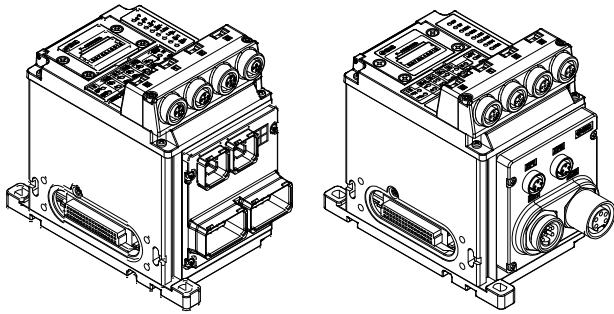




Instruction Manual

Fieldbus device - SI Unit for PROFIsafe

EX245-FPS1 / -FPS2 / -FPS3



IMPORTANT

When supplied in the European Union or the United Kingdom this document does not contain the necessary safety instructions as required by the Machinery Directive 2006/42/EC or the UK Machinery Safety Regulations 2008. It is mandatory to refer to the Operation Manual, Document No. EX##-OMY0004 supplied with the product by your local SMC subsidiary for such safety instructions before using this product. The EU or UKCA Declaration of Conformity is supplied by your local subsidiary with the product. For other territories the Operation Manual and Declaration of Conformity may be downloaded from the SMC website (URL: <https://www.smcworld.com>).

The intended use of this product is to control pneumatic valves and I/O while connected to the PROFIsafe protocol.

1 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.

^{*)}ISO 4414: Pneumatic fluid power — General rules and safety requirements for systems and their components.

ISO 4413: Hydraulic fluid power — General rules and safety requirements for systems and their components

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

ISO 10218-1: Robotics — Safety requirements — Part 1: Industrial robots

- Refer to product catalogue, Operation Manual and Handling Precautions for SMC Products for additional information.
- Keep this manual in a safe place for future reference.

	Danger	Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
	Warning	Warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
	Caution	Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

Warning

- **Always ensure compliance with relevant safety laws and standards.**
All work must be carried out in a safe manner by a qualified person in compliance with applicable national regulations.

2 Specifications

2.1 SI Unit specifications

Item		EX245-FPS1	EX245-FPS2	EX245-FPS3
General				
Dimensions (W x L x H)		85 x 148.5 x 130 mm		
Weight		1000 g max.		
Housing materials		Aluminium		
Max. number of modules		8		
Max. number of digital inputs		128 (independent of safe inputs)		
Max. number of analogue inputs		8		
Max. number of digital outputs		64 (independent of valves)		
Electrical				
Internal current consumption at 24 V DC (via US1)		350 mA or less	300 mA or less	
Reverse Polarity Protection		Included (US1 and US2)		
Loop through current between power connectors (US1 and US2)		16 A max.		10 A max.
US1	Operating voltage	24 VDC +20%/-15%		
	Under-voltage detection	Detected : < approx. 20.4 VDC Cancelled: > approx. 21.6 VDC		
	Max. current	6 A total		
	Dropout voltage (sensors)	< approx. 17 V DC		
US2	Operating voltage	24 VDC +20%/-15%		
	Over-voltage detection	Detected : < approx. 21.6 VDC Cancelled: > approx. 22.8 VDC		
	Max. current	4 A (independent of valves)		
	Dropout voltage (valves/loads)	< approx. 17 VDC		
	Voltage drop to valve supply	1.2 V at 24 VDC max.		
Galvanic isolation		Included (between US1 and US2)		
Safe Inputs				
Number of inputs		4 two-channel or 8 single-channel		
Power supply voltages		Via UT1 or UT2 from US1		
Permissible supply voltage for external supply		24 VDC +20%/-15%		
Max. power supply current		2 A per power supply UT1 1 A per power supply UT2 3 A 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		Typ. 3.8 mA at 24 VDC		
Input characteristic		Complies with IEC 61131, type 3		
Safe Power Supply				
For valves	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		
	Power source	From US2		
For modules	Number of outputs	1		
	Short circuit protection	Yes		
	Max current	4 A		
	Power source	From US2		
Solenoid valve				
Applicable series		JSY3000 / 5000 SY3000 / 5000 VQC2000 / 4000		
Max. number of solenoid valves		24 valve coils (3 zones of 8 valve coils)		
Output type of solenoid		Source/PNP (negative common)		
Over current protection		Yes		
Over current detection		Yes		

