Specifications

Item		Robot safety option	CC-Link IE TSN safety communication function	Remarks Note 2
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	–
	Function — 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 60204-1:2016
	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 60204-1:2016
	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 60204-1:2016
	SOS function	Checks that the robot has stopped without shutting off power to the motors in the robot.		EN 61800-5-2:2017 compliant
	SLS function	Checks that parts of the robot arm do not exceed the speed limit.		EN 61800-5-2:2017 compliant
	SLP function	Checks that a predetermined position does not pass through the position monitoring plane.		EN 61800-5-2:2017 compliant
	Safety communication function	–	This function performs safety communication with the safety CPU 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 61784-3:2017 compliant
Safety performance	Standard	EN ISO 10218-1: 2011		–
		EN ISO 13849-1: 2015		–
		IEC 61508: 2010		–
		EN 61800-5-1: 2007/A1: 2017		–
		EN 61800-5-2: 2017		–
		IEC 61326-3-1: 2008		–
		EN 60204-1: 2018		–
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)	–	–
	Power supply specifications — Maximum current consumption	300 mA	–	–
	Structure (IP rating)	IP20	–	–
	Weight	0.8kg	–	–
	Environment — Operating temperature	0 to 40°C	–	Do not use the unit near heat sources including heating appliances.
	Environment — Relative humidity	45 to 75%	–	Non-condensing
	Environment — Vibration	During transportation: 34 m/s^2 or less During operation: 5 m/s^2 or less	–	–
	Environment — Atmosphere	No corrosive gas, flammable gas, oil mist, and dust	–	–
	Environment — 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.

Function	Item Note 3		Performance	Remarks
STO Note 4	Safety Level		SIL3 (IEC 61508: 2010)	With changes to parameter settings
			Category 4, PL e (ISO 13849-1:2015)	
	Mean time to dangerous failure (MTTFd)		MTTFd ≥ 100 years	
	Diagnostic coverage (DC)		DC = 99%	
	Probability of dangerous failure per hour (PFH)		PFH = 1.40×10^{-8} [1/hour]	
	Safety Level		SIL2 (IEC 61508: 2010)	At factory settings
			Category 3, PL d (ISO 13849-1:2015)	
	Mean time to dangerous failure (MTTFd)		MTTFd ≥ 100 years	
	Diagnostic coverage (DC)		DC = 90%	
	Probability of dangerous failure per hour (PFH)		PFH = 1.57×10^{-8} [1/hour]	
SS1, SS2, SOS, SLS, SLP Note 5	Safety Level		SIL2 (IEC 61508: 2010)	–
			Category 3, PL d (ISO 13849-1:2015)	
	Mean time to dangerous failure (MTTFd)		MTTFd = 24 years	
	Diagnostic coverage (DC)		DC = 90%	
	Probability of dangerous failure per hour (PFH)		PFH = 3.42×10^{-7} [1/hour]	

