



Operation Manual

PRODUCT NAME

Fieldbus system
PROFINET compatible SI Unit

MODEL / Series / Product Number

EX245-SPN1A / 2A / 3A (SI Unit)
EX245-DX1 (Digital Input Module)
EX245-DY1 (Digital Output Module)
EX245-LA1 / LB1 (IO-Link Module)
EX245-EA2-# (End Plate)

SMC Corporation

Contents

1. Product Summary	11
1.1. Features	11
1.2. Structure	12
2. General Specifications	13
3. Installation	14
3.1. Mounting	14
3.2. Wiring	16
4. Commissioning	22
4.1. Configuration	22
4.2. Parameterisation	26
5. Diagnosis	30
5.1. Diagnostics data on I/O mapping	30
5.2. Maintenance alarm for the Fibre-optic cables	34
6. SI Unit	35
6.1. Parts and description	35
6.2. Specifications	37
6.3. Process data for valves	39
6.4. LED indicators	40
6.5. Block diagram	43
7. Digital Input Module - EX245-DX1	46
7.1. Parts and description	46
7.2. Specifications	47
7.3. Wiring	48
7.4. Process data	48
7.5. LED indicators	49
7.6. Block diagram	50
8. Digital Output Module - EX245-DY1	51
8.1. Parts and description	51
8.2. Specifications	52
8.3. Wiring	53
8.4. Process data	53
8.5. LED indicators	54
8.6. Block diagram	55
9. IO-Link Module - EX245-LA1/LB1	56
9.1. Parts and description	56
9.2. Specifications	57

9.3. Wiring	58
9.4. Connector allocation and process data	59
9.5. Slot structure	59
9.6. Sub-modules	60
9.7. Diagnostics data on I/O mapping (PQI)	61
9.8. Parameterisation	62
9.9. Diagnosis	66
9.10. LED indicators	67
9.11. Block diagram	68
10. End Plate - EX245-EA2-1/2/3/4/5	70
10.1. Parts and description	70
10.2. Specifications	73
11. Accessories	74
11.1. Markers	74
11.2. Y Connector	75
11.3. Seal cap	77
11.4. Joint pack	79
12. Dimensions	80
12.1. The Modules Manifold	80
13. Troubleshooting	81
13.1. EX245-SPN1A/SPN2A/SPN3A	81
13.2. EX245-DX1	83
13.3. EX245-DY1	83
13.4. EX245-LA1/LB1	84



Safety Instructions

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

*1) ISO 4414: Pneumatic fluid power -- General rules relating to systems.

ISO 4413: Hydraulic fluid power -- General rules relating to systems.

IEC 60204-1: Safety of machinery -- Electrical equipment of machines. (Part 1: General requirements)

ISO 10218: Manipulating industrial robots -Safety.

etc.



Caution

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



Warning

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



Danger

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

Warning

1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results.

The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product.

This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly.

The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.

1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.

2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.

3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.

2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.

3. An application which could have negative effects on people, property, or animals requiring special safety analysis.

4. Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.



Safety Instructions

Caution

1. The product is provided for use in manufacturing industries.

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

Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following "Limited warranty and Disclaimer" and "Compliance Requirements".

Read and accept them before using the product.

Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first.*2)

Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.

2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.

This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.

3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.

***2) Vacuum pads are excluded from this 1 year warranty.**

A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.

Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

Compliance Requirements

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited.

2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulation of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.

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 with wet hands.
This may lead to an electric shock.
- Do not operate the product outside of the specifications.
Do not use for flammable or harmful fluids.
Fire, malfunction, or damage to the product can result.
Verify the specifications before use.
- Do not operate in an atmosphere containing flammable or explosive gases.
Fire or an explosion can result.
This product is not designed to be explosion proof.
- If using the product in an interlocking circuit:
 - Provide a double interlocking system, for example a mechanical system.
 - Check the product regularly for proper operation.Otherwise malfunction can result, causing an accident.
- The following instructions must be followed during maintenance:
 - Turn off the power supply.
 - Stop the air supply, exhaust the residual pressure and verify that the air is released before performing maintenance.Otherwise an injury can result.

Caution

- When handling the unit or assembling/replacing units:
 - Do not touch the sharp metal parts of the connector or plug for connecting units.
 - Take care not to hit your hand when disassembling the unit.
The connecting portions of the unit are firmly joined with seals.
 - When joining units, take care not to get fingers caught between units.
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 Fieldbus system.
Individual grounding should be provided close to the product with a short cable.

■ **NOTE**

- Follow the instructions given below when designing, selecting and handling the product.
 - The instructions on design and selection (installation, wiring, environment, adjustment, operation, maintenance, etc.) described below must also be followed.
 - *Product specifications
 - The direct current power supply to combine should be UL1310 Class 2 power supply when conformity to UL is necessary.
 - 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 or malfunction to the product.
It may also result in non-conformity to safety standards.
 - Beware of inrush current when the power supply is turned on.
Some connected loads can apply an initial charge current which will activate the over current protection function, causing the unit to malfunction.

●Product handling

*Installation

- Do not drop, hit or apply excessive shock to the 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.

IP65 protection cannot be guaranteed if the screws are not tightened to the specified torque.

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

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

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

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

*Wiring

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

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

- Wire correctly.

Incorrect wiring can break the product.

- Do not perform wiring while the power is on.

Otherwise damage to the SI Unit and/or input or output module can result, causing malfunction.

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

Otherwise the SI Unit and/or input or output module 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 SI Unit and/or input or output module 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.

IP65 protection is achieved when the following conditions are met.

- (1)The EX245-SPN1A/EX245-SPN2A and/or input or output module are connected properly with power/fieldbus cable with Push Pull connector and I/O device cable with M12 connector.

The EX245-SPN3A and/or input or output module are connected properly with power cable with 7/8 inch connector, fieldbus cable with M12 connector and I/O device cable with M12 connector.

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

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

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

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

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

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

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

Otherwise damage to the product and malfunction can result.

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

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

- 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 product.
- The product is CE marked, but not immune to lightning strikes. Take measures against lightning strikes in the system.
- Prevent foreign matter such as dust or wire debris from getting inside the product.
- Mount the product in a place that is not exposed to excessive vibration or impact.
Otherwise failure or malfunction can result.
- Do not use the product in an environment that is exposed to temperature cycle.
Heat cycles other than ordinary changes in temperature can adversely affect the inside of the product.
- Do not expose the product to direct sunlight.
If using in a location directly exposed to sunlight, shade the product from the sunlight.
Otherwise failure or malfunction can result.
- Keep within the specified ambient temperature range.
Otherwise malfunction can result.
- Do not operate close to a heat source, or in a location exposed to radiant heat.
Otherwise malfunction can result.

*Adjustment and Operation

- Perform settings suitable for the operating conditions.
Incorrect setting can cause operation failure.
For details of each setting, refer to the SI Unit Operation Manual.
- Please refer to the IO Controller manufacturer's manual etc. for details of programming and addresses.
For the IO Controller 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 product.
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 refer to 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.

1. Product Summary

1.1. Features

SI Unit

The SI (Serial Interface) Unit represents a PROFINET IO-device for SMC pneumatic valves. It is designed for digital data control by connecting compatible the EX245 digital Input/Output modules and IO-Link modules and for use within rugged industrial environments, especially automotive plants. The SI Unit has the following properties:

- IP65 protection
- Two connectors for supply voltages and two connectors for PROFINET IO connection, EX245-SPN1A: 2 x Push Pull connectors (24 Volt) and 2 x Push Pull connectors (SCRJ)
EX245-SPN2A: 2 x Push Pull connectors (24 Volt) and 2 x Push Pull connectors (RJ45)
EX245-SPN3A: 2 x 7/8 inch 5 pins connectors and 2 x M12 4 pins socket D-coded connectors
- Up to 32 solenoid valves
- Up to 128 digital inputs
- Up to 64 digital outputs independent of solenoid valves
- Up to 32 IO-Link devices can be connected
- Up to 8 modules (limited by the total current consumption)
- FSU (Fast Start Up) supported
- Conformance Class C (Only for IRT switch function) supported
- MRP (Media Redundancy Protocol) and MRPD (Media Redundancy for Planned Duplication) function supported
- System redundancy S2 supported
- Shared device function supported
- PROFIenergy function supported
- Net Load Class III of Security Level 1 supported
- Built-in Web server function
- A firmware update function
- Maintenance alarm supported for the Fibre-optic cables for the EX245-SPN1A
- Integrated diagnostic and protection function
- Maximum loop through current between power connectors is 16A (EX245-SPN1A/EX245-SPN2A), or is 6A (EX245-SPN3A)
- Galvanically isolated power supplies
- Free module configuration

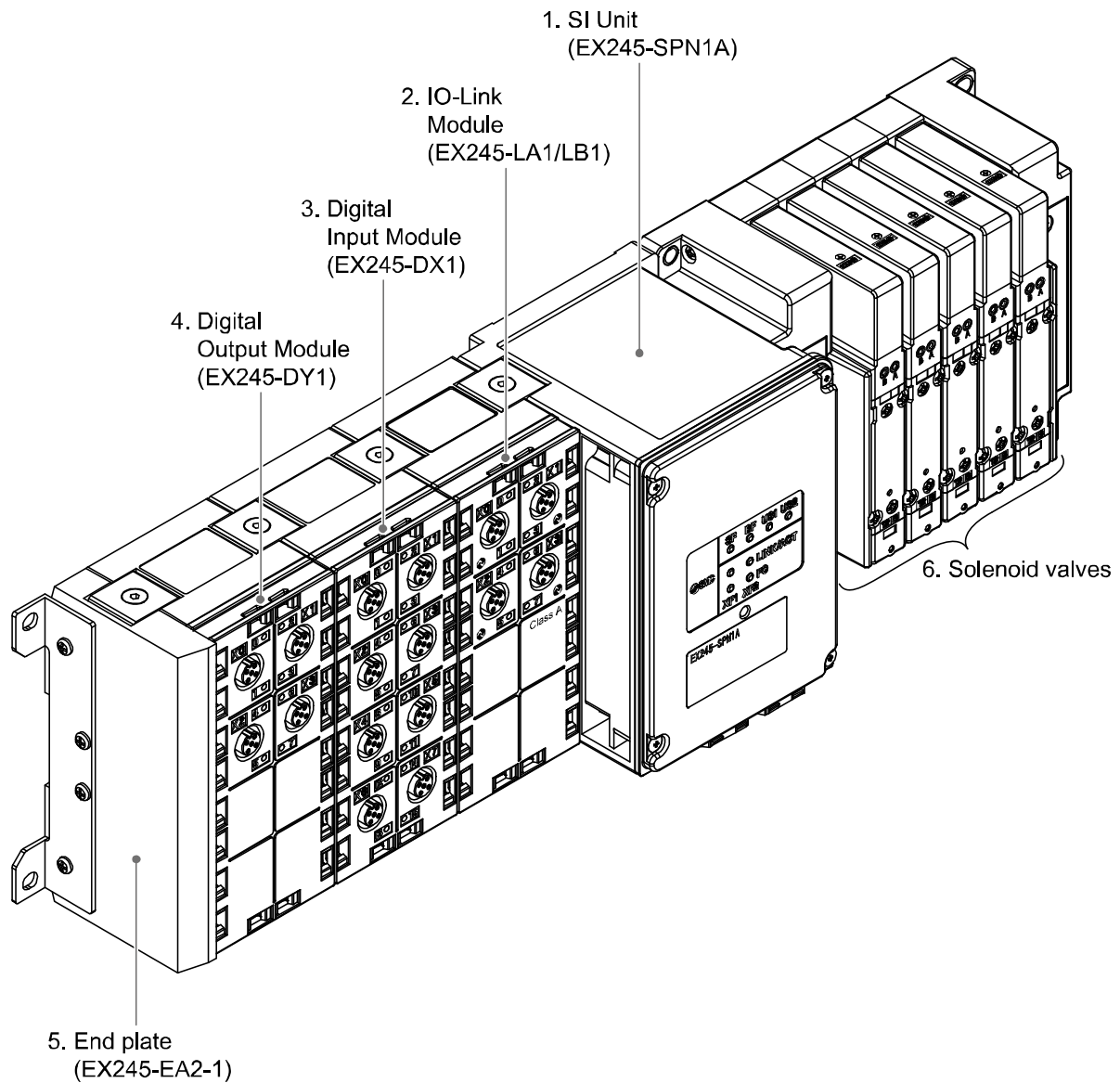
Corresponding solenoid valve manifolds

- JSY series JSY3000, JSY5000
- SY series SY3000, SY5000
- VQC series VQC2000, VQC4000

Compatible EX245 modules

- Digital Input Module : EX245-DX1 (16 digital inputs)
- Digital Output Module : EX245-DY1 (8 digital outputs)
- IO-Link Module : EX245-LA1 (4 IO-Link ports, Class A)
EX245-LB1 (4 IO-Link ports, Class B)

1.2. Structure



No.	Components	Function
1	SI Unit	Fieldbus, valve interface and supply voltage to modules
2	IO-Link Module	Communicate and control to IO-Link devices
3	Digital Input Module	Supply voltage to sensors and input digital data
4	Digital Output Module	Output to electric loads
5	End plate	End plate of module side
6	Solenoid valves	Operate pneumatic devices

Fig. 1-1 System structure

2. General Specifications

Table. 2-1 EX245 series general specifications

Item	Specification
Rated voltage	24 VDC
Allowable instantaneous electrical stop	1 msec maximum
Protection class	IP65 rating (when fully installed or fitted with protective cover) (complies with IEC 60529)
Applicable standard	CE / UKCA Marked UL(CSA) RoHS directive EN50581: 2012
Withstand voltage	500 VAC 1 min. (between FE and all accessible terminals)
Insulation resistance	10 M ohm or more (500 VDC is given between FE and all accessible terminals)
Ambient temperature	Operation: -10 °C to 50 °C Storage: -20 °C to 60 °C
Ambient humidity	35% to 85% RH (non-condensing)
Vibration resistance	10 Hz to 57 Hz (constant amplitude) 0.75 mm 57 Hz to 150 Hz (constant acceleration) 49 m/s ² 2 hours for each direction X, Y and Z (complies with IEC60068-2-6)
Impact resistance	147 m/s ² is given 3 times for each direction X, Y and Z (complies with IEC60068-2-27)
Operating environment	No corrosive gas

3. Installation

3.1. Mounting

⚠ Caution

- To prevent manifold components being damaged, apply the recommended tightening torque.
- Mount the manifold using the 6 mounting positions on the base with screws.

Required screws are as follows:

- ① 2 x M5 (End plate: torque = 1.5 N•m)
- ② 4 x M* (Valve manifold: refer to valve manifold catalogue)

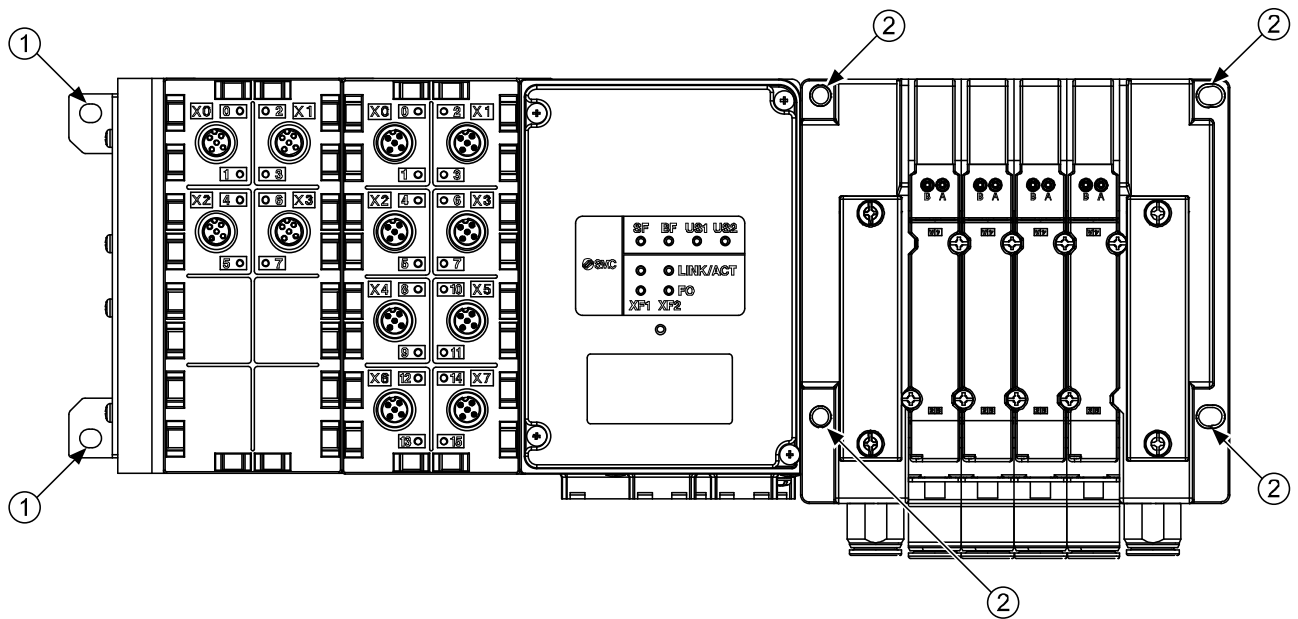


Fig. 3-1 Required screws

All manifolds are mounted using 6 screws (except VQC4000 which uses 5 screws).

3.1.1. Valve manifold connection

Connect the valve manifold with the 2 screws on the SI Unit. (hexagonal socket wrench size 2.5)
For torque value, refer to valve manifold catalogue.

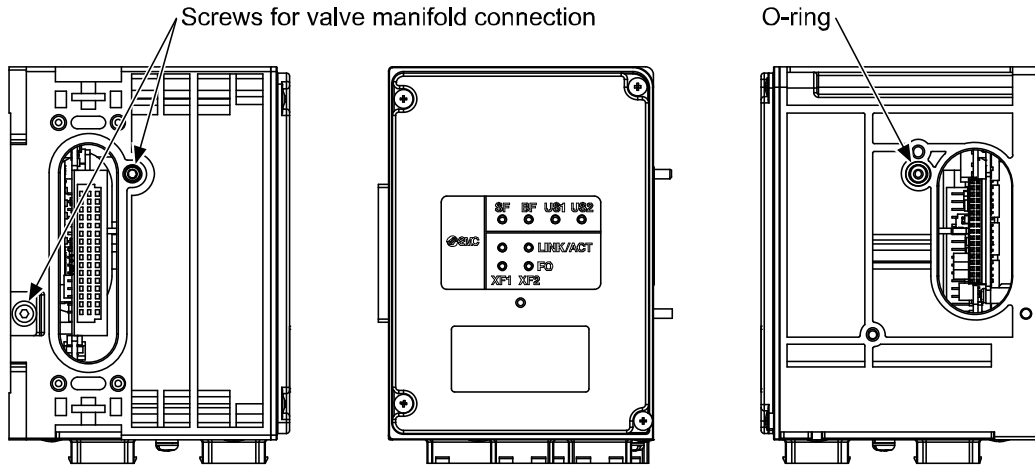


Fig. 3-2 Valve manifold connection

⚠ Caution

- For a protection rating of IP65 to be ensured, apply the recommended tightening torque and make sure that the O-ring is positioned correctly on the screw.

3.1.2. Module connection

Connect the SI Unit, the Input/Output modules, the IO-Link modules and the End plate with the 2 modular adaptor assemblies and the joint assembly. These are grouped together in the Joint pack, refer to [Section 11.4](#).

- 1 x Joint assembly
- 2 x Modular adaptor assembly (hexagonal socket wrench size 2.5, torque = 1.3 N•m)

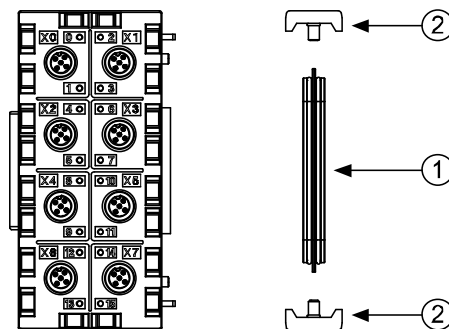


Fig. 3-3 Module connection

⚠ Caution

- For a protection rating of IP65 to be maintained, the End plate must be installed on the end of module side correctly.
- For a protection rating of IP65 to be ensured, modular adaptor assemblies and joint assembly must be installed between each module correctly.
- To prevent the modules and assemblies being damaged, apply the recommended tightening torque.

3.2. Wiring

⚠ Caution

- To prevent damage, all voltages to the SI Unit must be turned off (i.e. de-energized) before the modules are installed or removed.

Wire the grounding cable, the PROFINET cables and the power cable.