3 Specifications (continued)

3.1 Fieldbus specifications

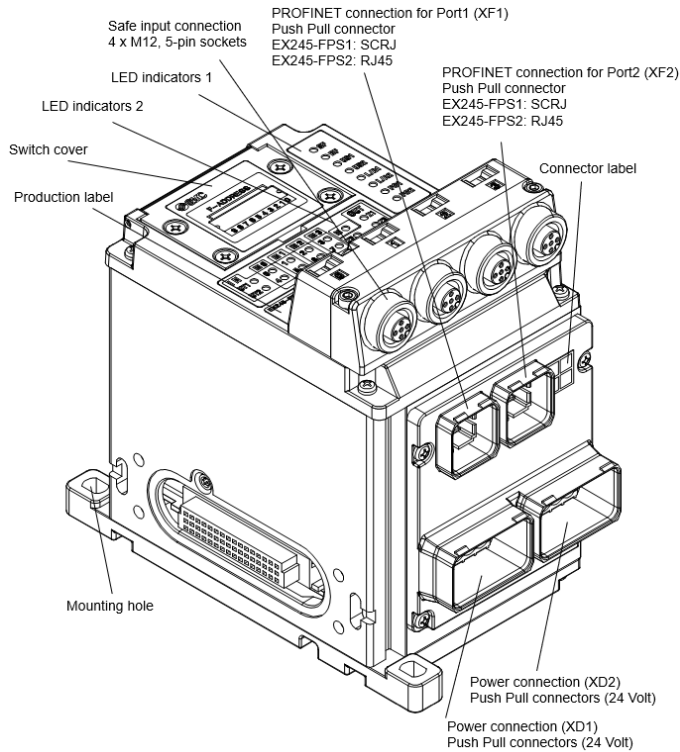
Item	Description
Bus protocol	PROFIsafe on PROFINET
FSU (Fast Start Up)	No
MRP (Media Redundancy Protocol)	Yes
IRT	Yes (only for IRT switch function)
Vendor ID	0083h
Device ID	0006h
GSD file	GSDML-V2.3-SMC-EX245-FPS-V*.*-*****.xml
Parameterisation file	EX245-FPS*_*V**_*.xml
Device Description file for PxC	SMC-EX245-FPS_FX_****-***_**_****.zip

3.2 General specifications

Item	Specification
Rated voltage	24 VDC +20%/-15%
Supply interruption with no loss of function	1 ms maximum
Protection class	IP65 to IEC 60529 (when fully installed or fitted with protective cover).
Withstand voltage	500 VAC 1 min. between FE and accessible terminals to IEC 61131-2.
Insulation resistance	10 Mohm @ 500 VAC between FE and accessible terminals to IEC 61131-2.
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 to 57 Hz (constant amplitude) 0.75 mm 57 to 150 Hz (constant acceleration) 49 m/s ² 2 hours in each direction X, Y and Z
Impact resistance	147 m/s ² applied 3 times in each direction X, Y and Z to EN 60068-2-27/29.
Operating environment	No corrosive gas

