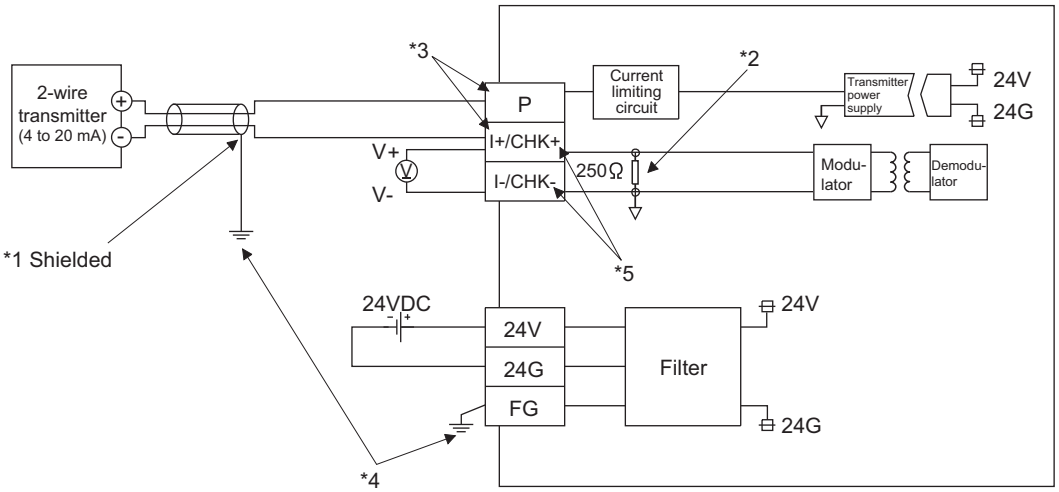
Remark

If the external wiring is disconnected during use of voltage input on the Q68AD-G, depending on the internal circuit characteristics, a certain time is required until the digital output reaches a value equivalent to 0V.

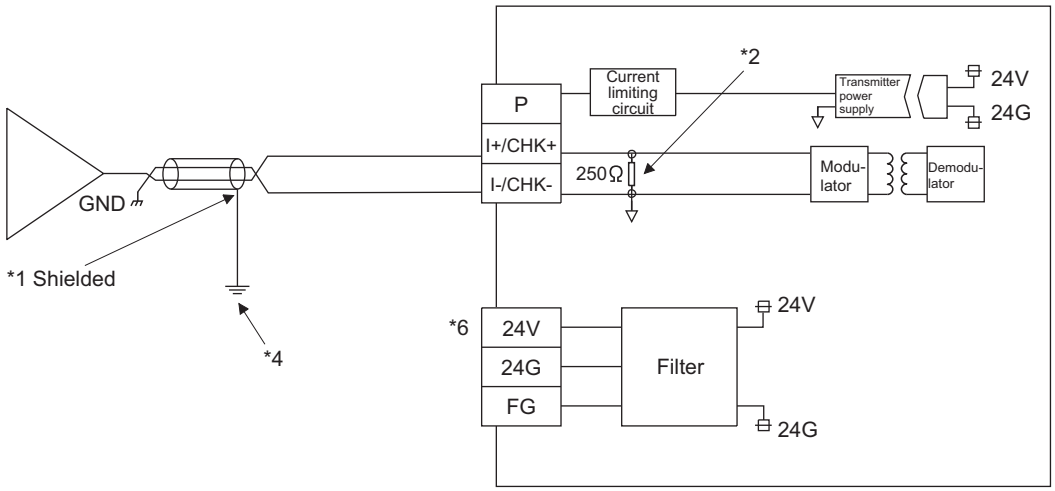
To avoid the phenomenon, connect a resistor (approximately 1MΩ) across (V+) and (V-) terminals.

(2) Q66AD-DG

(a) For 2-wire transmitter input



(b) For current input



*1 Use a 2-core twisted shielded wire for the power wire.

*2 Shows input resistance.

*3 To connect with the 2-wire transmitter, be sure to connect to P and I+/CHK+.

*4 Always ground the shield of the wire of each channel.

*5 The check terminals (CHK+, CHK-) are used to check the amount of input in mA in relation to the 2-wire transmitter output.
This can be checked since analog inputs of 4 to 20mA are converted to analog outputs of 1 to 5V.
The relationship of this conversion can be expressed by the following formula:

$$\text{Analog output(V)} = \frac{\text{Analog input(mA)}}{1000} \times 250\,\Omega$$

*6 When all the channels used are for current input, wiring for 24VDC is not required.
Note that to use the Q66AD-DG with a product number (first five digits) of 15031 or earlier, refer to Appendix 2.

Remark

The Q66AD-DG needs to powered on 30 minutes prior to operation for compliance to the specification (accuracy).
Therefore, power on 30 minutes prior to offset/gain setting or after online module change.

4.4.3 Connector/terminal block converter module

For the following products, please consult your local Mitsubishi Electric sales office or representative.

(1) Q68AD-G

Product	Model	Manufacturer
Dedicated cable	FA-CBL□□Q68ADGN*1	Mitsubishi Electric Engineering Co., Ltd.
Connector/terminal block converter module	FA1-TBS40ADGN	
	FA-LTB40ADGN	

*1 □□ shows the cable length (05: 0.5m, 10: 1.0m, 20: 2.0m, 30: 3.0m).

(2) Q66AD-DG

Product	Model	Manufacturer
Dedicated cable	FA-CBL□□Q66ADDG*1	Mitsubishi Electric Engineering Co., Ltd.
Connector/terminal block converter module	FA1-TBS40ADDG	
	FA-LTB40ADDG	

*1 □□ shows the cable length (05: 0.5m, 10: 1.0m, 20: 2.0m, 30: 3.0m).

Point

The offset/gain setting is adjusted in each module (Q68AD-G and Q66AD-DG) at the factory default setting of the modules.
Therefore an error may occur for the conversion characteristic because of the influence such as the conductor resistance when a dedicated cable or connector/terminal block converter module is used.
If a problem occurs by the influence, perform the offset/gain setting by using the user range setting. (Refer to Section 4.6.)

4.5 Intelligent Function Module Switch Setting

The intelligent function module switches are set using the I/O assignment settings of GX Developer.

(1) Setting item

The intelligent function module switches consist of switches 1 to 5 and are set using 16-bit data. When the intelligent function module switches are not set, the default value for switches 1 to 5 is 0.

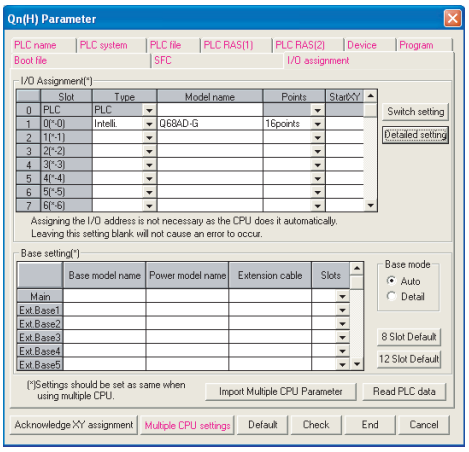
Table4.1 Switch setting item

<table>
<tr><th>Switch No.</th><th colspan="2">Setting item</th></tr>
<tr><td>Switch 1</td><td>Input range setting
(CH1 to CH4)
□□□□ H
CH4 CH3 CH2 CH1</td><td rowspan="2">Q68AD-G
<table><tr><th>Analog input range</th><th>Input range setting value</th></tr><tr><td>4 to 20mA</td><td>0H</td></tr><tr><td>0 to 20mA</td><td>1H</td></tr><tr><td>1 to 5V</td><td>2H</td></tr><tr><td>0 to 5V</td><td>3H</td></tr><tr><td>-10 to 10V</td><td>4H</td></tr><tr><td>0 to 10V</td><td>5H</td></tr><tr><td>4 to 20mA (Extended mode)</td><td>AH</td></tr><tr><td>1 to 5V (Extended mode)</td><td>BH</td></tr><tr><td>User range setting</td><td>FH</td></tr></table>
Q66AD-DG
<table><tr><th>Analog input range</th><th>Input range setting value</th></tr><tr><td>4 to 20mA (For 2-wire transmitter input)</td><td>0H</td></tr><tr><td>4 to 20mA (For current input)</td><td>6H</td></tr><tr><td>0 to 20mA (For current input)</td><td>7H</td></tr><tr><td>4 to 20mA (Extennded mode) (For 2-wire transmitter input)</td><td>AH</td></tr><tr><td>4 to 20mA (Extended mode) (For current input)</td><td>CH</td></tr><tr><td>User range setting (For current input)</td><td>EH</td></tr><tr><td>User range setting (For 2-wire transmitter input)</td><td>FH</td></tr></table></td></tr>
<tr><td>Switch 2</td><td>Input range setting
(CH5 to CH8)
□□□□ H
CH8 CH7 CH6 CH5
Fixed at 00H
for Q66AD-DG</td></tr>
<tr><td>Switch 3</td><td colspan="2">Empty</td></tr>
<tr><td>Switch 4</td><td colspan="2">□□□□ H
00H: Fixed
0H: Normal resolution mode
1H to FH (value other than 0H)*1: High resolution mode
0H: Normal mode (A/D conversion processing)
1H to FH (value other than 0H)*1: Offset/gain setting mode</td></tr>
<tr><td>Switch 5</td><td colspan="2">0H : Fixed</td></tr>
</table>

*1 Setting any value within the setting range will provide the same operation.
When the setting range is 1H to FH, set 1H for example.

(2) Operating procedure

Start the settings with GX Developer I/O assignment setting window.

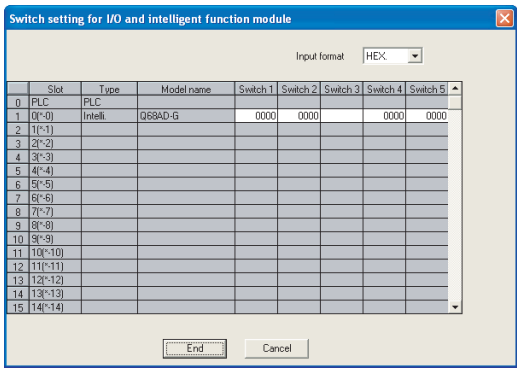


(a) I/O assignment setting window

Set the following for the slot in which the A/D converter module is mounted.

The type setting is required; set other items as needed.

Type	:	Select "intelli."
Model name	:	Enter the module model name.
Points	:	Select 16 points.
Start	:	Enter the start I/O number for the A/D converter module.
Detailed setting	:	Specify the control PLC for the A/D converter module. It is unnecessary to set the "Error time output mode" or "H/W error time PLC operation mode" since these settings are invalid for the A/D converter module.



(b) Switch setting for intelligent function module window

Click on [Switch setting] on the I/O assignment setting window to display the window shown at left, then set switches 1 to 5.

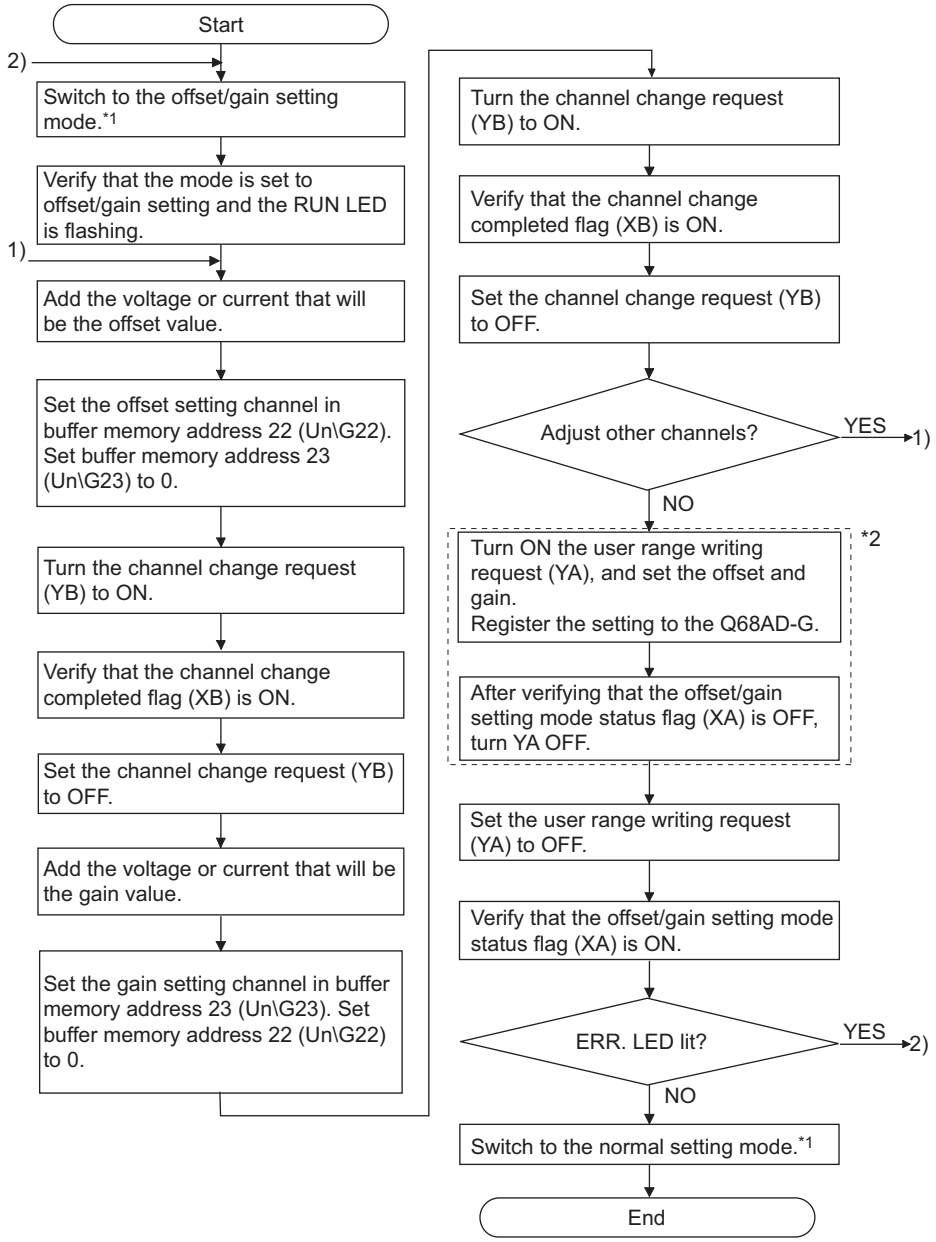
The switches can easily be set if values are entered in hexadecimal. Change the entry format to hexadecimal and then enter the values.

4.6 Offset/Gain Settings

When using the user range setting, make the offset/gain setting according to the operation indicated in Section 4.6.1 or Section 4.6.2.
When the Factory default is used, offset/gain setting is not necessary.
If the utility package is installed, perform the offset/gain settings according to the procedure described in Section 5.6.2.

4.6.1 Offset/gain settings (Q68AD-G)

(1) Offset/gain setting procedure



*1 The mode switching (normal mode to offset/gain setting mode to normal mode) method is given below.
- Dedicated instruction (G(P).OFFGAN) .....Refer to Section 4.6.1 (2) (a)
- Setting made to mode switching setting (buffer memory addresses 158, 159: Un\G158, Un\G159) and turning the operation condition setting request (Y9) from OFF to ON .....Refer to Section 4.6.1 (2) (b)
- Intelligent function module switch setting ..... Refer to Section 4.5, Section 4.6.1 (2) (c)

(After intelligent function module switch setting, reset the programmable controller CPU or switch power OFF, then ON.)

*2 Do not perform the operations below during the steps indicated with *2. If they are performed, the data inside a flash memory will have a problem, and the Q68AD-G may not operate normally.
- Powering off the programmable controller CPU
- Resetting the programmable controller CPU

Point

(1) Perform the offset/gain settings in the range that satisfies the conditions specified in POINT of Section 3.1.2 (2).
When the setting exceeds this range, the maximum resolution or total accuracy may not be within the range indicated in the performance specification.

(2) Though the offset/gain settings can be performed on multiple channels at the same time, set the offset and gain separately (0 at either of the buffer memory addresses 22, 23).
If channels are set at Un\G22 and Un\G23 at the same time, an error will occur and the ERR. LED will be lit.

(3) After the offset/gain settings are completed, verify that the offset and gain values have been set correctly under actual usage conditions.

(4) The offset and gain values are stored into the Flash memory and are not erased at power-off.

(5) At the time of offset/gain setting, turn ON the user range write request (YA) to write the values to the flash memory.
Data can be written to the flash memory the maximum of 50 thousand times.
To prevent accidental writing to the flash memory, an error (error code: 162) will occur if data is written 26 times consecutively.

(6) If an error (error code: 40 □[*1]) occurs during offset/gain setting, re-set the correct offset/gain value.
The offset/gain value of the channel where the error has occurred is not written to the module.(*1: □ indicates the corresponding channel number.)

(7) Module ready (X0) turns from OFF to ON when the offset/gain setting mode switches to the normal mode by the dedicated instruction (G(P).OFFGAN) or the setting of the mode switching setting (Un\G158, Un\G159).
Note that initial setting processing will be executed if there is a sequence program that makes initial setting when module ready (X0) turns ON.

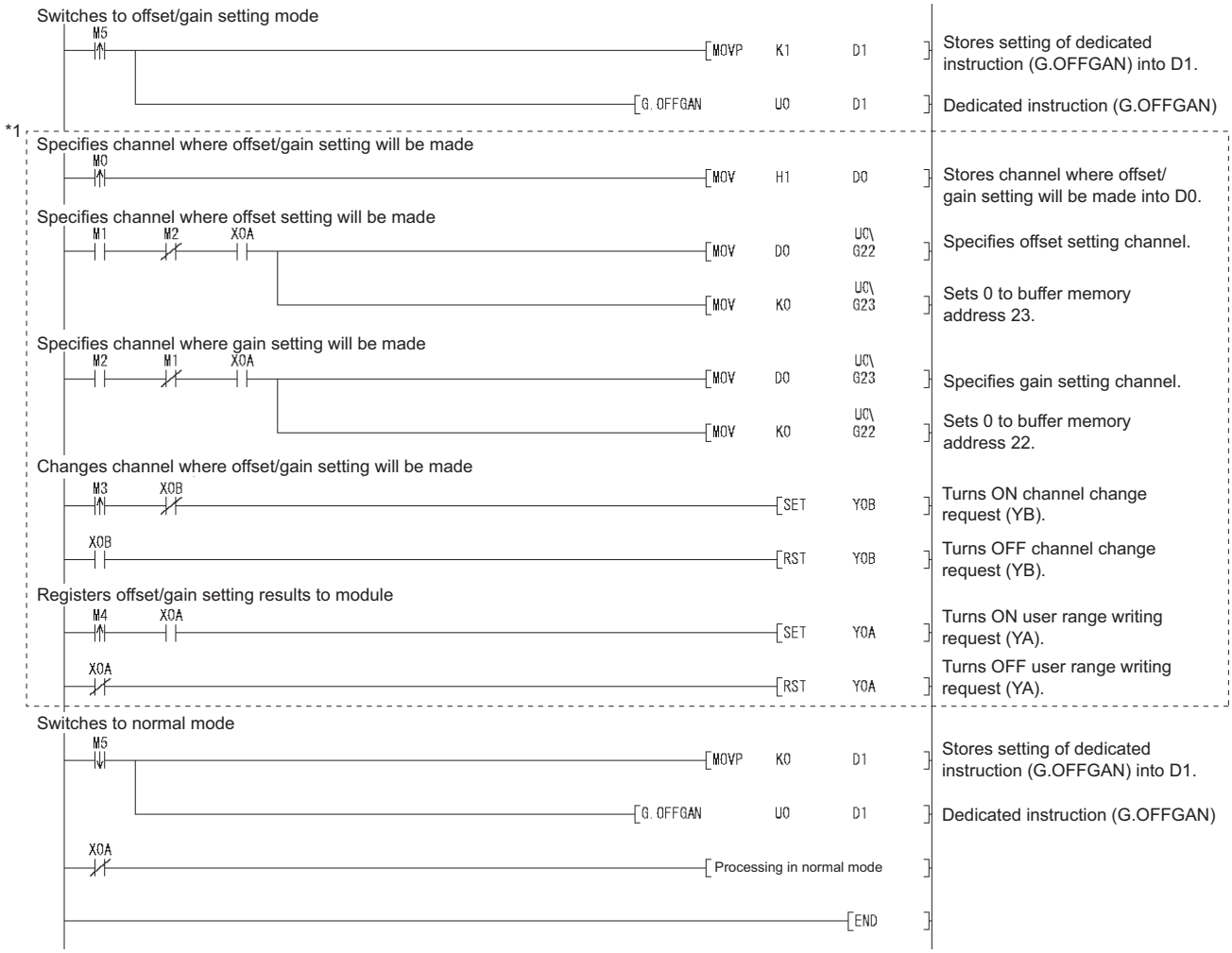
(8) Un\G200, Un\G202 to Un\G233 are the areas used to restore the User-set offset/gain values when online module change is made.
Refer to Chapter 7 for details of online module change.

(2) Program examples

The program in the dotted area of (a) is common to (a), (b) and (c).
Is this example, the I/O signals for the Q68AD-G are X/Y0 to X/YF

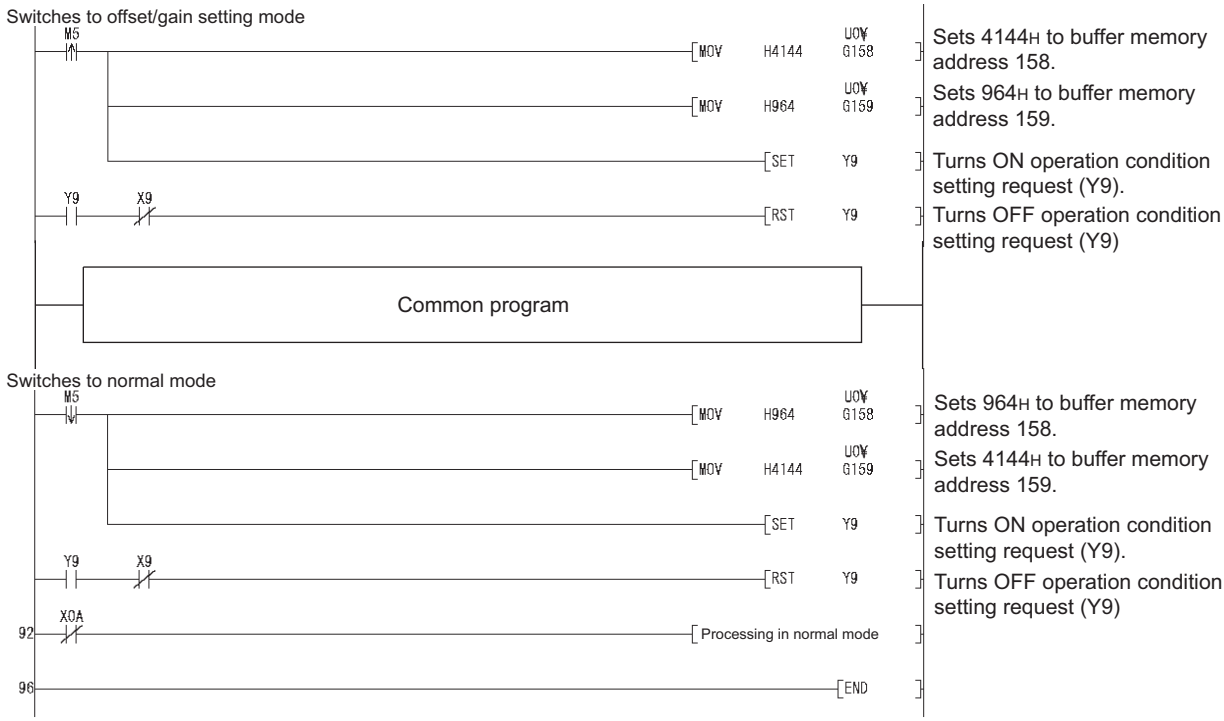
- Channel selection.. . . . . M0
- Offset setting M1
- Gain setting M2
- Channel change command M3
- Offset/gain setting value write command to the module M4
- Mode switching M5
- Channel designation storage device D0
- Dedicated instruction (G(P).OFFGAN) setting storage device . . D1

(a) When switching the mode using the dedicated instruction (G(P).OFFGAN)
The following program switches to the offset/gain setting mode with the dedicated instruction (G(P).OFFGAN), changes the channel where offset/gain setting will be made, writes the offset/gain values to the Q68AD-G, and then switches to the normal mode.



*1: The program in the dotted area is a common program.

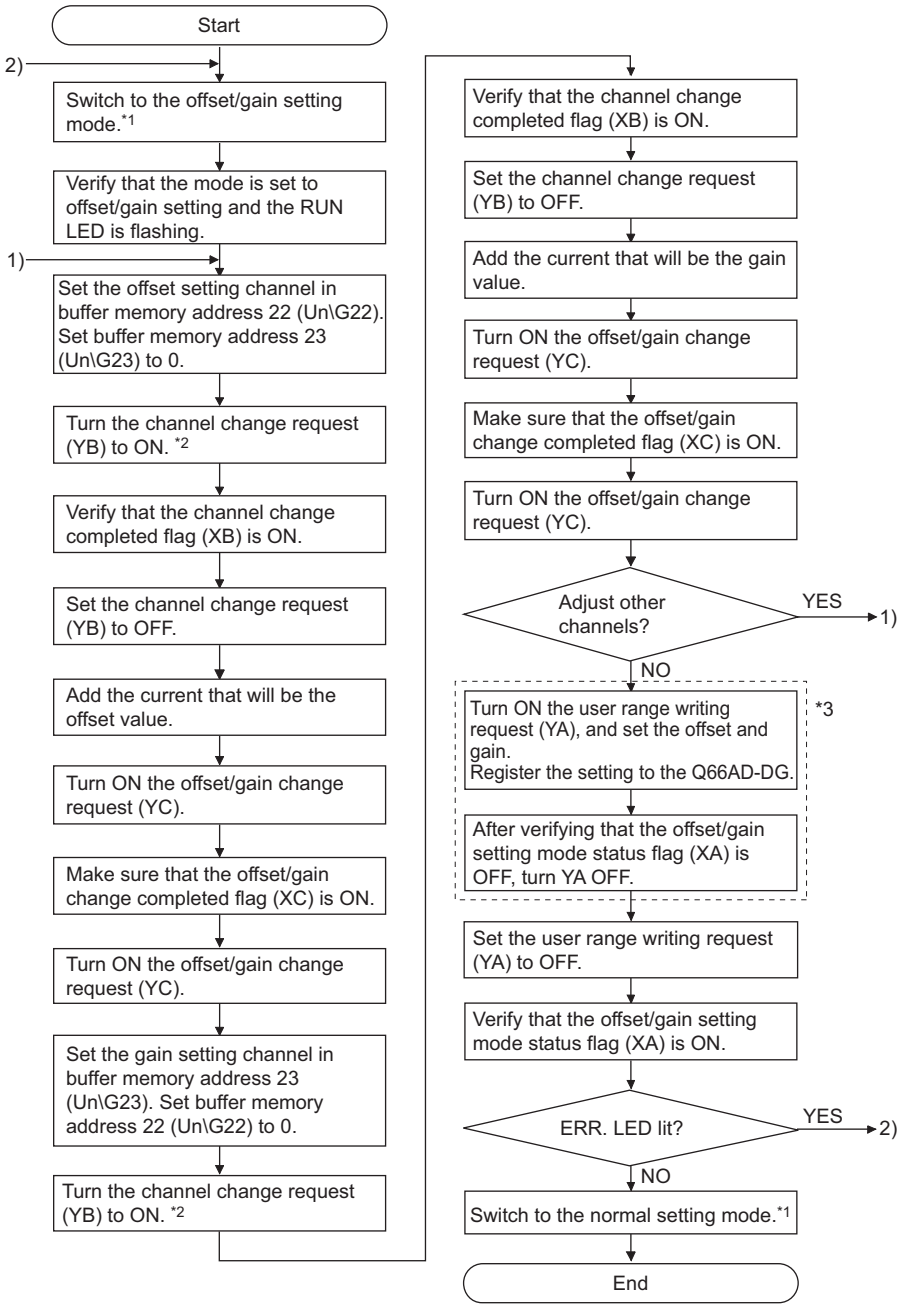
(b) When switching the mode using the setting of the mode switching setting (Un\G158, Un\G159) and operation condition setting request (Y9)



(c) When switching the mode by making intelligent function module switch setting
Only the common program is necessary.

4.6.2 Offset/gain settings (Q66AD-DG)

(1) Offset/gain setting procedure



*1 The mode switching (normal mode to offset/gain setting mode to normal mode) method is given below.
- Dedicated instruction (G(P).OFFGAN) ..... Refer to Section 4.6.2 (2) (a)
- Setting made to mode switching setting (Un\G158, Un\G159) and turning the operation condition setting request (Y9) from OFF to ON ..... Refer to Section 4.6.2 (2) (b)
- Intelligent function module switch setting .... Refer to Section 4.5, Section 4.6.2 (2) (c)

(After intelligent function module switch setting, reset the programmable controller CPU or switch power OFF, then ON.)

*2 Turning ON the channel change request (YB) starts to supply power from the corresponding channel to the 2-wire transmitter. After fully checking the wiring, settings, etc., turn ON the channel change request (YB).

*3 Do not perform the following during the operation (*3 in the above flow chart). Doing so may cause malfunction of the Q66AD-DG because of a data error in the flash memory.
- Power-off of the system
- Reset of the programmable controller CPU

Point

(1) Perform the offset/gain settings in the range that satisfies the conditions specified in POINT of Section 3.1.2 (2).
When the setting exceeds this range, the maximum resolution or total accuracy may not be within the range indicated in the performance specification.

(2) Though the offset/gain settings can be performed on multiple channels at the same time, set the offset and gain separately (0 at either of the buffer memory addresses 22, 23).
If channels are set at Un\G22 and Un\G23 at the same time, an error will occur and the ERR. LED will be lit.

(3) After the offset/gain settings are completed, verify that the offset and gain values have been set correctly under actual usage conditions.

(4) The offset and gain values are stored into the Flash memory and are not erased at power-off.

(5) At the time of offset/gain setting, turn ON the user range write request (YA) to write the values to the Flash memory.
Data can be written to the Flash memory up to 100 thousand times.
To prevent accidental write to the Flash memory, an error will occur and the error code (Un\G19) will be stored if write is performed 26 consecutive times.

(6) If an error (error code: 40□ *1) occurs during offset/gain setting, re-set the correct offset/gain value.
The offset/gain value of the channel where the error has occurred is not written to the A/D converter module. (*1: □ indicates the corresponding channel number.)

(7) When the offset/gain setting mode is switched to the normal mode, the module ready (X0) turns from OFF to ON.
Note that the initial setting processing will be executed at this time if there is a sequence program that performs initial settings when the module ready (X0) turns ON.

(8) When one mode is switched to the other (the normal mode is switched to the offset/gain setting mode or the offset/gain setting mode is switched to the normal mode), A/D conversion is suspended and the power supply to the 2-wire transmitter is turned OFF.
To resume A/D conversion and supply power to the 2-wire transmitter, turn ON the operating condition setting request (Y9) after the mode is switched to the normal mode.

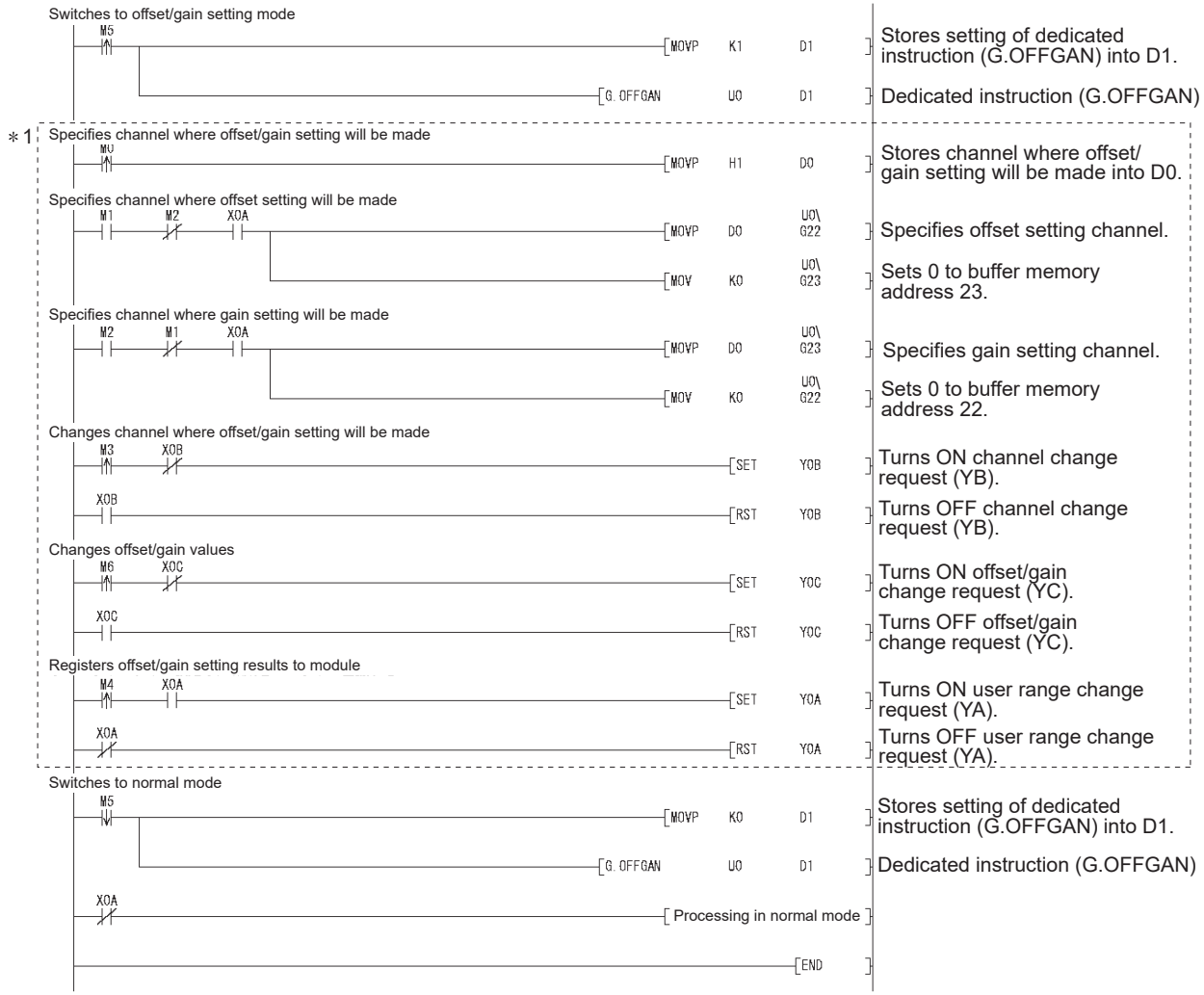
(9) Un\G202 to Un\G225 are the areas used to restore the User-set offset/gain values when online module change is made.
Refer to Chapter 7 for details of online module change.

(2) Program examples

The program in the dotted area of (a) is common to (a), (b) and (c).
In this example, the I/O signals for the Q66AD-DG are X/Y0 to X/YF.

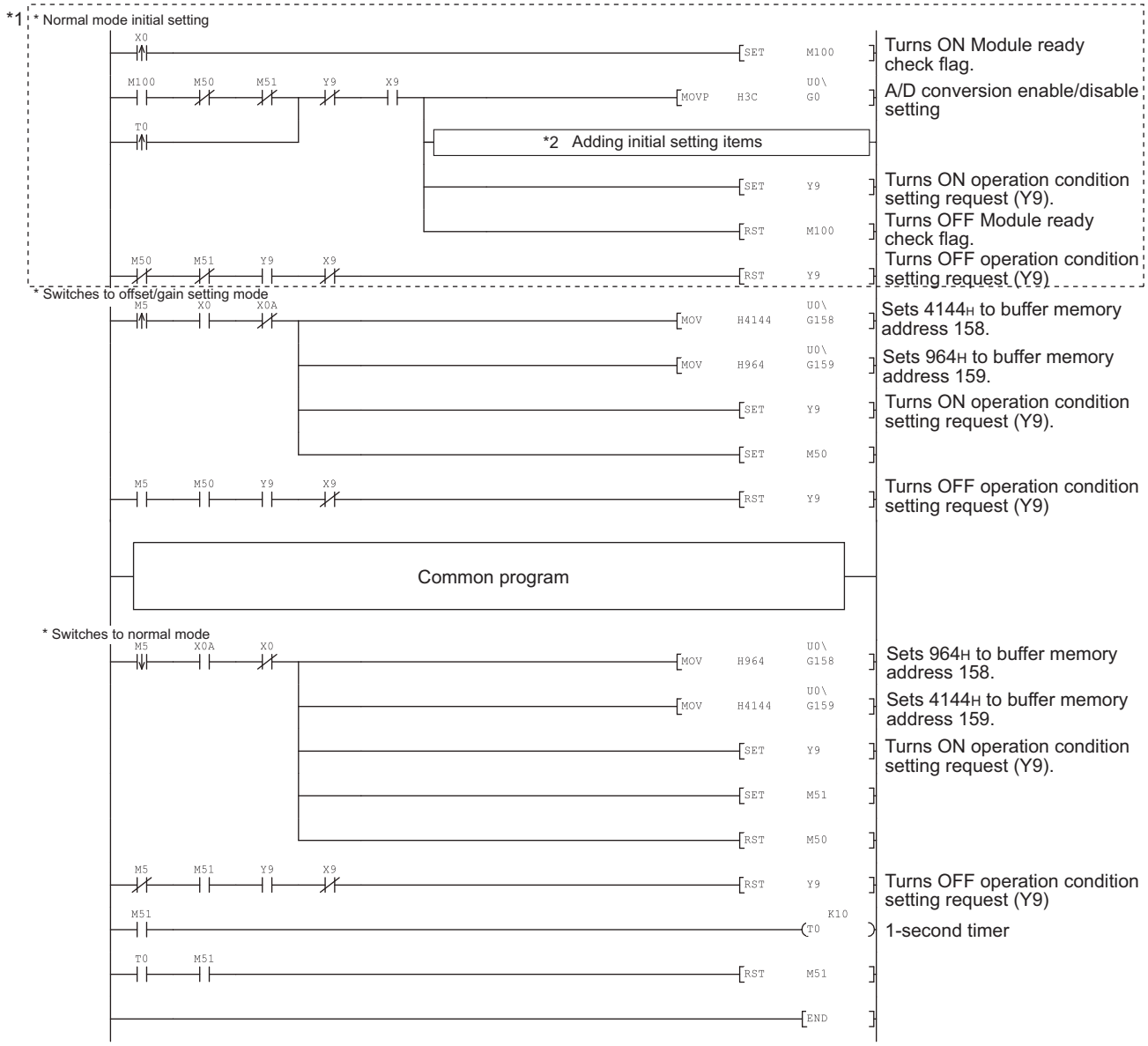
- Channel selection. M0
- Offset setting M1
- Gain setting M2
- Channel change command M3
- Offset/gain setting value write command to the module. M4
- Mode switching M5
- Offset/gain change command M6
- Normal mode checking signal M50
- Module ready check flag M100
- Channel designation storage device D0
- Dedicated instruction (G(P).OFFGAN) setting storage device. . . D1

(a) When switching the mode using the dedicated instruction (G(P).OFFGAN)
The following program switches to the offset/gain setting mode with the dedicated instruction (G(P).OFFGAN), changes the channel where offset/gain setting will be made, writes the offset/gain values to the Q66AD-DG, and then switches to the normal mode.



*1 The program in the dotted area is a common program.

(b) When switching the mode using the setting of the mode switching setting (Un\G158, Un\G159) and operation condition setting request (Y9)

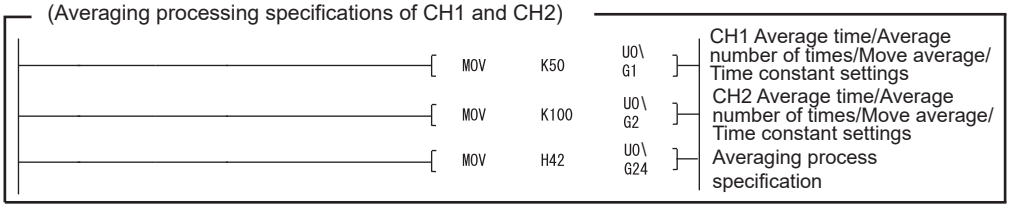


Point

When running this program together with the normal-mode A/D conversion program (shown in Section 6.4.3), use *1 of this program as the initial setting program.

To use each function of the Q66AD-DG for A/D conversion in the normal mode, add appropriate initial setting items to the part marked *2 depending on the function to be used. (Refer to an example below.)

*2 Example of adding initial setting items
(Averaging processing specifications of CH1 and CH2)



Note) When adding this program to the normal-mode A/D conversion program (shown in Section 6.4.3), replace the existing initial setting program with the program marked *1. Before using this program, check the device numbers.

(c) When switching the mode by making intelligent function module switch setting
Only the common program is necessary.

4.6.3 A/D conversion value storage during offset/gain setting

If during the offset/gain setting, the A/D conversion values are stored into Un\G11 to Un\G18 as in the normal mode.

(1) Q68AD-G

The A/D conversion values of all channels are stored into the buffer memory.

(2) Q66AD-DG

The A/D conversion values of the channels specified in the offset/gain setting mode (Un\G22, Un\G23) are stored into the buffer memory.

5 UTILITY PACKAGE (GX Configurator-AD)

5.1 Utility Package Functions

Table 5.1 shows an overview of the utility package functions.

Table5.1 Utility package (GX Configurator-AD) function list

Item	Description	Reference section
Initial setting*1	(1) Sets the following items that require initial setting. ・A/D conversion enable/disable setting ・Averaging process specification ・Average time/Average number of times/Move average/ Time constant settings ・Conversion starting time setting (For 2-wire transmitter) (Q66AD-DG) ・Warning output settings (Process alarm setting) ・Process alarm upper upper limit value/upper lower limit value/ lower upper limit value/lower lower limit value ・Warning output settings (Rate alarm setting) ・Rate alarm upper limit value/lower limit value ・Rate alarm warning detection period ・Input signal error detection extended/Input signal error detection setting ・Input signal error detection setting value/Input signal error detection lower limit setting value ・Input signal error detection upper limit setting value ・Scaling enable/disable setting ・Scaling upper limit value/lower limit value (2) The data for which initial setting has been completed is registered in the parameters for the programmable controller CPU, and automatically written to the A/D converter module when the programmable controller CPU changes to the RUN status.	Section 5.4
Auto refresh setting*1	(1) Sets auto refresh for the A/D converter module buffer memory. (2) The buffer memory that was set for auto refresh is automatically read and written to the specified device when the END command for the programmable controller CPU is executed.	Section 5.5
Monitor/Test	(1) Monitor/Test The buffer memory and I/O signals for the A/D converter modules are monitored and tested. (2) Operating condition setting Changes the initial setting during operation. (3) Offset/gain setting When setting the offset/gain to a value selected by the user (when the analog output range setting is user range setting), the offset and gain can be easily set while viewing the window. (4) Pass data The pass data (industrial shipment settings offset/gain values, user range settings offset/gain values) can be monitored and set.	Section 5.6
FB conversion	Generates FB automatically from the intelligent function module parameter (initial setting/auto refresh setting).	Section 5.7

5.2 Installing and Uninstalling the Utility Package

For how to install or uninstall the utility package, refer to "Method of installing the MELSOFT Series" included in the utility package.

