Fieldbus system

Instruction Manual

EX245-FPS1/EX245-FPS2/EX245-FPS3

Please read this manual carefully before operating the product and make sure you understand its capabilities and limitations.

To obtain the operation manual and the Declaration of Conformity about this product, please refer to the SMC website (URL https://www.smcworld.com) or contact SMC directly.

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) and other safety regulations.

⚠ 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.

Operator

- The 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 the 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 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

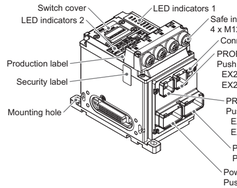
- For UL conformity a DC power supply meeting the requirements of UL1310 Class 2 must be used. For other applications a SELV or PELV DC power supply should be used.

Maintenance

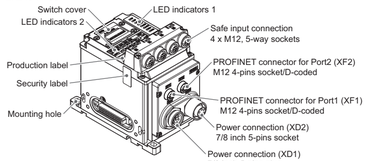
- Maintenance should be performed according to the operation manual.
- Turn off the power supply, stop the supplied air, exhaust the residual pressure and verify the release of air before performing maintenance.
There is risk of unexpected malfunction.

Summary of Product parts

•EX245-FPS1, EX245-FPS2



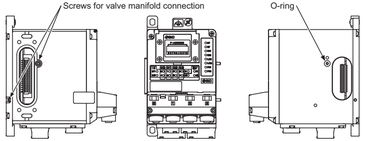
•EX245-FPS3



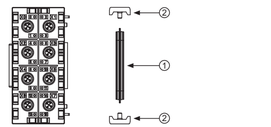
Mounting and Installation

■Installation

•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.

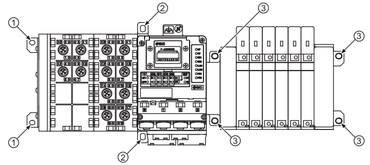


•Module connection
Connect the SI Unit, the I/O modules and the End plate using the 2 modular adaptor assemblies and a joint assembly. These are supplied together in the Joint pack.
①1 x Joint assembly
②2 x Modular adaptor assembly (hexagonal socket wrench size 2.5 mm, torque = 1.3 Nm)



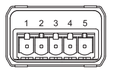
■Mounting

To prevent the manifold components being damaged, apply the recommended tightening torque.
Mount the manifold using the 6 base mounting positions with screws.
Required screws are as follows:
①2 x M5 (End plate: torque = 1.5 Nm)
②2 x M5 (SI unit: torque = 1.5 Nm)
③4 x M□ (Valve manifold: refer to valve manifold catalogue)



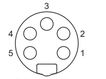
■Wiring

•Power connectors
Pin allocation of Push Pull Connector for EX245-FPS1/FPS2

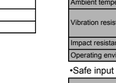


Pin	Remarks
1	24 V (US1)
2	0 V (US1)
3	24 V (US2)
4	0 V (US2)
5	FE

Pin allocation of 7/8" 5-pins Connector for EX245-FPS3



7/8" 5-pins Plug (XD1)



7/8" 5-pins Socket (XD2)

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

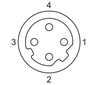
•PROFINET communication connectors
Pin allocation of Push Pull (SCRJ) Connector for EX245-FPS1

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

Pin allocation of Push Pull (RJ45) Connector for EX245-FPS2

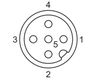
Pin	Port1 (XF1) Port type: MDI	Port2 (XF2) Port type: MDI-X
1	TD+ Transmit	RD+ Receive
2	TD– Transmit	RD– Receive
3	RD+ Receive	TD+ Transmit
4	–	–
5	–	–
6	RD– Receive	TD– Transmit
7	–	–
8	–	–

Pin allocation of M12 4-pins (D-code) Socket for EX245-FPS3



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

•Safety input connectors
Pin allocation of the M12, 5-way socket connector for All unit



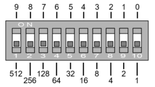
Pin	Allocation
1	UT1
2	DI (Input signal "in+4")
3	0V (US1)
4	DI (Input signal "in")
5	UT2
Outer shell	FE (functional earth)

•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.
- FE terminal screw tightening torque = 1.5 Nm.

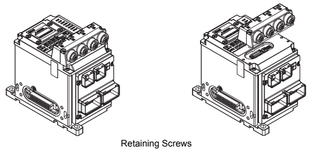
Setting

■Mounting

•PROFIsafe address switch
A ten bit DIP-Switch is provided for the safety address setting. The switch setting is only checked at power-up. Any changes made during operation are ignored and may lead to problems during the next power-up sequence.



•A two bit DIP-switch and a six bit DIP-Switch
Two DIP-switches SW2 and SW3 are under the M12 safe input connector box. To access the switches remove the retaining screws as shown below.



SW3

SW2

When the DIP-Switches have been set ensure the M12 connector block and all retaining screws are refitted. (torque = 0.4 Nm) The module must be in a fully assembled state with all parts securely fastened before using the product.

Refer to the operation manual to obtain more detailed information about DIP-Switch specification.

