SMC

Operation Manual

PRODUCT NAME

Fieldbus system
PROFINET compatible SI unit

MODEL / Series/ Product Number

EX600-SPN#
EX600-ED#

SMC Corporation

Table of Contents

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No.EX※※-OMQ0016

Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of "Caution", "Warning" or "Danger". They are all important notes for safety and must be followed in addition to International standards (ISO/IEC) *1) and other safety regulations.

∗1) ISO 4414: Pneumatic fluid power -- General rules relating to systems
ISO 4413: Hydraulic fluid power -- General rules relating to systems
IEC 60204-1: Safety of machinery -- Electrical equipment of machines (Part 1: General requirements)
ISO 10218-1992: Manipulating industrial robots -Safety.
etc.

⚠ **Caution** : CAUTION indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

⚠ **Warning** : WARNING indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.

⚠ **Danger** : DANGER indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

⚠ Warning

1. **The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.**
   Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results. The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product. This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. **Only personnel with appropriate training should operate machinery and equipment.**
   The product specified here may become unsafe if handled incorrectly. The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

3. **Do not service or attempt to remove product and machinery/equipment until safety is confirmed.**
   1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.
   2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.
   3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. **Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.**
   1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
   2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.
   3. An application which could have negative effects on people, property, or animals requiring special safety analysis.
   4. Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.

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⚠Caution

The product is provided for use in manufacturing industries.
The product herein described is basically provided for peaceful use in manufacturing industries.
If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary.
If anything is unclear, contact your nearest sales branch.

Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following "Limited warranty and Disclaimer" and "Compliance Requirements".
Read and accept them before using the product.

Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first. [*2)]
   Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.
2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.
   This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.
3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.

   *2) Vacuum pads are excluded from this 1 year warranty.
   A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.
   Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

Compliance Requirements

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited.
2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulation of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.

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Operator

♦ This operation manual is intended for those who have knowledge of machinery using pneumatic equipment, and have sufficient knowledge of assembly, operation and maintenance of such equipment. Only those persons are allowed to perform assembly, operation and maintenance.
♦ Read and understand this operation manual carefully before assembling, operating or providing maintenance to the product.

■Precautions

⚠Warning

■Do not disassemble, modify (including changing the printed circuit board) or repair.
An injury or failure can result.

■Do not operate or set with wet hands.
This may lead to an electric shock.

■Do not operate the product outside of the specifications.
Do not use for flammable or harmful fluids.
Fire, malfunction, or damage to the product can result.
Verify the specifications before use.

■Do not operate in an atmosphere containing flammable or explosive gases.
Fire or an explosion can result.
This product is not designed to be explosion proof.

■If using the product in an interlocking circuit:
•Provide a double interlocking system, for example a mechanical system.
•Check the product regularly for proper operation.
Otherwise malfunction can result, causing an accident.

■The following instructions must be followed during maintenance:
•Turn OFF the power supply.
•Stop the air supply, exhaust the residual pressure and verify that the air is released before performing maintenance.
Otherwise an injury can result.

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⚠ Caution

■When handling, assembling or replacing the units:
  •Avoid touching any sharp metal parts of the connectors for connecting units.
  •When assembling units, take care not to get any fingers caught between units.
   Injury can result.
  •When disassembling units, take care to avoid excessive force.
  The connection parts of the unit are firmly joined with seals and injury can result.

■After maintenance is complete, perform appropriate functional inspections.
  Stop operation if the equipment does not function properly.
  Safety cannot be assured in the case of unexpected malfunction.

■Provide grounding to assure the safety and noise resistance of the Fieldbus system.
  Individual grounding should be provided close to the product with a short cable.

■NOTE

○Follow the instructions given below when designing, selecting and handling the product.

●The instructions on design and selection (installation, wiring, environment, adjustment, operation, maintenance, etc.) described below must also be followed.

∗Product specifications
  •When conformity to UL is required, the SI unit should be used with a UL1310 Class 2 power supply.
  •Use the specified voltage.
   Otherwise failure or malfunction can result.
  •The power supply for the unit should be 0 V as the standard for both the power supply for outputs and the power supply for inputs and control.
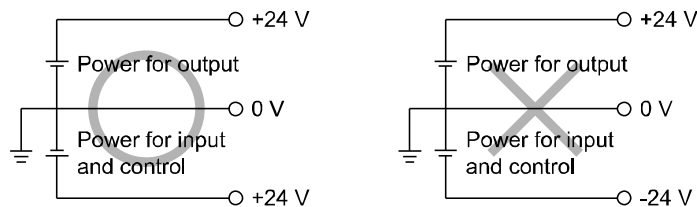
  •Reserve a space for maintenance.
   Allow sufficient space for maintenance when designing the system.
  •Do not remove any nameplates or labels.
   This can lead to incorrect maintenance, or misreading of the operation manual, which could cause damage or malfunction to the product.
   It may also result in non-conformity to safety standards.
  •Beware of inrush current when the power supply is turned ON.
   Some connected loads can apply an initial charge current which will activate the over current protection function, causing the unit to malfunction.

● Product handling

∗ Installation

• Do not drop, hit or apply excessive shock to the SI unit.

  Otherwise damage to the product can result, causing malfunction.

• Tighten to the specified tightening torque.

  If the tightening torque is exceeded the mounting screws may be broken.

  IP67 protection cannot be guaranteed if the screws are not tightened to the specified torque.

• If a large manifold valve is mounted, lift the unit so that stress is not applied to the connecting part while transporting.

  The stress may cause breakage of the connecting part. The unit may become very heavy depending on the combination. Transportation/installation shall be performed by multiple operators.

• Never mount a product in a location that will be used as a foothold.

  The product may be damaged if excessive force is applied by stepping or climbing onto it.

∗ Wiring

• Avoid repeatedly bending or stretching the cables, or placing heavy load on them.

  Repetitive bending stress or tensile stress can cause breakage of the cable.

• Wire correctly.

  Incorrect wiring can break the product.

• Do not perform wiring while the power is ON.

  Otherwise damage to the Fieldbus system and/or input or output device can result, causing malfunction.

• Do not route wires and cables together with power or high voltage cables.

  Otherwise the Fieldbus system and/or input or output device can malfunction due to interference of noise and surge voltage from power and high voltage cables to the signal line.

  Route the wires (piping) of the Fieldbus system and/or input or output device separately from power or high voltage cables.

• Confirm proper insulation of wiring.

  Poor insulation (interference from another circuit, poor insulation between terminals, etc.) can lead to excess voltage or current being applied to the product, causing damage.

• Take appropriate measures against noise, such as using a noise filter, when the Fieldbus system is incorporated into equipment.

  Otherwise noise can cause malfunction.

∗ Environment

• Select the proper type of protection according to the environment of operation.

  IP67 protection is achieved when the following conditions are met.

   (1) The units are connected properly with fieldbus cable with M12 connector and power cable with M12 (M8) connector.

   (2) Suitable mounting of each unit and manifold valve.

   (3) Be sure to fit a waterproof cap on any unused connectors.

  If using in an environment that is exposed to water splashes, please take measures such as using a cover.

  Do not use in an environment where moisture or water vapor are present. Otherwise failure and malfunction can result.

• Do not use in a place where the product could be splashed by oil or chemicals.

  If the product is to be used in an environment containing oils or chemicals such as coolant or cleaning solvent, even for a short time, it may be adversely affected (damage, malfunction etc.).

• Do not use the product in an environment where corrosive gases or fluids could be splashed.

  Otherwise damage to the product and malfunction can result.

• Do not use in an area where surges are generated.

  If there is equipment generating large surge near the unit (magnetic type lifter, high frequency inductive furnace, welding machine, motor, etc.), this can cause deterioration of the internal circuitry element of the unit or result in damage. Take measures against the surge sources, and prevent the lines from coming into close contact.

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- When a surge-generating load such as a relay, valve or lamp is driven directly, use a product with a built-in surge absorbing element.

  Direct drive of a load generating surge voltage can damage the unit.
- The product is CE marked, but not immune to lightning strikes. Take measures against lightning strikes in the system.
- Prevent foreign matter such as dust or wire debris from getting inside the product.
- Mount the product in a place that is not exposed to vibration or impact.

  Otherwise failure or malfunction can result.
- Do not use the product in an environment that is exposed to temperature cycle.

  Heat cycles other than ordinary changes in temperature can adversely affect the inside of the product.
- Do not expose the product to direct sunlight.

  If using in a location directly exposed to sunlight, shade the product from the sunlight.

  Otherwise failure or malfunction can result.
- Keep within the specified ambient temperature range.

  Otherwise malfunction can result.
- Do not operate close to a heat source, or in a location exposed to radiant heat.

  Otherwise malfunction can result.

∗Adjustment and Operation
- Perform settings suitable for the operating conditions.

  Incorrect setting can cause operation failure.
- Please refer to the PLC manufacturer's manual etc. for details of programming and addresses.

 For the PLC protocol and programming refer to the relevant manufacturer's documentation.

∗Maintenance
- Turn OFF the power supply, stop the supplied air, exhaust the residual pressure and verify the release of air before performing maintenance.

  There is a risk of unexpected malfunction.
- Perform regular maintenance and inspections.

  There is a risk of unexpected malfunction.
- After maintenance is complete, perform appropriate functional inspections.

  Stop operation if the equipment does not function properly.

  Otherwise safety is not assured due to an unexpected malfunction or incorrect operation.
- Do not use solvents such as benzene, thinner etc. to clean each unit.

  They could damage the surface of the body and erase the markings on the body.

  Use a soft cloth to remove stains.

  For heavy stains, use a cloth soaked with diluted neutral detergent and fully squeezed, then wipe up the stains again with a dry cloth.

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System Outline

•System configuration

The EX600 range of units can be connected to various types of fieldbus to realize the reduction of input or output device wiring and the distributed control system. The unit communicates with the fieldbus through the SI unit. One SI unit can be connected with manifold valves with up to 32 output s and the input • output • I/O units with maximum 10 units.
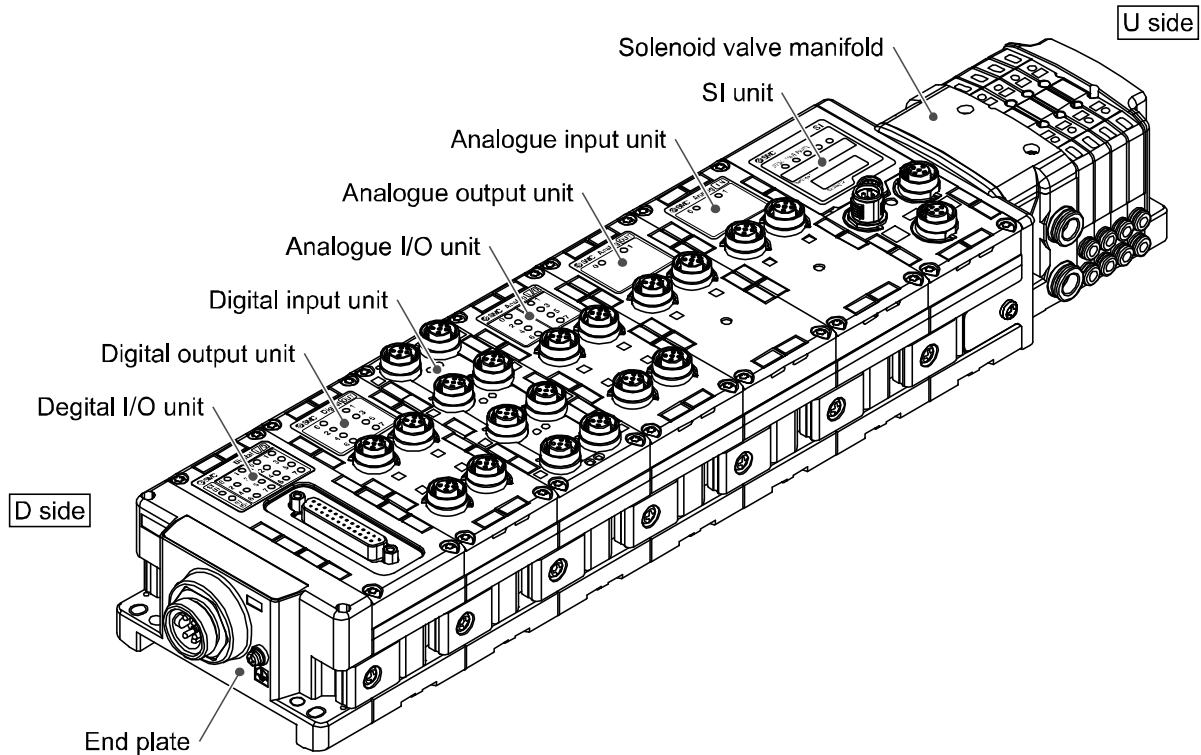
SI unit: Performs fieldbus communication and solenoid valve manifold ON/OFF output.

Digital input unit: For connecting sensors with switch output capability. PNP and NPN types are available.

Digital output unit: For connecting output device such as solenoid valves, lamps, buzzers, etc. PNP and NPN types are available.

Digital I/O unit: This unit has both digital input and output functions. PNP and NPN types are available.

Analogue input unit: For connecting sensors with analogue output capability.

Analogue output unit: This can be connected to the equipment which can read analogue input.

Analogue I/O unit: This unit has both analogue input and output functions.

End plate: Connected at EX600 Manifold's D side, incorporating the power supply connection.

Solenoid valve manifold: An assembly of solenoid valves. One connector is used as the electric connection to all connected valves.

■Definition and terminology

|	Terminology	Definition
A	AD value	The signal from the analogue input device is converted to digital, and displayed in decimal and hexadecimal. These hexadecimal and decimal values are also outputted to the analogue output device.
C	Communication speed	A speed at which data is sent and received in fieldbus etc. It depends on an equipment (PLC etc.) at high side and is indicated by bps (bit per second).
	Current consumption	The current necessary to operate each unit.
D	Diagnostic information	Consists of standard diagnostic information specified by PROFINET and specific diagnostic information for the EX600.
	DIN rail	A metal rail conforming with DIN (German) standard.
	D Side	The side connected to the end plate when the product is connected to a manifold.
E	Enclosure (IP□□)	Abbreviation of international (ingress) protection. A standard related to the protection from external objects (hands, steel ball, steel wire, dust, water, etc.) applied to the product.
F	F.E.	Abbreviation of functional earth.
	Fieldbus	The protocol that uses digital communication to exchange signals between field equipment (instruments and actuators) running on site and a PLC.
G	GSDML file	File describes the product master data.
H	Handheld Terminal (H.T.)	Abbreviation of handheld terminal. It is possible to monitor the input/output data and diagnostic data and set parameters.
I	Idle	PLC is in an idle state. EX600 system output will be constantly cleared.
	IP address	A 32 bit digit sequence which is assigned to identify devices which are connected to the network.
M	MAC address	A unique number inherent to all devices which are connected to PROFINET.
	Manifold	A form consisting of multiple components. A form made by combining multiple components.
N	NPN input	Takes the sensor output that uses the NPN transistor to the signal output line.
	NPN output	The output type that uses an NPN transistor to operate output device. It is also known as a positive common type since a positive potential is applied to the power supply line.
	Number of inputs	The number of points that can receive information from input device (sensor, switch, etc.).
	Number of outputs	The number of points that can operate output device (solenoid valve, light, motor, etc.)
O	Open circuit detection	A diagnosis function to detect if the input or output device wiring is disconnected.
P	PLC	Abbreviation of programmable logic controller. A digital computer used for automation of electromechanical processes.
	PNP input	Takes the sensor output that uses the PNP transistor to the signal output part.
	PNP output	The output type that uses a PNP transistor to operate output device. It is also known as a negative common type since a negative potential is applied to the power supply line.
S	Short circuit detection	A diagnosis function to detect an over current due to the short circuit of the output and/or power supply positive line with respect to the GND line.
	Short circuit protection	A function to protect the internal circuit from being broken by an over current due to the short circuit of the output and/or power supply positive line with respect to the GND line.
	SI unit	Abbreviation of serial interface unit. A unit connected to a PLC to communicate input and output data.
U	U Side	The side connected to the solenoid valve when the product is connected to a manifold.

Assembly

• Assembling the unit as a manifold

∗: If the unit was purchased as a manifold, the work described in this section is not necessary.
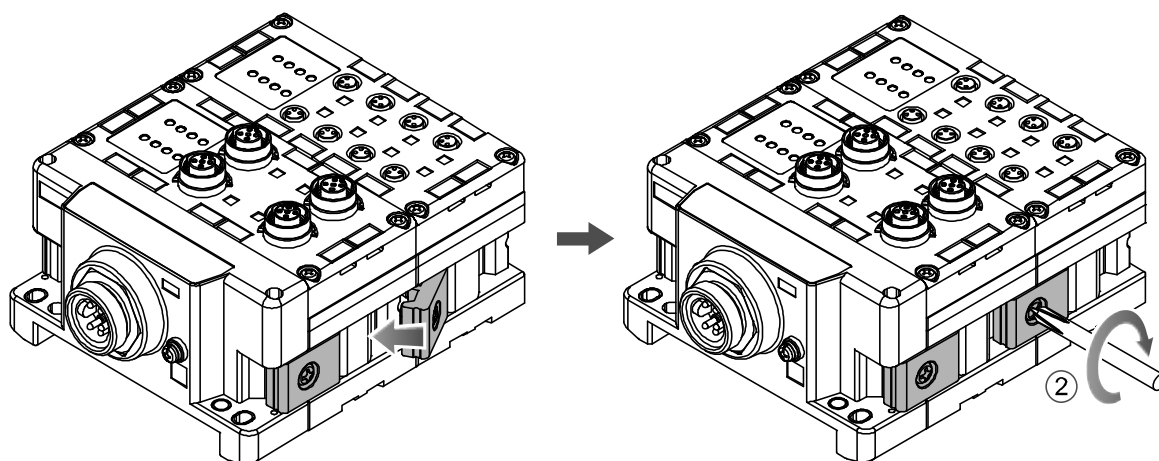
(1) Connect a unit to the end plate.
Digital and Analogue I/O units can be connected in any order.
Tighten the joint brackets to a torque of 1.5 to 1.6 Nm.
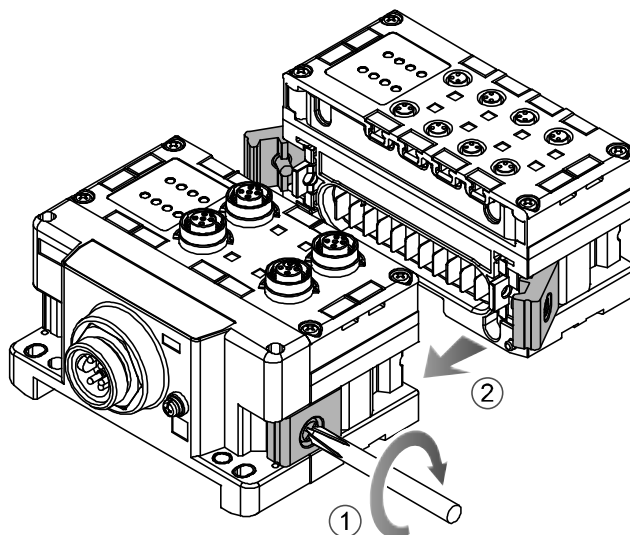
(2) Add more I/O units.
Up to 10 units (including the SI unit) can be connected to one manifold.
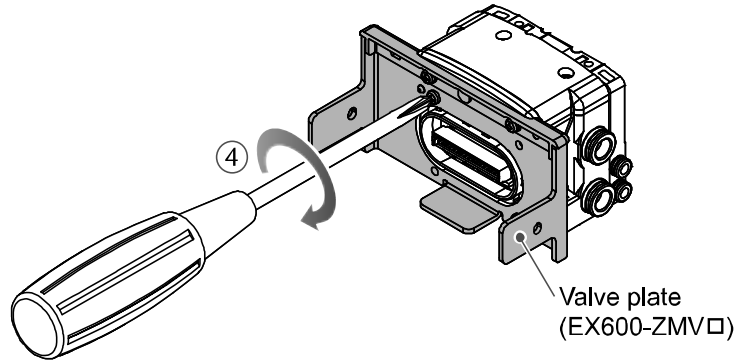

(3) Connecting the SI unit.
After connecting the required I/O units, connect the SI unit.
The method is as above in (1), (2).