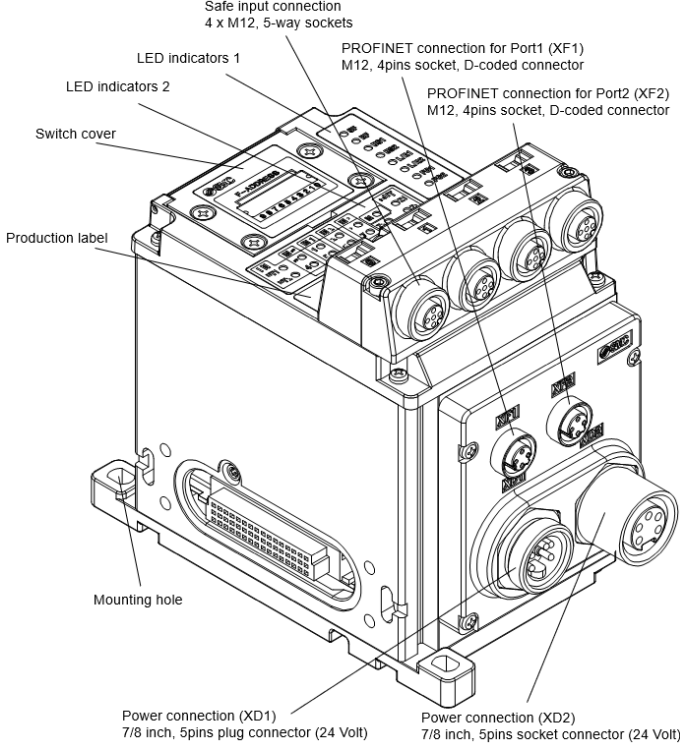
4 Name and Function of Parts

EX245-FPS1 / EX245-FPS2



4 Name and Function of Parts (continued)

EX245-FPS3



5 Installation

5.1 Installation

Warning

- Do not install the product unless the safety instructions have been read and understood.

5.2 Environment

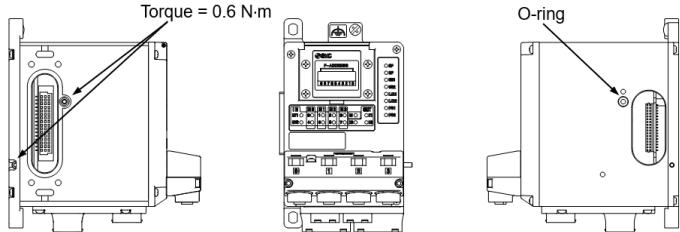
Warning

- Do not use in an environment where corrosive gases, chemicals, salt water or steam are present.
- Do not use in an explosive atmosphere.
- Do not expose to direct sunlight. Use a suitable protective cover.
- Do not install in a location subject to vibration or impact in excess of the product's specifications.
- Do not mount in a location exposed to radiant heat that would result in temperatures in excess of the product's specifications.

5.3 Connection to Valve Manifold

Connect the valve manifold using the 2 screws on the SI Unit (hexagonal socket wrench size 2.5 mm).

Recommended tightening torque value 0.6 N•m.



Caution

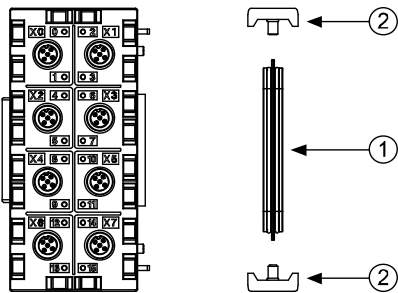
To ensure a protection rating of IP65, apply the recommended tightening torque (0.6 N•m) and make sure that the O-ring is positioned correctly on the screw.

5 Installation (continued)

5.4 Module Connection

Connect the SI Unit, the I/O modules and the End plate with the 2 modular adaptor assemblies and a joint assembly.

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



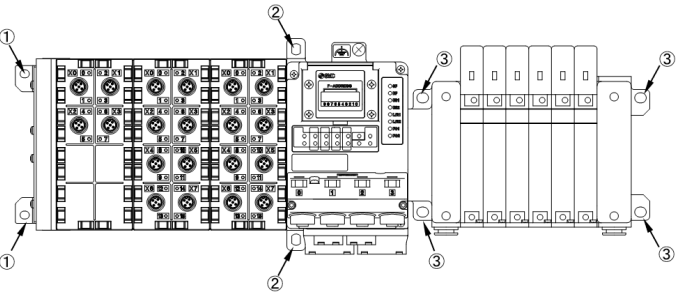
Caution

- 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.

