

MITSUBISHI ELECTRIC INDUSTRIAL ROBOT MELFA FR Series Robot Safety Solutions

Specifications					
Item	Robot safety option		CC-Link IE TSN safety communication function	Remarks	
Equipment	Classification	Option (4F-SF002-01)		Supported as standard ^{Note 1}	
	Applicable model	CR800-D/R/Q series		CR800-R series	
	Function	Safety I/O	Safety I/O (safety extension unit)	Safety communication	
		Driving safety monitoring	STO, SS1, SS2, SOS, SLS, SLP		
Safety function	STO function	Electrically shuts off power to the motors in the robot.		Applicable to stop category 0 of IEC 60204-1	
	SS1 function	Decelerates the motors in the robot. After the motors stop, the robot goes into the STO state.		Applicable to stop category 1 of IEC 60204-1	
	SS2 function	Decelerates the motors in the robot. After the motors stop, the robot goes into the SOS state.		Applicable to stop category 2 of IEC 60204-1	
	SOS function	Checks that the robot has stopped without shutting off power to the motors in the robot.		EN 61800-5-2 compliant	
	SLS function	Checks that parts of the robot arm do not exceed the speed limit.		EN 61800-5-2 compliant	
	SLP function	Checks that a predetermined position does not pass through the position monitoring plane.		EN 61800-5-2 compliant	
	Safety communication function	-	This function performs safety communication with the safety programmable controller using functional safety-compatible protocols. When the safety communication function is enabled, the following safety monitoring functions are available. SS1 (STO), SS2 (SOS), SLS, SLP	IEC 61784-3 compliant	
Safety performance	Standard	ISO 10218-1		-	
		EN 62061		-	
		ISO 13849-1		-	
		IEC 61508		-	
		EN 61800-5-1 (ES, EN for Drive)		-	
		EN 61800-5-2 (Safety function Drive)		-	
		IEC 61326-3-1 (EMC for RS)		-	
	Safety level ^{Note 3}	STO	SIL 3, PL e/Category 4		External emergency stop input (when the test pulse diagnosis is set), safety communication function
			SIL 2, PL d/Category 3		External emergency stop input (at factory settings), safety extension unit
		SS1, SS2, SOS, SLS, SLP	SIL 2, PL d/Category 3		Safety extension unit, safety communication function
Dangerous failure rate ^{Note 3}	STO	PFH = 1.40 × 10 ⁻⁸ [1/h]		External emergency stop input (when the test pulse diagnosis is set), safety communication function	
		PFH = 3.42 × 10 ⁻⁷ [1/h]		Safety extension unit, safety communication function	
Safety communication function	Input data	-	8 points	-	
	Output data	-	4 points	-	
	Network	-	CC-Link IE TSN (CR800-R robot controller)	-	
CC-Link IE TSN	Station type	-	Local station (safety station)	-	
Safety extension unit	Power supply specifications	Voltage	24 V DC ±5%	-	
		Ripple voltage: 0.2 V (P-P)	-	-	
		Maximum current consumption	300 mA	-	
	Structure (IP rating)	IP20	-	-	
	Weight	0.8 kg	-	-	
	Environment	Operating temperature	0 to 40°C	-	Do not use the unit near heat sources including heating appliances.
		Relative humidity	45 to 75%	-	Non-condensing
		Vibration	During transportation: 34 m/s ² or less During operation: 5 m/s ² or less	-	-
		Atmosphere	No corrosive gas, flammable gas, oil mist, and dust	-	-
	Installation environment	Indoor use. Install on environments free from strong electric or magnetic fields. Install on a smooth, level surface.	-	-	No direct sunlight. Do not install the unit on a rough surface.
Input signal	8 routes (duplicate signal)	-	-	-	
Output signal	4 routes (duplicate signal)	-	-	-	

