NX-series Safety Control Units

NX-SL/SI/SO

CSM_NX-SL_SI_SO_E_2_3

Integration of Safety into Machine Automation Enables Simple, Flexible System Configuration.

- EN ISO13849-1 (PLe/Safety Category4), IEC 61508 (SIL3) certified.
- One connection using Safety over EtherCAT (FSoE) * protocol enables flexible configuration by mixing the Safety Units with standard NX I/O.
- Now supports stand-alone operation with EtherNet/IP monitoring up to 256 I/O.
- Hardware and safety circuits can be configured using the Sysmac Studio software (Ver. 1.07)
  - Full License Sysmac Studio - supports EtherCAT integration and EtherNet/IP Stand-alone configurations
  - Safety License Version - supports only EtherNet/IP Stand-alone configurations

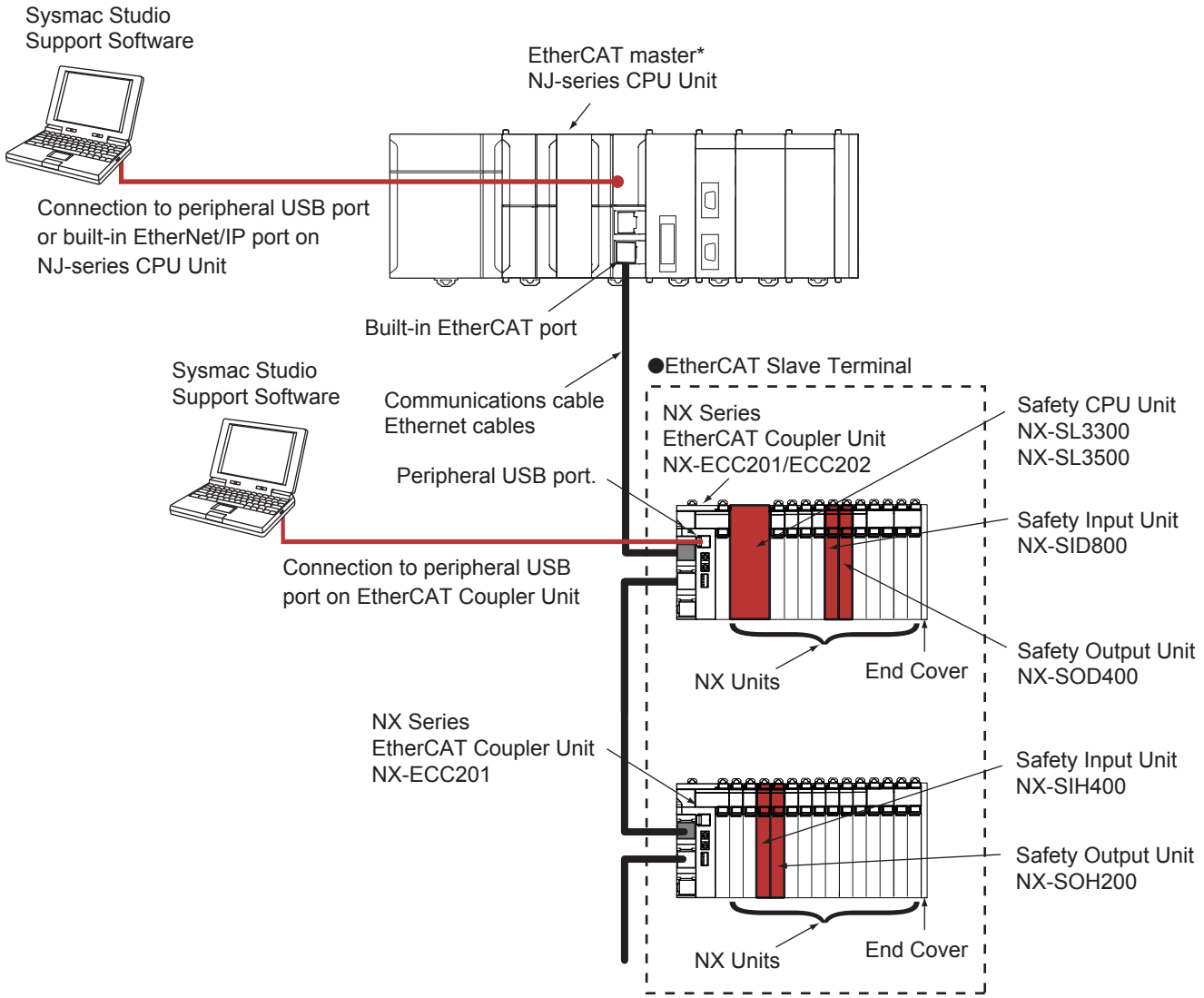
* Safety over EtherCAT (FSoE): The open protocol Safety over EtherCAT (abbreviated with FSoE "FailSafe over EtherCAT") defines a safety related communication layer for EtherCAT. Safety over EtherCAT meets the requirements of IEC 61508 SIL 3 and enables the transfer of safe and standard information on the same communication system without limitations with regard to transfer speed and cycle time.