5.5 Mounting

To prevent the manifold components being damaged, apply the recommended tightening torque.
Mount the manifold using the 8 base mounting positions with screws. Required screws are as follows:

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



All manifolds are mounted using 8 screws (except VQC4000 which uses 7 screws).

6 Wiring

The EX245-FPS1/FPS2/FPS3 has two power connectors (XD1/2) and two PROFINET communication connectors (XF1/2). If only one connector is used, cover the unused connector with the Seal cap so that the protection rating of IP65 is maintained.

6.1 Power / Bus Push Pull Connectors

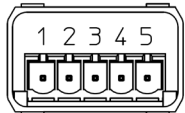
Caution

- To prevent damage the power supply to the SI Unit must be turned off (de-energised) before the modules are installed or removed.
- The Seal caps must be fitted to all unused bus & power connector ports to ensure an IP65 rating.
- The Seal caps must be fitted to all unused bus & power connector ports to prevent foreign matter such as dust or debris from getting inside the product and eye exposure to the light beam from the SCRJ connectors.
- Power and bus lines must be installed correctly.
- To prevent manifold components of the EX245 from being damaged the supply lines for the electronics and for the load voltage must be protected externally with a fuse.
- All external power supplies must meet the specification requirements.

6 Wiring (continued)

- Maximum loop through current between connectors must not be exceeded. Refer to the specifications.
- The SI unit makes use of a CLASS 1 LASER product. Do not stare into beam visible at XF1 and XF2.

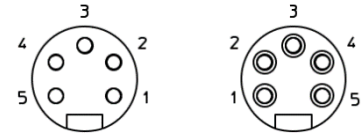
Power Connector (EX254-FPS1 / FPS2)



Push Pull Connector (24 V)
(XD1 / XD2)

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

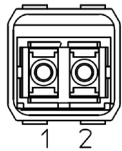
Power Connector (EX254-FPS3)



7/8" Plug / Socket Connector (24 V)
(XD1 / XD2)

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

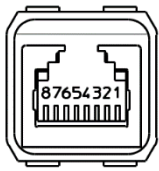
Bus Connector (SCRJ) for EX245-FPS1



Pin	Description
1	TX Transmit Data
2	RX Receive Data

Push Pull Connector (SCRJ)
for PROFINET (XF1 / XF2)

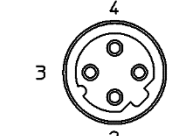
Bus Connector (RJ45) for EX245-FPS2



Push Pull Connector
(RJ45) for PROFINET
(XF1 / XF2)

Pin	Port 1 (XF1) Port type: MDI	Port 2 (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	-	-

Bus Connector (M12) for EX245-FPS3



M12 4-pin socket D-coded for PROFINET
(XF1 / XF2)

Pin	Port 1 (XF1) Port type: MDI	Port 2 (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-

6.2 FE Terminal (Ground)

The SI Unit must be connected to FE (Functional Earth) to divert electromagnetic interference. Connect the grounding cable using the FE terminal screw on the SI Unit. The other end of the grounding cable should be terminated to ground potential. For maximum protection the grounding cable should be as thick and short as reasonably possible.

7 How to Order

Refer to the operation manual or catalogue on the SMC website (URL: <https://www.smcworld.com>) for How to order information.

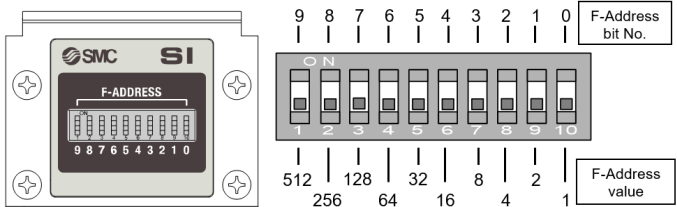
8 Outline Dimensions (mm)

Refer to the operation manual or catalogue on the SMC website (URL: <https://www.smcworld.com>) for outline dimensions.