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(4) Mounting the valve plate.
  Mount the valve plate (EX600-ZMV□) to the valve manifold using the valve set screws. (M3 x 8)
  Apply 0.6 to 0.7 Nm tightening torque to the screws.

  Screw mounting place
    SV   : 2 places
    S0700   : 2 places
    VQC1000: 2 places
    VQC2000: 3 places
    VQC4000: 4 places
    SY   : 2 places

④

Valve plate
(EX600-ZMV□)

(5) Connect the SI unit to the valve manifold.
  Insert the valve plate into the valve plate mounting groove on the side of the SI unit.
  Fix using the valve plate screws (M4 x 6) supplied, to a torque of 0.7 to 0.8 Nm.

Valve plate
mounting groove

⑤
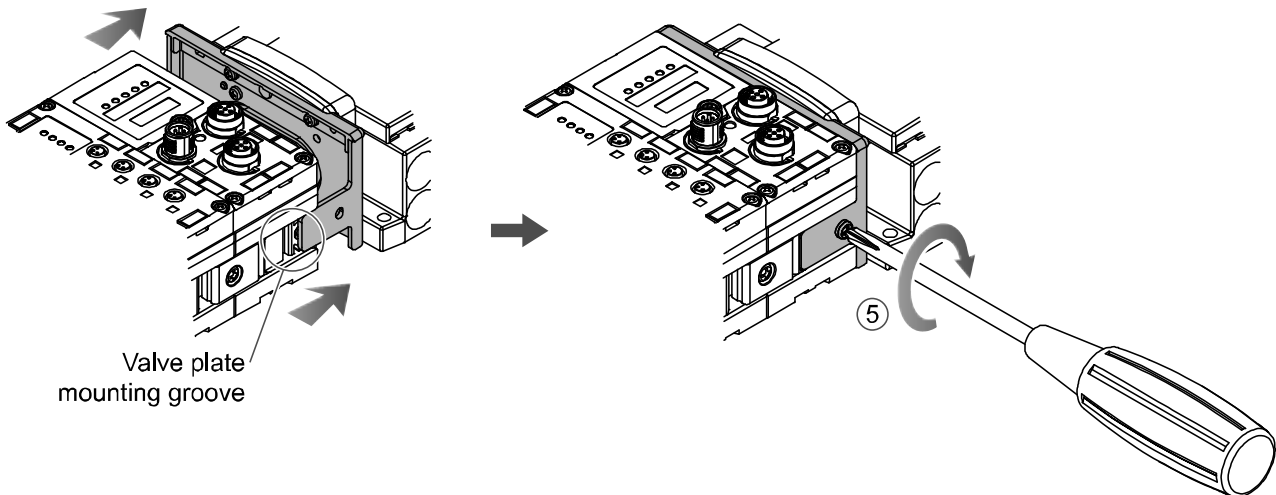
● Precautions for handling
  • Please do not connect the unit while the power supply is active. It will cause equipment damage.
  • Take care not to drop the nuts of Joint bracket.

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Mounting and Installation

■Installation

•Direct mounting

(1) When joining six or more units, fix the middle part of the complete EX600 unit with an intermediate reinforcing brace (EX600-ZMB1) before mounting, using 2-M4 x 5 screws.
Tightening torque: 0.7 to 0.8 Nm.

Intermediate reinforcing brace
（EX600-ZMB1）
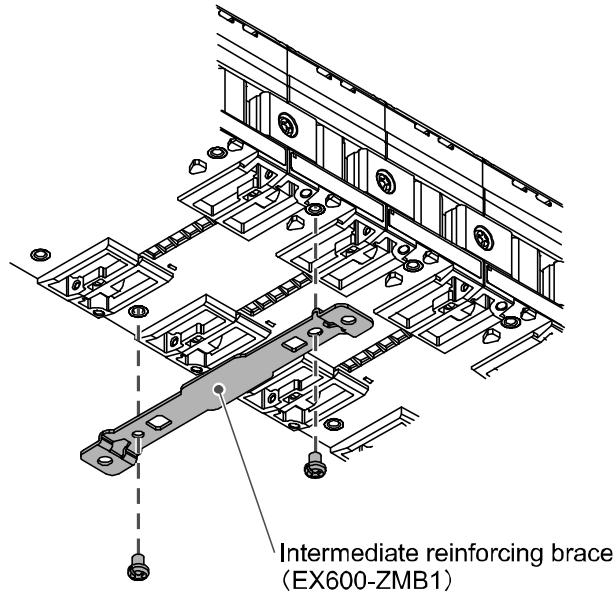
(2) Mount and tighten the end plate and the solenoid valve at one end of the unit. (M4)
Tightening torque: 0.7 to 0.8 Nm.
The tightening torque at the manifold solenoid valve side depends on the valve type. Refer to the operation manual of the corresponding valve manifold.

n (Number of connected units)≦10

•DIN rail mounting
 (Not available for SY series valves. Refer to the SY catalog.)
 (1)When joining six or more units, fix the middle part of the complete EX600 unit with an intermediate
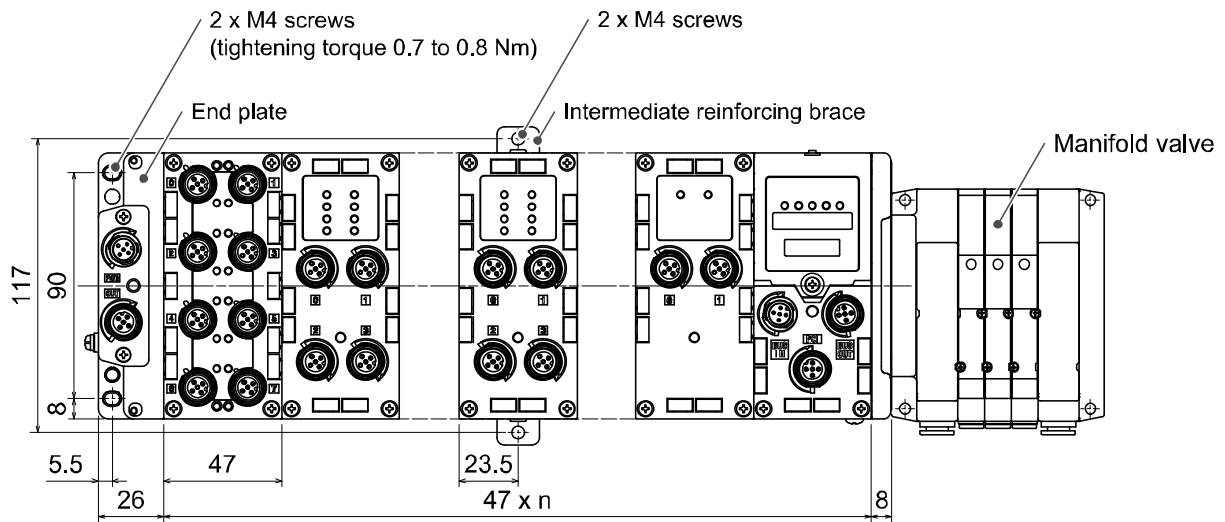   reinforcing brace (EX600-ZMB1) before mounting, using 2 - M4 x 6 screws.
    Tightening torque: 0.7 to 0.8 Nm.
 (2)Mount the end plate bracket (EX600-ZMA2) to the end plate using 2- M4 x 14 screws.
    Tightening torque: 0.7 to 0.8 Nm.

Intermediate reinforcing brace
(EX600-ZMB2)

End plate bracket
(EX600-ZMA2)

(3)Hook the DIN rail mounting groove on to the DIN rail.
(4)Press the manifold using its side hooked to the DIN rail as a fulcrum until the manifold is locked.
(5)Fix the manifold by tightening the DIN rail fixing screws of the EX600-ZMA2. (M4 x 20)
    Tightening torque: 0.7 to 0.8 Nm.
    The tightening torque at the manifold solenoid valve side depends on the valve type. Refer to the
    operation manual of the corresponding valve manifold.

DIN rail mounting groove

DIN rail

End plate bracket
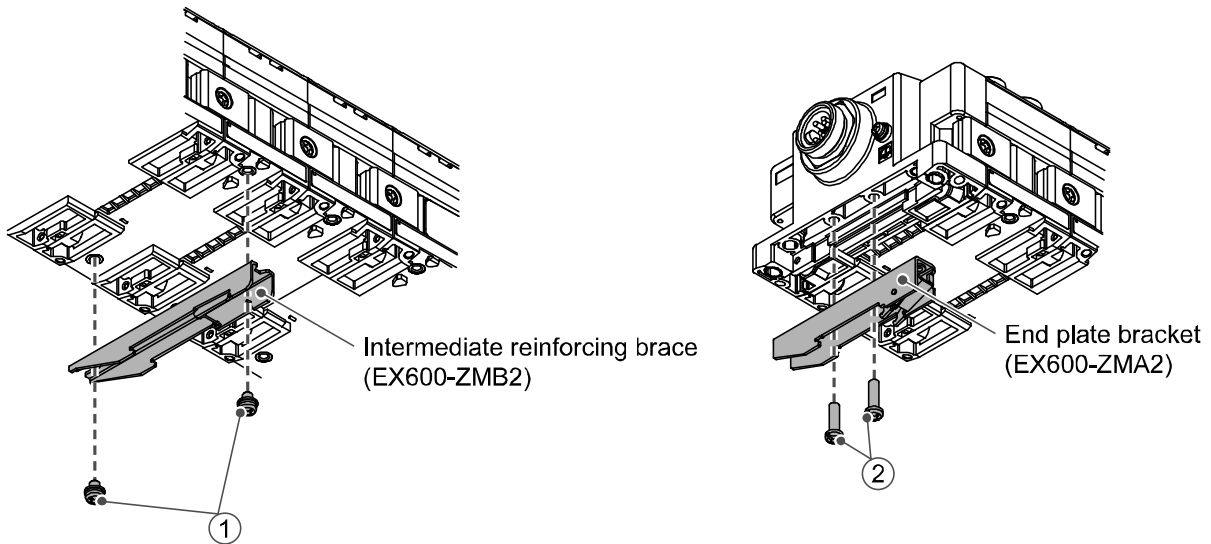(EX600-ZMA2)

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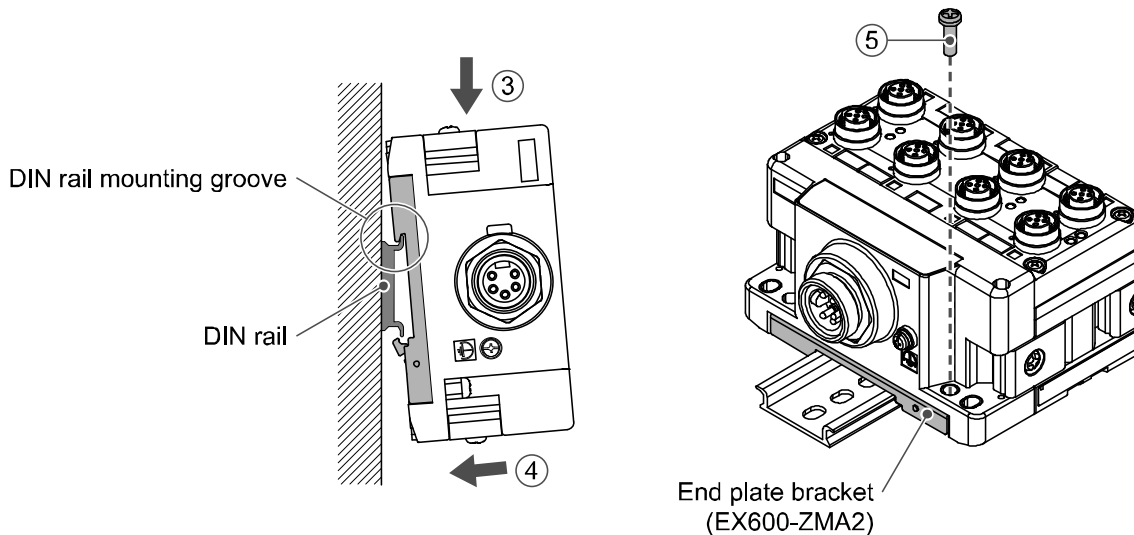
■Wiring

•Connect the M12 or M8 connector cable.

The M12 SPEEDCON connector connection method is explained below.

(1)Align mark B on the metal bracket of the cable connector (plug/socket) with mark A.

(2)Align with mark C on the unit and insert the connector vertically.

If they are not aligned, the connector cannot be connected correctly.

(3)When mark B has been turned 180 degrees (1/2 turn), wiring is complete. Confirm that the connection is not loose.

If turned too far, it will become hard to remove the connector.

(1)	(2)	(3)
Mark A Mark B Mark C on the unit		
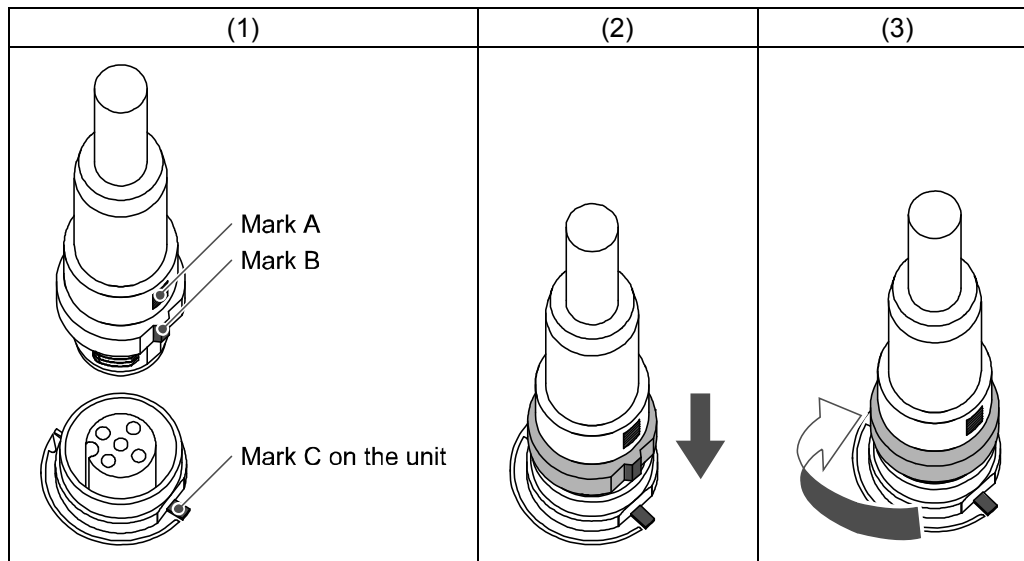
•Mounting the marker

The signal name of the input or output devices and unit address can be written on the marker, and can be installed on each unit.

Mount the marker (EX600-ZT1) into the marker groove as required.
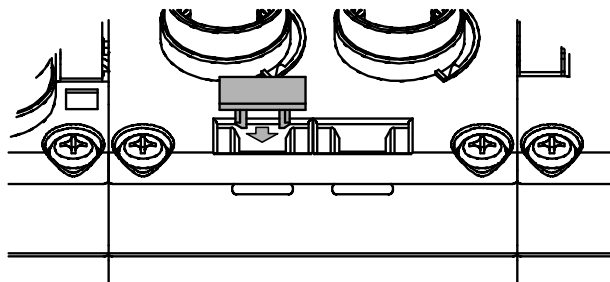
SI unit

Model Indication and How to Order

EX600-S ☐ ☐

SI unit

Polarity of output

Symbol	Content
1	Source / PNP (Negative common)
2	Sink / NPN (Positive common)

Protocol

Symbol	Content
PN	PROFINET
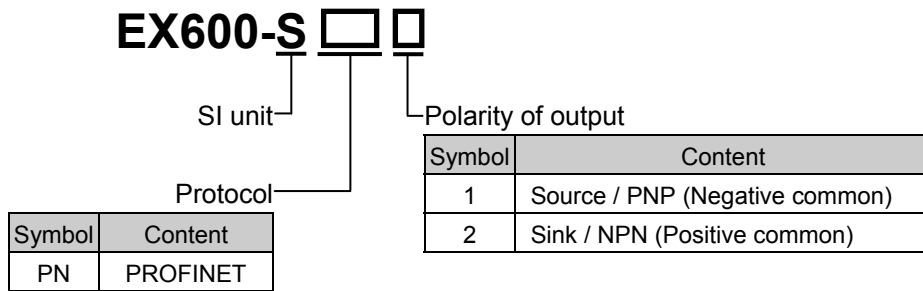
Summary of Product parts
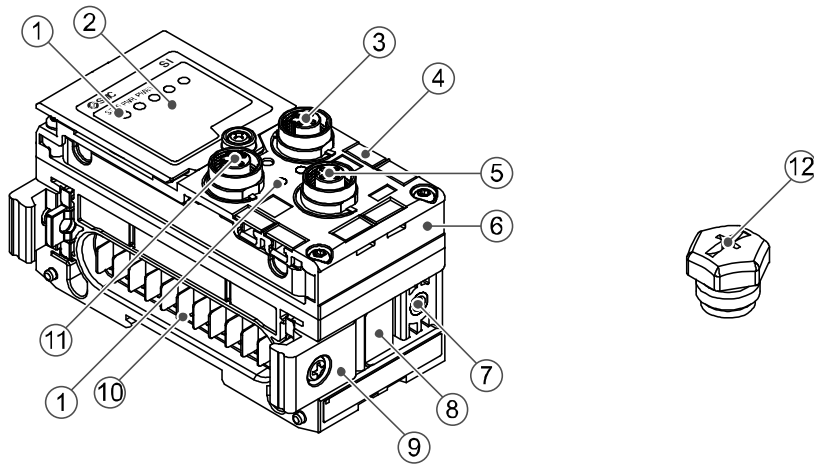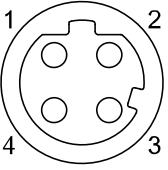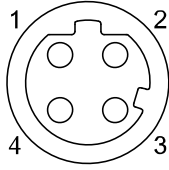
No.	Description	Function
1	Status display LED	Displays the status of the unit.
2	Display cover	The display cover should not be opened.
3	Connector (BUS OUT)	Connector for fieldbus outputs.
4	Marker groove	Groove for an identification marker.
5	Connector (PCI)	Connector for Handheld Terminal.
6	MAC address label	Displays the 12 digit MAC address which is different for each SI unit.
7	Valve plate mounting hole	Holes for fixing the valve plate.
8	Valve plate mounting groove	Groove for mounting the valve plate.
9	Joint bracket	Bracket for joining to adjacent units.
10	Unit connector (Plug)	Connector for signals and power supplies to adjacent units.
11	Connector (BUS IN)	Connector for fieldbus inputs.
12	Seal cap (2 pcs.)	Fitted to unused connectors. (BUS OUT and PCI)

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Mounting and Installation

■Wiring

•Connector pin assignment

Configuration		Pin number	Signal name
BUS IN	BUS OUT		
		1	TD+
		2	RD+
		3	TD-
		4	RD-

●Precautions for handling

Be sure to fit a seal cap on any unused connectors. Proper use of the seal cap enables the enclosure to achieve IP67 specification.

