MITSUBISHI ELECTRIC

Changes for the Better

Safety Programmable Controller/ Safety Controller

e-F@ctory

GLOBAL IMPACT OF MITSUBISHI ELECTRIC

Through Mitsubishi Electric's vision, "Changes for the Better" are possible for a brighter future.

Changes for the Better

"Changes for the Better" represents the Mitsubishi Electric Group's attitude to "always strive to achieve something better", as we continue to change and grow. Each one of us shares a strong will and passion to continuously aim for change, reinforcing our commitment to creating "an even better tomorrow".

Our advances in AI and IoT are adding new value to society in diverse areas from automation to information systems. The creation of game-changing solutions is helping to transform the world, which is why we are honored to be recognized in the 2019 "Forbes Digital 100" as one of world's most influential digital corporations.

#41
2019 Forbes
TOP 100 DIGITAL COMPANIES

Mitsubishi Electric is involved in many areas including the following:

Energy and Electric Systems
A wide range of power and electrical products from generators to large-scale displays.

Electronic Devices
A wide portfolio of cutting-edge semiconductor devices for systems and products.

Home Appliance
Dependable consumer products like air conditioners and home entertainment systems.

Information and Communication Systems
Commercial and consumer-centric equipment, products and systems.

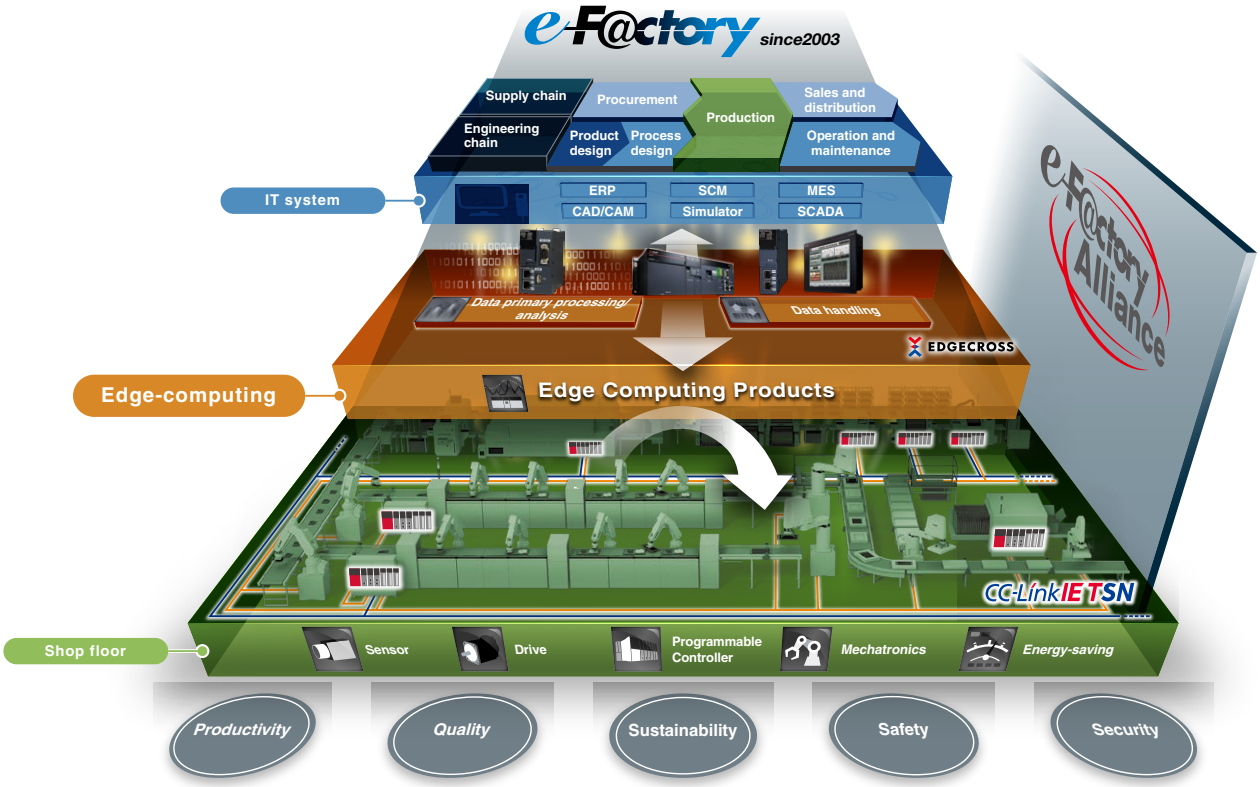
Industrial Automation Systems
Maximizing productivity and efficiency with cutting-edge automation technology.

Maximizing productivity and reducing total cost while adding value across the manufacturing enterprise

e-F@ctory is the Mitsubishi Electric solution for adding value across the manufacturing enterprise by enhancing productivity, and reducing the maintenance and operations costs together with seamless information flow throughout the plant. e-F@ctory uses a combination of factory automation and IT technologies in combination with various best-in-class partner products through its alliance program, offering solutions to reduce total cost while improving operations, production yield, and efficient management of the supply chain.

e-F@ctory

FA integrated solution reducing total cost



INDEX

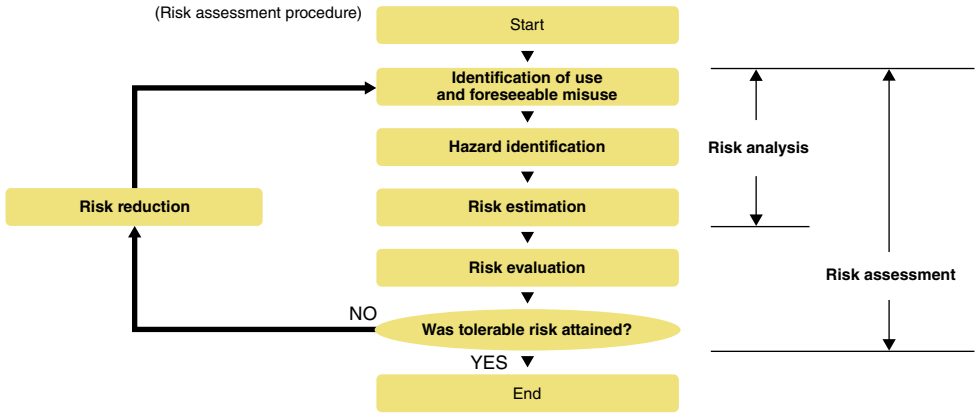
International safety standards

International standards for machinery safety are hierarchically classified into the following types:

- Type A standards (basic safety standards): ISO 12100
- Type B standards (group safety standards): ISO 13849-1, IEC 61508, etc.
- Type C standards: Individual product standards

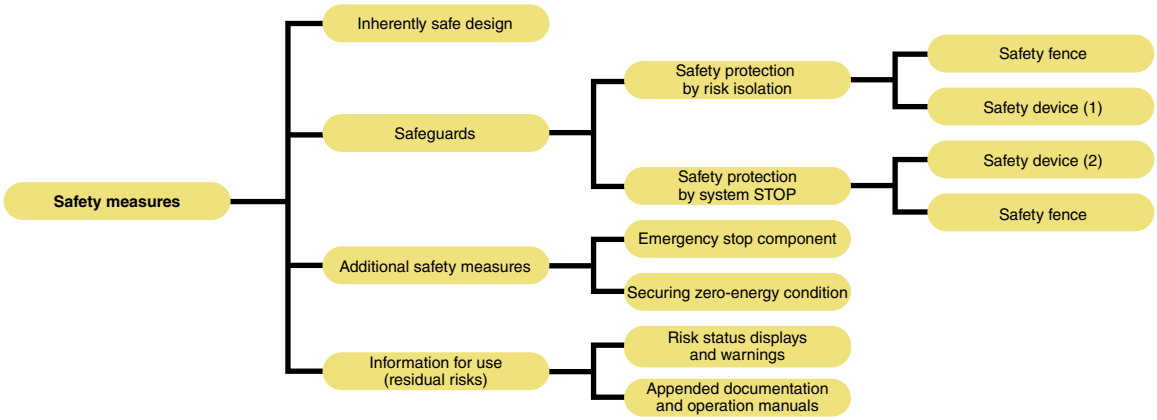
ISO 12100 Risk assessment

“Risk assessment” refers to identifying potential hazards present in machinery and evaluating the degree of hazard (risk).



ISO 12100 Risk reduction and safety measures

Under the International Safety Standards, protective measures are implemented to reduce risks to the degree that risks can be tolerated.



EN ISO 13849-1 Performance level

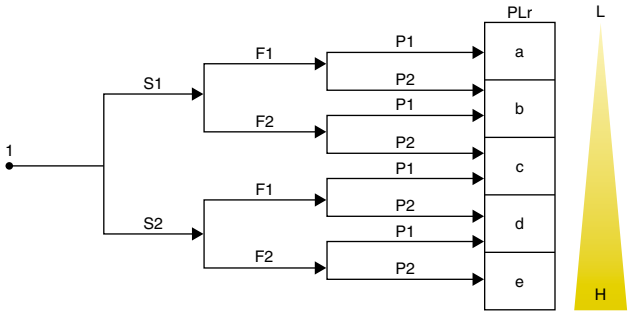
Frequency of a dangerous failure occurrence (the safety function does not work when needed), rate of a failure detection by diagnostics, etc. were added to evaluate comprehensively. The evaluation result is classified into five levels from “a” to “e” by the performance level (PL).

- The categories and the safety integrity level (SIL) described in the functional safety standard IEC 61508 can be referred to each other via the PL
- Like the safety categories, the risk is evaluated from a perspective of “S: Severity of injury”, “F: Frequency or duration of exposure to risk”, and “P: Possibility of avoidance”

The functional safety standard IEC 61508

With progress of microprocessor technologies, widespread IT, more complex control, etc., demands for configuring safety systems using microprocessors and software have been increased. To meet such demands of the time, the functional safety concept was developed, and the functional safety standard IEC 61508 (electrical/electronic/programmable electronic safety-related systems), which applies to programmable controllers, was issued in 2000.

Risk graph in EN ISO 13849-1 and PLr for safety function



S	F	P
Severity of injury	Frequency or duration of exposure to risk	Possibility of avoiding or deterring risk
S1	**F1**	**P1**
Minor injury	Rarely to low frequency or for a brief period	Possible under certain conditions
S2	**F2**	**P2**
Serious injury	Frequently to continuously or for a long period	Almost impossible

Safety category requirements

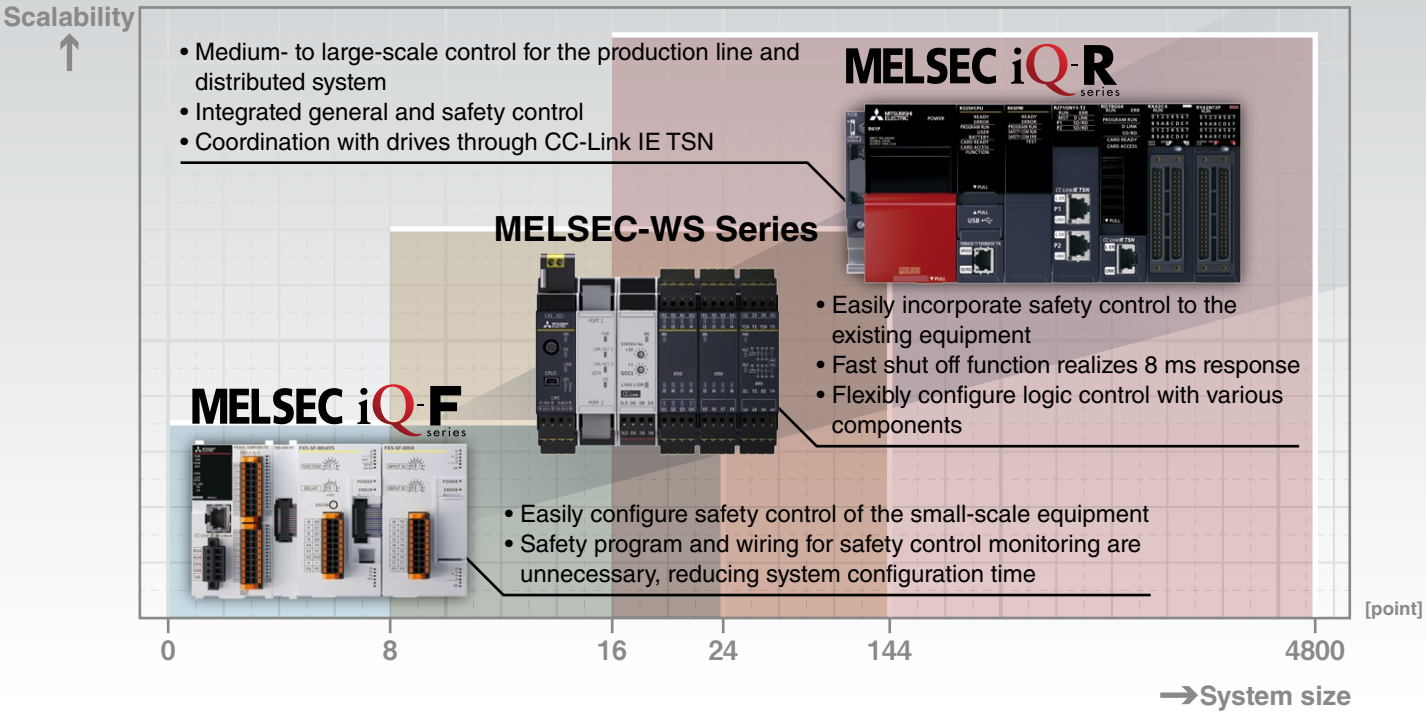
Category	Requirement summary	System behaviour
B	• Shall realize the intended functions of safety-related parts of the machine control system	• The occurrence of a fault can lead to the loss of the safety function
1	• Shall meet the requirements of Category B • Shall use well-examined reliable components and observe safety principles	• The same as Category B, but the safety-related part has more reliable safety function
2	• Shall meet the requirements of Category B • Shall observe safety principles • Shall check the safety function at appropriate intervals	• Although the loss of the safety function can be detected by checking, the safety function is lost between checks
3	• Shall meet the requirements of Category B • Shall observe safety principles • Design requirements: A single fault shall not lead to the loss of the safety function • Detect as many single faults as possible	• The safety function is not lost by a single fault • Some but not all faults can be detected. Accumulation of undetected faults may lead to the loss of the safety function
4	• Shall meet the requirements of Category B • Shall observe safety principles • Design requirements: Detect a single fault at or before executing safety function. In cases where this is not possible, the safety function shall not be disabled by accumulated faults	• The safety function is always in effect whenever a fault occurs • Faults will be detected in time to prevent the loss of the safety function

MELSEC Selection Guide

Safety control devices to meet customer's requirements

Selection points

Appropriate devices according to the system scale and scalability are available.



Performance comparison table

The table below shows programming development environment, supported networks, and number of safety I/O points for each Series.

S: Safety communication N: Non-safety communication

Series	iQ Platform-compatible PAC MELSEC iQ-R Series	Safety Controller MELSEC-WS Series	Safety extension module MELSEC iQ-F Series
Programming development environment	GX Works3	Setting and Monitoring Tool	-*1
Program capacity (step)	80K/160K/320K/1200K (40K for safety program)	255 (Function Blocks)	- (9 built-in program)
Network			
CC-Link IE TSN	S N	-	N
CC-Link IE Field Network	S N	-	N
CC-Link IE Control Network	N	-	-
Flexi Line/Link	-	S	-
Ethernet	N	N	N
CC-Link	N	N	N
Number of safety I/O points			
System scale (point)	4800	144	24
Max. number of connectable safety I/O modules per system	120 stations	12 modules	3 modules*2
Max. number of input points per system (single wiring) (point)	3840	96	20
Max. number of output points per system (single wiring) (point)	960	48	4

*1. Stored program can be selected by setting the rotary switch, requiring no programming.
*2. One safety main module and two safety input extension modules can be connected.

Slave device lineup

Flexible system configuration is realized with block-type remote modules and drives.

: CC-Link IE TSN : CC-Link IE Field Network

Block-type safety remote modules

NZ2GNSS2-16DTE

NZ2GFSS2-16DTE

Drives

AC servo MELSERVO

MELSERVO-J5

MELSERVO-J4

Inverter FREQROL

FR-E800

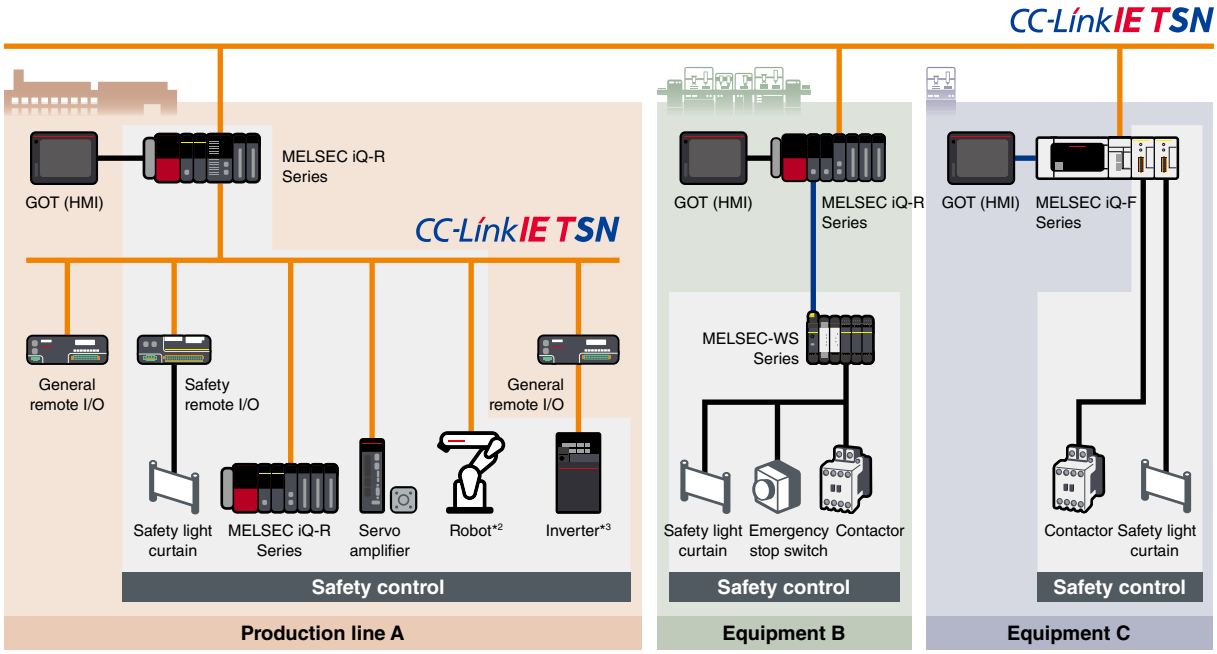
FR-A800*1

Industrial robot MELFA

MELFA-FR*1

System configuration examples

From a small- to large-scale system according to requirements are realized with Mitsubishi Electric safety devices.