EX245-SPN1A

- ① M4, FE terminal screw (torque = 0.7 to 0.8 N•m)
- ② Push Pull connector (24 Volt), Power connection (XD1)
- ③ Push Pull connector (24 Volt), Power connection (XD2)
- ④ Push Pull connector (SCRJ), PROFINET connection Port1 (XF1)
- ⑤ Push Pull connector (SCRJ), PROFINET connection Port2 (XF2)

EX245-SPN2A

- ① M4, FE terminal screw (torque = 0.7 to 0.8 N•m)
- ② Push Pull connector (24 Volt), Power connection (XD1)
- ③ Push Pull connector (24 Volt), Power connection (XD2)
- ④ Push Pull connector (RJ45), PROFINET connection Port1 (XF1), Port type: MDI
- ⑤ Push Pull connector (RJ45), PROFINET connection Port2 (XF2), Port type: MDI-X

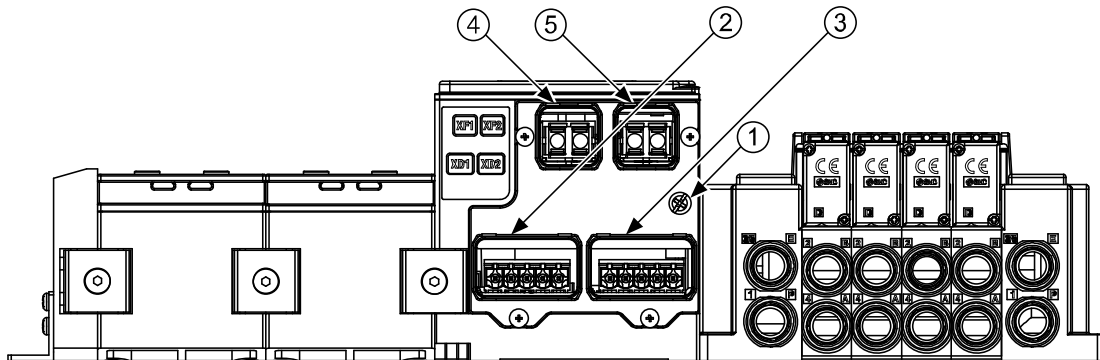


Fig. 3-4 Screw and connector allocation (EX245-SPN1A/SPN2A)

EX245-SPN3A

- ① M4, FE terminal screw (torque = 0.7 to 0.8 N•m)
- ② 7/8 inch 5 pins plug connector, Power connection (XD1)
- ③ 7/8 inch 5 pins socket connector, Power connection (XD2)
- ④ M12 4 pins socket D-coded connector, PROFINET connection Port1 (XF1), Port type: MDI
- ⑤ M12 4 pins socket D-coded connector, PROFINET connection Port2 (XF2), Port type: MDI-X

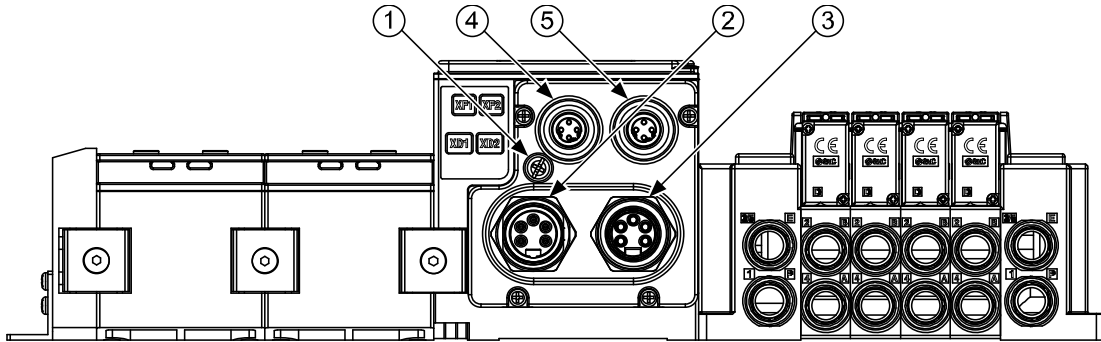


Fig. 3-5 Screw and connector allocation (EX245-SPN3A)

3.2.1. Power/Bus connection

The SI Unit has two Power connectors (XD1/XD2) and two PROFINET communication connectors (XF1/XF2). If only one connector is used, cover the unused connector with a seal cap so that the protection rating of IP65 is maintained.

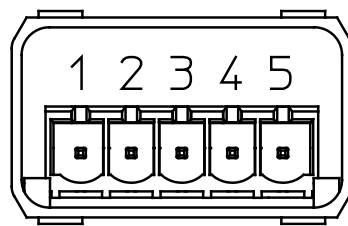
The supply for the logic/sensors "US1" and the supply for the valves/loads "US2" provide the connected modules and the valve coils via the SI Unit.

The two supplies are isolated electrically and can be switched independently.

⚠ Caution

- Seal caps must be fitted to all unused bus & power connector ports to ensure an IP65 rating.
- Seal caps must be fitted to all unused bus connector ports to prevent eye exposure to the light beam from the SCRJ connectors for the EX245-SPN1A
- Power and bus lines must be installed correctly.
- To prevent manifold components of the SI Unit from being damaged the supply lines for the electronics and for the load voltage must be protected externally with a fuse.
- Maximum loop through current between power connectors on each SI Unit must not be exceeded.
- The EX245-SPN1A makes use of a CLASS 1 LASER product. Do not stare into beam visible at XF1/XF2.

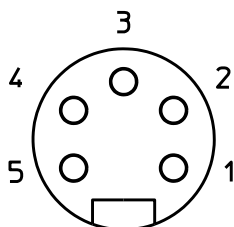
Power connectors



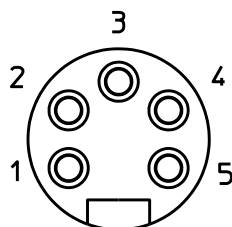
View of Push Pull connector (XD1/XD2)

Pin	Remarks
1	24 V (US1)
2	0 V (US1)
3	24 V (US2)
4	0 V (US2)
5	FE

Fig. 3-6 Pin allocation of Push Pull connector (24 Volt) for EX245-SPN1A/SPN2A



View of 7/8 inch 5 pins plug connector (XD1)

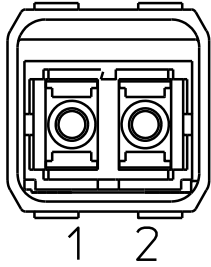


View of 7/8 inch 5 pins socket connector (XD2)

Pin	Remarks
1	0 V (US2)
2	0 V (US1)
3	FE
4	24 V (US1)
5	24 V (US2)

Fig. 3-7 Pin allocation of 7/8 inch 5 pins connector for EX245-SPN3A

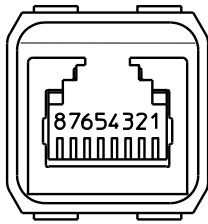
PROFINET communication connectors



View of Push Pull connector (XF1/XF2)

Pin	Port1/Port2
1	TX Transmit Data
2	RX Receive Data

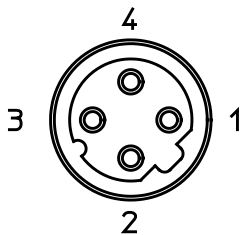
Fig. 3-8 Pin allocation of Push Pull connector (SCRJ) for EX245-SPN1A



View of Push Pull connector (XF1/XF2)

Pin	Port1 (XF1) Port type: MDI	Port2 (XF2) Port type: MDI-X
1	TD+ Transmit data+	RD+ Receive data+
2	TD- Transmit data-	RD- Receive data-
3	RD+ Receive data+	TD+ Transmit data+
4	-	-
5	-	-
6	RD- Receive data-	TD- Transmit data-
7	-	-
8	-	-

Fig. 3-9 Pin allocation of Push Pull connector (RJ45) for EX245-SPN2A



View of M12 4 pins socket D-coded connector (XF1/XF2)

Pin	Port1 (XF1) Port type: MDI	Port2 (XF2) Port type: MDI-X
1	TD+ Transmit data+	RD+ Receive data+
2	RD+ Receive data+	TD+ Transmit data+
3	TD- Transmit data-	RD- Receive data-
4	RD- Receive data-	TD- Transmit data-

Fig. 3-10 Pin allocation of M12 4 pins socket D-coded connector for EX245-SPN3A

NOTE

- When you use the EX245-SPN2A/EX245-SPN3A and the Autonegotiation function is disabled, you must select the correct network cable, refer to Fig 3-11, 3-12.
- Auto crossover function is not available when the Autonegotiation function is disabled.
- Auto crossover function shall be capable of switching over their twisted pair ports automatically between MDI and MDI-X pin assignment.

The following figure Fig. 3-11 shows examples on the use of two different cable types.

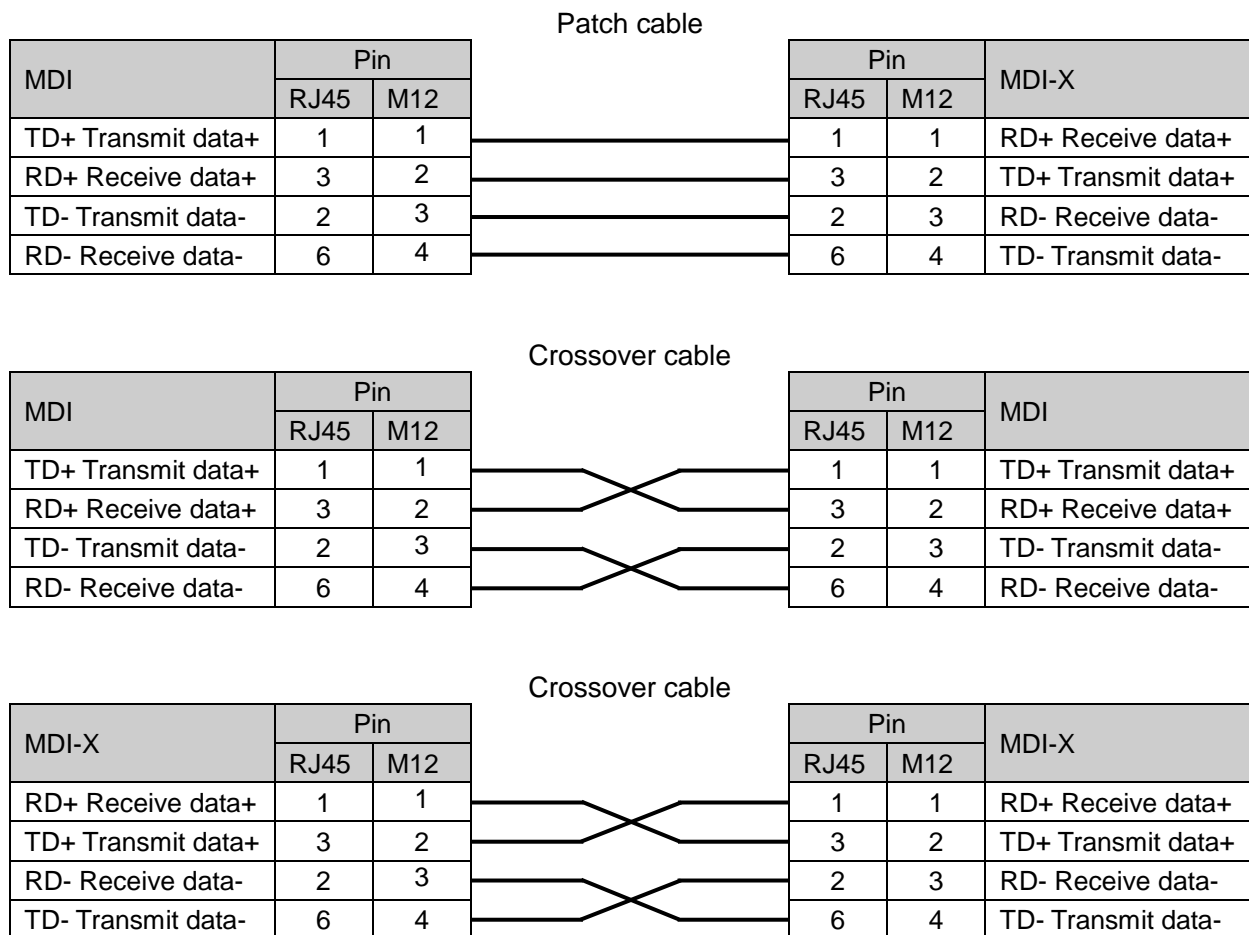
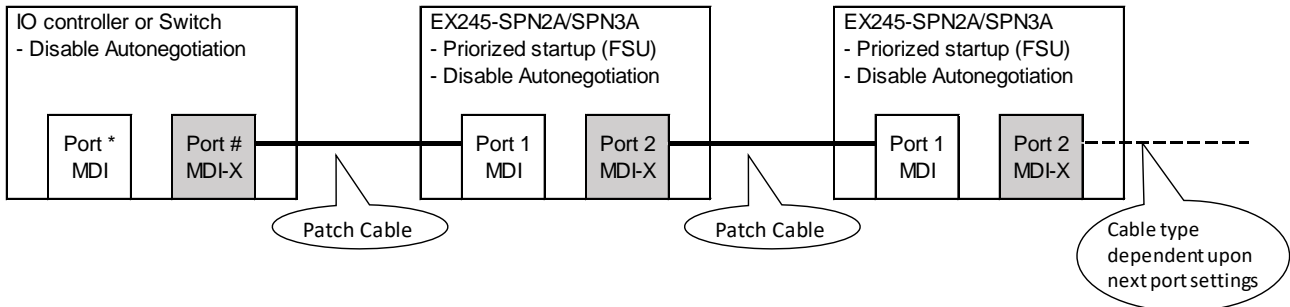


Fig. 3-11 Patch and Crossover Cable details

Connection example

Case 1



Case 2

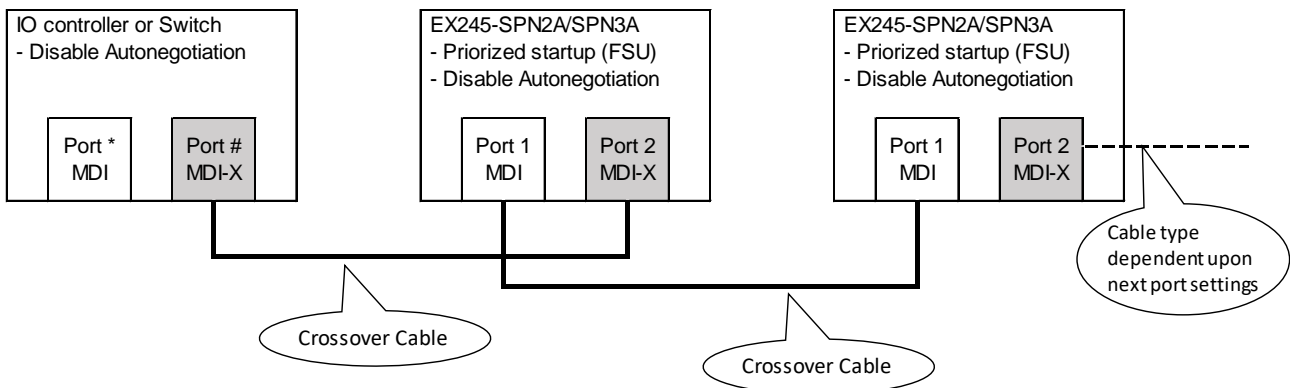


Fig. 3-12 Connection examples when using Disable Autonegotiation

3.2.2. FE terminal

The SI Unit must be connected to FE (Functional Earth) to divert electromagnetic interference. The FE terminal and the FE pin of the two power connectors (XD1/XD2) are internally connected. Please connect at least one of these three FEs to ground potential. For maximum protection the FE cable should be as thick and short as reasonably possible. If it is difficult to shorten the power cable, it is recommended to use the FE terminal screw.

3.2.3. Sensor/Load/IO-Link device connection

Regarding the wiring of each module, refer to following section:

- EX245-DX1 : [Section 7.3](#)
- EX245-DY1 : [Section 8.3](#)
- EX245-LA1 / LB1 : [Section 9.3](#)

4. Commissioning

4.1. Configuration

The SI Unit is a modular station that consists of several modules. Setup your PROFINET IO Controller's software to reflect the configuration of your system.

4.1.1. GSD file and symbol files

In order to configure the SI Unit with your PROFINET IO Controller's software the appropriate GSD file is required. The GSD file contains all of necessary information to configure the SI Unit on your PROFINET IO Controller's software.

In order to represent the SI Unit in your PROFINET IO Controller's software the appropriate symbol files are required.

Current GSD file and symbol files name are as follows.

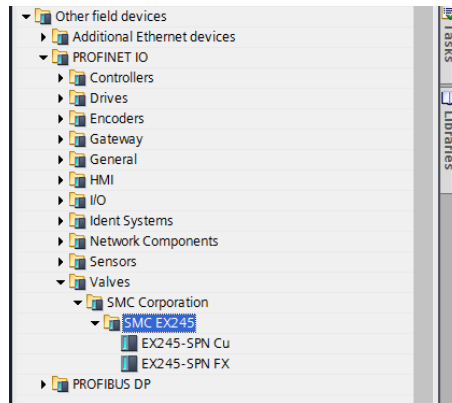
- GSD file : GSDML-V2.3*-SMC-EX245-SPN-*****.xml
- Symbol files : GSDML-0083-0011-EX245.bmp

4.1.2. Head modules

The GSD file contains the description for two Head modules and three SI Units.

Table. 4-1 Head modules

Head module	Available SI Unit
EX245-SPN FX	EX245-SPN1A
EX245-SPN Cu	EX245-SPN2A EX245-SPN3A



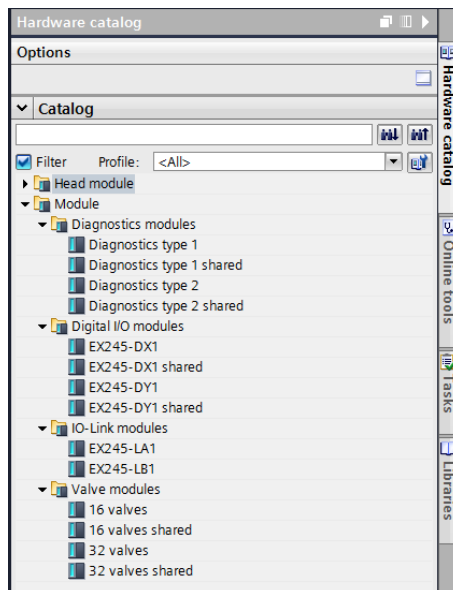
4.1.3. Modules

The SI Unit can consist of the following modules.

Table. 4-2 Overview of modules for the SI Unit

Module	Occupied bytes		Allowable slot (Number / Name)	Note
	Input	Output		
Diagnostics type 1	4 bytes	-	1 / Diagnostics	Refer to Section 5.1.1
Diagnostics type 1 shared	4 bytes	-	1 / Diagnostics	Refer to Section 5.1.1 and Table 4-3
Diagnostics type 2	4 bytes	-	1 / Diagnostics	Refer to Section 5.1.2
Diagnostics type 2 shared	4 bytes	-	1 / Diagnostics	Refer to Section 5.1.2 and Table 4-3
16 Valves	-	2 bytes	2 / Valves	Refer to Section 6.3
16 Valves shared	-	2 bytes	2 / Valves	Refer to Section 6.3 and Table 4-3
32 Valves	-	4 bytes	2 / Valves	Refer to Section 6.3
32 Valves shared	-	4 bytes	2 / Valves	Refer to Section 6.3 and Table 4-3
EX245-DX1	2 bytes	-	3..10 / module 1..8	Refer to Section 7.4
EX245-DX1 shared	2 bytes	-	3..10 / module 1..8	Refer to Section 7.4 and Table 4-3
EX245-DY1	-	1 byte	3..10 / module 1..8	Refer to Section 8.4
EX245-DY1 shared	-	1 byte	3..10 / module 1..8	Refer to Section 8.4 and Table 4-3
EX245-LA1	6 to 134 bytes*	6 to 130 bytes*	3..10 / module 1..8	Refer to Section 9.4
EX245-LB1	6 to 134 bytes*	6 to 130 bytes*	3..10 / module 1..8	Refer to Section 9.4

*: Depends on the configuration of the sub-modules



4.1.4. Sub-modules

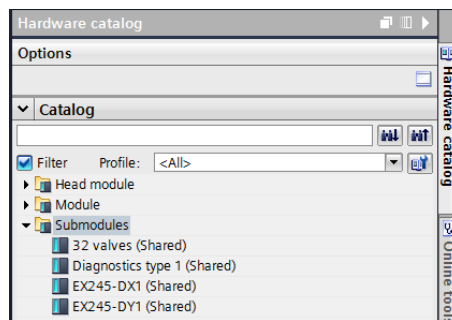
Using the module named as "shared", other PROFINET IO Controllers can use the copied input data in the sub-modules.

Each sub-module is appeared when it is added to the configuration slot.

Refer to [Section 9.6](#) for the sub-modules used in the IO-Link module EX245-LA1 / LB1.

