MITSUBISHI ELECTRIC

Programmable Controller

MELSEC iQ-R series

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

-R60DA4
-R60DAV8
-R60DAI8

SAFETY PRECAUTIONS

(Read these precautions before using this product.)

Before using the MELSEC iQ-R series programmable controllers, please read the manuals of each product and the relevant manuals introduced in the manuals of each product carefully, and pay full attention to safety to handle the product correctly.

The precautions given in this manual are concerned with this product only. For the safety precautions of the programmable controller system, refer to the MELSEC iQ-R Module Configuration Manual.

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.
- 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.

[Design Precautions]

⚠WARNING

- 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. Incorrect output or malfunction due to a communication failure may result in an accident.
- Analog outputs may remain on due to a failure of the module. Configure an external interlock circuit for output signals that could cause a serious accident.

[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 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 also can 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.
- Power on or off the external power supply while the programmable controller is on. Failure to do so may result in incorrect output or malfunction.
- At on/off of the power or external power supply, or at the output range switching, a voltage may occur or a current may flow between output terminals for a moment. In this case, start the control after analog outputs become stable.

[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]

⚠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 MELSEC iQ-R Module Configuration Manual. 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. / Failure to do so 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 or 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. Doing so may change the characteristics of the cables, resulting in malfunction.
- 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.
- Mitsubishi 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 each module. 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) 25cm or more 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/JIS B 3502 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.
- Do not touch the integrated circuits on the circuit board of an extended SRAM cassette. Doing so may cause malfunction.
- 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 discharge the static electricity 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 also 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 Electric MELSEC iQ-R series programmable controllers.
This manual describes the performance specifications, procedures before operation, wiring, and operation example of the following relevant modules.
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 introduced 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 describes the program examples in which the I/O numbers of X/Y0 to X/YF are assigned for a D/A converter module. I/O numbers must be assigned to apply the program examples introduced in this manual to an actual system. For I/O number assignment, refer to the following.
MELSEC iQ-R Module Configuration Manual

Relevant modules

R60DA4, R60DAV8, R60DAI8

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 (IB-0800525)

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.

MEMO

CONTENTS

SAFETY PRECAUTIONS 1
CONDITIONS OF USE FOR THE PRODUCT 10
INTRODUCTION 10
COMPLIANCE WITH EMC AND LOW VOLTAGE DIRECTIVES 11
RELEVANT MANUALS 14
TERMS 15
GENERIC TERMS AND ABBREVIATIONS 15

CHAPTER 1 PART NAMES 16

CHAPTER 2 SPECIFICATIONS 18

2.1 Performance Specifications 18

CHAPTER 3 FUNCTION LIST 21

CHAPTER 4 PROCEDURES BEFORE OPERATION 23

CHAPTER 5 SYSTEM CONFIGURATION 25

CHAPTER 6 WIRING 27

6.1 Terminal Block 27
6.2 External Wiring 29

CHAPTER 7 OPERATION EXAMPLE 32

7.1 Programming Procedure 32
7.2 Program Example (Normal Output Mode) 33
7.3 Program Example (Wave Output Mode) 41

CHAPTER 8 OFFSET/GAIN SETTING 52

8.1 Setting Procedure 52

APPENDICES 55

Appendix 1 I/O Conversion Characteristics 55
Appendix 2 Accuracy 58
Appendix 3 External Dimensions 59

INDEX 60

REVISIONS 62
WARRANTY 63
INFORMATION AND SERVICES 64
TRADEMARKS 64

RELEVANT MANUALS

The following manuals are relevant to this product.

Manual name [manual number]	Description
MELSEC iQ-R Digital-Analog Converter Module User's Manual (Startup) [SH-081235ENG] (this manual)	Specifications, procedures before operation, wiring, operation example, and offset/gain setting of the D/A converter module
MELSEC iQ-R Module Configuration Manual [SH-081262ENG]	Common information on the hardware configuration of all modules, overview of each system configuration, and specifications of the power supply module, base unit, SD memory card, and battery
MELSEC iQ-R Digital-Analog Converter Module User's Manual (Application) [SH-081237ENG]	Functions, parameter setting, troubleshooting, I/O signals, and buffer memory areas of the D/A converter module
MELSEC iQ-R Programming Manual (Module Dedicated Instructions) [SH-081976ENG]	Dedicated instructions for the intelligent function modules
MELSEC iQ-R Analog-Digital Converter Module/Digital-Analog Converter Module Function Block Reference [BCN-P5999-0375]	FBs of the A/D converter modules and D/A converter modules
GX Works3 Operating Manual [SH-081215ENG]	System configuration, parameter settings, and online operations of GX Works3
MELSEC iQ-R Online Module Change Manual [SH-081501ENG]	The online module change, which allows a module to be changed without stopping the system for MELSEC iQ-R series programmable controllers

This manual does not describe the details of the following.

- General specifications
- Applicable combinations of CPU modules and the other modules, and the number of mountable modules
- Installation

For details, refer to the following.

MELSEC iQ-R Module Configuration Manual

TERMS

Unless otherwise specified, this manual uses the following terms.

Term	Description
Buffer memory	A memory in an intelligent function module for storing data (such as setting values and monitored values). For a CPU module, it refers to a memory for storing data (such as setting values and monitored values of the Ethernet function, data used for data communications of the multiple CPU system function)
Engineering tool	A tool used for setting up programmable controllers, programming, debugging, and maintenance
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.
Normal mode	A mode used for normal D/A conversion. In the engineering tool, the item name of the mode is displayed as "Normal mode (D/A conversion process)".
Offset/gain setting mode	A mode for the offset/gain setting
Q compatible mode	A mode in which the module operates with the buffer memory map converted to the equivalent one to the MELSEC-Q series
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
User range	An analog output range where any value can be set. Set the user range in the offset/gain setting.
Watchdog timer error	Watchdog timer enables the module to monitor its own internal processing. An error that occurs if the internal processing of the module is abnormal.

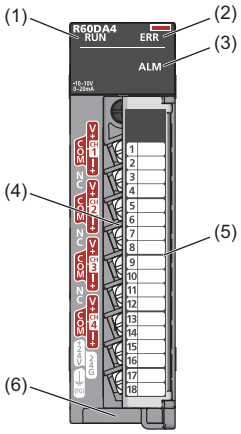
GENERIC TERMS AND ABBREVIATIONS

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

Generic term/abbreviation	Description
D/A converter module	An abbreviation for the MELSEC iQ-R series digital-analog converter module

1 PART NAMES

The following describes the part names of the D/A 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 output occurred Off: Normal operation
(4)	Terminal block	18-point screw terminal block for connecting output signal wires of external devices and others
(5)	Terminal block cover	Covers for preventing electric shock while the power is on
(6)	Production information display	Displays the production information (16 digits) of the module.

*1 For details, refer to the following.
MELSEC iQ-R Digital-Analog 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 D/A converter modules.

R60DA4

Item		Specifications			
Number of analog output points		4 points (4 channels)			
Digital input		16-bit signed binary value (-32768 to 32767)			
Analog output voltage		-10 to 10VDC (external load resistance value 1kΩ or more) 0 to 5VDC (external load resistance value 500Ω or more)			
Analog output current		0 to 20mADC (external load resistance value 0 to 600Ω)			
I/O characteristics, resolution*1		Analog output range		Digital value	Resolution
		Voltage	0 to 5V	0 to 32000	156.3μV
			1 to 5V		125.0μV
			-10 to 10V	-32000 to 32000	312.5μV
			User range setting (voltage)		312.5μV*4
		Current	0 to 20mA	0 to 32000	625.0nA
			4 to 20mA		500.0nA
			User range setting (current)	-32000 to 32000	350.9nA
Accuracy (accuracy for the maximum value of the analog output value)*2		Ambient temperature 25 ±5℃: Within ±0.1% (Voltage ±10mV, current ±20μA) Ambient temperature 0 to 55℃: Within ±0.3% (Voltage ±30mV, current ±60μA)			
Conversion speed	Normal output mode	80μs/CH			
	Wave output mode	80μs/CH			
Number of offset/gain settings*3		Up to 50000 times			
Output short protection		Protected			
Isolation method		Between I/O terminals and programmable controller power supply: Photocoupler Between output channels: Non-isolation Between the external power supply and analog outputs: Transformer isolation			
Withstand voltage		Between I/O terminals and programmable controller power supply: 500VACrms for 1 minute Between the external power supply and analog outputs: 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 connection system		18-point terminal block			
Applicable wire size		0.3 to 0.75mm²			
Applicable solderless terminal		R1.25-3 (solderless terminal with an insulation sleeve cannot be used)			
External power supply		24VDC +20%, -15%			
		Ripple, spike 500mV$_{P-P}$ or lower			
		Inrush current: 5.0A, 690μs or shorter			
		Current consumption: 0.14A (at 24VDC)			
Internal current consumption (5VDC)		0.16A			
External dimensions	Height	106mm (Base unit mounting side: 98mm)			
	Width	27.8mm			
	Depth	131mm			
Weight		0.19kg			

*1 For details on the I/O conversion characteristic, refer to the following.
☞ Page 55 I/O Conversion Characteristics

*2 Except for the conditions under noise influence.

*3 A count more than 50000 times causes Number of writes to offset/gain settings reach limit error (error code: 1080H).

*4 The maximum resolution of the user range setting

R60DAV8

Item		Specifications		
Number of analog output points		8 points (8 channels)		
Digital input		16-bit signed binary value (-32768 to 32767)		
Analog output voltage		-10 to 10VDC (external load resistance value 1kΩ or more) 0 to 5VDC (external load resistance value 500Ω or more)		
Analog output current		—		
I/O characteristics, resolution*1		Analog output range	Digital value	Resolution
		Voltage: 0 to 5V	0 to 32000	156.3μV
		Voltage: 1 to 5V		125.0μV
		Voltage: -10 to 10V	-32000 to 32000	312.5μV
		Voltage: User range setting (voltage)		312.5μV*4
Accuracy (accuracy for the maximum value of the analog output value)*2		Ambient temperature 25 ±5℃: Within ±0.1% (Voltage ±10mV) Ambient temperature 0 to 55℃: Within ±0.3% (Voltage ±30mV)		
Conversion speed		80μs/CH		
Number of offset/gain settings*3		Up to 50000 times		
Output short protection		Protected		
Isolation method		Between I/O terminals and programmable controller power supply: Photocoupler Between output channels: Non-isolation Between the external power supply and analog outputs: Transformer isolation		
Withstand voltage		Between I/O terminals and programmable controller power supply: 500VACrms for 1 minute Between the external power supply and analog outputs: 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 connection system		18-point terminal block		
Applicable wire size		0.3 to 0.75mm²		
Applicable solderless terminal		R1.25-3 (solderless terminal with an insulation sleeve cannot be used)		
External power supply		24VDC +20%, -15%		
		Ripple, spike 500mV$_{P-P}$ or lower		
		Inrush current: 5.0A, 670μs or shorter		
		Current consumption: 0.16A (at 24VDC)		
Internal current consumption (5VDC)		0.16A		
External dimensions	Height	106mm (Base unit mounting side: 98mm)		
	Width	27.8mm		
	Depth	131mm		
Weight		0.19kg		

*1 For details on the I/O conversion characteristic, refer to the following.
☞ Page 55 I/O Conversion Characteristics

*2 Except for the conditions under noise influence.

*3 A count more than 50000 times causes Number of writes to offset/gain settings reach limit error (error code: 1080H).

*4 The maximum resolution of the user range setting

R60DAI8

Item		Specifications			
Number of analog output points		8 points (8 channels)			
Digital input		16-bit signed binary value (-32768 to 32767)			
Analog output voltage		—			
Analog output current		0 to 20mADC (external load resistance value 0 to 600Ω)			
I/O characteristics, resolution*1		Analog output range		Digital value	Resolution
		Current	0 to 20mA	0 to 32000	625.0nA
			4 to 20mA		500.0nA
			User range setting (current)	-32000 to 32000	350.9nA*4
Accuracy (accuracy for the maximum value of the analog output value)*2		Ambient temperature 25±5℃: Within ±0.1% (Current ±20μA) Ambient temperature 0 to 55℃: Within ±0.3% (Current ±60μA)			
Conversion speed		80μs/CH			
Number of offset/gain settings*3		Up to 50000 times			
Output short protection		Protected			
Isolation method		Between I/O terminals and programmable controller power supply: Photocoupler Between output channels: Non-isolation Between the external power supply and analog outputs: Transformer isolation			
Withstand voltage		Between I/O terminals and programmable controller power supply: 500VACrms for 1 minute Between the external power supply and analog outputs: 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 connection system		18-point terminal block			
Applicable wire size		0.3 to 0.75mm²			
Applicable solderless terminal		R1.25-3 (solderless terminal with an insulation sleeve cannot be used)			
External power supply		24VDC +20%, -15%			
		Ripple, spike 500mV$_{P-P}$ or lower			
		Inrush current: 5.0A, 700μs or shorter			
		Current consumption: 0.26A (at 24VDC)			
Internal current consumption (5VDC)		0.16A			
External dimensions	Height	106mm (Base unit mounting side: 98mm)			
	Width	27.8mm			
	Depth	131mm			
Weight		0.19kg			

*1 For details on the I/O conversion characteristic, refer to the following.
☞ Page 55 I/O Conversion Characteristics

*2 Except for the conditions under noise influence.

*3 A count more than 50000 times causes Number of writes to offset/gain settings reach limit error (error code: 1080H).

*4 The maximum resolution of the user range setting

3 FUNCTION LIST

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

Item	Description
Range switching function	Switches the output range of the analog outputs for each channel. Switching the range makes it possible to change the output conversion characteristics.
D/A conversion enable/disable setting function	Controls whether to enable or disable the D/A conversion for each channel. Disabling the D/A conversion on unused channels reduces the D/A conversion cycles.
D/A output enable/disable setting function	Specifies whether to output the D/A conversion value or offset value for each channel. The conversion speed is a constant, regardless of the output enable/disable status.
Analog output HOLD/CLEAR function	Sets whether to hold or clear the analog output value output when the operating status of the CPU module is RUN, STOP, or stop error.
Analog output test function when the CPU module is in the STOP status	Analog output tests can be carried out when the CPU module is in the STOP status.
Scaling function	Performs scale conversion on digital values within a specified range between a scaling upper limit value and a scaling lower limit value. The program for scale conversion can be omitted.
Shift function	Adds a set input value shift amount to a digital value.
Alert output function	Outputs an alert when the digital value exceeds the alert output upper limit value or becomes less than the alert output lower limit value.
Rate control function	Restricts the increasing/decreasing amount of the analog output value per 80μs and prevents a sudden change of the value.
Interruption of external power supply detection function	Detects that the external power supply 24VDC is not supplied or is shut off.
Disconnection detection function*1	Monitors the analog output value and detects a disconnection.
Interrupt function	Executes an interrupt program of the CPU module when an interrupt factor such as a disconnection or an alert output is detected.
Wave output function	Registers the prepared wave data (digital input value) to the D/A converter module and continuously outputs the data (analog value) in the set conversion cycle.
Inter-module synchronization function	Outputs the D/A conversion values simultaneously from 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 D/A converter module to store them into the buffer memory area.
Event history function	Collects occurred errors and alarms, and performed operations in the D/A converter module as event information into the CPU module.
Offset/gain setting	Corrects errors in D/A conversion values for each channel.
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
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 output modules.
Firmware update function*2	Enables users to update the firmware versions of modules by using firmware update files. (For the firmware update file, please consult your local Mitsubishi representative.) For details on this function, refer to the following. MELSEC iQ-R Module Configuration Manual

*1 This function is supported only by the R60DA4 and R60DAI8.
*2 The firmware update function cannot be used for the module in offset/gain setting mode.

