MITSUBISHI ELECTRIC

Mitsubishi Programmable Controller

MELSEC iQ-R series

MELSEC iQ-R Analog-Digital Converter Module User's Manual (Startup)

-R60AD4
-R60ADV8
-R60ADI8

SAFETY PRECAUTIONS

(Read these precautions before using this product.)

Before using MELSEC iQ-R series programmable controllers, please read the manuals for the product and the relevant manuals introduced in those 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 Precautions]

⚠ WARNING

● Configure safety circuits external to the programmable controller to ensure that the entire system operates safely even when a fault occurs in the external power supply or the programmable controller. Failure to do so may result in an accident due to an incorrect output or malfunction.

    (1) Emergency stop circuits, protection circuits, and protective interlock circuits for conflicting operations (such as forward/reverse rotations or upper/lower limit positioning) must be configured external to the programmable controller.

    (2) When the programmable controller detects an abnormal condition, it stops the operation and all outputs are:

       • Turned off if the overcurrent or overvoltage protection of the power supply module is activated.

       • Held or turned off according to the parameter setting if the self-diagnostic function of the CPU module detects an error such as a watchdog timer error.

    (3) All outputs may be turned on if an error occurs in a part, such as an I/O control part, where the CPU module cannot detect any error. To ensure safety operation in such a case, provide a safety mechanism or a fail-safe circuit external to the programmable controller. For a fail-safe circuit example, refer to "General Safety Requirements" in the MELSEC iQ-R Module Configuration Manual.

    (4) Outputs may remain on or off due to a failure of a component such as a relay and transistor in an output circuit. Configure an external circuit for monitoring output signals that could cause a serious accident.

● In an output circuit, when a load current exceeding the rated current or an overcurrent caused by a load short-circuit flows for a long time, it may cause smoke and fire. To prevent this, configure an external safety circuit, such as a fuse.

● Configure a circuit so that the programmable controller is turned on first and then the external power supply. If the external power supply is turned on first, an accident may occur due to an incorrect output or malfunction.

● For the operating status of each station after a communication failure, refer to manuals relevant to the network. Incorrect output or malfunction due to a communication failure may result in an accident.

● When connecting an external device with a CPU module or intelligent function module to modify data of a running programmable controller, configure an interlock circuit in the program to ensure that the entire system will always operate safely. For other forms of control (such as program modification, parameter change, forced output, or operating status change) of a running programmable controller, read the relevant manuals carefully and ensure that the operation is safe before proceeding. Improper operation may damage machines or cause accidents.

[Design Precautions]

⚠WARNING

- Especially, when a remote programmable controller is controlled by an external device, immediate action cannot be taken if a problem occurs in the programmable controller due to a communication failure. To prevent this, configure an interlock circuit in the program, and determine corrective actions to be taken between the external device and CPU module in case of a communication failure.
- Do not write any data to the "system area" and "write-protect area" of the buffer memory in the module. Also, do not use any "use prohibited" signals as an output signal from the CPU module to each module. Doing so may cause malfunction of the programmable controller system. For the "system area", "write-protect area", and the "use prohibited" signals, refer to the user's manual for the module used.
- If a communication cable is disconnected, the network may be unstable, resulting in a communication failure of multiple stations. Configure an interlock circuit in the program to ensure that the entire system will always operate safely even if communications fail. Failure to do so may result in an accident due to an incorrect output or malfunction.
- To maintain the safety of the programmable controller system against unauthorized access from external devices via the network, take appropriate measures. To maintain the safety against unauthorized access via the Internet, take measures such as installing a firewall.

[Design Precautions]

⚠CAUTION

- Do not install the control lines or communication cables together with the main circuit lines or power cables. Keep a distance of 100mm or more between them. Failure to do so may result in malfunction due to noise.
- During control of an inductive load such as a lamp, heater, or solenoid valve, a large current (approximately ten times greater than normal) may flow when the output is turned from off to on. Therefore, use a module that has a sufficient current rating.
- After the CPU module is powered on or is reset, the time taken to enter the RUN status varies depending on the system configuration, parameter settings, and/or program size. Design circuits so that the entire system will always operate safely, regardless of the time.
- Do not power off the programmable controller or reset the CPU module while the settings are being written. Doing so will make the data in the flash ROM undefined. The values need to be set in the buffer memory and written to the flash ROM again. Doing so also may cause malfunction or failure of the module.
- When changing the operating status of the CPU module from external devices (such as the remote RUN/STOP functions), select "Do Not OPEN in Program" for "Open Method Setting" in the module parameters. If "OPEN in Program" is selected, an execution of the remote STOP function causes the communication line to close. Consequently, the CPU module cannot reopen the line, and external devices cannot execute the remote RUN function.

[Installation Precautions]

⚠WARNING

● Shut off the external power supply (all phases) used in the system before mounting or removing the module. Failure to do so may result in electric shock or cause the module to fail or malfunction.

[Installation Precautions]

⚠CAUTION

● Use the programmable controller in an environment that meets the general specifications in the Safety Guidelines included with the base unit. Failure to do so may result in electric shock, fire, malfunction, or damage to or deterioration of the product.
● To mount a module, place the concave part(s) located at the bottom onto the guide(s) of the base unit, and push in the module until the hook(s) located at the top snaps into place. Incorrect interconnection may cause malfunction, failure, or drop of the module.
● When using the programmable controller in an environment of frequent vibrations, fix the module with a screw.
● Tighten the screws within the specified torque range. Undertightening can cause drop of the screw, short circuit, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.
● When using an extension cable, connect it to the extension cable connector of the base unit securely. Check the connection for looseness. Poor contact may cause malfunction.
● When using an SD memory card, fully insert it into the SD memory card slot. Check that it is inserted completely. Poor contact may cause malfunction.
● Securely insert an extended SRAM cassette into the cassette connector of the CPU module. After insertion, close the cassette cover and check that the cassette is inserted completely. Poor contact may cause malfunction.
● Do not directly touch any conductive parts and electronic components of the module, SD memory card, extended SRAM cassette, or connector. Doing so can cause malfunction or failure of the module.

[Wiring Precautions]

⚠WARNING

● Shut off the external power supply (all phases) used in the system before installation and wiring. Failure to do so may result in electric shock or cause the module to fail or malfunction.
● After installation and wiring, attach the included terminal cover to the module before turning it on for operation. Failure to do so may result in electric shock.

[Wiring Precautions]

⚠CAUTION

- Individually ground the FG and LG terminals of the programmable controller with a ground resistance of 100 ohms or less. Failure to do so may result in electric shock or malfunction.
- Use applicable solderless terminals and tighten them within the specified torque range. If any spade solderless terminal is used, it may be disconnected when the terminal screw comes loose, resulting in failure.
- Check the rated voltage and signal layout before wiring to the module, and connect the cables correctly. Connecting a power supply with a different voltage rating or incorrect wiring may cause fire or failure.
- Connectors for external devices must be crimped or pressed with the tool specified by the manufacturer, or must be correctly soldered. Incomplete connections may cause short circuit, fire, or malfunction.
- Securely connect the connector to the module. Poor contact may cause malfunction.
- Do not install the control lines or communication cables together with the main circuit lines or power cables. Keep a distance of 100mm or more between them. Failure to do so may result in malfunction due to noise.
- Place the cables in a duct or clamp them. If not, dangling cable may swing or inadvertently be pulled, resulting in damage to the module or cables or malfunction due to poor contact. Do not clamp the extension cables with the jacket stripped.
- Check the interface type and correctly connect the cable. Incorrect wiring (connecting the cable to an incorrect interface) may cause failure of the module and external device.
- Tighten the terminal screws or connector screws within the specified torque range. Undertightening can cause drop of the screw, short circuit, fire, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, fire, or malfunction.
- When disconnecting the cable from the module, do not pull the cable by the cable part. For the cable with connector, hold the connector part of the cable. For the cable connected to the terminal block, loosen the terminal screw. Pulling the cable connected to the module may result in malfunction or damage to the module or cable.
- Prevent foreign matter such as dust or wire chips from entering the module. Such foreign matter can cause a fire, failure, or malfunction.
- A protective film is attached to the top of the module to prevent foreign matter, such as wire chips, from entering the module during wiring. Do not remove the film during wiring. Remove it for heat dissipation before system operation.
- Programmable controllers must be installed in control panels. Connect the main power supply to the power supply module in the control panel through a relay terminal block. Wiring and replacement of a power supply module must be performed by qualified maintenance personnel with knowledge of protection against electric shock. For wiring, refer to the MELSEC iQ-R Module Configuration Manual.
- For Ethernet cables to be used in the system, select the ones that meet the specifications in the user's manual for the module used. If not, normal data transmission is not guaranteed.

[Startup and Maintenance Precautions]

⚠WARNING

- Do not touch any terminal while power is on. Doing so will cause electric shock or malfunction.
- Correctly connect the battery connector. Do not charge, disassemble, heat, short-circuit, solder, or throw the battery into the fire. Also, do not expose it to liquid or strong shock. Doing so will cause the battery to produce heat, explode, ignite, or leak, resulting in injury and fire.
- Shut off the external power supply (all phases) used in the system before cleaning the module or retightening the terminal screws, connector screws, or module fixing screws. Failure to do so may result in electric shock.

[Startup and Maintenance Precautions]

⚠CAUTION

- When connecting an external device with a CPU module or intelligent function module to modify data of a running programmable controller, configure an interlock circuit in the program to ensure that the entire system will always operate safely. For other forms of control (such as program modification, parameter change, forced output, or operating status change) of a running programmable controller, read the relevant manuals carefully and ensure that the operation is safe before proceeding. Improper operation may damage machines or cause accidents.

- Especially, when a remote programmable controller is controlled by an external device, immediate action cannot be taken if a problem occurs in the programmable controller due to a communication failure. To prevent this, configure an interlock circuit in the program, and determine corrective actions to be taken between the external device and CPU module in case of a communication failure.

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

- Use any radio communication device such as a cellular phone or PHS (Personal Handy-phone System) more than 25cm away in all directions from the programmable controller. Failure to do so may cause malfunction.

- Shut off the external power supply (all phases) used in the system before mounting or removing the module. Failure to do so may cause the module to fail or malfunction.

- Tighten the screws within the specified torque range. Undertightening can cause drop of the component or wire, short circuit, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.

- After the first use of the product, do not mount/remove the module to/from the base unit, and the terminal block to/from the module, and do not insert/remove the extended SRAM cassette to/from the CPU module more than 50 times (IEC 61131-2 compliant) respectively. Exceeding the limit may cause malfunction.

- After the first use of the product, do not insert/remove the SD memory card to/from the CPU module more than 500 times. Exceeding the limit may cause malfunction.