Table. 4-3 Overview of Sub-modules for the shared device function

Sub-module	Occupied input bytes	Bytes to be copied
Diagnostics type 1 shared	4 bytes	4 bytes input data for diagnostics. Refer to Section 5.1.1 .
Diagnostics type 2 shared	4 bytes	4 bytes input data for diagnostics. Refer to Section 5.1.2
16 Valves shared	2 bytes	2 bytes output data for valve outputs. Refer to Section 6.3
32 Valves shared	4 bytes	4 bytes output data for valve outputs. Refer to Section 6.3
EX245-DX1 shared	2 bytes	2 bytes input data for EX245-DX1 inputs. Refer to Section 7.4
EX245-DY1 shared	1 byte	1 byte output data for EX245-DY1 outputs. Refer to Section 8.4



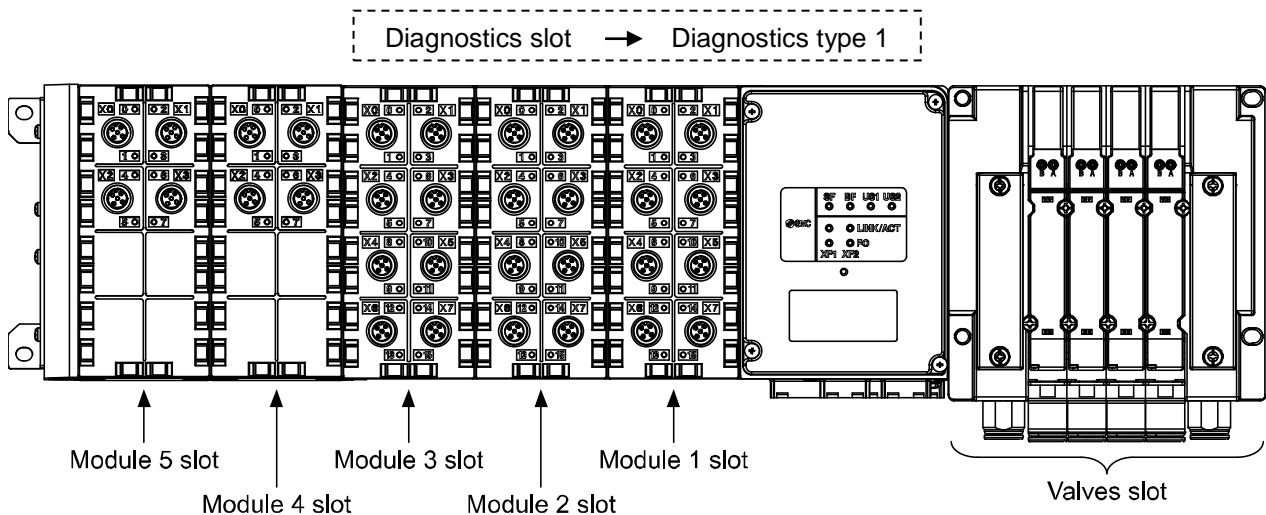
4.1.5. Configuration steps

Enter the modules in your configuration program corresponding to the actual module layout and a "Diagnostics type" module if required (Refer to [Section 5.1](#)). If the configuration does not match the actual layout, the connection to the IO Controller will not be established.

Configuration steps:

- When using the EX245-SPN1A, choose the Head module "EX245-SPN FX" on the configuration software. When using the EX245-SPN2A/EX245-SPN3A, choose the Head module "EX245-SPN Cu".
- Enter the "Diagnostics type 1/2" modules in Diagnostics slot if required.
- Enter the "16/32 Valves" module in Valves slot if use valves.
- Enter the modules "EX245-DX1", "EX245-DY1", "EX245-LA1" and "EX245-LB1" in each module slot if modules are connected (max. 8 modules).

Example of a configuration



Slot name	Actual module	Configuration module	Input bytes	Output bytes
Diagnostics	-	Diagnostics type 1	4	-
Valves	4 x Double solenoid Valves	16 Valves	-	2
Module 1	EX245-DX1	EX245-DX1	2	-
Module 2	EX245-DX1	EX245-DX1	2	-
Module 3	EX245-DX1	EX245-DX1	2	-
Module 4	EX245-DY1	EX245-DY1	-	1
Module 5	EX245-DY1	EX245-DY1	-	1

Fig. 4-1 Example of assignment of modules

4.2. Parameterisation

4.2.1. Module parameters

- **Module parameters for valves**

The "16 Valves" has the following module parameters.

Table. 4-4 Module parameters of the "16 Valves"

Name	Range of values	Default	Meaning
Valve Output 0	Force to OFF Force to ON Hold last state	Force to OFF	When a bus fault occurs, the output can be made to react in one of the following ways: •Force to OFF •Force to ON •Hold last state
Valve Output 1	Force to OFF Force to ON Hold last state	Force to OFF	
...	
Valve Output 15	Force to OFF Force to ON Hold last state	Force to OFF	

The "32 Valves" has the following module parameters.

Table. 4-5 Module parameters of the "32 Valves"

Name	Range of values	Default	Meaning
Valve Output 0	Force to OFF Force to ON Hold last state	Force to OFF	When a bus fault occurs, the output can be made to react in one of the following ways: •Force to OFF •Force to ON •Hold last state
Valve Output 1	Force to OFF Force to ON Hold last state	Force to OFF	
...	
Valve Output 31	Force to OFF Force to ON Hold last state	Force to OFF	

- **Module parameters for EX245-DX1**

The EX245-DX1 has the following module parameter.

Table. 4-6 Module parameter of "EX245-DX1"

Name	Range of values	Default	Meaning
Input filter	Enable Disable	Enable	Sets the time to ignore the input signal change per module as follows: •Enable : 8 msec. •Disable: No input filter

- **Module parameters for EX245-DY1**

The EX245-DY1 has the following module parameters.

Table. 4-7 Module parameters of "EX245-DY1"

Name	Range of values	Default	Meaning
Digital Output 0	Force to OFF Force to ON Hold last state	Force to OFF	When a bus fault occurs, the output can be made to react in one of the following ways: •Force to OFF •Force to ON •Hold last state
Digital Output 1	Force to OFF Force to ON Hold last state	Force to OFF	
...	
Digital Output 7	Force to OFF Force to ON Hold last state	Force to OFF	

- **Module parameters for EX245-LA1 / LB1**

For details on the parameters of the EX245-LA1 / LB1, please refer to [Section 9.8](#).

4.2.2. Energy saving mode for PROFlenergy

Each module has the following module parameters for PROFlenergy.
 The SI Unit starts the energy saving mode when the SI Unit receives the PROFlenergy command.
 Regarding the LED indicator during energy saving mode, refer to [Section 6.4.6](#).

Table. 4-8 PROFlenergy parameters of "16/32 Valves"

Parameters	Range of values	Explanation	
		Valves supply	Output value
Valves output operation at pause	Proceed	ON	Depending on valves behavior
	Force to OFF (Default)	OFF	Fixed 0x00
	Hold last status	ON	Hold last value

Table. 4-9 PROFlenergy parameters of "EX245-DX1"

Parameters	Range of values	Explanation		
		Switch/sensor supply	Input value	LED indicator of EX245-DX1
Sensor supply and input value at pause	Proceed	ON	Depending on switch/sensor behavior	Depending on switch/sensor behavior
	Shut down, Clear value (Default)	OFF	Fixed 0x00	OFF
	Shut down, Hold last status		Hold last value	

Table. 4-10 PROFlenergy parameters of "EX245-DY1"

Parameters	Range of values	Explanation		
		Load supply	Output value	LED indicator of EX245-DY1
Digital output operation at pause	Proceed	ON	Depending on load behavior	Depending on load behavior
	Force to OFF (Default)	OFF	Fixed 0x00	OFF
	Hold last status	ON	Hold last value	

Table. 4-11 PROFlenergy parameters of "EX245-LA1 / LB1"

Parameters	Range of values	Explanation			
		Power supply (L+, P24)	Digital input value (C/Q, I/Q)	Digital output value (C/Q)	LED indicator of EX245-LA1 / LB1
Power supply and I/O value at pause	Proceed	ON	Depending on switch/sensor behavior	Depending on load behavior	Depending on IO-Link device behavior
	Shutdown, Clear value (Default)	OFF	Fixed 0x00	Fixed 0x00	OFF
	Shutdown, Hold last value		Hold last value		

5. Diagnosis

5.1. Diagnostics data on I/O mapping

The SI Unit can be allocated diagnostics data as digital input data on I/O mapping, if one of the module, Diagnostics type 1 or Diagnostics type 2, is configured. Use PROFINET IO Controller's software to select a requested diagnostics type to allocate the diagnostics data on I/O mapping. The IO-Link modules EX245-LA1 / LB1 has diagnostics data (PQI) as digital input data on I/O mapping. Refer to [Section 9.7](#).

5.1.1. Diagnostics type 1

Table. 5-1 Overview of Diagnostics type 1

Byte	Description
0	General diagnostics 1
1	General diagnostics 2
2	Valve diagnostics 1
3	Valve diagnostics 2

- **General diagnostics 1**

Table. 5-2 General diagnostics 1

Bit	Description	Explanation
0	System fault	0: No error on Diagnostics data on I/O mapping 1: At least one error on Diagnostics data on I/O mapping has occurred
1	Valve-coil(s) short circuit	0: No valve coil(s) have a short circuit 1: At least one valve coil has a short circuit
2	Module error	0: No module has an error 1: At least one connected module has an error
3	Changed module layout	0: Module has not disconnected. 1: At least one module has disconnected.
4	US1 Diagnostics	0: US1 present 1: US1 has dropped (< approx. 19.2V DC)
5	Reserved	Fixed 0
6	Reserved	Fixed 0
7	Reserved	Fixed 0

- **General diagnostics 2**

Table. 5-3 General diagnostics 2

Bit	Description	Explanation
0	Module 1 error	0: No error or not connected, 1: Module 1 has an error
1	Module 2 error	0: No error or not connected, 1: Module 2 has an error
2	Module 3 error	0: No error or not connected, 1: Module 3 has an error
3	Module 4 error	0: No error or not connected, 1: Module 4 has an error
4	Module 5 error	0: No error or not connected, 1: Module 5 has an error
5	Module 6 error	0: No error or not connected, 1: Module 6 has an error
6	Module 7 error	0: No error or not connected, 1: Module 7 has an error
7	Module 8 error	0: No error or not connected, 1: Module 8 has an error

- **Valve diagnostics 1**

Table. 5-4 Valve diagnostics 1

Bit	Description	Explanation
0	Valve 0, 1 diagnostics	0: No error, 1: Short circuit
1	Valve 2, 3 diagnostics	0: No error, 1: Short circuit
2	Valve 4, 5 diagnostics	0: No error, 1: Short circuit
3	Valve 6, 7 diagnostics	0: No error, 1: Short circuit
4	Valve 8, 9 diagnostics	0: No error, 1: Short circuit
5	Valve 10, 11 diagnostics	0: No error, 1: Short circuit
6	Valve 12, 13 diagnostics	0: No error, 1: Short circuit
7	Valve 14, 15 diagnostics	0: No error, 1: Short circuit

- **Valve diagnostics 2**

Table. 5-5 Valve diagnostics 2

Bit	Description	Explanation
0	Valve 16, 17 diagnostics	0: No error, 1: Short circuit
1	Valve 18, 19 diagnostics	0: No error, 1: Short circuit
2	Valve 20, 21 diagnostics	0: No error, 1: Short circuit
3	Valve 22, 23 diagnostics	0: No error, 1: Short circuit
4	Valve 24, 25 diagnostics	0: No error, 1: Short circuit
5	Valve 26, 27 diagnostics	0: No error, 1: Short circuit
6	Valve 28, 29 diagnostics	0: No error, 1: Short circuit
7	Valve 30, 31 diagnostics	0: No error, 1: Short circuit

5.1.2. Diagnostics type 2

Table. 5-6 Overview of Diagnostics type 2

Byte	Description
0	General diagnostics 1
1	Valve diagnostics 1
2	General diagnostics 2
3	Valve diagnostics 2

- **General diagnostics 1**

Table. 5-7 General Diagnostics 1

Bit	Description	Explanation
0	Maximum number of valves	0: 16 Valves 1: 32 Valves or no "Valves" module
1	Valve coil(s) short circuit	0: No valve coil(s) have a short circuit 1: At least one valve coil has a short circuit
2	US1 diagnostics 1	0: US1 present 1: US1 has dropped (< approx. 19.2 VDC)
3	Reserved	Fixed 0
...
7	Reserved	Fixed 0

- **Valve diagnostics 1**

Table. 5-8 Valve diagnostics 1

Bit	Description	Explanation
0	Valve 0, 1 diagnostics	0: Short circuit, 1: No error
1	Valve 2, 3 diagnostics	0: Short circuit, 1: No error
2	Valve 4, 5 diagnostics	0: Short circuit, 1: No error
3	Valve 6, 7 diagnostics	0: Short circuit, 1: No error
4	Valve 8, 9 diagnostics	0: Short circuit, 1: No error
5	Valve 10, 11 diagnostics	0: Short circuit, 1: No error
6	Valve 12, 13 diagnostics	0: Short circuit, 1: No error
7	Valve 14, 15 diagnostics	0: Short circuit, 1: No error

- **General diagnostics 2**

Table. 5-9 General diagnostics 2

Bit	Description	Explanation
0	Module 1 diagnostics	0: No error or not connected, 1: Module 1 has an error
1	Module 2 diagnostics	0: No error or not connected, 1: Module 2 has an error
2	Module 3 diagnostics	0: No error or not connected, 1: Module 3 has an error
3	Module 4 diagnostics	0: No error or not connected, 1: Module 4 has an error
4	Module 5 diagnostics	0: No error or not connected, 1: Module 5 has an error
5	Module 6 diagnostics	0: No error or not connected, 1: Module 6 has an error
6	Module 7 diagnostics	0: No error or not connected, 1: Module 7 has an error
7	Module 8 diagnostics	0: No error or not connected, 1: Module 8 has an error

- **Valve diagnostics 2**

Table. 5-10 Valve diagnostics 2

Bit	Description	Explanation
0	Valve 16, 17 diagnostics	0: Short circuit, 1: No error
1	Valve 18, 19 diagnostics	0: Short circuit, 1: No error
2	Valve 20, 21 diagnostics	0: Short circuit, 1: No error
3	Valve 22, 23 diagnostics	0: Short circuit, 1: No error
4	Valve 24, 25 diagnostics	0: Short circuit, 1: No error
5	Valve 26, 27 diagnostics	0: Short circuit, 1: No error
6	Valve 28, 29 diagnostics	0: Short circuit, 1: No error
7	Valve 30, 31 diagnostics	0: Short circuit, 1: No error

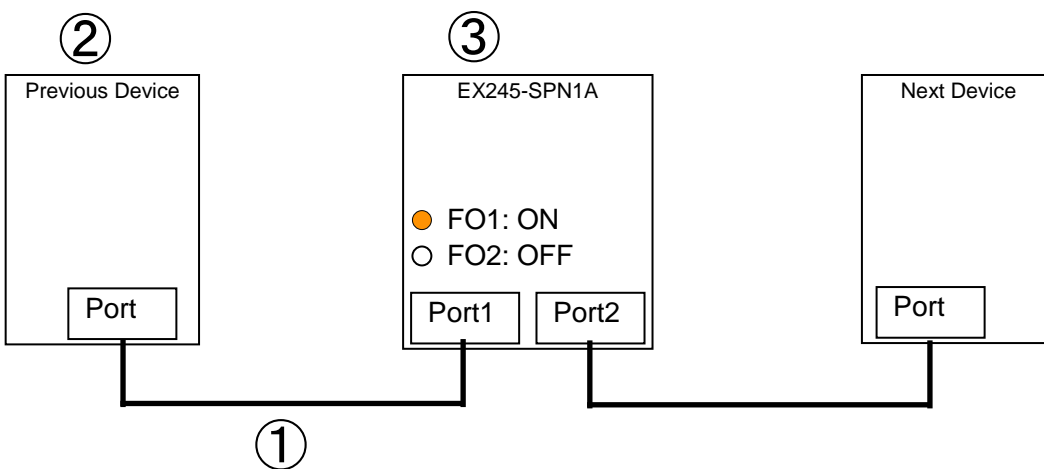
5.2. Maintenance alarm for the Fibre-optic cables

When the strength margin of the Fibre-optic communication is not enough, the EX245-SPN1A issues a "Maintenance alarm" for the Fibre-optic cable, if monitor setting of communication port is enable.

If the FO LED of the EX245-SPN1A is flashing (more than 0 dB but less than 2 dB) or ON (the margin is 0 dB), refer to [Section 6.4.5](#).

In order to recover from this alarm, please check in the following order.

Example



Step 1: Check/exchange ① the Fibre-optic cable.

Step 2: Check/exchange ② the previous device.

Step 3: Check/exchange ③ the EX245-SPN1A.