Note 3: This table shows the safety level, dangerous failure time, diagnostic coverage, and dangerous failure rate per hour of the robot controller. When constructing systems such as safety CPU programs and settings, and safety I/O devices, adopt a safe design and evaluate the safety.
Note 4: 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".
Note 5: 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]".
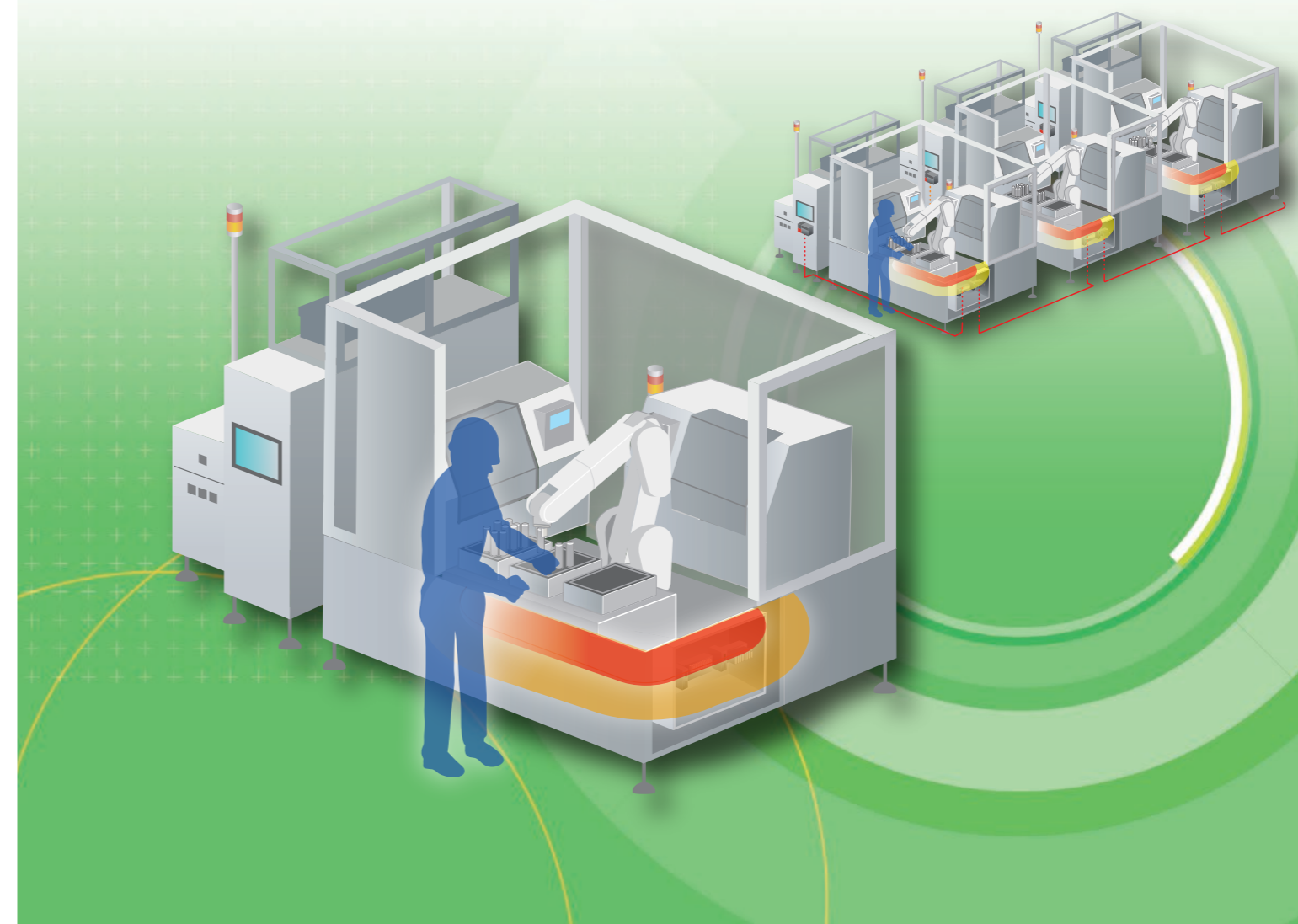
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⚠ Safety precautions

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

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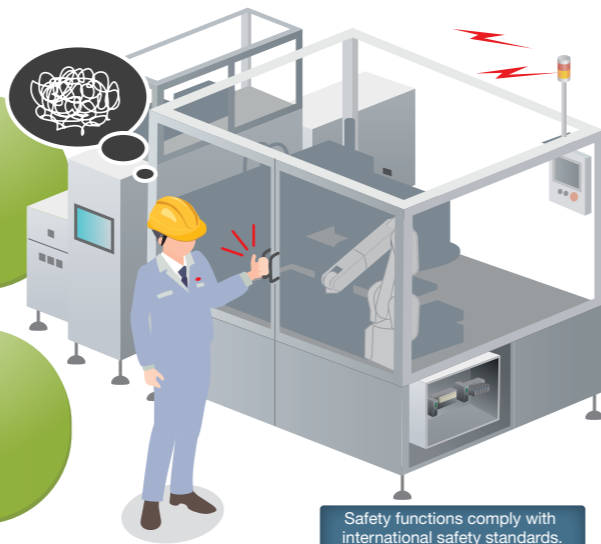HEAD OFFICE: TOKYO BLDG., 2-7-3, MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN

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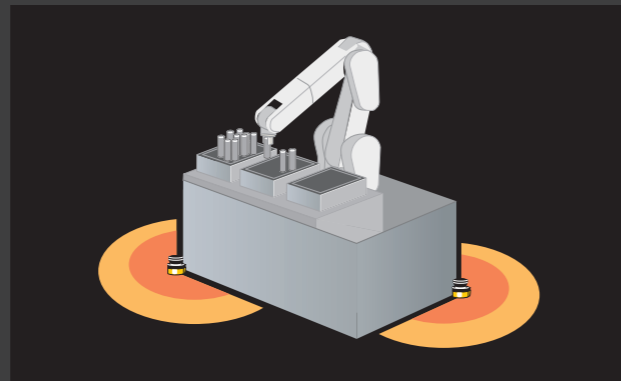
\Robot safety solutions available/

With safety solutions ➡

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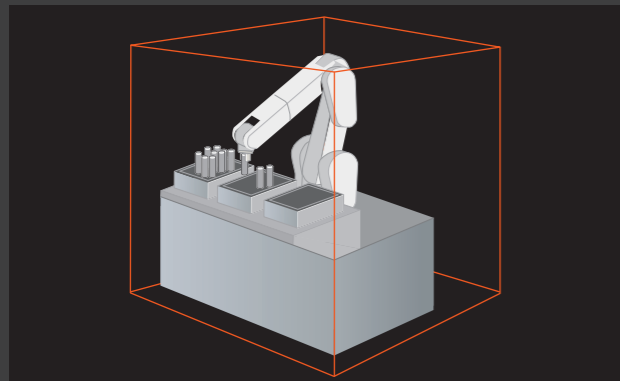
The safely limited position function (SLP) allows for the operating range to be limited, and prevents the robot from entering areas where people exist.