- Do not touch the metal terminals on the back side of the SD memory card. Doing so may cause malfunction or failure of the module.

- Do not touch the integrated circuits on the circuit board of an extended SRAM cassette. Doing so may cause malfunction or failure of the module.

- Do not drop or apply shock to the battery to be installed in the module. Doing so may damage the battery, causing the battery fluid to leak inside the battery. If the battery is dropped or any shock is applied to it, dispose of it without using.

- Startup and maintenance of a control panel must be performed by qualified maintenance personnel with knowledge of protection against electric shock. Lock the control panel so that only qualified maintenance personnel can operate it.

- Before handling the module, touch a conducting object such as a grounded metal to discharge the static electricity from the human body. Failure to do so may cause the module to fail or malfunction.

[Operating Precautions]

⚠ CAUTION

- When changing data and operating status, and modifying program of the running programmable controller from an external device such as a personal computer connected to an intelligent function module, read relevant manuals carefully and ensure the safety before operation. Incorrect change or modification may cause system malfunction, damage to the machines, or accidents.
- Do not power off the programmable controller or reset the CPU module while the setting values in the buffer memory are being written to the flash ROM in the module. Doing so will make the data in the flash ROM undefined. The values need to be set in the buffer memory and written to the flash ROM again. Doing so can cause malfunction or failure of the module.

[Disposal Precautions]

⚠ CAUTION

- When disposing of this product, treat it as industrial waste.
- When disposing of batteries, separate them from other wastes according to the local regulations. For details on battery regulations in EU member states, refer to the MELSEC iQ-R Module Configuration Manual.

[Transportation Precautions]

⚠ CAUTION

- When transporting lithium batteries, follow the transportation regulations. For details on the regulated models, refer to the MELSEC iQ-R Module Configuration Manual.
- The halogens (such as fluorine, chlorine, bromine, and iodine), which are contained in a fumigant used for disinfection and pest control of wood packaging materials, may cause failure of the product. Prevent the entry of fumigant residues into the product or consider other methods (such as heat treatment) instead of fumigation. The disinfection and pest control measures must be applied to unprocessed raw wood.

CONDITIONS OF USE FOR THE PRODUCT

(1) Mitsubishi 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 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'S USER, 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 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 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 representative in your region.

INTRODUCTION

Thank you for purchasing the Mitsubishi MELSEC iQ-R series programmable controllers.

This manual describes the performance specifications, procedures before operation, wiring, and operation examples of the relevant products listed below.

Before using this product, please read this manual and the relevant manuals carefully and develop familiarity with the functions and performance of the MELSEC iQ-R series programmable controller to handle the product correctly.

When applying the program examples provided in this manual to an actual system, ensure the applicability and confirm that it will not cause system control problems.

Please make sure that the end users read this manual.

> **Point**
>
> Unless otherwise specified, this manual provides program examples in which the I/O numbers of X/Y0 to X/YF are assigned to the A/D converter module. Assign I/O numbers when applying the program examples to an actual system. For I/O number assignment, refer to the following.
> 📖 MELSEC iQ-R Module Configuration Manual

Relevant products

R60AD4, R60ADV8, R60ADI8

COMPLIANCE WITH EMC AND LOW VOLTAGE DIRECTIVES

Method of ensuring compliance

To ensure that Mitsubishi 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.

- 📖 MELSEC iQ-R Module Configuration Manual
- 📖 Safety Guidelines (This manual is included with the base unit.)

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

Additional measures

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

CONTENTS

RELEVANT MANUALS

Manual name [manual number]	Description	Available form
MELSEC iQ-R Analog-Digital Converter Module User's Manual (Startup) [SH-081232ENG] (this manual)	Performance specifications, procedures before operation, wiring, operation examples, and offset/gain setting of the A/D converter module	Print book
		e-Manual PDF
MELSEC iQ-R Analog-Digital Converter Module User's Manual (Application) [SH-081233ENG]	Functions, parameter settings, troubleshooting, I/O signals, and buffer memory of the A/D converter module	Print book
		e-Manual PDF

This manual does not include detailed information on the following:
- General specifications
- Applicable CPU modules and the number of mountable modules
- Installation

For details, refer to the following.

📖 MELSEC iQ-R Module Configuration Manual

This manual does not include information on the module function blocks.

For details, refer to the Function Block Reference for the module used.

> **Point** 🔎
>
> e-Manual refers to the Mitsubishi FA electronic book manuals that can be browsed using a dedicated tool.
>
> e-Manual has the following features:
> - Required information can be cross-searched in multiple manuals.
> - Other manuals can be accessed from the links in the manual.
> - The hardware specifications of each part can be found from the product figures.
> - Pages that users often browse can be bookmarked.

TERMS

Unless otherwise specified, this manual uses the following terms.

Term	Description
A/D converter module	The abbreviation for the MELSEC iQ-R series analog-digital converter module
GX Works3	The product name of the software package for the MELSEC programmable controllers
Watchdog timer error	An error that occurs if the internal processing of the A/D converter module is abnormal. Watchdog timer enables the module to monitor its own internal processing.
Engineering tool	Another term for GX Works3
Normal mode	Setting items of the operation mode setting
Offset/gain setting mode	
Buffer memory	A memory in an intelligent module for storing data (such as setting values and monitored values) to be transferred to the CPU module
User range	An analog input range where any value can be set. This range can be set in the offset/gain setting.
R mode	A mode in which the module operates with the buffer memory map that has been newly laid out in the MELSEC iQ-R series
Q compatible mode	A mode in which the module operates with the buffer memory map converted to the equivalent one of the MELSEC Q series
Global label	A label that is valid for all the program data when multiple program data are created in the project. The global label has two types: a module specific label (module label), which is generated automatically by GX Works3, and an optional label, which can be created for any specified device.
Module label	A label that represents one of memory areas (I/O signals and buffer memory areas) specific to each module in a given character string. For the module used, GX Works3 automatically generates this label, which can be used as a global label.

1 PART NAMES

This chapter describes the part names of the A/D converter module.

No.	Name	Description
(1)	RUN LED	Indicates the operating status of the module. On: Normal operation Flashing (1s cycles): In offset/gain setting mode Flashing (400ms cycles): Selected as a module for the online module change Off: 5V power supply interrupted, watchdog timer error occurred, or module replacement allowed in the process of the online module change
(2)	ERR LED	Indicates the error status of the module.[1] On: Error occurred Off: Normal operation
(3)	ALM LED	Indicates the alarm status of the module.[1] On: Alert (process alarm or rate alarm) issued Flashing: Input signal error detected Off: Normal operation
(4)	Terminal block	18-point screw terminal block for connecting input signal wires of external devices and others
(5)	Terminal block cover	Covers for preventing electric shock while the power is on
(6)	Production information marking	Shows the product information (16 digits) of the module.

[1] For details, refer to the following.
📖 MELSEC iQ-R Analog-Digital Converter Module User's Manual (Application)

MEMO

2 SPECIFICATIONS

This chapter describes the performance specifications.

2.1 Performance Specifications

This section describes the performance specifications of the A/D converter modules.

R60AD4

Item	Specifications			
Number of analog input channels	4 channels			
Analog input voltage	-10 to 10VDC (input resistance 1MΩ)			
Analog input current	0 to 20mADC (input resistance 250Ω)			
Digital output value	16-bit signed binary value (-32768 to 32767)			
I/O characteristics, resolution[*1]	Analog input range		Digital output value	Resolution
	Voltage	0 to 10V	0 to 32000	312.5μV
		0 to 5V		156.3μV
		1 to 5V		125.0μV
		1 to 5V (extended mode)	-8000 to 32000	125.0μV
		-10 to 10V	-32000 to 32000	312.5μV
		User range setting		47.7μV
	Current	0 to 20mA	0 to 32000	625.0nA
		4 to 20mA		500.0nA
		4 to 20mA (extended mode)	-8000 to 32000	500.0nA
		User range setting	-32000 to 32000	190.7nA
Accuracy (accuracy of the maximum digital output value)[*2]	Ambient temperature 25±5℃: within ±0.1% (±32 digit) Ambient temperature 0 to 55℃: within ±0.3% (±96 digit)			
Conversion speed	80μs/CH			
Absolute maximum input	Voltage: ±15V, Current: 30mA[*3]			
Number of offset/gain settings[*4]	50000 times maximum			
Isolation method	Between I/O terminals and programmable controller power supply: Photocoupler Between input channels: Non-isolation			
Withstand voltage	Between I/O terminals and programmable controller power supply: 500VACrms for 1 minute			
Insulation resistance	Between I/O terminals and programmable controller power supply: 10MΩ or higher, at 500VDC			
Number of occupied I/O points	16 points (I/O assignment: Intelligent 16 points)			
External interface	18-point terminal block			
Applicable wire size	0.3 to 0.75㎟ (22 to 18 AWG)			
Applicable solderless terminal	R1.25-3 (solderless terminal with an insulation sleeve cannot be used)			
Internal current consumption (5VDC)	0.22A			
External dimensions	Height	106mm (Base unit mounting side: 98mm)		
	Width	27.8mm		
	Depth	131mm		
Weight	0.12kg			

*1   For details on the I/O conversion characteristics, refer to the following.
     ☞ Page 35 I/O Conversion Characteristics
*2   Except for the conditions under noise influence.
*3   These voltage and current values are instantaneous values at which no breakdown occurs in the internal resistance of the module.
*4   A count more than 50000 times causes Number of writes to offset/gain settings reach limit error (error code: 1080H).

R60ADV8

Item	Specifications		
Number of analog input channels	8 channels		
Analog input voltage	-10 to 10VDC (input resistance 1MΩ)		
Analog input current	—		
Digital output value	16-bit signed binary value (-32768 to 32767)		
I/O characteristics, resolution[*1]	Analog input range	Digital output value	Resolution
	Voltage 0 to 10V	0 to 32000	312.5μV
	0 to 5V		156.3μV
	1 to 5V		125.0μV
	1 to 5V (extended mode)	-8000 to 32000	125.0μV
	-10 to 10V	-32000 to 32000	312.5μV
	User range setting		47.7μV
Accuracy (accuracy of the maximum digital output value)[*2]	Ambient temperature 25±5℃: within ±0.1% (±32 digit) Ambient temperature 0 to 55℃: within ±0.3% (±96 digit)		
Conversion speed	80μs/CH		
Absolute maximum input	Voltage: ±15V[*3]		
Number of offset/gain settings[*4]	50000 times maximum		
Isolation method	Between I/O terminals and programmable controller power supply: Photocoupler Between input channels: Non-isolation		
Withstand voltage	Between I/O terminals and programmable controller power supply: 500VACrms for 1 minute		
Insulation resistance	Between I/O terminals and programmable controller power supply: 10MΩ or higher, at 500VDC		
Number of occupied I/O points	16 points (I/O assignment: Intelligent 16 points)		
External interface	18-point terminal block		
Applicable wire size	0.3 to 0.75mm² (22 to 18 AWG)		
Applicable solderless terminal	R1.25-3 (solderless terminal with an insulation sleeve cannot be used)		
Internal current consumption (5VDC)	0.23A		
External dimensions	Height	106mm (Base unit mounting side: 98mm)	
	Width	27.8mm	
	Depth	131mm	
Weight	0.12kg		

*1 For details on the I/O conversion characteristics, refer to the following.
  ☞ Page 35 I/O Conversion Characteristics
*2 Except for the conditions under noise influence.
*3 This voltage value is an instantaneous value at which no breakdown occurs in the internal resistance of the module.
*4 A count more than 50000 times causes Number of writes to offset/gain settings reach limit error (error code: 1080H).

