

Programmable Controller

**MELSEC iQ-R**  
series

## MELSEC iQ-R Flexible High-Speed I/O Control Module User's Manual (Startup)

---

-RD40PD01



# SAFETY PRECAUTIONS

(Read these precautions before using this product.)

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

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".

 <b>WARNING</b>	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
 <b>CAUTION</b>	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.

## [Design Precautions]

### **WARNING**

- 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.
- 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.
- Outputs may remain on or off due to a failure of a transistor for external output. Configure an external circuit for monitoring output signals that could cause a serious accident.
- When changing data and operating status of the running module from an external device such as a personal computer connected, configure an interlock circuit external to the programmable controller to ensure that the entire system always operates safely.

In addition, before performing online operations, determine corrective actions to be taken between the external device and the module in case of a communication failure due to poor contact of cables.

## [Design Precautions]

### **CAUTION**

- 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 by Program" for "Opening Method" of "Module Parameter". If "Open by 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.
- Do not install the control lines or communication cables together with the main circuit lines or power cables. Keep a distance of 150mm or more between them. Failure to do so may result in malfunction due to noise.

## [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.
- To mount a module with no module fixing hook, place the concave part(s) located at the bottom onto the guide(s) of the base unit, push in the module, and fix it with screw(s). 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.
- When connecting a differential output terminal to a differential receiver of a drive unit, connect the high-speed output common terminal to the differential receiver common terminal of the drive unit. Failure to do so may cause the module to fail or malfunction because of the potential difference that occurs between the high-speed output common terminal and the differential receiver common terminal.

## [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.
- 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.
- 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.
- Do not install the control lines or communication cables together with the main circuit lines or power cables. Keep a distance of 150mm or more between them. Failure to do so may result in malfunction due to noise.
- Ground the shield cable on the encoder side (relay box) with a ground resistance of 100 ohm or less. Failure to do so may cause malfunction.

## [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.

---

## [Startup and Maintenance Precautions]

---

### **CAUTION**

- 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.
- 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.
- When performing online operations of the running module from an external device such as a personal computer connected, read the relevant manuals carefully and ensure that the operation is safe before proceeding.
- Before changing any setting of the module, read the relevant manuals carefully, ensure the safety, and change the operating status of the CPU module to STOP.  
Especially when operating the module in the network system, ensure the safety thoroughly because controlled machines are likely to be moved inadvertently. Improper operation may damage machines or cause accidents.

---

## [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.

IMITSUBISHI 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 specifications, procedures before operation, wiring, and programming of the relevant product 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/Y1F are assigned to the flexible high-speed I/O control 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 product

RD40PD01

# COMPLIANCE WITH EMC AND LOW VOLTAGE DIRECTIVES

## Method of ensuring compliance

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

-  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

To ensure that this product maintains EMC and Low Voltage Directives, please refer to one of the following manuals.

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

# CONTENTS

SAFETY PRECAUTIONS .....	1
CONDITIONS OF USE FOR THE PRODUCT .....	9
INTRODUCTION .....	9
COMPLIANCE WITH EMC AND LOW VOLTAGE DIRECTIVES .....	10
RELEVANT MANUALS .....	12
TERMS .....	13
<b>CHAPTER 1 PART NAMES</b>	<b>14</b>
<b>CHAPTER 2 SPECIFICATIONS</b>	<b>16</b>
2.1 Performance Specifications .....	16
<b>CHAPTER 3 FUNCTION LIST</b>	<b>20</b>
<b>CHAPTER 4 PROCEDURES BEFORE OPERATION</b>	<b>22</b>
<b>CHAPTER 5 INSTALLATION AND EXTERNAL WIRING</b>	<b>24</b>
5.1 External Wiring .....	24
External wiring precautions .....	24
Connector for external devices .....	28
Interface with external devices .....	29
Connectable encoders .....	36
5.2 Examples of Wiring Between a Controller and External Input Terminals .....	37
Example of external wiring with controllers (Sink load type) .....	37
Example of external wiring with controllers (Source load type) .....	37
5.3 Example of External Wiring Between the Flexible High-speed I/O Control Module and an Encoder .....	38
Example of external wiring with an open collector output type encoder (24VDC) .....	38
Example of external wiring with a line driver (equivalent to AM26LS31) encoder .....	40
Example of external wiring with the SSI encoder (serial communication) .....	41
5.4 Example of External Wiring with External Output Terminals .....	42
Example of external wiring with output terminals (Sink output type) .....	42
Example of external wiring with differential receivers (Differential output type) .....	43
<b>CHAPTER 6 CONFIGURATION TOOL</b>	<b>44</b>
<b>CHAPTER 7 OPERATION EXAMPLE</b>	<b>46</b>
7.1 Programming Procedure .....	46
7.2 Program Examples .....	46
<b>APPENDIX</b>	<b>54</b>
Appendix 1 External Dimensions .....	54
<b>INDEX</b>	<b>56</b>
REVISIONS .....	58
WARRANTY .....	59
TRADEMARKS .....	60

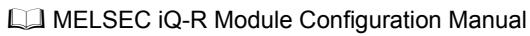
# RELEVANT MANUALS

Manual name [manual number]	Description	Available form
MELSEC iQ-R Flexible High-Speed I/O Control Module User's Manual (Startup) [SH-081645ENG] (this manual)	System configuration, specifications, procedures before operation, wiring, and operation examples of the flexible high-speed I/O control module	Print book e-Manual PDF
MELSEC iQ-R Flexible High-Speed I/O Control Module User's Manual (Application) [SH-081647ENG]	Functions, parameter settings, I/O signals, buffer memory, and troubleshooting of the flexible high-speed I/O control module, and details on the configuration tool	Print book e-Manual PDF

This manual does not include detailed information on 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.



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

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



e-Manual refers to the Mitsubishi Electric 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.

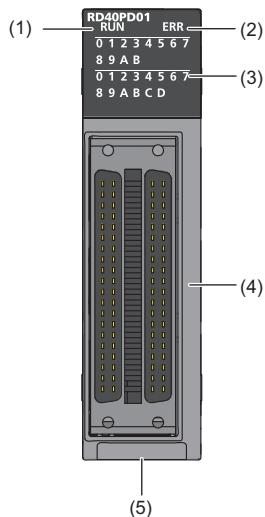
# TERMS

Unless otherwise specified, this manual uses the following terms.

Term	Description
Buffer memory	A memory in an intelligent function module, where data (such as setting values and monitoring values) exchanged with a CPU module are stored
Configuration tool	The abbreviation for the configuration tool for flexible high-speed I/O control modules
Engineering tool	Another term for GX Works3
Execution memory	The memory in a flexible high-speed I/O control module where the hardware logic is written
External wiring	Wiring between a flexible high-speed I/O control module and external devices
Flash ROM	A non-volatile memory to which the hardware logic can be written. Although the number of writes to a flash ROM is limited, the written hardware logic is not deleted even after the power off and automatically read at the power-on.
Flexible high-speed I/O control module	The abbreviation for the MELSEC iQ-R series flexible high-speed I/O control module
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.
GX Works3	The product name of the software package for the MELSEC programmable controllers
Hardware logic	A control logic that users create graphically combining inputs, outputs, logical operation circuits, and counters with the configuration tool
Link	Connecting blocks or terminals on the configuration tool
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.
Watchdog timer error	An error that occurs if the internal processing of the flexible high-speed I/O control module is abnormal. Watchdog timer enables the module to monitor its own internal processing.

# 1 PART NAMES

This chapter lists the part names of the flexible high-speed I/O control module.



No.	Name	Description
(1)	RUN LED	This LED indicates the operating status. On: Normal operation Flashing (1s-cycle): During simulation Flashing (400ms-cycle): When a module is selected for an online module change Off: When 5V power off, a watchdog timer error has occurred, or module replacement allowed in the process of the online module change
(2)	ERR LED	This LED indicates the error status. On: An error has occurred. Off: Normal operation
(3)	Indicator LED	This LED indicates the I/O status of external I/O terminals.
	Upper section	This LED indicates the input status of each external input terminal. • On: A voltage has been applied. • Off: No voltage has been applied. 0 to B indicate external input terminals (IN 0 to IN B).
	Lower section	This LED indicates the output status of each external output terminal.*1 • On: A signal output is on. • Off: A signal output is off. 0 to D indicate the following external output terminals. • 0 to 7: OUT 0 to OUT 7 • 8 to D: OUT 0_DIF to OUT 5_DIF
(4)	Connector for external devices (40 pins)	A connector used to connect encoders and control devices. For the terminal layout, refer to the following. ☞ Page 29 Interface with external devices
(5)	Production information marking	The marking shows the production information (16 digits) of the module.

\*1 For differential output terminals, the LED indicates the ON/OFF status of each differential output+ signal.

# MEMO

---

# 2 SPECIFICATIONS

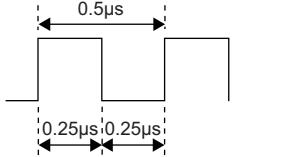
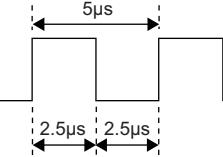
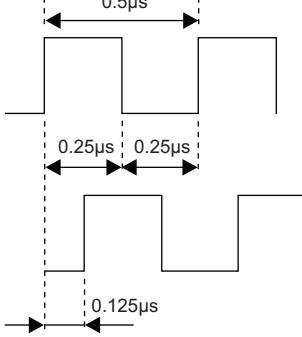
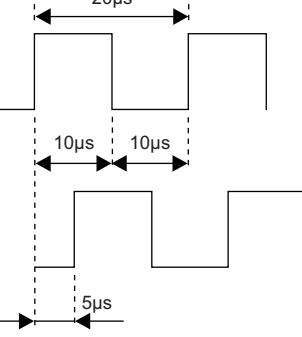
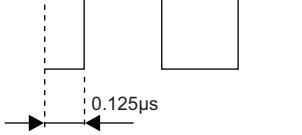
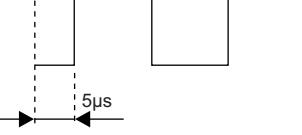
This chapter describes performance specifications.

## 2.1 Performance Specifications

The following table lists the performance specifications of the flexible high-speed I/O control module.

Item	Specifications	
	Differential	DC
Number of input points	12 points (common to 5VDC/24VDC/differential)	
Number of output points	6 points	8 points (5 to 24VDC, 0.1A/point)
Number of interrupts	8 points	
Input response time	1µs or less	
Output response time	1µs or less	
Pulse input speed	Max. 8Mpps (2MHz)	Max. 200kpps (200kHz)
Pulse output speed	Max. 8Mpps (2MHz)	Max. 200kpps (200kHz)

Item			Specifications		
			Differential		DC
Main block*1	External input block	Logic Select	Inverted, not inverted		
		Filter Time	General-purpose input: 0μs, 10μs, 50μs, 0.1ms, 0.2ms, 0.4ms, 0.6ms, 1ms, 5ms		
			Pulse input: 10kpps, 100kpps, 200kpps, 500kpps, 1000kpps, 2000kpps, 4000kpps, 8000kpps		
		Initial State	Low, High		
Inter-module synchronization signal input terminal			Outputs the fixed scan clock synchronized with the inter-module synchronization cycle as a signal.		
Y device terminal			Outputs the ON/OFF states of General command 0 to General command F (Y10 to Y1F) as signals.		
OUT terminal			Outputs the same signal as the one to be output from the external output block.		
Parallel encoder block	Input Data Type		Pure binary, Gray code, BCD		
	Data Length		1 bit to 12 bits		
SSI encoder block	Input Data Type		Pure binary, Gray code		
	Data Length		1 bit to 32 bits		
Multi function counter block	Terminal		Input terminal, latch input terminal, event input terminal, output terminal, event output terminal, cam switch output terminal, pattern generator output terminal		
	Input signal event detection block		Combination of rise, fall, Low, and High		
	Latch event detection block		Rise, fall		
	Counter timer block	Type	Addition, subtraction, linear counter mode, ring counter mode, addition mode, preset counter function, latch counter function, internal clock function		
		Internal clock	25ns, 50ns, 0.1μs, 1μs, 10μs, 100μs, 1ms		
		Counting range	32-bit signed binary value (-2147483648 to 2147483647) 32-bit unsigned binary value (0 to 4294967295) 16-bit signed binary value (-32768 to 32767) 16-bit unsigned binary value (0 to 65535)		
	Compare block	Compare Value	Same as the counting range		
		Compare Mode	16-bit counter: =, >, <, ≥, ≤, <> 32-bit counter: =, >, <, ≥, ≤, <>		
	Pattern generator block	Number of output pattern points	8192 points		
	Cam switch block	Refreshing cycle	0.1μs		
		Number of steps	Up to 16 steps		
	Set/reset block		Uses the signal input to the Set terminal as a trigger to output the High fixed signal. Uses the signal input to the Reset terminal as a trigger to output the Low fixed signal.		
Logical operation block	Logical operation type		AND, OR, XOR		
External output block	Logic Select		Inverted, not inverted		
	Delay Time		None, 12.5ns × (1 to 64), 25ns × (1 to 64), 50ns × (1 to 64), 0.1μs × (1 to 64), 1μs × (1 to 64), 10μs × (1 to 64), 100μs × (1 to 64), 1ms × (1 to 64), inter-module synchronization cycle		
	Error-time Output Mode		OFF, ON, HOLD		
SI device terminal			Interrupt to a CPU module		