Note 1: Available for CR800-R robot controllers with version C2 or later manufactured in or after April 2021. The MELSEC IQ-R series CC-Link IE TSN master/local module (RJ71GN11-T2) is required.
 Note 2: The robot safety option and the safety communication function cannot be used together.
 Note 3: This table shows the safety level and dangerous failure rate of the robot controller. When constructing systems such as safety programmable controller programs and settings, and safety I/O devices, adopt a safe design and evaluate the safety.
 The STO function activated by an external emergency stop input of the robot controller (when the test pulse diagnosis is set) and the CC-Link IE TSN safety communication function meets the requirements of safety level "SIL 3, PL e/Category 4" and dangerous failure rate "PFH = 1.40 × 10⁻⁸ [1/h]".
 The STO function activated by an external emergency stop input of the robot controller (at factory settings) and a safety extension unit input signal of the robot safety option meets the requirements of safety level "SIL 2, PL d/Category 3".
 The SS1, SS2, SOS, SLS, and SLP functions activated by a safety extension unit input signal of the robot safety option and the CC-Link IE TSN safety communication function meet the requirements of safety level "SIL 2, PL d/Category 3" and dangerous failure rate "PFH = 3.42 × 10⁻⁷ [1/h]".

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⚠ Safety precautions

Read the relevant instruction manual thoroughly before using the product. Use the product correctly.

Mitsubishi Electric Corporation Nagoya Works is a factory certified for ISO 14001 (standards for environmental management systems).



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MELFA

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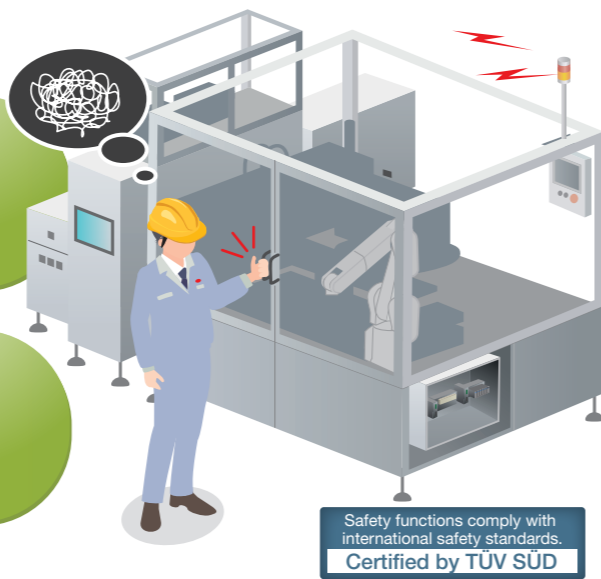
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Using industrial robots without installing safety fences

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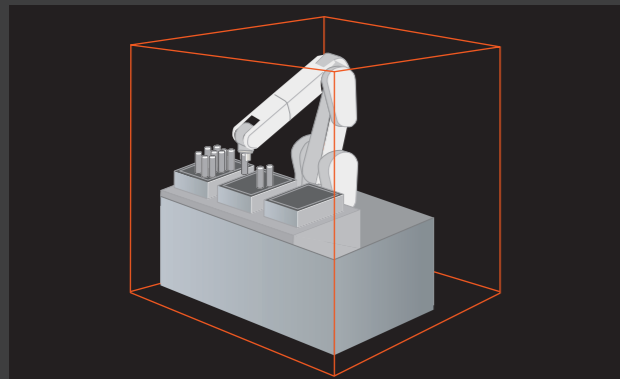
Constructing a safe robot system with high productivity



Robot safety solutions available/

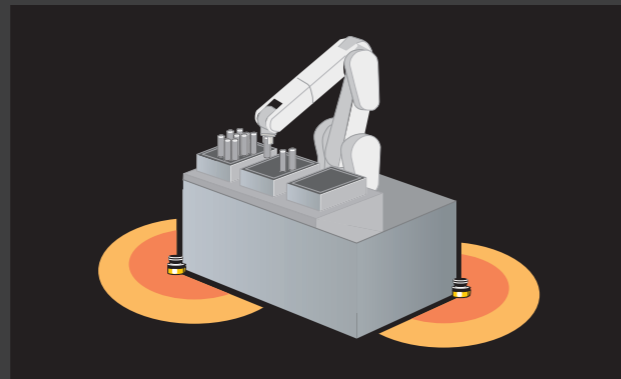
With safety solutions

Safely limited position function



The safely limited position function (SLP) allows for the operating range to be limited, and prevents the robot from entering areas where people exist.