R60ADI8

Item	Specifications		
Number of analog input channels	8 channels		
Analog input voltage	—		
Analog input current	0 to 20mADC (input resistance 250Ω)		
Digital output value	16-bit signed binary value (-32768 to 32767)		
I/O characteristics, resolution[1]	Analog input range	Digital output value	Resolution
	Current	0 to 20mA	0 to 32000	625.0nA
		4 to 20mA		500.0nA
		4 to 20mA (extended mode)	-8000 to 32000	500.0nA
		User range setting	-32000 to 32000	190.7nA
Accuracy (accuracy of the maximum digital output value)[2]	Ambient temperature 25±5℃: within ±0.1% (±32 digit) Ambient temperature 0 to 55℃: within ±0.3% (±96 digit)		
Conversion speed	80μs/CH		
Absolute maximum input	Current: 30mA[3]		
Number of offset/gain settings[4]	50000 times maximum		
Isolation method	Between I/O terminals and programmable controller power supply: Photocoupler Between input channels: Non-isolation		
Withstand voltage	Between I/O terminals and programmable controller power supply: 500VACrms for 1 minute		
Insulation resistance	Between I/O terminals and programmable controller power supply: 10MΩ or higher, at 500VDC		
Number of occupied I/O points	16 points (I/O assignment: Intelligent 16 points)		
External interface	18-point terminal block		
Applicable wire size	0.3 to 0.75㎟ (22 to 18 AWG)		
Applicable solderless terminal	R1.25-3 (solderless terminal with an insulation sleeve cannot be used)		
Internal current consumption (5VDC)	0.22A		
External dimensions	Height	106mm (Base unit mounting side: 98mm)	
	Width	27.8mm	
	Depth	131mm	
Weight	0.12kg		

*1 For details on the I/O conversion characteristics, refer to the following.
☞Page 35 I/O Conversion Characteristics
*2 Except for the conditions under noise influence.
*3 This current value is an instantaneous value at which no breakdown occurs in the internal resistance of the module.
*4 A count more than 50000 times causes Number of writes to offset/gain settings reach limit error (error code: 1080H).

3 FUNCTION LIST

The following table lists the functions of the A/D converter module. For further details on the function, refer to the following.
📖 MELSEC iQ-R Analog-Digital Converter Module User's Manual (Application)

Item			Description
Range switching function			Allows switching the input range of an analog input for each channel. Switching the range makes it possible to change the input signal characteristics.
A/D conversion enable/disable setting function			Controls whether to enable or disable the A/D conversion for each channel. Disabling the A/D conversion on unused channels reduces the A/D conversion cycles.
A/D conversion method	Sampling processing		Executes A/D conversion of analog input values sequentially and stores the digital output values to the buffer memory areas.
	Averaging processing	Time average	Executes A/D conversion for a set time, and calculates the average of the total value excluding the maximum value and the minimum value to store it in the buffer memory area. The number of processing times within the set time changes depending on the number of channels where the A/D conversion is enabled.
		Count average	Executes A/D conversion for a set number of times, and calculates the average of the total value excluding the maximum value and the minimum value to store it in the buffer memory area. The time taken to store the average value obtained by the average processing in the buffer memory area changes depending on the number of channels where the A/D conversion is enabled.
		Moving average	Averages digital output values taken at every sampling cycle for a specified number of times, and stores the averaged value in the buffer memory area. Because the target range for averaging processing is moved in response to every sampling processing, the latest digital output value can be obtained.
	Primary delay filter		Performs digital output where the transient noise of analog input is smoothed depending on the set time constant, and stores the value in the buffer memory area.
Scaling function			Performs scale conversion on digital output values within a specified range between a scaling upper limit value and a scaling lower limit value. This function reduces the time and effort to create a program of the scale conversion.
Shift function			Adds (shifts) a set conversion value shift amount to a digital output value and stores the result in the buffer memory area. The digital operation value reflects the change in the conversion value shift amount on a realtime basis. Therefore, fine adjustment can be easily performed when the system starts.
Digital clipping function			Fixes a possible digital operation value to the maximum digital output value or the minimum digital output value when an input current or voltage exceeds the input range.
Difference conversion function			Subtracts a difference conversion reference value from a digital operation value and stores the acquired value in the buffer memory area.
Maximum value/minimum value hold function			Stores the maximum and minimum values of digital operation values to the buffer memory area for each channel.
Alert output function	Process alarm		Outputs an alert when a digital operation value enters the preset alert output range.
	Rate alarm		Outputs an alert when the change rate of a digital output value is equal to or more than the rate alarm upper limit value, or the rate is equal to or less than the rate alarm lower limit value.
Input signal error detection function			Detects an analog input value that is above or below the set range.
Logging function			Logs (records) digital output values or digital operation values. 10000 points of data can be logged for each channel.
Logging read function			Makes it possible to store more than 10000 points of logging data without stopping logging by transferring the device data to the file register of the CPU module during logging. This function reduces the takt time in a test demanding high-speed conversion.
Interrupt function			Executes an interrupt program of the CPU module when an interrupt factor such as an input signal error or alert output is detected.
Inter-module synchronization function			Allows the A/D conversion values to be held simultaneously among multiple modules in which the inter-module synchronization function is active.
Error history function			Records up to the 16 errors and alarms that occurred in the A/D converter module to store them into the buffer memory area.
Event history function			Collects occurred errors and alarms, and performed operations in the A/D converter module as event information into the CPU module.
Offset/gain setting			Corrects errors in digital output values.
Backing up, saving, and restoring offset/gain values			Makes it possible to back up, save, and restore the offset/gain values of the user range setting.
Online module change			Allows module replacement without stopping the system. For the procedure of the online module change, refer to the following. 📖 MELSEC iQ-R Online Module Change Manual

Item	Description
Q compatible mode function	Controls an operation state with the buffer memory layout converted to equivalent one of the Q series. This compatibility makes it possible to reuse sequence programs that have exhibited high performance on the Q series analog input modules.

3

4 PROCEDURES BEFORE OPERATION

This chapter describes the procedures before operation.

1. Mounting a module

Mount the A/D converter module in any desired configuration.

☞ Page 27 System configuration

2. Wiring

Perform wiring of external devices to the A/D converter module.

☞ Page 24 External Wiring

3. Adding a module

Add the A/D converter module to a module configuration by using the engineering tool. For details, refer to the following.

📖 GX Works3 Operating Manual

4. Parameter settings

Set up the parameters of the A/D converter module by using the engineering tool. For details, refer to the following.

📖 MELSEC iQ-R Analog-Digital Converter Module User's Manual (Application)

5. Offset/gain setting

Perform the offset/gain setting to set a user range, if necessary.

☞ Page 32 OFFSET/GAIN SETTING

6. Programming

Create a program. For details, refer to the following.

☞ Page 27 OPERATION EXAMPLES

MEMO

4

5 WIRING

This chapter describes the wiring of the A/D converter module.

5.1 Terminal Blocks

Precautions

Tighten the module fixing screws and others within the specified torque range.

Screw type	Tightening torque range
Module fixing screw (M3)[*1]	0.37 to 0.48N·m
Terminal screw (M3)	0.42 to 0.58N·m
Terminal block mounting screw (M3.5)	0.66 to 0.89N·m

*1 The hook on the top of the module allows the module to be fixed to a base unit easily. In a place where there is a lot of vibration, however, fixing with module fixing screws is recommended.

The following table lists an applicable solderless terminal to be connected to the terminal block. When wiring, use the wire and tightening torque applicable to the table. Use UL listed solderless terminals and, for processing, use the tools recommended by their manufacturer. Note that a solderless terminal with an insulation sleeve cannot be used.

Solderless terminal		Wire			
Model	Applicable tightening torque	Diameter	Type	Material	Temperature rating
R1.25-3	0.42 to 0.58N·m	0.3 to 0.75mm² (22 to 18 AWG)	Stranded	Copper	75℃ or greater

Signal names of the terminal blocks

The following table shows signal names of the terminal blocks.

■R60AD4

Terminal block	Terminal number	Signal name	
	1	CH1	V+
	2		V-/I-
	3		I+
	4		SLD
	5	CH2	V+
	6		V-/I-
	7		I+
	8		SLD
	9	CH3	V+
	10		V-/I-
	11		I+
	12		SLD
	13	CH4	V+
	14		V-/I-
	15		I+
	16		SLD
	17	AG	
	18	FG	

■R60ADV8

Terminal block	Terminal number	Signal name	
	1	CH1	V+
	2		V-
	3	CH2	V+
	4		V-
	5	CH3	V+
	6		V-
	7	CH4	V+
	8		V-
	9	CH5	V+
	10		V-
	11	CH6	V+
	12		V-
	13	CH7	V+
	14		V-
	15	CH8	V+
	16		V-
	17	AG	
	18	FG	

■R60ADI8

Terminal block	Terminal number	Signal name	
	1	CH1	I+
	2		I-
	3	CH2	I+
	4		I-
	5	CH3	I+
	6		I-
	7	CH4	I+
	8		I-
	9	CH5	I+
	10		I-
	11	CH6	I+
	12		I-
	13	CH7	I+
	14		I-
	15	CH8	I+
	16		I-
	17	AG	
	18	FG	

Point

Terminal blocks that have been used on MELSEC-Q series A/D converter modules can be used just the way they are. The terminal layout is the same as the MELSEC-Q series A/D converter modules (the Q64AD, Q68ADV, and Q68ADI).

The terminal blocks for MELSEC-L series A/D converter modules, however, cannot be used because of the shape difference.

5.2 External Wiring

Wiring to the terminal block

The following figures show wiring to the terminal block.

