



Operation Manual

PRODUCT NAME

**Fieldbus System Equipment
PROFINET-Compatible Fieldbus Module**

MODEL / Series / Product Number

EX600-BPN1
EX600-ED□

SMC Corporation

1 Contents

Safety Instructions	4
2 System Overview	11
2.1 System Configuration	11
2.2 Assignment of Module Numbers and Channel Numbers	12
2.3 Terminology	13
3 Assembly	14
4 Mounting and Installation	17
4.1 Direct Mounting	17
4.2 DIN Rail Mounting	20
4.3 Marker Installation	22
5 Fieldbus Module	23
5.1 Model Indication and Part Number System	23
5.2 Names and Functions of Product Components	23
5.3 Wiring	24
5.4 Display Screen	25
5.4.1 Overview of Indicators and Push Buttons	25
5.4.2 Indicator Details	26
5.4.3 LCD Display Operation	29
5.5 Specifications	42
5.6 External Dimensions	43
6 End Plate	44
6.1 Model Indication and Part Number System	44
6.1.1 End Plate (D-side)	44
6.1.2 U-side End Plate	44
6.2 Names and Functions of Product Components	45
6.3 Wiring Method	46
6.4 Power Supply System (US1 / US2)	47
6.5 Specifications	48
6.6 External Dimensions	49
7 Troubleshooting	52
7.1 Troubleshooting Chart	52
7.2 List of Troubleshooting Methods	55
8 Parameter Settings	72
8.1 Fieldbus Module Parameter Settings	72
8.2 Safety I/O Module Parameter Settings	73
8.2.1 Safety-Related Parameters	73
8.2.2 Valve Module-Related Parameter List	73
8.2.3 ITV Module-Related Parameter List	74
8.3 Digital Module Parameter Settings	75
8.3.1 Digital Input Module Parameter Settings	75
8.3.2 Digital Output Module Parameter Settings	76

8.4 Analog Module Parameter Settings	77
8.4.1 Analog Input/Output Module Parameter Settings	77
8.4.2 Analog Output Module Parameter Settings	78
8.4.3 Analog Setting Value Scale	79
8.5 IO-Link Master Module Parameter Settings	81
8.5.1 Parameter List	81
8.5.2 Data Storage Function	84
9 Diagnostics	85
9.1 Diagnostic Overview	85
9.2 Diagnostic Data Details	86
9.3 Diagnostic Log	88
9.3.1 Checking via the LCD Display	88
9.3.2 How to Check Diagnostics Using the Engineering Tool	90
9.4 Diagnostics of the IO-Link Master Module	91
10 Input/Output Process Data	92
10.1 Data Size	92
10.1.1 Input/Output Byte Occupation for Each Module	92
10.2 I/O Map of the IO-Link Master Module	93
10.2.1 I/O Map	93
10.2.2 Port Status (PQI) Details	94
11 Hardware Configuration	95
11.1 GSDML File	95
11.2 PLC Configuration	96
11.2.1 GSDML File Installation	96
11.2.2 Module Configuration	97
11.2.3 Adding the EX600-BPN1	98
11.2.4 Adding Modules	99
11.2.5 Adding Submodules	99
11.2.6 Module Parameter Settings	100
11.2.7 Device Name Setting	101
11.3 Setting Safety Parameters via Safety Outputs	102
11.4 Module Replacement	102
11.5 Fast Start Up (FSU) Function	103
11.6 IO-Link Device Parameter Settings	105
12 Record data	106
13 Accessories	107



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 and safety requirements for systems and their components
ISO 4413: Hydraulic fluid power - General rules and safety requirements for systems and their components
IEC 60204-1: Safety of machinery - Electrical equipment of machines - Part 1: General requirements
ISO 10218-1: Robots and robotic devices - Safety requirements for industrial robots - Part 1: Robots
etc.



Danger

Warning

Caution

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

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

Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate 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. SMC products cannot be used beyond their specifications. They are not developed, designed, and manufactured to be used under the following conditions or environments. Use under such conditions or environments is not allowed.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
2. Use for nuclear power, railways, aviation, space equipment, ships, vehicles, military application, equipment affecting human life, body, and property, combustion equipment, entertainment equipment, emergency shut-off circuits, press clutches, brake circuits, safety equipment, etc., and use for applications that do not conform to standard specifications such as catalogs and operation manuals.
3. Use for interlock circuits, except for use with double interlock such as installing a mechanical protection function in case of failure. Please periodically inspect the product to confirm that the product is operating properly.



Safety Instructions

Caution

SMC develops, designs, and manufactures products to be used for automatic control equipment, and provides them for peaceful use in manufacturing industries.

Use in non-manufacturing industries is not allowed.

Products SMC manufactures and sells cannot be used for the purpose of transactions or certification specified in the Measurement Act of each country.

The new Measurement Act prohibits use of any unit other than SI units in Japan.

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 regulations 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.

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.

■ Safety Instructions

 Warning	
■ Do not disassemble, modify (including changing the printed circuit board) or repair. An injury or failure can result.	
■ Do not operate or set up with wet hands. An electric shock can result.	
■ 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.	

Caution

- When handling or assembling or replacing the unit, pay attention to the following:
 - Do not touch the sharp edges when overseeing the unit.
 - The unit joints are tightly bound with gaskets, so do not hit your hands when replacing the unit.
 - Do not put your fingers between them when joining the units.Otherwise, an 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 noise resistance of the Serial System.
Individual grounding should be provided close to the product with a short cable.

NOTE

- Follow the instructions given below when designing, selecting and overseeing the product.
- The instructions on design and selection (installation, wiring, environment, adjustment, operation, maintenance, etc.) described below must also be followed.
- *Product specifications
 - For the power supply, use SELV or PELV circuits that guarantee a reliable electric disconnection from the MAINS.
 - Use the specified voltage.
Otherwise, failure or malfunction can result.
 - 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 to or malfunction of 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 product.
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.
The ingress protection cannot be guaranteed if the screws are not tightened to the specified torque.
- If a large valve module is assembled, lift the manifold so that stress is not applied to the connecting part while transporting.
The stress may cause breakage of the connecting part. The manifold may become very heavy depending on the module 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 product 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 product 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 product 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.
The ingress protection is achieved when the following conditions are met.
(1) The modules are connected properly with cable with M12/M8 connector.
(2) Suitable mounting of each module.
(3) Be sure to fit a seal 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 module or result in damage. Take measures against the surge sources, and prevent the lines from coming into close contact.

- 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 module.
- The product is CE/UKCA 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.
- Use with caution at altitudes above 2000 m, as the reduction in atmospheric pressure reduces withstand voltage performance and noise immunity (lightning surge, electro-static discharge).

*Adjustment and Operation

- Do not press the setting buttons with a sharp pointed object.
It may damage the setting buttons.
- 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.

Fieldbus System/ Industrial IoT Cybersecurity

In recent years, factories have introduced industrial IoT, building up complex networks of production machines. These systems may be subject to a new threat, cyberattack. To protect the industrial IoT from cyberattacks, it is important to take multiple measures (multi-layer protection) for IoT devices, networks and clouds.

For this purpose, SMC recommends that the following measures are always taken into consideration. For further details of the following measures, please see security information published by your local country security agencies.

1. Do not connect the devices via a public network.

- If you unavoidably need to access the device or cloud via a public network, ensure to use a secure, private network such as VPN.
- Do not connect an office IT network and factory IoT network.

2. Build a firewall to prevent a threat from entering the device and system.

- Set up a router or firewall at network boundaries to allow minimum required communications.
- Disconnect from the network or turn off the device if no continuous connection is required.

3. Physically block an access to unused communication ports or disable them.

- Inspect regularly each port if any unnecessary device is connected to the network system.
- Operate necessary services (SSH, FTP, SFTP, etc.) only.
- Set a transmission range of the device using a wireless LAN or other radio system to the minimum required and use only devices approved according to the radio act in the country concerned.
- Install a device generating radio waves in such place as there is no interference from indoor or outdoor.

4. Set up a secure communication method such as data encryption.

- Encrypt data in every environment, including IoT networks, secure gate-way connections, for secure communications.

5. Grant access permissions by user accounts and limit the number of users.

- Regularly review accounts and delete all unused accounts or permissions.
- Establish an account lockout system to block an access to the account for a certain period if log-in fails more than the given threshold.

6. Protect passwords.

- Change the default password when you first use the device or system.
- Choose a long password (minimum 8 characters) using a mix of different letters and characters to make the password more secure and harder to hack.

7. Use the latest security software.

- Install antivirus software on all computers to detect and remove viruses.
- Keep the antivirus software up to date.

8. Use the latest version of the device and system software.

- Apply patches to keep the OS and applications up to date.

9. Monitor and detect abnormalities in the network.

- Keep monitoring the network for any abnormalities to take a prompt measure and issue an alert if any abnormality is detected. Install an intrusion detection system (IDS) and intrusion prevention system (IPS).

10. Delete data from devices when disposed of.

- Before disposing of any IoT devices, delete stored data or physically destruct media to prevent any misuse of the data.

2 System Overview

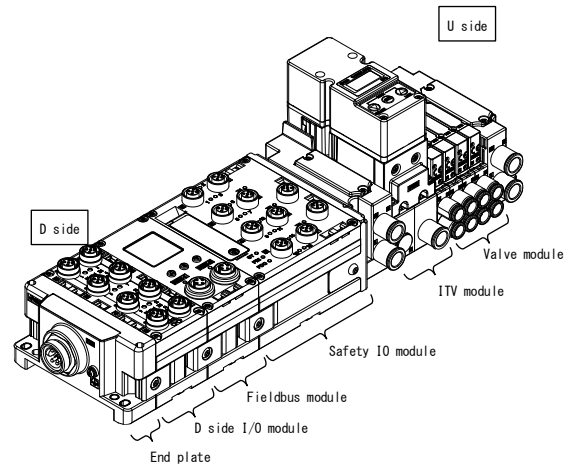
2.1 System Configuration

The EX600 Fieldbus System connects to PROFINET communication and enables reduced wiring and distributed installation of both general-purpose I/O devices (such as sensors, indicator lights, and IO-Link devices) and safety I/O devices (such as light curtains and residual pressure release valves). The valve manifold operates through a combination of various modules.

In addition, the input/output functionality can be expanded by connecting additional I/O modules. Up to nine input modules, output modules, and IO-Link master modules can be connected in any order to the D-side of the fieldbus module.

Safety I/O modules can be connected to the U-side of the fieldbus module, allowing the power supplied to valves to be safely shut off without installing a separate safety output unit.

In addition to valve modules, safety input devices, safety output devices, and plug-in electro-pneumatic regulators (ITV modules) can be connected to the safety I/O modules.



Name	Description
End Plate	A module that supplies power to the entire valve manifold. The power supply cable is connected to this module.
Digital Input Module	Receives switch output signals from input devices.
Digital Output Module	Drives output devices such as solenoid valves, lamps, and buzzers.
IO-Link Master Module	Connects IO-Link devices and performs IO-Link communication.
Fieldbus Module	Performs fieldbus communication and controls the internal operation of the manifold.
Safety I/O Module	Controls valves using safety outputs. It also provides external access to safety inputs and safety outputs.
Valve Module	A module that controls pneumatic pressure. It is controlled by the Safety I/O Module.
ITV Module	A module that controls output pressure according to electrical signals. It is controlled by the Safety I/O Module.



Important Notes

- The fieldbus module (EX600-BPN1) can be connected to the Safety I/O Module (EX600-FVP#). For details of the safety functions, refer to the Safety I/O Module Safety Manual.
- The Safety Manual for the Safety I/O Module (EX600-FVP#) is originally provided as an English version (DOC1155669).

Note

- For detailed information on the functions of the plug-in electro-pneumatic regulator (ITV module), refer to the plug-in electro-pneumatic regulator instruction manual (DIY-60L00-OM001).

2.2 Assignment of Module Numbers and Channel Numbers

In the EX600 system, a Module Number and a Channel Number are assigned to each module in order to specify the location of diagnostics and the target of parameter settings.

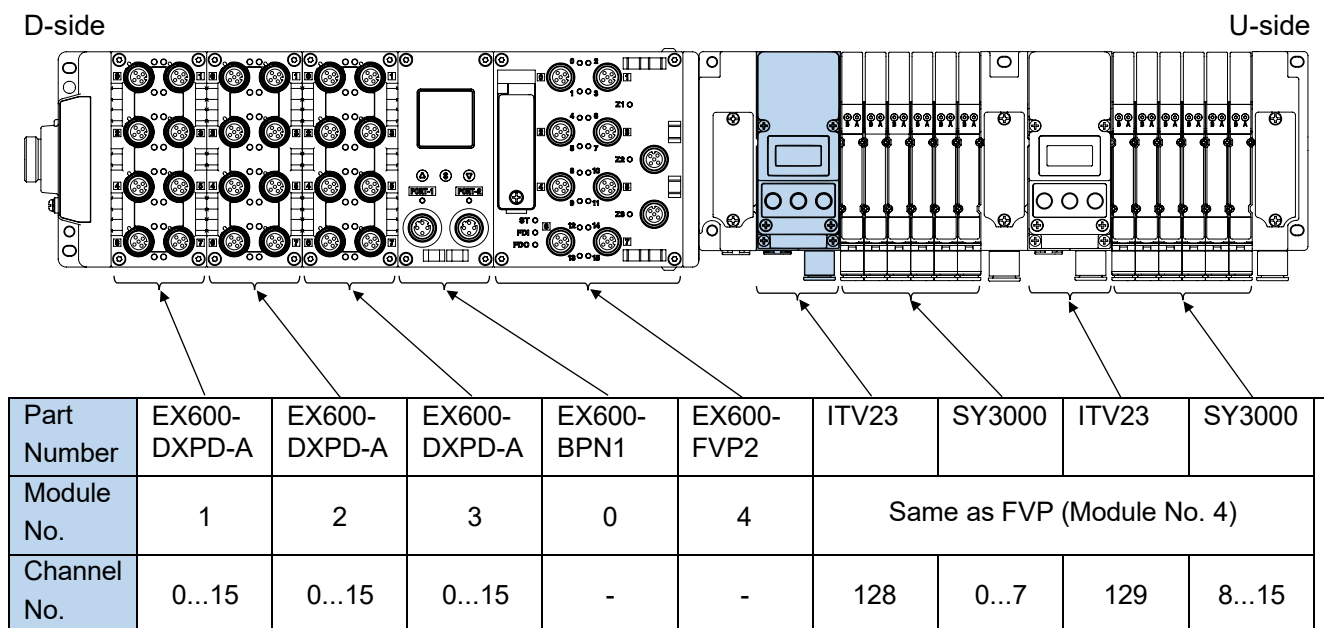
Module numbers are assigned according to the order in which the modules are connected at system startup, as described below:

- The fieldbus module is fixed as Module No. 0.
- Starting from the modules on the D-side, module numbers are assigned sequentially as Module No. 1, 2,

Channel numbers are assigned according to the specifications of each module.

- For D-side I/O modules, channel numbers are assigned in connector order.
For IO-Link master modules, Port 1 is assigned Channel No. 0, and Port 2 is assigned Channel No. 1.
- For valve outputs of the Safety I/O Module, channel numbers are assigned sequentially as Channel No. 0, 1, 2, ..., starting from the A-side solenoid of the valve located on the D-side.
- ITV modules are assigned Channel No. 128, 129, 130, and 131, in order from the D-side.
- No channel numbers are assigned to safety inputs or safety outputs.

Assignment Example : In the system configuration shown below, Module No. 4, Channel No. 128 specifies the first ITV module counted from the D-side.
Refer to the highlighted area in the illustration.



2.3 Terminology

	Term	Definition
100	100BASE-TX	A LAN transmission standard with a transmission speed of 100 Mbps.
D	Device name	A DNS-format name defined in IEC 61158-6-10 and used to identify an IO device in PROFINET IO communication. The IO controller uses this name to identify the target device and establish communication.
	DIN Rail	A metal rail that conforms to DIN (German Institute for Standardization) standards.
	Disconnection Detection	A diagnostic function that detects disconnection of an output device or its wiring.
	D-side	In a manifold configuration of the EX600, this refers to the side where the EX600 end plate is connected.
F	FE	Abbreviation for Functional Earth. This refers to functional grounding. When simply referred to as "earth," it usually means FE.
	Fieldbus	A digital communication standard used for exchanging signals between field devices (such as measuring instruments and actuators) and PLCs in factories and similar environments.
	FSU	Fast Start Up. A PROFINET function that reduces the time from power-on of an IO device to the start of cyclic communication with the IO controller.
	Full Duplex	A communication method that allows simultaneous two-way transmission and reception.
G	GSDML File	A file that describes product information and is used in engineering tools.
H	Half Duplex	A communication method in which transmission and reception are performed alternately during bidirectional communication.
I	Internal Current Consumption	The current required to operate each module. Inrush current and current supplied to external devices are not included.
	IP□□	Abbreviation for International Protection or Ingress Protection. A standard related to protection against intrusion of foreign objects (such as hands, steel balls, wires, dust, water, etc.). The degree of protection is indicated by a two-digit code.
	IP Address	A 32-bit numeric identifier assigned to a device connected to a network.
	ISDU	Abbreviation for Index Service Data Unit. A command used in IO-Link communication for acyclic service data communication, such as parameter read/write operations and device control.
M	Manifold	A multi-branch assembly or integrated unit.
	MRP	Media Redundancy Protocol. A redundancy protocol used in PROFINET ring network topologies to prevent communication interruptions. When a failure occurs in the ring, communication is automatically switched to an alternative path to maintain continuity.
N	NPN Output	An output type that drives output devices using an NPN transistor. Since a positive potential is applied to the power line, it is also referred to as a plus-common type.
	NPN Input	An input that receives sensor outputs in which an NPN transistor is used in the signal output section.
O	On request data	Parameter data or event data transmitted and received via ISDU in IO-Link communication.
P	PLC	Abbreviation for Programmable Logic Controller. A controller that performs sequential control according to programs for logical, sequential, and arithmetic operations.
	PNP Output	An output type that drives output devices using a PNP transistor. Since a negative potential is applied to the power line, it is also referred to as a minus-common type.
	PNP Input	An input that receives sensor outputs in which a PNP transistor is used in the signal output section.
S	Short-circuit Detection	A diagnostic function that detects overcurrent caused by a short circuit between output lines, communication lines, or power supply lines.
U	U-side	In a manifold configuration of the EX600, this refers to the side where valve modules are connected.

3 Assembly

Assemble the modules into a manifold by following the assembly procedures described below.



Important Notes

- Do not attach or remove modules while the power is turned on.
- Tighten screws securely using the specified tightening torque.
Insufficient tightening may cause unintended operation, product malfunction, or damage to the equipment.

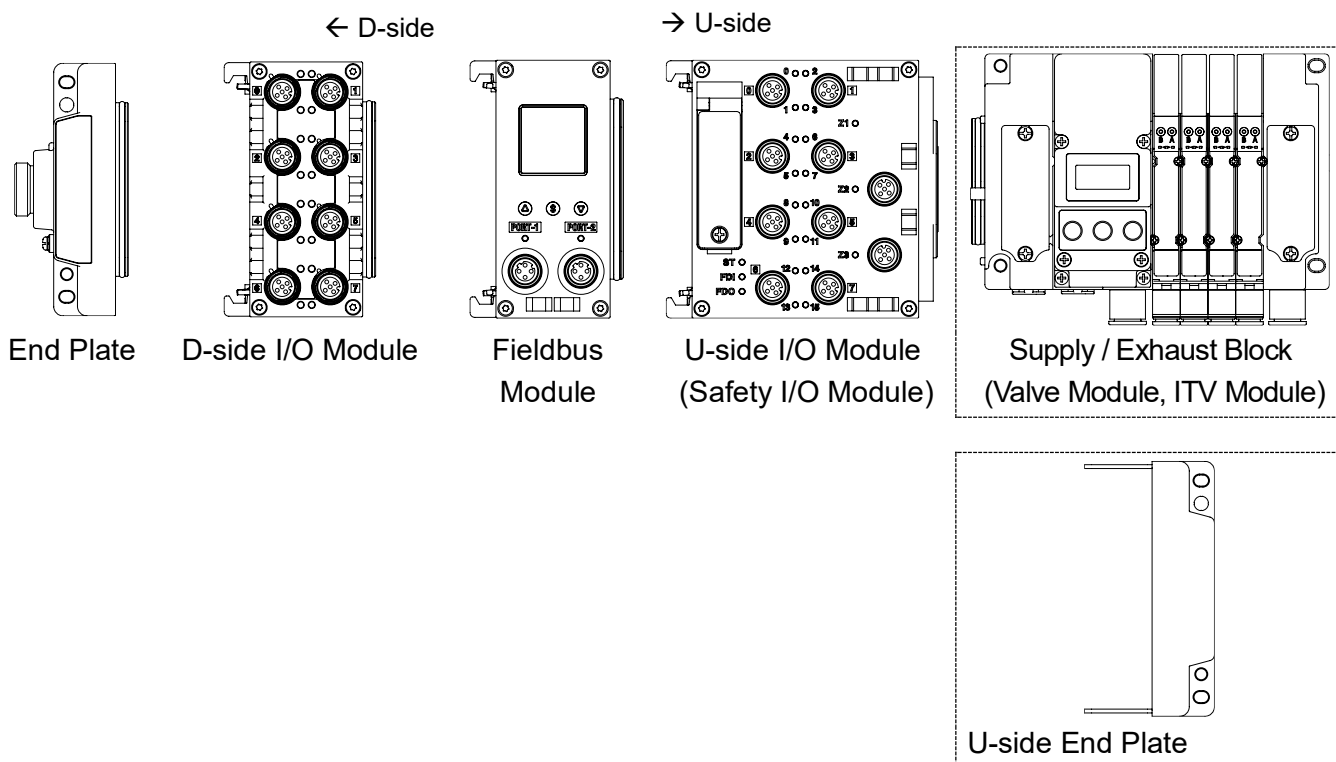
Note

- For a list of compatible modules, refer to the catalog that includes the fieldbus module (EX600-BPN1).

(1) Checking the Module Arrangement Order

The EX600 manifold is connected in the following order: End Plate, D-side I/O Modules, Fieldbus Module, U-side I/O Module (Safety I/O Module), and Supply/Exhaust Block (Valve Module), as shown below.

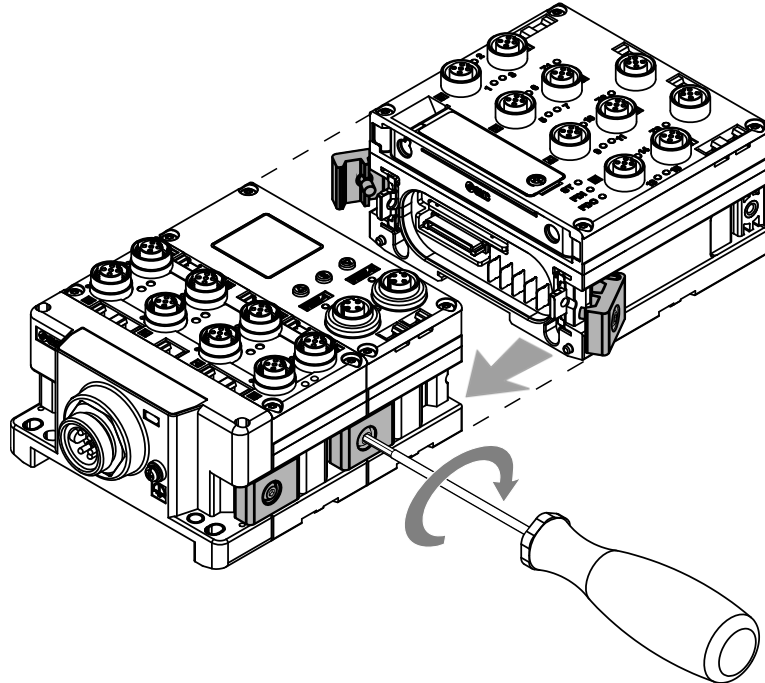
- Up to nine D-side I/O modules can be connected.
- The D-side I/O modules can be connected in any order.
The I/O map is automatically determined based on the actual connection order.
- If valve modules are not used, connect a U-side End Plate (EX600-EU1-#-A) instead of the supply/exhaust block.



(2) Module Connection

Align the connector positions of each module and connect them.

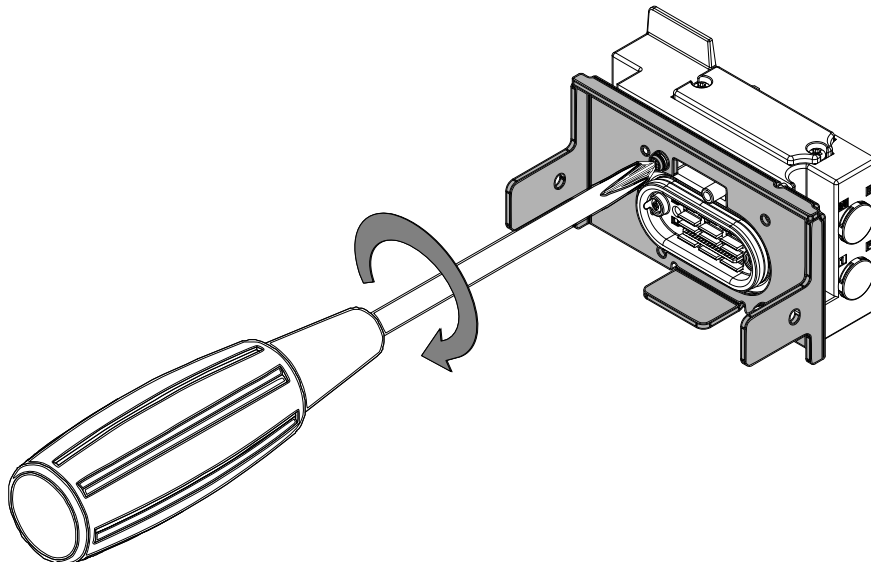
After connecting the modules, tighten the hex socket head screws (2.5 mm across flats) on the joint fittings. Tighten the screws to a tightening torque of 1.5 to 1.6 N·m.



(3) Installation of Valve Plate (EX600-ZMV(-A))*

Attach the valve plate to the supply/exhaust block using the supplied valve mounting screws (M3 × 8, 2 to 4 pcs).

Tighten the screws to a tightening torque of 0.6 to 0.7 N·m.



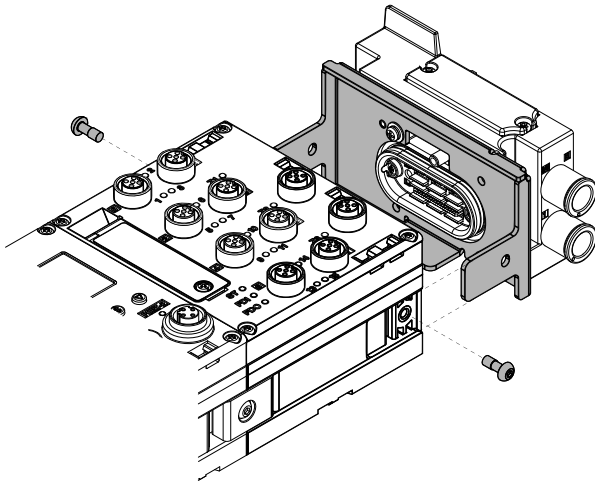
Note

- If valve modules are not connected, the EX600-ZMV(-A)* is not required. In this case, connect a U-side End Plate to ensure the dustproof and waterproof performance (degree of protection).

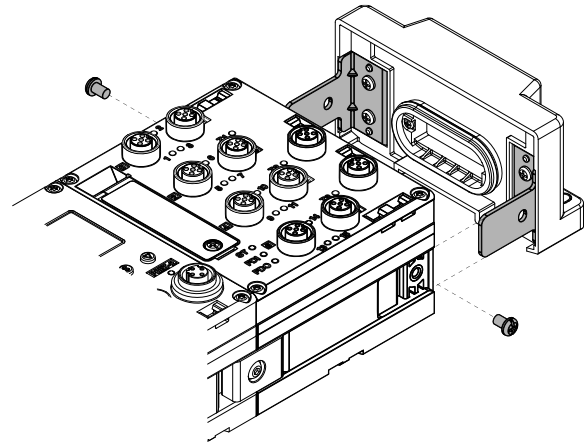
(4) Connection of the Safety I/O Module and the Valve Plate (or U-side End Plate)

Insert the valve plate (or U-side end plate) along the groove for valve plate installation located on the side of the Safety I/O Module, and secure it by tightening the supplied screws.

Tighten the screws to a tightening torque of 0.7 to 0.8 N·m.



Hex Socket Head Screw
(M4 × 6, 2.5 mm across flats)



Hex Socket Head Screw
(M4 × 6, 2.5 mm across flats)



Important Notes

- When five or more modules are connected, installation of an intermediate reinforcement bracket (EX600-ZMB#) is required to prevent poor connections between modules caused by sagging.

For details on the intermediate reinforcement bracket, refer to Section 4, Mounting and Installation (Direct Mounting: page [17](#), DIN Rail Mounting: page [20](#)).