5.2.1 Handling precautions

The following explains the precautions on using the GX Configurator-AD.

(1) For safety

Since GX Configurator-AD is add-in software for GX Developer, read "Safety Precautions" and the basic operating procedures in the GX Developer Operating Manual.

(2) About installation

GX Configurator-AD is add-in software for GX Developer Version 4 or later.
Therefore, GX Configurator-AD must be installed on the personal computer that has already GX Developer Version 4 or later installed.

(3) Window error of Intelligent function module utility

Insufficient system resource may cause the window to be displayed inappropriately while using the Intelligent function module utility.
If this occurs, close the Intelligent function module utility, GX Developer (program, comments, etc.), and other applications, and then start GX Developer and Intelligent function module utility again.

(4) To start the Intelligent function module utility

(a) In GX Developer, select "QCPU (Q mode)" for PLC series and specify a project.
If any PLC series other than "QCPU (Q mode)" is selected, or if no project is specified, the Intelligent function module utility will not start.

(b) Multiple Intelligent function module utilities can be started.
However, [Open parameters] and [Save parameters] operations under [Intelligent function module parameter] are allowed for one Intelligent function module utility only. Only the [Monitor/test] operation is allowed for the other utilities.

(5) Switching between two or more Intelligent function module utilities

When two or more Intelligent function module utility windows cannot be displayed side by side, select a window to be displayed on the top of others using the task bar.

(6) Number of parameters that can be set in GX Configurator-AD

When multiple intelligent function modules are mounted, the number of parameter settings must not exceed the following limit.

When intelligent function modules are installed to:	Maximum number of parameter settings	
	Initial setting	Auto refresh setting
Q00J/Q00/Q01CPU	512	256
Q02/Q02H/Q06H/Q12H/Q25HCPU	512	256
Q02PH/Q06PH/Q12PH/Q25PHCPU	512	256
Q12PRH/Q25PRHCPU	512	256
Q00UJ/Q00U/Q01UCPU	512	256
Q02UCPU	2048	1024
Q03UD/Q04UDH/Q06UDH/Q10UDH/Q13UDH/ Q20UDH/Q26UDH/Q03UDE/Q04UDEH/Q06UDEH/ Q10UDEH/Q13UDEH/Q20UDEH/Q26UDEHCPU	4096	2048
CPU modules other than the above	Not available	Not available
MELSECNET/H remote I/O station	512	256

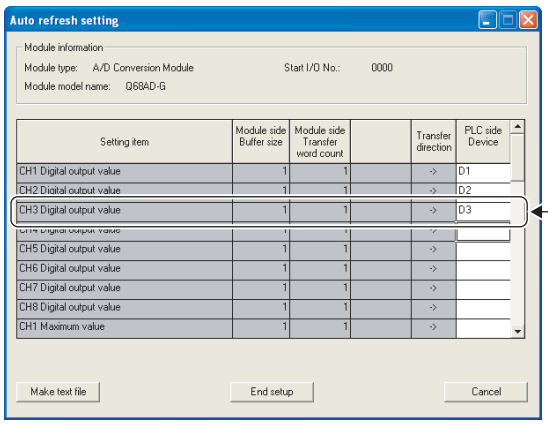
For example, if multiple intelligent function modules are installed to the MELSECNET/H remote I/O station, configure the settings in GX Configurator so that the number of parameter settings for all the intelligent function modules does not exceed the limit of the MELSECNET/H remote I/O station.

Calculate the total number of parameter settings separately for the initial setting and for the auto refresh setting.

The number of parameters that can be set for one module in GX Configurator-AD is as shown below.

Target module	Initial setting	Auto refresh setting
Q68AD-G	6 (Fixed)	36 (Max.)
Q66AD-DG	10 (Fixed)	28 (Max.)

Example) Counting the number of parameter settings in Auto refresh setting



This one row is counted as one setting.
Blank rows are not counted.
Count up all the setting items on this window, and add the total to the number of settings for other intelligent function modules to get a grand total.

5.2.2 Operating environment

This section explains the operating environment of the personal computer that runs GX Configurator-AD.

Item		Description
Installation (Add-in) target*1		Add-in to GX Developer Version 4 (English version) or later*2
Computer		A personal computer with any of the operating systems below
	CPU	Refer to the next page "Operating system and performance required for personal computer".
	Required memory	
Hard disk space*3	For installation	65 MB or more
	For operation	20 MB or more
Display		800×600 dots or more resolution*4
Operating system		Microsoft® Windows® 95 Operating System (English version) Microsoft® Windows® 98 Operating System (English version) Microsoft® Windows® Millennium Edition Operating System (English version) Microsoft® Windows NT® Workstation Operating System Version 4.0 (English version) Microsoft® Windows® 2000 Professional Operating System (English version) Microsoft® Windows® XP Professional Operating System (English version) SP1 or later Microsoft® Windows® XP Home Edition Operating System (English version) SP1 or later Microsoft® Windows Vista® Home Basic Operating System (English version) Microsoft® Windows Vista® Home Premium Operating System (English version) Microsoft® Windows Vista® Business Operating System (English version) Microsoft® Windows Vista® Ultimate Operating System (English version) Microsoft® Windows Vista® Enterprise Operating System (English version) Microsoft® Windows® 7 Starter Operating System (English version)*4 Microsoft® Windows® 7 Home Premium Operating System (English version)*4 Microsoft® Windows® 7 Professional Operating System (English version)*4 Microsoft® Windows® 7 Ultimate Operating System (English version)*4 Microsoft® Windows® 7 Enterprise Operating System (English version)*4

*1: Install the GX Configurator-AD in GX Developer Version 4 or higher in the same language. GX Developer (English version) and GX Configurator-AD (Japanese version) cannot be used in combination, and GX Developer (Japanese version) and GX Configurator-AD (English version) cannot be used in combination.

*2: GX Configurator-AD cannot be used as an add-in with GX Developer Version 3 or earlier versions.
In addition, GX Developer Version 8 or later is necessary to use the FB conversion function.

*3: When Windows Vistaor® Windows®7 is used, resolution of 1024×768 dots or more is recommended.

*4: When 32-bit Windows®7 is used, add GX Configurator-AD Version 2.11M or later in GX Developer Version 8.91V or later.

When 64-bit Windows®7 is used, add GX Configurator-AD Version 2.11M or later in GX Developer Version 8.98C or later.

Operating system and performance required for personal computer

Operating system	Performance required for personal computer	
	CPU	Memory
Windows® 95	Pentium® 133MHz or more	32MB or more
Windows® 98	Pentium® 133MHz or more	32MB or more
Windows® Me	Pentium® 150MHz or more	32MB or more
Windows NT® Workstation 4.0	Pentium® 133MHz or more	32MB or more
Windows® 2000 Professional	Pentium® 133MHz or more	64MB or more
Windows® XP	Pentium® 300MHz or more	128MB or more
Windows Vista®	Pentium® 1GHz or more	1GB or more
Windows® 7	Pentium® 1GHz or more	1GB or more (32-bit) 2GB or more (64-bit)

Point

(1) The functions shown below are not available for Windows® XP, Windows Vista® , and Windows® 7.
If any of the following functions is attempted, this product may not operate normally.
- Start of application in Windows® compatible mode
- Fast user switching
- Remote desktop
- Large fonts (Details setting of Display Properties)
- DPI setting other than 100%

Also, GX Configurator-AD is not supported by 64-bit Windows® XP and 64-bit Windows Vista® .

(2) A user with USER authority or higher can access GX Configurator-AD for Windows Vista® and Windows® 7.

(3) When Windows® 7 is used, the following functions are not available.
- Windows XP Mode
- Windows Touch

5.3 Utility Package Operation

5.3.1 Common utility package operations

(1) Control keys

Special keys that can be used for operation of the utility package and their applications are shown in the table below.

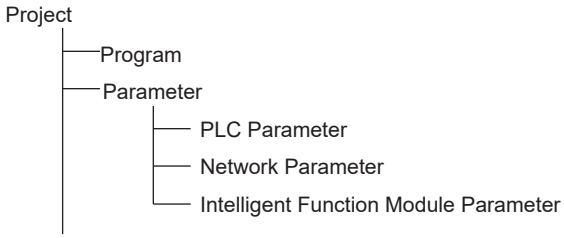
Key	Application
Esc	Cancels the current entry in a cell. Closes the window.
Tab	Moves between controls in the window.
Ctrl	Used in combination with the mouse operation to select multiple cells for test execution.
Delete	Deletes the character where the cursor is positioned. When a cell is selected, clears all of the setting contents in the cell.
Back Space	Deletes the character where the cursor is positioned.
↑ ↓ ← →	Moves the cursor.
Page Up	Moves the cursor one page up.
Page Down	Moves the cursor one page down.
Enter	Completes the entry in the cell.

(2) Data created with the utility package

The following data or files that are created with the utility package can be also handled in GX Developer. Figure 5.1 shows respective data or files are handled in which operation.

(a) Ntelligent function module parameter

This represents the data created in Auto refresh setting, and they are stored in an intelligent function module parameter file in a project created by GX Developer.



(b) Text files

A text file can be created by clicking the Make text file button on the initial setting, Auto refresh setting, or Monitor/Test window. The text files can be utilized to create user documents.

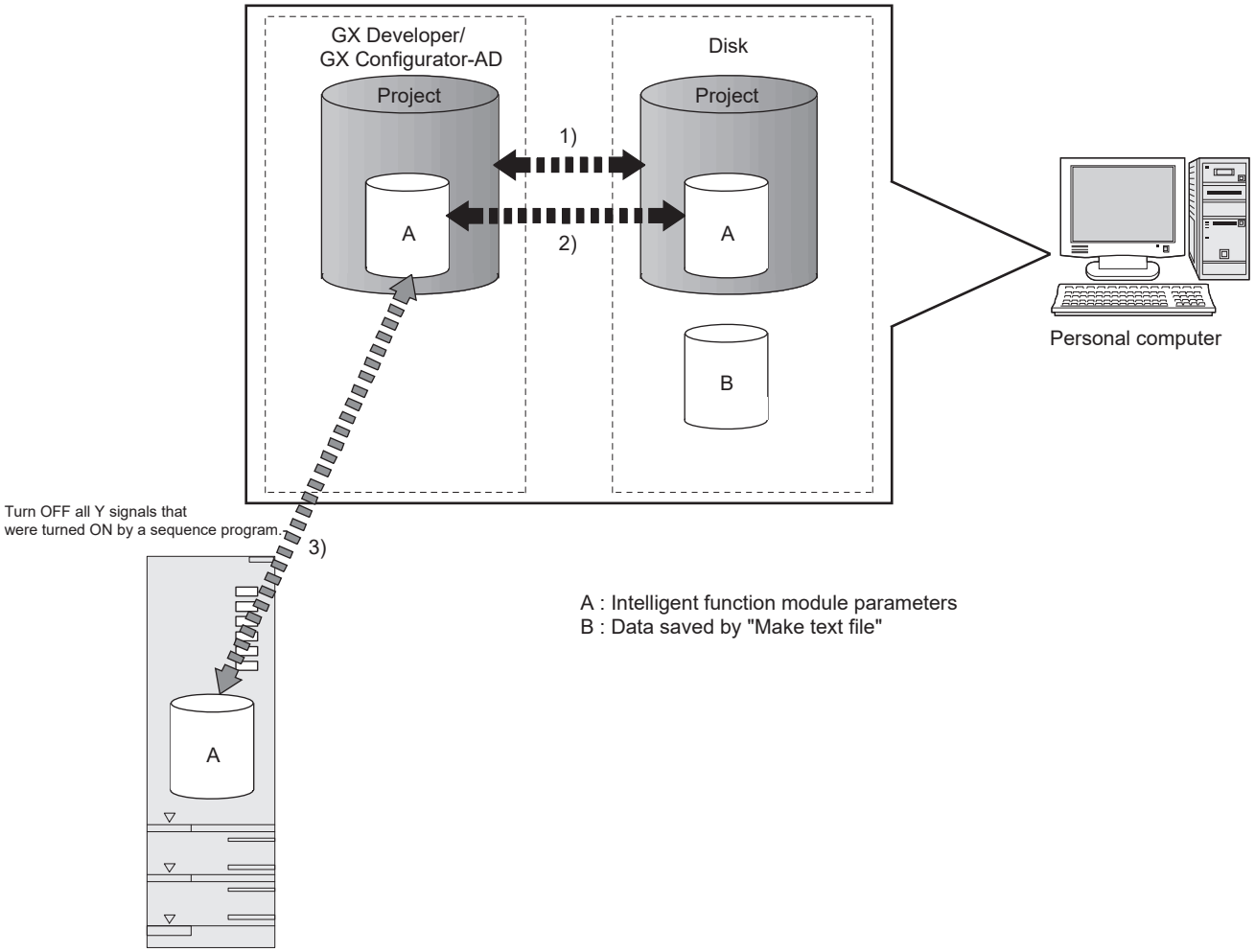


Fig5.1 Correlation chart for data created with the utility package

Steps 1) to 3) shown in Fig5.1 are performed as follows:

1) From GX Developer, select:

[Project] → [Open project] / [Save]/ [Save as]

2) On the intelligent function module selection window of the utility, select:

[Intelligent function module parameter] → [Open parameters] / [Save parameters]

3) From GX Developer, select:

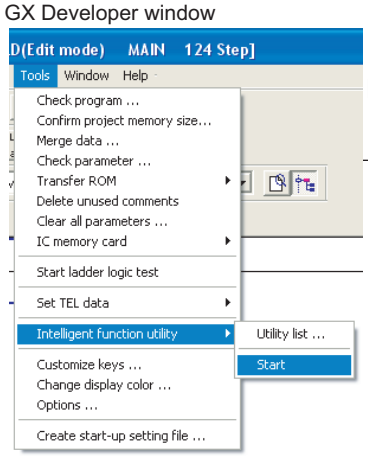
[Online] → [Read from PLC] / [Write to PLC] "Intelligent function module parameters"

Alternatively, from the intelligent function module selection window of the utility, select:

[Online] → [Read from PLC] / [Write to PLC]

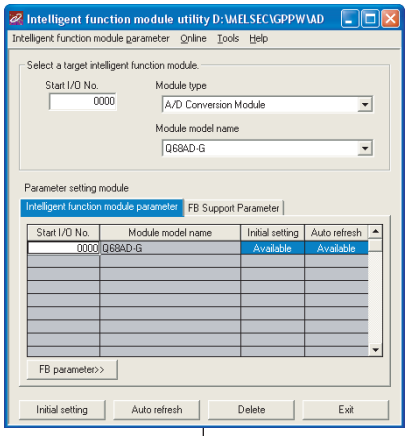
5.3.2 Operation overview

GX Developer window



[Tools] – [Intelligent function utility] – [Start]

Window for selecting a target intelligent function module

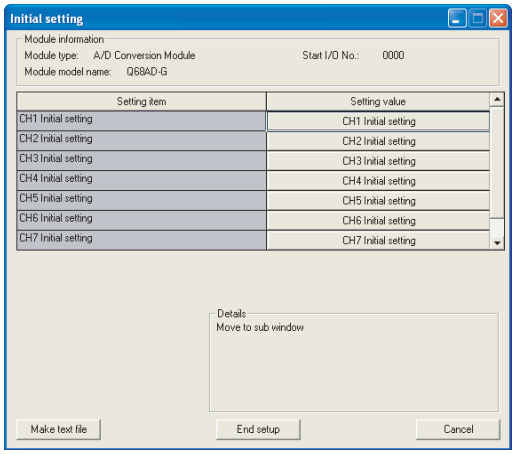


Refer to Section 5.5.3.

1)

Initial setting

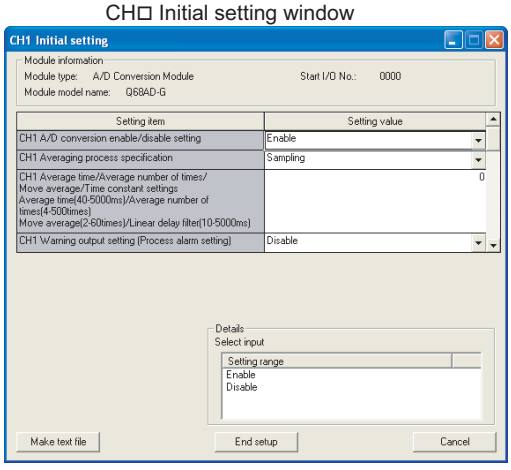
Initial setting window



Refer to Section 5.4.

CH□ Initial setting

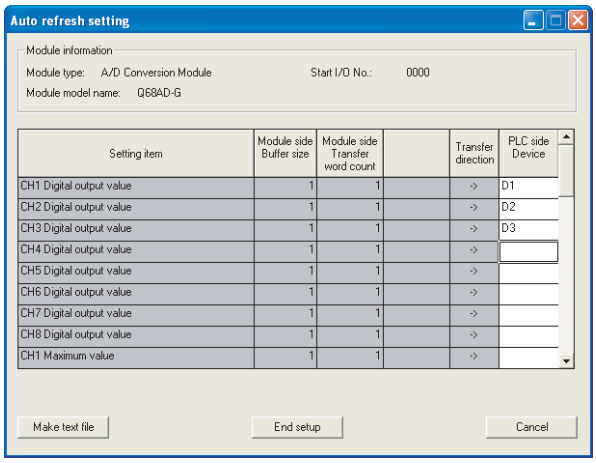
CH□ Initial setting window



Refer to Section 5.4.

Auto refresh

Auto refresh setting window

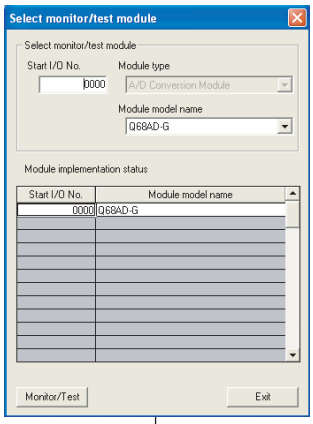


Refer to Section 5.5.

1)

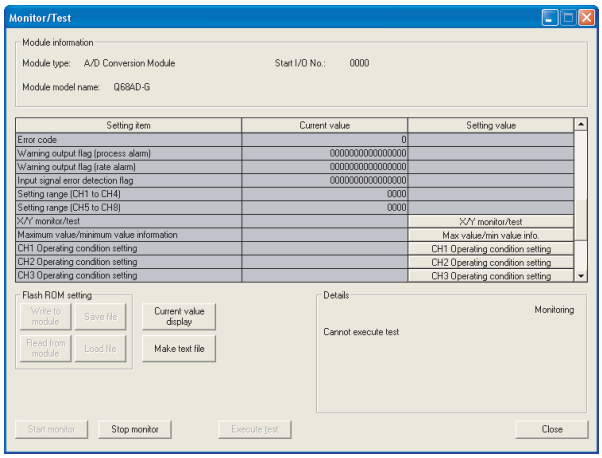
[Online] – [Monitor/Test]

Selecting monitor/test module window



Select a module to be monitored/tested.

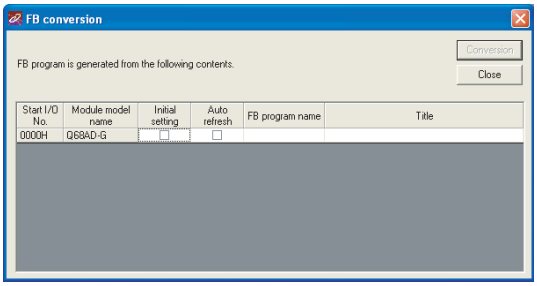
Monitor/Test window



Refer to Section 5.6.

<<FB support parameter>> tab – FB conversion window

FB conversion window



Refer to Section 5.7.

5.3.3 Starting the intelligent function module utility

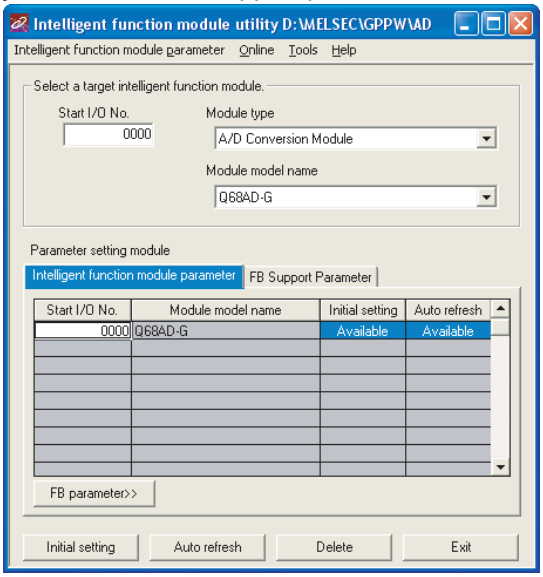
[Operating procedure]

Intelligent function module utility is started from GX Developer.

[Tools] → [Intelligent function utility] → [Start]

[Setting window]

Display when the <<FB support parameter>> tab is selected



[Explanation of items]

(1) Activation of other windows

Following windows can be displayed from the intelligent function module utility window.

Common operations to the <<Intelligent function module parameter>> tab and <<FB support parameter>> tab

(a) Initial setting window

"Start I/O No.*1" → "Module type" → "Module model name" → Initial setting

(b) Auto refresh setting window

"Start I/O No.*1" → "Module type" → "Module model name" → Auto refresh

(c) Select monitor/test module window

[Online] → [Monitor/Test]

*1 Enter the start I/O No. in hexadecimal.

On the <<FB support parameter>> tab

(a) Start-up of the FB conversion window

<<FB support parameter>> tab → FB conversion

For details, refer to Section 5.7.

Point

The <<FB support parameter>> tab is displayed when the project which is being edited is a label project.

(2) Command buttons

Common operations to the <<Intelligent function module parameter>> tab and <<FB support parameter>> tab

Delete	Deletes the initial setting and auto refresh setting of the selected module. However, if "initial setting" and "auto refresh setting" have been prepared and the cell of initial setting or auto refresh setting is selected and executed, only the setting of the selected cell is deleted.
Exit	Close this window.

When the <<FB support parameter>> tab is selected

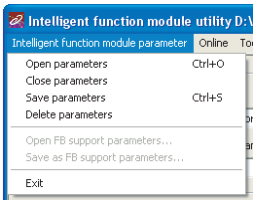
<<Parameter	Moves the setting of the selected line to the <<Intelligent function module parameter>> tab.

When the <<Intelligent Function Module Parameter>> tab is selected

FB Parameter>>	Moves the setting of the selected line to the <<FB support parameter>> tab.

(3) Menu bar

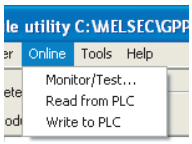
(a) File menu



Intelligent function module parameters of the project opened by GX Developer are handled.

[Open parameters]	: Reads a parameter file.
[Close parameters]	: Closes the parameter file. If any data are modified, a dialog asking for file saving will appear.
[Save parameters]	: Saves the parameter file.
[Delete parameters]	: Deletes the parameter file.
[Open FB support parameters]	: Opens the FB support parameter file.
[Save as FB support parameters]	: Saves the FB support parameter file.
[Exit]	: Close this window.

(b) Online menu



[Monitor/Test]	: Activates the Select monitor/test module window.
[Read from PLC]	: Reads intelligent function module parameters from the CPU module.
[Write to PLC]	: Writes intelligent function module parameters to the CPU module.

Point

(1) Saving intelligent function module parameters in a file
Since intelligent function module parameters cannot be saved in a file by the project saving operation of GX Developer, save them on the shown module selection window.

(2) Reading/writing intelligent function module parameters from/to a programmable controller CPU using GX Developer
(a) Intelligent function module parameters can be read from and written into a programmable controller after having been saved in a file.
(b) Set a target programmable controller CPU in GX Developer:
[Online] → [Transfer setup].

(3) Checking the required utility
While the start I/O is displayed on the Intelligent function module utility setting window, " * " may be displayed for the model name.
This means that the required utility has not been installed or the utility cannot be started from GX Developer.
Check the required utility, selecting [Tools] - [Intelligent function utility] - [Utility list...] in GX Developer.

5.4 Initial Setting

[Purpose]

The following A/D initial setting parameters are set:

- A/D conversion enable/disable setting
- Averaging process specification
- Average time/Average number of times/Move average/Time constant settings
- A/D conversion starting time setting (Q66AD-DG)
- Warning output settings (Process alarm setting)
- Process alarm upper upper limit value/upper lower limit value/lower upper limit value/lower lower limit value
- Warning output settings (Rate alarm setting)
- Rate alarm upper limit value/lower limit value
- Rate alarm warning detection period
- Input signal error detection extended/input signal error detection setting
- Input signal error detection setting value/Input signal error detection lower limit setting value
- Input signal error detection upper limit setting value
- Scaling enable/disable setting
- Scaling upper limit value/lower limit value

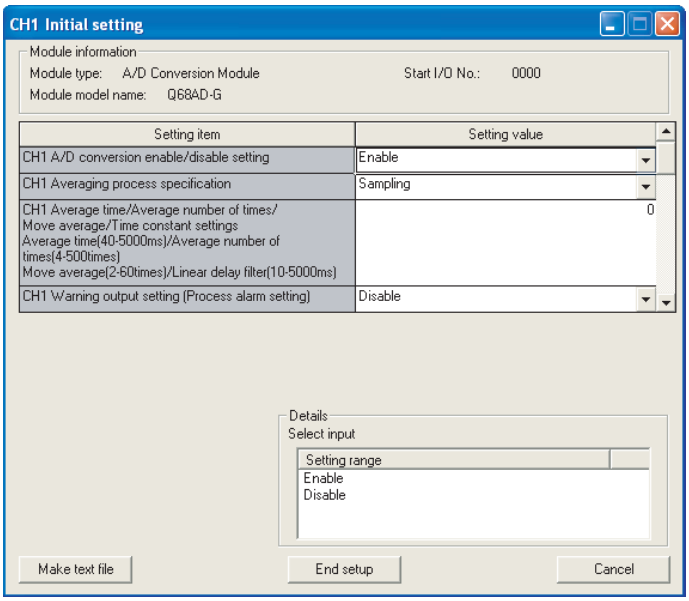
Setting parameters in the Initial setting window can omit parameter settings in sequence programs.

[Operating procedure]

"Start I/O No. ∗ [1]" → "Module type" → "Module model name" → Initial setting → CH□ Initial setting

*1 Enter the start I/O No. in hexadecimal.

[Setting window]



[Explanation of items]

(1) Setting contents

Set A/D conversion enable/disable, averaging process specification and others for each channel.

(2) Command buttons

Make text file	Creates a file containing the window data in text file format.
End setup	Saves the set data and ends the operation.
Cancel	Cancels the setting and ends the operation.

Point

(1) Change the RUN/STOP switch of the CPU module: STOP → RUN → STOP → RUN.

(2) After setting the RUN/STOP switch to RUN, power the programmable controller OFF → ON or reset the CPU module.

When using a sequence program to write initial setting data, the data will be written when the CPU module is switched from STOP to RUN. Create a program so that initial setting is re-executed in the sequence program.

5.5 Auto Refresh Setting

[Purpose]

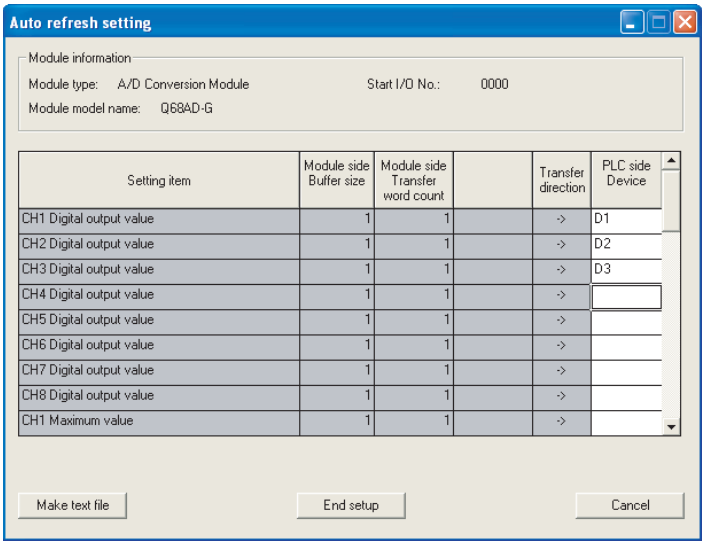
Configure the A/D converter module's buffer memory for auto refresh.

[Operating procedure]

"Start I/O No. ∗ " →"Module type" → "Module model name" → Auto refresh

* Enter the start I/O No. in hexadecimal.

[Setting window]



[Explanation of items]

(1) Items

Module side Buffer size	:	Displays the size of the buffer memory for the setting item that can be transferred (fixed at one word).
Module side Transfer word count	:	Displays the number of words to transfer the CPU device from the head device (fixed at one word).
Transfer direction	:	"←" indicates that data is written from the device to the buffer memory. "→" indicates that data is read from the buffer memory to the device.
PLC side Device	:	Enter a CPU module side device that is to be automatically refreshed. Applicable devices are X, Y, M, L, B, T, C, ST, D, W, R, and ZR. When using bit devices X, Y, M, L or B, set a number that can be divided by 16 points (examples: X10, Y120, M16, etc.) Also, buffer memory data are stored in a 16-point area, starting from the specified device number. For example, if X10 is entered, data are stored in X10 to X1F.

(2) Command buttons

Make text file	Creates a file containing the window data in text file format.
End setup	Saves the set data and ends the operation.
Cancel	Cancels the setting and ends the operation.

Point

Auto refresh setting data are stored in intelligent function module parameters. After being written to the CPU module, the auto refresh setting data are made effective by operating either (1) or (2).

(1) Change the RUN/STOP switch of the CPU module: STOP → RUN → STOP → RUN.

(2) After setting the RUN/STOP switch to RUN, power the programmable controller OFF → ON or reset the CPU module.

The auto refresh settings cannot be changed from sequence programs. However, processing equivalent to auto refresh can be added using the FROM/TO instruction in the sequence program.

5.6 Monitoring/Test

5.6.1 Monitor/test window

[Purpose]

Buffer memory monitoring/testing, I/O signal monitoring/testing, operating condition setting, offset/gain settings (Refer to Section 5.6.2) and pass data (Refer to Section 5.6.3, 5.6.4) are started from this window.

[Operating procedure]

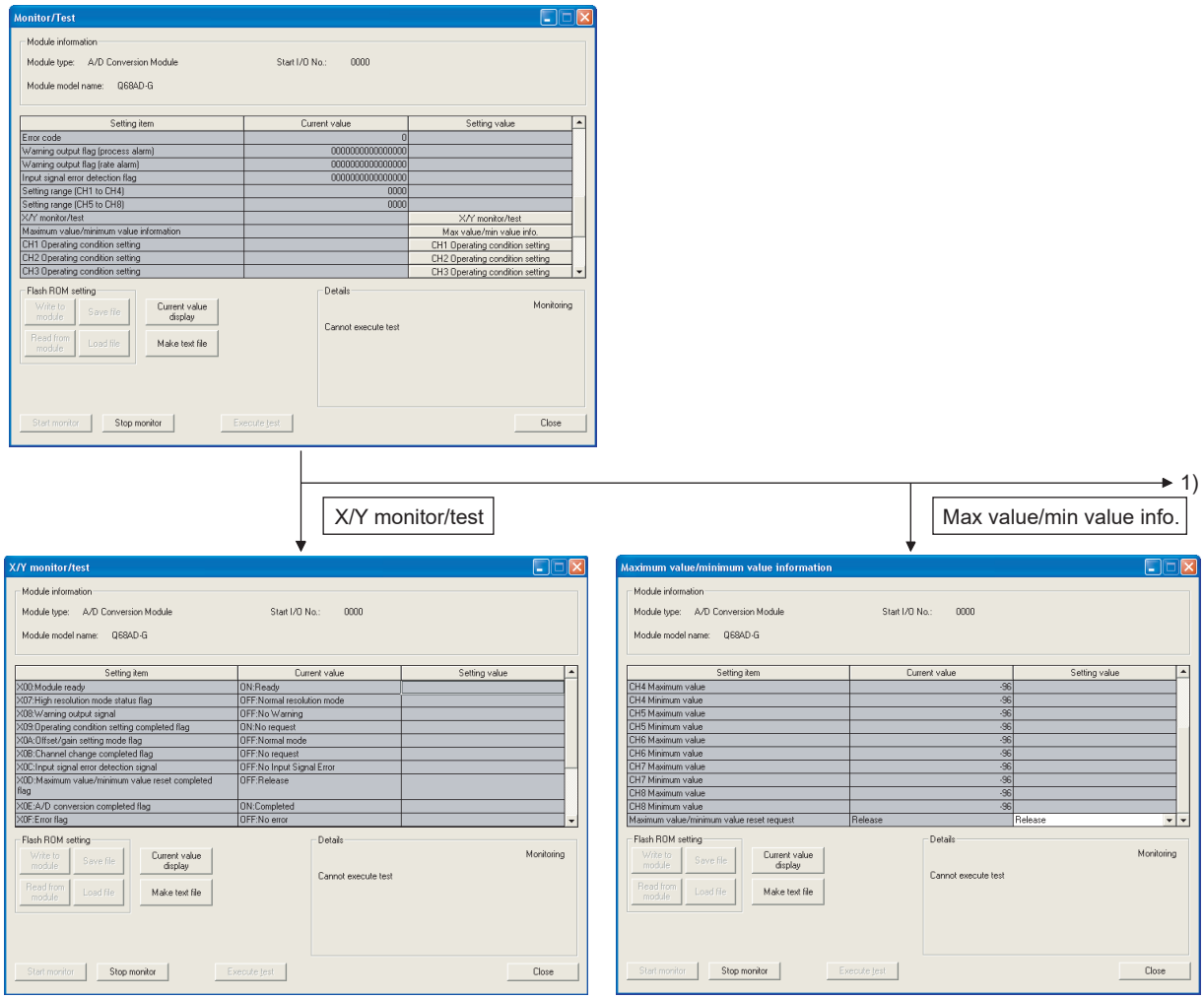
"Select monitor/test module" window → "Start I/O No. ∗ [1]" → "Module type" → "Module model name" → Monitor/test

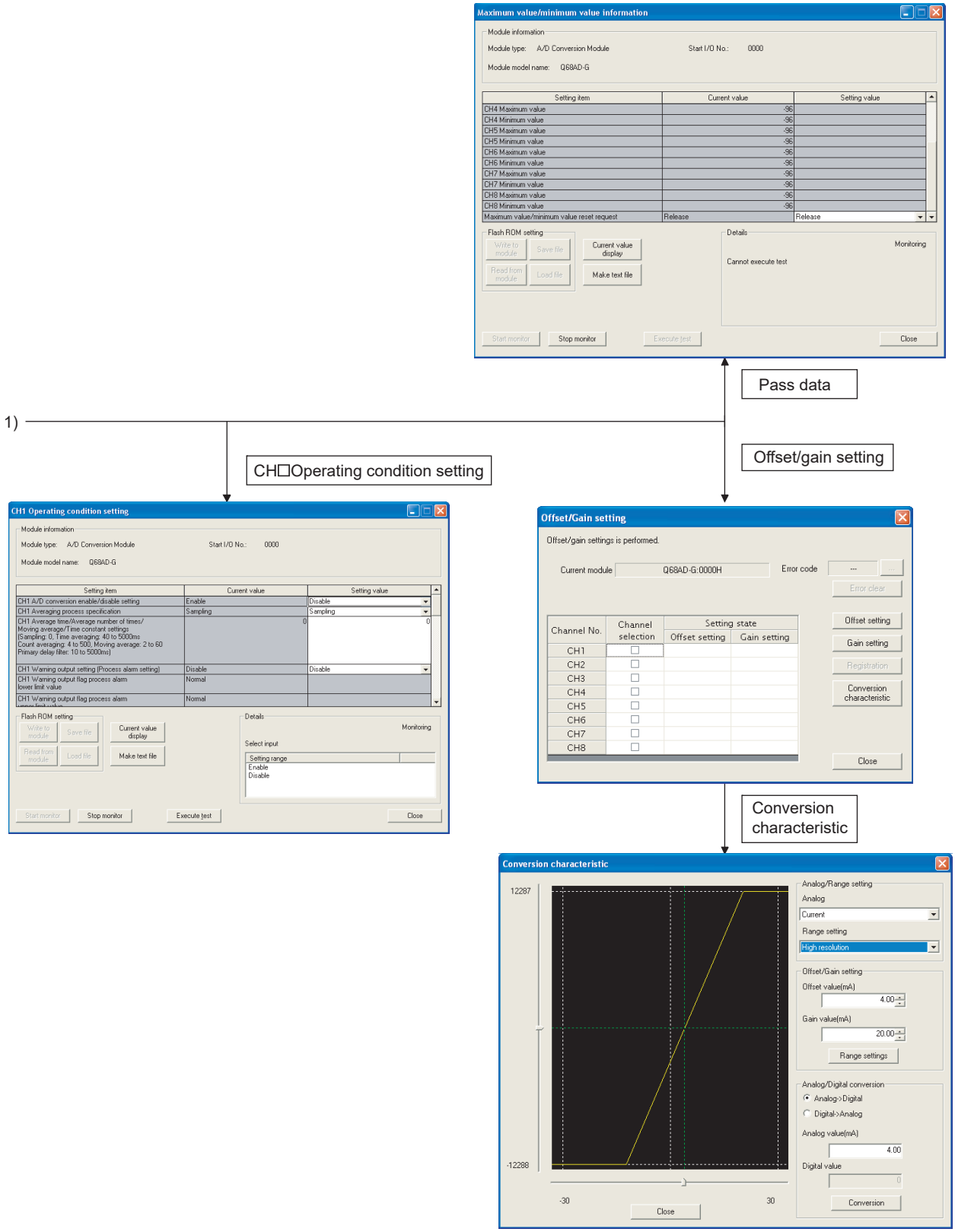
∗ 1 Enter the start I/O No. in hexadecimal.

The window can also be started from System monitor of GX Developer Version 6 or later.

Refer to the GX Developer Operating Manual for details.

[Setting window]




Maximum value/minimum value information
Pass data
1)
CH□Operating condition setting
Offset/gain setting
CH1 Operating condition setting
Offset/Gain setting
Conversion characteristic
Conversion characteristic

[Explanation of items]

(1) Items

Setting item	:	Displays I/O signals and buffer memory names.
Current value	:	Monitors the I/O signal states and present buffer memory values.
Setting value	:	Select or enter the data to be written during test operation.

(2) Command buttons

Current value display	Displays the current value of the item selected. (This is used to check the text that cannot be displayed in the current value field. However, in this utility package, all items can be displayed in the display fields).
Make text file	Creates a file containing the window data in text file format.
Start monitor / Stop monitor	Selects whether or not to monitor current values.
Execute test	Performs a test on the selected items. To select more than one item, select them while holding down the Ctrl key.
Close	Closes the window that is currently open and returns to the previous window.

(3) Example of using "Execute test"

The following is an example to change sampling processing of CH1 to count averaging processing in 10 times.

(a) Click the Operating setting button in the "Monitor/Test" window.

(b) Set CH1 Averaging process specification to "Count".

(c) Click the setting field of CH1 Average time/Average number of times/Move average/Time constant settings.

(d) Input "10" as the number of averaging, then click the Enter key.
At this point, CH1 is still set to sampling processing.

(e) Select the setting areas (b) to (d), holding the Ctrl key.
Multiple items can be selected by dragging the mouse over them also.

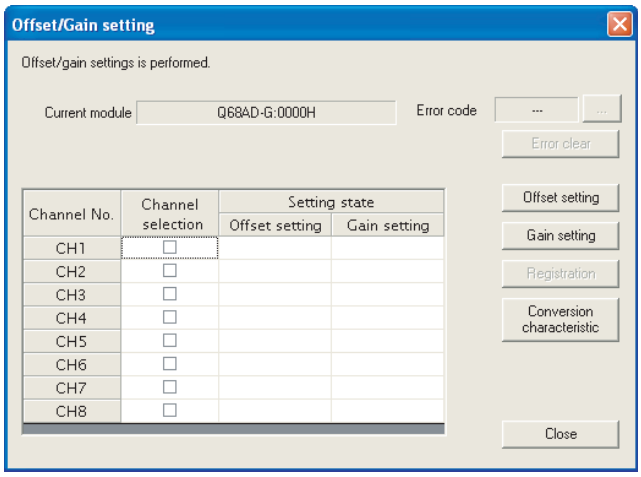
(f) Click the Execute test button to write the data.
After the writing is completed, the written values are displayed in the "Current value" field.

5.6.2 Offset/gain setting operation

Perform the offset/gain setting operation in the following sequence.

(1) Switch to the offset/gain setting window

Perform the operation in Section 5.6.1 to display the offset/gain setting window.
At this point, a dialog box to confirm the transition of module's operation mode (normal mode -> offset/gain setting mode) is displayed. Click the Yes button to transit to the offset/gain setting mode.



(2) Specify channels

Place check marks in "Channel selection" column to specify the channels for each of which the offset or gain setting is to be made.

(3) Apply current/voltage

Apply current or voltage to the module. Note that "Current" only is allowed for the Q66AD-DG.

(4) Execute offset/gain setting

For each of the channels specified in (2), click the Offset setting or Gain setting button to execute respective setting.

(5) Write settings into module

Write the content set up by operations (2) to (4) into module by clicking the Registration button.

(a) Precaution

While the set data of the steps (2) to (4) are written to the module after clicking the Registration button, do not perform the operations below.
If they are performed, the data inside E2PROM will have a problem, and the A/D converter module may not operate normally.

- Powering off the programmable controller CPU
- Resetting the programmable controller CPU

(6) Switch to the normal mode

When the offset/gain setting window is closed by clicking the Close button after the setting operation has finished, module's operation mode transits to the normal mode.

Point

If an error code is displayed while performing the setting operation, the details and measure of the error can be confirmed by clicking the . . . button to the right of the error code display area. In addition, the error code can be cleared by clicking the Error clear button.