Precautions

Check that output from the D/A converter module is stopped before performing the firmware update function. Performing the firmware update function without stopping the output may cause unintended operation of the module, resulting in failure of the system.

MEMO

4 PROCEDURES BEFORE OPERATION

This chapter describes the procedures before operation.

1. Mounting a module

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

2. Wiring

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

☞ Page 29 External Wiring

3. Adding a module

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

📖 GX Works3 Operating Manual

4. Parameter setting

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

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

5. Offset/gain setting

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

☞ Page 52 OFFSET/GAIN SETTING

6. Programming

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

☞ Page 32 OPERATION EXAMPLE

MEMO

5 SYSTEM CONFIGURATION

For system configurations using the MELSEC iQ-R series modules, CPU modules that can be used with the D/A converter module, and the number of mountable modules, refer to the following.

MELSEC iQ-R Module Configuration Manual

MEMO

6 WIRING

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

6.1 Terminal Block

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.

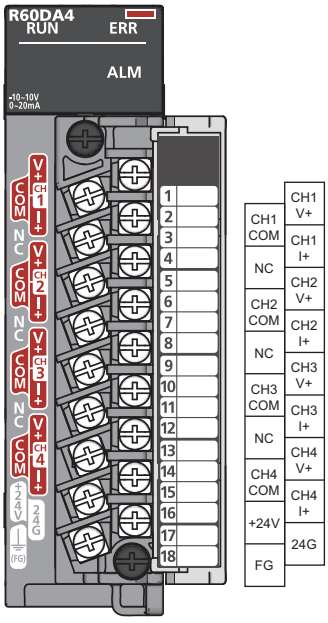
The following table lists an applicable solderless terminal to be connected to the terminal block. When wiring, use applicable wires and an appropriate tightening torque. Use UL listed solderless terminals and, for processing, use a tool recommended by their manufacturer. Note that a solderless terminal 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

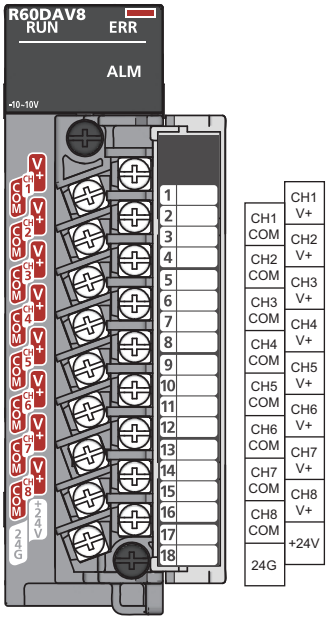
Signal names of the terminal blocks

The following table shows signal names of the terminal blocks.

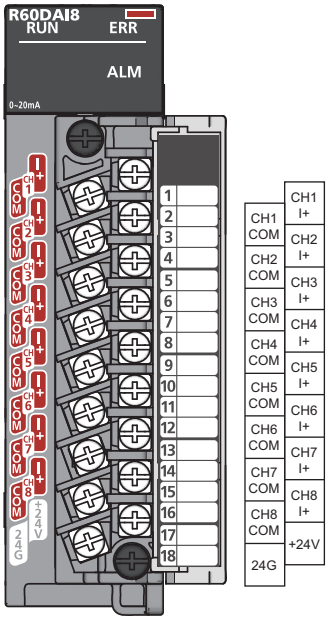
■R60DA4

Terminal block	Terminal number	Signal name	
	1	CH1	V+
	2		COM
	3		I+
	4	NC	
	5	CH2	V+
	6		COM
	7		I+
	8	NC	
	9	CH3	V+
	10		COM
	11		I+
	12	NC	
	13	CH4	V+
	14		COM
	15		I+
	16	+24V	
	17	24G	
	18	FG	

■R60DAV8

Terminal block	Terminal number	Signal name	
	1	CH1	V+
	2		COM
	3	CH2	V+
	4		COM
	5	CH3	V+
	6		COM
	7	CH4	V+
	8		COM
	9	CH5	V+
	10		COM
	11	CH6	V+
	12		COM
	13	CH7	V+
	14		COM
	15	CH8	V+
	16		COM
	17	+24V	
	18	24G	

■R60DAI8

Terminal block	Terminal number	Signal name	
	1	CH1	I+
	2		COM
	3	CH2	I+
	4		COM
	5	CH3	I+
	6		COM
	7	CH4	I+
	8		COM
	9	CH5	I+
	10		COM
	11	CH6	I+
	12		COM
	13	CH7	I+
	14		COM
	15	CH8	I+
	16		COM
	17	+24V	
	18	24G	

Point

Terminal blocks that have been used on MELSEC-Q series D/A converter modules can be used just the way they are. The terminal layout is the same as the MELSEC-Q series D/A converter modules (Q64DAN, Q68DAVN, and Q68DAIN).
The terminal blocks for MELSEC-L series D/A converter modules, however, cannot be used because of the shape difference.

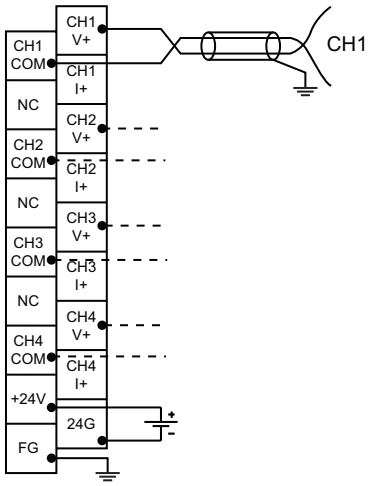
6.2 External Wiring

Wiring to the terminal block

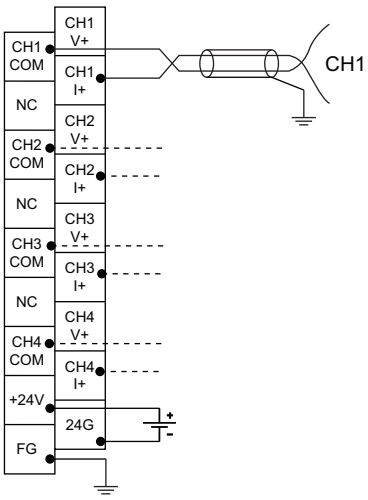
The following figures show wiring to the terminal block.

■R60DA4

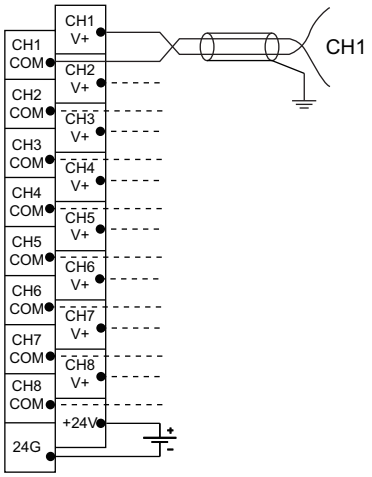
For voltage output



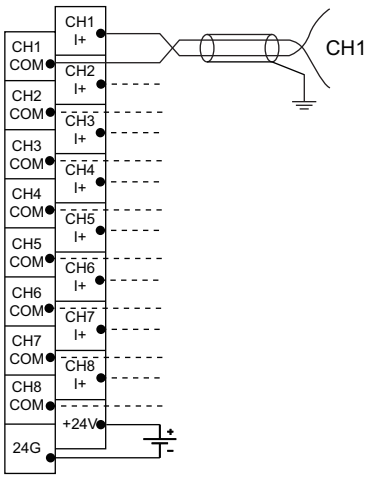
For current output



■R60DAV8



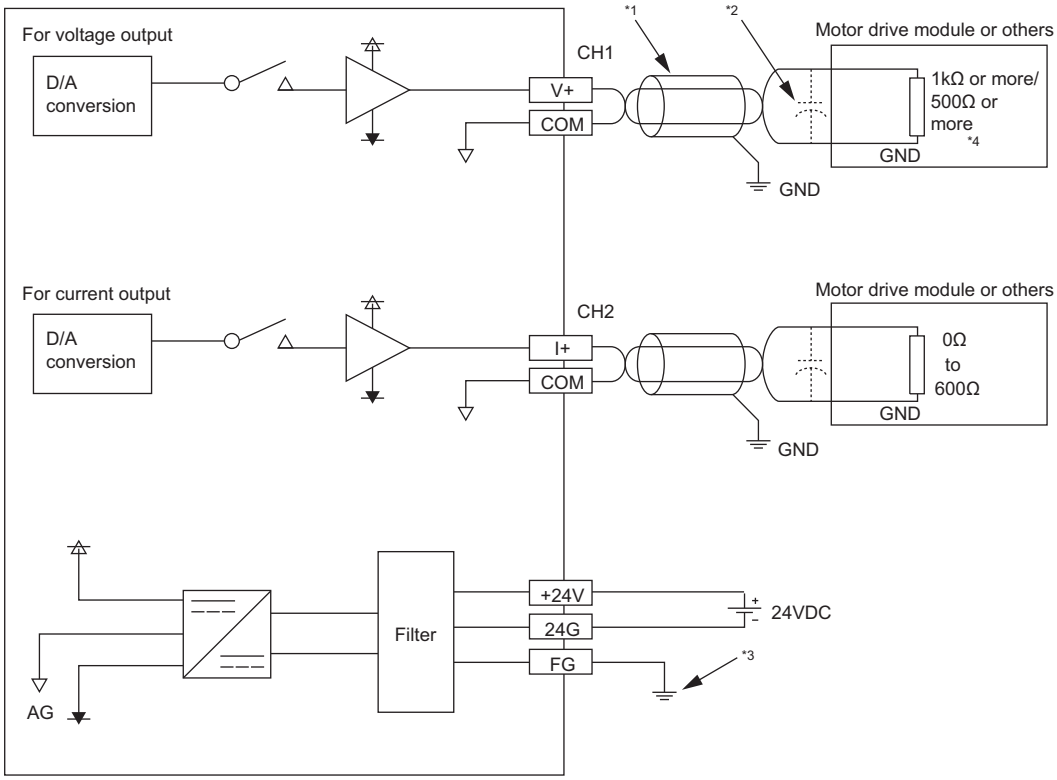
■R60DAI8



External wiring example

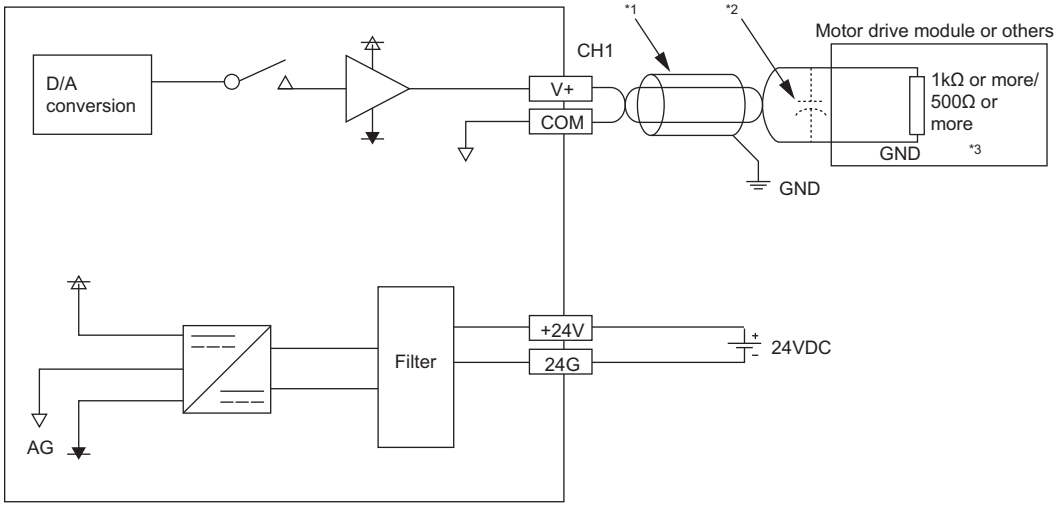
The following figures show the examples of external wiring.

■R60DA4



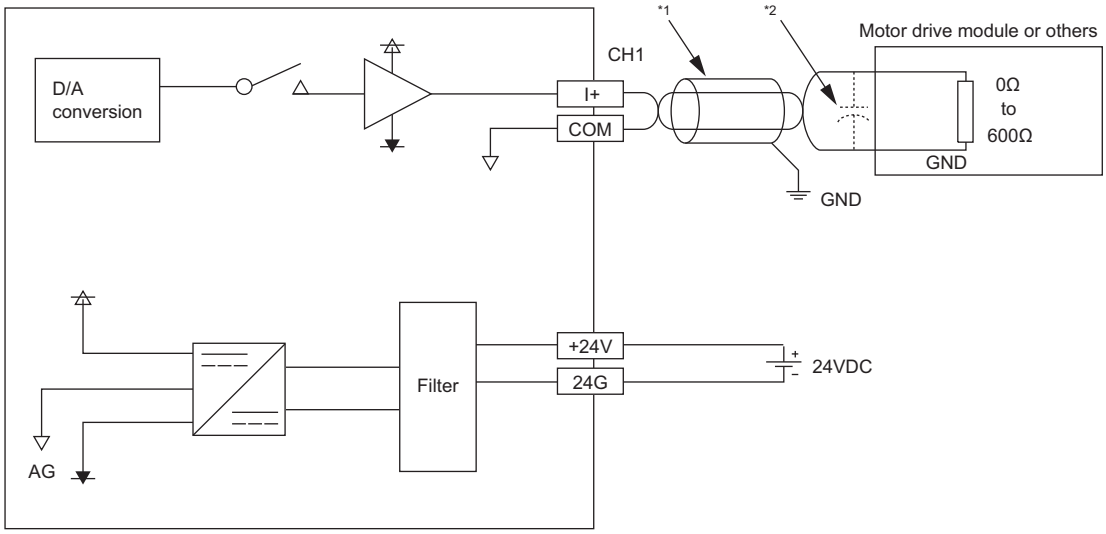
*1 For the wire, use the 2-core twisted cable.
*2 If noise or ripple occurs for analog signals, connect a capacitor with the value of 0.1 to 0.47μF (withstand voltage 25V or higher) to the input terminal of an external device.
*3 Always ground the FG terminal.
*4 When the analog output range is 0 to 5V, the external load resistance value should be 500Ω or more.
When the analog output range is -10 to 10V, the external load resistance value should be 1kΩ or more.