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.
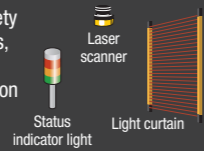
Laser scanner
Status indicator light
Light curtain

Safety communication function

The safety devices connected to the safety remote I/O module of the safety CPU 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
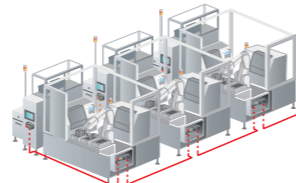
Using the robot safety option

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)
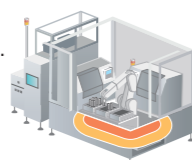
Constructing a safety system with multiple robots

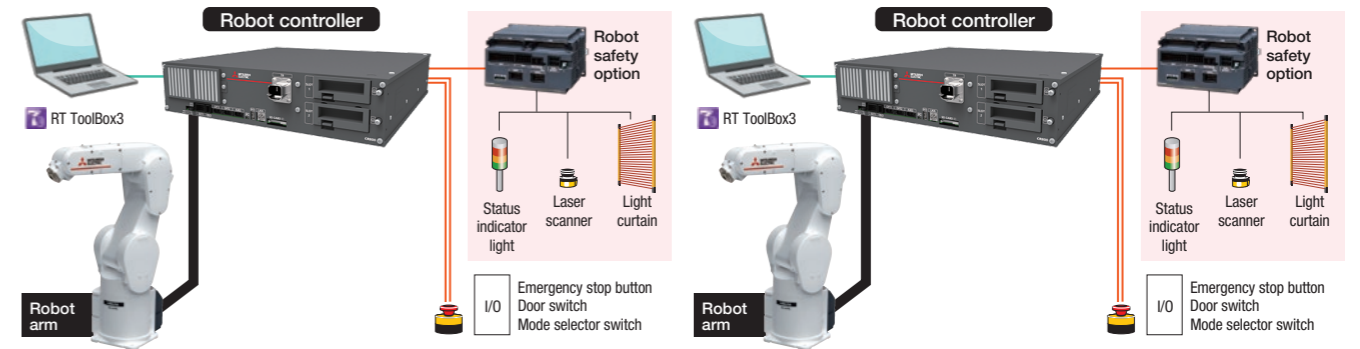#### Using the CC-Link IE TSN safety communication function

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

System configurations
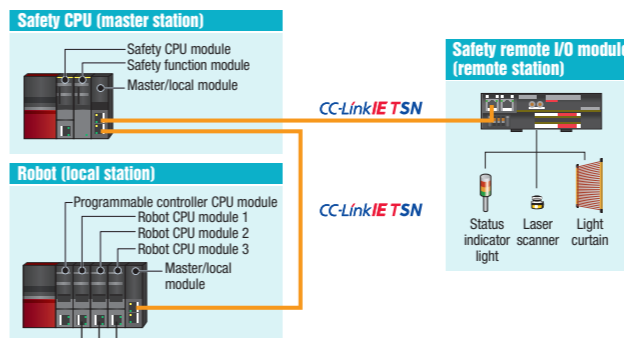
When using the robot safety option

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

Robot controller
Robot safety option
RT ToolBox3
Status indicator light
Laser scanner
Light curtain
Robot arm
I/O
Emergency stop button
Door switch
Mode selector switch

Robot controller
Robot safety option
RT ToolBox3
Status indicator light
Laser scanner
Light curtain
Robot arm
I/O
Emergency stop button
Door switch
Mode selector switch

When using the CC-Link IE TSN safety communication function

- Using safety communication and safety CPU 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 flexible safety system control in association with the safety CPU.
- The robot safety option is not required.
- The application configuration combines the safety CPU (master station) and robot (local station) of the basic configuration into one.

Basic configuration

Safety CPU (master station)
Safety CPU module
Safety function module
Master/local module

Safety remote I/O module (remote station)
Status indicator light
Laser scanner
Light curtain

CC-Link IE TSN

Robot (local station)
Programmable controller CPU module
Robot CPU module 1
Robot CPU module 2
Robot CPU module 3
Master/local module

CC-Link IE TSN

Robot controller
Robot controller
Robot controller
Robot arm
Robot arm
Robot arm

Application configuration

Safety CPU/Robot (master/local station)
Safety CPU module
Robot CPU module 1
Robot CPU module 2
Robot CPU module 3
Safety function module
Master/local module

Safety remote I/O module (remote station)
Status indicator light
Laser scanner
Light curtain

CC-Link IE TSN
Ethernet cable

Robot controller
Robot controller
Robot controller
Robot arm
Robot arm
Robot arm