5.6.3 Confirmation of conversion characteristic

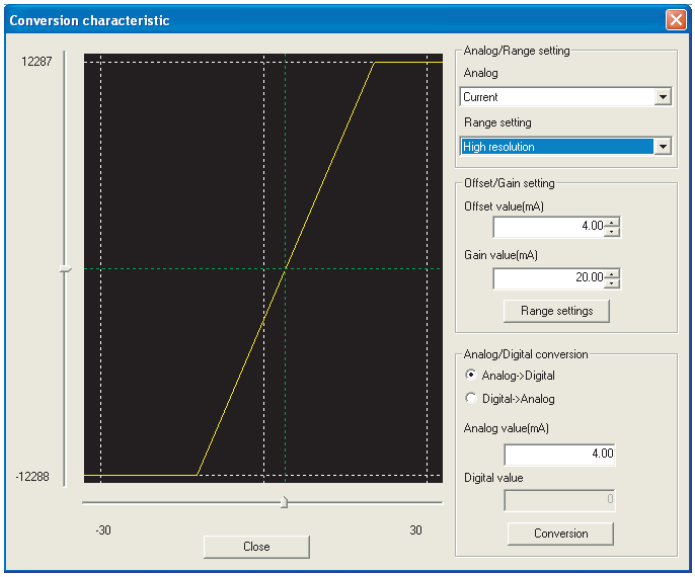
[Purpose]

The converted value of digital-analog conversion can be confirmed according to the tilt of the graph, based on the offset/gain setting.

[Operating procedure]

Monitor/test window → Offset/gain setting → Conversion characteristic

[Setting window]



[Explanation of items]

(1) Items displayed on the window

I/O characteristic diagram: Displays the I/O conversion characteristic to the prepared offset/gain setting.

(2) Setting details

Analog/Range setting

Analog : Select the type of the analog signal input (voltage or current). When the target module is the Q66AD-DG, "Current" only can be selected.

Range setting : Make selection from "Normal resolution" or "High resolution"

Offset/Gain setting

Offset value : Enter an offset value to display the I/O characteristic diagram.

Gain value : Enter a gain value to display the I/O characteristic diagram.

Analog/Digital conversion : Select a conversion type shown below for confirming the correspondence between an analog value and a digital value caused by the conversion characteristic.

- Digital → Analog
- Analog → Digital

Analog value : <When converted to a digital value>
Enter an analog value to be converted to a digital value
<When converted to an analog value>
The analog value converted from a digital value is displayed.

Digital value : <When converted to a digital value>
The digital value corresponding to an entered analog value is displayed.
<When converted to an analog value>
Enter a digital value to be converted to an analog value.

Point

(1) The following explains an offset value and a gain value.
(a) An offset value is an analog input value (voltage or current) that is converted to 0 in digital output value.
(b) A gain value is an analog input value (voltage or current) that is converted to the following digital output value.
400 (Normal resolution mode)
16000/12000 (High resolution mode)

(2) Satisfy the conditions below when setting an offset value and a gain value. Note that they are different from the I/O characteristics of the A/D converter module. (In case of the Q66AD-DG, the option for the analog/range setting is "Current" only".
(a) When "Voltage" is selected for the analog/range setting
• Setting range of offset/gain values: -10 to 10V
• Depending on the range setting, adjust the offset/gain values as follows.
1) Normal resolution mode
{ (Gain value) - (Offset value)} > 1.5V
2) High resolution mode
{ (Gain value) - (Offset value)} > 4.0V
(b) When "Current" is selected for the analog/range setting
• Gain value ≦ 20mA, Offset value ≧ 0mA
• Depending on the range setting, adjust the offset/gain values as follows.
1) Normal resolution mode
{ (Gain value) - (Offset value)} > 5.5mA
2) High resolution mode
{ (Gain value) - (Offset value)} > 16.0mA

(3) Explanation of window command buttons

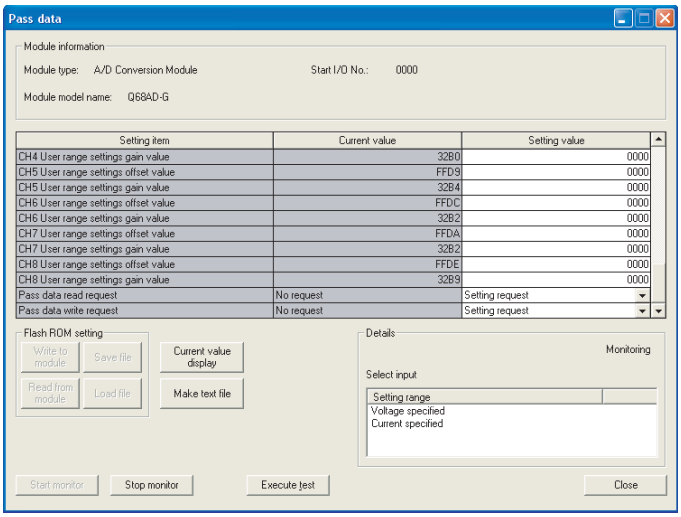
Range setting	The entered offset/gain value is determined, and the I/O characteristic diagram is updated.
Conversion	Conversion for the entered value is performed.

5.6.4 Pass data (Q68AD-G)

Perform operation in the following sequence to save/restore the user range.

(1) Switch to the pass data window

Perform the operation in Section 5.6.1 to display the Pass data window.



(2) User range saving

(a) Set "Voltage specified" or "Current specified" in the Setting value field of Pass data classification setting, and click the Execute test button.
When the setting is completed, the set data is displayed in the Current value field of CH □ Pass data classification setting.

(b) Change the Setting value field of Pass data read request to "Request", and click the Execute test button.
When read is completed, the values are displayed in the Current value fields of CH □ Industrial shipment settings offset/gain values/CH □ User range settings offset/gain values.

(c) Compare the values with those in the range reference table, and record them if they are correct.
Refer to Section 7.4 for the range reference table.

(3) User range restoration

(a) Set "Voltage specified" or "Current specified" in the Setting value field of Pass data classification setting, and click the Execute test button.
When the setting is completed, the set data is displayed in the Current value field of CH □ Pass data classification setting.

(b) Set the recorded values in the Setting value fields of CH □ Industrial shipment settings offset/gain values/user range settings offset/gain values.

(c) Select all the Setting value fields of CH □ Industrial shipment settings offset/gain values/user range settings offset/gain values, and click the Execute test button.
When write is completed, the set values are displayed in the Current value fields of CH □ Industrial shipment settings offset/gain values/CH □ User range settings offset/gain values.

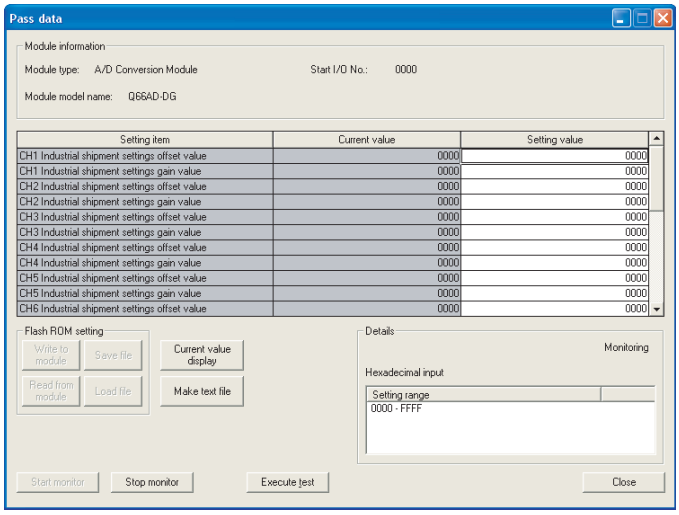
(d) Change the Setting value field of Pass data write request to "Request", and click the Execute test button.
Make sure that the indication in the Current value field of Pass data write request changes from "Request" to "OFF" on completion of write.

5.6.5 Pass data (Q66AD-DG)

Perform operation in the following sequence to save/restore the user range.

(1) Switch to the Pass data window

Perform the operation in Section 5.6.1 to display the pass data window.



(2) User range saving

(a) Change the Setting value field of pass data read request to "Request", and click the Execute test button.
When read is completed, the values are displayed in the Current value fields of CH □ industrial shipment settings offset/gain values/CH □ user range settings offset/gain values.

(b) Compare the values with those in the range reference table, and record them if they are correct.
Refer to Section 7.4 for the range reference table.

(3) User range restoration

(a) Set the recorded values in the Setting value fields of CH □ industrial shipment settings offset/gain values/user range settings offset/gain values.

(b) Select all the Setting value fields of CH □ industrial shipment settings offset/gain values/user range settings offset/gain values, and click the Execute test button.
When write is completed, the set values are displayed in the Current value fields of CH □ industrial shipment settings offset/gain values/ CH □ user range settings offset/gain values.

(c) Change the Setting value field of pass data write request to "Request", and click the Execute test button.
Make sure that the indication in the Current value field of pass data write request changes from "Request" to "OFF" on completion of write.

5.7 FB Conversion of Initial Setting/Auto Refresh Setting

[Purpose]

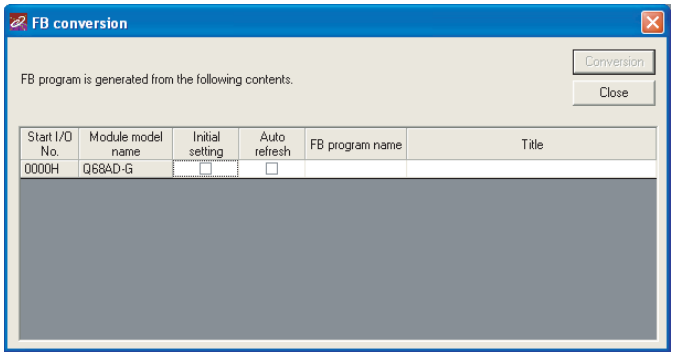
FB is generated automatically from the intelligent function module parameter (initial setting/auto refresh setting).

[Operating procedure]

Intelligent Function Module Parameter Setting Module Selection Window →

<<FB Support Parameter>> → FB conversion

[Setting window]



[Explanation of items]

(1) Items displayed on the window

Start I/O No. : The start I/O No. of the information which is set up on the currently open intelligent function module parameter is displayed.

Module model name : The module model name of the information which is set up on the currently open intelligent function module parameter is displayed.

Initial setting : Set up whether to apply FB conversion to the parameter or not. Check if you apply FB conversion to the parameter.

Auto refresh : Set up whether to apply FB conversion to the parameter or not. Check if you apply FB conversion to the parameter.

FB program name : Set up the name of the converted FB program.
Up to six single-byte characters can be set up as an FB program name.
However, the characters and terms shown below cannot be set up as FB program name.
Character:\, /, :, ;, *, ?, ", <, >, |, ,
Term :COM1 to COM9, LPT1 to LPT9, AUX, PRN, CON, NUL, CLOCK$
In addition, I- is added for initial setting and A- is added for auto refresh setting respectively to the top of the FB name setting to be registered in GX Developer after FB conversion is performed.
Ex.:If the FB program name is "ABCDE, " the initial setting is "I-ABCDE" and the auto refresh setting is "A-ABCDE".

Title : Set up a title on a converted FB program. Up to 32 single-byte characters can be set up as a title.

(2) Explanation of window command buttons

Conversion	FB conversion is performed for the checked columns of initial setting and auto refresh setting.

5.8 Usage of FB

This section describes the procedure for using FB with GX Developer.
For details, refer to "GX Developer Version 8 Operating Manual (Function Block). "

5.8.1 Outline

The procedure for creating FB is shown below.

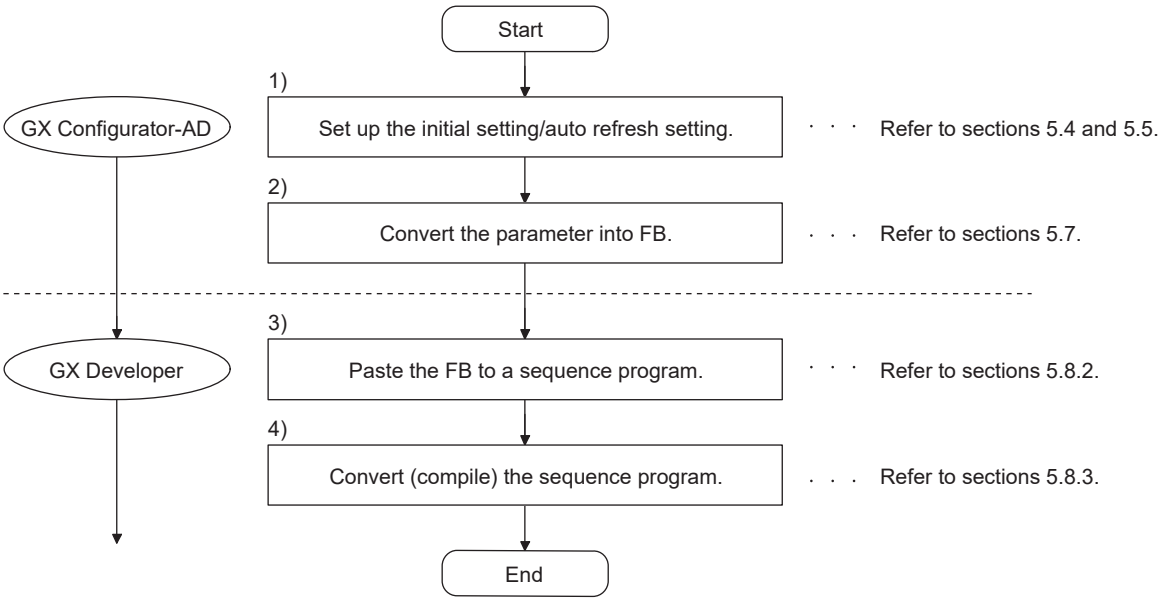
(1) Set up the intelligent function module parameter (initial setting/auto refresh setting).

(2) Convert the intelligent function module parameter into FB.

(3) Paste the FB to a sequence program.

(4) Convert (compile) the sequence program.

Next, a flowchart of procedures 1) to 4) is shown below.



Point

The initial setting/auto refresh setting of the intelligent function module can be performed by each of the following methods.

(1) Set intelligent function parameters (Initial setting/Auto refresh setting) and write them to the programmable controller CPU.

(2)Create an FB of the intelligent function module parameter (initial setting/auto refresh setting) and paste it to the sequence program.

In accordance with the specification of the system, perform the initial setting/auto refresh setting of the intelligent function module by one of the methods above.*1

∗ 1:The following explains the case in which both of (1) and (2) are performed.

(a) Initial setting
FB setting given in (2) is valid.

(b) Auto refresh setting

- Both (1) and (2) are valid.
- At the time of FB execution and in the END processing of the sequence program, auto refresh is performed.

5.8.2 Paste an FB to a sequence program

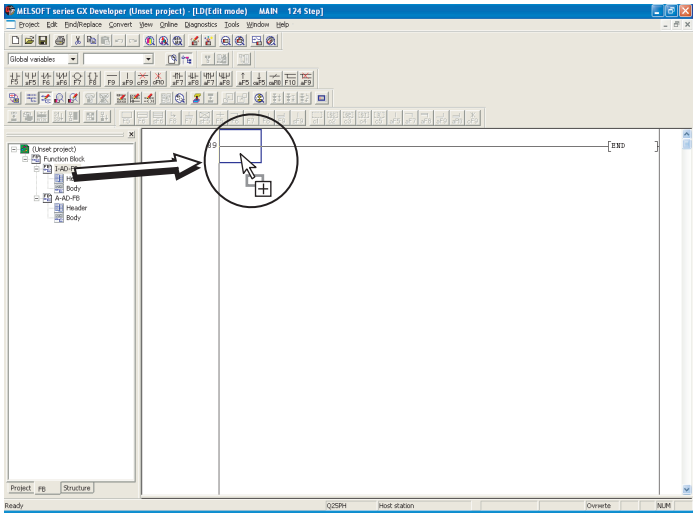
[Purpose of operation]

Paste an FB in order to use it with a sequence program.

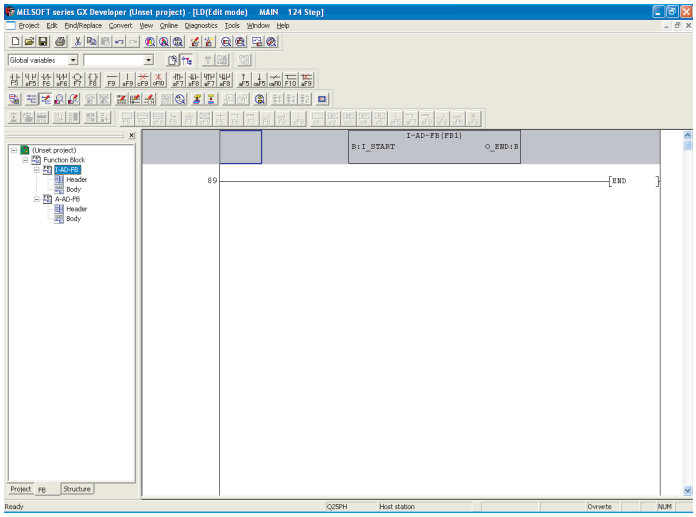
[Operation procedure]

Switch the <<Project>> tab into the <<FB>> tab on GX Developer, and drag & drop the FB to be used onto the sequence program.

Before pasting



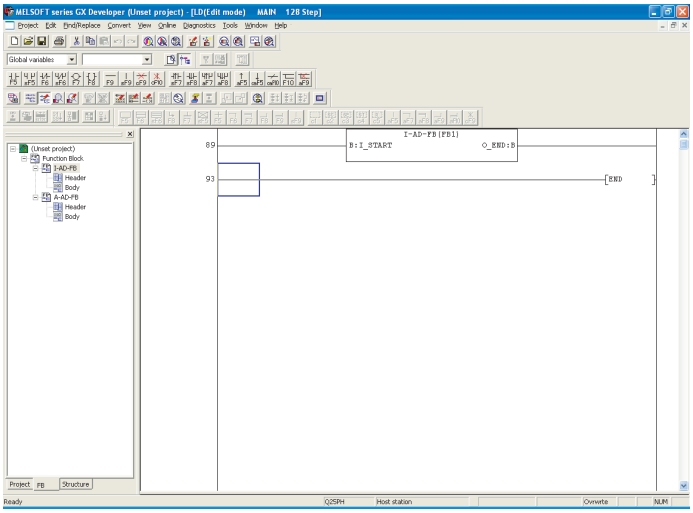
After pasting



5.8.3 Convert (compile) a sequence program

[Purpose of operation]

Convert (compile) the sequence program to which an FB was pasted so that it can be executed.



[Operation procedure]

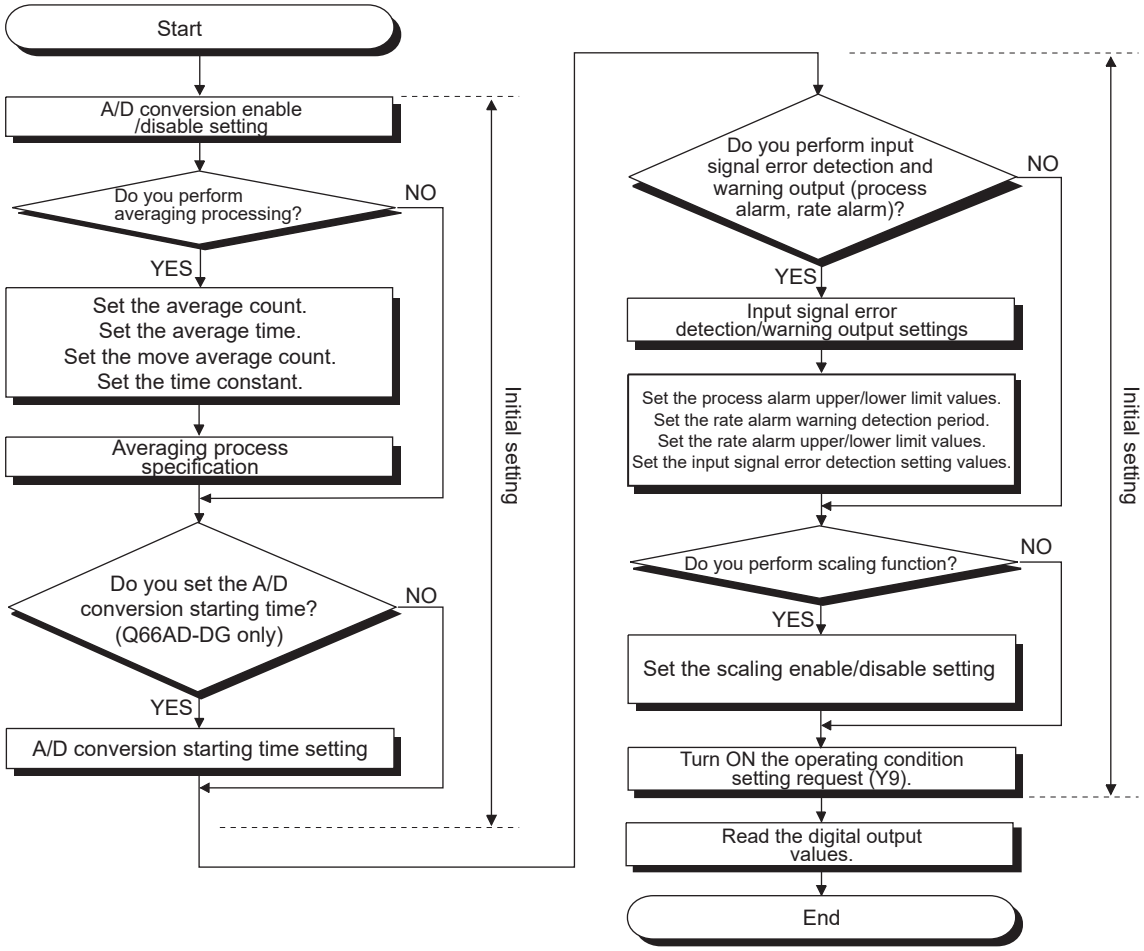
Click the [Convert] menu → [Convert/Compile] menu of GX Developer.

6 PROGRAMMING

This chapter describes the programs of the A/D converter modules.
When applying any of the program examples introduced in this chapter to the actual system, verify the applicability and confirm that no problems will occur in the system control.

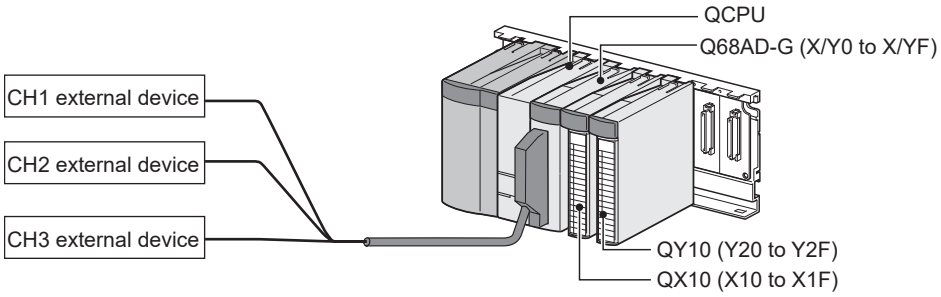
6.1 Programming Procedure

In the following procedure, create a program that will execute the analog/digital conversion of the A/D converter module.



6.2 For Use in Normal System Configuration (Q68AD-G)

(1) System configuration



(2) Conditions for the intelligent function module switch setting

	Input range setting	Normal resolution mode/ High resolution mode
CH1 CH2 CH3	4 to 20mA	High resolution mode
CH4 to CH8	not used	-

(3) Program conditions

(a) The following averaging processing specification is used for each channel.
- CH1: Sampling processing
- CH2: Time averaging (50 times)
- CH3: Primary delay filtering (100ms)

(b) CH1 uses the input signal error detection function (Refer to Section 3.2.3.)
- Input signal error detection: 10%

(c) CH2 uses the warning output setting (process alarm) (Refer to Section 3.4.1 (1).)
- Process alarm lower lower limit value: 1000
- Process alarm lower upper limit value: 1500
- Process alarm upper lower limit value: 6000
- Process alarm upper upper limit value: 7000

(d) CH3 uses the warning output setting (rate alarm) (Refer to Section 3.2.4 (2).)
- Rate alarm warning detection period : 50ms
- Rate alarm upper limit value: 0.3%
- Rate alarm upper limit value: 0.1%

(e) In the event of a write error, an error code shall be displayed in BCD format. The error code shall be reset after removal of the cause.

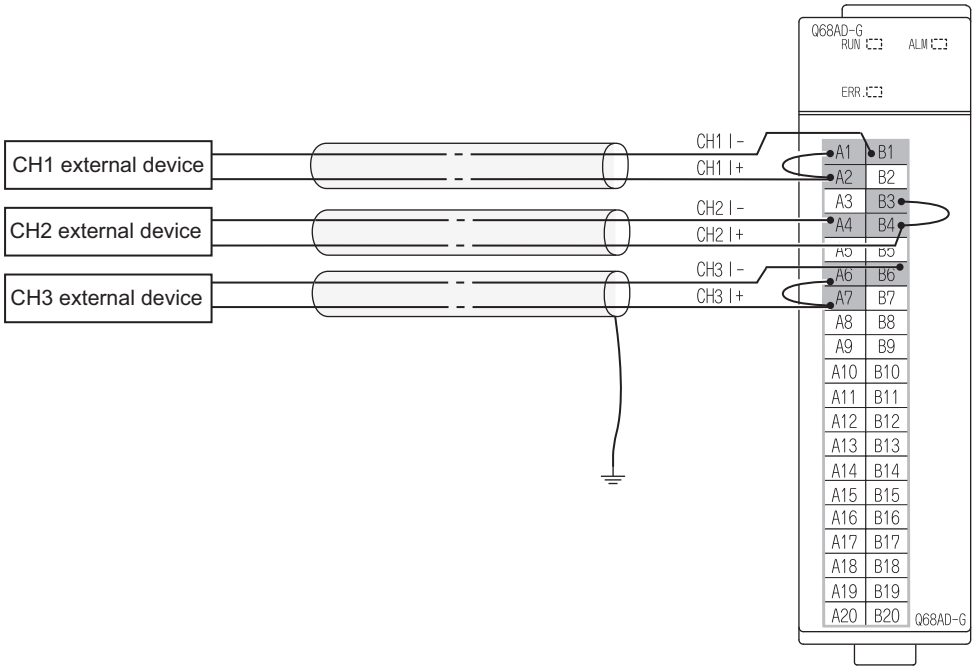
6.2.1 Before creating a program

Perform the following steps before creating a program.

(1) Wiring of external devices

Mount the Q68AD-G on the base unit and connect the external devices.

- For all of CH1 to CH3, run the cables for current input.
  For details, refer to "4.4.2 (2) (b) For current input".

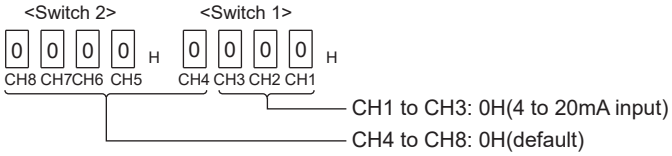


(2) Intelligent function module switch setting

Based on the setting conditions given in Section 6.2 (2), make the intelligent function module switch settings.

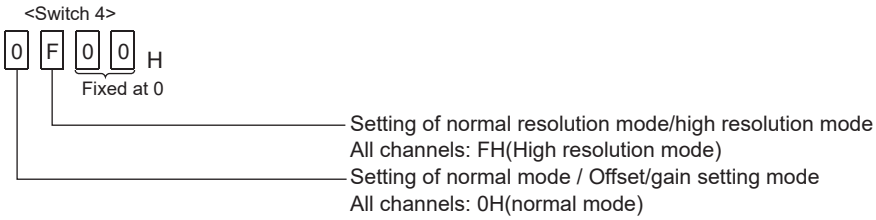
(a) Each switch setting

1) Switch1,Switch2: Input range setting

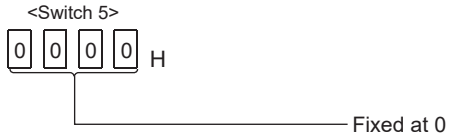


2) Switch3: Empty (No setting required)

3) Switch4: Mode setting

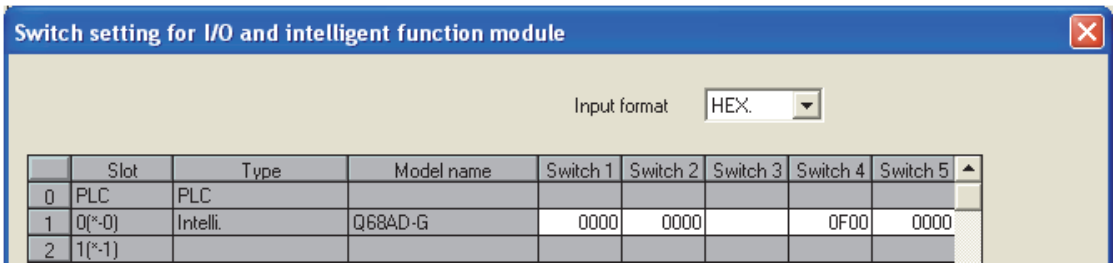


4) Switch5: Use prohibited (0H:fixed*1)



*1:If any other than 0H is set to Switch 5, an error occurs.

(b) Write the settings in (a) to the Q68AD-G.
On GX Developer's "Parameter setting" window, select the "I/O assignment" tab, click "Switch setting", and make settings of Switch 1 to 5 on the window shown below.



6.2.2 Programming example using the utility package

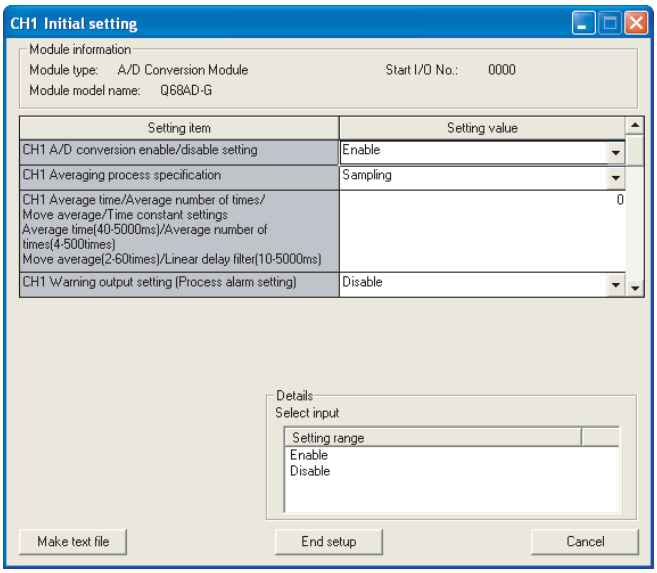
(1) List of devices

Device	Function	
D1, D11	CH1 Digital output value	
D2, D12	CH2 Digital output value	
D3, D13	CH3 Digital output value	
D6,D7*1	Warning output flag	
D8*1	Input signal error detection flag	
D9*1	Error code	
M0 to M2	A/D conversion completed flag	
M12,M13	CH2 Warning output flag (Process alarm)	
M34,M35	CH3 Warning output flag (Rate alarm)	
M50	CH1 Input signal error detection flag	
X0	Module ready	Q68AD-G (X/Y0 to X/YF)
XC	Input signal error detection signal	
XE	A/D conversion completed flag	
XF	Error flag	
Y9	Operating condition setting request	
YF	Error clear request	
X10	Digital output value read command input signal	QX10 (X10 to X1F)
X11	Input signal error detection reset signal	
X12	Error reset signal	
Y20 to Y2B	Error code display (BCD 3 digits)	QY10 (Y20 to Y2F)

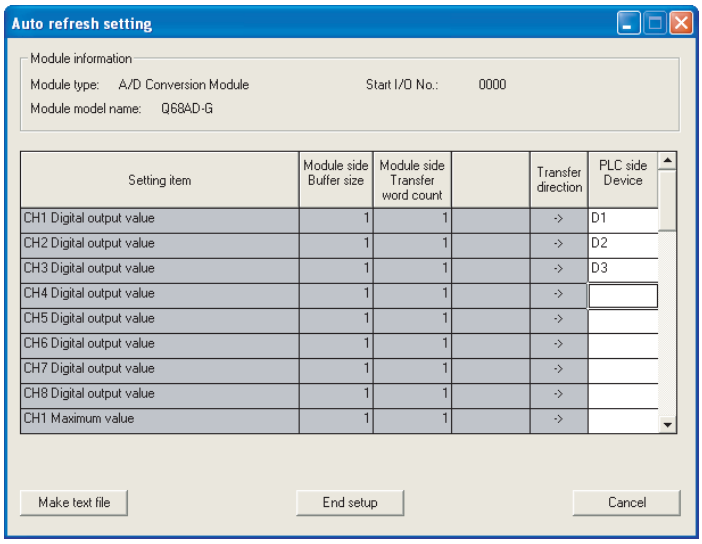
*1:Devices used for the auto refresh function of GX Configurator-AD.

(2) Operating the utility package

(a) Initial setting (Refer to Section 5.4)
Set the initial settings of CH1 to CH3.
Refer to Section 6.2 for the settings.

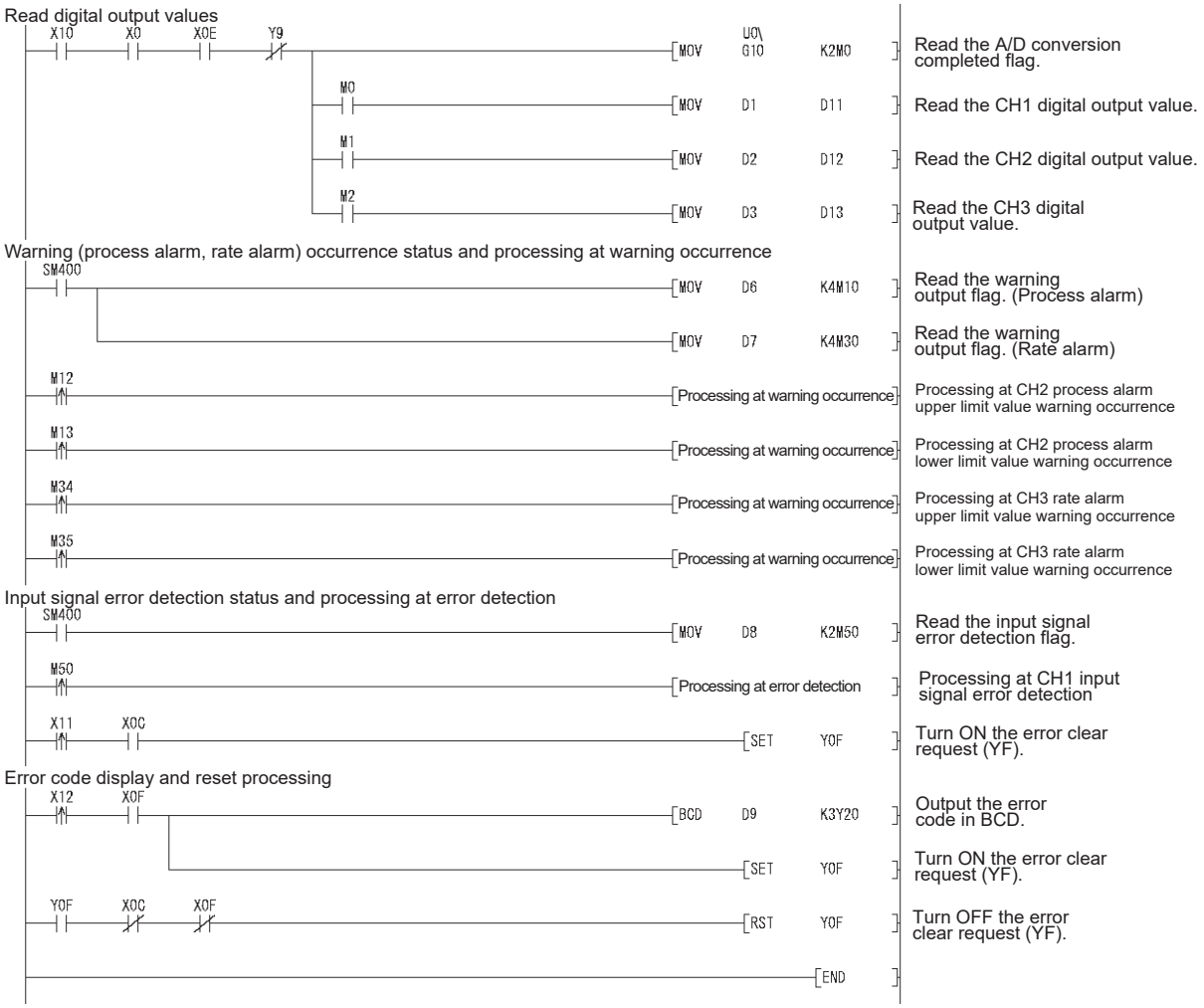


(b) Auto refresh setting (Refer to Section 5.5)
Set the digital output values, warning output flags, input signal error detection flags, and error codes of CH1 to CH3.



(c) Writing the intelligent function module parameters (Refer to Section 5.3.3)
Write the intelligent function module parameters to the CPU module.
This operation is performed using the parameter setting module selection window.

(3) Programming example

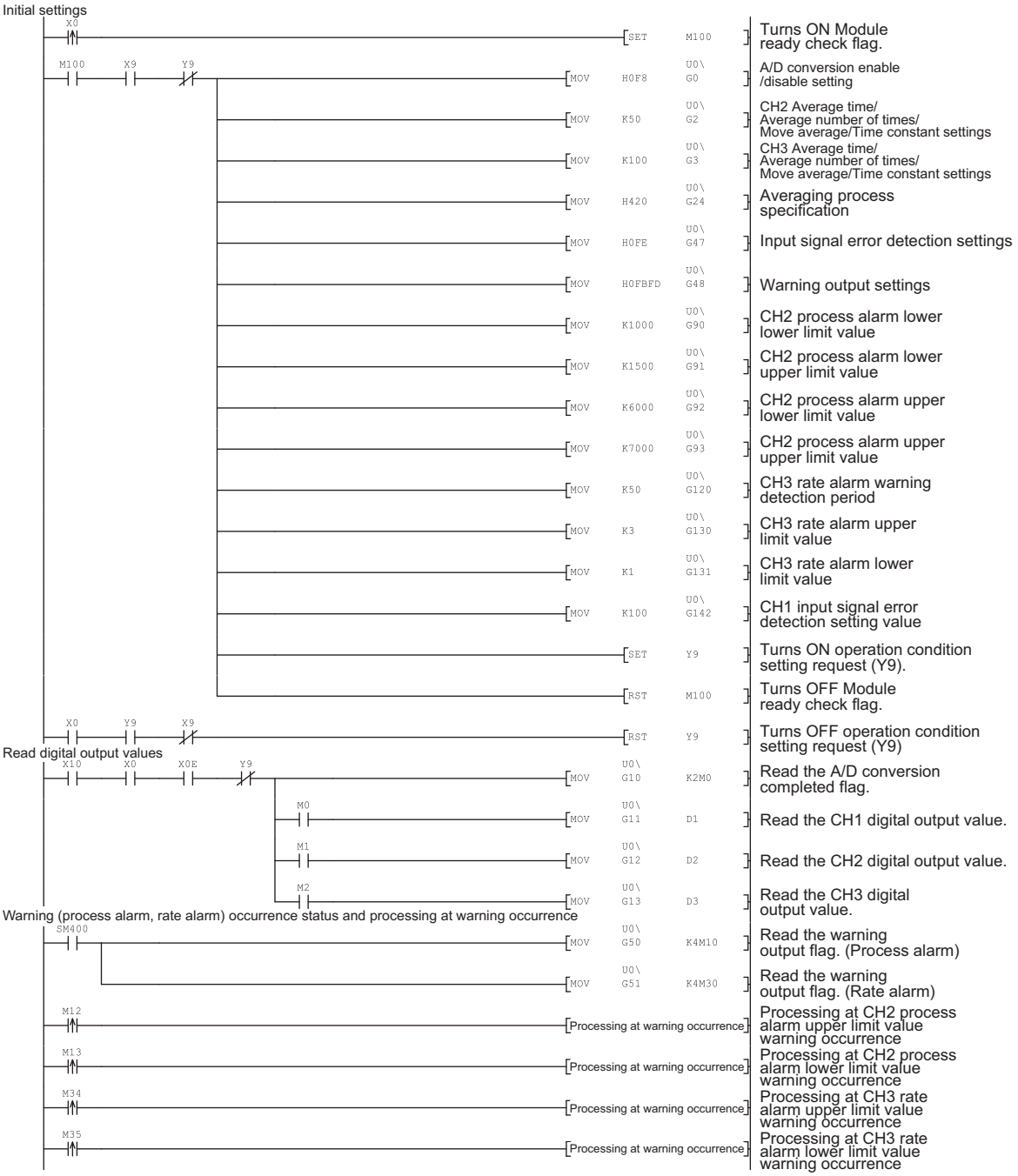


6.2.3 Programming example without using the utility package

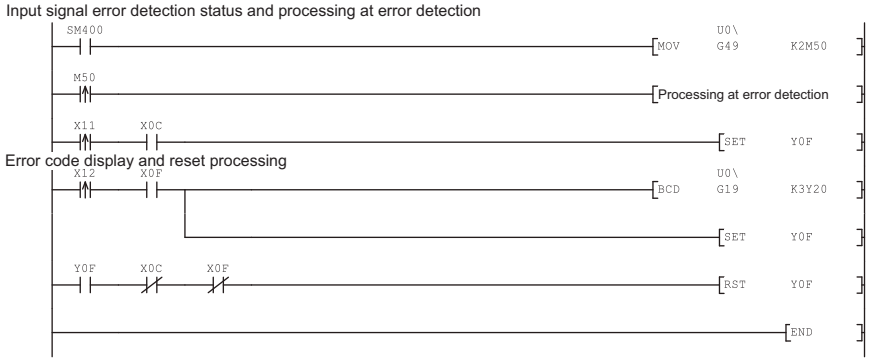
(1) List of devices

Device	Function	
D1	CH1 Digital output value	
D2	CH2 Digital output value	
D3	CH3 Digital output value	
M0 to M2	A/D conversion completed flag	
M100	Module ready check flag	
M12,M13	CH2 Warning output flag (Process alarm)	
M34,M35	CH3 Warning output flag (Rate alarm)	
M50	CH1 Input signal error detection flag	
X0	Module ready	Q68AD-G (X/Y0 to X/YF)
X9	Operating condition setting completed flag	
XC	Input signal error detection signal	
XE	A/D conversion completed flag	
XF	Error flag	
Y9	Operating condition setting request	
YF	Error clear request	
X10	Digital output value read command input signal	QX10 (X10 to X1F)
X11	Input signal error detection reset signal	
X12	Error reset signal	
Y20 to Y2B	Error code display (BCD 3 digits)	QY10 (Y20 to Y2F)

(2) Programming example



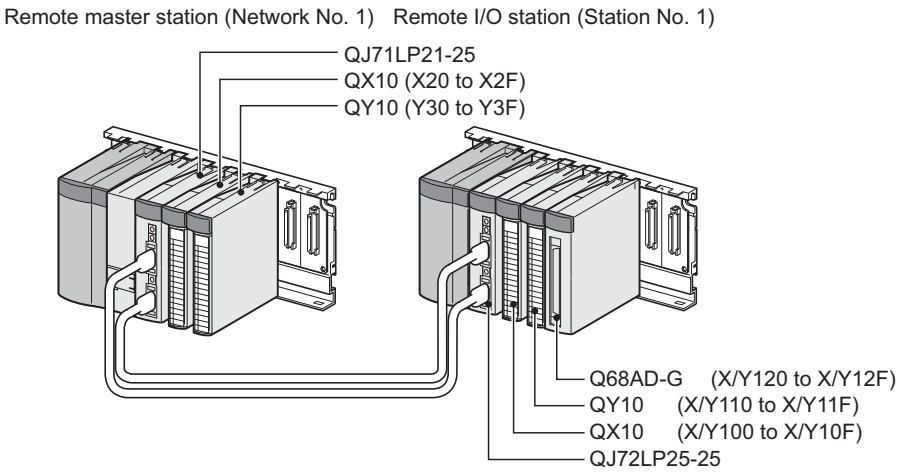
Input signal error detection status and processing at error detection



Error code display and reset processing

6.3 For Use in Remote I/O Network (Q68AD-G)

(1) System configuration



(2) Conditions for the intelligent function module switch setting

	Input range setting	Normal resolution mode/ High resolution mode
CH1	4 to 20mA	High resolution mode
CH2		
CH3		
CH4 to CH8	not used	-

Based on the setting conditions given in the above, make the intelligent function module switch settings.
Select the "I/O assignment" tab on the "Intelligent function module switch settings" window, and click "Switch setting" to set the following values.