6. SI Unit

6.1. Parts and description

EX245-SPN1A
EX245-SPN2A

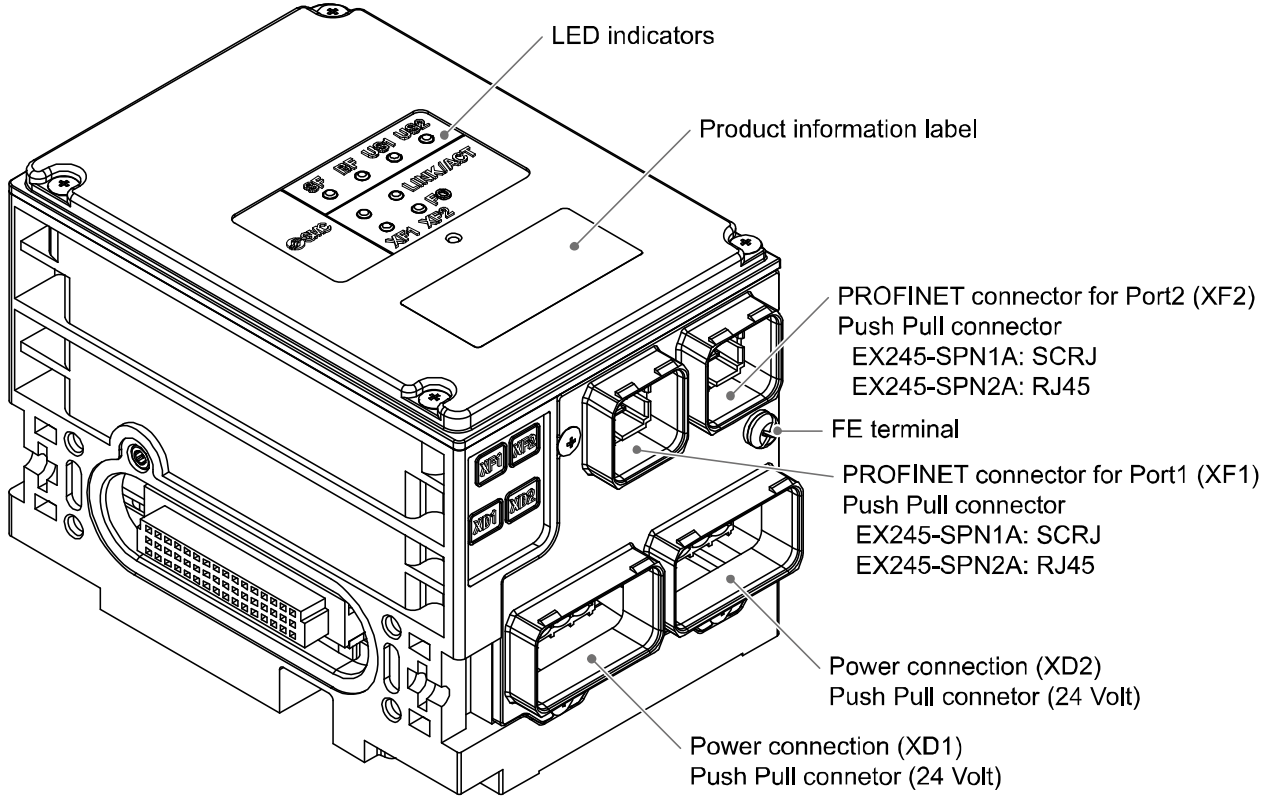


Fig. 6-1 Allocation of parts on the EX245-SPN1A/SPN2A

EX245-SPN3A

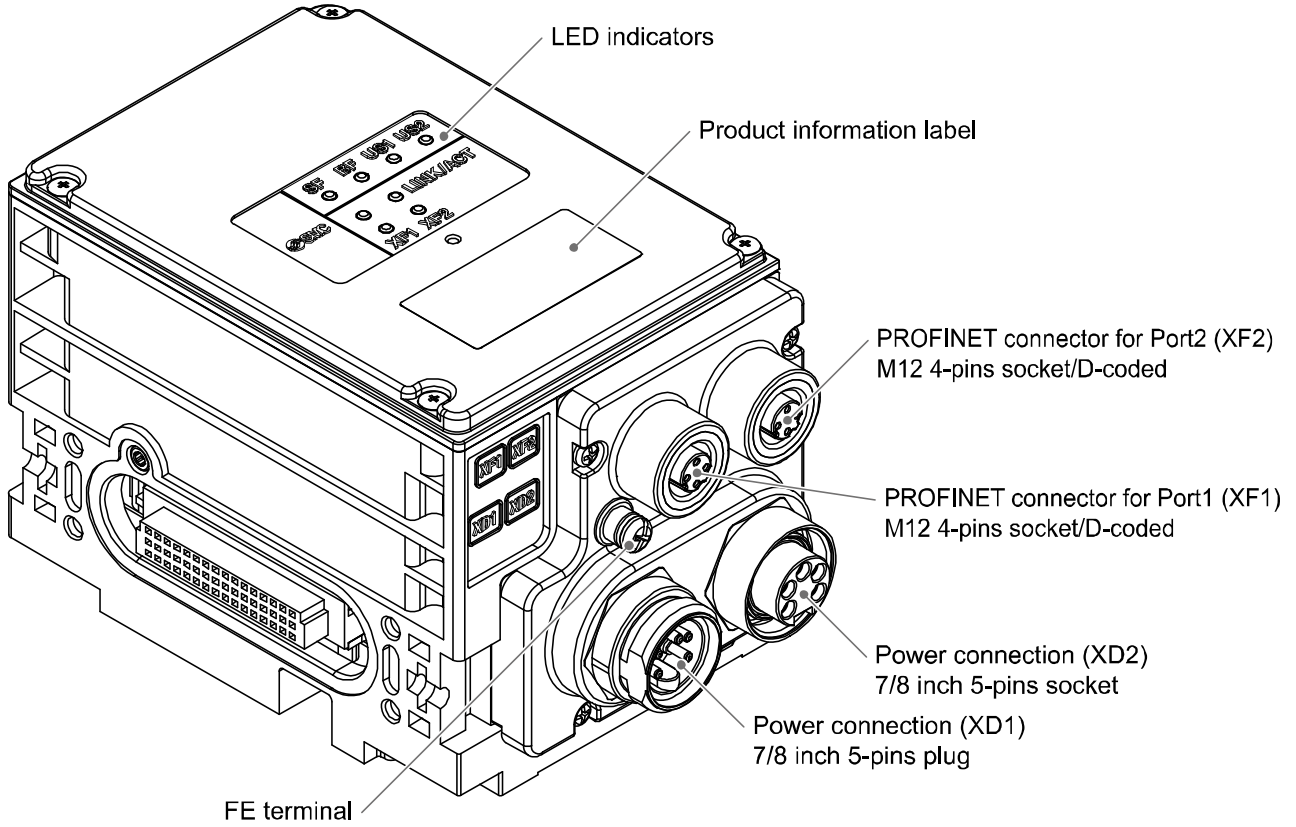


Fig. 6-2 Allocation of parts on the EX245-SPN3A

6.2. Specifications

Table. 6-1 Specifications

Item	Description		
	EX245-SPN1A	EX245-SPN2A	EX245-SPN3A
General			
Dimensions (W x L x H) in mm	85 x 127.5 x 89.5		85 x 147.7 x 89.5
Weight	465 g		540 g
Housing materials	PBT		
Maximum number of modules	8		
Maximum number of digital inputs	128		
Maximum number of digital outputs	64 (independent of solenoid valves)		
Maximum number of IO-Link ports	32		
Electrical			
Internal current consumption at 24 V DC (Via US1)	300 mA or less	200 mA or less	
Protection against polarity reversal	Yes (US1 and US2)		
Loop through current between power connector XD1 to XD2	16 A or less		6 A or less *
US1	Operating voltage	24 VDC +20%/-15%	
	Under-voltage detection	Detected: < approx. 19.2 VDC	
	Max. current	6 A total	
US2	Operating voltage	24 VDC +20%/-15%	
	Max. current	4 A	
	Voltage drop to valve supply	Max. 1.2 V at 24 VDC	
Galvanic isolation	Yes (between US1 and US2)		
Solenoid valve			
Applicable series	JSY series	JSY3000, JSY5000	
	SY series	SY3000, SY5000	
	VQC series	VQC2000, VQC4000	
Max. number of solenoid valves	32 solenoid coils		
Load	Solenoid valve with surge voltage suppressor of 24 VDC, 1 W or less (SMC)		
Output type of solenoid	Source / PNP (negative common)		
Over current protection	Yes		
Over current detection	Yes		

NOTE

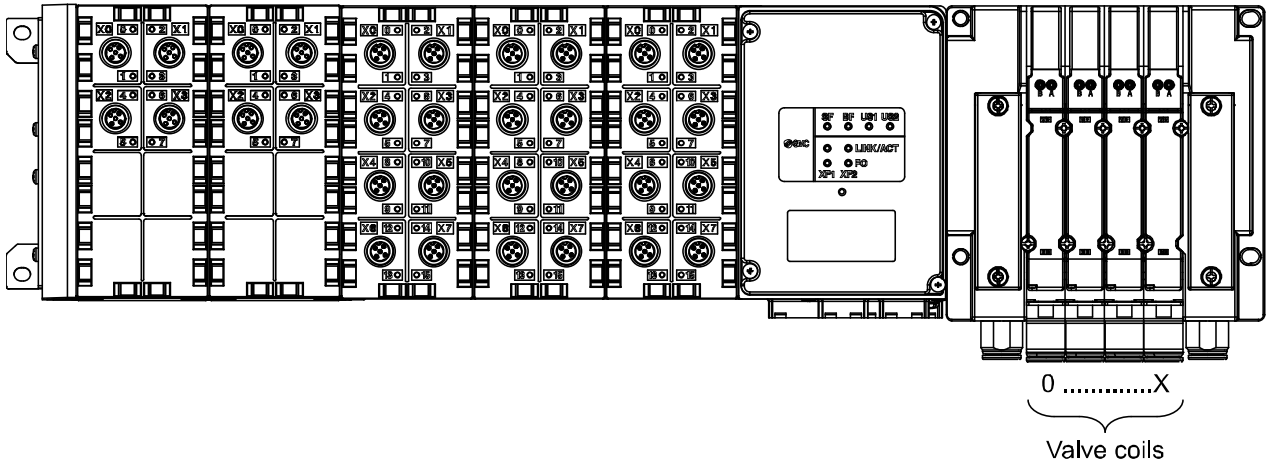
- Maximum permissible current of 7/8 inch 5 pins plug connector is 10A. So for example, the EX245-SPN3A can use 4A and a loop through current of 6A can be drawn between connectors "XD1" and "XD2"

Table. 6-2 Specifications (continued)

Item	Description		
	EX245-SPN1A	EX245-SPN2A	EX245-SPN3A
Fieldbus			
Bus protocol	PROFINET I/O		
Conformance Class C	Yes (Only for IRT switch function)		
FSU (Fast Start Up)	Yes		
MRP (Media Redundancy Protocol)	Yes		
MRPD (Media Redundancy for Planned Duplication)	Yes		
Shared device	Yes		
PROFenergy	Yes		
System redundancy S2	Yes		
Web server function	Yes		
Firmware update	Yes		
Net Load Class III	Yes		
Maintenance alarm for the Fibre-optic cable	Yes	-	
Vendor ID	0083h		
Device ID	0011h		
GSD file	GSDML-V2.3*-SMC-EX245-SPN-*****.xml		

6.3. Process data for valves

The SI Unit occupies 2 or 4 bytes of output data for valves. The counting of valve coils starts at the SI Unit from left to right.

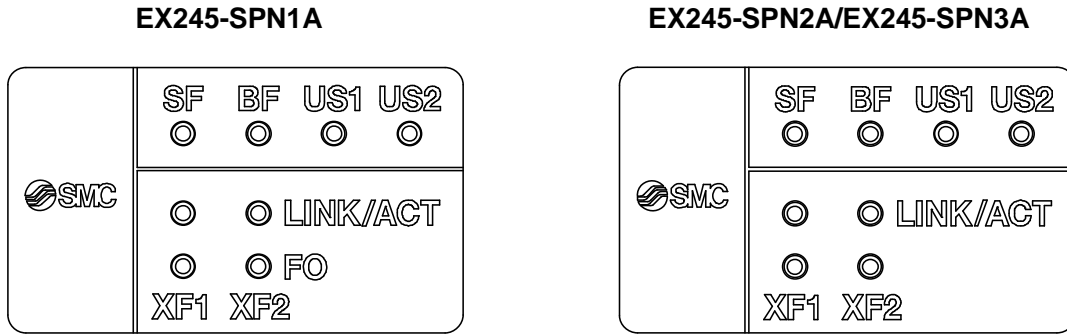


Byte	Output data	
	16 Valves	32 Valves
0	Valve coils 0-7	Valve coils 0-7
1	Valve coils 8-15	Valve coils 8-15
2		Valve coils 16-23
3		Valve coils 24-31

Fig. 6-3 The process data for valves

6.4. LED indicators

The LED indicators are arranged on the SI Unit as shown in the illustration below. The layout of the LINK/ACT LEDs and FO LEDs are for port1 on the left side (XF1) and for port2 on the right side (XF2).



Designation	Description	Colour
SF	System fault	Red
BF	Bus fault	Red
US1	Supply for the logic/sensors	Green
US2	Supply for the valves/loads	Green
LINK/ACT	A combination of LINK LED and ACT LED Connection status via Ethernet (LINK: Green) Data exchange status (ACT: Orange)	Green/Orange
FO	Fibre-Optic communication diagnostics	Orange

Fig. 6-4 LED indicators of the SI Unit

6.4.1. SF and BF indicators

Table. 6-3 SF and BF indicators

SF	BF	Meaning
OFF	OFF	No fault (The SI Unit is currently exchanging data with the IO Controller without errors).
ON	---	One of the following may have occurred. <ul style="list-style-type: none"> • US1 is below the permissible level (< approx. 19.2 VDC). • The valve coil has a short circuit or the connected module has a short circuit. • The connected module has disconnected.
---	ON	One of the following may have occurred. <ul style="list-style-type: none"> • The connection to the IO Controller is nothing, or disconnection to the IO Controller. • Device name is not correct. • IP address is not set or not correct. • The GSD file is not correct. • The configuration data sent by the IO Controller does not match the actual layout.
Alternately flash at 1 Hz (SF ON SF OFF) (BF OFF ⇔ BF ON)		One of the following may have occurred. <ul style="list-style-type: none"> • During firmware update. • During forced output mode by Web server function.
Simultaneously flash at 1 Hz (SF ON SF OFF) (BF ON ⇔ BF OFF)		Firmware update failed.

6.4.2. US1 indicator

Table. 6-4 US1 indicator

US1	Meaning
OFF	US1 is not present.
Flash at 1 Hz	US1 is present but is below the permissible level (< approx. 19.2 VDC).
ON	US1 is present.

6.4.3. US2 indicator

Table. 6-5 US2 indicator

US2	Meaning
OFF	US2 is not present.
ON	US2 is present.

6.4.4. LINK/ACT indicator

Table. 6-6 LINK/ACT indicator

LINK/ACT	Meaning
Green ON	Connection via Ethernet to the SI Unit via Port 1/2 (XF1/XF2)
Green OFF	No connection established via Port 1/2 (XF1/XF2)
Orange ON	Transmission or reception of Ethernet telegrams on Port 1/2 (XF1/XF2)
Orange OFF	No transmission or reception of Ethernet telegrams on Port 1/2 (XF1/XF2)
Flash * at 1 Hz	Received node flash request

*: The LINK (green) and ACK (orange) LEDs flash same time

6.4.5. FO indicator

Table. 6-7 FO indicator

FO 1/2	Meaning
OFF	No fault. The strength margin of the Fibre-optic communication is more than 2 dB on Port 1/2 (XF1/XF2).
Flash at 1 Hz	The strength margin of the Fibre-optic communication is more than 0 dB but less than 2 dB on Port 1/2 (XF1/XF2).
ON	The strength margin of the Fibre-optic communication is 0 dB on Port 1/2 (XF1/XF2).

NOTE

- If monitor setting of communication port is enable, the FO indicator shows the status of the maintenance alarm for the Fibre-optic cables, refer to [Section 5.2](#).

6.4.6. LED indicator during energy saving mode for PROFlenergy

Table. 6-8 LED indicator during energy saving mode for PROFlenergy

LED	Indicator
LINK/ACT	OFF
FO	OFF
SF	OFF
BF	OFF
US1	0.5 sec ON ⇔ 3 sec OFF
US2	OFF

NOTE

- For module parameter of PROFlenergy, refer to [Section 4.2.2](#).

6.5. Block diagram

The following figure shows the block diagram of each SI Unit.

