BCN-P5999-0502-I(2111)MEE

Mitsubishi Electric Safety Programmable Controller MELSEC iQ-R Series

Machinery Directive (2006/42/EC) Compliance

Thank you for purchasing the Mitsubishi Electric safety programmable controller MELSEC iQ-R series.
The MELSEC iQ-R series programmable controller is suitable for establishing safety functions for general industrial machinery and complies with the Machinery Directive (2006/42/EC).

Before using this product, please read this manual (translation of the original instructions), the relevant manuals, and the safety standards carefully and pay full attention to safety to handle the product correctly.

1. Safety Programmable Controller Product List

Product name	Model	Description
Safety CPU	RnSFCPU	A CPU module that performs logic operations for safety control, and can be used in applications compliant with SIL3 of IEC61508 and performance level "e" of ISO13849-1. Safety control and standard control programs can be simultaneously executed under a safety CPU. The module must be mounted on the main base unit and used with a safety function module as a pair.
Safety function module	R6SFM	A module that can be used in applications compliant with SIL3 of IEC61508 and performance level "e" of ISO13849-1 on the condition that it is used with a Safety CPU. Make sure that the module is used with a Safety CPU as a pair.

2. Relevant Manuals

The following lists the safety programmable controller relevant manuals.
The following are translated from the original Japanese version. For the Japanese version, please consult your local Mitsubishi representative.

Manual name	Manual number
MELSEC iQ-R Module Configuration Manual	SH-081262ENG
MELSEC iQ-R CPU Module User's Manual (Startup)	SH-081263ENG
MELSEC iQ-R CPU Module User's Manual (Application)	SH-081264ENG
MELSEC iQ-R Programming Manual (Program Design)	SH-081265ENG
MELSEC iQ-R Programming Manual (CPU Module Instructions, Standard Functions/Function Blocks)	SH-081266ENG
GX Works3 Operating Manual	SH-081215ENG
MELSEC iQ-R Safety Application Guide	SH-081538ENG

3. Safety Standards

Use the product according to the following safety standards.

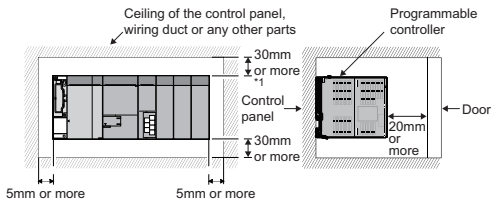
Region	Safety standards
International	IEC61508, IEC62061, ISO13849, IEC61131-2, IEC61010-2-201 IEC61000-6-2, IEC61000-6-4, IEC61326-3-1
Europe	EN62061, EN ISO13849, EN61131-2, EN61010-2-201 EN61000-6-2, EN61000-6-4

4. Installation

When installing a programmable controller to a control panel or similar, fully consider its operability, maintainability, and environmental resistance. For details, refer to the following:
📖 MELSEC iQ-R Module Configuration Manual.

Installation position

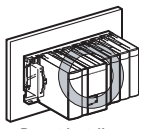
Keep the clearances shown below between the top/bottom faces of the modules and the control panel or other parts so that good ventilation is ensured and the modules can be easily replaced.



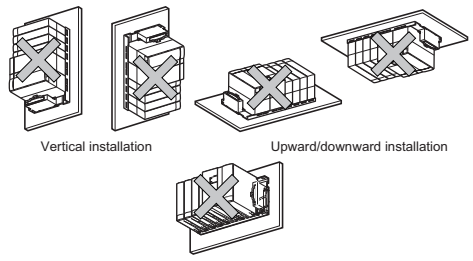
*1 A clearance required when the wiring duct is 50mm or less in height. A 40mm or more clearance is required when the wiring duct is longer.

Installation orientations

■ **Install a programmable controller in the following orientation to ensure good ventilation for heat release.**



■ **Do not install a programmable controller in the following orientations.**

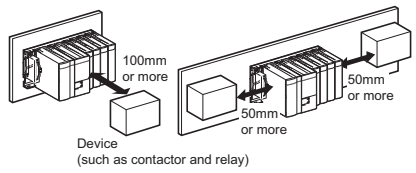


Installation precautions

■ **Install a base unit on a flat surface.**
If the surface is not flat, the printed circuit board is distorted, resulting in malfunction of the modules mounted.