Item	Specifications			
	Differential		DC	
Main functions that can be performed with the combination of main blocks	Pulse count	Count input signal	Phase	
		Counting speed	1-phase input (1 multiple/2 multiples), 2-phase input (1 multiple/2 multiples/4 multiples), CW/CCW	
			10kpps/100kpps/200kpps/ 500kpps/ 1Mpps/2Mpps	
			10kpps/100kpps/200kpps/500kpps/ 1Mpps/2Mpps/4Mpps	
			10kpps/100kpps/200kpps/500kpps/ 1Mpps/2Mpps/4Mpps/8Mpps	
		Counting range		
		Type		
		Addition, subtraction, linear counter mode, ring counter mode, addition mode, preset counter function, latch counter function		
		Minimum count pulse width (duty ratio: 50%)	1-phase input (1 multiple/2 multiples), CW/CCW	
				
				
			2-phase input (1 multiple/2 multiples/4 multiples)	
				
				
				
				
			32-bit signed binary value, 32-bit unsigned binary value, 16-bit signed binary value, 16-bit unsigned binary value	
			Setting value < count value, setting value = count value, setting value > count value	
			Coincidence detection interrupt function	
			Up to 16 steps/1 block	
			The ON/OFF timing can be adjusted in increments of 25ns at a minimum using trigger input as the starting point.	
			Max. 2MHz	
			Max. 200kHz	
			Any value (Can be set in increments of 25ns at a minimum.)	
			Number of output pulses = (1 to 2147483647)/(1 to 2147483647) × Number of input pulses	
			Note that a value obtained by dividing (1 to 2147483647) by (1 to 2147483647) should not exceed 1.	
			Pulse width (ON width, OFF width, from a rising edge to the next rising edge, from a falling edge to the next falling edge)	
			25ns	
			24VDC/5VDC/differential	
			Logical operation: Min. 87.5ns, Coincidence output: Min. 137.5ns, Cam switch: Min. 262.5ns	
Processing time of the main hardware logic				
Number of writes to a flash ROM		Up to 10000 times		
Internal current consumption (5VDC)		0.76A		
Applicable wire size	40-pin connector	0.088mm <sup>2</sup> to 0.3mm <sup>2</sup> (28 to 22 AWG) (When the A6CON1 or A6CON4 is used) 0.088mm <sup>2</sup> to 0.24mm <sup>2</sup> (28 to 24 AWG) (When the A6CON2 is used)		
External wiring connector (sold separately)		A6CON1, A6CON2, A6CON4		
Number of occupied I/O points		32 points (I/O assignment: Intelligent, 32 points)		

Item	Specifications	
	Differential	DC
External dimensions	Height	106mm
	Width	27.8mm
	Depth	110mm
Weight		0.16kg

\*1 The basic blocks supplied by the configuration tool

# 3 FUNCTION LIST

The following table lists the functions of the flexible high-speed I/O control module. For details on the functions, refer to the following.

 MELSEC iQ-R Flexible High-Speed I/O Control Module User's Manual (Application)

Item	Description
Hardware logic control function	Users can create the hardware logic to perform a desired control with the configuration tool.
Continuous logging function	The function collects the status of the Output terminal of the external input blocks (IN 0 to IN B) continuously at a specified interval.
Interrupt function	This function notifies the CPU module that either of following conditions is satisfied as an interrupt request. <ul style="list-style-type: none"><li>• A signal is input to the SI device terminal of the hardware logic.</li><li>• The logging data for 5120 points is stored in Continuous logging data storage area (Un\G15020 to Un\G25259).</li></ul>
Inter-module synchronization function	The function synchronizes the control timing of multiple modules for which the inter-module synchronization function are enabled with the inter-module synchronization cycle.
Error history function	The function stores up to 16 errors that occurred in the flexible high-speed I/O control module in the buffer memory as an error history.
Event history function	The function collects the errors that occurred in the flexible high-speed I/O control module and the operations that were performed in the module in the CPU module as event information.
Hardware logic backup/restore	The flexible high-speed I/O control module can back up and restore the hardware logic written to a flash ROM.
Online module change	The function changes a module without stopping the system. For the procedure of the online module change, refer to the following.  MELSEC iQ-R Online Module Change Manual

# MEMO

---

3

# 4 PROCEDURES BEFORE OPERATION

---

This chapter describes the procedures before operation.

## 1. Installing the module

Install the flexible high-speed I/O control module with a desired configuration.

## 2. External wiring

Wire external devices to the flexible high-speed I/O control module.

 Page 24 External Wiring

## 3. Adding the module

Add the flexible high-speed I/O control module to the module configuration using an engineering tool. For details, refer to the following.

 GX Works3 Operating Manual

## 4. Creating a hardware logic

Create a hardware logic with the configuration tool. For details, refer to the following.

 MELSEC iQ-R Flexible High-Speed I/O Control Module User's Manual (Application)

## 5. Programming

Create a program. For details, check the following.

 Page 46 OPERATION EXAMPLE

# MEMO

---

4

# 5 INSTALLATION AND EXTERNAL WIRING

This chapter describes the installation and external wiring of the flexible high-speed I/O control module.

## 5.1 External Wiring

This section describes wiring of encoders and controllers to the flexible high-speed I/O control module.

### External wiring precautions

To obtain the maximum performance from the functions of the flexible high-speed I/O control module and improve the system reliability, an external wiring with high durability against noise is required.

This section describes the precautions for wiring of encoders and controllers.

#### Wiring

- Different terminals are prepared depending on the voltage of the signal to be input. Connecting to a terminal with an incorrect voltage may cause a malfunction of the module or failure of the connected devices.
- In 1-phase pulse input, always connect a pulse input cable on the phase A side.
- Install a fuse for each external terminal to prevent the external devices or module from being burnt out or damaged if a load shorts in an output circuit. The following fuses have been tested by Mitsubishi Electric Corporation.

Fuse model name	Rated current	Contact
312.750	0.75A	Littelfuse <a href="http://www.littelfuse.com">www.littelfuse.com</a>
216.800	0.8A	

#### Connector for external devices

- Connectors for external devices must be soldered or crimped properly. A poor soldering or crimping may result in a malfunction.
- Securely connect the connectors for external devices to the connectors of the flexible high-speed I/O control module, and securely tighten the two screws.
- When disconnecting a cable from the flexible high-speed I/O control module, do not pull the cable holding the cable part. Remove a cable supporting the connector part of the cable by hand. Pulling the cable being connected to the flexible high-speed I/O control module can cause a malfunction. In addition, a damage of the flexible high-speed I/O control module or cables can result.

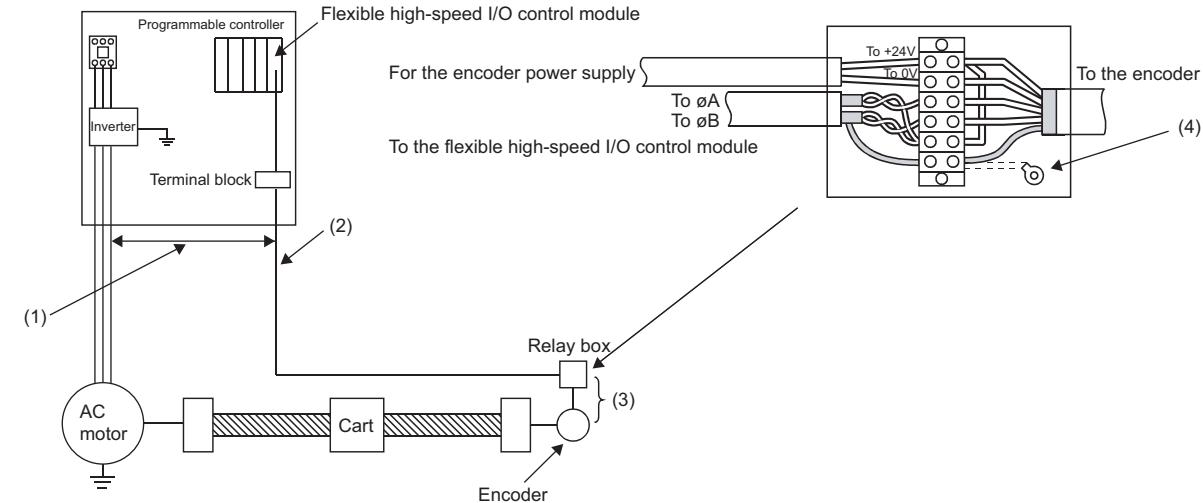
## Measures to reduce noise

The flexible high-speed I/O control module may malfunction if pulse-like noise is input. Thus, take the following measures to reduce noise:

- Always use a shielded twisted pair cable.
- Arrange a shielded twisted pair cable keeping a distance of 150mm or more from the power cable, I/O cables, or other cables that cause much noise. Wire the shielded twisted pair cable in the minimum distance to the extent possible.
- Ground a shield wire on the encoder side (relay box) with a ground resistance of 100 ohms or less.
- Do not wire terminals that are not to be used. Doing so may result in malfunction due to noise.

## Wiring example for measures to reduce noise

The following figure shows a wiring example of when the measures to reduce noise are reflected to the actual system.

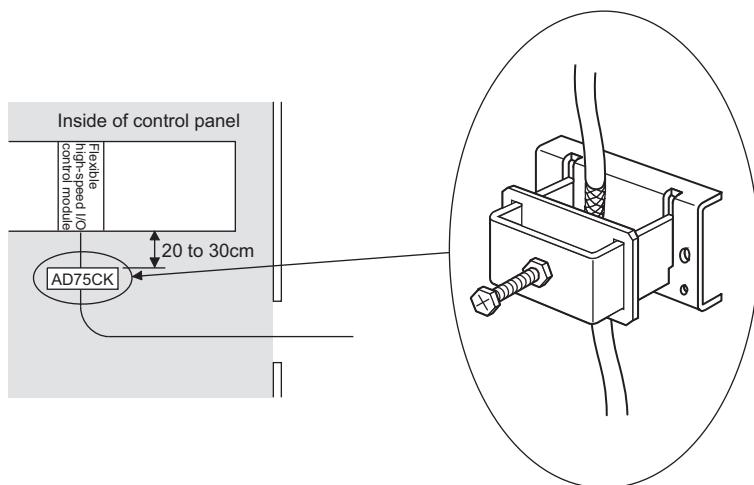


- (1) Keep a distance of 150mm or more from the I/O cables of high voltage devices including a relay and an inverter regardless of whether the devices are inside and outside the panel.
- (2) For metal pipes, do not use solenoid valves and inductive loads together in a single pipe. When the distance from high voltage cables cannot be kept because of duct wiring or other factors, use shield wires such as CVVS for the high voltage cables.
- (3) Keep the minimum distance between an encoder and a relay box. When the distance between the flexible high-speed I/O control module and an encoder is long, a voltage drop may occur. Check that the voltage while the encoder is operating and the voltage while the encoder is stopped are within the rated voltage range of the encoder using a measuring instrument such as a tester on the terminal block of the relay box. When a voltage drop is large, use a thicker wire or use the 24VDC encoder that consumes less current.
- (4) Connect the shield wires of the encoder and the shield wires of the shielded twisted pair cable inside the relay box. When the shield wires of the encoder in use are not grounded in the encoder, ground them inside the relay box as shown above.

## Compliance with the EMC and Low Voltage Directives

Take the following measures for compliance with the EMC and Low Voltage Directives.

- Always attach a ferrite core on the DC power supply cable to be connected to the flexible high-speed I/O control module and the one to be connected to a controller. Using the ESD-SR-250 ferrite core manufactured by NEC TOKIN Corporation is recommended.
- Install a DC power and the module in the same control panel.
- Use a shielded cable for the DC power when the DC power supply cable is extended out of the control panel.
- The length of the cables to be connected to the output section and external devices must be 2m or shorter for open collector output or 10m or shorter for differential output.
- Keep the length of the cables between the input section and the external devices to 30m or less.
- Use a shielded twisted pair cable and ground the shielded part of the cable to the control panel with the AD75CK cable clamp manufactured by Mitsubishi Electric Corporation.