Features

- Integrated safety into machine automation possible by connecting with the NX-series EtherCAT Coupler.
- The Safety CPU Unit controls up to 128 Safety I/O Units.
- 4 or 8 points per Safety Input Unit. The 4-point Safety Input Unit can be directly connected with OMRON Non-contact Switches and Singlebeam Sensors.
- 2 or 4 points per Safety Output Unit. The 2-point Safety Output Unit is characterized by large output breaking current of 2.0 A.
- The Safety Units can be freely allocated in any combination with standard NX I/O.
- Compliant with IEC61131-3
- Safety programs can be standardized and reused efficiently by using POUs for design and operation.

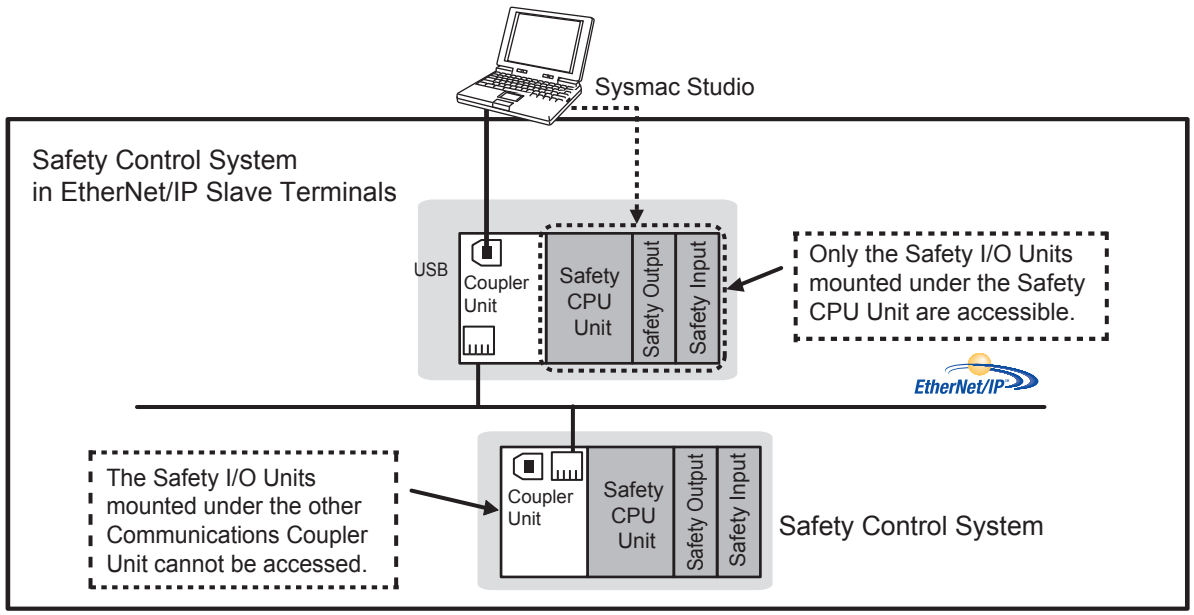
System Configuration

EtherCAT Network Operation



* OMRON CJ1W-NC□81/□82 Position Control Units cannot be connected to the EtherCAT Slave Terminal even though they support EtherCAT.

Stand-alone EtherNet/IP Network Operation



Precautions for Correct Use

There are functional restrictions when you connect to the EtherCAT Coupler Unit via the USB port in comparison with connecting to the NJ-series CPU Unit. We therefore recommend that you connect to the NJ-series CPU Unit.

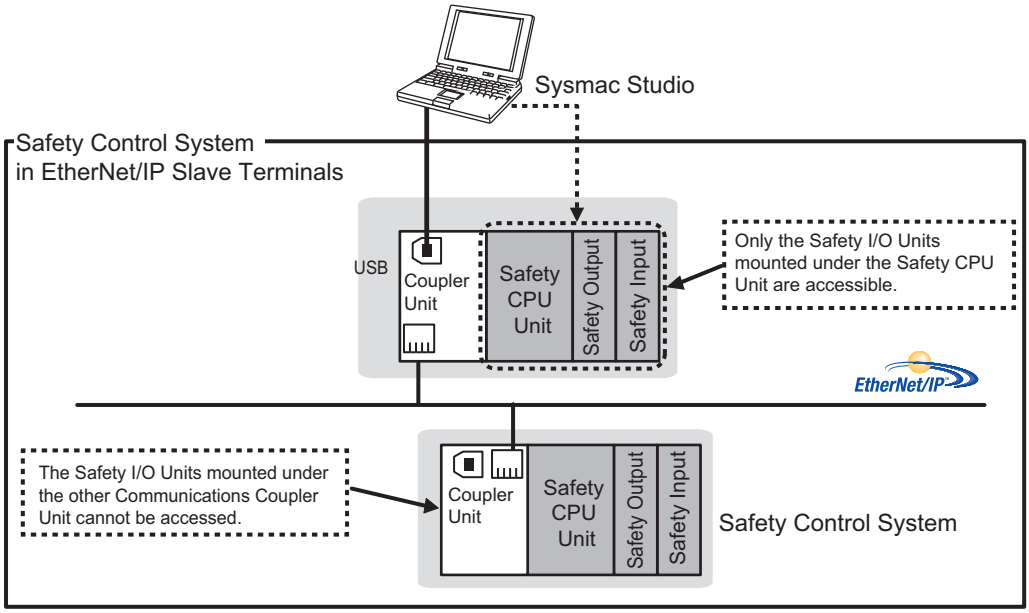
Functional Differences on the Sysmac Studio Based on the Connection Point

The functions that you can use on the Sysmac Studio depend on what the Sysmac Studio is connected to. Refer to the *NX-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519) for details.