■R60DAV8



*1 For the wire, use the 2-core twisted cable.
*2 If noise or ripple occurs for analog signals, connect a capacitor with the value of 0.1 to 0.47μF (withstand voltage 25V or higher) to the input terminal of an external device.
*3 When the analog output range is 0 to 5V, the external load resistance value should be 500Ω or more.
When the analog output range is -10 to 10V, the external load resistance value should be 1kΩ or more.

■R60DAI8



*1 For the wire, use the 2-core twisted cable.

*2 If noise or ripple occurs for analog signals, connect a capacitor with the value of 0.1 to 0.47μF (withstand voltage 25V or higher) to the input terminal of an external device.

Point

Ground the FG terminal of the power supply module.

7 OPERATION EXAMPLE

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

7.1 Programming Procedure

Take the steps described below to create a program for performing the D/A conversion. This section describes the procedures for creating programs in the normal output mode and the wave output mode.

Normal output mode

1. Set module parameters.

☞ Page 33 Module parameters

2. Create a program.

☞ Page 38 Program examples

Wave output mode

1. Set module parameters.

☞ Page 42 Module parameters

2. Configure the initial setting of the wave output function.

☞ Page 45 Initial setting of the wave output function

3. Create a program.

☞ Page 48 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.

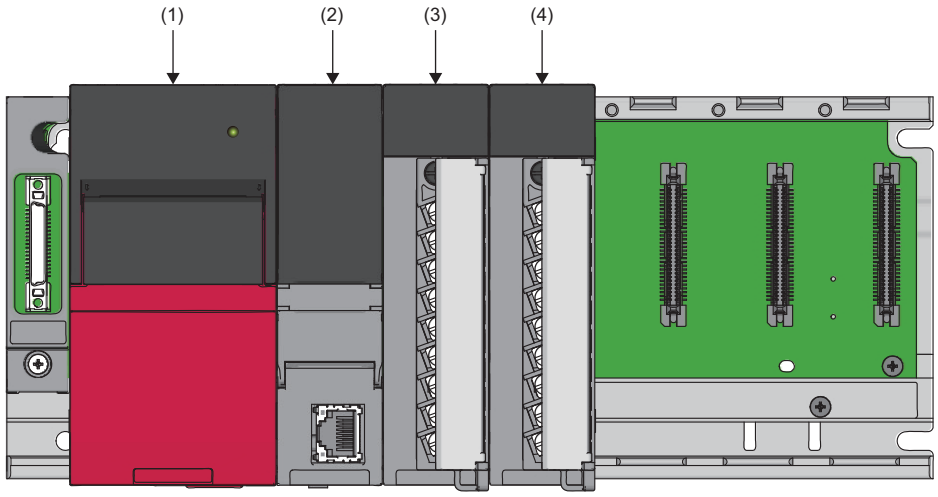
MELSEC iQ-R Analog-Digital Converter Module/Digital-Analog Converter Module Function Block Reference

7.2 Program Example (Normal Output Mode)

This section shows a program example for operating the D/A converter module in the normal output mode.

System configuration

The following figure shows an example of the system configuration.



(1) Power supply module (R61P)
(2) CPU module (R120CPU)
(3) D/A converter module (R60DA4)
(4) Input module (RX10)

Parameter setting

Configure the initial setting with the module parameters of the engineering tool. The auto refresh setting does not need to be changed here.

■Module parameters

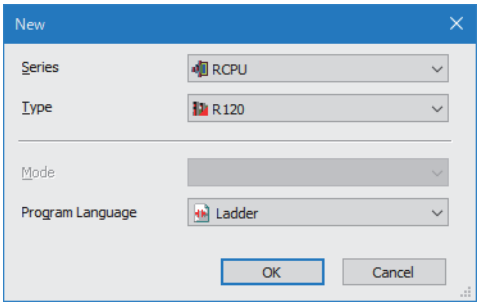
Function	Setting item	CH1	CH2	CH3	CH4
Range switching function	Output range setting	-10 to 10V	-10 to 10V	0 to 20mA	4 to 20mA
Operation mode setting function	Drive mode setting	Normal mode (D/A conversion process)			
	Output mode setting	Normal output mode			
Output mode setting function	Analog output HOLD/CLEAR setting	HOLD	CLEAR	HOLD	HOLD
D/A conversion enable/disable setting function	D/A conversion enable/disable setting	D/A conversion enabled	D/A conversion enabled	D/A conversion enabled	D/A conversion enabled
Scaling function	Scaling enable/disable setting	Disable	Disable	Enable	Disable
	Scaling lower limit value	—	—	2000	—
	Scaling upper limit value	—	—	16000	—
Shift function	Input value shift amount	0	0	2000	0
Warning output function	Warning output setting	Disable	Enable	Disable	Disable
	Warning output lower limit value	—	0	—	—
	Warning output upper limit value	—	32000	—	—
Rate control function	Rate control enable/disable setting	Enable	Disable	Disable	Disable
	Increase digital limit value	8000	—	—	—
	Decrease digital limit value	1600	—	—	—

Function	Setting item	CH1	CH2	CH3	CH4
Disconnection detection function	Disconnection detection enable/disable setting	—	—	—	Enable
	Disconnection check count enable/ disable setting	—	—	—	Disable
	Disconnection check count	—	—	—	—
	Disconnection detection auto-clear enable/disable setting	—	—	—	Disable
	Disconnection detection auto-clear check count	—	—	—	—
Inter-module synchronization function	Output selection during synchronous error	Inter-module synchronization continue			
Online module change	Auto restore of Offset/gain setting with the module change	Enable			
CPU error output mode setting	CPU error output mode setting	Clear			

Operating procedure

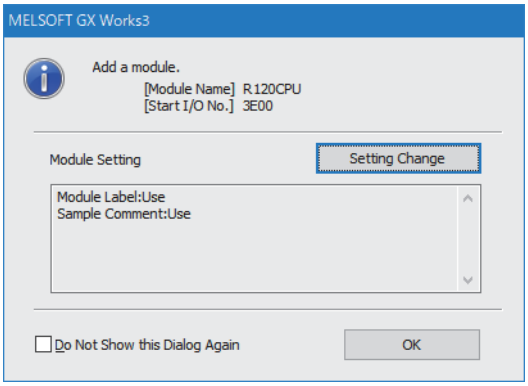
1. Set the window as follows to create the project.

[Project] ⇨ [New]



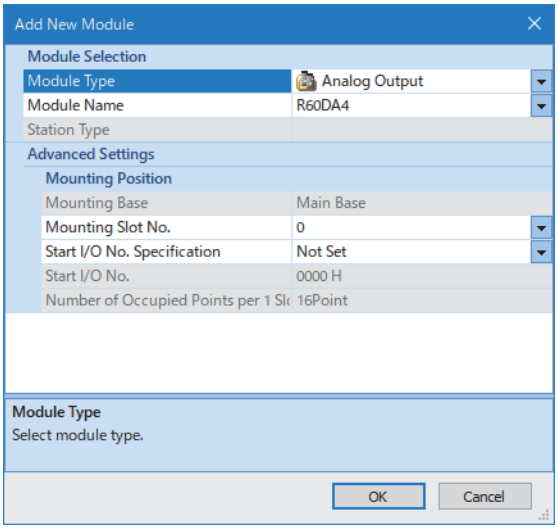
2. Click the [Setting Change] button and set the module to use the module label.

3. Click the [OK] button in the following window to add the module label of the CPU module.

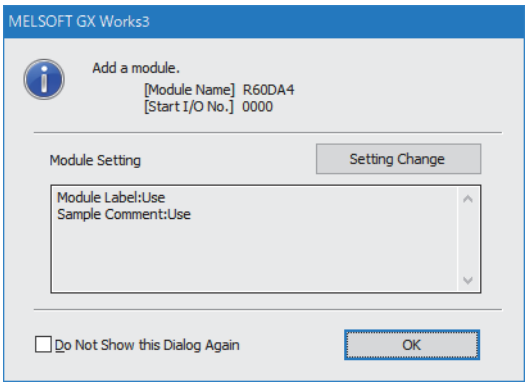


4. Add the D/A converter module with the window set as follows.

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Right-click ⇨ [Add New Module]

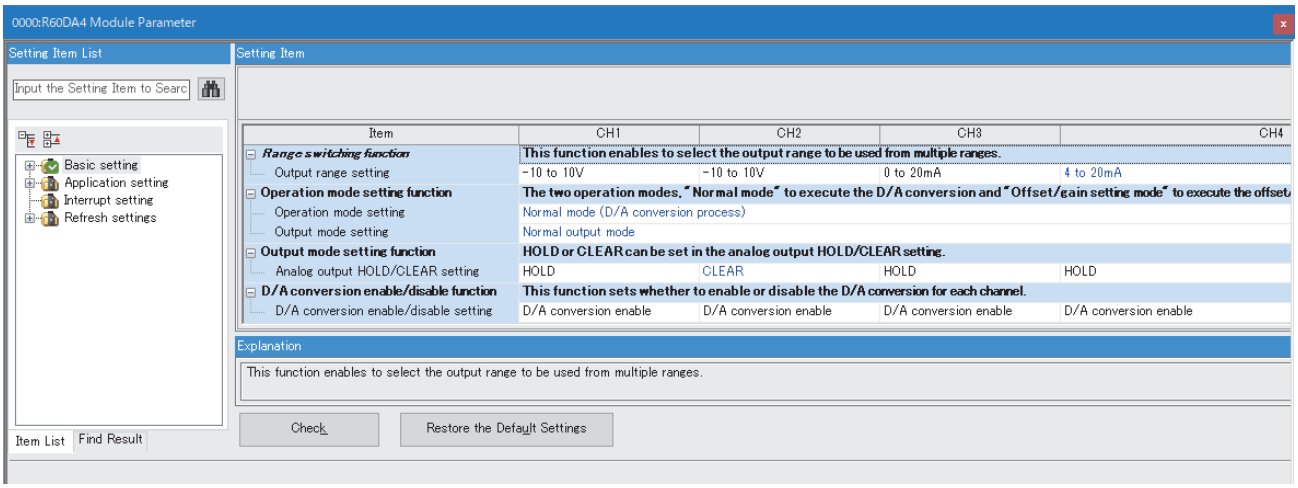


5. Set the window as follows to add the module label of the D/A converter module.



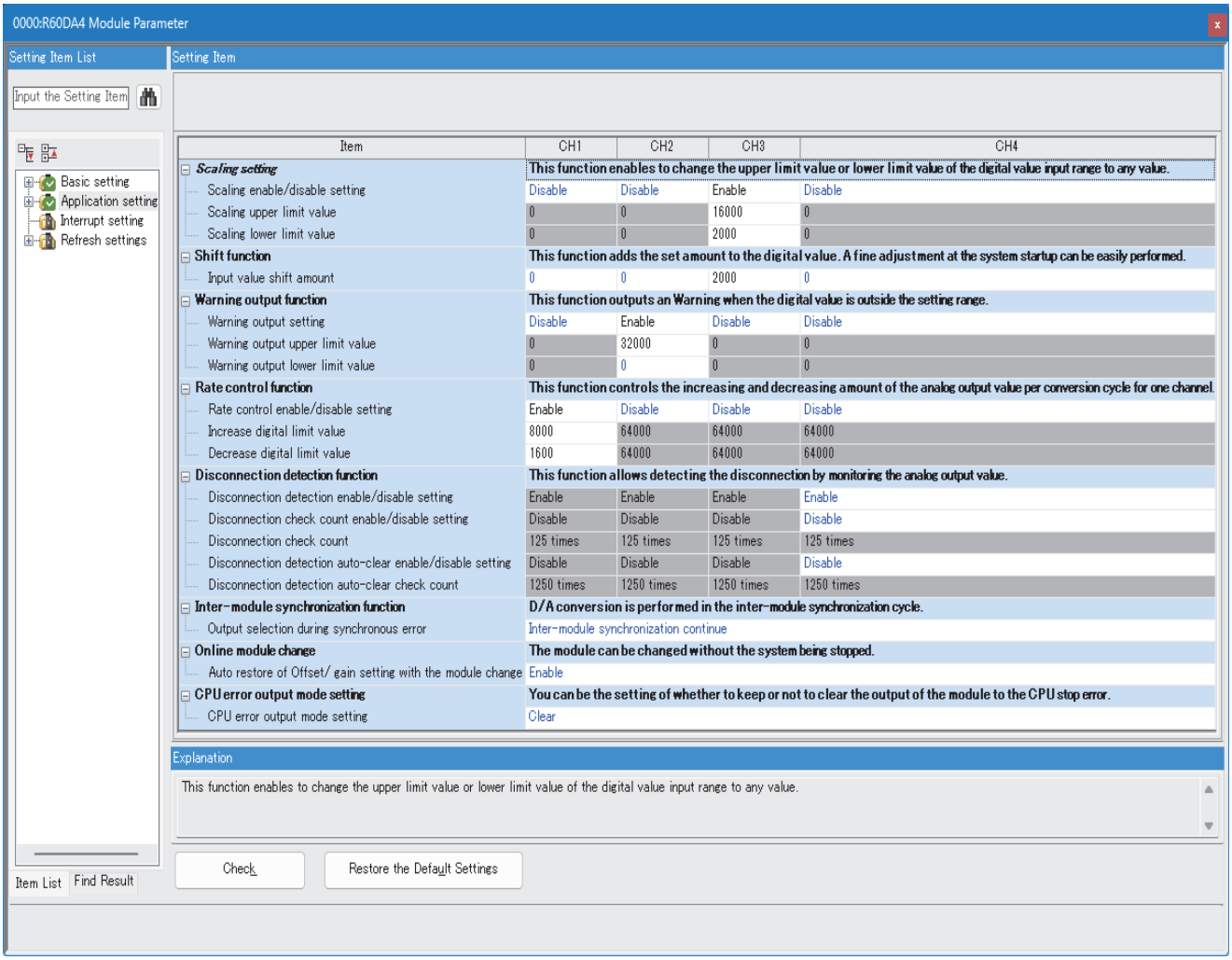
6. Set "Basic setting" of "Module Parameter" of the D/A converter module as shown below.

