

## Before Using the Product

Before using the product, please read this manual. Make sure that the end users read this manual and then keep the manual in a safe place for future reference.

### 1. Relevant manuals

Before using the product, please read the Safety Guidelines included with the base unit used, especially the following sections.

- SAFETY PRECAUTIONS
- CONDITIONS OF USE FOR THE PRODUCT
- EMC AND LOW VOLTAGE DIRECTIVES
- WARRANTY

For the product information, refer to the following.

Description	Manual name [manual number]
Common information on MELSEC IQ-R series programmable controllers <sup>1</sup>	MELSEC IQ-R Module Configuration Manual [SH-081262ENG]
Detailed information on this product used in normal mode	MELSEC IQ-R I/O Module (With Diagnostic Functions) User's Manual (Startup) [SH-081619ENG]
	MELSEC IQ-R I/O Module (With Diagnostic Functions) User's Manual (Application) Part 1 [SH-081621ENG]
Detailed information on this product used in SIL2 mode	MELSEC IQ-R I/O Module (With Diagnostic Functions) User's Manual (Application) Part 2 [SH-081621ENG]

<sup>1</sup>The information includes the system configuration, specifications, installation, wiring, maintenance, and inspection. Please develop familiarity with the functions and performance of the product to handle the product correctly.

### 1. Manuels correspondants

Avant d'utiliser ce produit, prière de lire les "Safety Guidelines" (directive de sécurité) fournies avec l'unité de base, en particulier dans les sections suivantes.

- PRÉCAUTIONS DE SÉCURITÉ
- CONDITIONS D'UTILISATION DE PRODUIT
- DIRECTIVES CEM ET BASSE TENSION
- GARANTIE

### 2. Packing list

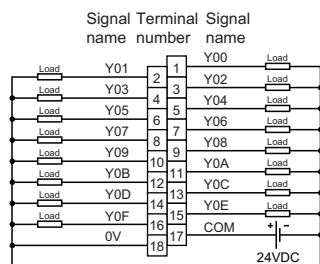
Check that the following items are included in the package of the product.

Item	Quantity
Module	1
Before Using the Product (this manual)	1

## 3. Wiring diagram

### Schémas de câblage

The following figure shows the wiring diagram for using the module in normal mode.



Viewed from the front of the module

For the wiring diagram to use the module in SIL2 mode, refer to the MELSEC IQ-R I/O Module (With Diagnostic Functions) User's Manual (Application).

English	French
The following figure shows the wiring diagram for using the module in normal mode.	L'illustration suivante montre le schéma de câblage pour utiliser le module en mode normal.
Signal name	Nom de signal
Terminal number	Borne N°
Viewed from the front of the module	Vue de l'avant du module
Load	Charge
24VDC	24V cc
For the wiring diagram to use the module in SIL2 mode, refer to the MELSEC IQ-R I/O Module (With Diagnostic Functions) User's Manual (Application).	Pour le schéma de câblage à utiliser le module en mode SIL2, consultez MELSEC IQ-R I/O Module (avec fonctions de Diagnostic) Manuel de l'utilisateur (Application).

## 4. Wiring products

The table below shows applicable solderless terminals connected to the terminal block. When wiring, use applicable wires and an appropriate tightening torque. Use UL-listed solderless terminals and, for processing, use a tool recommended by their manufacturer. Also, sleeved solderless terminals cannot be used.

Solderless terminal		Wire			
Model	Tightening torque	Diameter	Type	Material	Temperature rating
R1.25-3	0.42 to 0.58N·m	22 to 18 AWG	Stranded	Copper	75°C or more

### 4. Produits pour câblage

Le tableau ci-dessous indique quelles bornes sans soudure on doit utiliser pour les raccordements sur la plaque à bornes. Pour le câblage, utiliser les fils et couples de serrage prescrits. Utiliser les bornes sans soudure répertoriées par UL et, pour le montage, utiliser l'outil recommandé par le fabricant de ces bornes. En outre, il ne faut pas utiliser de bornes sans soudure sous manchon.

Borne sans soudure		Fil			
Modèle	Couple de serrage	Diamètre	Type	Matériau	Gamme de température
R1.25-3	0,42 à 0,58N·m	AWG22 à 18	Torsadé	Cuivre	75°C ou plus

## 5. Operating ambient temperature

Use the product within the following range.

- 0 to 55°C (when an extended temperature range base unit is not used)
- 0 to 60°C (when an extended temperature range base unit is used)

### 5. Température ambiante de fonctionnement

Ce produit doit être utilisé dans les conditions suivantes.

- 0 et 55°C (quand une unité de base à gamme de température élargie n'est pas utilisée)
- 0 et 60°C (quand une unité de base à gamme de température élargie est utilisée)

## 6. Mounting modules

When installing the programmable controller in a control panel, fully consider its operability, maintainability, and environmental resistance. Securely mount all the MELSEC IQ-R series modules used on the base unit. For details on the mounting method, refer to the MELSEC IQ-R Module Configuration Manual.

### 6. Montage des modules

Pour installer l'automate programmable dans un tableau de commande, prendre en compte tous les aspects d'opérabilité, de maintenabilité et de résistance à l'environnement.

Monter fermement sur l'unité de base tous les modules de la série MELSEC IQ-R à utiliser.