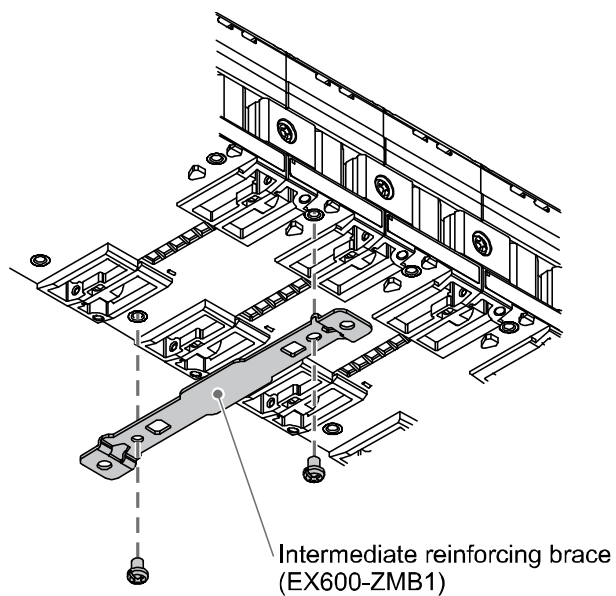
4 Mounting and Installation

4.1 Direct Mounting

(1) Installation of the Intermediate Reinforcement Bracket

Install the intermediate reinforcement brackets for direct mounting (EX600-ZMB1) using the supplied screws (M4 × 5, 2 pcs) so that the manifold is evenly supported, at a ratio of one bracket for every five modules.

Tighten the screws to a tightening torque of 0.7 to 0.8 N·m.



(2) Securing to the Installation Location

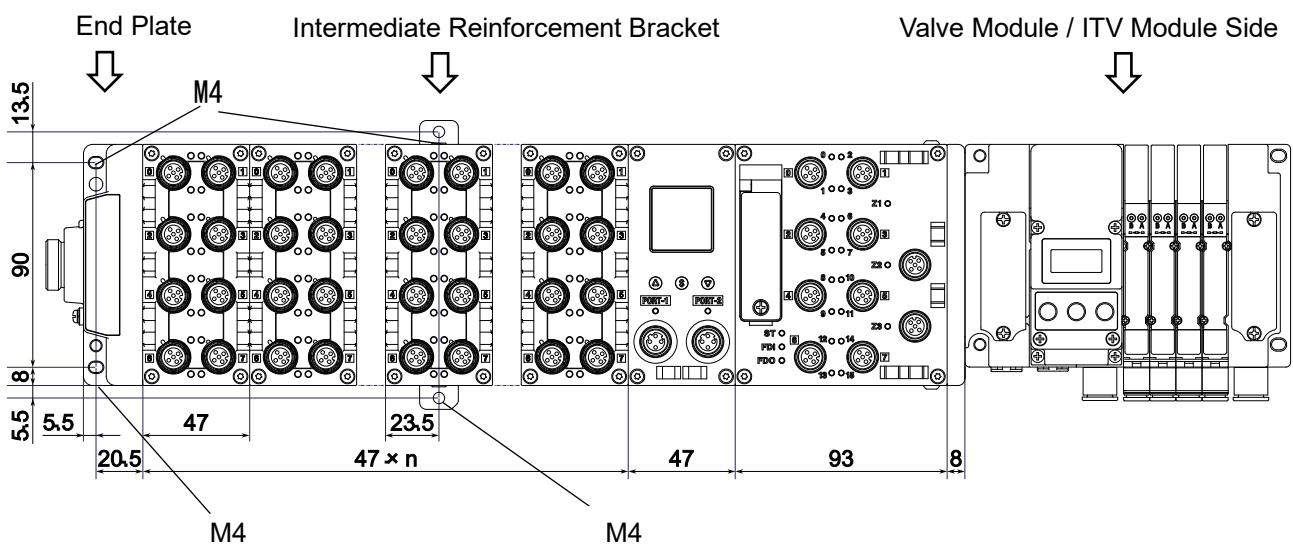
Secure the end plate side and the valve module / ITV module side (and the intermediate reinforcement bracket, if required).

Tighten the screws to a tightening torque of 0.7 to 0.8 N·m.

For securing the valve module / ITV module side, refer to the Operation Manuals for the valve modules and ITV modules being used.

If the valve modules and ITV modules are not used and the unit is secured using a U-side End Plate, tighten the screws to a tightening torque of 0.7 to 0.8 N·m.

- When valve modules and ITV modules are used



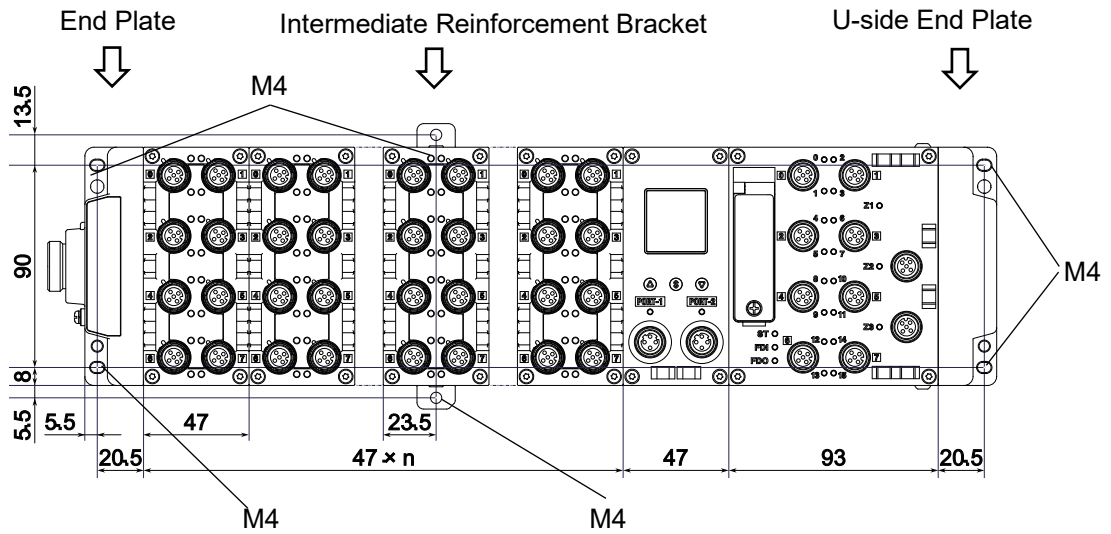
n = Number of D-side I/O modules



Important Notes

- To prevent poor connections between units caused by sagging, install an intermediate reinforcement bracket when five or more modules are connected.

- When Using the U-side End Plate



n = Number of D-side I/O modules



Important Notes

- To prevent poor connections between units caused by sagging, install an intermediate reinforcement bracket when five or more modules are connected.

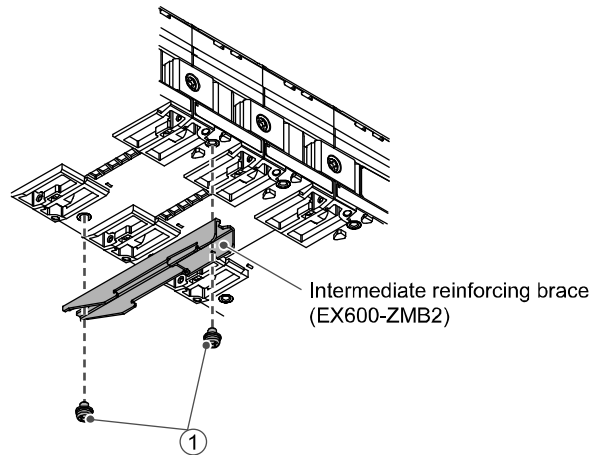
4.2 DIN Rail Mounting

(1) Installation of the Intermediate Reinforcement Bracket

Install the intermediate reinforcement brackets for DIN rail mounting (EX600-ZMB2) using the supplied screws (M4 × 6, 2 pcs) so that the manifold is evenly supported, at a ratio of one bracket for every five modules.

Align the installation direction of the intermediate reinforcement bracket with the orientation of the end plate mounting bracket.

Tighten the screws to a tightening torque of 0.7 to 0.8 N·m.



(2) Installation of the End Plate Mounting Bracket

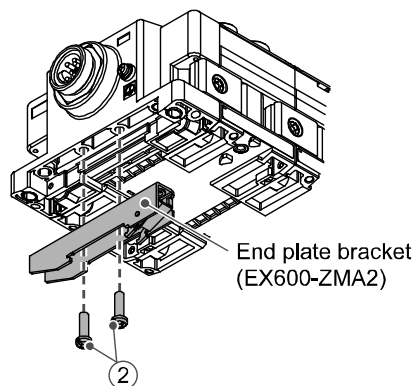
Attach the end plate mounting bracket to the end plate using the supplied screws (M4 × 14, 2 pcs). Tighten the screws to a tightening torque of 0.7 to 0.8 N·m.

The type of end plate mounting bracket to be installed differs depending on the valve module to be connected.

Valve Module Series	End Plate Mounting Bracket Part No.
VQC Series	EX600-ZMA2
JSY Series SY Series	EX600-ZMA3

For the DIN rail mounting bracket on the supply/exhaust block side, refer to the Operation Manual of the valve module being used.

If the supply/exhaust block is not used and a U-side End Plate is installed, attach an end plate mounting bracket to the U-side End Plate as well.



(3) Securing to the DIN Rail

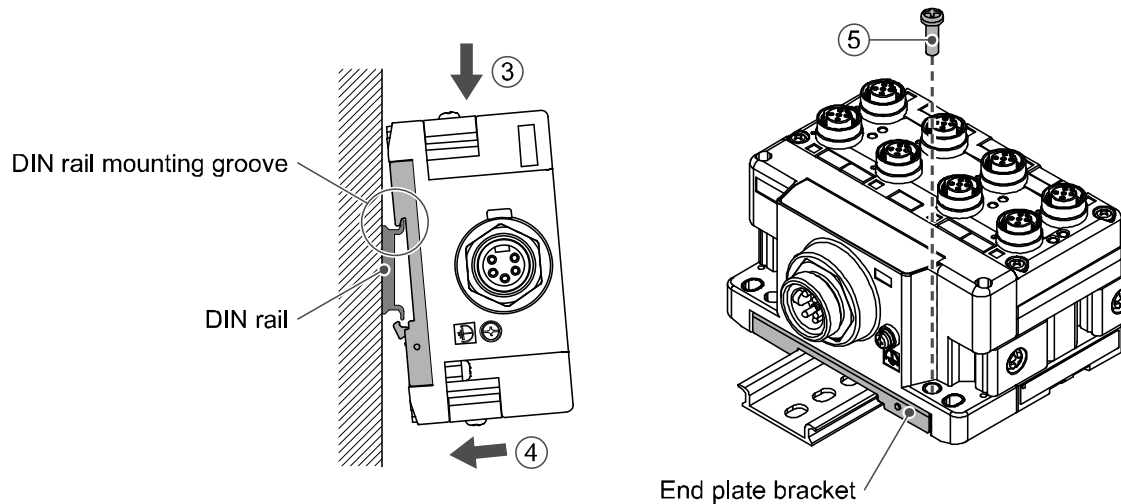
Hook the DIN rail mounting groove onto the DIN rail.

Then, using the DIN rail mounting groove as a pivot, push the manifold inward until the mounting bracket is locked.

After the bracket is locked, secure the end plate mounting bracket to the DIN rail using the supplied screw (M4 × 20).

Tighten the screw to a tightening torque of 0.7 to 0.8 N·m.

For securing the supply/exhaust block side, refer to the Operation Manual of the manifold being used.

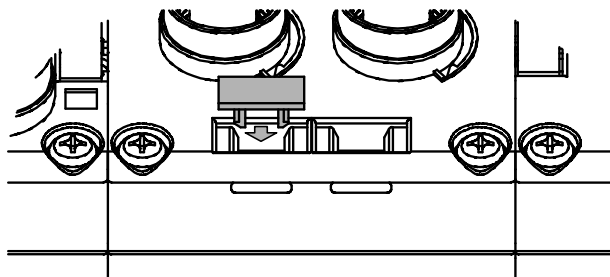


Important Notes

- To prevent poor connections between units caused by sagging, install an intermediate reinforcement bracket when five or more modules are connected.

4.3 Marker Installation

Markers can be attached to each module after writing signal names for input devices or output devices.
If necessary, install markers (EX600-ZT1) in the marker grooves.



5 Fieldbus Module

5.1 Model Indication and Part Number System

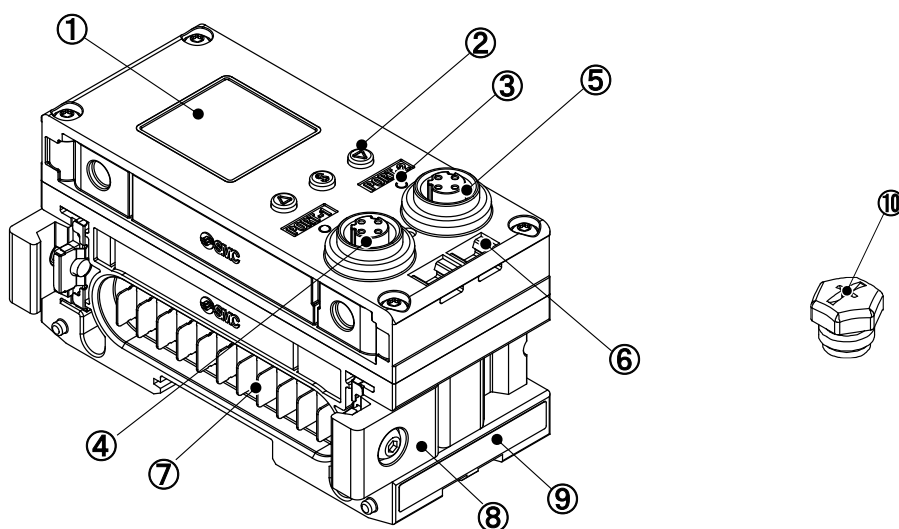
EX600-B PN 1

Fieldbus Module

Protocol

Symbol	Description
PN	PROFINET

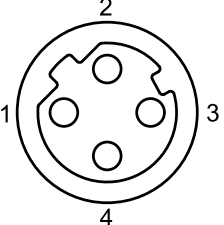
5.2 Names and Functions of Product Components



No.	Name	Function
1	LCD Display	Displays the module status and screens for push-button operation.
2	Push Button	Used to operate diagnostic displays and change parameters on the module.
3	Link/Act LED	Indicates the communication status of the fieldbus.
4	Communication Connector (PORT 1)	Used to connect the fieldbus cable.
5	Communication Connector (PORT 2)	Used to connect the fieldbus cable.
6	Marker Groove	Allows a marker to be installed.
7	Module Connection Connector	Transmits power and control signals to adjacent modules.
8	Joint Bracket	Connects modules to each other.
9	Nameplate	Displays product-specific information (such as the MAC address).
10	Waterproof Cap (1 pc.)	Installed on unused connectors. At the time of factory shipment, it is installed on PORT 2.

5.3 Wiring

● Communication Connectors

Connector Configuration Port1 / Port2	Pin No.	Signal Name
 Connector Type: M12 4-pin Socket, D-coded Connector	1	TX+
	2	RX+
	3	TX-
	4	RX-

● When Port Polarity Is Fixed

If the “Port Interface”* parameter of the fieldbus module is set to any value other than “Autonegotiation”, the port type is fixed as shown below.

Pin No.	Signal Name	
	Port1 Port Type: MDI	Port2 Port Type: MDI-X
1	TX+	RX+
2	RX+	TX+
3	TX-	RX-
4	RX-	TX-

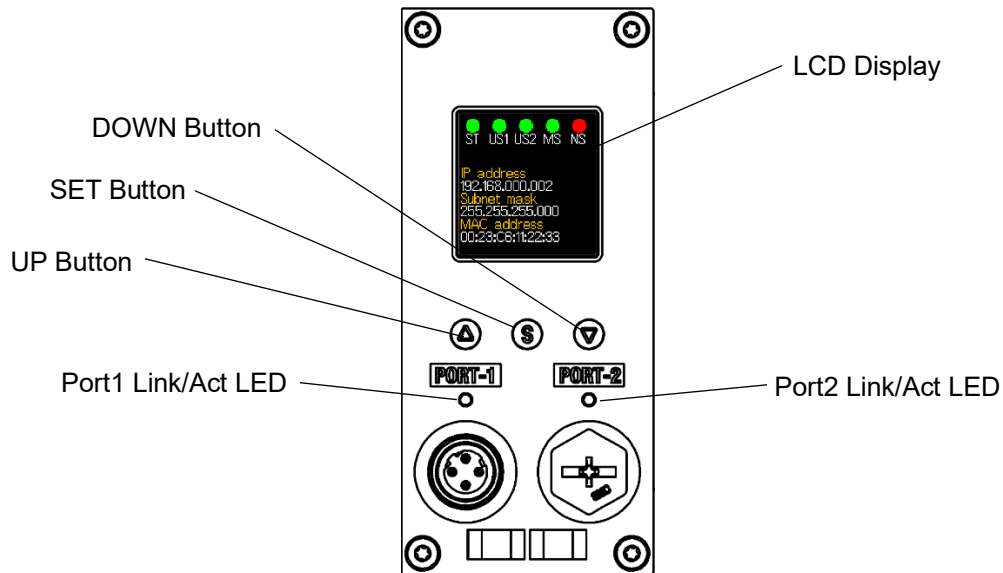


Important Notes

- Always install the waterproof cap on any unused connector. By properly using the waterproof caps, the dustproof and waterproof performance (degree of protection) can be ensured.

5.4 Display Screen

5.4.1 Overview of Indicators and Push Buttons



Name	Function
LCD Display	After power is turned on, various indicators are displayed at the top of the screen. Using the push buttons, detailed diagnostic information can be checked and parameters can be changed. For details, refer to Section 5.4.3 “LCD Display Operation” (page 29).
UP Button / DOWN Button	Used to switch items or increase/decrease setting values during LCD display operation. Pressing both buttons simultaneously switches to the menu screen. On the menu screen, simultaneous pressing is used to cancel the operation.
SET Button	Used to confirm and execute operations.
PORT1 Link/Act LED	Indicates the communication status of each communication connector.
PORT2 Link/Act LED	



Important Notes

- Do not turn on the power while pressing any buttons. Doing so may prevent the module from starting up correctly.

5.4.2 Indicator Details

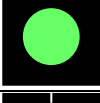
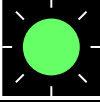
● ST

Indicates diagnostics that are occurring on the module.

Display Status		Description
	Green ON	Normal operation.
	Green Flashing (2 Hz)	A diagnostic has been detected on one of the modules. Follow the troubleshooting procedures to eliminate the cause of the error.
	Red Flashing (2 Hz)	One of the following errors has been detected. Modify the manifold configuration to be within the specified range and restart the system. - The I/O size exceeds the specified limit. - The number of connected I/O modules exceeds the specified limit. - The F-address setting value of the Safety I/O Module is 0.
	Red/Green Alternating Flashing (2 Hz)	An internal communication error has occurred. Check the connections between all modules.
	Red ON	Power cycling is required. Initialization of the fieldbus module has failed, or communication with the Safety I/O Module could not be established.

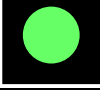
● US1

Indicates the status of the US1 power supply (control power supply).

Display Status		Description
	OFF	The US1 power supply voltage level is 19 V or lower. (When the "US1 voltage monitoring" parameter is set to "Disable")
	Green ON	The US1 power supply voltage level is normal.
	Green Flashing (2 Hz)	The US1 power supply voltage level is 19 V or lower. (When the "US1 voltage monitoring" parameter is set to "Enable")

● US2

Indicates the status of the US2 power supply (output power supply).

Display Status		Description
	OFF	The US2 power supply voltage level is 19 V or lower.
	Green ON	The US2 power supply voltage level is normal.

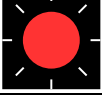
● SF

Indicates the status of the module.

Display Status		Description
	OFF	Normal operation.
	Green Flashing (2 Hz)	The Node flashing test command has been received.
	Red ON	A diagnostic error has been detected.

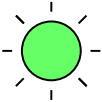
● BF

Indicates the communication status.

Display Status		Description
	OFF	PRPROFINET communication has been established.
	Red Flashing (2 Hz)	The PLC configuration does not match the EX600 configuration data.
	Red ON	One of the following diagnostics has been detected: • The communication cable for the fieldbus module is not connected. • The PLC power is turned off. • The PLC or the fieldbus module is faulty. • The Device Name is mismatched or not set.

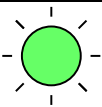
- PORT-1

Indicates the communication status on the PORT 1 side.

Display Status		Description
	OFF	PORT 1 side: No link / No activity
	Green ON	PORT 1 side: Link / No activity (100 Mbps)
	Green Flickering (20 Hz)	PORT 1 side: Link / Activity (100 Mbps)

- PORT-2

Indicates the communication status on the PORT 2 side.

Display Status		Description
	OFF	PORT 2 side: No link / No activity
	Green ON	PORT 2 side: Link / No activity (100 Mbps)
	Green Flickering (20 Hz)	PORT 2 side: Link / Activity (100 Mbps)

5.4.3 LCD Display Operation

By operating the push buttons, the following items can be performed on the LCD display:

- Check the communication status with the upper-level device
- Check the current values of input/output data
- Display diagnostic status
- Check parameters

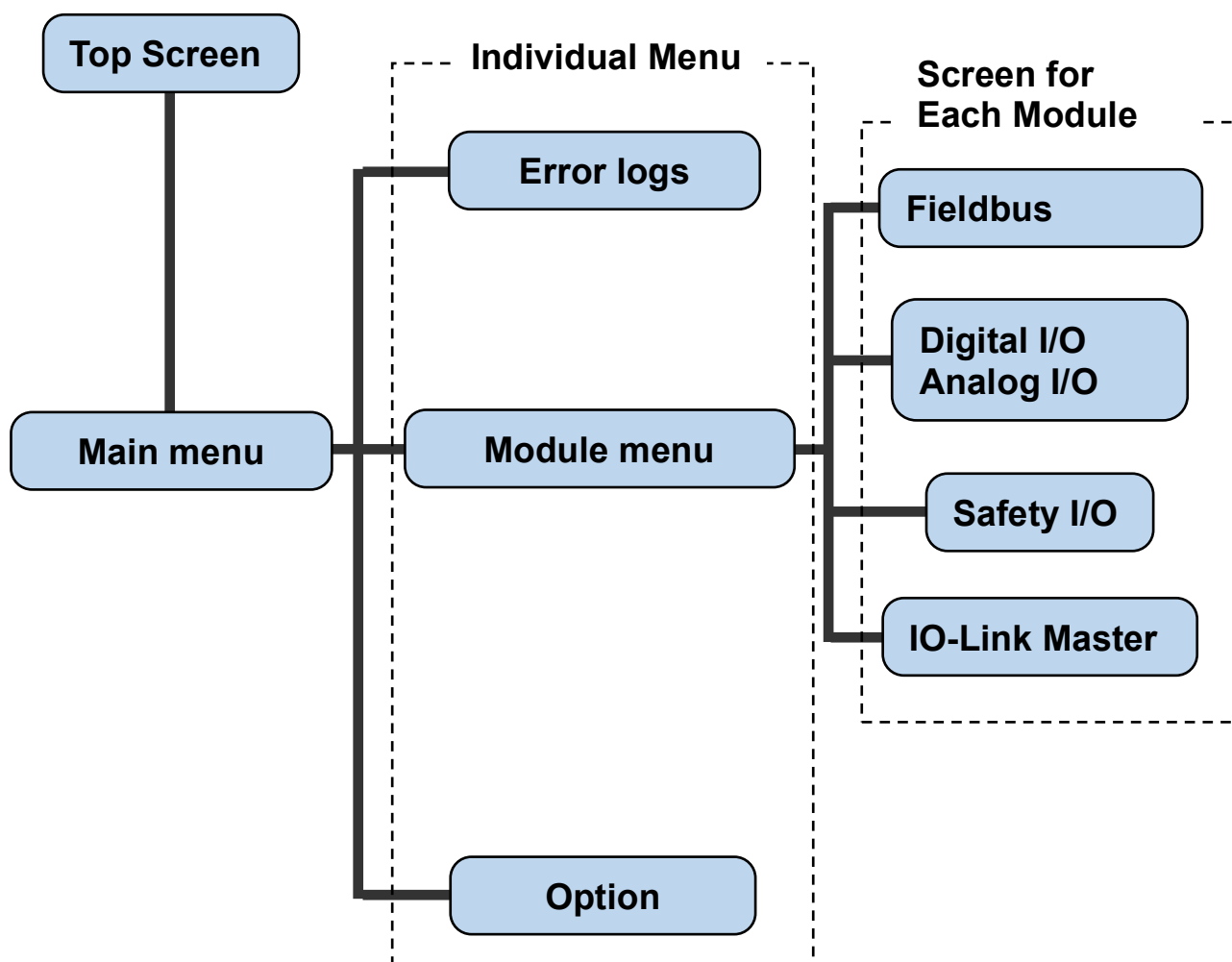
Note

- DynaFont, the font used in this manual, is a registered trademark of DynaComware Taiwan Inc.

Basic Operation of Push Buttons

Button Operation	Description
 / 	Press the UP button or DOWN button. Pressing and holding the button is also possible.
	Press the SET button.
 + 	Press and hold the UP and DOWN buttons simultaneously.

Overall Screen Structure Map

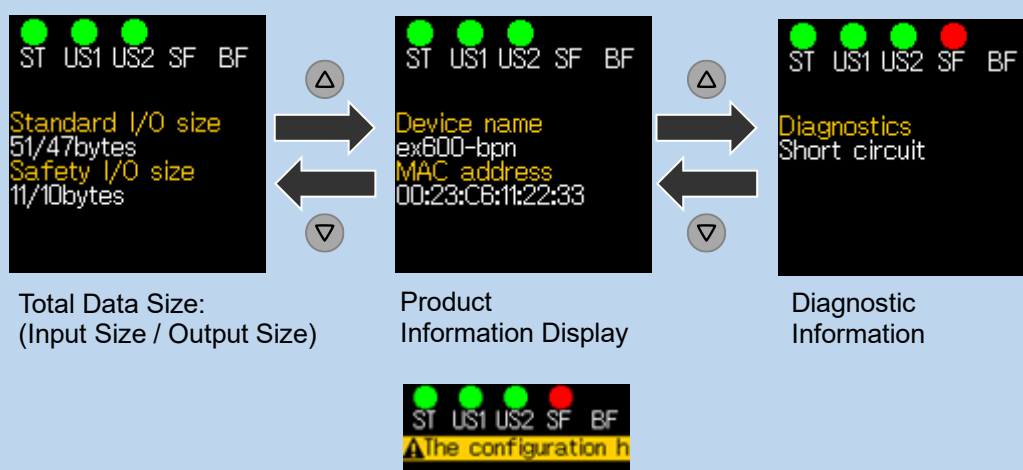


Turn on the Power



TOP Screen

This screen displays the manifold information after power is turned on. The display also returns to this screen when there has been no operation for 30 minutes.



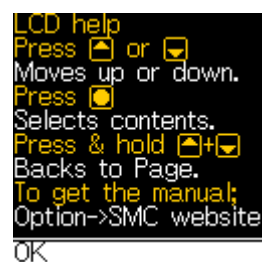
TOP menu may be displayed above message. In that case, please follow the instructions on the screen.



Shift Main menu



Shift the simple Help menu how to operate LCD display.





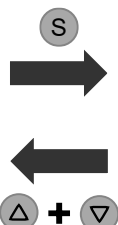
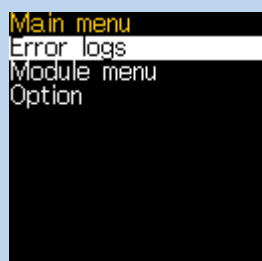
Returns from the Main Menu to the Top Screen.



Main menu

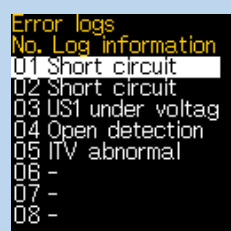
From this screen, you can navigate to individual screens.

- Select a menu item to move to the selected screen.
- You can also return to the Top Screen

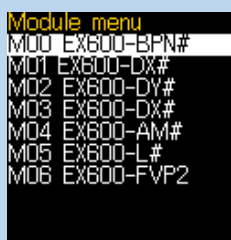


Individual menus

For an overview of the individual menus, refer to the corresponding page.



Error logs
(Page [33](#))



Module menu
(Page [34](#))



Option
(Page [41](#))

● ● ●
 ST US1 US2 SF BF
 Device name
 ex600-bpn
 MAC address
 00:23:C6:11:22:33

Top Screen

Main menu
 Error logs
 Module menu
 Option

Main menu

Returns from the Individual Menu to the Main Menu.



Error logs

Error logs
 No. Log information
 01 Short circuit
 02 Short circuit
 03 US1 under voltage
 04 Open detection
 05 ITV abnormal
 06 -
 07 -
 08 -

Up to 30 diagnostic error history records can be checked.

When a No. is selected, the log details are displayed with horizontal scrolling. For details, refer to Section 9.3.1 "Checking via the LCD Display" (page [88](#)).

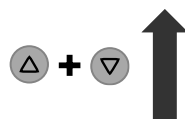


Top Screen

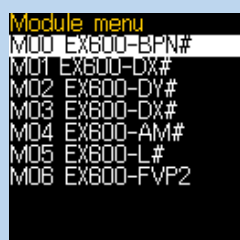


Main menu

Returns from the Individual Menu to the Main Menu.