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ [R60DA4] ⇨ [Basic setting]



7. Set "Application setting" of "Module Parameter" of the D/A converter module as shown below.

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ [R60DA4] ⇨ [Application setting]



8. Write the set parameters to the CPU module, then reset the CPU module or power off and on the system.

[Online] ⇨ [Write to PLC]

Label setting

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 setting of the module labels. For details on the global labels, refer to the following.

MELSEC iQ-R Programming Manual (Program Design)

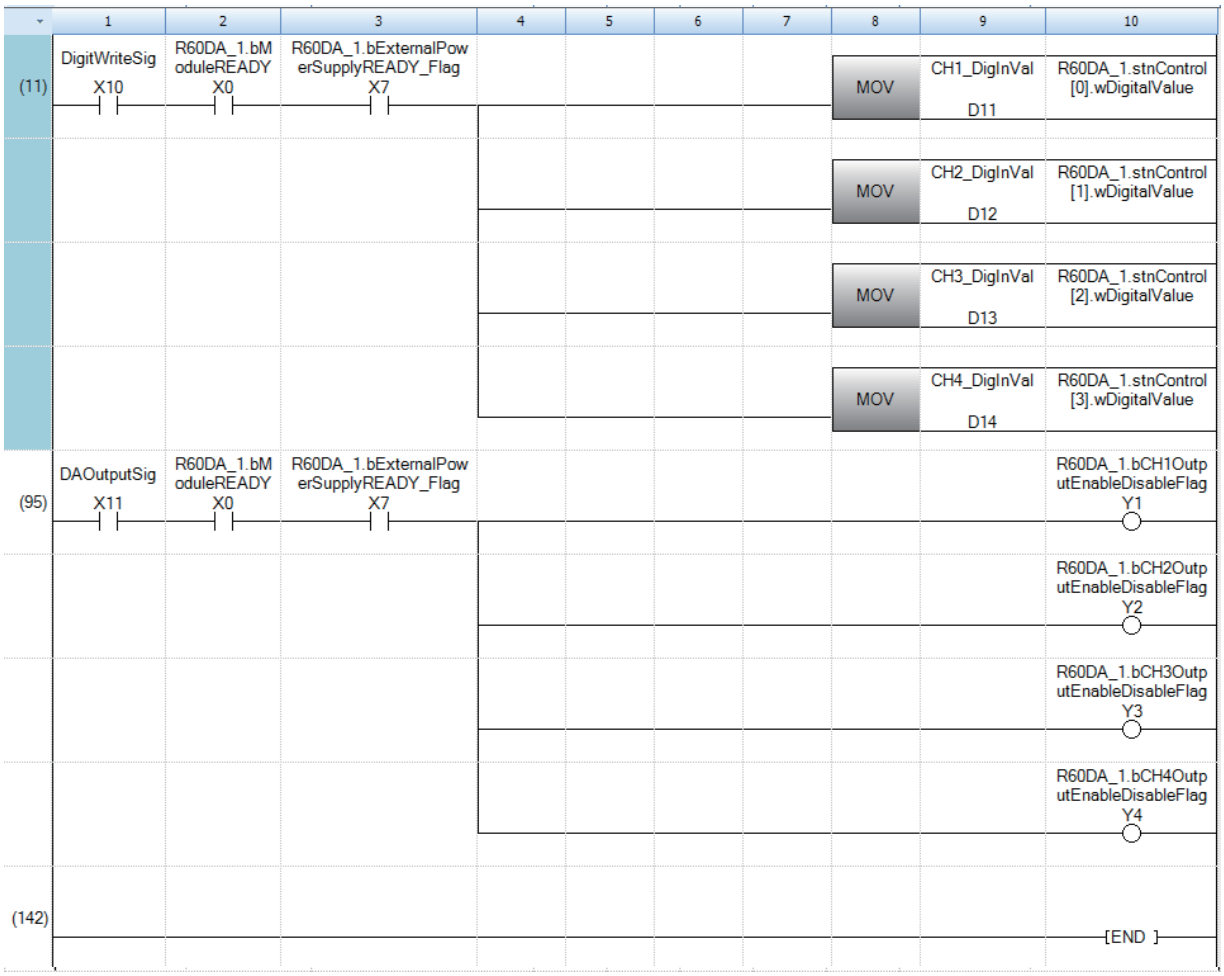
Classification	Label name	Description	Device
Module label	R60DA_1.bModuleREADY	Module READY	X0
	R60DA_1.bExternalPowerSupplyREADY_Flag	External power supply READY flag	X7
	R60DA_1.bDisconnectionDetectionSignal	Disconnection detection signal	XD
	R60DA_1.bWarningOutputSignal	Alert output signal	XE
	R60DA_1.bErrorFlag	Error flag	XF
	R60DA_1.bCH1OutputEnableDisableFlag	CH1 Output enable/disable flag	Y1
	R60DA_1.bCH2OutputEnableDisableFlag	CH2 Output enable/disable flag	Y2
	R60DA_1.bCH3OutputEnableDisableFlag	CH3 Output enable/disable flag	Y3
	R60DA_1.bCH4OutputEnableDisableFlag	CH4 Output enable/disable flag	Y4
	R60DA_1.bWarningOutputClearRequest	Warning output clear request	YE
	R60DA_1	Target module	—
	R60DA_1.stnControl[0].wDigitalValue	CH1 Digital value	—
	R60DA_1.stnControl[1].wDigitalValue	CH2 Digital value	—
	R60DA_1.stnControl[2].wDigitalValue	CH3 Digital value	—
	R60DA_1.stnControl[3].wDigitalValue	CH4 Digital value	—
	R60DA_1.uDisconnectionDetectionFlag.3	Disconnection detection flag	—
	R60DA_1.uWarningOutputUpperFlag.1	Warning output upper flag	—
	R60DA_1.uWarningOutputLowerFlag.1	Warning output lower flag	—
Labels to be defined	Define global labels as shown below:		

	Label Name	Data Type		Class	Assign (Device/Label)
1	CH1_DigInVal	Word [Signed]	...	VAR_GLOBAL	D11
2	CH2_DigInVal	Word [Signed]	...	VAR_GLOBAL	D12
3	CH3_DigInVal	Word [Signed]	...	VAR_GLOBAL	D13
4	CH4_DigInVal	Word [Signed]	...	VAR_GLOBAL	D14
5	CH2_AlmUpLimit	Bit	...	VAR_GLOBAL	F0
6	CH2_AlmLowLimit	Bit	...	VAR_GLOBAL	F1
7	CH4_DisconnectDetect	Bit	...	VAR_GLOBAL	F2
8	DigitWriteSig	Bit	...	VAR_GLOBAL	X10
9	DAOutputSig	Bit	...	VAR_GLOBAL	X11
10	WarningOutClrSig	Bit	...	VAR_GLOBAL	X12
11	ErrResetSig	Bit	...	VAR_GLOBAL	X13
12	ErrOperationEN	Bit	...	VAR_GLOBAL	
13	ErrOperationENO	Bit	...	VAR_GLOBAL	
14	ErrOperationOK	Bit	...	VAR_GLOBAL	
15	UnitErrFlg	Bit	...	VAR_GLOBAL	
16	UnitErrCode	Word [Signed]	...	VAR_GLOBAL	
17	UnitAlarmCode	Word [Signed]	...	VAR_GLOBAL	

Program examples

■Program example 1

- The following figure shows an example of a program that enables the analog output and starts the D/A conversion after digital values for the D/A conversion of CH1 to CH4 are set in the D/A converter module.

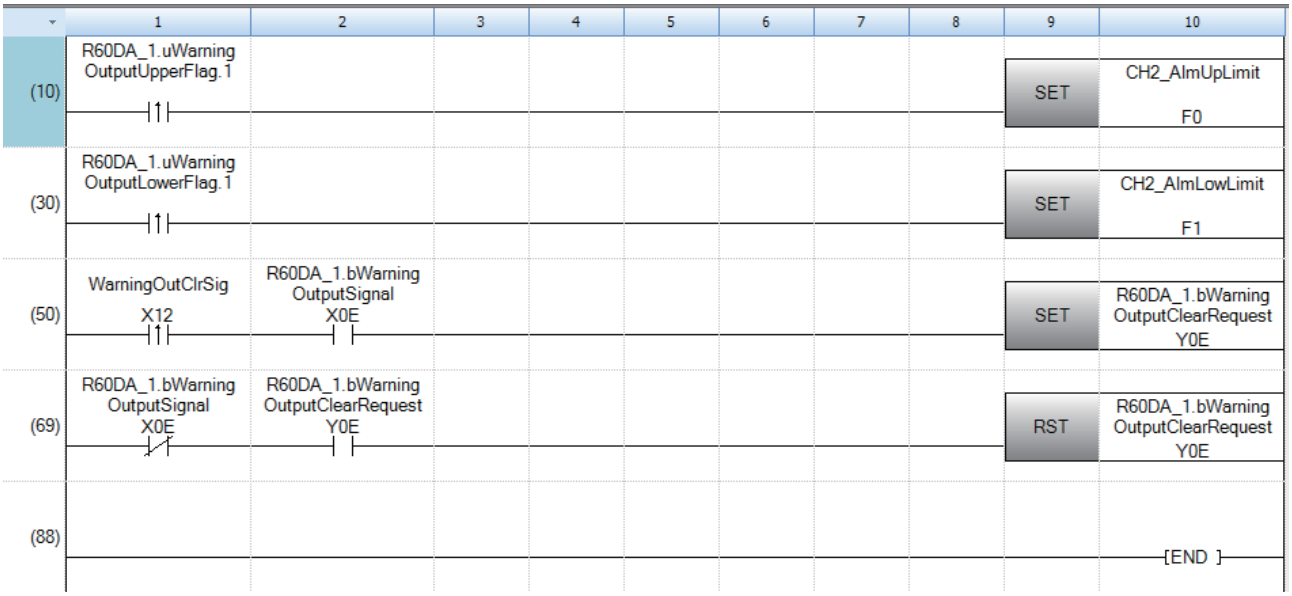


(11)Sets CH1 Digital value to CH4 Digital value.

(95)Enables the output of CH1 to CH4.

■Program example 2

- The following figure shows an example of a program that clears the processing when an alert output occurs in the CH2 and the alert output in the D/A converter module.



(10)At the time when an upper limit alert is issued in CH2, the processing is to be performed.

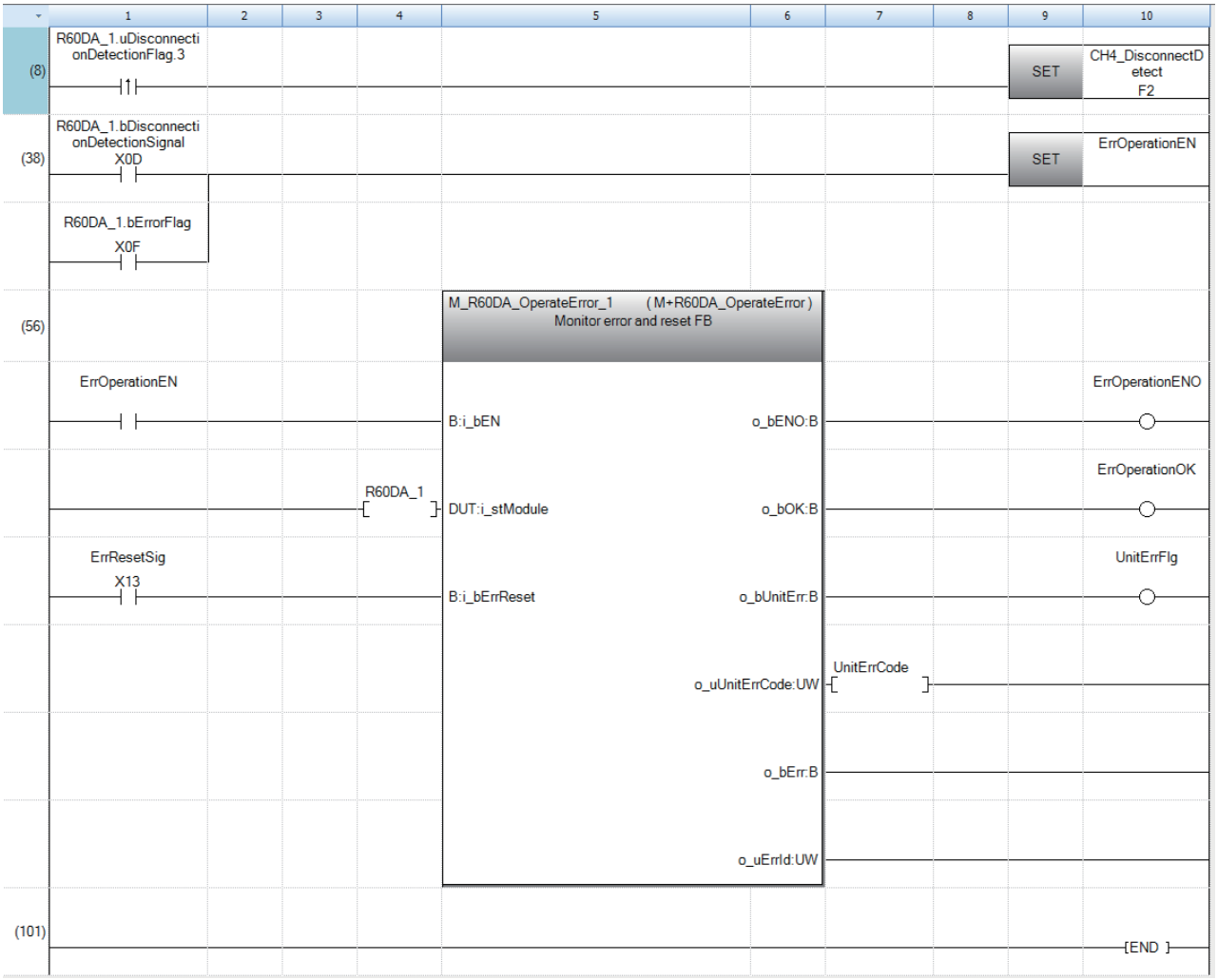
(30)At the time when a lower limit alert is issued in CH2, the processing is to be performed.

(50)Turns on 'Warning output clear request' (YE).

(69)Turns off 'Warning output clear request' (YE).

■Program example 3

- The following figure shows an example of a program that displays the latest error code when a disconnection is detected in CH4 or an error occurs in the D/A converter module. After that, the program clears the disconnection detection flag, error flag, and the stored error code.



(8) At the time when a disconnection is detected, the processing is to be performed.