Pour le détail de la méthode de montage, voir le MELSEC IQ-R Module Configuration Manual (Manuel de configuration du module MELSEC IQ-R).

## 7. Safety standards

- For UL listed

UL evaluation was performed only to UL508.

Functional safety evaluation was performed by TÜV Rheinland<sup>®</sup>.<sup>\*1</sup>

<sup>\*1</sup> TÜV Rheinland is a registered trademark.

- For IEC 61508 SIL 2

The RY40PT5B meets IEC 61508: 2010 SIL 2 and IEC 61511: 2015 SIL 2 when it is used in the specified redundant system configuration and its parameter is set in the specified way.

The RY40PT5B set to operate in SIL2 mode can be used for building safety function in generic industrial machines.

For details, refer to the MELSEC IQ-R I/O Module (With Diagnostic Functions) User's Manual (Application).

## 8. Calculation of the target failure measure (PFDavg/PFH)

The systems using the SIL2 Process CPU obtained safety approval (IEC 61511: 2015 SIL 2 and IEC 61508: 2010 SIL 2). The target failure measure (PFDavg/PFH) is a target value of reliability for each SIL level defined in IEC 61508: 2010 and IEC 61511: 2015.

When configuring a system using the SIL2 Process CPU, a SIL2 application shall configure a safety path, including safety input devices through safety output devices. Calculate the PFDavg/PFH for each SIL2 application using the following formula. If the safety path goes through the module set to operate in SIL2 mode multiple times, add the PFDavg/PFH for that module multiple times.

$PFD_{avg}/PFH = (PFD_{avg}/PFH \text{ of A}) + (PFD_{avg}/PFH \text{ of B}) \times \alpha^{-5} + (PFD_{avg}/PFH \text{ of C}) \times \beta^{-5} + (PFD_{avg}/PFH \text{ of D}) + (PFD_{avg}/PFH \text{ of E})$

Symbol	Definition
A <sup>1</sup>	SIL2 Process CPU
B <sup>2,4</sup>	Module set to operate in SIL2 mode and connected to safety input devices
C <sup>2,4</sup>	Module set to operate in SIL2 mode and connected to safety output devices
D <sup>3,4</sup>	Safety input device
E <sup>3,4</sup>	Safety output device

<sup>\*1</sup> When performing safety communications between SIL2 Process CPUs on the safety path, add the PFDavg/PFH for SIL2 Process CPUs performing safety communications on the safety path. Add no PFDavg/PFH for SIL2 Process CPUs not performing safety communications on the safety path, even if they are on the same network.

<sup>\*2</sup> Perform the calculation with the PFDavg/PFH for the SIL2-mode modules used.

<sup>\*3</sup> For PFDavg/PFH of D and E, refer to manuals for the safety devices used.

<sup>\*4</sup> When the SIL2 application includes multiple safety input devices and safety output devices, perform the calculation by adding all PFDavg/PFH for the safety input devices, safety output devices, and SIL2-mode modules that are connected to these safety input/output devices.

<sup>\*5</sup> For SIL2-mode modules used in a SIL2 application configured with multiple inputs and outputs, multiply the PFDavg/PFH of these modules by the number of input points (α) and the number of output points (β) for the calculation.

The following tables list PFDavg/PFH for the RY40PT5B set to operate in SIL2 mode.

PFDavg <sup>5</sup>		
2 years	5 years	10 years
4.64×10 <sup>-6</sup>	1.26×10 <sup>-5</sup>	2.87×10 <sup>-5</sup>

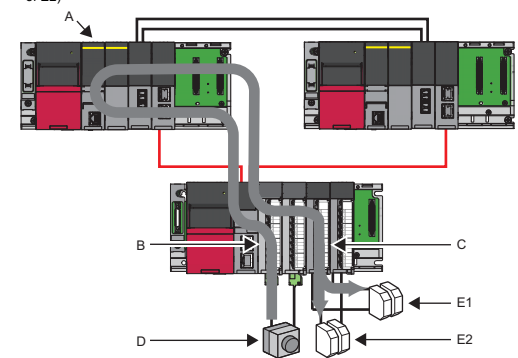
PFH <sup>6</sup>		
2 years	5 years	10 years
5.46×10 <sup>-10</sup>	6.16×10 <sup>-10</sup>	7.35×10 <sup>-10</sup>

<sup>\*6</sup> The PFDavg/PFH values are listed by proof test interval.

The following formulas show calculation examples of PFDavg/PFH for a SIL2 application with multiple outputs where SIL2 Process CPUs and an I/O module with diagnostic functions are used.

Connect an emergency stop switch to the input module with diagnostic functions. Connect multiple safety relays to the output module with diagnostic functions. A SIL2 Process CPU controls ON/OFF of the safety relays according to the input from the emergency stop switch.

- $PFD_{avg} = (PFD_{avg} \text{ of A}) + (PFD_{avg} \text{ of B}) + (PFD_{avg} \text{ of C}) \times 2 + (PFD_{avg} \text{ of D}) + (PFD_{avg} \text{ of E1}) + (PFD_{avg} \text{ of E2})$
- $PFH = (PFH \text{ of A}) + (PFH \text{ of B}) + (PFH \text{ of C}) \times 2 + (PFH \text{ of D}) + (PFH \text{ of E1}) + (PFH \text{ of E2})$



## 9. Information and services

For further information and services, please consult your local Mitsubishi representative.