MITSUBISHI ELECTRIC

Changes for the Better

for a greener tomorrow eco Changes

Safety Programmable Controller/ Safety Controller/Safety Relay Module MELSEC Safety

MELSEC Safety

MITSUBISHI SAFETY FA SOLUTION

Safety programmable controller stands between workers and hazards

"Safety" is crucial on the shop floor.

Index

The concept of safety is shifting from "zero accidents" to "zero risk."

As many industries have expanded globally, it has become necessary to conform to international standards such as ISO12100 "Safety of machinery - basic concepts, general principles for design" in order to ensure workplace safety. At the same time, the safety concept has shifted from human intervention based "zero accidents" to risk assessment based "zero risk".
As a solution for this, Mitsubishi Electric has introduced the MELSEC-QS Safety programmable controller, based on the world leading technology of the established the MELSEC-Q series Automation Platform.
This solution conforms to international safety standards and maintains compatibility with other MELSEC programmable controllers while providing a comprehensive safety control solution.

Ensuring safety in manufacturing facilities around the world, while meeting growing demands for compliance with international standards.

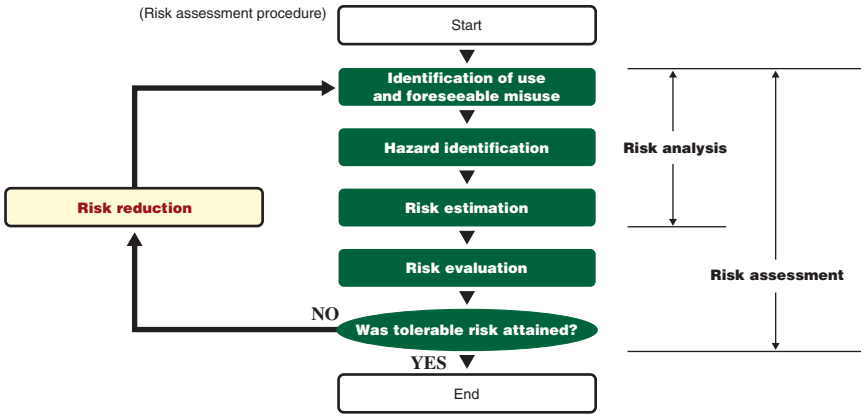
International safety standards

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

- Type A standards (basic safety standards): ISO12100 and ISO14121
- Type B standards (group safety standards): ISO13849-1, IEC61508, etc.
- Type C standards: Individual product standards

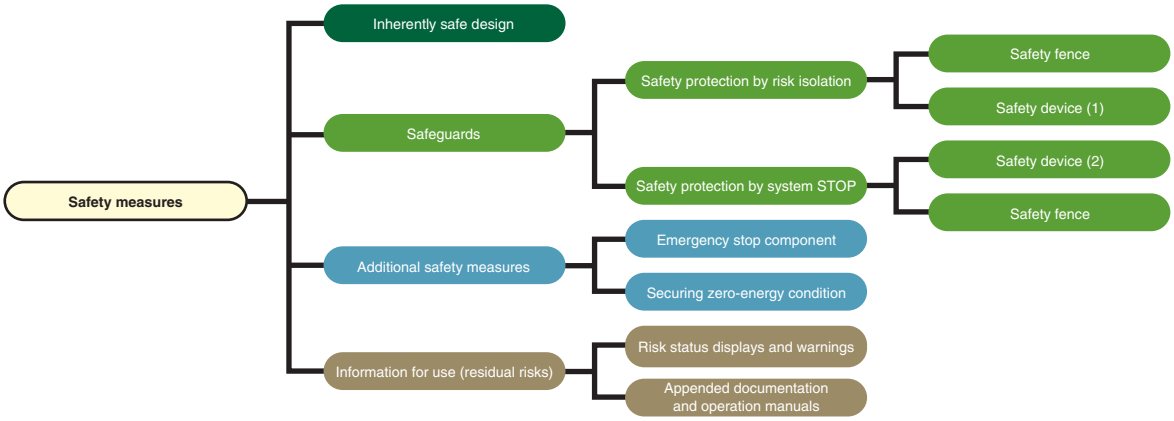
ISO14121 Risk assessment

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



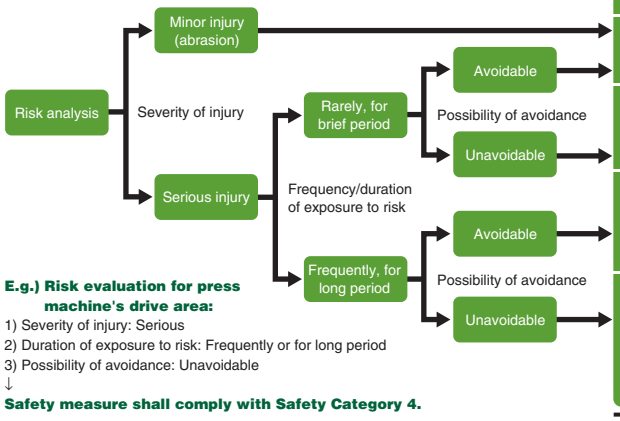
ISO12100 Risk reduction and safety measures

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



EN954-1/ISO13849-1 Safety categories

"Safety categories" are indicators used to determine specific safety measures based on risk assessment results.



E.g.) Risk evaluation for press machine's drive area:
1) Severity of injury: Serious
2) Duration of exposure to risk: Frequently or for long period
3) Possibility of avoidance: Unavoidable
↓
Safety measure shall comply with Safety Category 4.

■Safety category requirements

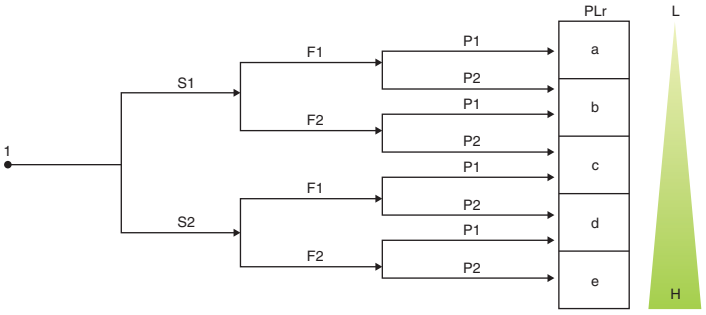
Category	Requirement summary	System behaviour
B	・Shall realize the intended functions of safety-related parts of the machine control system.	・The occurrence of a fault can lead to the loss of the safety function.
1	・Shall meet the requirements of Category B. ・Shall use well-examined reliable components 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.

ISO13849-1:2006 Performance level

Performance levels for safety-related parts of control systems have been revised in ISO13849-1:2006. Based on the original safety categories, 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 IEC61508 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."

■Risk graph in ISO13849-1:2006 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

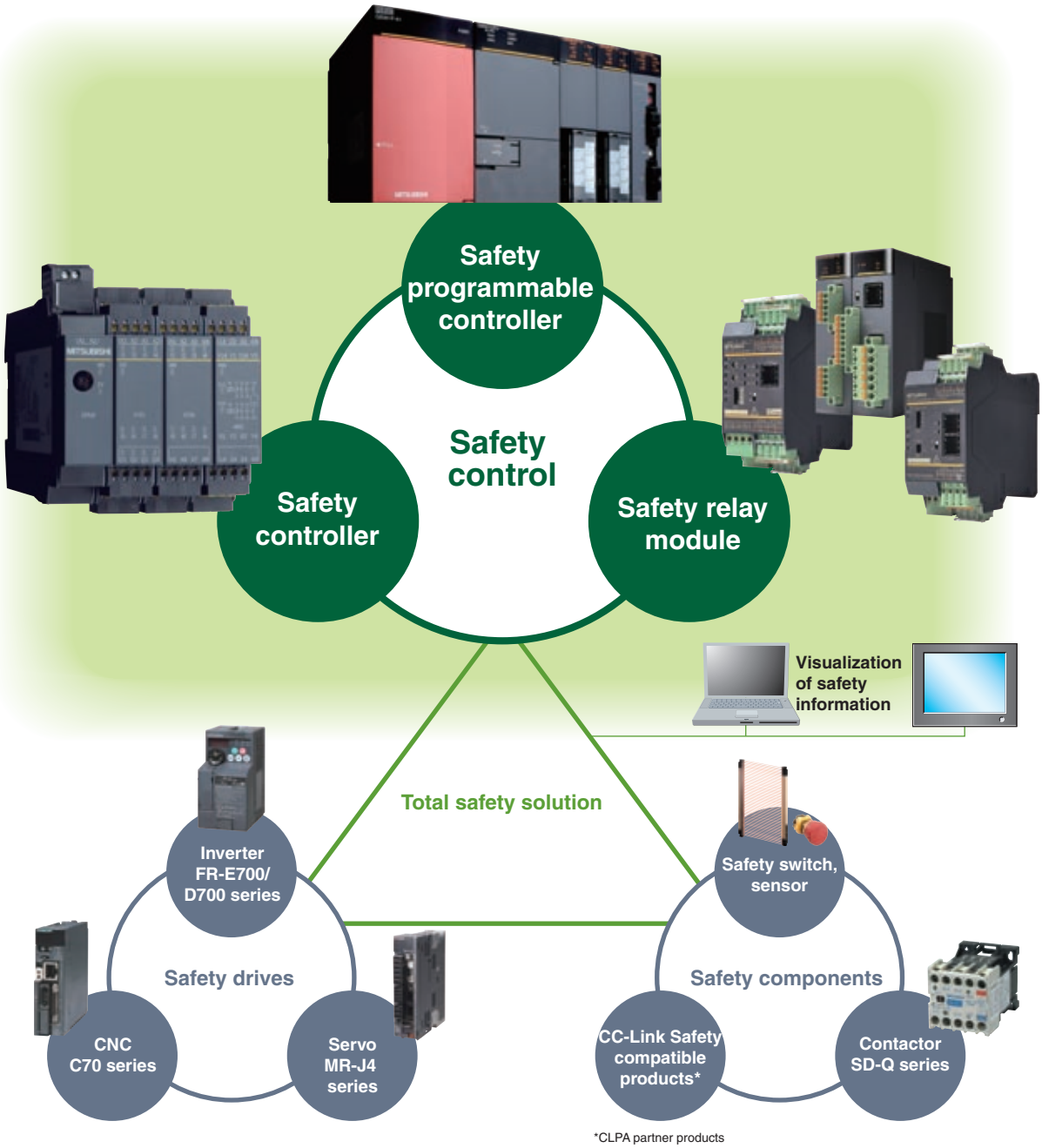
Functional safety standard IEC61508

In the past, a safety function of control systems were realized by safety relays and mechanical safety components. The safety function was standardized in the international safety standard ISO13849-1 (EN954-1) and classified by categories. But ISO13849-1 applied to only parts and components with a clear failure mode. Besides, the safety standards for electrical equipment of machines, such as IEC60204-1, stipulated that emergency stop circuits should be hard wired.
In recent years, however, 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 IEC61508 (electrical/electronic/programmable electronic safety-related systems), which applies to programmable controllers, was issued in 2000.

Offering a total safety solution centered on various safety controls that collaborate with safety drives and safety components.

Total safety solution lineup

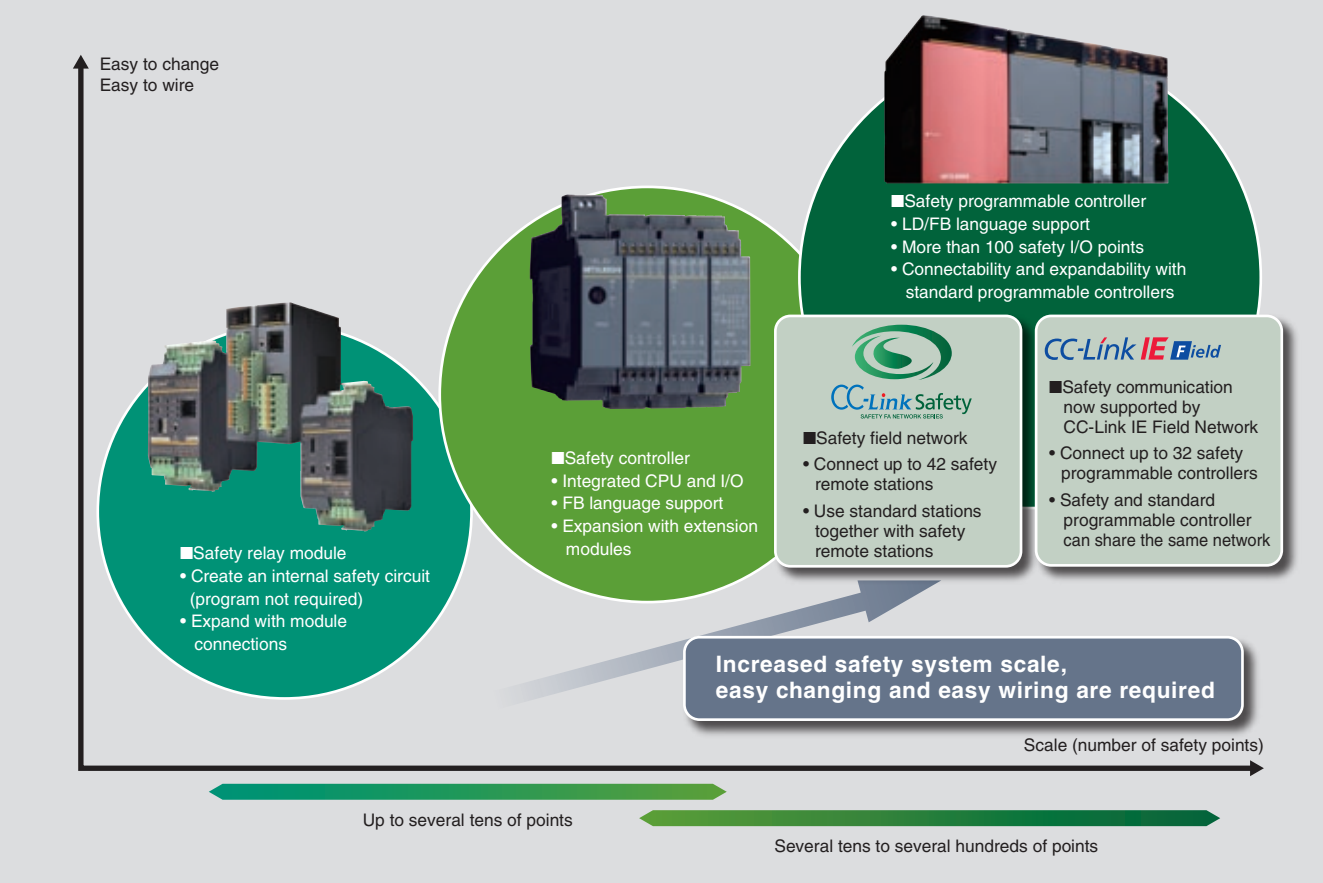
Mitsubishi Electric provides a total safety solution by incorporating safety control devices, safety drive devices, and safety components* required for safety systems. This allows visualization of safety information, realizing optimal safety control and boosting productivity.

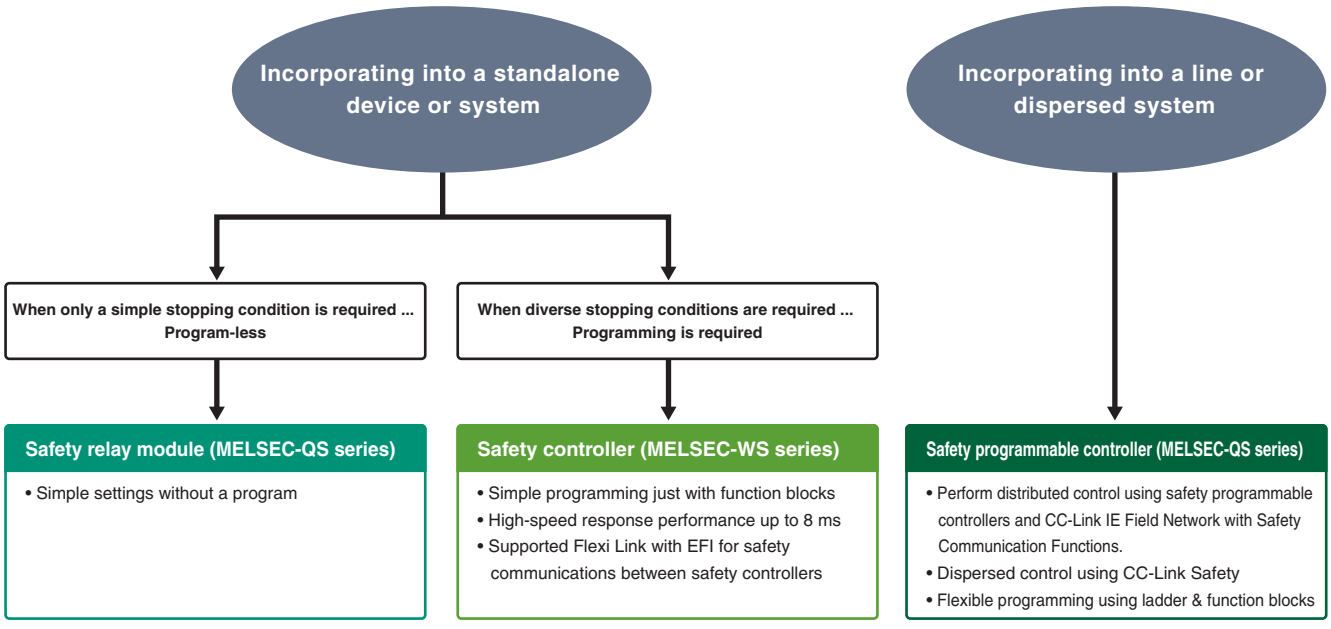


*CLPA partner products

Points for selection

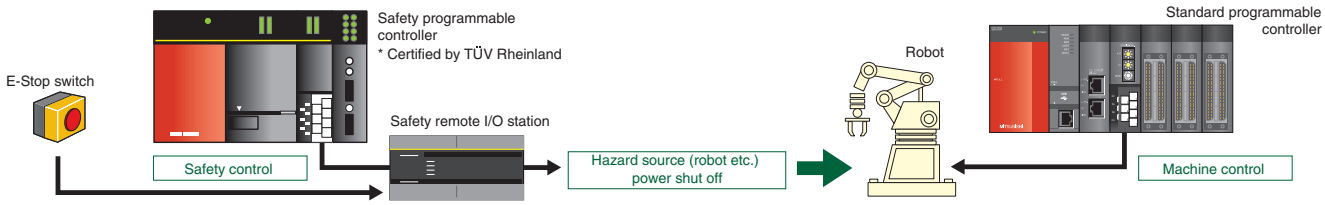
Select the safety control devices most suitable for your system configuration from the diverse lineup of MELSEC Safety devices.





MELSEC-QS Safety programmable controller

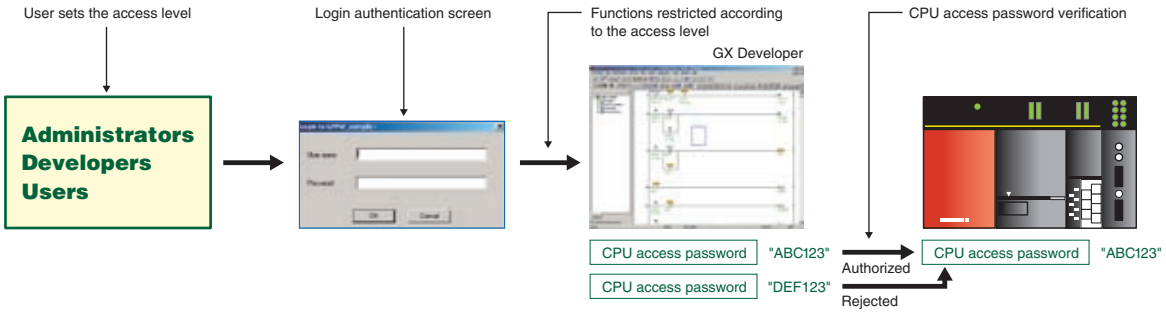
The safety programmable controller is an International Safety Standard certified PLC for safety control. When connected with a safety device, such as an emergency stop switch or light curtain, this programmable controller executes safety control by turning the safety output OFF with a user-created sequence program to stop movement toward a source of hazard, such as a robot.
Machine control of the robot and conveyor, etc., is executed with a general-purpose programmable controller in the conventional manner. The difference between the safety programmable controller and general-purpose programmable controller lies in that if the safety programmable controller itself fails, it performs a self-diagnosis to detect the failure and turn the safety output OFF forcibly. This prevents the safety functions from being disabled because of a fault. Create a distributed safety control system using the CC-Link Safety network or the CC-Link IE Field Network with Safety Communication Functions for large scale systems requiring many safety I/O points.



GX Developer safety compliant engineering environment

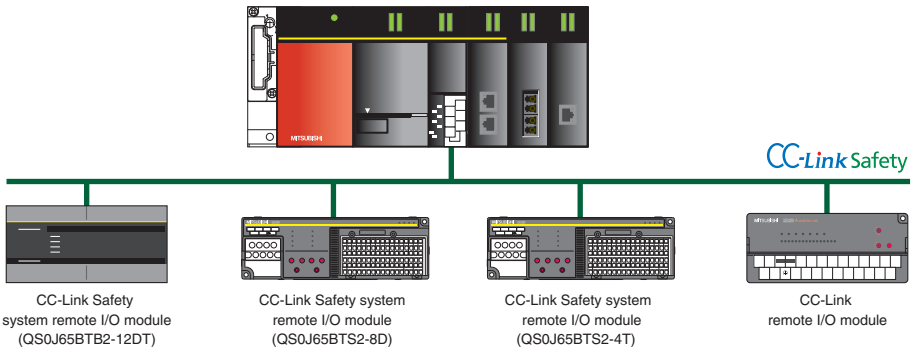
Programming the MELSEC-QS uses the same GX Developer programming tools already familiar to users of Mitsubishi systems; there are no new techniques to learn or software to buy.
However, a safety system should prevent malfunctions due to user-specified parameter settings or accidental program changes. GX Developer prevents this with the following additional functions:

- Prevents unauthorized access to safety control programs.
  Login authentication prevents unauthorized users from accessing project files.
- Prevents unauthorized access to the Safety CPU.
  CPU access password prevents project files from being incorrectly written to the Safety CPU.



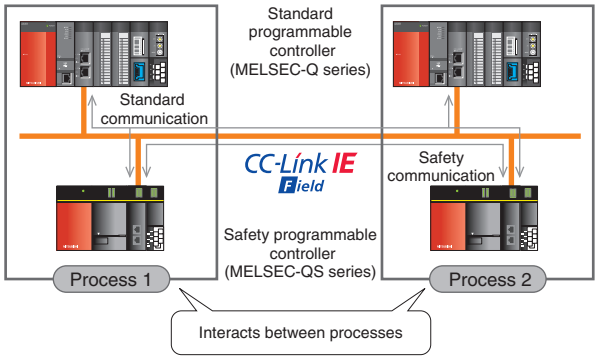
CC-Link Safety open field network

The CC-Link Safety network detects the communication errors defined by safety standards, and serves as a safety system to turn outputs OFF when those errors are detected. CC-Link Safety is compatible with the established CC-Link open device level network, and features an additional error detection function protocol required for safety control, thereby permitting it to be used as a safety field network. Communication is stopped when an error is detected, and the Safety CPU and Safety Remote I/O modules turn the outputs OFF.
CC-Link Safety is an international standard for the safety field network, and has been enacted as the safety communication standard IEC61784-3-8.



CC-Link IE Field Network

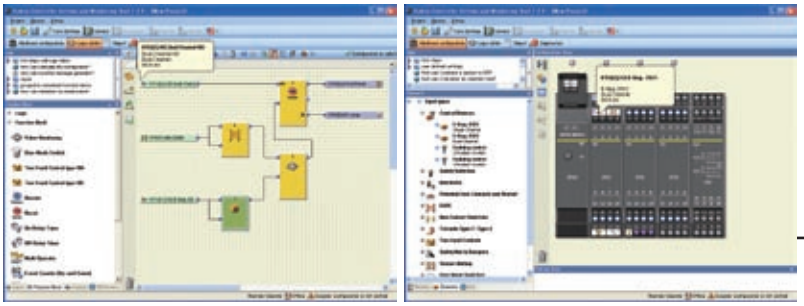
This industrial Ethernet field network "CC-Link IE Field Network" enables intelligent manufacturing systems to perform high speed I/O control and distributed control simultaneously. Wiring is done easily thanks to standard Ethernet cables and flexible cabling.
Safety information can be shared between two or more safety programmable controllers using "Safety Communication Functions". Communications between standard programmable controllers may be performed concurrently with communications between safety programmable controllers.
CC-Link IE Field Network with Safety Communication Functions meets international safety standards IEC61508 SIL3 and IEC61784-3(2010).



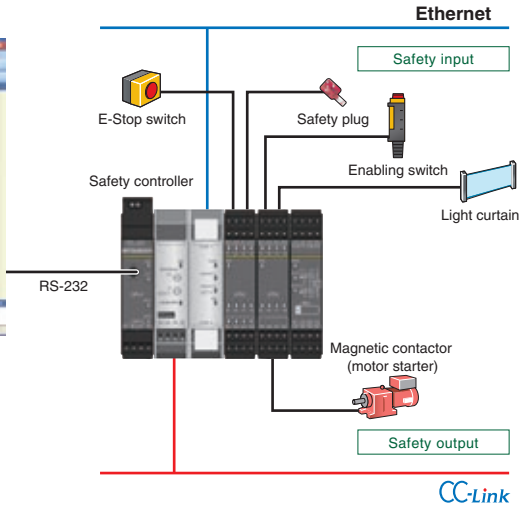
Safety controller

The safety controller is an expandable compact controller suitable for the safety control of small to medium-sized devices and systems. The controller can be expanded to a maximum 144 safety input/output points (single channel) and two network interface units. The dedicated "Setting and Monitor Tool" is equipped with safety sensors, switch connections, and safety-dedicated function blocks, allowing a safety system to be structured easily.