Switch No	Setting value	
Switch 1	0000H	(CH1 to CH3: 4 to 20mA
Switch 2	0000H	CH4 to CH8: Default)
Switch 3	-	
Switch 4	0F00H (High resolution mode)	
Switch 5	0000H (0H: Fixed)	

(3) Program conditions

(a) The following averaging processing specification is used for each channel.
- CH1: Sampling processing
- CH2: Time averaging (50 times)
- CH3: Primary delay filtering (100ms)

(b) CH1 uses the input signal error detection function (Refer to Section 3.2.3.)
- Input signal error detection: 10%

(c) CH2 uses the warning output setting (process alarm) (Refer to Section 3.2.4 (1).)
- Process alarm lower lower limit value: 1000
- Process alarm lower upper limit value: 1500
- Process alarm upper lower limit value: 6000
- Process alarm upper upper limit value: 7000

(d) CH3 uses the warning output setting (rate alarm) (Refer to Section 3.2.4 (2).)
- Rate alarm warning detection period : 50ms
- Rate alarm upper limit value: 0.3%
- Rate alarm upper limit value: 0.1%

(e) In case of a write error, an error code is indicated in BCD format.
The error code is reset after the error cause is resolved.

(4) List of devices

Device	Function	
D1(W1)	CH1 Digital output value	
D2(W2)	CH2 Digital output value	
D3(W3)	CH3 Digital output value	
D6,D7(W6,W7)*1	Warning output flag	
D8(W8)*1	Input signal error detection flag	
D9(W9)*1	Error code	
D10	A/D conversion completed flag	
M12,M13	CH2 Warning output flag (Process alarm)	
M34,M35	CH3 Warning output flag (Rate alarm)	
M50	CH1 Input signal error detection flag	
X20	Initialization request signal	QX10 (X20 to X2F)
X21	Digital output value read command input sinal	
X22	Input signal error detection reset signal	
X23	Error reset signal	
Y30 to Y3B	Error code display (BCD 3 digits)	QY10 (Y30 to Y3F)
X120	Module ready	Q68AD-G (X/Y120 to X/Y12F)
X129	Operating condition setting completed flag	
X12C	Input signal error detection signal	
X12E	A/D conversion completed flag	
X12F	Error flag	
Y129	Operating condition setting request	
Y12F	Error clear request	

*1:Devices used for the auto refresh function of GX Configurator-AD.

Point

For details on the MELSECNET/H remote I/O network, refer to the Q Corresponding MELSECNET/H Network System Reference Manual (Remote I/O Network).

6.3.1 Programming example using the utility package

(1) Operating GX Developer

(a) CPU parameter setting

- Network type : MNET/H (Remote master)
- Starting I/O No. : 0000H
- Network No. : 1
- Total stations : 1
- Mode : Online
- Network range assignment :

StationNo.	M station -> R station						M station <- R station					
	Y			Y			X			X		
	Points	Start	End	Points	Start	End	Points	Start	End	Points	Start	End
1	256	0100	01FF	256	0000	00FF	256	0100	01FF	256	0000	00FF

StationNo.	M station -> R station			M station <- R station			M station -> R station			M station <- R station		
	B			B			W			W		
	Points	Start	End	Points	Start	End	Points	Start	End	Points	Start	End
1							160	0100	019F	160	0000	009F

- Refresh parameters :

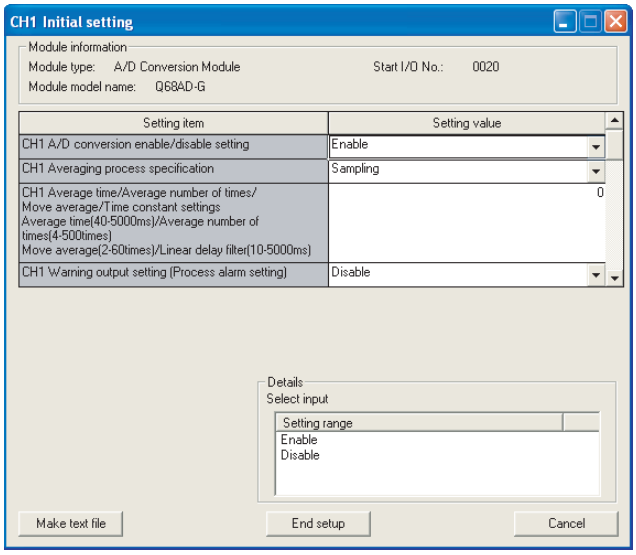
	Link side					PLC side			
	Dev. name	Points	Start	End		Dev. name	Points	Start	End
Transfer SB	SB	512	0000	01FF	↔	SB	512	0000	01FF
Transfer SW	SW	512	0000	01FF	↔	SW	512	0000	01FF
Random cyclic	LB				↔				
Random cyclic	LW				↔				
Transfer1	LB	8192	0000	1FFF	↔	B	8192	0000	1FFF
Transfer2	LW	8192	0000	1FFF	↔	W	8192	0000	1FFF
Transfer3	LX	512	0000	01FF	↔	X	512	0000	01FF
Transfer4	LY	512	0000	01FF	↔	Y	512	0000	01FF
Transfer5					↔				
Transfer6					↔				

(2) Operating the utility package

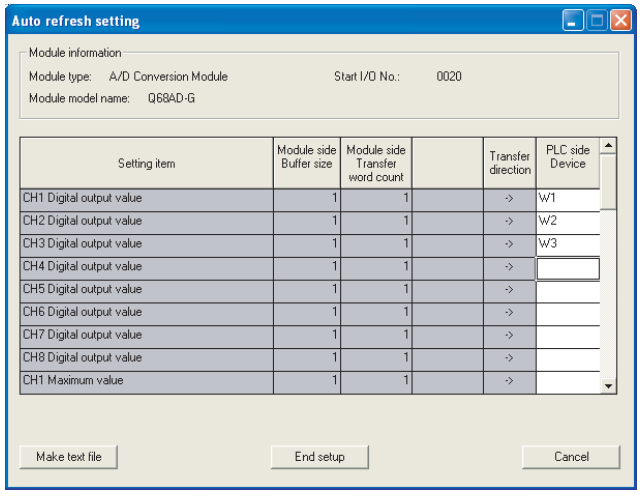
Operate the utility package on the remote I/O station side.
Set the following in the Intelligent function module parameter setting module select area.

- Start I/O No. : 20
- Module type : A/D Conversion Module
- Module model name: Q68AD-G

(a) Initial setting (Refer to Section 5.4)
Set the initial settings of CH1 to CH3.
Refer to Section 6.3 for the settings.

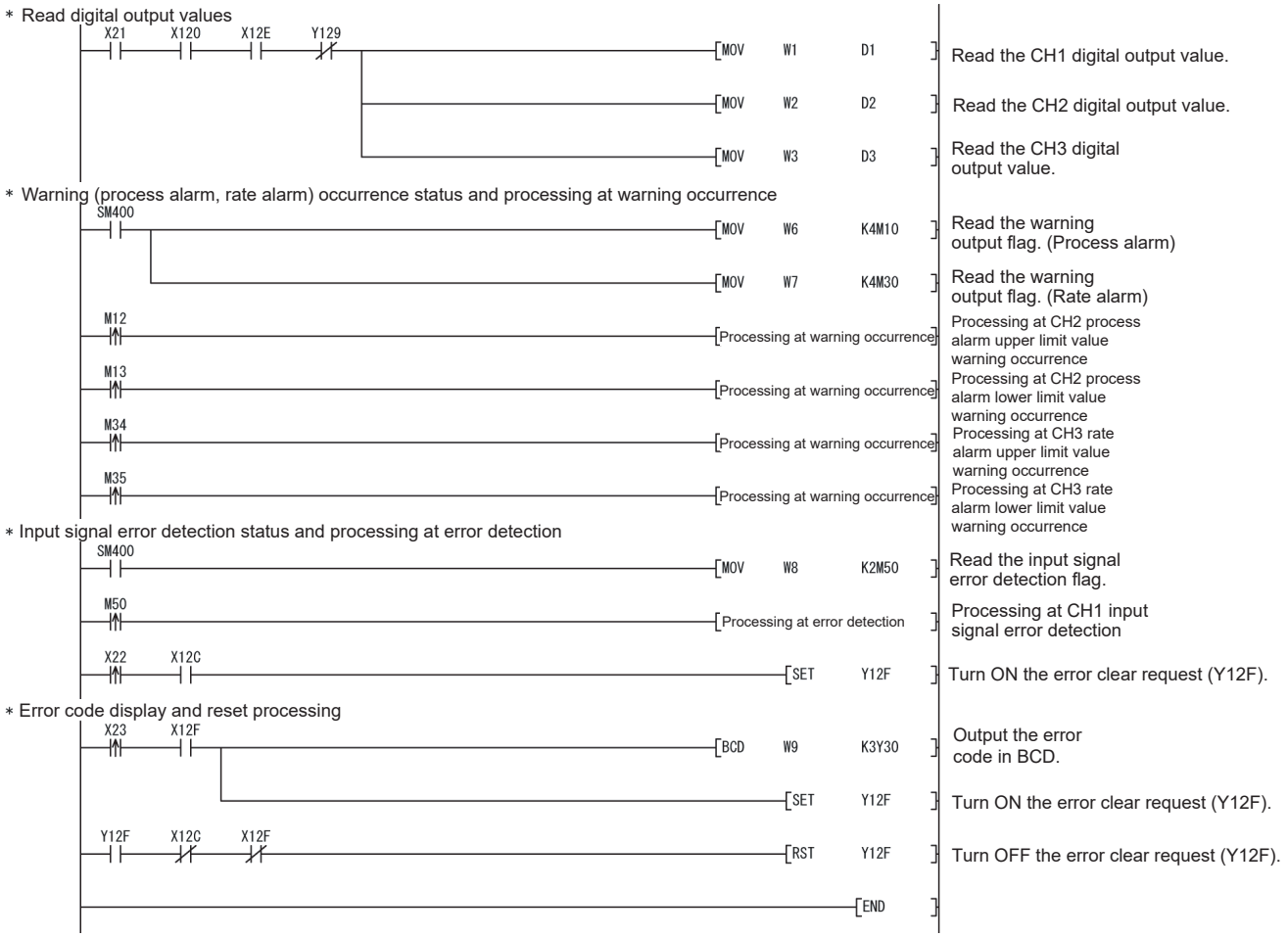


(b) Auto refresh setting (Refer to Section 5.5)
Set the digital output values, warning output flags, input signal error detection flags, and error codes of CH1 to CH3.



(c) Writing the intelligent function module parameters (Refer to Section 5.3.3)
The intelligent function module parameters are written to the remote I/O station.
This operation is performed using the intelligent function module parameter setting module select window.

(3) Programming example



Point

To write the intelligent function module parameters, set the target remote I/O station from [Online] - [Transfer setup] on GX Developer.

They can be written by:

- Directly connecting GX Developer to the remote I/O station.
- Connecting GX Developer to another device such as a CPU module and passing through the network.

6.3.2 Programming example without using the utility package

Point

The dedicated instructions used for reading/writing the buffer memory of the intelligent function module on a remote I/O station (REMTO and REMFR) are the execution type for which several scans are needed. Therefore, transmissions of the execution results are not synchronized with the I/O signal operations. When reading a digital output value on an A/D converter module after changing the operating condition during operation, be sure to read the A/D conversion completed flag (buffer memory address 10) at the same time.
Also, for the case of changing the operating condition, insert an interlock to prevent the execution of the REMFR instruction.

(1) Operating GX Developer (CPU parameter setting)

- Network type : MNET/H (Remote master)
- Starting I/O No. : 0000H
- Network No. : 1
- Total stations : 1
- Mode : Online
- Network range assignment :

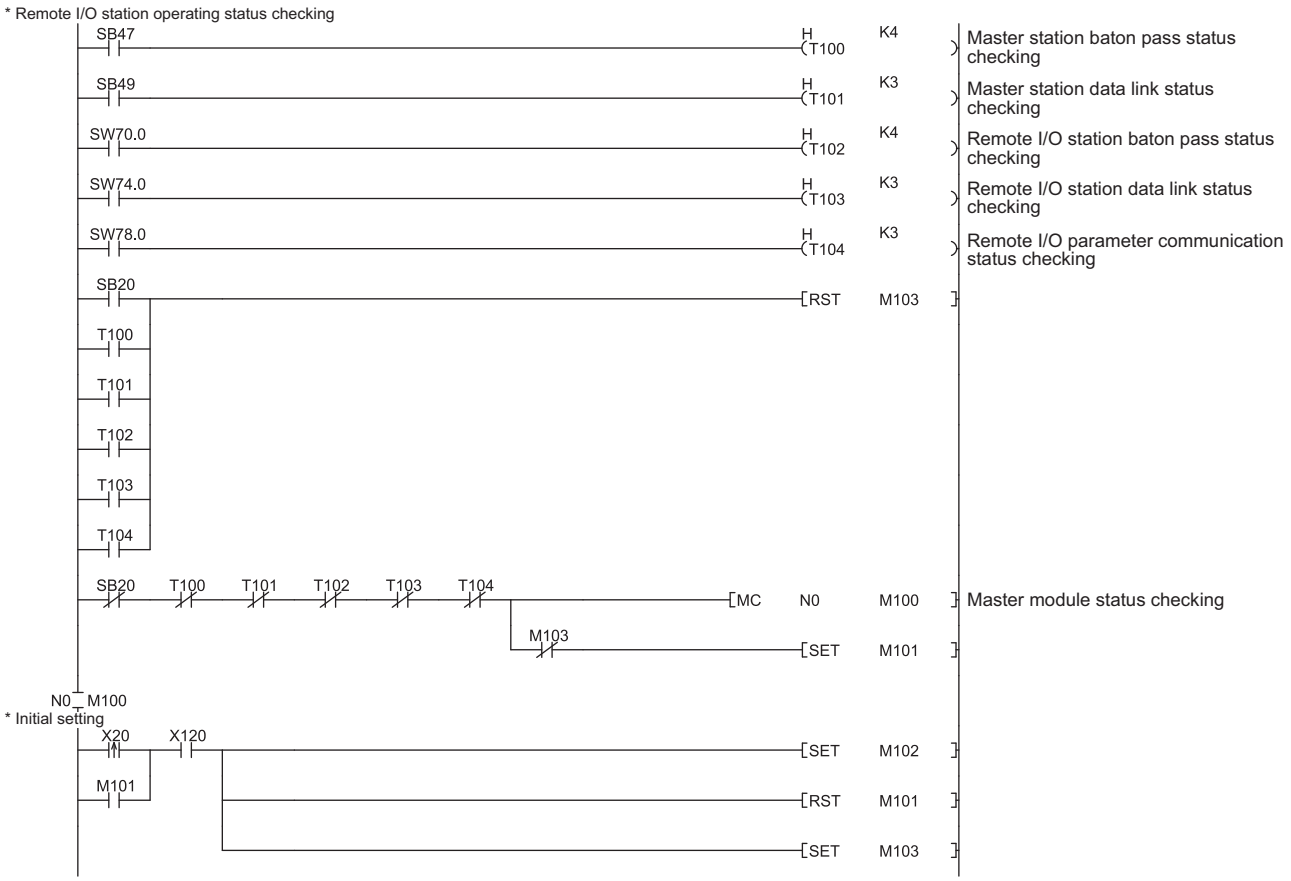
StationNo.	M station -> R station						M station <- R station					
	Y			Y			X			X		
	Points	Start	End	Points	Start	End	Points	Start	End	Points	Start	End
1	256	0100	01FF	256	0000	00FF	256	0100	01FF	256	0000	00FF

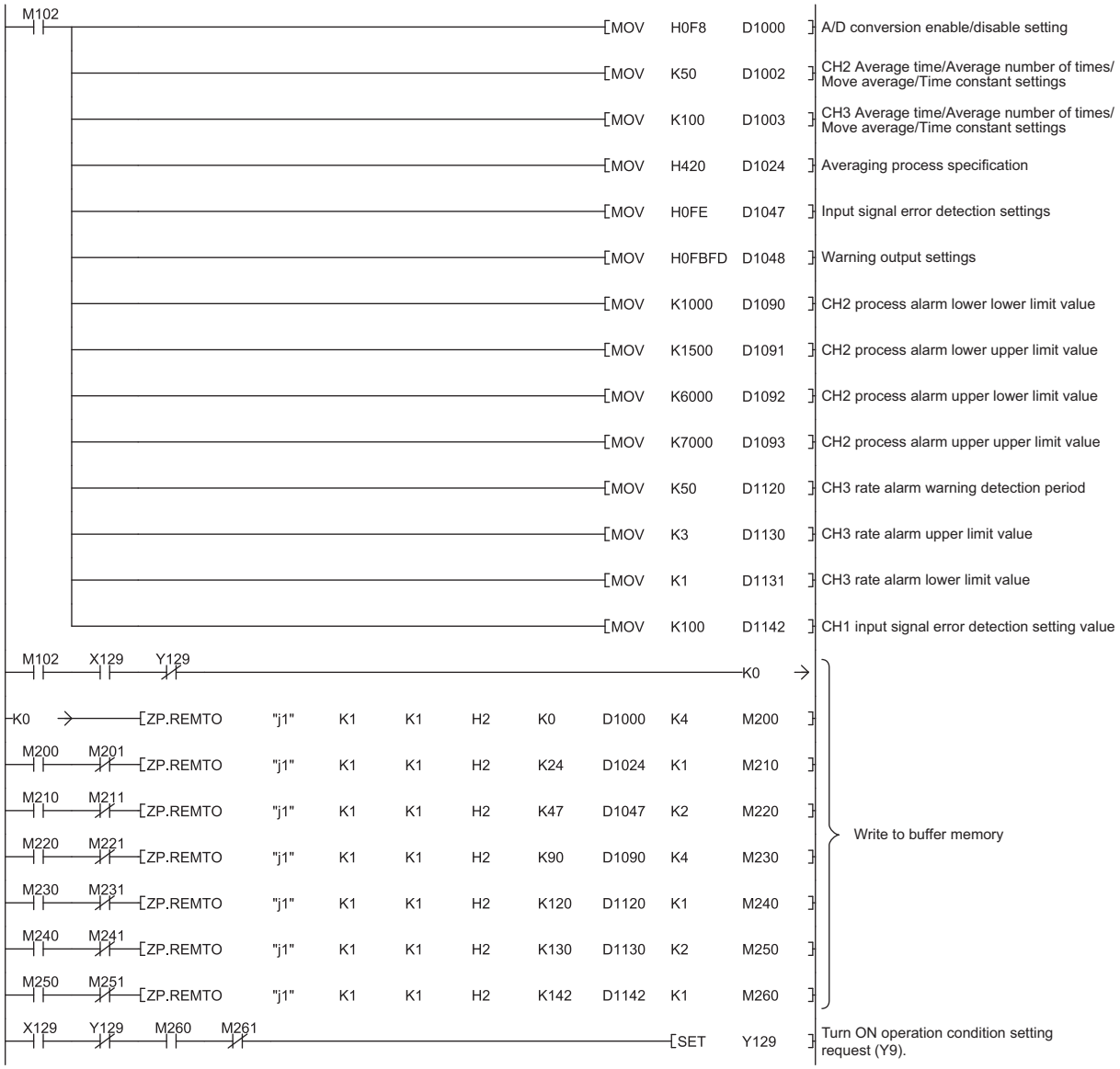
StationNo.	M station -> R station			M station <- R station			M station -> R station			M station <- R station		
	B			B			W			W		
	Points	Start	End	Points	Start	End	Points	Start	End	Points	Start	End
1							160	0100	019F	160	0000	009F

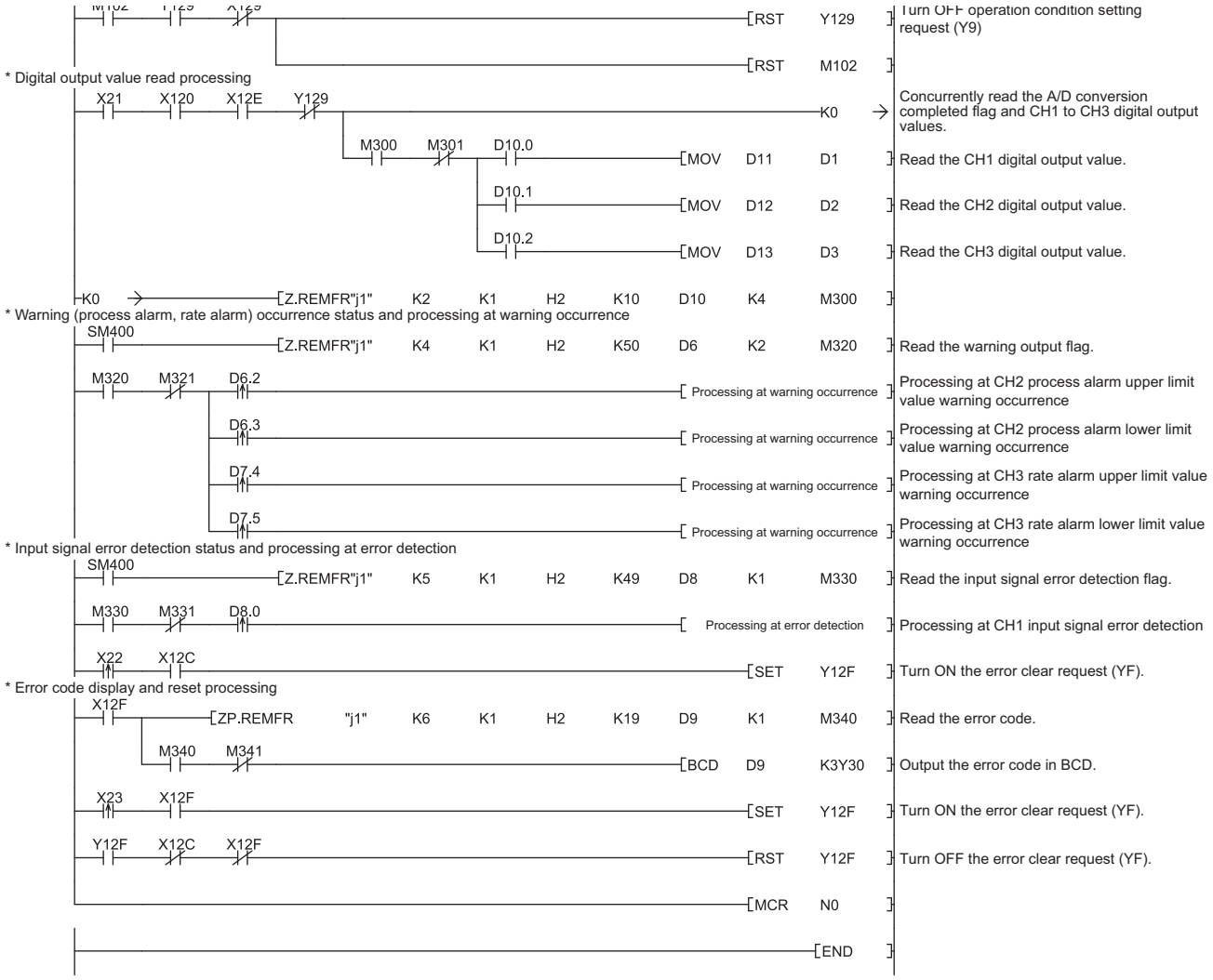
- Refresh parameters :

	Link side					PLC side			
	Dev. name	Points	Start	End		Dev. name	Points	Start	End
Transfer SB	SB	512	0000	01FF	⇔	SB	512	0000	01FF
Transfer SW	SW	512	0000	01FF	⇔	SW	512	0000	01FF
Random cyclic	LB				⇔				
Random cyclic	LW				⇔				
Transfer1	LB	8192	0000	1FFF	⇔	B	8192	0000	1FFF
Transfer2	LW	8192	0000	1FFF	⇔	W	8192	0000	1FFF
Transfer3	LX	512	0000	01FF	⇔	X	512	0000	01FF
Transfer4	LY	512	0000	01FF	⇔	Y	512	0000	01FF
Transfer5					⇔				
Transfer6					⇔				

(2) Programming example

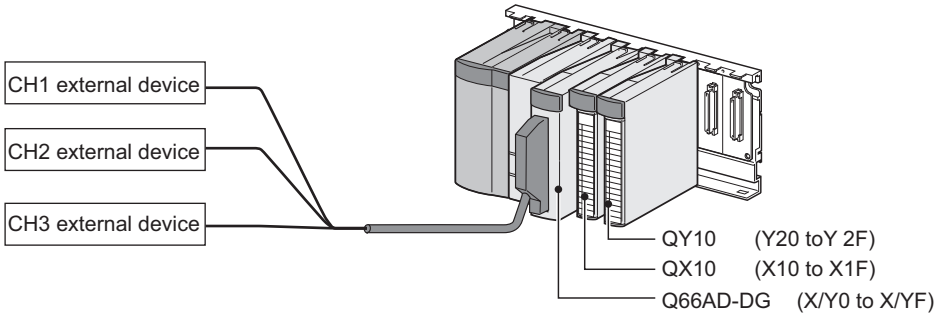



M102
MOV H0F8 D1000 A/D conversion enable/disable setting
MOV K50 D1002 CH2 Average time/Average number of times/ Move average/Time constant settings
MOV K100 D1003 CH3 Average time/Average number of times/ Move average/Time constant settings
MOV H420 D1024 Averaging process specification
MOV H0FE D1047 Input signal error detection settings
MOV H0FBFD D1048 Warning output settings
MOV K1000 D1090 CH2 process alarm lower lower limit value
MOV K1500 D1091 CH2 process alarm lower upper limit value
MOV K6000 D1092 CH2 process alarm upper lower limit value
MOV K7000 D1093 CH2 process alarm upper upper limit value
MOV K50 D1120 CH3 rate alarm warning detection period
MOV K3 D1130 CH3 rate alarm upper limit value
MOV K1 D1131 CH3 rate alarm lower limit value
MOV K100 D1142 CH1 input signal error detection setting value
M102 X129 Y129
K0
K0 ZP.REMTO "j1" K1 K1 H2 K0 D1000 K4 M200
M200 M201 ZP.REMTO "j1" K1 K1 H2 K24 D1024 K1 M210
M210 M211 ZP.REMTO "j1" K1 K1 H2 K47 D1047 K2 M220
M220 M221 ZP.REMTO "j1" K1 K1 H2 K90 D1090 K4 M230
M230 M231 ZP.REMTO "j1" K1 K1 H2 K120 D1120 K1 M240
M240 M241 ZP.REMTO "j1" K1 K1 H2 K130 D1130 K2 M250
M250 M251 ZP.REMTO "j1" K1 K1 H2 K142 D1142 K1 M260
Write to buffer memory
X129 Y129 M260 M261
SET Y129 Turn ON operation condition setting request (Y9).


[RST Y129] Turn OFF operation condition setting request (Y9)
[RST M102]
* Digital output value read processing
X21 X120 X12E Y129 [K0] Concurrently read the A/D conversion completed flag and CH1 to CH3 digital output values.
M300 M301 D10.0 [MOV D11 D1] Read the CH1 digital output value.
D10.1 [MOV D12 D2] Read the CH2 digital output value.
D10.2 [MOV D13 D3] Read the CH3 digital output value.
[K0 Z.REMFR"j1" K2 K1 H2 K10 D10 K4 M300]
* Warning (process alarm, rate alarm) occurrence status and processing at warning occurrence
SM400 [Z.REMFR"j1" K4 K1 H2 K50 D6 K2 M320] Read the warning output flag.
M320 M321 D6.2 [Processing at warning occurrence] Processing at CH2 process alarm upper limit value warning occurrence
D6.3 [Processing at warning occurrence] Processing at CH2 process alarm lower limit value warning occurrence
D7.4 [Processing at warning occurrence] Processing at CH3 rate alarm upper limit value warning occurrence
D7.5 [Processing at warning occurrence] Processing at CH3 rate alarm lower limit value warning occurrence
* Input signal error detection status and processing at error detection
SM400 [Z.REMFR"j1" K5 K1 H2 K49 D8 K1 M330] Read the input signal error detection flag.
M330 M331 D8.0 [Processing at error detection] Processing at CH1 input signal error detection
X22 X12C [SET Y12F] Turn ON the error clear request (YF).
* Error code display and reset processing
X12F [ZP.REMFR "j1" K6 K1 H2 K19 D9 K1 M340] Read the error code.
M340 M341 [BCD D9 K3Y30] Output the error code in BCD.
X23 X12F [SET Y12F] Turn ON the error clear request (YF).
Y12F X12C X12F [RST Y12F] Turn OFF the error clear request (YF).
[MCR N0]
[END]

6.4 For Use in Normal System Configuration (Q66AD-DG)

(1) System configuration



(2) Conditions for the intelligent function module switch setting

	Input range setting	Normal resolution mode/ High resolution mode
CH1	4 to 20mA (For 2-wire transmitter input)	High resolution mode
CH2		
CH3		
CH4 to CH6	not used	-

(3) Program conditions

(a) The following averaging processing specification is used for each channel.
- CH1: Sampling processing
- CH2: Time averaging (50 times)
- CH3: Primary delay filtering (100ms)

(b) CH1 uses the input signal error detection function (Refer to Section 3.2.3.)
- Input signal error detection: 10%

(c) CH2 uses the warning output setting (process alarm) (Refer to Section 3.2.4 (1).)
- Process alarm lower lower limit value: 1000
- Process alarm lower upper limit value: 1500
- Process alarm upper lower limit value: 6000
- Process alarm upper upper limit value: 7000

(d) CH3 uses the warning output setting (rate alarm) (Refer to Section 3.2.4 (2).)
- Rate alarm warning detection period : 50ms
- Rate alarm upper limit value: 0.3%
- Rate alarm upper limit value: 0.1%

(e) In the event of a write error, an error code shall be displayed in BCD format. The error code shall be reset after removal of the cause.

6.4.1 Before creating a program

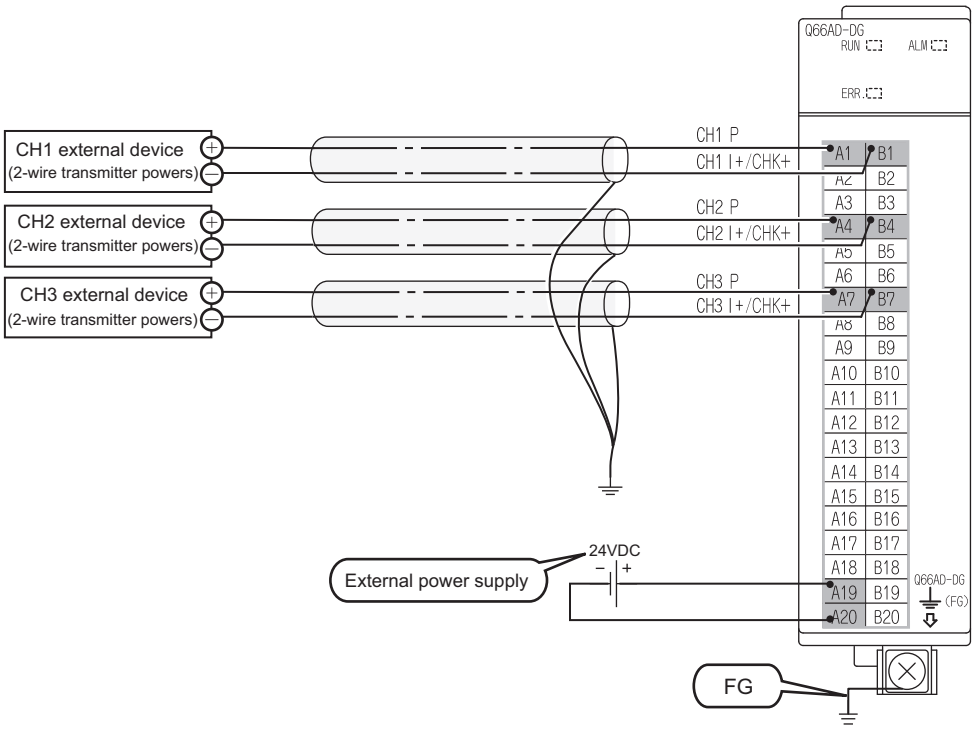
Perform the following steps before creating a program.

(1) Wiring of external devices

Mount the Q68AD-G on the base unit and connect the external devices.

- For all of CH1 to CH3, run the cables for current input.

For details, refer to "4.4.2 (2) (a) For 2-wire transmitter input".

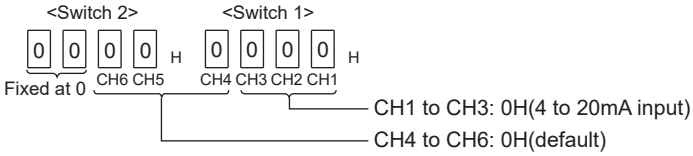


(2) Intelligent function module switch setting

Based on the setting conditions given in Section 6.2 (2), make the intelligent function module switch settings.

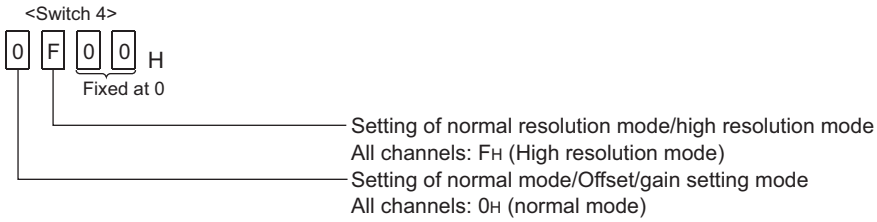
(a) Each switch setting

1) Switch1,Switch2: Input range setting



2) Switch3: Empty (No setting required)

3) Switch4: Mode setting

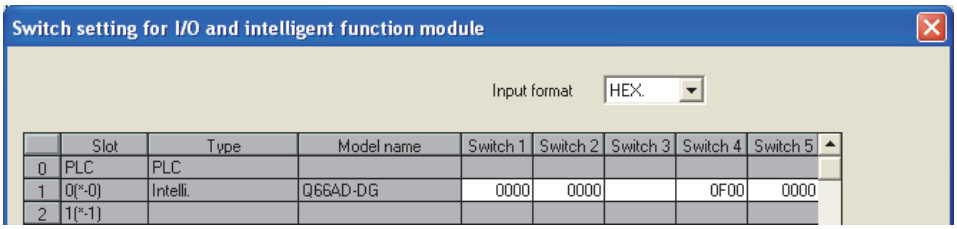


4) Switch5: Use prohibited (0:fixed)

*1:If any other than 0H is set to Switch 5, an error occurs.

(b) Write the settings in (a) to the Q66AD-DG

On GX Developer's "Parameter setting" window, select the "I/O assignment" tab, click "Switch setting", and make settings of Switch 1 to 5 on the window shown below.



6.4.2 Programming example using the utility package

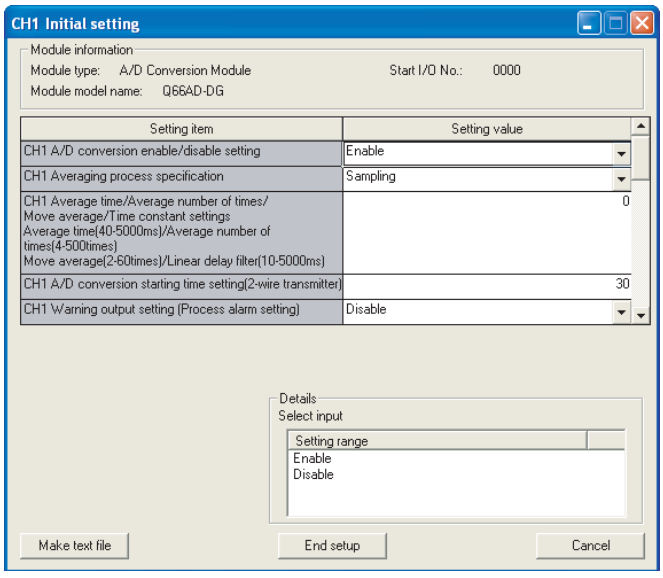
(1) List of devices

Device	Function	
D1, D11	CH1 Digital output value	
D2, D12	CH2 Digital output value	
D3, D13	CH3 Digital output value	
D6,D7*1	Warning output flag	
D8*1	Input signal error detection flag	
D9*1	Error code	
M0 to M2	A/D conversion completed flag	
M12,M13	CH2 Warning output flag (Process alarm)	
M34,M35	CH3 Warning output flag (Rate alarm)	
M50	CH1 Input signal error detection flag	
X0	Module ready	Q66AD-DG (X/Y0 to X/YF)
XC	Input signal error detection signal	
XE	A/D conversion completed flag	
XF	Error flag	
Y9	Operating condition setting request	
YF	Error clear request	
X10	Digital output value read command input signal	QX10 (X10 to X1F)
X11	Input signal error detection reset signal	
X12	Error reset signal	
Y20 to Y2B	Error code display (BCD 3 digits)	QY10 (Y20 to Y2F)

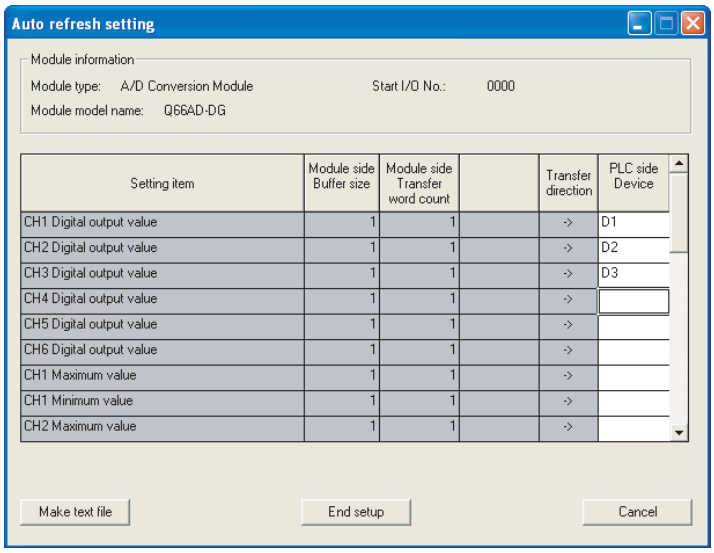
*1:Devices used for the auto refresh function of GX Configurator-AD.

(2) Operating the utility package

(a) Initial setting (Refer to Section 5.4)
Set the initial settings of CH1 to CH3.
Refer to Section 6.4 for the settings.

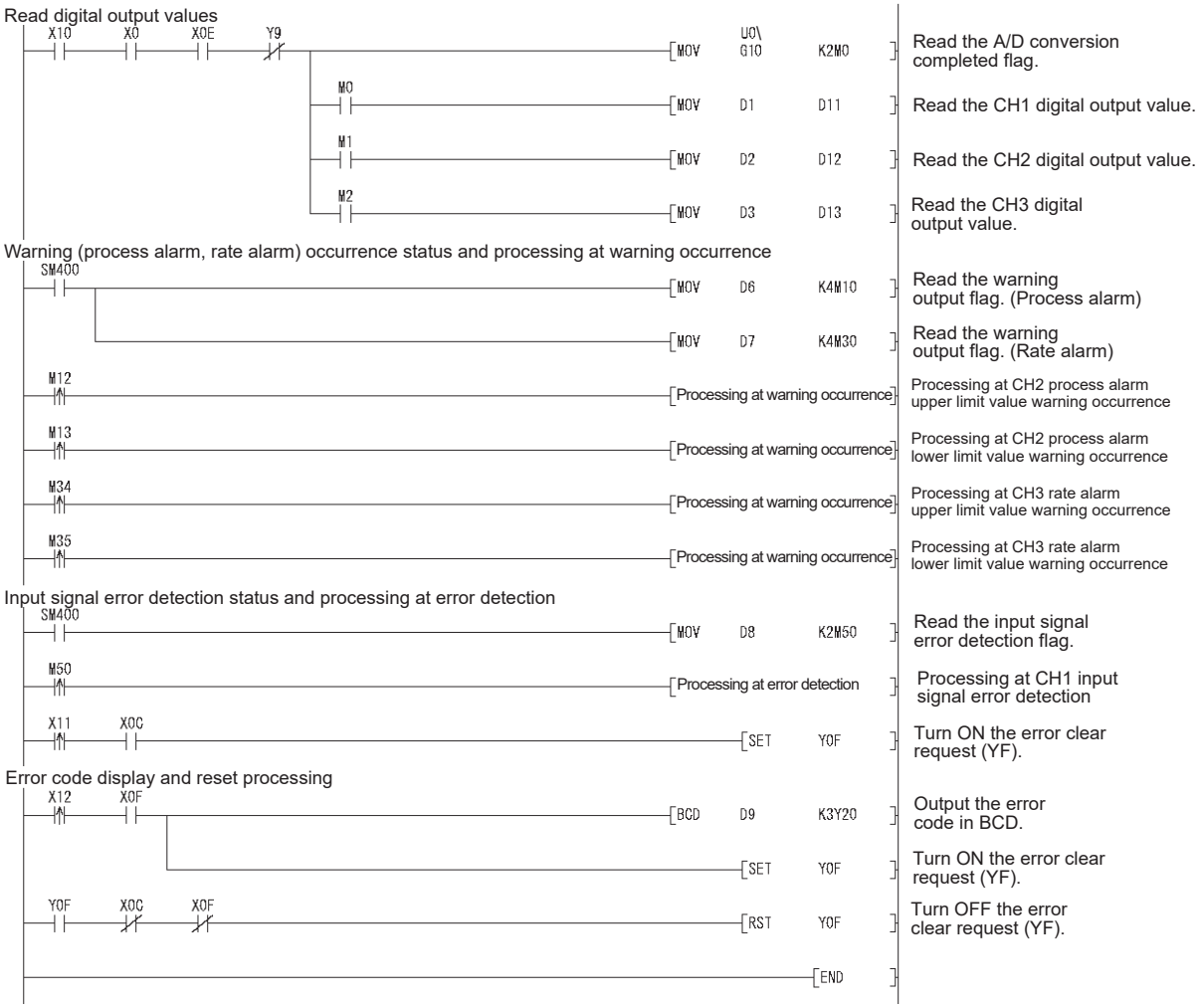


(b) Auto refresh setting (Refer to Section 5.5)
Set the digital output values, warning output flags, input signal error detection flags, and error codes of CH1 to CH3.