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LED Display

The status display LED displays the power supply and communication status.
Various kinds of status can be checked as follows:
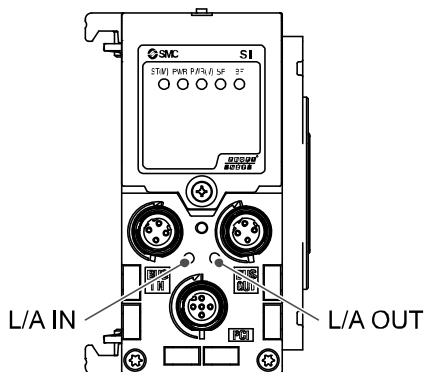
Display	Content
ST(M)	Displays the diagnostic status of the unit.
PWR	Displays the status of the power supply voltage for control and input.
PWR(V)	Displays the status of the power supply voltage for outputs.
SF	Displays the system status.
BF	Displays the communication status.

Display	Content
L/A IN	Displays the communication status of the BUS IN side.
L/A OUT	Displays the communication status of the BUS OUT side.

• SI unit common status

LED display	Content
ST(M) PWR PWR(V) OFF.	The power supply for control and input is OFF.
ST(M) PWR PWR(V) Green LEDs are ON.	The unit is in normal operation.
ST(M) PWR PWR(V) Red ST(M) LED is ON.	An internal memory error has occurred in the SI unit.
ST(M) PWR PWR(V) Red PWR LED is ON.	The power supply voltage for control and input is abnormal. (Control and input power supply voltage monitoring parameter is valid)
ST(M) PWR PWR(V) Red PWR(V) LED is ON.	The power supply voltage for outputs is abnormal. (Output power supply voltage monitoring parameter is valid)
ST(M) PWR PWR(V) Green ST(M) LED is flashing.	A unit other than the SI unit has been detected.
ST(M) PWR PWR(V) Red ST(M) LED is flashing.	Either of the following conditions: •The valve ON/OFF counter has exceeded the set value. •The valve is short circuited or disconnected.
ST(M) PWR PWR(V) Red/Green ST(M) LED is flashing alternately.	Communication error between units has occurred.

∗: For further details of countermeasures, refer to the troubleshooting section (page 26).

• PROFINET status

LED display		Content
SF BF ○ ○ OFF.		The communication with the PLC has been established normally, or the power supply for control and input is OFF.
SF BF ● ○ Red SF LED is ON.		The communication with the PLC has been established, but a diagnosis error has occurred.
SF BF ○ ● Red BF LED is flashing.		The configuration data of the PLC and EX600 are not consistent.
SF BF ○ ● Red BF LED is ON.		Either of the following conditions: •Power supply for the PLC is OFF. •The cable between the PLC and SI unit is not connected. •The PLC or the SI unit has broken. •The configuration data of the PLC and the Device Name of the SI unit are not consistent.
SF BF ● ○ Green SF LED is flashing.		The SI unit received a Node flashing test command.
(L/A IN) ● (Green)	OFF	BUS IN side　 : No Link, No Activity
	ON	BUS IN side　 :　　Link, No Activity
	Flashing	BUS IN side　 :　　Link,　　Activity
(L/A OUT) ● (Green)	OFF	BUS OUT side: No Link, No Activity
	ON	BUS OUT side:　　Link, No Activity
	Flashing	BUS OUT side:　　Link,　　Activity

∗: For further details of countermeasures, refer to the troubleshooting section (page 26).

Specification

■Specifications

Model		EX600-SPN1	EX600-SPN2
Communication	Protocol	PROFINET IO(PROFINET RT)	
	Communication speed	100 Mbps	
	Configuration file	GSDML file	
	Occupied area (Number of inputs/outputs)	(512 inputs/512 outputs) Max.	
Internal current consumption (The power supply for control and input)		120 mA or less	
Output	Polarity of output	Source / PNP (Negative common)	Sink / NPN (Positive common)
	Number of Outputs	32 outputs	
	Connected load	Solenoid valve with lamp and circuit of protection of surge voltage of 24 VDC 1.0 W (SMC)	
	Output condition at the time of communication error	HOLD/CLEAR/Force ON	
	Protective function	Short circuit protection	
Environment	Enclosure	IP67 (With manifold assembled) *	
	Operating temperature range	-10 to 50 $^{\circ}$C	
	Storage temperature range	-20 to 60 $^{\circ}$C	
	Operating humidity range	35 to 85%R.H. (No condensation)	
	Withstand voltage	500 VAC for 1 minute between external terminals and F.E.	
	Insulation resistance	500 VDC, 10 MΩ or more between external terminals and F.E.	
Standard		CE marking, UL (CSA), RoHS	
Weight		300 g	

∗: All unused connectors must have a seal cap fitted.

■Dimensions (in mm)

SMC

No.EX※※-OMQ0016
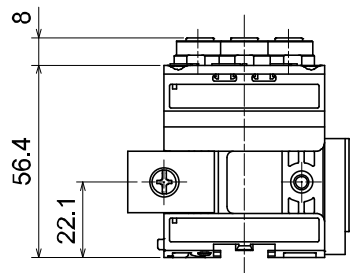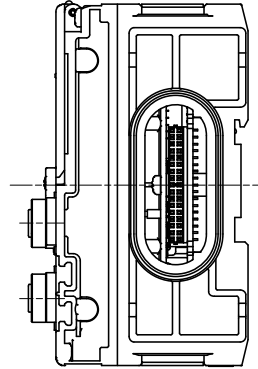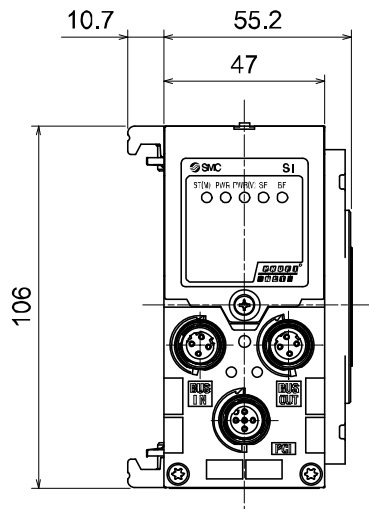
End plate

Model Indication and How to Order

EX600-ED□-□

End plate at D side ┘

Connector ┘

Symbol	Content
2	M12 (5 pin)
3	7/8 inch (5 pin)

└ Mounting method

Symbol	Content
Nil	No DIN rail bracket
2	With DIN rail bracket (Except SY series)
3	With DIN rail bracket (Specified for SY series)

Summary of Product parts

•EX600-ED2-□

•EX600-ED3-□
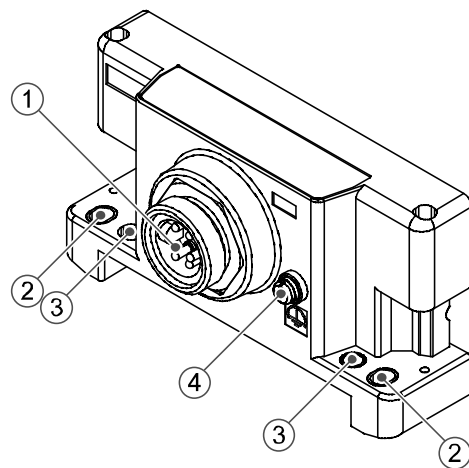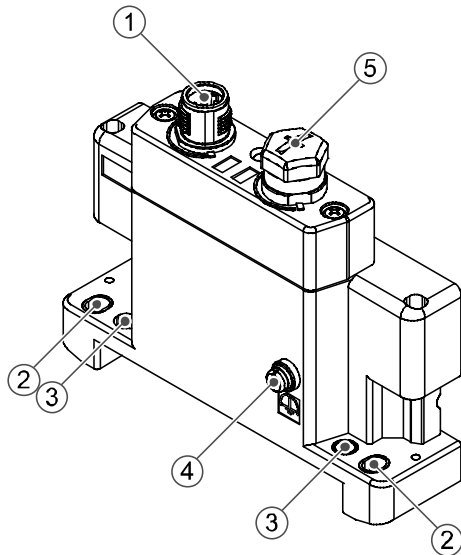
No.	Description	Function
1	Power connector	Connector for power supply to SI unit and I/O unit.
2	Fixing hole for direct mounting	Holes for direct mounting.
3	DIN rail fixing hole	Holes for fix DIN rail mounting.
4	F.E. terminal	Functional Earth terminal - must be connected directly to system earth (ground).
5	Connector (Not used)	Unused connector. Do not remove seal cap.

∗: Individual grounding should be provided close to the product with a short cable.

Mounting and Installation

■Wiring

○Connector pin assignment
(1)EX600-ED2-□

Configuration	Pin No.	Signal name
	1	24 V (Output)
	2	0 V (Output)
	3	24 V (Control and input)
	4	0 V (Control and input)
	5	F.E.

(2)EX600-ED3-□

Configuration	Pin No.	Signal name
	1	0 V (Output)
	2	0 V (Control and input)
	3	F.E.
	4	24 V (Control and input)
	5	24 V (Output)

○Regarding the 2 types of power supply
The power supply consists of two power supply systems as follows:
•Power supply for control and input: Supplying power for control of each unit's power supply for control and also for device connected to input port of Digital and Analogue unit.
•Power supply for output: Supplying power for equipment connected to output port of Digital and Analogue unit, and also power supply for solenoid valve manifold.
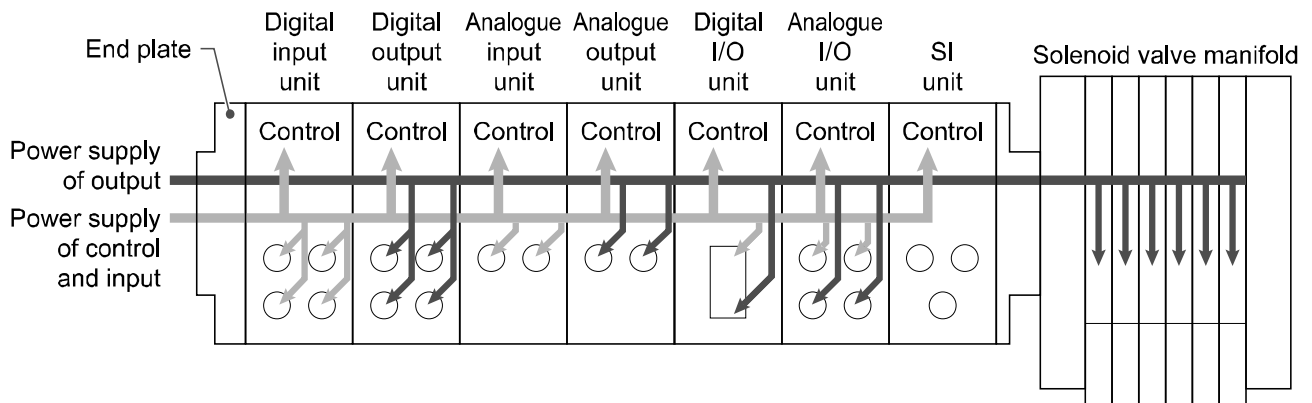
●Precautions for handling
Be sure to fit a seal cap on any unused connectors. Proper use of the seal cap enables the enclosure to achieve IP67 specification.

Specification

■Specifications

Model		EX600-ED2-□	EX600-ED3-□
Power	Power connector	M12 (5 pin) Plug	7/8 inch (5 pin) Plug
	Power supply (Control and input)	24 VDC ±10% Class2, 2 A	24 VDC ±10%, 8 A
	Power supply (Output)	24 VDC +10/-5% Class2, 2 A	24 VDC +10/-5%, 8 A
Environment	Enclosure	IP67 (With manifold assembled) *	
	Operating temperature range	-10 to 50 °C	
	Storage temperature range	-20 to 60 °C	
	Operating humidity range	35 to 85%R.H. (No condensation)	
	Withstand voltage	500 VAC for 1 minute between external terminals and F.E.	
	Insulation resistance	500 VDC, 10 MΩ min. between external terminals and F.E.	
Standard		CE marking, UL (CSA), RoHS	
Weight		170 g	175 g

∗: All unused connectors must have a seal cap fitted.

■Dimensions (in mm)

•EX600-ED2-□
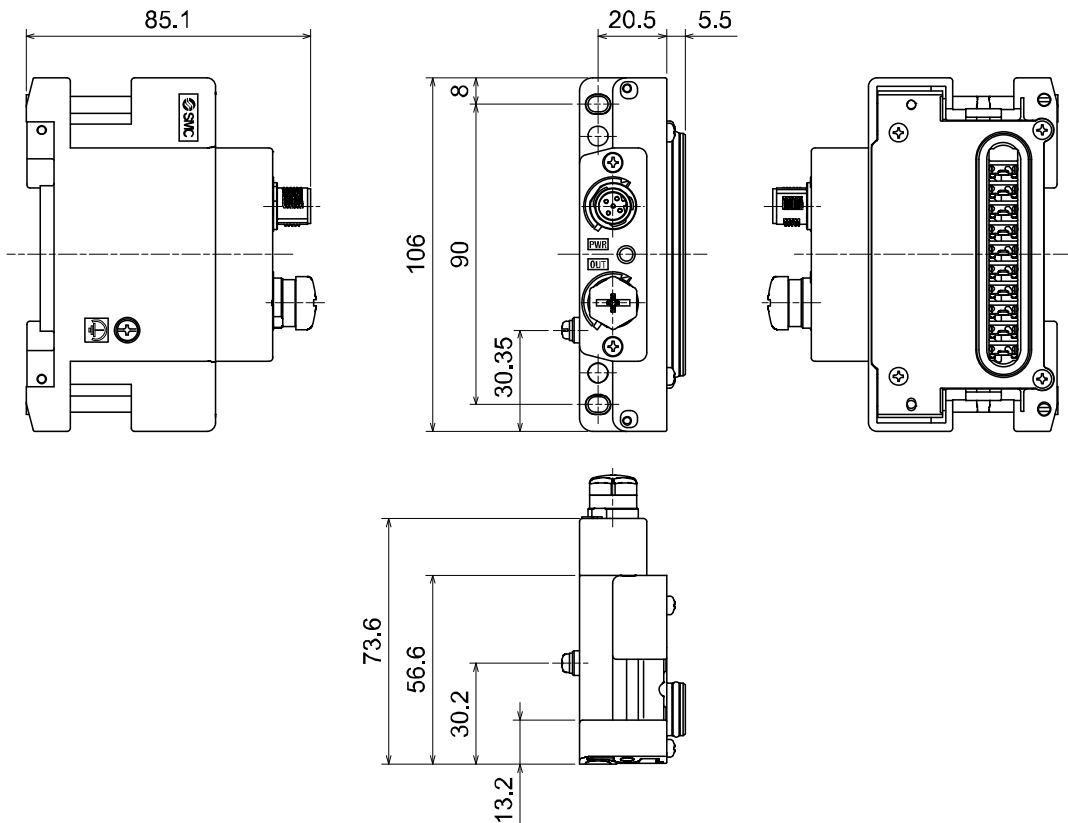
•EX600-ED3-☐
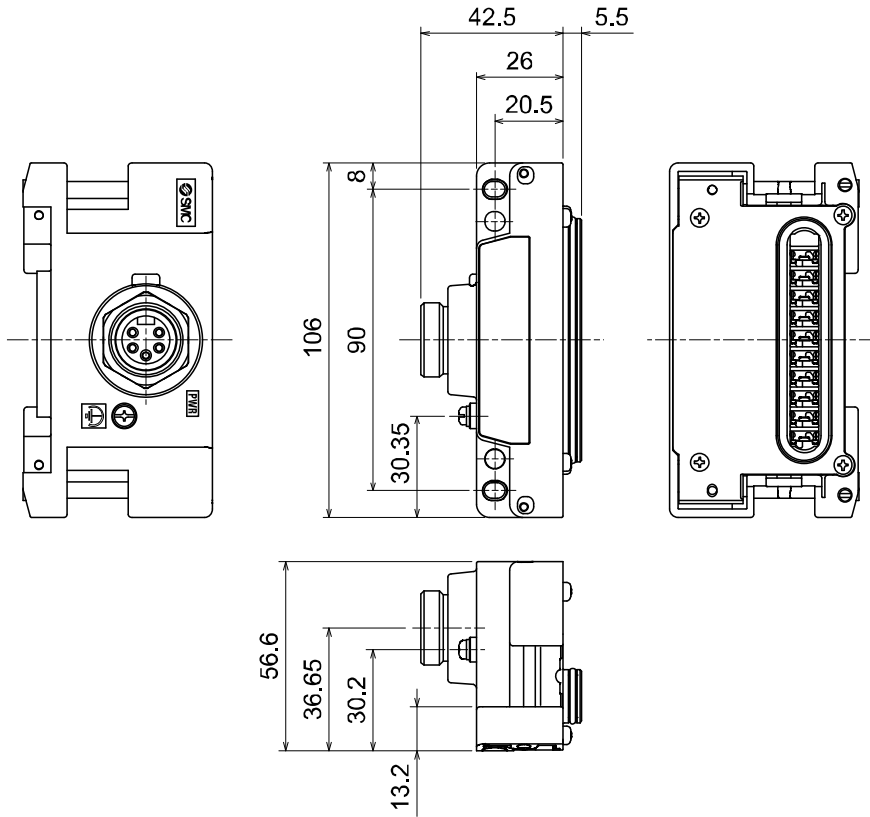
SMC

No.EX※※-OMQ0016

Maintenance

Turn OFF the power supply, stop the supplied air, exhaust the residual pressure and verify the release of air before performing maintenance.

Cleaning method

Use a soft cloth to remove stains.
For heavy stains, use a cloth soaked with diluted neutral detergent and fully squeezed, then wipe up the stains again with a dry cloth.
Do not use solvents such as benzene, thinner etc. to clean each unit.

Inspection item	Content of inspection
Connector/Electric wiring	Connect properly if the connection is loose.
Seal cap	Tighten properly if the connection is loose.
Thread for mounting and installation	If the thread is loose, re-tighten it to the specified torque.
Connection cables	If the cable is broken or any other abnormality is confirmed by appearance, replace the cable with a new one.
Supply source voltage	Check if source voltage within the specification range (24 VDC ±10%) is supplied.

How to reset the product for power cut or forcible de-energizing

Supply power to the product.
The output status just before the power failure is not maintained when power supply is recovered.
Start operation after confirming safety of the entire equipment.