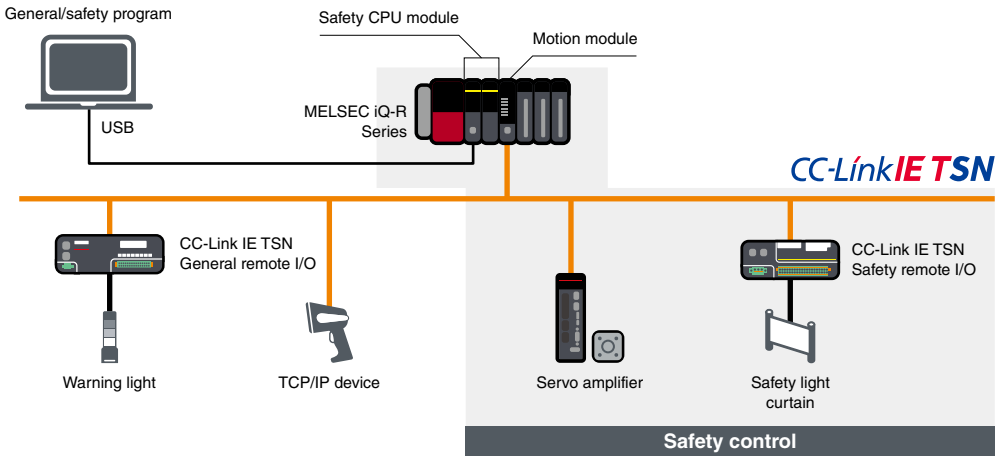


*1. Can be used in combination with a block-type safety remote module (robot safety option is necessary for a robot).
*2. The robot controller CR800-R can be connected via the MELSEC iQ-R Series CC-Link IE TSN master/local module. For detailed information, please refer to page 17.
*3. A device supporting 100 Mbps should be connected following a device supporting 1 Gbps (class B).

MELSEC iQ-R Series
iQ Platform-compatible PAC

The MELSEC iQ-R Series is equipped with a safety CPU module that is compliant with ISO 13849-1 PL e and IEC 61508 SIL 3. The safety CPU module can be installed directly on the MELSEC iQ-R Series base rack and can execute both safety and general programs.

System configuration



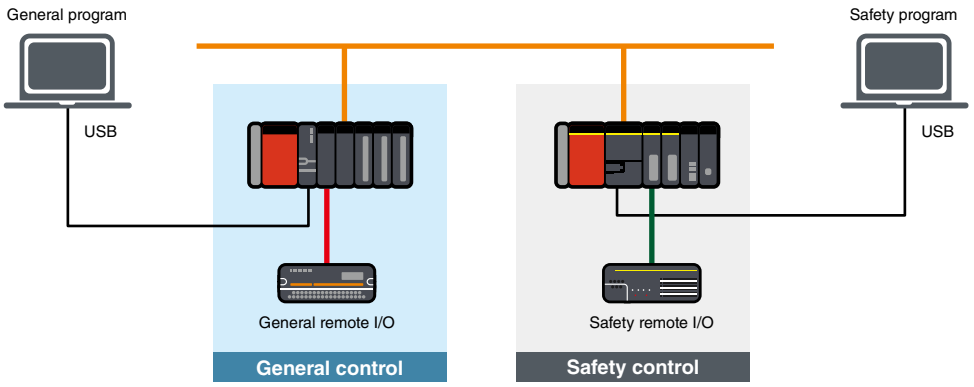
■ CC-Link IE TSN features

- Use general Ethernet cables
- Mix general and safety communications on one network
- Combine with TCP/IP communications

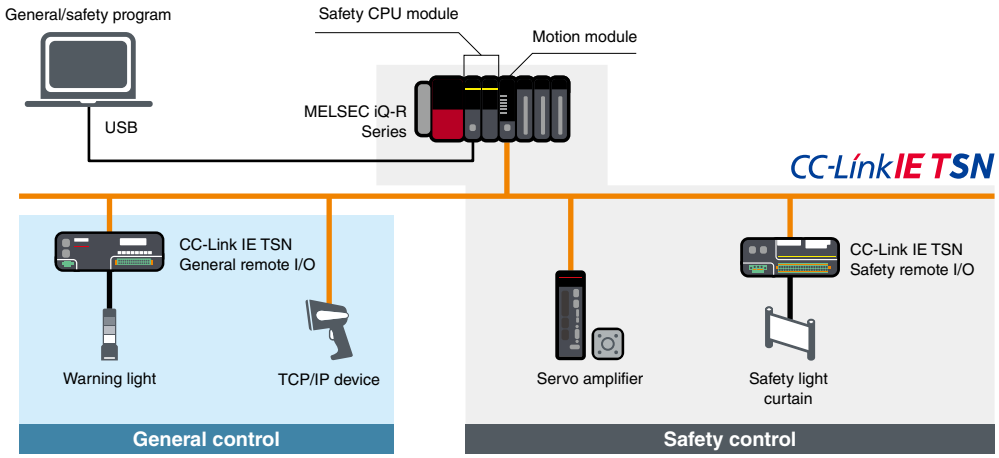
Integrated general and safety control

The MELSEC iQ-R Series safety programmable controller and CC-Link IE TSN can execute both safety and general programs, enabling easy integration into existing or new control systems, reducing costs and saving space.

Before



After



Specifications

Safety CPU module specifications

LD : Ladder diagram ST : Structured text FBD : Function block diagram

Item	R08SFCPU-SET*1	R16SFCPU-SET*1	R32SFCPU-SET*1	R120SFCPU-SET*1
Category	Category 4 (EN ISO 13849-1)			
Safety Integrity Level (SIL)	SIL 3 (IEC 61508)			
Performance Level (PL)	PL e (EN ISO 13849-1)			
Control method	Stored program cyclic operation			
I/O control mode	Refresh mode (Direct access I/O is available by specifying direct access I/O (DX, DY).)			
Programming language	LD ST*2 FBD*2			
Extended programming language	Function block (FB), label programming (system/local/global)			
Program execution type	Fixed scan, initial*2, scan*2, interrupt*2, standby type*2			
Number of I/O points	4096	4096	4096	4096
Memory capacity				
Program capacity (step)	80K (40K for safety programs)	160K (40K for safety programs)	320K (40K for safety programs)	1200K (40K for safety programs)
Program memory (KB)	320	640	1280	4800
Device/label memory*3 (KB)	1178	1710	2306	3370
Data memory (MB)	5	10	20	40
SLMP communication	●	●	●	●

*1. Product package includes a safety CPU module (R□SFCPU) and safety function module (R6SFM).
*2. Not supported for safety control program.
*3. An extended SRAM cassette expands the device/label memory area.

Common engineering platform realizes efficient engineering

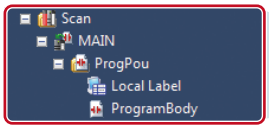
GX Works3

In GX Works3, general and safety programs are included in the same project folder. GX Works3 is highly adaptable to projects in different countries through its multiple language features.

General/safety shared labels
A general/safety shared label is used to pass device data from a safety program to a general program, and vice versa

Safety device
Append "SA\" to the device name

General control program (non-safety)



Safety control program

Safety FB*1
Safety FBs are units of ladder blocks repeatedly used in creating a safety program. Efficient engineering is realized, reducing programming errors

*1. On the actual GX Works3 screen, FB version is shown.

Safety FB (Function blocks)

Functions that are frequently used for creating safety programs are provided as certified safety function blocks.

Safety FB list

FB name	Function	Description
M+SF_2HAND2_R	Two hand switch Type II	Provides the two-hand control functionality.
M+SF_2HAND3_R	Two hand switch Type III	Provides the two-hand control functionality. (Fixed specified time difference is 500 ms.)
M+SF_EDM_R	External device monitor	Controls a safety output and monitors controlled actuators, e.g. subsequent contractors.
M+SF_ENBLSW_R	Enable switch	Evaluates the signals of an enable switch with three positions.
M+SF_ESPE_R	Light Curtain (ESPE)	Safety-related FB for monitoring electro-sensitive protective equipment (ESPE).
M+SF_ESTOP_R	Emergency Stop	Safety-related FB for monitoring an emergency stop switch. This FB can be used for emergency switch off functionality (stop category 0).
M+SF_GLOCK_R	Guard Lock and Interlocking	Controls an entrance to a hazardous area via an interlocking guard with guard locking ("four state interlocking").
M+SF_GMON_R	Guard Monitoring	Monitors the relevant safety guard. There are two independent input parameters for two switches at the safety guard coupled with a time difference (Monitoring Time) for closing the guard.
M+SF_MODSEL_R	Mode Selector	Selects the system operation mode, such as manual, automatic, and semi-automatic, etc.
M+SF_OUTC_R	Output Control	Control of a safety output with a signal from the functional application and a safety signal with optional startup inhibits.
M+SF_MUTE2_R	Muting with 2 sensors	Muting is the intended suppression of the safety function. (e.g., light barriers) In this FB, parallel muting with two muting sensors is specified.
M+SF_MUTE2-2_R	Muting with 2 sensors 2	Muting is the intended suppression of the safety function. (e.g., light barriers) In this FB, parallel muting with two muting sensors is specified. The effective time of the muting control can be set to be unlimited.
M+SF_MUTEP_R	Parallel muting	Parallel muting with four muting sensors is specified.
M+SF_MUTEP-2_R	Parallel muting 2	In this FB, parallel muting with four muting sensors is specified. The effective time of the muting control can be set to be unlimited.
M+SF_MUTES_R	Sequential muting	Sequential muting with four muting sensors is specified.
M+SF_MUTES-2_R	Sequential muting 2	In this FB, sequential muting with four muting sensors is specified. The effective time of the muting control can be set to be unlimited.
M+SF_TSSEN_R	Testable safety sensor	Detects, for example, the loss of the sensing unit detection capability, the response time exceeding that specified, and static ON signal in signal-channel sensors systems. It can be used for external testable safety sensors.
M+SF_EQUI_R	Double input (NC + NC or NO + NO)	Converts two equivalent bit inputs (both NO or NC) to one bit with discrepancy time monitoring. This FB output shows the result of the evaluation of both channels.
M+SF_ANTI_R	Double input (NO + NC)	Converts two antivalent*2 bit inputs (NO/NC pair) to one bit output with discrepancy time monitoring. This FB output shows the result of the evaluation of both channels.

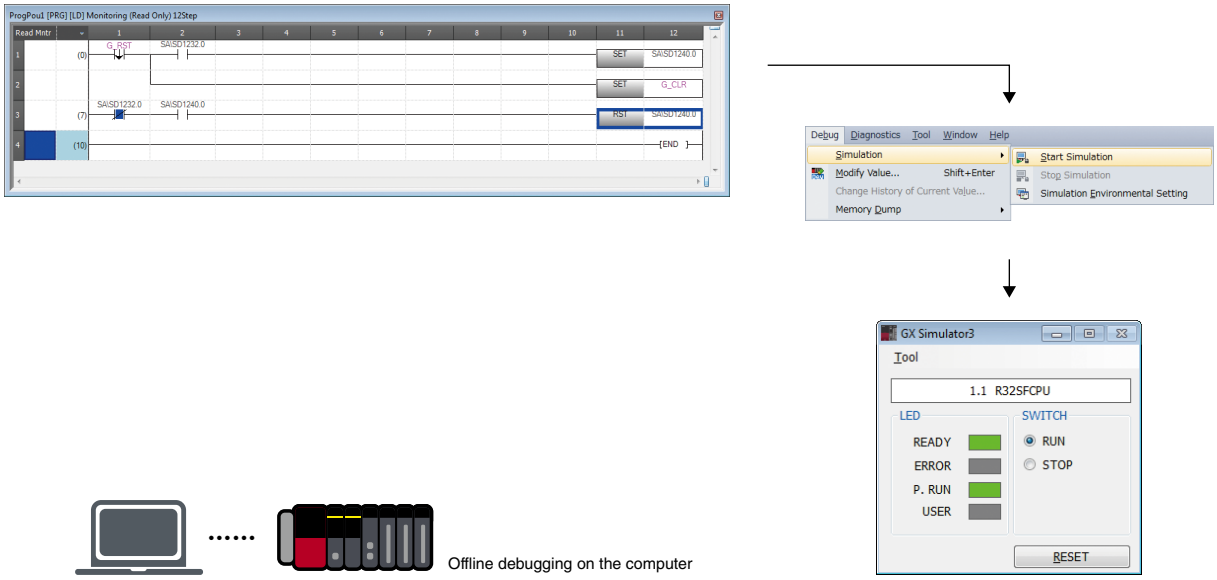
*2. "Antivalent" means that during normal operation, the two inputs are in opposite states at the same time. This is sometimes called "complementary" or "non-equivalent".

Integrated hardware simulator simplifying debugging

GX Works3 features an integrated simulator which helps to visualize the operation of the program during the debugging process.

- Programs can be debugged with a virtual safety programmable controller on the computer
- No need for connecting to the CPU module

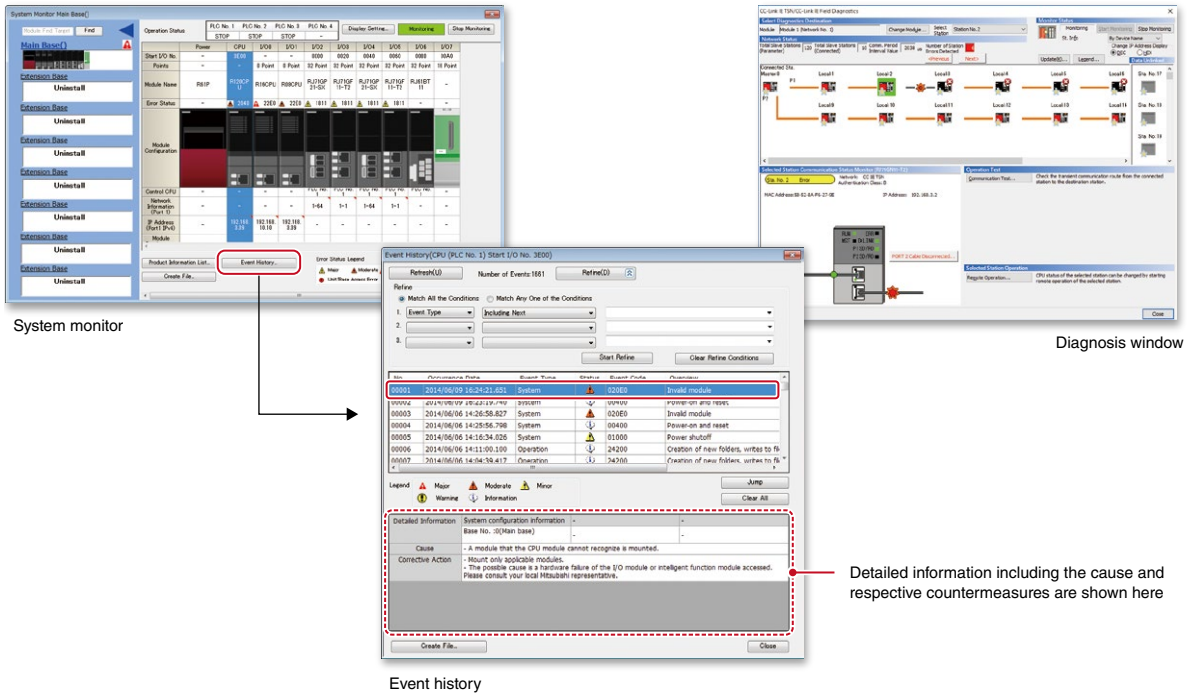
■ Offline debugging without requiring a control CPU



Offline debugging on the computer

Easier troubleshooting reducing downtime

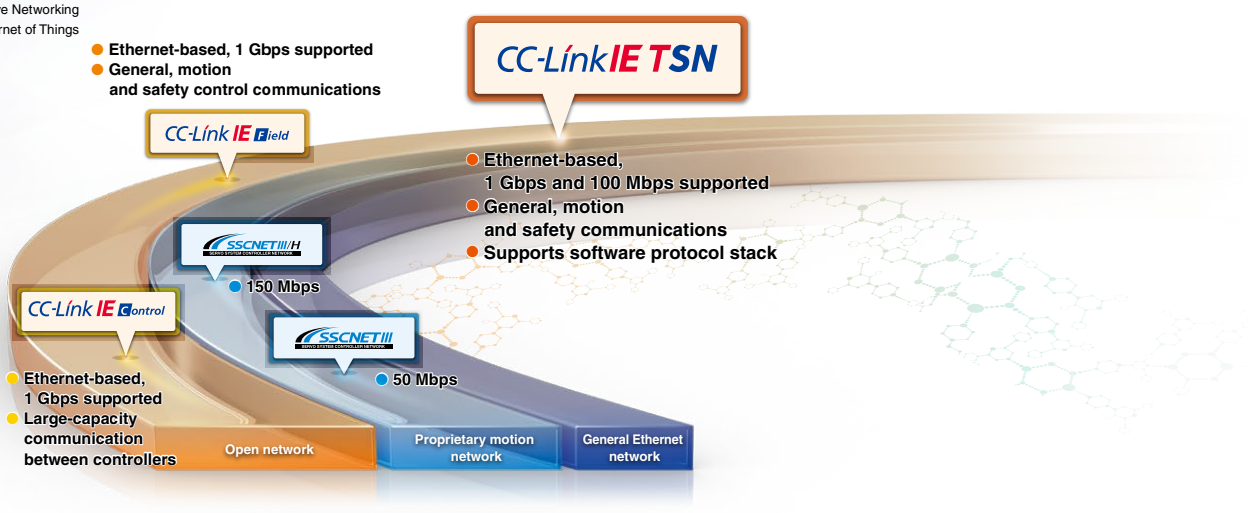
The MELSEC iQ-R Series includes various maintenance features:



Open integrated networking across the manufacturing enterprise

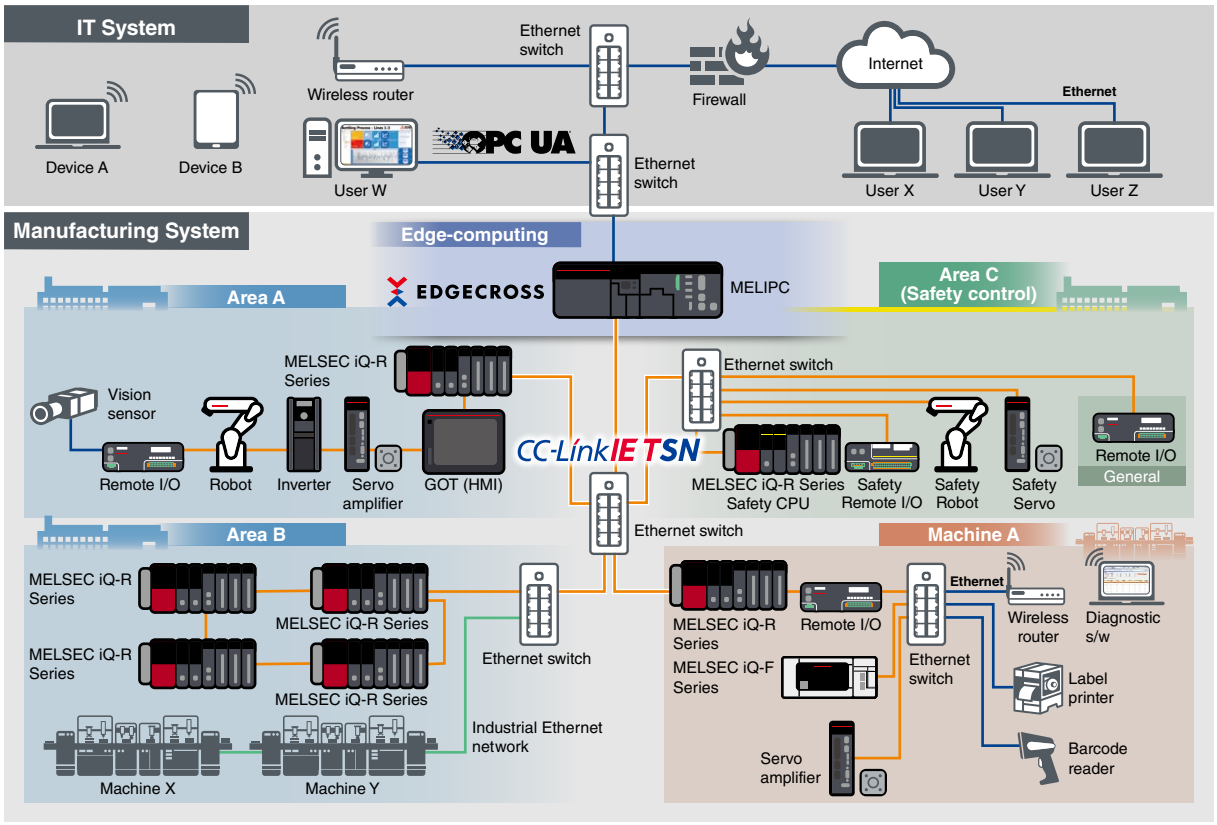
CC-Link IE TSN*1 supports TCP/IP communications and applies it to industrial architectures through its support of TSN enabling real-time communications. With its flexible system architecture and extensive setup and troubleshooting features make CC-Link IE TSN ideal for building an IIoT*2 infrastructure across the manufacturing enterprise.

*1. TSN: Time Sensitive Networking
*2. IIoT: Industrial Internet of Things



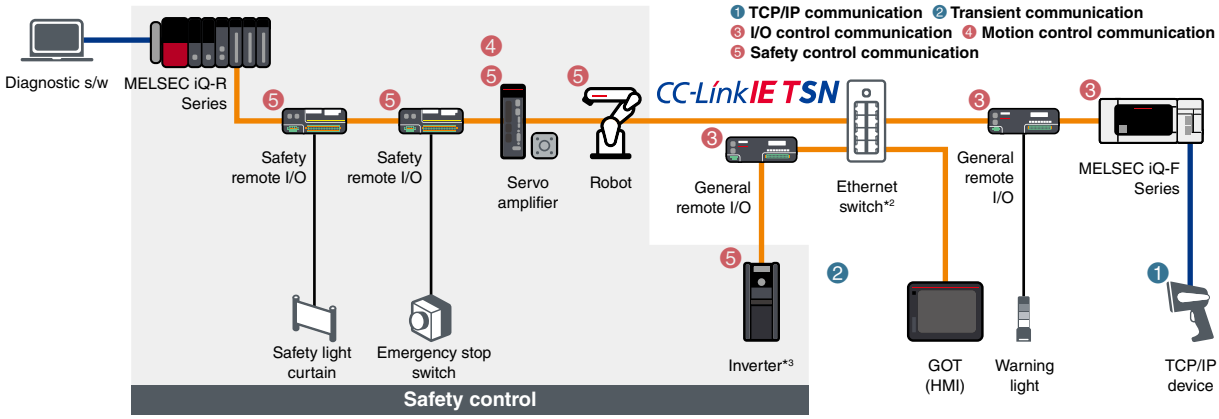
Smart factory integration combining IT systems such as OPC UA with networked devices supporting other communication protocols

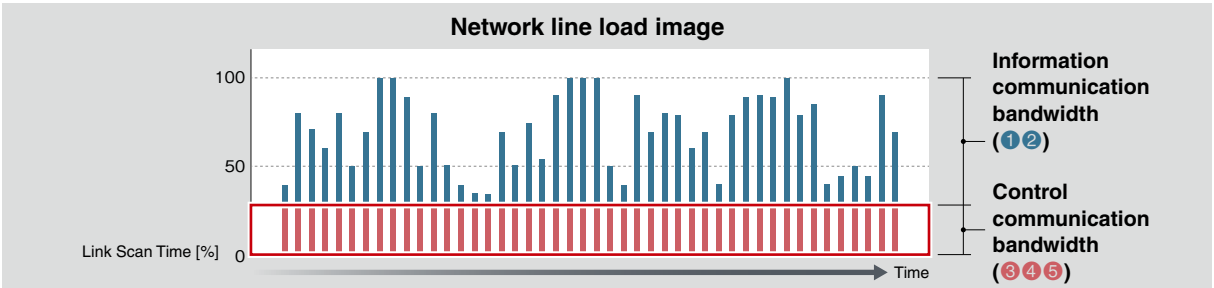
Build fully connected factory networks with vertical and horizontal integration across many different layers, automation control zones and network nodes. Realize system optimization on the same network while reducing overall network hardware and software costs.



Deterministic control even if mixed with TCP/IP and safety communication

CC-Link IE TSN enables mixing of safety and non-safety communications.*1 Safety monitoring functions such as (STO, SS1, SS2, SOS, SLS, SBC, SSM) are also supported for safety drives that are on the network. Deterministic performance of cyclic communication is maintained even when mixed with slower information data (non real-time). This enables TCP/IP communication devices to be used without affecting overall control.



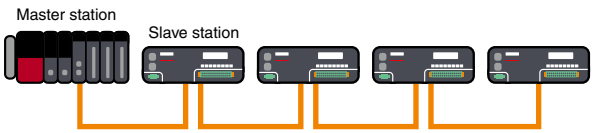


*1. Some devices cannot be connected to CC-Link IE TSN depending on the system configuration.
*2. Class B switching hub supporting CC-Link IE TSN recommended by the CC-Link Partner Association
*3. A device supporting 100 Mbps should be connected following the device supporting 1 Gbps (class B).

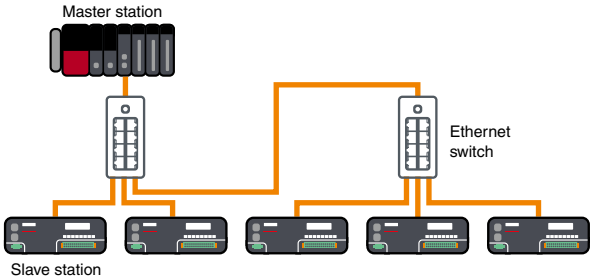
Flexible system configuration with multiple topologies

Line, star, and ring topologies are supported, allowing a flexible system configuration. Use line topology for high-speed, high-performance control. This is realized when a system is configured with CC-Link IE TSN-compatible slave devices only without additional branch lines. Choose a star topology if a more flexible system configuration is needed. Depending on Ethernet switch specifications, slave devices can be easily distributed to achieve the desired system configuration. Ring topology is ideal for systems requiring high reliability. Data communications continue with normal stations even if a cable is disconnected or an error occurs on a slave station via multi-directional communication.

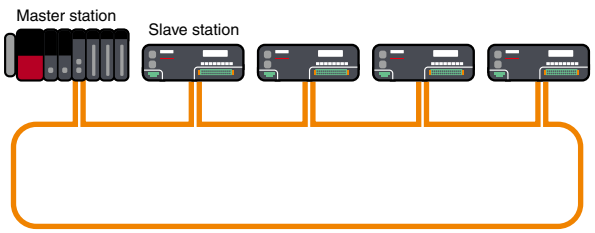
Line topology



Star topology



Ring topology



Block-type safety remote modules

Remote I/O modules that support safety communication functions of CC-Link IE TSN or CC-Link IE Field Network. These modules perform safety control when used together with MELSEC iQ-R Series safety CPU modules.

CC-Link IE TSN

Main safety input module

- Input module with safety functions
- Single or double wiring can be selected per input point
- Compliant with international safety standards, ISO 13849-1 Category 4 PL e and IEC 61508 SIL 3

Spring-clamp terminal block type

NZ2GNSS2-8D

Model	Input type DC input	Input points	Rated input voltage/current	Wiring type
NZ2GNSS2-8D	Negative common	Single wiring: 8 points Double wiring: 4 points	24 V DC (7.3 mA)	2-wire

Main safety output module

- Output module with safety functions
- Single or double wiring can be selected per output point
- Compliant with international safety standards, ISO 13849-1 Category 4 PL e and IEC 61508 SIL 3

Spring-clamp terminal block type

NZ2GNSS2-8TE

Model	Output type Transistor output	Output points	Rated load voltage/ Max. load current	Wiring type
NZ2GNSS2-8TE	Source + source type	Single wiring: 8 points Double wiring: 4 points	24 V DC (0.5 A)	2-wire

Main safety I/O combined module

- I/O combined module with safety functions
- Single or double wiring can be selected per input and output point
- Compliant with international safety standards, ISO 13849-1 Category 4 PL e and IEC 61508 SIL 3
- Embedded fast logic function enables control of safety logic from within the remote module. High-speed control (response speed: 5.8 ms*1) is realized without being affected by the safety CPU module or network

*1. Depends on the parameter settings.

Spring-clamp terminal block type

NZ2GNSS2-16DTE

Model	Input type DC input	Input points	Rated input voltage/current	Output type Transistor output	Output points	Rated load voltage Max. load current	Wiring type
NZ2GNSS2-16DTE	Negative common	Single wiring: 8 points Double wiring: 4 points	24 V DC (7.3 mA)	Source + source type	Single wiring: 8 points Double wiring: 4 points	24 V DC (0.5 A)	2-wire

CC-Link IE Field

Main safety input module

Spring-clamp terminal block type

NZ2GFSS2-8D/NZ2GFSS2-32D

Model	Input type DC input	Input points	Rated input voltage/current	Wiring type	Extension module compatibility
NZ2GFSS2-8D	Negative common	Single wiring: 8 points Double wiring: 4 points	24 V DC (7 mA)	2-wire	●
NZ2GFSS2-32D	Negative common	Single wiring: 32 points Double wiring: 16 points	24 V DC (6 mA)	2-wire	●

Main safety output module

Spring-clamp terminal block type

NZ2GFSS2-8TE

Model	Output type Transistor output	Output points	Rated load voltage/ Max. load current	Wiring type	Extension module compatibility
NZ2GFSS2-8TE	Source + source type	Single wiring: 8 points Double wiring: 4 points	24 V DC (0.5 A)	2-wire	●

Main safety I/O combined module

Spring-clamp terminal block type

NZ2GFSS2-16DTE

Model	Input type DC input	Input points	Rated input voltage/current	Output type Transistor output	Output points	Rated load voltage/ Max. load current	Wiring type	Extension module compatibility
NZ2GFSS2-16DTE	Negative common	Single wiring: 8 points Double wiring: 4 points	24 V DC (7 mA)	Source + source type	Single wiring: 8 points Double wiring: 4 points	24 V DC (0.5 A)	2-wire	●

Extension safety output module

Spring-clamp terminal block type

NZ2EXSS2-8TE

Model	Output type Transistor output	Output points	Rated load voltage/ Max. load current	Wiring type
NZ2EXSS2-8TE*1	Source + source type	Single wiring: 8 points Double wiring: 4 points	24 V DC (0.5 A)	2-wire

*1. Use in combination with NZ2GFSS2-32D.

Waterproof/dustproof type (IP67) safety I/O module

Waterproof connector

NZ2GFS12A2-14DT
NZ2GFS12A2-16DTE

Model	Input type DC input	Input points	Rated input voltage/current	Output type Transistor output	Output points	Rated load voltage/ Max. load current	Wiring type
NZ2GFS12A2-14DT	Negative common	Single wiring: 12 points Double wiring: 6 points	24 V DC (6 mA)	Source + sink type	Single wiring: not possible Double wiring: 2 points	24 V DC (2.0 A)	2-wire
NZ2GFS12A2-16DTE	Negative common	Single wiring: 12 points Double wiring: 6 points	24 V DC (6 mA)	Source + source type	Single wiring: 4 points Double wiring: 2 points	24 V DC (1.0 A)	2-wire

General specifications and product guarantee conditions for co-branded products may vary from those of MELSEC products.

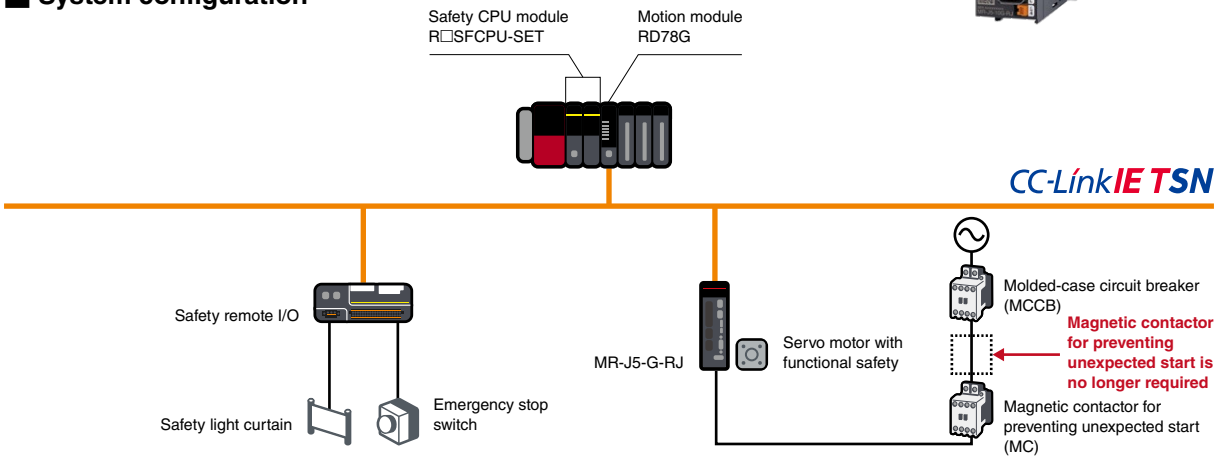
Higher level of safety in coordination with AC servo MELSERVO-J5 Series

The MR-J5-G-RJ supports CC-Link IE TSN safety communication function as standard. Safety sub-functions are used by combining the safety CPU module R□SFCPU-SET with the motion module RD78G/RD78GH. Safety sub-functions of the servo amplifier can be controlled using safety signals of the safety remote I/O connected with CC-Link IE TSN without connecting with the servo amplifier, realizing the safety system with less wiring.

■ AC servo MELSERVO-J5 Series

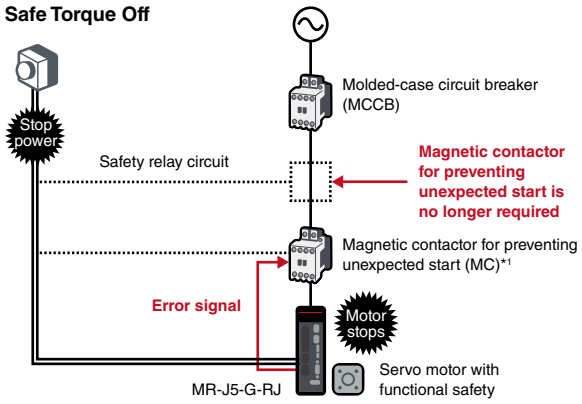
- CC-Link IE TSN (1 Gbps) and safety control part are embedded as standard
- The servo motor HK-KT_WS/HK-ST_WS supporting functional safety complies with SIL 3 safety level
- Provide 10 safety sub-functions complying with IEC 61800-5-2 as SIL 2 or SIL 3 compliant safety level

■ System configuration



■ Support functional safety of IEC/EN 61800-5-2

- Safe Torque Off (STO) is the function categorized as stop category 0 of IEC 60204-1 that corresponds to an immediate removal of power to a motor
- In addition to rotary motors, direct drives and linear servo motors are available with safety sub-functions



Safety level combinations*2

Servo amplifier		MR-J5-G-RJ			
Servo motor		Servo motor with functional safety (HK-KT_WS/HK-ST_WS)		Rotary servo motor (HK Series) Linear servo motor (LM Series) Direct drive motor (TM Series)	
Functional safety category (ISO 13849-1, IEC 62061)		Cat. 4, PL e, SIL 3	Cat. 3, PL d, SIL 2	Cat. 4, PL e, SIL 3	Cat. 3, PL d, SIL 2
STO	Safe Torque Off	●	-	●	-
SS1-t	Safe Stop 1, time controlled	●	-	●	-
SS1-r*3	Safe Stop 1, ramp monitored	●	-	-	●
SS2-t*3	Safe Stop 2, time controlled	●	-	-	-
SS2-r*3	Safe Stop 2, ramp monitored	●	-	-	-
SOS*3	Safe Operating Stop	●	-	-	-
SBC	Safe Brake Control	●	-	●	-
SLS*3	Safely-Limited Speed	●	-	-	●
SSM*3	Safe Speed Monitor	●	-	-	●
SDI*3	Safe Direction	●	-	-	●
SLI*3	Safely-Limited Increment	●	-	-	-
SLT	Safely-Limited Torque	-	●	-	●

*1. Magnetic contactors are not required to meet the STO requirements. However, this illustration recommends the use of a magnetic contactor which shuts off the main circuit power supply of the servo amplifier at an alarm occurrence.