(c) Writing the intelligent function module parameters (Refer to Section 5.3.3)
Write the intelligent function module parameters to the CPU module.
This operation is performed using the parameter setting module selection window.

(3) Programming example



Point

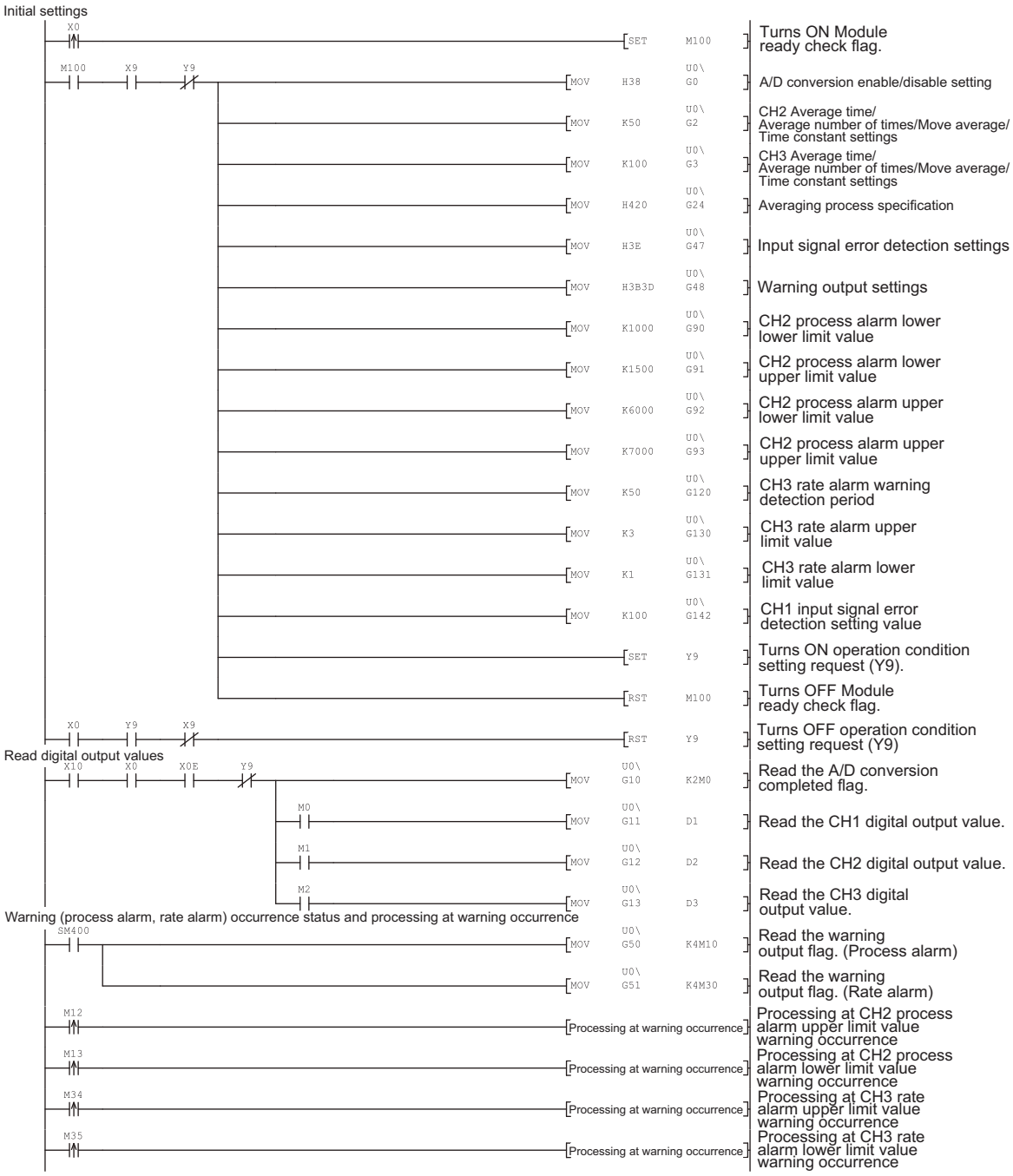
To perform only current input by means of the Q66AD-DG with a product number (first five digits) of 15031 or earlier, refer to Appendix 2.

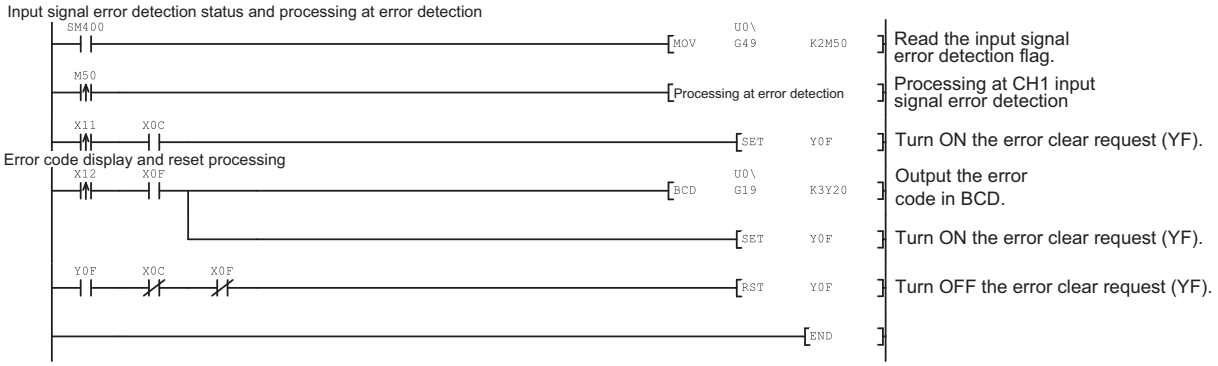
6.4.3 Programming example without using the utility package

(1) List of devices

Device	Function	
D1	CH1 Digital output value	
D2	CH2 Digital output value	
D3	CH3 Digital output value	
M0 to M2	A/D conversion completed flag	
M100	Module ready check flag	
M12,M13	CH2 Warning output flag (Process alarm)	
M34,M35	CH3 Warning output flag (Rate alarm)	
M50	CH1 Input signal error detection flag	
X0	Module ready	Q66AD-DG (X/Y0 to X/YF)
X9	Operating condition setting completed flag	
XC	Input signal error detection signal	
XE	A/D conversion completed flag	
XF	Error flag	
Y9	Operating condition setting request	
YF	Error clear request	
X10	Digital output value read command input signal	QX10 (X10 to X1F)
X11	Input signal error detection reset signal	
X12	Error reset signal	
Y20 to Y2B	Error code display (BCD 3 digits)	QY10 (Y20 to Y2F)

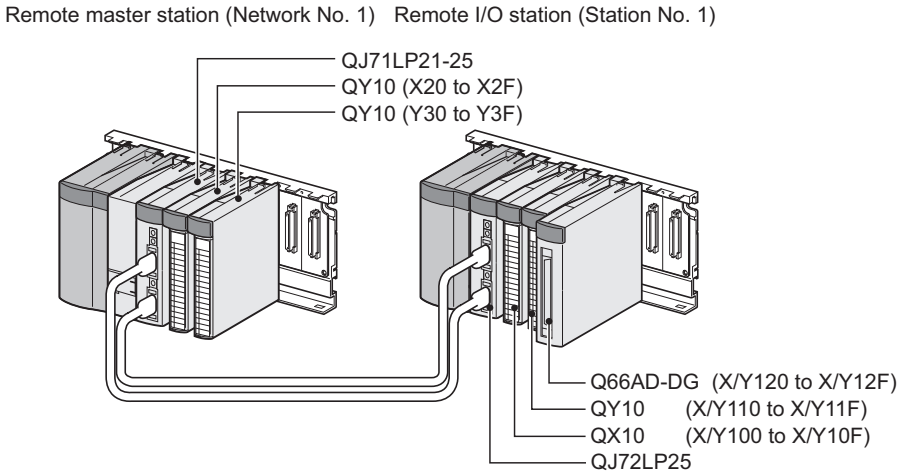
(2) Programming example




Input signal error detection status and processing at error detection
SM400
MOV U0\G49 K2M50
Read the input signal error detection flag.
M50
Processing at error detection
Processing at CH1 input signal error detection
X11 X0C
SET Y0F
Turn ON the error clear request (YF).
Error code display and reset processing
X12 X0F
BCD U0\G19 K3Y20
Output the error code in BCD.
SET Y0F
Turn ON the error clear request (YF).
Y0F X0C X0F
RST Y0F
Turn OFF the error clear request (YF).
END

6.5 For Use in Remote I/O Network (Q66AD-DG)

(1) System configuration



(2) Conditions for the intelligent function module switch setting

	Input range setting	Normal resolution mode/ High resolution mode
CH1	4 to 20mA (For 2-wire transmitter input)	High resolution mode
CH2		
CH3		
CH4 to CH6	not used	-

Based on the setting conditions given in the above, make the intelligent function module switch settings.
Select the "I/O assignment" tab on the "Intelligent function module switch settings" window, and click "Switch setting" to set the following values.

Switch No.	Setting value	
Switch 1	0000H	(CH1 to CH3: 4 to 20mA(For 2-wire transmitter input), CH4 to CH6: Default)
Switch 2	0000H	
Switch 3	-	
Switch 4	0F00H (High resolution mode)	
Switch 5	0000H (0H: Fixed)	

(3) Program conditions

(a) The following averaging processing specification is used for each channel.
- CH1: Sampling processing
- CH2: Time averaging (50 times)
- CH3: Primary delay filtering (100ms)

(b) CH1 uses the input signal error detection function (Refer to Section 3.2.3.)
- Input signal error detection: 10%

(c) CH2 uses the warning output setting (process alarm) (Refer to Section 3.2.4 (1).)
- Process alarm lower lower limit value: 1000
- Process alarm lower upper limit value: 1500
- Process alarm upper lower limit value: 6000
- Process alarm upper upper limit value: 7000

(d) CH3 uses the warning output setting (rate alarm) (Refer to Section 3.2.4 (2).)
- Rate alarm warning detection period : 50ms
- Rate alarm upper limit value: 0.3%
- Rate alarm upper limit value: 0.1%

(e) In case of a write error, an error code is indicated in BCD format.
The error code is reset after the error cause is resolved.

(4) List of devices

Device	Function	
D1(W1)	CH1 Digital output value	
D2(W2)	CH2 Digital output value	
D3(W3)	CH3 Digital output value	
D6,D7(W6,W7)*1	Warning output flag	
D8(W8)*1	Input signal error detection flag	
D9(W9)*1	Error code	
D10	A/D conversion completed flag	
M12,M13	CH2 Warning output flag (Process alarm)	
M34,M35	CH3 Warning output flag (Rate alarm)	
M50	CH1 Input signal error detection flag	
X20	Initialization request signal	QX10 (X20 to X2F)
X21	Digital output value read command input sinal	
X22	Input signal error detection reset signal	
X23	Error reset signal	
Y30 to Y3B	Error code display (BCD 3 digits)	QY10 (Y30 to Y3F)
X120	Module ready	Q66AD-DG (X/Y120 to X/Y12F)
X129	Operating condition setting completed flag	
X12C	Input signal error detection signal	
X12E	A/D conversion completed flag	
X12F	Error flag	
Y129	Operating condition setting request	
Y12F	Error clear request	

*1:Devices used for the auto refresh function of GX Configurator-AD.

Point

For details on the MELSECNET/H remote I/O network, refer to the Q Corresponding MELSECNET/H Network System Reference Manual (Remote I/O Network).

6.5.1 Programming example using the utility package

(1) Operating GX Developer

(a) CPU parameter setting

- Network type : MNET/H (Remote master)
- Starting I/O No. : 0000H
- Network No. : 1
- Total stations : 1
- Mode : Online
- Network range assignment :

StationNo.	M station -> R station						M station <- R station					
	Y			Y			X			X		
	Points	Start	End	Points	Start	End	Points	Start	End	Points	Start	End
1	256	0100	01FF	256	0000	00FF	256	0100	01FF	256	0000	00FF

StationNo.	M station -> R station			M station <- R station			M station -> R station			M station <- R station		
	B			B			W			W		
	Points	Start	End	Points	Start	End	Points	Start	End	Points	Start	End
1							160	0100	019F	160	0000	009F

- Refresh parameters :

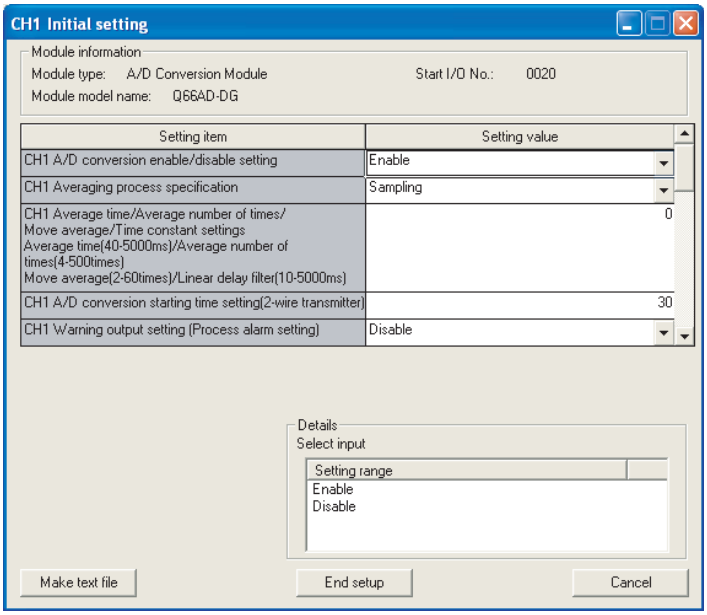
	Link side					PLC side			
	Dev. name	Points	Start	End		Dev. name	Points	Start	End
Transfer SB	SB	512	0000	01FF	↔	SB	512	0000	01FF
Transfer SW	SW	512	0000	01FF	↔	SW	512	0000	01FF
Random cyclic	LB				↔				
Random cyclic	LW				↔				
Transfer1	LB	8192	0000	1FFF	↔	B	8192	0000	1FFF
Transfer2	LW	8192	0000	1FFF	↔	W	8192	0000	1FFF
Transfer3	LX	512	0000	01FF	↔	X	512	0000	01FF
Transfer4	LY	512	0000	01FF	↔	Y	512	0000	01FF
Transfer5					↔				
Transfer6					↔				

(2) Operating the utility package

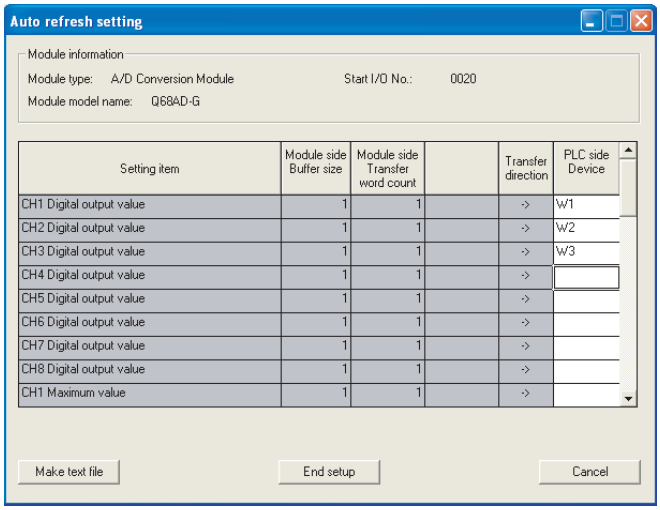
Operate the utility package on the remote I/O station side.
Set the following in the Intelligent function module parameter setting module select area.

- Start I/O No. : 20
- Module type : A/D Conversion Module
- Module model name : Q66AD-DG

(a) Initial setting (Refer to Section 5.4)
Set the initial settings of CH1 to CH3.
Refer to Section 6.5 for the settings.

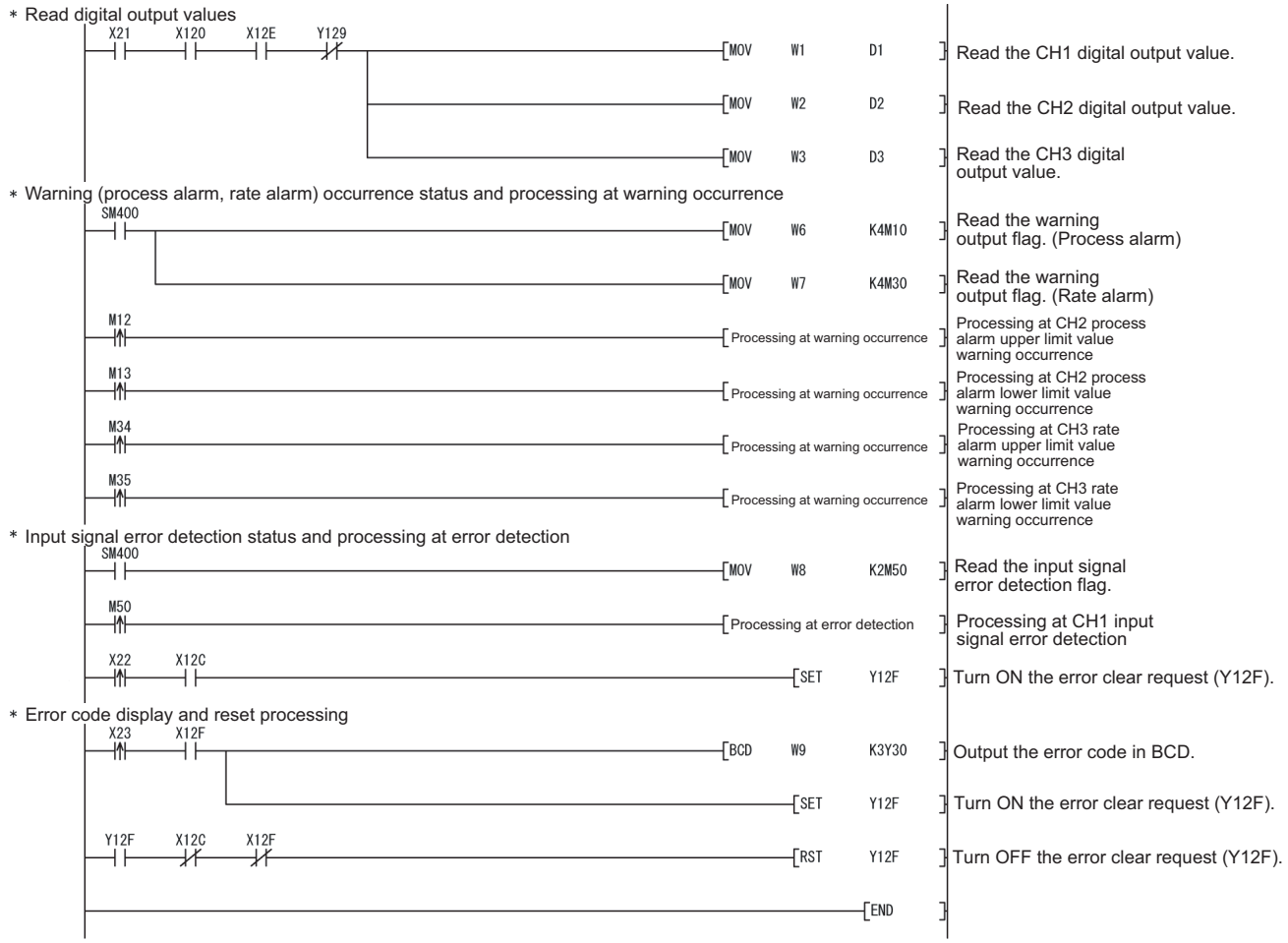


(b) Auto refresh setting (Refer to Section 5.5)
Set the digital output values, warning output flags, input signal error detection flags, and error codes of CH1 to CH3.



(c) Writing the intelligent function module parameters (Refer to Section 5.3.3)
The intelligent function module parameters are written to the remote I/O station.
This operation is performed using the intelligent function module parameter setting module select window.

(3) Programming example



Point

(1) To write the intelligent function module parameters, set the target remote I/O station from [Online] - [Transfer setup] on GX Developer.
They can be written by:
- Directly connecting GX Developer to the remote I/O station.
- Connecting GX Developer to another device such as a CPU module and passing through the network.

(2) To perform only current input by means of the Q66AD-DG with a product number (first five digits) of 15031 or earlier, refer to Appendix 2.

6.5.2 Programming example without using the utility package

Point

The dedicated instructions used for reading/writing the buffer memory of the intelligent function module on a remote I/O station (REMTO and REMFR) are the execution type for which several scans are needed. Therefore, transmissions of the execution results are not synchronized with the I/O signal operations. When reading a digital output value on an A/D converter module after changing the operating condition during operation, be sure to read the A/D conversion completed flag (buffer memory address 10) at the same time.
Also, for the case of changing the operating condition, insert an interlock to prevent the execution of the REMFR instruction.

(1) Operating GX Developer (CPU parameter setting)

- Network type : MNET/H (Remote master)
- Starting I/O No. : 0000H
- Network No. : 1
- Total stations : 1
- Mode : Online
- Network range assignment :

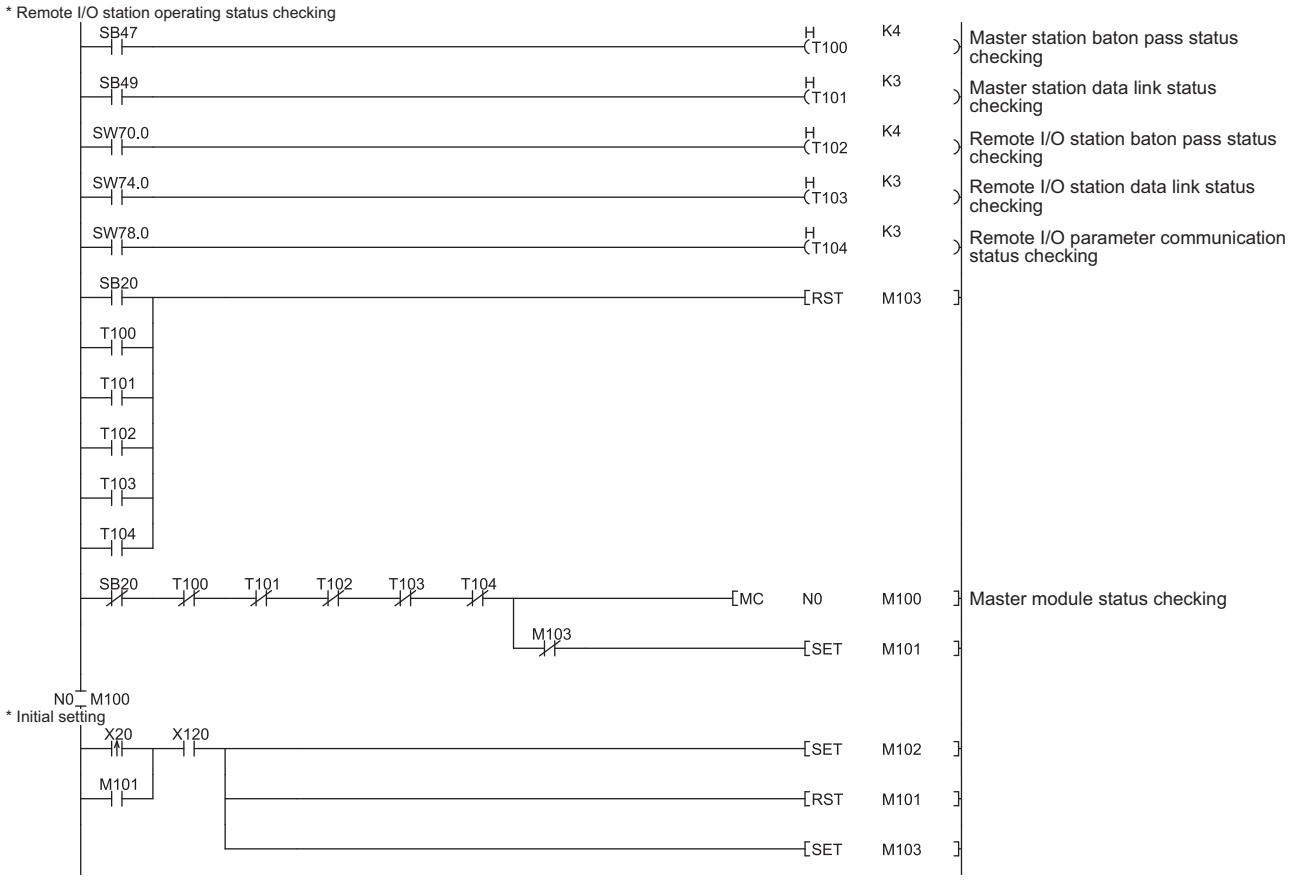
StationNo.	M station -> R station						M station <- R station					
	Y			Y			X			X		
	Points	Start	End	Points	Start	End	Points	Start	End	Points	Start	End
1	256	0100	01FF	256	0000	00FF	256	0100	01FF	256	0000	00FF

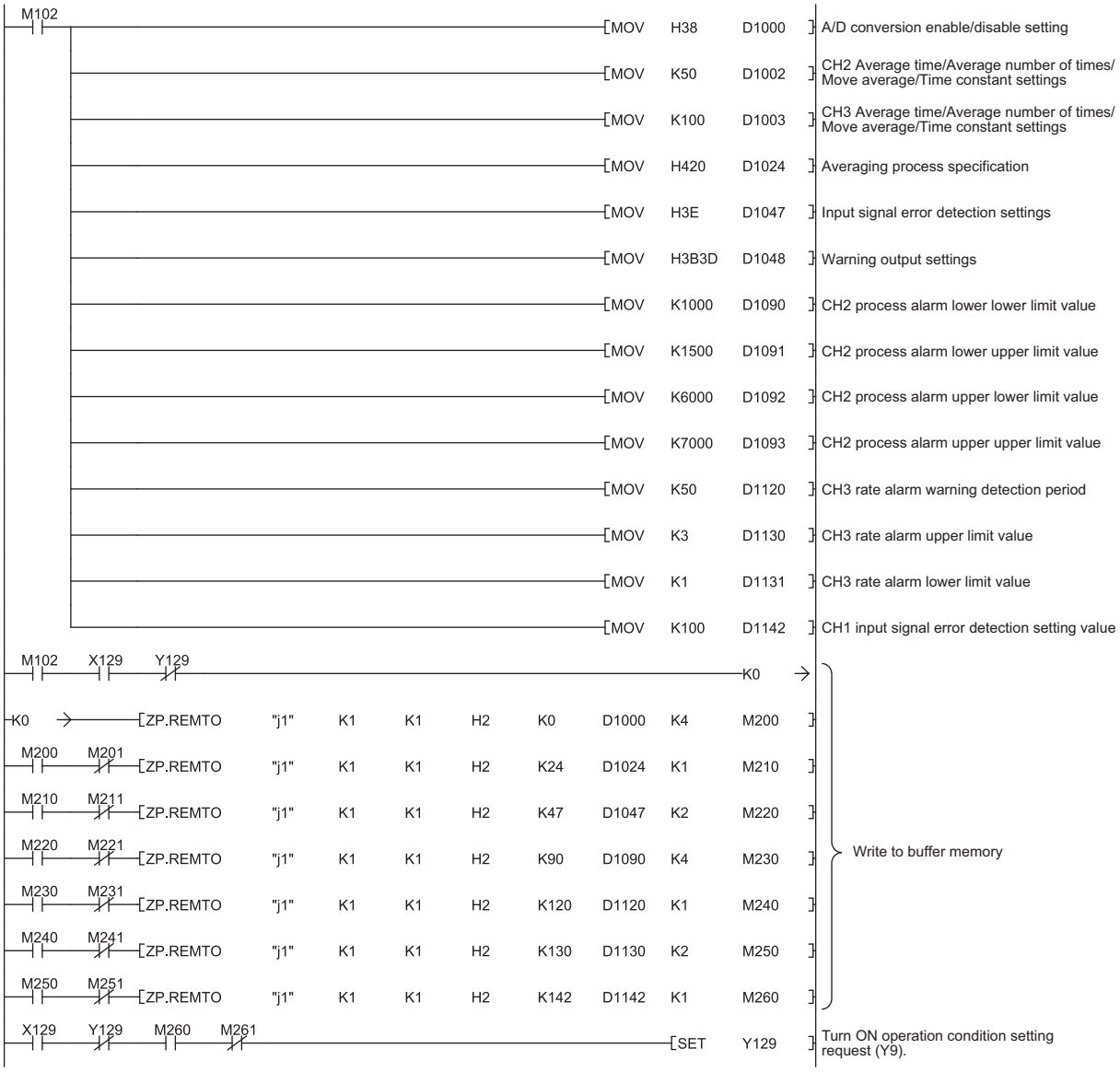
StationNo.	M station -> R station			M station <- R station			M station -> R station			M station <- R station		
	B			B			W			W		
	Points	Start	End	Points	Start	End	Points	Start	End	Points	Start	End
1							160	0100	019F	160	0000	009F

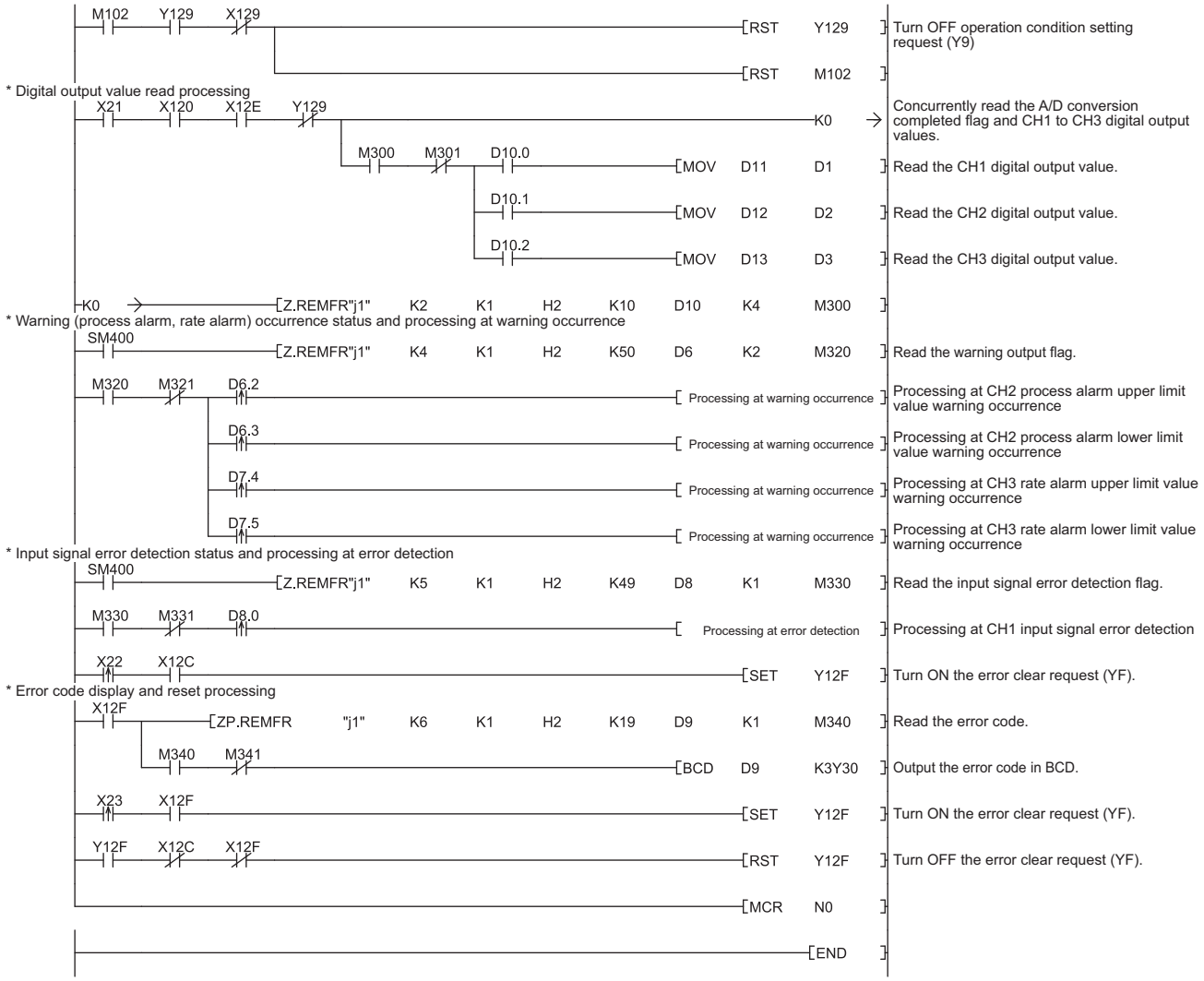
- Refresh parameters :

	Link side					PLC side			
	Dev. name	Points	Start	End		Dev. name	Points	Start	End
Transfer SB	SB	512	0000	01FF	⇔	SB	512	0000	01FF
Transfer SW	SW	512	0000	01FF	⇔	SW	512	0000	01FF
Random cyclic	LB				⇔				
Random cyclic	LW				⇔				
Transfer1	LB	8192	0000	1FFF	⇔	B	8192	0000	1FFF
Transfer2	LW	8192	0000	1FFF	⇔	W	8192	0000	1FFF
Transfer3	LX	512	0000	01FF	⇔	X	512	0000	01FF
Transfer4	LY	512	0000	01FF	⇔	Y	512	0000	01FF
Transfer5					⇔				
Transfer6					⇔				

(2) Programming example




M102
MOV H38 D1000
A/D conversion enable/disable setting
MOV K50 D1002
CH2 Average time/Average number of times/ Move average/Time constant settings
MOV K100 D1003
CH3 Average time/Average number of times/ Move average/Time constant settings
MOV H420 D1024
Averaging process specification
MOV H3E D1047
Input signal error detection settings
MOV H3B3D D1048
Warning output settings
MOV K1000 D1090
CH2 process alarm lower lower limit value
MOV K1500 D1091
CH2 process alarm lower upper limit value
MOV K6000 D1092
CH2 process alarm upper lower limit value
MOV K7000 D1093
CH2 process alarm upper upper limit value
MOV K50 D1120
CH3 rate alarm warning detection period
MOV K3 D1130
CH3 rate alarm upper limit value
MOV K1 D1131
CH3 rate alarm lower limit value
MOV K100 D1142
CH1 input signal error detection setting value
M102 X129 Y129
K0
K0 ZP.REMTO "j1" K1 K1 H2 K0 D1000 K4 M200
M200 M201 ZP.REMTO "j1" K1 K1 H2 K24 D1024 K1 M210
M210 M211 ZP.REMTO "j1" K1 K1 H2 K47 D1047 K2 M220
M220 M221 ZP.REMTO "j1" K1 K1 H2 K90 D1090 K4 M230
M230 M231 ZP.REMTO "j1" K1 K1 H2 K120 D1120 K1 M240
M240 M241 ZP.REMTO "j1" K1 K1 H2 K130 D1130 K2 M250
M250 M251 ZP.REMTO "j1" K1 K1 H2 K142 D1142 K1 M260
Write to buffer memory
X129 Y129 M260 M261
SET Y129
Turn ON operation condition setting request (Y9).


M102 Y129 X129
RST Y129
Turn OFF operation condition setting request (Y9)
RST M102
* Digital output value read processing
X21 X120 X12E Y129
K0
Concurrently read the A/D conversion completed flag and CH1 to CH3 digital output values.
M300 M301 D10.0
MOV D11 D1
Read the CH1 digital output value.
D10.1
MOV D12 D2
Read the CH2 digital output value.
D10.2
MOV D13 D3
Read the CH3 digital output value.
K0
Z.REMFR"j1" K2 K1 H2 K10 D10 K4 M300
* Warning (process alarm, rate alarm) occurrence status and processing at warning occurrence
SM400
Z.REMFR"j1" K4 K1 H2 K50 D6 K2 M320
Read the warning output flag.
M320 M321 D6.2
Processing at warning occurrence
Processing at CH2 process alarm upper limit value warning occurrence
D6.3
Processing at warning occurrence
Processing at CH2 process alarm lower limit value warning occurrence
D7.4
Processing at warning occurrence
Processing at CH3 rate alarm upper limit value warning occurrence
D7.5
Processing at warning occurrence
Processing at CH3 rate alarm lower limit value warning occurrence
* Input signal error detection status and processing at error detection
SM400
Z.REMFR"j1" K5 K1 H2 K49 D8 K1 M330
Read the input signal error detection flag.
M330 M331 D8.0
Processing at error detection
Processing at CH1 input signal error detection
X22 X12C
SET Y12F
Turn ON the error clear request (YF).
* Error code display and reset processing
X12F
ZP.REMFR "j1" K6 K1 H2 K19 D9 K1 M340
Read the error code.
M340 M341
BCD D9 K3Y30
Output the error code in BCD.
X23 X12F
SET Y12F
Turn ON the error clear request (YF).
Y12F X12C X12F
RST Y12F
Turn OFF the error clear request (YF).
MCR N0
END

7 ONLINE MODULE CHANGE

To perform online module change, read the following manual.

- QCPU User's Manual (Hardware Design, Maintenance and Inspection)

(1) Perform an online module change by operating GX Developer.

(2) To ensure ease of offset/gain re-setting, there is a user range save/restoration function that is performed by executing the dedicated instruction or read/write from/to buffer memory.

Point

(1) Perform an online module change after making sure that the system outside the programmable controller will not malfunction.

(2) To prevent an electric shock and malfunction of operating modules, provide means such as switches for powering off each of the external power supply and external devices connected to the module to be replaced online.

(3) After the module has failed, data may not be saved properly. Referring to Section 3.4.23, therefore, prerecord the data to be saved (offset/gain values of the industrial shipment settings and user range settings in the buffer memory).

(4) It is recommended to perform an online module change in the actual system in advance to ensure that it would not affect the other modules by checking the following:

- Means of cutting off the connection to external devices and its configuration are correct.
- Switching ON/OFF does not bring any undesirable effect.

(5) Do not install/remove the module to/from the base unit more than 50 times after the first use of the product. (IEC 61131-2 compliant)
Failure to do so may cause malfunction.

(Note)
The dedicated instruction cannot be executed during an online module change. When using the dedicated instruction to execute save/restoration, therefore, execute save/restoration in the other system*1.
If the other system is unavailable, execute restoration by performing write to the buffer memory.

*1: If the module is mounted on the remote I/O station, execute save/restoration in the other system mounted on the main base unit. (Save/restoration cannot be executed in the other system mounted on the remote I/O station.)

7.1 Online Module Change Conditions

The CPU, MELSECNET/H remote I/O module, A/D converter module, GX Developer and base unit given below are needed to perform an online module change.

(1) CPU

The Process CPU or Redundant CPU are required.
For precautions on multiple CPU system configuration, refer to the QCPU User's Manual (Multiple CPU System).
For precautions on redundant system configuration, refer to the QnPRHCPU User's Manual (Redundant System).

(2) MELSECNET/H remote I/O module

The module of function version D or later is necessary.

(3) A/D converter module

The module of function version C or later is necessary.

(4) GX Developer

GX Developer of Version 7.10L or later is necessary.
GX Developer of Version 8.18U or later is required to perform an online module change on the remote I/O station.

(5) Base unit

1) **When the slim type main base unit (Q3□SB) is used, an online module change cannot be performed.**
2) **When the power supply module unnecessary type extension base unit (Q5□B) is used, online module change cannot be performed for the modules on all the base units connected.**

7.2 Online Module Change Operations

The following gives the operations performed for an online module change.

CPU operation ○: Executed ×: Not executed						(User operation)	(Intelligent function module operation)
X/Y refresh	FROM/TO instruction *1	Dedicated instruction	Device test	GX Configurator: Initial setting parameter	GX Configurator: Monitor/test		
○	○	○	○	×	○	(1) Conversion disable Turn OFF all Y signals that were turned ON by a sequence program.	Module is operating as usual.
×	×	×	×	×	×	(2) Dismounting of module Operate GX Developer to start an online module change. Click the [Execution] button of GX Developer to make the module dismountable. Dismount the corresponding module.	Module stops operating. ・RUN LED turns off. ・Conversion disabled.
○	×	×	×	○	×	(3) Mounting of new module Mount a new module*3 After mounting the module, click the [Execution] button of GX Developer. Operation check before control start	X/Y refresh resumes and the module starts. ・RUN LED turns off. ・Default operation (X0 remains OFF) When there are initial setting parameters, operation is performed according to the initial setting parameters at this point.
○	×	×	○	×	○	(4) Operation check Click the [Cancel] button of GX Developer to leave the online mode. Conduct an operation test on the new module using "Device test" of GX Developer or "Monitor/test" of GX Configurator. Perform user range restoration processing by write to buffer memory at this point. Operation check completed	Module operates according to test operation*2
○	○	○	○	×	○	(5) Resumption of control Operate GX Developer to resume the online module change mode, and click the [Execution] button to resume control.	X0 (Module ready) turns ON. ↓ Start is made when X0 turns from OFF to ON. Operation is performed according to the initial setting sequence.*2

*1: Access to the intelligent function module device (U□\G□) is included.

*2: In the absence of the operation marked *2, the operation of the intelligent function module is the operation performed prior to that.

*3: If the module is changed online to a module that has no extended mode for analog input range under the following input range settings, an intelligent function module switch error will occur. Also, the analog input range extended mode cannot be used in that case.

Q68AD-G: 4 to 20mA (extended mode): A_H

1 to 5V (extended mode): B_H

Q66AD-DG: 4 to 20mA (extended mode) (2-wire transmitter input): A_H

4 to 20mA (extended mode) (current input): C_H

7.3 Online Module Change Procedure

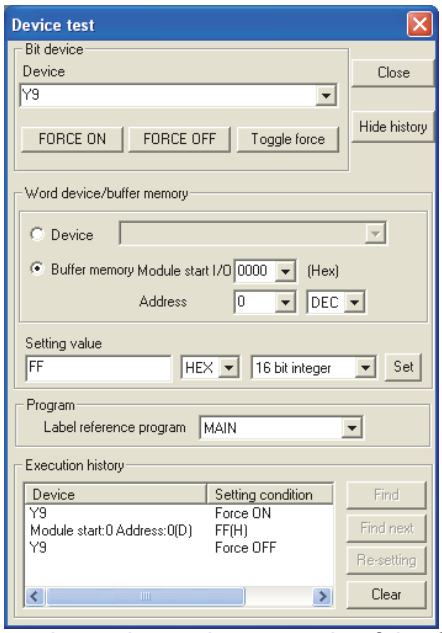
There are the following online module change procedures depending on whether the user range setting has been made or not, whether the initial setting of GX Configurator-AD has been made or not, and whether the other system exists or not.