Troubleshooting

•Troubleshooting
When any failure happens with this Fieldbus system, the following chart is used to identify the cause of the failure.
Error status is reflected from the parameter setting of the Fieldbus system.
When a failure occurs, take the appropriate countermeasures referring to the LED display, the troubleshooting and the parameter setting.
If a cause applicable to the failure cannot be identified, it indicates that the Fieldbus system itself is broken. The Fieldbus system breakage can be caused by the operating environment. Contact SMC separately to obtain countermeasures.

```
The system does
not work correctly.

Yes  →
No   ┄┄►

                    LED is OFF. ─────────────────────────→ Refer to Fault 1.

SI unit

                                        Digital input unit ────→ Refer to Fault 2.
                                        displays error.

                                        Digital output unit ───→ Refer to Fault 3.
                                        displays error.

                                        Digital I/O unit ──────→ Refer to Fault 4.
                                        displays error.

    Green ST(M) LED is                  Analogue input unit ──→ Refer to Fault 5.
    flashing.                           displays error.

                                        Analogue output unit ─→ Refer to Fault 6.
                                        displays error.

                                        Analogue I/O unit ────→ Refer to Fault 7.
                                        displays error.

                        Contact SMC if it does not recover after
                        replacing the SI unit whose unit is broken.
```

SMC

```
SI unit

Red ST(M) LED is flashing. ──────────────────────────────▶ Refer to Fault 8.

Red ST(M) LED is ON.
Or red/green ST(M)
LED is flashing alternately. ──────────────────────────────▶ Refer to Fault 9.

Red PWR or PWR(V)
LED is ON. ──────────────────────────────▶ Refer to Fault 10.

Green L/A IN or L/A OUT
LED is not flashing. ──────────────────────────────▶ Refer to Fault 11.

At least one SF and/or
BF LED is ON red or
flashing red. ──────────────────────────────▶ Refer to Fault 12.

The valve does not
work correctly. ──────────────────────────────▶ Refer to Fault 13.

The digital input or output
device does not work
correctly. ──────────────────────────────▶ Refer to Fault 14.

The analogue input or
output device does not
work correctly. ──────────────────────────────▶ Refer to Fault 15.

──────────────────────────────▶ Contact SMC.
```

SMC

•Trouble counter measure method

No.	Part No. EX600-	Problem	Presumed cause	Troubleshooting
1	-	LED is OFF.	Power supply for control and input is OFF.	Check if the power for control and input is supplied.
2	DX☐B DX☐C☐ DX☐D	Red LED is ON. (Diagnosis is activated)	Diagnosis error Input device power supply is short-circuited.	Check the parts with error by using the LED display or PLC * or H.T. Re-wire the short-circuited part or check if the cable and input device are normal.
		Red LED is flashing. (Diagnosis is activated)	Diagnosis error (1)ON/OFF count of the input device has exceeded the set value. (2)The wire of the input device is broken or disconnected. (Only EX600-DX☐C1)	Check the parts with error by using the LED display or PLC * or H.T. (1)Reset the ON/OFF count to zero or change the set value. Or invalidate diagnosis. (2)Check if the connector is loose and if the wire is broken.
		Red/green all LEDs are flashing alternately.	An internal memory error occurred in the Digital input unit.	Turn OFF the power for the unit and then turn it ON again. If the error is not eliminated, stop the operation and contact SMC.
	DX☐E DX☐F	Red ST LED is ON. (Diagnosis is activated)	Diagnosis error Input device power supply is short-circuited.	Check the parts with error by using the LED display or PLC * or H.T. Re-wire the short-circuited part or check if the cable and input device are normal.
		Red ST LED is flashing. (Diagnosis is activated)	Diagnosis error ON/OFF count of the input device has exceeded the set value.	Check the parts with error by using the LED display or PLC * or H.T. Reset the ON/OFF count to zero or change the set value. Or invalidate diagnosis.
		Red/green ST LED is flashing alternately.	An internal memory error occurred in the Digital input unit.	Turn OFF the power for the unit and then turn it ON again. If the error is not eliminated, stop the operation and contact SMC.

∗: Refer to "Diagnostic" (page 66) for details.

No.	Part No. EX600-	Problem	Presumed cause	Troubleshooting
3	DY□B	Red LED is ON. (Diagnosis is activated)	Diagnosis error 　Output device is short-circuited.	Check the parts with error by using the LED display or PLC * or H.T. Re-wire the short-circuited part or check if the cable and output device are normal.
		Red LED is flashing. (Diagnosis is activated)	Diagnosis error (1)ON/OFF count of the output device has exceeded the set value. (2)The wire of the output device is broken or disconnected.	Check the parts with error by using the LED display or PLC * or H.T. (1)Reset the ON/OFF count to zero or change the set value. Or invalidate diagnosis. (2)Check if the connector is loose and if the wire is broken.
		Red/green all LEDs are flashing alternately.	An internal memory error occurred in the Digital output unit.	Turn OFF the power for the unit and then turn it ON again. If the error is not eliminated, stop the operation and contact SMC.
	DY□E DY□F	Red ST LED is ON. (Diagnosis is activated)	Diagnosis error 　Output device is short-circuited.	Check the parts with error by using the LED display or PLC * or H.T. Re-wire the short-circuited part or check if the cable and output device are normal.
		Red ST LED is flashing. (Diagnosis is activated)	Diagnosis error (1)ON/OFF count of the output device has exceeded the set value. (2)The wire of the output device is broken or disconnected.	Check the parts with error by using the LED display or PLC * or H.T. (1)Reset the ON/OFF count to zero or change the set value. Or invalidate diagnosis. (2)Check if the connector is loose and if the wire is broken.
		Red/green ST LED is flashing alternately.	An internal memory error occurred in the Digital output unit.	Turn OFF the power for the unit and then turn it ON again. If the error is not eliminated, stop the operation and contact SMC.
4	DM□E DM□F	Red ST(I) LED is ON. (Diagnosis is activated)	Diagnosis error 　Input device power supply is short-circuited.	Check the parts with error by using the LED display or PLC * or H.T. Re-wire the short-circuited part or check if the cable and input device are normal.
		Red ST(I) LED is flashing. (Diagnosis is activated)	Diagnosis error 　ON/OFF count of the input device has exceeded the set value.	Check the parts with error by using the LED display or PLC * or H.T. Reset the ON/OFF count to zero or change the set value. Or invalidate diagnosis.
		Red ST(O) LED is ON. (Diagnosis is activated)	Diagnosis error 　Output device is short-circuited.	Check the parts with error by using the LED display or PLC * or H.T. Re-wire the short-circuited part or check if the cable and output device are normal.
		Red ST(O) LED is flashing (Diagnosis is activated)	Diagnosis error (1)ON/OFF count of the output device has exceeded the set value. (2)The wire of the output device is broken or disconnected.	Check the parts with error by using the LED display or PLC * or H.T. (1)Reset the ON/OFF count to zero or change the set value. Or invalidate diagnosis. (2)Check if the connector is loose and if the wire is broken.
		Red/green ST LED is flashing alternately.	An internal memory error occurred in the Digital input/ output unit.	Turn OFF the power for the unit and then turn it ON again. If the error is not eliminated, stop the operation and contact SMC.

∗: Refer to "Diagnostic" (page 66) for details.

SMC

No.	Part No. EX600-	Problem	Presumed cause	Troubleshooting
5	AXA	Red LED is ON. (Diagnosis is activated)	Diagnosis error Analogue input device power supply is short-circuited.	Check the parts with error by using the LED display or PLC * or H.T. Re-wire the short-circuited part, and check if the cable and analogue input device are normal.
		"0 and 1" red LEDs are ON.	Input value has exceeded the upper limit when set to current input type range.	Check the following when the range of the Analogue input unit is set to current input. (1)Set the input value of the analogue input device so that it does not exceed the upper limit. (2)Voltage is input from the analogue input device. Ensure the range of the Analogue input unit matches the range of the analogue input device.
		Red LED is flashing. (Diagnosis is activated)	Diagnosis error (1)Input value has exceeded the upper or lower limit of the range. (2)Input value (value set by user) has exceeded the upper or lower limit.	(1)If the input value from the analogue input device exceeds the upper or lower limit of the range, select the appropriate range so that the input value is within the range. Or invalidate diagnosis. (2)If the input value from the analogue input device exceeds the upper or lower limit of the user set value, adjust it so that the input value is within the range of the user set value. Or invalidate diagnosis.
		Red/green all LEDs are flashing alternately.	An internal memory error occurred in the Analogue input unit.	Turn OFF the power for the unit and then turn it ON again. If the error is not eliminated, stop the operation and contact SMC.
6	AYA	Red LED is ON. (Diagnosis is activated)	Diagnosis error Analogue output device power supply is short-circuited.	Check the parts with error by using the LED display or PLC * or H.T. Re-wire the short-circuited part, and check if the cable and analogue output device are normal.
		Red LED is flashing. (Diagnosis is activated)	Diagnosis error Output value (value set by user) has exceeded the upper or lower limit.	If the output value from the analogue output device exceeds the upper or lower limit of the user set value, adjust it so that the output value is within the range of the user set value. Or invalidate diagnosis.
		Red/green all LEDs are flashing alternately.	An internal memory error occurred in the Analogue output unit.	Turn OFF the power for the unit and then turn it ON again. If the error is not eliminated, stop the operation and contact SMC.

*: Refer to "Diagnostic" (page 66) for details.

SMC

No.	Part No. EX600-	Problem	Presumed cause	Troubleshooting
7	AMB	Red LED is ON. (Diagnosis is activated)	Diagnosis error Analogue input or output device power supply is short-circuited.	Check the parts with error by using the LED display or PLC * or H.T. Re-wire the short-circuited part, and check if the cable and analogue input or output device are normal.
		"0 and 1" red LEDs are ON.	Input value has exceeded the upper limit when set to current input type range.	Check the following when the range of the Analogue input unit is set to current input. (1)Set the input value of the analogue input device so that it does not exceed the upper limit. (2)Voltage is input from the analogue input device. Ensure the range of the Analogue input unit matches the range of the analogue input device.
		Red LED is flashing. (Diagnosis is activated)	Diagnosis error (1)Input value has exceeded the upper or lower limit of the range. (2)Input or output value (value set by user) has exceeded the upper or lower limit.	(1)If the input value from the analogue input device exceeds the upper or lower limit of the range, select the appropriate range so that the input value is within the range. Or invalidate diagnosis. (2)If the input (output) value from the analogue input (output) device exceeds the upper or lower limit of the user set value, adjust it so that the input (output) value is within the range of the user set value. Or invalidate diagnosis.
		Red/green all LEDs are flashing alternately.	An internal memory error occurred in the Analogue input/ output unit.	Turn OFF the power for the unit and then turn it ON again. If the error is not eliminated, stop the operation and contact SMC.
8		Red ST(M) LED is flashing. (Diagnosis is activated)	Diagnosis error (SI unit) (1)Valve is short-circuited. (2)Valve is open-circuited. (3)ON/OFF count of the valve has exceeded the set value.	Check the parts with error by using the LED display or PLC * or H.T. (1)Check the operation after replacing the valve. (2)Check the operation after replacing the valve. (3)Reset the ON/OFF count to zero or change the set value. Or invalidate diagnosis.
9		Red ST(M) LED is ON.	An internal memory error has occurred in the SI unit.	Turn OFF the power for the unit and then turn it ON again. If the error is not eliminated, stop the operation and contact SMC.
		Red/green ST(M) LED is flashing alternately.	Unit communication error	Make sure that the units are connected correctly and are not loose.
10		Red PWR LED is ON. (Diagnosis is activated)	Power supply voltage for control and input is abnormal.	Supply 24 VDC ±10% for control and input power source.
		Red PWR(V) LED is ON. (Diagnosis is activated)	Power supply voltage for output is abnormal.	Supply 24 VDC +10/-5% for output power source.

∗: Refer to "Diagnostic" (page 66) for details.

No.	Problem	Presumed cause	Troubleshooting
11	L/A IN or L/A OUT LED is OFF.	LINK has not yet been established.	Check the following and restart. (1)Check if the power is supplied to the PROFINET device one level above. (When L/A IN LED is OFF.) (2)Check that the connectors of L/A IN and L/A OUT communication cables are connected and there are no broken wires. (3)Keep noise sources away from the communication cable. ∗: The L/A OUT LED will be OFF if the BUS OUT connector is not used.
	L/A IN or L/A OUT Green LED is ON.	LINK is established but data has not been received.	Check the following and restart. (1)Check the PLC condition and run the PLC. (2)Check that the communication connector is not loose and there are no broken wires. (3)Keep noise sources away from the communication cable.
12	SF: Red LED is ON BF: LED is OFF (Diagnosis is activated)	Diagnosis error	Check the LED status and eliminate the error by referring to countermeasure No.2 to 7.
	SF: LED is OFF BF: Red LED is flashing	Configuration data does not match	Check PLC configuration setting so that it matches the actual configuration.
	SF: LED is OFF BF: Red LED is ON	Error in communication with PLC station.	Check the following. (1)Power supply for the PLC station is OFF. (2)Loose connector or broken wire. (3)Failure of the PLC station or SI unit. (4)The configuration data of the PLC and the Device Name of the SI unit are consistent.
13	Abnormal valve operation	Abnormality with program, etc.	Check if the ladder logic program works correctly.
		Abnormal power supply for output.	Check if the green PWR(V) LED of the SI unit is ON. If the LED is OFF, or the red LED is ON, supply 24 VDC +10/-5% to the power supply for output.
		Connection between SI unit and manifold valve is defective.	Check the connectors between the SI unit and manifold valve are not damaged, such as bent pins, and connect them correctly.
		Polarity of output does not match.	If the polarity of the SI unit and the valve are different, replace one of them to make the combination match. •EX600-SPN1 (PNP output) ⇒ Negative common type valve •EX600-SPN2 (NPN output) ⇒ Positive common type valve
		SI unit has failed.	Replace the SI unit with a normal one, and check the operation.
		Valve failure.	Replace the valve with a normal one, and check the operation. Or refer to the troubleshooting of the valve used.

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No.	Problem	Presumed cause	Troubleshooting
14	Abnormal digital input device operation	Polarity of input does not match.	If the polarity (PNP, NPN) of the input unit and the input device are different, replace one of them to make the combination match.
		Power supply for control and input is abnormal.	Check if the green PWR LED of the SI unit is ON. If the LED is OFF, or the red LED is ON, supply 24 VDC ±10% to the power supply for control and input.
		Wiring or connection is defective.	Connect the wiring correctly between the digital input device and the Digital input unit.
		Digital input unit has failed.	Replace the Digital input unit with a normal one, and check the operation.
		Digital input device failure.	Replace the digital input device with a normal one, and check the operation. Or refer to the troubleshooting of the input device used.
	Abnormal digital output device operation	Polarity of output does not match.	If the polarity (PNP, NPN) of the output unit and the output device are different, replace one of them to make the combination match.
		Power supply for output is abnormal.	Check if the green PWR(V) LED of the SI unit is ON. If the LED is OFF, or the red LED is ON, supply 24 VDC +10/-5% to the power supply for output.
		Wiring or connection is defective.	Connect the wiring correctly between the digital output device and the Digital output unit.
		Digital output unit has failed.	Replace the Digital output unit with a normal one, and check the operation.
		Digital output device failure.	Replace the digital output device with a normal one, and check the operation. Or refer to the troubleshooting of the output device used.
		Abnormality with program, etc.	Check if the ladder logic program works correctly.

No.	Problem	Presumed cause	Troubleshooting
15	Abnormal analogue input device operation	Power supply for control and input is abnormal.	Check if the green PWR LED of the SI unit is ON. If the LED is OFF, or the red LED is ON, supply 24 VDC ±10% to the power supply for control and input.
		Analogue input signal range setting failure.	Check the analogue input device specification, and set the input signal range which satisfies the specification.
		Analogue data format does not match.	Check if the data format of the Analogue input unit is properly set.
		Wiring or connection is defective.	Connect the wiring correctly between the analogue input device and the Analogue input unit.
		Analogue input unit has failed.	Replace the Analogue input unit with a normal one, and check the operation.
		Analogue input device failure.	Replace the analogue input device with a normal one, and check the operation. Or refer to the troubleshooting of the analogue input device used.
	Abnormal analogue output device operation	Power supply for output is abnormal.	Check if the green PWR(V) LED of the SI unit is ON. If the LED is OFF, or the red LED is ON, supply 24 VDC +10/-5% to the power supply for output.
		Analogue output signal range setting failure.	Check the analogue output device specification, and set the output signal range which satisfies the specification.
		Analogue data format does not match.	Check if the data format of the Analogue output unit is properly set.
		Wiring or connection is defective.	Connect the wiring correctly between the analogue output device and the Analogue output unit.
		Analogue output unit has failed.	Replace the Analogue output unit with a normal one, and check the operation.
		Analogue output device failure.	Replace the analogue output device with a normal one, and check the operation. Or refer to the troubleshooting of the analogue output device used.
		Abnormality with program, etc.	Check if the ladder logic program works correctly.

Parameter Setting

The EX600 parameters can be configured for each unit and channel. Parameters can be changed by the PLC or handheld terminal (hereafter referred to as H.T.).

⬤Precautions for handling

•Changing parameters with the H.T. does not change the parameter settings in the PLC.
•If PROFINET communication is cut after changing parameters with the H.T. and then communication is connected again, the parameters will be changed to those set in the PLC.

■Parameter definition and setting
•With EX600 series, parameters can be set for each unit. The table below shows settable parameters for the SI unit and input/ output units.

No.EX※※-OMQ0016

• SI unit parameters (1)

No.	Parameter [H.T. display] [GSDML display]	Definition	Item	Content	Default setting	Parameter setting	
						By PLC	By H.T.
1	Power supply for control and input voltage monitor [PWRC_Mon] [Monitor 24V_C]	Generates error when control and input power supply voltage is above approx. 29 V or below 18 V.	Enable	Generates an error.		○	○
			Disable	Does not generate an error.	○		
2	Power supply for output voltage monitor [PWRO_Mon] [Monitor 24V_D]	Generates error when output power supply voltage is above approx. 29 V or below 19 V.	Enable	Generates an error.		○	○
			Disable	Does not generate an error.	○		
3	Short Circuit Detection [SC_MonOp] [Monitior Short Circuit(Out)]	Generates error when the short circuit of the valve is detected.	Enable	Generates an error.	○	○	○
			Disable	Does not generate an error.			
4	Restart after short circuit [SC_RstOp] [Restart After Short Circuit]	Restores the status after the short circuit of the valve is cleared.	Auto	Error is automatically cleared when the short circuit is fixed.	○	○	○
			Manual	Even when the short circuit is fixed, error is not cleared until the power is supplied again.			
5	Open Circuit Detection [OC_Mon] [Monitor Open Circuit]	Generates error per channel when the disconnection of the valve is detected.	Enable	Generates an error.		○	○
			Disable	Does not generate an error.	○		
6	Output setting during communication fault [1] [Fault_MD] [Fault Mode]	Set output per channel when communication is abnormal.	Clear	Turn OFF the output	○	○	○
			Hold	Hold the output			
			ForceON	Turn ON the output forcefully			
7	Output setting during communication idling [1] [Idle_MD] [None]	Output setting per channel at the time of communication idling	Clear	Turn OFF the output	○	×	○
			Hold				
			ForceON				

No.	Parameter [H.T. display] [GSDML display]	Definition	Item	Content	Default setting	Parameter setting	
						By PLC	By H.T.
8	Valve ON/OFF counter [Counter] [None]	Memorizes the number of times the output device is ON. Generates error per channel when the operation count exceeds the set value. [*2]	Enable	Generates an error. Val: 1 to 65000 [*3]		×	○
			Disable	Does not generate an error.	○		

∗1: The Handheld terminal can change the set value (for Clear, Hold and Force ON), but the output is OFF when the PLC communication is in an idle state.

∗2: The count is memorized every 30 seconds per channel. When the power supply is turned ON again, counting starts from the last value memorized.

∗3: Times for setting is set value x1000 times.