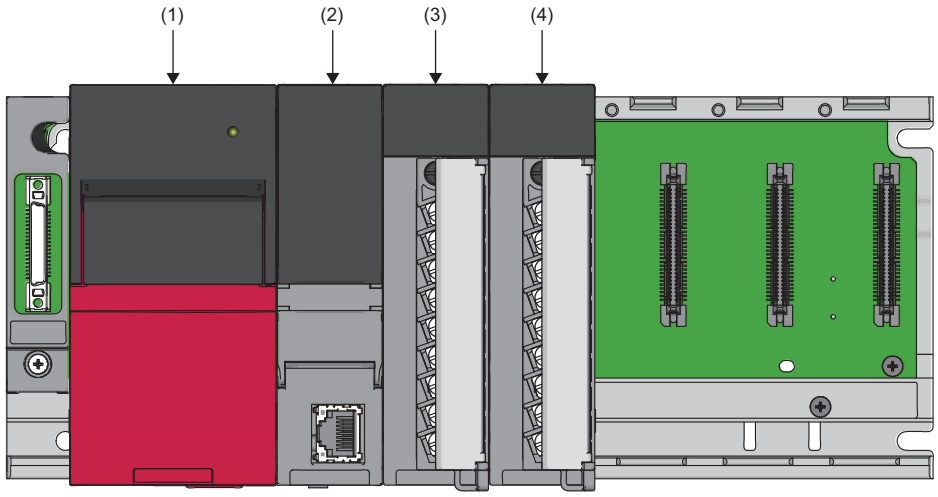
(38)Turns on Error manipulation start flag.

7.3 Program Example (Wave Output Mode)

This section shows a program example for operating the D/A converter module in the wave output mode.

System configuration

The following figure shows an example of the system configuration.



(1) Power supply module (R61P)
(2) CPU module (R120CPU)
(3) D/A converter module (R60DA4)
(4) Input module (RX10)

Programming condition

- The system outputs a voltage that describes a sine wave from CH1.
- Store the wave pattern and the parameters of the wave output function in the file register of the CPU module.

Programs

The following describes the programs for the wave output mode. Execute the programs in the following order.

1. Wave output data read processing program

☞ Page 48 Wave output data read processing program example

2. Operating condition setting request processing program

☞ Page 50 Operating condition setting request processing program example

3. Wave output start processing program

☞ Page 51 Wave output start processing program example

To change the parameters of the wave output function after execution of the wave output data read processing program, execute the following program.

☞ Page 49 Wave output parameter setting processing program example

Parameter setting

Configure the initial setting with the module parameters and "Create wave output data" of the engineering tool. The auto refresh setting does not need to be changed here.

■Module parameters

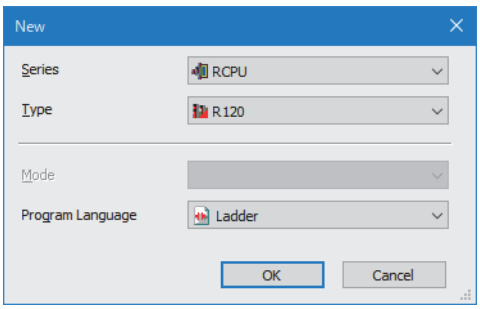
Set the module parameters as shown in the following table.

Function	Setting item	CH1	CH2	CH3	CH4
Range switching function	Output range setting	-10 to 10V	4 to 20mA	4 to 20mA	4 to 20mA
Operation mode setting function	Operation mode setting	Normal mode (D/A conversion process)			
	Output mode setting	Wave output mode			
Output mode setting function	Analog output HOLD/CLEAR setting	HOLD	CLEAR	CLEAR	CLEAR
D/A conversion enable/disable setting function	D/A conversion enable/disable setting	D/A conversion disabled	D/A conversion disabled	D/A conversion disabled	D/A conversion disabled
Scaling function	Scaling enable/disable setting	Disable	Disable	Disable	Disable
	Scaling lower limit value	—	—	—	—
	Scaling upper limit value	—	—	—	—
Shift function	Input value shift amount	0	0	0	0
Warning output function	Warning output setting	Enable	Disable	Disable	Disable
	Warning output lower limit value	0	—	—	—
	Warning output upper limit value	32000	—	—	—
Rate control function	Rate control enable/disable setting	Disable	Disable	Disable	Disable
	Increase digital limit value	—	—	—	—
	Decrease digital limit value	—	—	—	—
Disconnection detection function	Disconnection detection enable/disable setting	—	Enable	Enable	Enable
	Disconnection check count enable/ disable setting	—	Disable	Disable	Disable
	Disconnection check count	—	—	—	—
	Disconnection detection auto-clear enable/disable setting	—	Disable	Disable	Disable
	Disconnection detection auto-clear check count	—	—	—	—
Inter-module synchronization function	Output selection during synchronous error	Inter-module synchronization continue			
Online module change	Auto restore of Offset/gain setting with the module change	Enable			
CPU error output mode setting	CPU error output mode setting	Clear			

Operating procedure

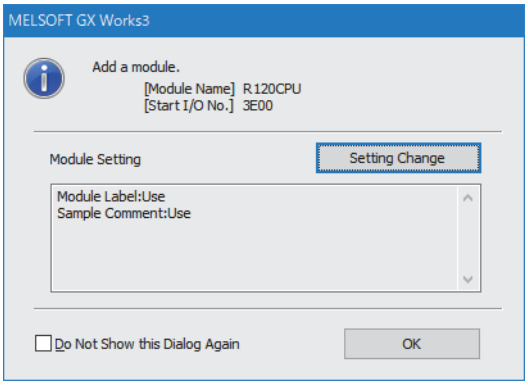
1. Set the window as follows to create the project.

[Project] ⇨ [New]



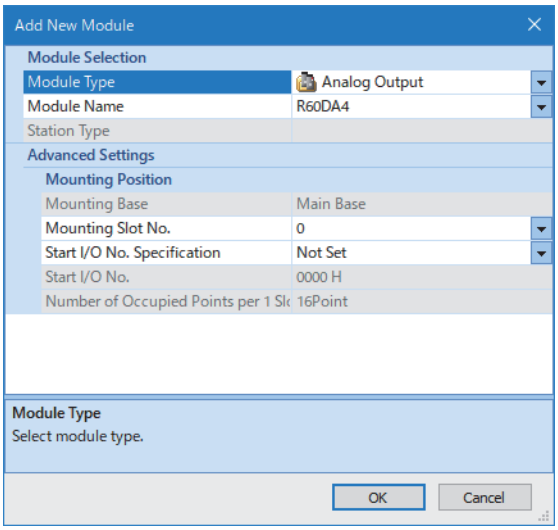
2. Click the [Setting Change] button and set the module to use the module label.

3. Click the [OK] button in the following window to add the module label of the CPU module.

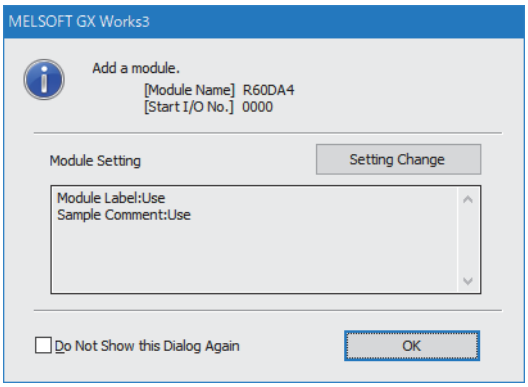


4. Add the D/A converter module with the window set as follows.

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ Right-click ⇨ [Add New Module]

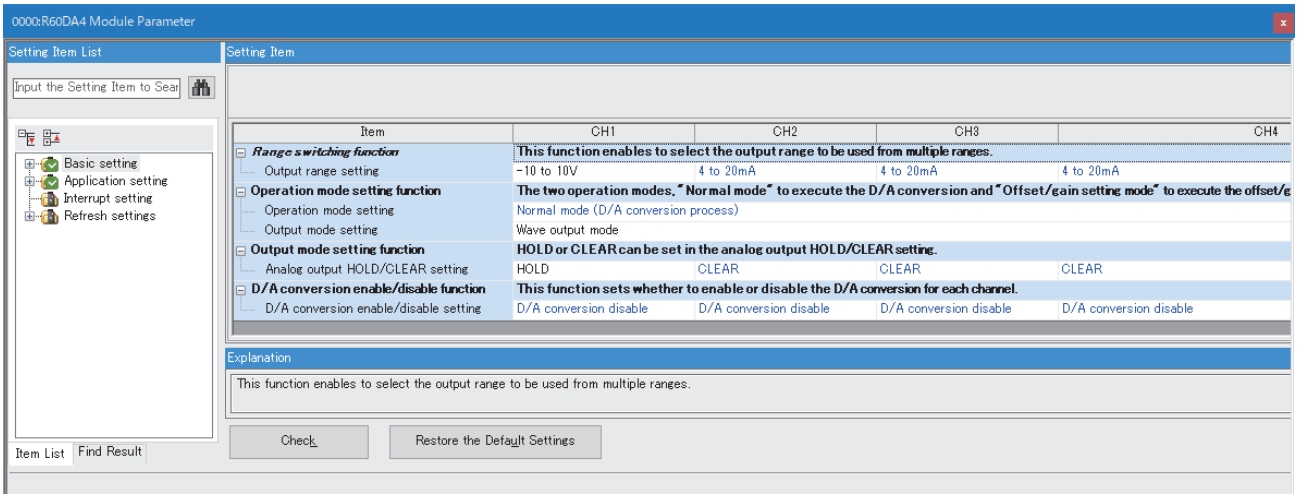


5. Set the window as follows to add the module label of the D/A converter module.



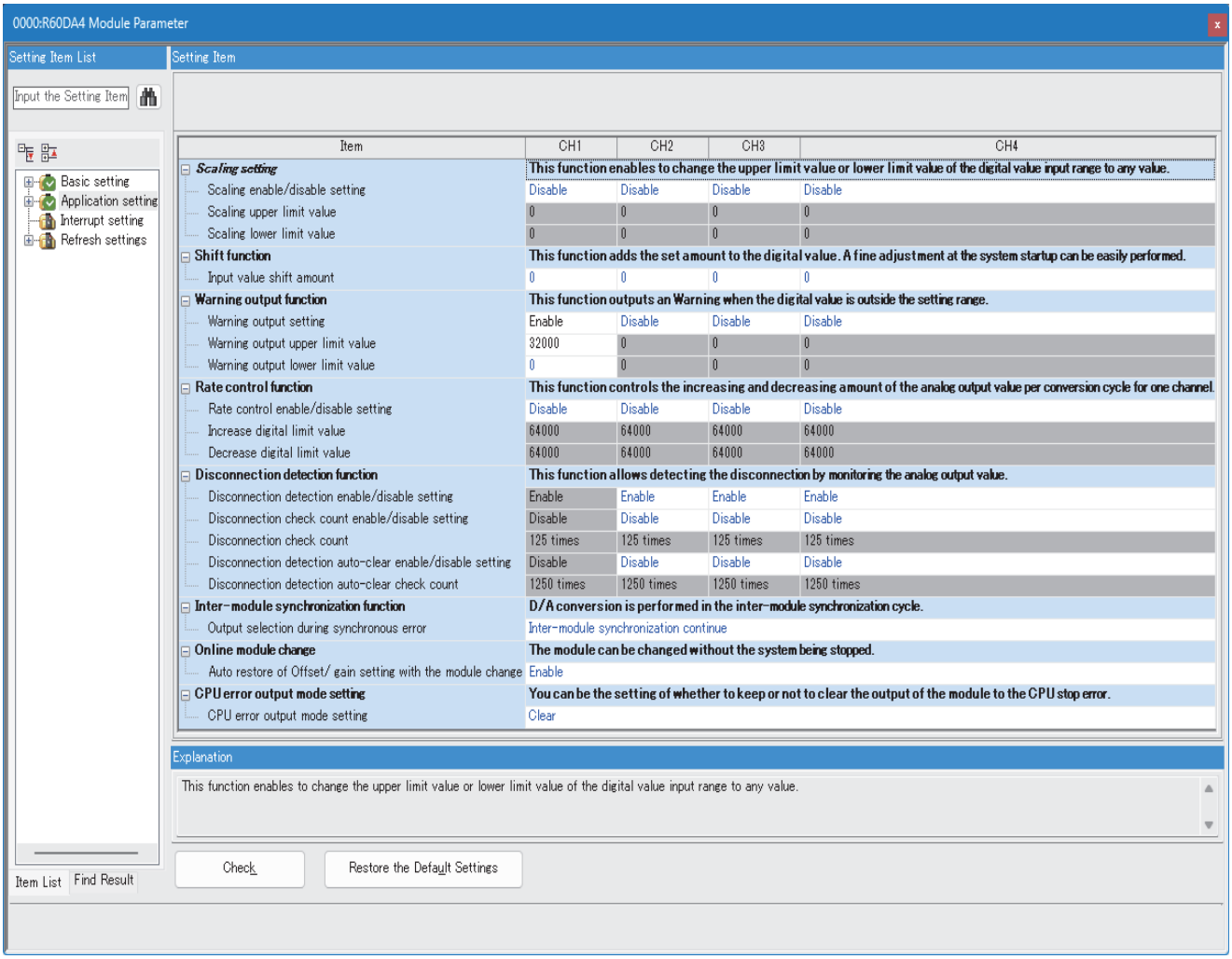
6. Set "Basic setting" of "Module Parameter" of the D/A converter module as shown below.

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ [R60DA4] ⇨ [Basic setting]



7. Set "Application setting" of "Module Parameter" of the D/A converter module as shown below.

[Navigation window] ⇨ [Parameter] ⇨ [Module Information] ⇨ [R60DA4] ⇨ [Application setting]



8. Write the set parameters to the CPU module, then reset the CPU module or power off and on the system.

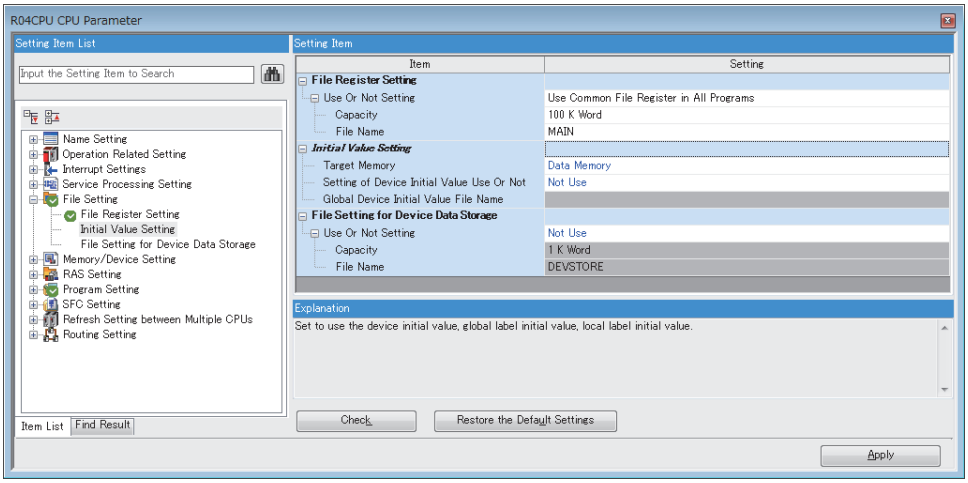
[Online] ⇨ [Write to PLC]

■Initial setting of the wave output function

Create a wave pattern and the parameters of the wave output function by using the wave output data creation tool. For details, refer to the following.