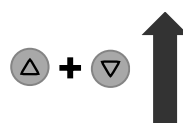
Module menu



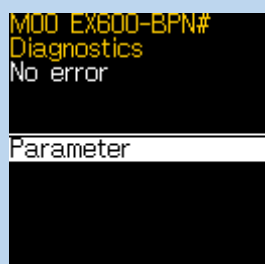
Menus are displayed in order of the Module No.
For details on the Module No., refer to Section 2.2 “Assignment of Module Numbers and Channel Numbers” (page [12](#)).
Select a module using “ Δ / ∇ ”, and then press “S” again to navigate to the screen corresponding to the selected module.

S

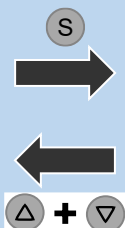
Returns to the Module Menu.



Fieldbus module

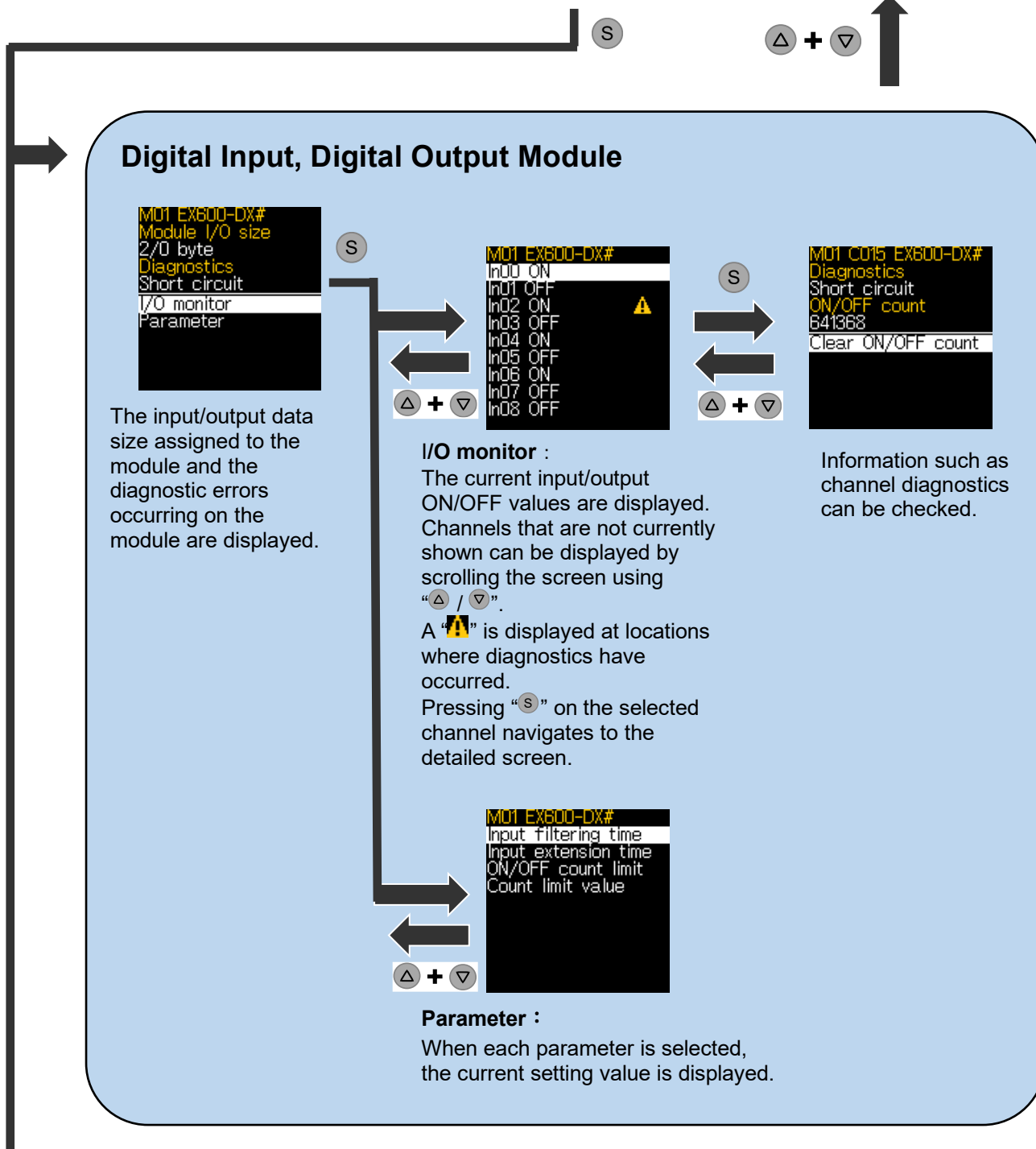
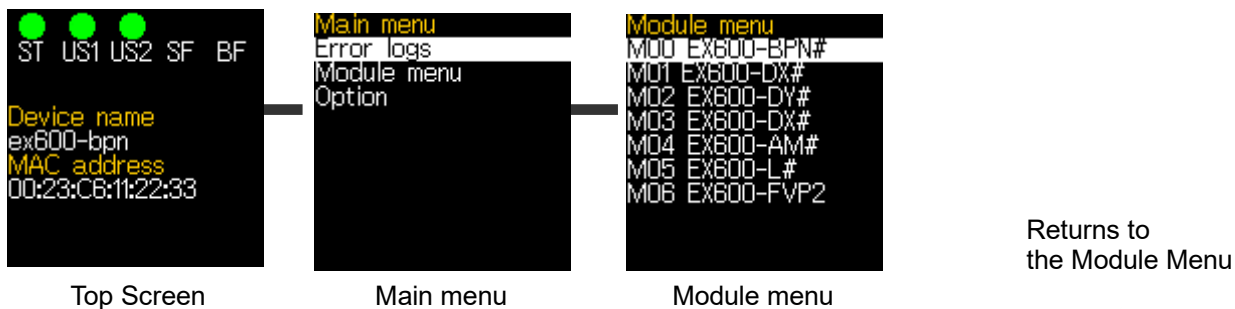


Dagnostic errors occurring on the fieldbus module are displayed.



Parameter :

The parameter list is displayed.
When a parameter is selected, the current setting value is displayed.



● ● ●
ST US1 US2 SF BF
Device name
ex600-bpn
MAC address
00:23:C6:11:22:33

Top Screen

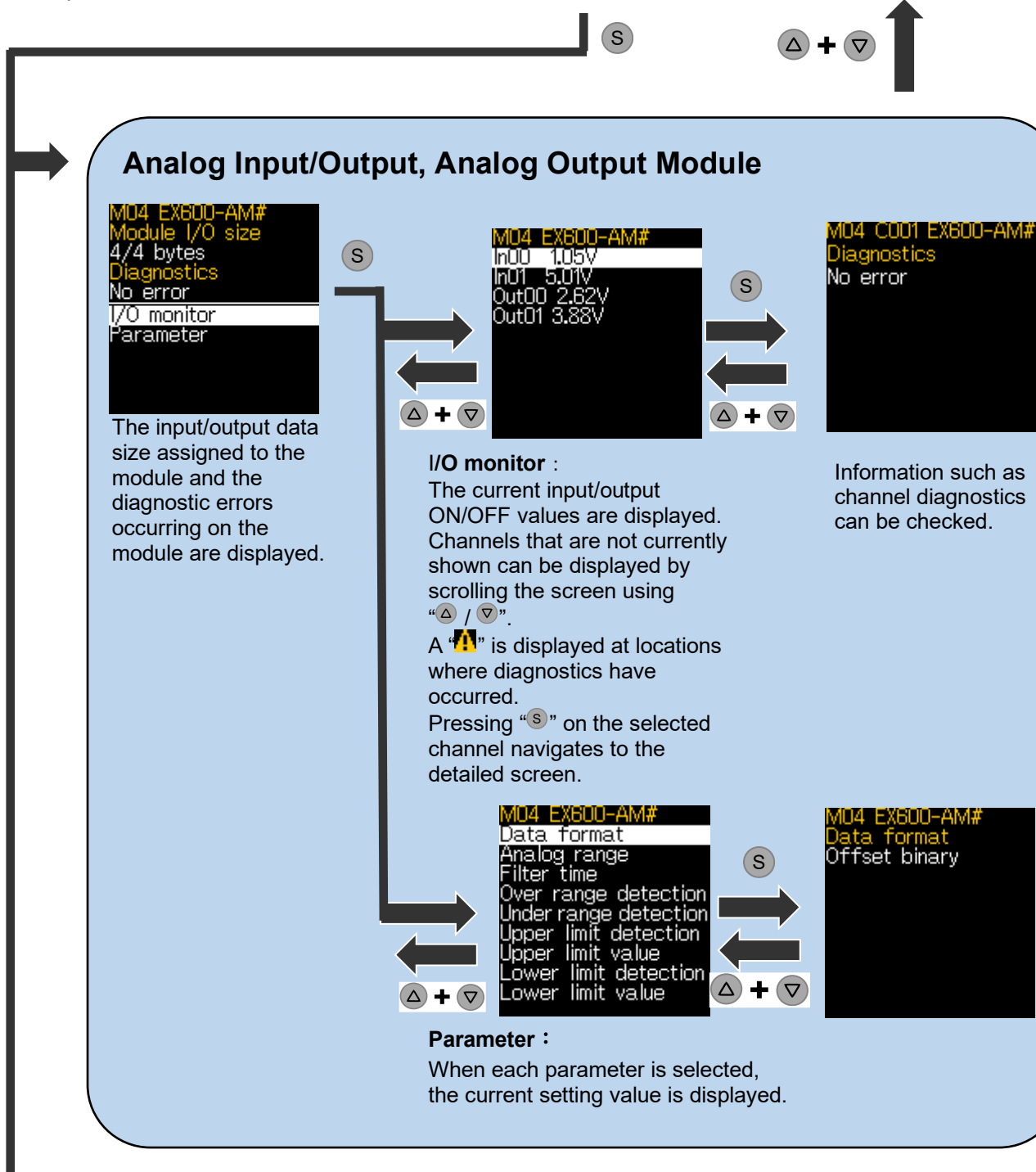
Main menu
Error logs
Module menu
Option

Main menu

Module menu
MD0 EX600-BPN#
MD1 EX600-DX#
MD2 EX600-DY#
MD3 EX600-DX#
MD4 EX600-AM#
MD5 EX600-L#
MD6 EX600-FVP2

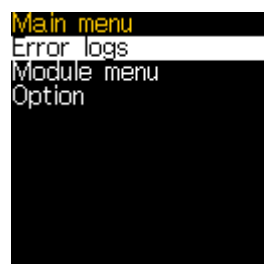
Module menu

Returns to
the Module Menu





Top Screen

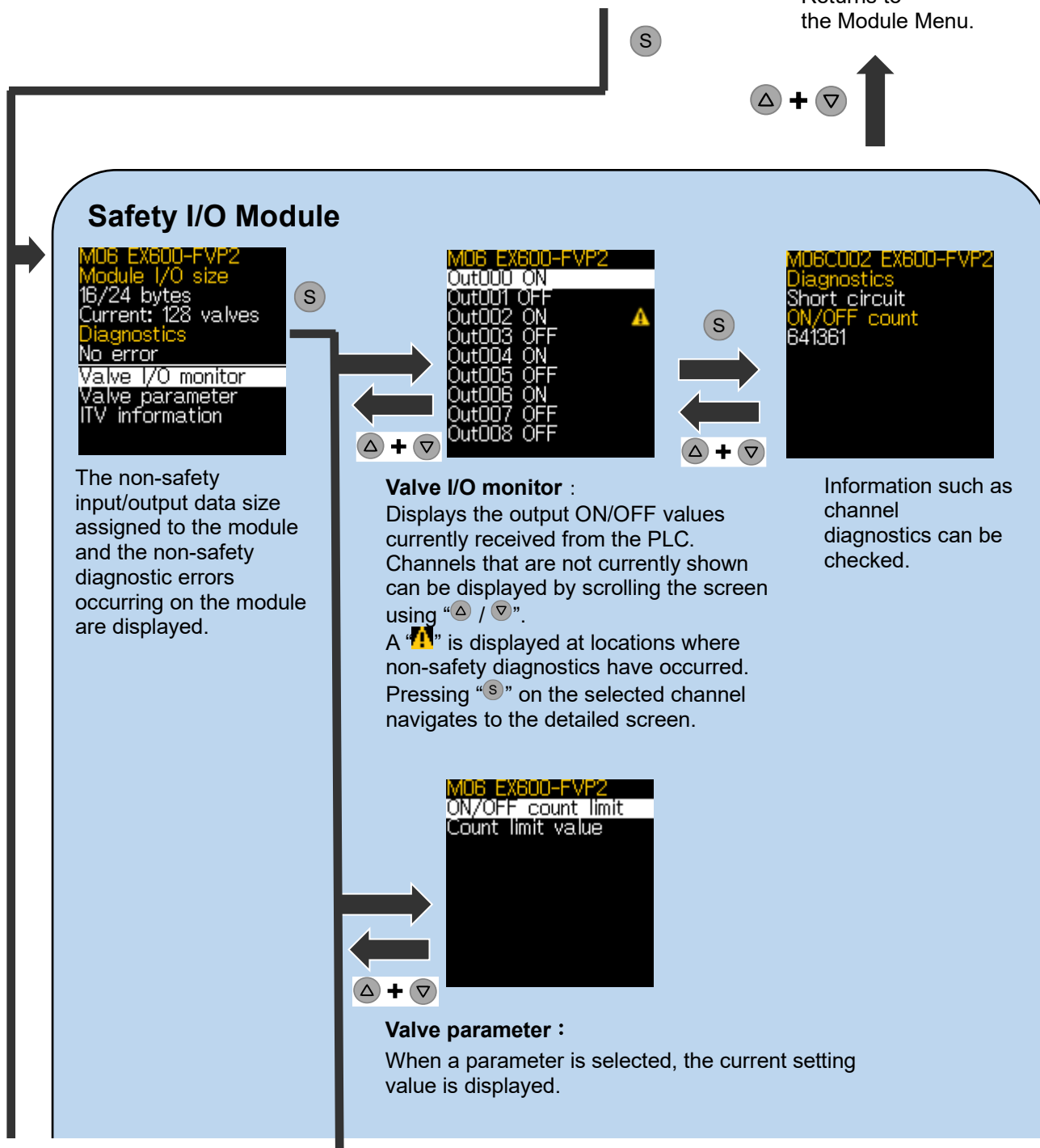
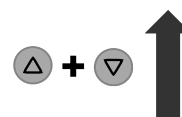


Main menu

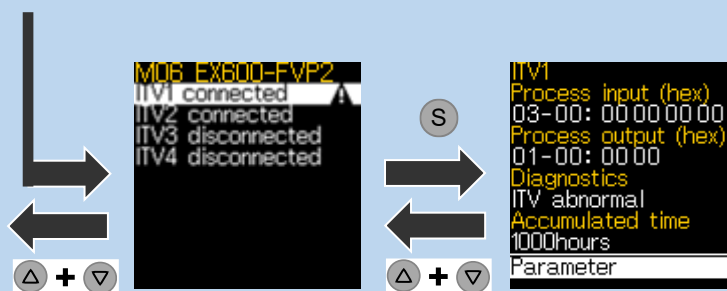


Module menu

Returns to the Module Menu.



Safety I/O Module (Continued)



ITV information :

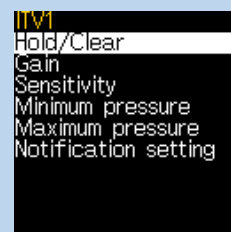
Displays the "ITV connection" status.

A "!" is displayed at locations where non-safety diagnostics have occurred.

When the status is "connected," selecting it and pressing "S" allows you to navigate to the detailed screen.

Process data and diagnostic information can be checked.

Pressing "S" allows you to navigate to the parameter setting screen.



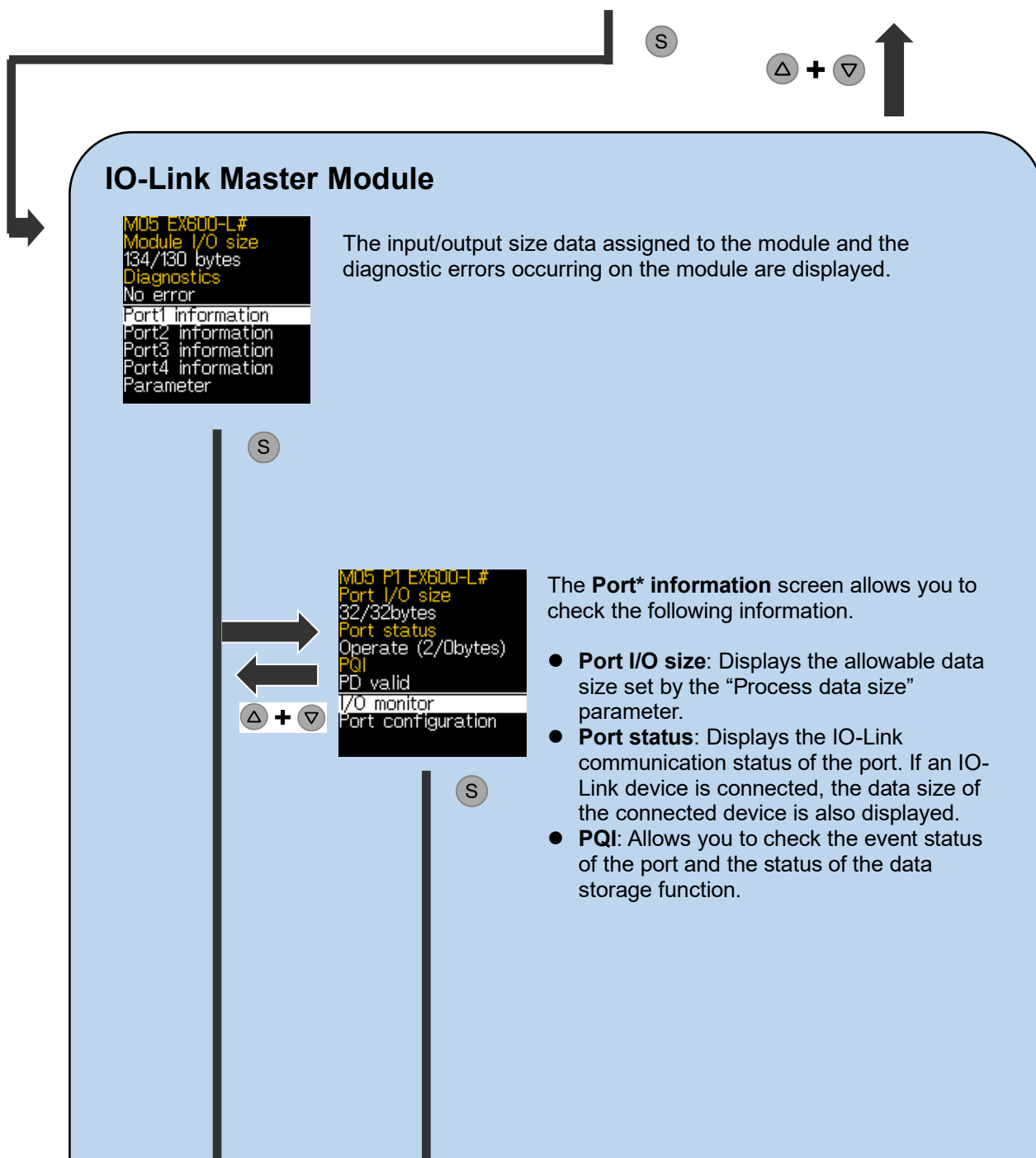
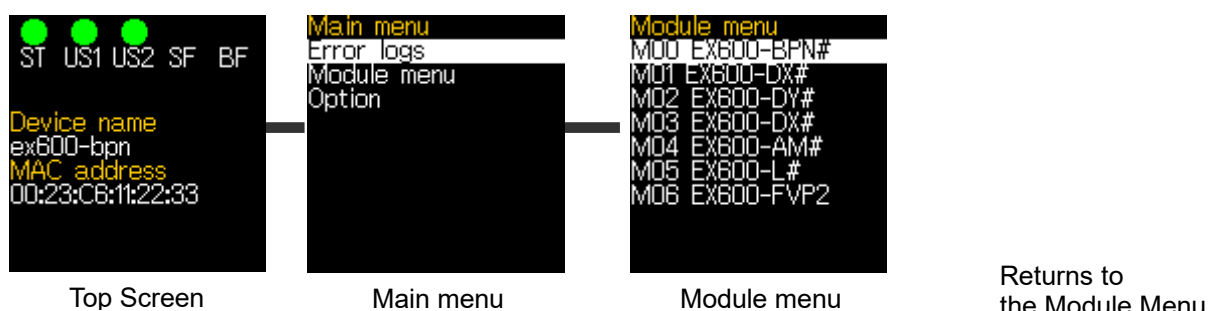
Parameter :

When each parameter is selected, the current setting value is displayed.

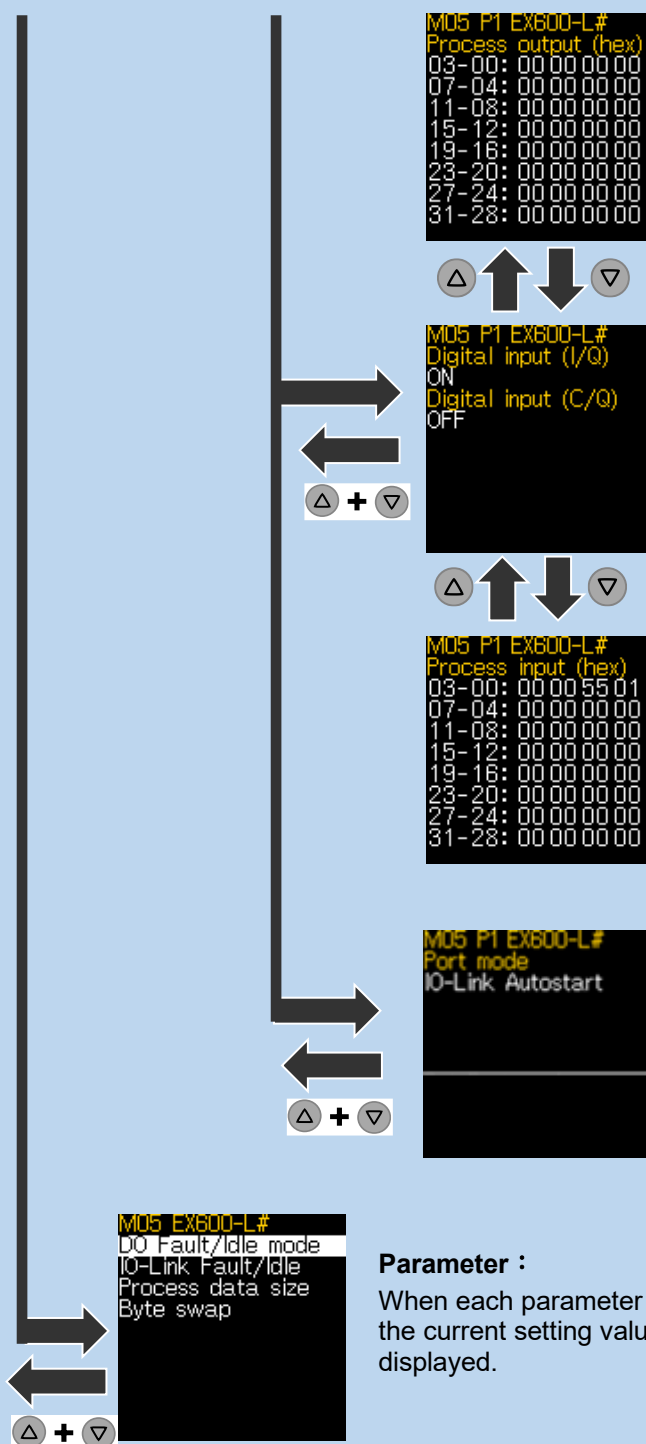


Important Notes

- Safety-related parameter settings, checking diagnostic bits, and checking the current safety input/output status cannot be performed on the LCD display.



IO-Link Master Module (Continued)



I/O Monitor:

Displays the current input/output data values. The display is divided into the Standard I/O Data screen, Input Process Data screen, and Output Process Data screen, and the screens can be switched using “ / ”.

Port configuration :

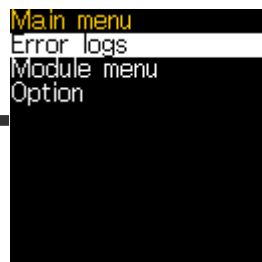
Allows you to check the setting value of “Port mode”.

Parameter :

When each parameter is selected, the current setting value is displayed.



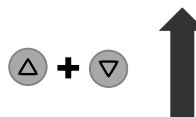
Top Screen



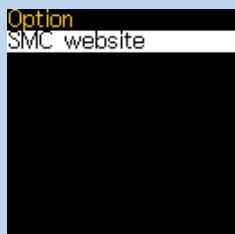
Main menu



Returns to the Main Menu.



Option



SMC website: A QR code for the company website URL shown below is displayed, allowing you to check product information.

<https://api.smcworld.com/smcqr/-/ex600/>

5.5 Specifications

● Specifications Table

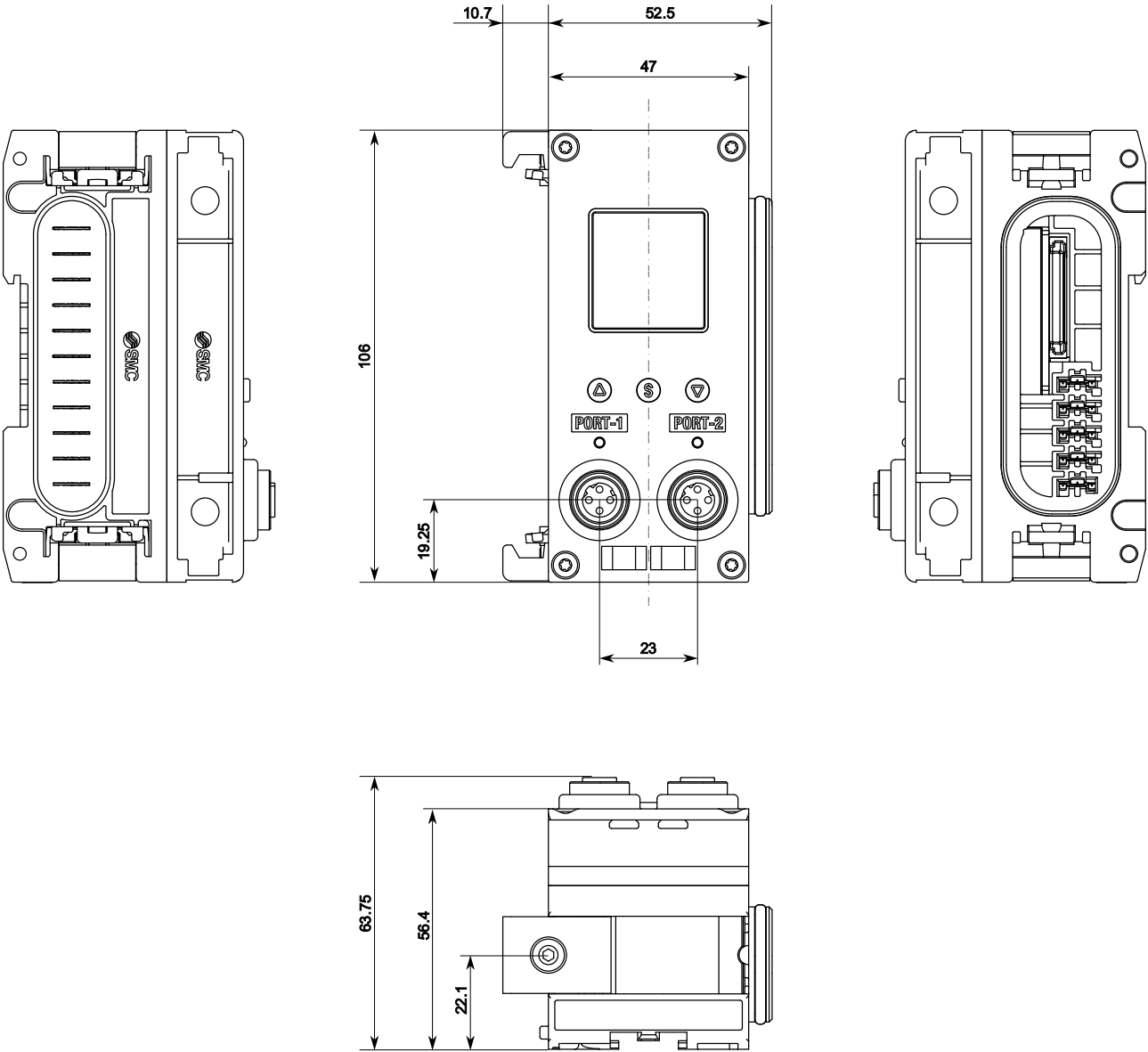
Model		EX600-BPN1
Communication Specifications	Protocol	PROFINET
	Conformance Class	Class C (only for IRT switch function)
	Communication Speed	100 Mbps
	Supported Functions	Fast start up ^{*1)} MRP (Media redundancy protocol) System redundancy S2
	Data Size	Standard Input: Max. 1308 bytes Standard Output: Max. 1308 bytes Safety Input: 12 bytes ^{*2)} Safety Output: 11 bytes ^{*2)}
Number of I/O Modules		Max. 9 D-side modules + Safety I/O Module
Power Supply Specifications	US1 Power Supply (Control / Input)	DC24V +20%/-15%
	Internal Current Consumption (US1)	150 mA or less
	US2 Power Supply (Output)	DC24 V +20%/-15%
	Internal Current Consumption (US2)	10 mA or less
	Internal Protection	Reverse polarity protection built in
Environmental Resistance	Degree of Protection	IP65 / IP67 (when manifold is assembled) ^{*3)}
	Operating Temperature Range	-10~50 °C
	Storage Temperature Range	-20~60 °C
	Operating Humidity Range	35 to 85% RH (no condensation)
	Dielectric Withstand Voltage	AC 500 V for 1 min Between all external terminals and FE
	Insulation Resistance	DC 500 V, 10 MΩ or more Between all external terminals and FE
	Vibration Resistance	10 to 57 Hz: Constant amplitude 0.75 mm p-p 57 to 150 Hz: Constant acceleration 49 m/s ² 2 hours each in X, Y, and Z directions (power OFF)
	Shock Resistance	147 m/s ² , 3 times each in X, Y, and Z directions (power OFF)
Standards		CE / UKCA marking, UL (CSA)
Material		PBT
Mass		310 g