Safely limited speed function



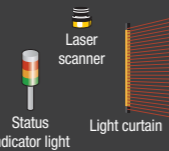
The safely limited speed function (SLS) allows for the robot's operating speed to be limited and the robot to decelerate or stop if a person nears the robot.

Safe operating stop function

This function checks that the robot has stopped without shutting off power to the motors in the robot. → This makes it possible to make automatic and fast operation recovery from stops.

Safety I/O

The duplicate safety I/O (input: 8 points, output: 4 points) supports connection to safety devices.



Safety communication function

The safety devices connected to the safety remote I/O module of the safety programmable controller are available via CC-Link IE TSN.

Safety logic edit

Safety logic edit facilitates the construction and operation of safety systems. Safety I/O or other states can be used to set whether to activate safety functions.

Conduct a risk assessment and check that the risk is sufficiently reduced before using these features.

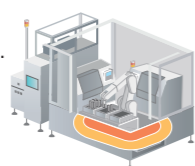
How to get a safety solution

There are two types of methods to get a safety solution. Select a method that is relevant to your needs.

Introducing a safety solution for a single device

Using the robot safety option

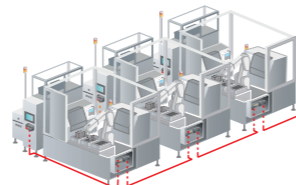
A simple configuration of a robot and robot safety option allows for robot safety functions to be used. (Applicable robot controllers: CR800-D/R/Q)



Constructing a safety system with multiple robots

Using the CC-Link IE TSN safety communication function

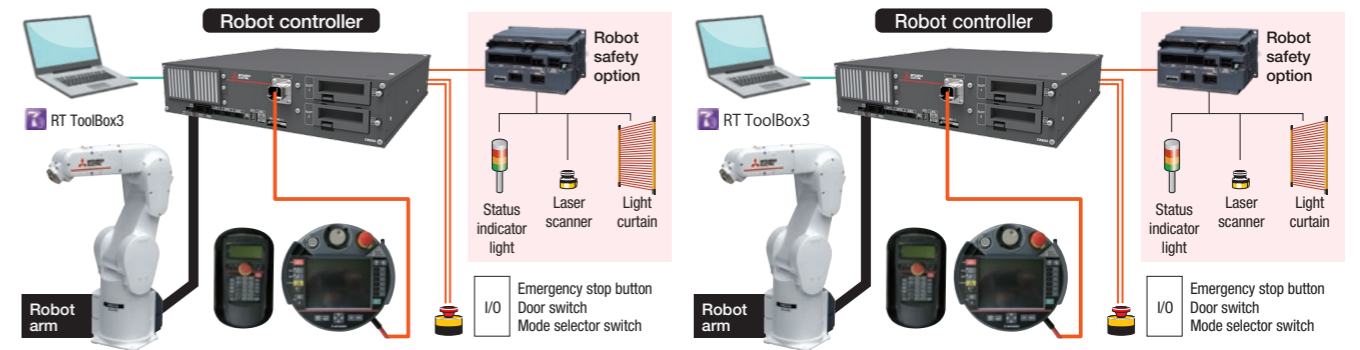
The safety devices connected to the safety I/O module of the safety programmable controller can be used among multiple robots. (Applicable robot controller: CR800-R)



System configurations

When using the robot safety option

- Safety devices can be directly connected to the robot controller with safety I/O.
- The robot safety option is required for each robot.



When using the CC-Link IE TSN safety communication function

- Using safety communication and safety programmable controllers can reduce the number of safety I/Os and safety relays. This helps construct a safety system with less wiring and reduced costs.
- The safety communication function achieves safety system control flexibly in association with the safety programmable controller.
- The CPU modules in the multiple CPU system use one master/local module.
- The robot safety option is not required.