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

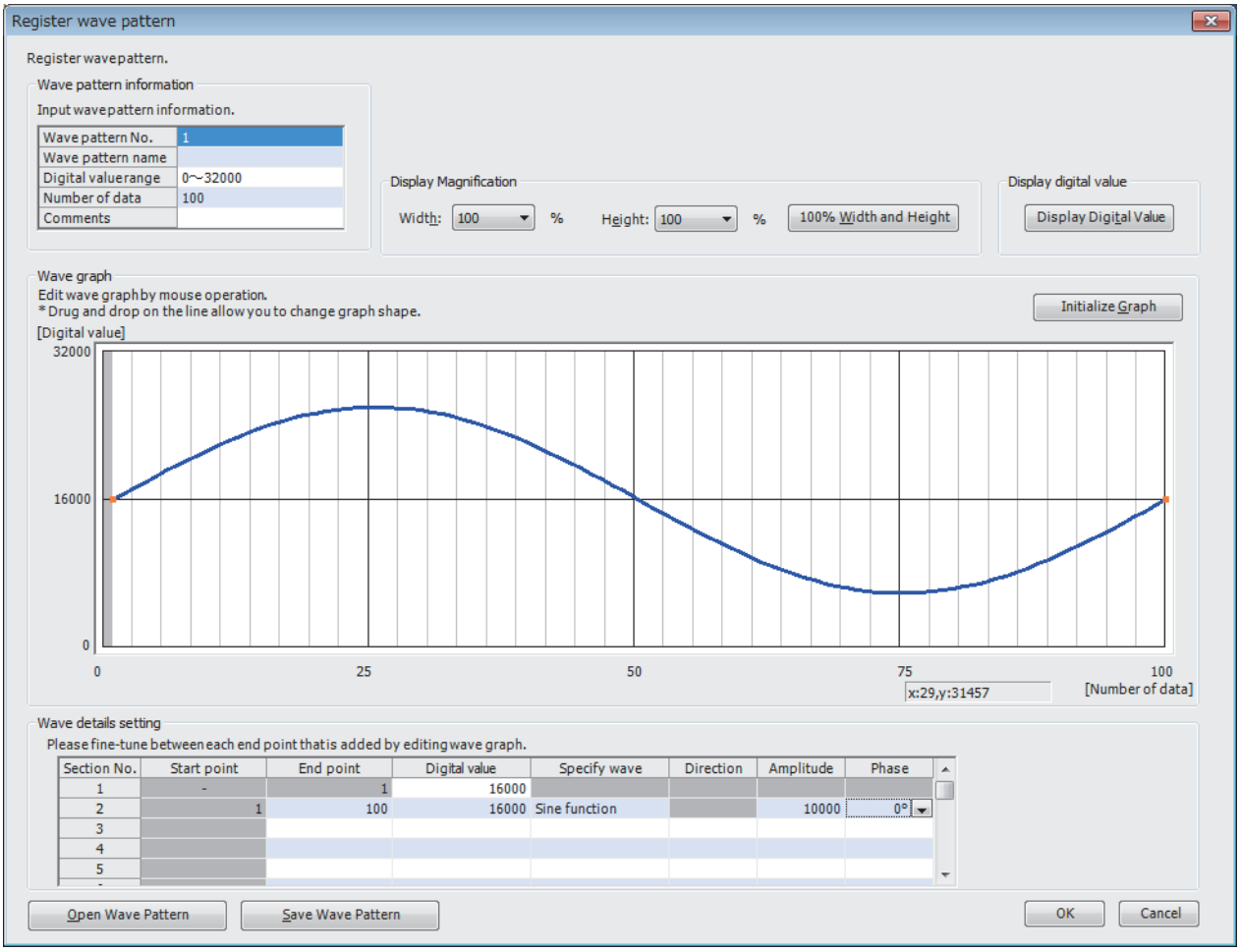
1. Set the file register of the CPU parameter as follows to enable the file register.



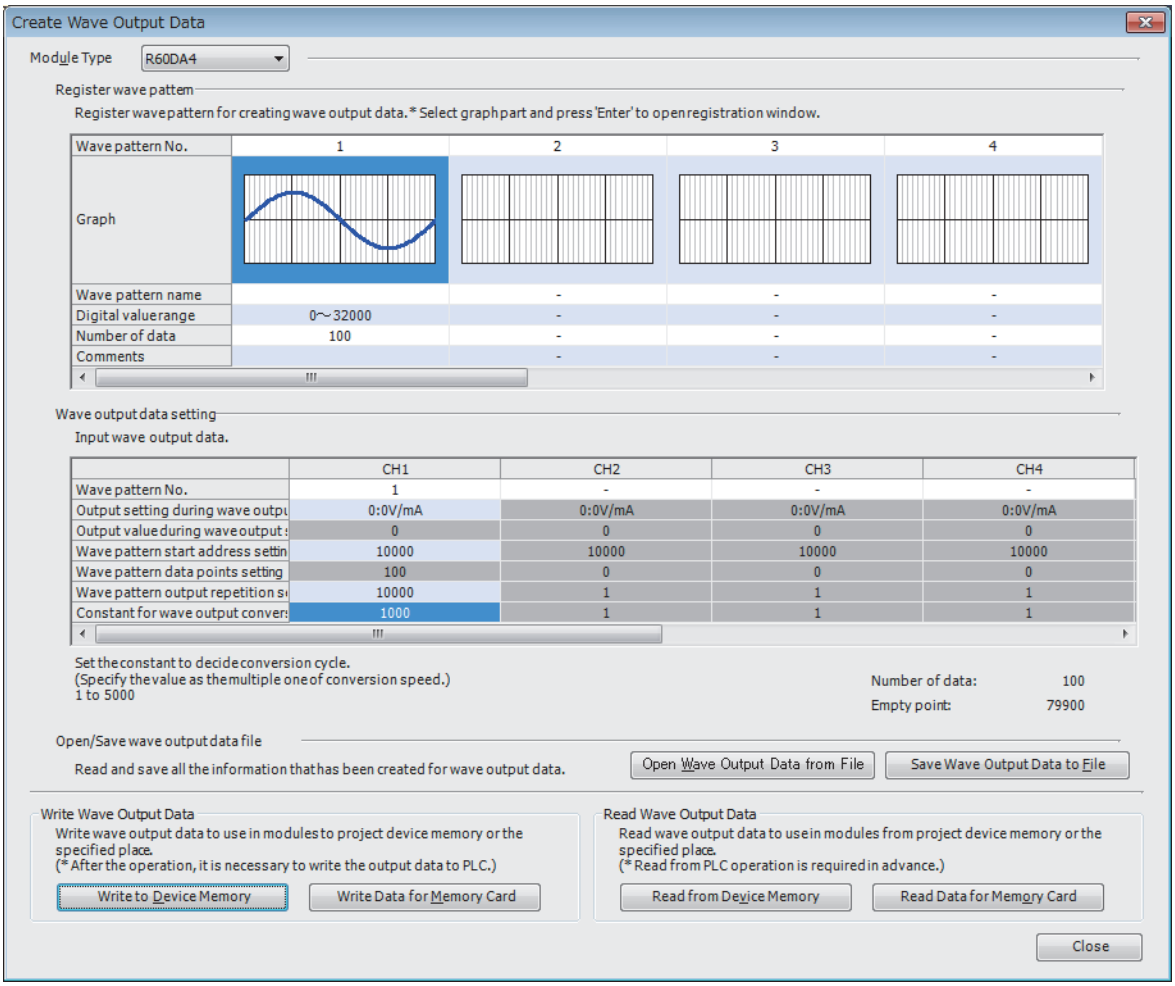
2. Start "Create Wave Output Data".

[Tool]⇨[Module Tool List]⇨[Analog Output]⇨[Create wave output data]

3. Display the "Register wave pattern" window and set each item as follows.



4. Set the parameters in "Wave output data setting" as follows.



5. Click the [Write to Device Memory] button to write the wave output data.

Label setting

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

The module label setting does not need to be changed here. For details on global labels, refer to the following.

MELSEC iQ-R Programming Manual (Program Design)

Classification	Label name	Description	Device
Module label	R60DA_1.bModuleREADY	Module READY	X0
	R60DA_1.bExternalPowerSupplyREADY_Flag	External power supply READY flag	X7
	R60DA_1.bOperatingConditionSettingCompletedFlag	Operating condition setting completed flag	X9
	R60DA_1.bCH1OutputEnableDisableFlag	CH1 Output enable/disable flag	Y1
	R60DA_1.bOperatingConditionSettingRequest	Operating condition setting request	Y9
	R60DA_1.stnControl_D[0].uWaveOutputStartStopRequest_D	CH1 Wave output start/stop request	U0\G462
	R60DA_1.stnSetting_D[0].uD_A_conversionEnableDisableSetting_D	CH1 D/A conversion enable/disable setting	U0\G500
	R60DA_1	Target module	—
Labels to be defined	Define global labels as shown below:		

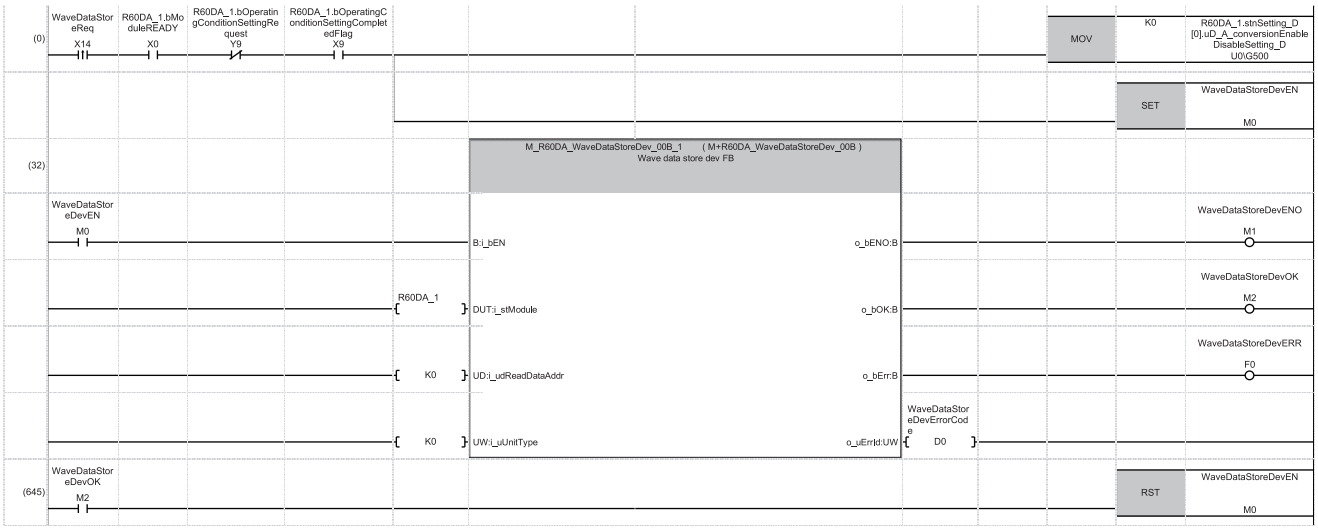
	Label Name	Data Type		Class	Assign (Device/Label)
1	WaveDataStoreReq	Bit	...	VAR_GLOBAL	X14
2	WaveOutputSetting	Bit	...	VAR_GLOBAL	X15
3	WaveRequestSetting	Bit	...	VAR_GLOBAL	X16
4	OutputReq	Bit	...	VAR_GLOBAL	X17
5	WaveStartStopReq	Bit	...	VAR_GLOBAL	X18
6	WaveDataStoreDevEN	Bit	...	VAR_GLOBAL	M0
7	WaveDataStoreDevENO	Bit	...	VAR_GLOBAL	M1
8	WaveDataStoreDevOK	Bit	...	VAR_GLOBAL	M2
9	WaveDataStoreDevERR	Bit	...	VAR_GLOBAL	F0
10	WaveDataStoreDevErrorCode	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL	D0
11	WaveOutputSettingEN	Bit	...	VAR_GLOBAL	M10
12	WaveOutputSettingENO	Bit	...	VAR_GLOBAL	M11
13	WaveOutputSettingOK	Bit	...	VAR_GLOBAL	M12
14	WaveOutputSettingERR	Bit	...	VAR_GLOBAL	F10
15	WaveOutputSettingOutputSelect	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL	D10
16	WaveOutputSettingOutputValue	Word [Signed]	...	VAR_GLOBAL	D11
17	WaveOutputSettingdStartingAddr	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL	D12
18	WaveOutputSettingPointsSetting	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL	D14
19	WaveOutputSettingFrequency	Word [Signed]	...	VAR_GLOBAL	D16
20	WaveOutputSettingConvSpeed	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL	D17
21	WaveOutputSettingErrorCode	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL	D18
22	RequestSettingEN	Bit	...	VAR_GLOBAL	M20
23	RequestSettingENO	Bit	...	VAR_GLOBAL	M21
24	RequestSettingOK	Bit	...	VAR_GLOBAL	M22
25	RequestSettingERR	Bit	...	VAR_GLOBAL	F20
26	RequestSettingErrorCode	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL	D20
27	WaveOutputReqSettingEN	Bit	...	VAR_GLOBAL	M30
28	WaveOutputReqSettingENO	Bit	...	VAR_GLOBAL	M31
29	WaveOutputReqSettingOK	Bit	...	VAR_GLOBAL	M32
30	WaveOutputReqSettingERR	Bit	...	VAR_GLOBAL	F30
31	WaveStartStop	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL	D30
32	WaveStatusCH1	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL	D31
33	WaveStatusCH2	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL	D32
34	WaveStatusCH3	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL	D33
35	WaveStatusCH4	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL	D34
36	WaveStatusCH5	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL	D35
37	WaveStatusCH6	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL	D36
38	WaveStatusCH7	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL	D37
39	WaveStatusCH8	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL	D38
40	WaveOutputReqSettingErrorCode	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL	D39

Program examples

■Wave output data read processing program example

Set CH1 D/A conversion enable/disable setting to D/A conversion enabled. Read data from the file register (ZR) where the parameter settings of the wave pattern and the wave output function have been stored, and register the data to the buffer memory of the D/A converter module.

After the reading of the wave output data is completed, enable the settings with the operating condition setting request program. (☞ Page 50 Operating condition setting request processing program example)



(0) Sets CH1 D/A conversion enable/disable setting to D/A conversion enabled.