Range setting	Initial setting	Other system	Reference section
Industrial shipment setting	GX Configurator-AD	-	Section 7.3.1
Industrial shipment setting	Sequence program	-	Section 7.3.2
User range setting	GX Configurator-AD	Present	Section 7.3.3
User range setting	GX Configurator-AD	Absent	Section 7.3.4
User range setting	Sequence program	Present	Section 7.3.5
User range setting	Sequence program	Absent	Section 7.3.6

7.3.1 When industrial shipment setting is used and initial setting was made with GX Configurator-AD

(1) Conversion disable

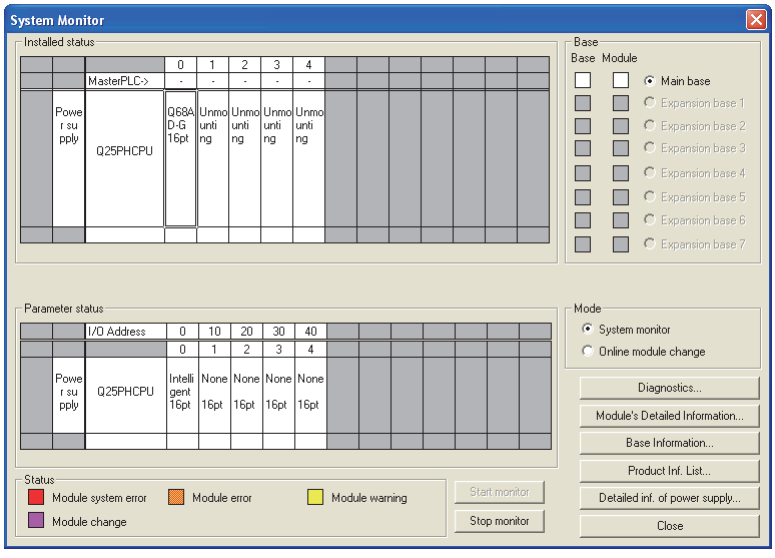
(a) Set the A/D conversion enable/disable setting (Un\G0) for all channel conversion disable and turn operating condition setting request (Y9) from OFF to ON to stop conversion.
After confirming that conversion has stopped with the A/D conversion completion flag (Un\G10), turn off Operation Condition Setting Request (Y9).



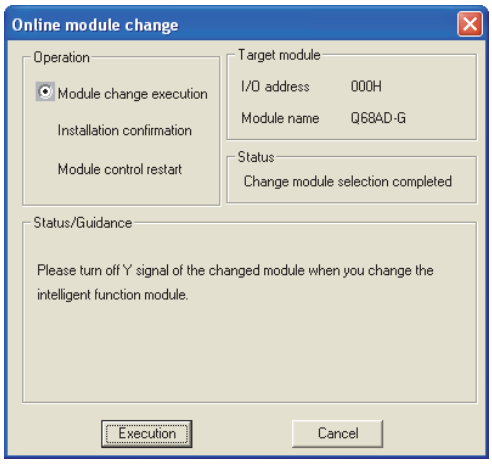
(The window shows the setting example of the Q68AD-G.)

(2) Dismounting of module

(a) After choosing [Diagnosis] - [Online module change] on GX Developer to enter the "Online module change" mode, double-click the module to be changed online to display the "Online module change" window.



(b) Click the "Execution" button to enable a module change.



If the following error window appears, click the [OK] button, dismount the module as-is, and mount a new module.

(c) After confirming that the "RUN" LED of the module has turned off, remove the connector and dismount the module.

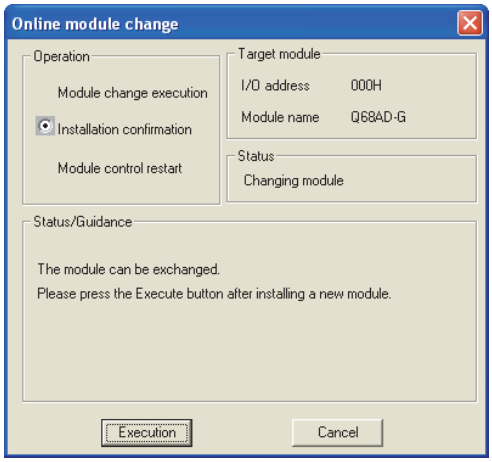
Point

Always dismount the module. If mounting confirmation is made without the module being dismounted, the module will not start properly and the "RUN" LED will not be lit.

(3) Mounting of new module

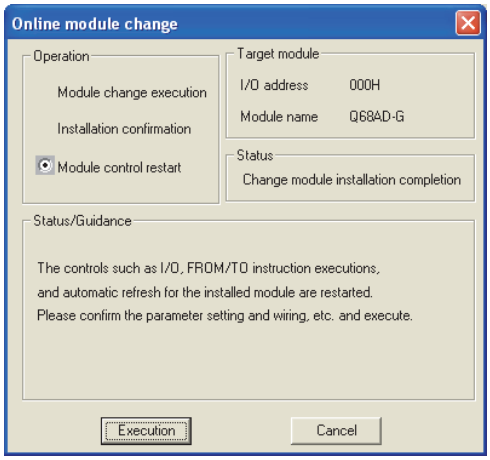
(a) Mount a new module to the same slot and install the connector.

(b) After mounting the module, click the [Execution] button and make sure that the "RUN" LED is lit. Module ready (X0) remains OFF.

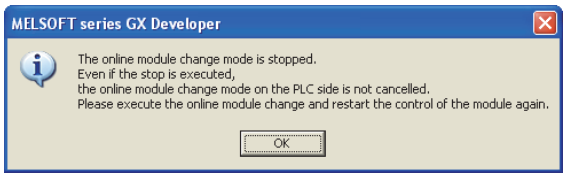


(4) Operation check

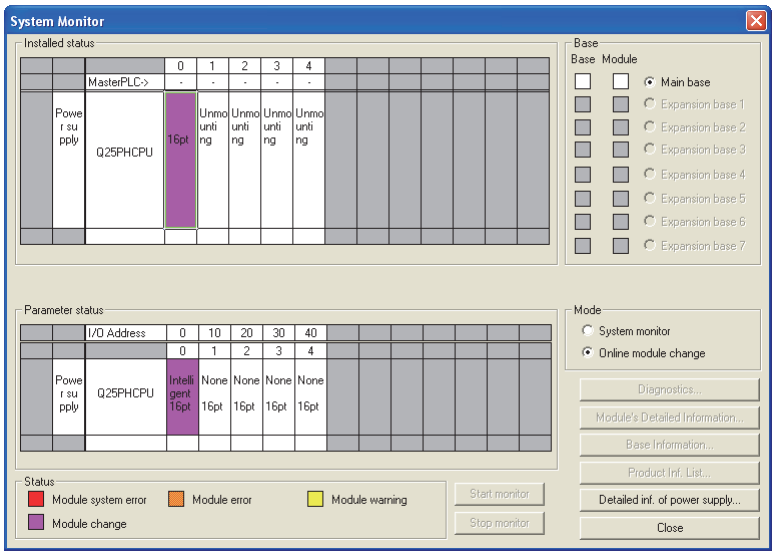
(a) To make an operation check, click the [Cancel] button to cancel control resumption.



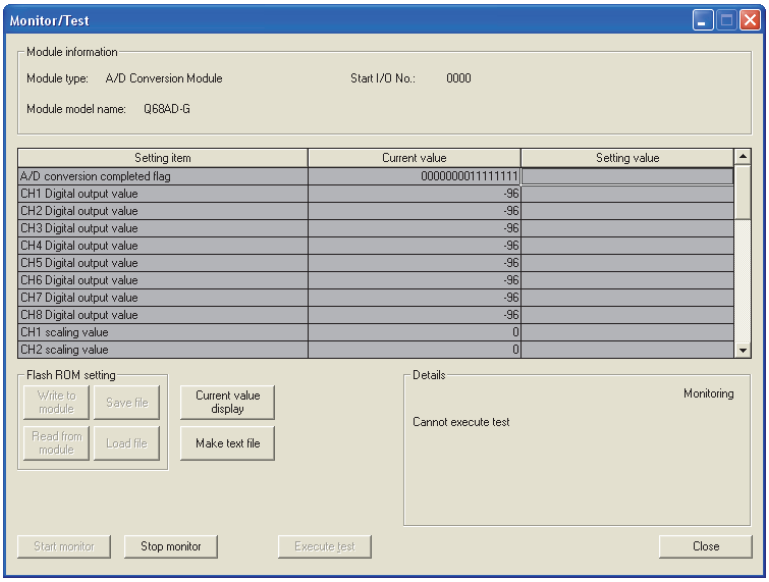
(b) Click the [OK] button to leave the "Online module change" mode.



(c) Click the [Close] button to close the System monitor window.

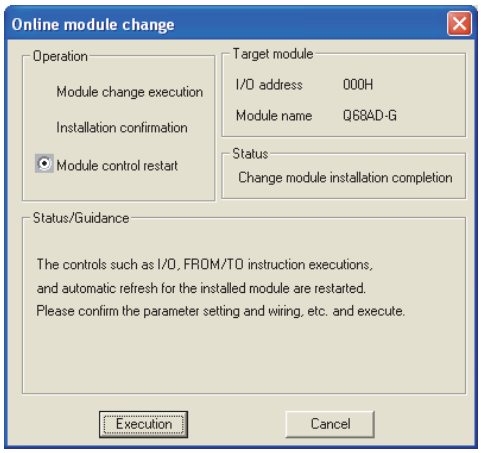


(d) Monitor CH□ digital output values (Un\G11 to Un\G18) to check if the conversion is processed normally.



(5) Resumption of control

(a) After choosing [Diagnosis] - [Online module change] on GX Developer to redisplay the "Online module change" window, click the [Execution] button to resume control. Module ready (X0) turns on.



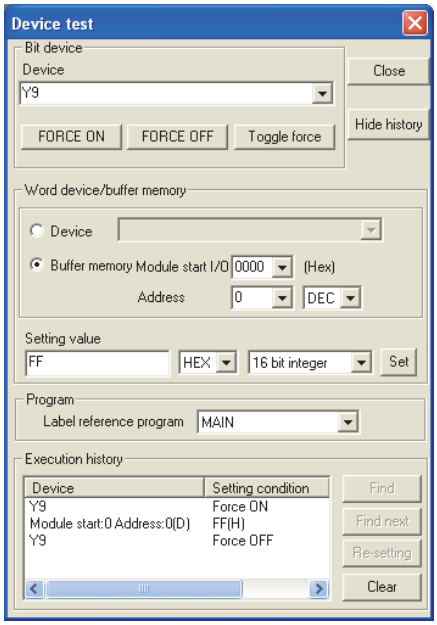
(b) The "Online module change completed" window appears.

7.3.2 When industrial shipment setting is used and initial setting was made with sequence program

(1) Conversion disable

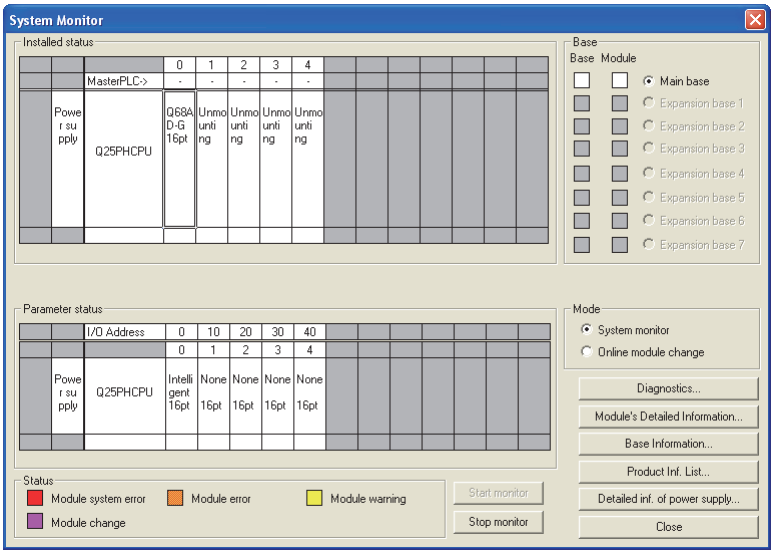
(a) Set the A/D conversion enable/disable setting (Un\G0) for all channel conversion disable and turn operating condition setting request (Y9) from OFF to ON to stop conversion.
After confirming that conversion has stopped with the A/D conversion completion flag (Un\G10), turn off Operation Condition Setting Request (Y9).

(The window shows the setting example of the Q68AD-G.)

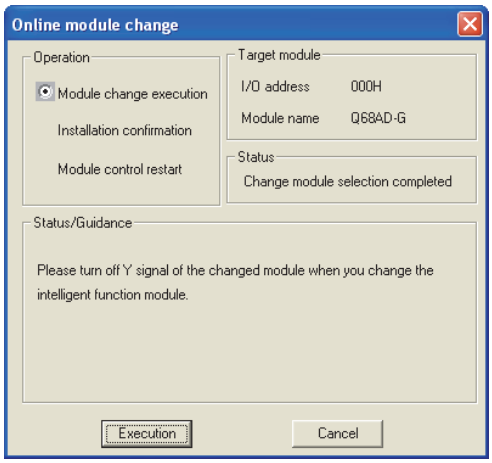


(2) Dismounting of module

(a) After choosing [Diagnosis] - [Online module change] on GX Developer to enter the "Online module change" mode, double-click the module to be changed online to display the "Online module change" window.



(b) Click the "Execution" button to enable a module change.



If the following error window appears, click the [OK] button, dismount the module as-is, and mount a new module.

(c) After confirming that the "RUN" LED of the module has turned off, remove the connector and dismount the module.

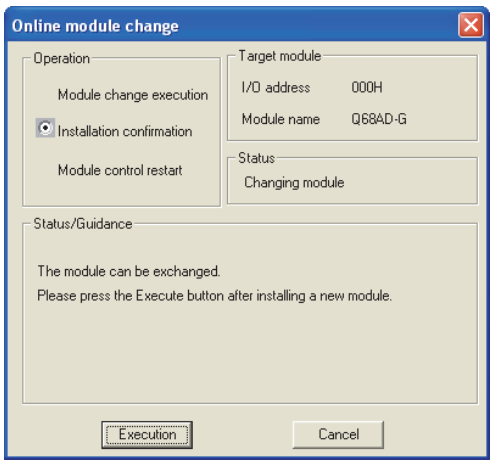
Point

Always dismount the module. If mounting confirmation is made without the module being dismounted, the module will not start properly and the "RUN" LED will not be lit.

(3) Mounting of new module

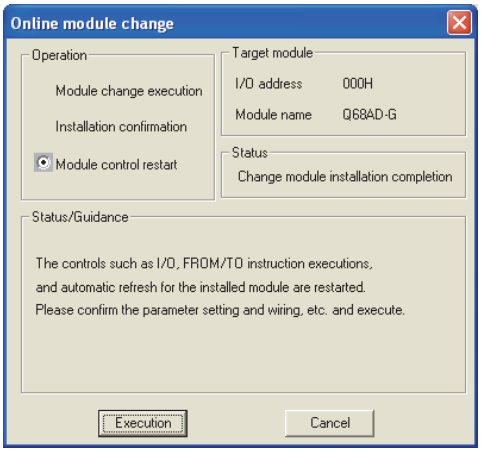
(a) Mount a new module to the same slot and install the connector.

(b) After mounting the module, click the [Execution] button and make sure that the "RUN" LED is lit. Module ready (X0) remains OFF.

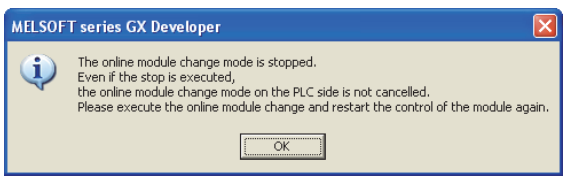


(4) Operation check

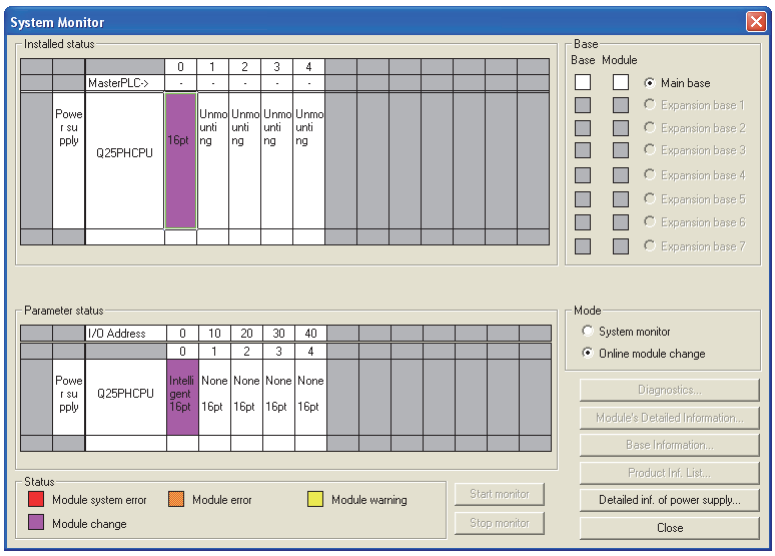
(a) To make an operation check, click the [Cancel] button to cancel control resumption.



(b) Click the [OK] button to leave the "Online module change" mode.



(c) Click the [Close] button to close the System monitor window.



(d) Enable the conversion of the channel to be used in A/D conversion enable/disable setting (Un\G0). Monitor CH□ digital output values (Un\G11 to Un\G18) to check if the conversion is processed normally.

(e) Since the new module is in a default status, it must be initialized by a sequence program after control resumption.
Before performing initialization, check whether the contents of the initialization program are correct or not.

1) Normal system configuration

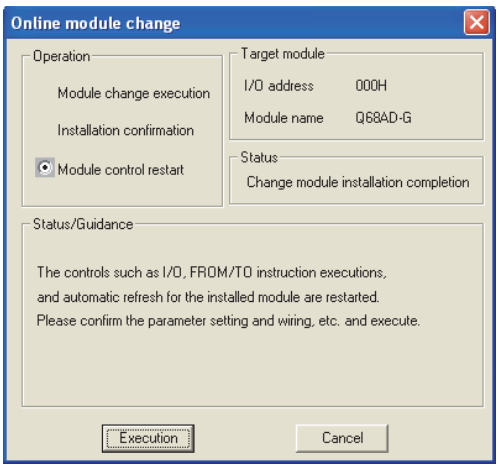
The sequence program should perform initialization on the leading edge of Module READY (X9) of the A/D converter module.
When control resumption is executed, Module READY (X0) turns ON and initialization is performed. (If the sequence program performs initialization only one scan after RUN, initialization is not performed.)

2) When used on remote I/O network

Insert a user device that will execute initialization at any timing (initialization request signal) into the sequence program. After control resumption, turn ON the initialization request signal to perform initialization. (If the sequence program performs initialization only one scan after a data link start of the remote I/O network, initialization is not performed.)

(5) Resumption of control

(a) After choosing [Diagnosis] - [Online module change] on GX Developer to redisplay the "Online module change" window, click the [Execution] button to resume control. Module ready (X0) turns on.

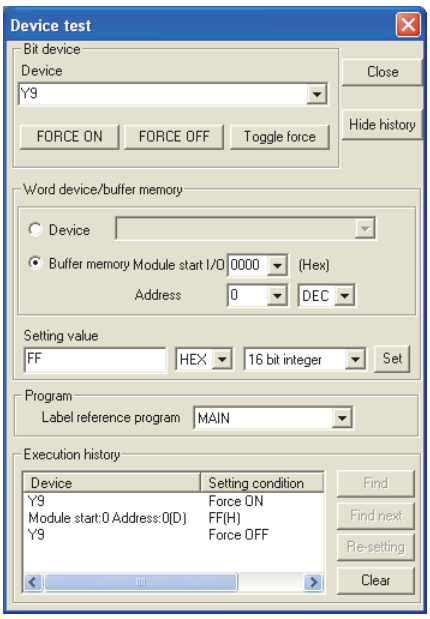


(b) The "Online module change completed" window appears.

7.3.3 When user range setting is used and initial setting was made with GX Configurator-AD (other system is available)

(1) Conversion disable

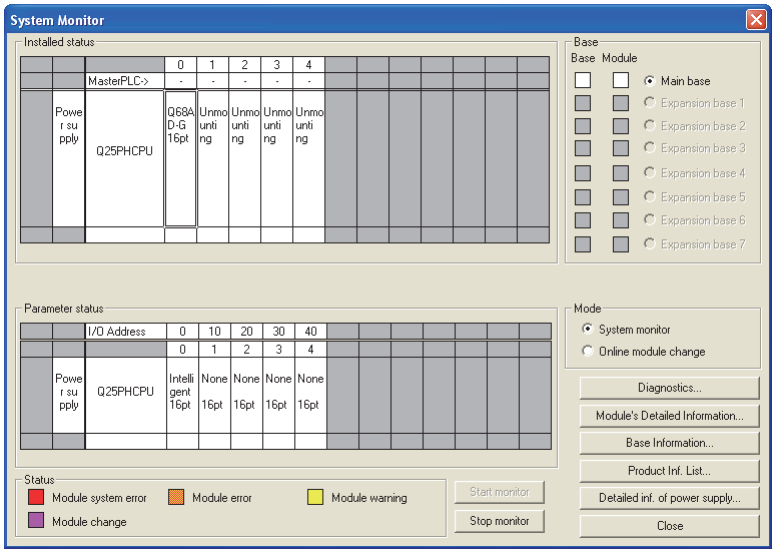
(a) Set the A/D conversion enable/disable setting (Un\G0) for all channel conversion disable and turn operating condition setting request (Y9) from OFF to ON to stop conversion.
After confirming that conversion has stopped with the A/D conversion completion flag (Un\G10), turn off Operation Condition Setting Request (Y9).



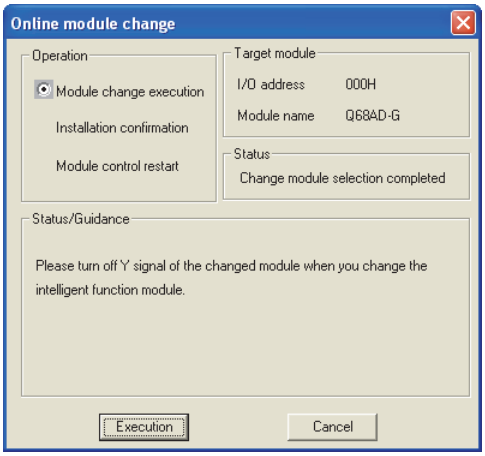
(The window shows the setting example of the Q68AD-G.)

(2) Dismounting of module

(a) After choosing [Diagnosis] - [Online module change] on GX Developer to enter the "Online module change" mode, double-click the module to be changed online to display the "Online module change" window.



(b) Click the "Execution" button to enable a module change.



If the following error window appears, the user range cannot be saved.
Click the [OK] button, dismount the module as-is, and perform the operation in Section 7.3.4 (2) (c) and later.

(c) After confirming that the "RUN" LED of the module has turned off, remove the connector and dismount the module.

Point

Always dismount the module. If mounting confirmation is made without the module being dismounted, the module will not start properly and the "RUN" LED will not be lit.

(3) Mounting of new module

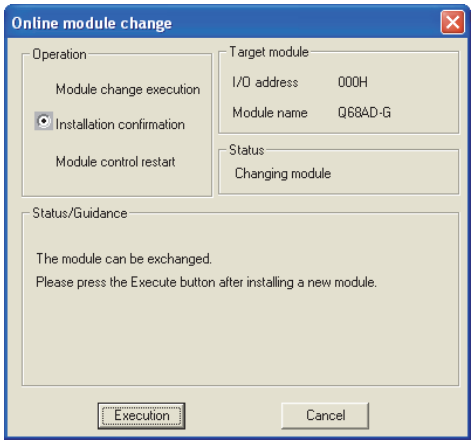
(a) Mount the dismounted module and new module to the other system.

(b) Using the G(P).OGLOAD instruction, save the user set values to the CPU device. Refer to Appendix 1.2 for the G(P).OGLOAD instruction.

(c) Using the G(P).OGSTOR instruction, restore the user set values to the module. Refer to Appendix 1.3 for the G(P).OGSTOR instruction.

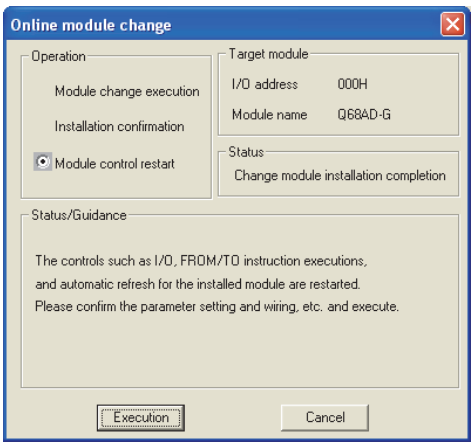
(d) Dismount the new module from the other system, mount it to the slot from where the old module was dismounted in the original system, and install the connector.

(e) After mounting the module, click the [Execution] button and make sure that the "RUN" LED is lit. Module ready (X0) remains OFF.

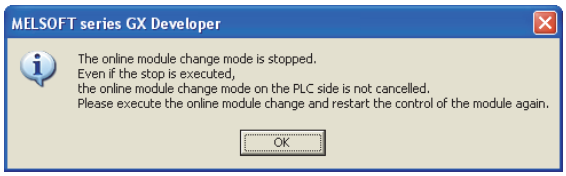


(4) Operation check

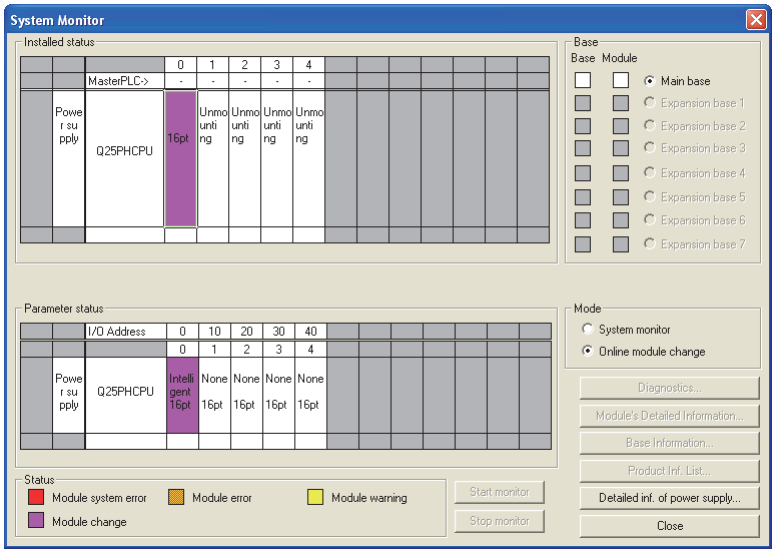
(a) To make an operation check, click the [Cancel] button to cancel control resumption.



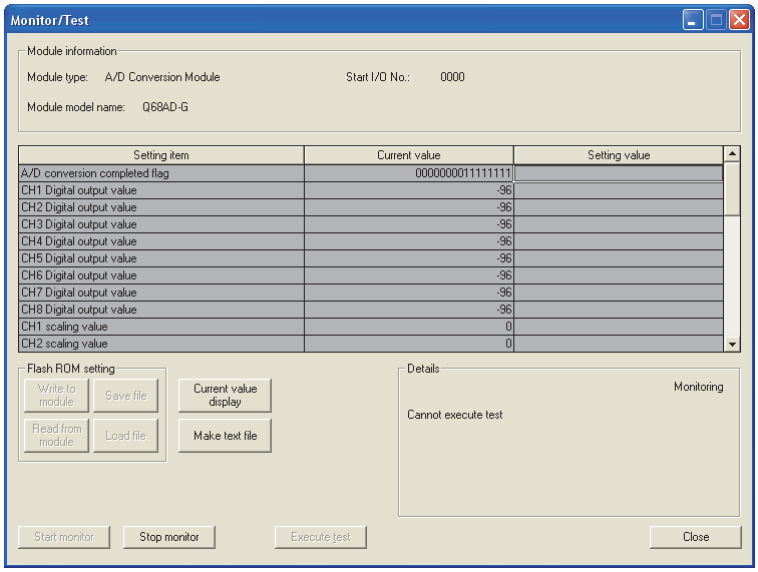
(b) Click the [OK] button to leave the "Online module change" mode.



(c) Click the [Close] button to close the System monitor window.

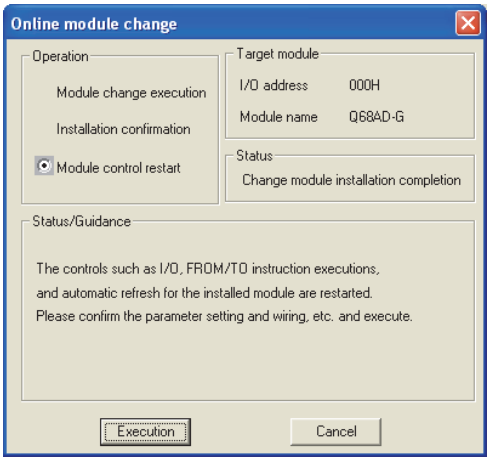


(d) Monitor CH□ digital output values (Un\G11 to Un\G18) to check if the conversion is processed normally.



(5) Resumption of control

(a) After choosing [Diagnosis] - [Online module change] on GX Developer to redisplay the "Online module change" window, click the [Execution] button to resume control. Module ready (X0) turns on.

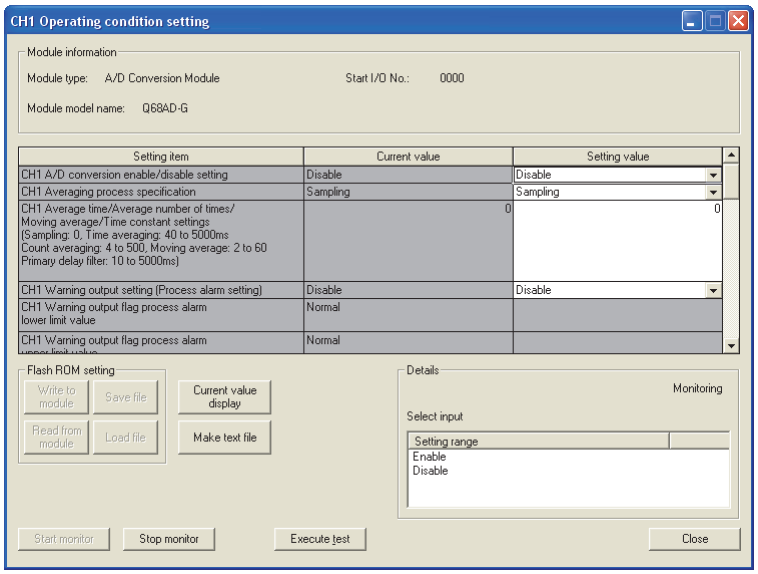


(b) The "Online module change completed" window appears.

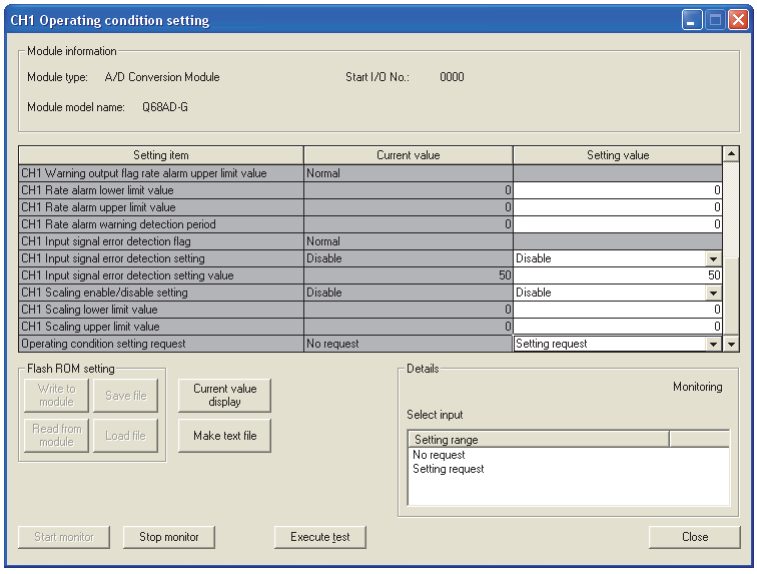
7.3.4 When user range setting is used and initial setting was made with GX Configurator-AD (other system is unavailable)

(1) Conversion disable

(a) On the Operating condition setting window of GX Configurator-AD, set "Disable" in the Setting value field of CH□ A/D conversion enable/disable setting, and click the [Execute test] button.



(b) After making sure that the indication in the Current value field of CH□ A/D conversion enable/disable setting is "Disable", change the Setting value field of Operating condition setting request to "Setting request", and click the [Execute test] button to stop conversion.
Monitor the A/D conversion completion flag (Un\G10) and confirm that conversion has stopped.



(c) If the saved buffer memory contents are not yet prerecorded, record them in the following procedure.

1) Display the pass data window of GX Configurator-AD.

2) Set the pass data classification setting*1 and make a pass data read request. (Refer to Section 5.6.3, 5.6.4)

3) Compare the current values of the industrial shipment settings and user range settings offset/gain values with those of the range reference table. Refer to Section 7.4 for the range reference table.

4) If the values are proper, record the offset/gain values of the pass data classification setting, industrial shipment settings and user range settings.

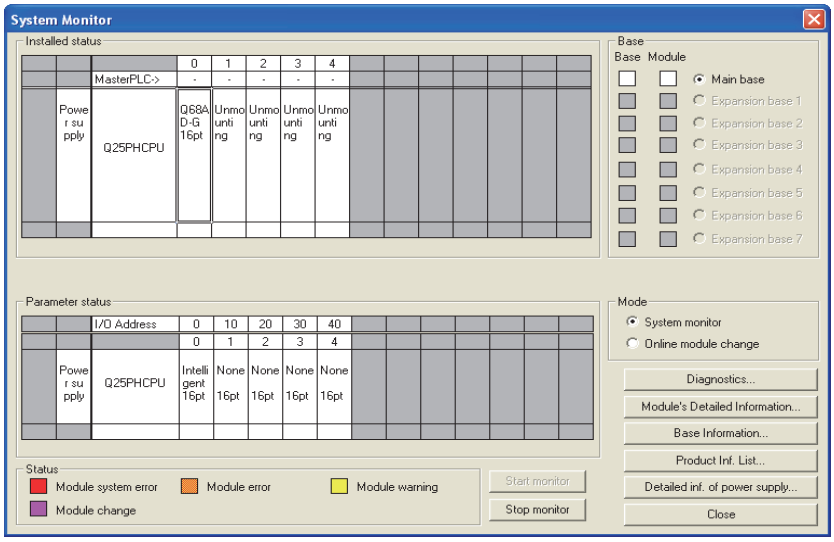
*1:The Q66AD-DG does not require the setting and recording of the pass data classification setting.

Point

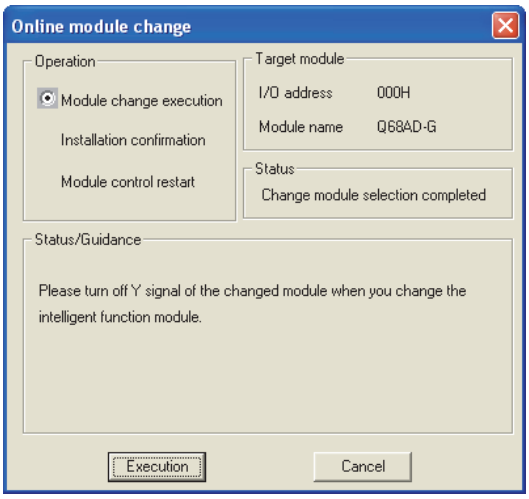
If the buffer memory values compared with the reference table are not proper, save and restoration of the user range cannot be executed.
Before executing module control resumption, make offset/gain setting in the GX Configurator-AD. (Refer to Section 5.6.2.)
Note that if module control is resumed without offset/gain setting being made, operation will be performed with the default values.

(2) Dismounting of module

(a) After choosing [Diagnosis] - [Online module change] on GX Developer to enter the "Online module change" mode, double-click the module to be changed online to display the "Online module change" window.



(b) Click the "Execution" button to enable a module change.



If the following error window appears, the user range cannot be saved.
Click the [OK] button, dismount the module as-is, and perform the operation in Section (2) (c) and later.

(c) After confirming that the "RUN" LED of the module has turned off, remove the connector and dismount the module.

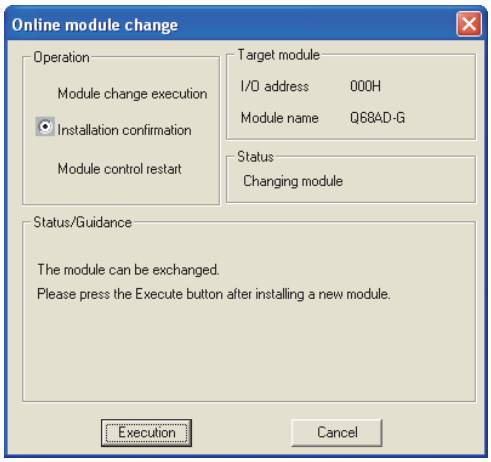
Point

Always dismount the module. If mounting confirmation is made without the module being dismounted, the module will not start properly and the "RUN" LED will not be lit.

(3) Mounting of new module

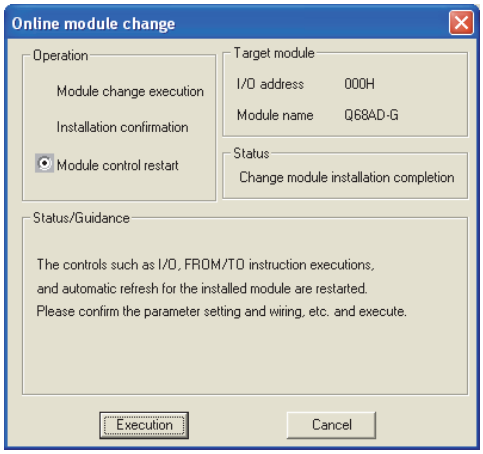
(a) Mount a new module to the same slot and install the connector.

(b) After mounting the module, click the [Execution] button and make sure that the "RUN" LED is lit. Module ready (X0) remains OFF.

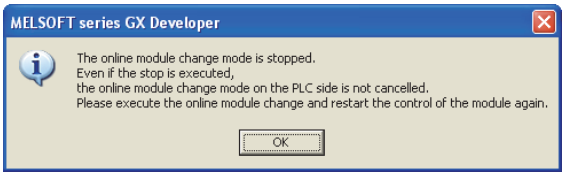


(4) Oeration check

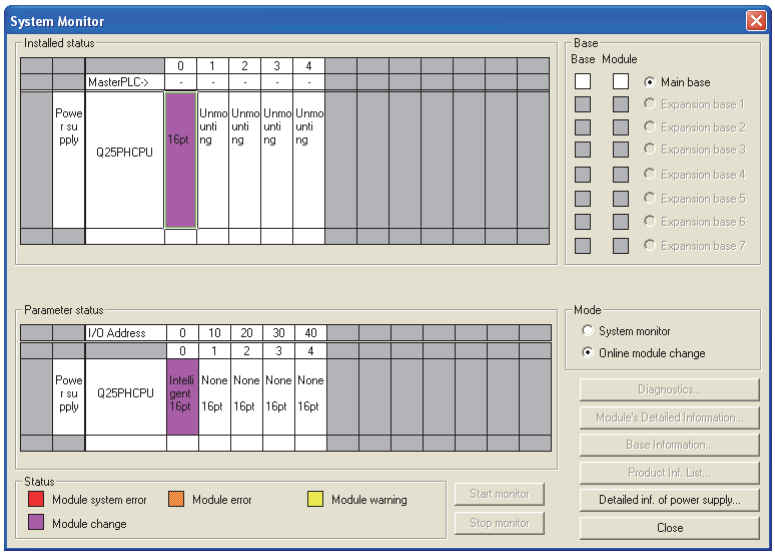
(a) To make an operation check, click the [Cancel] button to cancel control resumption.



(b) Click the [OK] button to leave the "Online module change" mode.

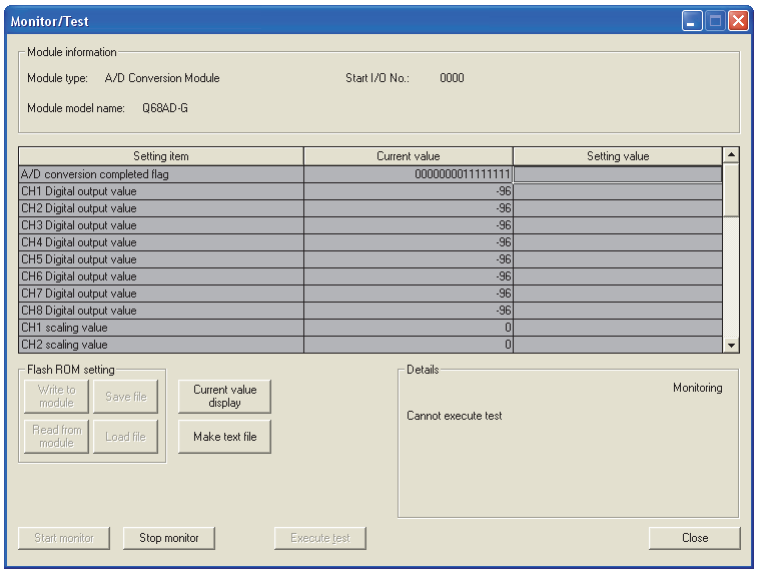


(c) Click the [Close] button to close the System monitor window.



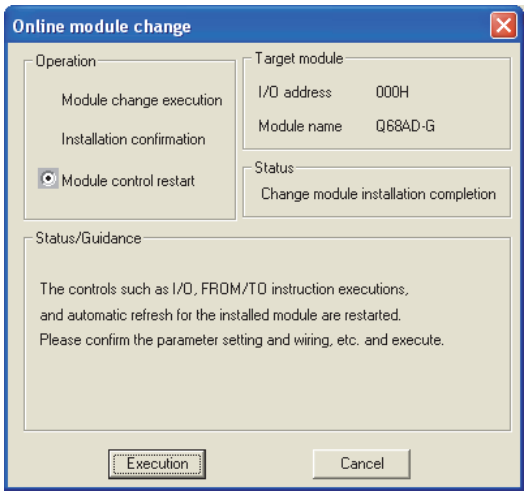
(d) On the pass data window of GX Configurator-AD, set the prerecorded values and make a pass data write request. (Refer to Section 5.6.3, 5.6.4.)

(e) Monitor CH□ digital output values (Un\G11 to Un\G18) to check if the conversion is processed normally.



(5) Resumption of control

(a) After choosing [Diagnosis] - [Online module change] on GX Developer to redisplay the "Online module change" window, click the [Execution] button to resume control. Module ready (X0) turns on.