9 Settings

9.1 PROFIsafe Address switch

- A 10-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.
- Using the DIP switches:
 - Unscrew the cover and hinge it upwards.
 - The DIP switches can be adjusted with a small flat-blade screwdriver.
 - Tighten the cover after setting, making sure that the seals are positioned correctly (torque = 0.3 N•m).

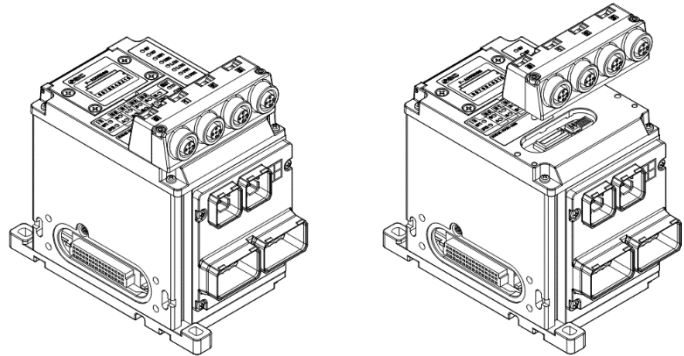


Note:

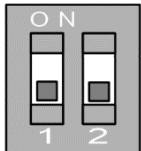
- The F-Address bit numbering shown on the label has priority over any numbers printed on the DIP switch e.g. in the example above the DIP switch is printed with numbers 1 to 10 where 1 is on left and 10 is on the right. In this case the numbers are provided for reference only and play no part in the address numbering.
- The default state (factory setting) for this DIP switch is all OFF.

9.2 Commissioning Mode setting switch

- Two DIP-Switches SW2 and SW3 are located under the M12 safe input connector box. SW2 is not used. To access the switches remove the connector box by removing the retaining screws as shown below.



- DIP-Switch SW3 is used for setting the commissioning mode (COMNG_MODE).



SW3

Bit 1	Bit 2	Description
OFF	OFF	SM (Safety Mode)
ON	OFF	Failure state
OFF	ON	Failure state
ON	ON	CM (Commissioning Mode)

- When the DIP-Switches have been set ensure that the M12 safe input connector box and all retaining screws are refitted (torque = 0.4 N•m). The module must be used in a fully assembled state with all parts securely fastened.
- It is forbidden to make modifications to the module whilst setting the DIP-Switches. Non-approved modifications may compromise the module safety functionality and will invalidate the product guarantee.

9.3 Configuration

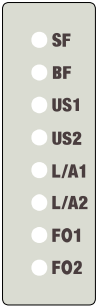
In order to configure the SI Unit with the PROFIsafe controller software the appropriate GSD file is required. The GSD file contains all the necessary information to configure the SI Unit.

For the latest GSD file and other Configuration, Commissioning and Diagnostics settings refer to the Operation manual on the SMC website (URL: <https://www.smcworld.com>).

10 LED Display

10.1 LED Indicators 1

The LED indicators 1 are arranged on the SI Unit as shown below.



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
L/A1 *	A combination of Link LED and Act LED. Connection via PROFINET on Port1 (XF1), and Data exchange on Port1 (XF1)	Green / Yellow
L/A2 *	A combination of Link LED 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 and Act LED are both ON, the combined colour may appear orange.
** Only EX245-FPS1 has this function.

10.1.1 SF and BF Indicators

SF	BF	Meaning
OFF	OFF	No fault (The SI Unit is currently exchanging data with the Controller without errors.)
---	Flash	Faulty or no connect message frame (although the SI Unit is physically connected to the bus) <ul style="list-style-type: none">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
OFF	ON	No IO Controller on the bus.
Flash at 2.0 Hz	OFF	PROFIsafe communication is not established due to the following reason(s). <ul style="list-style-type: none">The SI unit is not parameterised by the Safe Controller.The parameterisation is not acceptable.The F-address is not matched.
Flash at 0.5 Hz	---	The Safe Controller requests operator acknowledgment
ON	---	The following diagnostic event occurred. <ul style="list-style-type: none">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 levelAt 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.