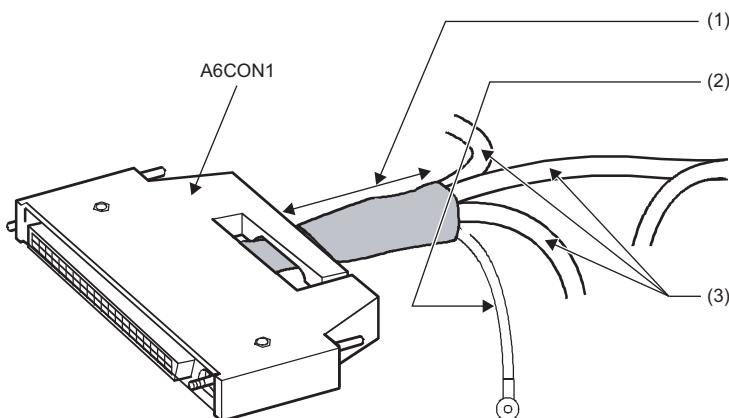
For details on the AD75CK, refer to the following.

说明书 AD75CK-type Cable Clamping Instruction Manual

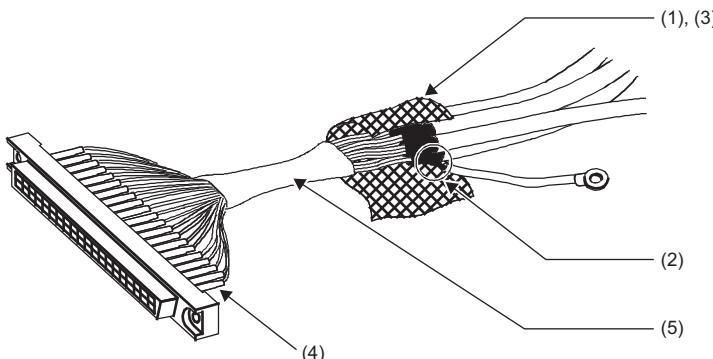
- Take the following measures to reduce noise when wiring connectors for external devices.

### ■Wiring to use a shielded cable

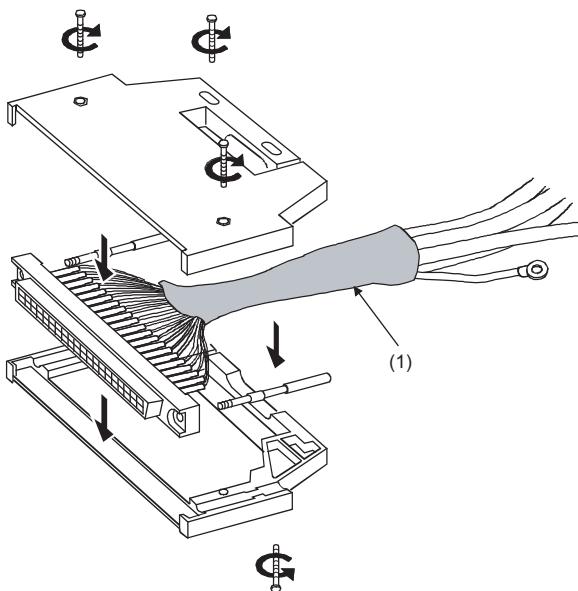
The following figure shows a wiring example for measures to reduce noise using the A6CON1.



- (1) Shorten the distance between the connector and shielded cable as far as possible.
- (2) Ground a FG cable of 2mm<sup>2</sup> or thicker in the minimum distance. Securely ground the cable to the control panel on the module side.
- (3) Shielded cables

**■How to process shielded cables**

- (1) Remove the jacket of each shielded cable.
- (2) Take out a shield from a shielded cable and solder it on the FG wire.
- (3) Connect a shield of each shielded cable with a conductive tape.
- (4) Cover a connector pin with a heat-shrinkable insulation tube to protect signal wires. If signal wires are bared, the module may be affected by static electricity and malfunction.
- (5) Cover the signal wires with an insulating tape.

**■Assembling the A6CON1**

- (1) Cover the cables on which a conductive tape has been applied with a heat-shrinkable tube.

# Connector for external devices

## Precautions

- Tighten the connector screws within the tightening torque range.

Screw	Tightening torque range
Connector screw (M2.6)	0.20 to 0.29N·m

- Use copper wires having temperature rating of 75°C or more for the connectors.
- Use UL listed connectors if necessary for UL compliance.

## Applicable connectors

Prepare connectors for external devices to be used with the flexible high-speed I/O control module by users.

The following tables list the applicable connectors, and the reference product of a crimping tool.

### ■40-pin connector

Type	Model	Applicable wire size
Soldering type connector (Straight type)	A6CON1 <sup>*1</sup>	0.088 to 0.3mm <sup>2</sup> (28 to 22 AWG) (stranded wire)
Crimping type connector (Straight type)	A6CON2	0.088 to 0.24mm <sup>2</sup> (28 to 24 AWG) (stranded wire)
Soldering type connector (Dual purpose (straight/oblique) type)	A6CON4 <sup>*1</sup>	0.088 to 0.3mm <sup>2</sup> (28 to 22 AWG) (stranded wire)

\*1 When using 40 wires, use wires whose sheath outside diameter is 1.3mm or less.

Select the wire applicable to the current value to be used.



The A6CON3 (IDC type connector (Straight type)) cannot be used.

### ■40-pin connector crimping tool

Type	Model	Contact
Crimping tool	FCN-363T-T005/H	FUJITSU COMPONENT LIMITED <a href="http://www.fcl.fujitsu.com/en">www.fcl.fujitsu.com/en</a>

For how to wire connectors and how to use the crimping tool, contact FUJITSU COMPONENT LIMITED.

## Wiring method, installation procedure, disconnection procedure

For the wiring method, installation procedure, and disconnection procedure, refer to the following.

MELSEC iQ-R Module Configuration Manual

## Interface with external devices

The following table shows the interface of the flexible high-speed I/O control module with external devices.

### Internal circuit of the interface for external devices

The following table lists the internal circuits of the interface for external devices of the flexible high-speed I/O control module.

I/O classification	Internal circuit	Connector		Signal name	
		CON1	CON2	CON1	CON2
Input		B19	B19	High-speed input 0 24VDC	High-speed input 6 24VDC
		A19	A19	High-speed input 0 5VDC	High-speed input 6 5VDC
		B18	B18	High-speed input 0 differential	High-speed input 6 differential
		A18	A18	High-speed input 0 common	High-speed input 6 common
		B17	B17	High-speed input 1 24VDC	High-speed input 7 24VDC
		A17	A17	High-speed input 1 5VDC	High-speed input 7 5VDC
		B16	B16	High-speed input 1 differential	High-speed input 7 differential
		A16	A16	High-speed input 1 common	High-speed input 7 common
		B15	B15	High-speed input 2 24VDC	High-speed input 8 24VDC
		A15	A15	High-speed input 2 5VDC	High-speed input 8 5VDC
		B14	B14	High-speed input 2 differential	High-speed input 8 differential
		A14	A14	High-speed input 2 common	High-speed input 8 common
		B13	B13	High-speed input 3 24VDC	High-speed input 9 24VDC
		A13	A13	High-speed input 3 5VDC	High-speed input 9 5VDC
		B12	B12	High-speed input 3 differential	High-speed input 9 differential
		A12	A12	High-speed input 3 common	High-speed input 9 common
		B11	B11	High-speed input 4 24VDC	High-speed input A 24VDC
		A11	A11	High-speed input 4 5VDC	High-speed input A 5VDC
		B10	B10	High-speed input 4 differential	High-speed input A differential
		A10	A10	High-speed input 4 common	High-speed input A common

I/O classification	Internal circuit	Connector		Signal name	
		CON1	CON2	CON1	CON2
Input		B9	B9	High-speed input 5 24VDC	High-speed input B 24VDC
		A9	A9	High-speed input 5 5VDC	High-speed input B 5VDC
		B8	B8	High-speed input 5 differential	High-speed input B differential
		A8	A8	High-speed input 5 common	High-speed input B common
Output		B7	B7	High-speed output 0	High-speed output 4
		A7	A7	High-speed output 1	High-speed output 5
		B6	B6	High-speed output 2	High-speed output 6
		A6	A6	High-speed output 3	High-speed output 7
		B5	B5	High-speed output 0-3 common	High-speed output 4-7 common
		A5	A5	High-speed output common*1	High-speed output common*1
		B4	B4	High-speed output 0 differential+	High-speed output 3 differential+
		A4	A4	High-speed output 0 differential-	High-speed output 3 differential-
		B3	B3	High-speed output 1 differential+	High-speed output 4 differential+
		A3	A3	High-speed output 1 differential-	High-speed output 4 differential-
		B2	B2	High-speed output 2 differential+	High-speed output 5 differential+
		A2	A2	High-speed output 2 differential-	High-speed output 5 differential-

\*1 The high-speed output common (A5) is connected with the common wire of high-speed output 0 to 5 differential.

## ■Input signal status in the hardware logic (High/Low)

The input signal status (High/Low) in the hardware logic is determined depending on the input signals (ON/OFF) from external devices and logic selection.

Logic selection <sup>*1</sup>	External wiring	High/Low state of the external input signal IN 0 observed from the flexible high-speed I/O control module <sup>*2</sup>
Not inverted	When a voltage is not applied (OFF)	Low
Inverted	When a voltage is applied (ON)	High

\*1 Set the logic selection with the parameters of the external input block. For details, refer to the following.

MELSEC iQ-R Flexible High-Speed I/O Control Module User's Manual (Application)

\*2 The input signal status in the hardware logic is described as High and Low. For details, refer to the following.

MELSEC iQ-R Flexible High-Speed I/O Control Module User's Manual (Application)

## ■Status of an output signal to external devices (ON/OFF)

The status of an output signal to external devices (ON/OFF) is determined depending on the status of Input terminal of the external output block (High/Low) and logic selection.

Output type	Logic selection <sup>*1*2</sup>	
	Not inverted	Inverted
DC	 	
Differential	 	

\*1 Set the logic selection with the parameters of the external output block. For details, refer to the following.

MELSEC iQ-R Flexible High-Speed I/O Control Module User's Manual (Application)

\*2 The output signal status in the hardware logic is described as High and Low. For details, refer to the following.

MELSEC iQ-R Flexible High-Speed I/O Control Module User's Manual (Application)

## Electrical specifications of external I/O signals

### ■External input signal

The following table shows the input specifications of the flexible high-speed I/O control module.

Signal name	Operation	Input voltage (Guaranteed value)	Operating current	Response time <sup>*1</sup>
24VDC input	On	21.6 to 26.4V	4 to 6mA	1μs
	Off	5V or less	1.0mA or less	
5VDC input	On	4.5 to 5.5V	4 to 8mA	1μs
	Off	2V or less	1.0mA or less	
Differential input	—	Equivalent to AM26C32	—	1μs

\*1 When the filter time is set to 0μs

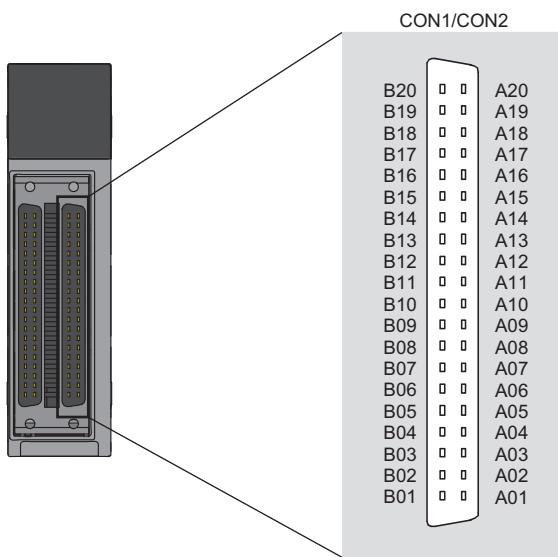
### ■External output signal

The following table shows the output specifications of the flexible high-speed I/O control module.

Signal name	Item	Description
DC output	Operating load voltage	4.75 to 30VDC
	Maximum load current	0.1A/point
	Maximum voltage drop at ON	0.5V
	Response time	OFF→ON 1μs or less (Rated load, resistive load) ON→OFF 1μs or less (Rated load, resistive load)
	Operating load voltage	Equivalent to AM26C31
Differential output	Maximum load current	
	Maximum voltage drop at ON	
	Response time	1μs or less

## Signal layout of a connector for external devices

The following shows the signal layout of a connector for external devices of the flexible high-speed I/O control module.