*1) Supported depending on system configuration

*2) Safety data values

*3) When modules are correctly assembled into a manifold

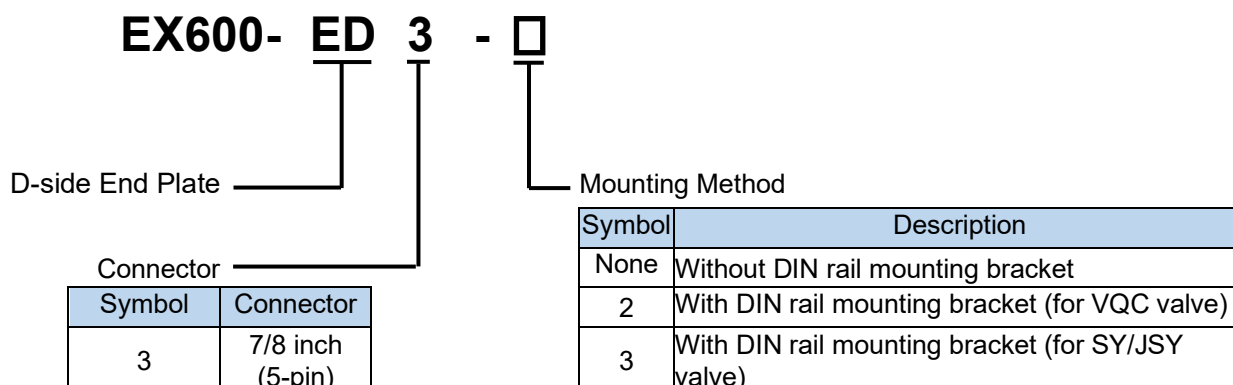
5.6 External Dimensions



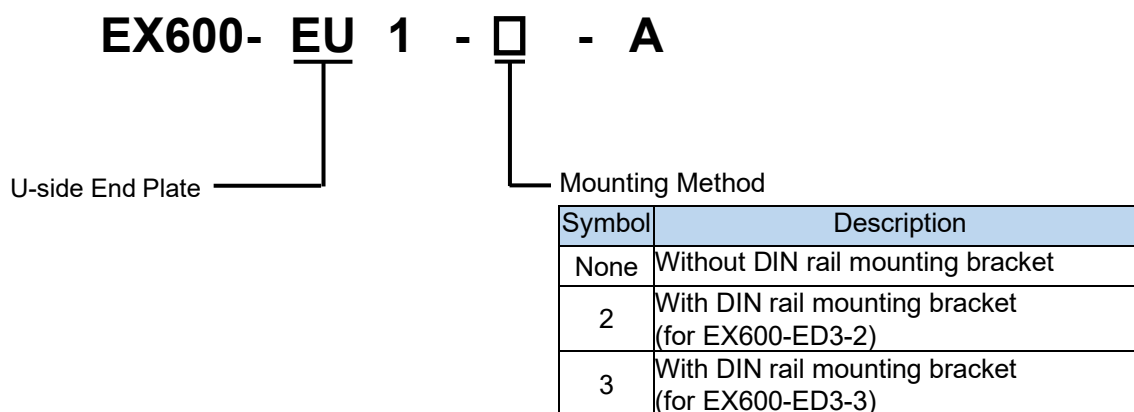
6 End Plate

6.1 Model Indication and Part Number System

6.1.1 End Plate (D-side)



6.1.2 U-side End Plate

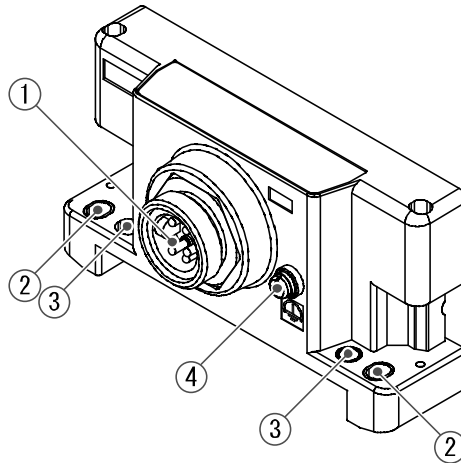


Important Notes

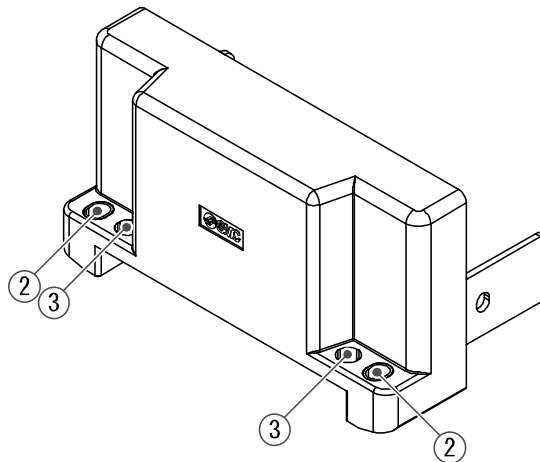
- The EX600 EU1 □ A can be connected only to the EX600 FVP1.

6.2 Names and Functions of Product Components

- EX600-ED3-□



- EX600-EU1-□-A



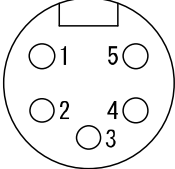
No.	Name	Function
1	Power Supply Connection Port	Supplies power to the unit and input/output devices.
2	Direct Mounting Holes	Used when mounting the unit directly to equipment.
3	DIN Rail Bracket Mounting Holes	Used when assembling as a manifold and mounting on a DIN rail.
4	FE Terminal (M3)	Used for grounding. Ground this terminal to improve noise immunity.

Note

- Use a dedicated grounding point as much as possible, locate it close to the manifold, and keep the grounding distance as short as possible.

6.3 Wiring Method

- Power Supply Connection Port

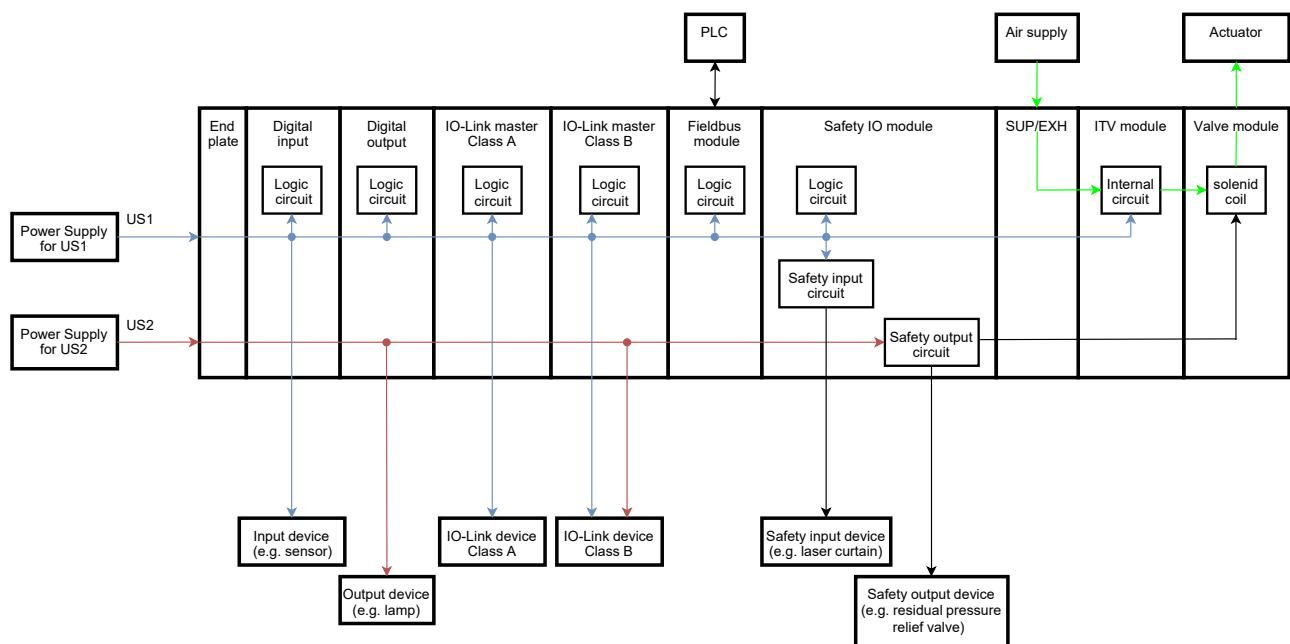
Connector Type: 7/8 inch 5-pin plug	Pin No.	Signal Name
	1	0V_US2 (Output)
	2	0V_US1 (Control / Input)
	3	FE
	4	24V_US1 (Control / Input)
	5	24V_US2 (Output)

6.4 Power Supply System (US1 / US2)

Two power supply systems are provided to the end plate, as described below.

These power supplies are electrically isolated inside the product.

Power name	Description
US1 Power Supply (Control / Input Power Supply)	This power supply is used for control of each module. Within the Safety I/O Module, this power supply is also used to supply the safety input circuits. It also serves as the power supply line for input devices connected to each module and for IO Link devices.
US2 Power Supply (Output Power Supply)	This power supply is used to drive output devices connected to digital and analog output modules. It also serves as the P24 power supply line provided by a Class B IO Link master. Within the Safety I/O Module, this power supply is also used to supply the safety output circuits.



Note

- For detailed block diagrams inside the Safety I/O Module, refer to the Safety I/O Module Safety Manual.

6.5 Specifications

● Specifications Table

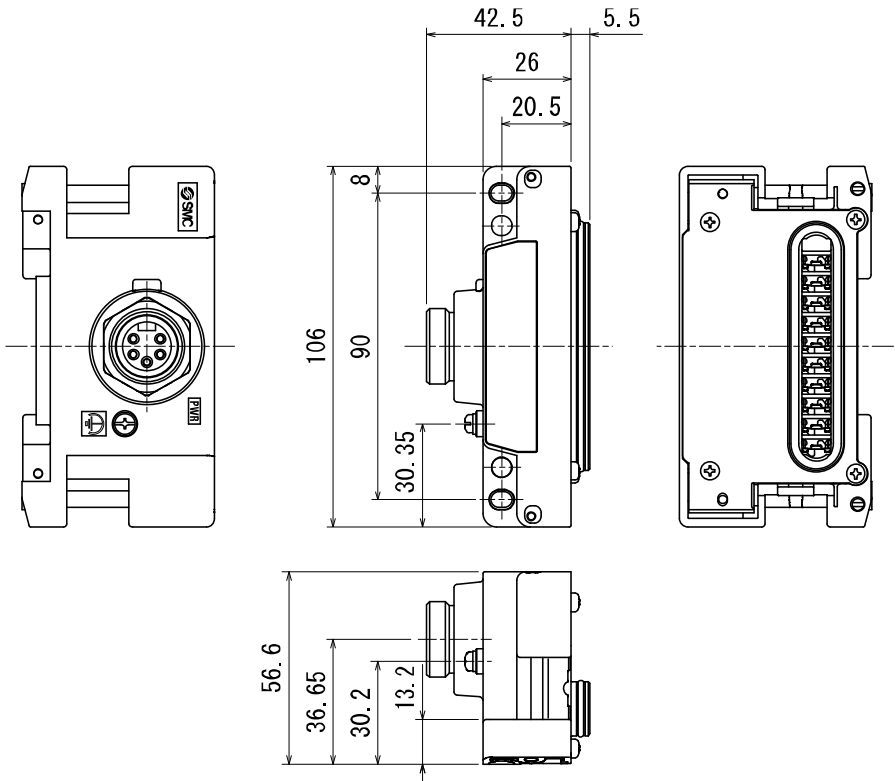
Model		EX600-ED3-□	EX600-EU1-□-A
Power Supply	Power Supply Connector	7/8 inch (5-pin) plug	-
	US1 Power Supply (Control / Input)	DC24V +20%/-15%、8A max.	-
	US2 Power Supply (Output)	DC24V +20%/-15%、8A max.	-
Environmental Resistance	Degree of Protection	IP65 / IP67 (when manifold is assembled) ^{*1)}	
	Operating Temperature Range	-10~50 °C	
	Storage Temperature Range	-20~60 °C	
	Operating Humidity Range	35 to 85 % RH (no condensation)	
	Dielectric Withstand Voltage	AC 500 V for 1 min, between all external terminals and FE	
	Insulation Resistance	DC 500 V, 10 MΩ or more, between all external terminals and FE	
Standards		CE / UKCA marking, UL (CSA)	
Housing Material		PBT	
Mass ^{*2)}		175 g	240g

^{*1)} To ensure the dustproof and waterproof performance (degree of protection), always install waterproof caps on any unused connectors.

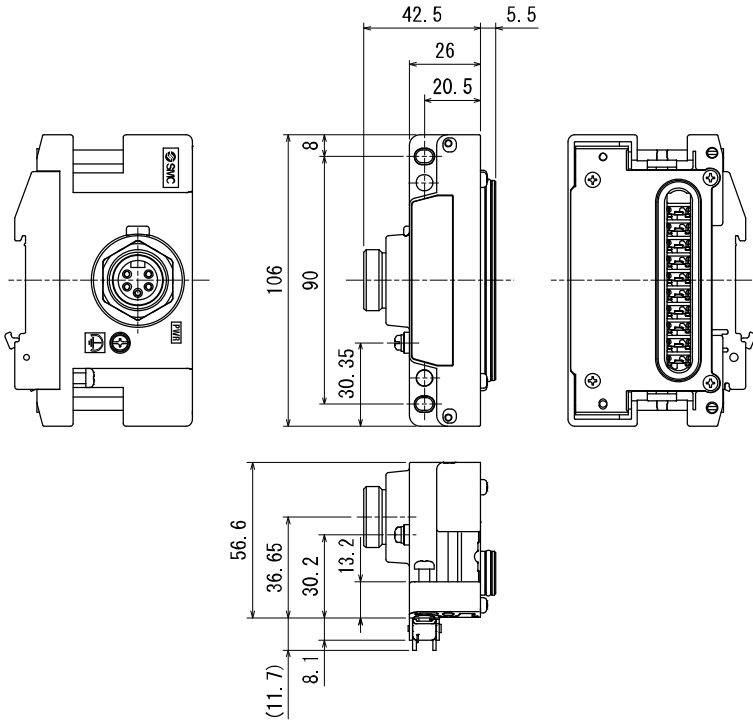
^{*2)} The mass does not include the weight of the DIN rail mounting bracket.