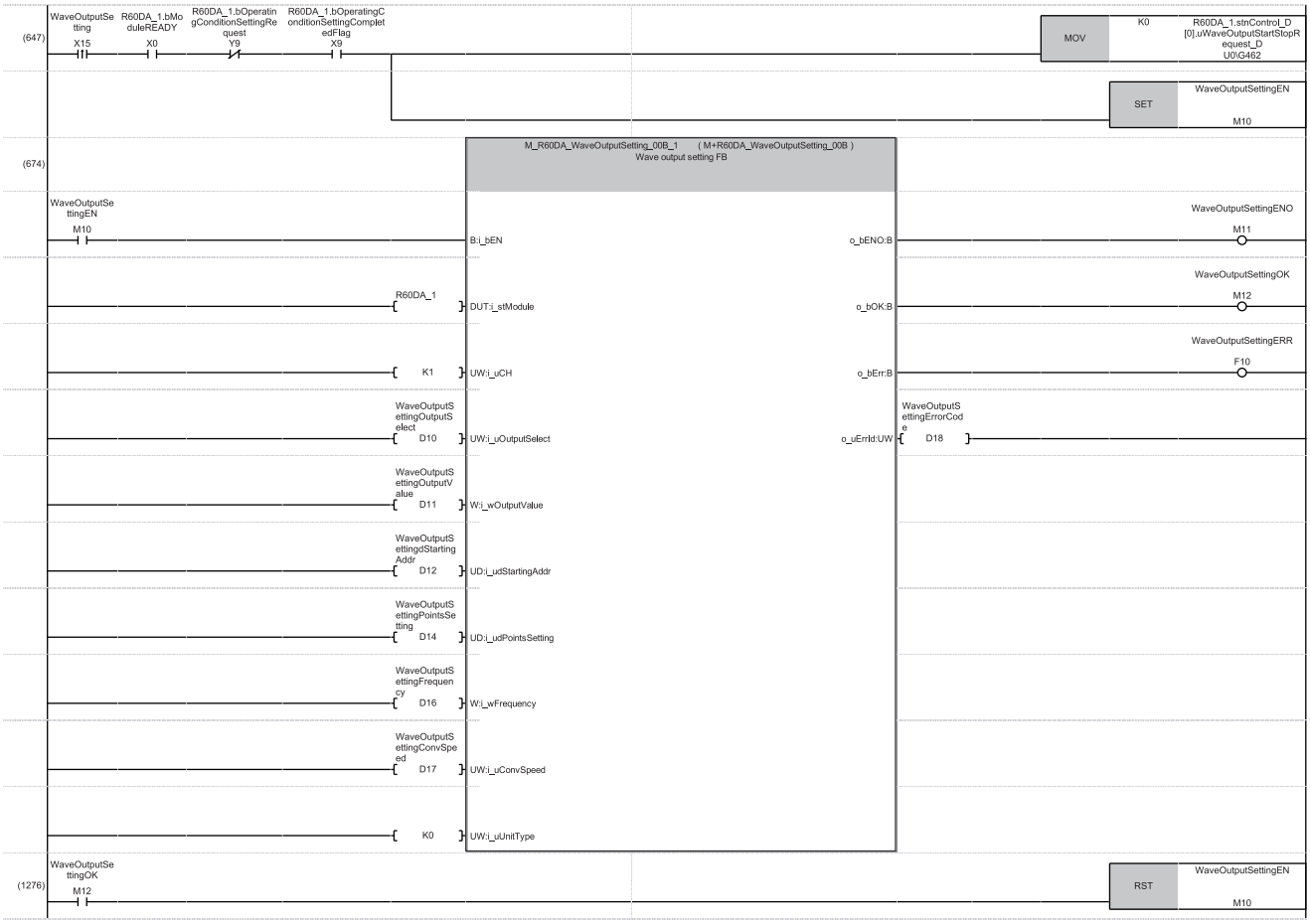
(32) Turns on Wave data read (device) FB start flag and registers the parameter settings of the wave pattern and the wave output function to the buffer memory.

(645) Turns off Wave data read (device) FB start flag.

■Wave output parameter setting processing program example

The following figure shows an example of a program that is used to partially change the parameter settings of the wave output function read from the file register (ZR) or a CSV file. When no change is made, this program is not required.

After changing the settings, enable the settings with the operating condition setting request program. (☞ Page 50 Operating condition setting request processing program example)



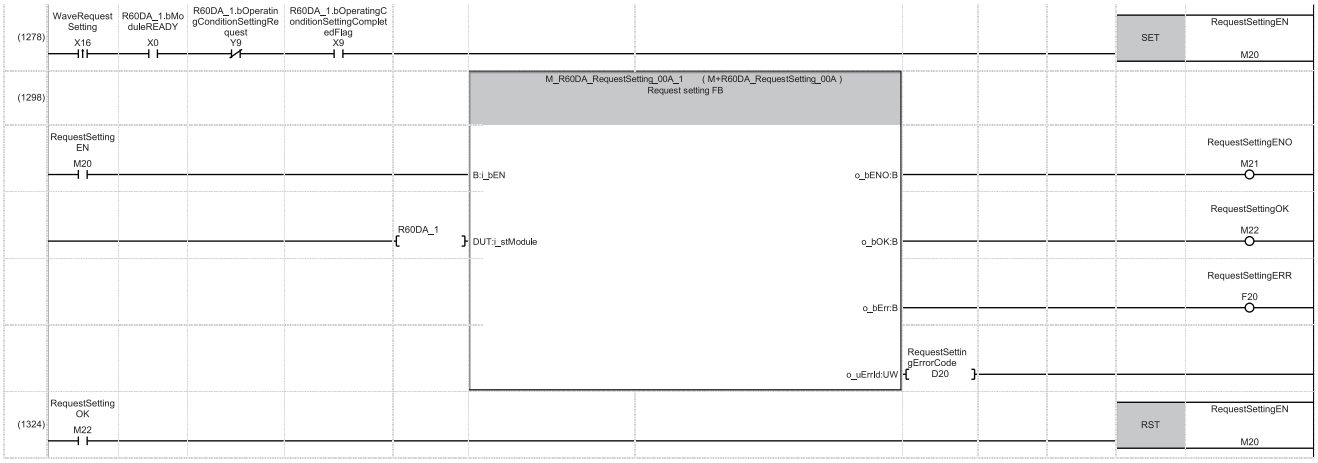
(647) Sets CH1 Wave output start/stop request to Wave output stop request (0).

(674) Turns on Wave output setting FB start flag and changes the value of the wave output function in the buffer memory.

(1276)Turns off Wave output setting FB start flag.

■Operating condition setting request processing program example

After registering a new wave output parameter or changing the settings, enable the settings with this program.



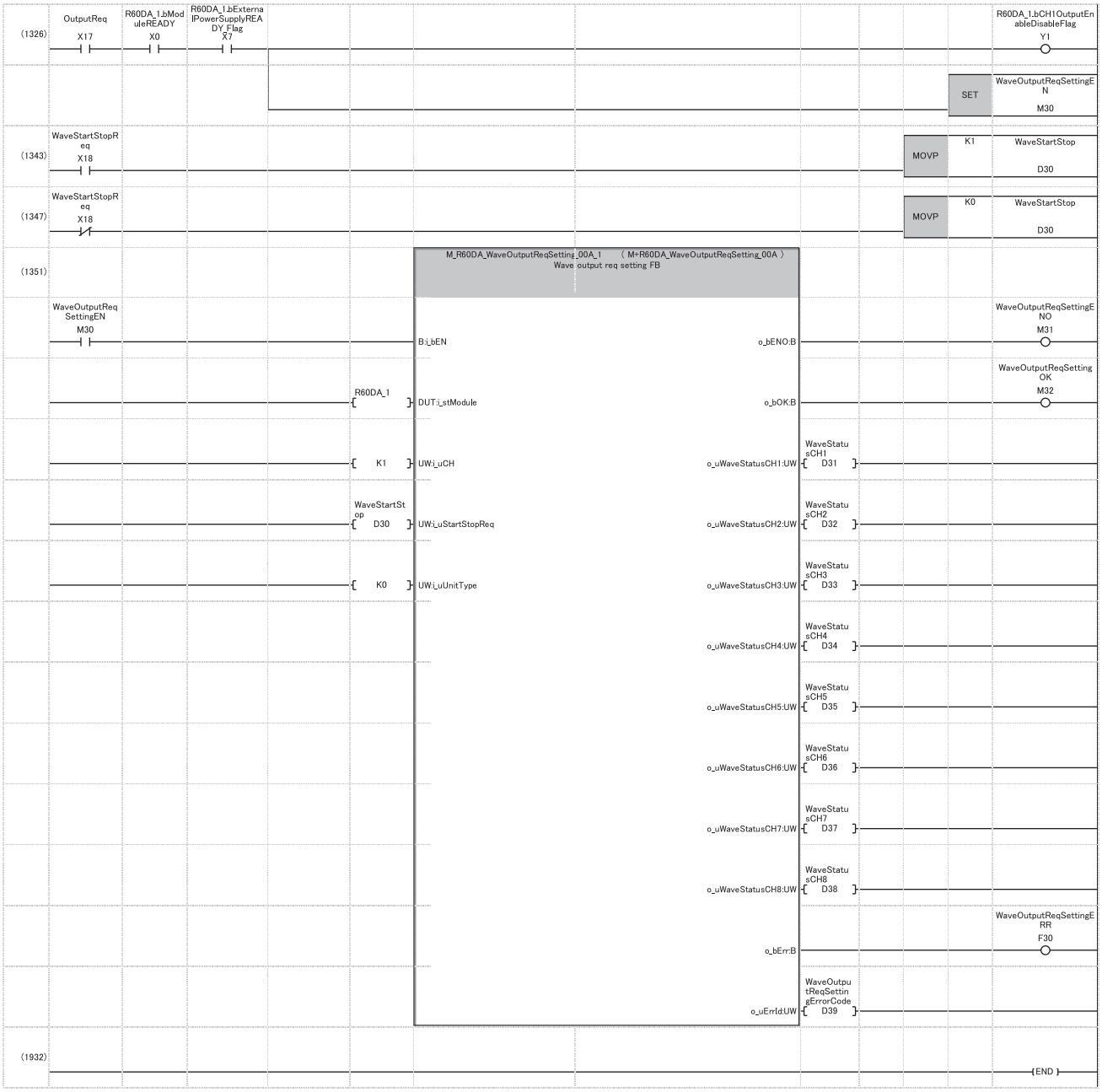
(1278)Turns on Operating condition setting request FB start flag.

(1298) Performs the operating condition setting request processing.

(1324)Turns off Operating condition setting request FB start flag.

■Wave output start processing program example

The following figure shows an example of a program that starts the wave output of CH1.



(1326) Turns on CH1 Output enable/disable flag.

(1343) Turns on Wave data output start/stop request and sets Wave output start/stop request to Wave output start request (1).

(1347) To stop the wave output, turn off Wave data output start/stop request and set Wave output start/stop request to Wave output stop request (0).

(1351) Turns on Wave output start/stop request FB start flag to start or stop the wave output.

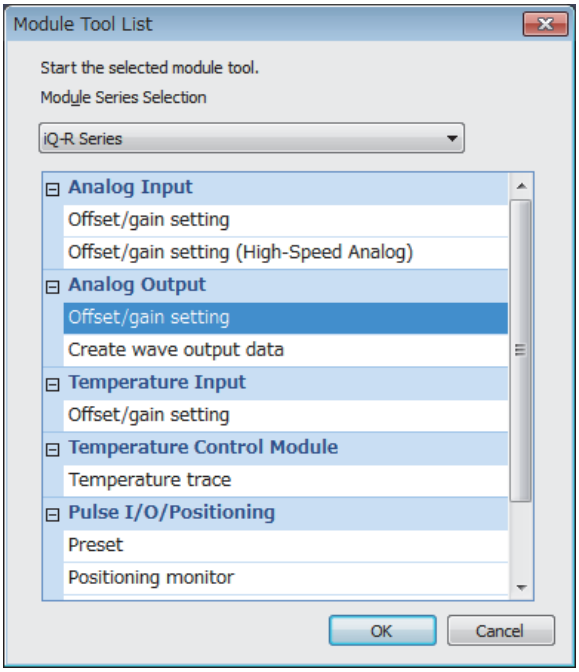
8 OFFSET/GAIN SETTING

When using the user range setting, configure the offset/gain setting.
Access to the offset/gain setting window in the engineering tool to set the offset/gain setting.

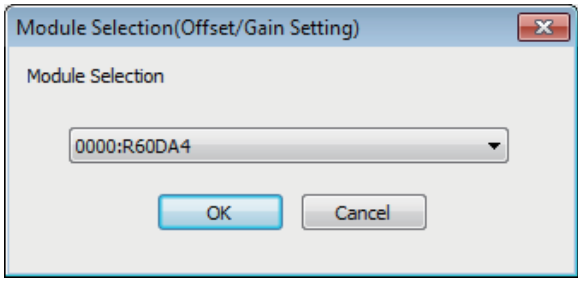
8.1 Setting Procedure

This section describes the setting procedure for the offset/gain setting of the D/A converter module. In wave output mode, the offset/gain setting cannot be accessed. Change the mode to the normal output mode or the offset/gain setting mode in advance.
Do not turn off the external power supply in the middle of the offset/gain setting. Otherwise, the offset/gain setting is not properly applied.

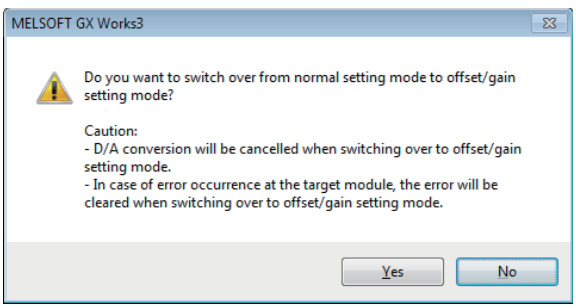
[Tool] ⇨ [Module Tool List]



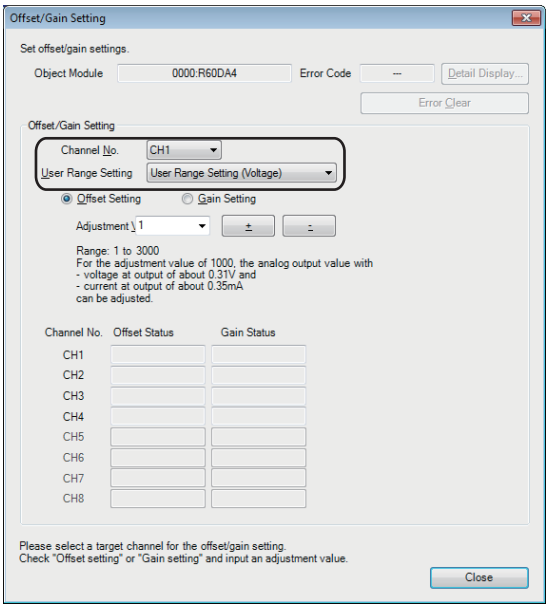
1. Select "Analog Output" ⇨ "Offset/gain setting" and click the [OK] button.