SMC

•Digital input unit parameters

No.	Parameter [H.T. display] [GSDML display]	Definition	Item	Content	Default setting	Parameter setting By PLC	Parameter setting By H.T.
1	The power supply short circuit detection for control and input [SC_MonSs] [Monitior Short Circuit(Power)]	Generates error per unit when the short circuit of the power supply for the input device is detected.	Enable	Generates an error.	○	○	○
			Disable	Does not generate an error.			
2	Open circuit detection *1 [OC_Mon] [Monitor Open Circuit]	Generates error per channel when the disconnection of the input device is detected. *2	Enable	Generates an error.		○	○
			Disable	Does not generate an error.	○		
3	Inrush current filter [Inrush] [Inruch Current Filter]	Ignores excess current per unit for 100 msec. after inrush.	Enable	Ignores excess current.		○	○
			Disable	Does not ignore excess current.	○		
4	Input filtering time [Filter_T] [Input Filtering Time]	Sets the time to ignore the input signal change per unit.	0.1 ms / 1.0 ms / 10 ms / 20 ms	Selects the time for filtering.	1.0 ms	○	○
5	Input extension time [SigExt_T] [Input Extention Time]	Sets the time to hold the input signal per unit.	1.0ms / 15 ms / 100 ms / 200 ms	Selects the time to hold the input signal.	15 ms	○	○
6	Channel ON/OFF counter [Counter] [None]	Memorizes the number of times the input device is ON. Generates error per channel when the operation count exceeds the set value. *3	Enable	Generates an error. Val: 1 to 65000 *4		×	○
			Disable	Does not generate an error.	○		

*1: Disconnection detection is a function only available for Digital unit (EX600-DXPC1, EX600-DXNC1) with disconnection detection.

*2: 2-wire type input equipment cannot be correctly detected if its leakage current is 0.5 mA or less while the equipment is in the OFF state (reed sensor, etc.).
Ensure that all input equipment used has a leakage current above 0.5 mA in the OFF state.
3-wire type input equipment cannot be correctly detected if its current consumption is 0.5mA or less.
The open circuit of input signals cannot be detected.

*3: The count is memorized every hour. When the power supply is turned ON again, counting starts from the last value memorized.

*4: Times for setting is set value x1000 times.

•Digital output unit parameters

No.	Parameter [H.T. display] [GSDML display]	Definition	Item	Content	Default setting	Parameter setting	
						By PLC	By H.T.
1	Output load short circuit detection [SC_MonOp] [Monitior Short Circuit(Out)]	Generates error per unit when the short circuit of the output device is detected. *1	Enable	Generates an error.	○	○	○
			Disable	Does not generate an error.			
2	Restart after output load short circuit [SC_RstOp] [Restart After Short Circuit]	Restore the setting of short circuit detection error per unit after the output device short circuit is cleared.	Auto	Error is automatically cleared when the short circuit is fixed.	○	○	○
			Manual	Even when the short circuit is fixed, error is not cleared until the power is supplied again.			
3	Open circuit detection [OC_Mon] [Monitor Open Circuit]	Generates error per channel when the disconnection of the output device is detected.	Enable	Generates an error.		○	○
			Disable	Does not generate an error.	○		
4	Output setting during communication fault *2 [Fault_MD] [Fault Mode]	Set output per channel when communication is abnormal.	Clear	Turn OFF the output	○	○	○
			Hold	Hold the output			
			ForceON	Turn ON the output forcefully			
5	Output setting during communication idling *2 [Idle_MD] [None]	Set output per channel during communication idling.	Clear	Turn OFF the output	○	×	○
			Hold				
			ForceON				
6	Output ON/OFF counter [Counter] [None]	Memorizes the number of times the output device is ON. Generates error per channel when the operation count exceeds the set value. *3	Enable	Generates an error. Val: 1 to 65000 *4		×	○
			Disable	Does not generate an error.	○		

∗1: Could be incorrectly recognized as short circuit by inrush current depending on used load. (ex.: lamp load) If detection is incorrect, disable the parameter setting.

∗2: Handheld terminal can change the set value (for Clear, Hold and Force ON), but the output is OFF when the PLC communication is in an idle state.

∗3: The count is memorized every hour. When the power supply is turned ON again, counting starts from the last value memorized.

∗4: Times for setting is set value x1000 times.

•Digital I/O unit parameters (1)

No.	Parameter [H.T. display] [GSDML display]	Definition	Item	Content	Default setting	Parameter setting	
						By PLC	By H.T.
1	The power supply short circuit detection for control and input [SC_MonSs] [Monitior Short Circuit (Power)]	Generates error per unit when the short circuit of the control or input power supply is detected.	Enable	Generates an error.	○	○	○
			Disable	Does not generate an error.			
2	Inrush current filter [Inrush] [Inruch Current Filter]	Ignores excess current per unit for 100 msec. after inrush.	Enable	Ignores excess current.		○	○
			Disable	Does not ignore excess current	○		
3	Input filtering time [Filter_T] [Input Filtering Time]	Sets the time to ignore the input signal change per unit	0.1 ms	Selects the time for filtering.	1.0 ms	○	○
			1.0 ms				
			10 ms				
			20 ms				
4	Input extension time [SigExt_T] [Input Extention Time]	Sets the time to hold the input signal per unit.	1.0 ms	Selects the time to hold the input signal.	15 ms	○	○
			15 ms				
			100 ms				
			200 ms				
5	Output load short circuit detection [SC_MonOp] [Monitior Short Circuit (Out)]	Generates error per unit when the short circuit of the output device is detected. [1]	Enable	Generates an error.	○	○	○
			Disable	Does not generate an error.			
6	Restart after output load short circuit [SC_RstOp] [Restart After Short Circuit]	Restore the setting of short circuit detection error per unit after the output device short circuit is cleared.	Auto	Error is automatically cleared when the short circuit is fixed.	○	○	○
			Manual	Even when the short circuit is fixed, error is not cleared until the power is supplied again.			
7	Open circuit detection [OC_Mon] [Monitor Open Circuit]	Generates error per channel when the disconnection of the output device is detected.	Enable	Generates an error.		○	○
			Disable	Does not generate an error.	○		
8	Output setting during communication fault [2] [Fault_MD] [Fault Mode]	Set output per channel when communication is abnormal.	Clear	Turn OFF the output	○	○	○
			Hold	Hold the output			
			ForceON	Turn ON the output forcefully			

•Digital I/O unit parameters (2)

No.	Parameter [H.T. display] [GSDML display]	Definition	Item	Content	Default setting	Parameter setting	
						By PLC	By H.T.
9	Output setting for communication idling *2 [Idle_MD] [None]	Set output per channel during communication idling.	Clear	Turn OFF the output	○	×	○
			Hold				
			ForceON				
10	Input or Output ON/OFF counter [Counter] [None]	Memorizes the number of times the input or output device is ON. Generates error per channel when the operation count exceeds the set value. *3	Enable	Generates an error. Val: 1 to 65000 *4		×	○
			Disable	Does not generate an error.	○		

∗1: Could be incorrectly recognized as short circuit depending on used load (ex.: lamp load). If detection is incorrect, disable the parameter setting.

∗2: The Handheld terminal can change the set value (for Clear, Hold and Force ON), but theoutput is OFF when the PLC communication is in an idle state.

∗3: The count is memorized every hour. When the power supply is turned ON again, counting starts from the last value memorized.

∗4: Times for setting is set value x1000 times.

•Analogue input unit parameters (1)

No.	Parameter [H.T. display] [GSDML display]	Definition	Item	Content	Default setting	Parameter setting	
						By PLC	By H.T.
1	Monitor power supply short circuit of input equipment. [SC_MonSs] [Monitior Short Circuit(Power)]	Generates error per unit when a short circuit of the power supply for input equipment is detected.	Enable	Generates an error.	○	○	○
			Disable	Does not generate an error.			
2	Analogue input range [Range] [Measurement Range]	Set the analogue input device range per channel.	-10..10 V	Selects the analogue input range.	-10..10 V	○	○
			-5..5 V				
			-20..20 mA				
			0..10 V				
			0..5 V				
			1..5 V				
			0..20 mA				
			4..20 mA				
3	Analogue data format [D_Format] [Data Format]	Configure analog data format per unit.	Offset binary	Offset binary.	○	○	○
			Signed Magnitude	Signed binary.			
			2's Complement	2's complement.			
4	Analogue average filter [Filter] [Filtering Mode]	Sets analogue filtering time per channel. Sampling interval is approx. 2 sec.	None	None		○	○
			2 Value Average	2 value average	○		
			4 Value Average	4 value average			
			8 Value Average	8 value average			
5	Over range detection [Over_Rng] [Monitor Over Range]	Generates error per unit when the input value has exceeded the "Range upper limit +0.5% of full span"	Enable	Generates an error.		○	○
			Disable	Does not generate an error.	○		
6	Under range detection [Undr_Rng] [Monitor Lower Range]	Generates error per unit when the input value is below the "Range lower limit - 0.5% of full span"	Enable	Generates an error.		○	○
			Disable	Does not generate an error.	○		
7	User setting value upper limit error [Upr_Lmt] [Monitor Upper Limit]	Generates error per channel when the input value has exceeded the upper set value.	Enable	Generates an error. [1]		○	○
			Disable	Does not generate an error.	○		
	User setting value upper limit [Upr_Lmt] [Upper Limit Value]	Set the user set upper limit.	[1]	-	1000	○	○

•Analogue input unit parameters (2)

No.	Parameter [H.T. display] [GSDML display]	Definition	Item	Content	Default setting	Parameter setting	
						By PLC	By H.T.
8	User setting value lower limit error [Lwr_Lmt] [Monitor Lower Limit]	Generates error per channel when the input value exceeds the lower set value.	Enable	Generates an error. *1		○	○
			Disable	Does not generate an error.	○		
	User setting value lower limit [Lwr_Lmt] [Lower Limit Value]	Set the user set lower limit.	*1	-	0	○	○

*1: The Set value should be set per channel within the settable range given in the following table. When the range is changed, check the set value and change it to an appropriate value.
   Refer to the following table for the settable range for user when setting the values by PLC.

Table. Settable range of user set value

Range	Settable value range	
	Lower limit	Upper limit
-10..+10 V	-10.50 to +10.45 V	-10.45 to +10.50 V
-5..+5 V	-5.25 to +5.22 V	-5.22 to +5.25 V
-20..+20 mA	-21.00 to +20.90 mA	-20.90 to +21.00 mA
0..10 V	0.00 to +10.45 V	+0.05 to +10.50 V
0..5 V	0.00 to +5.22 V	+0.03 to +5.25 V
1..5 V	+0.75 to +5.22 V	+0.78 to +5.25 V
0..20 mA	0.00 to +20.90 mA	+0.10 to +21.00 mA
4..20 mA	+3.00 to +20.90 mA	+3.10 to +21.00 mA

Table. User set values

Analogue input range	Settable value by PLC	Expected value
-10..+10 V	0 to 1050 32768 to 33818	+0.00 to +10.50 V -0.00 to -10.50 V
-5..+5 V	0 to 525 32768 to 33293	+0.00 to +5.25 V -0.00 to -5.25 V
-20..+20 mA	0 to 2100 32768 to 34868	+0.00 to +21.00 mA -0.00 to -21.00 mA
0..10 V	0 to 1050	+0.00 to +10.50 V
0..5 V	0 to 525	+0.00 to +5.25 V
1..5 V	75 to 525	+0.75 to +5.25 V
0..20 mA	0 to 2100	+0.00 to +21.00 mA
4..20 mA	300 to 2100	+3.00 to +21.00 mA

∗: Follow the methods below when assigning the user set upper and lower limit by PLC.

• Assigning positive value: Input the desired data x 100 in decimal system.
 Example: +10.50 V is assigned --- Assign 10.50 × 100 = 1050 by PLC.

• Assigning negative value: Convert the absolute value x 100 that you desire to assign in 16bit binary. Then, change the most significant bit to "1" before inputting.
 Example: -10.50 V is assigned --- Assign 10.50 × 100 = 1050 → 10000011010b → 1000010000011010b → 33818 by PLC.

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•Analogue output unit parameters (1)

No.	Parameter [H.T. display] [GSDML display]	Definition	Item	Content	Default setting	Parameter setting	
						By PLC	By H.T.
1	Monitor power supply short circuit of output equipment. [SC_MonSs] [Monitior Short Circuit(Power)]	Generates error per unit when the short circuit of the output device is detected.	Enable	Generates an error.	○	○	○
			Disable	Does not generate an error.			
2	Analogue output range [Range] [Measurement Range]	Sets the range of the analogue output device per channel.	0..10 V	Selects the analogue output range.	0..10 V	○	○
			0..5 V				
			1..5 V				
			0..20 mA				
			4..20 mA				
3	Analogue data format [D_Format] [Data Format]	Configure analogue data format per unit.	Offset binary	Offset binary.	○	○	○
			Signed Magnitude	Signed binary.			
			2's Complement	2's complement.			
			Scaled	Scale conversion type.			
4	User setting value upper limit error [Upr_Lmt / UpLm/Scl] [Monitor Upper Limit]	Generates error per channel when the output value has exceeded the user set upper limit or scale upper limit.	Enable	Generates an error. [2][3]		○	○
			Disable	Does not generate an error.	○		
	User set upper limit/ scale upper limit [1] [Upr_Lmt / UpLm/Scl] [Upper Limit Value]	Set the user set upper limit or scale upper limit per channel.	[2]	–	1000	○	○
5	User setting value lower limit error [Lwr_Lmt / LwLm/Scl] [Monitor Lower Limit]	Generates error per channel when the output value is below the user set lower limit or scale lower limit.	Enable	Generates an error.		○	○
			Disable	Does not generate an error.	○		
	User set lower limit/ scale lower limit [1] [Lwr_Lmt / LwLm/Scl] [Lower Limit Value]	Set the user set lower limit or scale lower limit per channel.	[2]	–	0	○	○

•Analogue output unit parameters (2)

No.	Parameter [H.T. display] [GSDML display]	Definition	Item	Content	Default setting	Parameter setting	
						By PLC	By H.T.
6	Output setting for communication error *3 [Fault_MA] [Fault Mode]	Set output per channel when communication is abnormal.	Enable	Output will be user fault value.		○	○
			Disable	Output will be held last state.	○		
	Fault Value [Fault_MA] [Fault Value]	Set the output value per channel when a communication error occurs.	*2	–	0	○	○
7	Output setting for communication idling *3 [Idle_MA] [None]	Set output per channel during communication idling.	Enable	Output will be set to the lower limit.		×	○

∗1: When "Scaled" is selected as the analogue data format, the display of H.T. is switched from Upr_Lmt to UpLm/Scl, from Lwr_Lmt to LwLm/Scl.

∗2: The Set value should be set per channel within the settable range in the following table. When the range is changed, check the set value and change it to an appropriate value.

∗3:The Handheld terminal can change the parameters, but when the the PLC communication is in an idle state, the lower limit value is output.

Table. Settable range for user set upper or lower limit and Fault Value

Range	User set output value Settable range		Fault Value Settable range
	Lower limit	Upper limit	
0..10 V	0.00 to +10.45 V	+0.05 to +10.50 V	0.00 to +10.50 V
0..5 V	0.00 to +5.22 V	+0.03 to +5.25 V	0.00 to +5.25 V
1..5 V	+0.75 to +5.22 V	+0.78 to +5.25 V	+0.75 to +5.25 V
0..20 mA	0.00 to +20.90 mA	+0.10 to +21.00 mA	0.00 to +21.00 mA
4..20 mA	+3.00 to +20.90 mA	+3.10 to +21.00 mA	+3.00 to +21.00 mA

Table. User set values (PLC)

Range	Settable value by PLC (Offset Binary Signed Magnitude 2's Complement)	Expected value
0..10 V	0 to 1050	0.00 to +10.50 V
0..5 V	0 to 525	0.00 to +5.25 V
1..5 V	75 to 525	+0.75 to +5.25 V
0..20 mA	0 to 2100	0.00 to +21.00 mA
4..20 mA	300 to 2100	+3.00 to +21.00 mA

∗: If the data format is scaled data format, set the data as follows, regardless of the range setting.
 (Refer to page 50 for scaled data format.)

 •PLC set value: 0 to 32767 → Converted value +0 to +32767
 •PLC set value: 32768 to 65535 → Converted value -0 to -32767

•Output value during communication error (Fault Value)
 Refer to the tables below for setting the Fault value via PLC.
 •Set in decimal number.
 •Conversion value varies depending on the assigned analogue data format and the analogue output
   range.

(1)Offset binary data format

•Range: 0 to 10 V, 0 to 5 V, 0 to 20 mA

•Range: 1 to 5V, 4 to 20 mA

Settable value by PLC (AD value)	Output signal range (0 to b)		
Decimal number	Voltage [V]		Current [mA]
	0 to 10	0 to 5	0 to 20
4095	10.5	5.25	21
3901	10	5	20
2048	5.25	2.625	10.5
0	0	0	0

Settable value by PLC (AD value)	Output signal range (a to b)		
Decimal number	Voltage [V]		Current [mA]
	1 to 5		4 to 20
4095	5.25		21
3868	5		20
2048	3		12
228	1		4
0	0.75		3

Example: To set the Fault value to 10 V when offset binary data format (analogue data format) and range
0 to 10 V (analogue output range) are set, the value set to PLC is "3901" from the table on the
left.

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(2)Signed binary data format & 2's complement data format

•Range: 0 to 10 V, 0 to 5 V, 0 to 20 mA   •Range: 1 to 5 V, 4 to 20 mA

Settable value by PLC (AD value)	Output signal range (0 to b)		
Decimal number	Voltage [V]		Current [mA]
	0 to 10	0 to 5	0 to 20
2047	10.5	5.25	21
1950	10	5	20
1024	5.25	2.625	10.5
0	0	0	0

Settable value by PLC (AD value)	Output signal range (a to b)	
Decimal number	Voltage [V]	Current [mA]
	1 to 5	4 to 20
2047	5.25	21
1934	5	20
1024	3	12
114	1	4
0	0.75	3

Example: To set the Fault value to 10 V when signed binary data format (analogue data format) and range 0 to 10 V (analogue output range) are set, the value set to PLC is "1950" from the table on the left.

(3)Scaled data format

Function to set any value between "-32767 to 32767" as the AD value for output signal range. Resolution is determined by specifying the upper and lower scale limit.

$$\text{Resolution} = \frac{\text{Upper limit value of the range} - \text{Lower limit value of the range}}{\text{Upper limit value of the scale} - \text{Lower limit value of the scale}}$$

Example: when the range is 1 to 5 V
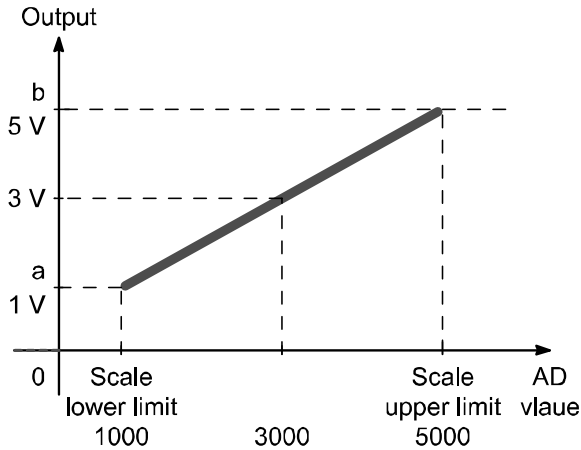
(1)Set the range to 1 to 5 V.
(2)When the upper limit of the scale is set to 5000, and the lower limit of the scale is set to 1000, the result will be as follows.
    1000···1 V output
    2000···2 V output
    3000···3 V output
    4000···4 V output
    5000···5 V output
(3)The resolution from 1 to 5 V is 1/1000 based on the calculation.
(5 V – 1 V) / (5000 — 1000) = 1/1000

Settable value by PLC (AD value)		Output signal range (a to b)				
	Decimal number	Voltage [V]			Current [mA]	
		0 to 10	1 to 5	0 to 5	0 to 20	4 to 20
Scale upper limit	-32766 to 32767	10	5	5	20	20
Scale lower limit	-32767 to 32766	0	1	0	0	4

If the data format is scaled data format, set the Fault Value as follows, regardless of the range setting.
•PLC settable value: 0 to 32767 → Converted value +0 to +32767
•PLC settable value: 32768 to 6553 → Converted value -0 to -32767

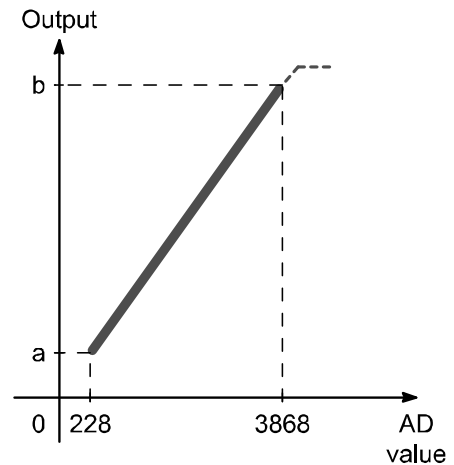Example: To set the Fault Value to 4 V when range is 1 to 5 V (analogue output range), scale upper limit 5000, and scale lower limit 1000, set 4000 to Fault Value by PLC.