1-3-3 Connection Method and Procedures for EtherNet/IP Coupler Units

Connect the Sysmac Studio to the USB port on the EtherNet/IP Coupler Unit.

This connection allows you to download, upload, and monitor the safety programs for only the Safety CPU Unit and Safety I/O Units that are under the EtherNet/IP Coupler Unit that the Sysmac Studio is online with. The other devices cannot be accessed.



Ordering Information

Safety CPU Unit

Unit type	Appearance	Specifications				Unit version	Model
		Maximum number of safety I/O points	Program capacity	Number of safety master connections	I/O refreshing method		
Safety CPU Unit		256 points	512KB	32	Free-Run refreshing	Ver. 1.1	**NX-SL3300**
		1024 points	2048KB	128	Free-Run refreshing	Ver. 1.1	**NX-SL3500**

Safety Input Units

Unit type	Appearance	Specifications							Unit version	Model
		Number of safety input points	Number of test output points	Internal I/O common	Rated input voltage	OMRON special safety input devices	Number of safety slave connections	I/O refreshing method		
Safety Input Units		4 points	2 points	Sinking inputs (PNP)	24 VDC	Can be connected. ✻	1	Free-Run refreshing	Ver. 1.1	**NX-SIH400**
		8 points	2 points	Sinking inputs (PNP)	24 VDC	Cannot be connected.	1	Free-Run refreshing	Ver. 1.0	**NX-SID800**

✻ The following OMRON special safety input devices can be connected directly without a special controller.
For detail of connectable OMRON special safety input devices,refer to NX-series Safety Control Units User's Manual(No.Z930-E1).

Type	Model and corresponding PL and safety category
OMRON Single-beam Safety Sensors	E3ZS and E3FS
OMRON Non-contact Door Switches	D40Z D40A
OMRON Safety Mats	UM
OMRON Safety Edges	SGE (4-wire connection)

Safety Output Units

Unit type	Appearance	Specifications						Unit version	Model
		Number of safety output points	Internal I/O common	Maximum load current	Rated voltage	Number of safety slave connections	I/O refreshing method		
Safety Output Units		2 points	Sourcing outputs (PNP)	2.0 A/point, 4.0 A/Unit at 40°C, and 2.5 A/Unit at 55°C The maximum load current depends on the installation orientation and ambient temperature.	24 VDC	1	Free-Run refreshing	Ver. 1.0	**NX-SOH200**
		4 points	Sourcing outputs (PNP)	0.5 A/point and 2.0 A/Unit	24 VDC	1	Free-Run refreshing	Ver. 1.0	**NX-SOD400**

Option

Product Name	Specification	Model
Unit/Terminal Block Coding Pins	For 10 Units (Terminal Block: 30 pins, Unit: 30 pins)	**NX-AUX02**

Product name	Specification				Model
	No. of terminals	Terminal number indications	Ground terminal mark	Terminal current capacity	
Terminal Block	8	A/B	None	10A	**NX-TBA082**
	16	A/B	None	10A	**NX-TBA162**

Accessories

Not included.

Specifications

Regulations and Standards

Certification body	Standards	
TÜV Rheinland ✻	• EN ISO 13849-1: 2008 + AC: 2009 • EN ISO 13849-2: 2012 • IEC 61508 parts 1-7: 2010 • EN 62061: 2005 • EN 61131-2: 2007 • EN ISO 13850: 2008 • EN 60204-1: 2006 + A1: 2009 + AC: 2010	• EN 61000-6-2: 2005 • EN 61000-6-4: 2007 • NFPA 79: 2012 • ANSI RIA 15.06-1999 • ANSI B11.19-2010 • UL1998 • IEC 61326-3-1: 2008
UL	cULus: Listed (UL508) and ANSI/ISA 12.12.01	

✻ Certification was received for applications in which OMRON FSoE devices are connected to each other.

The NX-series Safety Control Units allow you to build a safety control system that meets the following standards.

- Requirements for SIL 3 (Safety Integrity Level 3) in IEC 61508, EN 62061, Safety Standard for Safety Instrumented Systems (Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems)
- Requirements for PLe (Performance Level e) and for safety category 4 in EN ISO13849-1

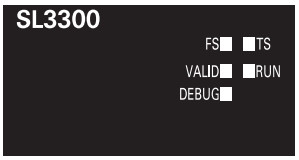
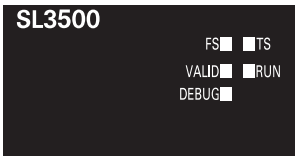
The NX-series Safety Control Units are also registered for C-Tick and KC compliance.