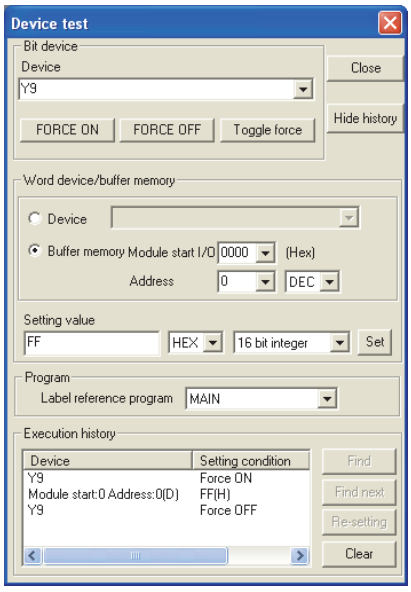


(b) The "Online module change completed" window appears.

7.3.5 When user range setting is used and initial setting was made with sequence program (other system is available)

(1) Conversion disable

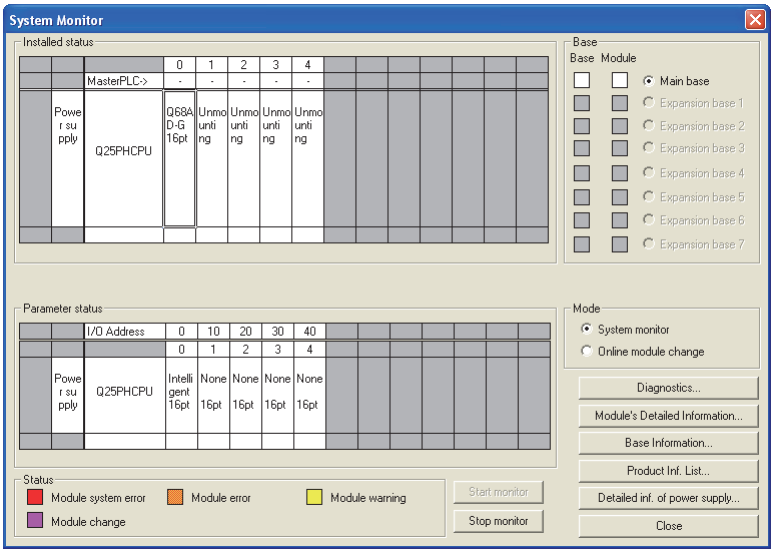
(a) Set the A/D conversion enable/disable setting (Un\G0) for all channel conversion disable and turn operating condition setting request (Y9) from OFF to ON to stop conversion.
After confirming that conversion has stopped with the A/D conversion completion flag (Un\G10), turn off Operation Condition Setting Request (Y9).



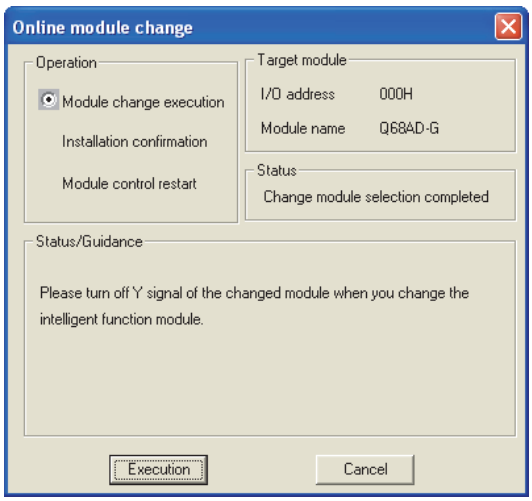
(The window shows the setting example of the Q68AD-G.)

(2) Dismounting of module

(a) After choosing [Diagnosis] - [Online module change] on GX Developer to enter the "Online module change" mode, double-click the module to be changed online to display the "Online module change" window.



(b) Click the "Execution" button to enable a module change.



If the following error window appears, the user range cannot be saved.
Click the [OK] button, dismount the module as-is, and perform the operation in Section 7.3.6 (2) (c) and later.

(c) After confirming that the "RUN" LED of the module has turned off, remove the connector and dismount the module.

Point

Always dismount the module. If mounting confirmation is made without the module being dismounted, the module will not start properly and the "RUN" LED will not be lit.

(3) Mounting of new module

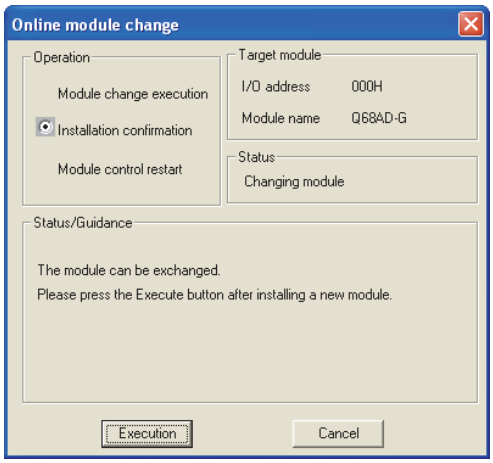
(a) (Mount the dismounted module and new module to the other system.

(b) Using the G(P).OGLOAD instruction, save the user set values to the CPU device. Refer to Appendix 1.2 for the G(P).OGLOAD instruction.

(c) Using the G(P).OGSTOR instruction, restore the user set values to the module. Refer to Appendix 1.3 for the G(P).OGSTOR instruction.

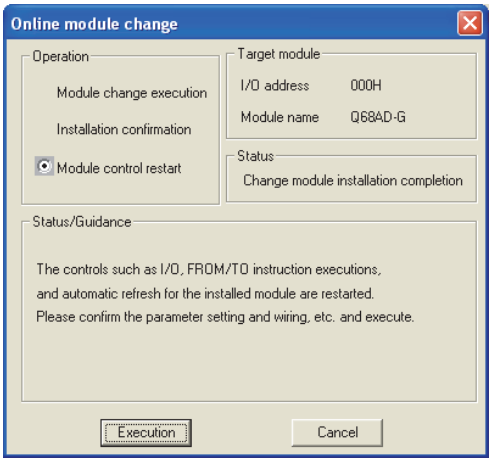
(d) Dismount the new module from the other system, mount it to the slot from where the old module was dismounted in the original system, and install the connector.

(e) After mounting the module, click the [Execution] button and make sure that the "RUN" LED is lit. Module ready (X0) remains OFF.

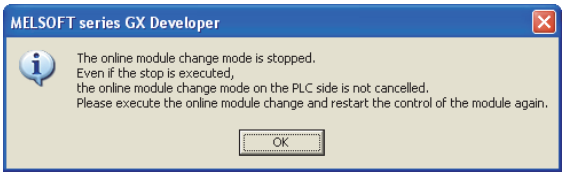


(4) Operation check

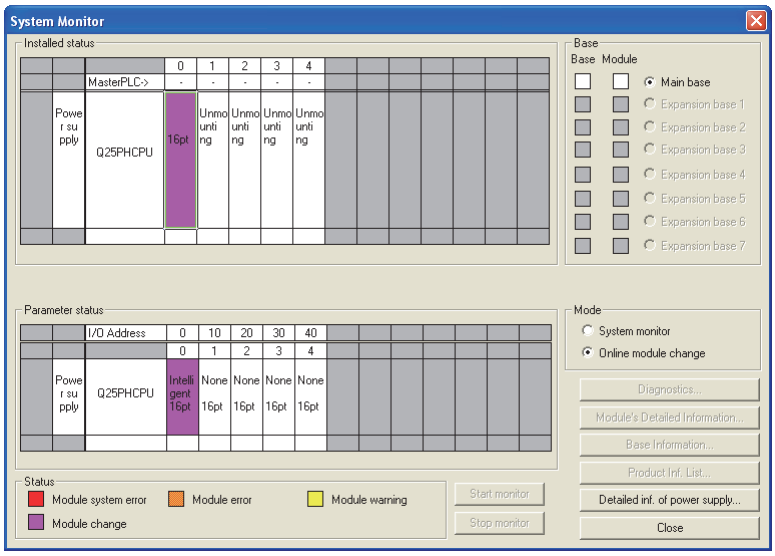
(a) To make an operation check, click the [Cancel] button to cancel control resumption.



(b) Click the [OK] button to leave the "Online module change" mode.



(c) Click the [Close] button to close the System monitor window.



(d) Enable the conversion of the channel to be used in A/D conversion enable/disable setting (Un\G0). Monitor CH□ digital output values (Un\G11 to Un\G18) to check if the conversion is processed normally.

(e) Since the new module is in a default status, it must be initialized by a sequence program after control resumption.
Before performing initialization, check whether the contents of the initialization program are correct or not.

1) Normal system configuration

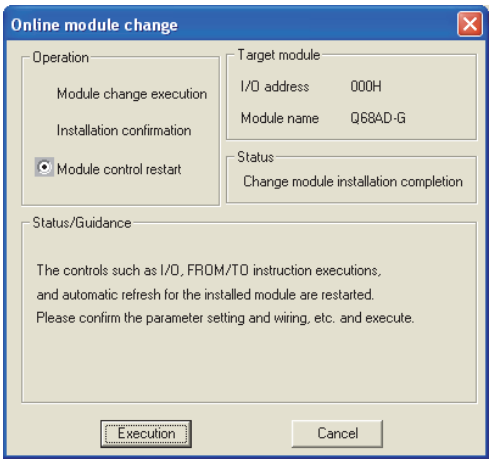
The sequence program should perform initialization on the leading edge of Module READY (X9) of the A/D converter module.
When control resumption is executed, Module READY (X0) turns ON and initialization is performed. (If the sequence program performs initialization only one scan after RUN, initialization is not performed.)

2) When used on remote I/O networ

Insert a user device that will execute initialization at any timing (initialization request signal) into the sequence program. After control resumption, turn ON the initialization request signal to perform initialization. (If the sequence program performs initialization only one scan after a data link start of the remote I/O network, initialization is not performed.)

(5) Resumption of control

(a) After choosing [Diagnosis] - [Online module change] on GX Developer to redisplay the "Online module change" window, click the [Execution] button to resume control. Module ready (X0) turns on.

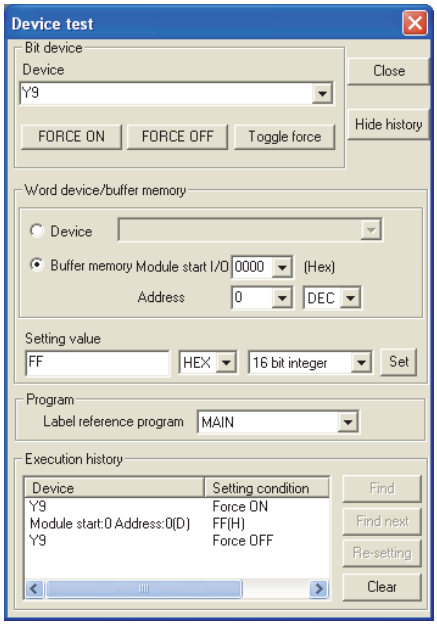


(b) The "Online module change completed" window appears.

7.3.6 When user range setting is used and initial setting was made with sequence program (other system is unavailable)

(1) Conversion disable

(a) Set the A/D conversion enable/disable setting (Un\G0) for all channel conversion disable and turn operating condition setting request (Y9) from OFF to ON to stop conversion.
After confirming that conversion has stopped with the A/D conversion completion flag (Un\G10), turn off Operation Condition Setting Request (Y9).



(The window shows the setting example of the Q68AD-G.)

(b) If the saved buffer memory contents are not yet prerecorded, record them in the following procedure.

1) Make the pass data classification setting*1 (Un\G200).
2) Turn operating condition setting request (Y9) from OFF to ON.
3) Compare the offset/gain values of the industrial shipment settings and user range settings (Un\G202 to Un\G233) with the range reference table. Refer to Section 7.4 for the range reference table.
4) If the values are proper, record the offset/gain values of the pass data classification setting*1, industrial shipment settings and user range settings.

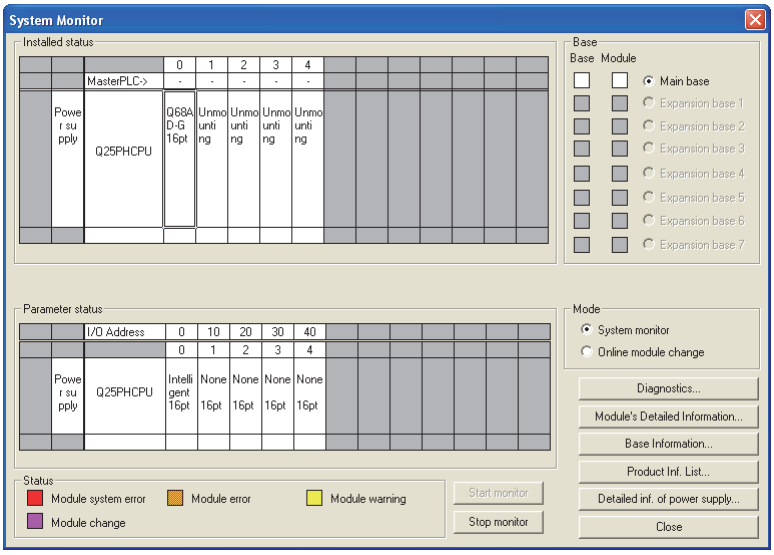
*1:The Q66AD-DG does not require the setting and recording of the pass data classification setting.

Point

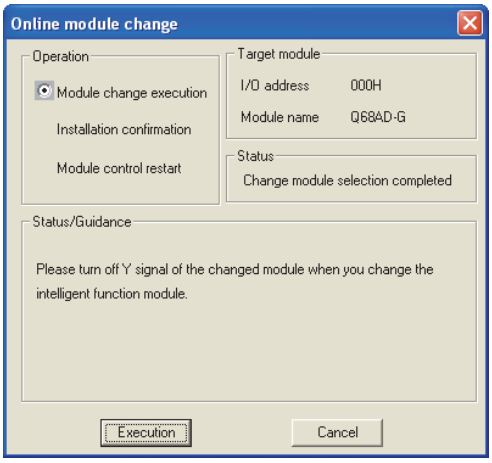
If the buffer memory values compared with the reference table are not proper, save and restoration of the user range cannot be executed. Before resuming module control, follow the flowchart in Section 4.6.1 for the Q68AD-G, or follow the flowchart in Section 4.6.2 for the Q66AD-DG, and make offset/gain setting in the device test of GX Developer.
Perform mode switching by making the setting of the mode switching setting (Un\G158, Un\G159) and turning operating condition setting request (Y9) from OFF to ON.
Note that if module control is resumed without offset/gain setting being made, operation will be performed with the default values.

(2) Dismounting of module

(a) After choosing [Diagnosis] - [Online module change] on GX Developer to enter the "Online module change" mode, double-click the module to be changed online to display the "Online module change" window.



(b) Click the "Execution" button to enable a module change.



If the following error window appears, the user range cannot be saved.
Click the [OK] button, dismount the module as-is, and perform the operation in Section (2) (c) and later.

(c) After confirming that the "RUN" LED of the module has turned off, remove the connector and dismount the module.

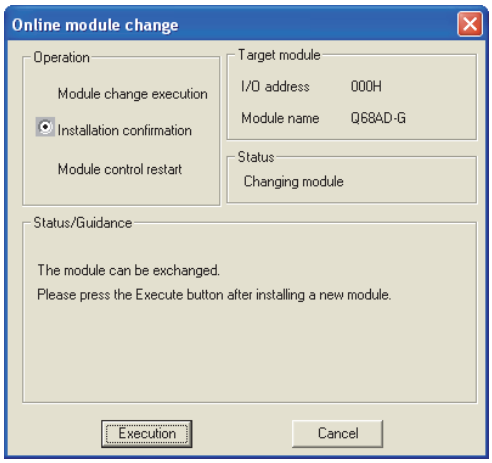
Point

Always dismount the module. If mounting confirmation is made without the module being dismounted, the module will not start properly and the "RUN" LED will not be lit.

(3) Mounting of new module

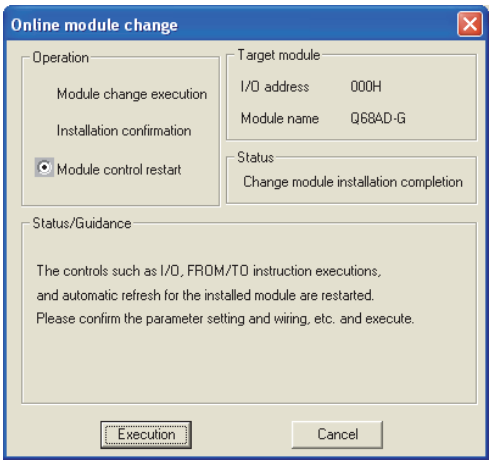
(a) Mount a new module to the same slot and install the connector.

(b) After mounting the module, click the [Execution] button and make sure that the "RUN" LED is lit. Module ready (X0) remains OFF.

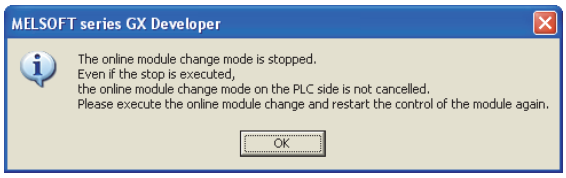


(4) Operation check

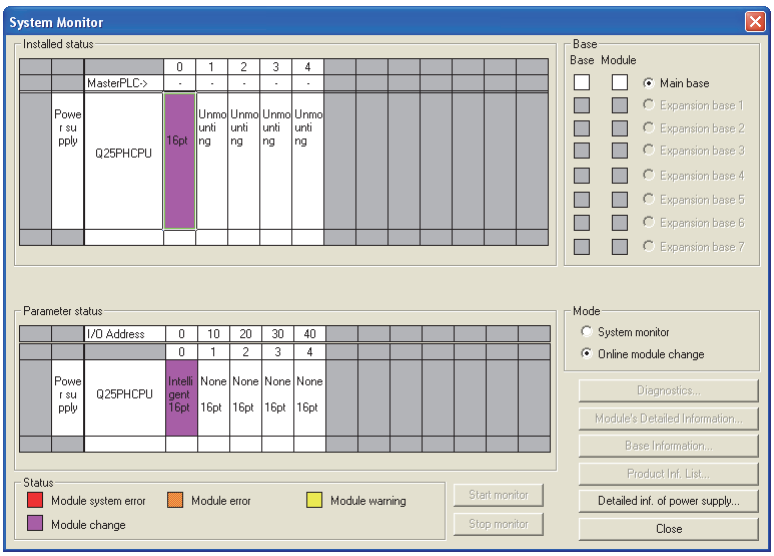
(a) To make an operation check, click the [Cancel] button to cancel control resumption.



(b) Click the [OK] button to leave the "Online module change" mode.



(c) Click the [Close] button to close the System monitor window.



(d) Choose [Online] - [Debug] - [Device test] on GX Developer and set the prerecorded values to the buffer memory.

(e) Turn the user range writing request (YA) from OFF to ON to restore the user set values to the module.
After confirming that the offset/gain setting mode status flag (XA) is ON, turn OFF the user range write request (YA).

(f) Enable the conversion of the channel to be used in A/D conversion enable/disable setting (Un\G0). Monitor CH□ digital output values (Un\G11 to Un\G18) to check if the conversion is processed normally.

(g) Since the new module is in a default status, it must be initialized by a sequence program after control resumption.
Before performing initialization, check whether the contents of the initialization program are correct or not.

1) Normal system configuration

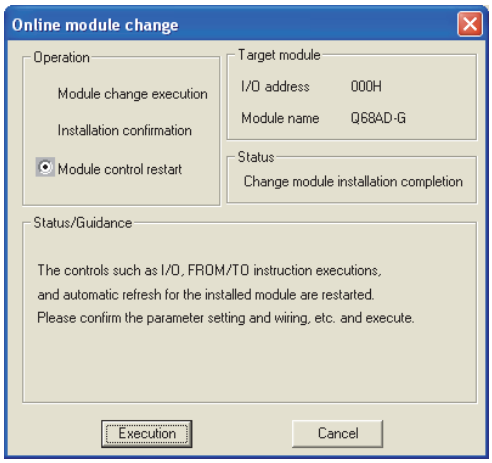
The sequence program should perform initialization on the leading edge of Module READY (X9) of the A/D converter module.
When control resumption is executed, Module READY (X0) turns ON and initialization is performed. (If the sequence program performs initialization only one scan after RUN, initialization is not performed.)

2) When used on remote I/O network

Insert a user device that will execute initialization at any timing (initialization request signal) into the sequence program. After control resumption, turn ON the initialization request signal to perform initialization. (If the sequence program performs initialization only one scan after a data link start of the remote I/O network, initialization is not performed.)

(5) Resumption of control

(a) After choosing [Diagnosis] - [Online module change] on GX Developer to redisplay the "Online module change" window, click the [Execution] button to resume control. Module ready (X0) turns on.



(b) The "Online module change completed" window appears.

7.4 Range Reference Table

The range reference tables are given below.

(1) Reference table for offset/gain values of industrial shipment settings (Un\G202 to Un\G217)

(a) For Q68AD-G

The reference values change depending on the setting of the pass data classification setting (Un\G200).

Address (Decimal)								Description	Pass data classification setting (Un\G200)	Reference value (Hexadecimal)
CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8			
202	204	206	208	210	212	214	216	Industrial shipment settings offset value	Voltage specified (0V)	Approx. 0H
									Current specified (0mA)	Approx. 0H
203	205	207	209	211	213	215	217	Industrial shipment settings gain value	Voltage specified (10V)	Approx. 6666H
									Current specified (20mA)	Approx. 3333H

(b) For Q66AD-DG

Address (Decimal)						Description	Reference value (Hexadecimal)
CH1	CH2	CH3	CH4	CH5	CH6		
202	204	206	208	210	212	Industrial shipment settings offset value	Approx. 0H
							Approx. 0H
203	205	207	209	211	213	Industrial shipment settings gain value	Approx. 6666H
							Approx. 3333H

(2) Reference table for user range settings offset/gain values (Un\G218 to 233)

(a) For Q68AD-G

Offset/gain value		Reference value (Hexadecimal)
Voltage	0V	Approx. 0H
	1V	Approx. 0A3DH
	5V	Approx. 3333H
	10V	Approx. 6666H
Current	0mA	Approx. 0H
	4mA	Approx. 0A3DH
	20mA	Approx. 3333H

(b) For Q66AD-DG

Offset/gain value	Reference value (Hexadecimal)
0mA	Approx. 0H
4mA	Approx. 10E5H
20mA	Approx. 547BH

Example)

When the offset value of the Q68AD-G channel 1 is 1V and its gain value is 5V, the reference value of the CH1 user range settings offset value (Un\G218) is approximately 0A3DH, and the reference value of the CH1 user range settings gain value (Un\G220) is approximately 3333H.

7.5 Precautions for Online Module Change

The following are the precautions for online module change.

(1) Always perform an online module change in the correct procedure. A failure to do so can cause a malfunction or failure.

(2) If an online module change is made with the user range setting, the accuracy after that will fall to about less than three times of the accuracy before that.
Re-set the offset/gain values as necessary.

(3) During an online module change, do not perform the operations below. If they are performed, the A/D converter module may not operate normally.
- Powering off the programmable controller CPU
- Resetting the programmable controller CPU

8 TROUBLESHOOTING

The following section explains the types of errors that may occur when the A/D converter module is used, and how to troubleshoot such errors.

8.1 Error Code List

If an error occurs in the A/D converter module while writing to or reading data from the programmable controller CPU, an error code is written to buffer memory address 19 (Un\G19).

Table8.1 Error code list (1/3)

Error code (decimal)	Error description	Action
10□	The input range is set with an illegal value in the intelligent function module switch setting in GX Developer. □ indicates the channel number set incorrectly.	Set a correct parameter value in the parameter setting of GX Developer. (Refer to Section 4.5.)
111	Hardware error of the module.	Turn the power OFF and ON again. If the error occurs again, the module may be malfunctioning. Please consult your local Mitsubishi representative.
112	The setting of the intelligent function module switch 5 is other than 0.	Set a correct parameter value in the parameter setting of GX Developer. (Refer to Section 4.5.)
120*1	An invalid value is set in the offset/gain setting. The number of the error channel is not identified	Perform the offset/gain setting again for all of the channels that use the user range settings. If the error occurs again, the module may be malfunctioning. Please consult your local Mitsubishi representative.
12□*1	An invalid value is set in the offset/gain setting. □ indicates the channel number set incorrectly.	Perform the offset/gain setting again for the error channel. If the error occurs again, the module may be malfunctioning. Please consult your local Mitsubishi representative.
161*2	The G(P).OGSTOR instruction was executed in the offset/gain setting mode.	Do not execute the G(P).OGSTOR instruction in the offset/gain setting mode.
162	• The G(P).OGSTOR instruction was executed consecutively. • At the time of offset/gain setting, a set value was written to the E^2PROM 26 or more times.	• Execute the G(P).OGSTOR instruction only once for one module. • At the time of offset/gain setting, write a set value only once at one time.
163	The G(P).OGSTOR instruction was executed for the model that differs from the model for which the G(P).OGLOAD instruction had been executed.	Execute the G(P).OGLOAD and G(P).OGSTOR instructions for the same model.

Table 8.1 Error code list (2/3)

Error code (decimal)	Error description	Processing
20□*3	The averaging time set in Un\G1 to Un\G8 is outside the range of 40 to 5000ms. □ indicates the channel number set incorrectly.	Reset the averaging time setting to within 40 to 5000ms. Also, the set value must be "4 x 10 x No. of channels used" or greater.
30□*3	The averaging count set in Un\G1 to Un\G8 is outside the range of 4 to 500 times. □ indicates the channel number set incorrectly.	Reset the averaging count setting to within 4 to 500 times.
31□*3	The moving average count set in Un\G1 to Un\G8 is outside the range of 2 to 60 times. □ indicates the channel number set incorrectly.	Reset the moving average count setting to within 2 to 60 times.
32□*3	The time constant for the primary delay filter set in Un\G1 to Un\G8 is outside the range of 10 to 5000. □ indicates the channel number set incorrectly.	Reset the time constant setting to within 10 to 5000. Also, the set value must be "10 x No. of channels used" or greater.
34□*3	In the CH□ rate alarm upper/lower limit value (Un\G126 to Un\G141) setting, Lower limit ≧ Upper limit. □ indicates the channel number set incorrectly.	Reset the CH□ rate alarm upper/lower limit value (Un\G126 to Un\G141) so that the lower limit value is smaller than the upper limit value.
35□*3 (Q66AD-DG only)	The conversion starting time setting (for 2-wire transmitter) (Un\G78 to Un\G83) is outside the range of 0 to 32767. □ indicates the channel number set incorrectly.	Reset the conversion starting time setting (for 2-wire transmitter) to within 0 to 32767.
40□*1	The offset value is equal to or greater than the gain value at the time of user range setting or user range restoration. □ indicates the error causing channel number.	Reset so that the offset value becomes smaller than the gain value.
500*1	The offset/gain channels were set at the same time during offset and gain value settings, or both were set to 0.	Reset the contents of buffer memory addresses 22 and 23 (Un\G22 and Un\G23).

Table 8.1 Error code list (3/3)

Error code (decimal)	Error description	Processing
6△□*3	The process alarm upper/lower limit value (Un\G86 to Un\G117) are set contradictorily. □indicates the channel number set incorrectly. △indicates the following state. 2: Lower lower limit value > lower upper limit value 3: Lower upper limit value > upper lower limit value 4: Upper lower limit value > upper upper limit value	Reset the contents of the process alarm upper/ lower limit values (Un\G86 to Un\G117).
70□*3	The rate alarm warning detection period (Un\G118 to Un\G125) is outside the range of 10 to 5000ms. □ indicates the channel number set incorrectly.	Reset the rate alarm warning detection period (Un\G118 to Un\G125) to within 10 to 5000ms.
71□*3	The rate alarm warning detection period (Un\G118 to Un\G125) is not: • A multiple of the sampling cycle or • A multiple of the time or count averaging conversion cycle. □ indicates the channel number set incorrectly.	Change the value of the rate alarm warning detection period as follows: • For sampling processing: A multiple of conversion cycle (10ms x No. of conversion-enabled channels) • For averaging processing: A multiple of time or count averaging conversion cycle
72□*3	When the time or count averaging setting in Un\G1 to Un\G8 is changed, the rate alarm warning detection period is not a multiple of the corresponding new time or count averaging conversion period. □ indicates the channel number set incorrectly.	Reset the time averaging or count averaging setting so that the corresponding rate alarm warning detection period is a multiple of the time or count averaging conversion period.
80□*3	When the "Same upper limit value/lower limit value" is selected for the input signal error detection extended setting, • CH□ input signal error detection setting value (Un\G142 to Un\G149) is outside the range of 0 to 250. □ indicates the channel number set incorrectly.	Reset the input signal error detection setting value to within 0 to 250.
	When the "Different upper limit value/lower limit value" is selected for the input signal error detection extended setting, • Input signal error detection lower limit setting value (Un\G142 to Un\G149) is outside the range of 0 to 251. • Input signal error detection upper limit setting value (Un\G150 to Un\G157) is outside the range of 0 to 251. □ indicates the channel number set incorrectly.	Reset the input signal error detection lower limit setting value and input signal error detection upper limit setting value within 0 to 251.
90□*3	The scaling upper/lower limit value (Un\G62 to Un\G77) is set outside the range of –32000 to 32000. □ indicates the channel number set incorrectly.	Correct the scaling upper/lower limit value within the range of –32000 to 32000.
91□*3	In the scaling upper/lower limit value setting (Un\G62 to Un\G77), Lower limit ≧ Upper limit. □ indicates the channel number set incorrectly.	Set them again so that he scaling upper limit value is greater than the scaling lower limit value.

Point

(1) When two or more errors have occurred, the latest error found by the A/D converter module is stored.

(2) The error codes marked with *1 can be cleared by turning ON the error clear request (YF).

(3) Error code 161 marked with *2 is not stored in the Error code (Un\G19) area. It is written to the Completion status area, (S) + 1, of the G(P).OGSTOR instruction.

(4) The error codes marked with *3 can be cleared by one of the following operations.

(a) Turning on the error clear request (YF)

(b) Turning on the operating condition setting request (Y9) after correcting the set value to the one in the setting range

8.2 Troubleshooting

8.2.1 When the "RUN" LED is flashing or turned off

(1) When flashing

Check item	Corrective action
Is the mode set to the offset/gain setting mode?	Reset switch 4 of the intelligent function module switch setting for GX Developer to the normal mode (Refer to Section 4.5).

(2) When off

Check item	Corrective action
Is the power being supplied?	Confirm that the supply voltage for the power supply module is within the rated range.
Is the capacity of the power supply module adequate?	Calculate the current consumption of the CPU module, I/O module and intelligent function module mounted on the base unit to see if the power supply capacity is adequate.
Has a watchdog timer error occurred?	Reset the programmable controller CPU and verify that it is lit. If the RUN LED does not light even after doing this, the module may be malfunctioning. Please consult your local Mitsubishi representative.
Is the module correctly mounted on the base unit?	Check the mounting condition of the module.
Is a module change enabled during an online module change?	Refer to Chapter 7 and take corrective action.

8.2.2 When the "ERR." LED is on or flashing

(1) When on

Check item	Corrective action
Is an error being generated?	Confirm the error code and take corrective action described in Section 8.1.

(2) When flashing

Check item	Corrective action
Is intelligent function module setting switch 5 set to "other than 0"?	Using GX Developer parameter setting, set intelligent function module setting switch 5 to "0" (Refer to Section 4.5).

8.2.3 When the "ALM" LED is on or flashing

(1) When on

Check item	Corrective action
Is a warning output being generated?	Check the warning output flag (Un\G50, Un\G51).

(2) When flashing

Check item	Corrective action
Is an input signal error being generated?	Check the input signal error detection flag (Un\G49).

8.2.4 When the digital output values cannot be read

Check item	Corrective action
Is 24VDC external power supply being supplied? (Q66AD-DG only)	Check that the external power supply terminals (between terminals No. A19 and A20 or B19 and B20) are supplied with a 24VDC voltage.
Is there any fault with the analog signal lines such as disconnection (for the Q66AD-DG, disconnection of the signal line with the 2-wire transmitter) or wire break?	Check for faulty condition of the signal lines by a visual check and a continuity check.
Is the CPU module in the STOP status?	Set the CPU module to the RUN status.
Are the offset/gain settings correct?	Verify that the offset/gain settings are correct (Refer to Section 4.6 and 5.6.2). If the user range is being used, switch to a different default input range and check if A/D conversion is correctly performed. If so redo the offset/gain settings.
Is the input range setting correct?	Check the Un\G20, Un\G21 in the monitor of GX Developer. If the input range setting is incorrect, redo the GX Developer intelligent function module switch setting (Refer to Section 4.5).
Is the A/D conversion enable/disable setting for the channel to be used set to A/D conversion disabled?	Check the ON/OFF status with Un\G0 in GX Developer monitor and review the initial setting of the sequence program or utility package. (Refer to Section 3.4).
Is a large value set to the A/D conversion starting time setting (for the 2-wire transmitter) (Q66AD-DG only)?	Check the Un\G78 to Un\G83 in the monitor of GX Developer.
Has the operating condition setting request (Y9) been executed?	From GX Developer, turn the operating condition setting request (Y9) from ON to OFF to check that the digital output values are stored into the Un\G11 to Un\G18. If so, review the initial setting of the sequence program or utility package (Refer to Section 3.3).
Is the value set for the averaging processing specification correct?	• For the time averaging, set a value of "4 (times) x 10 (ms) x No. of channels" or greater. • For the primary delay filter, set a value of "10 (ms) x No. of channels" or greater. If the above requirements are not met, 0 is stored as a digital output value.
In the case of current input are terminals (V+) and (|+) connected ? (For the Q68AD-G only)	In the case of current input, connect terminals (V+) and (|+) referring to Section 4.4.2.

Point

The module may be faulty if the digital output values cannot be read after proper corrective actions have been taken according to the above check items. Please consult your local Mitsubishi representative.

8.2.5 When A/D conversion completed flag does not turn ON during use in normal mode

Check item	Corrective action
Is 24VDC external power supply being supplied? (Q66AD-DG only)	Check that the external power supply terminals (between terminals No. A19 and A20 or B19 and B20) are supplied with a 24VDC voltage.
Is an input signal error being generated?	Check the input signal error detection flag (Un\G49).

8.2.6 Checking the A/D converter module status using GX Developer system monitor

When the A/D converter module detail information is selected in GX Developer system monitor, error code, LED ON status and status of the intelligent function module switch setting can be checked.

(1) Operating GX Developer

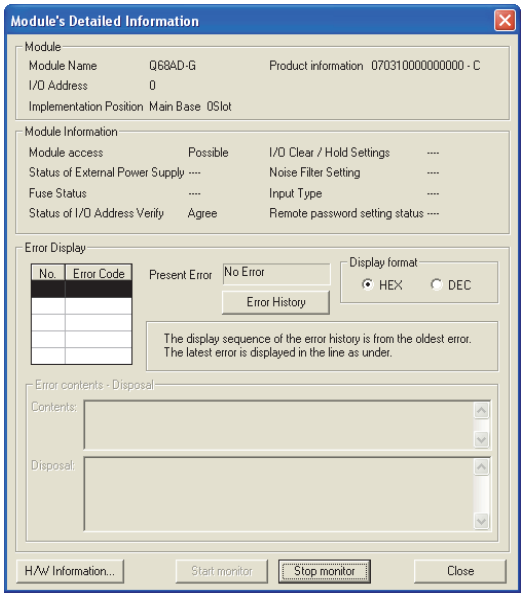
[Diagnostics] → [System monitor] → Select the A/D conversion module checking the status. → Module Detailed Information

(2) Module Detail Information

(a) Checking the function version and product information
The function version and product information of the A/D converter module are displayed in the product information field.

(b) Checking the error code
The error code stored in buffer memory address 19 (Un\G19) of the A/D converter module is displayed in the Present Error field.

(When the Error History button is pressed, the contents displayed in the Present Error field are displayed in the No. 1 field.)



(3) H/W information

(a) H/W LED information

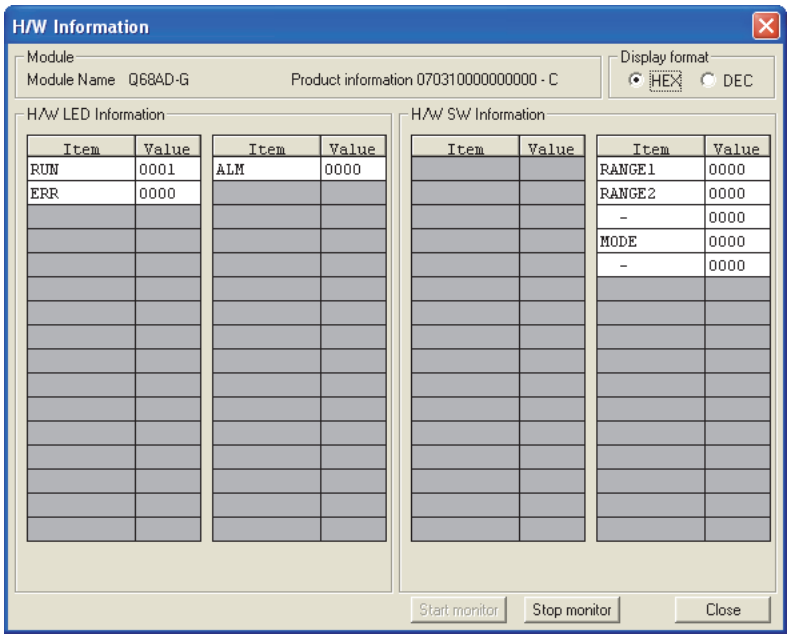
The LED ON status is displayed.

No.	LED name	Status
1)	RUN LED	0000H : Indicates that LED is unlit.
2)	ERR. LED	0001H : Indicates that LED is lit.
3)	ALM LED	Alternate display of 0000H and 0001H: Indicates that LED is flashing.

(b) H/W SW information

The status of the intelligent function module switch setting is displayed.

No.	Switch setting for intelligent function module
RANGE 1	Switch 1
RANGE 2	Switch 2
-	Switch 3
RANGE 3	Switch 4
-	Switch 5



For GX Developer Version 8

APPENDIX

Appendix 1 Dedicated Instruction List and Available Devices

(1) Dedicated instruction list

The following table lists the dedicated instructions that can be used with the A/D converter modules.

Instruction	Description	Reference section
G(P).OFFGAN	Switches to the offset/gain setting mode. Switches to the normal mode.	Appendix 1.1
G(P).OGLOAD	Reads the offset/gain values of the user range setting to the CPU.	Appendix 1.2
G(P).OGSTOR	Restores the offset/gain values of the user range setting stored in the CPU to the A/D converter module.	Appendix 1.3

Point

When the module is mounted to a MELSECNET/H remote station, the dedicated instructions cannot be used.

(2) Available devices

The following devices are available for the dedicated instructions:

Internal devices		File register	Constant
Bit*1	Word		
X, Y, M, L, F, V, B	T, ST, C, D, W	R, ZR	-

*1 Word device bit designation can be used as bit data.

Word device bit designation is done by designating Word device . Bit No. .
(Designation of bit numbers is done in hexadecimal.)

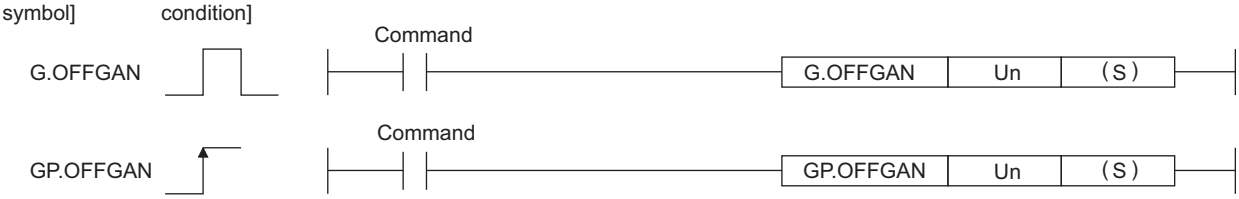
For example, bit 10 of D0 is designated as D0.A .
However, there can be no bit designation for timers (T), retentive timers (ST) and counters (C).

Appendix 1.1 G(P).OFFGAN

Switches the mode of the A/D converter module. (Normal mode to offset/gain setting mode, offset/gain setting mode to normal mode)

Set data	Usable devices								
	Internal device (System, user)		File register	Link direct device J□\□		Intelligent function module device U□\G□	Index register Z□	Constant		Other
	Bit	Word		Bit	Word			K, H	$	
(S)	—	○		—				—	—	—

[Instruction symbol] [Execution condition]



Set data

Set data	Description	Setting range	Data type
Un	Start I/O number of the module	0 to FEH	Binary 16 bits
(S)	Mode switching 0: Switching to normal mode 1: Switching to offset/gain setting mode The setting of any other value results in "switching to offset/gain setting mode".	0 ,1	Binary 16 bits

(1) Function

Switches the mode of the A/D converter module.

- Normal mode to offset/gain setting mode (the offset/gain setting mode flag (XA) turns ON)
- Offset/gain setting mode to normal mode (the offset/gain setting mode flag (XA) turns OFF)

Point

(1) When the offset/gain setting mode is switched to the normal mode, Module ready (X0) turns from OFF to ON.
Note that initial setting processing will be executed if there is a sequence program that makes initial setting when Module ready (X0) turns ON.

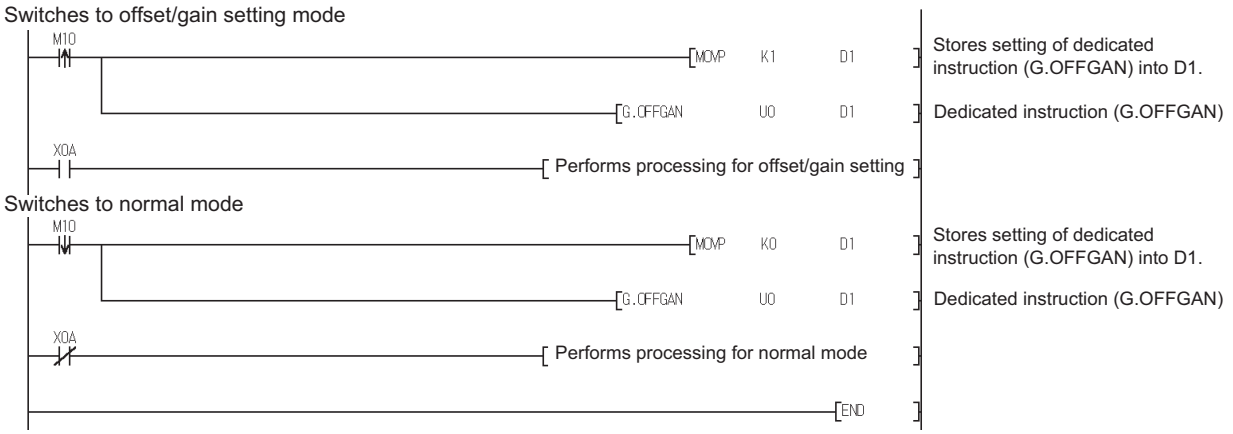
(2) When one mode is switched to the other (the normal mode is switched to the offset/gain setting mode or the offset/gain setting mode is switched to the normal mode), the A/D converter module suspends A/D conversion and switches OFF the power supply to the 2-wire transmitter.
To resume A/D conversion and power supply to the 2-wire transmitter, turn ON the operating condition setting request (Y9) after the mode is switched to the normal mode.