*2. For detailed information, please refer to the "Mitsubishi Electric AC Servo System MELSERVO-J5 Catalog (L(NA)03179ENG)."

*3. A fully closed loop system does not support SS1-r, SS2, SOS, SLS, SSM, SDI, and SLI.

Coordination with FREQROL-E800 Series inverter and MELFA FR Series industrial robot ensures safety and productivity

The FR-E800-SCE inverter is provided with safety functions as standard. The CR800-R robot controller can use safety devices connected to the safety remote I/O modules. Preparing separate safety communication devices or complex wiring are not required.

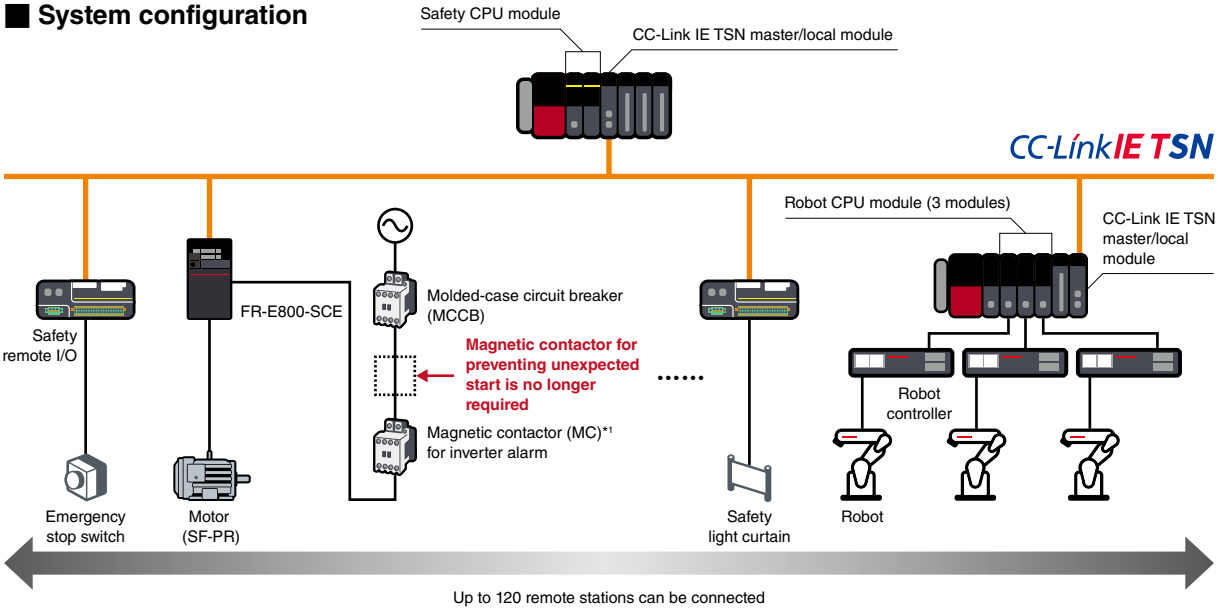
Inverter FREQROL-E800 Series

- CC-Link IE TSN (100 Mbps) and safety control part are embedded as standard
- Efficient protocol enables real-time collection of shop floor data
- Enables mixing of real-time control communication and TCP/IP communication

Industrial robot MELFA FR Series controller CR800-R

- Safety communication and safety programmable controllers reduce the number of safety I/Os and safety relays, realizing a system with less wiring and reduced costs
- Flexible system configuration is possible through coordination with the safety programmable controller utilizing safety communication function

System configuration



Expanded functional safety realizing collaboration of operators and machines

- Compliant with safety sub-functions (IEC 61800-5-2) such as STO (Safe Torque Off) and SLS (Safely-Limited Speed), contributing to operation ensuring operator's safety

		FR-E800-SCE
Functional safety category (ISO 13849-1, IEC 62061)		Cat. 3, PL e, SIL 3
STO	Safe Torque Off	●
SS1	Safe Stop 1, ramp monitored	●
SBC	Safe Brake Control	●
SLS	Safely-Limited Speed	●
SSM	Safe Speed Monitor	●

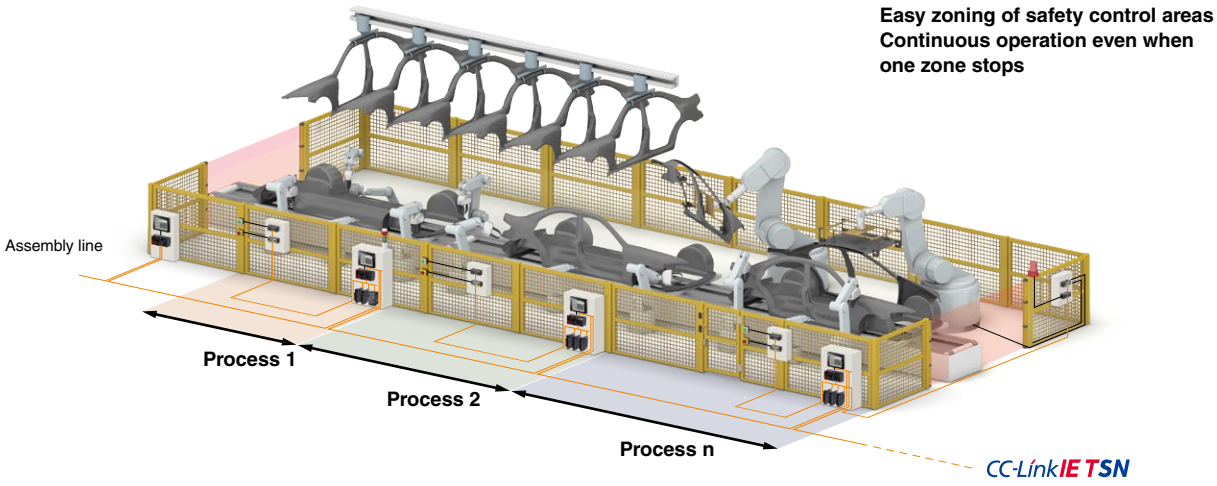
		CR800-R	
Functional safety category (ISO 13849-1, IEC 62061)		Cat. 4, PL e, SIL 3	Cat. 3, PL d, SIL 2
STO	Electrically shuts off power to the motors	●*2	●*2
SS1	After decelerating the motors to stop, the robot goes into the STO state	-	●
SS2	After decelerating the motors to stop, the robot goes into the SOS state	-	●
SOS	Checks that the robot has stopped without shutting off power to the motors	-	●
SLS	Checks that parts of the robot arm do not exceed the speed limit	-	●
SLP	Checks that a predetermined position does not pass through the position monitoring plane	-	●

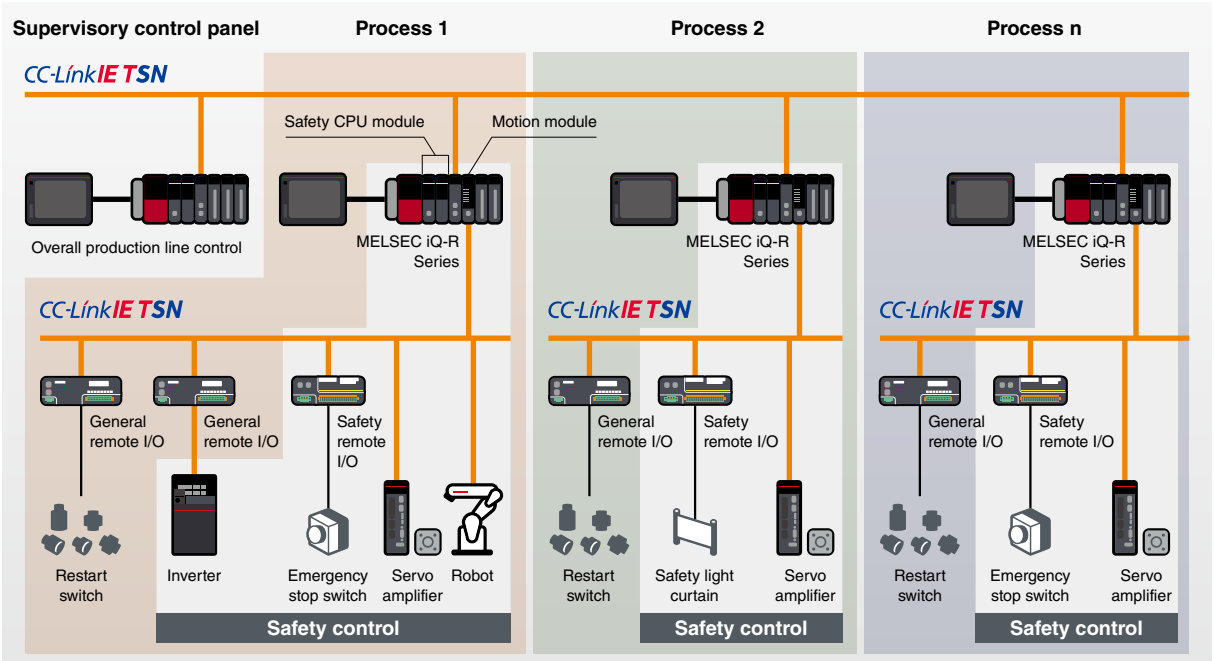
*1. A magnetic contactor is not required when STO is used. However, in this system configuration, one magnetic contactor is used to shut off the power at alarm occurrence.
*2. Functional safety category can be switched by parameter.

Application example

■ Automotive assembly line

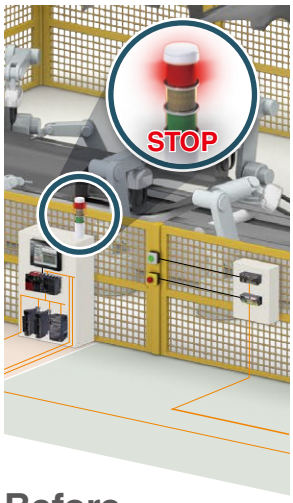
Ensures safety on a large-scale production line and distributed system such as an automotive assembly line with multiple welding robots operating. In systems with multiple stations and safety controllers, critical safety data is shared over the network which allows an emergency stop signal to be sent to the stations before and after within the production line. The safety CPU module is connected using the CC-Link IE TSN with safety communication integrated into the network protocol. Also, the motion module supports safety communication with the AC servo via CC-Link IE TSN. General and safety devices, and drives can be connected together with one CC-Link IE TSN, realizing a reduced wiring and highly scalable system, lowering total cost of ownership (TCO). Up to 120 devices in total can be connected to the CC-Link IE TSN master/local module.





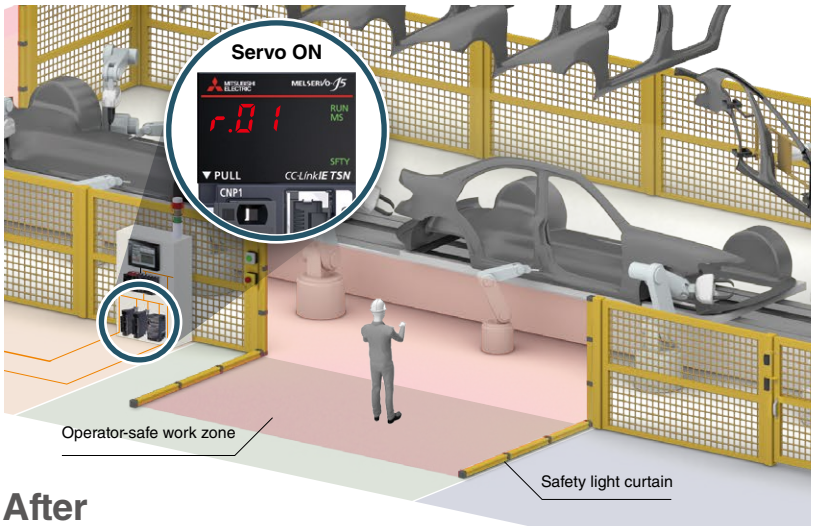
Smooth production restart by utilizing Safe Stop 2 (SS2) and Safe Operating Stop (SOS)

An operator-safe work zone is ensured by providing an exclusion fence around the production robots or stopping the production line when activating the STO (Safe Torque Off) (shuts off power to the servo motors and robots responding to the input signal from a safety light curtain or switch). With MELSERVO-J5 Series and MELFA FR Series, the zone can be ensured by utilizing SS2 and SOS that enable the production line to stop while power to the servo motors and robots is kept supplied, enabling a smooth production restart and ensuring improved productivity without compromising safety.



Before

- Production is stopped when STO is activated
- Restart requires more time

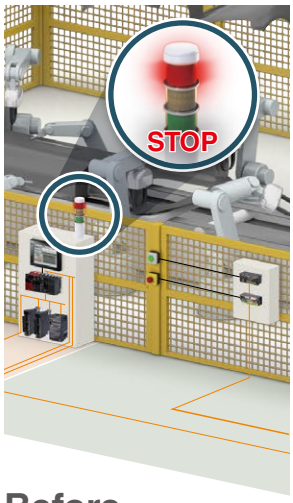


After

- Production is brought to a safe stop (while power to the servo motors and robots is kept supplied)
- Reduction in production restart time

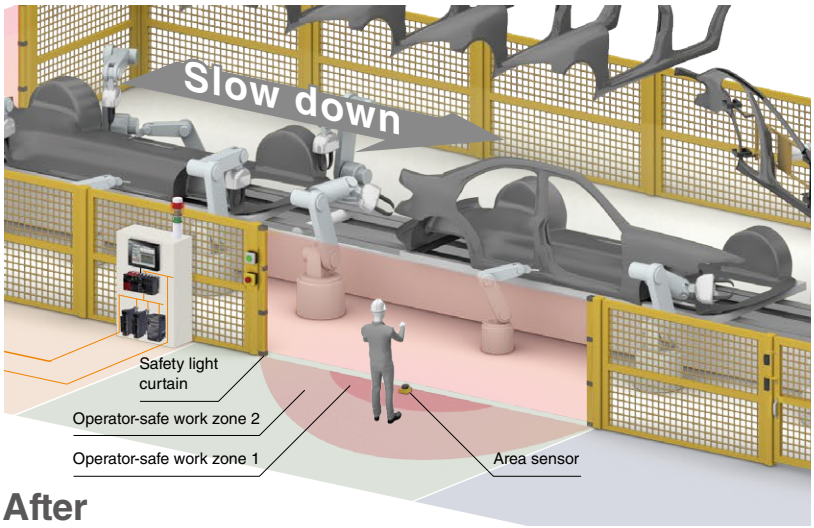
Maintenance while continuously operating machines with Safety-Limited Speed (SLS)

Utilizing the STO (Safe Torque Off), safety of an operator-safe work zone is ensured by enabling the control system to be brought to a safe stop. Safety total solution with the FR-E800-SCE inverter, Safely-Limited Speed (SLS) enables continuous operation with the set frequency without stopping machines when an operator enters the operator-safe work zone.



Before

- Production is stopped when STO is activated



After

- Operation with reduced speed by SLS

Safety Controller
MELSEC-WS Series

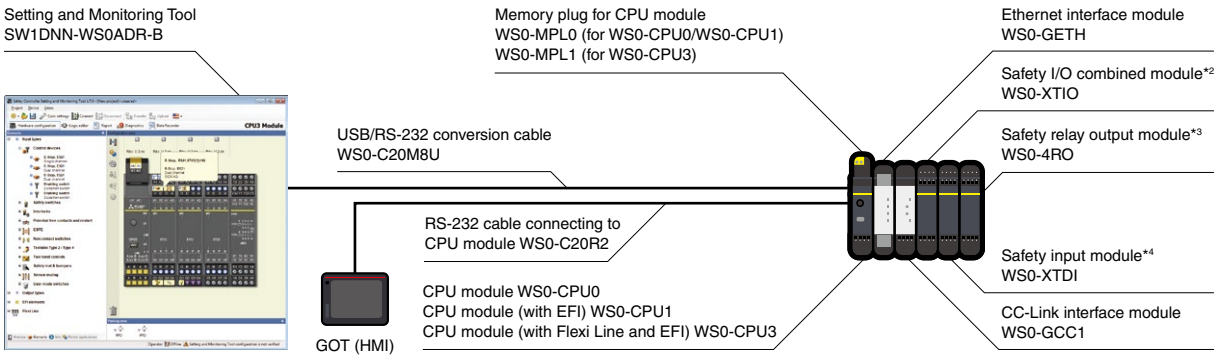
Powered by SICK

The MELSEC-WS Series was developed and manufactured by SICK AG. Sick is a German supplier of safety solutions. For more information, please refer to the relevant product manuals or contact your local Mitsubishi Electric sales office or representative.

This compact safety controller complies with EN ISO 13849-1 Category 4/PL e and IEC 61508 SIL 3 safety standards. It is ideal for small- to medium-scale safety control system. Safety I/O points can be extended to 144 points per CPU module according to the system configuration. Utilizing the dedicated Setting and Monitoring Tool*1, setup and logic creation can be easily done.

*1. For details on how to obtain the tool, please contact your local Mitsubishi Electric sales office or representative.

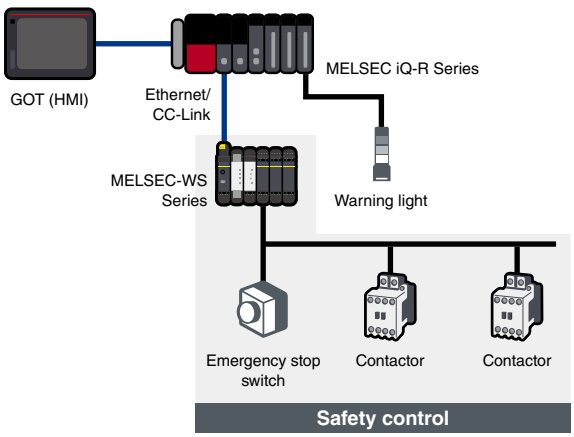
System configuration



*2. No. of input points: 8 points (single wiring), No. of output points: 4 points (single wiring)
*3. Safety relay output: 4 points
*4. No. of input points: 8 points (single wiring)

Safety control can be easily added to existing programmable controllers (CC-Link/Ethernet)

Connecting the safety controller to CC-Link, safety control can be performed with the existing MELSEC iQ-R/Q/L Series module. Furthermore, operation status and error status of the safety controller can be monitored with the programmable controller. This helps quickly identifying the factor of emergency stop and faulty equipment.