■Dedicated "Setting and Monitor Tool"

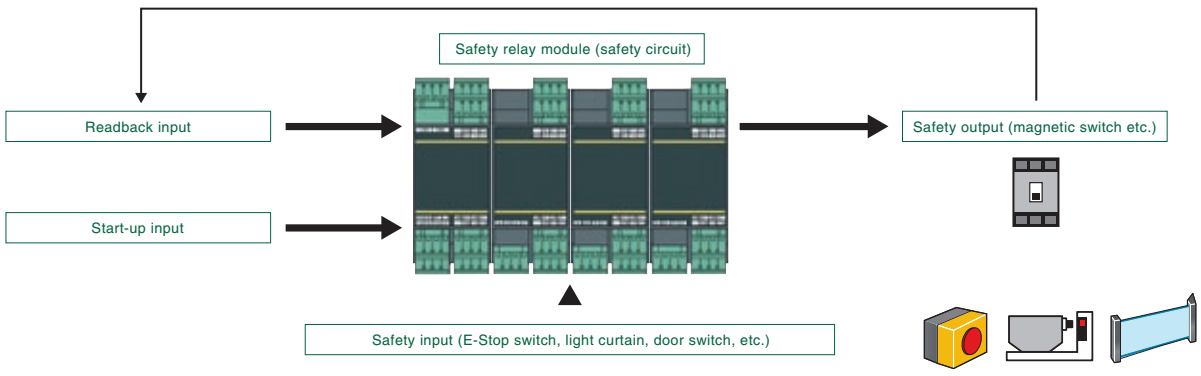


● CPU module(WS0-CPU1) supports Flexi Link with EFI for safety communications between safety controllers
Safety communications between safety controllers can be easily established at a low cost just by connecting the CPU modules with dedicated cables (Flexi Link cables).Using Flexi Link, safety communication can be conducted between up to four safety controllers.



Safety relay module

The safety relay module integrates the emergency stop circuit and the restart circuit with a double safety relay. A basic safety function can be realized with just wiring, eliminating the need for programming and parameter settings. Furthermore, the number of I/O points can be increased by adding extension modules.



Safety Programmable Controller

The MELSEC-QS series

A key element of safety

MELSEC Safety

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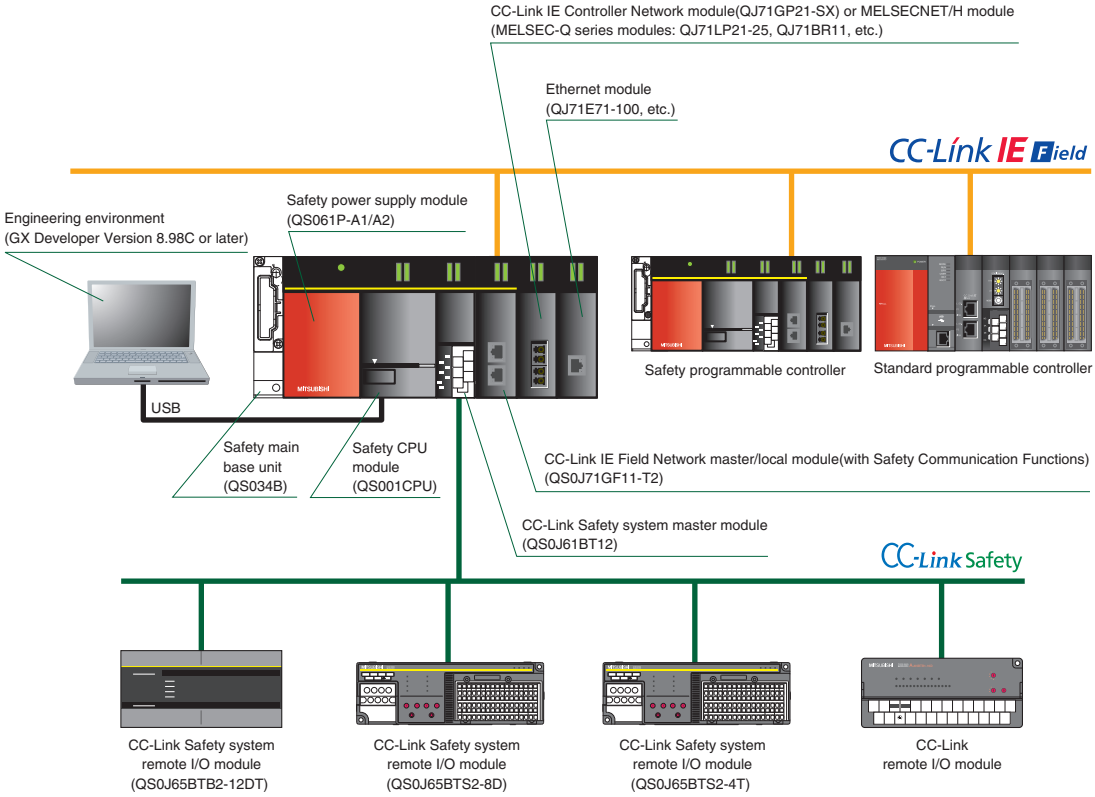
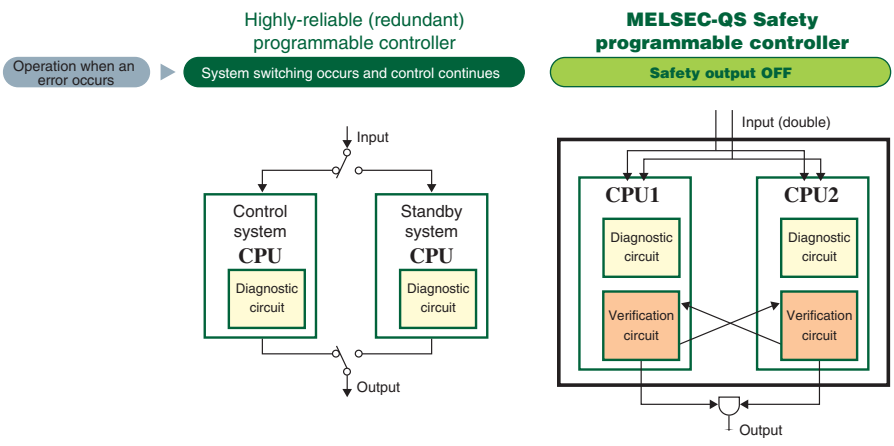
CC-Link IE Field and CC-Link Safety enable distributed safety control for medium to large-scale systems. Ladder programs and function blocks offer flexible programming for safety control.

MELSEC-QS Safety programmable controller system configuration



●Differences between the highly-reliable (redundant) programmable controller and the QS Safety programmable controller



To support production line safety: Expanding capabilities of a system with functions and modules.

Safety programmable controller function upgrades

●Improved maintenance

Using GX Developer to access safety programmable controllers across the network, complete engineering of safety CPU systems is possible including maintenance functions like online monitor, etc. Improve maintenance efficiency by remotely investigating the status of safety CPUs, without the need to physically be in front of the hardware.

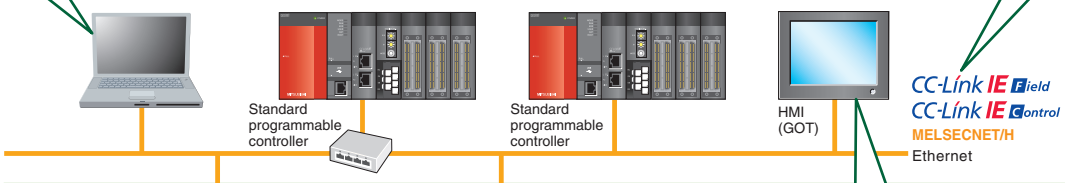
Note) GX Works2 is necessary to configure CC-Link IE Field network settings when using standard programmable controllers.

●Expanding network connections (CC-Link IE Field Network)

In addition to Ethernet, MELSECNET/H, and CC-Link IE Control Network, it is now possible to connect with CC-Link IE Field Network.

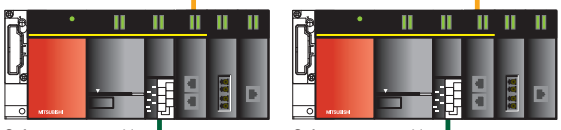
CC-Link IE Field Network with Safety Communication Functions

By using safety programmable controllers to control each process in a production line, and connecting them using CC-Link IE Field Network (with Safety Communication Functions), an emergency stop at one station also results in the safe and timely stopping of machines behind and ahead in the process. Up to 128 bits(8 words) per station of safety data can be communicated between safety programmable controllers. Furthermore, the status of safety controls can be monitored from standard programmable controller stations.

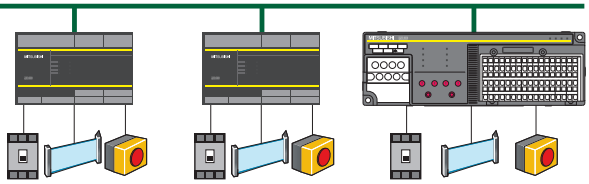


●GOT supports MELSEC-QS series

Monitor programs, devices, and error/failure histories of MELSEC-QS Safety programmable controllers using a networked GOT. Safety ladder logic can be displayed for improved maintenance capability.



CC-Link Safety



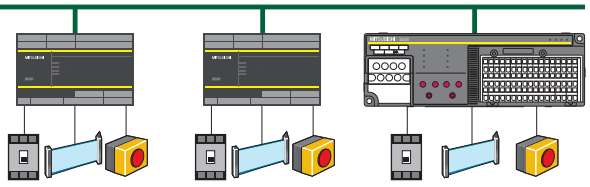
●Improved response and performance of CC-Link Safety

CC-Link Safety has the same high-speed, deterministic performance of CC-Link, allowing it to maintain a consistent communication speed even with a large number of modules connected.

●Dedicated input and output modules added to the lineup

QS0J65BTB2-12DT (safety inputs: 8 points, safety outputs: 4 points),
QS0J65BTS2-8D (safety inputs: 8 points), and
QS0J65BTS2-4T (safety outputs: 4 points)
are available to help meet demanding design requirements.

CC-Link Safety



Safety system

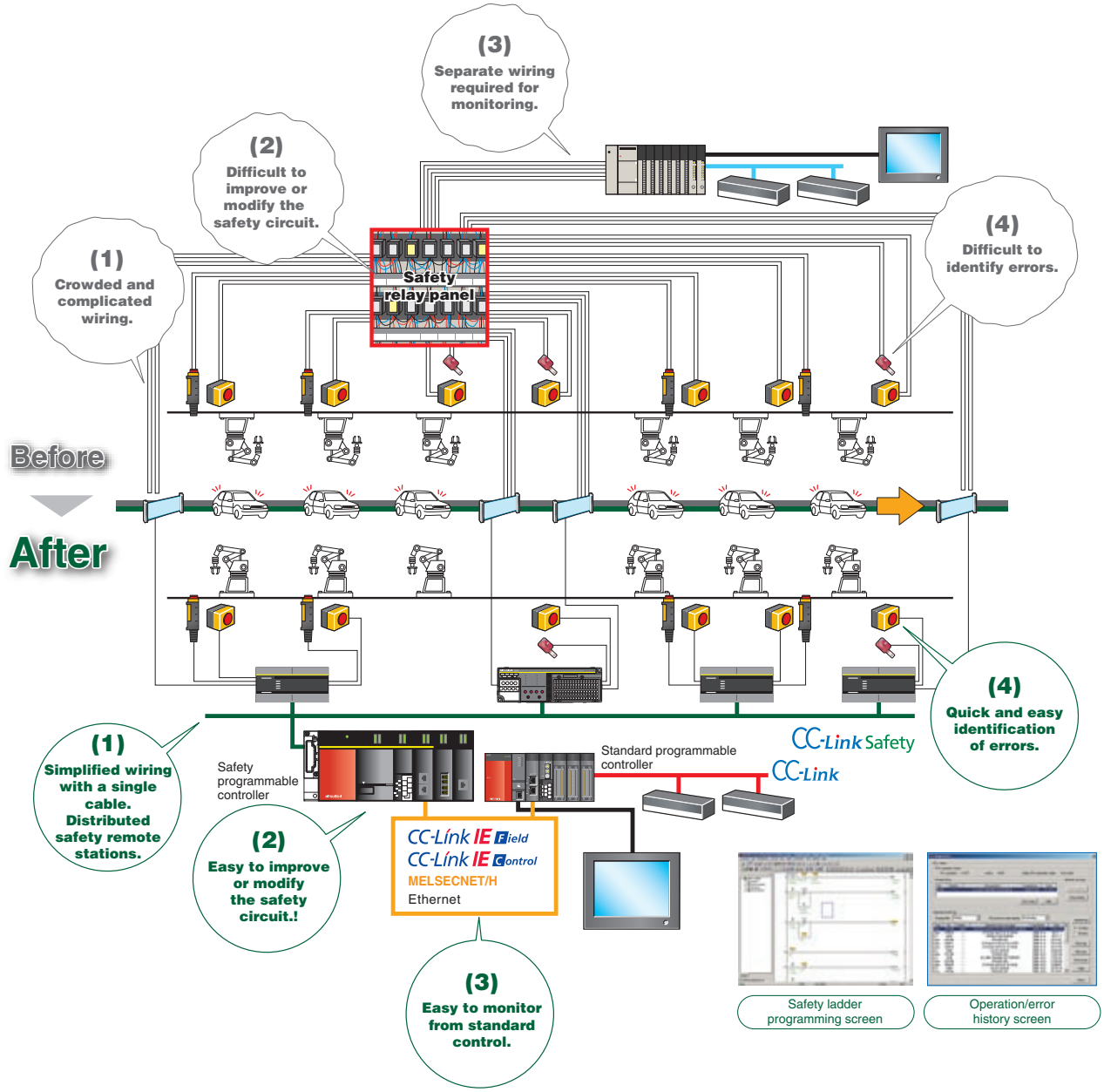
Building on the MELSEC-Q series technology to provide higher safety levels with enhanced system functions.

Solution 1

Reduce costs and increase diagnostic capabilities and system flexibility by replacing hard-wired safety relay panels

MELSEC-QS Safety programmable controller solves the complicated wiring and time-consuming troubleshooting issues associated with previous safety relay systems.

Conventional system with safety relay



System with MELSEC-QS Safety programmable controller

Safety, design, and maintenance all integrated into one comprehensive system.

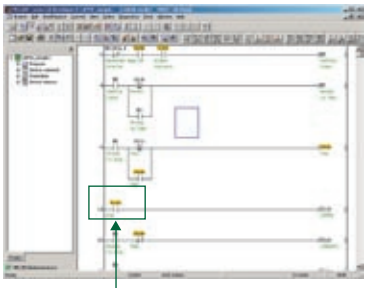
Solution 2

Simple engineering of systems which integrate machine and safety control

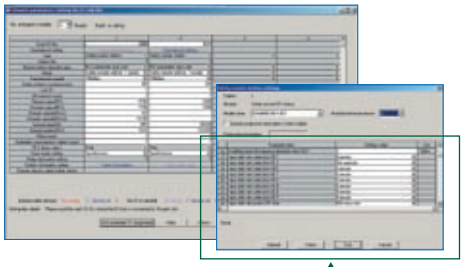
GX Developer

- Use GX Developer to start up both standard and safety control systems (programming, monitoring, diagnostics, and debugging).
- GX Developer can configure CC-Link Safety, CC-Link IE Field Network and remote safety station parameters.*

*GX Works2 is necessary to configure CC-Link IE Field Network settings when using standard programmable controllers.



Safety device
(1) Safety devices displayed in yellow.



Examples of settable safety remote station parameters:
(1) Double input verification time
(2) Dark test pulse enable
(3) Dark test pulse duty cycle

* Parameter setting examples are shown on page 19.

Safety FB (Function Block)

- Functions that are frequently used for creating safety programs are provided as safety FBs. Programming is streamlined, enhancing productivity and maintainability of safety programs.
- Since the safety FBs have been certified, they can be used to structure EN954/ISO13849-1 Category 4 and IEC61508 SIL3 safety applications. In addition, acquiring safety certification for safety programs is easy.
- The safety FBs are provided for GX Developer (SW8D5C-GPPW) version 8.82L and higher. (QS001CPU is supported from serial numbers having 11042 or higher for the first five digits.)

Safety FB list

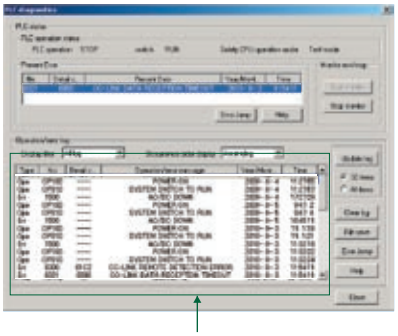
FB name	Function	Description	Number of steps after compilation
F+2HAND2	Two hand switch type II	Controls a type II two-hand switch (EN574 Chapter 4).	35
F+2HAND3	Two hand switch type III	Controls a type III two-hand switch (EN574 Chapter 4, double detection discrepancy time fixed to 500 ms).	35
F+EDM	External device monitor	Controls a safety output and monitors controlled safety shutdown devices (e.g., actuators and contactors).	51
F+ENBLSW	Enable switch	Evaluates input signals of a 3-position enabling switch.	43
F+ESPE	Light curtain (ESPE)	Emergency stop (stop category 0) by a light curtain etc.	40
F+ESTOP	Emergency stop	Emergency stop (stop category 0) by an emergency stop switch.	40
F+GLOCK	Guard lock and interlocking	Controls an entrance to a hazardous area by an interlocking guard with guard locking (four state interlocking).	50
F+GMON	Guard monitoring	Monitors a safety guard by two safety switches and discrepancy time for closing the guard.	46
F+MODSEL	Mode selector	Selects the system operation mode (manual, semi-automatic, etc.).	79
F+MUTE2	Muting with 2 sensors	Blocks (mutes) the safety function of a light curtain by two muting sensors.	60
F+MUTEP	Parallel muting	Blocks (mutes) the safety function of a light curtain by four parallel muting sensors.	76
F+MUTES	Sequential muting	Blocks (mutes) the safety function of a light curtain by four series muting sensors.	68
F+OUTC	Output control	The safety output control and activation prevention settings depend on the application and the overall system.	46
F+TSSEN	Safety testable sensor	Tests external sensors (light curtains etc.) that can be tested. (e.g., detection of loss of the sensing unit detection capability, the response time exceeding that specified, and static ON signal in single-channel sensor systems)	58
F+EQUI	Double input (NC+NC or NO+NO)	Monitors the status of two safety input signals (two NO contacts or two NC contacts), and outputs the results.	38
F+ANTI	Double input (NO+NC)	Monitors the status of two safety input signals (NC contact and NO contact), and outputs the results.	38

Solution 3

Easy error/failure troubleshooting

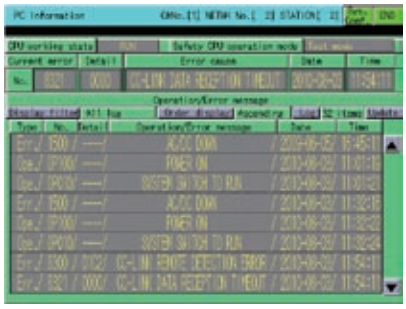
Up to 3,000 safety CPU module operations conducted by the user and the details of trouble which occurred in the Safety CPU module, CC-Link Safety system or CC-Link IE Field Network system can be recorded as the operation and trouble history.

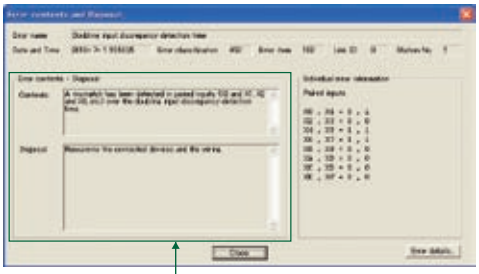
- Troubleshooting is fully supported by analyzing failures from various perspectives including the location of failure, time of failure occurrence, details of operation, user, and order of failure and operation, etc.
- Circuit monitor of safety CPUs and other engineering functions are possible to engineer over the network from a PC equipped with GX Developer. Circuit status from the shop can be confirmed remotely, thus improving serviceability.
- The safety programmable controller's circuit monitor can be displayed on the GOT over a network. Maintenance can be done without bringing a PC to the shop floor, thus improving serviceability and reducing maintenance time.
- Expanded networking options for connection with standard programmable controllers. In addition to Ethernet, Ethernet-based CC-Link IE networks are now supported.



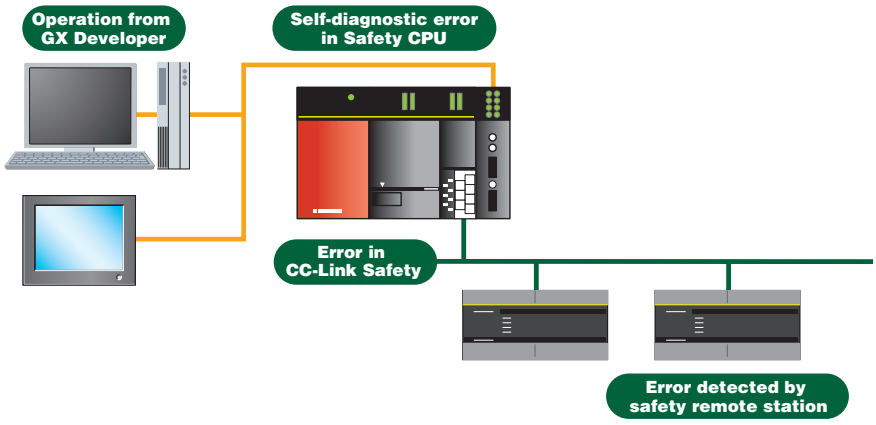
History details can be checked from GX Developer.

· Remote STOP operation at 14:12 on 2006-12-19
· CC-Link Safety timeout at 15:20 on 2006-12-19
· Double input discrepancy in safety remote station at 0:10 on 2006-12-20





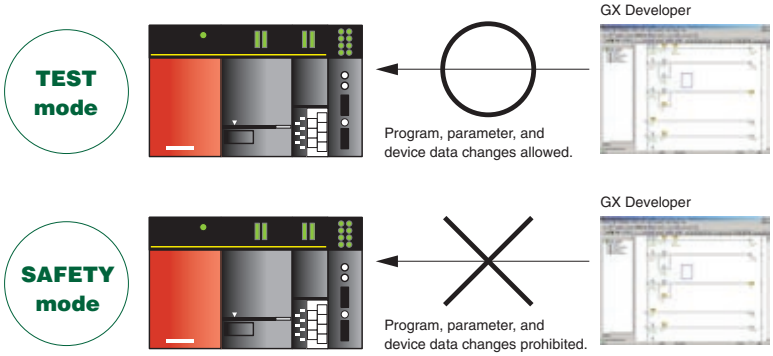
Remote I/O errors can be easily displayed for CC-Link IE Field Network.



Solution 4

Same efficient debugging capabilities as MELSEC-Q series

Debug functions (device test, write during RUN, etc.) are available in test mode.

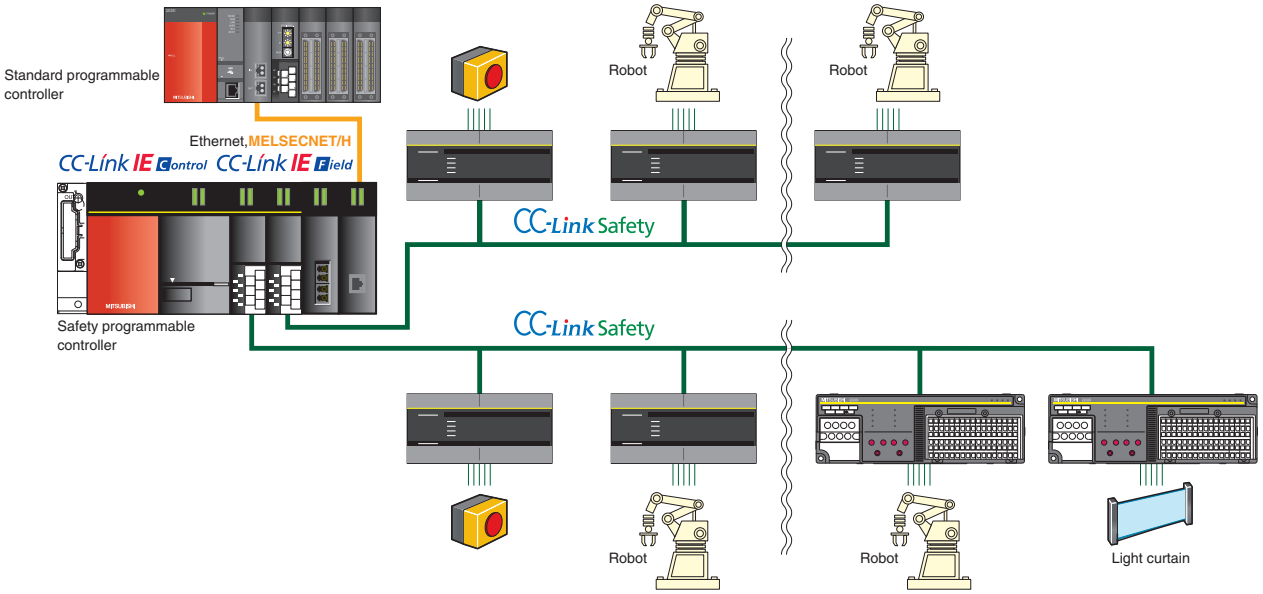


- TEST mode: Used at system startup and during maintenance.
- SAFETY mode: Used during actual safety system operation.