General Specification

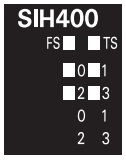
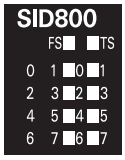
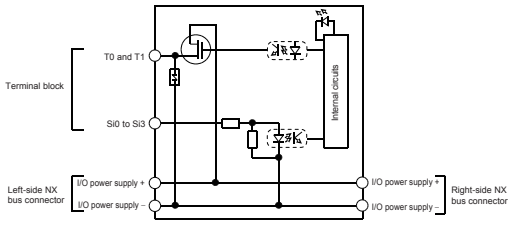
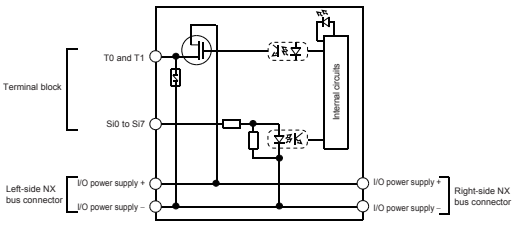
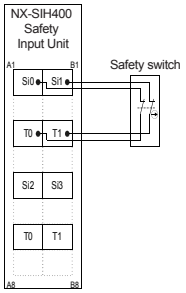
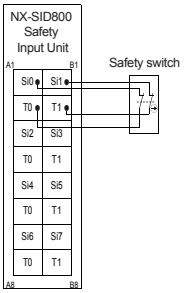
Item		Specification
Enclosure		Mounted in a panel (open)
Grounding method		Ground to 100 Ω or less.
Operating environment	Ambient operating temperature	0 to 55°C (The upper limit of the ambient operating temperature is restricted by the installation orientation.)
	Ambient operating humidity	10% to 95% (with no condensation or icing)
	Atmosphere	Must be free from corrosive gases.
	Ambient storage temperature	–25 to 70°C (with no condensation or icing)
	Altitude	2,000 m max.
	Pollution degree	2 or less: Conforms to JIS B3502 and IEC 61131-2.
	Noise immunity	Conforms to IEC 61131-2. 2 kV on power supply line (Conforms to IEC 61000-4-4.)
	Insulation class	Class III (SELV)
	Overvoltage category	Category II: Conforms to JIS B3502 and IEC 61131-2.
	EMC immunity level	Zone B
	Vibration resistance	Conforms to IEC 60068-2-6. 5 to 8.4 Hz with 3.5-mm amplitude, 8.4 to 150 Hz, acceleration of 9.8 m/s^2, 100 minutes each in X, Y, and Z directions (10 sweeps of 10 min each = 100 min total)
	Shock resistance	Conforms to IEC 60068-2-27. 147 m/s^2, 3 times each in X, Y, and Z directions
	Insulation resistance	20 MΩ between isolated circuits (at 100 VDC)
	Dielectric strength	510 VAC for 1 min between isolated circuits, leakage current: 5 mA max.
Installation method		DIN Track (IEC 60715 TH35-7.5/TH35-15)
Applicable standards		IEC 61508: 2010 SIL 3, EN 62061: 2005 SIL CL3 EN ISO 13849-1, 13849-2: 2008 PL e/Safety Category 4 UL 1998 cULus: Listed UL508, ANSI/ISA 12.12.01 EN 61131-2, C-Tick, KC: KC Registration

Specifications of Individual Units

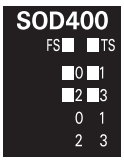
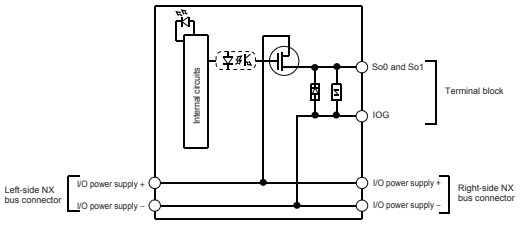
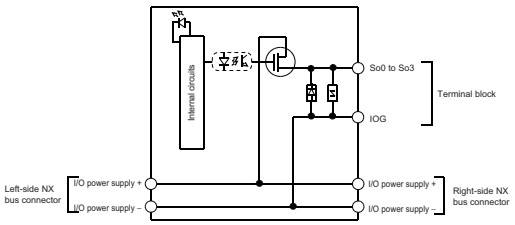
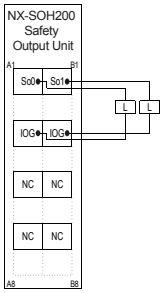
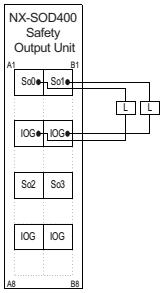
Safety CPU Unit NX-SL3300/SL3500