LED Display

•LED Indicators 1

Designation	Description	Colour
SF	System Fault.	Red
BF	Bus Fault.	Red
US1	Power Supply for logic/sensors.	Green
US2	Power Supply for valves/loads.	Green
L/A1 *	A combination of LINK and ACT LED. Connection via PROFINET on Port1 (XF1), and Data exchange on Port1 (XF1).	Green/Yellow
L/A2 *	A combination of LINK and ACT LED. Connection via PROFINET on Port2 (XF2), and Data exchange on Port2 (XF2).	Green/Yellow
FO1 **	Fibre-Optic communication diagnostics for Port 1 (XF1).	Orange
FO2 **	Fibre-Optic communication diagnostics for Port 2 (XF2).	Orange

*: When Link LED and Act LED are both on the combined color may appear to be orange.
**: Only EX245-FPS1 has this function.

•SF and BF Indicators

SF	BF	Description
OFF	OFF	No fault (The SI Unit is exchanging data with the IO Controller without errors).
–	Flash	Faulty or no connect message frame (although the SI unit is physically connected to the bus) •IO configuration is defective, or before initial commissioning has been done. •Device name or IP Address is different from the programmed setting. •The GSD file is not correct. •The IO Controller is defective.
–	ON	No IO Controller on the bus
Flashing at 2Hz	–	PROFIsafe communication is not established due to the following reason(s) •The SI unit is not parameterized by the Safe Controller. •The parameterization is not acceptable. •The F-address is not matched.
Flashing at 0.5Hz	–	The Safe controller requests operator acknowledment
ON	–	The following diagnostic event(s) occurred •No safe communication. •The configuration data sent by the Controller does not match the actual layout. •Power supply is not present or is below the dropout level. •At least one valve coil has a short circuit, or at least one connected module has a short circuit, or the module layout has changed. •Self-test has failed and a power reset is required. •An incompatible module is connected to the SI unit.

•US1 Indicator

US1	Meaning
OFF	US1 is not present or is below the dropout level (< approx. 17 VDC).
Flash	US1 is below the permissible level but above the dropout level (17 to 20.4 VDC).
ON	US1 is present (> approx. 21.6 VDC).

•US2 Indicator

US2	Meaning
OFF	US2 [US3, US4 .. etc] is not present or is below the dropout level (< approx. 17 VDC). *
Flash	US2 [US3, US4 .. etc] is below the permissible level but above the dropout level (17 to 21.6 VDC).
ON	US2 [US3, US4 .. etc] is present (> approx. 22.8 VDC).

*: If the US2 power supply is not present or below the dropout level, the SF LED will also flash and the error code "0x01F1" will be generated.

•L/A Indicator

L/A 1/2	Meaning
Green ON	Connection via Ethernet to the SI Unit via Port 1/2 (XF1/2)
Green OFF	No connection established via Port 1/2 (XF1/2)
Yellow ON	Transmission or reception of Ethernet telegrams on Port 1/2 (XF1/2)
Yellow OFF	No transmission or reception of Ethernet telegrams on Port 1/2 (XF1/2)
Orange Flash *	Received Node flash request

*: When Link LED and Act LED are both on the combined colour may appear to be orange

•L/A Indicator

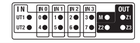
L/A 1/2	Meaning
Green ON	Connection via Ethernet to the SI Unit via Port 1/2 (XF1/2)
Green OFF	No connection established via Port 1/2 (XF1/2)
Yellow ON	Transmission or reception of Ethernet telegrams on Port 1/2 (XF1/2)
Yellow OFF	No transmission or reception of Ethernet telegrams on Port 1/2 (XF1/2)
Orange Flash *	Received Node flash request

*: When Link LED and Act LED are both on the combined colour may appear to be orange

•FO 1/2 Indicator

FO 1/2	Meaning
OFF	The strength of the Fibre-Optic communication is more than 2 dB.
Flashing	The strength of the Fibre-Optic communication is more than 0 dB but less than 2 dB.
ON	The strength of the Fibre-Optic communication is less than 0 dB.

•LED Indicators 2



Designation	Description	Colour
UT1, UT2	Status for the clock power supply UT1 and UT2	Red
IN0, IN1, ..., IN7	Status for safe inputs	Green
M	Status for safe US2 power supply for IO modules	Green/Red
Z1, Z2, Z3	Status for safe US2 zone power supplies for valves	Green/Red

•UT1 and UT2 LEDs

UT1/2	Meaning
OFF	No error
Flashing at 1 Hz	At least one of the safe inputs has a cross circuit with another signal (e.g. the other safe input, 24 V or an external signal)
ON	The clock power supply has a short circuit or overload.

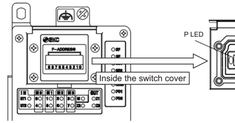
•IN0-7 LEDs

IN0-7	Meaning
ON	Input is ON
OFF	Input is OFF

•OUT M, OUT Z1-Z3 LEDs

OUT	Meaning
OFF	Safe output is OFF
Green ON	Safe output is ON
Red ON	Error detected. (e.g. Short circuit, overload of the safe output, internal test error) The safe output is switched OFF.