10 LED Display (continued)

10.1.2 US1 Indicator

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

10.1.3 US2 Indicator

US2	Meaning
OFF	US2 is not present or is below the dropout level (< approx. 17 V DC).
Flashing	US2 is below the permissible level but above the dropout level (17 to 21.6 V DC).
ON	US2 is present (> approx. 22.8 V DC).

*: 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.

10.1.4 L/A Indicators

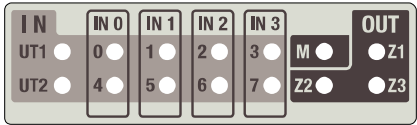
L/A1, L/A2	Meaning
Green ON	Connection via Ethernet to the SI Unit via Port 1/2 (XF1/2)
Green OFF	No connection established via Port 1/2 (XF1/2)
Yellow ON	Transmission or reception of Ethernet telegrams on Port 1/2 (XF1/2)
Yellow OFF	No transmission or reception of Ethernet telegrams on Port 1/2 (XF1/2)
Orange flashing *	Received Node flash request

10.1.5 FO1 / FO2 Indicators

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.

10.2 LED Indicators 2

The LED indicators 2 are arranged on the SI Unit as shown below.



Designation	Description	Colour
UT1, UT2	Status for clock power supply UT1 and UT2	Red
IN0 to 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

10.2.1 UT1 and UT2 Indicators

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.

10.2.2 IN0 to IN7 Indicators

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

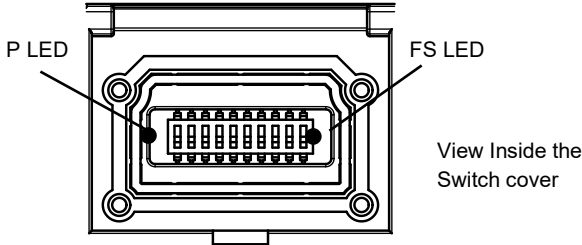
10 LED Display (continued)

10.2.3 OUT M, Z1 to Z3 Indicators

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

10.3 LED Indicators 3

The LED indicators 3 inside the switch cover are arranged as shown below.



10.3.1 FS Indicator

FS	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 flashing	Module is not parameterized or parameterization was not accepted.

10.3.2 P Indicator

P	Meaning
OFF	No safe communication
Green ON	Safe communication is running.
Green flashing	Safe communication is running. The controller is requesting 'operator acknowledgment'

11 Maintenance

11.1 General Maintenance



Caution

- Not following proper maintenance procedures could cause the product to malfunction and lead to equipment damage.
- If handled improperly, compressed air can be dangerous.
- Maintenance of pneumatic systems should be performed only by qualified personnel.
- Before performing maintenance, turn off the power supply and be sure to cut off the supply pressure. Confirm that the air is released to atmosphere.
- After installation and maintenance, apply operating pressure and power to the equipment and perform appropriate functional and leakage tests to make sure the equipment is installed correctly.
- If any electrical connections are disturbed during maintenance, ensure they are reconnected correctly and safety checks are carried out as required to ensure continued compliance with applicable national regulations.
- Do not make any modification to the product.
- Do not disassemble the product, unless required by installation or maintenance instructions.

12 Limitations of Use

12.1 Limited warranty and Disclaimer/Compliance Requirements

Refer to Handling Precautions for SMC Products.

13 Product disposal

This product should not be disposed of as municipal waste. Check your local regulations and guidelines to dispose of this product correctly, in order to reduce the impact on human health and the environment.

14 Contacts

Refer to www.smcworld.com or www.smc.eu for your local distributor / importer.

SMC Corporation

URL : <https://www.smcworld.com> (Global) <https://www.smc.eu> (Europe)
SMC Corporation, 1-5-5, Kyobashi, Chuo-ku, Tokyo 104-0031, JAPAN
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