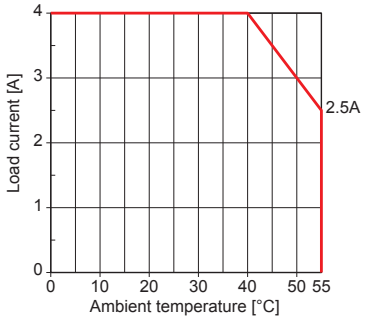
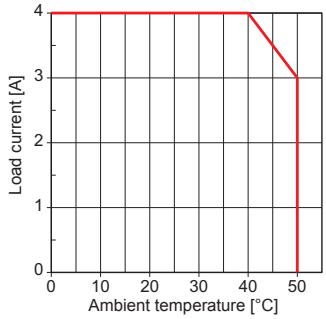
Unit name	Safety CPU Unit	
Model	NX-SL3300	NX-SL3500
Maximum number of safety I/O points	256 points	1024 points
Program capacity	512 KB	2048 KB
Number of safety master connections	32	128
I/O refreshing method	Free-Run refreshing	
External connection terminals	None	
Indicators	FS indicator, VALID indicator, DEBUG indicator, TS indicator, and RUN indicator 	FS indicator, VALID indicator, DEBUG indicator, TS indicator, and RUN indicator 
Dimensions	30 × 100 × 71 mm (W × H × D)	
I/O power supply method	Not supplied.	
Current capacity of I/O power supply terminals	No I/O power supply terminals	
NX Unit power consumption	0.90 W max.	
Current consumption from I/O power supply	No consumption	
Weight	75 g max.	
Installation orientation and restrictions	Installation orientation: 6 possible orientations Restrictions: None	

Safety Input Units NX-SIH400/SID800

Unit name	Safety Input Unit	
Model	NX-SIH400	NX-SID800
Number of safety input points	4 points	8 points
Number of test output points	2 points	2 points
Internal I/O common	PNP (sinking inputs)	
Rated input voltage	24 VDC (20.4 to 28.8 VDC)	
OMRON special safety input devices	Can be connected.	Cannot be connected.
Number of safety slave connections	1	
I/O refreshing method	Free-Run refreshing	
External connection terminals	Screwless clamping terminal block (8 terminals)	Screwless clamping terminal block (16 terminals)
Indicators	TS indicator, FS indicator, input indicators (yellow), and input error indicators (red) 	TS indicator, FS indicator, input indicators (yellow), and input error indicators (red) 
Safety input current	4.5 mA typical	3.0 mA typical
Safety input ON voltage	11 VDC min.	15 VDC min.
Safety input OFF voltage/OFF current	5 VDC max., 1 mA max.	
Test output type	Sourcing outputs (PNP)	
Test output load current	25 mA max.	50 mA max.
Test output residual voltage	1.2 V max. (Between IOV and all output terminals)	
Test output leakage current	0.1 mA max.	
Dimensions	12 × 100 × 71 mm (W × H × D)	
Isolation method	Photocoupler isolation	
Insulation resistance	20 MΩ min. between isolated circuits (at 100 VDC)	
Dielectric strength	510 VAC for 1 min between isolated circuits, leakage current: 5 mA max.	
I/O power supply method	Power supplied from the NX bus	
Current capacity of I/O power supply terminals	No applicable terminals.	
NX Unit power consumption	0.70 W max.	0.75 W max.
Current consumption from I/O power supply	20 mA max.	
Weight	70 g max.	
Circuit layout		
Terminal connection diagram	Si0 to Si3: Safety input terminals T0 and T1: Test output terminals  Refer to User's manual (Z930-E1) for details.	Si0 to Si7: Safety input terminals T0 and T1: Test output terminals  Refer to User's manual (Z930-E1) for details.
Installation orientation and restrictions	Installation orientation: 6 possible orientations. Restrictions: Maximum ambient temperature is 50ºC for any orientation other than upright installation.	
Protective functions	Overvoltage protection circuit and short detection (test outputs)	

Safety Output Units NX-SOH200/SOD400

Unit name	Safety Output Unit	
Model	NX- SOH200	NX-SOD400
Number of safety output points	2 points	4 points
Internal I/O common	PNP (sourcing outputs)	
Maximum load current	2.0 A/point 4.0 A/Unit at 40°C 2.5 A/Unit at 55°C The maximum load current depends on the installation orientation and ambient temperature	0.5 A/point and 2.0 A/Unit
Rated voltage	24 VDC (20.4 to 28.8 VDC)	
Number of safety slave connections	1	
I/O refreshing method	Free-Run refreshing	
External connection terminals	Screwless clamping terminal block (8 terminals)	
Indicators	TS indicator, FS indicator, output indicators (yellow), and output error indicators (red) 	TS indicator, FS indicator, output indicators (yellow), and output error indicators (red) 
Safety output ON residual voltage	1.2 V max. (Between IOV and all output terminals)	
Safety output OFF residual voltage	2 V max. (Between IOG and all output terminals)	
Safety output leakage current	0.1 mA max.	
Dimensions	12 × 100 × 71 mm (W × H × D)	
Isolation method	Photocoupler isolation	
Insulation resistance	20 MΩ min. between isolated circuits (at 100 VDC)	
Dielectric strength	510 VAC for 1 min between isolated circuits, leakage current: 5 mA max.	
I/O power supply method	Power supplied from the NX bus	
Current capacity of I/O power supply terminals	IOG: 2 A max./terminal	IOG (A3 and B3): 2 A max./terminal IOG (A7 and B7): 0.5 A max./terminal
NX Unit power consumption	0.70 W max.	0.75 W max.
Current consumption from I/O power supply	40 mA max.	60 mA max.
Weight	65 g max.	
Circuit layout		
Terminal connection diagram	So0 and So1: Safety output terminals IOG: I/O power supply 0 V  Refer to User's manual (Z930-E1) for details.	So0 to So3: Safety output terminals IOG: I/O power supply 0 V  Refer to User's manual (Z930-E1) for details.