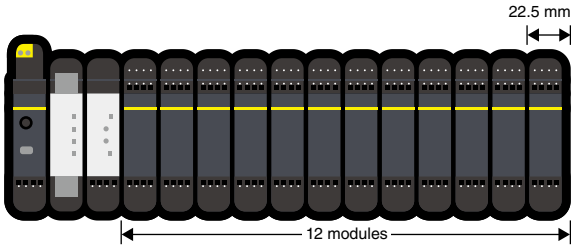


Applicable functions with network interface

	CC-Link (WS0-GCC1)	Ethernet (WS0-GETH)
PLC/PC		
Monitoring information	●	●
Notification data	●	●
Setting and Monitoring tool		
Connection via network	-	●

Flexible extensibility

- Up to 12 safety input and I/O modules, 4 safety relay output modules, and 2 network modules can be installed
- I/O points can be extended to 144 points (single input). Safety input: 96 points (single input) and safety output: 48 points (single output)

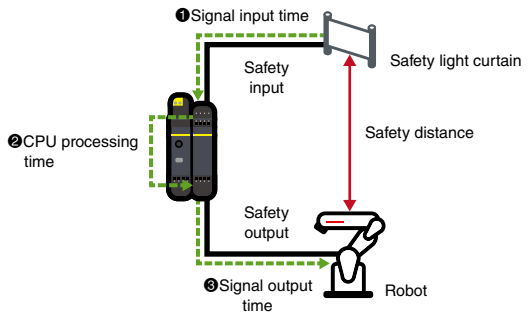


Fast shut off function realizes a response time of 8 ms

Fast shut off function that enables the safety I/O module to shut off safety output without going through the CPU module realizes a response time of 8 ms. Since similar response time is achieved even with increased I/O points, the safety distance can be shortened even in the large-scale safety system.

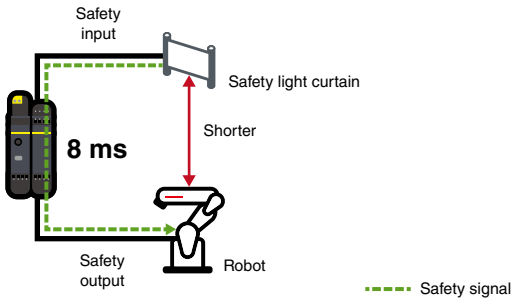
■ Fast shut off function is not used

Response time = ❶ + ❷ + ❸



■ Fast shut off function is used

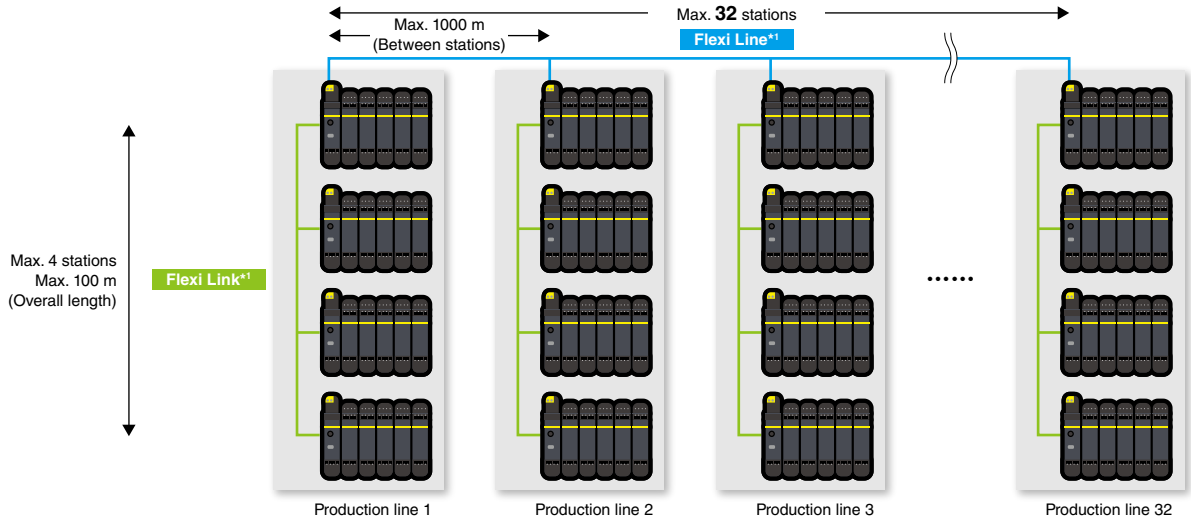
Response time = 8 ms



Flexi Line/Flexi Link

Safety communication network between safety controllers

Safety communications between safety controllers can be easily established at a low cost just by connecting the CPU modules with dedicated cables. Safety communication is realized without a dedicated network module, allowing utilization in various production site. In addition, coordination between multiple devices is possible, improving production system safety.

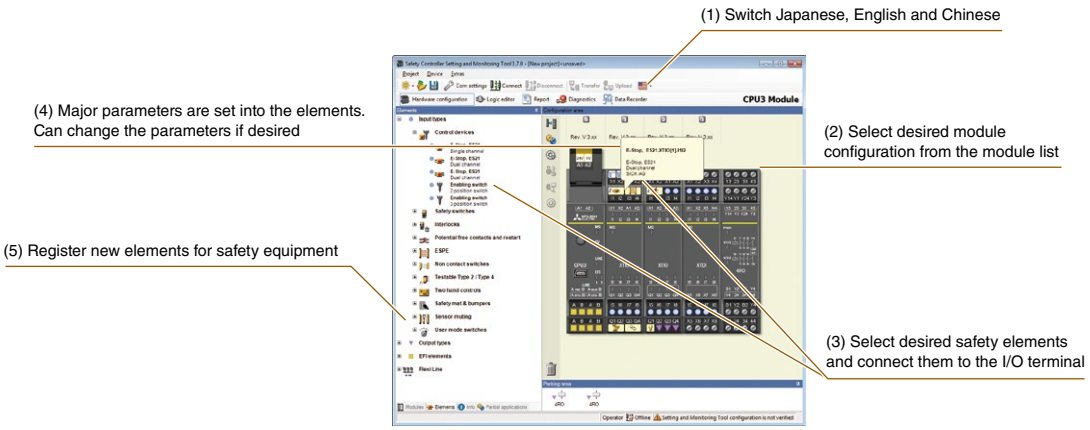


*1. Flexi Line is supported by WS0-CPU3 only and Flexi Link is supported by WS0-CPU1 and WS0-CPU3 only.

Dedicated “Setting and Monitoring Tool*1” provides intuitive system configuration environment

■ Configuration

Hardware configuration can be easily and quickly done using a wide range of elements*2.

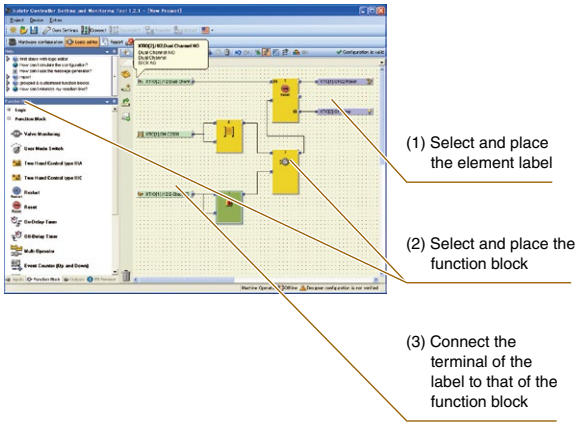


*1. For details on how to obtain the tool, please contact your local Mitsubishi Electric sales office or representative.

*2. Connecting parameters of major safety equipment, such as emergency stop switches, safety door switches and safety light curtains, are expressed by an icon. Make settings simply by drag-and-drop decision. Elements for Safety devices of Mitsubishi's partners are also available. Please contact your local Mitsubishi representative.

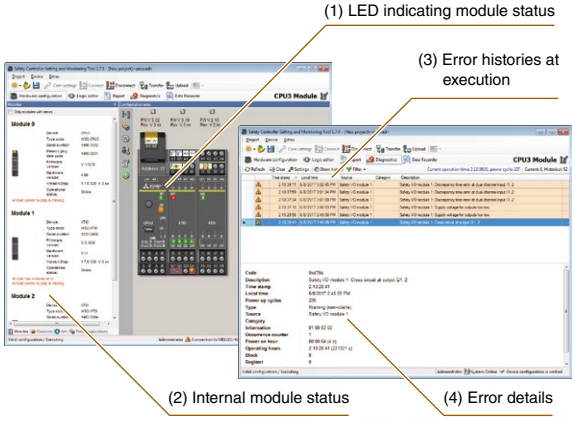
■ Logic Editor

Elements connected to the I/O terminal are automatically labeled, enabling logic creation easier using labels and function blocks.



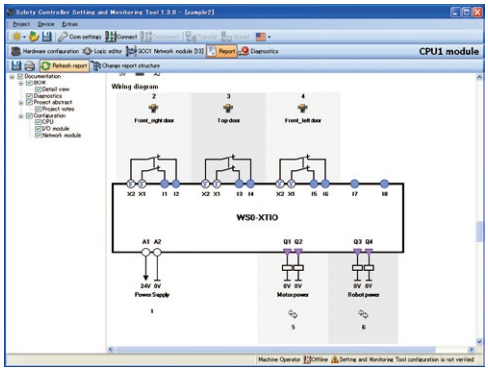
■ Diagnosis/monitor

Monitoring of the internal status of modules and error histories is possible.



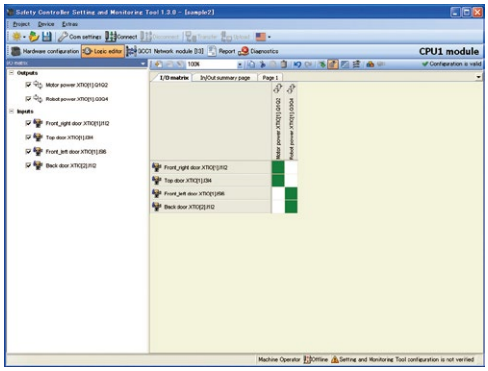
■ Report

The wiring diagram for I/O modules can be automatically created. Report such as error diagnosis can be created, printed, and saved as PDF.



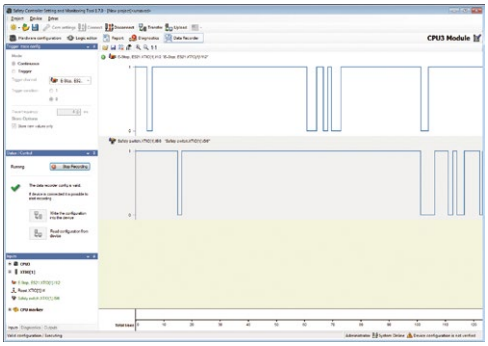
■ I/O matrix

The relation of inputs and outputs can be displayed as a matrix.



■ Data recorder

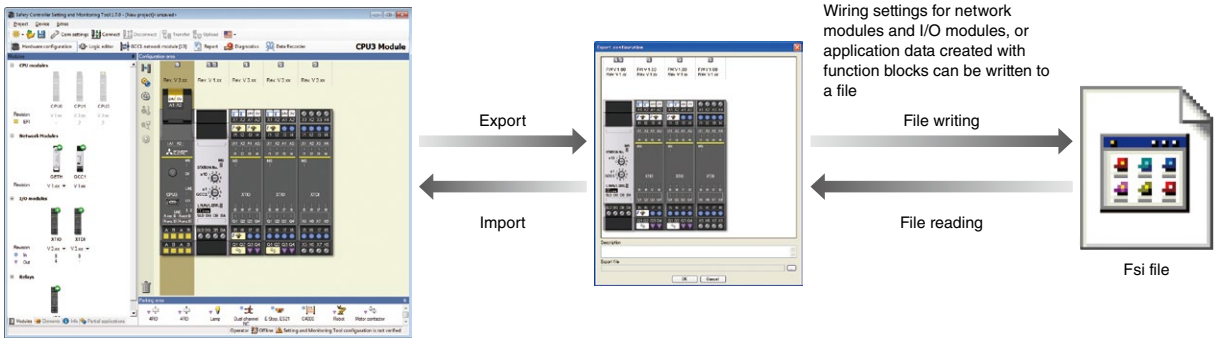
ON/OFF status of safety input signal and safety output signal processed by the safety controller can be stored.*1 Results recorded on the Setting and Monitoring Tool can also be viewed on the computer to utilize for troubleshooting.



*1. Available when a CPU module with firmware version of V2.01 (revision 2.XX) or later and a Setting and Monitoring Tool of V1.7.0 or later are used together.

■ Import and export of logic

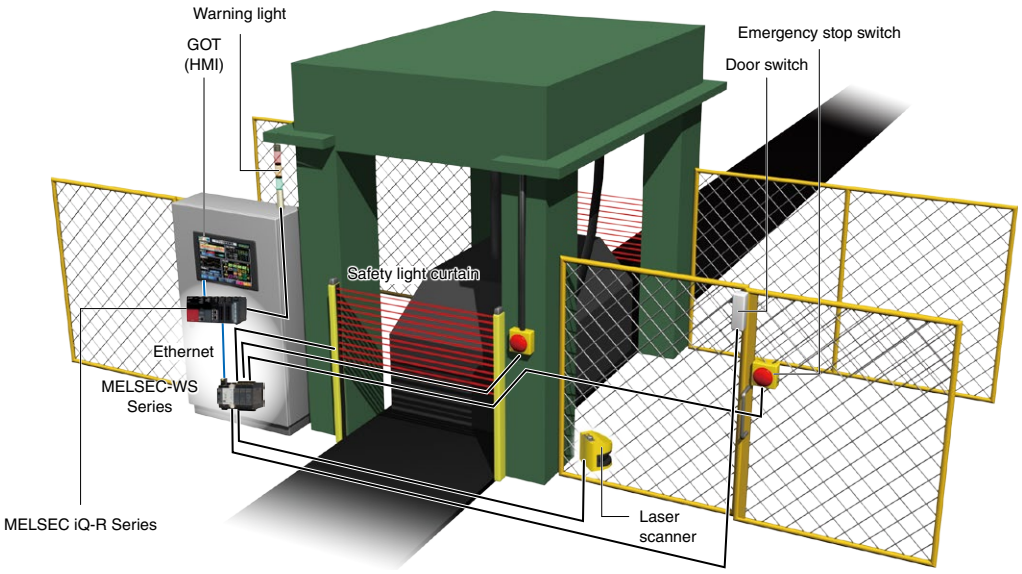
The connection settings to the I/O modules or application logic created with function blocks can be stored in a single setting file, and data can be read out of stored setting files.

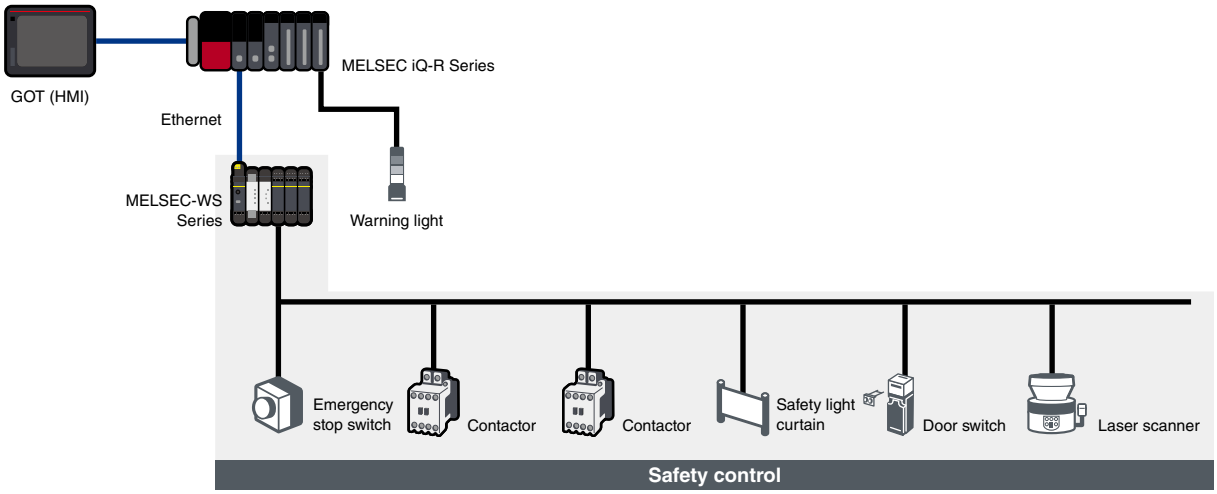


Application example

■ Press machine

The MELSEC-WS Series secures safety of standalone devices such as press machine. The MELSEC-WS Series are compact controllers with flexible features such as extendable I/Os, safety communication between CPUs, communication with a general programmable controller, and fast shut off function realizing faster response times.