(2) Operation error

No errors.

(3) Program example

The following program is designed to switch the A/D converter module mounted in the position of I/O number X/Y0 to X/YF to the offset/gain setting mode when M10 is turned ON, and to return it to the normal mode when M10 is turned OFF.

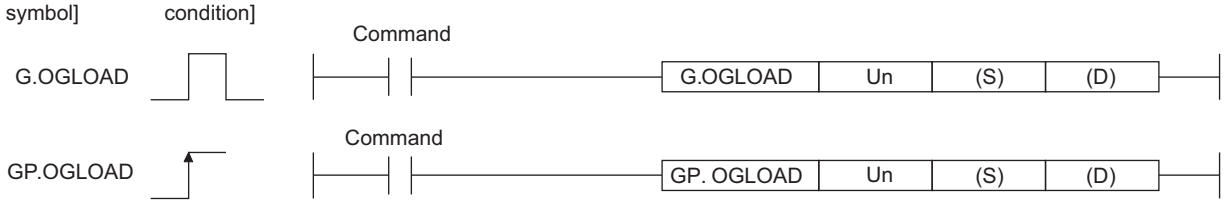


Appendix 1.2 G(P).OGLOAD

Reads the offset/gain values of the user range setting of the A/D converter module to the CPU.

Set data	Usable devices									
	Internal device (System, user)		File register	Link direct device J□\□		Intelligent function module device U□\G□	Index register Z□	Constant		Other
	Bit	Word		Bit	Word			K, H	$	
(S)	—	○		—				—	—	—
(D)	○			—				—	—	—

[Instruction symbol] [Execution condition]



Set data

Set data	Description	Setting range	Data type
Un	Start I/O number of the module	0 to FEH	Binary 16 bits
(S)	Start number of the device in which control data is stored.	Within the range of the specified device	Device name
(D)	Device that is turned ON 1 scan on completion of dedicated instruction processing. (D) + 1 also turns ON at an abnormal completion.	Within the range of the specified device	Bit

Control data*1 of Q68AD-G

Device	Item	Set data	Setting range	Set by
(S)	System area	—	—	—
(S) + 1	Completion status	Stores the status when the instruction is complete. 0 : Normal completion Other than 0: Abnormal completion	—	System
(S) + 2	Pass data classification setting	Specify the voltage/current of the offset/gain values to be read. 0: Voltage specified 1: Current specified b15 b8 b7 b6 b5 b4 b3 b2 b1 b0 0 ~ 0 CH8 CH7 CH6 CH5 CH4 CH3 CH2 CH1	0000H to 00FF H	User
(S) + 3	System area	—	—	—
(S) + 4	CH1 Industrial shipment settings offset value	—	—	System
(S) + 5	CH1 Industrial shipment settings gain value	—	—	System
(S) + 6	CH2 Industrial shipment settings offset value	—	—	System
(S) + 7	CH2 Industrial shipment settings gain value	—	—	System
(S) + 8	CH3 Industrial shipment settings offset value	—	—	System
(S) + 9	CH3 Industrial shipment settings gain value	—	—	System
(S) + 10	CH4 Industrial shipment settings offset value	—	—	System
(S) + 11	CH4 Industrial shipment settings gain value	—	—	System
(S) + 12	CH5 Industrial shipment settings offset value	—	—	System
(S) + 13	CH5 Industrial shipment settings gain value	—	—	System
(S) + 14	CH6 Industrial shipment settings offset value	—	—	System
(S) + 15	CH6 Industrial shipment settings gain value	—	—	System
(S) + 16	CH7 Industrial shipment settings offset value	—	—	System
(S) + 17	CH7 Industrial shipment settings gain value	—	—	System
(S) + 18	CH8 Industrial shipment settings offset value	—	—	System
(S) + 19	CH8 Industrial shipment settings gain value	—	—	System
(S) + 20	CH1 user range settings offset value	—	—	System
(S) + 21	CH1 user range settings gain value	—	—	System
(S) + 22	CH2 user range settings offset value	—	—	System
(S) + 23	CH2 user range settings gain value	—	—	System
(S) + 24	CH3 user range settings offset value	—	—	System
(S) + 25	CH3 user range settings gain value	—	—	System
(S) + 26	CH4 user range settings offset value	—	—	System
(S) + 27	CH4 user range settings gain value	—	—	System
(S) + 28	CH5 user range settings offset value	—	—	System
(S) + 29	CH5 user range settings gain value	—	—	System
(S) + 30	CH6 user range settings offset value	—	—	System
(S) + 31	CH6 user range settings gain value	—	—	System
(S) + 32	CH7 user range settings offset value	—	—	System
(S) + 33	CH7 user range settings gain value	—	—	System
(S) + 34	CH8 user range settings offset value	—	—	System
(S) + 35	CH8 user range settings gain value	—	—	System

*1 Set only the pass data classification setting (S)+2. If data is written to the area set by the system, the offset/gain values will not be read properly.

Control data*2 of Q66AD-DG

Device	Item	Set data	Setting range	Set by
(S)	System area	—	—	—
(S) + 1	Completion status	Stores the status when the instruction is complete. 0 : Normal completion Other than 0: Abnormal completion	—	System
(S) + 2 (S) + 3	System area	—	—	—
(S) + 4	CH1 Industrial shipment settings offset value	—	—	System
(S) + 5	CH1 Industrial shipment settings gain value	—	—	System
(S) + 6	CH2 Industrial shipment settings offset value	—	—	System
(S) + 7	CH2 Industrial shipment settings gain value	—	—	System
(S) + 8	CH3 Industrial shipment settings offset value	—	—	System
(S) + 9	CH3 Industrial shipment settings gain value	—	—	System
(S) + 10	CH4 Industrial shipment settings offset value	—	—	System
(S) + 11	CH4 Industrial shipment settings gain value	—	—	System
(S) + 12	CH5 Industrial shipment settings offset value	—	—	System
(S) + 13	CH5 Industrial shipment settings gain value	—	—	System
(S) + 14	CH6 Industrial shipment settings offset value	—	—	System
(S) + 15	CH6 Industrial shipment settings gain value	—	—	System
(S) + 16 to (S) + 19	System area	—	—	—
(S) + 20	CH1 user range settings offset value	—	—	System
(S) + 21	CH1 user range settings gain value	—	—	System
(S) + 22	CH2 user range settings offset value	—	—	System
(S) + 23	CH2 user range settings gain value	—	—	System
(S) + 24	CH3 user range settings offset value	—	—	System
(S) + 25	CH3 user range settings gain value	—	—	System
(S) + 26	CH4 user range settings offset value	—	—	System
(S) + 27	CH4 user range settings gain value	—	—	System
(S) + 28	CH5 user range settings offset value	—	—	System
(S) + 29	CH5 user range settings gain value	—	—	System
(S) + 30	CH6 user range settings offset value	—	—	System
(S) + 31	CH6 user range settings gain value	—	—	System
(S) + 32 to (S) + 35	System area	—	—	—

*2 Setting is not necessary. If setting is made, the offset/gain values will not be read properly.

(1) Functions

(a) Reads the offset/gain values of the user range setting of the A/D converter module to the CPU.

(b) There are two types of interlock signals for the G(P).OGLOAD instruction: the completion device (D) and the status display device at completion (D) + 1.

1) Completion device

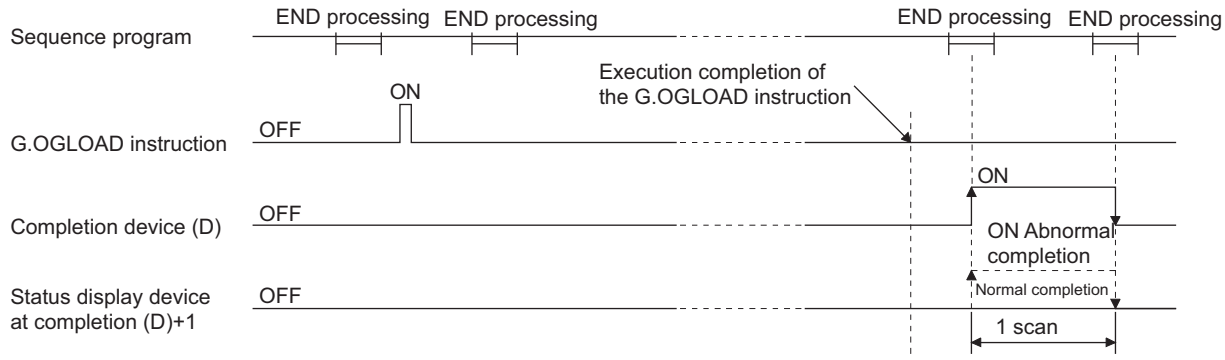
Turns ON in the END processing of the scan where the G(P).OGLOAD instruction is completed, and turns OFF in the next END processing.

2) Status display device at completion

Turns ON and OFF depending on the completion status of the G(P).OGLOAD instruction.

Normal completion : Stays OFF and does not change.

Abnormal completion: Turns ON in the END processing of the scan where the G(P).OGLOAD instruction is completed, and turns OFF in the next END processing.

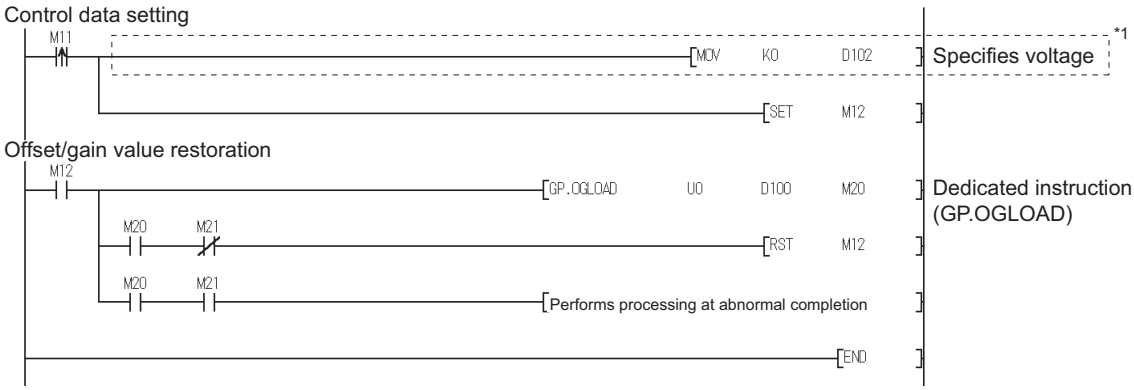


(2) Operation error

No errors.

(3) Program example

The following program is designed to read the offset/gain values of the A/D converter module mounted in the position of I/O number X/Y0 to X/YF when M11 is turned ON.

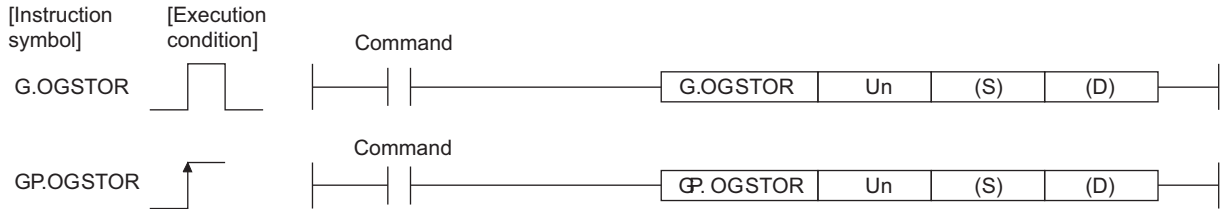


*1 For the Q66AD-DG, the program in the dotted area is not necessary.

Appendix 1.3 G(P).OGSTOR

Restores the offset/gain values of the user range setting stored in the CPU to the A/D converter module.

Set data	Usable devices								
	Internal device (System, user)		File register	Link direct device J□\□		Intelligent function module device U□\G□	Index register Z□	Constant		Other
	Bit	Word		Bit	Word			K, H	$	
(S)	—	○		—				—	—	—
(D)	○			—				—	—	—



Set data

Set data	Description	Setting range	Data type
Un	Start I/O number of the module	0 to FEH	Binary 16 bits
(S)*1	Start number of the device in which control data is stored.	Within the range of the specified device	Device name
(D)	Device that is turned ON 1 scan on completion of dedicated instruction processing. (D) + 1 also turns ON at an abnormal completion.	Within the range of the specified device	Bit

*1 When executing the G(P).OGLOAD instruction, specify the device designated in (S).
Do not change the data read with the G(P).OGLOAD instruction.
If it is changed, normal operation cannot be guaranteed.

Control data of Q68AD-G

Device	Item	Set data	Setting range	Set by
(S)	System area	—	—	—
(S) + 1	Completion status	Stores the status when the instruction is complete. 0 : Normal completion Other than 0: Abnormal completion	—	System
(S) + 2	Pass data classification setting	The value set to Pass data classification setting (S)+2 using the G.OGLOAD instruction is stored. 0: Voltage specified 1: Current specified b15 ~ b8 b7 b6 b5 b4 b3 b2 b1 b0 0 ~ 0 CH8 CH7 CH6 CH5 CH4 CH3 CH2 CH1	0000H to 00FF H	System
(S) + 3	System area	—	—	—
(S) + 4	CH1 Industrial shipment settings offset value	—	—	System
(S) + 5	CH1 Industrial shipment settings gain value	—	—	System
(S) + 6	CH2 Industrial shipment settings offset value	—	—	System
(S) + 7	CH2 Industrial shipment settings gain value	—	—	System
(S) + 8	CH3 Industrial shipment settings offset value	—	—	System
(S) + 9	CH3 Industrial shipment settings gain value	—	—	System
(S) + 10	CH4 Industrial shipment settings offset value	—	—	System
(S) + 11	CH4 Industrial shipment settings gain value	—	—	System
(S) + 12	CH5 Industrial shipment settings offset value	—	—	System
(S) + 13	CH5 Industrial shipment settings gain value	—	—	System
(S) + 14	CH6 Industrial shipment settings offset value	—	—	System
(S) + 15	CH6 Industrial shipment settings gain value	—	—	System
(S) + 16	CH7 Industrial shipment settings offset value	—	—	System
(S) + 17	CH7 Industrial shipment settings gain value	—	—	System
(S) + 18	CH8 Industrial shipment settings offset value	—	—	System
(S) + 19	CH8 Industrial shipment settings gain value	—	—	System
(S) + 20	CH1 user range settings offset value	—	—	System
(S) + 21	CH1 user range settings gain value	—	—	System
(S) + 22	CH2 user range settings offset value	—	—	System
(S) + 23	CH2 user range settings gain value	—	—	System
(S) + 24	CH3 user range settings offset value	—	—	System
(S) + 25	CH3 user range settings gain value	—	—	System
(S) + 26	CH4 user range settings offset value	—	—	System
(S) + 27	CH4 user range settings gain value	—	—	System
(S) + 28	CH5 user range settings offset value	—	—	System
(S) + 29	CH5 user range settings gain value	—	—	System
(S) + 30	CH6 user range settings offset value	—	—	System
(S) + 31	CH6 user range settings gain value	—	—	System
(S) + 32	CH7 user range settings offset value	—	—	System
(S) + 33	CH7 user range settings gain value	—	—	System
(S) + 34	CH8 user range settings offset value	—	—	System
(S) + 35	CH8 user range settings gain value	—	—	System

Control data*2 of Q66AD-DG

Device	Item	Set data	Setting range	Set by
(S)	System area	—	—	—
(S) + 1	Completion status	Stores the status when the instruction is complete. 0 : Normal completion Other than 0: Abnormal completion	—	System
(S) + 2 (S) + 3	System area	—	—	—
(S) + 4	CH1 Industrial shipment settings offset value	—	—	System
(S) + 5	CH1 Industrial shipment settings gain value	—	—	System
(S) + 6	CH2 Industrial shipment settings offset value	—	—	System
(S) + 7	CH2 Industrial shipment settings gain value	—	—	System
(S) + 8	CH3 Industrial shipment settings offset value	—	—	System
(S) + 9	CH3 Industrial shipment settings gain value	—	—	System
(S) + 10	CH4 Industrial shipment settings offset value	—	—	System
(S) + 11	CH4 Industrial shipment settings gain value	—	—	System
(S) + 12	CH5 Industrial shipment settings offset value	—	—	System
(S) + 13	CH5 Industrial shipment settings gain value	—	—	System
(S) + 14	CH6 Industrial shipment settings offset value	—	—	System
(S) + 15	CH6 Industrial shipment settings gain value	—	—	System
(S) + 16 to (S) + 19	System area	—	—	—
(S) + 20	CH1 user range settings offset value	—	—	System
(S) + 21	CH1 user range settings gain value	—	—	System
(S) + 22	CH2 user range settings offset value	—	—	System
(S) + 23	CH2 user range settings gain value	—	—	System
(S) + 24	CH3 user range settings offset value	—	—	System
(S) + 25	CH3 user range settings gain value	—	—	System
(S) + 26	CH4 user range settings offset value	—	—	System
(S) + 27	CH4 user range settings gain value	—	—	System
(S) + 28	CH5 user range settings offset value	—	—	System
(S) + 29	CH5 user range settings gain value	—	—	System
(S) + 30	CH6 user range settings offset value	—	—	System
(S) + 31	CH6 user range settings gain value	—	—	System
(S) + 32 to (S) + 35	System area	—	—	—

*2 Setting is not necessary. If setting is made, the offset/gain values will not be read properly.

(1) Functions

(a) Restores the offset/gain values of the user range setting stored in the CPU to the A/D converter module.

(b) There are two types of interlock signals for the G(P).OGSTOR instruction: the completion device (D) and the status display device at completion (D) + 1.

1) Completion device

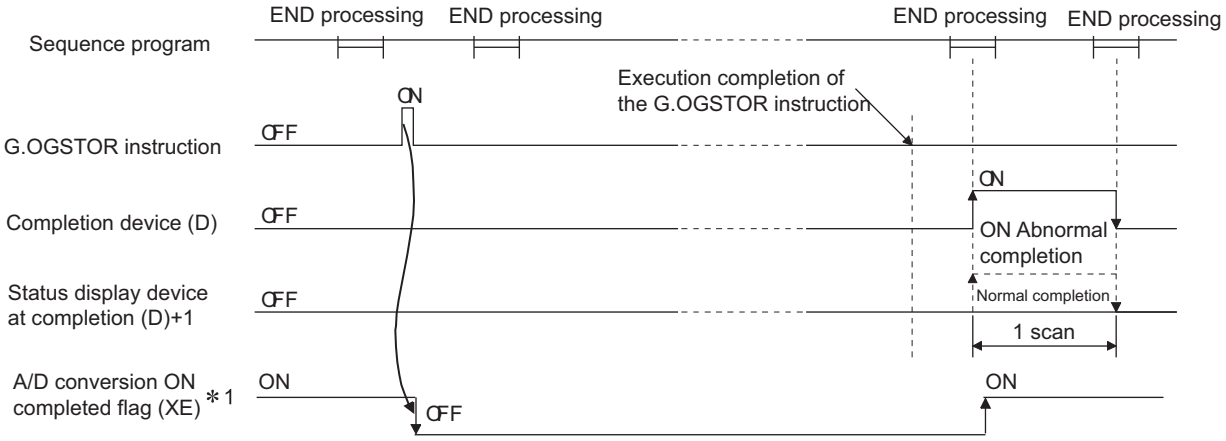
Turns ON in the END processing of the scan where the G(P).OGSTOR instruction is completed, and turns OFF in the next END processing.

2) Status display device at completion

Turns ON and OFF depending on the completion status of the G(P).OGSTOR instruction.

Normal completion : Stays OFF and does not change.

Abnormal completion: Turns ON in the END processing of the scan where the G(P).OGSTOR instruction is completed, and turns OFF in the next END processing.



*1 When the G(P).OGSTOR instruction is executed, A/D conversion is not performed. After the completion device (D) turns ON, A/D conversion starts, the A/D conversion value is stored into the buffer memory, and the A/D conversion completed flag (XE) then turns ON.

(c) When the offset/gain values are restored, the reference accuracy falls to about less than three times of the accuracy before that.

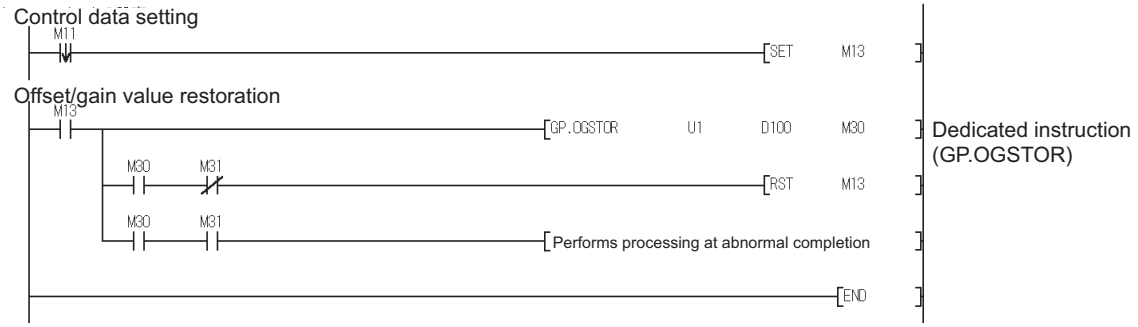
(2) Operation error

In any of the following cases, an error occurs and the corresponding error code is stored into the completion status area (S)+1.

Error code	Case resulting in operation error
161	The G(P).OGSTOR instruction was executed in the offset/gain setting mode.
162	The G(P).OGSTOR instruction was executed consecutively.
163	The G(P).OGSTOR instruction was executed for the model that differs from the model for which the G(P).OGLOAD instruction had been executed.

(3) Program example

Program that restores the offset/gain setting to the A/D converter module mounted in the position of I/O No. X/Y10 to X/Y1F when M11 is turned OFF.



Appendix 2 Functions Added or Changed Due to Version Upgrade

The A/D converter has been upgraded with new functions and specifications.
The functions available for use of the A/D converter module vary with the first five digits of product number.
Also, use the GX Configurator-AD whose version number is compatible one or later.

(1) Q68AD-G

App.1 Q68AD-G

Added or changed function	Description	Applicable version		Reference section
		First 5 digits of product number	GX Configurator-AD	
Analog input range extended mode	When the following input ranges are selected in the intelligent function module switch setting, the analog input ranges can be extended. • 4 to 20mA (Extended mode) • 1 to 5V (Extended mode) The input ranges supported by the analog input range extended mode cannot be used for products of incompatible version.	10062 or later	2.09K or later	Section3.1.1 Section4.5
Input signal error detection extended setting	When the warning of input signal error detection is enabled, the input signal error detection can be performed by setting the same value of upper and lower limit or different value of upper and lower limit. The input signal error detection cannot be performed by setting the different value of upper and lower limit, but can be performed by setting the same value of upper and lower limit. Set the buffer memories as follows. • Un\G47.b15 to b8 ⋯ Fixed at 0 • Un\G150 to Un\G157 ⋯ Reserved (system area)	10062 or later	2.09K or later	Section3.2.3 Section3.4.11 Section3.4.22

(2) Q66AD-DG

App.2 Q66AD-DG

Added or changed function	Description	Applicable version		Reference section
		First 5 digits of product number	GX Configurator-AD	
Analog input range extended mode	When the following input ranges are selected in the intelligent function module switch setting, the analog input ranges can be extended. • 4 to 20mA (Extended mode) (For 2-wire transmitter input) • 4 to 20mA (Extended mode) (For current input) The input ranges supported by the analog input range extended mode cannot be used for products of incompatible version.	10102 or later	2.09K or later	Section3.1.1 Section4.5
Input signal error detection extended setting	When the warning of input signal error detection is enabled, the input signal error detection can be performed by setting the same value of upper and lower limit or different value of upper and lower limit. The input signal error detection cannot be performed by setting the different value of upper and lower limit, but can be performed by setting the same value of upper and lower limit. Set the buffer memories as follows. • Un\G47.b15 to b6 ⋯ Fixed at 0 • Un\G150 to Un\G155 ⋯ Reserved (system area)	10102 or later	2.09K or later	Section3.2.3 Section3.4.11 Section3.4.22

(a) When using the product with product number 15031 or earlier

1) How the A/D conversion completed flag status changes

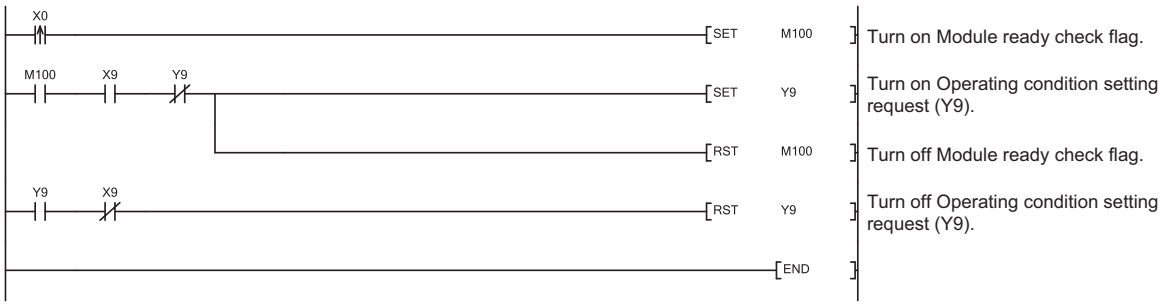
<table>
<tr><th>Signal name</th><th>Description</th></tr>
<tr><td>A/D conversion completed flag (XE)</td><td>(1) This signal turns ON when all conversion-enabled channels have completed the initial A/D conversion.
(2) When the external power supply is turned off, the A/D conversion stops and this signal turns OFF. At this time, the previous digital output values are held.
The A/D conversion resumes when the external power supply is turned on again. Then, when all conversion-enabled channels have completed the initial A/D conversion, this signal turns ON. The processing such as averaging processing and primary delay filter starts from the initial status after the A/D conversion resumes.
(3) The following table lists the signal status when the A/D conversion is enabled in the off condition of the external power supply.
<table>
<tr><th colspan="2">Selected range</th><th>A/D conversion disable → enable</th></tr>
<tr><td colspan="2">Analog current input range only without 2-wire transmitter</td><td>• When the A/D conversion resumes and all conversion-enabled channels have completed the initial A/D conversion, the signal turns ON.</td></tr>
<tr><td colspan="2">2-wire transmitter range only</td><td>• A/D conversion resumes and the signal turns ON.*1
• Digital output value become the minimum value (normal resolution: -96, high resolution: -288).</td></tr>
<tr><td rowspan="2">Mix</td><td>Analog current input range without 2-wire transmitter</td><td rowspan="2">• A/D conversion resumes and the signal turns ON.*1
• Digital output value of the channel of the 2-wire transmitter become the minimum value (normal resolution: -96, high resolution: -288).</td></tr>
<tr><td>2-wire transmitter range</td></tr>
</table>
*1 When the external power supply is turned ON, this signal turns OFF temporarily and the A/D conversion resumes. Then, when all conversion-enabled channels have completed the initial A/D conversion, the signal turns ON again.</td></tr>
<tr><td>A/D conversion completed flag (Un\G10)</td><td>(1) When A/D conversion in the off condition of the external power supply is enabled, A/D conversion completed flag (Un\G10) in the channels of a 2-wire transmitter is set to 1.
Also, for the channels of the analog current input range without a 2-wire transmitter, A/D conversion completed flag (Un\G10) is set to 1 when the initial A/D conversion is completed.
(2) When the external power supply is turned off, A/D conversion completed flag (Un\G10) of all channels is set to 0.</td></tr>
</table>

2) When channels being used are all for current input and in addition the external power supply (24VDC) is not supplied.

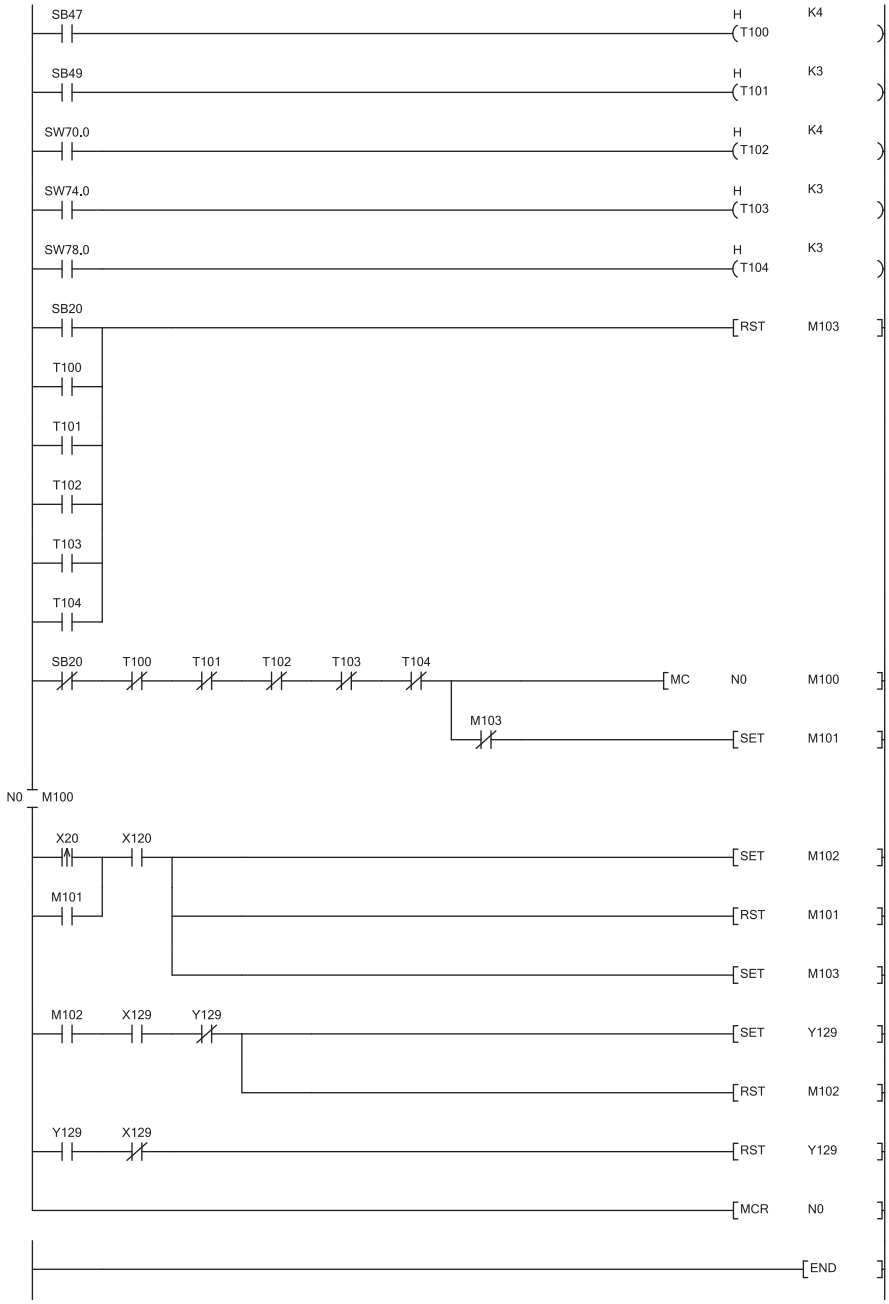
To start the A/D conversion of analog current input range by using the utility package, Operating condition setting request (Yn9) is required.

Add the following programs to the programming examples of Section 6.4.2 (3) and Section 6.5.1 (3).

• When a normal system configuration is employed

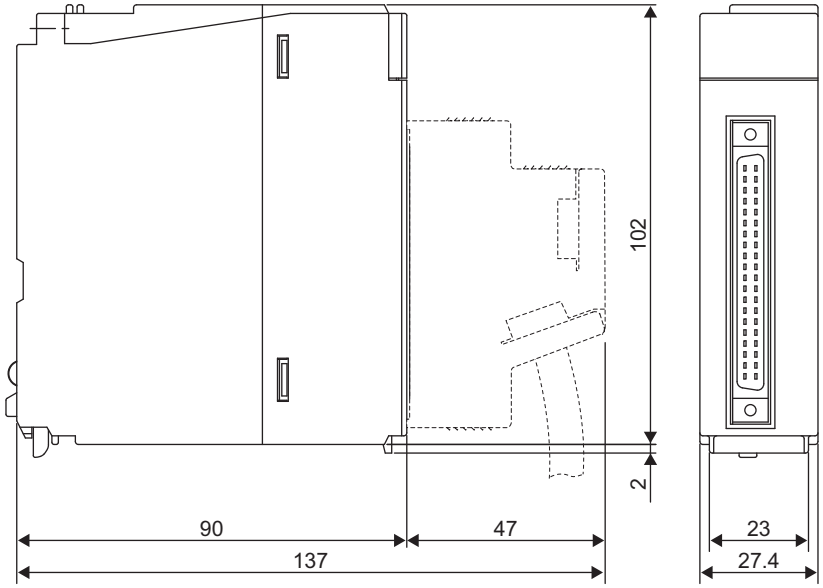


• When the remote I/O network is employed



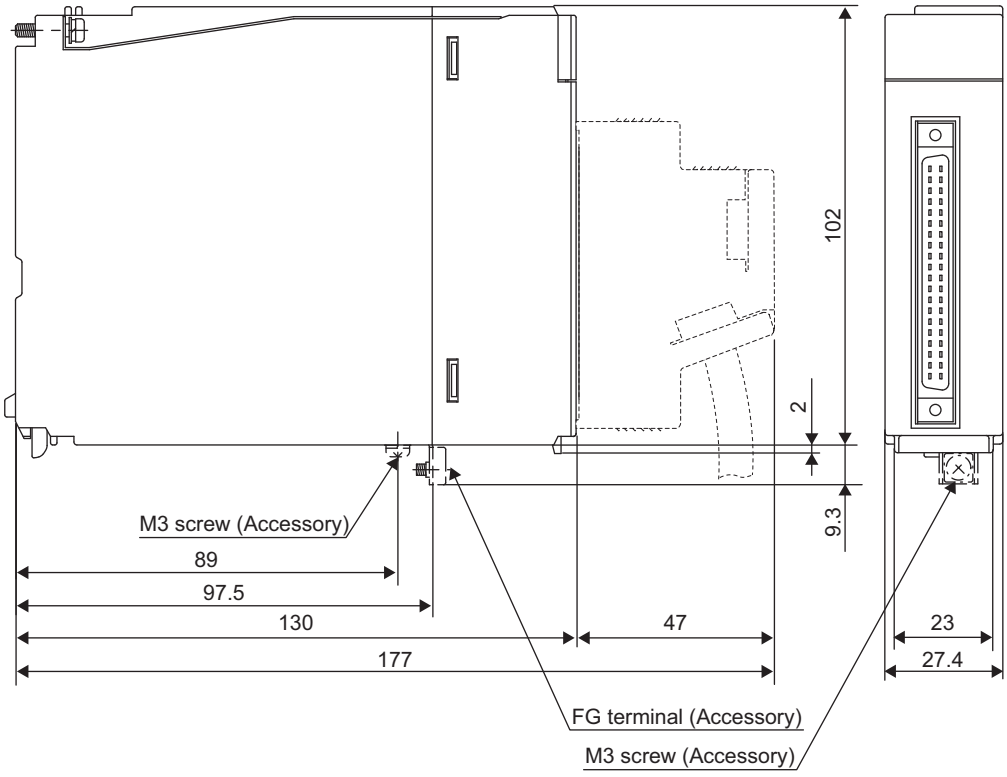
Appendix 3 External Dimensions

(1) Q68AD-G



(Unit: mm)

(2) Q66AD-DG



(Unit: mm)

INDEX

[Number]

2-wire transmitter 1-1

[A]

A/D conversion completed flag 3-39,3-57
A/D conversion enable/disable setting 3-13,3-55
A/D conversion methods 3-13
A/D conversion starting time setting 3-67
A/D conversion starting time setting function 3-29
A/D conversion value storage during offset/gain setting 4-24
A/D converter module A-13
Absolute maximum input 3-1
Accuracy 3-1,3-2,3-12
ALM LED 4-5
Analog input 3-1,3-3
Applicable module 2-1
Applicable wire size 3-2,3-3
Auto refresh setting 5-16
Average time/Average number of times/Move average/Time constant settings 3-56
Averaging process specification 3-61
Averaging processing 3-13

[B]

Buffer memory 3-43,3-50

[C]

Channel change completed flag 3-37
Channel change request 3-41
Check terminals 3-3
Close parameters 5-12
Common mode characteristic 3-1
Confirmation of Conversion Characteristic 5-23
Count averaging 3-13
Current input characteristic 3-8

[D]

Dedicated instruction list App-1
Delete parameters 5-12
Dielectric withstand voltage 3-2,3-3
Digital output 3-1,3-3
Digital output value 3-58

[E]

ERR. LED 4-5
Error clear request 3-41
Error code List 8-1
Error flag 3-40
External dimensions App-17
External power supply 3-3
External wiring 4-8,4-9

[F]

FB Conversion 5-28

[G]

G(P).OFFGAN App-2
G(P).OGLOAD App-4
G(P).OGSTOR App-8
Gain value 3-5
GX Configurator-AD 2-2,5-1
GX Developer A-13,2-2

[H]

H/W information 8-8
Handling Precautions 4-1

[I]

I/O assignment setting 4-12
I/O characteristics 3-1,3-3
Industrial shipment setting A-13
Industrial shipment settings and User range settings offset/gain value 3-75
Initial setting 5-14
Input range 3-59
Input signal error detection extended/input signal error detection setting 3-62
Input signal error detection flag 3-65
Input signal error detection function 3-18
Input signal error detection lower limit setting value 3-71
Input signal error detection setting value 3-71
Input signal error detection signal 3-38
Input signal error detection upper limit setting value 3-71
Inrush current 3-3
Installing 5-2
Insulation resistance 3-2,3-3
Intelligent function module parameter setting module select window 5-11
Internal current consumption 3-2,3-4
Isolation method 3-2,3-3

[L]

List of I/O signals 3-33,3-34

[M]

Maximum and minimum values hold function 3-18
Maximum resolution 3-1,3-3
Maximum supply current 3-3
Maximum value/minimum value reset completed flag 3-38
Maximum value/minimum value reset request 3-41
Mode switching setting 3-74
Module ready 3-35
Monitor/Test 5-18
Move averaging 3-13
Multiple CPU system 2-1

[N]

No. of modules 2-1
Number of analog input channels 3-1
Number of analog input points 3-3

Number of I/O occupied points 3-2,3-3

[O]

Offset value 3-5
Offset/gain setting 4-15,4-19,5-21,5-23
Offset/gain setting change completed flag 3-38
Offset/gain setting change request 3-41
Offset/gain setting mode 3-60
Offset/gain setting mode flag 3-37
Online module change 2-1,7-1
Open parameters 5-12
Operating condition setting 5-18
Operating condition setting completed flag 3-36
Operating condition setting request 3-41
Operating environment 5-4

[P]

Part identification nomenclature 4-4
Pass data 5-25,5-27
Pass data classification setting 3-74
Performance specifications 3-1,3-3
Primary delay filter 3-16
Process alarm 3-25
Programming procedure 6-1

[Q]

QCPU (Q mode) A-13

[R]

Rate alarm 3-26
Rate alarm upper/lower limit value 3-70
Rate alarm warning detection period 3-69
Read from PLC 5-12
Reference accuracy 3-1,3-3,3-12
Remote I/O network 6-11,6-30
RUN LED 4-5

[S]

Sampling processing 3-13
Save parameters 5-12
Setting range 3-59
Setup and procedures before operation 4-1
Short circuit protection 1-1,3-3
Software package 2-2
Software Version 2-2
Supply power ON/OFF function 3-13
Supply voltage 3-3
Switch setting for intelligent function module 4-12
System monitor 8-7

[T]

Temperature coefficient 3-1,3-3,3-12
Time averaging 3-13
Time constant 3-16
Transfer setup 5-13
Troubleshooting 8-5

[U]

Uninstalling 5-2
User range writing request 3-41
Utility package 5-1

[V]

Voltage input characteristic 3-6

[W]

Warning output flag 3-66
Warning output function 3-25
Warning output settings 3-64
Warning output signal 3-35
Weight 3-2,3-4
Write data error code 3-59
Write to PLC 5-12

WARRANTY

Please confirm the following product warranty details before using this product.

1. Gratis Warranty Term and Gratis Warranty Range

If any faults or defects (hereinafter "Failure") found to be the responsibility of Mitsubishi occurs during use of the product within the gratis warranty term, the product shall be repaired at no cost via the sales representative or Mitsubishi Service Company.

However, if repairs are required onsite at domestic or overseas location, expenses to send an engineer will be solely at the customer's discretion. Mitsubishi shall not be held responsible for any re-commissioning, maintenance, or testing on-site that involves replacement of the failed module.

[Gratis Warranty Term]

The gratis warranty term of the product shall be for one year after the date of purchase or delivery to a designated place. Note that after manufacture and shipment from Mitsubishi, the maximum distribution period shall be six (6) months, and the longest gratis warranty term after manufacturing shall be eighteen (18) months. The gratis warranty term of repair parts shall not exceed the gratis warranty term before repairs.

[Gratis Warranty Range]

(1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.

(2) Even within the gratis warranty term, repairs shall be charged for in the following cases.

1. Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
2. Failure caused by unapproved modifications, etc., to the product by the user.
3. When the Mitsubishi product is assembled into a user's device, Failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.
4. Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.
5. Failure caused by external irresistible forces such as fires or abnormal voltages, and Failure caused by force majeure such as earthquakes, lightning, wind and water damage.
6. Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
7. Any other failure found not to be the responsibility of Mitsubishi or that admitted not to be so by the user.

2. Onerous repair term after discontinuation of production

(1) Mitsubishi shall accept onerous product repairs for seven (7) years after production of the product is discontinued. Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.

(2) Product supply (including repair parts) is not available after production is discontinued.

3. Overseas service

Overseas, repairs shall be accepted by Mitsubishi's local overseas FA Center. Note that the repair conditions at each FA Center may differ.

4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to:

(1) Damages caused by any cause found not to be the responsibility of Mitsubishi.

(2) Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products.

(3) Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products.

(4) Replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Changes in product specifications

The specifications given in the catalogs, manuals or technical documents are subject to change without prior notice.

Microsoft and Windows are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.
Celeron, Intel, and Pentium are either registered trademarks or trademarks of Intel Corporation in the United States and/or other countries.
The company names, system names and product names mentioned in this manual are either registered trademarks or trademarks of their respective companies.
In some cases, trademark symbols such as '™' or '®' are not specified in this manual.

SH(NA)-080647ENG-K

SH(NA)-080647ENG-K(2102)MEE
MODEL: Q-A/D-(D)G-U-SY-E
MODEL CODE: 13JR96

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE : TOKYO BUILDING, 2-7-3 MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN
NAGOYA WORKS : 1-14 , YADA-MINAMI 5-CHOME , HIGASHI-KU, NAGOYA , JAPAN

When exported from Japan, this manual does not require application to the Ministry of Economy, Trade and Industry for service transaction permission.

Specifications subject to change without notice.