6.6 External Dimensions

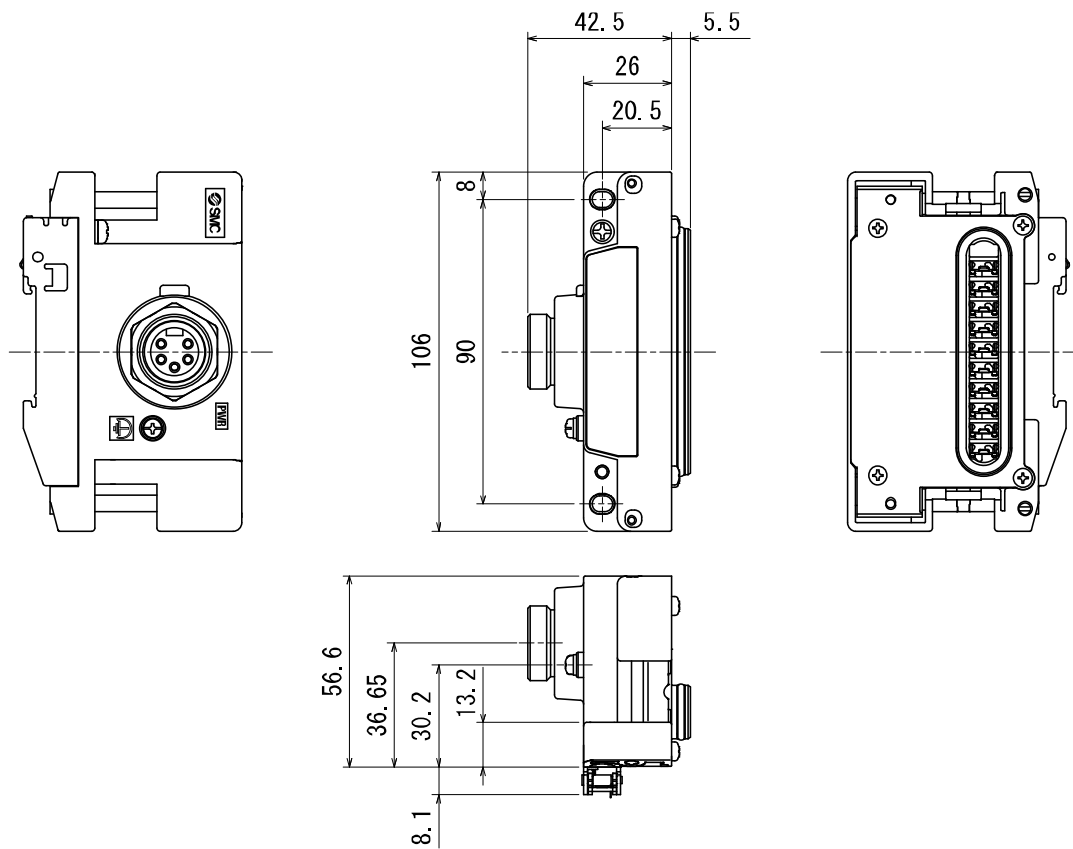
6.6.1 EX600-ED3



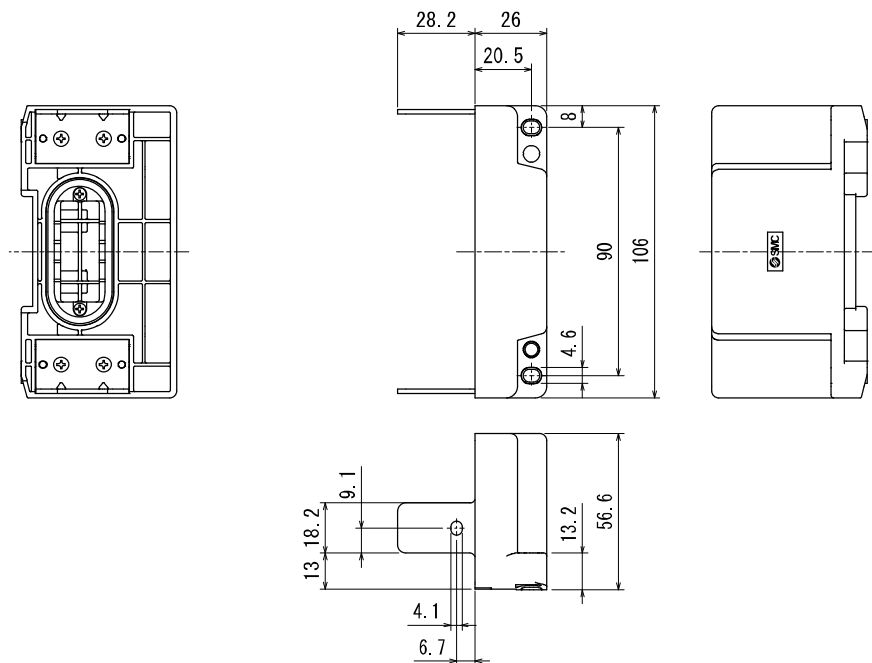
6.6.2 EX600-ED3-2



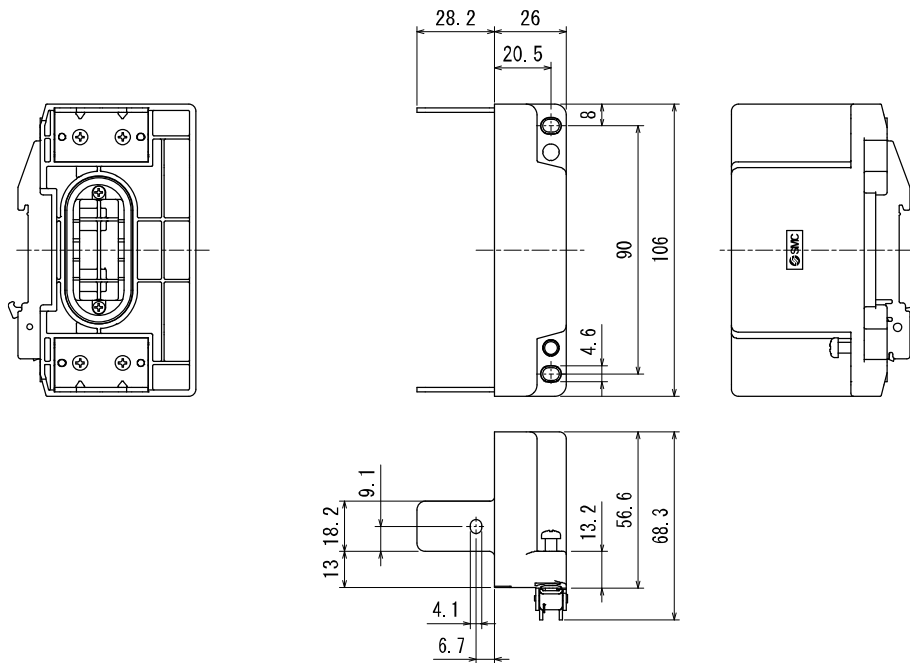
6.6.3 EX600-ED3-3



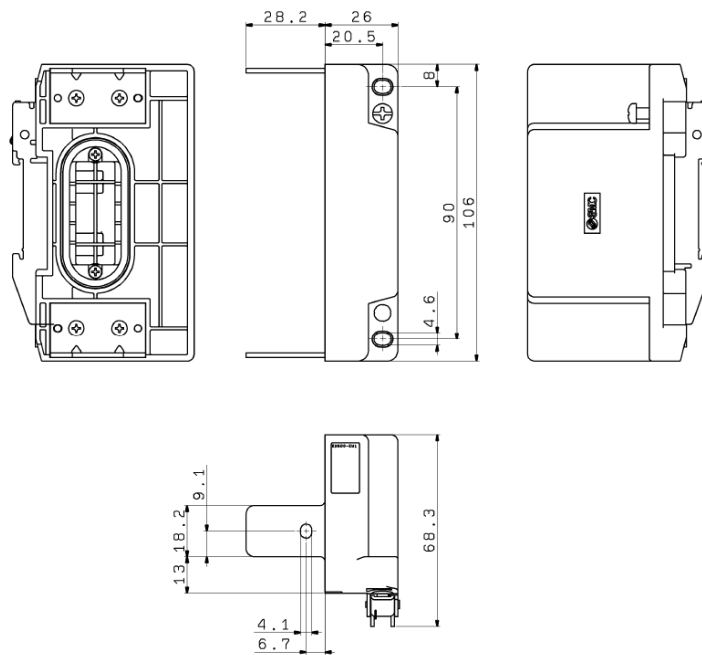
6.6.4 EX600-EU1-A



6.6.5 EX600-EU1-2-A



6.6.6 EX600-EU1-3-A



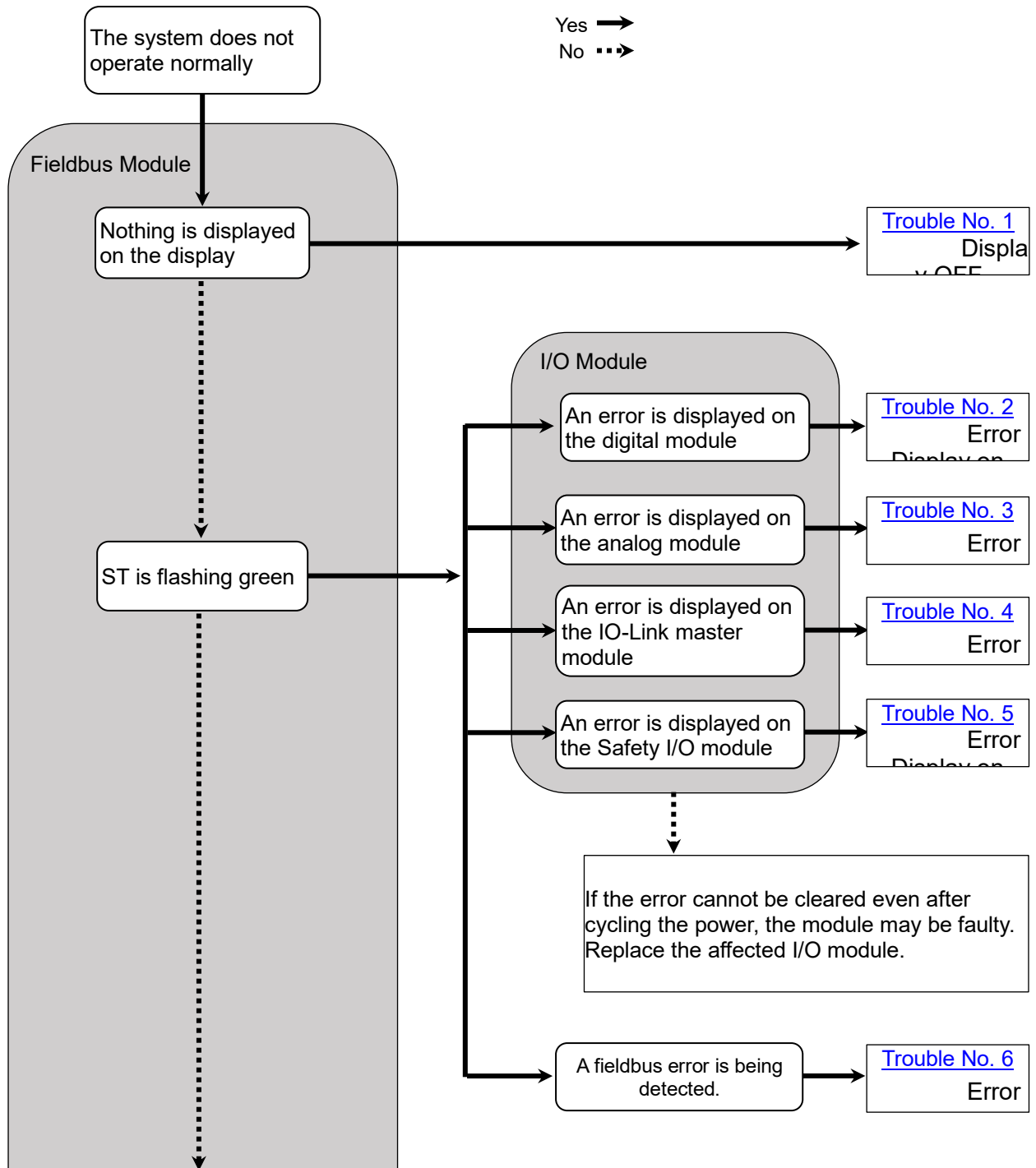
7 Troubleshooting

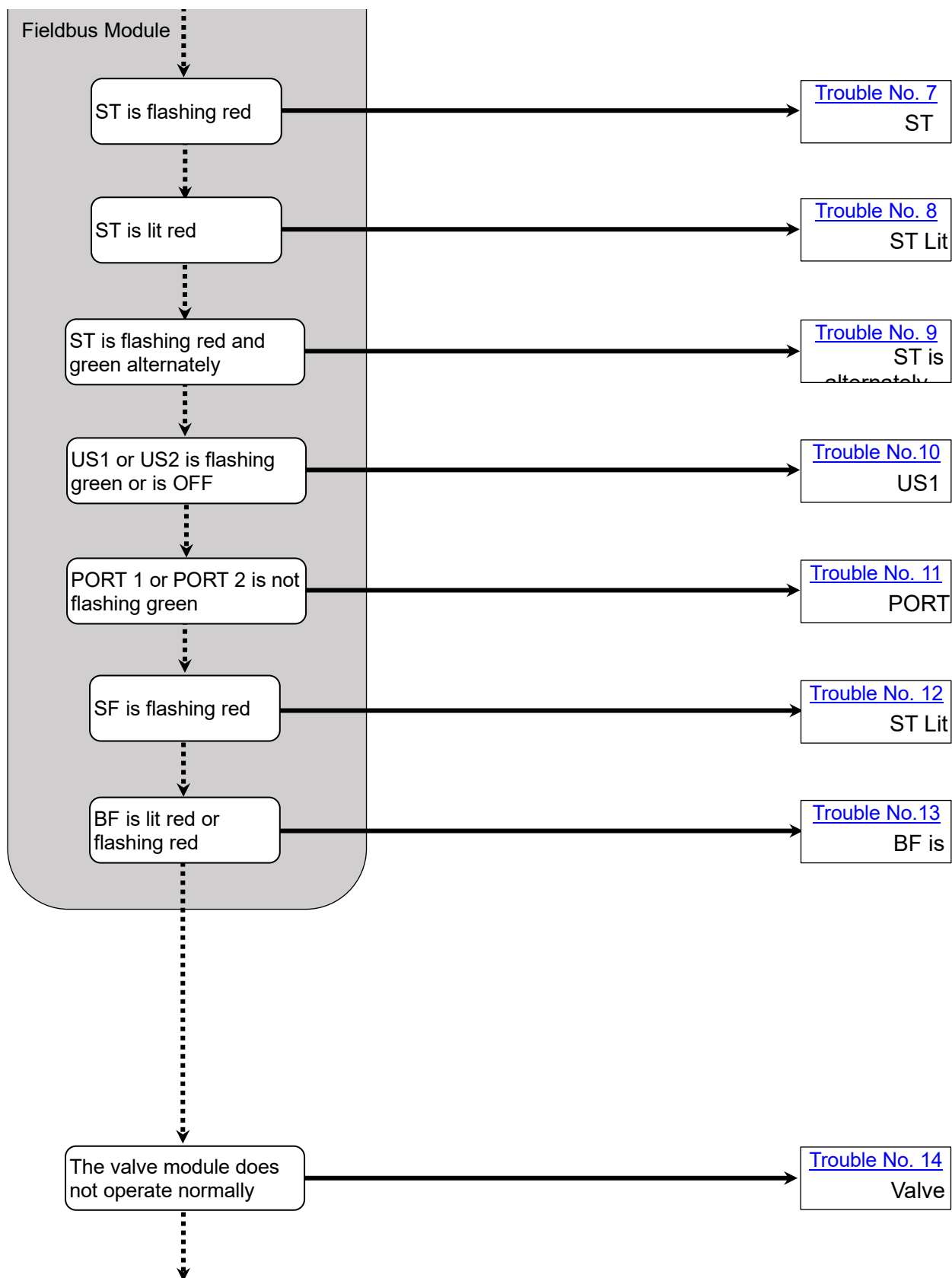
7.1 Troubleshooting Chart

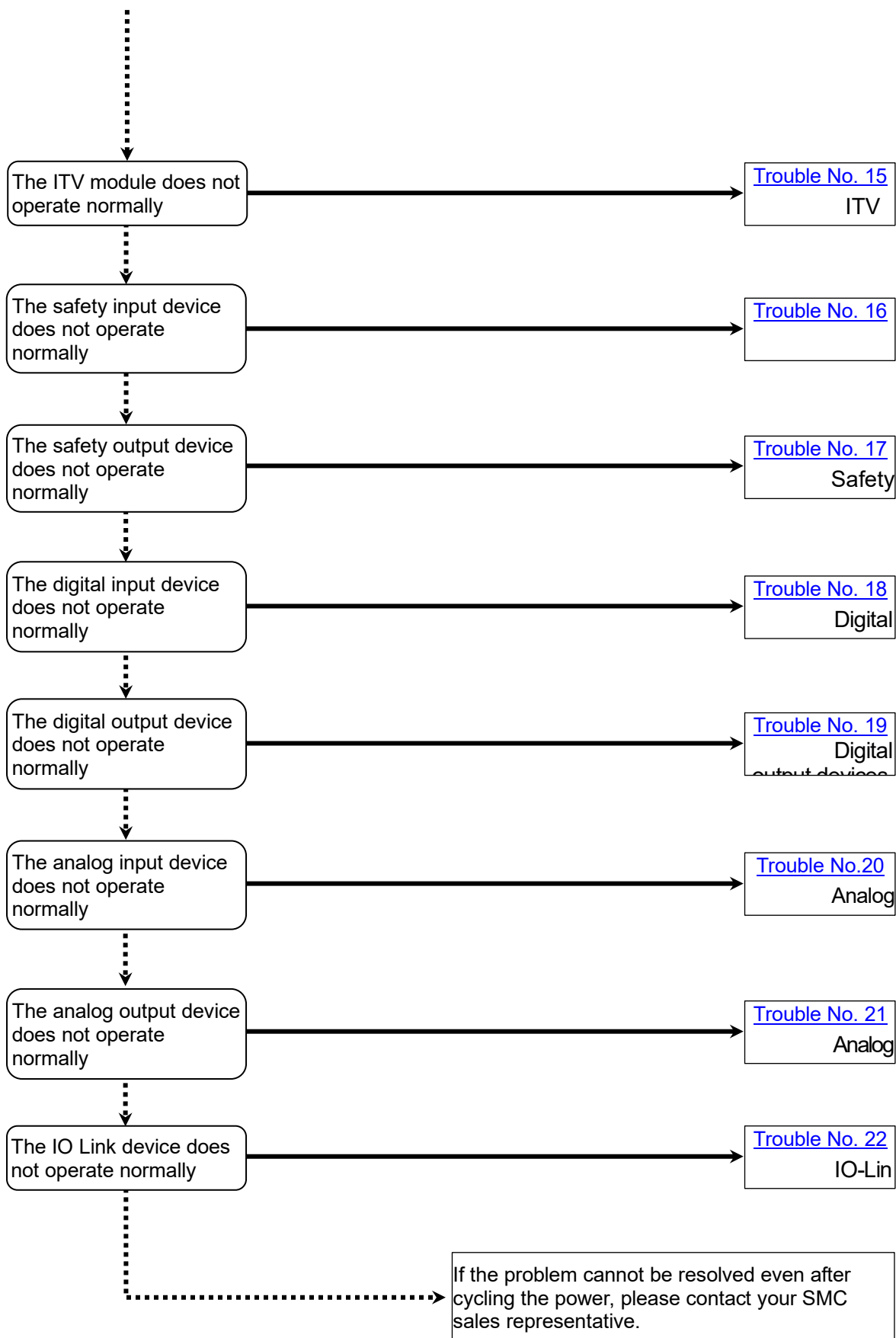
If a malfunction occurs in this fieldbus system device, follow the flowchart below to identify and eliminate the cause of the trouble.

When a problem occurs, refer to the LED indications, diagnostic data, this troubleshooting section, and the setting parameters, and take appropriate corrective actions.

If the problem is not resolved after cycling the power, or if the cause cannot be identified by referring to the troubleshooting chart, contact your SMC sales representative.







7.2 List of Troubleshooting Methods

Trouble No. 1 Display OFF

Part No. EX600-	Symptom	Possible Cause	Investigation and Corrective Action
BPN1	Display is OFF	US1 (control/input) power supply is OFF	Check whether the US1 power supply is turned ON.
		Power cable wiring error or poor connection	Check for incorrect power wiring at the end plate and for any damage to the cables.

Trouble No. 2 Error Display on Digital Module

Part No. EX600-	Symptom	Possible Cause	Investigation and Corrective Action
DXPC DXPD	Red ON	Short circuit of US1 (control/input) power supply	Identify the location where the error has occurred using the LED indications, LCD display, and diagnostic data. After identifying the error location, check the following items. • Check for incorrect wiring or damaged cables. • Check whether the connected input device is operating normally. • Check whether the connected input device is within the specified supply current range of the input module.
	Red Flashing	The ON/OFF operation count of the input device exceeds the set value.	Identify the location where the error has occurred using the LED indications, LCD display, and diagnostic data. For the location where the ON/OFF count exceeds the limit, check the following items. • Execute "Clear ON/OFF count value". • Change the "Count limit value" parameter to a value larger than the current value. • Change the "ON/OFF count limit" parameter to "Disable". • Check whether input chattering is occurring due to loose connectors or damaged cables. • Check whether the connected input device is configured to switch ON/OFF at a high frequency.
	All LEDs are flashing red and green alternately	A memory error has occurred in the digital input module.	Cycle the power of the manifold. If the problem is not resolved after cycling the power, turn the power OFF and replace the module where the error has occurred.

Part No. EX600-	Symptom	Possible Cause	Investigation and Corrective Action
DYPB	Red ON	Output is short-circuited	Identify the location where the error has occurred using the LED indications, LCD display, and diagnostic data. Check the following items at the location where the short circuit has been detected. • Check for incorrect wiring or damaged cables. • Check whether the connected output load is operating normally. • Check whether the output load is within the specified maximum load current of the output module.
	Red Flashing	The ON/OFF operation count of the output exceeds the set value.	Identify the location where the error has occurred using the LED indications, LCD display, and diagnostic data. For the location where the ON/OFF count exceeds the limit, check the following items. • Execute "Clear ON/OFF count value". • Change the "Count limit value" parameter to a value larger than the current value. • Change the "ON/OFF count limit" parameter to "Disable".
		Output is open-circuited (disconnected).	Identify the location where the error has occurred using the LED indications, LCD display, and diagnostic data. Check the following items at the location where the open circuit has been detected. • Check for loose connectors, incorrect wiring, or damaged cables. • Check whether the connected output load is disconnected. • Change the "Open circuit" parameter to "Disable".
	All LEDs Flashing Red and Green Alternately	A memory error has occurred in the digital output module.	Cycle the power of the manifold. If the problem is not resolved after cycling the power, turn the power OFF and replace the module where the error has occurred.

Trouble No. 3 Error Display on Analog Module

Part No. EX600-	Symptom	Possible Cause	Investigation and Corrective Action
AYA	Red ON	Short circuit of the analog output device power supply	Identify the location where the error has occurred using the LED indications, LCD display, and diagnostic data. Check the following items at the location where the short circuit has been detected. • Check for incorrect wiring or damaged cables. • Check whether the connected output load is operating normally. • Check whether the output load is within the specified maximum load current of the output module.
	Red Flashing	Analog output value (user-set value) exceeds the upper or lower limit	Identify the location where the error has occurred using the LED indications, LCD display, and diagnostic data. If the output value of the analog output module exceeds the user-set upper or lower limit, adjust the output value so that it falls within the user-set range. Alternatively, disable "Upper/Lower limit detection" function.
	All LEDs Flashing Red and Green Alternately	A memory error has occurred in the analog output module	Cycle the power of the manifold. If the problem is not resolved after cycling the power, turn the power OFF and replace the module where the error has occurred.

Part No. EX600-	Symptom	Possible Cause	Investigation and Corrective Action
AMB	Red ON	Short circuit of the analog input or output device power supply	Identify the location where the error has occurred using the LED indications, LCD display, and diagnostic data. Check the following items at the location where the short circuit has been detected. • Check for incorrect wiring or damaged cables. • Check whether the connected output load is operating normally. • Check whether the output load is within the specified maximum load current of the output module.
	"0" and "1" Lit Red	Analog input value exceeds the upper limit during current range setting	If the analog input module range is set to current input, check the following items. • Ensure that the input value from the analog input device does not exceed the upper limit. • Voltage is being input from the analog input device. Match the range of the analog input/output module with that of the analog input device.
	Red Flashing	• Range upper/lower limit exceeded • Analog input value (user-set) or analog output value (user-set) exceeds the upper or lower limit	• If the input value from the analog input device exceeds the range upper or lower limit, select an appropriate range so that the input value falls within the allowable range. Alternatively, disable "Upper/Lower limit detection" function. • If the input/output value from the analog input or output device exceeds the user-set upper or lower limit, adjust the input/output value so that it falls within the user-set range. Alternatively, disable "Upper/Lower limit detection" function.
	All LEDs Flashing Red and Green Alternately	A memory error has occurred in the analog input/output module	Cycle the power of the manifold. If the problem is not resolved after cycling the power, turn the power OFF and replace the module where the error has occurred.

Trouble No. 4 Error Display on IO-Link Master Module

Part No. EX600-	Symptom	Possible Cause	Investigation and Corrective Action
L*B1	C/Q: Red ON	Short circuit of the L+ power supply	Identify the location where the error has occurred using the LED indications, LCD display, and diagnostic data. Check the following items at the location where the short circuit has been detected. • Check for incorrect wiring or damaged cables. • Check whether the connected IO-Link device is operating normally. • Check whether the L+ or P24 power supply specification of the connected IO-Link device is within the maximum supply current specification of the IO-Link master module. • If the C/Q line is used as a digital output, check whether the load connected to the C/Q terminal is within the maximum load current specification of the IO-Link master module.
		C/Q Terminal Short-Circuited	
	P24: Red ON	Short circuit of the P24 power supply	
	All LEDs Flashing Red and Green Alternately	A memory error has occurred in the IO-Link master module	Cycle the power of the manifold. If the problem is not resolved after cycling the power, turn the power OFF and replace the module where the error has occurred.

Trouble No. 5 Error Display on Safety I/O Module

Part No. EX600-	Symptom	Possible Cause	Investigation and Corrective Action
FVP*	One of the following error indications - ST: Red ON - FDI: Indication other than Green ON - FDO: Indication other than Green ON - INx: Red ON - Zx: Red ON	A safety-related error has occurred.	Safety-related errors cannot be identified via the LCD display or diagnostic data. Identify the error by following the troubleshooting procedures described in the Safety I/O Module Safety Manual.
	ST: Flashing Red and Green Alternately	The valve is short-circuited.	Identify the location where the error has occurred using the LED indications, LCD display, and diagnostic data. After identifying the short-circuited location, refer to the operation manual of the valve in use and inspect or replace the valve as necessary. The short-circuit diagnostic will not be cleared while a valve output command exists at the affected location. Clear it by one of the following methods - Turn OFF the valve output command at the affected location. - Turn OFF all safety outputs. - Restart the module.
		The ITV power supply or communication line is short-circuited.	Identify the error location by checking the 7-segment display on the ITV module or the LCD display on the fieldbus module. The ITV power supply is shared across the entire manifold. After identifying the short-circuited location, refer to the operation manual of the ITV module in use and inspect or replace the ITV module as necessary.
		The ON/OFF operation count of the valve exceeds the set value.	Identify the location where the error has occurred using the LED indications, LCD display, and diagnostic data. For the location where the ON/OFF count has exceeded the limit, check the following items - Execute "Clear ON/OFF count value". - Change the "Count limit value" parameter to a value larger than the current value. - Change the "ON/OFF count limit" parameter to "Disable".

Part No. EX600-	Symptom	Possible Cause	Investigation and Corrective Action
FVP*	ST: Flashing Red and Green Alternately	A disconnection has occurred between the Safety I/O Module and the valve modules, or the number of connected valve modules has changed.	Identify the location where the error has occurred using the LED indications, LCD display, and diagnostic data. If the error "Changed valves" (diagnostic data Byte 2, bit 0) is detected, cycle the power of the manifold. If the problem is not resolved after cycling the power, turn the power OFF and reassemble the manifold correctly according to the valve module operation manual. Note : You can check the number of currently connected valve modules in the Module Menu on the LCD display (page 36).
		Disconnection between the Safety I/O Module and the ITV Module	Identify the error location using the LED indications, LCD display, and diagnostic data. After identifying the disconnection point, refer to the operation manual of the ITV module in use and inspect or replace the ITV module. If the disconnection condition does not improve even after replacing the ITV module, turn the power OFF and reassemble the manifold correctly according to the ITV module operation manual. Note : You can check whether the ITV module is disconnected by using the PLC engineering tool (TIA Portal) or by checking the "ITV information" screen on the LCD display (page 38).
		An abnormal diagnostic has occurred on the ITV module	Identify the error location using the 7-segment display on the ITV module, the LCD display on the fieldbus module, and diagnostic data. After identifying the location where the abnormal diagnostic occurred, refer to the operation manual of the ITV module in use and inspect or replace the ITV module.
		A memory error has occurred in the Safety I/O Module	Cycle the power of the manifold. If the problem is not resolved after cycling the power, turn the power OFF and replace the module where the error has occurred.

Trouble No. 6 Error Detection on Fieldbus Module

Part No. EX600-	Symptom	Possible Cause	Investigation and Corrective Action
BPN1	ST: Green Flashing	Live insertion/removal of a module has been performed.	Identify the location where the error has occurred using the LCD display and diagnostic data. If live insertion/removal was performed on the Safety I/O module, cycle the power of the manifold.
		A memory error has occurred in the fieldbus module.	Identify the error location using the LCD display and diagnostic data. Cycle the power of the manifold. If the problem is not resolved, turn the power OFF and replace the module where the error has occurred.

Trouble No. 7 ST Flashing Red

Symptom	Possible Cause	Investigation and Corrective Action
ST: Flashing Red	The number of connected I/O modules exceeds the specified limit.	Turn the power OFF and reduce the number of connected I/O modules according to Section 3 "Assembly" (page 14). Refer to Section 5.5 "Specifications" (page 42) for the allowable number of modules.
	The input/output data size exceeds the specified limit.	Review the following items and reduce the input/output data size. • Change the "Process data size" parameter. • Reduce the number of connected I/O modules.

Trouble No. 8 ST Lit Red

Symptom	Possible Cause	Investigation and Corrective Action
ST: Red ON	Internal safety communication has stopped.	Cycle the power of the manifold. If the problem is not resolved after cycling the power, internal safety communication within the manifold may have failed due to one of the following causes. • The Safety I/O Module is in an unrecoverable error state. • The internal signal path of the fieldbus module is damaged. Replace the Safety I/O Module and check whether the problem is resolved. If replacing the Safety I/O Module does not resolve the problem, replace the fieldbus module and check again.
	Fieldbus module initialization error	Cycle the power of the manifold. If the problem is still not resolved after cycling the power, turn the power OFF and replace the fieldbus module.

Trouble No. 9 ST is alternately flashing red and green.

Symptom	Possible Cause	Investigation and Corrective Action
ST: Flashing Red and Green Alternately	Poor connection between I/O modules	Turn the power OFF and, referring to Section 3 "Assembly" (page 14) and Section 4 "Mounting and Installation" (page 17), check the following manifold conditions. • Check whether the module connection connectors are damaged or contaminated with foreign matter. • Check whether the joints are loose and verify that they are tightened to the specified torque. • Check whether the intermediate reinforcement brackets are properly installed. • Check whether installation or mounting applies stress to the module connection connectors. If the problem is not resolved after checking the manifold condition, replace the modules one by one.
	I/O module failure	Use the LCD display indications and diagnostic data to identify the module where the error has occurred. After identifying the faulty module, turn the power OFF and replace the affected module.

Trouble No.10 US1 or US2 is flashing green or turned OFF

Symptom	Possible Cause	Investigation and Corrective Action
US1: Green Flashing	The voltage of the US1 (control/input) power supply is low.	• Supply DC 24 V to the US1 power supply. • Disable the "US1 monitoring" parameter.
US1: OFF	The voltage of the US1 (control/input) power supply is low.	Supply DC 24 V to the US1 power supply.
US2: OFF	The voltage of the US2 (output) power supply is low.	Supply DC 24 V to the US2 power supply.

Trouble No. 11 PORT1 or PORT2 LED Is Not Flashing Green

Symptom	Possible Cause	Investigation and Corrective Action
PORT1 or PORT2: OFF	Link is not established.	Check the following items. • Check whether the power of the upstream PROFINET device is turned ON. • Check the PORT1 and PORT2 communication cables for loose connectors or broken wiring.
PORT1 or PORT2: Green ON	Link is established, but PROFINET data is not being received.	Check the following items. • Check the PLC status and set the PLC to RUN mode. • Check for loose connectors or broken wiring.

Trouble No. 12 ST Lit Red

Symptom	Possible Cause	Investigation and Corrective Action
SF: Red ON	A diagnostic error has been detected on the manifold.	Check the indications on each module. Based on the displayed information, refer to Troubleshooting No. 2 through No. 10 and take the appropriate corrective actions.

Trouble No.13 BF is flashing red or lit red

Symptom	Possible Cause	Investigation and Corrective Action
BF: Flashing Red	Configuration data mismatch	• Check the PLC configuration settings and the actual system configuration, and make sure they match. • Turn the power OFF and, referring to the manifold valve operation manual, reassemble the supply/exhaust block and manifold block correctly.
BF: Red ON	PROFINET communication error	Check the following items. • Check whether the PLC power is turned OFF. • Check for loose connectors or broken wiring. • Check whether the PLC or the fieldbus module is faulty. • Check whether the Device Name set in the PLC matches that of the fieldbus module.

Trouble No. 14 Valve Modules Connected to the Safety I/O Module Do Not Operate Normally

Symptom	Possible Cause	Investigation and Corrective Action
Abnormal valve operation	The PLC settings are incorrect.	Check the PLC configuration and verify that the Safety I/O Module settings are correct. For details, refer to Section 11 "Hardware Configuration" (page 95).
	Safety parameters are not set correctly.	Check whether the ST, FDI, and FDO LEDs of the Safety I/O Module are lit green. If they are not lit green, refer to the Safety I/O Module Safety Manual and set valid safety parameters.
	The Safety I/O Module is in a safe state.	Check whether the ST and FDO LEDs of the Safety I/O Module are lit green. If they are not lit green, refer to the Safety I/O Module Safety Manual, eliminate the cause of the diagnostic error, and then perform an error reset.
	Abnormal voltage of the US2 (output) power supply.	Check the safety input data of the Safety I/O Module and verify whether any diagnostics related to power supply abnormalities have been detected. If a diagnostic is detected, supply a voltage within the specified range to the US2 power supply and perform an error reset. If the power supply rise time is slow, a diagnostic may be detected before the voltage fully rises. If the problem is not resolved after checking the voltage, turn the power OFF and replace the Safety I/O Module.
	Safety output for the valve manifold is not ON.	Check the address assignment and control program to confirm that the safety output for the valves is ON.
	The PLC is not in RUN mode.	Check the PLC status and set the PLC to RUN mode.
	Valve polarity mismatch.	Check whether the polarity of the valve in use (plus common / minus common) matches the valve output polarity of the Safety I/O Module. Refer to the specifications of the Safety I/O Module and the valve for polarity information.
	Incorrect address assignment in the PLC control program.	Monitor the PLC status and check whether the address assignment and control program for the valve output signals are correct.
	Poor connection between the Safety I/O Module and the manifold valves.	Check the following items and verify that there are no issues with the connection between the Safety I/O Module and the manifold valves. - Check whether there is any looseness in the screws securing the valve plate. - Check whether the connector between the Safety I/O Module and the supply/exhaust block is damaged, deformed, or otherwise abnormal.
	The number of connected valve modules exceeds the specification.	Check the specifications of the Safety I/O Module and ensure that the number of connected valve modules does not exceed the specified limit.
	Valve failure or non-electrical issues.	Replace the valve and check its operation. Alternatively, refer to the valve troubleshooting procedures.
	Safety I/O Module failure.	Turn the power OFF, replace the Safety I/O Module, then turn the power ON again and check the operation.

Trouble No. 15 ITV Module Connected to the Safety I/O Module Does Not Operate Normally

Symptom	Possible Cause	Investigation and Corrective Action
Abnormal operation of the ITV module	Parameter settings outside the allowable range	Change the parameters so that the difference between “Maximum pressure” and “Minimum pressure” is 410 or greater.
	Abnormal voltage of the US1 (control/input) power supply	Supply a voltage within the specified range to the US1 power supply.
	Incorrect address assignment in the PLC control program	Monitor the PLC status and verify that the output signal address assignment, endianness, and control program are correct.
	The PLC is not in RUN mode	Check the PLC status and set the PLC to RUN mode.
	Poor connection between the Safety I/O Module and the ITV Module	Check the connection status using the PLC engineering tool (TIA Portal) or the “ITV information” screen on the LCD display (page 38). If any ITV module is in the “disconnect” status, check the following items to verify that there are no issues with the connection between the Safety I/O Module and the ITV module. • Check whether the screws securing the valve plate are loose. • Check whether the connector between the Safety I/O Module and the supply/exhaust block is damaged or deformed. • Check whether the ITV module is correctly installed.
	An abnormal diagnostic has occurred on the ITV module	Refer to the operation manual of the ITV module in use and inspect or replace the ITV module.
	The number of connected ITV modules exceeds the specification	Refer to the specifications of the Safety I/O Module and reduce the number of connected ITV modules if it exceeds the specified limit.
	ITV module failure or non-electrical issues	Replace the ITV module and check its operation. Alternatively, refer to the troubleshooting section of the ITV module operation manual.
	Safety I/O Module failure	Turn the power OFF, replace the Safety I/O Module, then turn the power ON again and check the operation.

Trouble No. 16 Safety Input Devices Connected to the Safety I/O Module Do Not Operate Normally

Symptom	Possible Cause	Investigation and Corrective Action
Abnormal operation of safety input devices	The PLC settings are incorrect.	Check the PLC configuration and verify that the Safety I/O Module settings are correct. For details, refer to Section 11 "Hardware Configuration" (page 95).
	Safety parameters are not set correctly.	Check whether the ST, FDI, and FDO LEDs of the Safety I/O Module are lit green. If they are not lit green, refer to the Safety I/O Module Safety Manual and set valid safety parameters. Wiring methods and input ON conditions vary depending on the safety parameter settings; set the parameters appropriately.
	The Safety I/O Module is in a safe state.	Check whether the FDI LED of the Safety I/O Module is lit green. If it is not lit green, refer to the Safety I/O Module Safety Manual, eliminate the cause of the diagnostic error, and perform an error reset.
	Abnormal voltage of the US1 (control/input) power supply.	Check the safety input data of the Safety I/O Module and verify whether diagnostics related to power supply abnormalities have been detected. If diagnostics are detected, supply a voltage within the specified range to the US1 power supply and perform an error reset. If the power supply rise time is slow, diagnostics may be detected before the voltage fully rises. Also check the power supply voltage range of the safety input device and ensure that the supplied voltage is within the specified range. If the problem is not resolved after checking the voltage, turn the power OFF and replace the Safety I/O Module.
	The PLC is not in RUN mode.	Check the PLC status and set the PLC to RUN mode.
	Polarity mismatch of the safety input device.	Check whether the polarity (NPN / PNP) of the safety input device matches the input polarity of the Safety I/O Module. Refer to the specifications of the Safety I/O Module and the manual of the safety input device for polarity information.
	Incorrect address assignment in the PLC control program.	Monitor the PLC status and verify that the address assignment and control program for the safety inputs are correct.
	Wiring or connection failure.	Check for loose connectors, incorrect wiring, or damaged cables at the locations where the safety input devices are not operating.
	Failure of the safety input device.	Replace the connected safety input device.
	Safety I/O Module failure.	Turn the power OFF, replace the Safety I/O Module, then turn the power ON again and check the operation.

Trouble No. 17 Safety Output Devices Connected to the Safety I/O Module Do Not Operate

Symptom	Possible Cause	Investigation and Corrective Action
Abnormal operation of safety output devices	The PLC settings are incorrect.	Check the PLC configuration and verify that the Safety I/O Module settings are correct. For details, refer to Section 11 "Hardware Configuration" (page 95).
	Safety parameters are not set correctly.	Check whether the ST, FDI, and FDO LEDs of the Safety I/O Module are lit green. If they are not lit green, refer to the Safety I/O Module Safety Manual and set valid safety parameters.
	The Safety I/O Module is in a safe state.	Check whether the FDO LED of the Safety I/O Module is lit green. If it is not lit green, refer to the Safety I/O Module Safety Manual, eliminate the cause of the diagnostic error, and then perform an error reset.
	Abnormal voltage of the US2 (output) power supply.	Check the safety input data of the Safety I/O Module and verify whether diagnostics related to power supply abnormalities have been detected. If diagnostics are detected, supply a voltage within the specified range to the US2 power supply and perform an error reset. If the power supply rise time is slow, diagnostics may be detected before the voltage fully rises. Also check the power supply voltage range of the safety output device and ensure that the supplied voltage is within the specified range. If the problem is not resolved after checking the voltage, turn the power OFF and replace the Safety I/O Module.
	The PLC is not in RUN mode.	Check the PLC status and set the PLC to RUN mode.
	Polarity mismatch of the safety output device.	Check whether the output polarity of the Safety I/O Module matches the polarity of the safety output device in use.
	Incorrect address assignment in the PLC control program.	Monitor the PLC status and verify that the address assignment and control program for the safety outputs are correct.
	Wiring or connection failure.	Check the following items and verify that there are no issues with the connection between the Safety I/O Module and the manifold valves.
	Failure of the safety output device.	Replace the safety output device and check its operation.
	Safety I/O Module failure.	Turn the power OFF, replace the Safety I/O Module, then turn the power ON again and check the operation.

Trouble No. 18 Digital Input Devices Connected to the Digital Input Module Do Not Operate Normally

Symptom	Possible Cause	Investigation and Corrective Action
Abnormal operation of digital input devices	Polarity mismatch of the input device	Check whether the polarity (NPN / PNP) of the input device matches the input polarity of the digital input module.
	Abnormal voltage of the US1 (control/input) power supply	Check whether the US1 indicator on the fieldbus module is lit green. If it is OFF or flashing green, supply a voltage within the specified range to the US1 power supply.
	Wiring or connection failure	Check the wiring between the input device and the digital input module for loose connectors, incorrect wiring, or damaged cables.
	Failure of the input device	Replace the input device and check its operation. Alternatively, refer to the troubleshooting section of the input device manual.
	Digital input module failure	Replace the digital input module and check its operation.

Trouble No. 19 Digital output devices connected to the digital output module do not operate normally.