Solution 5

Scalable to a wide variety of system sizes

- One system can handle the safety demands of an entire line or large machine, avoiding the issues of multiple separate controllers. (A single Safety CPU can control up to 84 safety remote stations.)
- Flexible programming allows full system stops, partial system stops, and muting condition assignments, etc.
- Easy to expand I/O by changing parameters and programs, without requiring additional CPUs.
- Choose from three different CC-Link Safety system remote I/O module types based on the I/O requirements of the application.
  QS0J65BTB2-12DT: 8 safety input points (double input)/4 safety output points (double output)
  QS0J65BTS2-8D: 8 safety input points (double input)
  QS0J65BTS2-4T: 4 safety output points (double output)
- Stable speed communications available even when the number of stations increases.



CC-Link IE Field and CC-Link Safety provide high speed stable communications that ensure safety and minimize wiring costs.

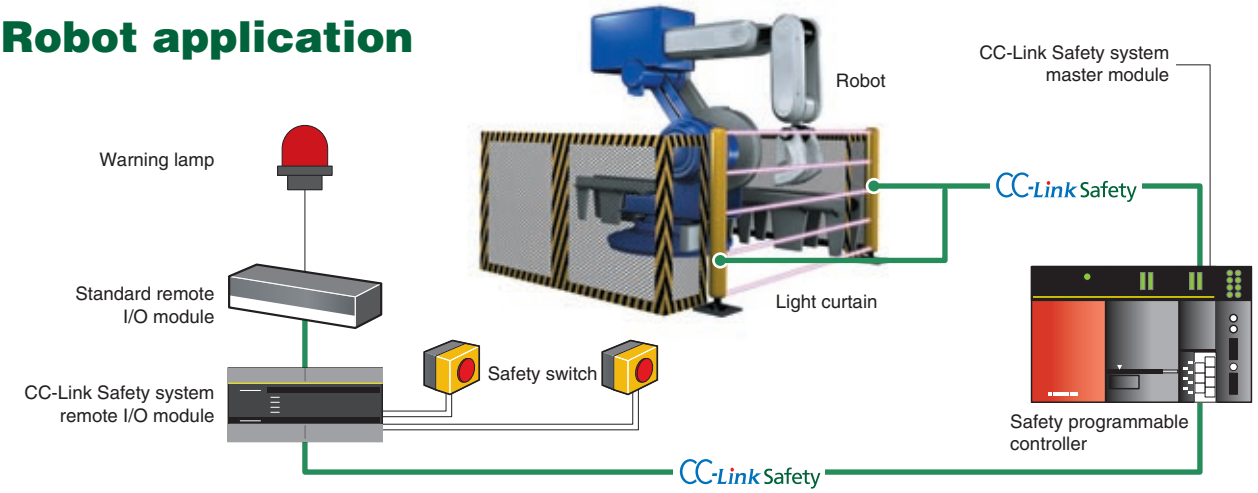
Solution 6

Compatible with CC-Link Safety, the safety field network

CC-Link Safety is based on the Japanese open field network CC-Link. It includes communication error detection functions, enabling it to be used in the protection against mechanical hazards. It meets several international safety standards including IEC61508: SIL3, EN954-1: Category 4, and ISO13849-1: PL e. The detailed specifications of CC-Link Safety are provided by the CLPA (CC-Link Partner Association) and are open to the public. CC-Link Safety has been standardized as IEC61784-3-8 and is now recognized internationally as a solid choice for safety communications.

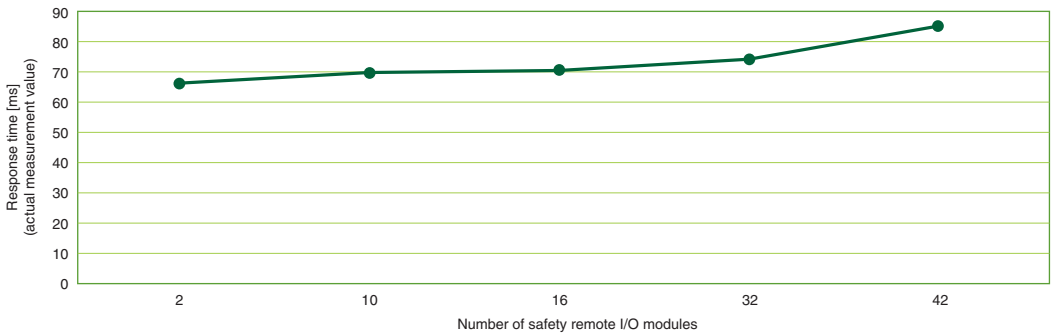
Inherited functions	Transmission speed of 10 Mbps equivalent to CC-Link is realized, allowing use of the same CC-Link cables. Standard CC-Link stations can be connected.
Identifying the communication target station (safety remote I/O station)	The model name and production information of safety remote I/O stations can be set in the network parameters. Hence, an error can be detected if an incorrect safety remote I/O station is connected.
Enhanced RAS function	Detects communication errors such as communication delays and lost of messages and then stops the system completely.
Flexible safety system configuration	Safety remote I/O stations can be spread out, minimizing wiring for I/O. Extending I/O stations is also easy.

Robot application



High-speed, deterministic performance inherited from CC-Link helps shorten the safe distance

Time from safety input off to safety output off (measurement example: communication speed of 10 Mbps, synchronous mode)

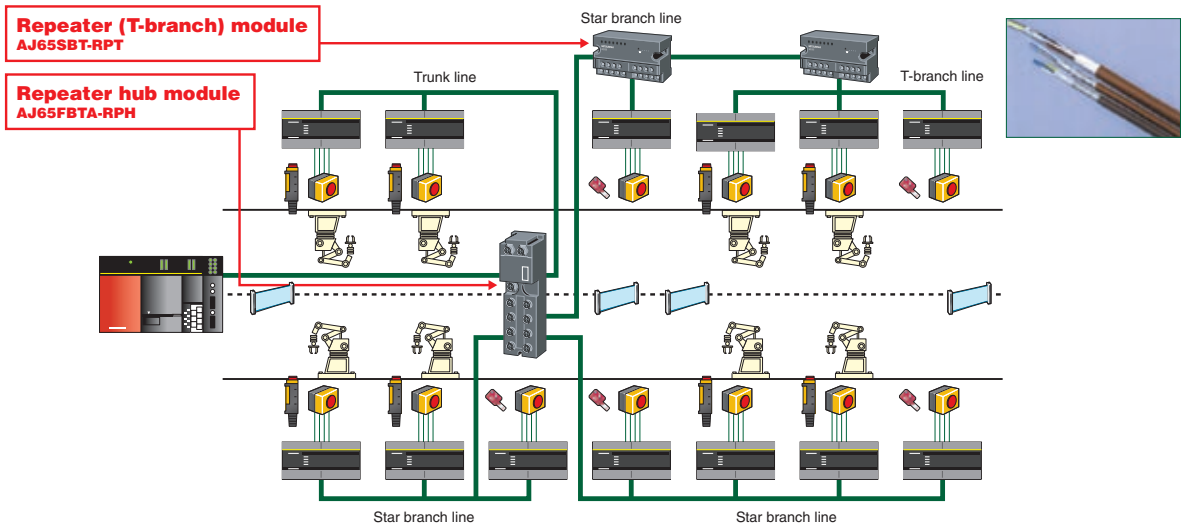


Solution 7

CC-Link Safety allows flexible network wiring

The same cables and wiring method as CC-Link are employed for CC-Link Safety (safety network). Moreover, existing T-branch, repeater hub modules, etc. can be used, allowing flexible wiring like CC-Link.

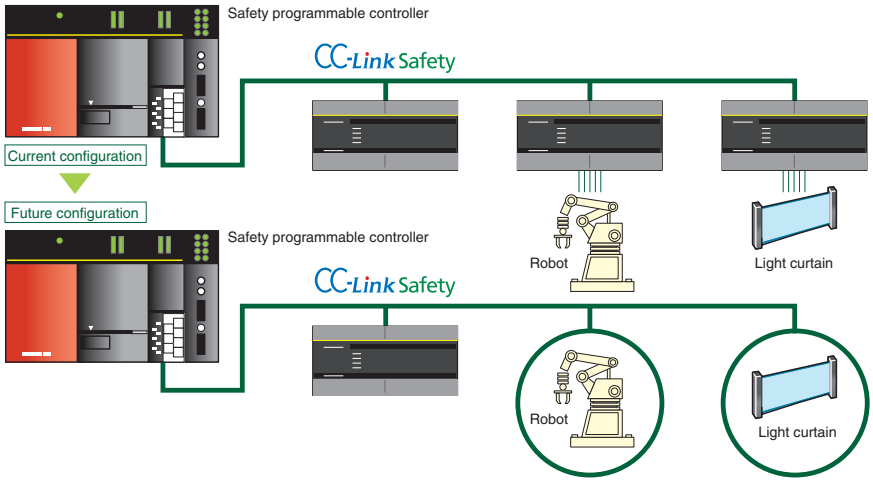
- Cables can be extended while maintaining high-speed transmission of max. 10 Mbps.
- At 10 Mbps, each branch line can be extended to maximum of 100 m.



Solution 8

Possibility of further reduction in wiring

The CC-Link Safety protocol specifications have been released by CLPA (CC-Link Partner Association).
Therefore, CC-Link Safety compatible products will be released by partner manufacturers, further minimizing wiring.

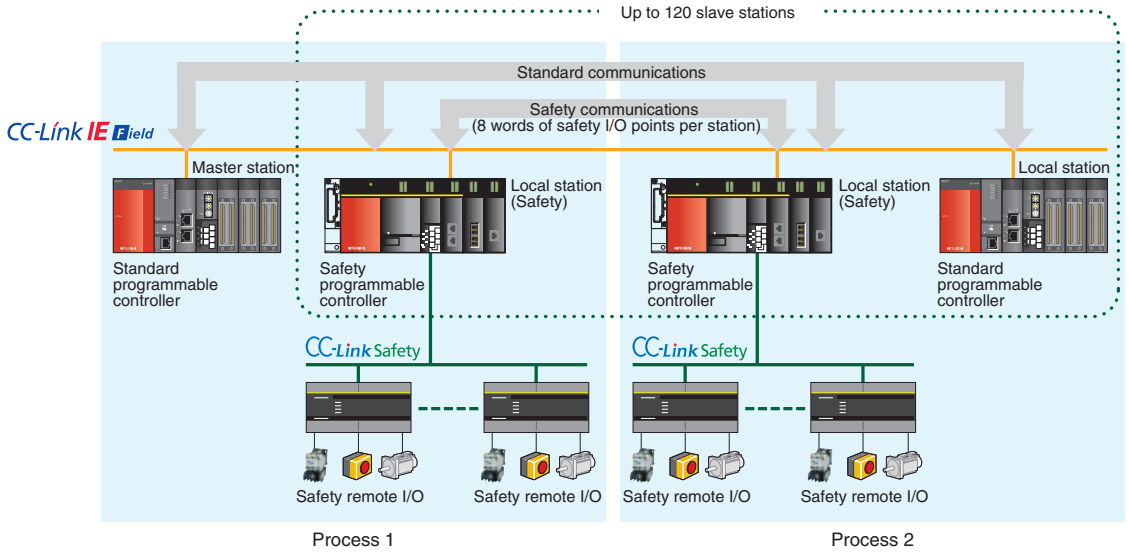


Solution 9

Ensures entire safety process control with distributed safety controls interactively

By using safety programmable controller to control each process in a production line, and connecting them using CC-Link IE Field Network (with Safety Communication Functions), an emergency stop at one station can also result in the safe and timely stopping of machines behind and ahead in the process.

- Share up to 128 bits (8 words) of safety I/O per safety programmable controller station.
- Both safety and non-safety communications can be performed using the same network. Standard communications between a standard programmable controller and safety programmable controller, and safety communications between safety programmable controllers is possible.



Solution 10

Compatible with KOSHA S-Mark, the Korean Safety Standard

Compliance with the Korean KOSHA S-Mark allows incorporation into safety devices destined for Korea.
A lineup (custom order) of Korean KOSHA S-Mark certified safety programmable controllers supports global expansion of safety devices.

* Contact your nearest Mitsubishi sales office or dealer for details on the Korean KOSHA S-Mark certified modules.
* Refer to page 52 for a list of compatible products.

The safety certification follows the Korean Industrial Safety and Health Law Article 34-2. This certification aims to improve safety and quality by issuing a safety certification mark (S-Mark) to products which have been objectively verified as safe through an integral review of the safety and reliability of products used in industrial fields and the quality control ability of the manufacturers. The S-Mark certification is a voluntary safety certification system operated by the Korea Occupational Safety and Health Agency (KOSHA) and was established following the Industrial Safety and Health Law to reduce occupational accidents.

For CC-Link Safety specifications and information on compatible products, refer to the following CC-Link Partner Association website:
URL:http://www.cc-link.org/

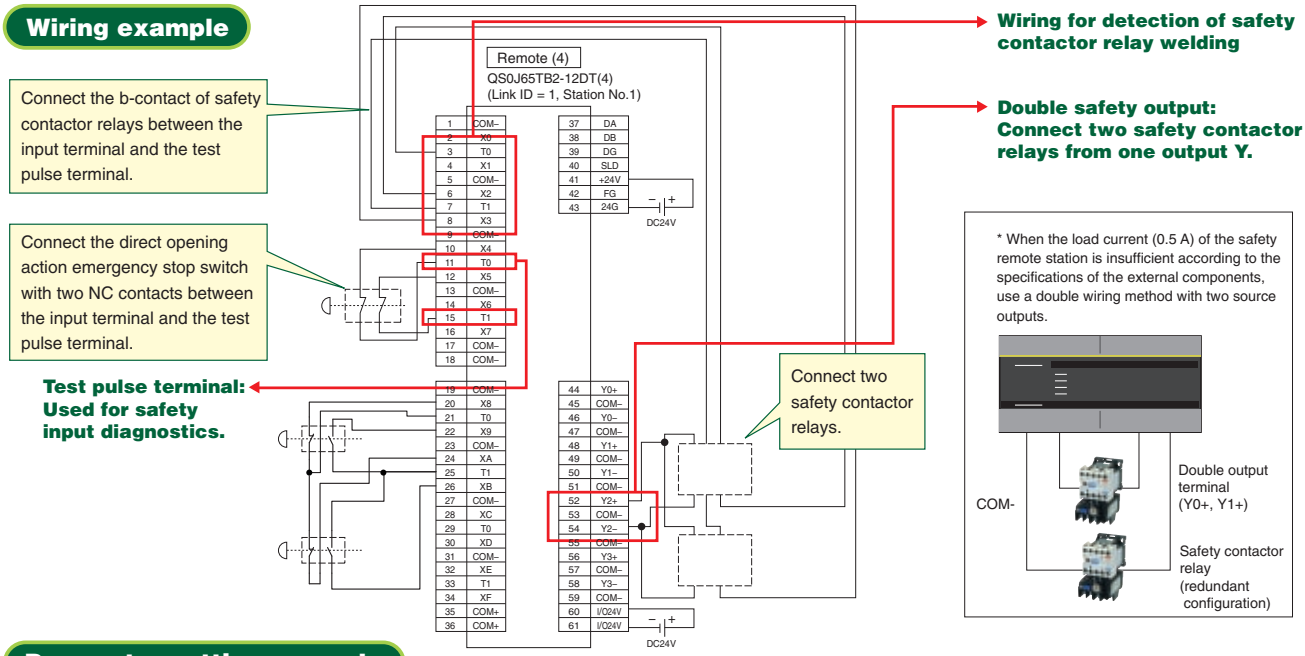
GX Developer handles parameter settings, programming, and error diagnostics, and facilitates MELSEC Safety design and maintenance.

Wiring and parameter setting example

The Safety programmable controller parameter settings, programming, and error diagnostics can be performed just like other MELSEC series products.

The following wiring example shows a system in which an emergency stop switch, a two-hand control safety device and two safety contactor relays are connected.

Wiring example



Parameter setting example

The following is an example of parameter settings when an emergency stop switch, a two-hand control safety device and two safety contactors relay are connected.

Item	Setting
Time of noise removal filter X2.3*1	0: 1 ms . 1: 5 ms. 2: 10 ms. 3: 20 ms. 4: 50 ms
Time of noise removal filter X4.5*1	0: 1 ms . 1: 5 ms. 2: 10 ms. 3: 20 ms. 4: 50 ms
Time of noise removal filter X8.9*1	0: 1 ms . 1: 5 ms. 2: 10 ms. 3: 20 ms. 4: 50 ms
Time of noise removal filter XA.B*1	0: 1 ms . 1: 5 ms. 2: 10 ms. 3: 20 ms. 4: 50 ms
Double input discrepancy detection time X2.3*1	100 ms (Setting range: 20ms to 60s*2)
Double input discrepancy detection time X4.5*1	100 ms (Setting range: 20ms to 60s*2)
Double input discrepancy detection time X8.9*1	100 ms (Setting range: 20ms to 60s*2)
Double input discrepancy detection time XA.B*1	100 ms (Setting range: 20ms to 60s*2)
Input dark test selection X2.3	0:Execute .1:Not execute .3*3:X2:Execute, X3:Not execute .4*3:X2:Not execute, X3:Execute
Input dark test selection X4.5	0:Execute .1:Not execute .3*3:X4:Execute, X5:Not execute .4*3:X4:Not execute, X5:Execute
Input dark test selection X8.9	0:Execute .1:Not execute .3*3:X8:Execute, X9:Not execute .4*3:X8:Not execute, X9:Execute
Input dark test selection XA.B	0:Execute .1:Not execute .3*3:XA:Execute, XB:Not execute .4*3:XA:Not execute, XB:Execute
Input dark test pulse OFF time	0: 400 µs .1: 1 ms. 2: 2 ms
Method of wiring of output Y2	0: No use. 1: Double wiring (source + sink). 2: Double wiring (source + source)
Output dark test selection Y2	0: Execute .1: Not execute
Output dark test pulse OFF time Y2	0: 400 µs .1: 1 ms. 2: 2 ms
Double input/single input selectionX2.3*3	0:Double input .1:X2,X3:Single input .3:X2:Single input, X3:No use .4:X2:No use, X3:Single input
Double input/single input selectionX4.5*3	0:Double input .1:X4,X5:Single input .3:X4:Single input, X5:No use .4:X4:No use, X5:Single input
Double input/single input selectionX8.9*3	0:Double input .1:X8,X9:Single input .3:X8:Single input, X9:No use .4:X8:No use, X9:Single input
Double input/single input selectionXA.B*3	0:Double input .1:XA,XB:Single input .3:XA:Single input,XB:No use .4:XA:No use, XB:Single input
Auto RTN Func to detect double input mismatch*3	0:Invalid .1:Valid

*1 Adjust "Time of noise removal filter", "Input dark test pulse OFF time", and "Output dark test pulse OFF time" according to the installation environment and wiring length. Set "Double input discrepancy detection time" to "100 ms" for the mechanical switch and "20 ms" for the sensor input as a guideline.

*2 The setting range is 20 ms to 500 ms for QS0J65BTB2-12DT models prior to module technical version B. The range is 20 ms to 60 s for subsequent models.

*3 The setting is only possible for QS0J65BTB2-12DT units of technical version D or later, and QS0J65BTS2-8D units of technical version B or later.

Double input/single input selection

Input signal type (single/double) can be changed easily via parameters.

- Maximum 16 points of single inputs.
- Double and single type inputs may mixed.

Input/output dark test function

When the input/output is on, the module outputs a momentary OFF pulse which is used for failure diagnostics of contacts and external components.

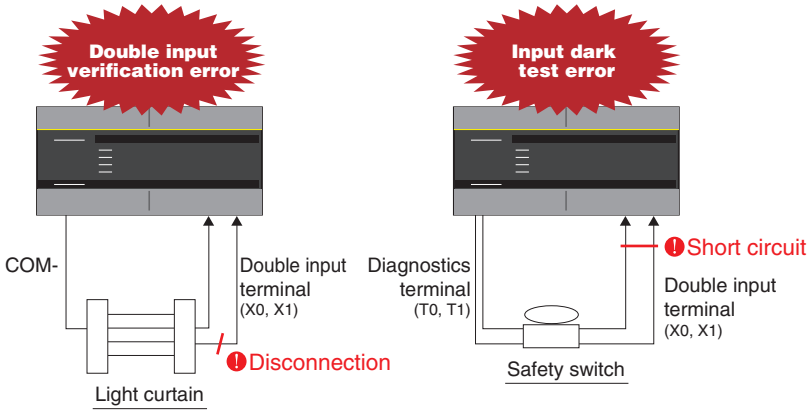
For details regarding this failure diagnostics, refer to the "Safety input diagnostics" and "Safety output diagnostics" shown on page 20.

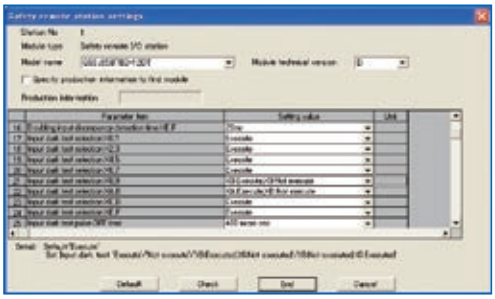
* For programming examples, refer to the "Safety Application Guide" (SH (NA)-080613ENG-A).

Safety input diagnostics

Diagnoses a failure including that of external components by verifying input signals of double input wiring. Detects disconnection etc.

Diagnoses a failure of contacts and external components by the input dark test function. Detects short circuit etc.





Safety remote station setting screen (input parameters)

Auto recovery after double input discrepancy error function

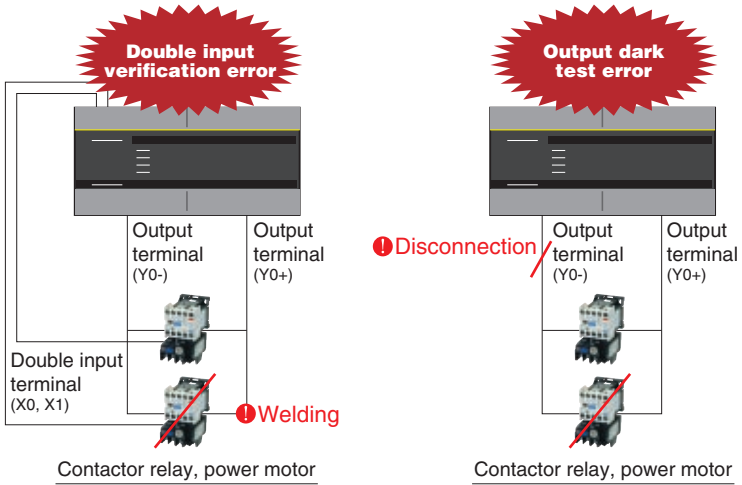
Using a parameter setting, it is possible to recover from a double input mismatch error without a reset operation.

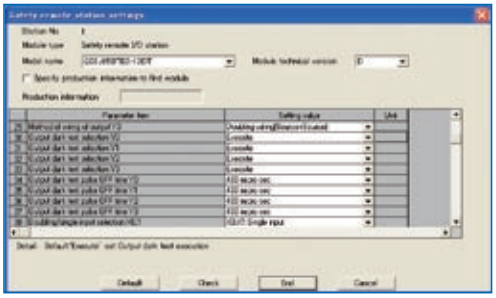
- Remote I/O units continue to function normally, only the effected input signal is turned OFF.
- After resolving the cause of the double input signal disagreement, normal operation is restored by turning OFF the input signal. It is unnecessary to press the reset button of the remote I/O unit.

Safety output diagnostics

Inputs the b-contact of contactor relay and detects welding etc. of the contactor relay by the input dark test function.

Diagnoses a failure of contacts and external components by the output dark test function. Detects disconnection etc.