■R60AD4

For the voltage input
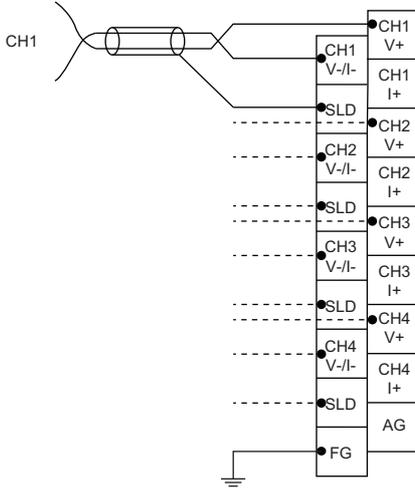
For the current input
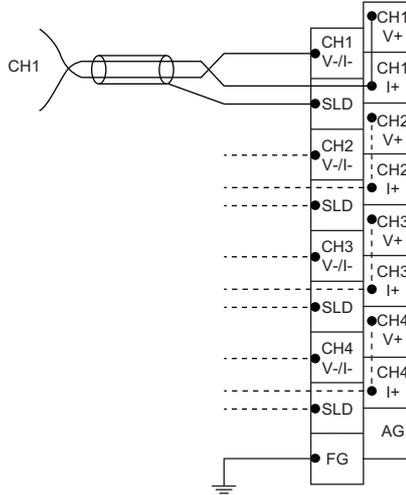
■R60ADV8
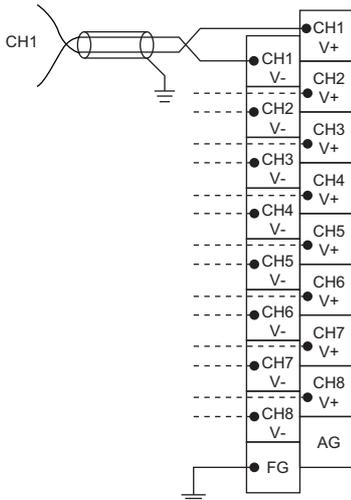
■R60ADI8
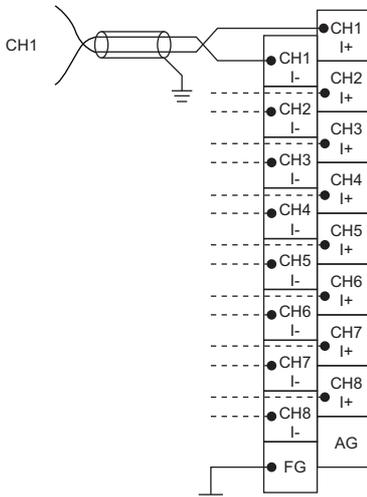
External wiring examples

The following figures show the examples of external wiring.

■R60AD4

For voltage input

Signal source -10 to 10V
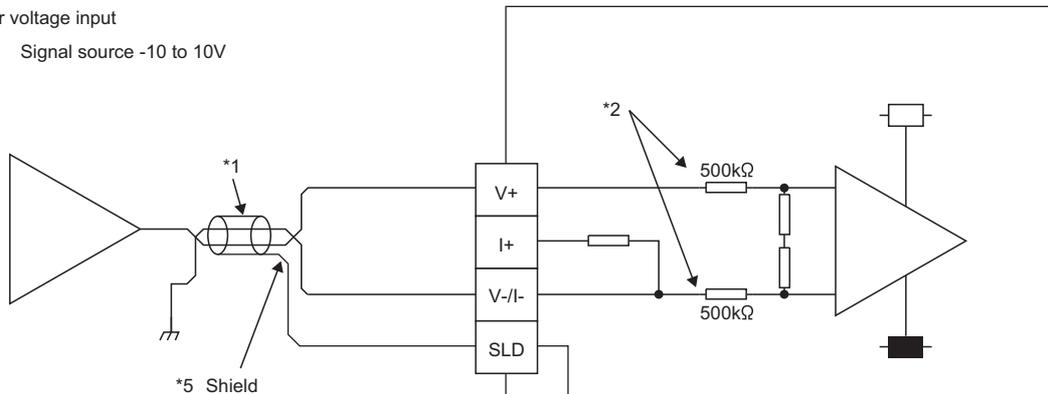
For current input

Signal source 0 to 20mA
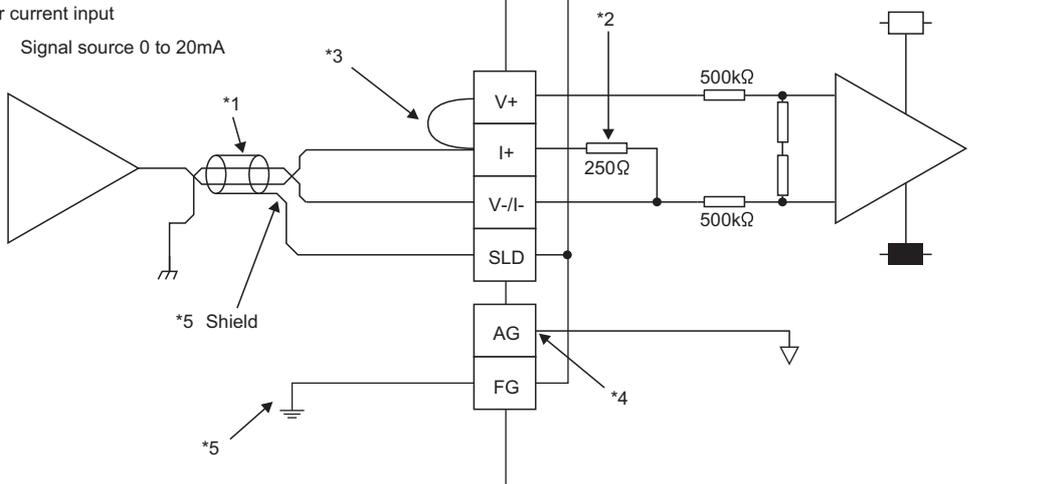
*1   For the wire, use the 2-core twisted cable.
*2   These values indicate the input resistance of the R60AD4.
*3   For the current input, be sure to connect the terminals (V+) and (I+).
*4   Connect the AG terminal and the GND of the external device if there is a potential difference between them.
*5   Be sure to connect the shield wire of cables on each channel to the SLD terminal, and ground the FG terminal.

■R60ADV8
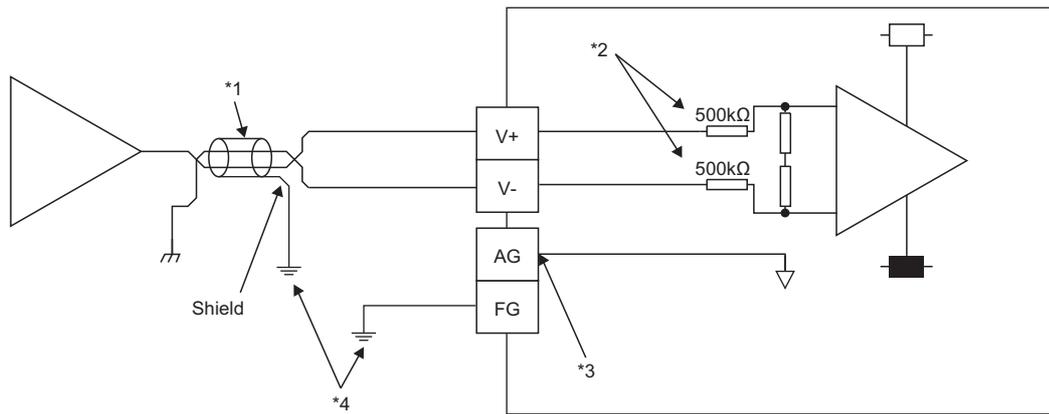
*1 For the wire, use the 2-core twisted cable.
*2 These values indicate the input resistance of the R60ADV8.
*3 Connect the AG terminal and the GND of the external device if there is a potential difference between them.
*4 Be sure to ground the shield wire of cables on each channel and the FG terminal.

■R60ADI8
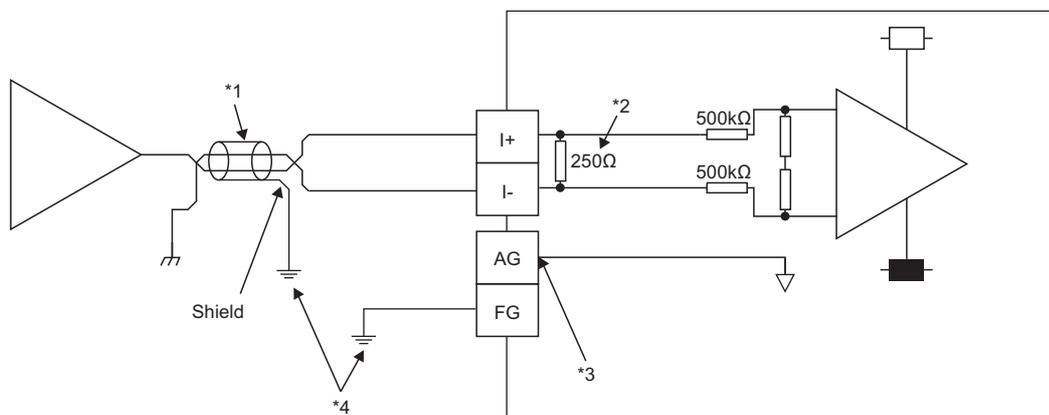
*1 For the wire, use the 2-core twisted cable.
*2 These values indicate the input resistance of the R60ADI8.
*3 Connect the AG terminal and the GND of the external device if there is a potential difference between them.
*4 Be sure to ground the shield wire of cables on each channel and the FG terminal.

Point

Establish a connection of the FG terminal of the power supply module.

In the R60AD4 and R60ADV8, If the circuit is left open between terminals of unused channels, enabling A/D conversion may generate an undefined digital value. To prevent this phenomenon, take any of the following measures:

• Set the A/D conversion enable/disable setting in the unused channels to disable the A/D conversion. Note that changing the A/D conversion enable/disable setting from A/D conversion enable to A/D conversion disable causes a shorter sampling cycle.

• Short-circuit the input terminals (V+) and (V-) in the unused channels.

6 OPERATION EXAMPLES

This chapter describes the programming procedure and the basic program of the A/D converter module.