Specifications

CPU module specifications

Item	WS0-CPU0	WS0-CPU1	WS0-CPU3
Category	Category 4 (EN ISO 13849-1)		
Safety Integrity Level (SIL)	SIL 3 (IEC 61508)		
Performance Level (PL)	PL e (EN ISO 13849-1)		
PFHd (probability of a dangerous failure per hour)	1.07×10^{-9}	1.69×10^{-9}	
Degree of protection (EN/IEC 60529)	Terminals: IP20, Housing: IP40		
EMC	EN 61000-6-2, EN 55011 (class A)		
Protection class	3		
Number of EFI interfaces	0	2	
Number of Flexi Line interfaces	0		2
Configuration interface	RS-232		RS-232, USB
Weight (kg)	0.11	0.12	0.13
External dimensions (H x W x D, mm)	96.5 x 22.5 x 120.8	101.7 x 22.5 x 120.8	

CC-Link interface module specifications

Item	WS0-GCC1
Station type	Remote device station
CC-Link version	Ver.1.10
Number of stations occupied	1…4
Max. number of connectable modules	Max. 64 stations (number of stations connectable to one master station)
Connection cable	Ver.1.10 compatible CC-Link dedicated cable
Degree of protection (EN/IEC 60529)	Terminals: IP20, Housing: IP40
External dimensions (H x W x D, mm)	96.5 x 22.5 x 120.8

Ethernet interface module specifications

Item	WS0-GETH
Network type	Ethernet (TCP/IP) 100Base-TX 10Base-T
Number of connections	Max. 4 connections + 1 connection (for Setting and Monitoring Tool only)
Degree of protection (EN/IEC 60529)	Terminals: IP20, Housing: IP40
External dimensions (H x W x D, mm)	96.5 x 22.5 x 120.8

Safety input and I/O combined modules specifications

Item	WS0-XTIO	WS0-XTDI
Category	Category 4*1 (EN ISO 13849-1)	Category 4 (EN ISO 13849-1)
Safety Integrity Level (SIL)	SIL 3 (IEC 61508)	
Performance Level (PL)	PL e (EN ISO 13849-1)	
PFHd	0.9×10^{-9} (for dual channel outputs) 4.8×10^{-9} (for single channel outputs)	0.4×10^{-9}
Degree of protection (EN/IEC 60529)	Terminals: IP20, Housing: IP40	
EMC	EN 61000-6-2, EN 55011 (class A)	
Protection class	3	
Weight (kg)	0.16	0.14
Number of input points	8 (single), 4 (double)	
Number of output points	4 (single), 2 (double)	-
External dimensions (H x W x D, mm)	106.5 x 22.5 x 120.8	

*1. It depends on the connection and setting methods with safety output devices. Please refer to the manual for the details.

Safety relay output module specifications

Item	WS0-4RO
Category	Category 4 (EN ISO 13849-1)
Safety Integrity Level (SIL)	SIL 3 (IEC 61508)
PFHd	1.2×10^{-9} (I = 0.75 A, switching frequency = 1/h)*2
Degree of protection (EN/IEC 60529)	Terminals: IP20, Housing: IP40
EMC	EN 61131-2, EN 61000-6-2, EN 55011 (class A)
Weight (kg)	0.19
Output circuit specs (13-14, 23-24, 33-34, 43-44)	
Number of NO contacts	2 (double output)
Output circuit specs (Y1-Y2, Y3-Y4)	
Number of NC contacts	2
Output circuit specs (Y14, Y24)	
Number of NO contacts	2
External dimensions (H x W x D, mm)	106.5 x 22.5 x 120.8

*2. It depends on output current or other output values. Please refer to the manual for the details.

Safety Extension Module

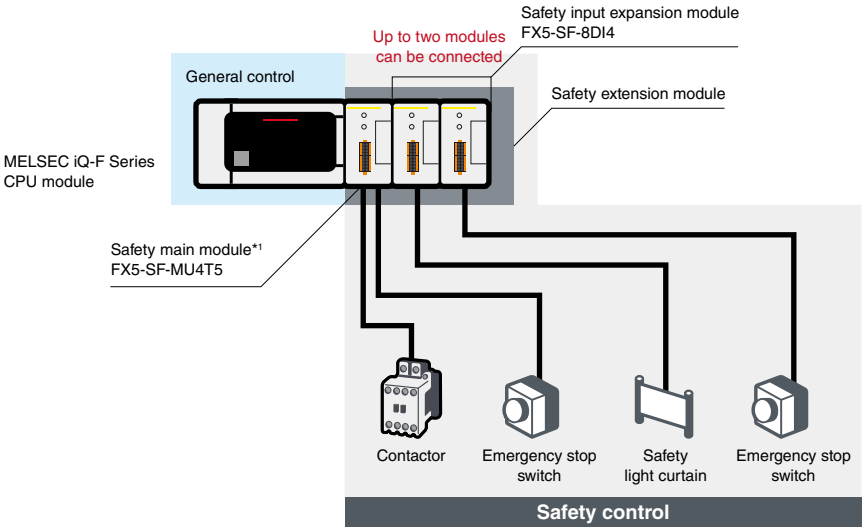
MELSEC iQ-F Series

Powered by SICK

The MELSEC iQ-F Series safety extension module was developed and manufactured by SICK AG. SICK is a German supplier of safety solutions. For more information, please refer to the relevant product manuals or contact your local Mitsubishi Electric sales office or representative.

The MELSEC iQ-F Series safety extension module is compliant with international safety standards EN ISO 13849-1 Category 4 PL e and IEC 61508 SIL 3. Safety control of a small sized equipment is easily realized with easier settings without a program. Just connecting with the CPU module executes safety control, enabling both general and safety control in one system.

System configuration

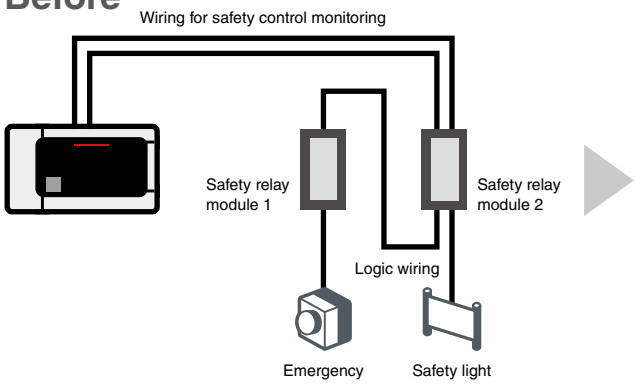


*1. Up to one safety main module can be connected. The extension module for general control cannot be connected following the safety extension module.

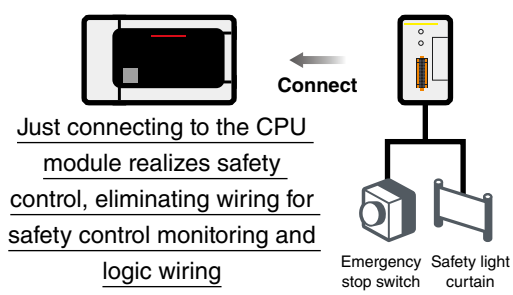
Realizes safety control with less wiring and minimal space

The safety control system can be configured by connecting the safety extension modules with the CPU module. Wiring for safety control monitoring and logic wiring between safety relays are no longer required, reducing wiring cost and space.

Before

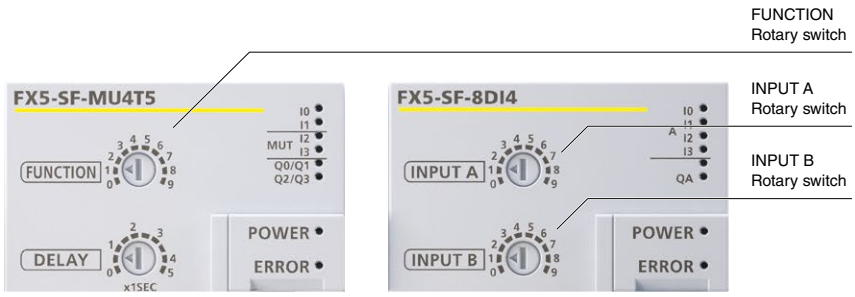


After



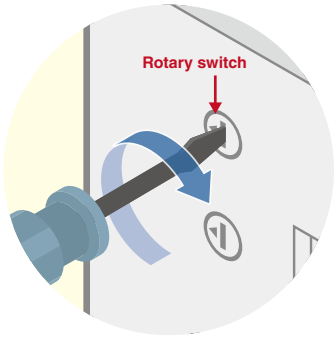
Turn the rotary switch to select a built-in program

Each safety extension module has nine different programs installed. The safety control system can be configured simply by selecting a program with the rotary switch on the front and enabling the setting. It is no longer necessary to create a control program for safety control.



Safety main module
FX5-SF-MU4T5

Safety input expansion module
FX5-SF-8DI4

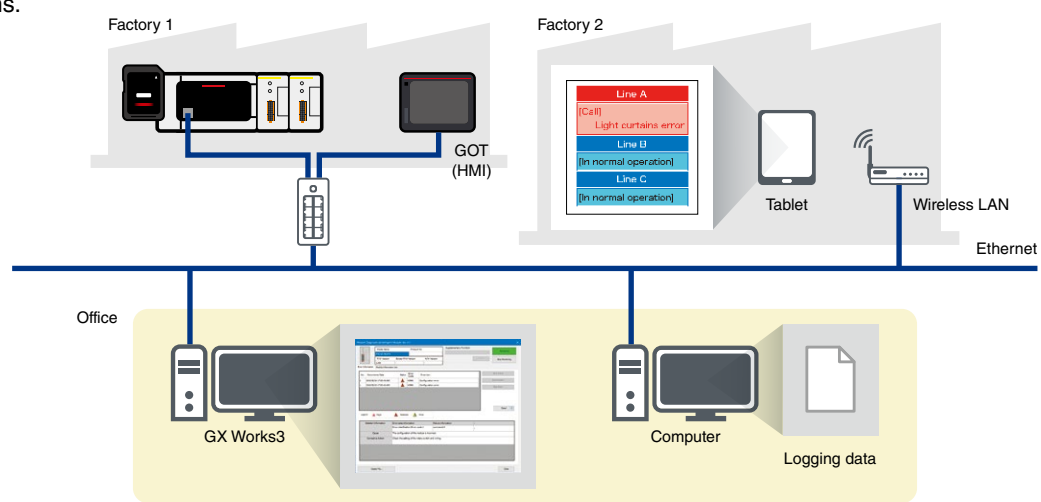


Program list

Program	Safety main module FX5-SF-MU4T5	Safety input expansion module FX5-SF-8DI4
0	Inactive	
1	OR control (1)	AND link (single channel)
2	OR control (2)	AND link (dual channel) (1)
3	Muting control	AND link (dual channel) (2)
4	Two-hand control (1)	AND link (dual channel) (3)
5	Two-hand control (2)	AND link (dual channel) (4)
6	AND control (1)	AND link (dual channel) (5)
7	AND control (2)	OR link (dual channel)
8	Independent control	Bypass
9	AND control (3)	All paths batch connection

Interconnectivity with external devices visualizes the equipment status

Information can be shared on the factory floor through interconnectivity between devices utilizing built-in function of the FX5U/FX5UC/FX5UJ CPU modules and a GOT (HMI). Additionally, the safety status of equipment can be monitored (including error monitoring and information collection) via network from an office or other remote locations.



Check the wiring with Safety Extension Module Configuration Guide

The MELSEC iQ-F Series Safety Extension Module Configuration Guide*1 is a useful tool to check the system configuration, settings, and wiring of the safety extension module. Connected terminals of I/O devices, wiring diagram, and rotary switch setting change can be checked and also the created wiring diagram can be printed.

❶Place the safety extension module.

⬇

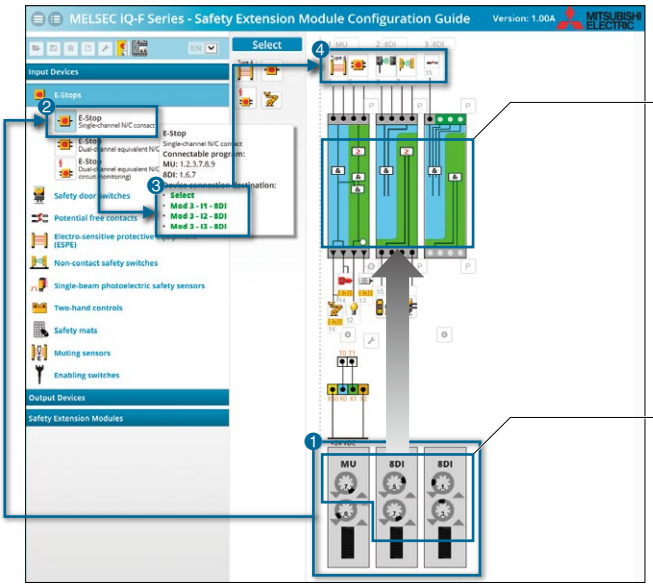
❷Click the device to connect.

⬇

❸Select the connection destination.

⬇

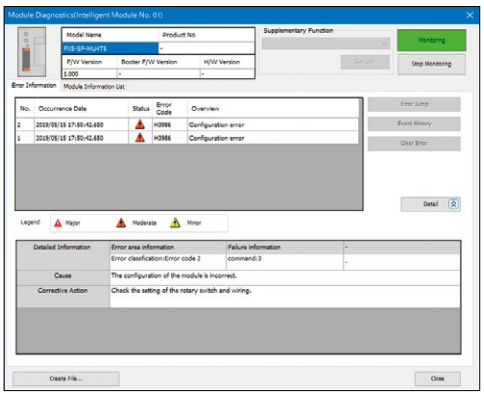
❹The set device is applied to the configuration.

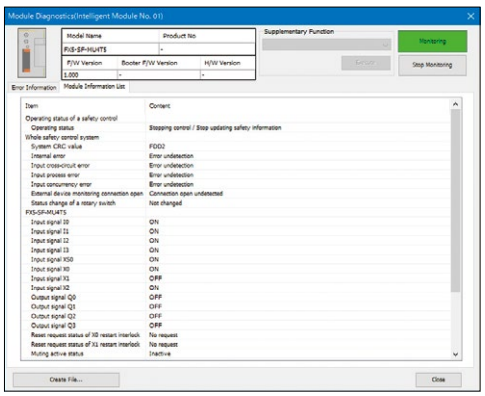


*1. For details on how to obtain the tool, please contact your local Mitsubishi Electric sales office or representative.

Module diagnostics with GX Works3

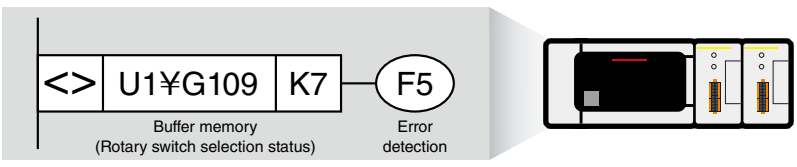
Safety extension module information such as its I/O, settings, and error codes is stored in the buffer memory in the safety main module. The error history can be recorded up to 16 items. When an error occurs, information such as the error details or countermeasures can be checked from the module diagnosis function of GX Works3, making troubleshooting easier.





Settings and I/O status of the safety devices can be checked from the buffer memory. General control operation can be changed under safe control (when equipment is under safe operation or at an emergency stop). Since monitoring of the status is possible from the CPU module, settings of control program can be checked to notify the operator for measures, reducing troubleshooting time.

Notify that program 7 is not set to the set program



Notifying that program 7 is not set

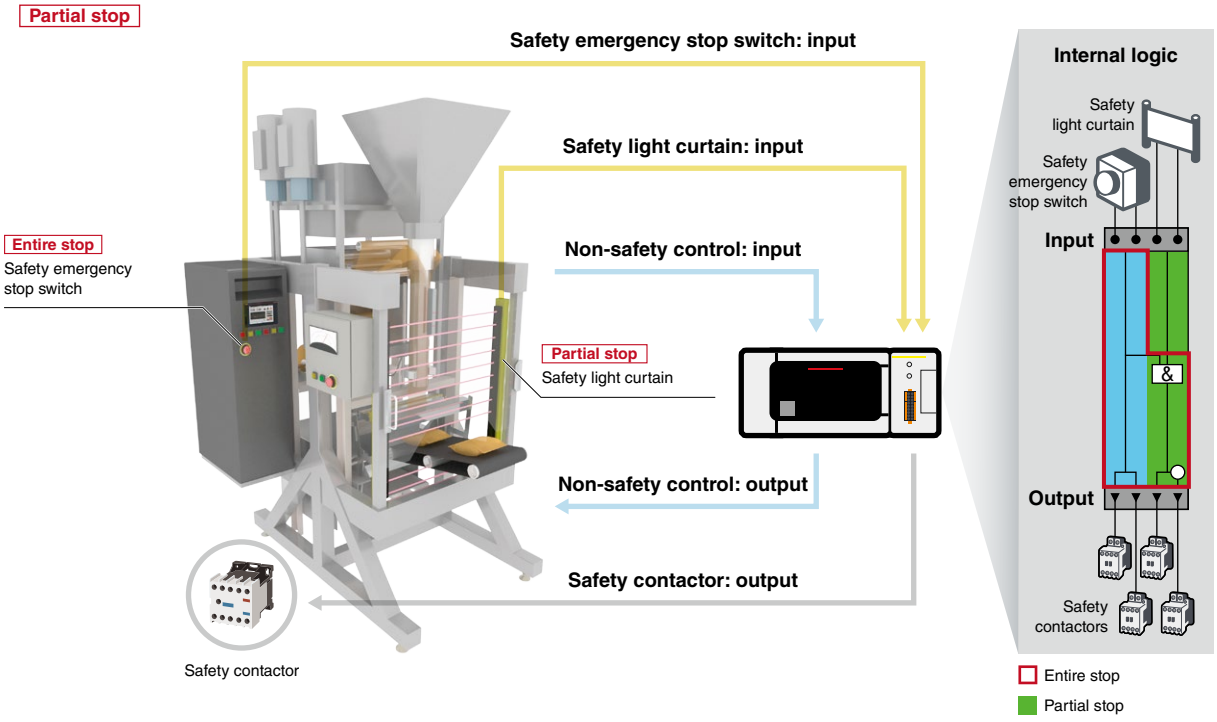
Application example

■ Packaging machine

When a safety extension module is embedded with a packaging machine, pressing a safety emergency stop switch stops all the safety contactors. While, a safety light curtain detects a person, only the safety contactors of the processing part will stop.