Symptom	Possible Cause	Investigation and Corrective Action
Abnormal operation of digital output devices	Polarity mismatch of the output device	Check whether the polarity (NPN / PNP) of the output device matches the output polarity of the digital output module. Alternatively, use a non-polarity output device.
	Abnormal voltage of the US2 (output) power supply	Check whether the US2 indicator on the fieldbus module is lit green. If it is OFF or flashing green, supply a voltage within the specified range to the US2 power supply.
	Wiring or connection failure	Check the wiring between the output device and the digital output module for loose connectors, incorrect wiring, or damaged cables.
	The PLC is not in RUN mode	Check the PLC status and set the PLC to RUN mode.
	Incorrect address assignment in the PLC control program	Monitor the PLC status and check whether the address assignment and control program for the output signals are correct.
	Failure of the output device	Replace the output device and check its operation. Alternatively, refer to the troubleshooting section of the output device manual.
	Digital output module failure	Replace the digital output module and check its operation.

Trouble No.20 Analog input devices connected to the analog input/output module do not operate normally

Symptom	Possible Cause	Investigation and Corrective Action
Abnormal operation of analog input devices	Abnormal voltage of the US1 (control/input) power supply	Check whether the US1 indicator on the fieldbus module is lit green. If it is OFF or flashing green, supply a voltage within the specified range to the US1 power supply.
	Incorrect analog input signal range setting	Check the specifications of the analog input device and set an input signal range that matches the specifications.
	Analog data format mismatch	Check whether the data format setting of the analog input module is correct.
	Wiring or connection failure	Ensure that the wiring between the analog input device and the analog input module is connected correctly.
	Analog input module failure	Replace the analog input module and check its operation.
	Failure of the analog input device	Replace the analog input device and check its operation. Alternatively, refer to the troubleshooting section of the analog input device manual.

Trouble No. 21 Analog Output Devices Connected to the Analog Output / I/O Module Do Not Operate Normally

Symptom	Possible Cause	Investigation and Corrective Action
Abnormal operation of analog output devices	Abnormal voltage of the US2 (output) power supply	Check whether the US2 indicator on the fieldbus module is lit green. If it is OFF or flashing green, supply a voltage within the specified range to the US2 power supply.
	Incorrect analog output signal range setting	Check the specifications of the analog output device and set an output signal range that matches the specifications.
	Analog data format mismatch	Check whether the data format setting of the analog output module is correct.
	Wiring or connection failure	Ensure that the wiring between the analog output device and the analog output module is connected correctly.
	Analog output module failure	Replace the analog output module and check its operation.
	Failure of the analog output device	Replace the analog output device and check its operation. Alternatively, refer to the troubleshooting section of the analog output device manual.
	Program-related abnormality	- Check whether the address assignment and control program are correct. - Check the PLC status and set the PLC to RUN mode.

Trouble No. 22 IO-Link Devices Connected to the IO-Link Master Module Do Not Operate Normally

Symptom	Possible Cause	Investigation and Corrective Action
The C/Q LED of the IO-Link master module is OFF or lit orange	Port is not set to IO-Link communication mode	To perform IO-Link communication, set the "Port mode" parameter to "IO-Link Manual" or "IO-Link Autostart".
The C/Q LED of the IO-Link master module is flashing green (1 Hz)	IO-Link device not connected	Connect an IO-Link device.
The C/Q LED of the IO-Link master module is flashing green (2 Hz)	Data size abnormality	Check the "Process data size" parameter of the IO-Link master. Set the process data size of each port to a value equal to or greater than the process data size of the connected IO-Link device.
	Connected IO-Link device validation error	Check the following parameters of the IO-Link master. - Check the "Port mode" parameter, and if the device validation function is not required, change it to "IO-Link Autostart". - Check whether the Vendor ID and Device ID of the connected IO-Link device are correctly set in the "Vendor ID" and "Device ID" parameters. - Check whether the IO-Link version determined by the "Validation & Backup" parameter matches the version of the connected IO-Link device.
	Data storage write error	Perform the data storage write operation again. For details on the data storage function, refer to Section 8.5.2 "Data Storage Function" (page 84).
The C/Q LED of the IO-Link master module is lit green, but the IO-Link device does not operate	Abnormal voltage of the US1 (control/input) power supply	Check whether the US1 indicator on the fieldbus module is lit green. If it is OFF or flashing green, supply a voltage within the specified range to the US1 power supply.
	Abnormal P24 power supply voltage	Check whether the P24_LED on the EX600-LBB1-A is lit green. If it is OFF, supply a voltage within the specified range to the US2 (output) power supply.
	Wiring or connection failure	Check the wiring between the IO-Link master module port and the IO-Link device. Check for loose connectors, incorrect wiring, or damaged cables.
	The PLC is not in RUN mode	Check the PLC status and set the PLC to RUN mode.
	Incorrect address assignment in the PLC control program	Check whether the address assignment, data endianness, and control program are correct. Data endianness can be changed using the "Byte swap" parameter.
	Failure of the IO-Link device	Replace the IO-Link device and check its operation. Alternatively, refer to the troubleshooting section of the IO-Link device manual.
	IO-Link master module failure	Replace the IO-Link master module and check its operation.

8 Parameter Settings

Each module has configurable parameters that can be set for each module and each channel. The various parameters can be changed using a PLC engineering tool (such as TIA Portal). The table below describes the parameters that can be set for each module.



Important Notes

- When reusing a module whose parameters have already been changed, be sure to reset the module to the factory default settings before use.
- The safety parameters of the Safety I/O Module are set via process data. For details on how to set safety parameters, refer to the Safety Manual.

8.1 Fieldbus Module Parameter Settings

No.	Name	Parameter Description	Setting Options	Setting Description	Factory Default	Parameter Effective Scope
1	US1 monitoring	Select whether to generate a diagnostic error when the US1 power supply voltage falls to approximately 19 V or lower.	Disable	No diagnostic error is generated.	Enable	Module
			Enable	A diagnostic error is generated.		
2	Configuration tool selection (IO-Link)	Select whether to set IO-Link module parameters via a GSDML file or via an IO-Link Device Tool.	GSD	Parameters are set via a GSDML file.	GSD	Module
			IO-Link device tool	Parameters are set via an IO-Link Device Tool.		

Note

- When “Configuration tool selection” is set to “GSD”, parameters of the IO Link devices can be set using Record Data or Function Blocks such as IO_LINK_DEVICE. For details on the Index (Record Data) or the usage of the Function Blocks, refer to the operation manual of the engineering tool being used.

8.2 Safety I/O Module Parameter Settings

8.2.1 Safety-Related Parameters

Safety parameters are set using safety output data. For details, refer to the Safety I/O Module Safety Manual.

8.2.2 Valve Module–Related Parameter List

No.	Name	Definition	Setting Options	Setting Description	Factory Default	Parameter Effective Scope
1	ON/OFF count limit	Sets whether a diagnostic error is generated when the valve ON/OFF operation count exceeds the specified value.	Enable	Generates a diagnostic error.	Disable	Module
			Disable	Does not generate a diagnostic error.		
2	Count limit value	When the "ON/OFF count limit" parameter is set to "Enable", sets the upper limit of the ON/OFF operation count at which a diagnostic error is generated.	1~65535	The upper limit is determined as the set value × 1000 cycles. A diagnostic error is generated when the ON/OFF operation count exceeds this limit.	65535	Channel



Important Notes

- When the Safety I/O Module detects a valve short circuit, it turns OFF the valve output at the short circuited location and does not automatically recover. To turn the output ON again, turn OFF the corresponding valve output once, or turn OFF all safety outputs.

Note

- Immediately after power is turned on, the ON/OFF operation count is the value stored in the internal memory of each I/O module. Counting resumes from the read value, and the count is saved to the internal memory at intervals of one hour.

8.2.3 ITV Module–Related Parameter List

No.	Name	Definition	Setting Options	Setting Description	Factory Default	Parameter Effective Scope
1	Hold/Clear	Sets the output pressure control state during PROFINET communication errors or idle conditions.	Pressure Clear	Exhausts all pressure.	Pressure Clear	Channel
			Pressure Hold	Holds the output pressure.		
2	Gain	Adjusts the gain to change the response characteristics.	0~15	Gain can be adjusted from 0 to 15.	9	Channel
3	Sensitivity	Changes sensitivity, affecting pressure correction behavior near the set pressure.	0~7	Sensitivity can be adjusted from 0 to 7.	2	Channel
4	Minimum pressure	Sets the minimum pressure (F_1).	0~3686	Values where (Maximum pressure – Minimum pressure) < 410 cannot be set.	0	Channel
5	Maximum pressure	Sets the maximum pressure (F_2).	410~4914	Can be set within the following ranges: • Minimum pressure: 0–90% • Maximum pressure: 10–120%	4095	Channel
6	Notification setting	Generates a notification in the ITV module input data when the set time is reached.	0~4294967295	0: Notification disabled. 1–4294967295: Set in units of value × 1 hour.	0	Channel
7	Configuration tool selection (ITV)	Selects whether to set ITV module parameters via a GSDML file or via the ITV module.	GSD	Parameters are set via a GSDML file.	GSD	Channel
			ITV button	Parameters are set via the ITV module.		

Note

- For details on the parameters related to the ITV module, refer to the ITV module Operation Manual.

8.3 Digital Module Parameter Settings

8.3.1 Digital Input Module Parameter Settings

No.	Name	Definition	Setting Options	Setting Description	Factory Default	Parameter Effective Scope
1	ON/OFF count limit	Generates an error when the ON/OFF operation count of the input signal exceeds the set value.	Enable	Generates a diagnostic error. Does not generate a diagnostic error.	Disable	Module
			Disable			
2	Input filtering time	Sets the time during which changes in the input signal are ignored.	0.1 ms	Selects the filtering time.	1.0 ms	Module
			1.0 ms			
			10 ms			
			20 ms			
3	Input extension time	Sets the time for holding the input signal.	1.0 ms	Selects the time for holding the input signal.	15 ms	Module
			15 ms			
			100 ms			
			200 ms			
4	Input values with module failure	Determines the input value transmitted to the upper-level device when a module failure is detected.	Input value 0	Transmits input value 0.	Input value 0	Module
			Keep last value	Transmits the value immediately before the failure was detected.		
5	Count limit value	Determines the upper limit of the ON/OFF operation count at which a diagnostic error is generated when "ON/OFF count limit" is set to Enable.	1~65000	The upper limit is determined as the set value × 1000 cycles. A diagnostic error is generated when the ON/OFF operation count exceeds the upper limit.	65000	Channel

Note

- Immediately after power is turned on, the ON/OFF operation count is the value stored in the internal memory of each I/O module. Counting resumes from the read value, and the internal memory is updated at one-hour intervals.

8.3.2 Digital Output Module Parameter Settings

No.	Name	Definition	Setting Options	Setting Description	Factory Default	Parameter Effective Scope
1	ON/OFF count limit	Generates a diagnostic error when the ON/OFF operation count of the output device exceeds the set value.	Enable	Generates a diagnostic error.	Disable	Module
			Disable	Does not generate a diagnostic error.		
2	Digital out Fault mode	Determines the output state during communication errors and communication idle conditions.	Clear	Turns the output OFF.	Clear	Module
			Hold	Holds the output.		
			Force ON	Forces the output ON.		
3	Count limit value	Determines the upper limit of the ON/OFF operation count at which a diagnostic error is generated when "ON/OFF count limit" is set to Enable.	1~65000	The upper limit is determined as the set value × 1000 cycles. A diagnostic error is generated when the ON/OFF operation count exceeds the upper limit.	65000	Channel
4	Open circuit	Generates a diagnostic error when an open circuit of the output device is detected.	Enable	Generates a diagnostic error.	Disable	Channel
			Disable	Does not generate a diagnostic error.		

Note

- Immediately after power is turned on, the ON/OFF operation count is the value stored in the internal memory of each I/O module. Counting resumes from the read value, and the internal memory is updated at one-hour intervals.

8.4 Analog Module Parameter Settings

8.4.1 Analog Input/Output Module Parameter Settings

No.	Name	Definition	Setting Options	Setting Description	Factory Default	Parameter Effective Scope
1	Analog out Fault mode	Sets the output behavior during communication errors.	Hold	Holds the output.	Hold	Module
			Force value	Outputs the value set in "Fault force value". *1		
2	Upper limit detection	Generates an error when the input value exceeds the set value.	Enable	Generates an error. *1	Disable	Module
			Disable	Does not generate an error.		
3	Lower limit detection	Generates an error when the input value falls below the set value.	Enable	Generates an error. *1	Disable	Module
			Disable	Does not generate an error.		
4	Over range detection	Generates an error when the input value exceeds 0.5% of full span.	Enable	Generates an error.	Disable	Module
			Disable	Does not generate an error.		
5	Under range detection	Generates an error when the input value falls below 0.5% of full span.	Enable	Generates an error.	Disable	Module
			Disable	Does not generate an error.		
6	Data format	Sets the format of the analog data output to the PLC.	Offset binary	Offset binary format.	Offset binary	Module
			Signed magnitude	Signed magnitude binary format.		
			2's complement	Two's complement format.		
			Scaled	Scaled Conversion Format		
7	Filter time	Sets the number of analog filter operations.	None	No analog filtering.	2 Average	Channel
			2 Average	Average of the latest two values.		
			4 Average	Average of the latest four values.		
			8 Average	Average of the latest eight values.		
8	Analog range	Sets the range of the analog input/output device.	0...10 V	Selects the range.	1...5 V	Channel
			0...5 V			
			1...5 V			
			0...20 mA			
			4...20 mA			
9	Upper limit value	User-defined value / scale upper limit setting value	-32766~32767	This is the upper limit setting value.	1000	Channel
10	Lower limit value	User-defined value / scale lower limit setting value	-32767~32766	This is the lower limit setting value.	0	Channel
11	Fault force value	Sets the analog value during communication errors.	-32767~32767	Analog setting value	0	Channel

*1: Set the parameter values within the configurable range described in the table of the following section for each analog input range.

When changing the analog input range, be sure to check the parameter values and change them to appropriate values.

8.4.2 Analog Output Module Parameter Settings

No.	Name	Definition	Setting Options	Setting Description	Factory Default	Parameter Effective Scope
1	Analog out Fault mode	Sets the output behavior during communication errors.	Hold	Holds the output.	Hold	Module
			Force value	Outputs the value set in "Fault force value". *1		
2	Upper limit detection	Generates an error when the input value exceeds the set value.	Enable	Generates an error. *1	Disable	Module
			Disable	Does not generate an error.		
3	Lower limit detection	Generates an error when the input value falls below the set value.	Enable	Generates an error. *1	Disable	Module
			Disable	Does not generate an error.		
4	Data format	Sets the format of the analog data output to the PLC.	Offset binary	Offset binary format.	Offset binary	Module
			Signed magnitude	Signed magnitude binary format.		
			2's complement	Two's complement format.		
			Scaled	Scaled conversion format.		
5	Analog range	Sets the range of the analog output device.	0...10 V	Selects the range.	1...5 V	Channel
			0...5 V			
			1...5 V			
			0...20 mA			
			4...20 mA			
6	Upper limit value	User-defined value / scale upper limit setting value	-32766~32767	This is the upper limit setting value.	1000	Channel
7	Lower limit value	User-defined value / scale lower limit setting value	-32767~32766	This is the lower limit setting value.	0	Channel
8	Fault force value	Sets the analog value during communication errors.	-32767~32767	Analog setting value *1	0	Channel

*1: Set the parameter values within the configurable range described in the table in the following section for each analog input range.

When changing the analog input range, be sure to check the parameter values and change them to appropriate values.

8.4.3 Analog Setting Value Scale

Configurable Range for User-Defined Upper or Lower Limit Values

Range	Configurable Range for User-Defined Upper or Lower Limits	
	Lower Limit	Upper Limit
0..10 V	0.00~+10.45 V	+0.05~+10.50 V
0..5 V	0.00~+5.22 V	+0.03~+5.25 V
1..5 V	+0.75~+5.22 V	+0.78~+5.25 V
0..20 mA	0.00~+20.90 mA	+0.10~+21.00 mA
4..20 mA	+3.00~+20.90 mA	+3.10~+21.00 mA

User-Defined Upper or Lower Limit Setting Value Conversion Table

(Data format: Offset Binary / Signed Magnitude / 2's Complement)

Range	PLC Setting Value	Voltage / Current Conversion Value
0..10 V	0~1050	+0.00~+10.50 V
0..5 V	0~525	+0.00~+5.25 V
1..5 V	75~525	+0.75~+5.25 V
0..20 mA	0~2100	+0.00~+21.00 mA
4..20 mA	300~2100	+3.00~+21.00 mA

Note: When setting the user-defined upper or lower limit values in the PLC, set them as described below.

- When setting a positive value: enter the value obtained by multiplying the desired setting value by 100 directly as a decimal number.

Example: To set +10.50 V: $10.50 \times 100 = 1050$ is set in the PLC.

- When setting a negative value: convert the absolute value of the desired setting value $\times 100$ into a 16-bit binary number, set the most significant bit to 1, then convert it back to a decimal number and enter it.

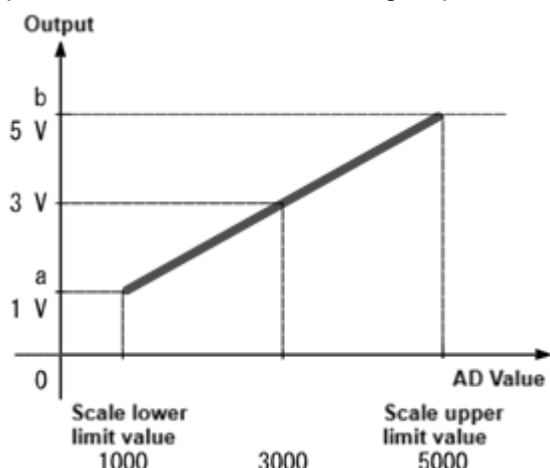
Example: To set -10.50 V: $10.50 \times 100 = 1050 \rightarrow 10000011010b$
 $1000010000011010b = 33818$ is set in the PLC.

Scaled Conversion Format

The scaled conversion format is a function that allows the A/D value corresponding to the input signal range to be set arbitrarily within the range of FFFF to 7FFF, or -32767 to 32767. The resolution is determined by specifying the upper and lower limits of the scale.

$$\text{Resolution} = \frac{\text{Range upper limit value} - \text{Range lower limit value}}{\text{Scale upper limit value} - \text{Scale lower limit value}}$$

Example: In the case of a 1 to 5 V range input



- (1) Set the range to 1 to 5 V.
- (2) By setting the scale upper limit value to 5000 and the scale lower limit value to 1000, the correspondence becomes as follows.
 - 1000 ... 1 V input
 - 2000 ... 2 V input
 - 3000 ... 3 V input
 - 4000 ... 4 V input
 - 5000 ... 5 V input
- (3) From $(5 \text{ V} - 1 \text{ V}) \div (5000 - 1000) = 1/1000$
The range from 1 to 5 V has a resolution of 1/1000.

Scale Setting Value (AD Value)			Input Signal Range (a to b)				
	Hexadecimal	Decimal	Voltage [V]			Current [mA]	
			0~10	1~5	0~5	0~20	4~20
Scale Upper Limit Value	FFFE~7EEF	-32766~32767	10	5	5	20	20
Scale Lower Limit Value	FFFF~7FFE	-32767~32766	0	1	0	0	4

Note: When the data format is set to the scaled conversion format, set the scale upper limit value and scale lower limit value by referring to the table below, regardless of the range setting.

Scale Upper or Lower Limit Setting Value Conversion Table

(Data format: Scaled conversion format)

PLC Setting Value	Converted Value
0~32767	+0~+32767
32768~65535	-0~-32767

8.5 IO-Link Master Module Parameter Settings

8.5.1 Parameter List

No.	Name	Definition	Setting Options	Setting Description	Factory Default	Parameter Effective Scope
1	Digital out Fault mode	Sets the digital output signal behavior during PROFINET communication errors and communication idle conditions for ports whose "Port mode" parameter is set to "Digital output C/Q".	Clear	Turns the digital output OFF.	Clear	Module
			Hold	Holds the digital output.		
			Force ON	Forces the digital output ON.		
2	IO-Link Fault mode	Determines how the output process data of IO-Link communication is handled when a PROFINET communication error occurs or when the system enters the idle state.	Clear, PDOOut valid	Clears the output of the IO-Link device. Output data value: Turns all points OFF Process data: Remains valid	Clear, PDOOut invalid	Module
			Hold	Holds the output of the IO-Link device. Output data value: Held Process data: Remains valid		
			Clear, PDOOut invalid	Operates according to the output settings of the IO-Link device when IO-Link communication on the device side is invalid. Output data value: Turns all points OFF Process data: Set to invalid		
3	Input values with module failure	Sets the digital input signal behavior during PROFINET communication errors and communication idle conditions for ports whose "Port mode" parameter is set to "Digital input C/Q".	Input value 0	Transmits input value 0.	Input value 0	Module
			Keep last value	Transmits the value immediately before the error was detected.		
4	Port mode	Sets the operating mode of the IO-Link port.	IO-Link Manual	Starts IO-Link communication based on the IO-Link device validation settings.	IO-Link Autostart	Port (Channel)
			IO-Link Autostart	Starts IO-Link communication without performing IO-Link device validation.		

No.	Name	Definition	Setting Options	Setting Description	Factory Default	Parameter Effective Scope
5	Byte swap	Reorders the byte order of the process data transmitted and received between PROFINET communication and IO-Link communication.	No Swap	Does not reorder the data order. IO-Link device size: 10 bytes IO-Link master port size: 16 bytes In this case 0xJIHG FEDC BA98 7654 3210 ↓ 0x0000 0000 0000 JIHG FEDC BA98 7654 3210	No Swap	Port (Channel)
			Swap 16 bit	Reorders data in word units. IO-Link device size: 10 bytes IO-Link master port size: 16 bytes In this case 0xJIHG FEDC BA98 7654 3210 ↓ 0x0000 0000 0000 HGJI DCFE 98BA 5476 1032		
			Swap 32 bit	Reorders data in double-word units. IO-Link device size: 10 bytes IO-Link master port size: 16 bytes In this case 0xJIHG FEDC BA98 7654 3210 ↓ 0x0000 0000 HGJI 0000 98BA DCFE 1032 5476		
			Swap All	Reorders all bytes. IO-Link device size: 10 bytes IO-Link master port size: 16 bytes In this case 0xJIHG FEDC BA98 7654 3210 ↓ 0x1032 5476 98BA DCFE HGJI 0000 0000 0000		

Note

- If the port size is 2 bytes, byte swapping is not performed even when “Swap 32 bit” is set.

No.	Name	Definition	Setting Options	Setting Description	Factory Default	Parameter Effective Scope
6	Validation & Backup	Performs validation with the connected IO-Link device (vendor ID and device ID verification) and configures the data storage (DS) function. By enabling the validation function, it is possible to detect an incorrect IO-Link device connection, and by enabling the data storage function, the parameters of the connected IO-Link device can be stored in the internal memory of the IO-Link master. For details, refer to page 84 .	No Device Check	Validation function: Disabled DS function: Disabled	No Device Check	Port (Channel)
			Type compatible Device V1.0	Connected device: V1.0 Validation function: Enabled DS function: Disabled		
			Type compatible Device V1.1	Connected device: V1.1 Validation function: Enabled DS function: Disabled		
			Type compatible Device V1.1, Backup + Restore	Connected device: V1.1 Validation function: Enabled DS function: Enabled (Backup & Restore)		
			Type compatible Device V1.1, Restore	Connected device: V1.1 Validation function: Enabled DS function: Enabled (Restore only)		
7	Cycle time	Sets the communication interval with the IO-Link device. The minimum configurable communication interval varies depending on the following factors. - Minimum cycle time of the IO-Link device - IO-Link communication speed - Process data size	As fast as possible (AFAP)	Communicates at the fastest possible interval among the configurable communication intervals.	As fast as possible (AFAP)	Port (Channel)
			0.4ms ~ 132.8ms	Communicates at the configured interval. If the parameter is set below the configurable value, the actual communication interval is extended to the fastest configurable value.		
8	Vendor ID	Sets the vendor ID used when the IO-Link device validation function is enabled.	0x0000 ~ 0xFFFF	For the connected device, set the vendor ID.	0x0001	Port (Channel)
9	Device ID	Sets the device ID used when the IO-Link device validation function is enabled.	0x000000 ~ 0xFFFFFFFF	For the connected device, set the device ID.	0x000001	Port (Channel)



Important Notes

- When using the verification function, please set the following parameters in advance:
Set "Port mode" to "IO-Link Manual"
Set "Vendor ID" to the vendor ID value of the connected IO-Link device
Set "Device ID" to the device ID value of the connected IO-Link device
- If "Port mode" is changed to anything other than "IO-Link Manual", the parameter will automatically switch to "No Device Check".

8.5.2 Data Storage Function

The data storage function can be used when the “Port mode” parameter is set to “IO-Link Manual” and the “Validation & Backup” parameter is set to either “Type compatible Device V1.1, Backup + Restore” or “Type compatible Device V1.1, Restore”.

- Overview of Backup and Restore

The parameter setting data stored in each IO-Link device can be saved to the IO-Link master (this is referred to as backup).

When an IO-Link device is replaced with another device of the same model, the parameter setting data backed up in the IO-Link master can be transferred from the IO-Link master to the IO-Link device (this is referred to as restore).

- Conditions for Backup/Restore Operation When Starting IO-Link Communication

The operation of the data storage function depends on the data storage status within the IO-Link master and the parameter change status of the IO-Link device, as described below.

Validation & Backup Setting	Condition			Data Storage Operation
	Data Storage Status	Backup request from device	Checksum comparison between data storage and device parameters	
No Device Check	—	—	—	Clear
Type compatible, Device V1.0	—	—	—	Clear
Type compatible, Device V1.1	—	—	—	Clear
Type compatible, Device V1.1, Backup +Restore	Data present	Request present	—	Backup
	Data present	No request	Mismatch	Restore
	Data present	No request	Match	No action
	No data	—	—	Backup
Type compatible, Device V1.1, Restore	Data present	Request present	—	No action
	Data present	No request	Mismatch	Restore
	Data present	No request	Match	No action
	No data	—	—	No action



Important Notes

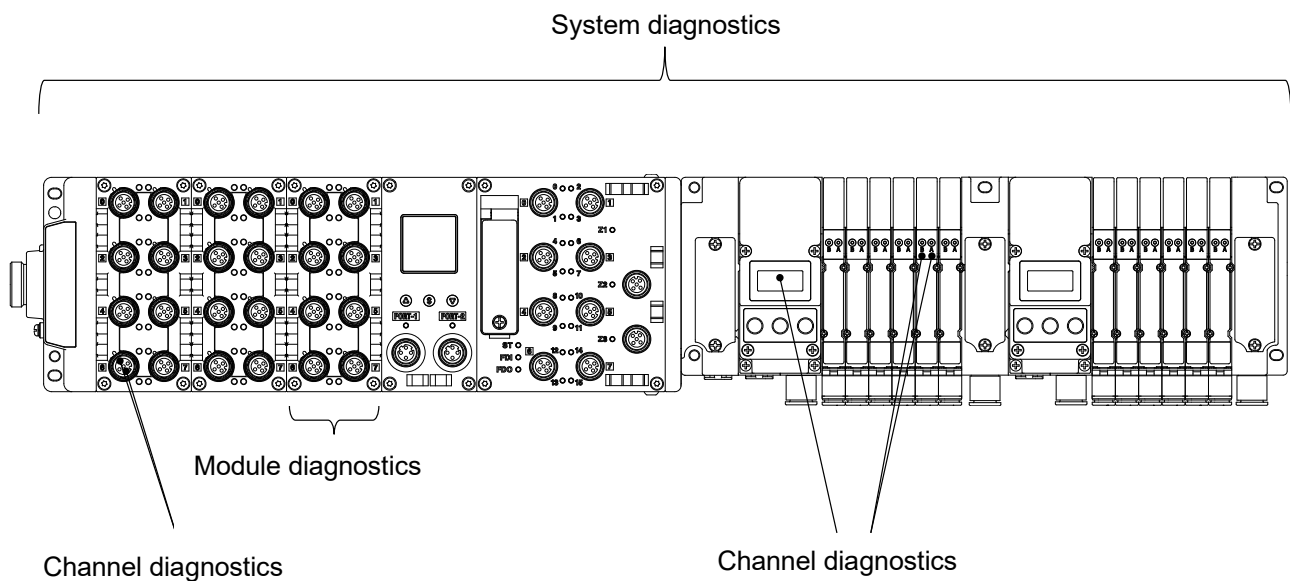
- If the “Vendor ID” parameter or the “Device ID” parameter is changed, the data storage is cleared.
- If the “Port mode” parameter is changed to a setting other than “IO-Link Manual”, the setting value of the “Validation & Backup” parameter is automatically switched to “No Device Check”. As a result, the data storage is cleared.

9 Diagnostics

9.1 Diagnostic Overview

The fieldbus module assigns the following diagnostic data to the beginning of the input process data. During normal operation, the diagnostic input data is 0. When a diagnostic error occurs, the data corresponding to the affected diagnostic location becomes 1.

Input Data Byte	Diagnostic Data	Description
0...1	System diagnostics	Errors affecting the entire EX600 manifold (such as power supply voltage drop).
2	Module diagnostics	Errors that occur for each module (such as module failure).
3	Channel diagnostics	Errors that occur for each channel (such as output short circuit).
4...5	Diagnostic location	Among the diagnostics listed above, this allows you to identify which module is generating module diagnostics or channel diagnostics.