Unit name	Safety Output Unit	
Model	NX- SOH200	NX-SOD400
Installation orientation and restrictions	Installation orientation: 6 possible orientations Restrictions: For upright installation, the ambient temperature is restricted as shown below depending on the total Unit load current.  For all installation orientations other than upright installation, the ambient temperature is restricted as shown below according to the total Unit load current.  	Installation orientation: 6 possible orientations Restrictions: None
Protective functions	Overvoltage protection circuit and short detection	

Version Information

The combinations that can be used of the unit versions of the Safety Control Units, NJ-series CPU Units, and NX-series EtherCAT Coupler Unit, and the version of the Sysmac Studio

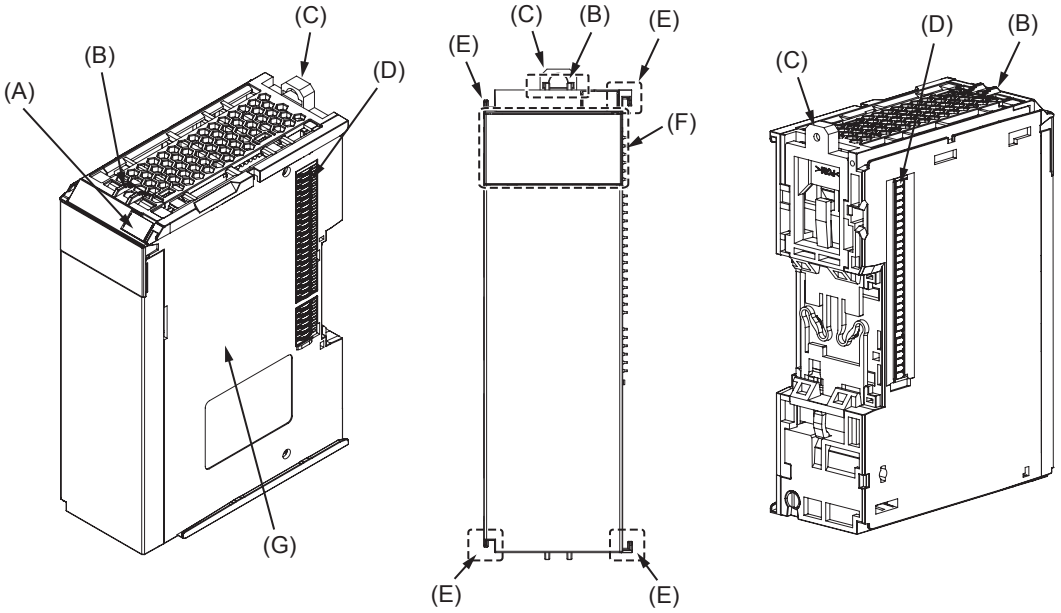
NX Unit		Corresponding version		
Model number	Unit version	EtherCAT Coupler Unit NX-ECC201/ECC202 ✻	NJ-series CPU Units (NJ501-□□□□) (NJ301-□□□□)	Sysmac Studio
NX-SL3300	1.0	1.1 or later ✻	1.06 or later	1.07 or later
	1.1			1.10 or later
NX-SL3500	1.0	1.2 or later ✻	1.07 or later	1.08 or later
	1.1			1.10 or later
NX-SIH400	1.0	1.1 or later ✻	1.06 or later	1.07 or later
	1.1			1.10 or later
NX-SID800	1.0			1.07 or later
NX-SOH200				
NX-SOD400				

✻ Some models do not have all of the versions given in the above table.
For those models, the oldest version applies. Refer to the user's manuals for the specific Units for the relation between models and versions.