Safety remote station setting screen (output parameters)

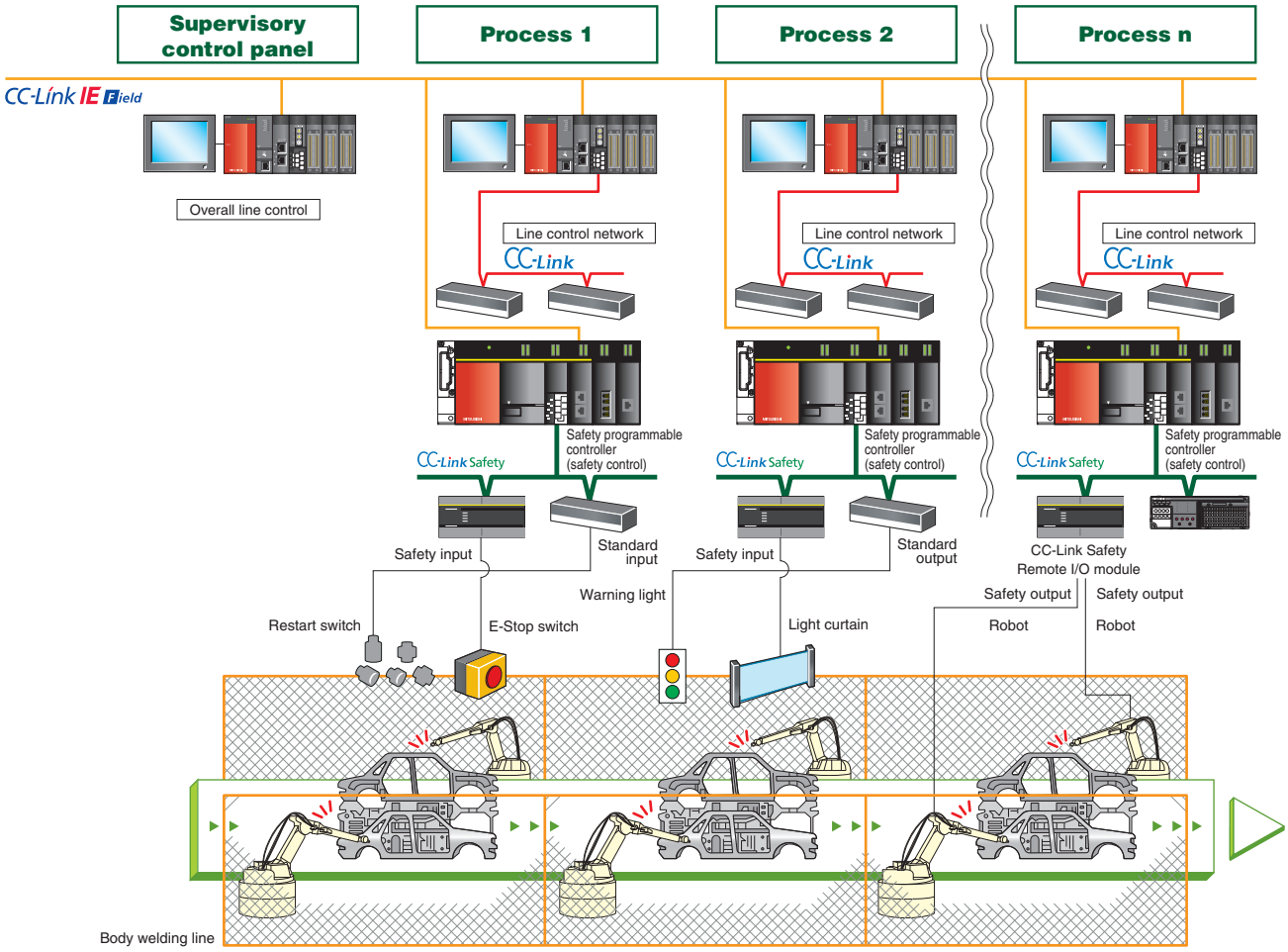
* Need to connect safety inputs to the b-contact of contactor relays with forcibly guided contacts.

Meeting the safety needs of a variety of end-user industries around the world.

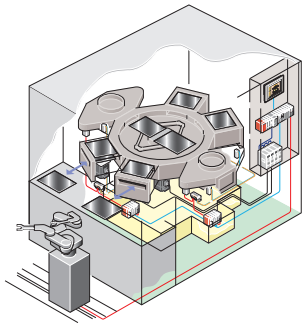
Application examples

Automotive welding line

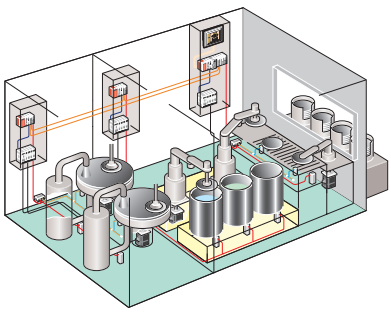
Ensures safety on a welding line with multiple welding robots.
In systems with multiple stations and safety controllers, critical safety data is shared over the network which allows an emergency stop in one station to safely stop the stations before and after in the line.



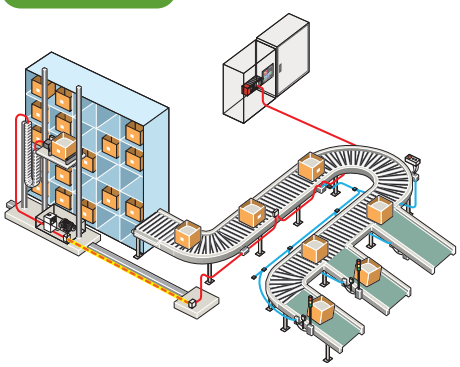
Liquid crystal manufacturing equipment



Semiconductor manufacturing equipment

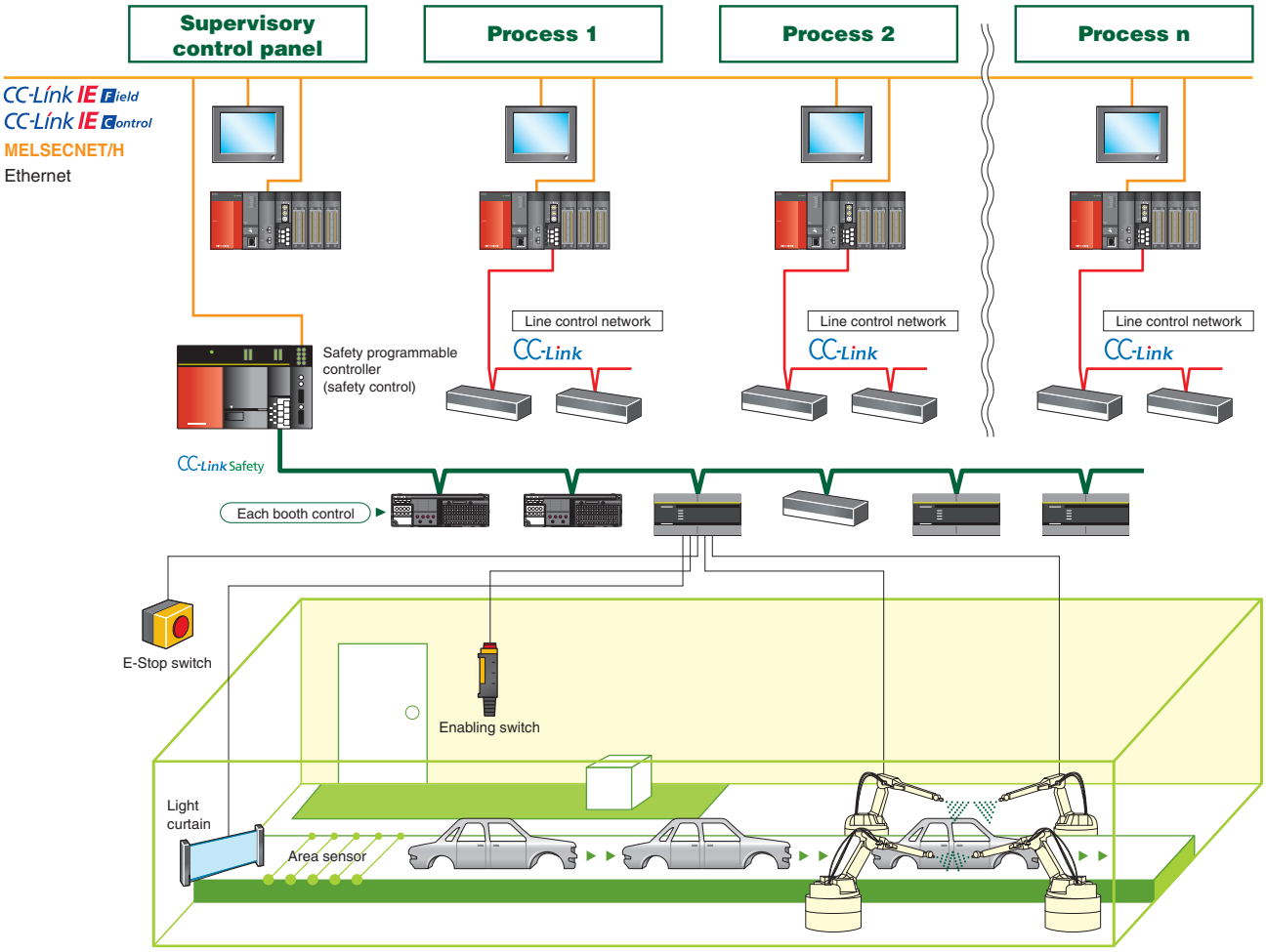


Material handling

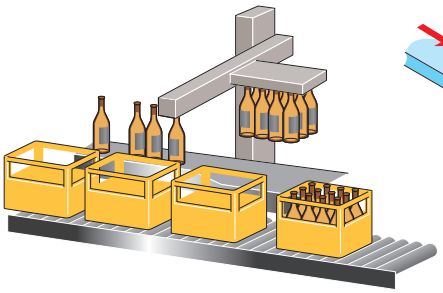


Automotive painting line

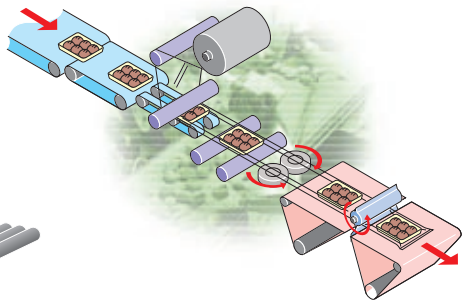
Monitor the operational condition of the paint booth, working area, etc. of a painting line via the network.



Beverage factory



Packaging equipment



Electronic assembly line

■ MELSEC-QS series general specifications

Item	Specifications					
Operating ambient temperature	0 to 55°C					
Storage ambient temperature	-40 to 75°C					
Operating ambient humidity	5 to 95% RH, non-condensing					
Storage ambient humidity	5 to 95% RH, non-condensing					
Vibration resistance	Conforms to JIS B 3502, IEC61131-2		Frequency range	Constant acceleration	Half amplitude	Sweep count
		Under intermittent vibration	5 to 8.4 Hz	–	3.5 mm	10 times each in X, Y, Z directions
			8.4 to 150 Hz	9.8 m/s²	–	
		Under continuous vibration	5 to 8.4 Hz	–	1.75 mm	–
			8.4 to 150 Hz	4.9 m/s²	–	
Shock resistance	Conforms to JIS B 3502, IEC61131-2 (147 m/s², 11 ms shock pulse duration, shine half-wave pulse applied 3 times each in X, Y, Z directions.)					
Operating ambience	No corrosive gases					
Operating altitude*3	2,000 m (6562 ft.) or less					
Installation location	Inside control panel					
Overvoltage category*1	II or less					
Pollution degree*2	2 or less					
Equipment category	Class I					

*1: This indicates the section of power supply to which the equipment is assumed to be connected between the public electrical power distribution network and the machinery within the premises. Category II 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.
*2: This index indicates the degree to which conductive material is generated in the environment where the device is used. Pollution degree 2 is when only non-conductive pollution occurs. However, temporary conductivity caused by condensation is to be expected.
*3: Do not store or use the programmable controller under the pressure higher than the atmospheric pressure of altitude 0 m. Doing so can cause a malfunction. When using the programmable controller under pressure, please consult your local sales representative.

■Safety CPU module specifications

Item		QS001CPU
Control method		Repetitive operation of stored program
I/O control mode		Refresh
Program language	Sequence control language	Relay symbol language, function block
Processing speed (sequence instruction)	LD X0	0.10 µs
	MOV D0 D1	0.35 µs
Constant scan (function that keeps scan time constant)		1 to 2,000 ms (setting unit: 1 ms)
Program capacity*1		14 k steps (56 KB)
Memory capacity	Program memory (Drive 0)	128 KB
	Standard ROM (Drive 4)	128 KB
Max. number of stored files	Program memory	3*2
	Standard ROM	3*2
Number of writes to standard ROM		Max. 100,000 times
Number of I/O device points		6144 points (X/Y0 to 17FF)
Number of I/O points		1024 points (X/Y0 to 3FF)
Number of device points	Internal relay [M]	Default: 6144 points (M0 to 6143) (changeable)
	Link relay [B]	Default: 2048 points (B0 to 7FF) (changeable)
	Timer [T]	Default: 512 points (T0 to 511) (changeable) (for low-/high-speed timer) Low-/high-speed timer is specified by instructions. The low-/high-speed timer measurement unit is set by parameters. (Low-speed timer: 1 to 1000 ms, in increments of 1 ms; default: 100 ms) (High-speed timer: 0.1 to 100 ms, in increments of 0.1 ms; default: 10 ms)
	Retentive timer [ST]	Default: 0 points (for low-/high-speed retentive timer) (changeable) Low-/high-speed retentive timer is specified by instructions. The low-/high-speed retentive timer measurement unit is set by parameters. (Low-speed retentive timer: 1 to 1000 ms, in increments of 1 ms; default: 100 ms) (High-speed retentive timer: 0.1 to 100 ms, in increments of 0.1 ms; default: 10 ms)
	Counter [C]	Normal counter default: 512 points (C0 to 511) (changeable)
	Data register [D]	Default: 6144 points (D0 to 6143) (changeable)
	Link register [W]	Default: 2048 points (W0 to 7FF) (changeable)
	Annunciator [F]	Default: 1024 points (F0 to 1023) (changeable)
	Edge relay [V]	Default: 1024 points (V0 to 1023) (changeable)
	Link special relay [SB]	1536 points (SB0 to 5FF)
	Link special register [SW]	1536 points (SW0 to 5FF)
	Special relay [SM]	5120 points (SM0 to 5119)
	Special register [SD]	5120 points (SD0 to 5119)
RUN/PAUSE contact		RUN contact: 1 point can be set in the range of X0 to 17FF, PAUSE contact: None
Clock function		Year, month, date, hour, minute, second, day (automatic leap-year detection) Accuracy: -3.18 to +5.25 s (TYP. +2.14 s)/d at 0°C Accuracy: -3.18 to +2.59 s (TYP. +2.07 s)/d at 25°C Accuracy: -12.97 to +3.63 s (TYP. +3.16 s)/d at 55°C
5 V DC internal current consumption		0.43 A
Weight		0.29 kg
Degree of protection		IP2X

*1: The maximum number of executable sequence steps is calculated using the following formula:
(Program capacity) - (File header size [default: 34 steps])
For details of program capacity and file, refer to the following manual.
QSCPU User's Manual (Function Explanations, Program Fundamentals).
*2: The memory stores 1 file for each of parameter, sequence program, and device comment.

■Safety power supply module specifications

Item			QS061P-A1	QS061P-A2
Mounting position on base			QS series power supply module mounting slot	
Applicable base unit			QS034B	
Input power supply			100 to 120 V AC +10% –15% (85 to 132 V AC)	200 to 240 V AC +10% –15% (170 to 264 V AC)
Input frequency			50/60 Hz ± 5%	
Input voltage distortion factor			5% or less	
Max. input apparent power			125 VA	
Inrush current			20 A 8 ms or less	
5 V DC	Rated output current		6 A	
	Overcurrent protection		6.6 A or more	
	Overvoltage protection		5.5 to 6.5 V	
Efficiency			70% or more	
Allowable momentary power failure period			20 ms or less	
Dielectric withstand voltage			Across inputs/LG and outputs/FG 1780 Vrms AC/3 cycles (Altitude: 2,000 m [6562 ft.])	Across inputs/LG and outputs/FG 2830 Vrms AC/3 cycles (Altitude: 2,000 m [6562 ft.])
Insulation resistance			Across Inputs/LG and outputs/FG, across inputs and LG, across outputs and FG: 10 MΩ or more by 500 V DC insulation resistance tester	
Noise immunity			• By noise simulator of 1500 Vp-p noise voltage, 1 µs pulse width, and 25 to 60 Hz noise frequency • Noise voltage IEC61000-4-4, 2 kV	
Operation indication			LED indicators (Normal: ON [green]; error: OFF)	
Fuse			Built-in (unchangeable by user)	
Contact output section	Application		ERR. contact	
	Rated switching voltage/current		24 V DC, 0.5 A	
	Min. switching load		5 V DC, 1 mA	
	Response time		OFF to ON: 10 ms or less, ON to OFF: 12 ms or less	
	Life		Mechanical: 20,000,000 times more; electrical: 100,000 times or more at rated switching voltage/current.	
	Surge suppressor		No	
	Fuse		No	
Terminal screw size			M3.5 screw	
Applicable wire size			0.75 to 2 mm²	
Applicable crimping terminal			RAV1.25-3.5, RAV2-3.5 (thickness of 0.8 mm or less)	
Applicable tightening torque			0.66 to 0.89 N·m	
Weight			0.40 kg	

■Safety main base unit specifications

Item	QS034B
Number of mountable I/O modules	4
Possibility of extension	Not extendable
Applicable modules	QS series modules
5 V DC internal current consumption	0.095 A
Mounting hole size	M4 screw hole or ϕ4.5 hole (for M4 screw)
Weight	0.28 kg
Accessories	Mounting screws M4 × 14 (4 screws) (DIN rail mounting adaptor to be sold separately)
DIN rail mounting adaptor type	Q6DIN2

■Specifications for CC-Link IE Field Network master/local module (with Safety Communication Functions)

Item			QS0J71GF11-T2
Maximum number of connectable stations per network*1	Standard station		121 stations (1 master plus 120 slave stations)
	Safety station		32 stations (1 master plus 31 slave stations)
Maximum number of networks			239
Maximum number of safety connections per station			31 connections
Number of safety inputs/outputs per safety connection		Input	8 words (128bits)
		Output	8 words (128bits)
Maximum link points per network		RWw	8192 points, 16KB
		RWr	8192 points, 16KB
		RX	16384 points, 2KB
		RY	16384 points, 2KB
Maximum link points per station	Master station (safety station)	RWw	8192 points, 16KB
		RWr	8192 points, 16KB
		RX	16384 points, 2KB
		RY	16384 points, 2KB
	Local station	RWw	8192 points, 16KB (also including the send range of own station)
		RWr	8192 points, 16KB
		RX	16384 points, 2KB
		RY	16384 points, 2KB (also including the send range of own station)
Maximum number of send points per station	Master station (safety station)	RWw	8192 points, 16KB
		RY	16384 points, 2KB
	Local station	RWw	1024 points, 2048 bytes 256 points, 512 bytes when mode is "Online (High-speed mode)".
		RY	2048 points, 256 bytes
Ethernet	Communication speed		1Gbps
	Network topology		Line topology, star topology (Coexistence of line topology and star topology is possible.), and ring topology
	Connection cable		An Ethernet cable that meets the 1000BASE-T standard: Category 5e or higher (double shielded, STP), straight cable
	Maximum station-to-station distance		100m max. (Compliant with ANSI/TIA/EIA-568-B (Category 5e))
	Overall cable distance		• Line topology: 12000m (when cables are connected to 1 master station and 120 slave stations) • Star topology: Depends on the system configuration. • Ring topology: 12100m (when cables are connected to 1 master station and 120 slave stations)
	Number of cascade connections		Up to 20
Communication method			Token passing method
Number of occupied I/O points			32 points (I/O assignment: Intelligent 32 points)
Internal current consumption (5VDC)			0.85A
Weight			0.18kg

*1: For combining standard and safety stations, up to 121 stations can be connected per network.
(Standard or safety station can be master station.)

■CC-Link Safety system master module specifications

Item		QS0J61BT12				
Transmission speed		Selectable from 156 kbps/625 kbps/2.5 Mbps/5 Mbps/10 Mbps				
Max. overall cable distance (max. transmission distance)		Ver. 1.10 compatible, CC-Link dedicated cable (Terminating resistor of 110 Ω is used)				
		Transmission speed	Station-to-station cable length		Max. overall cable distance	
		156 kbps	20 cm or more		1200 m	
		625 kbps			900 m	
		2.5 Mbps			400 m	
		5 Mbps			160 m	
		10 Mbps			100 m	
Max. number of connectable modules		64 modules (42 for safety remote stations)				
Max. number of link points per system		Remote I/O (RX, RY): 2048 points				
		Remote register (RWr): 256 points (remote device station to master station)				
		Remote register (RWw): 256 points (master station to remote device station)				
Number of link points per remote station	Station type	Safety remote station	Standard remote station			
	Number of occupied stations	1 station	1 station	2 stations	3 stations	4 stations
	RX	32 points	32 points	64 points	96 points	128 points
	RY	32 points	32 points	64 points	96 points	128 points
	RWr	0 points	4 points	8 points	12 points	16 points
	RWw	0 points	4 points	8 points	12 points	16 points
Communication method		Broadcast polling method				
Synchronization method		Flag synchronous method				
Coding method		NRZI method				
Transmission path		Bus (RS-485)				
Transmission format		HDLC compliant				
Error control system		CRC32*1 ($X^{32}+X^{26}+X^{23}+X^{22}+X^{16}+X^{12}+X^{11}+X^{10}+X^{8}+X^{7}+X^{5}+X^{4}+X^{2}+X+1$)				
		CRC16 ($X^{16}+X^{12}+X^{5}+1$)				
Connection cable		Ver. 1.10 compatible, CC-Link dedicated cable*2				
Number of occupied I/O points		32 points (I/O assignment: 32 intelligent points)				
5 V DC internal current consumption		0.46 A				
Weight		0.12 kg				

*1: Error detection using CRC32 is not performed for communication with standard remote I/O stations or remote device stations.

*2: CC-Link dedicated cable (Ver. 1.00) or CC-Link dedicated high-performance cable can also be used. Using a cable together with another type of cable is not allowed. Attach terminating resistors that match the cable type. Two terminating resistors (110 Ω) are included with the CC-Link Safety system master module.

■CC-Link Safety System remote I/O module specifications

Item		QS0J65BTB2-12DT			
Input specifications			Output specifications		
No. of input points*1		8 points (double input), 16 points (single input)	No. of output points		4 points(source + sink type) 2 points(source + source type)
Isolation method		Photocoupler	Isolation method		Photocoupler
Rated input voltage		24VDC	Rated load voltage		24VDC
Rated input current		Approx. 4.6mA	Operating load voltage range		19.2V to 28.8VDC (Ripple ratio: 5% or less)
Operating voltage range		19.2V to 28.8VDC (Ripple ratio: 5% or less)	Maximum load current		0.5A/point
Maximum simultaneous input points		100%	Maximum inrush current		1.0A, 10ms or less
ON voltage/ON current		15VDC/2mA or more	Leakage current at OFF		0.5mA or less
OFF voltage/OFF current		5VDC/0.5mA or less	Max. voltage drop at ON		1.0VDC or less
Input resistance		Approx.5.6k Ω	Protection function		Output overload protection function
Input type		Negative common (source type)	Output type		Source + sink type Source + source type
Response time	OFF → ON	0.4ms or less (at 24VDC)	Response time	OFF → ON	0.4ms or less (at 24VDC)
	ON → OFF	0.4ms or less (at 24VDC)		ON → OFF	0.4ms or less (at 24VDC)
Safety remote station input response time		11.2ms*2 or less + time of noise removal filter (1ms, 5ms, 10ms, 20ms, 50ms)	Safety remote station output response time		10.4ms or less (at ON → OFF) 11.2ms or less (at OFF → ON)*3
			Surge suppressor		Zener diode
External power supply	Voltage	19.2V to 28.8VDC (Ripple ratio: 5% or less)			
	Current	60mA (24VDC, with all points ON, excepting for external load current)			
	Protection function	External power supply overvoltage/overcurrent protection function			
	Fuse	8A (Not replaceable)			
Wiring method for common		16 input points/common, 4 output points/common (Terminal block 2-wire type)			
Common current		Maximum 4A (Total of inputs and outputs)			
No. of stations occupied		1 station			
No. of access to nonvolatile memory inside module		10^{12} times			
Safety refresh response processing time		9.6ms*5			
Module power*4	Voltage	19.2V to 28.8VDC (Ripple ratio: 5% or less)			
	Current	140mA or less (24VDC, with all points ON)			
	Protection function	Module power overvoltage/overcurrent protection function			
	Fuse	0.8A (Not replaceable)			
	Momentary power failure period	10ms or less			
Noise immunity		Tested by a DC-type noise simulator with noise voltage of 500Vp-p, noise width of 1μs and frequency of 25 to 60Hz.			
Dielectric withstand voltage		500VAC between all external DC terminals and ground, for 1 minute			
Insulation resistance		10M Ω or more between all external DC terminals and ground, by a 500VDC insulation resistance tester			
Level of protection		IP2X			
Weight		0.67kg			
External connection system	Communication section, module power section	7-point two-piece terminal block [Transmission circuits, module power, FG] M3 x 5.2 Tightening torque: 0.425 to 0.575N•m, 2 solderless terminals or less			
	External power supply section, I/O section	18-point two-piece terminal block x 3 [External power supply, I/O signals] M3 x 5.2 Tightening torque: 0.425 to 0.575N•m, 2 solderless terminals or less			
Module mounting screw		M4 screw with plain washer finished round (Tightening torque range: 0.824 to 1.11N•m) Mountable with a DIN rail (in 6 orientations)			
Applicable DIN rail		TH35-7.5Fe, TH35-7.5AI (Compliant with IEC60715)			
Applicable cable size		0.3 to 2.0mm²			
Applicable solderless terminal		• RAV1.25-3 [Applicable wire size: 0.3 to 1.25mm²] • V2-MS3 (JST Mfg. Co., Ltd.), RAP2-3SL (Nippon Tanshi Co., Ltd.), TGV2-3N (Nichifu) [Applicable wire size: 1.25 to 2mm²]			

*1: For module technical version C or earlier, the number of input points is 8 points. (Two inputs terminals are assigned for each input since double wiring is supported.)

*2: For module technical version A, the safety remote station input response time is 32ms or less + time of noise removal filter.

*3: For module technical version A, the safety remote station output response time is 32ms or less.

*4: The power supply connected to the QS0J65BTB2-12DT must satisfy the following conditions:

(1) Reinforced insulation

SELV (Safety Extra Low Voltage): Hazardous potential part (48V or more)

(2) Compliance with the LVD (Low Voltage Directive)

(3) Output voltage within 19.2V to 28.8VDC (Ripple ratio: 5% or less.)

*5: For module technical version A, the safety refresh response processing time is 38ms.