■ **If there is a vibration source, such as an electromagnetic contactor or no fuse breaker, separate the control panel or keep enough clearance from the vibration source to install the programmable controller.**
In addition, keep the clearances shown below between the programmable controller and devices (such as contactors and relays) to avoid being affected by radiated electromagnetic interference or heat.

- In front of the programmable controller: 100mm or more
- On the right or left of the programmable controller: 50mm or more



■ **When installing a programmable controller to a control panel, do not mount any module in the rightmost slot of the base unit.**
Before uninstalling, remove the module mounted in the rightmost slot of the base unit.

5. Module Status after Power-on and LED Indication

A Safety CPU and safety function module performs initial processing (such as self-diagnostics) after the system is powered on or the Safety CPU is reset. The LEDs of each module indicate the module operating status after initial processing.

Safety CPU

No.	Name	Application
1)	READY LED	Indicates the operating status of the CPU module and the error level. READY LED - ERROR LED status On - off: Normal operation On - on: Minor error On - flashing: Moderate error Flashing (every 2s) - off: Initial processing Off- on/flashing: Major error
2)	ERROR LED	
3)	PROGRAM RUN LED	Indicates the operating status of the program. On: Being executed (RUN state) Flashing: Being suspended (PAUSE state) Off: Stopped (STOP state) or stop error
4)	USER LED	Indicates the status of the annunciator (F). Flashing: Annunciator (F) on Off: Normal operation
5)	BATTERY LED	Indicates the battery status. Flashing: Battery low Off: Normal operation
6)	CARD READY LED	Indicates the availability of the SD memory card. On: Available Flashing: Ready Off: Not available or not inserted
7)	CARD ACCESS LED	Indicates the access status of the SD memory card. On: Being accessed Off: Not accessed
8)	FUNCTION LED	Indicates the status of the function being executed.

Safety function module

No.	Name	Application
1)	READY LED	Indicates the operating status of the module and the safety control related error level. READY LED - ERROR LED status On - off: Normal operation On - on: Minor error On - flashing: Moderate error Off - on/flashing: Major error
2)	ERROR LED	
3)	PROGRAM RUN LED	Indicates the operating status of the safety program. On: Being executed Off: Not executed or stopped
4)	SAFETY COM RUN LED	Indicates the status of the safety communications. On: Being executed Off: Not executed or stopped
5)	SAFETY COM ERR LED	Indicates the status of the safety communications. On: An error has occurred during communications Off: No error
6)	TEST LED	On: TEST MODE Flashing: SAFETY MODE (waiting for reboot) Off: SAFETY MODE

6. Precautions for Use

Users must prove that their entire safety system complies with the safety standards and the Machinery Directive. The third-party certification organization will validate the safety of product for the entire safety system, including a safety programmable controller and safety components.
For details on the safety system, refer to the following:
📖 "System using the Safety CPU" in the MELSEC iQ-R Module Configuration Manual

Calculation of the target failure measure (PFDavg/PFH)

To establish a safety system, calculate the target failure measure (PFDavg/PFH) for each safety application (safety function) based on the PFDavg/PFH values of the safety programmable controller and connected safety components. The target failure measure (PFDavg/PFH) is the reliability target value for each Safety Integrity Level (SIL) defined in IEC61508 and can be calculated by the following formula. If the safety loop goes through the same safety device multiple times, add PFDavg/PFH for each safety device one time only.
PFDavg/PFH = (PFDavg/PFH of A) + (PFDavg/PFH of B) + (PFDavg/PFH of C) + (PFDavg/PFH of D) + (PFDavg/PFH of E)

Variable	Definition
A*1	Safety CPU (paired with safety function module)
B*2 *4	Safety remote I/O module connected to safety input device
C*4	Safety remote I/O module connected to safety output device
D*3 *4	Safety input device
E*3 *4	Safety output device

*1 When performing safety communications between Safety CPUs on the safety loop, add PFDavg/PFH for the Safety CPU (paired with the safety function module) performing safety communications on the safety loop. Add no PFDavg/PFH for the Safety CPU (paired with the safety function module) not performing safety communications on the safety loop, even if it is on the same network.
For the system configuration for safety communications, refer to the following:
📖 "System using the Safety CPU" in the MELSEC iQ-R Module Configuration Manual
*2 When using an extension module (NZ2EXSS2-8TE) connected to the main module (NZ2GFSS2-32D) as a safety remote I/O module, perform the calculation using the PFDavg/PFH of "Main module connected to Extension module (NZ2GFSS2-32D + NZ2EXSS2-8TE)". For the PFDavg/PFH, refer to the manual for the safety remote I/O module (IB-0800542).
*3 For PFDavg/PFH, refer to the manuals for the safety components used.
*4 When the safety application includes multiple safety switches or safety actuators, perform the calculation by adding all PFDavg/PFH for the safety remote I/O module, safety input device, and safety output device connected to the device.