9.2 Diagnostic Data Details

Byte	bit	Description	Scope
0	0	1: The US1 power supply voltage has dropped to 19 V or lower.	System
	1	Reserved	
	2	1: Failed to establish a connection with the D-side I/O module during startup.	
	3	1: Failed internal communication with the D-side I/O module during startup.	
	4	1: Failed to establish a connection with the U-side I/O module during startup.	
	5	1: Failed internal communication with the U-side I/O module during startup.	
	6	1: The total I/O size of the manifold exceeds the specification.	
	7	1: The total number of connected I/O modules on the manifold exceeds the specification.	
1	0	1: An I/O module was added or removed while the power was ON.	System
	1	1: Safety communication with the Safety I/O Module has been disconnected.	
	2	1: The F-address setting value is 0	
	3...7	Reserved	
2	0	1: The number of valve blocks in the valve module has changed.	Module
	1	1: Some internal functions of the module are not operating.	
	2	1: Failed internal communication with the corresponding I/O module.	
	3	1: Module initialization failed.	
	4...7	Reserved	
3	0	1: The ON/OFF operation count of the digital signal has exceeded the upper limit setting.	Channel
	1	1: A short circuit has been detected.	
	2	1: An <i>abnormal</i> diagnostic has been detected in the ITV module.	
	3	1: An open circuit has been detected.	
	4	1: The analog value has fallen below the user-defined lower limit.	
	5	1: The analog value has exceeded the user-defined upper limit.	
	6...7	Reserved	

Byte	bit	Description	Scope
4	0	1: An error has occurred in Module 0 (Fieldbus Module).	Error location
	1	1: An error has occurred in Module 1.	
	2	1: An error has occurred in Module 2.	
	3	1: An error has occurred in Module 3.	
	4	1: An error has occurred in Module 4.	
	5	1: An error has occurred in Module 5.	
	6	1: An error has occurred in Module 6.	
	7	1: An error has occurred in Module 7.	
5	0	1: An error has occurred in Module 8.	
	1	1: An error has occurred in Module 9.	
	2	1: An error has occurred in Module 10.	
	3...7	Reserved	

Note

- Each bit of the diagnostic data indicates that no diagnostic has occurred when the bit value is 0, and that a diagnostic has occurred when the bit value is 1.
- The diagnostic content and the error location become 1 at the same time. In addition, when multiple errors occur, all corresponding diagnostic content bits become 1.
Example: When a short circuit is detected on Module No.2 and Module No.3, the following bit becomes 1.
Byte 3 – bit 1
Byte 4 – bit 2 & bit 3

9.3 Diagnostic Log

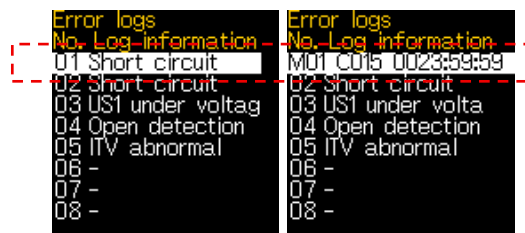
Each time a diagnostic occurs in the EX600 system, the fieldbus module stores up to 30 diagnostic log entries in its internal non-volatile memory. When the maximum number of entries is exceeded, the oldest log data is overwritten sequentially.

There are two methods to check the diagnostic log. For detailed procedures, refer to the respective operation description pages.

9.3.1 Checking via the LCD Display

The diagnostic log can be checked by navigating to the error log screen on the LCD display.

The diagnostic log can be displayed in the following format.



● Screen Display Contents

Display Item	Description
No.	Indicates the order in which diagnostic errors were recorded. No.01 is the most recent. The number is incremented each time an error occurs. When an error occurs while 30 errors are already recorded, No.30 is deleted.
Diagnostic Error Content	Text corresponding to the diagnostic error content shown in the table below is displayed.
M**	When the diagnostic error is a module diagnostic or a channel diagnostic, the module number where the error occurred is recorded.
C***	When the diagnostic error is a channel diagnostic, the channel number where the error occurred is recorded.
****.***	Indicates the time when the diagnostic error was recorded. Measurement starts from the time the system is powered on, and when the power is turned off, the count restarts from 0000:00:00.

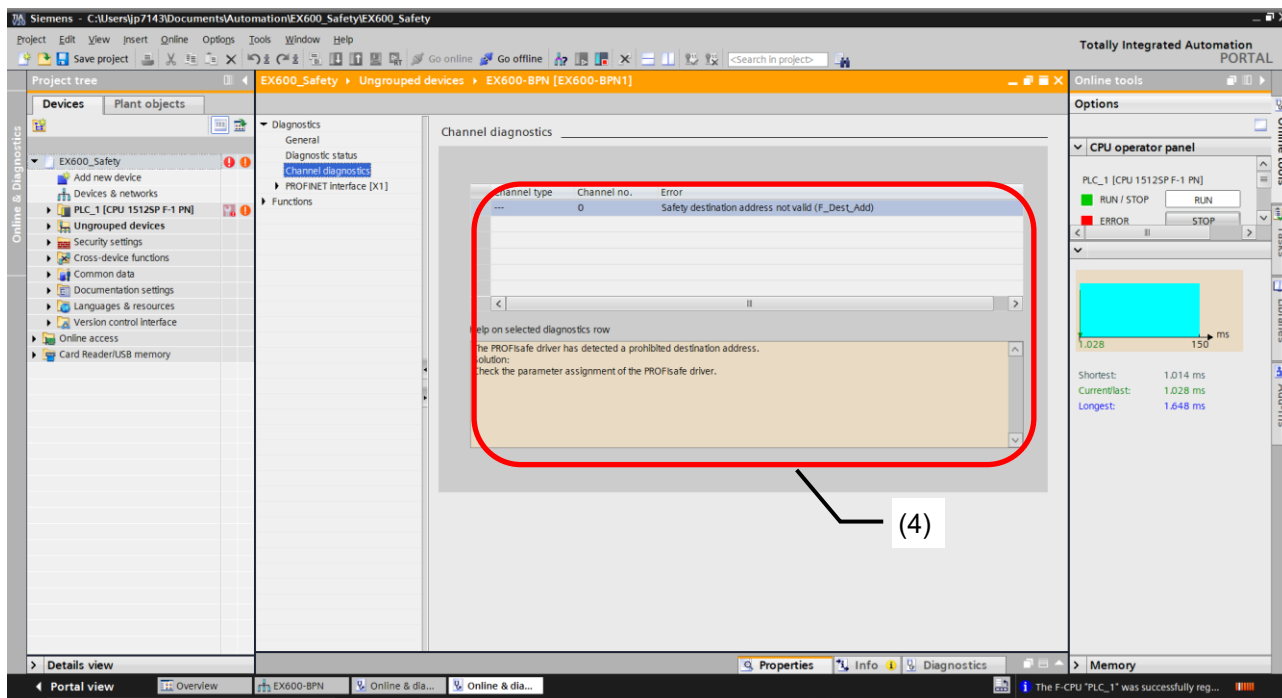
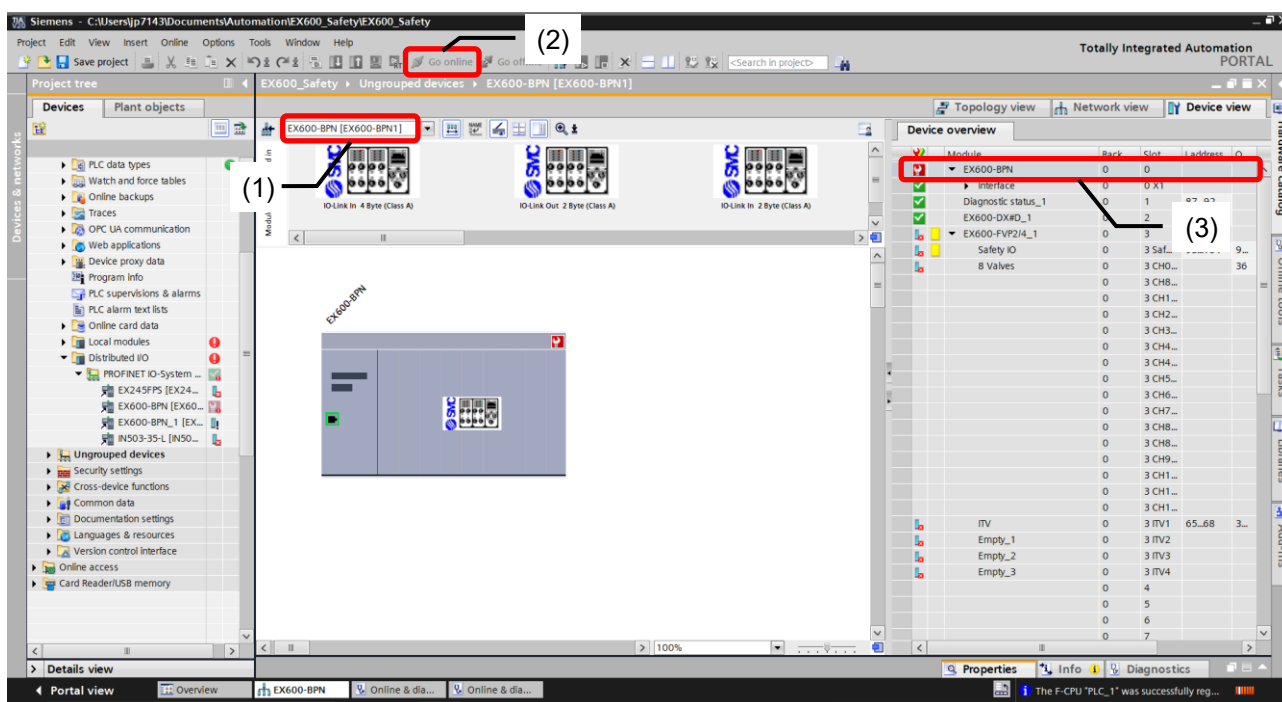
● Log Content

Description	Text
The US1 power supply voltage has dropped to 19 V or lower.	US1 under voltage
Failed to establish a connection with the D-side I/O module during startup.	D Connection fault
Failed internal communication with the D-side I/O module during startup.	D COM fault
Failed to establish a connection with the U-side I/O module during startup.	U Connection fault
Failed internal communication with the U-side I/O module during startup.	U COM fault
The total I/O size of the manifold exceeds the specification.	Too large I/O map
The total number of connected I/O modules on the manifold exceeds the specification.	Too many modules
The F-address setting value is 0.	F-address is set to 0
An I/O module was added or removed while the power was ON.	Hot swapping
Safety communication with the Safety I/O Module has been disconnected.	Black channel fault
The number of valve blocks in the valve module has changed.	Changed valves
Some internal functions of the module are not operating.	Hardware failure
Failed internal communication with the corresponding I/O module.	Communication fault
Module initialization failed.	Initialization failure
The ON/OFF operation count of the digital signal has exceeded the upper limit setting.	Over counter limit
A short circuit has been detected.	Short circuit
An abnormal diagnostic has been detected in the ITV module.	ITV abnormal
An open circuit has been detected.	Open detection

9.3.2 How to Check Diagnostics Using the Engineering Tool

An example of checking diagnostics using an engineering tool (Siemens TIA Portal) is shown below.

- (1) Select "EX600-BPN [EX600-BPN1]" in the Project tree and display the Device overview screen.
- (2) Click the Go online button.
- (3) The module where a diagnostic has occurred is displayed in red.
- (4) Double-click the part displayed in red to monitor the diagnostic information.



9.4 Diagnostics of the IO-Link Master Module

The EX600 IO-Link master module has diagnostic functions for each port. Diagnostic information is displayed by LEDs, PQI assigned to the process data input, and event codes.

The LED indications, PQI, and event codes for each diagnostic are as follows.

Diagnostic Error	Description	Port LED Status	PQI Bit No. (Name)	Event Code
L+ Short Circuit	Short-circuit detection between pins 1 and 3	 Red ON	2 (PwrShort)	0x1806
P24 Short Circuit	Short-circuit detection between pins 2 and 5	 Red ON	2 (PwrShort)	0x180F
C/Q Short Circuit	Short-circuit detection between pins 1 and 4 or pins 3 and 4	 Red ON	3 (CQShort)	0x1804 0x1813
Connected Device Validation Error	For a communication port where the "Port mode" parameter is set to "IO-Link Manual" and the "Validation & Backup" parameter is set to "Type compatible", the values read from the connected IO-Link device are compared with the "Vendor ID" and "Device ID" parameters. A diagnostic error is generated if they do not match.	 Green flashing 2 Hz	0 (ID Mismatch)	0x1803
Process Data Mapping Error	When the "Port mode" parameter is set to "IO-Link Manual" or "IO-Link Autostart", a diagnostic error is generated if an IO-Link device with a larger process data size than that mapped by the "Process data size" parameter is connected.	 Green flashing 2 Hz	1 (PDmapping-Mismatch)	0x1F01
Device Not Connected	Detects the condition where no IO-Link device is connected when the "Port mode" parameter is set to "IO-Link Manual" or "IO-Link Autostart".	 Green flashing 1 Hz	5 (DevCom)	0x1800
P24 Voltage Drop	Diagnoses a power supply voltage drop at pins 2 and 5 of the EX600-LBB1-A (Class B type).	OFF (P24 LED)	—	0x180E

Note

- Diagnostics other than short circuit detection (L+, P24, C/Q) are not reflected in the diagnostic data of the fieldbus module. For diagnostics other than short circuit detection, check the LED indications or PQI of the IO Link master module.
- When a process data mapping error occurs, all process data input values and output values become zero.
- When no IO Link device is connected, all process data input values become zero.

10 Input/Output Process Data

10.1 Data Size

The input/output process data used when the EX600 system is configured for upper-level communication varies depending on the connected modules and parameter settings. Refer to the table below for the input data size and output data size of each module.

10.1.1 Input/Output Byte Occupation for Each Module

Module Name	Module Part No.	Occupied Bytes [byte]			
		Standard Input	Standard Output	Safety Input	Safety Output
Fieldbus Module	EX600-BPN1	6	0	0	0
Safety I/O Module	EX600-FVP1	0	4	12	11
	EX600-FVP2	Without ITV: 0 With ITV: 4...16	Without ITV: 0...16 With ITV: 2...24	12	11
	EX600-FVP3	0	0...16	12	11
	EX600-FVP4	Without ITV: 0 With ITV: 4...16	Without ITV: 0...16 With ITV: 2...24	12	11
Digital Input Module	EX600-DXPC-A	1	0	0	0
	EX600-DXPD-A	2	0	0	0
Digital Output Module	EX600-DYPB-A	0	1	0	0
Analog Output Module	EX600-AYB-A	0	4	0	0
Analog Input/Output Module	EX600-AMB-A	4	4	0	0
IO-Link Master Module	EX600-LAB1-A	IO-Link process data + 6 bytes (fixed)	IO-Link process data + 2 bytes (fixed)	0	0
	EX600-LBB1-A	IO-Link process data + 6 bytes (fixed)	IO-Link process data + 2 bytes (fixed)	0	0

Note

- The fieldbus module occupies 6 bytes of standard input data for diagnostic data.
- For details of the input/output data of each ITV module, refer to the ITV module Operation Manual.
- For details of the input/output map of the IO-Link master module, refer to Section 10.2 "I/O Map of the IO-Link Master Module" (page [93](#)).

10.2 I/O Map of the IO-Link Master Module

The input/output map of the IO-Link master modules (EX600-LAB1-A, EX600-LBB1-A) is shown below.
The input/output map consists of fixed data (Standard I/O + PQI) and variable IO-Link process data.

Components	Description
StandardIO	Digital signal data when the “Port mode” parameter is set to “Digital input C/Q” or “Digital output C/Q”, and digital input signal data assigned to pin 2 of the EX600-LAB1-A.
PQI	Diagnostic data for each port. Uses 1 byte per port. For details of the data contents, refer to Section 10.2.2 “Port Status (PQI) Details” (page 94).
IO-Link Process Data	The data size for each port determined by the “Process data size” parameter.

10.2.1 I/O Map

Example: When the “Process data size” parameter of the IO-Link master is set to 2 / 4 / 8 / 32 bytes

Byte	Input Map								Output Map							
	Bit 7				Bit 0				Bit 7				Bit 0			
0 (StandardIO)	X2	X4	X2	X4	X2	X4	X2	X4		Y4		Y4		Y4		Y4
	Port 4		Port 3		Port 2		Port 1		Port 4		Port 3		Port 2		Port 1	
	Digital Input								Digital Output							
1 (StandardIO)	Reserved (fixed value: 0)								Reserved (fixed value: 0)							
2...3	Port 1 input process data (2 bytes)								Port 1 output process data (2 bytes)							
4...7	Port 2 input process data (4 bytes)								Port 2 output process data (4 bytes)							
8...15	Port 3 input process data (8 bytes)								Port 3 output process data (8 bytes)							
16...47	Port 4 input process data (32 bytes)								Port 4 output process data (32 bytes)							
48	Port 1 status (PQI)															
49	Port 2 status (PQI)															
50	Port 3 status (PQI)															
51	Port 4 status (PQI)															

X2: Input signal of pin 2 (EX600-LAB1-A only)

X4: Input signal of pin 4 when the IO-Link port operating mode is set to digital input mode (DI_C/Q)

Y4: Output signal of pin 4 when the IO-Link port operating mode is set to digital output mode (DO_C/Q)

Note

- When no IO Link device is connected, all port # input process data becomes 0.
- When the received input process data becomes invalid (Process Data Invalid), the previous input process data value is retained.

10.2.2 Port Status (PQI) Details

Input Byte n	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	PQ	DevErr	DevCom	DSSStatus	CQShort	PwrShort	PDmapping- Mismatch	ID- Mismatch

Bit	Name	Description	Value
0	ID-Mismatch	Connected device validation error	0: Match 1: Mismatch
1	PDmapping-Mismatch	Process data size of the connected device exceeds the configured size	0: Within the configured size of the IO-Link master 1: Exceeds the configured size of the IO-Link master
2	PwrShort	L+ short circuit or P24 short circuit	0: No short circuit 1: Short circuit detected
3	CQShort	C/Q Short	0: No short circuit 1: Short circuit detected
4	DSSStatus	Data Storage (DS) save status	0: DS stored data error / No DS data 1: DS stored data valid
5	DevCom	Port communication status	0: Device not connected 1: Operate or Preoperate state
6	DevErr	Event status of the IO-Link device or IO-Link master	0: No event or Notification 1: Warning or Error
7	PQ	Received input process data Valid (normal) / Invalid (error)	0: Invalid (error) 1: Valid (normal)

11 Hardware Configuration

To configure the EX600 manifold in a PLC, use the PLC engineering tools provided by each PLC manufacturer (such as Siemens TIA Portal). For details of each tool, refer to the corresponding tool manual. This section explains the configuration procedure using TIA Portal (V20) screens as examples.

11.1 GSDML File

A GSDML file is required to configure the EX600 in the PLC.

In addition, a dedicated icon is required to display the EX600 icon in the PLC software.

The GSDML file and icon can be downloaded from our website.

URL : <https://www.smcworld.com>

GSDML file: GSDML-V2.46-SMC-EX600-BPN1-#####.xml

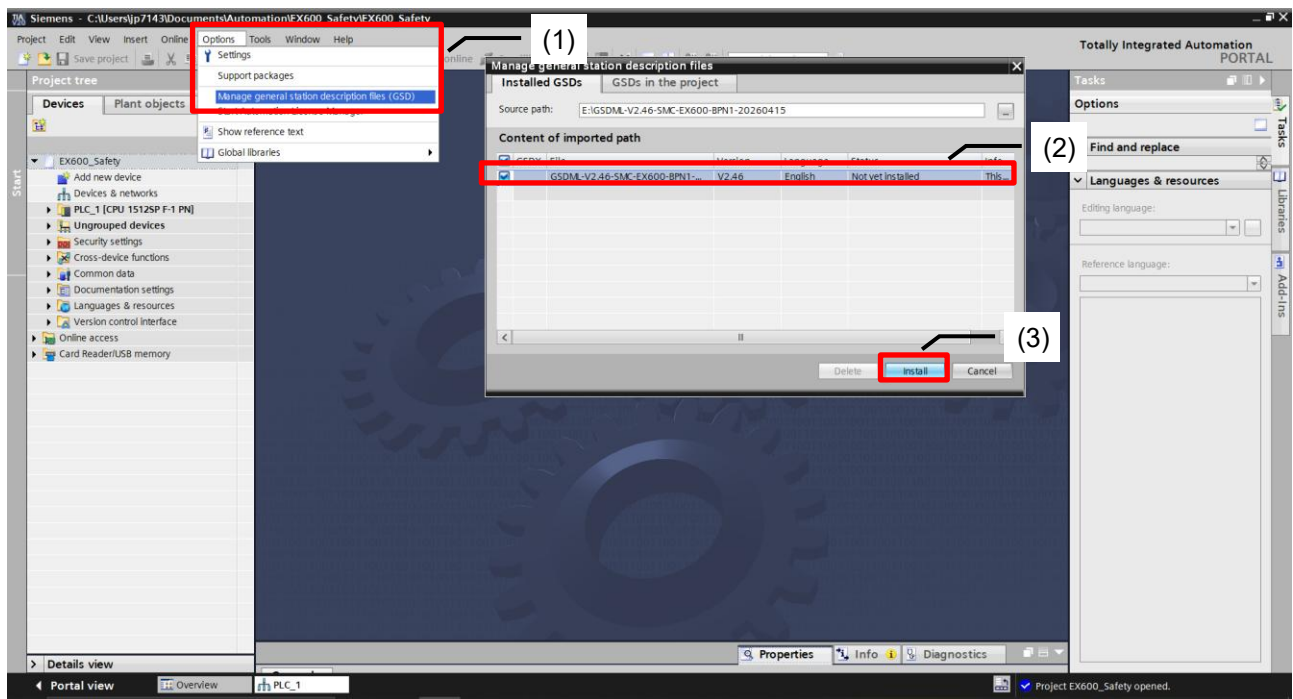
Icon file: GSDML-0083-0033-EX600_N.bmp

#####: A number greater than 20260415 is specified in this field.

11.2 PLC Configuration

11.2.1 GSDML File Installation

- (1) From the menu bar, select [Options], then choose [Manage general station description files (GSD)].
- (2) The [Manage general station description files] screen appears. Select the folder where the files to be installed are stored, and a list of GSDML files contained in the folder will be displayed.
- (3) Select the file to be installed and click [Install] to install the GSD file into the project.

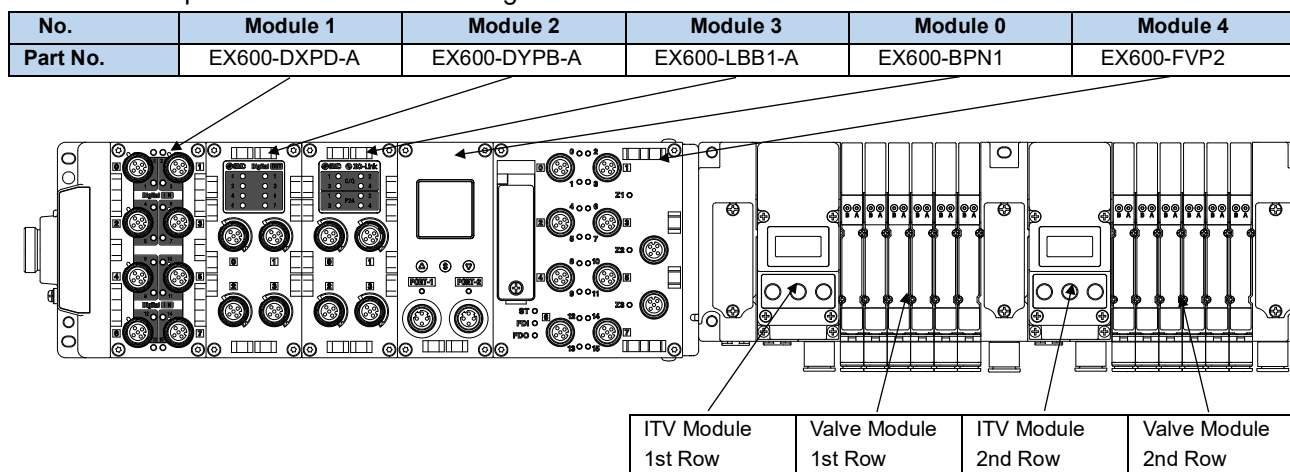


11.2.2 Module Configuration

In the EX600 system, module numbers are assigned sequentially starting with the fieldbus module and proceeding from the D-side end plate (see the table below). If the layout configured in the engineering tool does not match the actual hardware layout, communication with the PLC cannot be established.

In addition, for the Safety I/O Module (EX600-FVP), the input/output data size varies depending on the number of connected ITV modules and valve modules.* The input/output data of the ITV and valve modules assigned to the Safety I/O Module is allocated sequentially starting from the D-side. For details, refer to the Safety I/O Module Safety Manual.

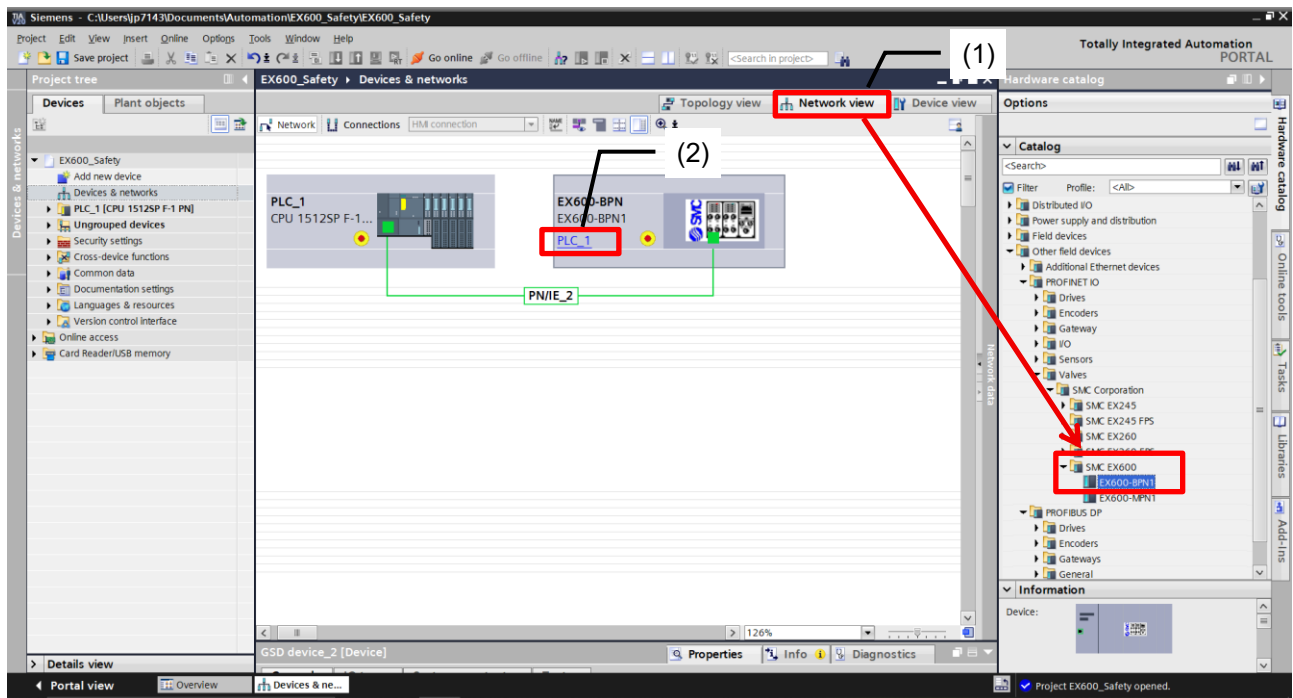
- Example of Module Number Assignment



Note: For details on the input/output data mapping of the ITV module, refer to the ITV Operation Manual (DIY-60L00-0M001).