CC-Link Safety System remote I/O module specifications

Item			QS0J65BTS2-8D	QS0J65BTS2-4T
No. of input points*1			8 points (double input), 16 points (single input)	—
No. of output points			—	4 points (source + sink type), 2 points (source + source type)
Insulation method			Photocoupler	
Rated input voltage			24VDC	—
Rated load voltage			—	24VDC
Rated input current			Approx.5.9mA	—
Operating voltage range			19.2 to 28.8VDC (Ripple ratio: 5% or less)	—
Operating load voltage range			—	19.2V to 28.8VDC (Ripple ratio: 5% or less)
Maximum load current			—	0.5A per point
Maximum inrush current			—	1.0A, 10ms or less
Maximum number of simultaneous input points			100%	—
ON voltage/ON current			15VDC/2mA or more	—
OFF voltage/OFF current			5VDC/0.5mA or less	—
Leakage current at OFF			—	0.5mA or less
Maximum voltage drop at ON			—	1.0VDC or less
Protection function			—	Output overload protection function
Input resistance			Approx.4.3k Ω	—
Input format			Negative common (source type)	—
Output format			—	Source + Sink type, Source + Source type
Response time	OFF → ON		0.4ms or less (at 24VDC)	
	ON → OFF		0.4ms or less (at 24VDC)	
Safety remote station	input response time		11.2ms or less + time of noise removal filter (1ms, 5ms, 10ms, 20ms, 50ms)	—
	output response time		—	10.4ms or less (at ON → OFF), 11.2ms or less (at OFF → ON)
Surge suppressor			—	Zener diode
External power supply	Voltage		19.2V to 28.8VDC (Ripple ratio: 5% or less)	
	Current		40mA (24VDC, all points ON, excluding the external load current)	45mA (24VDC, all points ON, excluding the external load current)
	Protection function		External power supply overvoltage/overcurrent protection function	
	Fuse		8A (Not replaceable)	
Wiring method for common			16 input points per common (Spring clamp terminal block 2-wire type)	4 output points per common (Spring clamp terminal block 2-wire type)
Common current			—	Maximum 2A
Number of occupied stations			1 station	
Number of accesses to nonvolatile memory inside module			10^{12}times	
Safety refresh response processing time			9.6ms	
Module power supply*2	Voltage		19.2V to 28.8VDC (Ripple ratio: 5% or less)	
	Current		120mA or less (24VDC, all points ON)	95mA or less (24VDC, all points ON)
	Protection function		Module power supply overvoltage/overcurrent protection function	
	Fuse		0.8A (Not replaceable)	
	Momentary power failure period		10ms or less	
Noise immunity			Tested by a DC-type noise simulator with noise voltage of 500Vp-p, noise width of 1μs and frequency of 25 to 60Hz.	
Dielectric withstand voltage			500VAC between all external DC terminals and ground, for 1 minute	
Insulation resistance			10M Ω or more between all external DC terminals and ground, by a 500VDC insulation resistance tester	
Level of protection			IP2X	
Weight			0.46kg	0.45kg
External connection system	Communication section, module power supply section		7-point two-piece terminal block [Transmission circuits, module power, FG] M3 x 5.2 Tightening torque: 0.425 to 0.575N•m, 2 solderless terminals or less	
	External power supply section, input secton		Two-piece spring clamp terminal block [External power supply, input section]	—
	External power supply section, output secton		—	Two-piece spring clamp terminal block [External power supply, output section]
Module mounting screw			M4 screw with plain washer finished round (Tightening torque range: 0.824 to 1.11N•m) Mountable with a DIN rail (in 6 orientations)	
Applicable DIN rail			TH35-7.5Fe, TH35-7.5Al (Compliant with IEC60715)	
Applicable wire size	Communication section, module power supply section		0.3 to 2.0mm²	
		Applicable solderless terminal	• RAV1.25-3 [Applicable wire size: 0.3 to 1.25mm²] • V2-MS3 (JST Mfg. Co., Ltd.), RAP2-3SL (Nippon Tanshi Co., Ltd.), TGV2-3N (Nichifu) [Applicable wire size: 1.25 to 2mm²]	
	External power supply section, input section		Twisted wire 0.08 to 1.5mm² (AWG28 to 16)*3 Applicable wire strip length: 8 to 11mm	
		Applicable solderless terminal	• TE0.5 (Nichifu) [Applicable wire size: 0.5mm²] • TE0.75 (Nichifu) [Applicable wire size: 0.75mm²] • TE1 (Nichifu) [Applicable wire size: 0.9 to 1.0mm²] • TE1.5 (Nichifu) [Applicable wire size: 1.25 to 1.5mm²] • FA-VTC125T9 (Mitsubishi Electric Engineering Co.,Ltd. [Applicable wire size: 0.3 to 1.65mm²] • FA-VTCW125T9 (Mitsubishi Electric Engineering Co.,Ltd. [Applicable wire size:0.3 to 1.65mm²]	

*1: For module technical version A, the number of input points is 8 points. (Two inputs terminals are assigned for each input since double wiring is supported.)

*2: The power supply connected to the QS0J65BTS2-8D, QS0J65BTS2-4T must satisfy the following conditions:

(1)Reinforced insulation

SELV (Safety Extra Low Voltage): Hazardous potential part (48V or more)

(2)Compliance with the LVD (Low Voltage Directive)

(3)Output voltage within 19.2V to 28.8VDC (Ripple ratio: 5% or less.)

*3: Do not insert two or more wires into one terminal.

Safety Controller

The MELSEC-WS series

The new standard controller jointly developed with the top safety-related companies.

MELSEC Safety

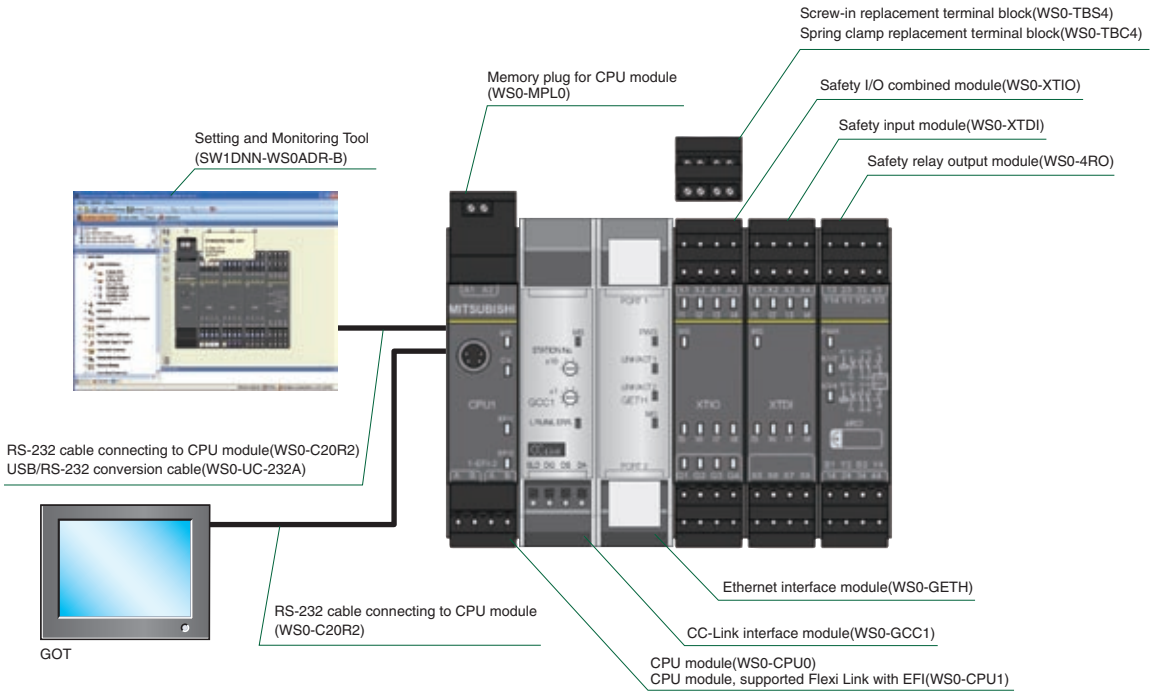
MITSUBISHI SAFETY FA SOLUTION

Best suited for small and medium safety systems! A compact new solution featuring easy to use settings.

MELSEC-WS series-a new safety controller

This compact new safety controller complies with ISO13849-1 PLe and IEC61508 SIL3 safety standards.
The most suitable application of MELSEC-WS is to ensure safe operation of stand-alone machines or systems.
To meet your system configuration, it allows you to have additional I/O points of up to 144. Also, you can easily make settings and create logic by using the Setting and Monitoring Tool exclusively provided for the controller.

MELSEC-WS basic configuration



Powered by SICK

The MELSEC-WS series is jointly developed and manufactured by Mitsubishi Electric and SICK
SICK AG a German company, is a supplier of safety solutions.
SICK designs and manufactures a broad range of safety products including industrial-use sensors and automatic identification systems.

Intuitively understandable setting operations, plus flexible expandability. The compact profile includes full cutting-edge safety technologies.

Feature:1

Compact design to meet today's needs for smaller safety control units

Each module is just 22.5 mm wide.
This compact size is optimum for incorporating into compact control boards and equipment.

Feature:2

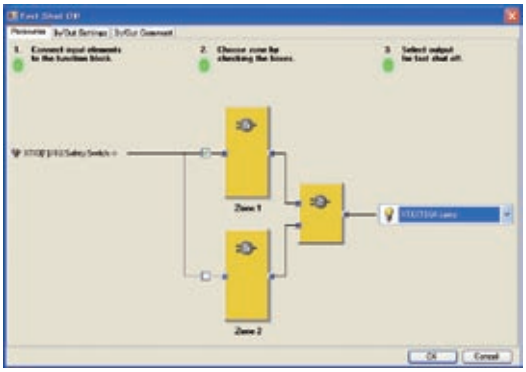
To meet today's needs - compact safety controller with flexible expandability

- Maximum expandable modules include 12 safety input/I/O modules, 4 safety relay output modules, and 2 network modules.
- At the maximum configuration of safety input and I/O modules, I/O points are 96 for single input and 48 for single output-totaling 144.

Feature:3

Fast shut off with a response of 8 ms

Fast shut off lets the safety I/O module shut off safety output not via the CPU module, speeding up response to 8 ms. Shorten safety distances in your safety systems.



Feature:4

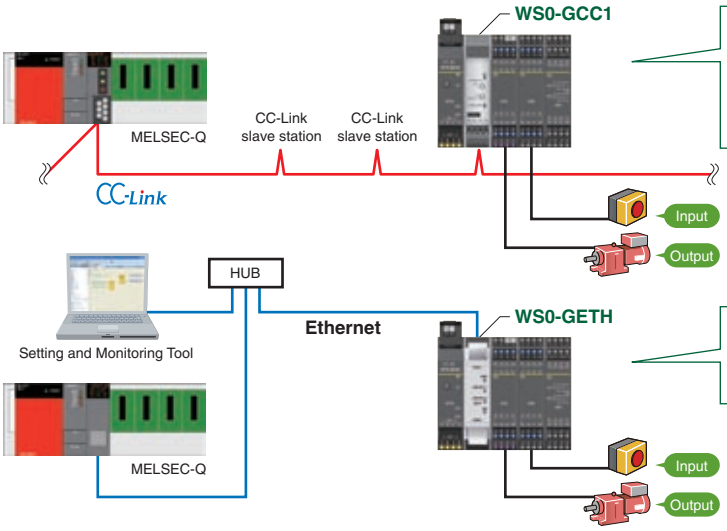
Safety control can be easily added to existing MELSEC PLCs (CC-Link/Ethernet)

Connecting safety controller to CC-Link, safety control can be performed with the existing MELSEC-Q/L modules. Furthermore, operation status and error status of the safety controller can be monitored with existing MELSEC-Q/L module. Safety control helps specifying the factor of emergency stop and faulty equipment efficiency.

*1 EFI communication:Extensible Firmware Interface(EFI) communication between WS0-CPU1 modules and SICK's safety products.

＜Applicable functions with network interface＞

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



WS0-GCC1 CC-Link interface module
- Just set parameters to have a MELSEC product monitor data and get notifications from the safety controller.
- Add the safety controller as a remote device station to your existing CC-Link network.

WS0-GETH Ethernet interface module
- Conduct remote maintenance using the Setting and Monitoring Tool.

Feature:5

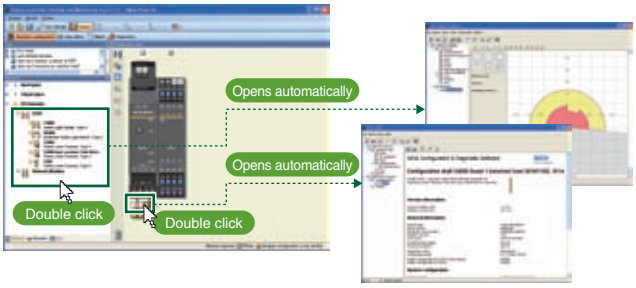
Enhanced by the distinctive technologies of SICK-the leading company of safety solutions

The EFI connection of the WS0-CP1 CPU module makes it possible to input safety data, make settings, and conduct diagnostics on SICK's safety products.

■EFI: SICK original network Interface between WS0-CPU1 and SICK's safety products

Supported equipment
- ●C4000 light curtain ●M4000 light barrier
- ●S3000/S300 laser scanner

Features
- ●Up to 4 safety products can be daisy-chain-connected per EFI 1Ch
- ●Retrieve safety data, make settings, and conduct diagnostics on SICK's safety products

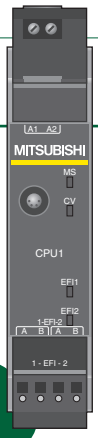


*SICK's setting tool(CDS) is included in the "Setting and Monitoring Tool".
By double-clicking the icon of EFI equipment, CDS starts up automatically.

Feature:6

CPU module(WS0-CPU1) supports Flexi Link with EFI for safety communications 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 (Flexi Link cables).
Using Flexi Link, safety communication can be conducted between up to four safety controllers.



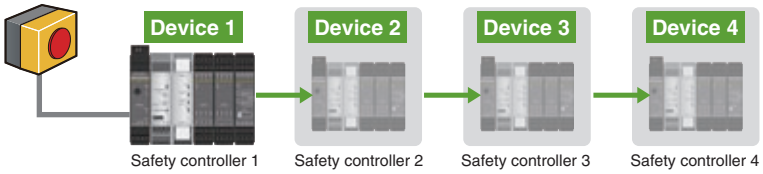
Supported **Flexi Link**[*1] with EFI

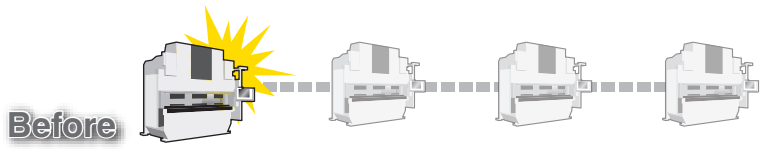
WS0-CPU1
Powered by SICK

*1) Flexi Link, developed by SICK is a safety communication network for use between safety controllers.
EFI is the communication interface for setting and monitoring the SICK safety devices.

■The Flexi Link cable connection between CPU modules enables safety communication

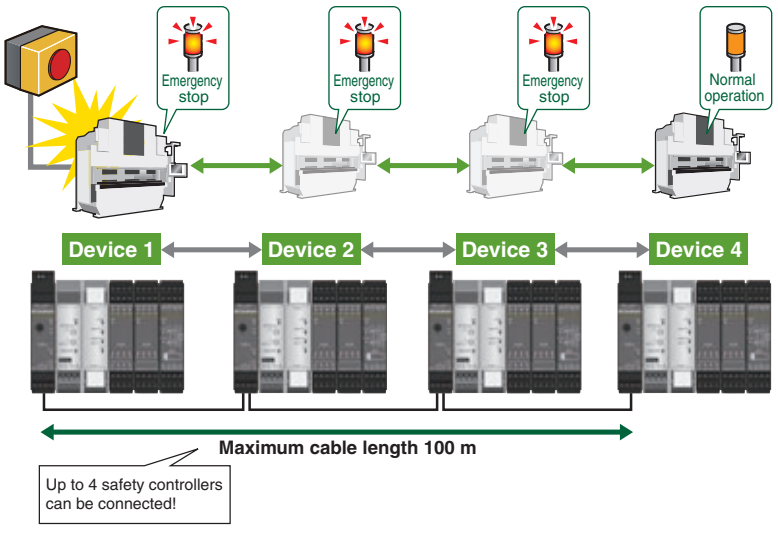
Just connect the device-controlling safety controllers with a Flexi Link cable. With a few simple settings, you'll be ready to start safe communication between devices and processes.





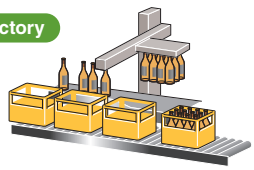
Linking independent devices
- Link several devices with safe communication
- Link error and alarm information to the next process's devices, and execute optimum control
- Easily connect multiple devices

After When an error occurs in device 1, devices 1 to 3 enter emergency stop, and device 4 continues operation

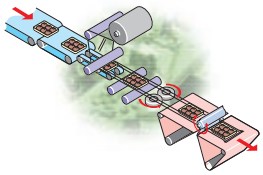


Use Flexi Link to link safety controllers for use in various production sites!
- Realize safe communication with Flexi Link!
- Perfect for linking two to four devices!
- Increase your production system safety by linking devices and processes.

Beverage factory



Packaging machine



Electronic assembly line

Setting and Monitor Tool (Flexi Link System Project)

Set all safety controllers connected with Flexi Link from the Setting and Monitor Tool connected to one safety controller.

System overview screen

Reciprocal switching

Individual safety controller setting screen

System conditions

Flexi Link is supported by WS0-CPU1 CPU modules of firmware version V2.01 (revision 2.xx) or later.

Note) The firmware version is indicated on the Software version field of the CPU module's label. This system is not supported with WS0-CPU0.

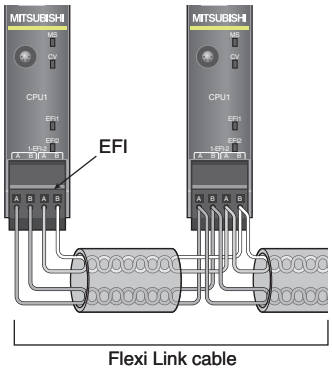
System component	Version
Hardware	WS0-CPU1 with firmware version V2.01 (revision 2.xx) or later
Software	Setting and Monitor Tool version 1.3.0 or later

Flexi Link cable

The CPU modules for up to four safety controllers can be connected with the Flexi Link cable via the EFI interface.

Note) For purchasing and inquiries about the Flexi Link cable, please contact SICK AG.

Cable type	Specifications
Shielded twisted pair cable	2 × 2 × 0.34 mm^2, Max. 100 m



Flexi Link cable

Connection method

There are two methods of connecting between the safety controllers. Either use the EFI interface 1, or use both the EFI interface 1 and 2.
The number of process data bits which can be used by the safety controller connected by Flexi Link differs according to the connection method.

Note) If EFI is used for Flexi Link, an EFI supported device cannot be connected.

Connection method	Available status bits per station
EFI1	26 bits
EFI1/EFI2	52 bits

SICK

This product was jointly developed and manufactured with the German safety device maker SICK AG.
Please note that the terms of the warranty differ from other PLC products.

SICK AG
http://www.sick.com/

Feature:7

The original "Setting and Monitoring Tool" makes intuitively configuration

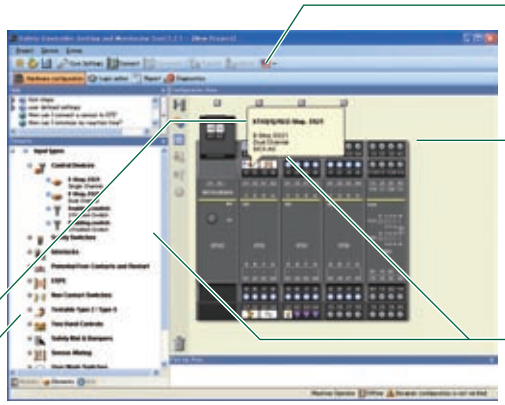
Configuration

Use the various elements to set your hardware configuration easily and quickly.

What are elements?

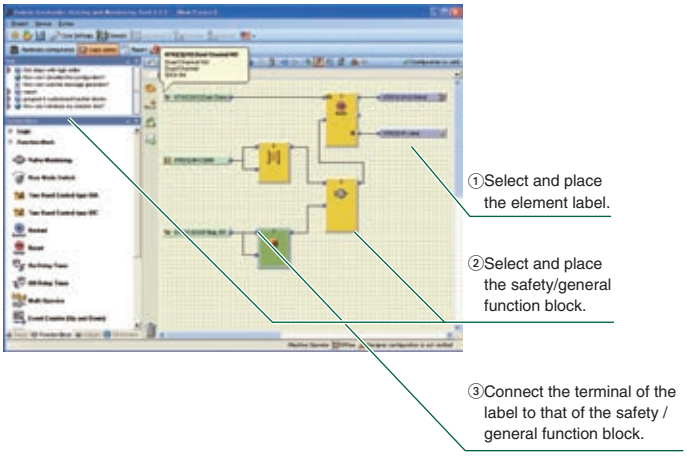
Connecting parameters of major safety equipment, such as Emergency stop and Safety door switches and Light curtain, are expressed by an icon. Make settings simply by drag-and-drop decision.

*Elements for Safety devices of Mitsubishi's partners are also available. Please contact your local Mitsubishi representative.



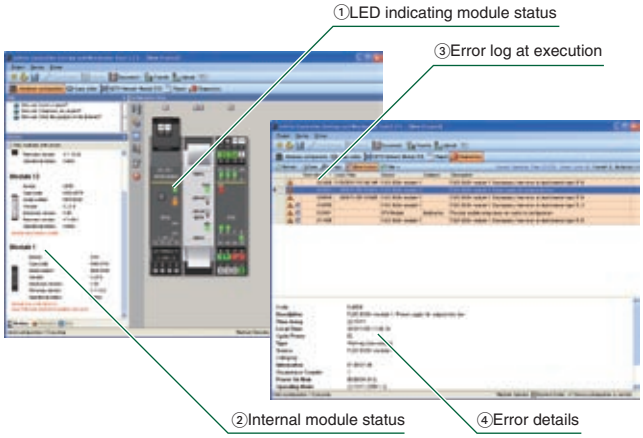
Logic Editor

Elements you connect to the I/O terminal are automatically labeled, enabling you to create logic easily using labels and function blocks.



Diagnosis

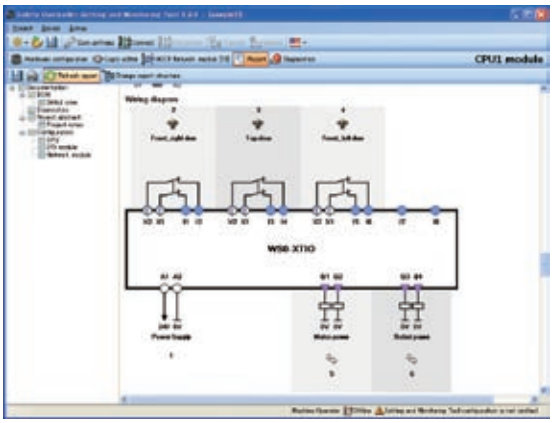
You can monitor the internal status of modules and error logs.



Improved reporting functions

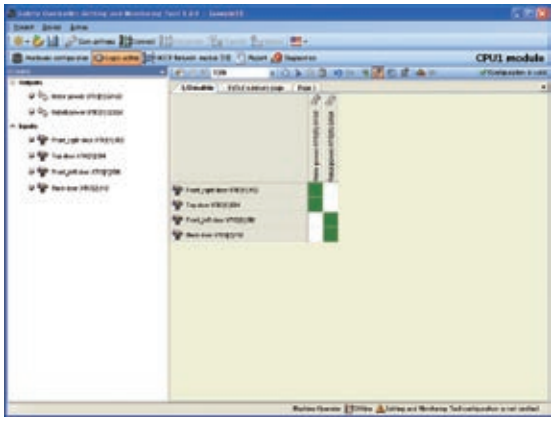
Detailed wiring diagram

The wiring diagram for I/O modules can be automatically created.



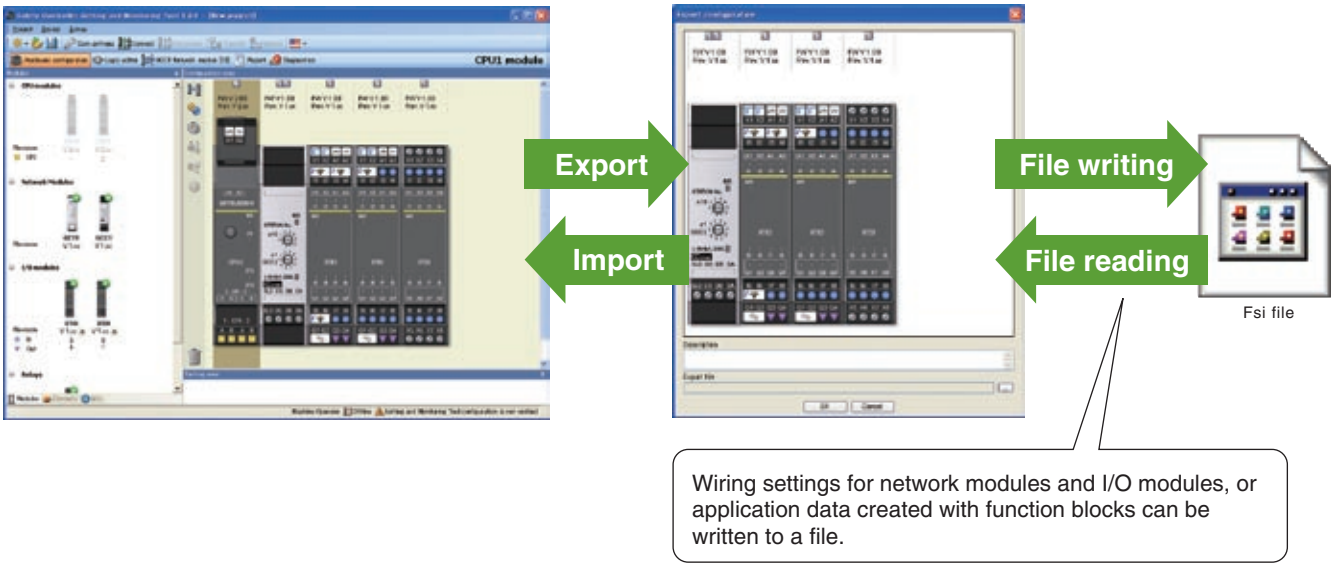
I/O matrix

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



Import and export of logic

The connection settings to the input/output modules or application logic created with the function blocks can be stored in a single setting file, and data can be read out of stored setting files.
There is no longer a need to create new projects or set the hardware again when changing the CPU module type (CPU0 to CPU1, or CPU1 to CPU0) or when using a CPU module of a new firmware version.