Program number: 7 Overview: AND control (2)

- When the safety emergency stop switch is pressed, all the safety contactors are stopped **Entire stop**
- When the safety light curtains detect a person, only the safety contactors in the processing part are stopped **Partial stop**



Specifications

Item	Safety main module FX5-SF-MU4T5	Safety input expansion module FX5-SF-8DI4
Category	Category 4 (DIN EN ISO 13849-1)	
Safety Integrity Level (SIL)	SIL 3 (IEC 61508)/SIL CL 3 (IEC 62061)	
Performance Level (PL)	PL e (DIN EN ISO 13849-1)	
PFHd (probability of a dangerous failure per hour)	1.5×10^{-8}	
Degree of protection (EN/IEC 60529)	IP54 (IEC 60529)	
EMC	EN 61000-6-2, EN 61131-2, DIN EN 61326-3-1, EN 55011 (class A)	
T_M (mission time)	20 years (EN ISO 13849-1)	
Weight (kg)	0.3	0.25
External dimensions (H x W x D, mm)	90 × 50 × 102.2	
Safety input		
Number of input points	4	8
Input voltage (ON) (V DC)	13 or more (13…30)	
Input voltage (OFF) (V DC)	5 or less (–5…5)	
Input current (ON) (mA)	3 (2.4…3.8)	
Input current (OFF) (mA)	2.1 or less (–2.5…2.1)	
Safety output		
Number of output points	4	-
Output method	PNP output (source output), short-circuit protection, cross-circuit detection*1	-
Output voltage (V DC)	18.4…30.0	-
Supported conditions		
Compatible CPU module	FX5U/FX5UC: Ver. 1.200 or later, FX5UJ: Ver. 1.010 or later	
Engineering tool	FX5U/FX5UC: GX Works3 Ver. 1.060N or later, FX5UJ: GX Works3 Ver. 1.075D or later	

*1. A cross-circuit detection is performed only in the module.

MITSUBISHI ELECTRIC ENGINEERING COMPANY LIMITED

Cables pre-connected with spring-clamp terminal block are available

Various components that reduce wiring time of Mitsubishi Electric programmable controller, servo system and GOT (HMI) contribute to productivity and cost reduction. Spring-clamp terminal blocks offer efficiency and stable quality which are increasingly demanded in the production site. A lineup includes spring-clamp terminal blocks with cables pre-connected which can be used with Mitsubishi Electric safety control devices.

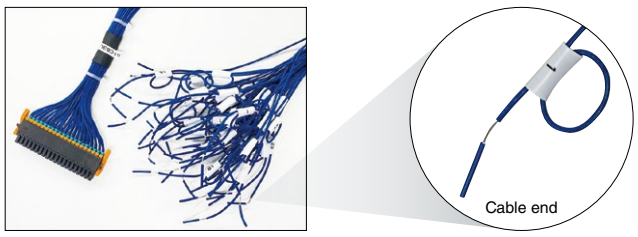
Cable with spring-clamp terminal block

■ Unbundled cables

- Cables are pre-connected with the Phoenix spring-clamp terminal block, eliminating tasks such as replacement of crimping terminals and wiring
- Two types of wires with 0.3 mm^2 (maximum current: 4 A) and 0.75 mm^2 (maximum current: 8 A) are available according to applications
- Compatible with programmable controller spring-clamp terminal blocks 18P, 34P, and 40P

For spring-clamp terminal block 40P (1, 2, 3 m)

FA1-CB3L03SQ□□E1F40
FA1-CB3L07SQ□□E1F40



Compatible products*1

Type	Model
CC-Link IE TSN block-type safety remote I/O modules	NZ2GNSS2-8D, NZ2GNSS2-8TE, NZ2GNSS2-16DTE
CC-Link IE Field Network block-type safety remote I/O modules	NZ2GFSS2-8D, NZ2GFSS2-32D, NZ2GFSS2-8TE, NZ2GFSS2-16DTE, NZ2EXSS2-8TE

*1. Unbundled cables connectable to the MELSEC iQ-R/iQ-F Series with spring-clamp terminal block type (18P, 34P) are also available.

MITSUBISHI ELECTRIC ENGINEERING COMPANY LIMITED
NAGOYA ENGINEERING OFFICE | 1-9, Daiko-Minami, 1-Chome, Higashi-ku, Nagoya, Aichi 461-0047 Japan

Providing safety devices to cover a wide range of requirements, assuring a safe environment for operators and machines

By thoroughly pursuing safety of environment where humans and machines work together, IDEC Corporation develops products and proposes system giving safety top priority to ensure personnel safety even if machines become faulty or operators make a mistake. To enhance safety and productivity, IDEC provides a variety of functional safety products. IDEC also supports customers to improve safety at production sites by providing support with appropriate safety products and safety systems according to risks.

Interlock switches
HS1, HS3, HS5, HS6

Interlock switches allow a machine to start only when the guard is closed or the closed guard is locked.

Safety laser scanner SE2L
Safety light curtains SE4D

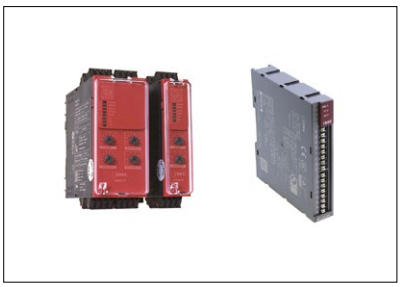
Light beams and laser beams are used to safeguard personnel. New model laser scanner is the world smallest with safety protection zone of 5 m and 270°. High functional model configurable using Master and Slave configuration.

Emergency stop switches
XA, XW, XN

IDEC's unique technology achieves high safety levels and satisfies international safety requirements.

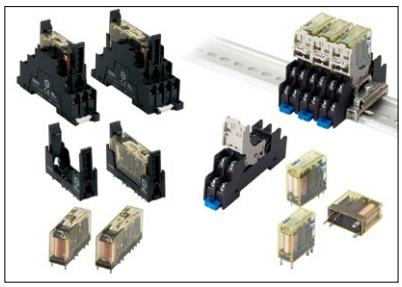
Enabling switches
HE2B, HE3B, HE6B

Safety devices for preventing unexpected starting of a machine when operation is required in the hazardous area inside the guard.



Safety relay modules
HR5S, HR6S

Advanced diagnostic and output functions available with the new HR6S. Categories 1 to 4 can be achieved with HR5S and HR6S safety relay modules.



Force guided relays
RF1, RF2

Detects contact welding. 2-, 4-, and 6-pole forced guided relays available.

IDEC CORPORATION

Head Office 6-64, Nishi-Miyahara-2-Chome, Yodogawa-ku, Osaka 532-0004, Japan

www.idec.com

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EMEA	APEM SAS	**Thailand**	IDEC Asia (Thailand) Co., Ltd.		IDEC Izumi (H.K.) Co., Ltd.		
		India	IDEC Controls India Private Ltd.	**Taiwan**	IDEC Taiwan Corporation		

SICK
Sensor Intelligence.

State-of-the-art safety system satisfying the international standard

As well as efficiency and high-speed performance, operational safety is fundamental requirement of factory automation. At a factory where machines operate, safety measure needs to be taken in the blind zones around machines. SICK safety system is the ideal products for machinery safety. The product lineups include advanced products which meet high safety standard of Europe such as safety light curtains and safety laser scanners, etc. These best-in-class products in Europe provide strong support to customers worldwide.

Safety light curtain
deTec4 Core

Simple assembly with innovative mounting. Up to 15 m scanning range, ambient operating temperature of -30°C to +55°C. Flexi Loop-compatible M12 (5 pin) male connector.

Safety laser scanner
microScan3 Core I/O

Innovative safeHDDM® scanning technology. Scanning angle: 275°, protective field range: 4.0 m, 5.5 m, and 9.0 m. Realizes reliable performance immune to ambient light and dust.

Transponder safety switches
STR1

High level of prevention against tampering. Universally coded, uniquely coded, and permanently coded sensors are available. Fast diagnostics via LED status indicator. OSSDs safety outputs type.

Safety light curtain
deTec4

Upper range model designed further developing the product concept of deTec4 Core. Cascade connection up to three devices. Scanning range up to 30 m.

The smallest safety laser scanner
nanoScan3 Pro I/O

Innovative safeHDDM® scanning technology. Scanning angle: 275°, protective field range: 3.0 m. Safety collision prevention and localization for AGC, AGV, and AMR (Autonomous Mobile Robot).

Magnetic safety switches
RE1, RE2

Robust and long product life cycle with less maintenance design. Compact housing can be installed with a minimum use of space.

SICK AG

Erwin-Sick-Str. 1 79183 Waldkirch Germany TEL: +49 (0)7681 202-0 http://www.sick.com

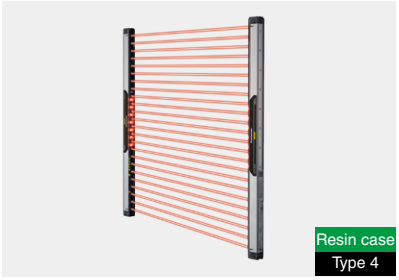
Panasonic

Diverse lineup of variety of safety light curtains and safety sensors

Safety regulations have been implemented around the world and safety product designs according to the risk level is the fundamental requirement. Panasonic Industrial Devices SUNX's safety light curtains and safety sensors, with their concept of "support for both safety and productivity", keep evolving and are available in a wide variation through extensive global distribution network.

Safety light curtain
SF4D Series

The SF4D Series are standard safety light curtains featuring robust and high-performance, and available from variety of types supporting minimum sensing object, Japanese press, etc.



Compact safety light curtain
SF4B-C Series

Realizes "compact", "light", and "optimum cost". Mounts flush on aluminum frames. Compact profile design, maximize the machinery opening area.

Ultra-slim safety light curtain
SF4C Series

Ultra-slim type with a slimness of 13 mm. Finger type with a shorter safety distance fits into a smaller equipment.

Ultra-slim safety light curtain
SF2C Series

Competitively priced Type 2 has been added to the Ultra-slim type Series with a slimness of 13 mm. Reduces wiring and adjusting beam axis is easy.

Safety beam sensor
ST4 Series

Safety beam sensor that can be used from a single beam axis. A standard sensor size can ensure safety in a narrow area.

Safety liquid leak sensor
SQ4 Series

Controls abnormal liquid leak in two stages. Improves productivity and ensures safety of personnel.

Panasonic Industrial Devices SUNX Co., Ltd. **Global Sales Department**
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EUCHNER

EUCHNER - More than Safety

EUCHNER is a pioneer and world leader for Safety Systems for safeguarding humans and processes machine doors and safety guards. For more than 60 years, EUCHNER has been developing and producing high-quality electromechanical and electronic systems. Industrial safety engineering is our core business. Our safety switches and electronic key system reliably safeguard and monitor safety doors on machines and installations. We help to minimize risks and to increase product quality and productivity.

Multifunctional Gate Box MGB/MGB2/MGBS

Among safeguarding against dangerous machine movements, the MGB combines integrated operating functions with a simple and robust design. Intuitive operation is guaranteed.

Transponder-coded safety switches with guard locking CET/CTP/CEM/CTA

Safety switches with guard locking are used to prevent unintentional opening of a safety doors or covers while dangerous machine movements are being performed.

Transponder-coded safety switches with guard locking CES

CES safety switches monitor safety doors and covers on machines and installations. Depending on the application, various technologies and functional principles are available.

Key Adapter for external Transponder-coded evaluation CKS

CKS provides enhanced key reading for safety applications in PL e Category 4. Versatile use, e.g. as a lockout mechanism, authorization for selecting operating modes, key transfer system.

Electronic-Key-System EKS

Typical applications for the EKS are the controlling and management of access rights for machinery. The EKS is an open system specifically designed for industrial use.

Enabling switches ZS

Enabling switches are used wherever personnel must work in the danger area on machines and installations. The robust and ergonomic design is suitable for numerous applications.

EUCHNER GmbH + Co. KG KohlhammerstraBe 16 D-70771 Leinfelden-Echterdingen
TEL: +49 711 7597-0 FAX: +49 711 753316 http://www.euchner.de

Factory Automation Global website

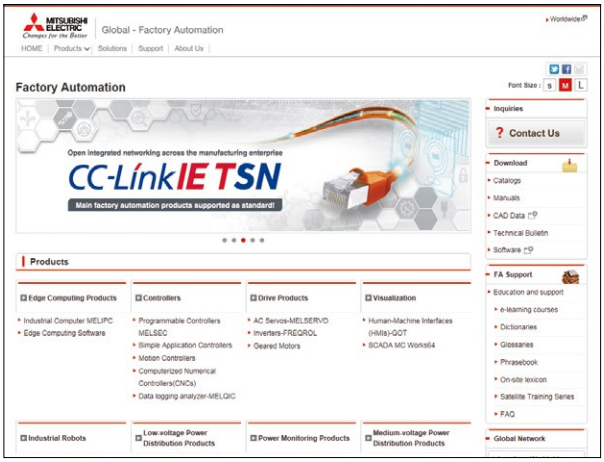
Mitsubishi Electric Factory Automation provides a mix of services to support its customers worldwide.
A consolidated global website is the main portal, offering a selection of support tools and a window to its local Mitsubishi Electric sales and support network.

■ From here you can find:

- Overview of available factory automation products
- Library of downloadable literature
- Support tools such as online e-learning courses, terminology dictionary, etc.
- Global sales and service network portal
- Latest news related to Mitsubishi Electric factory automation

Mitsubishi Electric Factory Automation Global website:

www.MitsubishiElectric.com/fa



Online e-learning

An extensive library of e-learning courses covering the factory automation product range has been prepared.
Courses from beginner to advanced levels of difficulty are available in various languages.

■ Beginner level

Designed for newcomers to Mitsubishi Electric Factory Automation products gaining a background of the fundamentals and an overview of various products related to the course.

■ Basic to Advanced levels

These courses are designed to provide education at all levels. Various different features are explained with application examples providing an easy and informative resource for in-house company training.

Innovative next-generation, e-Manual

e-Manual Viewer

The e-Manual viewer is a next-generation digital manual offered by Mitsubishi Electric that consolidates factory automation products manuals into an easy-to-use package with various useful features integrated into the viewer. The e-Manual allows multiple manuals to be cross-searched at once, further reducing time for setting up products and troubleshooting.

■ Key features included

- One-stop database containing all required manuals, with local file cache
- Included with GX Works3 engineering software
- Also available in tablet version
- Easily download manuals all at once
- Multiple users can share the latest manuals and knowhow with document sharing function
- Directly port sample programs within manuals to GX Works3
- Downloaded manuals are usable offline

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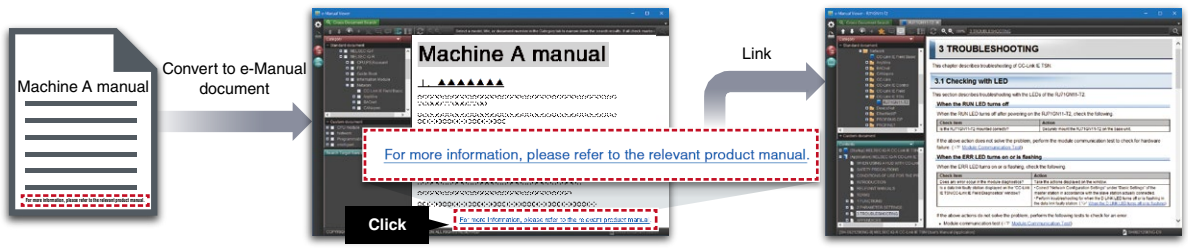
e-Manual Create

e-Manual Create is software for converting word files and chm files to e-Manual documents. e-Manual Create allows users to directly refer to Mitsubishi Electric e-Manuals from user's customized device maintenance manuals and such, supporting quick troubleshooting and reduction in document creation process.



Windows®

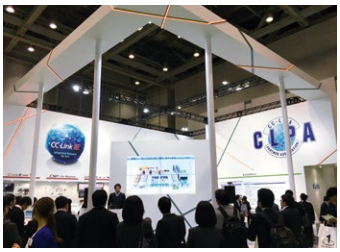
* To obtain the Windows® version of e-Manual Viewer and e-Manual Create, please contact your local Mitsubishi Electric sales office or representative.

CC-Link Partner Association (CLPA) - Actively promoting worldwide adoption of CC-Link networks

Proactively supporting CC-Link, from promotion to specification development

The CC-Link Partner Association (CLPA) was established to promote the worldwide adoption of the CC-Link open-field network. By conducting promotional activities such as organizing trade shows and seminars, conducting conformance tests, and providing catalogs, brochures and website information, CLPA activities are successfully increasing the number of CC-Link partner manufacturers and CC-Link-compatible products. As such, CLPA is playing a major role in the globalization of CC-Link.

Seminar



Trade show

Conformance testing lab

Visit the CLPA website for the latest CC-Link information.

URL:www.cc-link.org

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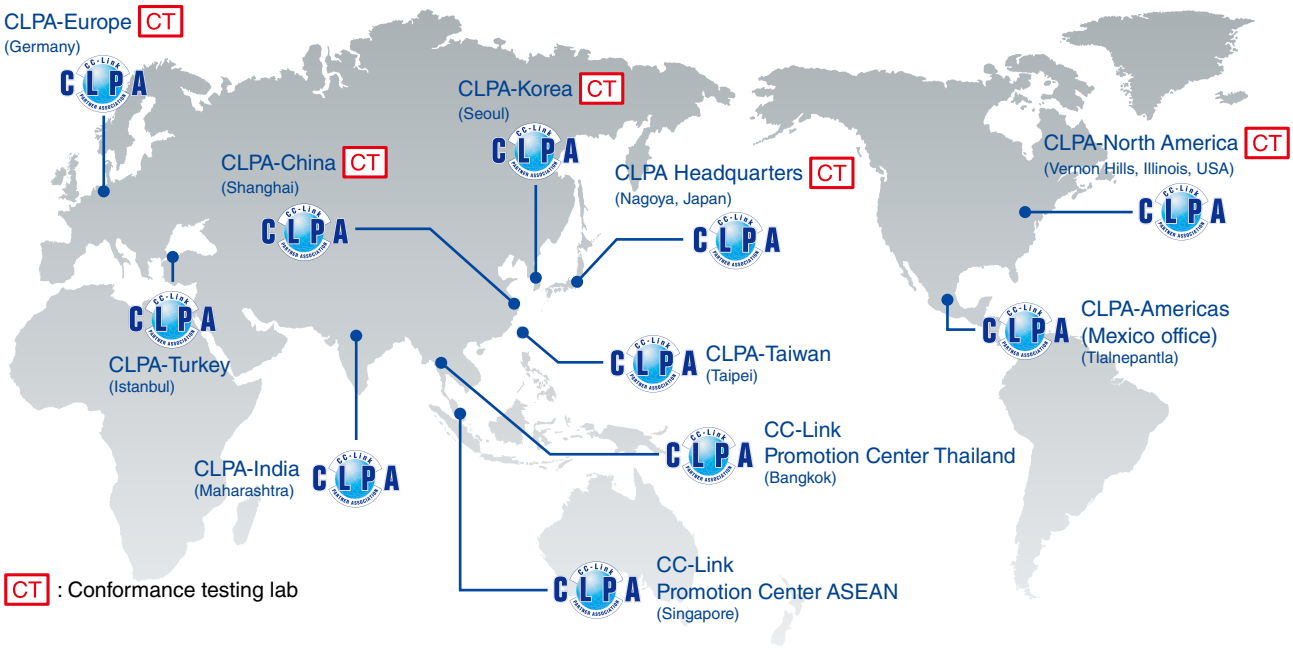
Kita-ku, Nagoya 462-0825, JAPAN
TEL: +81-52-919-1588 FAX: +81-52-916-8655
e-mail: info@cc-link.org

CC-Link Partner Association

Global influence of CC-Link continues to spread

CC-Link is supported globally by CLPA. With offices throughout the world, support for partner companies can be found locally. Each regional CLPA office undertakes various support and promotional activities to further the influence of CC-Link/CC-Link IE in that part of the world. For companies looking to increase their presence in their local area, CLPA is well placed to assist these efforts through offices in all major regions.