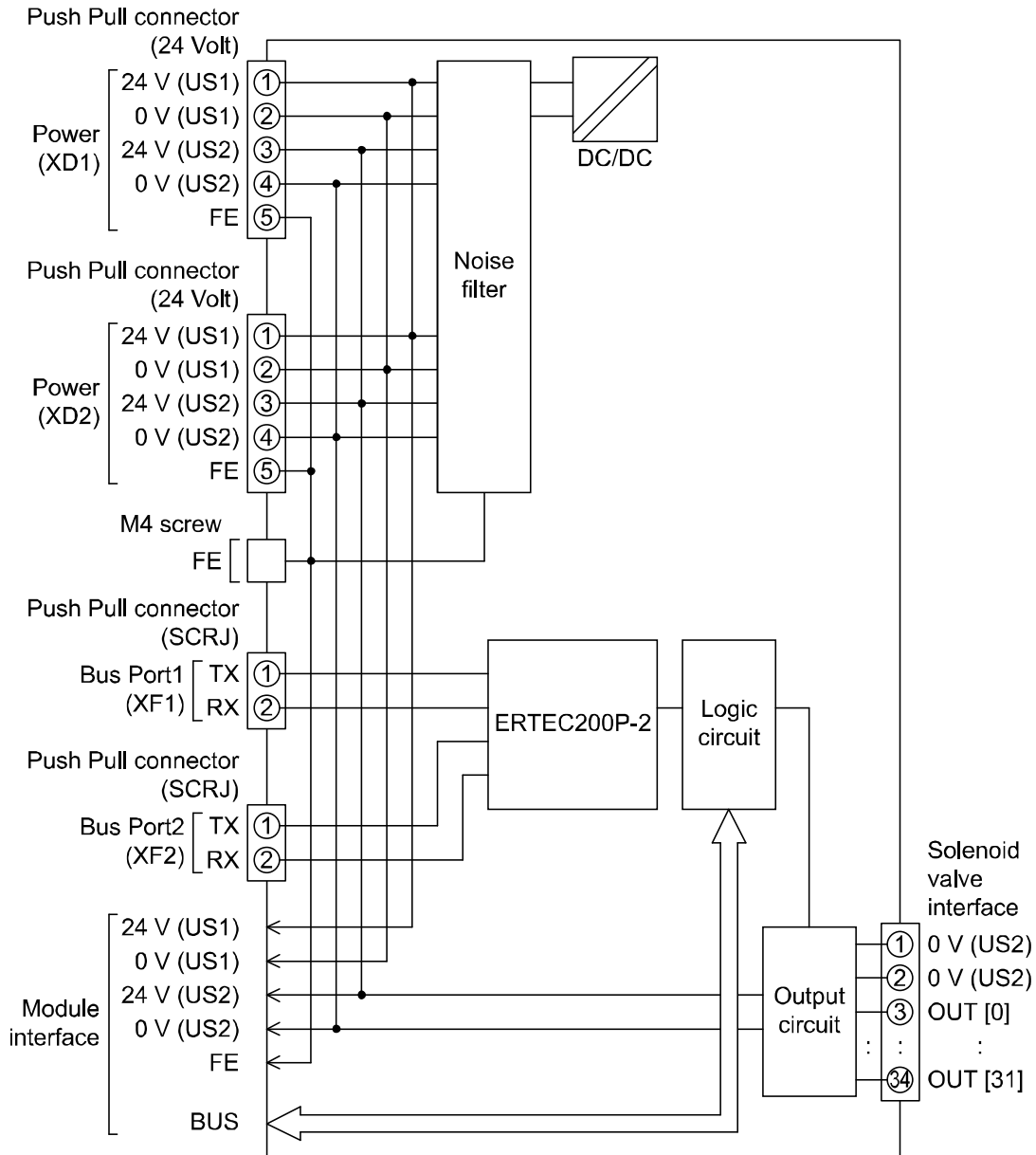


Fig. 6-5 Block diagram of the EX245-SPN1A

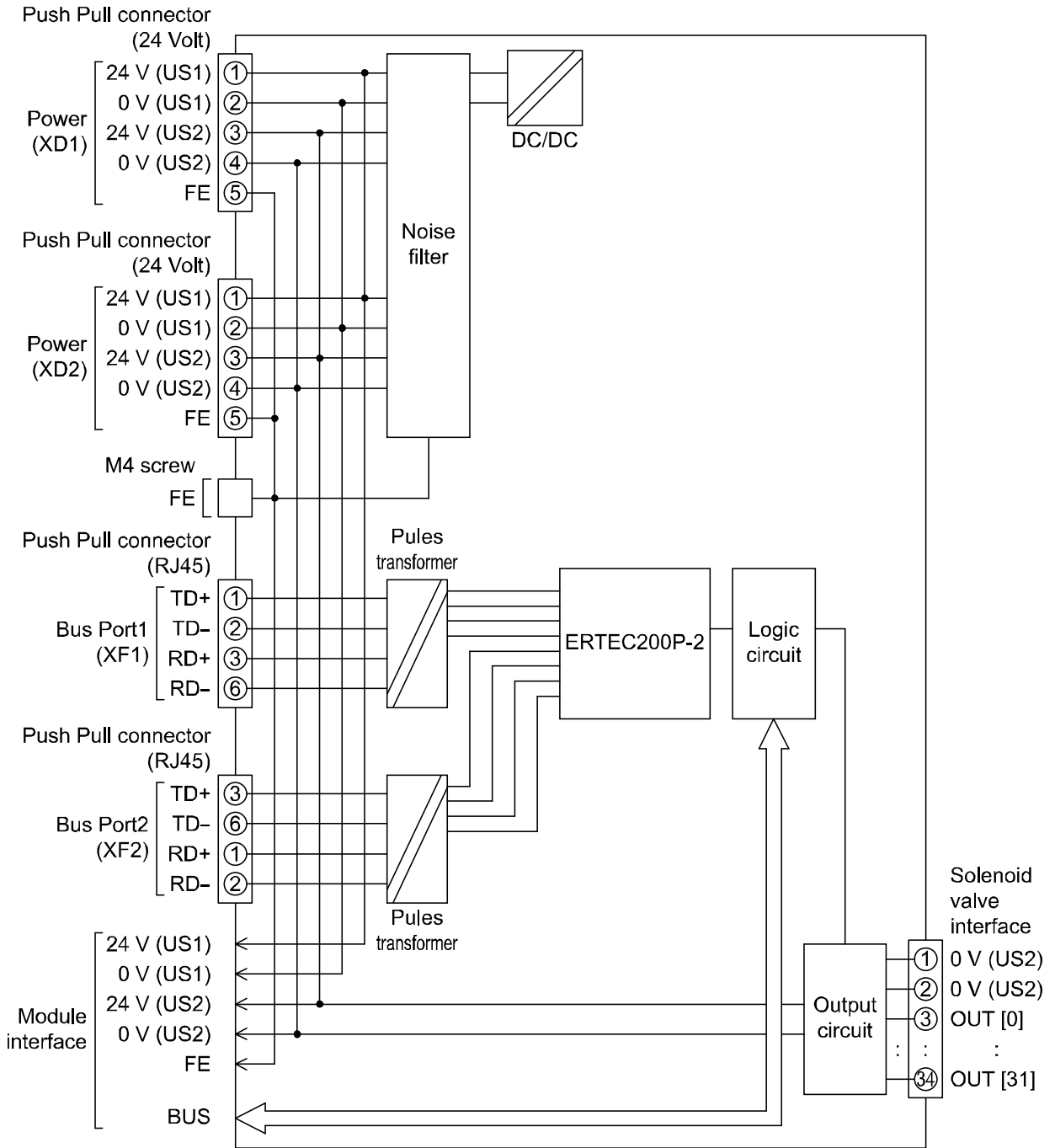


Fig. 6-6 Block diagram of the EX245-SPN2A

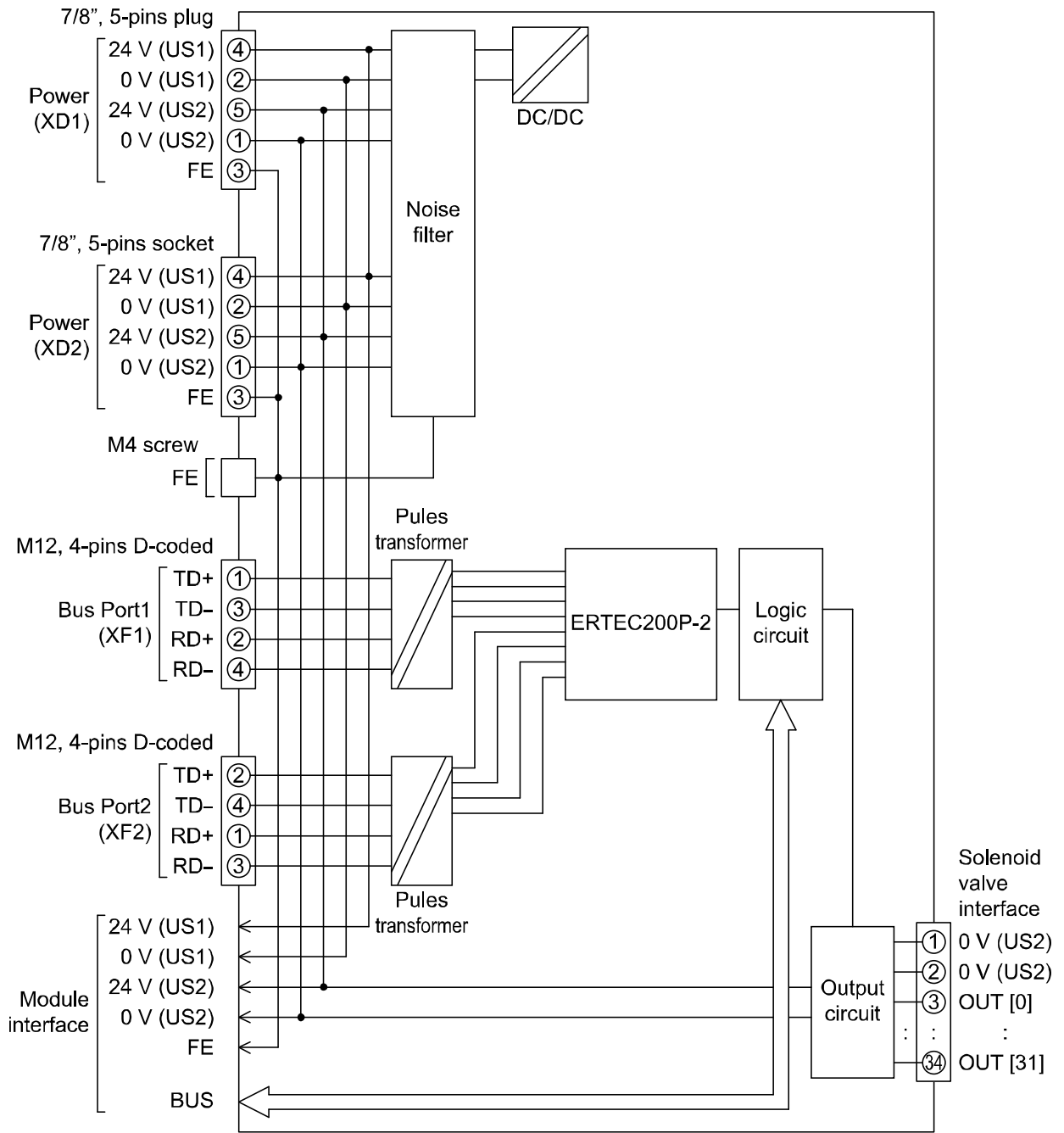


Fig. 6-7 Block diagram of the EX245-SPN3A

7. Digital Input Module - EX245-DX1

7.1. Parts and description

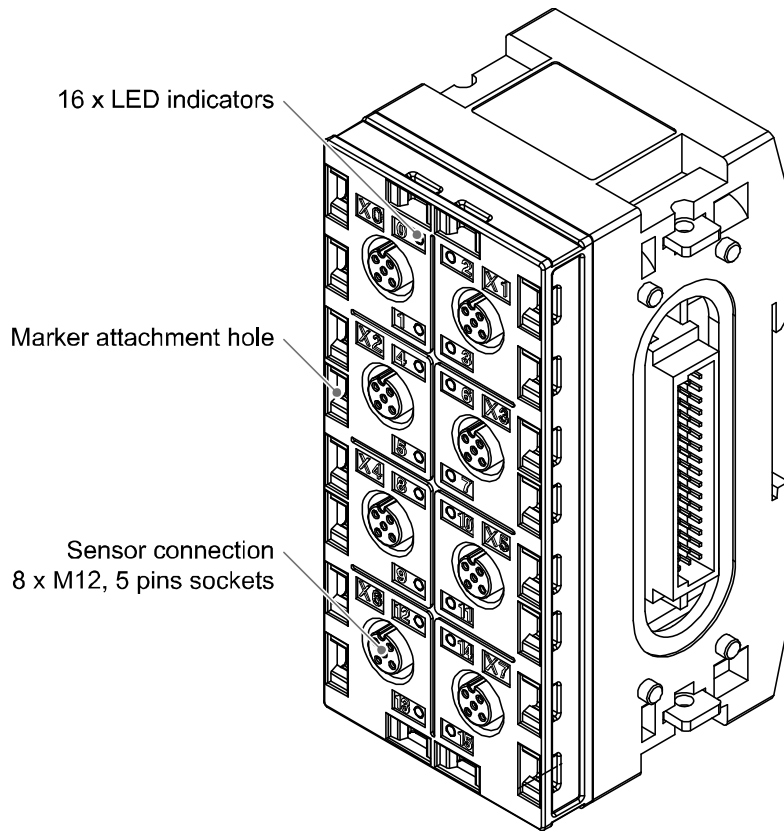


Fig. 7-1 Allocation of parts on the EX245-DX1

7.2. Specifications

Table. 7-1 EX245-DX1 specifications

Item	Description
General	
Dimensions (W x L x H) in mm	54 x 120 x 61
Weight	265 g
Housing material	Nylon, PBT
Electrical	
Rated supply voltage	24 VDC
Voltage drop to US1(sensor/input)	Max. 1.6 V
Internal current consumption at 24V DC	50 mA or less
Input connection type	8 x M12, 5 pins socket with double allocation
Over Voltage protection	Yes, more than 28 VDC at US1(sensor/input)
Over current protection	Yes
Sensor supply current per connector	Max. 0.5 A
Sensor supply current per module	Max. 2 A
Status indication	Yes, per input
Over current indication	Yes, per connector
Digital input	
Number of inputs	16
Input type	PNP
Signal 1	11 to 30 V
Signal 0	-3 to 5 V
Permissible residual current	Max. 1.5 mA
Input current signal	Typ. 4.5 mA

7.3. Wiring

⚠ Caution

- To prevent damage, all power for the SI Unit and modules must be turned off (i.e. de-energized) before the modules are installed or removed.
- For a protection rating of IP65 to be ensured, all covering caps must be screwed down correctly after wiring and setting have been performed.
- For a protection rating of IP65 to be ensured, sockets that are not used must be fitted with the M12 Seal cap.

Pin allocation of the M12, 5 pins socket connector as shown in the following table:

Table. 7-2 Pin allocation of the connector for EX245-DX1

Pin	Allocation	View of connector (module side)
1	24 V (US1)	
2	DI (input signal "n+1")	
3	0 V (US1)	
4	DI (input signal "n")	
5	FE/Shield	

7.4. Process data

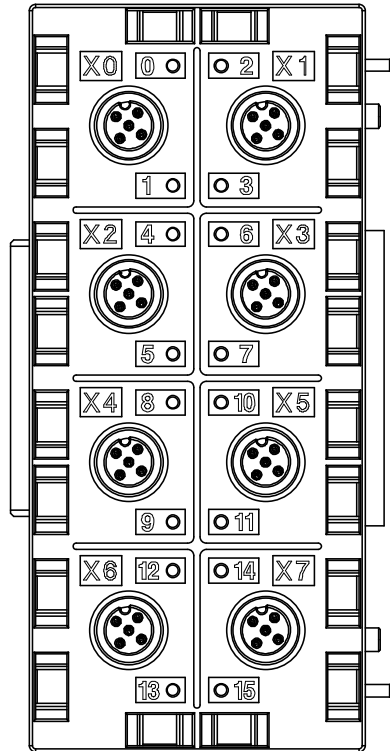
The EX245-DX1 occupies 2 bytes of input data. The following table shows the allocation of the digital inputs and the process image.

Table. 7-3 Digital input allocation and the process data

Connector position									
Connector designation	X0	X1	X2	X3	X4	X5	X6	X7	
Input	Pin 2	Bit 1	Bit 3	Bit 5	Bit 7	Bit 9	Bit 11	Bit 13	Bit 15
	Pin 4	Bit 0	Bit 2	Bit 4	Bit 6	Bit 8	Bit 10	Bit 12	Bit 14

7.5. LED indicators

The status indicators are arranged on the EX245-DX1 as shown in the illustration below.



0 to15	Description
OFF	Input is not activated and no errors.
Green ON	Input is activated.
Red ON	Short circuit is detected.

Fig. 7-2 Status indicators of the EX245-DX1

7.6. Block diagram

The following figure shows the block diagram of the EX245-DX1.

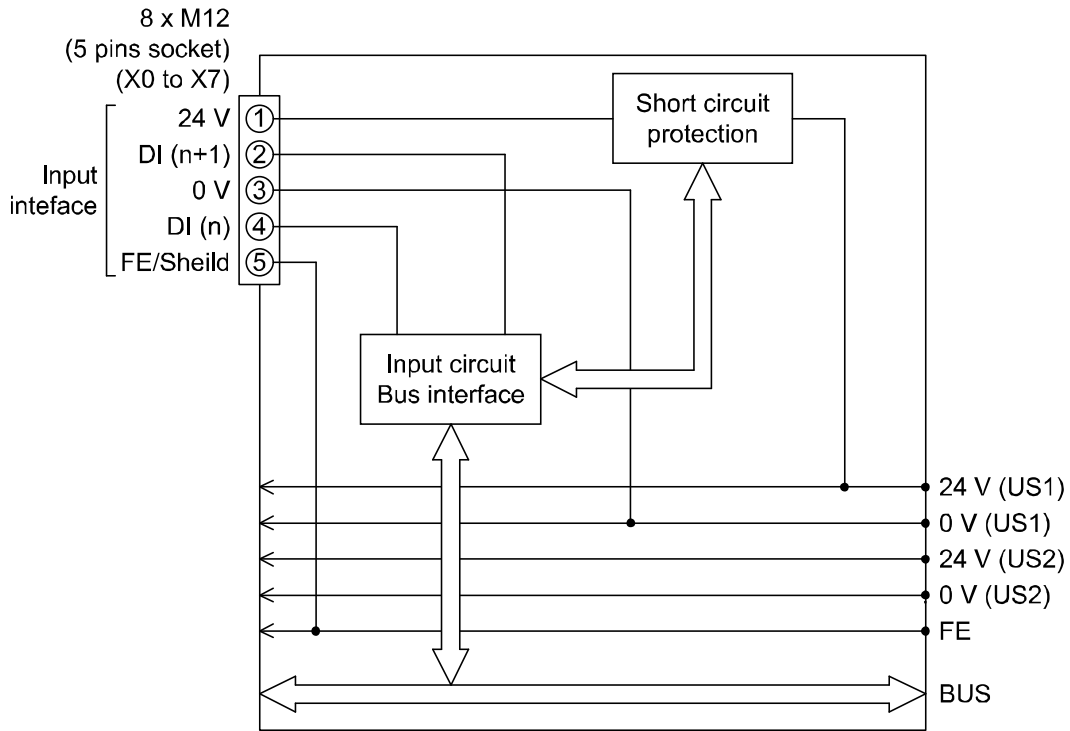


Fig. 7-3 Block diagram of the EX245-DX1

8. Digital Output Module - EX245-DY1

8.1. Parts and description

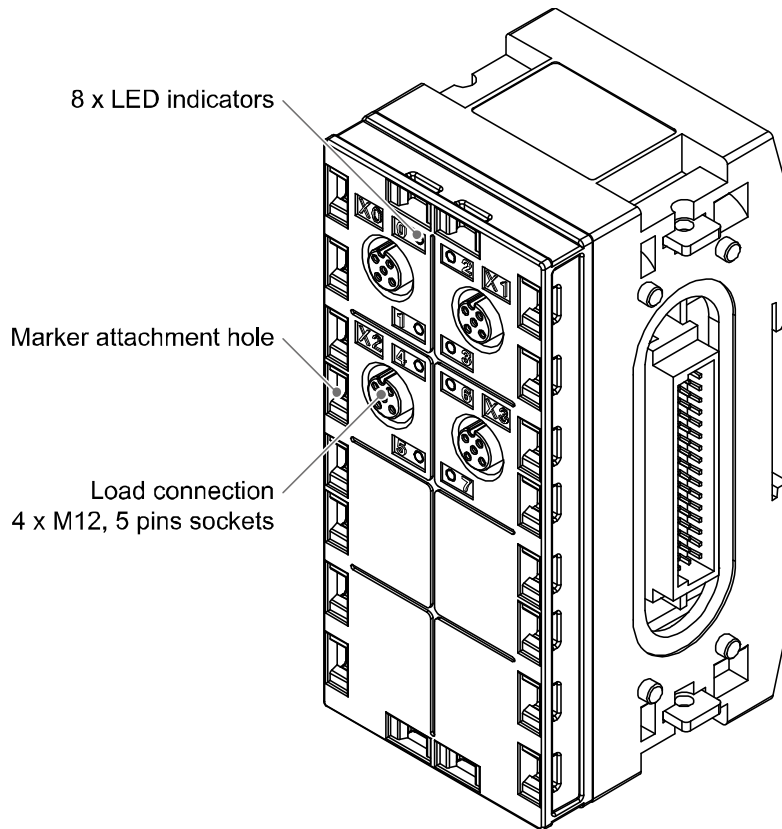


Fig. 8-1 Allocation of parts on the EX245-DY1

8.2. Specifications

Table. 8-1 EX245-DY1 specifications

Item	Description
General	
Dimensions (W x L x H) in mm	54 x 120 x 61
Weight	255 g
Housing material	Nylon, PBT
Electrical	
Rated supply voltage	24 VDC
Voltage drop to load supply	Max. 1.6 V
Internal current consumption at 24 V DC	50 mA or less
Load connection	4 x M12, 5 pins socket with double allocation
Over Voltage protection	Yes, more than 28 VDC at US2(solenoid/output)
Over current protection	Yes
Output current per output	Max.0.5 A
Output current per module	Max.2 A
Status indication	Yes, per output
Over current indication	Yes, per output
Digital output	
Number of outputs	8
Output type	PNP

8.3. Wiring

⚠ Caution

- To prevent damage, all power for the SI Unit and modules must be turned off (i.e. de-energized) before the modules are installed or removed.
- For a protection rating of IP65 to be ensured, all covering caps must be screwed down correctly after wiring and setting have been performed.
- For a protection rating of IP65 to be ensured, sockets that are not used must be fitted with the Seal cap.

Pin allocation of the M12, 5 pins socket connector as shown in the following table:

Table. 8-2 Pin allocation of the connector for EX245-DY1

Pin	Allocation	View of connector (module side)
1	N.C.	
2	DO (output signal "n+1", US2)	
3	0 V (US2)	
4	DO (output signal "n", US2)	
5	FE/Shield	

8.4. Process data

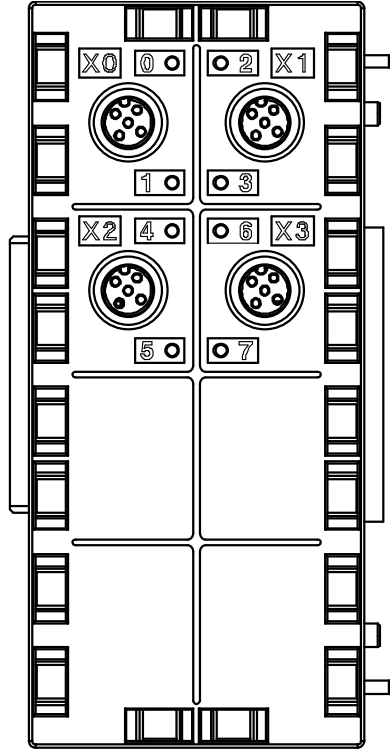
The EX245-DY1 occupies 1 byte of output data. The following table shows the allocation of the digital outputs and the process image.

Table. 8-3 Digital output allocation and the process data

Connector position					
Connector designation		X0	X1	X2	X3
Output	Pin 2	Bit 1	Bit 3	Bit 5	Bit 7
	Pin 4	Bit 0	Bit 2	Bit 4	Bit 6

8.5. LED indicators

The status indicators are arranged on the EX245-DY1 as shown in the illustration below.



0 to 7	Description
OFF	Output is not activated and no errors.
Green ON	Output is activated.
Red ON	Short circuit is detected.

Fig. 8-2 Status indicators of the EX245-DY1

8.6. Block diagram

The following figure shows the block diagram of the EX245-DY1.

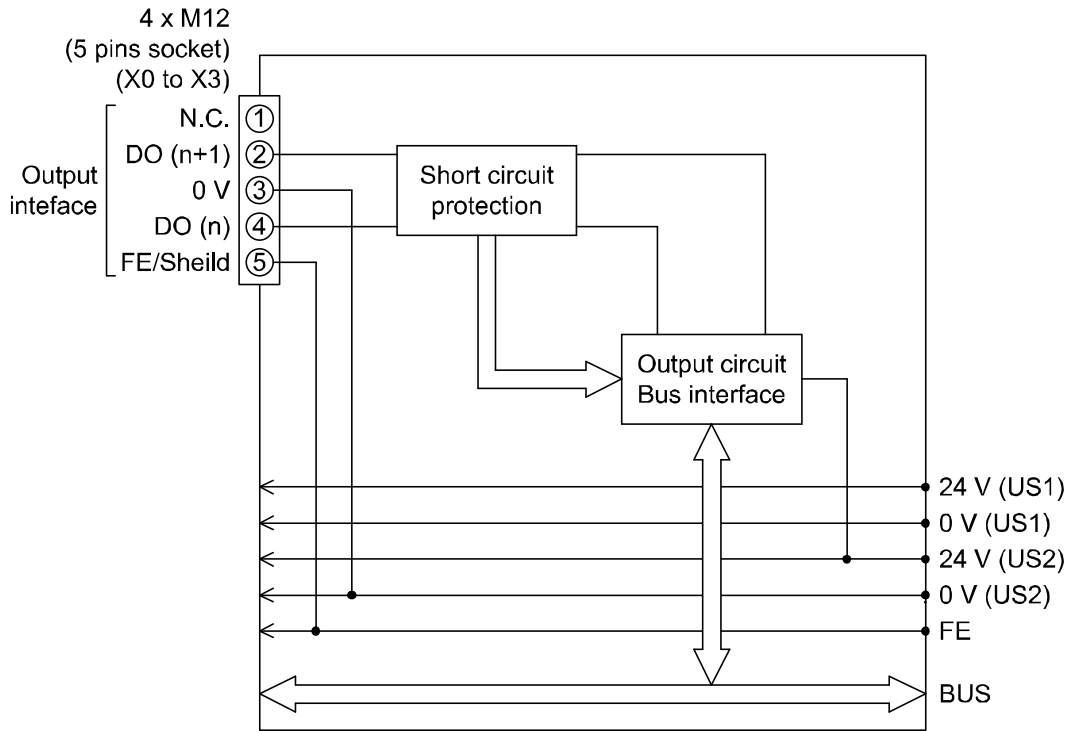


Fig. 8-3 Block diagram of the EX245-DY1

9. IO-Link Module - EX245-LA1 / LB1

9.1. Parts and description

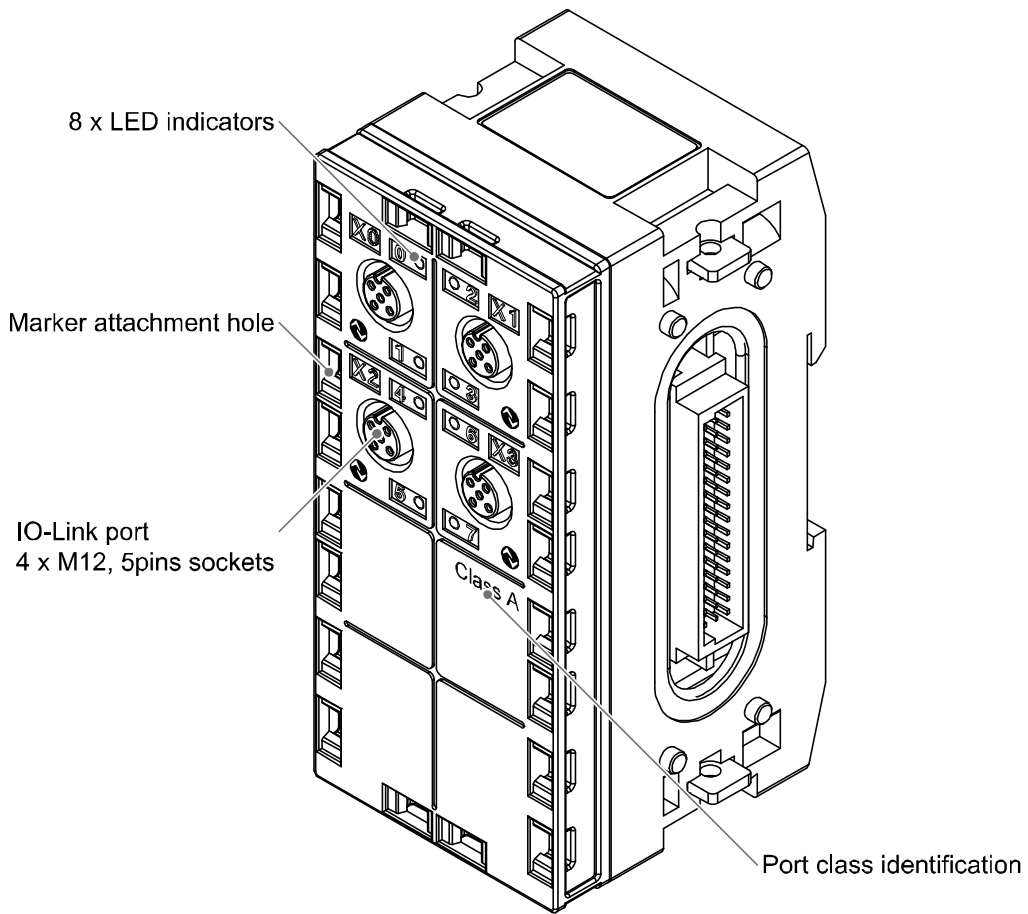


Fig. 9-1 Allocation of parts on the EX245-LA1 / LB1

9.2. Specifications

Table. 9-1 EX245-LA1 / LB1 specifications

Item	Description		
	EX245-LA1		EX245-LB1
General			
Dimensions (W x L x H) in mm	54 x 120 x 61		
Weight	265 g		
Housing material	Nylon, PBT		
Electrical			
Rated supply voltage	24 VDC		
Internal current consumption at 24 V DC	50 mA or less		
Max. supply current Device power supply (L+)	0.5 A / Connector (2 A / module)	0.5 A / Connector (1 A / module)	
Max. supply current External power supply (P24)	-	1.6 A / Connector (3 A / module)	
IO-Link			
IO-Link version	Version 1.1		
IO-Link port class	Class A	Class B	
Communication speed	COM 1 (4.8kbps) COM 2 (38.4kbps) COM 3 (230.4kbps) Changes automatically according to the connected device		
Number of IO-Link ports	4		
Digital input			
Pin No.	2	4	4
Input type	PNP		
Protection	Short-circuit protection		
Rated input current	Approx. 2.5 mA	Approx. 5.8 mA	
ON voltage	13 V or more		
OFF voltage	8 V or less		
Digital output			
Pin No.	4		
Output type	PNP		
Max. load current (C/Q line)	0.25 A / Output (Supplied from power supply for sensor / logic US1)		
Protection	Short-circuit protection		

9.3. Wiring

⚠ Caution

- To prevent damage, all power for the SI Unit and modules must be turned off (i.e. de-energized) before the modules are installed or removed.
- For a protection rating of IP65 to be ensured, all covering caps must be screwed down correctly after wiring and setting have been performed.
- For a protection rating of IP65 to be ensured, sockets that are not used must be fitted with the Seal cap.