MELSEC-WS series general specifications

Item	Specifications					
Operating ambient temperature	−25 to 55°C*1					
Storage ambient temperature	−25 to 70°C					
Operating ambient humidity	10 to 95 % RH, non-condensing					
Storage ambient humidity	10 to 95 % RH, non-condensing					
Vibration resistance	Conforms to JIS B 3502, IEC61131-2		Frequency range	Constant acceleration	Half amplitude	Sweep count
		Under intermittent vibration	5 to 8.4 Hz	—	3.5 mm	10 times each in X, Y, Z directions
			8.4 to 150 Hz	9.8 m/s²	—	
		Under continuous vibration	5 to 8.4 Hz	—	1.75 mm	
			8.4 to 150 Hz	4.9 m/s²	—	
Shock resistance	Conforms to JIS B 3502, IEC61131-2 (147 m/s², 11 ms shock pulse duration, shine half-wave pulse applied 3 times each in X, Y, Z directions.)					
Operating ambience	No corrosive gases					
Operating altitude*2	2,000 m or less					
Installation location	Inside control panel					
Overvoltage category*3	II or less					
Pollution degree*4	2 or less					
Equipment category	Class III					

*1 :0 to 55°C only for WS0-GCC100202.
*2 :Do not store or use the programmable controller under the pressure higher than the atmospheric pressure of altitude 0 m.
*3 :This indicates the section of power supply to which the equipment is assumed to be connected between the public electrical power distribution network and the machinery within the premises. Category II 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.
*4 :This index indicates the degree to which conductive material is generated in the environment where the device is used. Pollution degree 2 is when only non-conductive pollution occurs. However, temporary conductivity caused by condensation is to be expected.

Safety input and I/O combined modules specifications

Item		Specifications	
		WS0-XTIO	WS0-XTDI
Category		Category 4*1 (EN/ISO 13849-1)	Category 4 (EN/ISO 13849-1)
Safety Integrity Level (SIL)		SIL3 (IEC 61508), SIL CL3 (IEC 62061)	
Performance Level (PL)		PLe (EN/ISO 13849-1)	
PFHd (mean probability of a dangerous failure per hour)		4.8 × 10⁻⁹ (For single channel outputs) 0.9 × 10⁻⁹ (For dual channel outputs)	0.4 × 10⁻⁹
Enclosure rating (IEC 60529)		Terminals: IP20, Housing: IP40	
EMC		EN61000-6-2,EN55011 (Class A)	
Protection class		III	
External connection method		By spring clamp terminal block	
Data interface		Backplane bus (FLEX BUS+)	
Power input via FLEXBUS+ (without test pulse output)		Max. 2.2 W	Max. 2 W
Cross-section of connecting wires		Single-core or finely stranded: 0.2 to 1.5 mm² Finely stranded with ferrules: 0.25 to 1.5 mm²	
Weight		0.16 kg	0.14 kg
Power supply unit	Supply voltage	24 V DC (16.8 to 30 V DC)	—
	Type of supply voltage	PELV or SELV (The current of the power supply unit the module has to be limited to a maximum of 4 A - either by the power supply unit itself or by a fuse.)	
	Power consumption	Max. 120 W (30 V × 4 A), determined by the load at the outputs Q1 to Q4, plus max. 1 W power input for the internal circuit	
	Switch-on time	Max. 18 seconds	
	Short-circuit protection	4 A gG (with tripping characteristics B or C)	
Input circuit	Input voltage:ON	13 to 30 V DC	
	Input voltage:OFF	−5 to +5 V DC	
	Input current:ON	2.4 to 3.8 mA	
	Input current:OFF	−2.5 to 2.1 mA	
	Discrepancy times	4 ms to 30 s (Default: 3 s, Increase or decrease 4 ms by 4 ms)	
	Number of inputs	8 points (Single), 4 points (Dual-channel)	
Test outputs	Number of outputs	2 points (2 kinds)	8 points (2 kinds)
	Output type	PNP	
	Output voltage High	15 to 30 V DC	
	Output current (DC)	Max. 120 mA	
	Test pulse rate	1 to 25 Hz (Changeable by settings)	
	Test pulse duration	1 to 100 ms (Changeable by settings)	
	Load capacity	1 µF for test pulse duration ≥ 4 ms, 0.5µF for test pulse duration 1 ms	
	Cable resistance	100 Ω or less	
Safety outputs	Output points	4 points (Single), 2 points (Dual-channel)	—
	Output type	PNP	
	Output voltage High	16 to 30 V DC	
	Output current (DC)	Max. 2 A	
	Total output current	Max. 3.2 A	
	Test pulse width	0.65ms or less	
	Test pulse rate	Max.5 Hz	
	Load capacity	0.5 µF or less	
	Cable resistance	Max. 5 Ω (e.g. 100 m × 1.5 mm² = 1.2 Ω)	
	Response time	Changeable by logic configuration	
	Fast shut off time	8ms	

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

CPU module specifications

Item		Specifications	
		WS0-CPU0	WS0-CPU1
Category		Category 4 (EN/ISO 13849-1)	
Safety Integrity Level (SIL)		SIL3 (IEC 61508) SILCL3 (IEC 62061)	
Performance level (PL)		PLe (EN/ISO 13849-1)	
PFHd(mean probability of a dangerous failure per hour)		1.07×10^{-9}	1.69×10^{-9}
Enclosure rating (EN/IEC 60529)		Terminals: IP20, Housing: IP40	
EMC		IEC61131-2(ZONE B), IEC61000-6-2,EN55011(Class A)	
Protection class		Ⅲ	
Number of EFI interfaces		0	2
EFI connection		—	By spring clamp terminal block
Data interface		Backplane bus (FLEX BUS+)	
Configuration interface		RS-232	
Cross-section of connecting wires		Single-core or finely stranded: 1 × 0.14 to 2.5 mm² or 2 × 0.14 to 0.75 mm² Finely stranded with ferrules to DIN 46228: 1 × 0.25 to 2.5 mm² or 2 × 0.25 to 0.5 mm²	
Weight		0.11 kg	0.12 kg
External power specs	Supply voltage	24 V DC (16.8 to 30 V DC)	
	Type of supply voltage	PELV or SELV (The current of the power supply unit for the main module has to be limited to a maximum of 4 A - either by the power supply unit itself or by a fuse.)	
	Power consumption	Max. 2.5 W	
	Switch-on time	Max. 18 seconds	

Ethernet interface module specifications

Item		Specifications	
		WS0-GETH	
Number of modules mountable to the safety controller		Max. 2 modules (in total of WS0-GETH00200 and WS0-GCC100202)	
Communication specs	Network type	Ethernet (TCP/IP)	
		100Base-TX	10Base-T
	Transmission rate	100Mbps	10Mbps
	Connection technique	RJ45	
Number of connections		Max. 4 connections+1 connection (for Setting and Monitoring Tool only)	
Enclosure rating (EN/IEC 60529)		Terminals: IP20, Housing: IP40	
Data interface		Backplane bus (FLEX BUS+)	
Power consumption		Max. 2.4 W	

CC-Link interface module

Item		Specifications
		WS0-GCC1
Number of modules mountable to the safety controller		Max. 2 modules (in total of WS0-GETH00200 and WS0-GCC100202)
CC-Link communication specs	Station type	Remote device station
	CC-Link version	Ver.1.10
	Transmission speed	156kbps/625kbps/2.5Mbps/5Mbps/10Mbps
	Number of occupied stations	1 to 4 stations
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
Data interface		Backplane bus (FLEX BUS+)
Enclosure rating (EN/IEC60529)		Terminals: IP20, Housing: IP40
External connections		Spring clamp (two-piece terminal block)
Power consumption		Max. 1.4 W

Safety relay output module specifications

Item		Specifications
		WS0-4RO
Category		Category 4
Safety Integrity Level (SIL)		SIL3 (IEC 61508), SILCL3 (IEC 62061)
PFD		1.6×10^{-7}
PFHd		1.2×10^{-9}*1 (I = 0.75 A, switching frequency = h^{-1})
SFF		99.6%
DC		99%
Climatic conditions		55 °C, 95 % rel. humidity (IEC 61131-2), No corrosive gases
Input voltage ON		18 V DC to 30 V DC
Enclosure rating (EN/IEC 60529)		Terminals: IP20, Housing: IP40
EMC		EN61131-2,EN61000-6-2,EN55011 (Class A)
Power consumption		Max. 3.2 W
Impulse resistance voltage		4 kV
Rated voltage		300 V AC
Cross-section of connecting wires		Single-core or finely stranded: 0.2 to 1.5 mm² Finely stranded with ferrules: 0.25 to 1.5 mm²
Peeled off length of wire		8 mm
Max. tension		0.6 Nm
Insulation	Internal circuit-Input circuit	Not insulated
	Internal circuit-Output circuit	Insulated
	Input circuit-Output circuit	Insulated
Weight		0.19 kg
Output circuit specs 13-14 23-24 33-34 43-44 Y1-Y2 Y3-Y4	Number of NO contacts	2 contacts (4 outputs)
	Number of NC contacts	2 contacts
	Switching voltage	230 V AC (5 to 253 V AC), 230 V DC (5 to 253 V DC)
	Switching current	10 mA to 6 A
	Total current	8 A
	Response time	30ms
	Output type	Potential-free N/O contacts, positively guided
	Contact material	$AgSnO_2$ with 1 µm Au
	Output circuit fusing	6 A (gG), per current path
	Utilization category	AC-15:Ue 250V, Ie 3A, DC-13:Ue 24V, Ie 3A
Output circuit specs Y14 Y24	Output type	N/O contact, connected to internal 24 V DC, positively guided, current-limited
	Number of NO contacts	2 contacts
	Output voltage	24 V DC (16 to 30 V DC)
	Output current	Max. 75 mA
	Load capacity	200 nF

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

Safety Relay Module

The MELSEC-QS series

A new solution to visualize safety:
Safety relay module

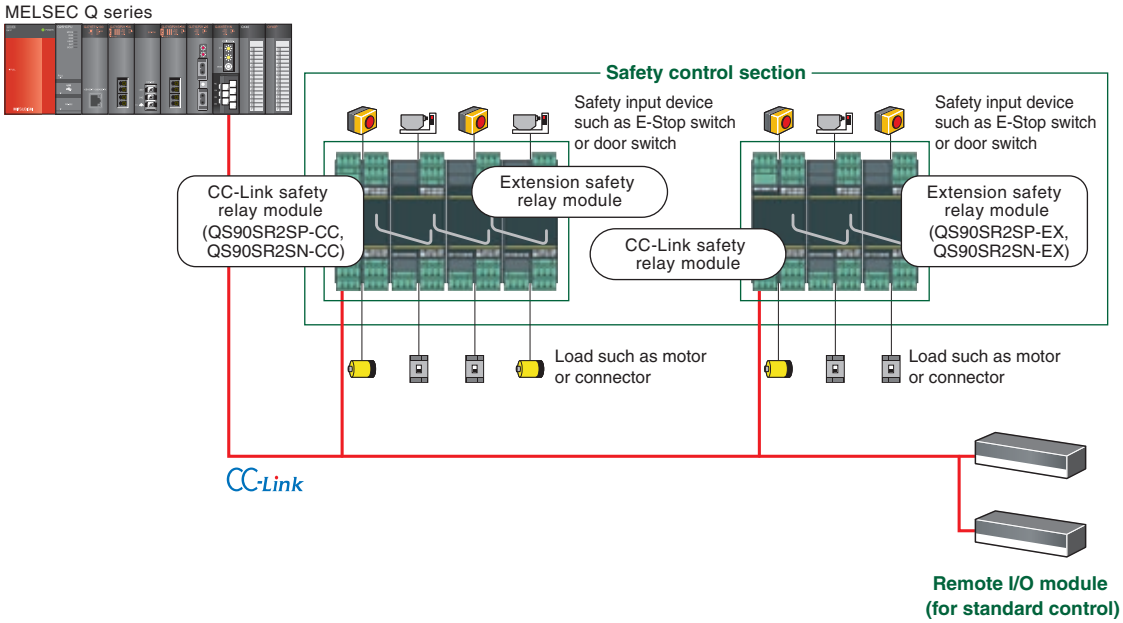
MELSEC Safety

MITSUBISHI SAFETY FA SOLUTION

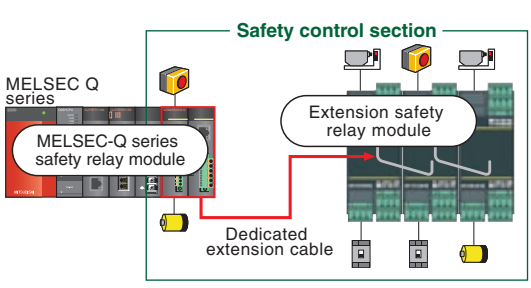
Small-scale safety control!
Easily add safety circuit to
the MELSEC-Q series without a program!

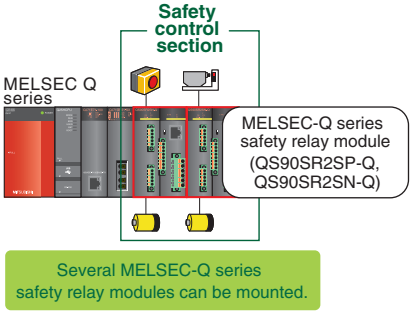
Safety relay module system configuration drawing

■Connecting to field network "CC-Link"



■Mounting on MELSEC-Q series base unit





Meeting needs for future expansion and full/partial stop options with easy implementation.

Feature 1

Easy to configure small-scale safety control without a program

- The safety relay module is suitable for small-scale safety control.
- A safety circuit can be configured by just wiring. Programs or complex parameter settings are not required.

Feature 2

Easy to add safety control to existing the MELSEC-Q series

- Safety control can be easily added to an existing MELSEC-Q series programmable controller by mounting/connecting the safety relay module to the MELSEC-Q base unit or CC-Link.
- Operating/error status of the safety relay module can be monitored from the existing MELSEC-Q series programmable controller. By visualization of safety systems, identification of the cause of emergency stop or investigation of error point become more efficient.

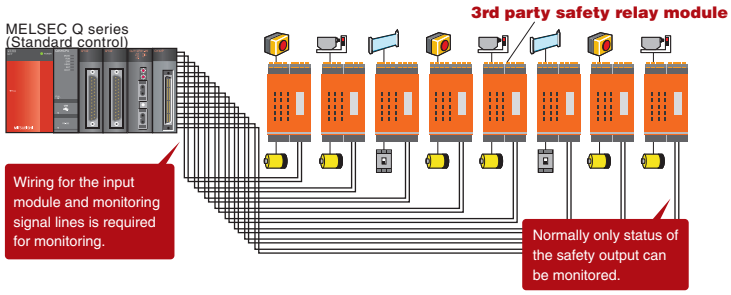
When using 3rd party safety relay modules

Time-consuming wiring

In order to monitor the safety circuit on standard control side, an input module must be added and wiring for monitoring signals is needed. Also, power must be supplied, thereby requiring more wiring.

Lack of monitoring information

Normally only status of the safety output can be monitored.
→It is difficult to find out the cause of safety circuit operation because only off status of the safety output can be monitored.



When using Mitsubishi safety relay modules

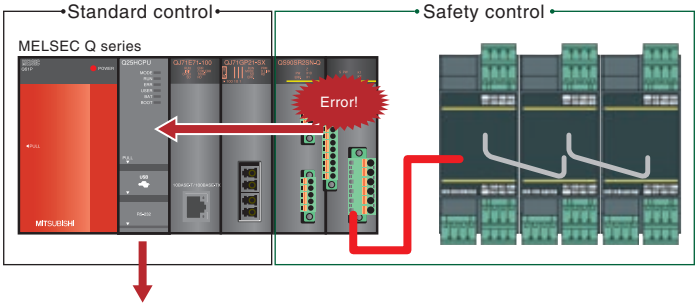
Powerful monitor functions

In addition to monitoring the safety output state, the status of the safety relay in the module, including safety input status (ON/OFF), coil drive status and relay contact ON/OFF are monitored.
For example, welding caused by a mismatch of the coil drive status and relay setting state can be detected!

Simple wiring

There's no need to wire the monitor!

■Example of troubleshooting with the safety relay module's monitor function



<Monitor signal status>

K1 relay contact side	K2 relay contact side	K1 relay coil side	K2 relay coil side	Start input	Safety output	Safety input 1	Safety input 0	Cause
OFF	ON	OFF	OFF	ON	ON	OFF	OFF	Welding of safety relay contact

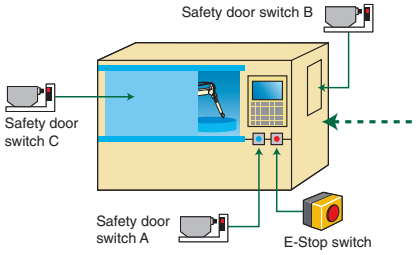
The contact side is ON even though the safety relay's coil side is OFF means the safety relay contact has welded!

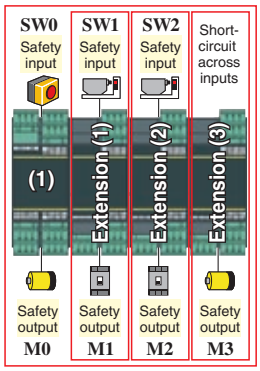
Feature 3

Capable of expanding safety circuit and partial stop

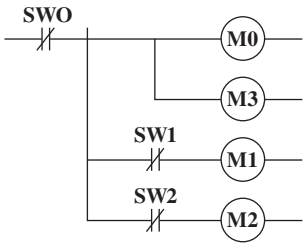
- Using extension safety relay modules, the safety circuits can be expanded up to 4 points each for safety input and safety output.
- The extension safety relay module's safety input shuts off only its safety output. This allows partial stop: only the necessary section can be stopped.

■Application example of NC processing machine





■Operation diagram



(1) MELSEC-Q/CC-Link safety relay module
When the safety input is off, whole outputs are shut off.

(2) Extension safety relay module
When the safety input of Extension 1 is off, only the safety output of Extension 1 is shut off.

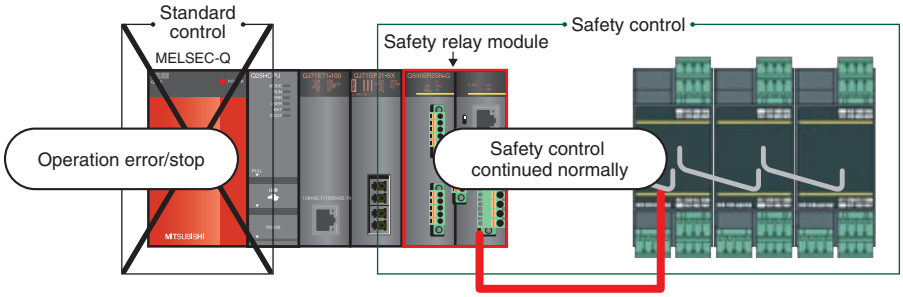
Operating rate improved by stopping only necessary section.

E.g.) If the emergency stop switch is pressed, the entire NC processing machine stops. If the safety door is opened and the safety door switch A is turned off, only the work piece processing section stops.

Feature 4

Independent safety control available

- The safety circuit and circuits of CPU module and CC-Link are separated. Therefore, regardless of the CPU module error or CC-Link communication status, safety control can be continued.



Feature 5

Various functions allow advanced safety control

■Safety relay module functions

Item	Description
Dual input function	Prevents damage of the safety functions due to a single failure by doubling inputs. ● Input N type: Dual input with positive common and negative common ● Input P type: Dual input with positive commons In the case of input N type, when a short circuit occurs between the dual inputs, a short circuit occurs between the power supply and grounding. Therefore, power goes off by the electric fuse.
Start-up/off check function	Checks that status of the safety relay module and external device are normal.
Start-up method selection function	Allows to select the start-up method either auto mode or manual mode with the setting switch.
Monitor function	Allows to check operating status of the whole safety relay modules including extension safety relay modules by connecting to the programmable controller using programming tool.
Partial shutdown function with extension module	Allows to shut off outputs of a certain module by using safety inputs of extension module.

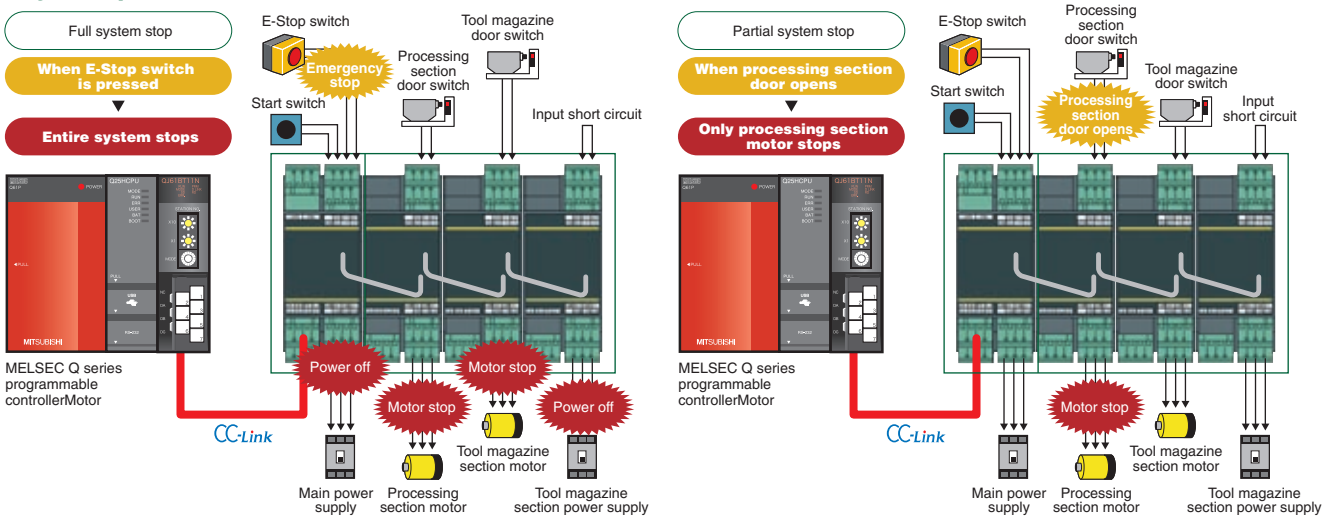
Whether stopping the system fully or partially, MELSEC Safety realizes flexible safety control with a simple program and wiring.

Application example

Machining center

At emergency, the relay module reliably stops power and motor of the machining center that contains many cutting tools, and secures safety.

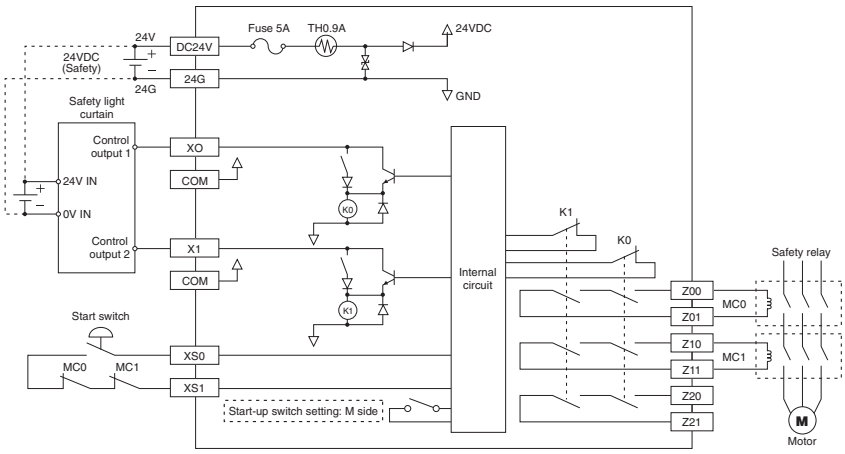
System operations



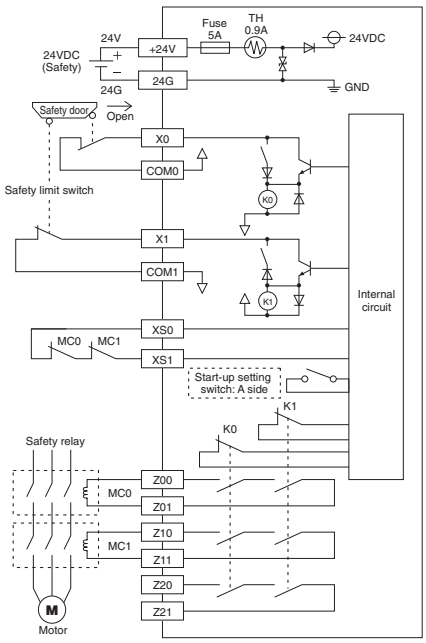
Wiring examples

Wiring to light curtain (manual start-up mode)

Type 4 light curtain can be connected to input P type only.
By short-circuiting between XS0 and XS1, auto start-up mode can be selected.