PFDavg and PFH of the Safety CPU (paired with the safety function module) are as follows.

Module	Proof test interval*5			
	2 years	5 years	10 years	20 years
PFDavg of Safety CPU (paired with safety function module)*8	5.36×10^{-6} *6	1.68×10^{-5} *6	4.51×10^{-5} *6	1.36×10^{-4} *6
Module	**Proof test interval*5**			
	2 years	**5 years**	**10 years**	**20 years**
PFH of Safety CPU (paired with safety function module)*8	6.66×10^{-10} *7	9.04×10^{-10} *7	1.30×10^{-9} *7	2.10×10^{-9} *7

*5 Each proof test interval is the duration of product use.
*6 When the third and fourth digits of the 16-digit production information of the Safety CPU and the safety function module are "03" or earlier and "04" or earlier respectively, each PFDavg is as follows.
· 2 years: 1.16×10^{-6}, 5 years: 3.70×10^{-6}, 10 years: 1.02×10^{-5}, 20 years: 3.14×10^{-5}
When the third and fourth digits of the 16-digit production information of the Safety CPU and the safety function module are "04" and "05" respectively, each PFDavg is as follows.
· 2 years: 6.05×10^{-6}, 5 years: 2.15×10^{-5}, 10 years: 6.43×10^{-5}, 20 years: 2.14×10^{-4}
*7 When the third and fourth digits of the 16-digit production information of the Safety CPU and the safety function module are "03" or earlier and "04" or earlier respectively, each PFH is as follows.
· 2 years: 5.35×10^{-9}, 5 years: 5.41×10^{-9}, 10 years: 5.50×10^{-9}, 20 years: 5.69×10^{-9}
When the third and fourth digits of the 16-digit production information of the Safety CPU and the safety function module are "04" and "05" respectively, each PFH is as follows.
· 2 years: 7.88×10^{-10}, 5 years: 1.23×10^{-9}, 10 years: 1.96×10^{-9}, 20 years: 3.42×10^{-9}
*8 The PFDavg and PFH values are for when the module is used at the ambient temperature of 40℃.

PL evaluation described in ISO 13849-1

For the PL evaluation described in ISO 13849-1, use the $MTTF_D$ (mean time to dangerous failure) and the DCavg (average diagnostic coverage) listed in the following table.

Module	$MTTF_D$	DCavg
Safety CPU (paired with safety function module)*2	110 years*1	95.2%*1

*1 When the third and fourth digits of the 16-digit production information of the Safety CPU and the safety function module are "03" or earlier and "04" or earlier respectively, each value is as follows.
· $MTTF_D$: 109 years, DCavg: 95.4%
When the third and fourth digits of the 16-digit production information of the Safety CPU and the safety function module are "04" and "05" respectively, each value is as follows.
· $MTTF_D$: 110 years, DCavg: 95.3%
*2 The values are for when the module is used at the ambient temperature of 40℃.

7. Safety Response Time

The safety response time is the maximum value of the time from when a safety input of the remote station (safety station) or remote device station (safety station) turns off to when a safety output of the remote station (safety station) or remote device station (safety station) turns off (including an error detection time).
The safety response time is calculated by the following formula.
Remote station (safety station) or remote device station (safety station) on the input side → Master station (safety station) → Remote station (safety station) or remote device station (safety station) on the output side
(SCmst × 3) + (SRref × 4.5) + (RM × 2) + SRin + SRout + (n × 4)