External Interface

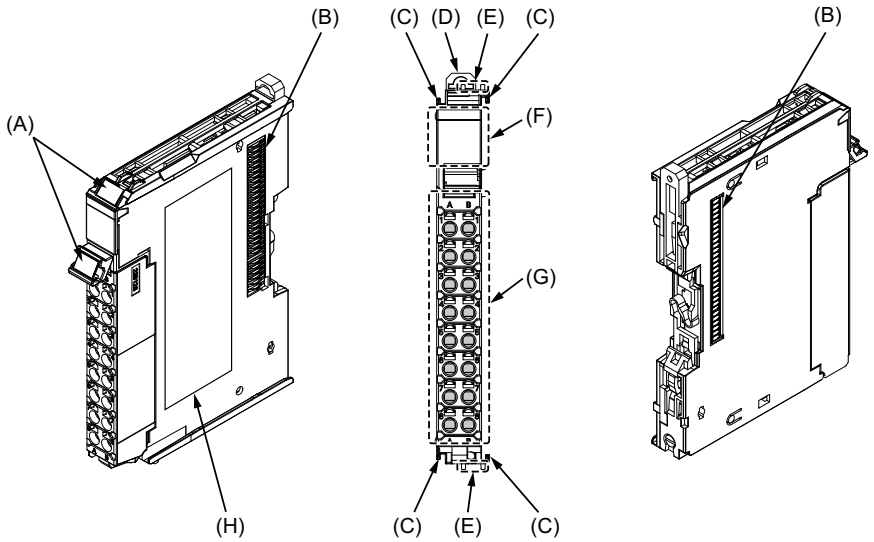
Safety CPU Unit

NX-SL3300/SL3500



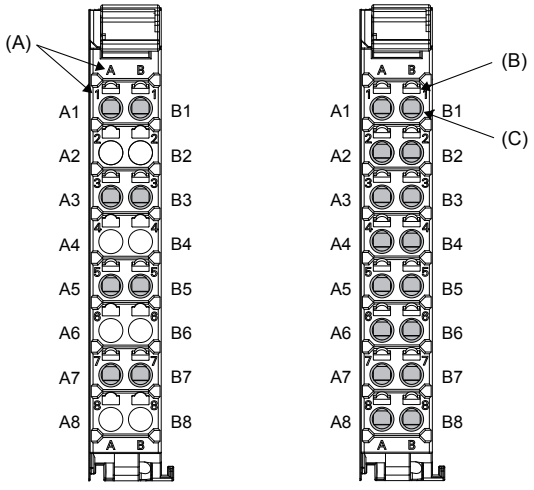
Letter	Item	Specification
(A)	Marker attachment locations	The locations where markers are attached. The markers made by OMRON are installed for the factory setting. Commercially available markers can also be installed. For details, refer to User's Manual (Z930-E1).
(B)	Protrusions for removing the Unit	The protrusions to hold when removing the Unit.
(C)	DIN Track mounting hooks	These hooks are used to mount the NX Unit to a DIN Track.
(D)	NX bus connector	This is the NX-series bus connector. It is used to connect an NX-series Safety I/O Unit or other NX Unit.
(E)	Unit hookup guides	These guides are used to connect two Units.
(F)	Indicators	The indicators show the current operating status of the NX Unit or signal I/O status. Refer to User's Manual (Z930-E1).
(G)	Unit specifications	The specifications of the NX Unit are given here.

Safety Input Unit NX-SIH400/SID800
Safety Output Unit NX-SOH200/SOD400



Letter	Item	Specification
(A)	Marker attachment locations	The locations where markers are attached. The markers made by OMRON are installed for the factory setting. Commercially available markers can also be installed. For details, refer to User's Manual (Z930-E1).
(B)	NX bus connector	This is the NX-series bus connector. Connect this connector to another Unit, such as the NX-series Safety CPU Unit or a Safety I/O Unit.
(C)	Unit hookup guides	These guides are used to connect two Units.
(D)	DIN Track mounting hooks	These hooks are used to mount the NX Unit to a DIN Track.
(E)	Protrusions for removing the Unit	The protrusions to hold when removing the Unit.
(F)	Indicators	The indicators show the current operating status of the NX Unit or signal I/O status. Refer to User's Manual (Z930-E1).
(G)	Terminal block	The terminal block is used to connect to external devices. It connects the safety outputs. The number of terminals depends on the NX Unit.
(H)	Unit specifications	The specifications of the NX Unit are given here.

Terminal Blocks



8-terminal type　16-terminal type

Letter	Item	Specification
(A)	Terminal number indications	The terminal numbers are given by column letters A and B, and row numbers 1 to 8. The combination of the column and row gives the terminal numbers from A1 to A8 and B1 to B8. The terminal number indicators are the same regardless of the number of terminals on the terminal block, as shown above.
(B)	Release holes	Insert a flat-blade screwdriver into these holes to connect and remove the wires.
(C)	Terminal holes	The wires are inserted into these holes.

Applicable Terminal Blocks for Each Unit Model

Unit model number	Terminal Blocks				
	Model	No. of terminals	Terminal number indications	Ground terminal mark	Terminal current capacity
NX-SIH400	NX-TBA082	8	A/B	None	10A
NX-SID800	NX-TBA162	16	A/B	None	10A
NX-SOH200	NX-TBA082	8	A/B	None	10A
NX-SOD400	NX-TBA082	8	A/B	None	10A

Applicable Wires

Using Ferrules

If you use ferrules, attach the twisted wires to them.
Observe the application instructions for your ferrules for the wire stripping length when attaching ferrules.
Always use one-pin ferrules. Do not use two-pin ferrules.

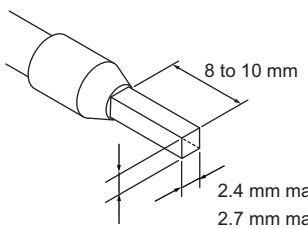
The applicable ferrules, wires, and crimping tool are given in the following table.