6.1 Programming Procedure

Take the following steps to create a program for running the A/D converter module:

1. Set parameters.
☞Page 28 Parameter settings

2. Create a program.
☞Page 30 Program examples

> **Point** 🔎
>
> Using function blocks (FBs) reduces load at programming and improves the readability of programs. For details on the function blocks, refer to the following.
>
> 📖 MELSEC iQ-R Analog-Digital Converter Module/Digital-Analog Converter Module Function Block Reference

6.2 Program Examples

System configuration

The following figure shows an example of the system configuration.
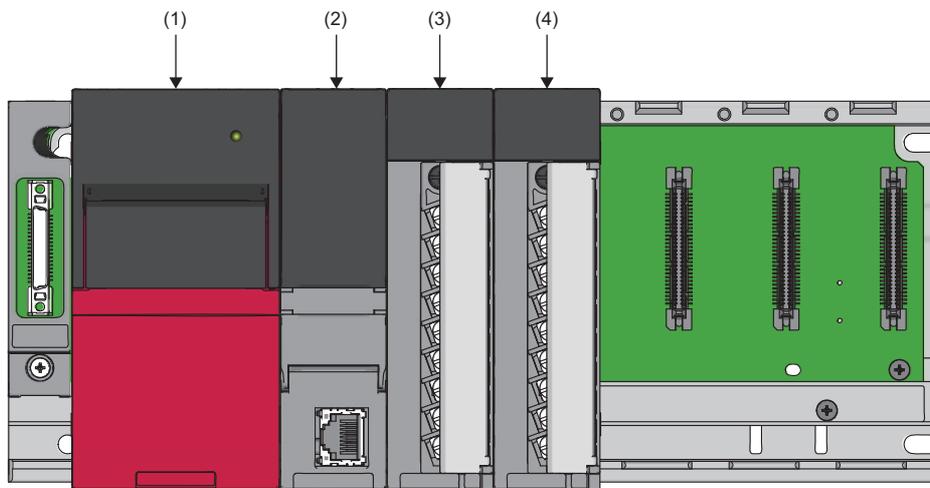
(1) Power supply module (R61P)

(2) CPU module (R120CPU)

(3) A/D converter module (R60AD4)

(4) Input module (RX10)

Parameter settings

Perform an initial setting in the parameter settings of the engineering tool. The auto refresh setting does not need to be changed here.

For details on the parameter settings, refer to the following.

📖 MELSEC iQ-R Analog-Digital Converter Module User's Manual (Application)

Function	Setting item	CH1	CH2	CH3	CH4
Range switching function	Input range setting	0 to 10V	0 to 10V	0 to 20mA	4 to 20mA
Operation mode setting function	Operation mode setting	Normal mode (A/D conversion processing)			
A/D conversion enable/disable setting function	A/D conversion enable/disable setting	A/D conversion enable	A/D conversion enable	A/D conversion enable	A/D conversion enable
A/D conversion method	Averaging process specification	Sampling processing	Count average	Moving average	Sampling processing
	Time average/Count average/ Moving average/Primary delay filter constant setting	—	50	10	—
Scaling function	Scaling enable/disable setting	Disable	Disable	Enable	Disable
	Scaling upper limit value	—	—	16000	—
	Scaling lower limit value	—	—	2000	—
Shift function	Conversion value shift amount	0	0	2000	0
Digital clipping function	Digital clipping enable/disable setting	Disable	Disable	Enable	Disable
Alert output function (process alarm)	Alert output setting (process alarm)	Disable	Enable	Disable	Disable
	Process alarm upper upper limit value	—	32000	—	—
	Process alarm upper lower limit value	—	28000	—	—
	Process alarm lower upper limit value	—	4000	—	—
	Process alarm lower lower limit value	—	0	—	—
Alert output function (rate alarm)	Alert output setting (rate alarm)	Enable	Disable	Disable	Disable
	Rate alarm alert detection cycle setting	5	—	—	—
	Rate alarm upper limit value	250	—	—	—
	Rate alarm lower limit value	-50	—	—	—
Input signal error detection function	Input signal error detection setting	Upper limit detection	Disable	Disable	Disable
	Input signal error detection setting value	100	—	—	—
Logging function	Logging enable/disable setting	Disable	Disable	Disable	Disable
	Logging data setting	—	—	—	—
	Logging cycle setting value	—	—	—	—
	Logging cycle unit setting	—	—	—	—
	Level trigger condition setting	—	—	—	—
	Post-trigger logging points	—	—	—	—
	Trigger data	—	—	—	—
	Trigger setting value	—	—	—	—
	Read interrupt enable/disable setting	—	—	—	—
	Logging read points setting value	—	—	—	—

Label settings

GX Works3 provides functions that support the creation of a program.

The following table lists the module labels and global labels used for the program examples in this section.

There is no need to change the settings of the module labels. For details on the global labels, refer to the following.

📖 MELSEC iQ-R Programming Manual (Program Design)

Classification	Label name	Description	Device
Module label	R60AD_1.bModuleREADY	Module READY	X0
	R60AD_1.bInputSignalErrorDetectionSignal	Input signal error detection signal	X0C
	R60AD_1.bMaxValueMinValueResetCompletedFlag	Maximum value/minimum value reset completed flag	X0D
	R60AD_1.bA_D_conversionCompletedFlag	A/D conversion completed flag	X0E
	R60AD_1.bErrorFlag	Error flag	X0F
	R60AD_1.bOperatingConditionSettingRequest	Operating condition setting request	Y9
	R60AD_1.bMaxValueMinValueResetRequest	Maximum value/minimum value reset request	Y0D
	R60AD_1.uA_D_conversionCompletedFlag.0	A/D conversion completed flag	—
	R60AD_1.stnMonitor[0].wDigitalOutputValue	CH1 Digital output value	—
	R60AD_1.uA_D_conversionCompletedFlag.1	A/D conversion completed flag	—
	R60AD_1.stnMonitor[1].wDigitalOutputValue	CH2 Digital output value	—
	R60AD_1.uA_D_conversionCompletedFlag.2	A/D conversion completed flag	—
	R60AD_1.stnMonitor[2].wDigitalOperationValue	CH3 Digital operation value	—
	R60AD_1.uA_D_conversionCompletedFlag.3	A/D conversion completed flag	—
	R60AD_1.stnMonitor[3].wDigitalOutputValue	CH4 Digital output value	—
	R60AD_1.stnMonitor[2].wMaxValue	CH3 Maximum value	—
	R60AD_1.stnMonitor[2].wMinValue	CH3 Minimum value	—
	R60AD_1.uWarningOutputFlagProcessAlarmUpperLimit.1	Alert output flag (Process alarm upper limit)	—
	R60AD_1.uWarningOutputFlagProcessAlarmLowerLimit.1	Alert output flag (Process alarm lower limit)	—
	R60AD_1.uWarningOutputFlagRateAlarmUpperLimit.0	Alert output flag (Rate alarm upper limit)	—
	R60AD_1.uWarningOutputFlagRateAlarmLowerLimit.0	Alert output flag (Rate alarm lower limit)	—
	R60AD_1.uInputSignalErrorDetectionFlag.0	Input signal error detection flag	—
Labels to be defined	Define global labels as shown below:		

| Label Name	Data Type		Class	Assign (Device/Label)
CH1_DigOutVal	Word [Signed]	...	VAR_GLOBAL ▼	D11
CH2_DigOutVal	Word [Signed]	...	VAR_GLOBAL ▼	D12
CH3_DigCalcVal	Word [Signed]	...	VAR_GLOBAL ▼	D13
CH4_DigOutVal	Word [Signed]	...	VAR_GLOBAL ▼	D14
CH3_DigMaxVal	Word [Signed]	...	VAR_GLOBAL ▼	D15
CH3_DigMinVal	Word [Signed]	...	VAR_GLOBAL ▼	D16
CH2_ProcAlmUpLimit	Bit	...	VAR_GLOBAL ▼	F0
CH2_ProcAlmLowLimit	Bit	...	VAR_GLOBAL ▼	F1
CH1_RateAlmUpLimit	Bit	...	VAR_GLOBAL ▼	F2
CH1_RateAlmLowLimit	Bit	...	VAR_GLOBAL ▼	F3
CH1_InputSigErr	Bit	...	VAR_GLOBAL ▼	F4
DigitOutValSig	Bit	...	VAR_GLOBAL ▼	X10
MaxMinReadSig	Bit	...	VAR_GLOBAL ▼	X11
MaxMinResetSig	Bit	...	VAR_GLOBAL ▼	X12
ErrResetSig	Bit	...	VAR_GLOBAL ▼	X13
ErrOperationEN	Bit	...	VAR_GLOBAL ▼	
ErrOperationENO	Bit	...	VAR_GLOBAL ▼	
ErrOperationOK	Bit	...	VAR_GLOBAL ▼	
UnitErrFlg	Bit	...	VAR_GLOBAL ▼	
UnitErrCode	Word [Signed]	...	VAR_GLOBAL ▼	
UnitAlarmCode	Word [Signed]	...	VAR_GLOBAL ▼	

Program examples

■Program example 1

- This program is an example to read and save the digital output values of CH1, CH2, and CH4, and the digital operation value of CH3.
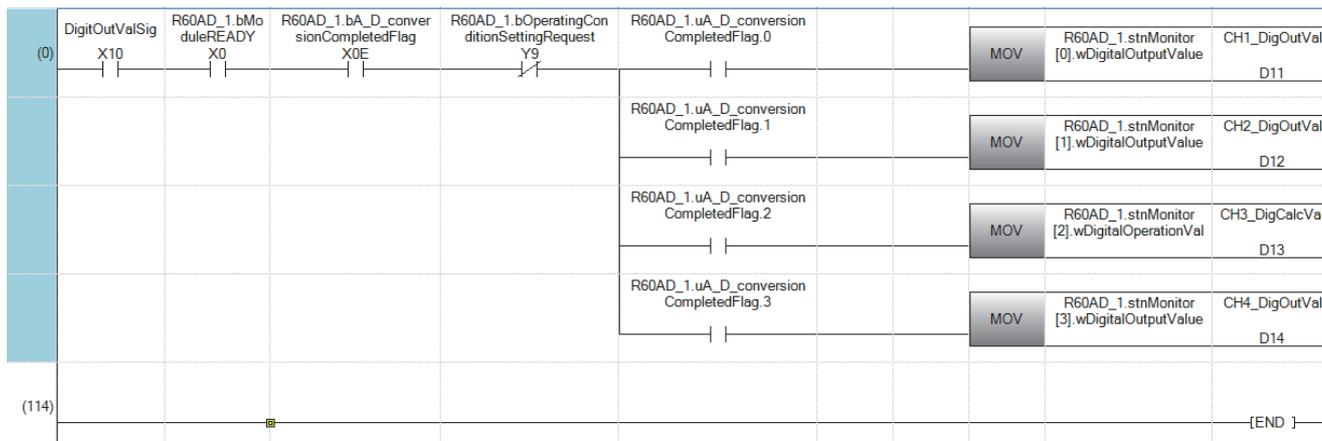
(0)   CH1 Digital output value, CH2 Digital output value, CH3 Digital operation value, and CH4 Digital output value are to be read.
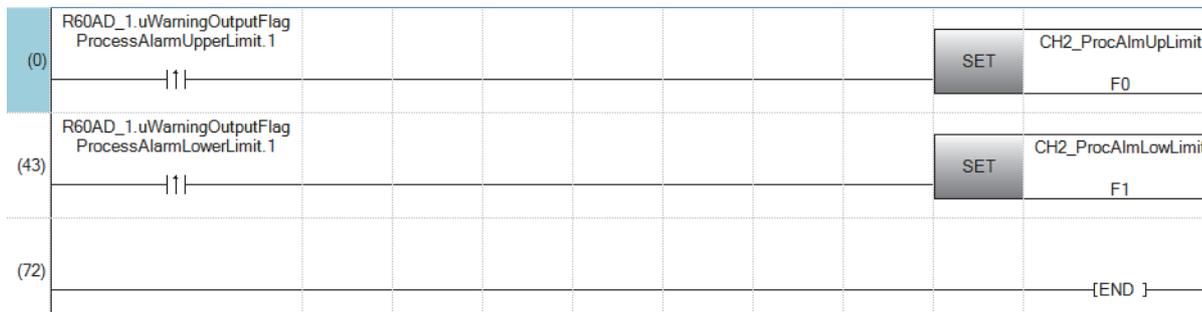
■Program example 2