Extensive global support coverage providing expert help whenever needed

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UK FA Center
MITSUBISHI ELECTRIC EUROPE B.V. UK Branch
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Czech Republic FA Center
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Italy FA Center
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India Coimbatore FA Center
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India Pune FA Center
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Mexico Monterrey FA Center
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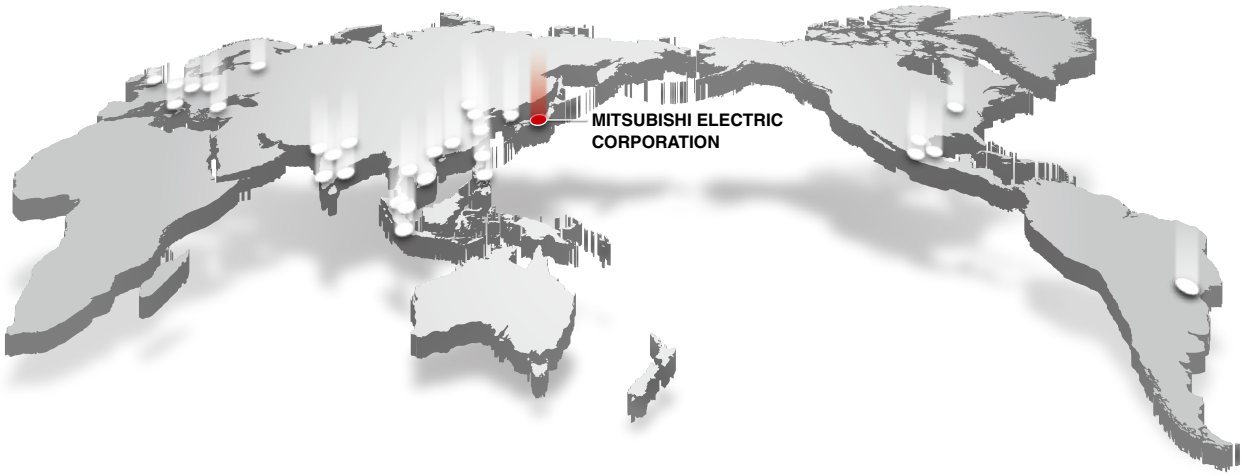

General specifications/Product list

General specifications*1

<table>
<tr><th>Item</th><th colspan="6">MELSEC iQ-R Series
Safety CPU module</th><th>MELSEC iQ-F Series
Safety extension module*2</th><th>MELSEC-WS Series</th></tr>
<tr><td>Operating ambient temperature</td><td colspan="6">0…55°C (when a base unit other than an extended temperature range base unit is used)
0…60°C (when an extended temperature range base unit is used)*3</td><td>–20…50°C</td><td>–25…55°C*4</td></tr>
<tr><td>Storage ambient temperature</td><td colspan="6">–25…75°C</td><td>–25…70°C</td></tr>
<tr><td>Operating ambient humidity</td><td colspan="6">5…95% RH, non-condensing</td><td>10…95% RH, non-condensing</td></tr>
<tr><td>Storage ambient humidity</td><td colspan="6">5…95% RH, non-condensing</td><td>10…95% RH, non-condensing</td></tr>
<tr><td rowspan="5">Vibration resistance</td><td rowspan="5">Compliant with JIS B 3502 and IEC 61131-2</td><td>-</td><td>Frequency</td><td>Constant acceleration</td><td>Half amplitude</td><td>Sweep count</td><td colspan="2" rowspan="5">10-500 Hz/5 g (EN 60068-2-6)</td></tr>
<tr><td rowspan="2">Under intermittent vibration</td><td>5…8.4 Hz</td><td>-</td><td>3.5 mm</td><td rowspan="2">10 times each in X, Y, Z directions</td></tr>
<tr><td>8.4…150 Hz</td><td>9.8 m/s²</td><td>-</td></tr>
<tr><td rowspan="2">Under continuous vibration</td><td>5…8.4 Hz</td><td>-</td><td>1.75 mm</td><td rowspan="2">-</td></tr>
<tr><td>8.4…150 Hz</td><td>4.9 m/s²</td><td>-</td></tr>
<tr><td>Shock resistance</td><td colspan="6">Compliant with JIS B 3502 and IEC 61131-2 (147 m/s², 3 times each in directions X, Y, Z)</td><td>Continuous shock:
10 g, 16 ms (EN 60068-2-29)
Single shock:
30 g, 11 ms (EN 60068-2-27)</td></tr>
<tr><td>Operating atmosphere</td><td colspan="6">No corrosive gases*5, no flammable gases, no excessive conductive dust</td><td>55°C, 95% rel. humidity
(IEC 61131-2)
no corrosive gases</td></tr>
<tr><td>Operating altitude*6</td><td colspan="6">0…2000 m*7</td><td>0…2000 m (80 kPa)</td></tr>
<tr><td>Installation location</td><td colspan="7">Inside a control panel</td></tr>
<tr><td>Overvoltage category*8</td><td colspan="7">≤ Ⅱ</td></tr>
<tr><td>Pollution degree*9</td><td colspan="7">≤ 2</td></tr>
</table>

*1. For general specifications of other products, please refer to the relevant product manuals.
*2. General specifications stated are the same as the CPU module connected.
*3. Enables standard MELSEC iQ-R Series modules to support extended operating ambient temperature of 0 to 60°C, ensuring the same performance as the standard operating ambient temperature (0 to 55°C). When requiring to use in an ambient temperature environment higher than 60°C, please consult your local Mitsubishi Electric representative.
*4. The operating ambient temperature of the WS0-GCC100202 is 0 to 55°C.
*5. The special coated product, which meets the regulation (IEC 60721-3-3: 1994 3C2) related to corrosive gas, is available for the use in a corrosive gas environment.
For more details on the special coated product, please consult your local Mitsubishi Electric representative.
*6. Do not use or store the programmable controller under pressure higher than the atmospheric pressure of altitude 0 m. Doing so may cause malfunction.
When using the programmable controller under pressure, please consult your local Mitsubishi Electric representative.
*7. When used at an altitude higher than 2000 m, the upper limits of the permissible voltage and the operating ambient temperature become lower. Please consult your local Mitsubishi Electric representative.
*8. This indicates the section of the power supply to which the equipment is assumed to be connected between the public electrical power distribution network and the machinery within premises.
Category 2 applies to equipment for which electrical power is supplied from fixed facilities. The surge voltage withstand level for up to the rated voltage of 300 V is 2500 V.
*9. This index indicates the degree to which conductive material is generated in terms of the environment in which the equipment is used.
Pollution level 2 is when only non-conductive pollution occurs. A temporary conductivity caused by condensing must be expected occasionally.

Product list

Programmable automation controller MELSEC iQ-R Series

: CC-Link IE TSN : CC-Link IE Field Network

Item	Model	Outline		
Safety CPU*10	R08SFCPU-SET	Program capacity: 80K steps (40K steps for safety programs); Basic operation processing speed (LD instruction), 0.98 ns	●	●
	R16SFCPU-SET	Program capacity: 160K steps (40K steps for safety programs); Basic operation processing speed (LD instruction), 0.98 ns	●	●
	R32SFCPU-SET	Program capacity: 320K steps (40K steps for safety programs); Basic operation processing speed (LD instruction), 0.98 ns	●	●
	R120SFCPU-SET	Program capacity: 1200K steps (40K steps for safety programs); Basic operation processing speed (LD instruction), 0.98 ns	●	●
Main base	R35B	5 slots	●	●
	R38B	8 slots	●	●
	R312B	12 slots	●	●
Power supply	R61P	AC power supply; input, 100…240 V AC; output, 5 V DC/6.5 A	●	●
	R62P	AC power supply; input, 100…240 V AC; output, 5 V DC/3.5 A, 24 V DC/0.6 A	●	●
	R64P	AC power supply; input, 100…240 V AC; output, 5 V DC/9 A	●	●
	R63P	DC power supply; input, 24 V DC; output, 5 V DC/6.5 A	●	●
CC-Link IE TSN master/local	RJ71GN11-T2	1 G/100 Mbps, master/local station	●	-
Motion	RD78G4	Maximum number of control axes: 4	●	-
	RD78G8	Maximum number of control axes: 8	●	-
	RD78G16	Maximum number of control axes: 16	●	-
	RD78G32	Maximum number of control axes: 32	●	-
	RD78G64	Maximum number of control axes: 64	●	-
	RD78GHV	High-performance type, maximum number of control axes: 128	●	-
	RD78GHW	High-performance type, maximum number of control axes: 256	●	-
CC-Link IE Field Network master/local	RJ71GF11-T2	1 Gbps, master/local station	-	●
Simple motion	RD77GF4	4 axes, linear/circular interpolation, advanced synchronous control	-	●
	RD77GF8	8 axes, linear/circular interpolation, advanced synchronous control	-	●
	RD77GF16	16 axes, linear/circular interpolation, advanced synchronous control	-	●
	RD77GF32	32 axes, linear/circular interpolation, advanced synchronous control	-	●
MELSOFT GX Works3	SW1DND-GXW3-E	Version 1.015R or later	●	●

*10. R□SFCPU-SET consists of R□SFCPU and R6SFM.

General specifications/Product list

Block-type safety remote modules

: CC-Link IE TSN : CC-Link IE Field Network DB : Co-branded product*1

Item	Model	Outline		
Main safety input	NZ2GNSS2-8D	Single wiring: 8 points/Double wiring: 4 points, 24 V DC Input response time: 1…70 ms, Negative common type Spring-clamp terminal block, 2-wire	●	-
	NZ2GFSS2-8D	Single wiring: 8 points/Double wiring: 4 points, 24 V DC Input response time: 1…70 ms, Negative common type, Spring-clamp terminal block, 2-wire	-	●
	NZ2GFSS2-32D	Single wiring: 32 points/Double wiring: 16 points, 24 V DC Input response time: 1…50 ms, Negative common type, Spring-clamp terminal block, 2-wire	-	●
Main safety output	NZ2GNSS2-8TE	Single wiring: 8 points/Double wiring: 4 points, 24 V DC (0.5 A) Source + source type, Spring-clamp terminal block, 2-wire	●	-
	NZ2GFSS2-8TE	Single wiring: 8 points/Double wiring: 4 points, 24 V DC (0.5 A) Source + source type, Spring-clamp terminal block, 2-wire	-	●
Main safety I/O combined	NZ2GNSS2-16DTE	Input: 8 points (single wiring)/4 points (double wiring), 24 V DC Input response time: 1…70 ms, Negative common type Output: 8 points (single wiring)/4 points (double wiring), 24 V DC (0.5 A) Source + source type, Spring-clamp terminal block, 2-wire	●	-
	NZ2GFSS2-16DTE	Input: 8 points (single wiring)/4 points (double wiring), 24 V DC Input response time: 1…70 ms, Negative common type Output: 8 points (single wiring)/4 points (double wiring), 24 V DC (0.5 A) Source + source type, Spring-clamp terminal block, 2-wire	-	●
Extension safety output	NZ2EXSS2-8TE*2	Single wiring: 8 points/Double wiring: 4 points, 24 V DC Source + source type, Spring-clamp terminal block, 2-wire	-	●
Waterproof/dustproof type (IP67) safety I/O combined	NZ2GFS12A2-14DT DB	Input: 12 points (single wiring)/6 points (double wiring), 24 V DC Negative common type Output: not possible (single wiring)/2 points (double wiring), 24 V DC Source + sink type, Waterproof connector, 2-wire	-	●
	NZ2GFS12A2-16DTE DB	Input: 12 points (single wiring)/6 points (double wiring), 24 V DC Negative common type Output: 4 points (single wiring)/2 points (double wiring), 24 V DC Source + source type, Waterproof connector, 2-wire	-	●

Safety controller MELSEC-WS Series

DB : Co-branded product*1

Item	Model	Outline
CPU	WS0-CPU000200 (WS0-CPU0)*3 DB	Program capacity: 255 FBs, Scan cycle: 4 ms, RS-232 Interface
CPU (with EFI)	WS0-CPU130202 (WS0-CPU1)*3 DB	EFI-equipped (EFI is the communication interface for setting SICK's safety products.) Flexi Link with EFI RS-232 Interface
CPU (with EFI, Flexi Line)	WS0-CPU320202 (WS0-CPU3)*3 DB	EFI-equipped (EFI is the communication interface for setting SICK's safety products.) Flexi Link with EFI Flexi Line with EFI RS-232 Interface, USB Interface
Memory plug for CPU	WS0-MPL000201 (WS0-MPL0)*3 DB	For storing CPU parameters and programs (required) (for WS0-CPU0/WS0-CPU1)
	WS0-MPL100201 (WS0-MPL1)*3 DB	For storing CPU parameters and programs (required) (for WS0-CPU3)
Safety input	WS0-XTDI80202 (WS0-XTDI)*3 DB	Safety input: 8 points (single input), Spring-clamp terminal block
Safety I/O combined	WS0-XTIO84202 (WS0-XTIO)*3 DB	Safety input: 8 points (single input), Safety output: 4 points (single output) Output current: max. 2 A, Spring-clamp terminal block, Fast shut off function (response of 8 ms)
Safety relay output	WS0-4RO4002 (WS0-4RO)*3 DB	Safety output: safety relay output 4 points, Switching current: max. 6 A
USB/RS-232 conversion cable	WS0-C20M8U DB	USB/RS-232 conversion cable for PC-CPU connection (2 m)
	WS0-UC-232A*4 DB	USB/RS-232 conversion cable (35 cm)
RS-232 cable connecting to CPU	WS0-C20R2 DB	RS-232 cable for PC-CPU connection (2 m)
CC-Link interface	WS0-GCC100202 (WS0-GCC1)*3 DB	For CC-Link communication (general communication), Remote device station, CC-Link version 1.10
Ethernet interface	WS0-GETH00200 (WS0-GETH)*3 DB	For Ethernet TCP/IP connection (general communication)
Screw-in replacement terminal block	WS0-TBS4 DB	Screw-in replacement terminal block (4 pcs)
Spring-clamp replacement terminal block	WS0-TBC4 DB	Spring-clamp replacement terminal block (4 pcs)
Setting and Monitoring Tool	SW1DNN-WS0ADR-B*5	Setting and monitoring tool for safety controller

*1. General specifications and product guarantee conditions for co-branded products may vary from those of general MELSEC products.
For more information, please refer to the relevant product manuals or contact your local Mitsubishi Electric sales office or representative.
*2. Only NZ2GFSS2-32D can be connected.
*3. Abbreviated product model name is shown in ( ) for this catalog. Please notify the full model name in the upper product list when contacting local Mitsubishi sales office or representative.
*4. Use this in combination with WS0-C20R2.
*5. For details on how to obtain the tool, please contact your local Mitsubishi Electric sales office or representative.

Safety extension modules MELSEC iQ-F Series

DB : Co-branded product*1

Item	Model	Outline
Safety main	FX5-SF-MU4T5 DB	Built-in program 9 types Safety input: 4 points (single input) Safety output: 4 points (single output) Off delay time: 0/0.5/1/1.5/2/2.5/3/3.5/4/5 s Spring-clamp terminal block
Safety input expansion	FX5-SF-8DI4*2 DB	Built-in program 9 types*3 Safety input: 8 points (single input) Off delay time*4: 0/0.5/1/1.5/2/2.5/3/3.5/4/5 s Spring-clamp terminal block

*1. General specifications and product guarantee conditions for co-branded products may vary from those of general MELSEC products.
For more information, please refer to the relevant product manuals or contact your local Mitsubishi Electric sales office or representative.
*2. The safety main module is necessary to connect to the CPU module.
*3. For built-in program, logic pass connecting method with the safety main module can be set for INPUT A and INPUT B each.
*4. Off delay time is set from the safety main module.

Precautions before use

This publication explains the typical features and functions of the products herein and does not provide restrictions or other information related to usage and module combinations. Before using the products, always read the product user manuals. Mitsubishi Electric will not be held liable for damage caused by factors found not to be the cause of Mitsubishi Electric; opportunity loss or lost profits caused by faults in Mitsubishi Electric products; damage, secondary damage, or accident compensation, whether foreseeable or not, caused by special factors; damage to products other than Mitsubishi Electric products; or any other duties.

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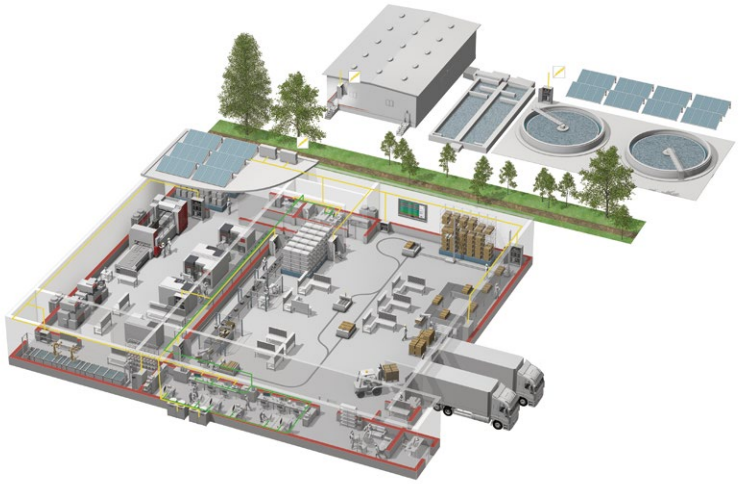

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* Not all products are available in all countries.

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