Pin allocation of the M12, 5 pins socket connector as shown in the following table:

Table. 9-1 Pin allocation of the connector for EX245-LA1 (Class A)

Pin	Signal	Description / Power source	View of connector (module side)
1	L+	24 V / US1	
2	I/Q	Digital Input / US1	
3	L-	0 V / US1	
4	C/Q	IO-Link communication, DI or DO * / US1	
5	N.C.	Not Connected	

*: Pin functionality can be altered by selecting a different sub-module configuration.

Refer to [9.6 Sub-modules](#)

Table. 9-3 Pin allocation of the connector for EX245-LB1 (Class B)

Pin	Signal	Description / Power source	View of connector (module side)
1	L+	24 V / US1	
2	P24	24 V / US2	
3	L-	0 V / US1	
4	C/Q	IO-Link communication, DI or DO * / US1	
5	N24	0 V / US2	

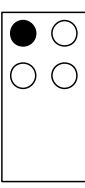
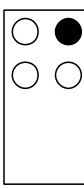
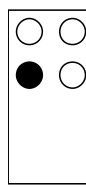
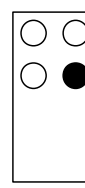
*: Pin functionality can be altered by selecting a different sub-module configuration.

Refer to [9.6 Sub-modules](#)

9.4. Connector allocation and process data

IO-Link port numbers and Connector designation are arranged as follows.
The EX245-LA1 / LB1 occupies 2 bytes of I/O process data on the Standard IO slot. The following table shows the allocation of the IO-Link ports and the I/O process image.

Table. 9-4 Connector allocation and the process data

Connector position						Note
Connector designation		X0	X1	X2	X3	-
IO-Link port number		1	2	3	4	Available when the IO-Link device sub-module is configured.
Digital input	Pin 2 (I/Q)	Byte N Bit 1	Byte N Bit 3	Byte N Bit 5	Byte N Bit 7	EX245-LA1 only (For EX245-LB1 bits are fixed at 0)
	Pin 4 (C/Q)	Byte N Bit 0	Byte N Bit 2	Byte N Bit 4	Byte N Bit 6	Available when the Digital input sub-module is configured.
Digital output	Pin 2	-	-	-	-	-
	Pin 4 (C/Q)	Byte N Bit 0	Byte N Bit 2	Byte N Bit 4	Byte N Bit 6	Available when the Digital output sub-module is configured.

*: Input and Output Byte N+1 is fixed at 0x00.

9.5. Slot structure

EX245-LA1 / LB1 has the slots as follow.

Table. 9-5 Overview of slot structure

Slot number *	Occupied Bytes		Description
	input	output	
1 st slot (Standard IO)	2	2	The I/O process data are allocated when set the Digital input/output sub-modules in the 2 nd to 5 th slot. The input process data on pin 2 (I/Q) is allocated when using the EX245-LA1. Refer to Section 9.4 .
2 nd Slot: (Config. for port 1)	Depend on configuration	Depend on configuration	The IO-Link device or Digital input/output sub-module can be configured for each slot. By default, all IO-Link ports are deactivated. To enable an IO-Link port, delete the sub-module 'Port deactivated' and replace it with one of the following sub-modules 'IO-Link Device', or 'Digital Input', or 'Digital Output'.
3 rd Slot: (Config. for port 2)			
4 th Slot: (Config. for port 3)			
5 th Slot: (Config. for port 4)			
6 th slot (PQI)	4	0	The diagnostic information for each port is shown as input process data in 1 Byte per port. Refer to Section 9.7 .

*: The name is displayed in Siemens software TIA Portal.

9.6. Sub-modules

The EX245-LA1 / LB1 has the sub-modules below. They can be set to slot number 2nd to 5th on IO-Link module.

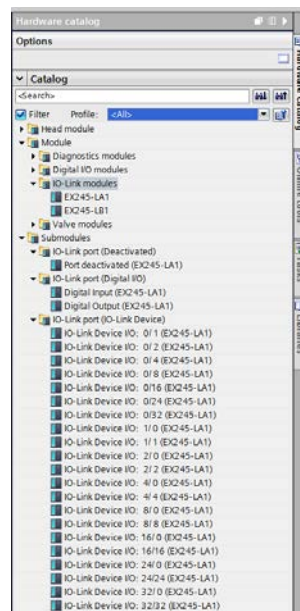
For the EX245-LA1, The digital input on pin 2 (I/Q) is available regardless of the configuration of the sub-module. Its process data is allocated to the Standard IO slot. Refer to [Section 9.4](#).

Table. 9-6 Sub-modules for the IO-Link port

Listed name	Sub-module name *	Description
IO-Link port (Deactivated)	Port deactivated	Disable the pin 4 (C/Q) of configured IO-Link port. Set this sub-module to all IO-Link port that does not connect to IO-Link device (set by default).
IO-Link port (Digital I/O)	Digital input	The pin No.4 (C/Q) of the configured IO-Link port works as a digital input. Its process data is allocated to the Standard IO slot. Refer to Section 9.4 .
	Digital output	The pin No.4 (C/Q) of the configured IO-Link port works as a digital output. Its process data is allocated to the Standard IO slot. Refer to Section 9.4 .
IO-Link port (IO-Link device)	IO Link Device I/O: "input bytes" / "output bytes"	The configured IO-Link port is capable of communicating with IO-Link devices. Select the appropriate module according to the I/O size of the IO-Link device. Input and output byte size are allocated in combinations of 0, 1, 2, 4, 8, 16, 24 and 32.

*: The full title for each sub-module incorporates the IO-Link module type (EX245-LA1 or EX245-LB1) as part of its name
e.g. Port deactivated (EX245-LA1), Port deactivated (EX245-LB1) etc.

When selecting a sub-module please choose the one which corresponds to the IO-Link module type in use.



9.7. Diagnostics data on I/O mapping (PQI)

The 6th slot: PQI shows the diagnostics data as digital input data on I/O mapping. The four input bytes to be occupied are allocated in the order of port 1, 2, 3 and 4, starting with the lowest number.

Table. 9-7 PQI I/O mapping and descriptions

Bit	Description	Details	Value
0	ID-Mismatch	Connection device matching error	0: Match 1: Mismatch (error)
1	PDmapping-Mismatch	Process data mapping size error * ¹	0: Set size or less 1: Exceeding size (error)
2	PwrShort	L+ short circuit or P24 short circuit	0: No short circuit 1: Short circuited (error)
3	CQShort	C/Q short circuit	0: No short circuit 1: Short circuited (error)
4	DSSatus	Display the status of the "Data storage (DS)" function * ²	0: DS not in use / DS data cleared or DS saved data error 1: DS in use / DS saved data is valid
5	DevCom	Port communication status	0: Device not connected (warning) 1: Operation or preparation
6	DevErr	Event (Device or master event status)	0: No event or notification 1: Warning or Error
7	PQ	Display of the status of the process data received from an IO-Link device. * ³	0: Invalid 1: Valid

*1: An error is detected when the amount of process data sent by the connected IO-Link device exceeds the configured value for the specified port of the IO-Link module.

*2: For data storage (DS) function details refer to [Validation & Backup](#)

*3: Process data values are maintained when the received process data from an IO-Link device is invalid.

9.8. Parameterisation

The EX245-LA1 / LB1 has the following module parameters.

Table. 9-8 Parameters of Standard IO sub-module

Parameter	Description	Range of value	Content
Power supply and I/O value at pause (PROFenergy)	The EX245-LA1 / LB1 starts the energy saving mode when the SI Unit receives the PROFenergy command.	-Proceed	Refer to Table 4-11
		-Shutdown, Clear value (Default)	
		-Shutdown, Hold last state	

Table. 9-9 Parameters of Digital output sub-module

Parameter	Description	Range of value	Content
Output operation at network fault	Set the digital output signal when PROFINET communication is in error	Force to OFF (Default)	Turn OFF the digital output.
		Force to ON	Turn ON the digital output.
		Hold last state	Maintain the digital output that the IO-Link module finally receives.

Table. 9-10 Parameters of IO-Link Device sub-module

Parameter	Description	Range of value	Content
IO-Link device operation at network fault *1	Set the output process data values and status to be sent to the IO-Link device when PROFINET communication is in error.	Clear / PD Out valid	<ul style="list-style-type: none"> All outputs are turned OFF The process data status is valid.
		Hold	<ul style="list-style-type: none"> All outputs hold the values of the last received process data. The process data status is valid.
		Clear / PD Out invalid (Default)	<ul style="list-style-type: none"> All outputs are turned OFF The process data status is invalid. (Outputs operation of an IO-Link device depends on the parameter set for itself.)
Byte Swap *2	Swap the byte order of the process data, which is sent and received between Fieldbus communication and IO-Link communication. For details refer to I/O byte swap function	Direct (No swap) (Default)	Data order is not swapped.
		Swap 16 bit	Swap in the word unit.
		Swap 32 bit	Swap in the double word unit.
		Swap All	Swap all bytes

*1: This parameter is available when using "IO-Link device I/O: */*" sub-module that include a output value.

*2: The available byte swap parameters vary depending on the process data of the device to be connected. Refer to [I/O byte swap function](#) for details.

Table. 9-10 Parameters of IO-Link Device sub-module (continued)

Parameter	Description	Range of value	Content
Port Mode	Set the operation mode of each port.	Manual	Start-up IO-LINK communication based on the IO-Link device comparison function
		Autostart (Default)	Start up the IO-Link communication instead of comparing IO-Link device
Validation & Backup *3	Set the comparison function (comparison of vendor ID and device ID) of the connected IO-Link device and data storage (DS) function. For details refer to Validation & Backup	No Device Check (Default)	Comparison function: Disable DS function: Disable
		Type compatible Device V1.0	Connected device: V1.0 Comparison function: Enable DS function: Disable
		Type compatible Device V1.1	Connected device: V1.1 Comparison function: Enable DS function: Disable
		Type compatible Device V1.1, Backup + Restore	Connected device: V1.1 Comparison function: Enable DS function: Enable (Backup & restore)
		Type compatible Device V1.1, Restore	Connected device: V1.1 Comparison function: Enable DS function: Enable (for restore only)
Cycle Time	Set the IO-Link device and communication cycle time.	As fast as possible (Default)	Automatic setting
		0.4 to 132.8 ms	0.4 to 6.3 ms (by 0.1 ms) 6.4 to 31.6 ms (by 0.4 ms) 32 to 132.8 ms (by 1.6 ms)
Vendor ID	Set the vendor ID. It is compared against the vendor ID of the connected IO-Link device when the device comparison function is enabled	0 to 65535 dec (Default value is 0)	Set the vendor ID of the device to be connected.
Device ID	Set the device ID. It is compared against the device ID of the connected IO-Link device when the device comparison function is enabled	0 to 16777215 dec (Default value is 0)	Set the device ID of the device to be connected.

*3: For function to work the IO-Link 'Port Mode' must be set to 'Manual'.

- **I/O byte swap function**

The data construction of each parameter of the byte swap function is as follows based on the connected device process data size and the mapping size of the master communication process data.

When the process data size of the connected device and mapping size of the master communication process data are identical
(E.g.: connected device process data size: 8-byte, mapping size: 8-byte)

Table. 9-11 I/O byte swap function example for 8-byte

Parameter	Data construction
Direct (No swap)	0x0123 4567 89AB CDEF
Swap 16 bit	0x2301 6745 AB89 EFCD
Swap 32 bit	0x6745 2301 EFCD AB89
Swap All	0xEFCD AB89 6745 2301

*: When the mapping size is 2-byte, even though the swap is set to 32bit, the byte will not be swapped.

When the process data size of the connected device and mapping size of the master communication process data are different
(E.g.: connected device process data size: 10-byte, mapping size: 16-byte)

Table. 9-12 I/O byte swap function example for 10-byte

Parameter	Data construction
Direct (No swap)	0x0123 4567 89AB CDEF GHIJ 0000 0000 0000
Swap 16 bit	0x2301 6745 AB89 EFCD IJGH 0000 0000 0000
Swap 32 bit	0x6745 2301 EFCD AB89 0000 IJGH 0000 0000
Swap All	0x0000 0000 0000 IJGH EFCD AB89 6745 2301

*: When the mapping size is 2-byte, even though the swap is set to 32bit, the byte will not be swapped.

*: When the mapping size of the master connection process data and the process data size of the connected device are different, swap the byte including the blank byte zero.

- **Validation & Backup**

The 'data storage' function is available when the following two conditions are satisfied

- IO-Link 'Port Mode' is set to 'Manual', and
- Validation & Backup is set to either
'Type compatible, Device V1.1, Backup + restore', OR
'Type compatible, Device V1.1, Restore'

- **Outline of backup or restore**

The parameter data for each IO-Link device can be stored (referred to as "backup") in the IO-Link module.

If the IO-Link device fails and is replaced by an identical device, the parameter 'backup' can be transferred (referred to as "restore") from the IO-Link module to the replacement IO-Link device.

- **Condition of the backup / restore operation when the IO-Link communication starts up**

The data storage function operation will be as follows based on the condition of the data storage of the IO-Link module and parameter change of the IO-Link device.

Table. 9-13 Data storage function description

Validation & Backup set value	Condition			Data storage operation
	Data for data storage in the IO-Link module	Backup requirement from the device	Checksum of the data storage and device parameter	
No Device Check	-	-	-	Clear data
Type compatible Device V1.0	-	-	-	Clear data
Type compatible Device V1.1	-	-	-	Clear data
Type compatible Device V1.1, Backup + Restore	Data exist	Required	-	Backup data
	Data exist	No requirement	Not identical	Restore data
	Data exist	No requirement	Identical	Do nothing
	No data	-	-	Backup data
Type compatible Device V1.1, Restore	Data exist	-	Not identical	Restore data
	Data exist	-	Identical	Do nothing
	No data	-	-	Do nothing

NOTE

- When the IO-Link module receives a setting that differs from the vendor ID or device ID stored in itself, the data for data storage is cleared.
- When the 'Port Mode' is changed to a setting other than 'Manual' (e.g. change to 'Autostart' or Digital input or output sub-module), the data stored in the IO-Link module for data storage will be cleared.

9.9. Diagnosis

The EX245-LA1 / LB1 has a diagnostic function for each port.

The diagnostics contents are displayed by LEDs and are assigned to the input process data as Port Status (PQI).

For details of the PQI behaviour, refer to [Section 9.7](#).

Table. 9-14 Diagnostics and indications

Port diagnostics function	Details	Status LED	PQI Bit No. (Description)
L+ short circuit detection	Pin No. 1 and 3 short circuit diagnostics	Red ON	2 (PwrShort)
P24 short circuit detection	Pin No. 2 and 5 short circuit diagnostics	Red ON	2 (PwrShort)
C/Q short circuit	Pin No. 1 and 4 or 3 and 4 short circuit diagnostics	Red ON	3 (CQShort)
Connected device matching error	A diagnosis check to confirm the Vendor ID and Device ID of the connected IO-Link device matches that in the configuration. The following 2 conditions must be satisfied in order to carry out the diagnosis check: - a. Pin 4 (C/Q) mode in specified port of IO-Link module must be set to IO-Link, and b. The port pin 'Validation & Backup' parameter must be set to 'Type compatible Device V1.x'.	Green flashing	0 (IDMismatch)
Device process data mapping error *1	A diagnosis error will occur when the port operation mode is set to IO-Link and the port receives exceed process data length than it is configured for.	Green flashing	1 (PDmapping-Mismatch)
Device disconnection is detected *2	When the pin function / operation mode is set to IO-Link, device disconnection is detected.	Green flashing	5 (DevCom)
P24 power supply reduction	Power supply reduction of class B type Pin No. 2 and 5 is diagnosed.	OFF	-

*1: When a mapping error is diagnosed the process data values for the Inputs and Outputs will be set to zero.

*2: The I/O process data values will be set to zero when the IO-Link device is not detected or has been disconnected.

Note) Diagnostics for short circuit detection (L+, P24, C/Q) is duplicated in the PROFINET 'diagnostic data on I/O mapping'. Refer to [5 Diagnosis](#).

Additional diagnostic faults are reported via the IO-Link module LED display and the PQI diagnostic bytes for the EX245-LA1/LB1. Refer to [9.5 Slot structure](#).

9.10. LED indicators

The status indicators are arranged on the EX245-LA1 / LB1 as shown in the illustration below. The behaviour of the LEDs depends on the configured function and using module port class.

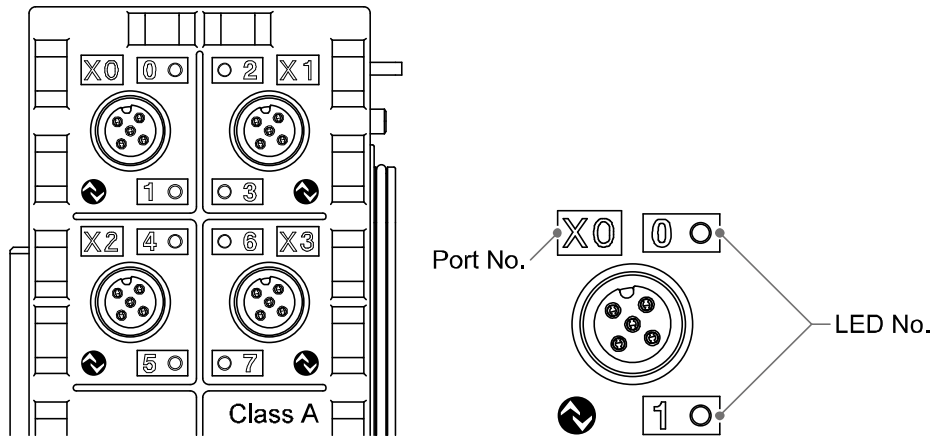


Table. 9-15 Status LED 0, 2, 4, 6 for Pin No. 4 C/Q

Function	LED status	Description
Port deactivated	OFF	Port disabled
	Red ON	Short circuit detection (L+)
IO-Link Device	Green flashing (ON/OFF: 1 Hz)	IO-Link device disconnected
	Green flashing (ON/OFF: 2Hz)	One of the following error conditions has been detected: <ul style="list-style-type: none"> •Connected IO-Link device matching error •Data size error •Data storage writing error
	Green ON	IO-Link device communicating
	Red ON	Short circuit (L+ or C/Q)
Digital input	OFF	Input signal OFF
	Orange ON	Input signal ON
	Red ON	Short circuit (L+)
Digital output	OFF	Output signal OFF
	Orange ON	Output signal ON
	Red ON	Short circuit (L+ or C/Q)

Table. 9-16 Status LED 1, 3, 5, 7, for Pin No. 2 I/Q (EX245-LA1, Port class A)

Function	LED status	Description
Digital input (I/Q)	OFF	I/Q Input signal OFF
	Orange ON	I/Q Input signal ON

Table. 9-17 Status LED 1, 3, 5, 7, for Pin No. 2 P24 (EX245-LB1, Port class B)

Function	LED status	Description
Power supply output (P24)	OFF	P24 Power supply OFF
	Green ON	P24 Power supply for output ON
	Red ON	Short circuit (P24)

9.11. Block diagram

The following figure shows the block diagram of the EX245-LA1 / LB1.