Wiring to safety door switch (auto start-up mode)



General specifications

Item	Specifications					
Operating ambient temperature	0 to 55˚C					
Storage ambient temperature	-25 to 70˚C*1					
Operating ambient humidity	30 to 85%RH, non-condensing					
Storage ambient humidity	30 to 85%RH, non-condensing					
Vibration resistance	Conforms to JIS B 3502, IEC61131-2		Frequency	Acceleration	Amplitude	Sweep count
		Under intermittent vibration	5 to 9Hz	–	3.5mm (0.14inch)	10 times each in X, Y, Z directions
			9 to 150Hz	9.8m/s^2	–	
		Under continuous vibration	5 to 9Hz	–	1.75mm (0.069inch)	–
			9 to 150Hz	4.9m/s^2	–	
Shock resistance	JIS B 3502, IEC 61131-2 compliant (147m/s^2, 11 ms shock pulse duration, shine half-wave pulse applied 3 times each in X, Y, Z directions.)					
Operating ambience	No corrosive gases					
Operating altitude*2	2000m (6562ft.) or less					
Installation location	Inside of control panel of IP standard 54 or more					
Overvoltage category*3	III or less					
Pollution degree*4	2 or less					
Equipment class	Class I					

*1 :The storage ambient temperature is -20 to 75˚C if the system includes any CC-Link safety relay modules or extension safety relay modules.

*2 :Do not use or store the programmable controller under pressure higher than the atmospheric pressure of altitude 0m. Doing so may cause a malfunction. When using the programmable controller under pressure, please contact your local Mitsubishi office.

*3 :This indicates the section of power supply to which the equipment is assumed to be connected between the public electrical power distribution network and the machinery within the premises. Category III applies to devices in fixed equipment such as switching device and industrial machine. The surge voltage withstand level of equipment for up to the rated voltage of 300V is 4000V.

*4 :This index indicates the degree to which conductive material is generated in the environment where the equipment is used. Pollution degree 2 is when non-conductive pollution occurs. However, temporary conductivity may be produced due to condensation.

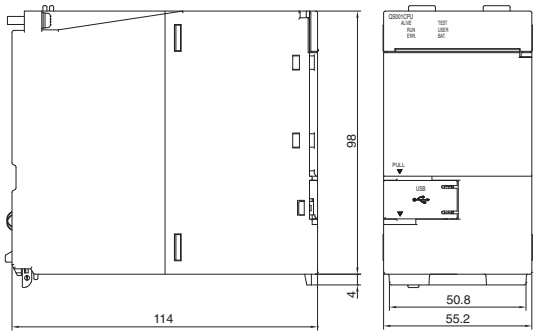
Safety relay module specifications

Item		MELSEC-Q safety relay module QS90SR2SP-Q/QS90SR2SN-Q	CC-Link safety relay module QS90SR2SP-CC/QS90SR2SN-CC	Extension safety relay module QS90SR2SP-EX/QS90SR2SN-EX
Applicable safety standard		EN954-1 Category 4, ISO13849-1 PL e		
Number of safety input points		1 point (2 inputs)		
Number of start-up input points		1 point		
Number of safety output points		1 point (3 outputs)		
Rated load current		Category 4: 3.6 A/point or less, Category 3: 5.0 A/point or less (250 V AC/30 V DC)		
Response time	Time until output OFF	20 ms or less (safety input OFF to safety output OFF)		
	Time until output ON	50 ms or less (safety input ON to safety output ON)		
Module power supply		20.4 to 26.4 V DC (ripple ratio: 5% or less)	20.4 to 26.4 V DC (ripple ratio: 5% or less)	Supplied from MELSEC-Q safety relay module or CC-Link safety relay module.
Safety power supply		20.4 to 26.4 V DC (ripple ratio: 5% or less)	20.4 to 26.4 V DC (ripple ratio: 5% or less)	Supplied from MELSEC-Q safety relay module or CC-Link safety relay module.
Number of extension modules		Max. 3 extension safety relay modules	Max. 3 extension safety relay modules	N/A
External connections		Two-piece spring clamp terminal block		
Relay life	Mechanical	5,000,000 times or more		
	Electrical	100,000 times or more		

External dimensions

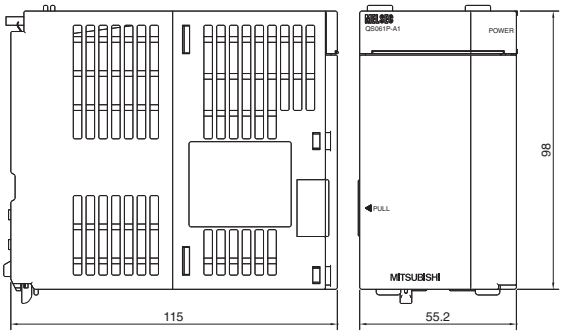
Safety CPU module

Unit: mm



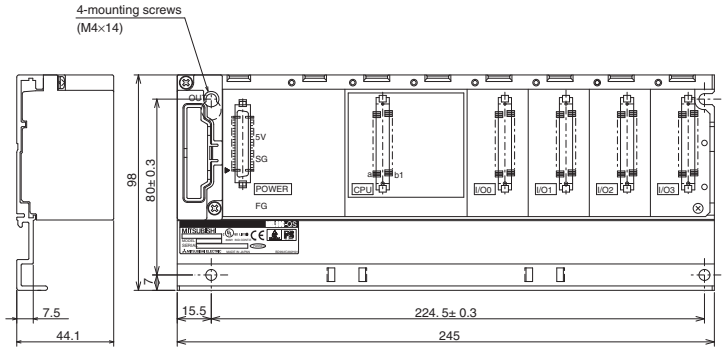
Safety power supply module

Unit: mm



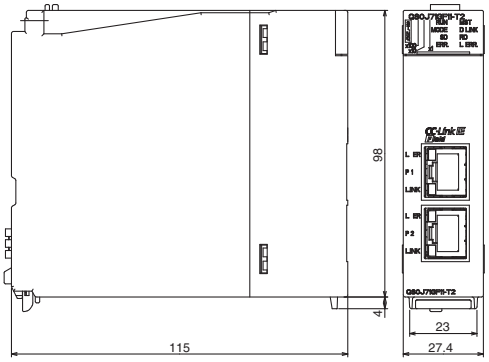
Safety main base unit

Unit: mm



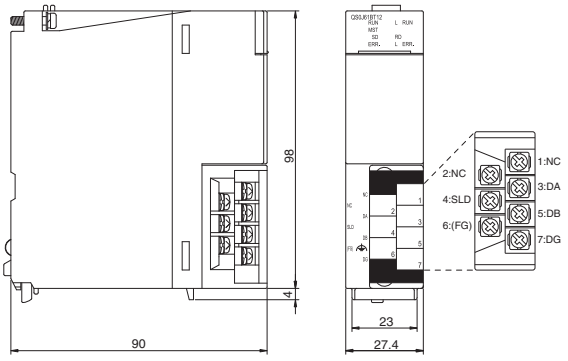
CC-Link IE Field Network master/local module (with Safety Communication Functions)

Unit: mm



CC-Link Safety system master module

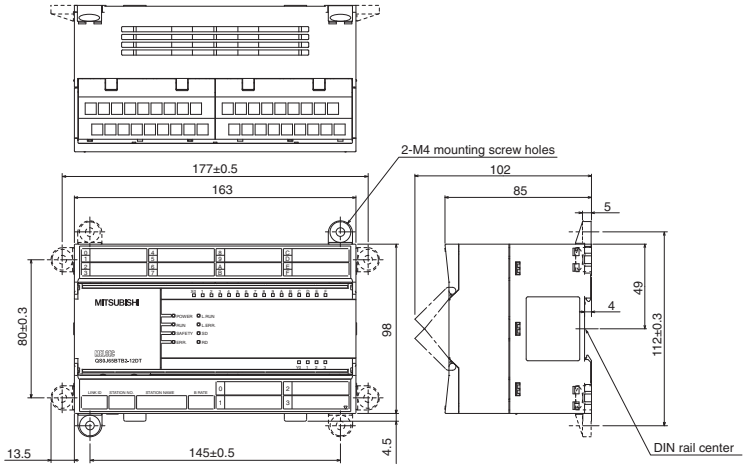
Unit: mm



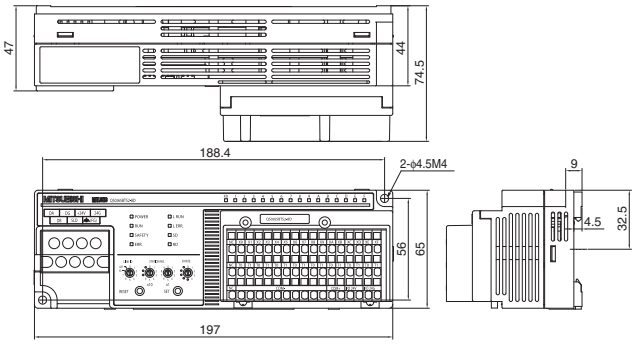
CC-Link Safety system remote I/O module

Unit: mm

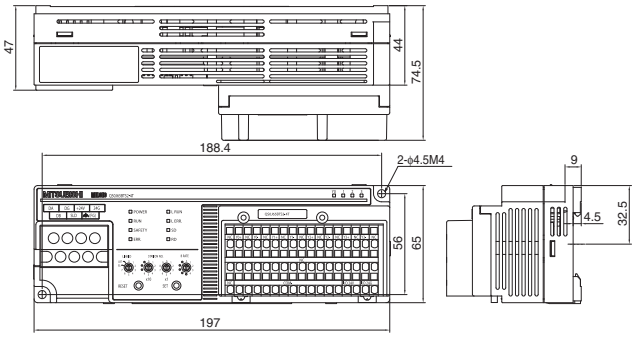
■QS0J65BTB2-12DT



■QS0J65BTS2-8D



■QS0J65BTS2-4T

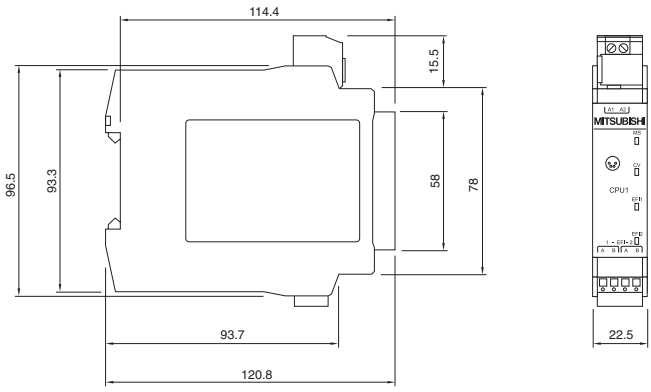


External dimensions

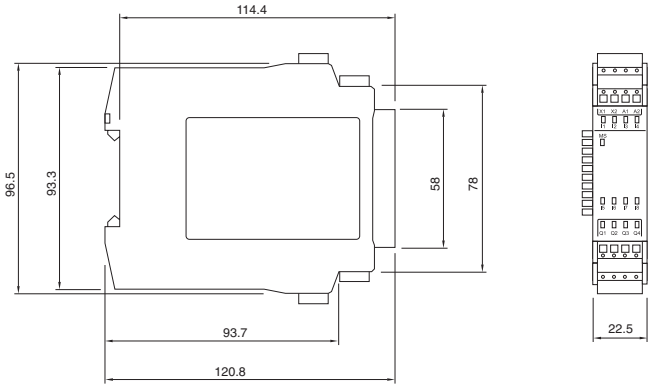
Safety controller

Unit: mm

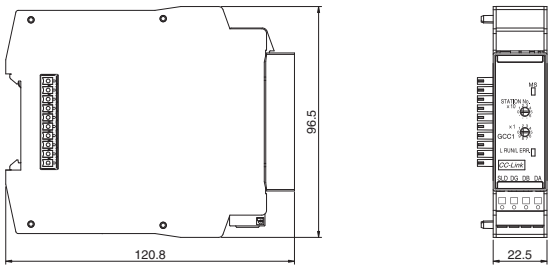
■WS0-CPU0/WS0-CPU1



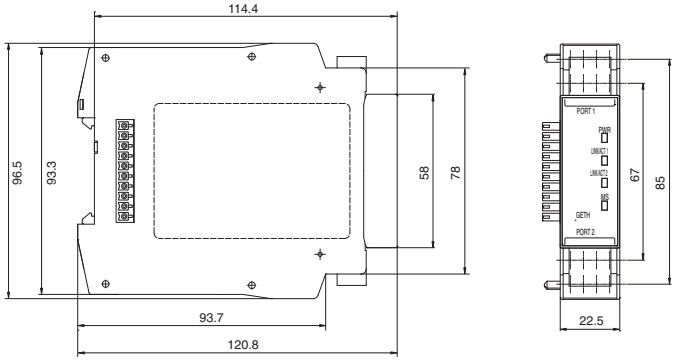
■WS0-XTIO/WS0-XTDI/WS0-4RO



■WS0-GCC1



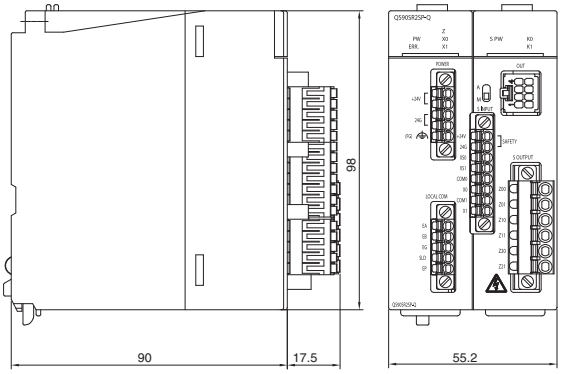
■WS0-GETH



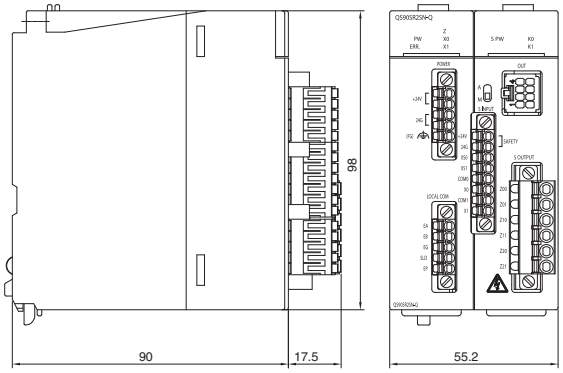
Safety relay module

Unit: mm

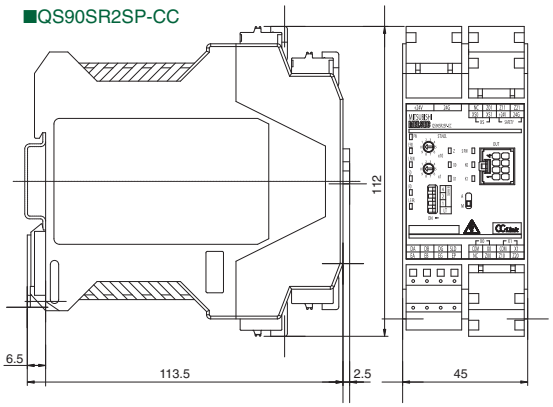
■QS90SR2SP-Q



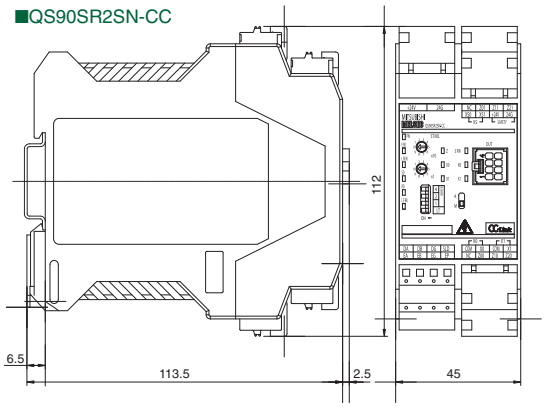
■QS90SR2SN-Q



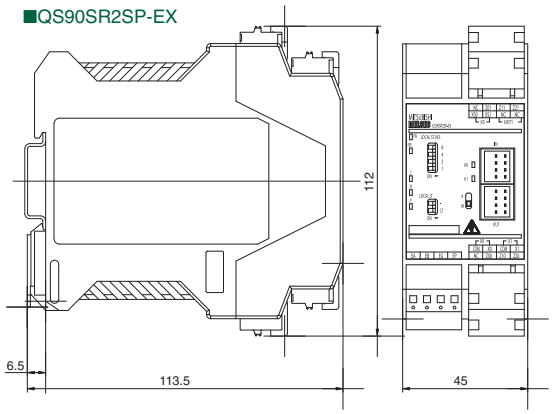
■QS90SR2SP-CC



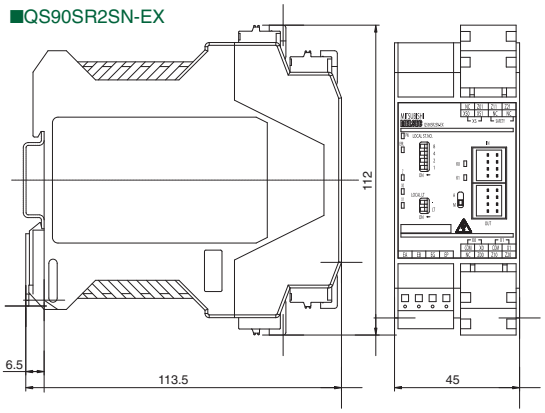
■QS90SR2SN-CC



■QS90SR2SP-EX



■QS90SR2SN-EX



AC Servo MELSERVO-J4 Series

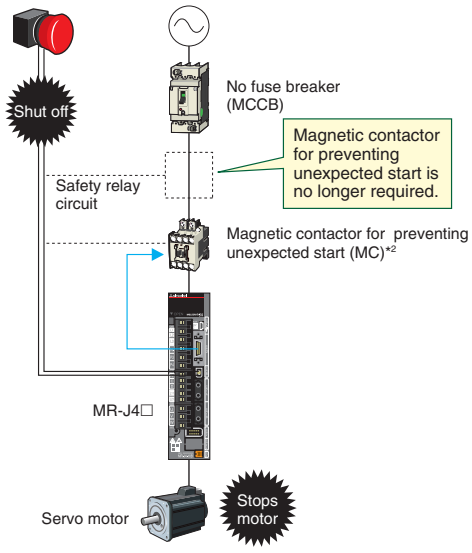
Advanced features for world-class safety

Equipped with various safety functions

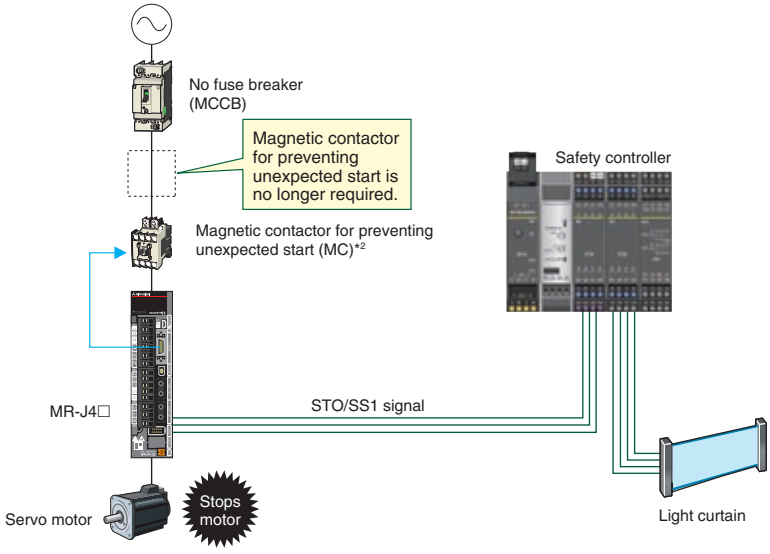
- Compatible with the safety function IEC/EN 61800-5-2 as standard
- MELSERVO-J4 series servo amplifiers have integrated STO(Safe Torque Off) and SS1*1(Safe Stop 1) functions. Safety system is easily configured in the machine. (SIL 2)
- Turning off the control power of servo amplifier is not required, cutting out the time for restart. Additionally, home position return is not required. Magnetic contactor for preventing unexpected motor start is not required.*2
- The MELSERVO-J4 series servo amplifiers conform to the following Safety Standards to be compliant to European EC Directive.
  ·EN ISO 13849-1 Category 3 PLd
  ·EN 61508 SIL 2
  ·EN 62061 SIL CL 2
  ·EN 61800-5-2 SIL 2

*1: Safety programmable controller(the MELSEC-QS series), Safety controller(the MELSEC-WS series) or Safety equipment (MR-J3-D05, etc.) is required.
*2: Two magnetic contactors are not required when STO function is used. However, in this diagram, one magnetic contactor is used to shut off the power at alarm occurrence.

Shut off with STO function



Shut off with STO/SS1 function



For detailed specifications, precautions, and restrictions of the MELSERVO-J4 series servo amplifiers, please refer to the catalog(P52) and User's Manual.

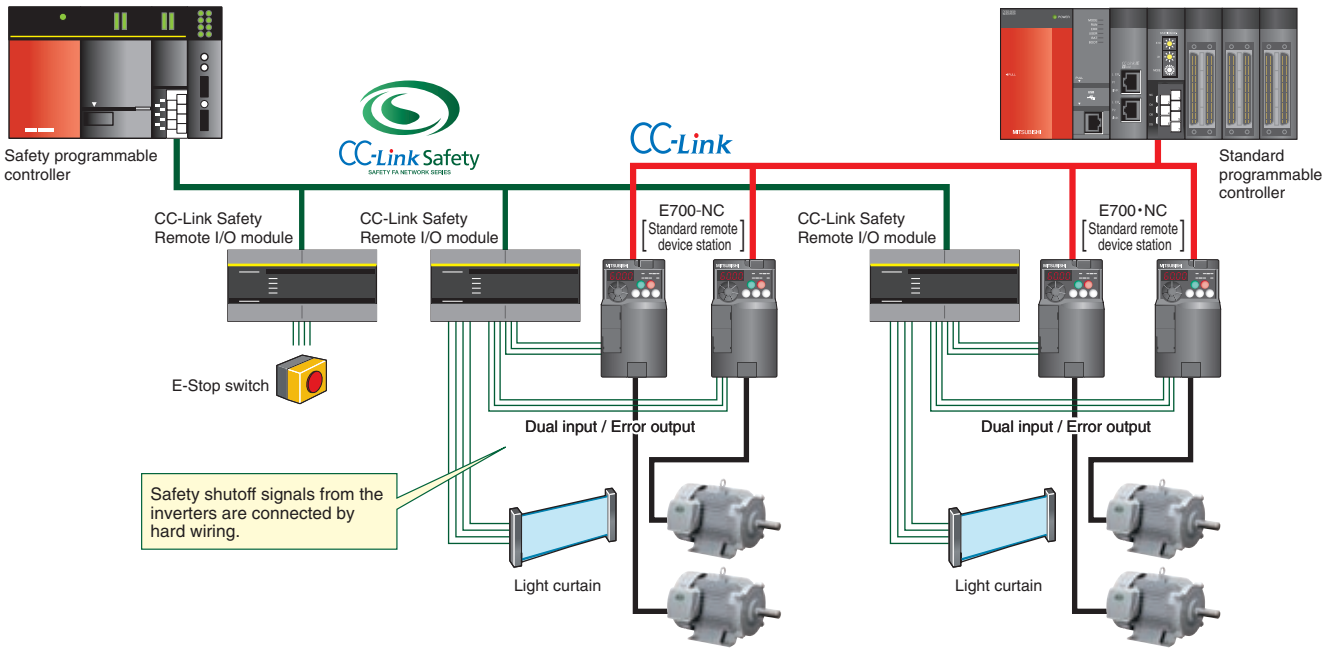
Inverter FREQROL-E700 Series

Achieve the safety standards at low cost

- The FREQROL-E700-SC series inverters for Safety Stop and FREQROL-E700-NC series for CC-Link communication are compliant to the STO(Safe Torque Off) safety function.
  Our inverters with the safety function achieve the safety standards at low cost.
- By connecting Safety programmable controller, Safety controller and Safety relay module, shutoff circuit (hardware) securely provides emergency output shutoffs.
- The FREQROL-E700 series inverters conform to the following Safety Standards to be compliant to European EC Directive.
  ·EN ISO 13849-1 Category 3/PLd
  ·EN 62061/IEC61508 SIL2

System component example

by FREQROL-E700-SC series inverters for CC-Link communication



For detailed specifications, precautions, and restrictions of the FREQROL-E700 series inverters, please refer to the catalog and User's Manual.

Increasing number of MELSEC Safety compatible products by actively collaborating with the CLPA partners pioneering safety components.

Providing safety solutions as an expert of "safety" and "explosion-proof" products

IDEC Corporation

IDEC Corporation, which configured the world's first cell manufacturing robot control system with high productivity and safety, has been providing the latest "manufacturing safety consulting". Various safety solutions are realized by the combined use of the MELSEC Safety and the wide array of safety components, such as safety switches, enabling switches, and emergency stop switches.