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• Analogue I/O unit parameters (1)

No.	Parameter [H.T. display] [GSDML display]	Definition	Item	Content	Default setting	Parameter setting	
						By PLC	By H.T.
1	The power supply short circuit detection for the input or output device [SC_MonSs] [Monitior Short Circuit(Power)]	Generates error per unit when the short circuit of the input device power supply or output device is detected.	Enable	Generates an error.	○	○	○
			Disable	Does not generate an error.			
2	Analogue range [Range] [Measurement Range]	Sets the analogue input or output device range per channel.	0..10 V	Selects the analogue input or output range	0..10 V	○	○
			0..5 V				
			1..5 V				
			0..20 mA				
			4..20 mA				
3	Analogue data format [D_Format] [Data Format]	Configure analogue data format per unit.	Offset binary	Offset binary.	○	○	○
			Signed Magnitude	Signed binary.			
			2's Complement	2's complement.			
			Scaled	Scale conversion type.			
4	Analogue average filter [Filter] [Filtering Mode]	Sets analogue filtering time per channel. Sampling interval is approx. 2 sec.	None	None		○	○
			2 Value Average	2 value average	○		
			4 Value Average	4 value average			
			8 Value Average	8 value average			
5	Over range detection [Over_Rng] [Monitor Over Range]	Generates error per unit when the input value has exceeded the "Range upper limit +0.5% of full span"	Enable	Generates an error.		○	○
			Disable	Does not generate an error.	○		
6	Under range detection [Undr_Rng] [Monitor Lower Range]	Generates error per unit when the input value is below the "Range lower limit +0.5% of full span"	Enable	Generates an error.		○	○
			Disable	Does not generate an error.	○		
7	User's set value upper limit error [Upr_Lmt / UpLm/Scl] [Monitor Upper Limit]	Generates error per channel when the input or output value has exceeded the user set upper limit or scale upper limit.	Enable	Generates an error.		○	○
			Disable	Does not generate an error.	○		
	User set upper limit/ scale upper limit [*1] [Upr_Lmt / UpLm/Scl] [Upper Limit Value]	Assign user set upper limit or scale upper limit per channel.	*2	-	1000	○	○

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•Analogue I/O unit parameters (2)

No.	Parameter [H.T. display] [GSDML display]	Definition	Item	Content	Default setting	Parameter setting	
						By PLC	By H.T.
8	User's set value lower limit error [Lwr_Lmt / LwLm/Scl] [Monitor Lower Limit]	Generates error per channel when the input or output value is below the user set lower limit or scale lower limit.	Enable	Generates an error. *2		○	○
			Disable	Does not generate an error.	○		
	User set lower limit/ Scale lower limit *1 [Lwr_Lmt / LwLm/Scl] [Lower Limit Value]	Set the user set lower limit or scale lower limit per channel.	*2	—	0	○	○
9	Output setting for communication fault [Fault_MA] [Fault Mode]	Set output per channel when communication is abnormal.	Enable	Output will be user fault value.		○	○
			Disable	Output will be held last state.	○		
	Fault Value [Fault_MA] [Fault Value]	Set output value per channel when communication error occurs.	*2	-	0	○	○
10	Output setting for communication idling *3 [Idle_MA] [None]	Sets output per channel during communication idling.	Enable	Output will be set to the lower limit.		×	○
			Disable		○		

∗1: When "Scaled" is selected as the analogue data format, the display of H.T. is switched from Upr_Lmt to UpLm/Scl, from Lwr_Lmt to LwLm/Scl.

∗2: Set value shall be set per range within the settable range in the following table. When the range is changed, check the set value and change it to an appropriate value.

∗3: The Handheld terminal can change the parameters, but when the the PLC communication is in an idle state, the lower limit value is output.

Table. Settable range for user set upper or lower limit and Fault Value

Range	User set output value Settable range		Fault Value Settable range
	Lower limit	Upper limit	
0..10 V	0.00 to +10.45 V	+0.05 to +10.50 V	0.00 to +10.50 V
0..5 V	0.00 to +5.22 V	+0.03 to +5.25 V	0.00 to +5.25 V
1..5 V	+0.75 to +5.22 V	+0.78 to +5.25 V	+0.75 to +5.25 V
0..20 mA	0.00 to +20.90 mA	+0.10 to +21.00 mA	0.00 to +21.00 mA
4..20 mA	+3.00 to +20.90 mA	+3.10 to +21.00 mA	+3.00 to +21.00 mA

Table. User set values (PLC)

Range	Settable value by PLC (Offset Binary Signed Magnitude 2's Complement)	Expected value
0..10 V	0 to 1050	0.00 to +10.50 V
0..5 V	0 to 525	0.00 to +5.25 V
1..5 V	75 to 525	+0.75 to +5.25 V
0..20 mA	0 to 2100	0.00 to +21.00 mA
4..20 mA	300 to 2100	+3.00 to +21.00 mA

∗: If the data format is scaled data format, set the data as follows, regardless of the range setting.
(Refer to page 50 for scaled data format.)

•PLC set value: 0 to 32767 → Converted value +0 to +32767
•PLC set value: 32768 to 65535 → Converted value -0 to -32767

・Output value during communication error (Fault Value)
 Refer to the tables below for setting the Fault value via PLC.
 ・Set as a decimal number.
 ・Conversion value varies depending on the assigned analogue data format and the analogue output
  range.

（1）Offset binary data format

・Range: 0 to 10 V, 0 to 5 V, 0 to 20 mA

Output

Settable value by PLC (AD value)	Output signal range (0 to b)		
Decimal number	Voltage [V]		Current [mA]
	0 to10	0 to 5	0 to 20
4095	10.5	5.25	21
3901	10	5	20
2048	5.25	2.625	10.5
0	0	0	0

・Range: 1 to 5 V, 4 to 20 mA

Output

Settable value by PLC (AD value)	Output signal range (a to b)	
Decimal number	Voltage [V]	Current [mA]
	1 to 5	4 to 20
4095	5.25	21
3868	5	20
2048	3	12
228	1	4
0	0.75	3

Example: To set the Fault value to 10 V when offset binary data format (analogue data format) and
        range 0 to 10 V (analogue output range) are set, the value set to PLC is "3901" from the table
        on the left.

(2)Signed binary data format & 2's complement data format

•Range: 0 to 10 V, 0 to 5 V, 0 to 20 mA   •Range: 1 to 5 V, 4 to 20 mA

Output (left graph): 0, 1950 on AD value axis; b on Output axis.

Output (right graph): 0, 114, 1934 on AD value axis; a and b on Output axis.

Settable value by PLC (AD value)	Output signal range (0 to b)		
Decimal number	Voltage [V]		Current [mA]
	0 to 10	0 to 5	0 to 20
2047	10.5	5.25	21
1950	10	5	20
1024	5.25	2.625	10.5
0	0	0	0

Settable value by PLC (AD value)	Output signal range (a to b)		
Decimal number	Voltage [V]		Current [mA]
	1 to 5		4 to 20
2047	5.25		21
1934	5		20
1024	3		12
114	1		4
0	0.75		3

Example: To set the Fault value to 10 V when signed binary data format (analogue data format) and range 0 to 10 V (analogue output range) are set, the value set to PLC is "1950" from the table on the left.

(3)Scaled data format
If the data format is scaled data format, set the data as follows, regardless of the range setting.

•PLC set value: 0 to 32767 → Converted value +0 to +32767
•PLC set value: 32768 to 65535 → Converted value -0 to -32767

Hardware Configuration

■GSDML file and icons

A GSDML file is required to configure the EX600 with the PLC. At the same time, a special icon is required to display the icon for EX600 in the software of the PLC.

The GSDML and icon files can be downloaded from the following URL.

•URL : http://www.smcworld.com
•GSDML file: GSDML-V2.3-SMC-EX600-∗∗∗.xml
•Icon file: GSDML-0083-0008-EX600_N.bmp

■Configuration layout

The unit numbers of the EX600 are assigned in order, starting from the end plate side. Unless the units are assigned in the order of the actual product, communication with the PLC will not be established.

•Unit number example

| End plate | Unit 0 | Unit 1 | Unit 2 | Unit 3 | Unit 4 | Manifold solenoid valve |
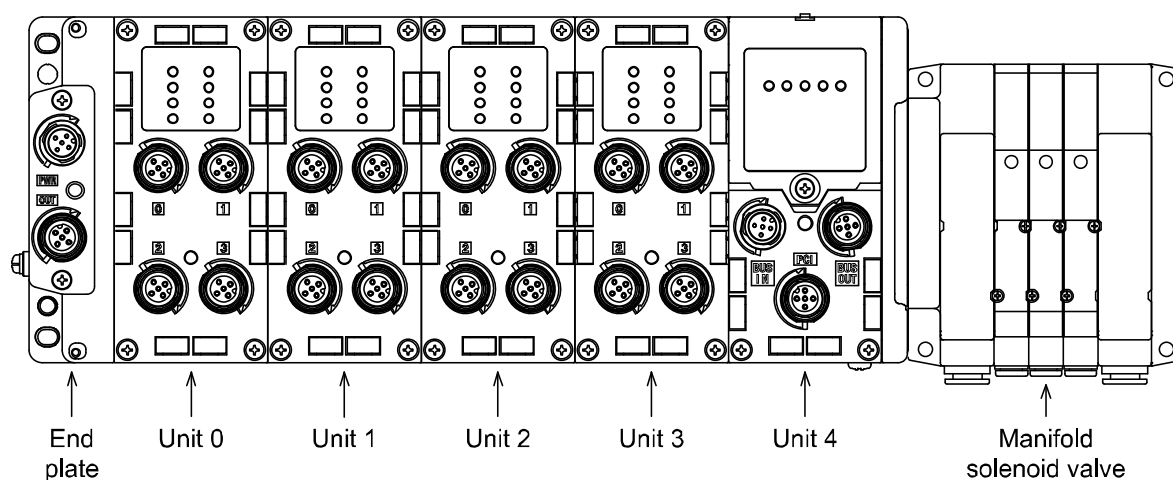
■Connection to SIEMENS PLC S7

How to connect the EX600 series to SIEMENS PLC is explained below.
Refer to the Operation Manual of the STEP7™ for the detailed operation.

∗: The drawing below shows the SIEMENS software, STEP7™ V5.5.

•GSDML file installation

(1)Open [HW Config] screen.
(2)Select [Options] → [Install GSD File...] in menu bar.
(3)[Install GSD Files] screen will be displayed. Select the folder in which the GSDML file is stored.
(4)A list of stored GSDML files will be displayed. Select the file to install, and press [Install].
(5)EX600-SPN# hardware component will be added to [Hardware Catalog] window folder.
    (PROFINET IO ¥Additional Field Devices ¥Valves ¥SMC EX600)

No.EX※※-OMQ0016
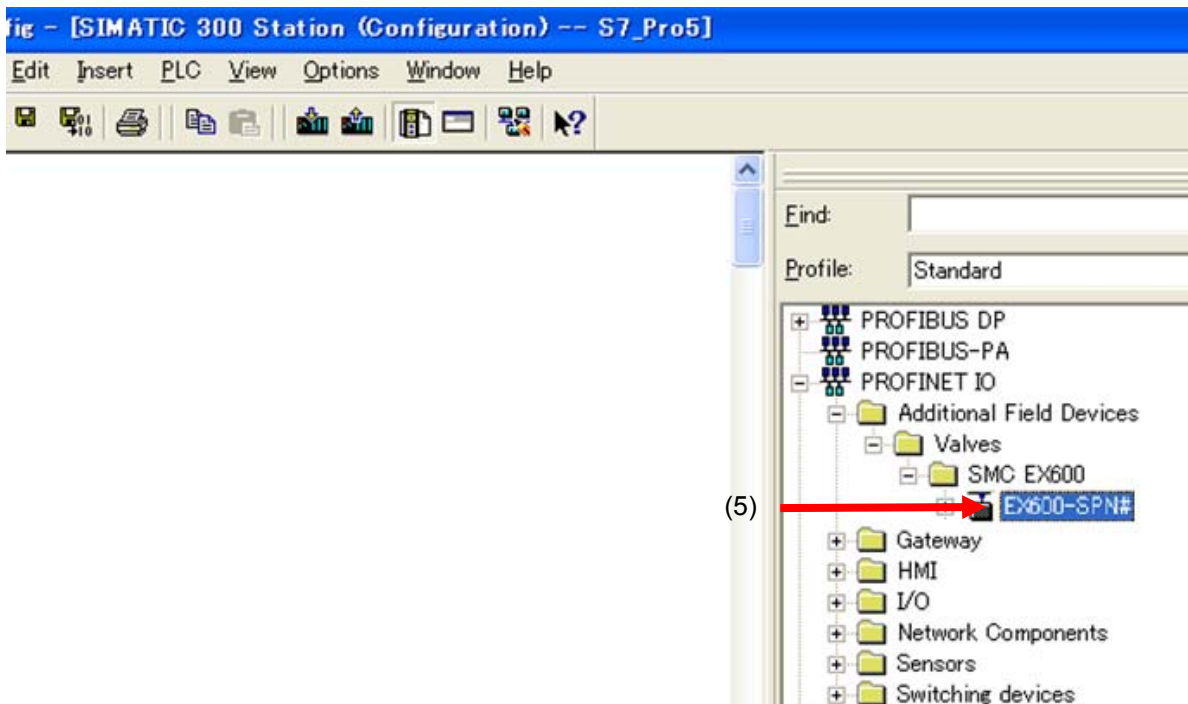
•Device Name assignment

(1)Connect the EX600 system to the PLC.
(2)Select [PLC] → [Ethernet] → [Edit Ethernet Node] from the menu bar of [HW Config].
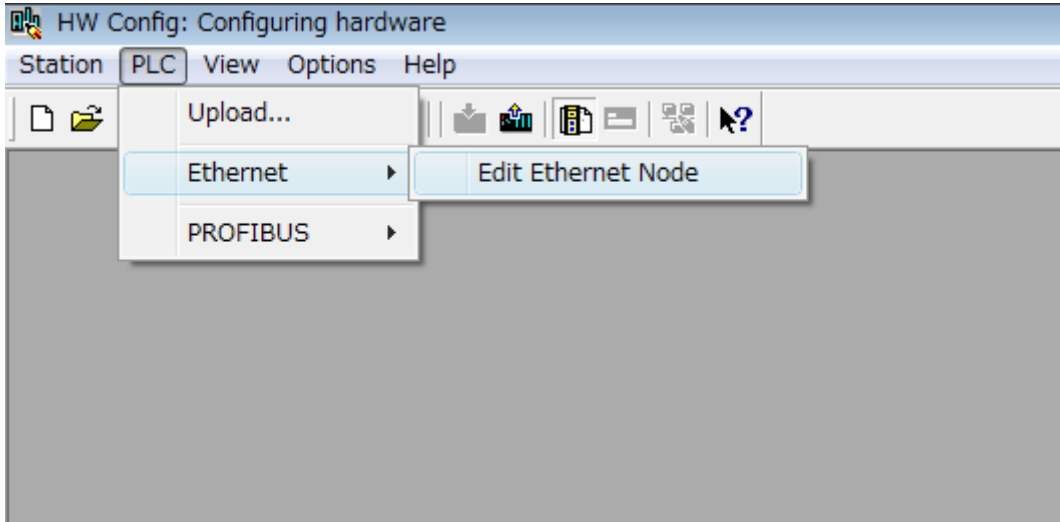
(3)[Edit Ethernet Node] screen will be displayed. Press the [Browse] button.
(4)[Browse Network] screen will be displayed. The list of equipment in the same network will be displayed.
   Select SI unit MAC address for assigning Device Name.
(5)Press the [OK] button.
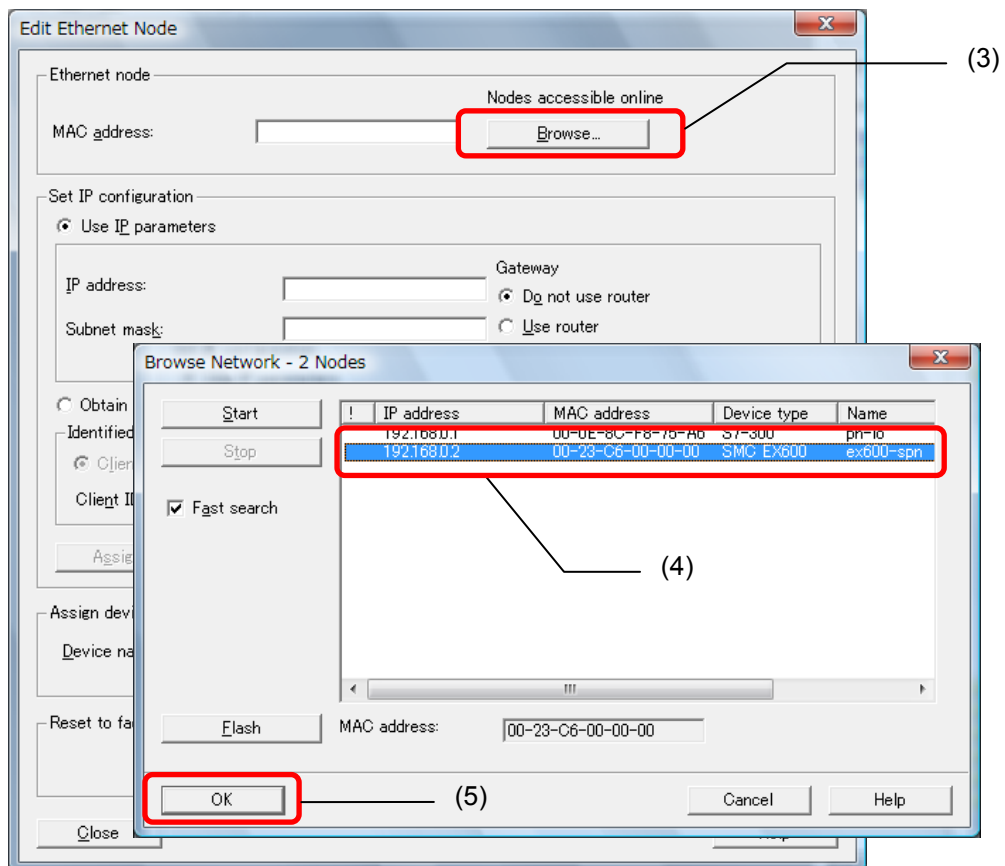
(6)[Edit Ethernet Node] will be displayed with SI unit MAC address. Enter [Device name].
(7)Press the [Assign Name] button.