- This program is an example to read and reset the maximum value and minimum value of CH3.
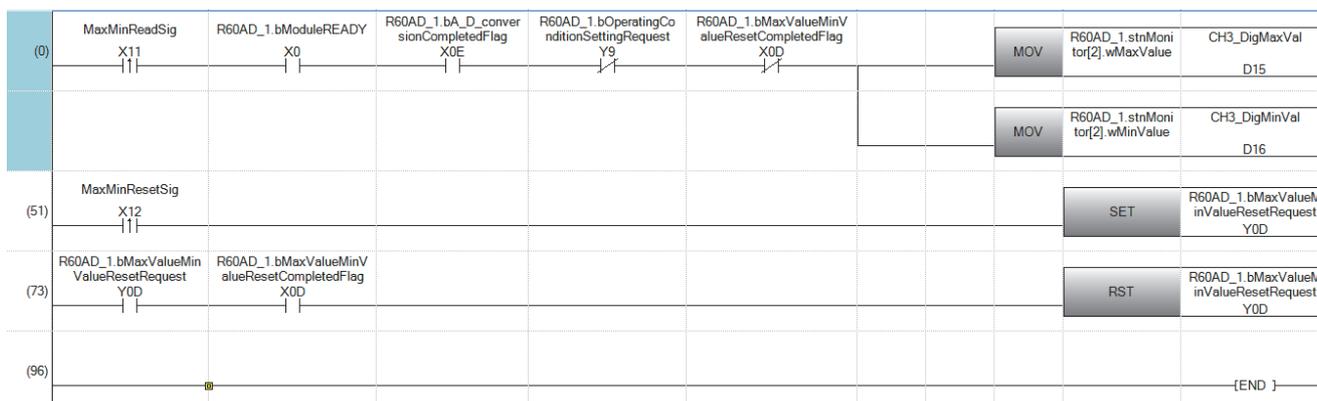
(0)   CH3 Maximum value and CH3 Minimum value are to be read.

(51)   Maximum value/minimum value reset request (YD) is to be turned on.

(73)   Maximum value/minimum value reset request (YD) is to be turned off.
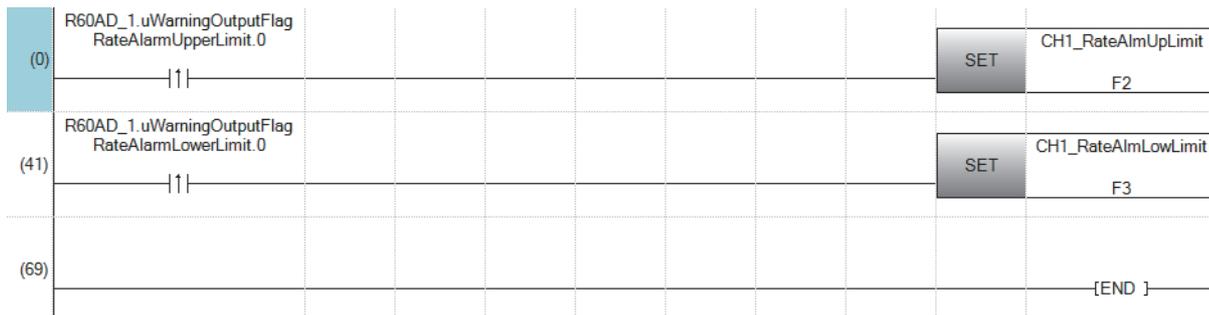
■Program example 3

- This program is an example to perform the processing at the time of the issuance of a process alarm upper/lower limit alert in CH2.

(0)   At the time when a process alarm upper limit alert is issued in CH2, the processing is to be performed.

(43)   At the time when a process alarm lower limit alert is issued in CH2, the processing is to be performed.

■Program example 4

- This program is an example to perform the processing at the time of the issuance of a rate alarm upper/lower limit alert in CH1.

```
        R60AD_1.uWarningOutputFlag
        RateAlarmUpperLimit.0                                                        CH1_RateAlmUpLimit
(0)        ┤↑├                                                              SET        F2

        R60AD_1.uWarningOutputFlag
        RateAlarmLowerLimit.0                                                        CH1_RateAlmLowLimit
(41)       ┤↑├                                                              SET        F3

(69)                                                                                  [END ]
```

(0)   At the time when a rate alarm upper limit alert is issued in CH1, the processing is to be performed.

(41)   At the time when a rate alarm lower limit alert is issued in CH1, the processing is to be performed.
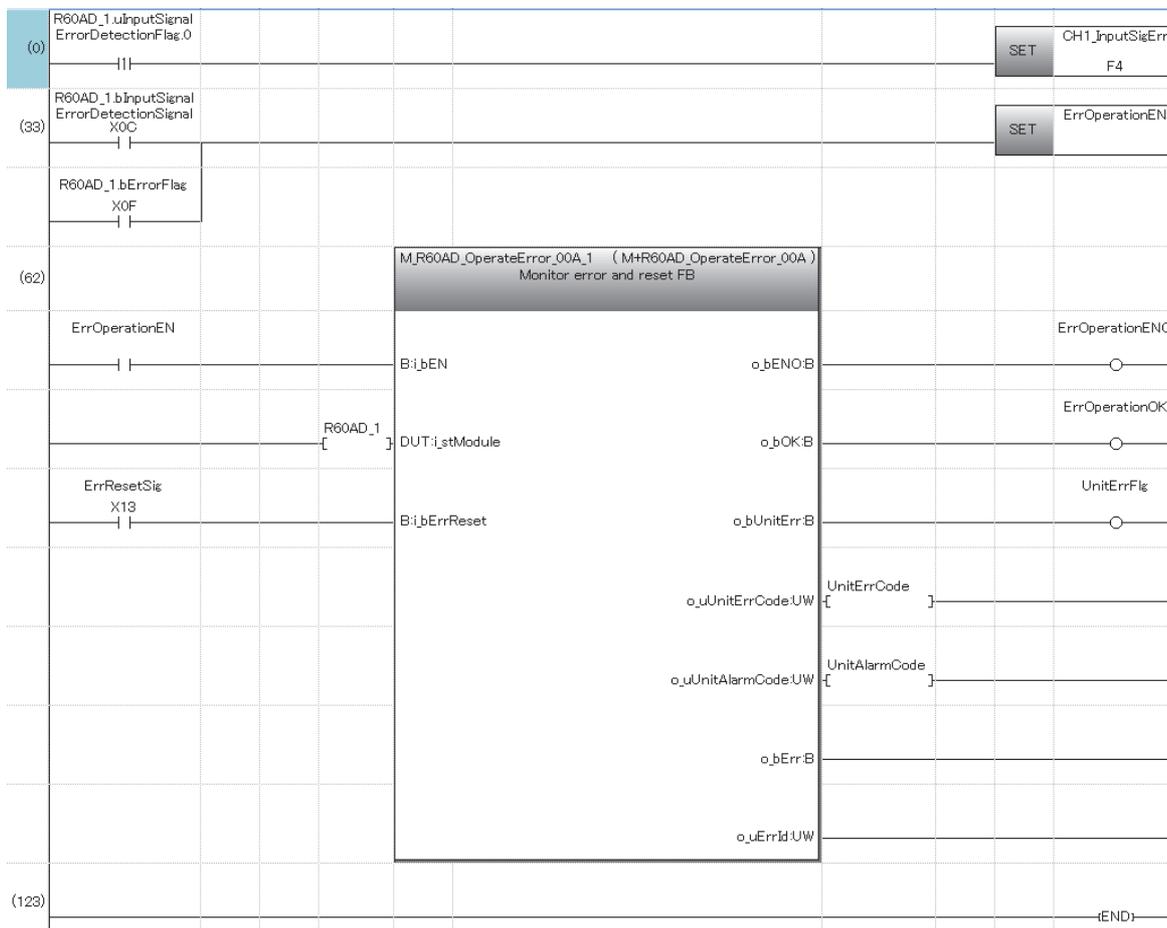
■Program example 5

- This program is an example to make the latest error code appear when an input signal error is detected in CH1, or an error occurs. After this, the program clears the error flag and the stored error code.

```
        R60AD_1.uInputSignal
        ErrorDetectionFlag.0                                                          CH1_InputSigErr
(0)        ┤↑├                                                             SET         F4

        R60AD_1.bInputSignal
        ErrorDetectionSignal
        X0C                                                                           ErrOperationEN
(33)       ┤ ├                                                             SET

        R60AD_1.bErrorFlag
        X0F
           ┤ ├

(62)
                              M_R60AD_OperateError_00A_1  ( M+R60AD_OperateError_00A )
                              Monitor error and reset FB
        ErrOperationEN                                                               ErrOperationENO
           ┤ ├              B:i_bEN                         o_bENO:B                     ◯

                                                                                     ErrOperationOK
                  R60AD_1                                                                ◯
                  ─[    ]─ DUT:i_stModule                  o_bOK:B

        ErrResetSig                                                                   UnitErrFlg
        X13                                                                              ◯
           ┤ ├              B:i_bErrReset                  o_bUnitErr:B

                                                                         UnitErrCode
                                                           o_uUnitErrCode:UW ─[    ]─

                                                                         UnitAlarmCode
                                                           o_uUnitAlarmCode:UW ─[    ]─

                                                           o_bErr:B

                                                           o_uErrId:UW

(123)                                                                                 [END]
```

(0)   At the time when an input signal error is detected in CH1, the processing is to be performed.