•LED indicators 3



•FS LED

LED state	Meaning
OFF	The safety application has valid F-Parameters and i-Parameters (Only applies if US1 is on at the same time)
Red ON	Hardware fault. Communication to the higher level safe controller is disabled
Red Flash	Module is not parameterized or parameterization was not accepted

•P LED

LED state	Meaning
OFF	No safe communication
Green ON	Safe communication is running.
Green Flash	Safe communication is running. The controller is requesting 'operator acknowledgment'

Troubleshooting

Refer to the LED Display. Refer to the operation manual to obtain more detailed information about troubleshooting.

Specification

•Electrical

Item		Description
Internal current consumption at 24 VDC (via US1)		350 mA or less (EX245-FPS1) 300 mA or less (EX245-FPS2/3)
Reverse Polarity Protection		Included (US1 and US2)
Loop through current between power connector		16 A or less (EX245-FPS1/2) 10 A or less (EX245-FPS3)
US1	Operating voltage	24 VDC +20%/-15%, Class 2
	Under-voltage detection	Detected: < approx. 20.4 VDC Cancelled: > approx. 21.6 VDC
	Dropout voltage (sensors)	< approx. 17 VDC
	Max. current	6 A total
US2	Operating voltage	24 VDC +20%/-15%
	Under-voltage detection	Detected: < approx. 21.6 VDC Cancelled: > approx. 22.8 VDC
	Dropout voltage (valves/loads)	< approx. 17 VDC
	Max. current	4 A (independent of valves)
	Voltage drop to valve supply	Max. 1.2 V at 24 VDC
Galvanic isolation		Yes (between US1 and US2)
Maintenance alarm for the Fibre-optic cable		Yes (EX245-FPS1)

•General specifications

Item	Specification
Rated voltage	24 VDC
Allowable instantaneous electrical stop	1 ms max.
Protection class	IP65 rating to IEC 60529 (IP rating is outside range UL/cUL certified)
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	-10 °C to 50 °C (Maximum surrounding air temperature: 50°C)
Ambient humidity	35% to 85% RH (non-condensing)
Ambient temperature	-20 °C to 60 °C
Vibration resistance	10 Hz to 57 Hz (constant amplitude) 0.75 mm 57 Hz to 150 Hz (constant acceleration) 49 m/s² 2 hours each direction X, Y and Z
Impact resistance	147 m/s² is given 3 times for each direction X, Y and Z
Operating environment	No corrosive gas

•Safe input

Item	Description
Number of inputs	4 two-channel or 8 signle-channel
Power supply voltages	Via UT1 or UT2 from UT1
Permissible supply voltage for external supply	24 VDC +20%/-15%
Power supply max current	2 A per power supply UT1 1 A per power supply UT2 3 A in total
Cross-circuit detection	Yes
Overload and short circuit protection for UT1/UT2	Yes
Input type	PNP
Signal 1	11 to 30 V
Signal 0	-3 to 5 V
Input current signal 1	Type. 3.8 mA at 24 VDC
Input characteristic	Complies with IEC 61131, type 3

•Safe power supply

Item		Description
For Valve	Number of outputs	3 zones 0 VDC switch is common for all 3 zones
	Number of valve coils per zone	Fixed 8 valve coils
	Short circuit protection	Yes
	Max current 1.5 A in total	1.5 A in total
	Power source	From US2
For Module	Number of outputs	1
	Short circuit protection	Yes
	Max. current	4 A
	Power source	From US2

•Solenoid Valve

Item	Description
Application series	VQC2000/4000, SY3000/5000, JSY3000/5000
Output type of solenoid	PNP
Max. number of solenoid valves	24 valve coils (3 zones of 8 valve coils)
Connected load	Solenoid valve with surge voltage suppressor of 24 VDC and 1.5W or less (manufactured by SMC)
Over current protection	Yes
Over current detection	Yes

•Fieldbus

Item	Specification
Bus protocol	PROFIsafe on PROFINET
Fast Start Up	No
Media Redundancy Protocol	Yes
IRT	Yes (Only for IRT switch function)

•Standards

Item	Specification
EMC directive	Yes, 2014/30/EU, EN 61131-2, EN 61131-6
Machinery directive	Yes, 2006/42/EC, EN 62061, EN ISO 13849
TUV Certification	Yes, IEC 61508, EN 62061, EN ISO 13849
PROFINET & PROFIsafe	Yes
RoHS compliant	Yes
UL/cUL	Yes, E209424

Refer to the product catalog or operation manual to obtain more detailed information about product specifications.

Outline with Dimensions

Refer to the product catalog or operation manual to obtain more detailed information about outline dimensions.

SMC Corporation URL https://www.smcworld.com
Akihabara UDX 15F, 4-14-1, Sotokanda, Chiyoda-ku, Tokyo 101-0021, JAPAN
Phone: +81 3-5207-8249 Fax: +81 3-5298-5362

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