Pin No.	CON1		CON2	
	B	A	B	A
20	NC	NC	NC	NC
19	IN 0_24V	IN 0_5V	IN 6_24V	IN 6_5V
18	IN 0_DIF	IN 0_COM	IN 6_DIF	IN 6_COM
17	IN 1_24V	IN 1_5V	IN 7_24V	IN 7_5V
16	IN 1_DIF	IN 1_COM	IN 7_DIF	IN 7_COM
15	IN 2_24V	IN 2_5V	IN 8_24V	IN 8_5V
14	IN 2_DIF	IN 2_COM	IN 8_DIF	IN 8_COM
13	IN 3_24V	IN 3_5V	IN 9_24V	IN 9_5V
12	IN 3_DIF	IN 3_COM	IN 9_DIF	IN 9_COM
11	IN 4_24V	IN 4_5V	IN A_24V	IN A_5V
10	IN 4_DIF	IN 4_COM	IN A_DIF	IN A_COM
9	IN 5_24V	IN 5_5V	IN B_24V	IN B_5V
8	IN 5_DIF	IN 5_COM	IN B_DIF	IN B_COM
7	OUT 0	OUT 1	OUT 4	OUT 5
6	OUT 2	OUT 3	OUT 6	OUT 7
5	OUT 0-3_COM	OUT_DIF_GND	OUT 4-7_COM	OUT_DIF_GND
4	OUT 0_DIF+	OUT 0_DIF-	OUT 3_DIF+	OUT 3_DIF-
3	OUT 1_DIF+	OUT 1_DIF-	OUT 4_DIF+	OUT 4_DIF-
2	OUT 2_DIF+	OUT 2_DIF-	OUT 5_DIF+	OUT 5_DIF-
1	NC	NC	NC	NC

## ■List of input signals

The following table lists the input signals of the flexible high-speed I/O control module.

Pin No.	CON1		CON2		Description
	Symbol	Signal name	Symbol	Signal name	
B20	NC	NC	NC	NC	Empty pin
A20	NC	NC	NC	NC	
B19	IN 0_24V	High-speed input 0 24VDC	IN 6_24V	High-speed input 6 24VDC	Inputs the + (plus) side. (common to 5VDC/ 24VDC/differential)
A19	IN 0_5V	High-speed input 0 5VDC	IN 6_5V	High-speed input 6 5VDC	
B18	IN 0_DIF	High-speed input 0 differential	IN 6_DIF	High-speed input 6 differential	
A18	IN 0_COM	High-speed input 0 common	IN 6_COM	High-speed input 6 common	Inputs the - (minus) side.
B17	IN 1_24V	High-speed input 1 24VDC	IN 7_24V	High-speed input 7 24VDC	Inputs the + (plus) side. (common to 5VDC/ 24VDC/differential)
A17	IN 1_5V	High-speed input 1 5VDC	IN 7_5V	High-speed input 7 5VDC	
B16	IN 1_DIF	High-speed input 1 differential	IN 7_DIF	High-speed input 7 differential	
A16	IN 1_COM	High-speed input 1 common	IN 7_COM	High-speed input 7 common	Inputs the - (minus) side.
B15	IN 2_24V	High-speed input 2 24VDC	IN 8_24V	High-speed input 8 24VDC	Inputs the + (plus) side. (common to 5VDC/ 24VDC/differential)
A15	IN 2_5V	High-speed input 2 5VDC	IN 8_5V	High-speed input 8 5VDC	
B14	IN 2_DIF	High-speed input 2 differential	IN 8_DIF	High-speed input 8 differential	
A14	IN 2_COM	High-speed input 2 common	IN 8_COM	High-speed input 8 common	Inputs the - (minus) side.
B13	IN 3_24V	High-speed input 3 24VDC	IN 9_24V	High-speed input 9 24VDC	Inputs the + (plus) side. (common to 5VDC/ 24VDC/differential)
A13	IN 3_5V	High-speed input 3 5VDC	IN 9_5V	High-speed input 9 5VDC	
B12	IN 3_DIF	High-speed input 3 differential	IN 9_DIF	High-speed input 9 differential	
A12	IN 3_COM	High-speed input 3 common	IN 9_COM	High-speed input 9 common	Inputs the - (minus) side.
B11	IN 4_24V	High-speed input 4 24VDC	IN A_24V	High-speed input A 24VDC	Inputs the + (plus) side. (common to 5VDC/ 24VDC/differential)
A11	IN 4_5V	High-speed input 4 5VDC	IN A_5V	High-speed input A 5VDC	
B10	IN 4_DIF	High-speed input 4 differential	IN A_DIF	High-speed input A differential	
A10	IN 4_COM	High-speed input 4 common	IN A_COM	High-speed input A common	Inputs the - (minus) side.
B9	IN 5_24V	High-speed input 5 24VDC	IN B_24V	High-speed input B 24VDC	Inputs the + (plus) side. (common to 5VDC/ 24VDC/differential)
A9	IN 5_5V	High-speed input 5 5VDC	IN B_5V	High-speed input B 5VDC	
B8	IN 5_DIF	High-speed input 5 differential	IN B_DIF	High-speed input B differential	
A8	IN 5_COM	High-speed input 5 common	IN B_COM	High-speed input B common	Inputs the - (minus) side.

## ■List of output signals

The following table lists the output signals of the flexible high-speed I/O control module.

Pin No.	CON1		CON2		Description
	Symbol	Signal name	Symbol	Signal name	
B7	OUT 0	High-speed output 0	OUT 4	High-speed output 4	5 to 24VDC output
A7	OUT 1	High-speed output 1	OUT 5	High-speed output 5	
B6	OUT 2	High-speed output 2	OUT 6	High-speed output 6	
A6	OUT 3	High-speed output 3	OUT 7	High-speed output 7	
B5	OUT 0-3_COM	High-speed output 0-3 common	OUT 4-7_COM	High-speed output 4-7 common	High-speed output common
A5	OUT_DIF_GND	High-speed output common	OUT_DIF_GND	High-speed output common	High-speed output differential ground
B4	OUT 0_DIF+	High-speed output 0 differential+	OUT 3_DIF+	High-speed output 3 differential+	Outputs the differential output + (plus) side.
A4	OUT 0_DIF-	High-speed output 0 differential-	OUT 3_DIF-	High-speed output 3 differential-	Outputs the differential output - (minus) sides.
B3	OUT 1_DIF+	High-speed output 1 differential+	OUT 4_DIF+	High-speed output 4 differential+	Outputs the differential output + (plus) side.
A3	OUT 1_DIF-	High-speed output 1 differential-	OUT 4_DIF-	High-speed output 4 differential-	Outputs the differential output - (minus) sides.
B2	OUT 2_DIF+	High-speed output 2 differential+	OUT 5_DIF+	High-speed output 5 differential+	Outputs the differential output + (plus) side.
A2	OUT 2_DIF-	High-speed output 2 differential-	OUT 5_DIF-	High-speed output 5 differential-	Outputs the differential output - (minus) sides.
B1	NC	NC	NC	NC	Empty pin
A1	NC	NC	NC	NC	

## Connectable encoders

The following tables list encoders that can be connected to the flexible high-speed I/O control module.

- Encoders with the following counting methods

Counting method	Condition
Incremental method	—
Absolute method	<p>Encoders with the following specifications can be connected.</p> <ul style="list-style-type: none"><li>• Parallel interface</li><li>• Resolution: 1 to 12 bits</li><li>• The absolute code is in pure binary, Gray code, or BCD.</li></ul> <p>Encoders with the following specifications can be connected.</p> <ul style="list-style-type: none"><li>• SSI (Synchronous Serial Interface)</li><li>• Resolution: 1 to 32 bits</li><li>• The absolute code is in pure binary or Gray code.</li></ul>

- Encoders of the following output type

Output type	Condition
Open collector output type	Check that the output voltage of the encoder meets the specifications of the flexible high-speed I/O control module.
Line driver output type (equivalent to AM26LS31)	
CMOS level voltage output type	

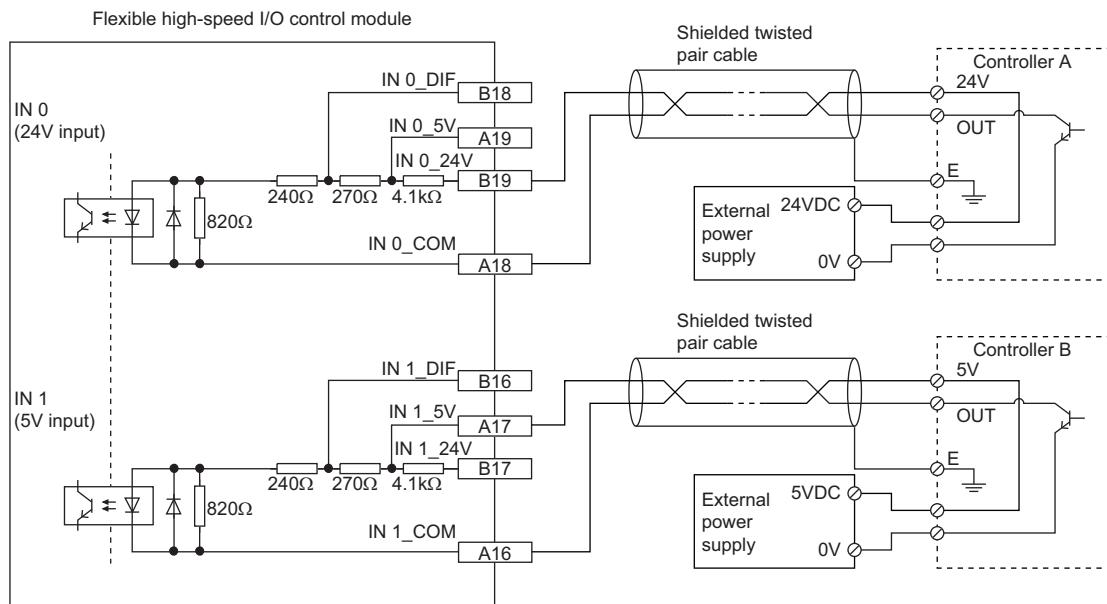


TTL level voltage output type encoders cannot be used with the flexible high-speed I/O control module.

## 5.2 Examples of Wiring Between a Controller and External Input Terminals

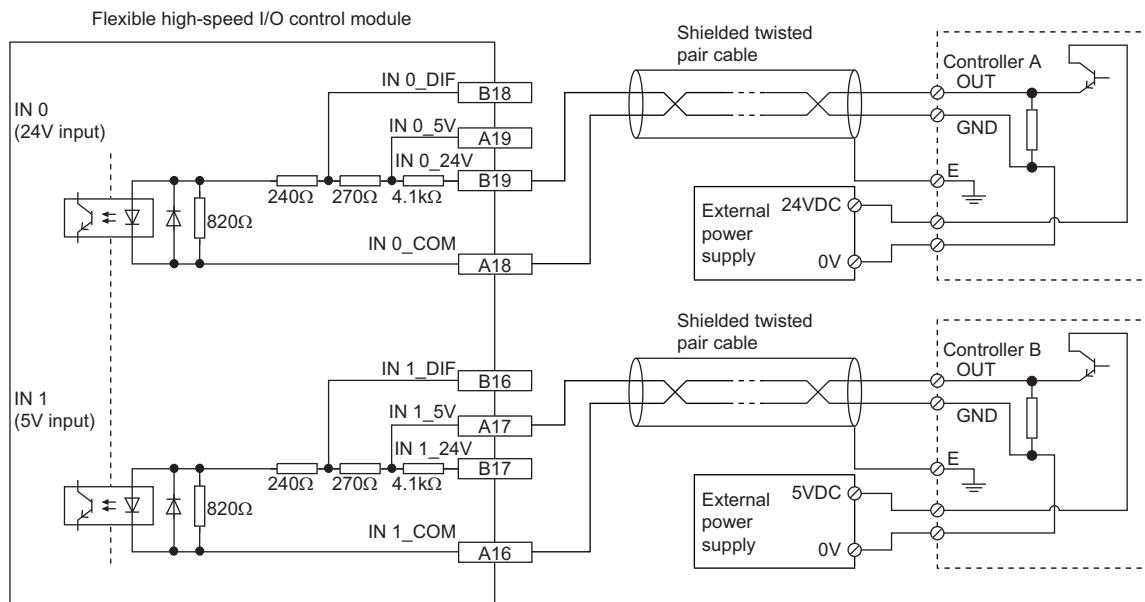
This section shows examples of wiring between a controller and external input terminals.