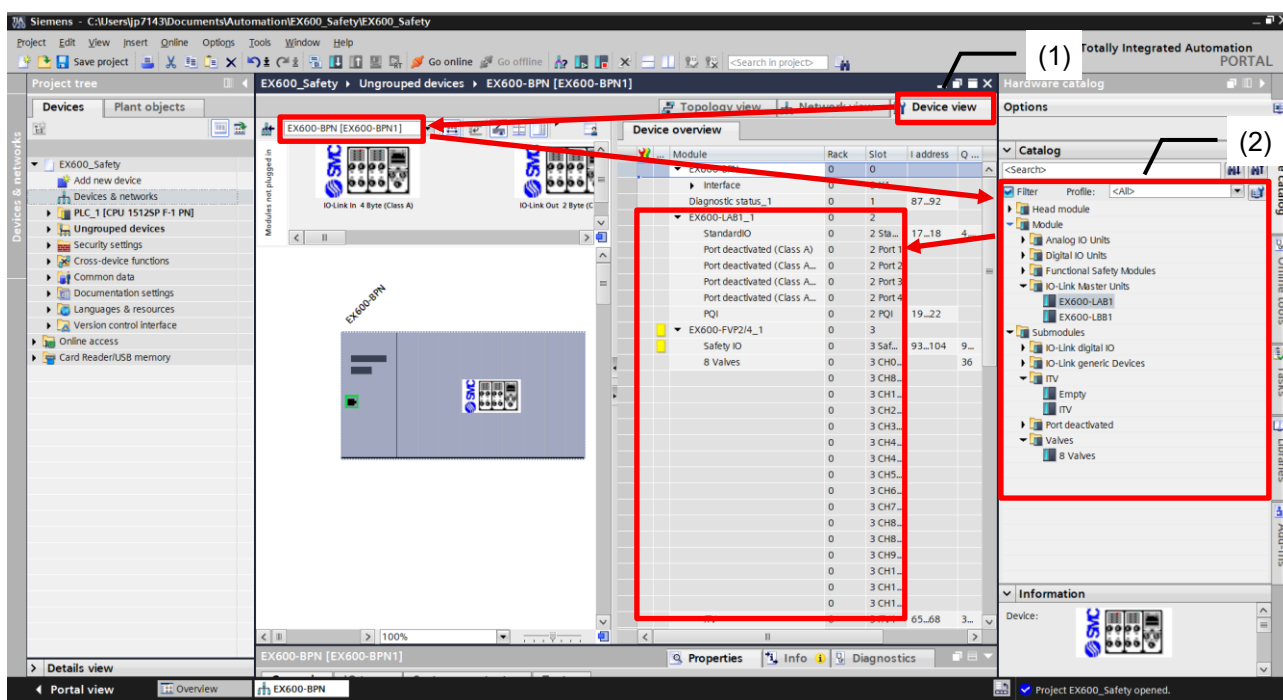
11.2.3 Adding the EX600-BPN1

- (1) After selecting the [Network view] tab, double-click EX600-BPN1 in the [Hardware catalog] to place the module in the [Devices & networks] screen.
- (2) After placing the EX600-BPN1, establish a network connection to the PLC to be connected.



11.2.4 Adding Modules

- (1) After establishing the network connection, double-click EX600-BPN1 in the Network view, or select the [Device view] tab and choose EX600-BPN1 under [Select device] to move to the EX600-BPN1 module configuration screen. “EX600-BPN” and “Diagnostic statis_1” are placed by default.
- (2) From the [Hardware catalog] window, add the modules connected to the D-side end plate in order by dragging and dropping them into the slots in [Device overview], or by double-clicking them.

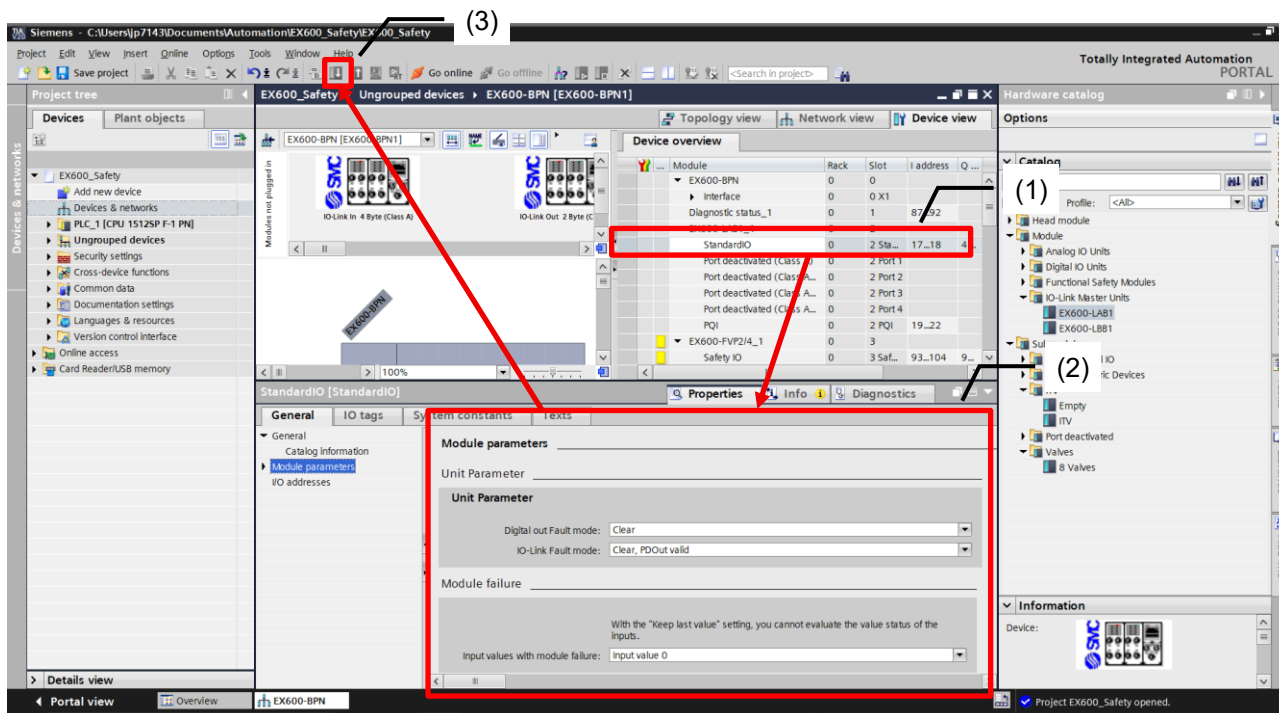


11.2.5 Adding Submodules

Submodules for ITV/valve modules are implemented for the IO-Link master module and Safety I/O modules other than EX600-FVP1. According to the operating environment, delete the submodules installed by default at the initial stage, then select the desired functions from the Submodules in the [Hardware catalog] window and add them by dragging and dropping, or by double-clicking.

11.2.6 Module Parameter Settings

- (1) In the [Device overview] screen, select the module for which you want to set parameters. Then, within the [Properties] tab of the selected module, select [Module parameters] under the [General] tab to display the list of configurable parameters.
- (2) Click the setting value of the parameter to be changed to modify the setting.
- (3) Select the [Download to device] icon to write the settings to the PLC.

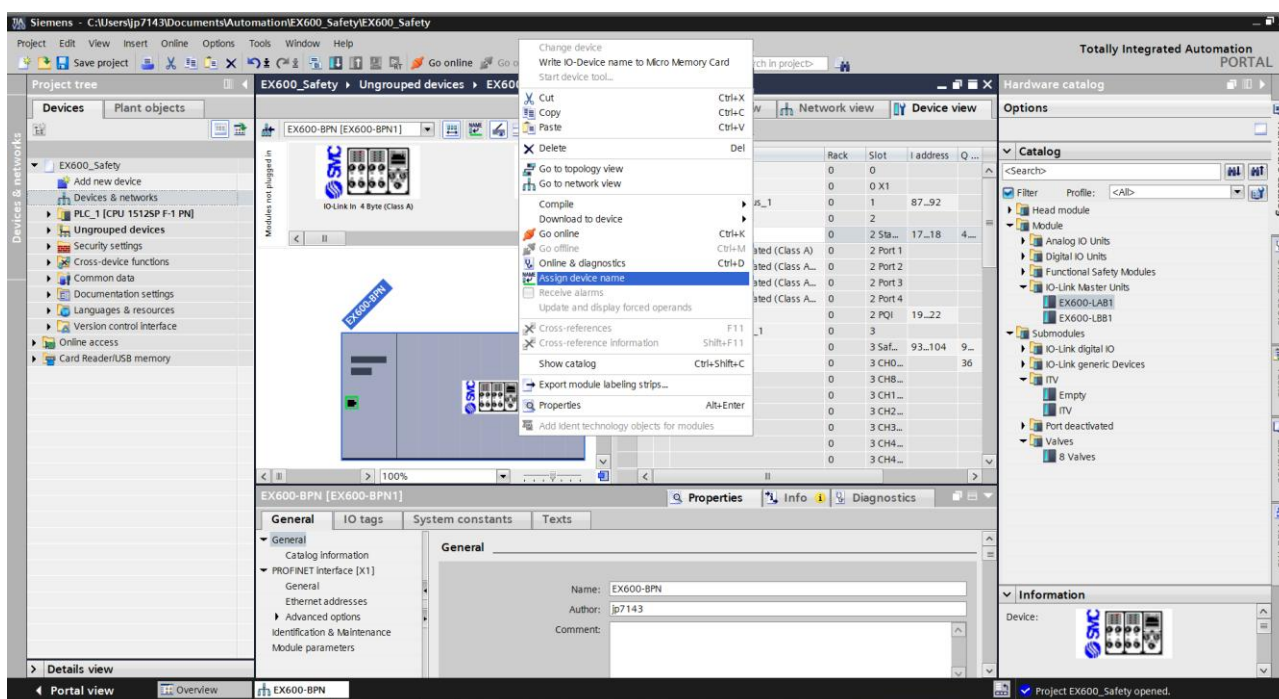


Note

- When the “Configuration tool selection” of EX600 BPN1 is set to “GSD”, parameters of the IO Link device can be set using Record Data or Function Blocks such as IO_LINK_DEVICE. In this case, use “255” as the Index (Record Data) or the Access point.
- For details on how to use Record Data or Function Blocks, refer to the operation manual of the engineering tool being used.

11.2.7 Device Name Setting

- (1) In the [Network view] tab, right-click EX600 and select [Assign device name], or click the [Assign device name] icon.
- (2) The [Assign PROFINET device name] screen is displayed. Set [Online access] according to your environment, then click [Update list].
- (3) All EX600-BPN1 devices connected to the network are displayed under [Accessible devices in the network]. Select the MAC address of the module for which you want to assign a device name, then execute [Assign name].
- (4) When the device name is successfully set, PROFINET communication with the target module is established, allowing control of I/O data and other functions of each module.



11.3 Setting Safety Parameters via Safety Outputs

To operate the Safety I/O Module, safety parameters must be set via safety output process data. Refer to the Safety I/O Module Safety Manual to set the safety parameters.

11.4 Module Replacement

The following describes points to note when replacing a module alone, such as when a module has failed or when checking operation by swapping a module from equipment with unstable operation with one from equipment operating stably.

Be sure to turn the power OFF before replacing a module. Refer to page 14 for assembly procedures and page 17 for installation procedures. For replacement procedures of ITV and valve modules, refer to their respective operation manuals.

- D-side Modules

If there is a possibility that the parameters set before replacement have been changed, record the parameters in advance.

After replacing the module with a new one, reconfigure the recorded parameters.

- Fieldbus Module

Record parameters such as the configured communication port settings.

After replacing with a new module, reconfigure the recorded parameters.

- Safety I/O Module

After replacement, the F-address (10-bit DIP switch) must be reset.

For the F-address setting method, refer to the Safety I/O Module Safety Manual.

11.5 Fast Start Up (FSU) Function

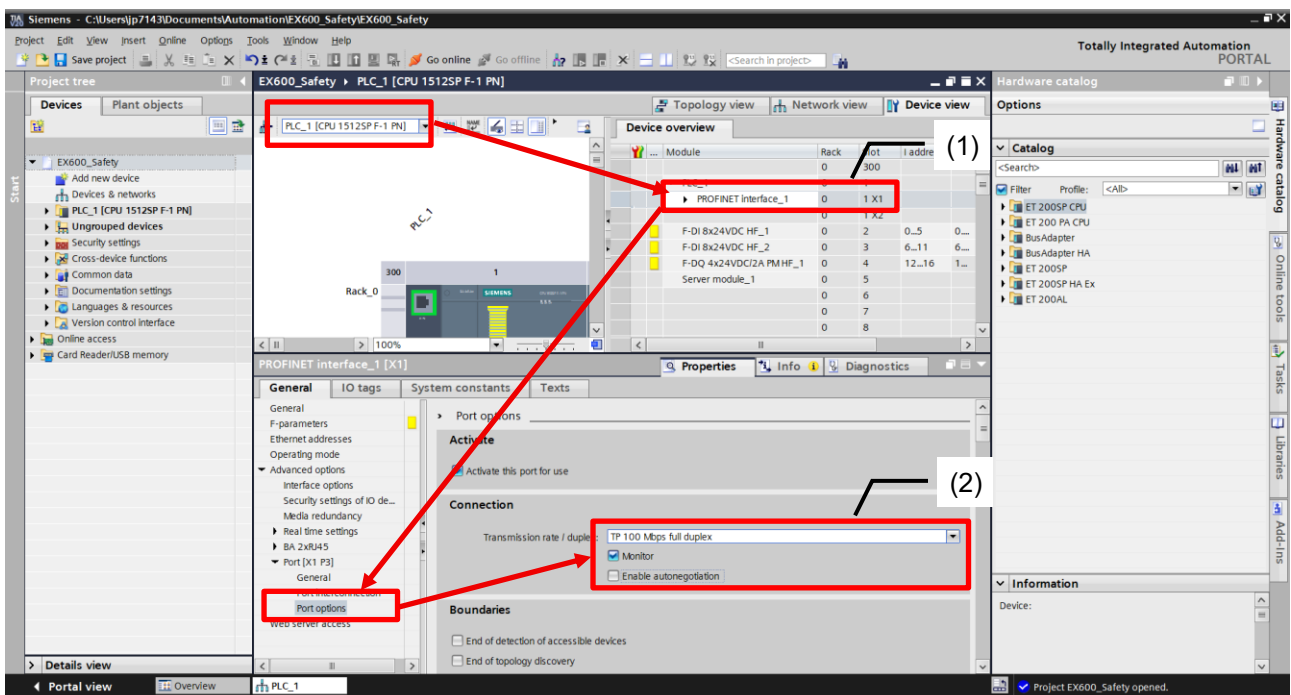
By enabling the FSU function, the time required from power ON to establishing PROFINET communication can be reduced. It is recommended to configure the FSU settings for the communication ports of all devices connected between the target modules.

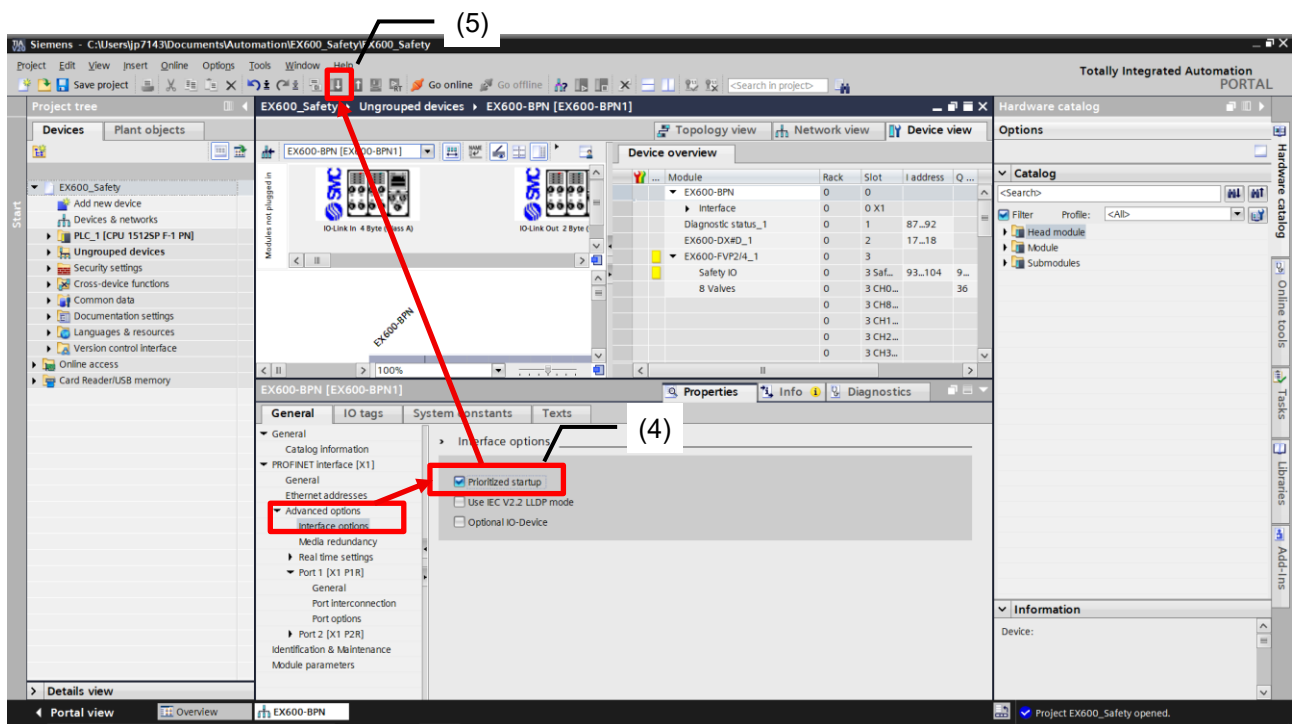
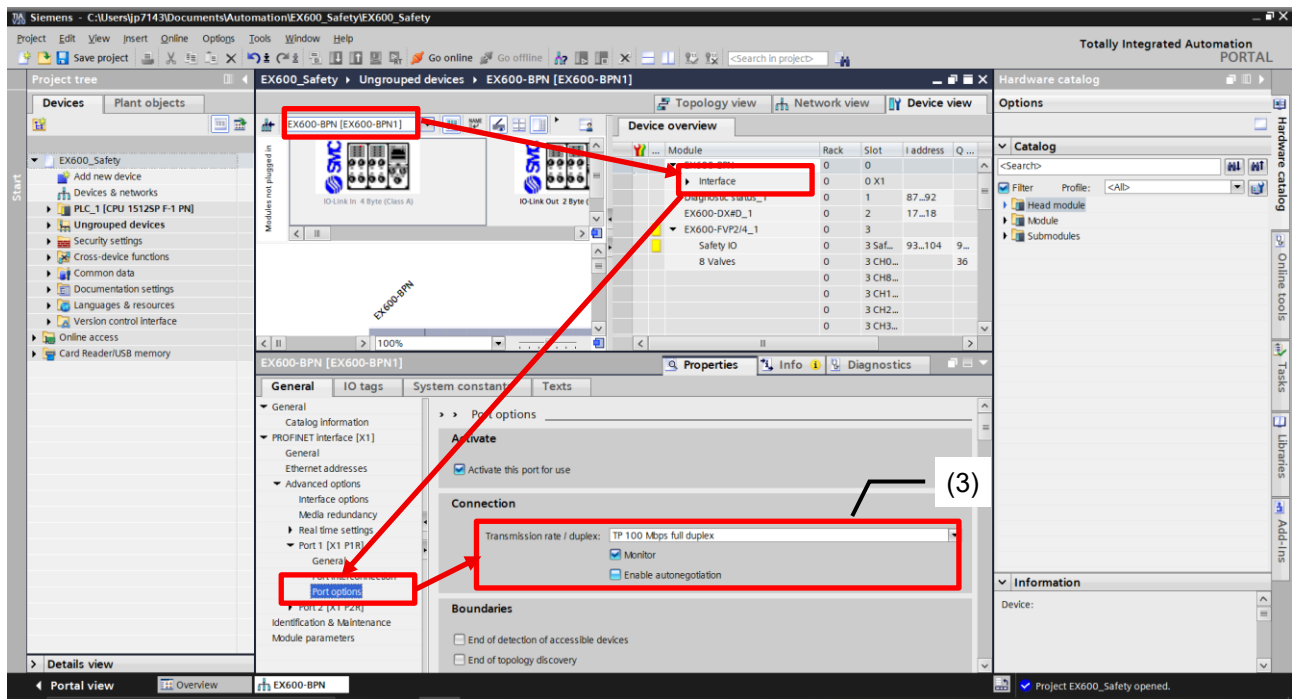
This section describes an example of the settings for a one-to-one connection between a PLC and the EX600-BPN1.

The startup time when this function is enabled varies depending on whether a Safety I/O Module is connected.

- Without Safety I/O Module connected: 500 ms or less
- With Safety I/O Module connected: approximately 1 s

- (1) After selecting the [Device view] tab, select the PLC under [Select device], then select [Port options] under the [General] tab within the [Properties] tab of the communication port where FSU settings will be applied.
- (2) In [Port options], set [Transmission rate / duplex] of the [Connection] parameter to [TP 100 Mbps full duplex], and clear the [Enable autonegotiation] checkbox.
- (3) Apply the same settings to the communication port of the EX600-BPN1 where FSU settings are to be applied.
- (4) After selecting [Advanced options] of the EX600-BPN1, select the [Prioritized startup] checkbox.
- (5) Select the [Download to device] icon to write the settings to the PLC.





11.6 IO-Link Device Parameter Settings

The EX600-BPN1 supports IO-Link device parameter settings using the methods described below.

1. Using an IO-Link Device Tool

This operation is enabled when the Module parameter setting value on the GSD of the EX600-BPN1 is set to "IO-Link device tool". When using the IO-Link device tool, operate it according to the tool's operation manual. The IO-Link device tool operation manual (EX##-OMY0013) can be downloaded from our website. An IODD file is required when using the IO-Link device tool.

2. Using Function Blocks such as Record Data / IO_LINK_DEVICE

This operation is enabled when the Module parameter setting value on the GSD of the EX600-BPN1 is set to "GSD". When using Record Data or IO_LINK_DEVICE, an IODD file is not required. The table below shows the Record Data formats supported by the IO-Link master modules (EX600-L### series). When using function blocks such as IO_LINK_DEVICE with the IO-Link master modules (EX600-L### series), use "255" as the "Access point (Client Access Point)".

For details on Record Data and function blocks such as IO_LINK_DEVICE, refer to the operation manual of the PLC engineering tool you are using.

Index	Byte	Target	Access	Items	Remark
0x0255	0	IO-Link master module	R/W	Function	0x08: Indicates Call Header
	1			Port	0x01: Port1 0x02: Port2 0x03: Port3 0x04: Port4
	2..3			FI_Index	0xFE4A: Fixed
	4			Control	0x00: Cancel/Release IOL_CALL 0x02: Write On-request Data or Port function 0x03: Read On-request Data
	5..6			IOL_Index	On-request Data 0..0x7FFF: IOLD data Index Port function 0xFFFF: Port function
	7			IOL_Subindex	On-request Data 0..0xFF: IOLD data Subindex Port function 0: Command-PortPowerMode
	8..n			IOL_Data	Write On-request Data "Payload" data Command-PortPowerMode Byte8: PortPowerMode 0x01: One time switch off (PowerOffTime) 0x02: Switch PortPowerOff(permanent) 0x03: Switch PortPowerOn(permanent) Byte9..10: PowerOffTime Duration of Master power off (ms)

12 Record data

Using Record Data enables monitoring of the ON/OFF operation count of each module, as well as initialization (reset) of the count value.

Refer to the table below for the parameters used with Record Data.

For details on how to access Record Data, refer to the instruction manual of your PLC manufacturer.

Index	Data size[Byte]*1	HW ID*2	Access
0x006C	0~31 (depending on the target module)	Depends on the target module	R/W

*1: The data size of Record Data depends on the type of module to be monitored.

Example: EX600-DXPD: 2 bytes

EX600-FVP1: 4 bytes

*2: The HW ID of the target module depends on your system configuration.

For details on how to identify the HW ID, refer to the instruction manual of your PLC manufacturer.

Note

- When reading the ON/OFF operation count, if the data size of the target module differs from the data size specified in Record Data, the read operation will be performed using the data size specified in Record Data.

Example:

Target module data size: 4 bytes

Record Data size: 2 bytes

→ Only 2 bytes of the ON/OFF operation count are read

- Clearing the ON/OFF operation count is executed by writing "0x01" to the above Index. If any value other than "0x01" is written, the fieldbus module does not accept the data.
- When writing Record Data, the fieldbus module accepts the execution command only when the data size of the target module matches the data size specified in Record Data.

Example 1:

Target module data size: 4 bytes

Record Data size: 2 bytes

→ Write not allowed

Example 2:

Target module data size: 4 bytes

Record Data size: 4 bytes

→ Write allowed

13 Accessories

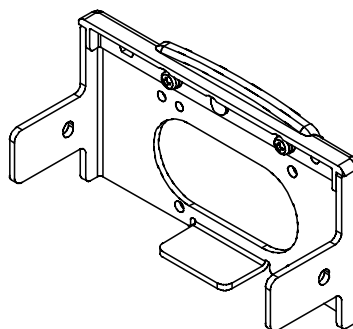
For selection, refer to the catalog.

(1) Valve Plate

EX600-ZMV1-A (for VQC)

Included items: Hex socket head screws ($M4 \times 6$) $\times 2$

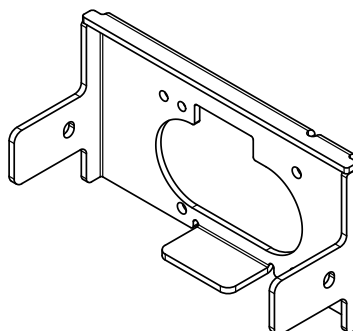
Pan head screws ($M3 \times 8$) $\times 4$



EX600-ZMV3-A (for SY, JSY)

Included items: Hex socket head screws ($M4 \times 6$) $\times 2$

Pan head screws ($M3 \times 8$) $\times 2$



(2) End Plate Mounting Bracket

EX600-ZMA2

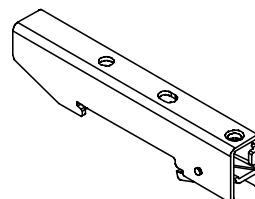
Included items: Pan head screw ($M4 \times 20$) $\times 1$

P-tight screws (4×14) $\times 2$

EX600-ZMA3

Included items: Pan head screw with washer ($M4 \times 20$) $\times 1$

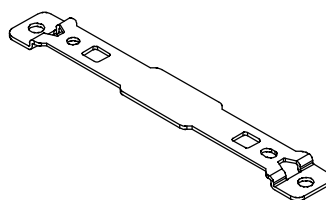
P-tight screws (4×14) $\times 2$



(3) Intermediate Reinforcement Bracket

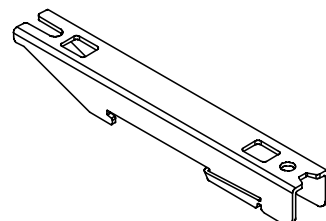
EX600-ZMB1 (for direct mounting)

Included items: Pan head screws ($M4 \times 5$) $\times 2$



EX600-ZMB2 (for DIN rail mounting)

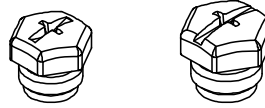
Included items: Pan head screws ($M4 \times 6$) $\times 2$



(4) Waterproof Cap (Pack of 10)

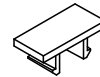
For EX9-AWES.. M8

For EX9-AWTS.. M12



(5) Markers (1 sheet, 88 pieces)

EX600-ZT1



(6) Assembled Connector

PCA-1446553 For PROFINET, M12 (4-pin), plug, D-coded

PCA-1578081 For power supply, 7/8 inch, socket, cable outer diameter 12 to 14 mm

(7) Power 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

(8) PROFINET Communication Cable

PCA-1446566 Cable with M12 connector, D-coded, plug, straight, 5 m, SPEEDCON compatible
EX9-AC010EN-PSRJ Cable with M12 connector, D-coded to RJ45, plug, straight, 1 m
EX9-AC020EN-PSRJ Cable with M12 connector, D-coded to RJ45, plug, straight, 2 m
EX9-AC030EN-PSRJ Cable with M12 connector, D-coded to RJ45, plug, straight, 3 m
EX9-AC050EN-PSRJ Cable with M12 connector, D-coded to RJ45, plug, straight, 5 m
EX9-AC100EN-PSRJ Cable with M12 connector, D-coded to RJ45, plug, straight, 10 m
EX9-AC005EN-PSPS Cable with M12 connectors, D-coded plugs on both ends, straight, 0.5 m
EX9-AC010EN-PSPS Cable with M12 connectors, D-coded plugs on both ends, straight, 1 m
EX9-AC020EN-PSPS Cable with M12 connectors, D-coded plugs on both ends, straight, 2 m
EX9-AC030EN-PSPS Cable with M12 connectors, D-coded plugs on both ends, straight, 3 m
EX9-AC050EN-PSPS Cable with M12 connectors, D-coded plugs on both ends, straight, 5 m
EX9-AC100EN-PSPS Cable with M12 connectors, D-coded plugs on both ends, straight, 10 m
EX9-AC005EN-PAPA Cable with M12 connectors, D-coded plugs on both ends, angled, 0.5 m
EX9-AC010EN-PAPA Cable with M12 connectors, D-coded plugs on both ends, angled, 1 m
EX9-AC020EN-PAPA Cable with M12 connectors, D-coded plugs on both ends, angled, 2 m
EX9-AC030EN-PAPA Cable with M12 connectors, D-coded plugs on both ends, angled, 3 m
EX9-AC050EN-PAPA Cable with M12 connectors, D-coded plugs on both ends, angled, 5 m
EX9-AC100EN-PAPA Cable with M12 connectors, D-coded plugs on both ends, angled, 10 m

(9) IO-Link Communication Cable

EX9-AC005-SSPS Cable with M12 connectors on both ends, socket and plug, straight, 0.5 m
EX9-AC010-SSPS Cable with M12 connectors on both ends, socket and plug, straight, 1 m
EX9-AC020-SSPS Cable with M12 connectors on both ends, socket and plug, straight, 2 m
EX9-AC030-SSPS Cable with M12 connectors on both ends, socket and plug, straight, 3 m
EX9-AC050-SSPS Cable with M12 connectors on both ends, socket and plug, straight, 5 m
EX9-AC100-SSPS Cable with M12 connectors on both ends, socket and plug, straight, 10 m

Revision history

SMC Corporation

Tel: + 81 3 5207 8249 Fax: +81 3 5298 5362
URL <https://www.smcworld.com>

Note: Specifications are subject to change without prior notice and any obligation on the part of the manufacturer.
© SMC Corporation All Rights Reserved