(33)   Error manipulation start flag is to be turned on.

7 OFFSET/GAIN SETTING

Using the user range setting requires setting the offset and gain values.

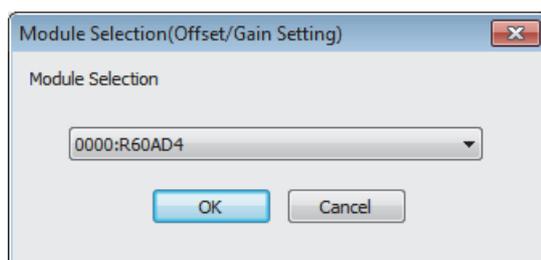Access to the offset/gain setting window in the engineering tool to set the offset and gain values.

7.1 Setting Procedure

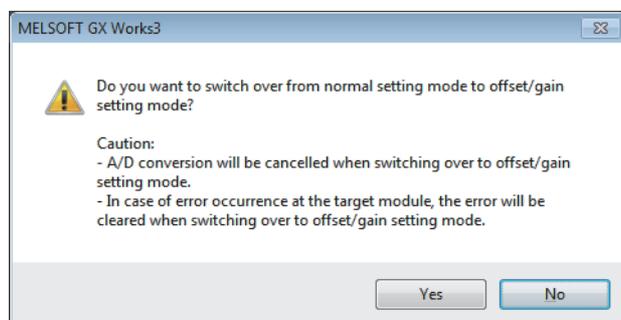The setting procedure for the offset/gain setting of the A/D converter module is as follows:
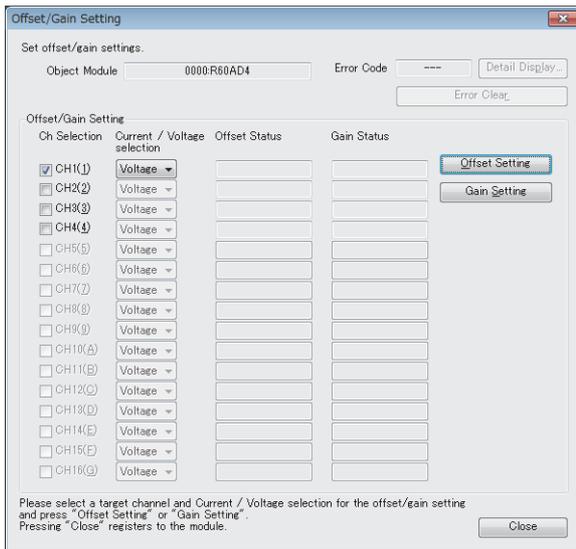
🖱 [Tool] ⇨ [Module Tool List]
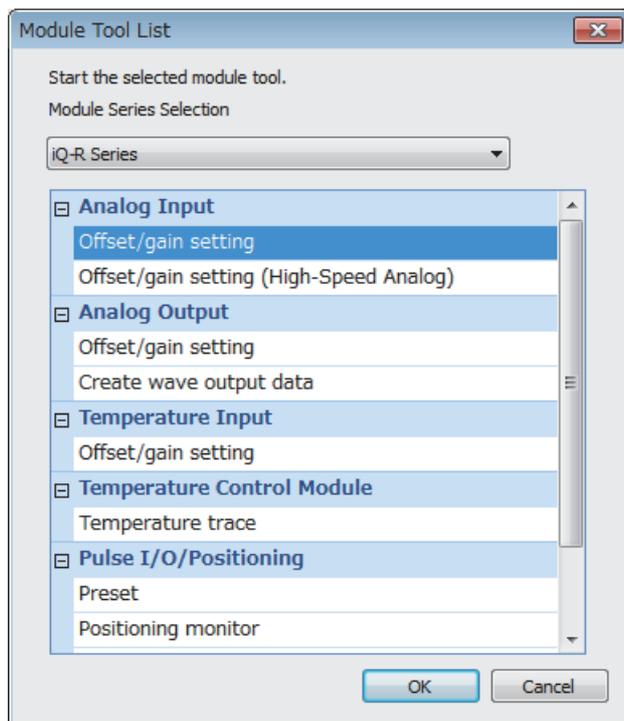
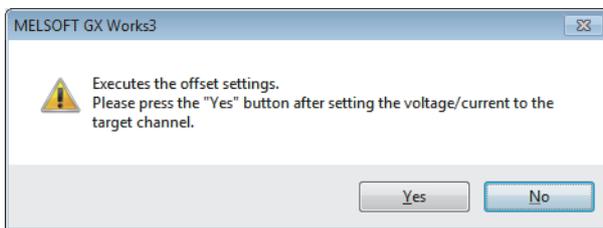**1.** In "Analog Input", select "Offset/gain Setting" and click [OK] button.

2. Select the target module for the offset/gain setting, and click [OK] button.

3. Click [Yes] button.

4. Mark the checkbox of the channel where offset and gain values are to be set.

5. Select the voltage or current and click the [Offset Setting] button.

6. Apply the offset voltage or current to the terminal of the corresponding channel, and click [Yes] button.
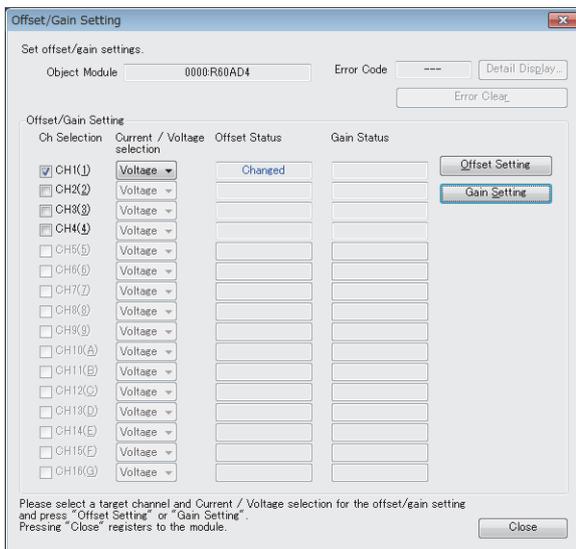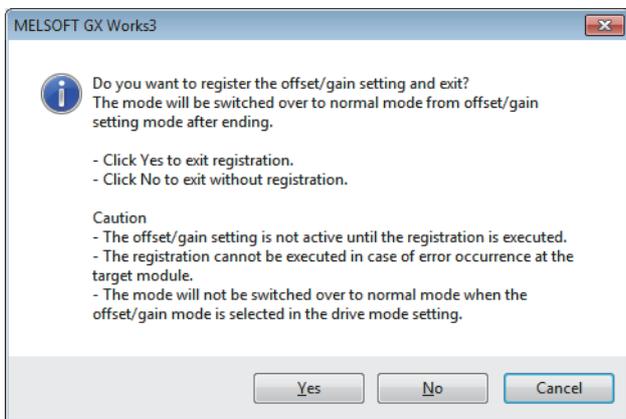
7. Check that "Offset Status" has changed to "Changed", and click [Gain Setting] button.
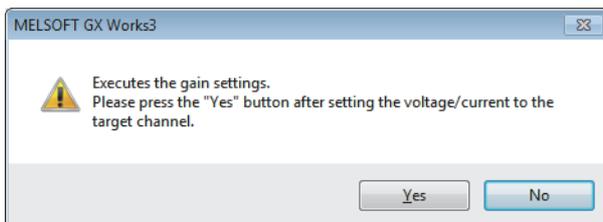
8. Apply the gain voltage or current to the terminal of the corresponding channel, and click [Yes] button.
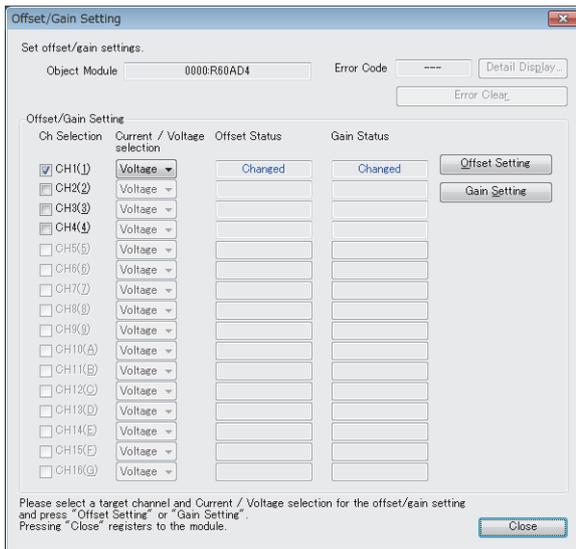
9. Check that "Gain Status" has changed to "Changed", and click [Close] button.

10. Click [Yes] button.

APPENDICES

Appendix 1 I/O Conversion Characteristics

An I/O conversion characteristic of A/D conversion is expressed by the slope of the straight line connecting the offset value and the gain value at the time when an analog signal (voltage or current) from outside the programmable controller is converted to a digital value.
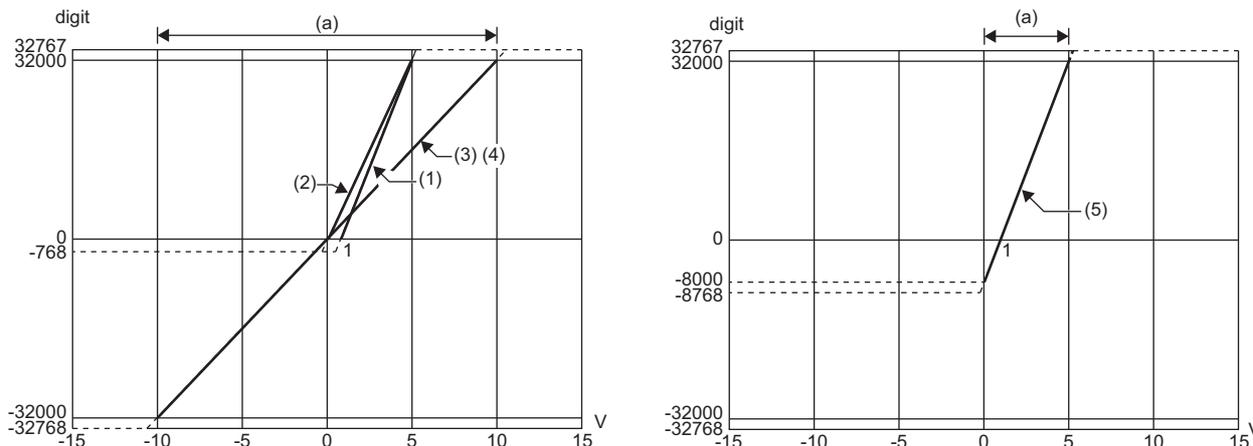
Offset value

This value is the analog input value (voltage or current) where the corresponding digital output value is 0.