Terminal types	Manufacturer	Ferrule model number	Applicable wire (mm^2 (AWG))	Crimping tool
Terminals other than ground terminals	Phoenix Contact	AI0,34-8	0.34 (#22)	Phoenix Contact (The figure in parentheses is the applicable wire size.) CRIMPFOX 6 (0.25 to 6 mm^2, AWG24 to 10)
		AI0,5-8	0.5 (#20)	
		AI0,5-10		
		AI0,75-8	0.75 (#18)	
		AI0,75-10		
		AI1,0-8	1.0 (#18)	
		AI1,0-10		
		AI1,5-8	1.5 (#16)	
		AI1,5-10		
Ground terminals		AI2,5-10	2.0 *	
Terminals other than ground terminals	Weidmuller	H0.14/12	0.14 (#26)	Weidmuller (The figure in parentheses is the applicable wire size.) PZ6 Roto (0.14 to 6 mm^2, AWG 26 to 10)
		H0.25/12	0.25 (#24)	
		H0.34/12	0.34 (#22)	
		H0.5/14	0.5 (#20)	
		H0.5/16		
		H0.75/14	0.75 (#18)	
		H0.75/16		
		H1.0/14	1.0 (#18)	
		H1.0/16		
		H1.5/14	1.5 (#16)	
		H1.5/16		

* Some AWG 14 wires exceed 2.0 mm^2 and cannot be used in the screwless clamping terminal block.

When you use any ferrules other than those in the above table, crimp them to the twisted wires so that the following processed dimensions are achieved.

Finished Dimensions of Ferrules



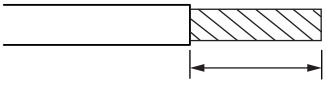
1.6 mm max. (except ground terminals)
2.0 mm max. (ground terminals)

2.4 mm max. (except ground terminals)
2.7 mm max. (ground terminals)

Using Twisted Wires/Solid Wires

If you use the twisted wires or the solid wires, the applicable wire range and conductor length (stripping length) are as follows.
Use the twisted wires to connect the ground wire to a ground of 100 Ω or less. Do not use the solid wires.

Terminal types	Applicable wires	Conductor length (stripping length)
Ground terminals	2.0 mm^2	9 to 10 mm
Terminals other than ground terminals	0.08 to 1.5 mm^2 AWG28 to 16	8 to 10 mm

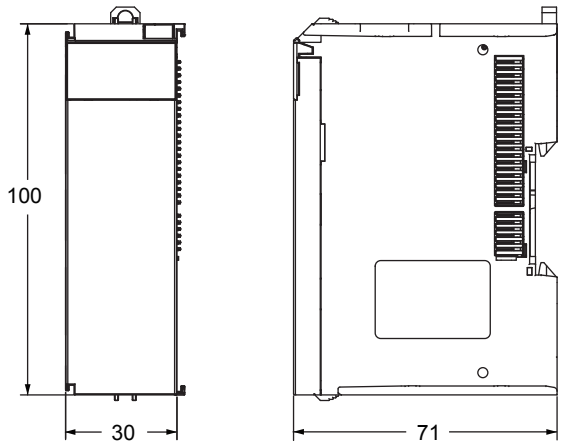


Conductor length (stripping length)

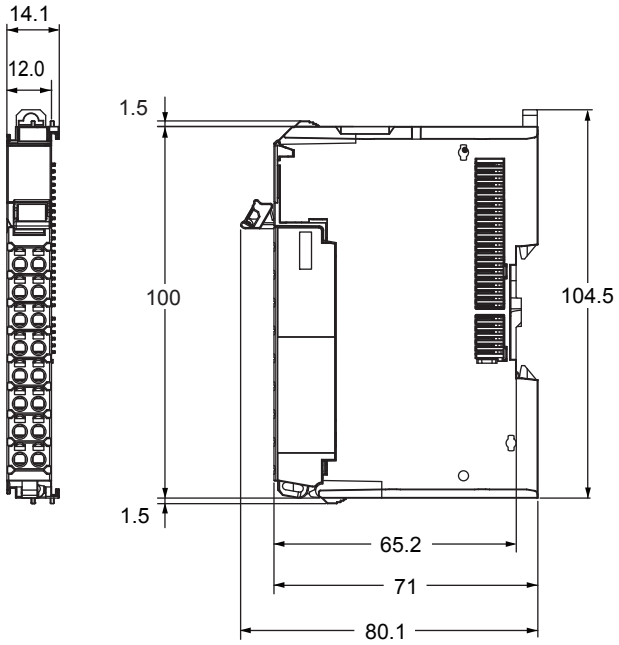
Dimensions

(Unit/mm)

Safety CPU Unit NX-SL3300/SL3500



Safety Input Units NX-SIH400/SID800
Safety Output Units NX-SOH200/SOD400



Related Manuals

Cat. No.	Model number	Manual name	Application	Description
Z930	NX-SL□□□□ NX-SI□□□□ NX-SO□□□□	NX-series Safety Control Unit User's Manual	Learning how to use NX-series Safety Control Units.	Describes the hardware, setup methods, and functions of the NX-series Safety Control Units.
Z931	NX-SL□□□□	NX-series Safety Control Unit Instructions Reference Manual	Learning about the specifications of instructions for the Safety CPU Unit.	Describes the instructions for the Safety CPU Unit. When programming, use this manual together with the *NX-series Safety Control Units User's Manual* (Cat. No. Z930).

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