### Example of external wiring with controllers (Sink load type)



5

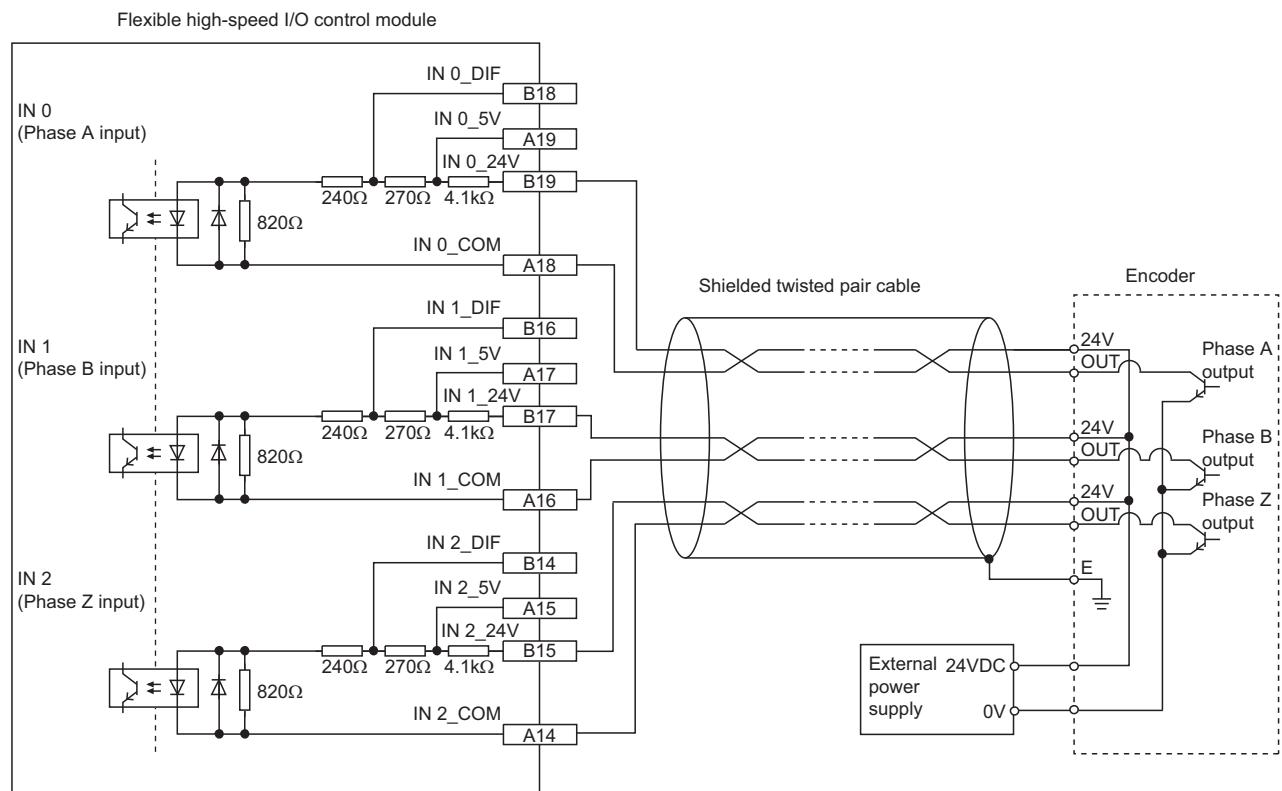
### Example of external wiring with controllers (Source load type)



## 5.3 Example of External Wiring Between the Flexible High-speed I/O Control Module and an Encoder

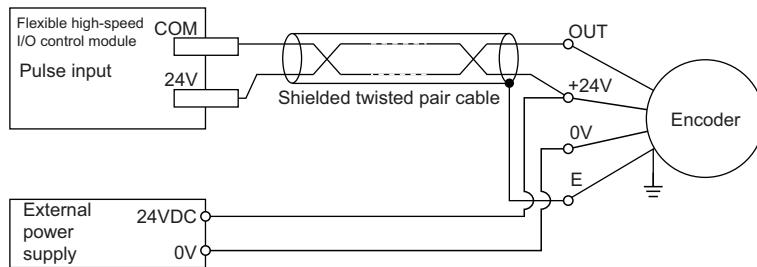
This section shows examples of external wiring between the flexible high-speed I/O control module and an encoder.

### Example of external wiring with an open collector output type encoder (24VDC)

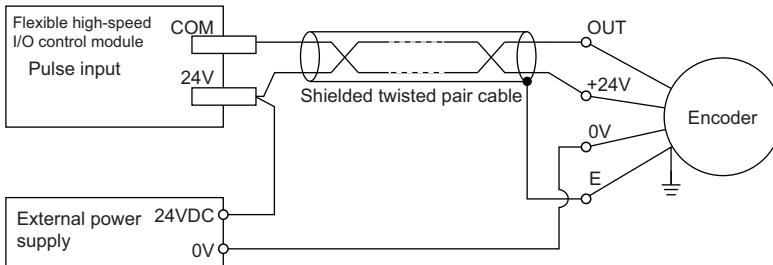


**Point**

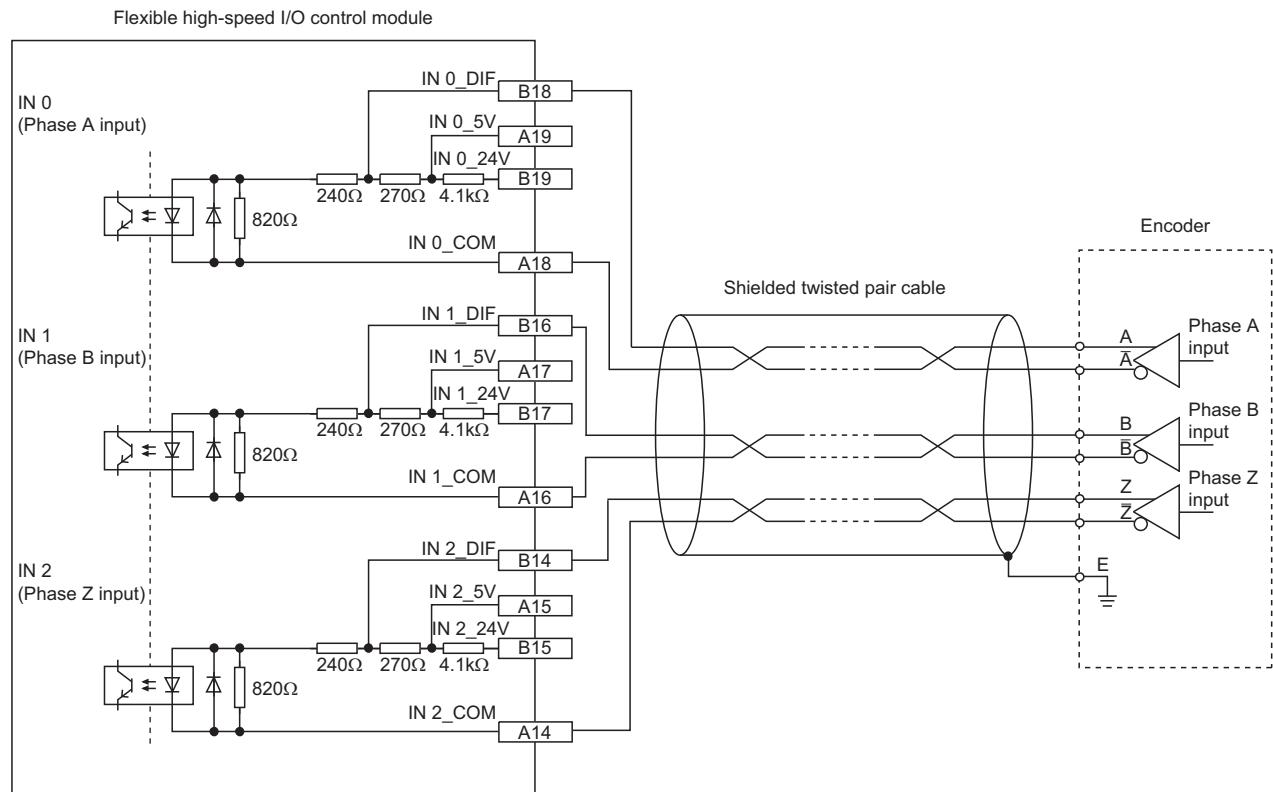
- For the wiring between the flexible high-speed I/O control module and an encoder, separate the power supply cables and signal wires as shown below.



- Do not wire the module and an encoder as shown in the figure below. Because a current flows through a shielded twisted pair cable in a single direction and the canceling effect disappears, the module is easy to be affected by electromagnetic induction.



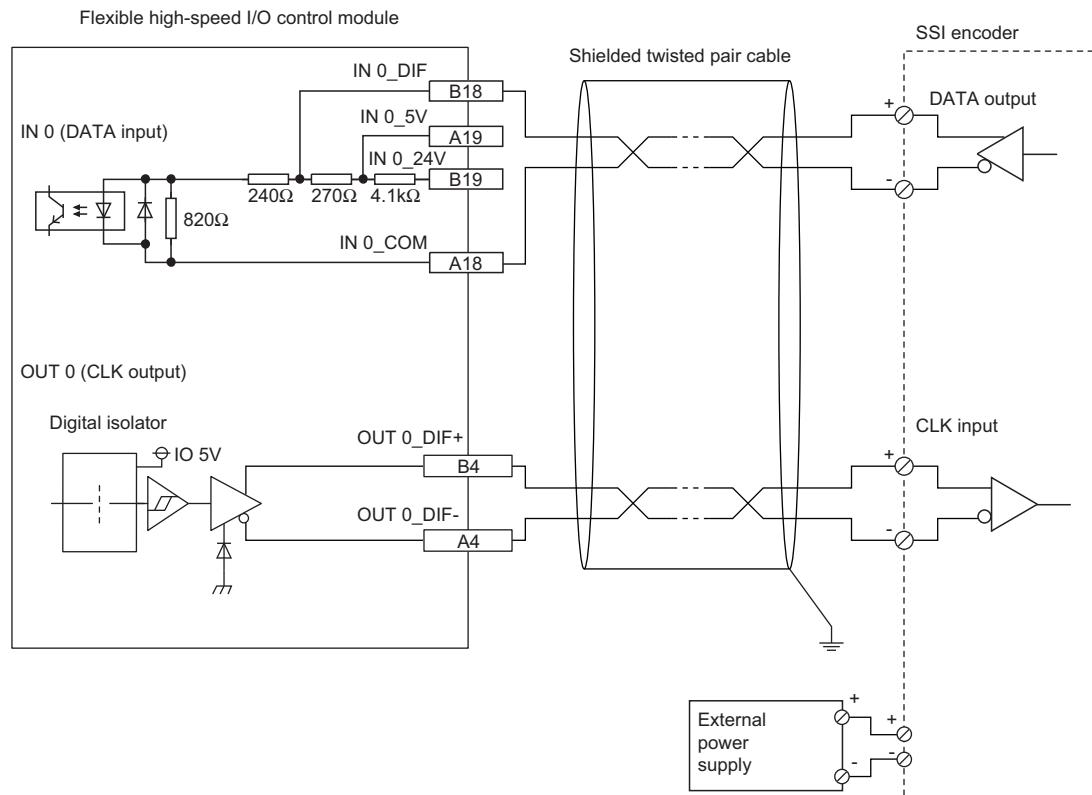
## Example of external wiring with a line driver (equivalent to AM26LS31) encoder



## Example of external wiring with the SSI encoder (serial communication)

Connect the flexible high-speed I/O control module to the SSI encoder using a shielded twisted pair cable of 0.2mm<sup>2</sup> or thicker (24 AWG or larger). Make sure to check the SSI encoder specifications.

In addition, separately prepare an external power supply for the SSI encoder.



- Connect the DATA input to any of IN 0 to IN B.
- Connect the CLK output to OUT 0\_DIF for SSI\_Encoder\_0, and to OUT 1\_DIF for SSI\_Encoder\_1.

### Relation between transmission speed and maximum cable length (reference value)

Transmission speed	Maximum cable length
100kHz	400m
200kHz	190m
300kHz	120m
400kHz	80m
500kHz	60m
1MHz	25m
1.5MHz	10m
2MHz	5m

The maximum cable length described in the above is a reference value. Depending on the response performance of the SSI encoder to be connected, the maximum cable length may become shorter than the above description because a response delay occurs.

Therefore, check the operation using an actual encoder to be connected, and use the module.



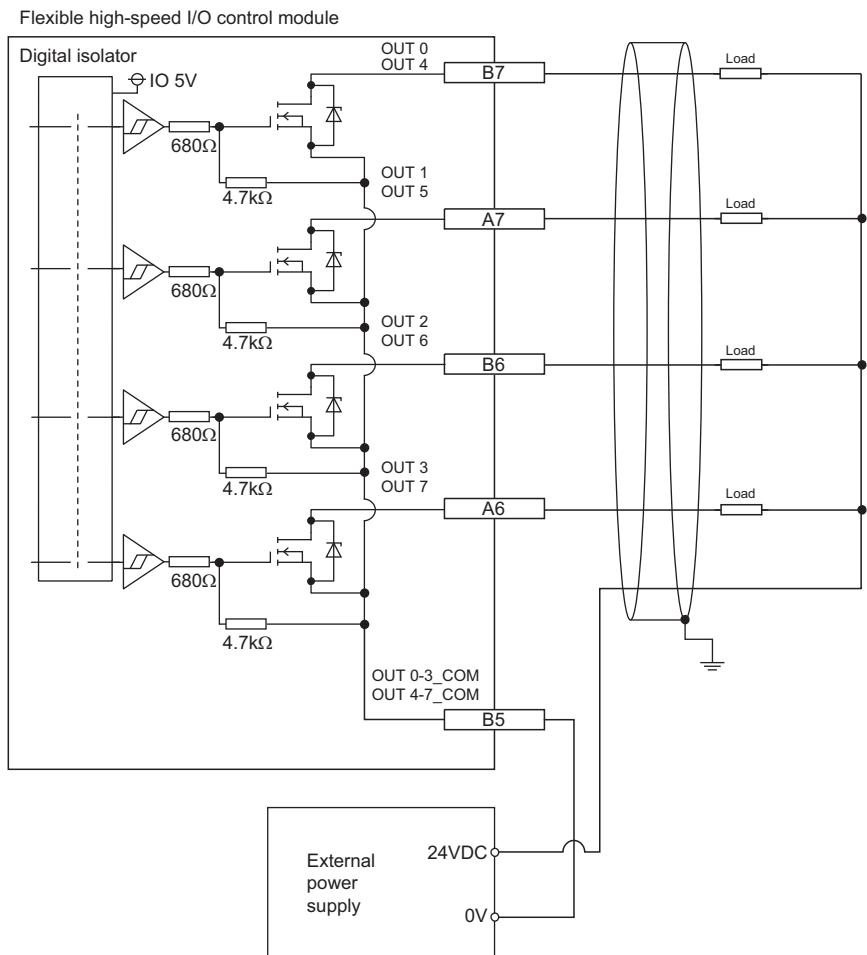
If the cable longer than the maximum length described above is used, the module becomes following states.