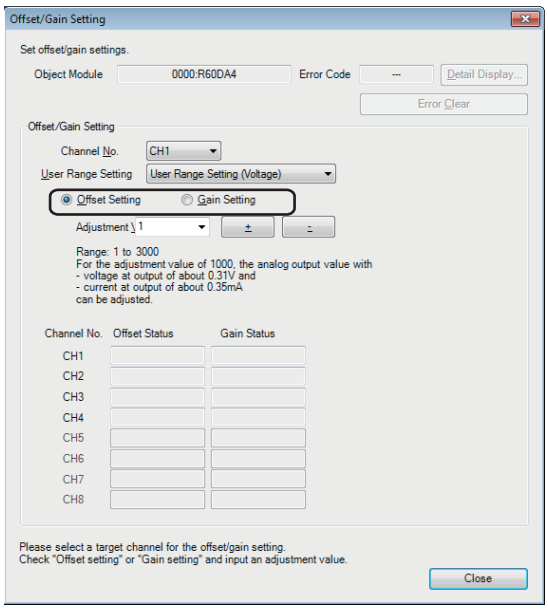
2. Select the target module for the offset/gain setting, and click [OK] button.



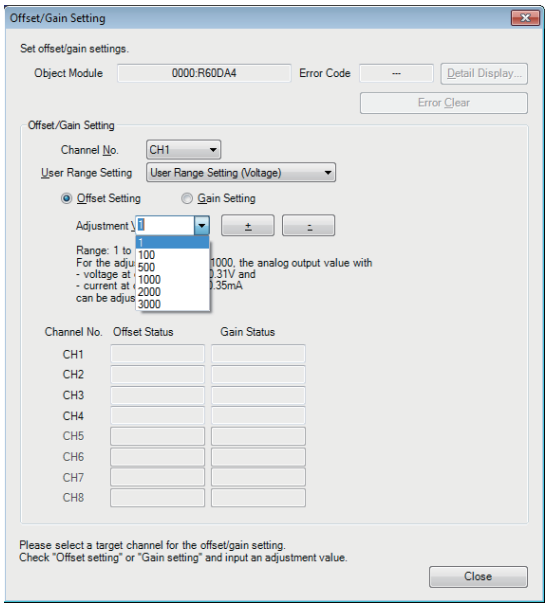
3. Click the [Yes] button.



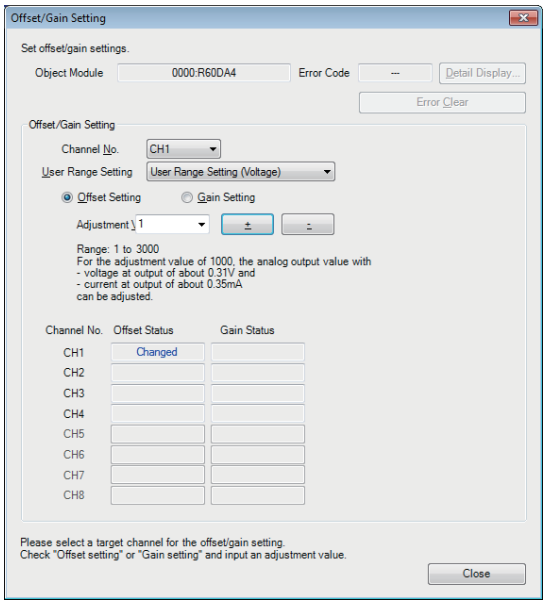
4. Specify the channel to configure the offset/gain setting and the user range setting.

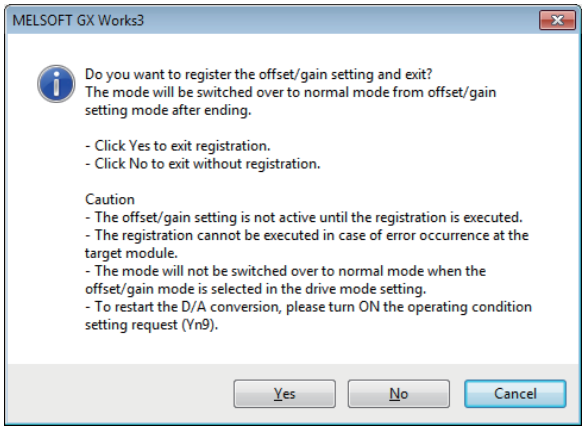


5. Use the radio button to specify whether to perform the offset setting or gain setting. (Step 6 and later describe the case when the offset setting is specified.)



6. The adjustment amount of the offset value or gain value can be selected from "1", "100", "500", "1000", "2000", and "3000" or it can be set by inputting any value (1 to 3000).





7. Clicking the [+(+)] or [-(-)] button fine-tunes the analog output voltage or analog output current value corresponding the set adjustment value.

8. Check that the offset setting status in the selected channel has changed to "Changed".

9. To perform the gain setting, repeat the procedure from step 5.

10. After setting is completed, click the [Close] button.

11. Click the [Yes] button.

APPENDICES

Appendix 1 I/O Conversion Characteristics

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

Offset value

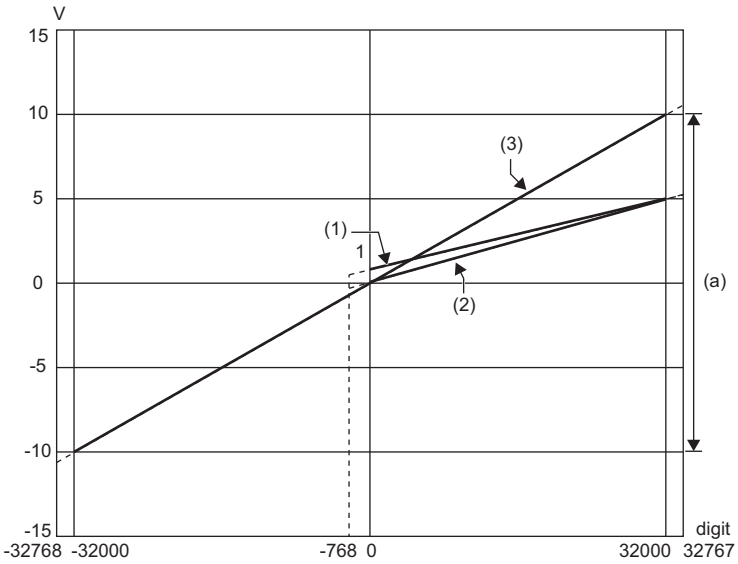
This analog output value (voltage or current) corresponds to a digital value of 0 that is set through the CPU module.

Gain value

This analog output value (voltage or current) corresponds to a digital value of 32000 that is set through the CPU module.

Voltage output characteristic

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



digit: Digital value

V: Analog output voltage (V)

(a): Practical analog output range

No.	Analog output range setting	Offset value	Gain value	Digital value	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
—	User range setting (Voltage)	*1	*1	-32000 to 32000	312.5μV*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, D/A conversion may not be performed properly.
· Setting range of the offset value and gain value: -10 to 10V
· ((gain value) - (offset value)) ≥ 4.0V

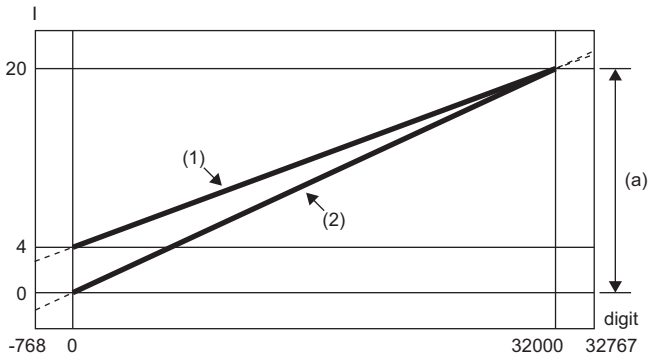
*2 Maximum resolution in the user range setting.

Point

- Set values within the practical range of the digital input and analog output at each output range. If the values are out of the range, the resolution and accuracy may not fall within the range of the performance specifications. (Do not use values in the dotted line region in the graph of voltage output characteristics.)

Current output characteristic

The following shows the list of the analog output ranges and the graphs of each current output characteristic, at the current output.



digit: Digital value

I: Analog output current (mA)

(a): Practical analog output range

No.	Analog output range setting	Offset value	Gain value	Digital value	Resolution
(1)	4 to 20mA	4mA	20mA	0 to 32000	500.0nA
(2)	0 to 20mA	0mA	20mA		625.0nA
—	User range setting (Current)	*1	*1	-32000 to 32000	350.9nA*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, D/A conversion may not be performed properly.
· Offset value ≥ 0mA, gain value ≤ 20mA
· ((gain value) - (offset value)) ≥ 11.3mA

*2 Maximum resolution in the user range setting.

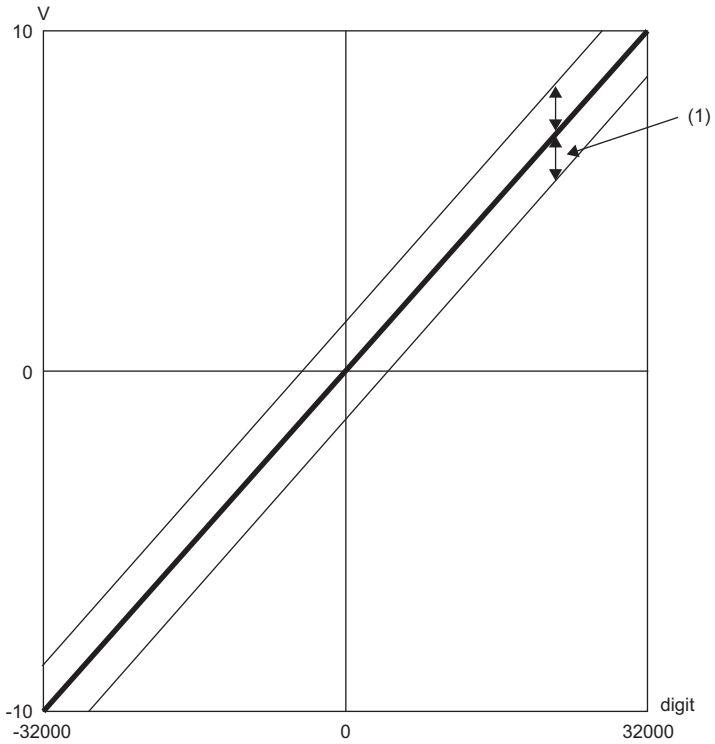
Point

- Set values within the practical range of the digital input and analog output at each output range. If the values are out of the range, the resolution and accuracy may not fall within the range of the performance specifications. (Do not use values in the dotted line region in the graph of current output characteristics.)

A

Appendix 2 Accuracy

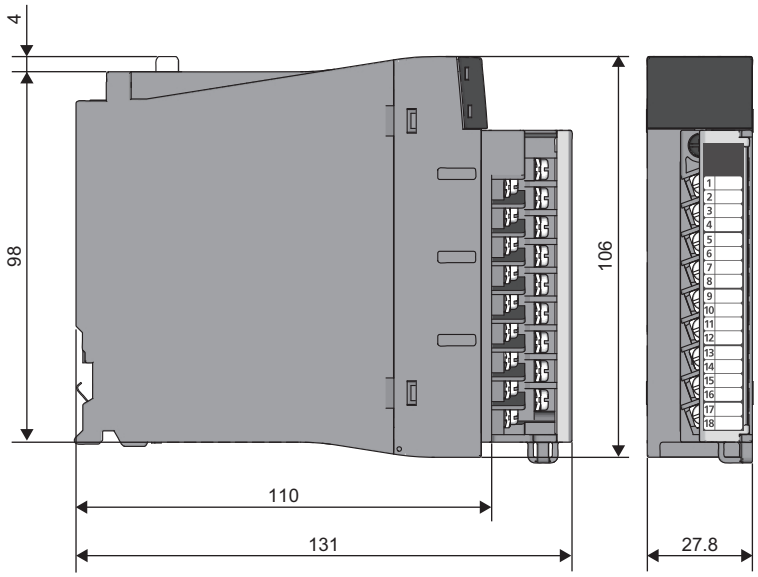
Accuracy of D/A conversion is determined by the accuracy for the maximum value of analog output value.
An output characteristic change through changes of the offset/gain setting or the output range does not sacrifice the accuracy, which is maintained within the described range of the performance specifications.
The following graph shows the fluctuation range of accuracy when the range of -10 to 10V is selected.
The accuracy is ±0.1% (±10mV) at ambient temperature of 25 ±5℃; the accuracy is ±0.3% (±30mV) at ambient temperature of 0 to 55℃. (except for the conditions under noise.)



digit: Digital value
V: Analog output value (V)
(1): Fluctuation range

Appendix 3 External Dimensions

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



(Unit: mm)

A

INDEX

A

Accuracy 58
ALM LED 16

C

Current output characteristic 57

E

ERR LED 16
External dimensions 59
External wiring 29

F

Function block (FB) 32

G

Gain value 55

O

Offset value 55
Offset/gain setting 52

P

Performance specifications 18

R

RUN LED 16

T

Terminal block 27

V

Voltage output characteristic 56

MEMO

I

REVISIONS

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

Print data	*Manual number	Revision
June 2014	SH(NA)-081235ENG-A	First edition
January 2015	SH(NA)-081235ENG-B	■Added function Online module change ■Added or modified parts RELEVANT MANUALS, Chapter 1, Section 2.1
May 2016	SH(NA)-081235ENG-C	■Added or modified parts SAFETY PRECAUTIONS, TERMS, Section 2.1, Chapter 4, Section 6.2, Section 7.1, Appendix 1
May 2020	SH(NA)-081235ENG-D	■Added function Firmware update function ■Added or modified parts SAFETY PRECAUTIONS, RELEVANT MANUALS, TERMS, Section 2.1, Chapter 3, 7, Addition of GENERIC TERMS AND ABBREVIATIONS and Chapter 5
May 2025	SH(NA)-081235ENG-E	■Added functions Disconnection detection enable/disable setting, disconnection check count enable/disable setting, disconnection detection auto-clear enable/disable setting ■Added or modified parts SAFETY PRECAUTIONS, Section 7.2

Japanese manual number: SH-081234-F

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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.
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2. Onerous repair term after discontinuation of production

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Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to:

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(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

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MODEL: R-DA-U-IN-E

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