Edit Ethernet Node

Ethernet node

MAC address: 00-23-C6-00-00-00   Nodes accessible online [Browse...]

Set IP configuration

◉ Use IP parameters

IP address: 192.168.0.2   Gateway
◉ Do not use router
Subnet mask: 255.255.255.0   ○ Use router
Address: 192.168.0.2

○ Obtain IP address from a DHCP server

Identified by
◉ Client ID   ○ MAC address   ○ Device name
Client ID:

[Assign IP Configuration]

Assign device name   (6)

Device name: ex600-spn   [Assign Name]   (7)

Reset to factory settings
[Reset]

[Close]   [Help]

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•Addition of device

　(1)Drag EX600-SPN# from [HW Config] screen [Hardware Catalog] window, and drop it into the
　　　[PROFINET-IO-System] line.
　(2)The EX600 icon will be added to the line. Double-click the EX600 icon, or place the cursor on the icon
　　　and right-click it to select [Object Properties ---].
　(3)The Module Properties screen is displayed. Enter the same name which was set by [Edit Ethernet Node]
　　　screen to [Device name].
　(4)Ensure that the box for [Assign IP address via IO controller] is ticked.
　(5)Press the [OK] button.

No.EX※※-OMQ0016
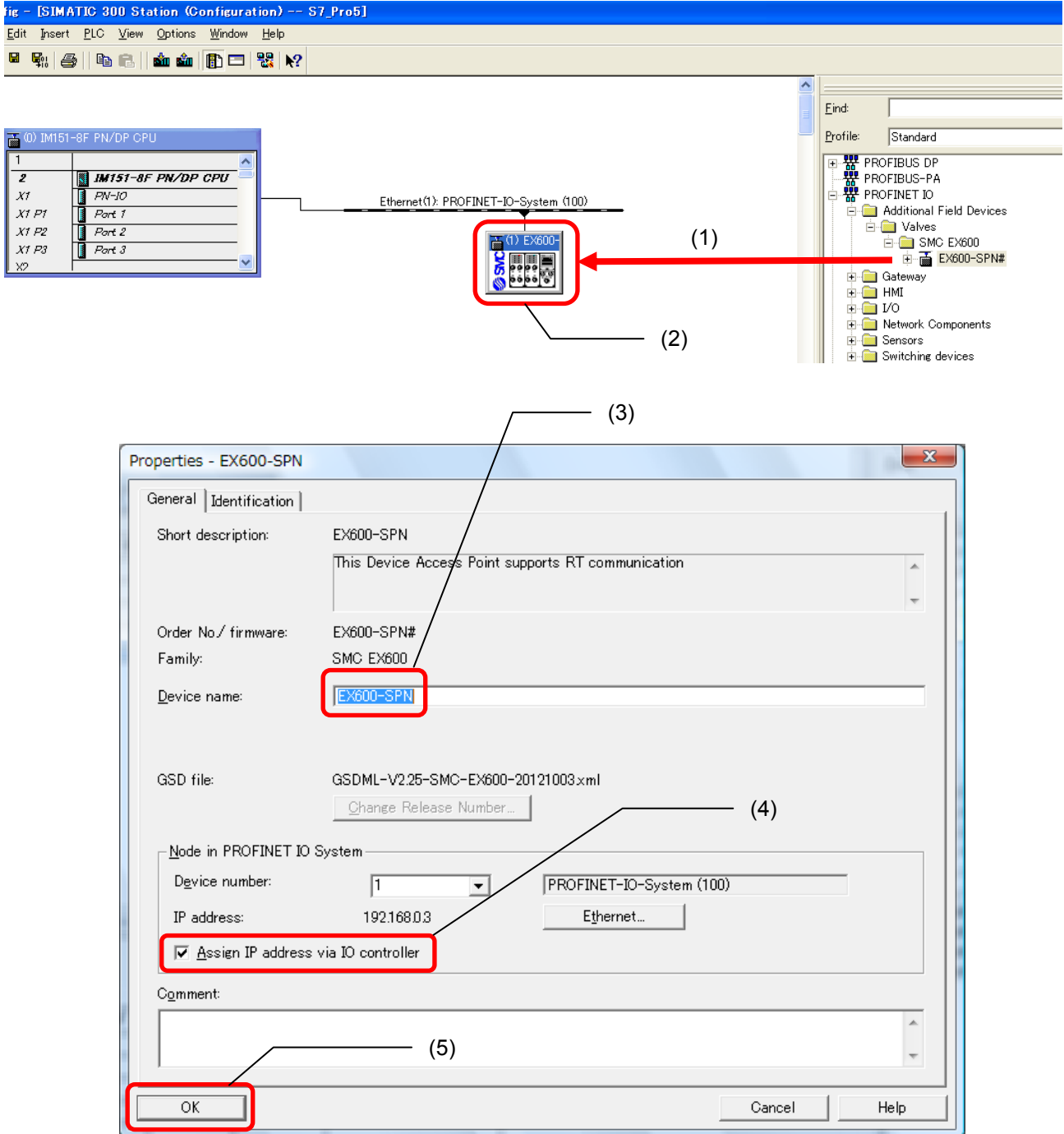
•**Addition of a unit**

(1)Click the EX600-SPN# icon on the [HW Config].

(2)Empty slots in the EX600-SPN# will be displayed in the [Configuration table] window.

(3)Select the unit whose unit no. is 0, which is actually connected next to the end plate, from the [Hardware Catalogue] window, and drag and drop it to the slot1 of the [Configuration table] window. Drag other units similarly and drop them into the corresponding slots.

End plate

Unit no. 1 = slot 2

Unit no. 0 = slot 1
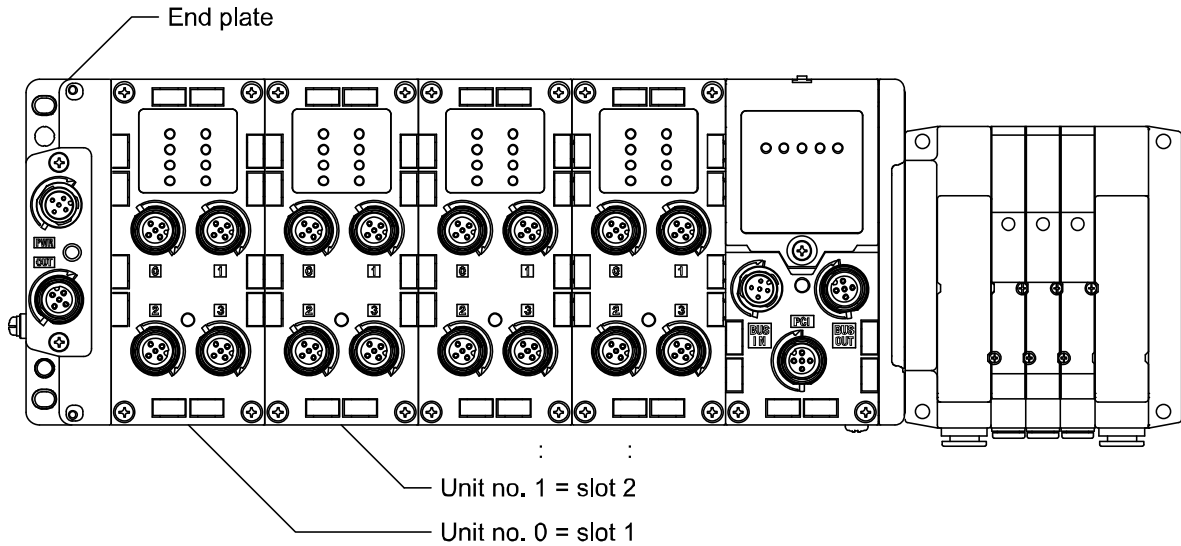
(4)Drag the SI unit and drop it into the corresponding slot in a similar way.

Two types of SI units can be selected (An SI unit cannot be assigned to multiple slots).

•Type1: EX600-SPN (32 coils) --- Occupies 4 bytes for output (No diagnostic data)

•Type2: EX600-SPN (32 coils, Status) --- Occupies 4 bytes for output and 4 bytes for diagnostics (input)

■Setting of parameters

•**Setting of system parameters**

(1) Click the EX600-SPN# icon in the [HW Config] screen, and double-click the unit that needs a change in the parameters. [Properties] screen will be displayed.

(2) Select the [Parameters] tab.

(3) A Settable parameters list will be displayed. Click the [Value] of the parameter to change the value.

(4) Press the [OK] button to download the configuration data to the PLC.
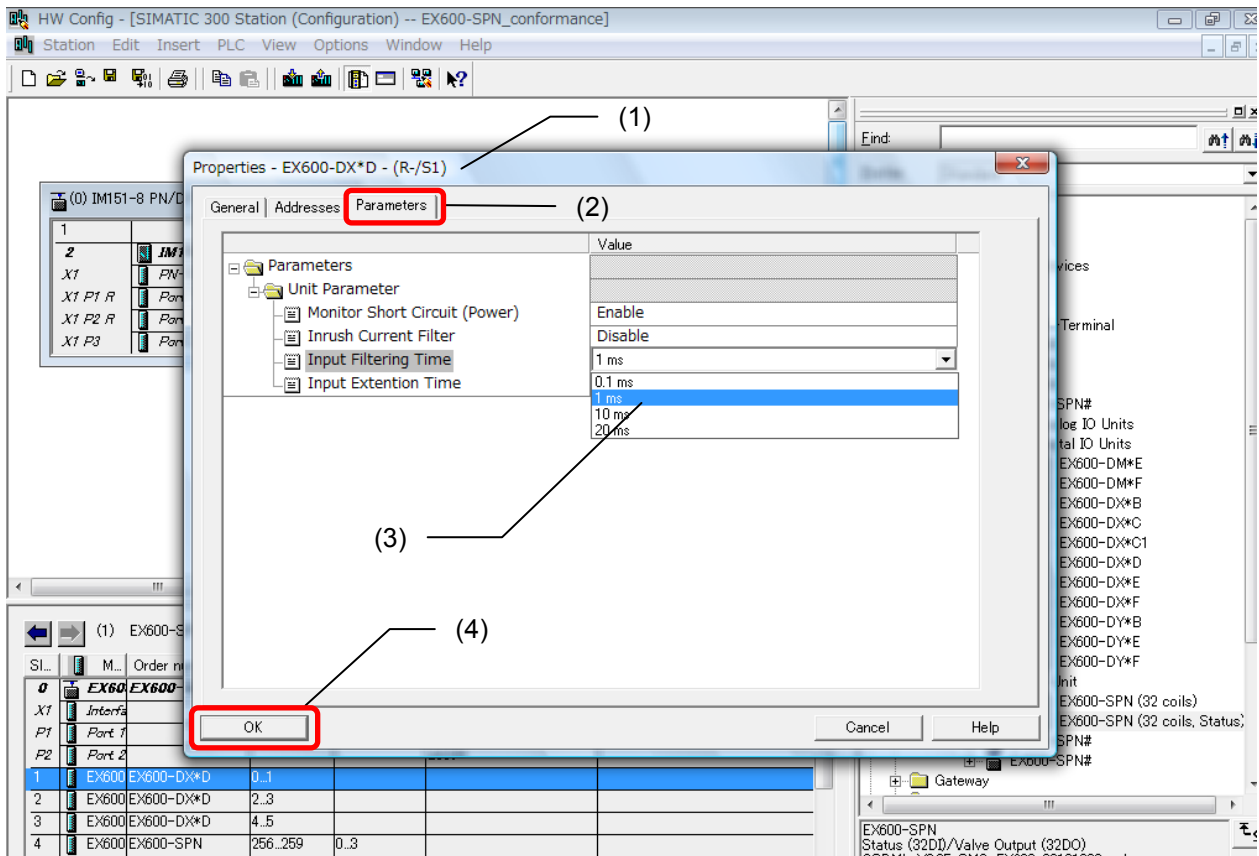
•Fast Start Up (FSU) setup

The EX600 supports the FSU function.
To enable the FSU function, it is necessary to change the FSU setting of the connected PLC.

PLC set up

(1)The [Properties] screen will be displayed by double-clicking the PLC PROFINET port in the [HW Config] screen, which is connected to the EX600.
(2)Select the [Options] tab.
(3)Select [TP 100Mbps full duplex] in the Connection screen.
(4)Tick the box for [Disable autonegotiation].
(5)Press the [OK] button.

No.EX※※-OMQ0016
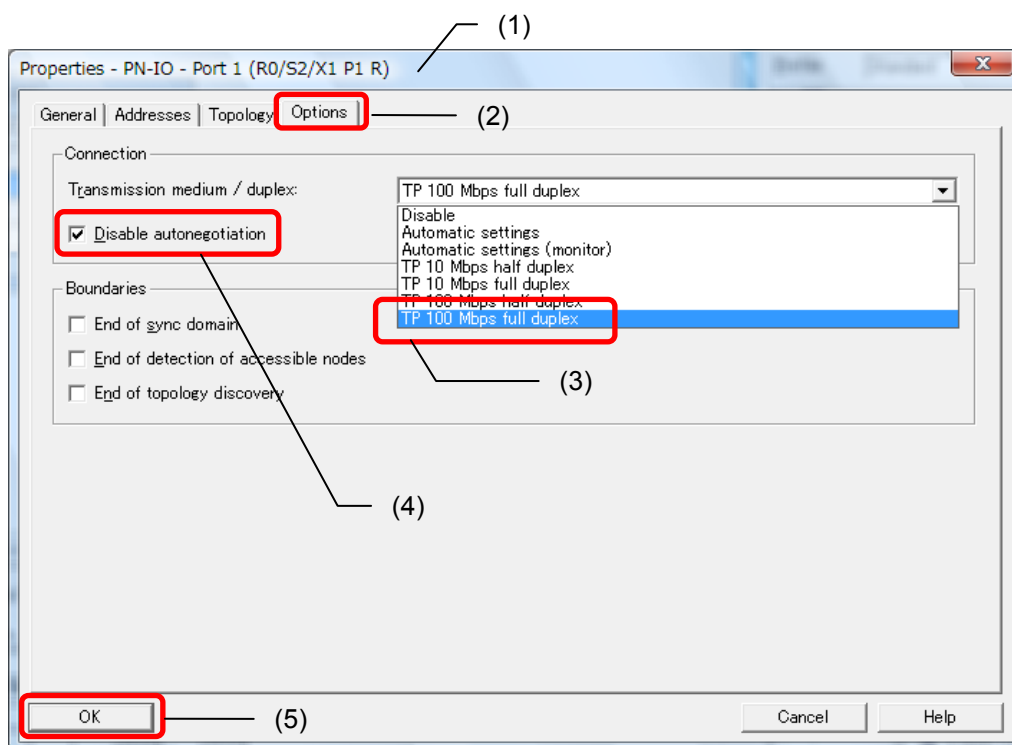
EX600 setup

(1)Click the EX600-SPN# icon in the [HW Config] screen.
(2)The [Properties] screen will be displayed by double-clicking the [Interface] of the [Configuration table] window [Slot X1].
(3)Tick the box for [Prioritized startup] in the [General] tab.
(4)Press the [OK] button.
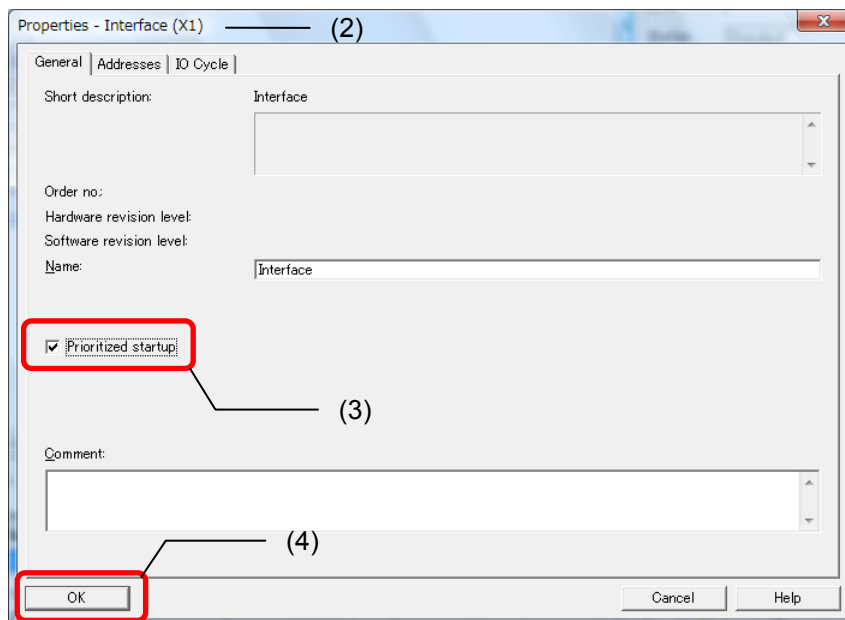
(5)The [Properties] screen will be displayed by double-clicking the Slot1 P1 or P2 (communication port using the FSU function) in the [HW Config] screen.
(6)Select the [Options] tab.
(7)Select [TP 100Mbps full duplex] in the [Connection] screen.
(8)Tick the box for [Disable autonegotiation].
(9)Press the [OK] button.
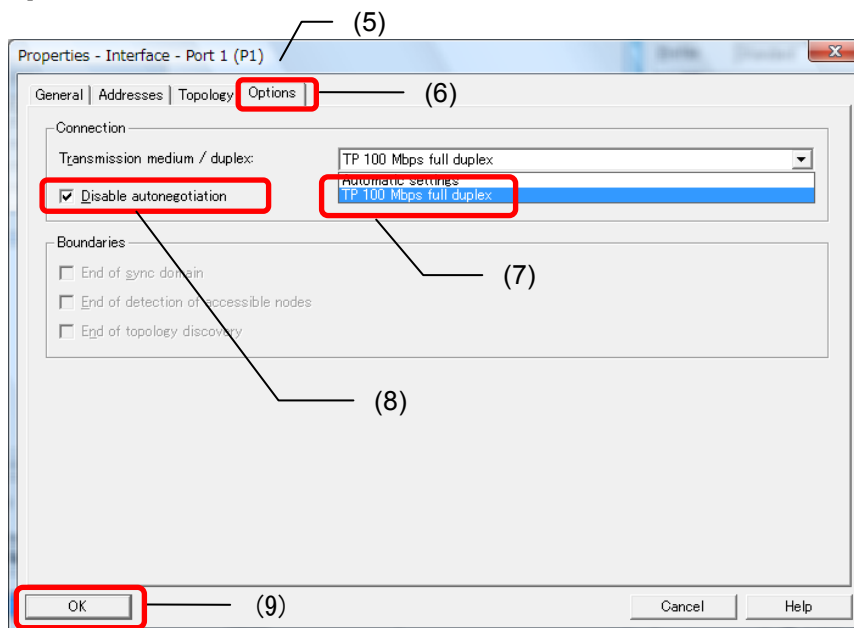
I/O Map

The table below shows the input/ output byte number which is occupied by each unit of the EX600 series.