- An encoder value is fixed to an incorrect value and the module does not count the value correctly.
- An encoder value fluctuates and the module does not count the value correctly.
- An encoder value cannot be read and the module does not count the value correctly.

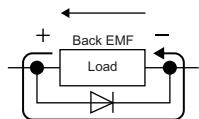
## 5.4 Example of External Wiring with External Output Terminals

This section shows examples of external wiring with external output terminals.

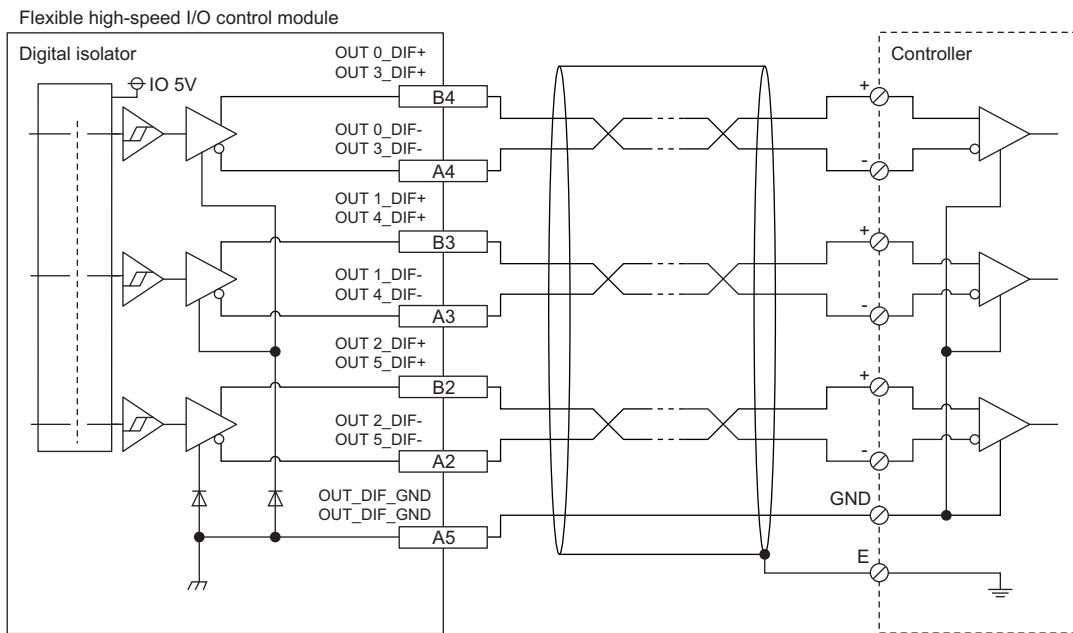
### Example of external wiring with output terminals (Sink output type)



When connecting an inductive load, connect a diode in parallel with the load to prevent back EMF from being generated to protect output elements.



## Example of external wiring with differential receivers (Differential output type)



## Point

When connecting differential output terminals to differential receivers of the drive unit, connect the high-speed output common (OUT\_DIF\_GND) and the common terminals of the differential receivers of the drive unit.

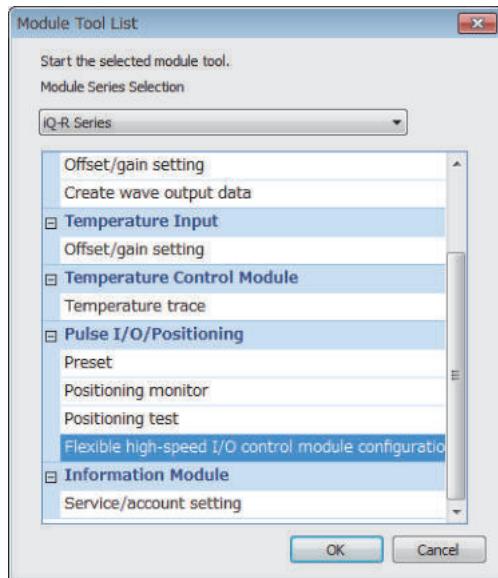
When the high-speed output common terminals are not connected, the potential difference will be generated between the high-speed output common (OUT\_DIF\_GND) and the common terminals of the differential receivers of the drive unit, damaging the module or causing a malfunction.

# 6 CONFIGURATION TOOL

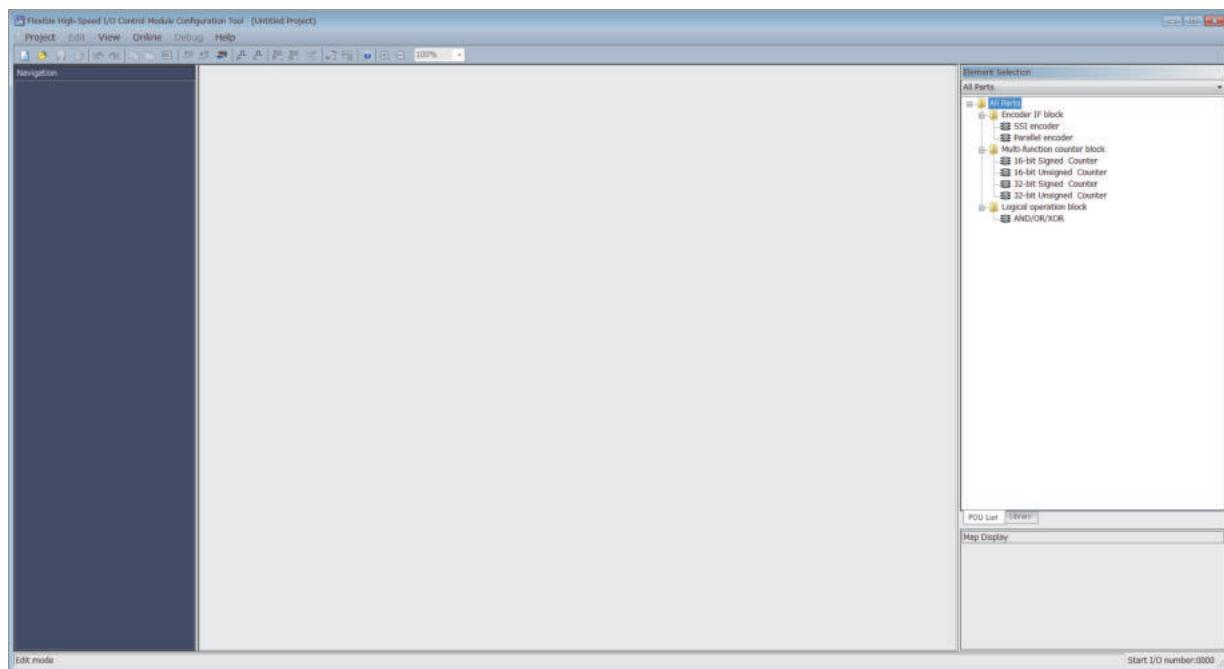
Start the configuration tool from [Module Tool List] of GX Works3.

⇨ [Tool] ⇒ [Module Tool List]

1. Select "iQ-R Series" for "Module Series Selection".
2. Select [Pulse I/O/Positioning] ⇒ [Flexible high-speed I/O control module configuration tool], and click the [OK] button.



3. The configuration tool is started.



For details on the configuration tool, refer to the following.

📖 MELSEC iQ-R Flexible High-Speed I/O Control Module User's Manual (Application)

# MEMO

---

# 7 OPERATION EXAMPLE

This chapter describes the programming procedure and basic programs of the flexible high-speed I/O control module.

## 7.1 Programming Procedure

Create programs for executing the flexible high-speed I/O control module with the following procedure.

1. Create a hardware logic with the configuration tool.

☞ Page 47 Creating a hardware logic

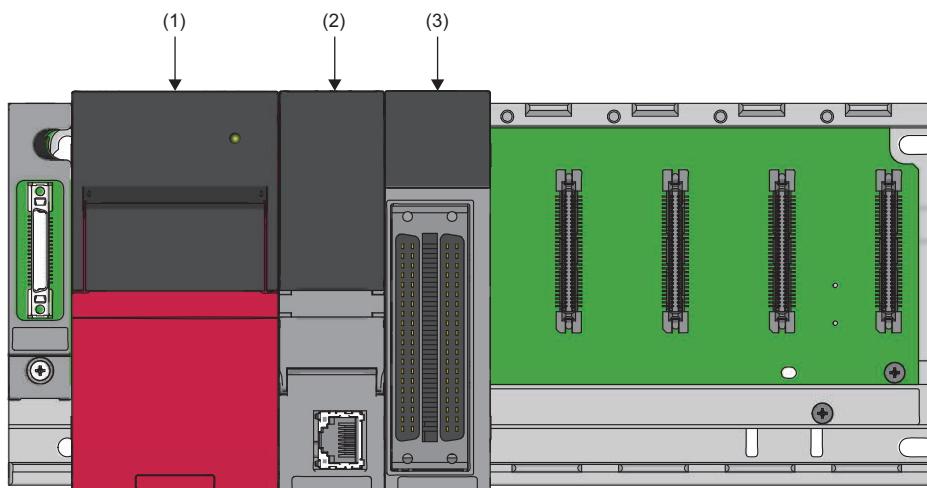
2. Create a program with GX Works3.

☞ Page 51 Program examples

## 7.2 Program Examples

### System configuration

The following shows an example of the system configuration.



(1) Power supply module (R61P)

(2) CPU module (R04CPU)

(3) Flexible high-speed I/O control module (RD40PD01)

### Programming conditions

The program counts pulses (2-phase 4 multiples) input to the flexible high-speed I/O control module with the multi function counter block.

### Parameter setting

Set parameters of the flexible high-speed I/O control module with GX Works3.

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

☞ MELSEC iQ-R Flexible High-Speed I/O Control Module User's Manual (Application)

Use the default values for the parameter setting in these program examples.

### Starting the configuration tool

Start the configuration tool with the following procedure.

☞ Page 44 CONFIGURATION TOOL

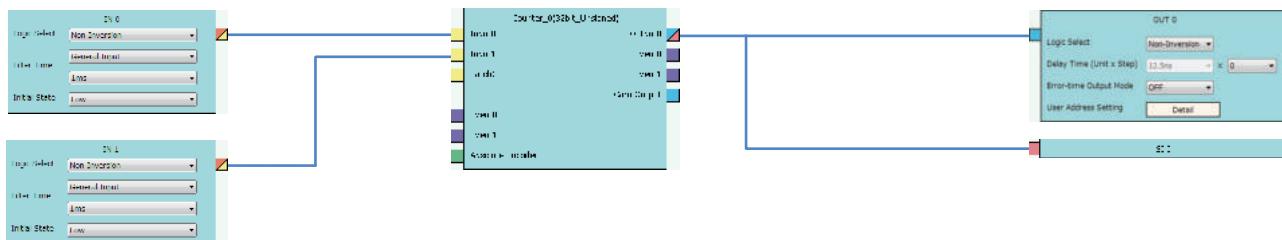
## Creating a hardware logic

Create a hardware logic with the configuration tool.

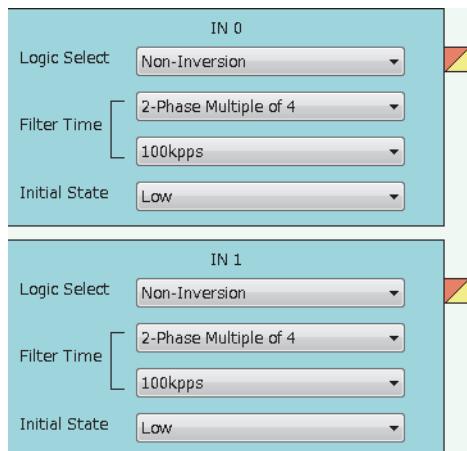
### ■Link and setting in the Hardware logic outline window

1. Arrange a 32-bit unsigned multi function counter block in the Hardware logic outline window, and link it to external input blocks.
- To perform external outputs according to the counting result, link the multi function counter block to an external output block.
- To start an interrupt program according to the counting result, link the multi function counter block to an SI device terminal.