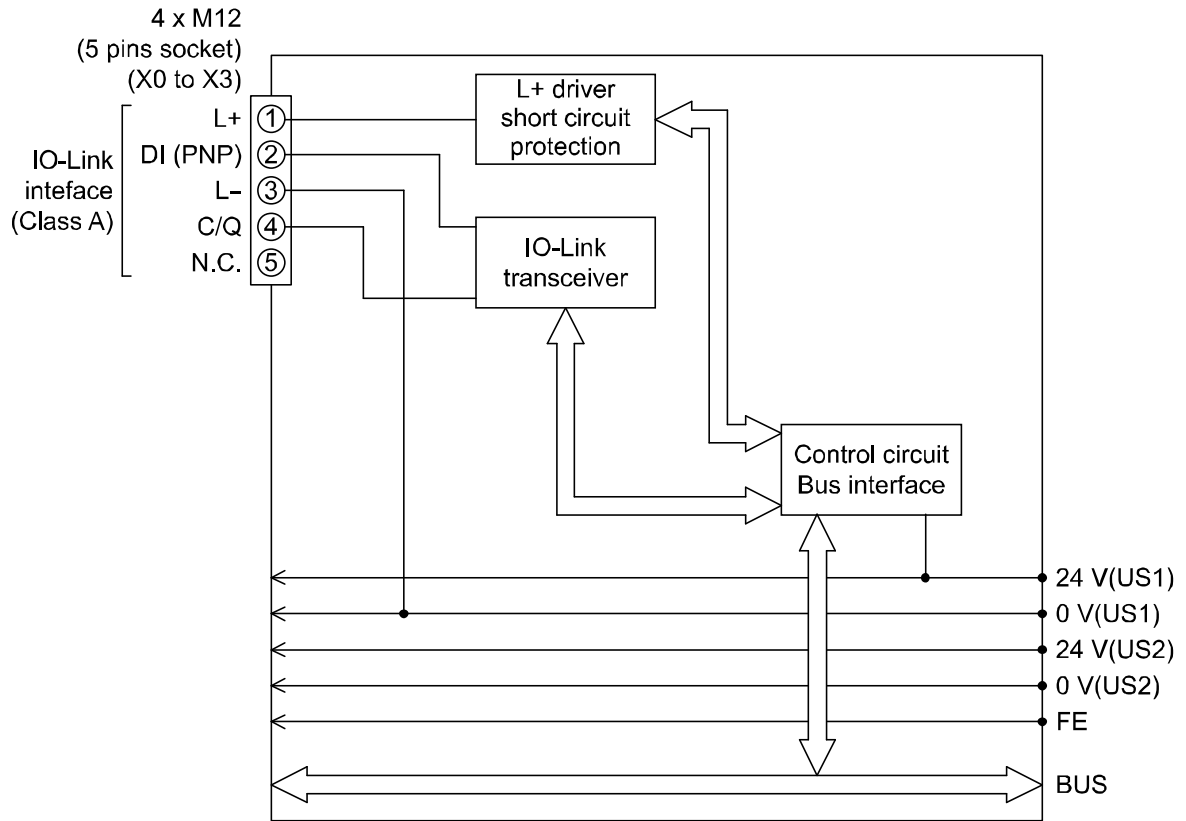


Fig. 9-2 Block diagram of the EX245-LA1

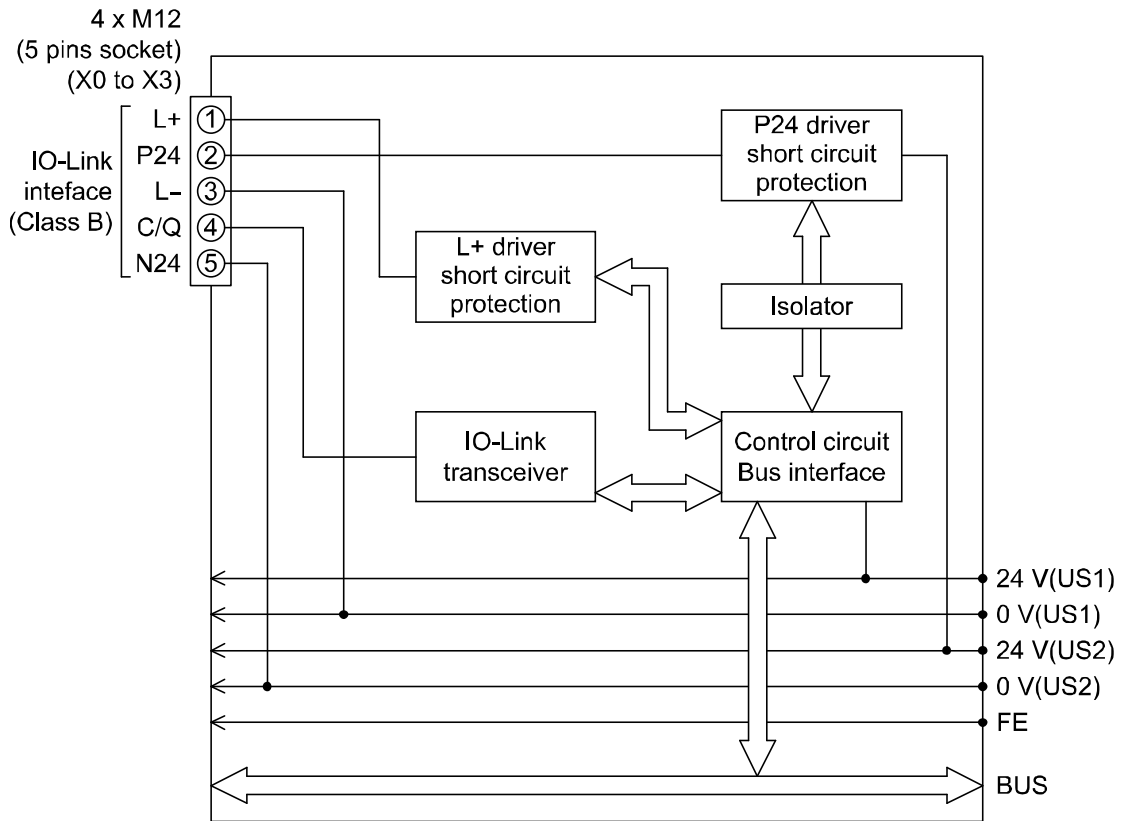


Fig. 9-3 Block diagram of the EX245-LB1

10. End Plate - EX245-EA2-1/2/3/4/5

10.1. Parts and description

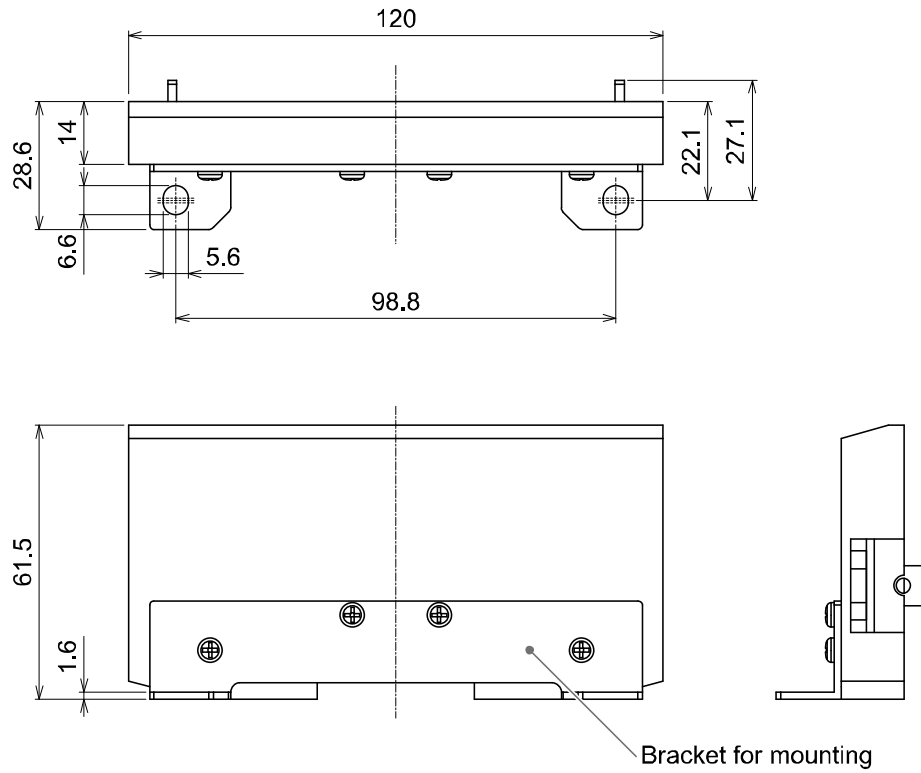


Fig. 10-1 Allocation of parts on the EX245-EA2-1

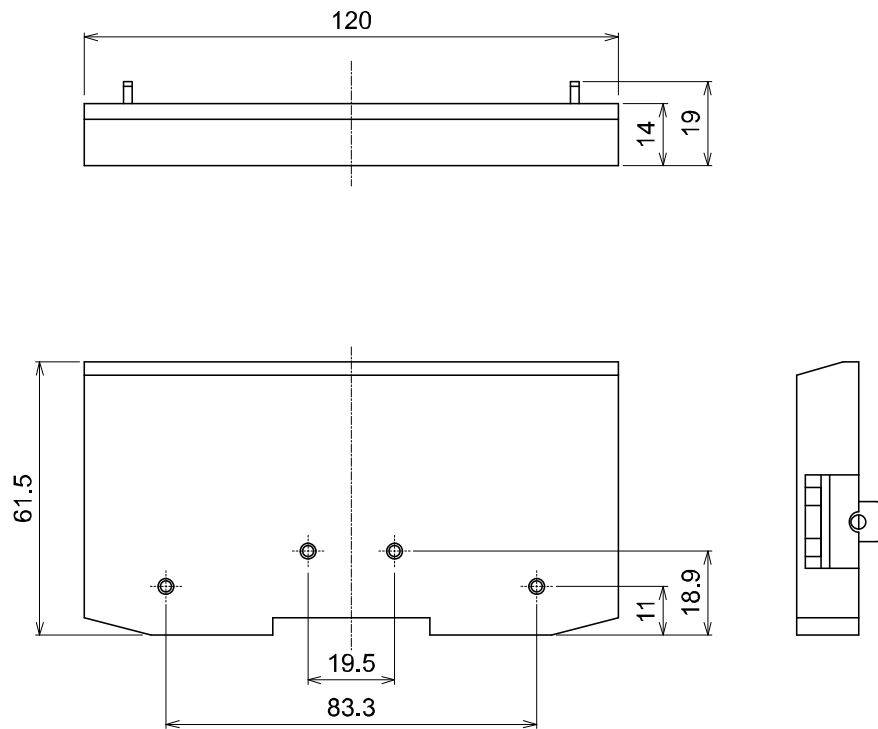


Fig. 10-2 Allocation of parts on the EX245-EA2-2

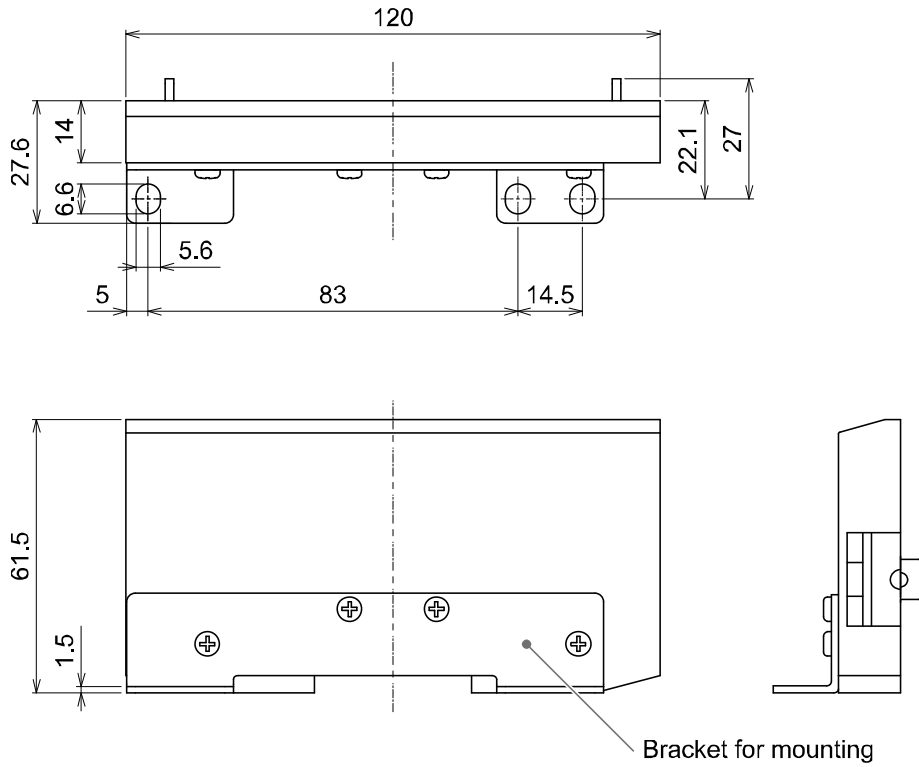


Fig. 10-3 Allocation of parts on the EX245-EA2-3

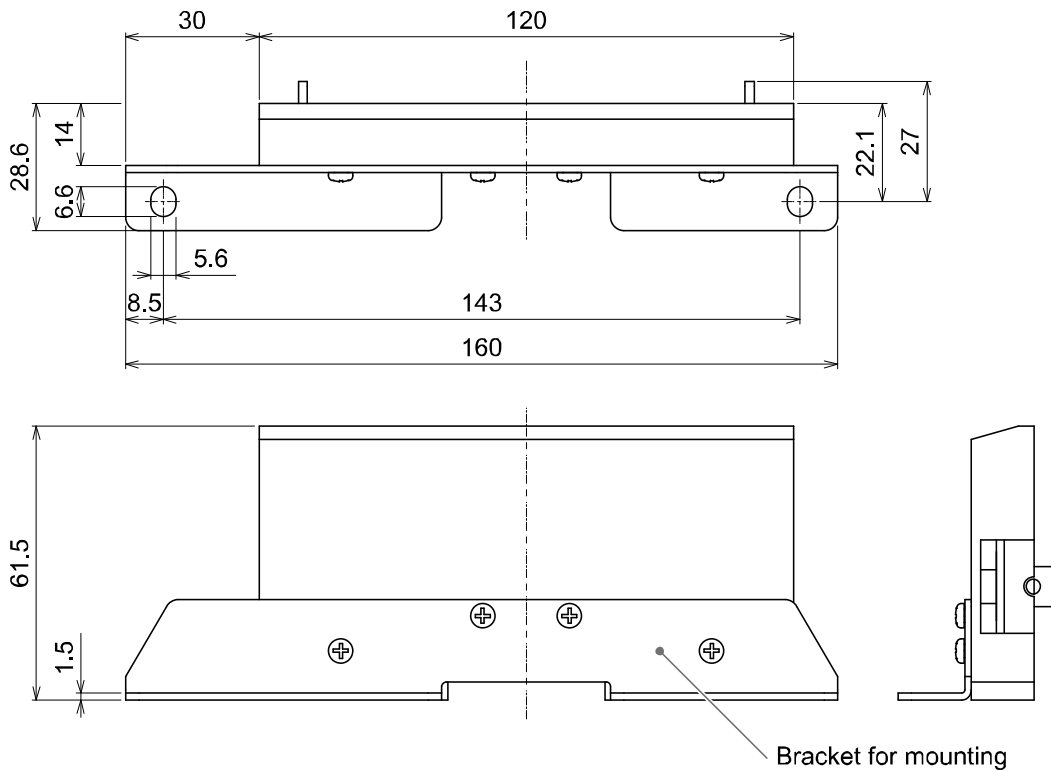


Fig. 10-4 Allocation of parts on the EX245-EA2-4

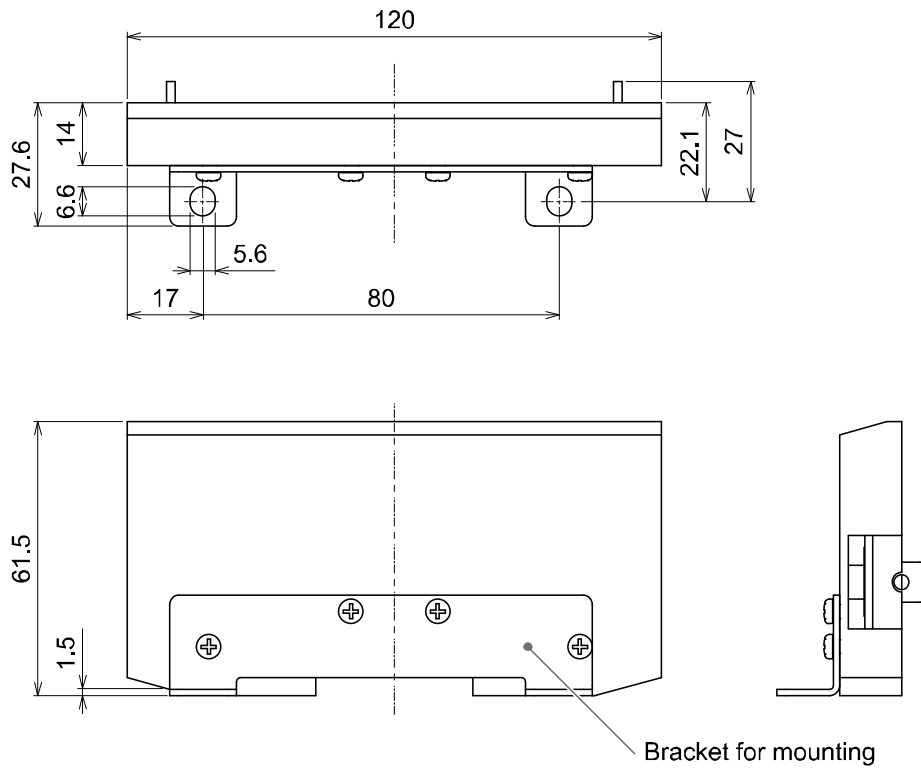


Fig. 10-5 Allocation of parts on the EX245-EA2-5

10.2. Specifications

Table. 10-1 EX245-EA2-1 specifications

Item	Description
Dimensions (W x L x H) in mm	28.6 x 120 x 61.5
Weight	120 g
Housing material	Nylon

Table. 10-2 EX245-EA2-2 specifications

Item	Description
Dimensions (W x L x H) in mm	14 x 120 x 61.5
Weight	85 g
Housing material	Nylon

NOTE

EX245-EA2-2 can be used to have a special bracket which must be assembled with 4 Cross-recessed head tapping screws (3x6, torque: $0.8 \pm 0.05 \text{ N}\cdot\text{m}$)

Table. 10-3 EX245-EA2-3 specifications

Item	Description
Dimensions (W x L x H) in mm	27.6 x 120 x 61.5
Weight	120 g
Housing material	Nylon

Table. 10-4 EX245-EA2-4 specifications

Item	Description
Dimensions (W x L x H) in mm	28.6 x 160 x 61.5
Weight	150 g
Housing material	Nylon

Table. 10-5 EX245-EA2-5 specifications

Item	Description
Dimensions (W x L x H) in mm	27.6 x 120 x 61.5
Weight	120 g
Housing material	Nylon

11. Accessories

11.1. Markers

Markers are available in single sheets each containing 88 pieces,
For the EX245-DX1, EX245-DY1 and EX245-LA1/LB1 use the model No.EX600-ZT1.