Unit	Unit part number	Occupied byte	
		Input	Output
SI unit	EX600-SPN☐ (32 outputs)	0	4
	EX600-SPN☐ (32 outputs diagnostic)	4	4
Digital input unit	EX600-DX☐B (8 inputs)	1	0
	EX600-DX☐C (8 inputs) (with open circuit detection)	1	0
	EX600-DX☐D (16 inputs)	2	0
	EX600-DX☐E (16 inputs)	2	0
	EX600-DX☐F (16 inputs)	2	0
Digital output unit	EX600-DY☐B (8 outputs)	0	1
	EX600-DY☐E (16 outputs)	0	2
	EX600-DY☐F (16 outputs)	0	1
Digital I/O unit	EX600-DM☐E (8 inputs/8 outputs)	1	1
	EX600-DM☐F (8 inputs/8 outputs)	1	1
Analogue input unit	EX600-AXA (2 channels)	4 (2 byte/1 channel)	0
Analogue output unit	EX600-AYA (2 channels)	0	4 (2 byte/1 channel)
Analogue I/O unit	EX600-AMB (2/2 channels)	4 (2 byte/1 channel)	4 (2 byte/1 channel)

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Diagnostic

■Diagnostics assignment to input map

4 bytes of diagnostic information can be assigned to the input by selecting "EX600-SPN# (32 coils, Status)" when adding the SI unit in hardware configuration.

System diagnostic

Channel diagnostic   Unit diagnostic
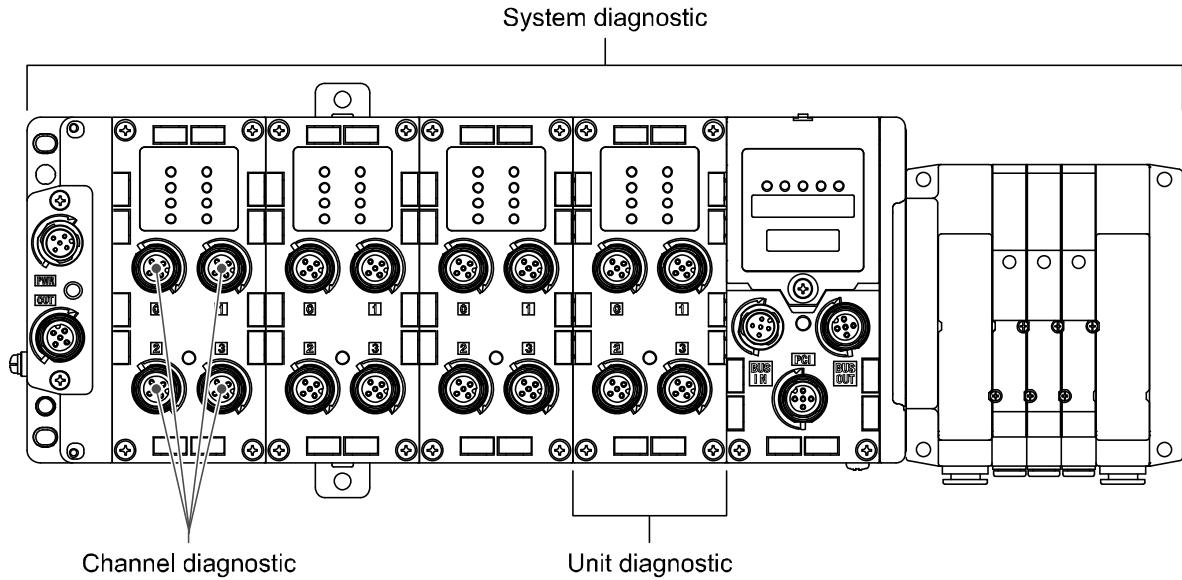
•Diagnostics map

Byte No.	Diagnostics name	Diagnostics type
Byte 0	System diagnostic status 0	System diagnostic
Byte 1	System diagnostic status 1	
Byte 2	Unit diagnostic status 0	Unit diagnostic
Byte 3	Unit diagnostic status 1	

•System diagnostic status0

7	6	5	4	3	2	1	0

Byte 0
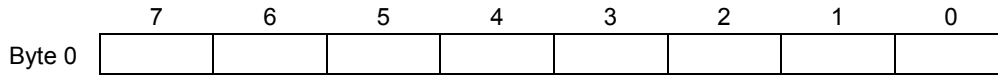
Bit No.	Content
0	1: The analogue input or output value has fallen below the user's set value.
1	1: The analogue input or output value has exceeded the user's set value.
2	1: The analogue input value has fallen below the set range.
3	1: The analogue input value has exceeded the set range.
4	1: The counter has exceeded the set value.
5	1: The open circuit has been detected.
6	1: The short circuit of the valve output or digital output has been detected.
7	1: The short circuit of the power supply for the input device has been detected.

•System diagnostic status1

7	6	5	4	3	2	1	0
		-			-		

Byte 1
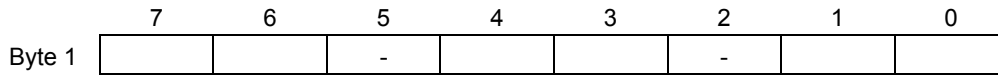
Bit No.	Content
0	1: The power supply for output device is outside of the specification.
1	1: The power supply for control and input device is outside of the specification.
2	Reserved
3	1: There is a connection failure between each unit (during operation).
4	1: There is a connection failure between each unit (when the power supply is applied).
5	Reserved
6	1: System error occurred.
7	1: Hardware error occurred.

•Unit diagnostic status 0

	7	6	5	4	3	2	1	0
Byte 2								
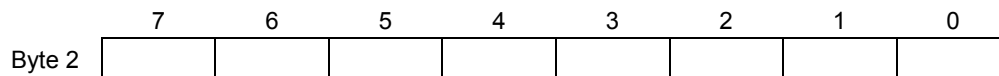
Bit No.	Content
0	1: There is an error in unit 0.
1	1: There is an error in unit 1.
2	1: There is an error in unit 2.
3	1: There is an error in unit 3.
4	1: There is an error in unit 4.
5	1: There is an error in unit 5.
6	1: There is an error in unit 6.
7	1: There is an error in unit 7.

•Unit diagnostic status 1

	7	6	5	4	3	2	1	0
Byte 3	-	-	-	-	-	-		
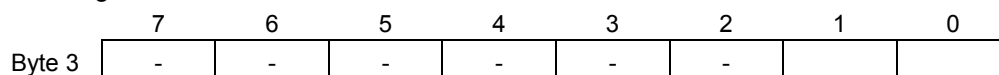
Bit No.	Content
0	1: There is an error in unit 8.
1	1: There is an error in unit 9.
2	Reserved
3	Reserved
4	Reserved
5	Reserved
6	Reserved
7	Reserved

• Channel diagnostic information

The drawing below shows the procedure for on-line diagnostics using the Siemens STEP7 PLC.
(1) Press the button in the [HW Config] screen to change from OFFLINE to ONLINE.
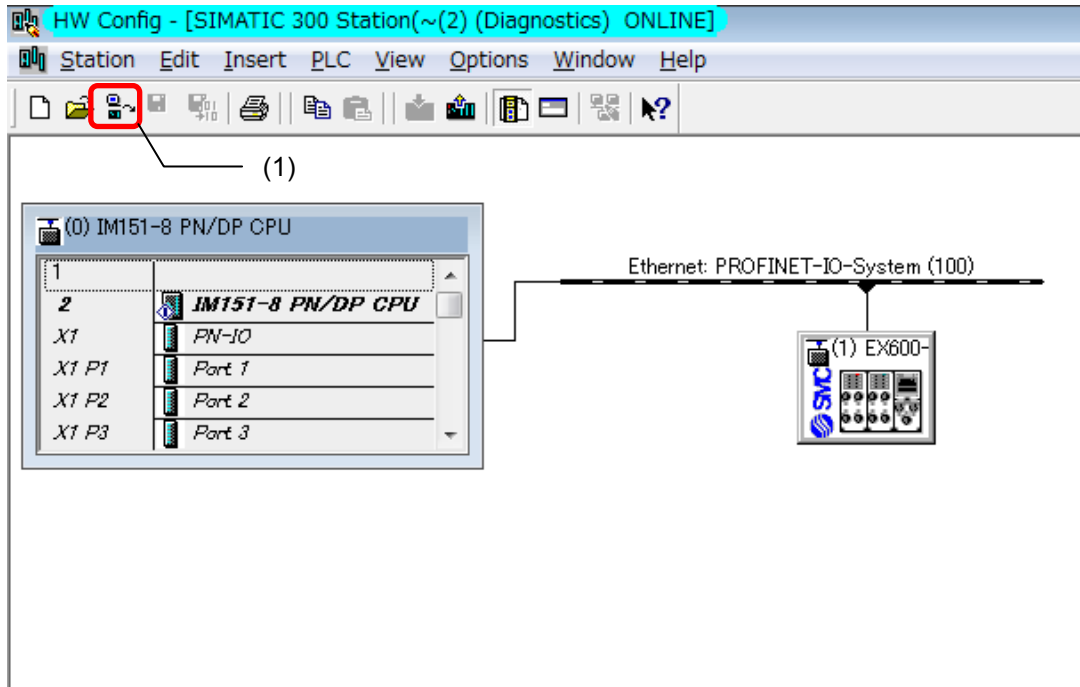
(2)Double-click the unit to check the diagnostics data in the [Configuration table].
(3)The [Module Information] window will be displayed. Click the [IO Device Diagnostics] tab.
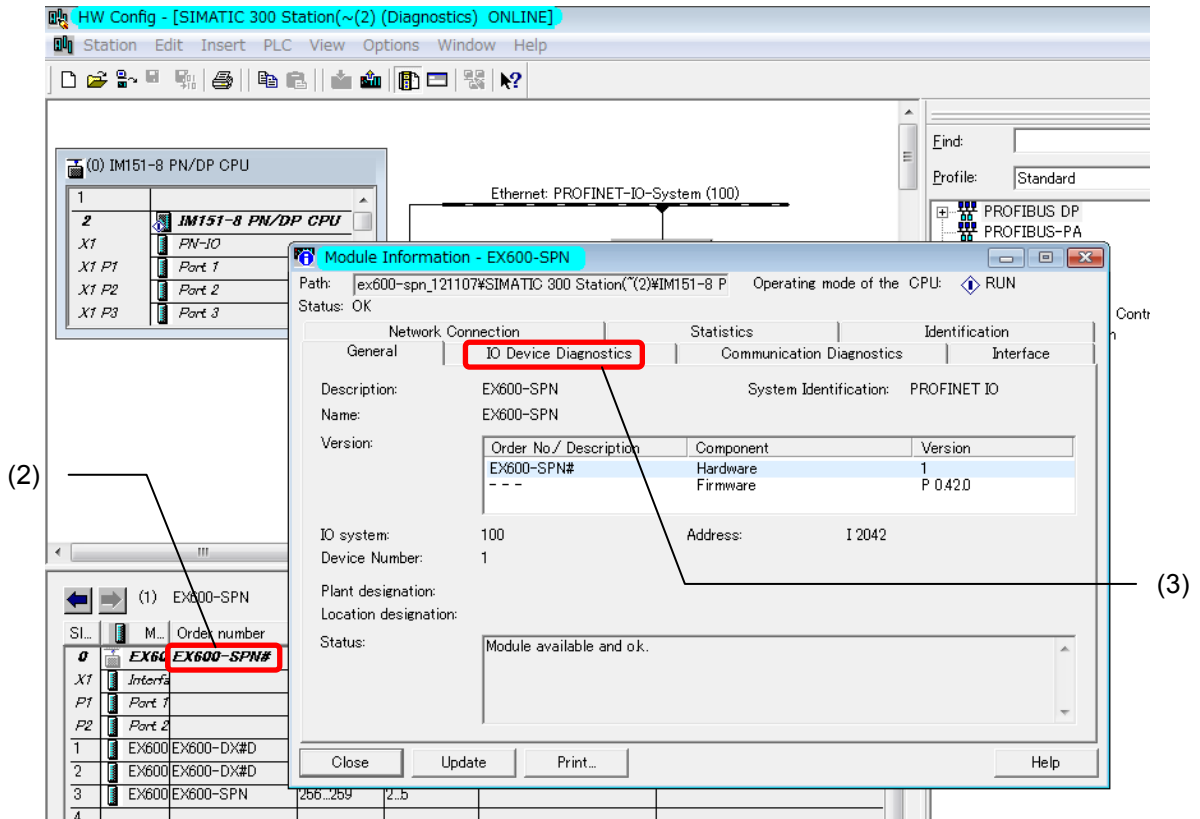
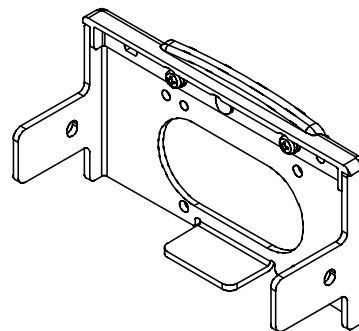(4)[Channel-specific diagnostics] information can be monitored.

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No.EX※※-OMQ0016
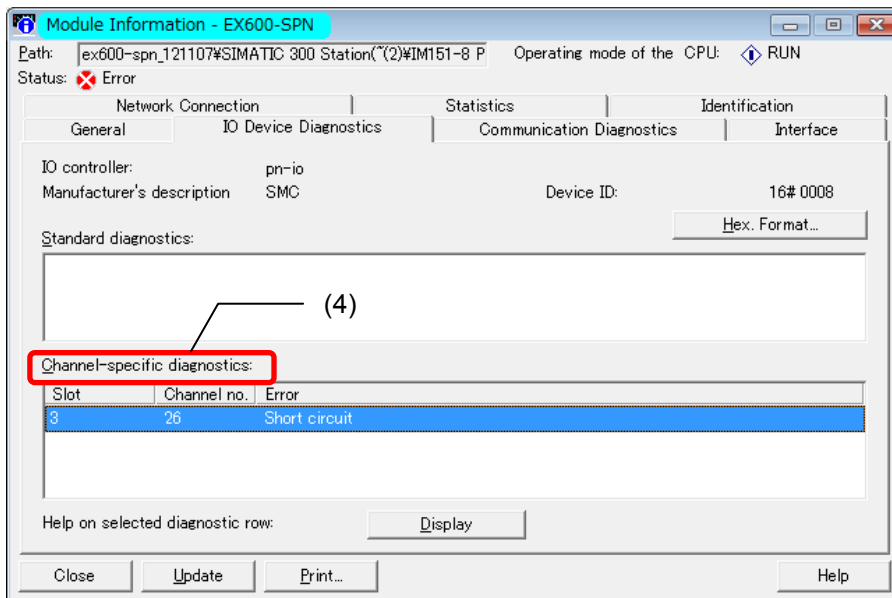
Accessories

For the selection of accessories, refer to the catalog.

(1)Valve plate

   EX600-ZMV1

      Enclosed parts: Round head screw (M4 x 6), 2 pcs.
                             Round head screw (M3 x 8), 4 pcs.

   EX600-ZMV2 (Specified for SY series)

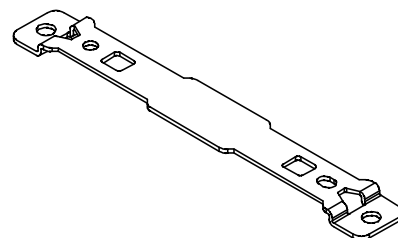   Enclosed parts: Round head screw (M4 x 6), 2 pcs.
                             Round head screw (M3 x 8), 4 pcs.
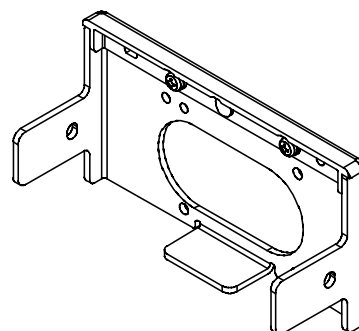
(2)End plate bracket

   EX600-ZMA2

      Enclosed parts: Round head screw (M4 x 20), 1 pc.
                             P tight screw (4 x 14), 2 pcs.

   EX600-ZMA3 (Specified for SY series)

      Enclosed parts: Round head screw (M4 x 20) with washer, 1 pc.
                             P tight screw (4 x 14), 2 pcs.
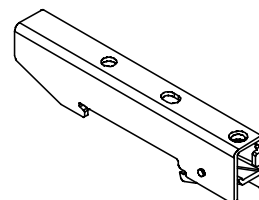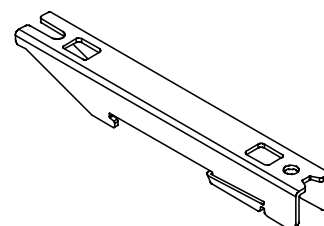
(3)Intermediate reinforcing brace

   EX600-ZMB1…for direct mounting
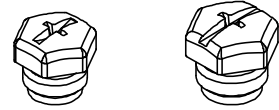
      Enclosed parts: Round head screw (M4 x 5), 2 pcs.

   EX600-ZMB2…for DIN rail mounting
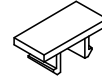
      Enclosed parts: Round head screw (M4 x 6), 2 pcs.

(4)Seal cap (10 pcs.)
　　EX9-AWES…for M8
　　EX9-AWTS…for M12

(5)Marker (1 sheet, 88 pcs.)
　　EX600-ZT1

(6)Y Junction connector
　　PCA-1557785 2 x M12 (3 pin) – M12 (5 pin)

(7)Assembled type connector
　　PCA-1446553 for PROFINET communication, M12 (4 pin) Plug, D code
　　PCA-1578078 for power supply, 7/8 inch, Plug, Cable O.D. 12 to 14 mm
　　PCA-1578081 for power supply, 7/8 inch, Socket, Cable O.D. 12 to 14 mm
　　PCA-1557730 M8 (3 pin), Plug
　　PCA-1557743 M12 (4 pin), Plug, for AWG26 to AWG22, SPEEDCON compatible
　　PCA-1557756 M12 (4 pin), Plug, for AWG22 to AWG18, SPEEDCON compatible

(8)Power supply cable
　　PCA-1558810 Cable with 7/8 inch connector, Socket, Straight 2 m
　　PCA-1558823 Cable with 7/8 inch connector, Socket, Straight 6 m
　　PCA-1558836 Cable with 7/8 inch connector, Socket, Right angle 2 m
　　PCA-1558849 Cable with 7/8 inch connector, Socket, Right angle 6 m
　　PCA-1564927 Cable with M12 connector, B code, Socket, Straight 2 m, SPEEDCON compatible
　　PCA-1564930 Cable with M12 connector, B code, Socket, Straight 6 m, SPEEDCON compatible
　　PCA-1564943 Cable with M12 connector, B code, Socket, Right angle 2 m, SPEEDCON compatible
　　PCA-1564969 Cable with M12 connector, B code, Socket, Right angle 6 m, SPEEDCON compatible

(9)PROFINET communication cable
　　PCA-1446566　　　　 Cable with M12 connector, D code, Plug, Straight 5 m, SPEEDCON compatible
　　EX9-AC010EN-PSRJ Cable with M12 connector, D code-RJ45, Plug, Straight 1 m
　　EX9-AC020EN-PSRJ Cable with M12 connector, D code-RJ45, Plug, Straight 2 m
　　EX9-AC030EN-PSRJ Cable with M12 connector, D code-RJ45, Plug, Straight 3 m
　　EX9-AC050EN-PSRJ Cable with M12 connector, D code-RJ45, Plug, Straight 5 m
　　EX9-AC100EN-PSRJ Cable with M12 connector, D code-RJ45, Plug, Straight 10 m

(10)Connector extension cable
　　PCA-1557769 M12 (4 pin), Straight 3 m, SPEEDCON compatible
　　PCA-1557772 M8 (3 pin), Straight 3 m

Revision history

No. EX※※-OMQ0016