Gain value

This value is the analog input value (voltage or current) where the corresponding digital output value is 32000.

A

Voltage input characteristics

The following shows the list of the analog input ranges and the graphs of each voltage input characteristic, at the voltage input.

digit: Digital output value

V: Analog input voltage (V)

(a): Practical analog input range

No.	Input range setting	Offset value	Gain value	Digital output value[*3]	Resolution
(1)	1 to 5V	1V	5V	0 to 32000	125.0μV
(2)	0 to 5V	0V	5V		156.3μV
(3)	-10 to 10V	0V	10V	-32000 to 32000	312.5μV
(4)	0 to 10V	0V	10V	0 to 32000	
(5)	1 to 5V (extended mode)	1V	5V	-8000 to 32000	125.0μV
—	User range setting	[*1]	[*1]	-32000 to 32000	47.7μV[*2]

*1 Set the offset value and gain value in the user range setting within a range that satisfies the following conditions. If the following conditions are not satisfied, A/D conversion may not be performed properly.
Setting range of the offset value and gain value: -10 to 10V
((gain value) - (offset value)) ≥ 1.6V

*2 Maximum resolution in the user range setting.

*3 When analog input exceeds the range of the digital output value, the digital output value is fixed to the maximum or minimum.
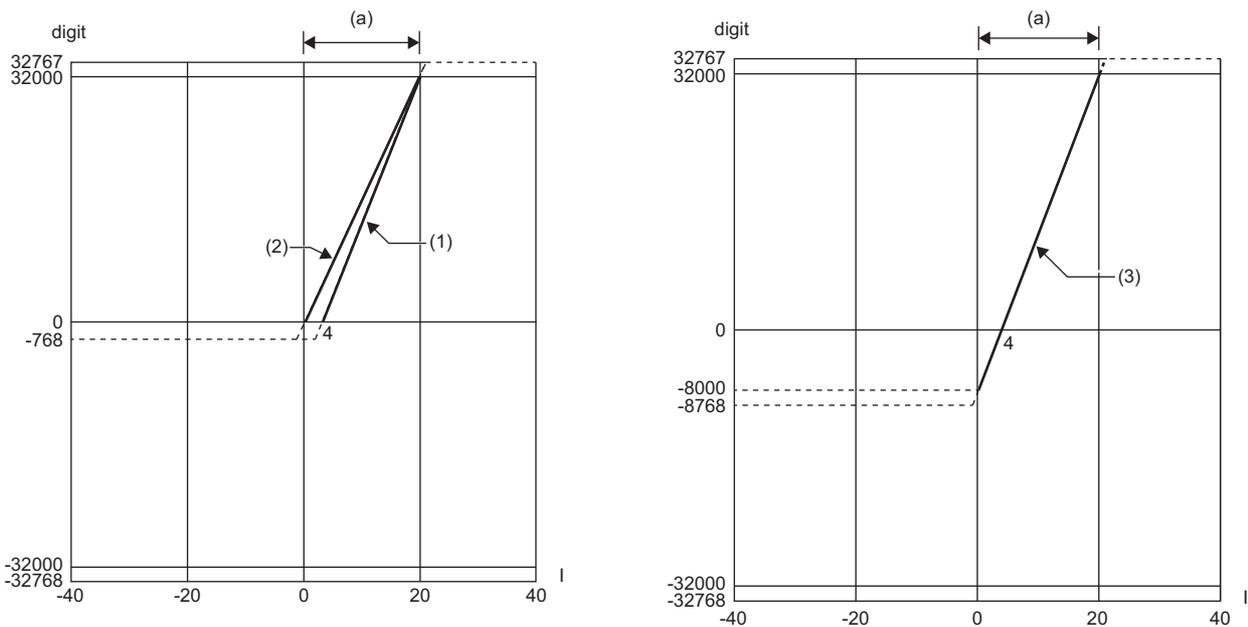
Input range setting	Digital output value	
	Minimum	Maximum
1 to 5V	-768	32767
0 to 5V		
-10 to 10V	-32768	
0 to 10V	-768	
1 to 5V (extended mode)	-8768	
User range setting	-32768	

Point

- Set values within the practical range of the analog input and digital output at each input range. If the values are out of the range, the resolution and accuracy may not fall within the range of the performance specifications. (Do not use values in the dotted line region in the graph of voltage input characteristics.)
- The range of 1 to 5V (extended mode) allows extending the lower limit value of analog input. The upper limit value of analog input cannot be extended.
- Do not set the voltage over ±15V. Doing so can cause breakdown of the elements.

Current input characteristics

The following shows the list of the analog input ranges and the graph of each current input characteristic, at the current input.

digit: Digital output value

I: Analog input current (mA)

(a): Practical analog input range

No.	Input range setting	Offset value	Gain value	Digital output value[3]	Resolution
(1)	4 to 20mA	4mA	20mA	0 to 32000	500.0nA
(2)	0 to 20mA	0mA	20mA		625.0nA
(3)	4 to 20mA (extended mode)	4mA	20mA	-8000 to 32000	500.0nA
—	User range setting	[1]	[1]	-32000 to 32000	190.7nA[2]

[1] Set the offset value and gain value in the user range setting within a range that satisfies the following conditions. If the following conditions are not satisfied, A/D conversion may not be performed properly.
Gain value $\leq$ 20mA, offset value $\geq$ 0mA
((gain value) - (offset value)) $\geq$ 6.1mA

[2] Maximum resolution in the user range setting.

[3] When analog input exceeds the range of the digital output value, the digital output value is fixed to the maximum or minimum.

Input range setting	Digital output value	
	Minimum	Maximum
4 to 20mA	-768	32767
0 to 20mA		
4 to 20mA (extended mode)	-8768	
User range setting	-32768	

Point

- Set values within the practical range of the analog input and digital output at each input range. If the values are out of the range, the resolution and accuracy may not fall within the range of the performance specifications. (Do not use values in the dotted line region in the graph of current input characteristics.)
- The range of 4 to 20mA (extended mode) allows extending the lower limit value of analog input. The upper limit value of analog input cannot be extended.
- Do not set the voltage over $\pm$30mA. Doing so can cause breakdown of the elements.

A

Appendix 2 Accuracy

Accuracy of A/D conversion is determined by the accuracy for the maximum value of digital output value.

An input characteristic change through changes of the offset/gain setting or the input range does not sacrifice the accuracy, which is maintained within the described range of the performance specifications.

The following graph shows the fluctuation range of accuracy when the range of -10 to 10V is selected.
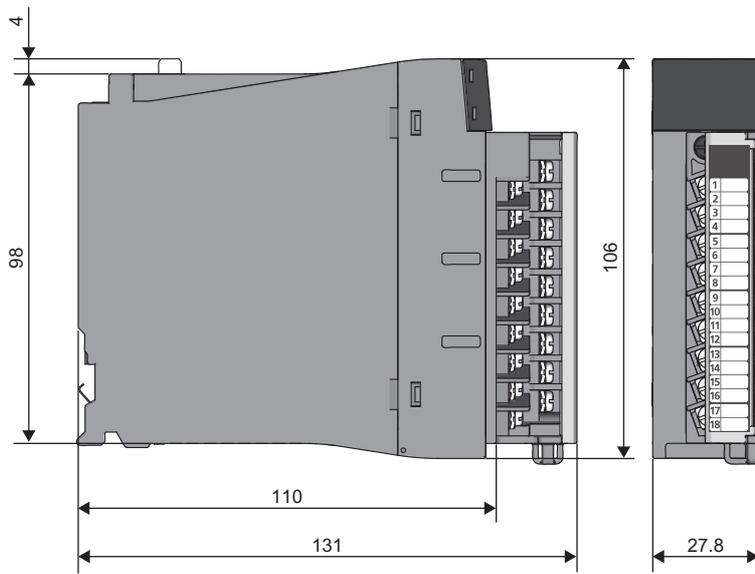
The accuracy is ±0.1% (±32 digit) at ambient temperature of 25±5℃; the accuracy is ±0.3% (±96 digit) at ambient temperature of 0 to 55℃ (except for the conditions under noise influence).
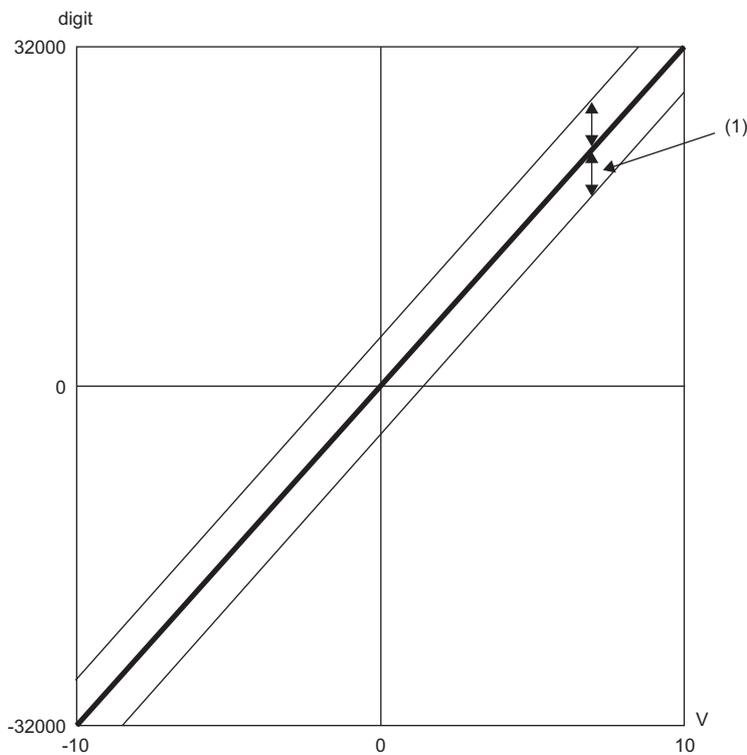
digit: Digital output value

V: Analog input voltage (V)

(1) Voltage fluctuation range

Appendix 3 External Dimensions

The following figure shows the external dimensions of the A/D converter module.

(unit: mm)

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MEMO

REVISIONS

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.

TRADEMARKS

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.

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.