Model No.: EX600-ZT1

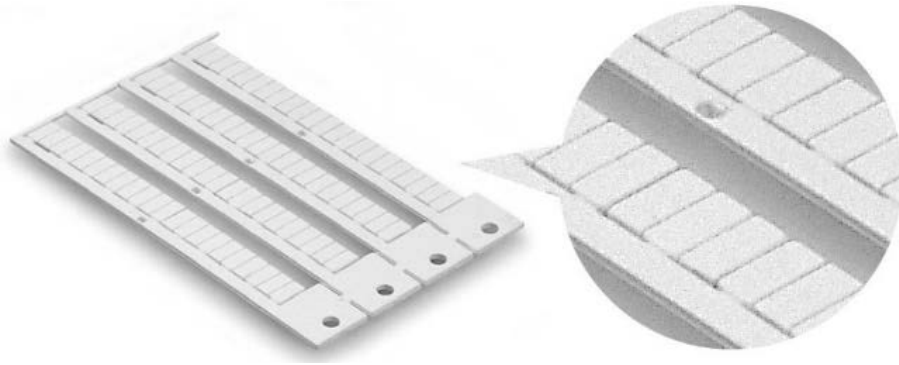


Fig. 11-1 EX600-ZT1

11.2. Y Connector

Y connectors can be used with the EX245-DX1 and EX245-DY1.

There are two options –

- 2 x M12 to M12
- 2 x M8 to M12

Model No.: PCA-1557785

(Y branch Connector (2 x M12 to M12))

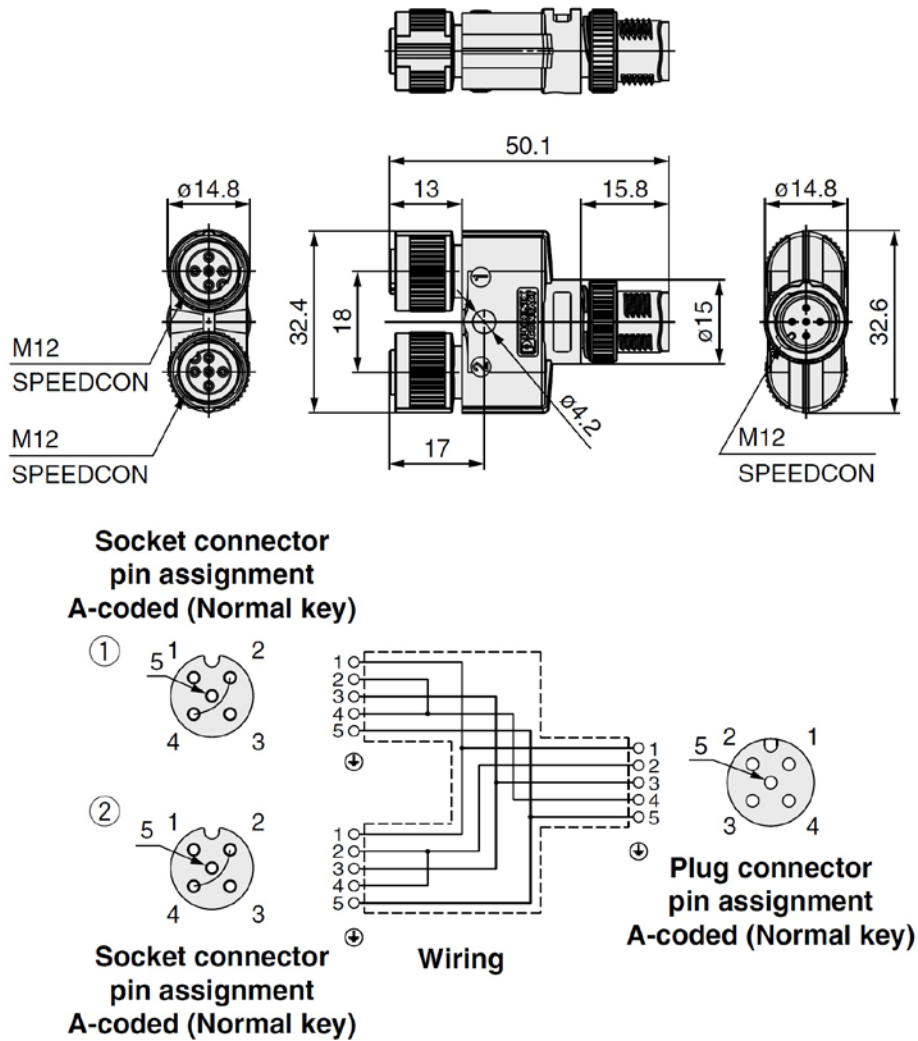
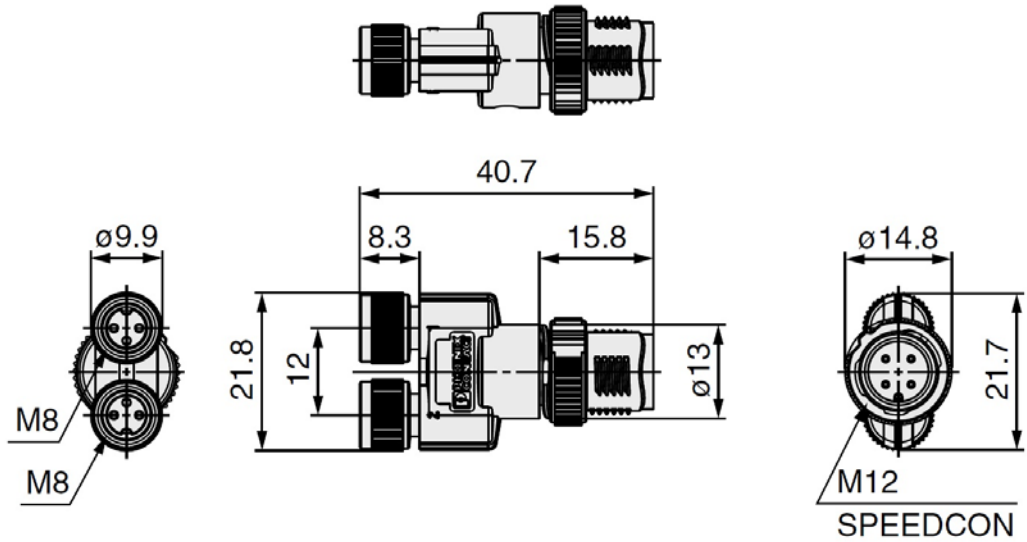
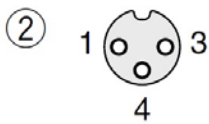
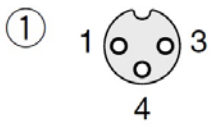


Fig. 11-2 PCA-1557785

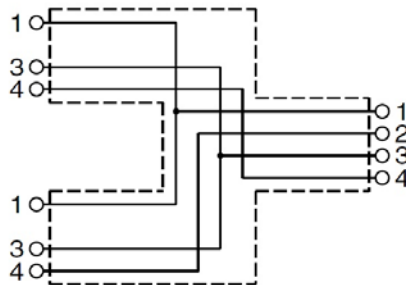
Model No.: PCA-1557798
 (Y branch Connector (2 x M8 to M12))



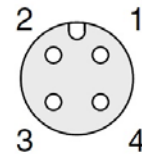
**Socket connector
pin assignment**



**Socket connector
pin assignment**



Wiring



**Plug connector
pin assignment
A-coded (Normal key)**

Fig. 11-3 PCA-1557798

11.3. Seal cap

Model No.: EX9-AWTS

(10 pieces for M12 socket connectors)

The EX9-AWTS can be used with the EX245-SPN3A, EX245-DX1, EX245-DY1 and EX245-LA1 / LB1.

Mount the seal cap in the unused sockets.

IP65 rating is maintained by using the seal cap properly.

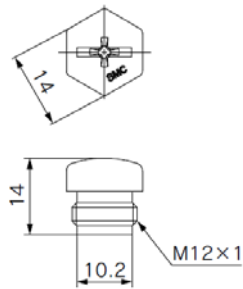


Fig. 11-4 EX9-AWTS

NOTE

- Tighten the seal caps to the tightening torque specified (0.2 N•m)
- In case of the EX245-SPN3A, M12 Seal caps is fitted to PROFINET connection Port2 (XF2) when shipped from factory.

Model No.: EX245-AWP

(10 pieces for Push Pull connectors of power connection)

The EX245-AWP can be used with the EX245-SPN1A/EX245-SPN2A.
Mount the seal cap in the unused connector.
IP65 rating is maintained by using the seal cap properly.

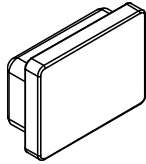


Fig. 11-5 EX245-AWP

Model No.: EX245-AWC

(10 pieces for Push Pull connectors of PROFINET connection)

The EX245-AWC can be used with the EX245-SPN1A/EX245-SPN2A.
Mount the seal cap in the unused connector.
IP65 rating is maintained by using the seal cap properly.

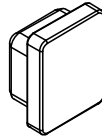


Fig. 11-6 EX245-AWC

NOTE

- In case of the EX245-SPN1A or EX245-SPN2A, the Seal caps is fitted to all bus & power connector when shipped from factory.

11.4. Joint pack

One "Joint assembly" and two "Modular adaptor assembly" are contained in one "Joint pack".

Model No.: EX245-ZJP

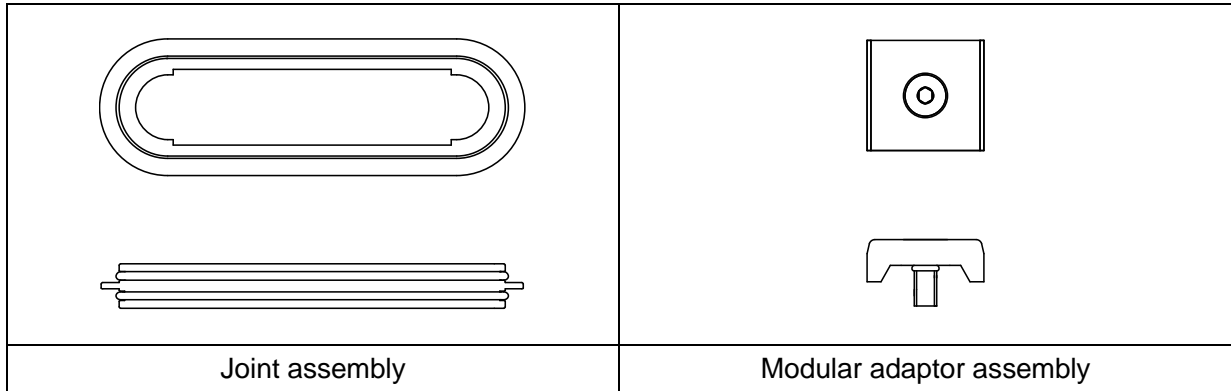


Fig. 11-7 EX245-ZJP

NOTE

- One Joint pack is attached to the EX245-DX1, EX245-DY1, EX245-LA1 / LB1 and EX245-EA2-1/2/3/4/5.
- Regarding mounting, refer to [Section 3.1.2](#).

12. Dimensions

12.1. The Modules Manifold

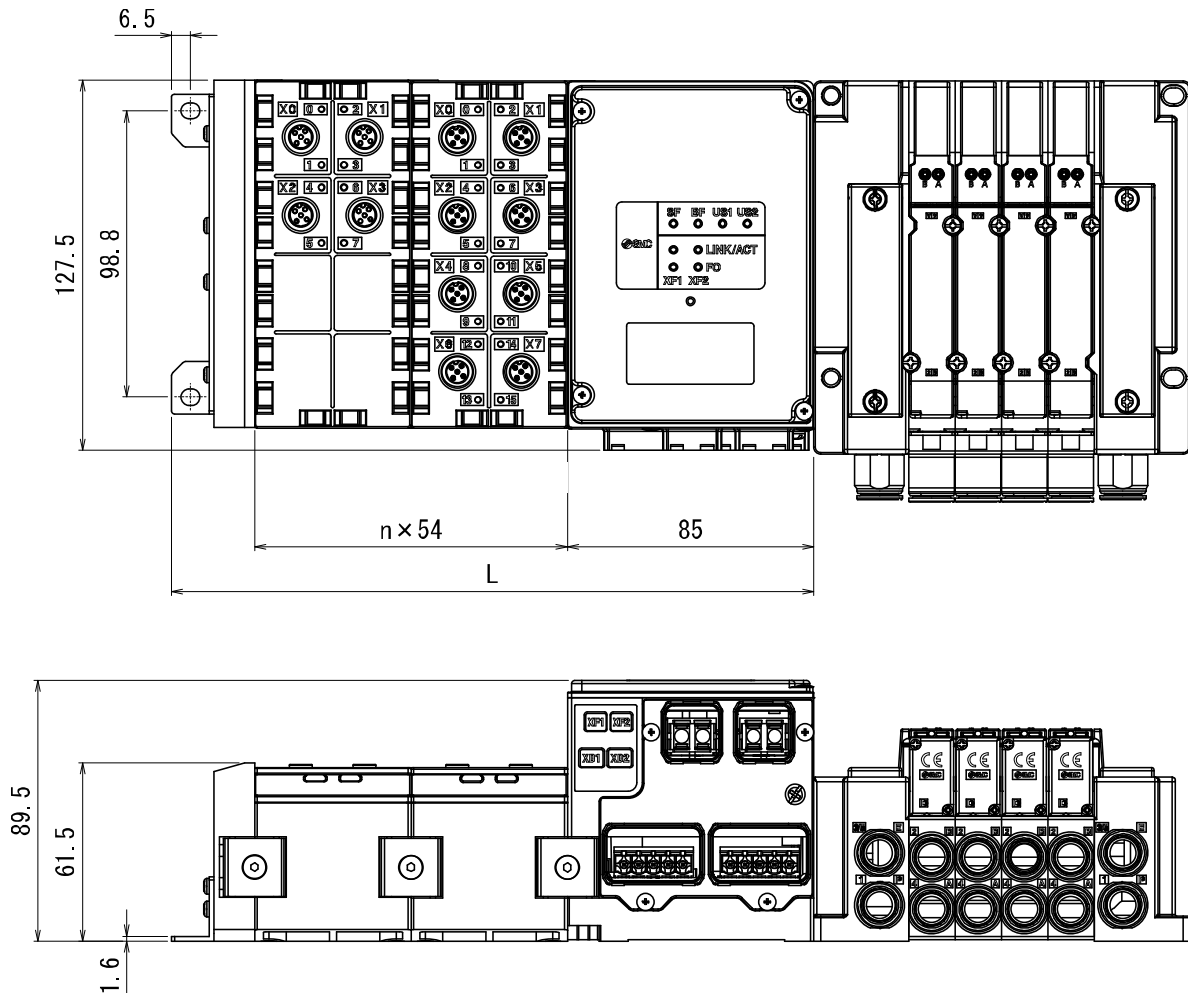


Fig. 12-1 Dimensions of the Modules manifold

NOTE

- Fig. 12-1 shows when the EX245-EA2-1 is used.

The following table shows the length of the Modules manifold.
For the valve manifold side, refer to the instruction manual for the appropriate valve series.

Table. 12-1 Length the EX245-SPN1A/SPN2A/SPN3A manifold

n	0	1	2	3	4	5	6	7	8
L	113.6	167.6	221.6	275.6	329.6	383.6	437.6	491.6	545.6

Formulas: $L = 54n + 113.6$ (max. 8 modules) (Dimensions in mm)

13. Troubleshooting

13.1. EX245-SPN1A/SPN2A/SPN3A

Table. 13-1 Troubleshooting for bus communication

No.	Problem	Possible cause	Remedy
1	BF indicator is ON. LINK indicator is OFF. ACT indicator is OFF.	The SI Unit is not connecting to any network.	Check the cable connection.
2	BF indicator is ON. LINK indicator is ON. ACT indicator is ON.	The SI Unit is physically connected to any network but the following problem has occurred.	---
		No communication.	Check the cable. Connect to the PROFINET communication.
		The IO Controller is defective.	Check the IO Controller.
		Device name is not correct.	Check the device names.
		The GSD file is not correct.	Check the GSD file.
		The configuration data sent by the IO Controller does not match the actual layout.	Configure the SI unit according to the actual layout. Refer to Section 4 .

Table. 13-2 Troubleshooting for the problem with display on SF LED

No.	Problem	Possible cause	Remedy
1	SF indicator is ON.	US1 is below the permissible level (< approx. 19.2 VDC).	Check the power supply.
		The valve coil has a short circuit or the connected module has a short circuit.	Check the solenoid valve for a short circuit and the module short circuit, error and/or layout.
		The connected module has disconnected.	Check the connected module.

Table. 13-3 Troubleshooting for the problem with display on SF and BF LED

No.	Problem	Possible cause	Remedy
1	SF and BF indicators are flashing alternately.	During firmware update.	---
		During forced output mode by Web server function.	---
2	SF and BF indicators are flashing simultaneously.	Firmware update failed.	Update the firmware again.

Table. 13-4 Troubleshooting for the problem with display on US1/US2 LED

No.	Problem	Possible cause	Remedy
1	US1 indicator is OFF.	Incorrect wiring.	Check the cable. Check the wiring and pin numbers.
		US1 is not present.	Check the supply for US1 (sensor/input) of the SI Unit.
2	US1 indicator is flashing.	US1 is below the permissible level (< approx. 19.2 VDC).	Check the supply for US1 (sensor/input) of the SI Unit.
3	US2 indicator is OFF.	Incorrect wiring.	Check the cable. Check the wiring and pin numbers.
		US2 is not present.	Check the supply for the valves/loads.

Table. 13-5 Troubleshooting for malfunction of the solenoid valve

No.	Problem	Possible cause	Remedy
1	A solenoid valve is not operating.	Incorrect mounting of valve manifold.	Check the mounting of the SI Unit and valve manifold.
		Solenoid valve is faulty.	Check the solenoid valve.
		US2 is not present.	Check the supply for the valves. Check the wiring and pin numbers.

Table. 13-6 Troubleshooting for the problem with display on FO LED

No.	Problem	Possible cause	Remedy
1	FO1 or FO2 indicator is flashing.	The strength margin of the Fibre-optic communication is more than 0 dB but less than 2 dB on Port 1/2 (XF1/XF2).	Check the Fibre-optic cable.
2	FO1 or FO2 indicator is ON.	The strength margin of the Fibre-optic communication is 0 dB on Port 1/2 (XF1/XF2).	Check the Fibre-optic cable.

13.2. EX245-DX1

Table. 13-7 Troubleshooting for EX245-DX1

No.	Problem	Possible cause	Remedy
1	Signals cannot be received even with sensor.	Incorrect wiring.	Check the wiring and pin numbers.
		US1 is not present.	Check the supply for US1 (sensor/input).
		Sensor is faulty.	Check the sensor.
2	Status indicator is red ON.	"Pin 1: 24 V" and "Pin 3: 0 V" of the sensor connection have over current.	Check the sensor. Check the cable. Check the wiring and pin numbers.

13.3. EX245-DY1

Table. 13-8 Troubleshooting for EX245-DY1

No.	Problem	Possible cause	Remedy
1	A load is not operating.	Incorrect wiring.	Check the wiring and pin numbers.
		US2 is not present.	Check the supply for the loads.
		Load is faulty.	Check the load.
2	Status indicator is red ON.	"Pin 2/4: output signal" and "Pin 3: 0 V" of the load connection have over current.	Check the load. Check the cable. Check the wiring and pin numbers.

13.4. EX245-LA1 / LB1

Table. 13-9 Troubleshooting for EX245-LA1 / LB1

No.	Problem	Possible cause	Remedy
1	An IO-Link device is not operating.	Incorrect wiring.	Check the wiring and pin numbers. Refer to 9.3 Wiring
		The configuration data sent by the IO Controller does not match the actual device.	Ensure the settings for the IO-Link module are appropriate for the connected IO-Link device Configure the IO-Link device parameters according to the actual device. Refer to 9.8 Parameterisation
		US1 is not present.	Check the supply for the IO-Link device.
		US2 is not present. P24 load is not operating	Check the supply for the P24 load.
		IO-Link device is faulty.	Check the IO-Link device
		IO Controller program is incorrect	Check the IO Controller program
2	Signals are not received from the connected sensor (when IO-Link module pin is configured as a Digital Input)	Incorrect wiring.	Check the wiring and pin numbers.
		US1 is not present.	Check the supply for the sensors.
		Sensor is faulty.	Check the sensor.
3	The connected load is not operating (when IO-Link module pin is configured as a Digital Output)	Incorrect wiring.	Check the wiring and pin numbers.
		US1 is not present.	Check the supply for the loads.
		Load is faulty.	Check the load.
4	Status indicator (LED 0, 2, 4, 6) is red ON.	"Pin 4: C/Q" and "Pin 3: L-" or "Pin 1: L+" and "Pin 3: L-" of the connection have over current.	Check the IO-Link device or sensor. Check the cable. Check the wiring and pin numbers.
5	Status indicator (LED 1, 3, 5, 7) is red ON. (EX245-LB1 only)	"Pin 2: P24" and "Pin 5: N24" of the connection have over current.	Check the IO-Link device. Check the cable. Check the wiring and pin numbers.

Revision history

- A: Minor update (correction of sentences, etc.).
[March 2019]
- B: Addition of IO-Link modules EX245-LA1,
EX245-LB1. [August 2021]

SMC Corporation

4-14-1, Sotokanda, Chiyoda-ku, Tokyo 101-0021 JAPAN
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.
© 2018-2021 SMC Corporation All Rights Reserved