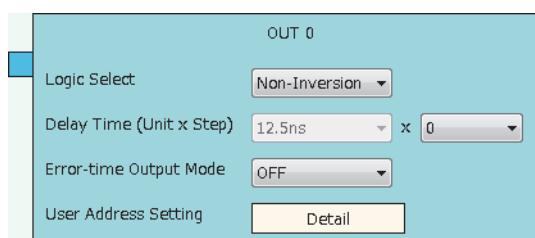
( Page 52 Interrupt program example)



2. Set the external input blocks according to the specifications of external input signals.

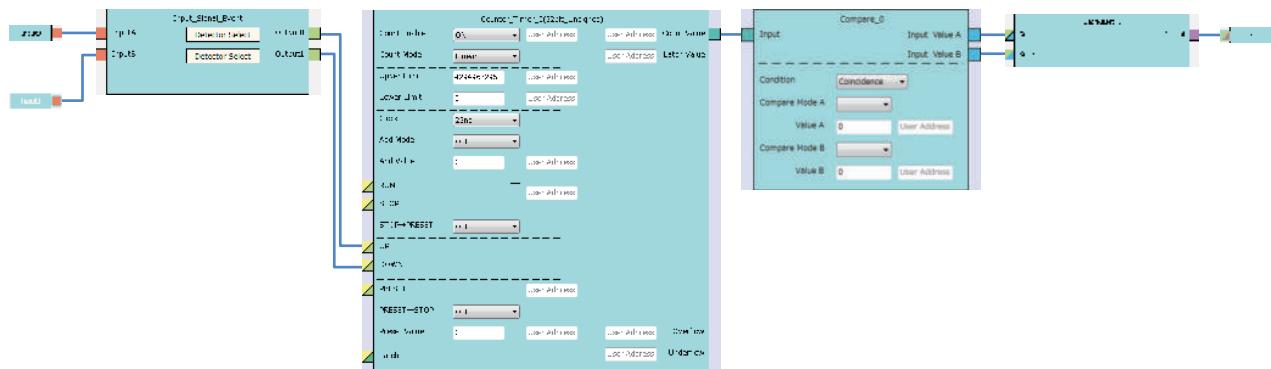


3. To use the external output block, set it according to the specifications of external output signals and desired output timings.

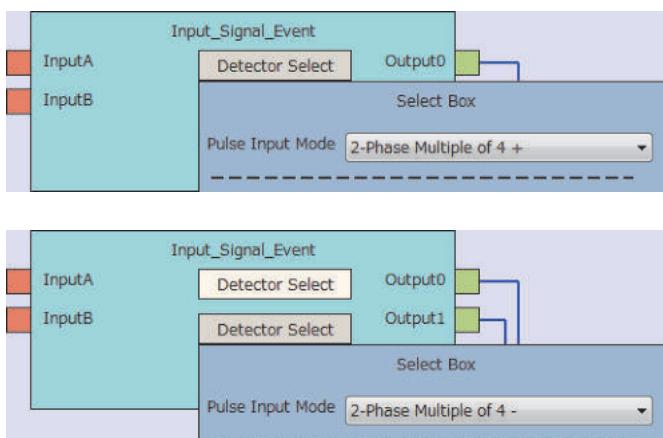


## ■Link and setting in the Multi function counter block detail window

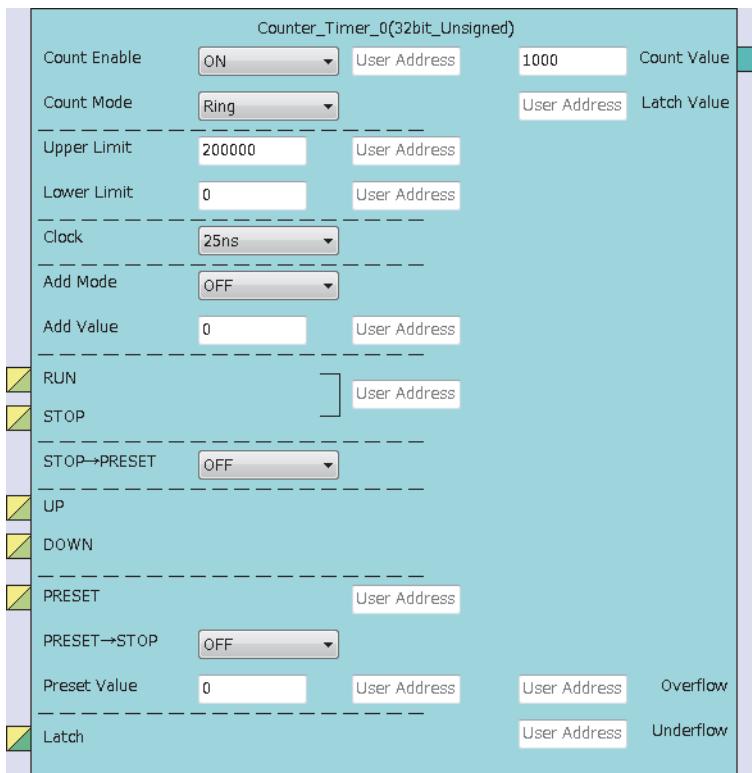
1. Link blocks in the Multi function counter block detail window as shown below.



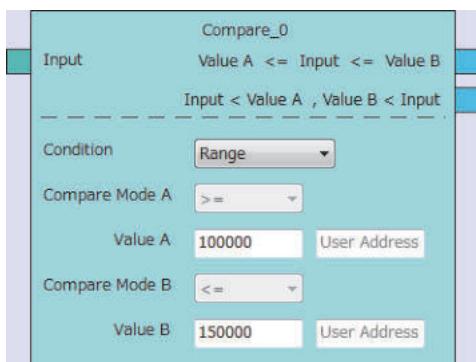
2. Set the setting values of the input signal event detection block as shown below.



3. Set the setting values of the counter timer block as shown below.



4. Set the setting values of the comparison block as shown below.



### ■Writing data to the module

Write a project to the CPU module with GX Works3.

Write the hardware logic to the flexible high-speed I/O control module with the configuration tool.

## Label setting

Functions that support creation of programs are prepared for GX Works3.

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

Do not 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	RD40PD01_1.bModuleREADY	Module READY	X0																																				
	RD40PD01_1.bOperatingConditionSettingsBatchResetCompleteFlag	Operating condition settings batch-reset complete flag	X3																																				
	RD40PD01_1.bHardwareLogicControlFlag	Hardware logic control flag	X4																																				
	RD40PD01_1.bErrorFlag	Error flag	XF																																				
	RD40PD01_1.bOperatingConditionSettingsBatchResetCommand	Operating condition settings batch-reset command	Y3																																				
	RD40PD01_1.bHardwareLogicControlStartRequest	Hardware logic control start request	Y4																																				
	RD40PD01_1.bHardwareLogicControlStopRequest	Hardware logic control stop request	Y5																																				
	RD40PD01_1.bErrorClearRequest	Error clear request	YF																																				
	RD40PD01_1.uLatestErrorCode_D	Latest error code	UnIG100																																				
	RD40PD01_1.udCumulativeNumberOfWriteAccessesToFlashROM_D	Cumulative number of write accesses to a flash ROM	UnIG102, UnIG103																																				
	RD40PD01_1.uClearSettingOfErrorHistory_D	Clear setting of error history	UnIG8002																																				
Label to be defined	Define the global labels as follows.																																						
	<table border="1"> <thead> <tr> <th>Label Name</th> <th>Data Type</th> <th>Class</th> <th>Assign (Device/Label)</th> </tr> </thead> <tbody> <tr> <td>LatestErrorCode</td> <td>Word [Unsigned]/Bit String [16-bit]</td> <td>... VAR_GLOBAL</td> <td>▼ D1 00</td> </tr> <tr> <td>CountValue</td> <td>Double Word [Signed]</td> <td>... VAR_GLOBAL</td> <td>▼ D1 010</td> </tr> <tr> <td>SettingStartReq</td> <td>Bit</td> <td>... VAR_GLOBAL</td> <td>▼ M1 00</td> </tr> <tr> <td>HardwareLogicControlStartReq</td> <td>Bit</td> <td>... VAR_GLOBAL</td> <td>▼ M1 10</td> </tr> <tr> <td>HardwareLogicControlStopReq</td> <td>Bit</td> <td>... VAR_GLOBAL</td> <td>▼ M1 11</td> </tr> <tr> <td>CountValueReadReq</td> <td>Bit</td> <td>... VAR_GLOBAL</td> <td>▼ M1 12</td> </tr> <tr> <td>HardwareLogicResetReq</td> <td>Bit</td> <td>... VAR_GLOBAL</td> <td>▼ M1 13</td> </tr> <tr> <td>ErrorResetReq</td> <td>Bit</td> <td>... VAR_GLOBAL</td> <td>▼ M1 20</td> </tr> </tbody> </table>			Label Name	Data Type	Class	Assign (Device/Label)	LatestErrorCode	Word [Unsigned]/Bit String [16-bit]	... VAR_GLOBAL	▼ D1 00	CountValue	Double Word [Signed]	... VAR_GLOBAL	▼ D1 010	SettingStartReq	Bit	... VAR_GLOBAL	▼ M1 00	HardwareLogicControlStartReq	Bit	... VAR_GLOBAL	▼ M1 10	HardwareLogicControlStopReq	Bit	... VAR_GLOBAL	▼ M1 11	CountValueReadReq	Bit	... VAR_GLOBAL	▼ M1 12	HardwareLogicResetReq	Bit	... VAR_GLOBAL	▼ M1 13	ErrorResetReq	Bit	... VAR_GLOBAL	▼ M1 20
Label Name	Data Type	Class	Assign (Device/Label)																																				
LatestErrorCode	Word [Unsigned]/Bit String [16-bit]	... VAR_GLOBAL	▼ D1 00																																				
CountValue	Double Word [Signed]	... VAR_GLOBAL	▼ D1 010																																				
SettingStartReq	Bit	... VAR_GLOBAL	▼ M1 00																																				
HardwareLogicControlStartReq	Bit	... VAR_GLOBAL	▼ M1 10																																				
HardwareLogicControlStopReq	Bit	... VAR_GLOBAL	▼ M1 11																																				
CountValueReadReq	Bit	... VAR_GLOBAL	▼ M1 12																																				
HardwareLogicResetReq	Bit	... VAR_GLOBAL	▼ M1 13																																				
ErrorResetReq	Bit	... VAR_GLOBAL	▼ M1 20																																				

## Program examples

### ■Program example 1

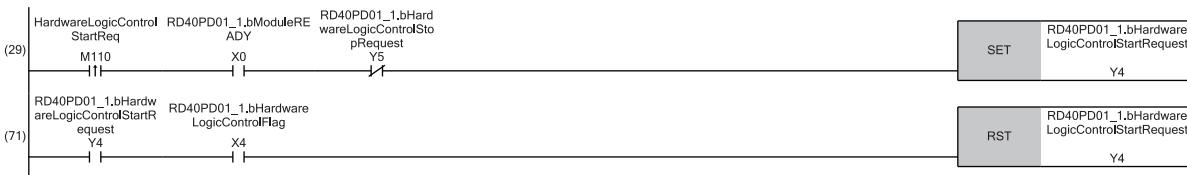
A program example to configure the clear setting of error history when a module is started



(0) Store Clear the history. (1) in 'Clear setting of error history' (Un|G8002).

### ■Program example 2

A program example to start the hardware logic control

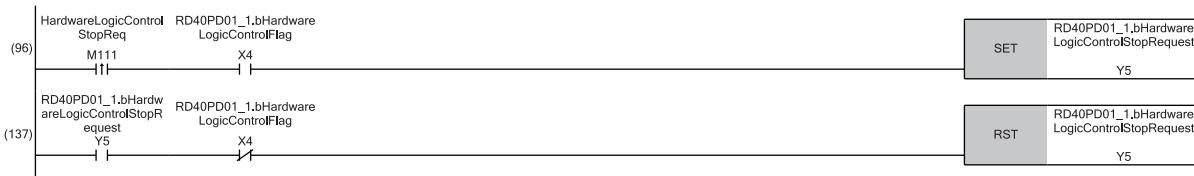


(29) Turn on 'Hardware logic control start request' (Y4).

(71) Turn off 'Hardware logic control start request' (Y4).

### ■Program example 3

A program example to stop the hardware logic control



(96) Turn on 'Hardware logic control stop request' (Y5).

(137) Turn off 'Hardware logic control stop request' (Y5).