SCmst: Safety cycle time*1 of the master station (safety station)
SRref: Safety remote station refresh response processing time*2
RM: Safety refresh monitoring time*3
SRin: Safety remote station input response time*2
SRout: Safety remote station output response time*2
n: Lower value of either 1) or 2) below
1) RM - TMmst - (TMrmt ÷ 2) + a
2) RM - (TMmst ÷ 2) - TMrmt + c
a: TMmst - b (This formula is valid when the station that is set to "Active" is a MELSEC product supporting CC-Link IE TSN or CC-Link IE Field Network. In other cases, a is 0.)
b: A value that is rounded up the calculation result of "TMmst ÷ 2" to the nearest multiple of the safety cycle time*4
c: TMrmt - d (This formula is valid when the station that is set to "Passive" is a MELSEC product supporting CC-Link IE TSN or CC-Link IE Field Network. In other cases, c is 0.)
d: A value that is rounded up the calculation result of "TMrmt ÷ 2" to the nearest multiple of the safety remote station refresh response processing time*5
TMmst: Transmission interval monitoring time*3 of the master station (safety station)
TMrmt: Transmission interval monitoring time*2 of the remote station (safety station) or remote device station (safety station)

*1 For the safety cycle time, refer to the following.
📖 MELSEC iQ-R CPU Module User's Manual (Application)
*2 For details, refer to the following.
📖 Manual for the remote station (safety station) or remote device station (safety station) used
*3 For details, refer to the following.
📖 MELSEC iQ-R CC-Link IE TSN User's Manual (Application)
📖 MELSEC iQ-R CC-Link IE Field Network User's Manual (Application)
*4 A sample calculation of b:
When the transmission interval monitoring time is 24ms and the safety cycle time is 10ms, the result is 20. (The value is rounded up the calculation result (24 ÷ 2 = 12) to the nearest multiple of 10.)
*5 A sample calculation of d:
When the transmission interval monitoring time is 24ms and the safety remote station refresh response processing time is 2ms, the result is 12. (The calculation result (24 ÷ 2 = 12) is the multiple of 2.)

For details on the Safety CPU and safety function module, refer to the following after reading this manual.
📖 "PART 5 WHEN USING THE SAFETY CPU" in the MELSEC iQ-R CPU Module User's Manual (Application)

8. EU Declaration of Conformity

MITSUBISHI ELECTRIC
Changes for the Better

EU DECLARATION OF CONFORMITY

We,
Manufacturer : MITSUBISHI ELECTRIC CORPORATION
Address (Place of Declare) : TOKYO 100-8310, JAPAN
Brand Name : MITSUBISHI ELECTRIC
declare under our sole responsibility that the product
Description : Programmable Logic Controller
Type of Model : MELSEC iQ-R series
Notice : Refer to next page about each type name

to which this declaration relates is in conformity with the following standard and directive.

Directive		Harmonized Standard	Notified Body
EMC Directive	2014/30/EU	EN61131-2:2007	—
Machinery Directive	2006/42/EC	EN ISO 13849-1:2015	1
RoHS Directive	2011/65/EU, (EU)2015/863 *1	EN IEC 63000:2018	—

*1 : Category 9 "Industrial monitoring and control instruments" is applicable.

This declaration is based on the conformity assessment of following Notified Body			
No.	Name and Address	Identification Number	Issued certificate No.
1	TÜV RHEINLAND INDUSTRIE SERVICE GMBH, Alboinstr. 56, 12103 Berlin, Germany	0035	01/205/5448.02/21

Authorized representative in Europe
(The person authorized to compile the Technical file or relevant Technical documentation)
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FA Product Marketing, Director, MITSUBISHI ELECTRIC EUROPE B.V., German Branch
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Issue Date (Date of Declaration): 9 Nov. 2021

Signed for and on behalf of

(Signature) Takayuki Suzuki

[Takayuki Suzuki]
Senior Manager, FA Hardware Platform Development Section
FA Systems Dept.1
MITSUBISHI ELECTRIC CORPORATION NAGOYA WORKS

Appendix List of type name to declare

R08SFCPU
R08SFCPU-SET
R08SFCPU-SET(C)
R08SFCPU(C)
R120SFCPU
R120SFCPU-SET
R120SFCPU-SET(C)
R120SFCPU(C)
R16SFCPU
R16SFCPU-SET
R16SFCPU-SET(C)
R16SFCPU(C)
R32SFCPU
R32SFCPU-SET
R32SFCPU-SET(C)
R32SFCPU(C)
R6SFM
R6SFM(C)