A wide selection of safety products essential to MELSEC Safety

Supporting safety assurance of production lines with technologies acquired over the years

Panasonic Industrial Devices SUNX Co., Ltd.

Panasonic Industrial Devise SUNX's light curtains work well with the MELSEC Safety via CC-Link Safety.
The excellent lineup is unique to SUNX, which has been developing sensing technology as a core.
In addition, other safety components such as door switches and the remote I/O unit flexibly link to the MELSEC Safety, expanding capabilities of safety control.

Remote I/O unit for light curtain (SF-CL1T264T)

Providing advanced safety solutions which satisfy international standards for safety to the world.

SICK AG

SICK AG of Germany is one of the first manufacturers in the world to develop and manufacture optoelectronic products.
More than 60 years of experience in FA fields and their world-class safety solutions have earned them a world-wide popularity as a leading company in the industry.
The diverse lineup of advanced products including safety light curtains,
safety laser scanners, safety switches and safety controllers has passed the high European safety standards.

Provide CC-Link IE Field Network Switching HUB as LAN products manufacturer in Japan

MITSUBISHI CABLE INDUSTRIES, LTD.

■CC-Link IE Field
Industrial switching HUB
Model: DT135TX

MITSUBISHI CABLE INDUSTRIES, LTD. is a LAN product manufacturer that has firm confidence and many excellent achievements in development, manufacture and sales of highly reliable industrial Ethernet products.
The company provides suitable products for MELSEC Safety on the based on extensive experiences and achievements cultivated in the social infrastructure network system fields such as electric power and railway companies.

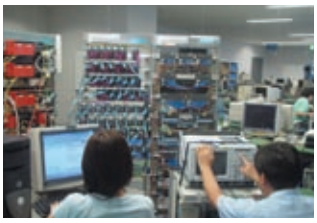
■DT135TX features
- ・MELSEC Safety Latency measure
- ・Ease of maintenance because STP cables can be inserted and removed during operation
- ・High-speed Gigabit Ethernet support (10/100/1000Mbps RJ-45 x 5 ports)
- ・Hydrogen Sulfide resistant coating on the printed circuit board

CC-Link Partner Association (CLPA) actively promotes the worldwide adoption of CC-Link networks and is working to make new advances in safety systems.

From promotion to specification development, CLPA actively supports CC-Link

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, implementing conformance tests, and providing catalogs, brochures, and website information, CLPA has been successfully increasing the number of CC-Link partner manufacturers and CC-Link compatible products. CLPA takes a major role in the globalization of CC-Link.

■Conformance test to support the rapid increase in CC-Link compatible products.



■Exhibitions and seminars are held to recruit new CLPA members.

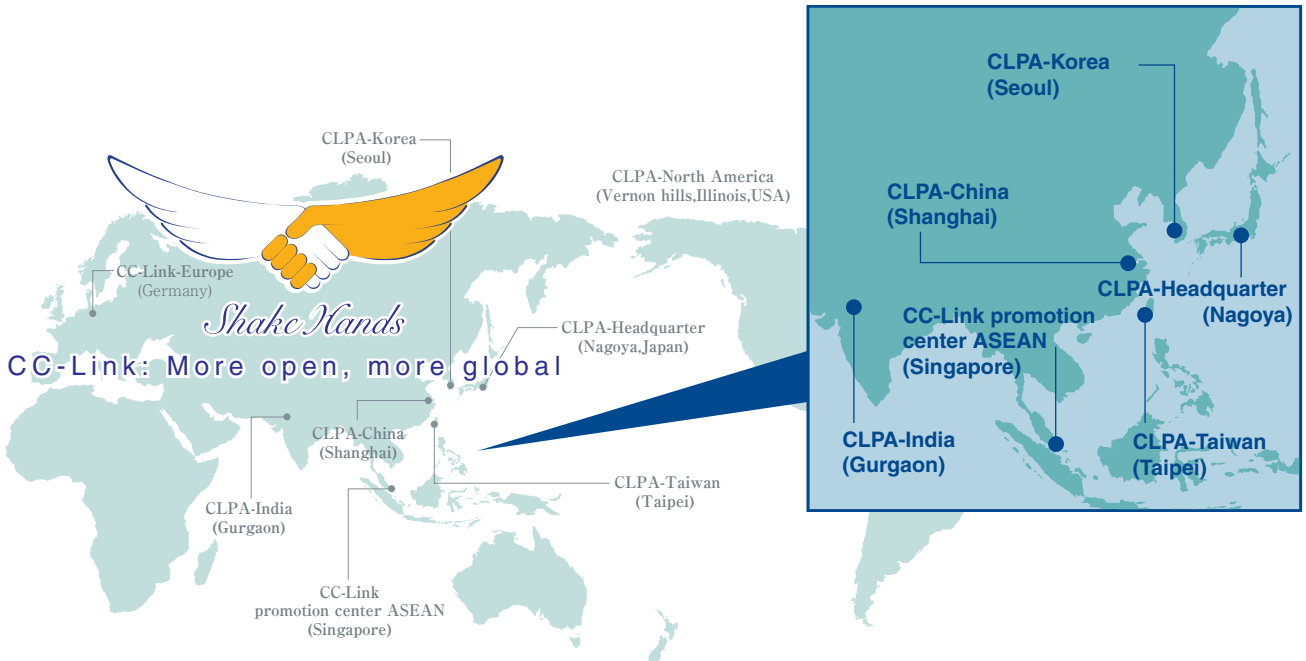
CC-Link Partner Association

The latest CC-Link information is posted on the website.

6F Ozone Front Bldg. 3-15-58 Ozone, Kita-ku, Nagoya 462-0825, Japan
TEL: +81-52-919-1588 FAX: +81-52-916-8655 URL: http://www.cc-link.org/ E-mail: info@cc-link.org

CC-Link continues to increase its global influence

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 the network in that part of the world. For companies looking to increase their presence in Asia, CLPA is well placed to assist these efforts through offices in all major Asian economies.



Related catalogs – Information on Mitsubishi safety solutions right in your hand.

Mitsubishi Safety Solutions

Mitsubishi Safety Controller Application Guide

iQ Platform Programmable Controllers MELSEC-Q series [QnU]

Ethernet-based Open Network CC-Link IE Product Catalog

Open Field Network CC-Link Compatible Product Catalog

DC Interface Contactor

SERVO AMPLIFIERS & MOTORS

INVERTER FAMILY

Mitsubishi iQ Platform CNC C70 series

Reaching out to the world using a global network

Global FA center

"Mitsubishi Electric Global FA centers" have been established in various countries around the world to cover the Americas, Europe, and Asia. FA centers help to ensure compliance with the certifications and regulations of different regions, initiate product development in response to local demands, and provide full-time, professional customer service.

UK FA Center

Mitsubishi Electric Europe B.V. UK Branch
Travellers Lane, Hatfield, Hertfordshire, AL10 8XB, UK.
Tel: +44-1707-28-8780 / Fax: +44-1707-27-8695
Area covered: UK, Ireland

European FA Center

Mitsubishi Electric Europe B.V. Polish Branch
32-083 Balice ul. Krakowska 50, Poland
Tel: +48-12-630-47-00 / Fax: +48-12-630-47-01
Area covered: Central and Eastern Europe

German FA Center

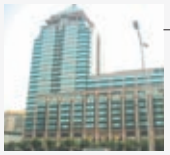
Mitsubishi Electric Europe B.V. German Branch
Gothaer Strasse 8, D-40880 Ratingen, Germany
Tel: +49-2102-486-0 / Fax: +49-2102-486-1120
Area covered: Mainly Western Europe

Czech republic FA Center

Mitsubishi Electric Europe B.V. Czech Branch
Avenir Business Park, Radicka 751/113e, 158 00 Praha5, Czech Republic
Tel: +420-251-551-470 / Fax: +420-251-551-471
Area covered: Czech, Slovakia

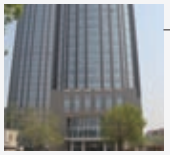
India FA Center

Mitsubishi Electric India Pvt. Ltd.
India Factory Automation Centre
Emerald House, EL-3, J Block, M.I.D.C., Bhosari, Pune, 411026, Maharastra State, India
Tel: +91-20-2710-2000 / Fax: +91-20-2710-2100
Area covered: India



Beijing FA Center

Mitsubishi Electric Automation (CHINA) Ltd.
Beijing Office
Unit 908, Office Tower 1, Henderson Centre, 18 Jianguomennei Avenue, Dongcheng District, Beijing, China
Tel: +86-10-6518-8830 / Fax: +86-10-6518-3907
Area covered: China



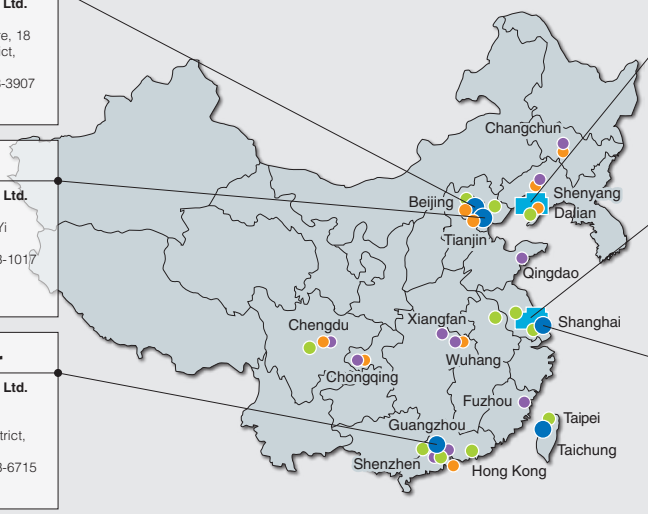
Tianjin FA Center

Mitsubishi Electric Automation (CHINA) Ltd.
Tianjin Office
Unit 2003, Tianjin City Tower, No.35, You Yi Road, Hexi District, Tianjin, China
Tel: +86-22-2813-1015 / Fax: +86-22-2813-1017
Area covered: China

Guangzhou FA Center

Mitsubishi Electric Automation (CHINA) Ltd.
Guangzhou Office
Rm.1609, North Tower, The Hub Center, No.1068, Xin Gang East Road, Haizhu District, Guangzhou, China
Tel: +86-20-8923-6730 / Fax: +86-20-8923-6715
Area covered: China

China (including Hong Kong area)



Local factory in China

Mitsubishi Electric Dalian Industrial Products Co., Ltd.

Local factory in China

Mitsubishi Electric Automation Manufacturing (Changshu) Co.,Ltd.
No.706 Southeast Building,Chengahu Southeast Economic Development Zone of Jiangsu,215500 China
Tel: 86-512-5213-3077 / Fax: 86-512-5213-3088

Shanghai FA Center

Mitsubishi Electric Automaiton (China) Ltd.
10F, Mitsubishi Electric Automation Center, No.1386 Hongqiao Road, Changning District, Shanghai, China
Tel: 86-21-2322-3030 / Fax: 86-21-2322-3000
Area covered: China

to provide comprehensive customer support.

FA center | FA center satellite (China) | Mechatronics service center (China) | Sales and Service office | Factory location | Development center

Russian FA Center

Mitsubishi Electric Europe B.V. Russian Branch St.Petersburg office
Piskarevsky pr. 2, bld 2, lit "Sch", BC "Benua", office 720, 195027, St. Petersburg, Russia
Tel: +7-812-633-3497 / Fax: +7-812-633-3499
Area covered: Russia

Korean FA Center

Mitsubishi Electric Automation Korea Co., Ltd.
3F, 1480-6, Gayang-Dong, Gangseo-Gu, Seoul, 157-200, Korea
Tel: +82-2-3660-9530 / Fax: +82-2-3664-8372
Area covered: Korea

Taiwan FA Center

L : Setsuyo Enterprise Co., Ltd.
6F., No.105, Wugong 3rd Road, Wugu District, New Taipei City 24889, Taiwan, R.O.C.
Tel: +886-2-2299-2499 / Fax: +886-2-2299-2509
R : Mitsubishi Electric Taiwan Co.,Ltd.
No.8-1.Industrial 16th Road,Taichung Industrial Park ,Taichung, Taiwan 407, R.O.C.
Tel: +886-(0)4-2359-0688 / Fax: +886-(0)4-2359-0689
Area covered: Taiwan

Thailand FA Center

Mitsubishi Electric Automation (Thailand) Co., Ltd.
Bang-Chan Industrial Estate No.111 Soi Serithai 54, T.Kannayao, A.Kannayao, Bangkok 10230 Thailand
Tel: +66-2906-3238 / Fax: +66-2906-3239
Area covered: Thailand

North American FA Center

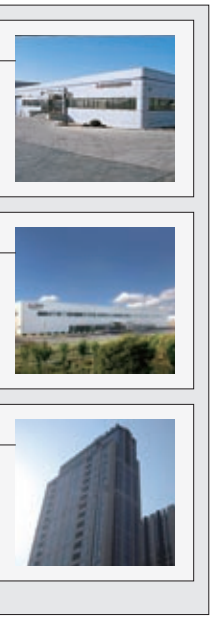
Mitsubishi Electric Automation, Inc.
500 Corporate Woods Parkway, Vernon Hills, IL 60061, USA
Tel: +1-847-478-2100 / Fax: +1-847-478-2253
Area covered: North America, Mexico, Chile, Brazil

ASEAN FA Center

Mitsubishi Electric Asia Pte. Ltd.
ASEAN Factory Automation Centre
307 Alexandra Road #05-01/02,
Mitsubishi Electric Bulding, Singapore
Tel: +65-6470-2480 / Fax: +65-6476-7439
Area covered: Southeast Asia

Brazil FA Center

Mitsubishi Electric Do Brasil Comercio E Servicos Ltda.
Rua Jussara, 1750 - Bloco B- Sala 01 Jardim Santa Cecília- CEP 06465-070, Barueri, São Paulo, Brazil
Tel: +55-11-4689-3000 / Fax: +55-11-4689-3016
Area covered: Brazil



Complying with international quality assurance standards.

All of Mitsubishi Electric's FA component products have acquired the international quality assurance "ISO9001" and environment management system standard "ISO14001" certification. Mitsubishi Electric's products also comply with various safety standards, including UL standards.
*For jointly developed and partner products, guaranteed quality standards may differ. Please refer to the product manuals for details.

Safety Standards

CE	CE : Council Directive of the European Communities
c UL us	UL : Underwriters Laboratories Listing

Product list

■Safety Programmable Controller

Product name	Model*1	Outline
Safety CPU module	QS001CPU(-K)	Program capacity: 14 k steps, number of I/O device points: 6144 points, operation/error history: 3,000 records
Safety main base unit	QS034B(-K)	4 slots; for QS series, MELSECNET/H, CC-Link IE, and Ethernet modules
Safety power supply module	QS061P-A1(-K)	Input: 100 to 120 V AC, 50/60 Hz; output: 5 V 6 A; with overvoltage/overcurrent protection and shutdown circuit diagnostics
	QS061P-A2(-K)	Input: 200 to 240 V AC, 50/60 Hz; output: 5 V 6 A; with overvoltage/overcurrent protection and shutdown circuit diagnostics
CC-Link IE Field Network master/local module (with Safety Communication Functions)	QS0J71GF11-T2	Max. number of stations per network: 121 (32 for safety stations) Safety CPU module QS001CPU whose first five serial number digits are 13042 or later
CC-Link Safety system master module	QS0J61BT12(-K)	Max. number of connectable modules: 64 (42 for safety stations)
CC-Link Safety system remote I/O module	QS0J65BTB2-12DT(-K)	No. of input points: 8 points (double input), 16 points (single input) No. of output points: 4 points(source + sink type), 2 points(source + source type)
	QS0J65BTS2-8D	No. of input points: 8 points (double input), 16 points (single input)
	QS0J65BTS2-4T	No. of output points: 4 points (source + sink type), 2 points (source + source type)
GX Developer*2	SW8D5C-GPPW-E	Version 8.98C or later
CC-Link IE Controller Network module	QJ71GP21-SX*3	Multi-mode fiber optic cable, Dual-loop controller network (control station/normal station)
	QJ71GP21S-SX*3	Multi-mode fiber optic cable, Dual-loop controller network (control station/normal station) with external power supply function
MELSECNET/H module	QJ71LP21-25*3	SI/QSI/H-PCF/wide range H-PCF optic cable, Dual-loop Controller network (control station/normal station)/remote I/O network (remote master station)
	QJ71LP21S-25*3	SI/QSI/H-PCF/wide range H-PCF optic cable, Dual-loop Controller network (control station/normal station)/remote I/O network (remote master station) with external power supply function
	QJ71LP21G*3	GI optic cable, Dual-loop Controller network (control station/normal station)/remote I/O network (remote master station)
	QJ71BR11*3	3C-2V/5C-2V/5C-FB coaxial cable, Single bus Controller network (control station/normal station)/remote I/O network (remote master station)
Ethernet module	QJ71E71-100	10BASE-T/100BASE-TX
	QJ71E71-B2	10BASE2
	QJ71E71-B5	10BASE5

*1 :S-mark compatible part models are indicated in parentheses.
*2 :GX Works2 Version 1.50C or later product package also includes GX Developer.
*3 :It can be used in conjunction with a Safety CPU module as a normal station.

■Safety Controller

Product name	Model	Outline
CPU module	WS0-CPU000200 (WS0-CPU0)*4	Program size: 255 FBs, Scan cycle: 4 ms, Interface: RS-232
CPU module (with EFI)	WS0-CPU130202 (WS0-CPU1)*4	EFI-equipped (EFI is the communication interface for setting SICK's safety products.) Flexi Link with EFI
CPU module memory plug	WS0-MPL00201 (WS0-MPL)*4	For storing CPU parameters and programs (required)
Safety input module	WS0-XTDI80202 (WS0-XTDI)*4	Safety input: 8 points (single input), Spring clamp terminal block
Safety I/O module	WS0-XTIO84202 (WS0-XTIO)*4	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 module	WS0-4RO4002 (WS0-4RO)*4	Safety output: safety relay output 4 points (single input), Output current: max. 6 A
RS-232 cable connecting to CPU module	WS0-C20R2	RS-232 cable for PC-CPU connection
USB/RS-232 conversion cable	WS0-UC-232A	USB/RS-232 conversion cable
CC-Link interface module	WS0-GCC100202 (WS0-GCC1)*4	For CC-Link communication (standard communication)
Ethernet interface module	WS0-GETH00200 (WS0-GETH)*4	For Ethernet/TCP connection (standard communication)
Screw-in replacement terminal block	WS0-TBS4	Screw-in replacement terminal block
Spring clamp replacement terminal block	WS0-TBC4	Spring clamp replacement terminal block
Setting and Monitor Tool	SW1DNN-WS0ADR-B*5	Setting and Monitor Tool for safety controller

*4 :Abbreviated product model name is shown in ( ) for this catalog. Please let us know the exact product model in the upper product list when you contact local Mitsubishi sales office or representative.
*5 :For the acquisition of Setting and Monitor Tool, please contact your local Mitsubishi sales office or representative.

■Safety Relay Module

Product name	Model	Outline
Q series safety relay module	QS90SR2SP-Q	For MELSEC-Q series safety input: 1 point (2 inputs), P type (dual input with positive commons); safety output: 1 point (3 outputs)
	QS90SR2SN-Q	For MELSEC-Q series safety input: 1 point (2 inputs), N type (dual input with positive common and negative common); safety output: 1 point (3 outputs)
CC-Link safety relay module	QS90SR2SP-CC	For CC-Link; safety input: 1 point (2 inputs), P type (dual input with positive commons); safety output: 1 point (3 outputs)
	QS90SR2SN-CC	For CC-Link; safety input: 1 point (2 inputs), N type (dual input with positive common and negative common); safety output: 1 point (3 outputs)
Extension safety relay module	QS90SR2SP-EX	For extension; safety input: 1 point (2 inputs), P type (dual input with positive commons); safety output: 1 point (3 outputs)
	QS90SR2SN-EX	For extension; safety input: 1 point (2 inputs), N type (dual input with positive common and negative common); safety output: 1 point (3 outputs)
Safety circuit part extension cable	QS90CBL-SE01	0.1 m cable for adding safety part
	QS90CBL-SE15	1.5 m cable for adding safety part

MEMO

Mitsubishi Electric Corporation Nagoya Works is a factory certified for ISO14001 (standards for environmental management systems) and ISO9001 (standards for quality assurance management systems)

Safety Programmable Controller/ Safety Controller/Safety Relay Module MELSEC Safety

Precautions before use

This publication explains the typical features and functions of the products herein and does not provide restrictions and 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; and to other duties.

⚠ For safe use

- To use the products given in this publication properly, always read the relevant manuals before use.
- The products have been manufactured as general-purpose parts for general industries, and have not been designed or manufactured to be incorporated in a device or system used in purposes related to human life.
- Before using the products for special purposes such as nuclear power, electric power, aerospace, medicine or passenger movement vehicles, consult with Mitsubishi.
- The products have been manufactured under strict quality control. However, when installing the products where major accidents or losses could occur if the products fail, install appropriate backup or fail-safe functions in the system.

Country/Region	Sales office	Tel/Fax
USA	Mitsubishi Electric Automation Inc. 500 Corporate Woods Parkway, Vernon Hills, IL 60061, USA	Tel : +1-847-478-2100 Fax : +1-847-478-2253
Brazil	Mitsubishi Electric Do Brasil Comercio E Servicos Ltda. Rua Jussara, 1750 - Bloco B- Sala 01 Jardim Santa Cecília- CEP 06465-070, Barueri, São Paulo, Brazil	Tel : +55-11-4689-3000 Fax : +55-11-4689-3016
Germany	Mitsubishi Electric Europe B.V. German Branch Gothaer Strasse 8, D-40880 Ratingen, Germany	Tel : +49-2102-486-0 Fax : +49-2102-486-1120
UK	Mitsubishi Electric Europe B.V. UK Branch Travellers Lane, Hatfield, Hertfordshire, AL10 8XB, UK.	Tel : +44-1707-28-8780 Fax : +44-1707-27-8695
Italy	Mitsubishi Electric Europe B.V. Italian Branch Viale Colleoni 7-20864 Agrate Brianza (Milano), Italy	Tel : +39-039-60531 Fax : +39-039-6053-312
Spain	Mitsubishi Electric Europe B.V. Spanish Branch Carretera de Rubi 76-80.AC.420, E-08190 Sant Cugat del Valles (Barcelona), Spain	Tel : +34-93-565-3131 Fax : +34-93-589-1579
France	Mitsubishi Electric Europe B.V. French Branch 25, Boulevard des Bouvets, F-92741 Nanterre Cedex, France	Tel : +33-1-5568-5568 Fax : +33-1-5568-5757
Czech Republic	Mitsubishi Electric Europe B.V. Czech Branch Avenir Business Park, Radicka 751/113e, 158 00 Praha5, Czech Republic	Tel : +420-251-551-470 Fax : +420-251-551-471
Poland	Mitsubishi Electric Europe B.V. Polish Branch 32-083 Balice ul. Krakowska 50, Poland	Tel : +48-12-630-47-00 Fax : +48-12-630-47-01
Russia	Mitsubishi Electric Europe B.V. Russian Branch St.Petersburg office Piskarevsky pr. 2, bld 2, lit "Sch", BC "Benua", office 720; 195027, St. Petersburg, Russia	Tel : +7-812-633-3497 Fax : +7-812-633-3499
South Africa	CBI-Electric. Private Bag 2016, ZA-1600 Isando, South Africa	Tel : +27-11-977-0770 Fax : +27-11-977-0761
China	Mitsubishi Electric Automaiton (China) Ltd. 10F, Mitsubishi Electric Automation Center, No.1386 Hongqiao Road, Changning District, Shanghai, China	Tel : +86-21-2322-3030 Fax : +86-21-2322-3000
Taiwan	Setsuyo Enterprise Co., Ltd. 6F., No.105, Wugong 3rd Road, Wugu District, New Taipei City 24889, Taiwan, R.O.C.	Tel : +886-2-2299-2499 Fax : +886-2-2299-2509
Korea	Mitsubishi Electric Automation Korea Co., Ltd. 3F, 1480-6, Gayang-Dong, Gangseo-Gu, Seoul, 157-200, Korea	Tel : +82-2-3660-9530 Fax : +82-2-3664-8372
Singapore	Mitsubishi Electric Asia Pte, Ltd. Industrial Division 307, Alexandra Road, Mitsubishi Electric Building, Singapore, 159943	Tel : +65-6470-2308 Fax : +65-6476-7439
Thailand	Mitsubishi Electric Automation (Thailand) Co., Ltd. Bang-Chan Industrial Estate No.111 Soi Serithai 54, T.Kannayao, A.Kannayao, Bangkok 10230 Thailand	Tel : +66-2906-3238 Fax : +66-2906-3239
Indonesia	P.T. Autoteknindo Sumber Makmur Muara Karang Selatan, Block A/Utara No.1 Kav. No.11, Kawasan Industri Pergudangan, Jakarta-Utara 14440, P.O, Box 5045, Indonesia	Tel : +62-21-663-0833 Fax : +62-21-663-0832
India	Mitsubishi Electric India Pvt. Ltd. Emerald House, EL-3, J Block, M.I.D.C., Bhosari, Pune, 411026, Maharastra State, India	Tel : +91-20-2710-2000 Fax : +91-20-2710-2100
Australia	Mitsubishi Electric Australia Pty.Ltd. 348 Victoria Road PO BOX11, Rydalmere, N.S.W 2116, Australia	Tel : +61-2-9684-7777 Fax : +61-2-9684-7245

MITSUBISHI ELECTRIC CORPORATION

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

L(NA)08192E-D 1301(MDOC)

New publication, effective Jan. 2013.