### ■Program example 4

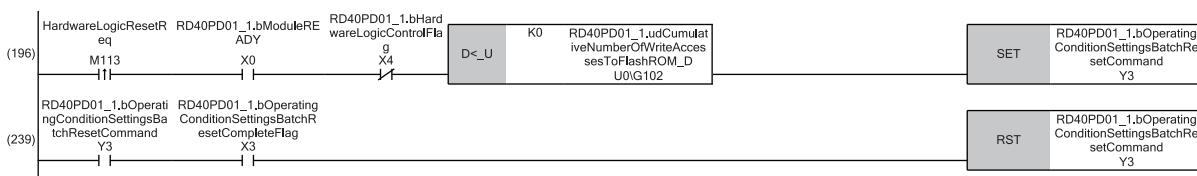
A program example to read the count value



(162) Read the count value.

### ■Program example 5

A program example to reset the operating condition settings in a batch

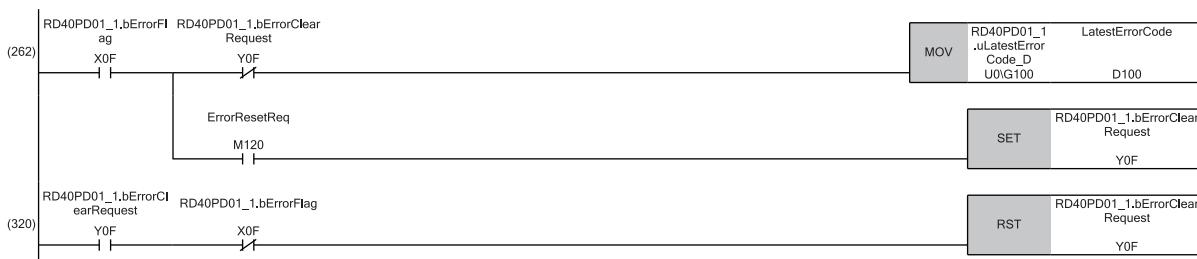


(196) Turn on 'Operating condition settings batch-reset command' (Y3).

(239) Turn off 'Operating condition settings batch-reset command' (Y3).

### ■Program example 6

A program example to read the latest error code and reset the error



(262) Read 'Latest error code' (Un|G100) and turn on 'Error clear request' (YF).

(320) Turn off 'Error clear request' (YF).

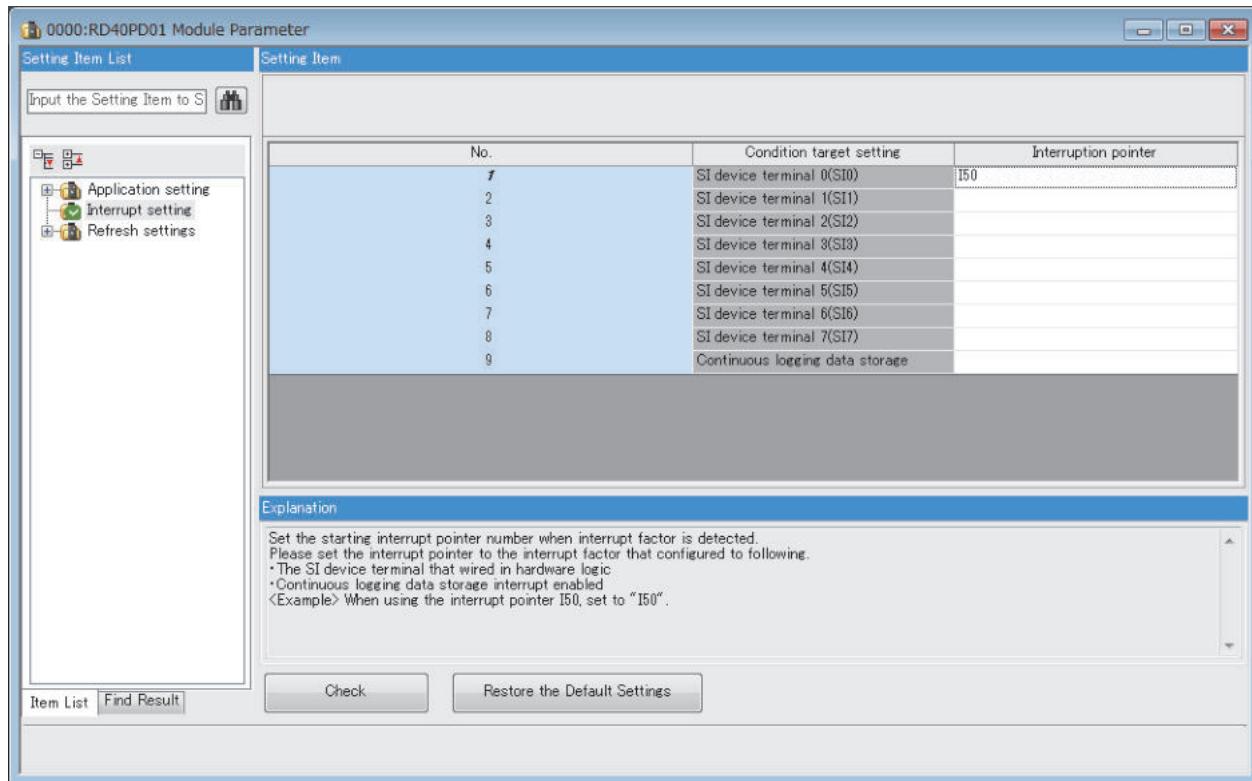
## Interrupt program example

This program outputs an interrupt request to the CPU module by inputting a signal to an SI device terminal.

### ■"Interrupt setting" of GX Works3

Set "Interrupt setting" from "Module Parameter" of GX Works3.

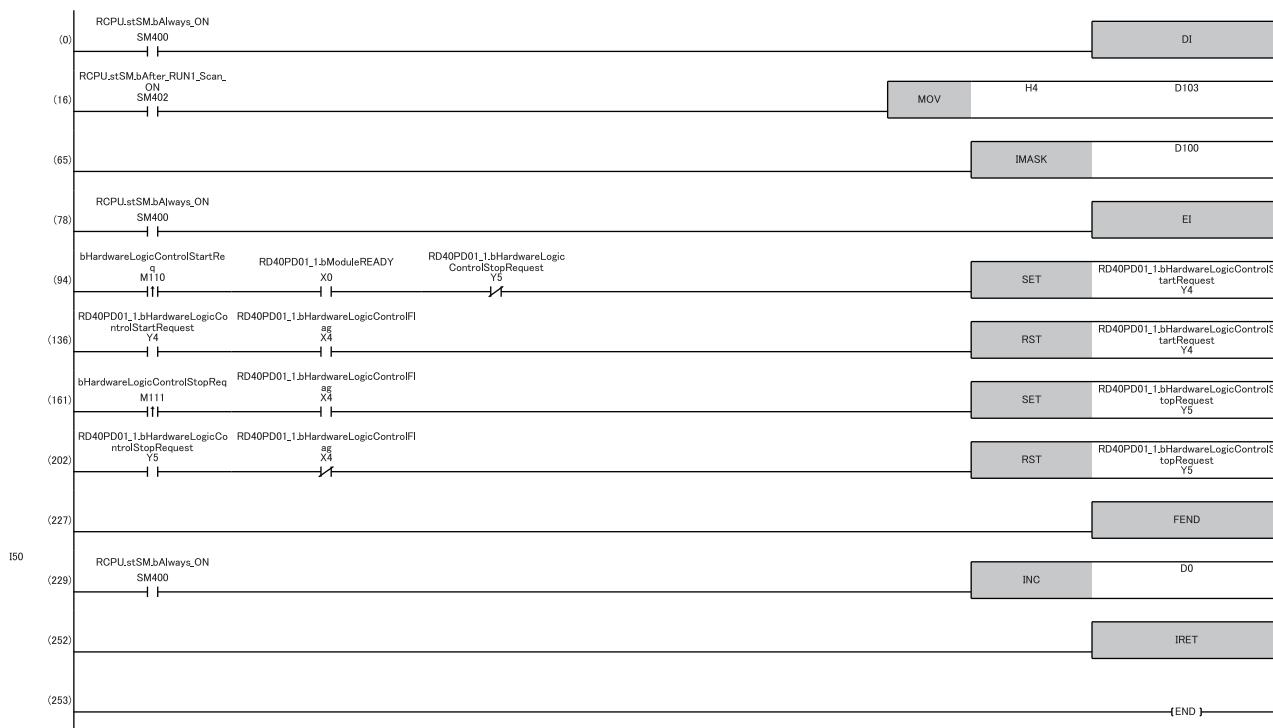
→ [Navigation window] ⇒ [Parameter] ⇒ [Module Information] ⇒ [RD40PD01] ⇒ [Module Parameter] ⇒ [Interrupt setting]



### ■User devices

Device	Description
D0	Used for interrupt program
D100 to D115	Interrupt enable flag storage for IMASK instruction

## ■Program example



(0) Prohibit the execution of an interrupt program.

(16) Turn on the bit corresponding to I50.

(65) Enable the interrupt of I50.

(78) Enable the execution of the interrupt program.

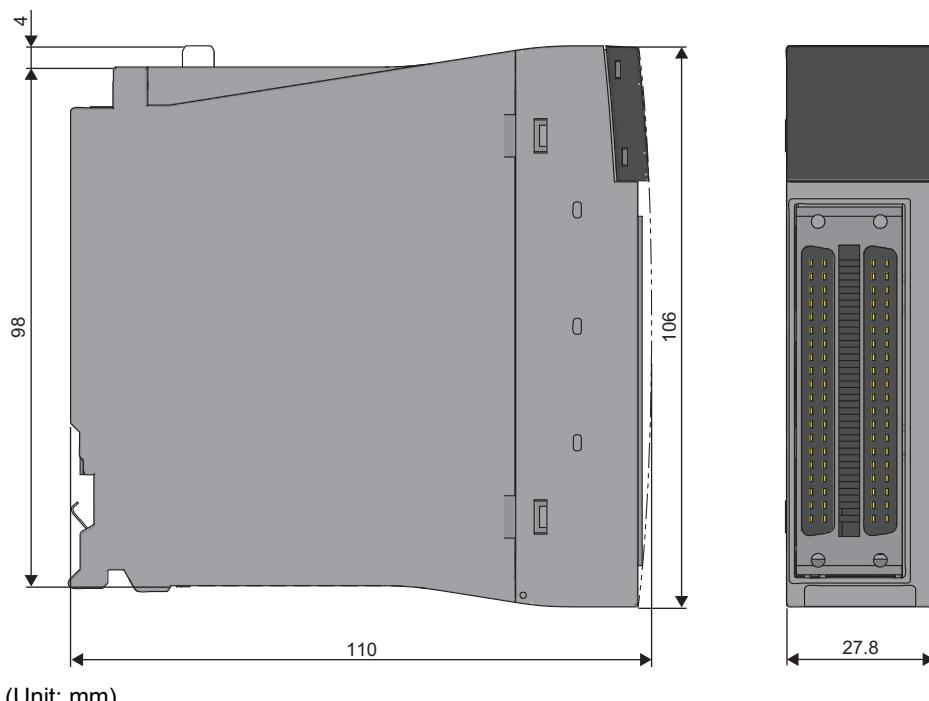
Arrange the main routine program between the EI instruction and FEND instruction.

(229) Execute the interrupt program (add 1 to D0).

# APPENDIX

This chapter shows the external dimensions of the flexible high-speed I/O control module.

## Appendix 1 External Dimensions



# MEMO

---

A

# INDEX

---

## C

---

Connector for external devices ..... 14

## E

---

ERR LED ..... 14

## I

---

Indicator LED ..... 14

## P

---

Performance specifications ..... 16

Production information marking ..... 14

## R

---

RUN LED ..... 14

# MEMO

---

I

# REVISIONS

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

Revision date	*Manual number	Description
October 2016	SH(NA)-081645ENG-A	First edition
April 2017	SH(NA)-081645ENG-B	■Added or modified parts SAFETY PRECAUTIONS, INTRODUCTION, Chapter 3

Japanese manual number: SH-081644-B

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

© 2016 MITSUBISHI ELECTRIC CORPORATION

# 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

---

Ethernet is a registered trademark of Fuji Xerox Co., Ltd. in Japan.

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 <sup>TM</sup> or <sup>®</sup> are not specified in this manual.



SH(NA)-081645ENG-B(1704)MEE

MODEL: RD40PD01-U-IN-E

MODEL CODE: 13JX55

## **MITSUBISHI ELECTRIC CORPORATION**

HEAD OFFICE : TOKYO BUILDING, 2-7-3 MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN  
NAGOYA WORKS : 1-14, YADA-MINAMI 5-CHOME, HIGASHI-KU, NAGOYA, JAPAN

When exported from Japan, this manual does not require application to the  
Ministry of Economy, Trade and Industry for service transaction permission.

Specifications subject to change without notice.