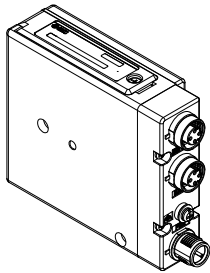




ORIGINAL INSTRUCTIONS

Instruction Manual
Fieldbus device - SI Unit for Functional
Safety over EtherCAT® (FSoE)
EX260-FSE1



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. DOC1096878 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 SI Unit is for the Safe control of pneumatic valves and I/O while connected to the EtherCAT® (FSoE) network.

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

The SI (Serial Interface) Unit represents a Functional Safety over EtherCAT® (FSoE) I/O device for SMC pneumatic valves. It can be used to implement a safety function for the directly connected valves.

2.1 General specifications

Item	Specifications
Ambient temperature	Operation: -10 to +50 °C Storage: -20 to +60 °C
Ambient humidity	35 to 85% RH (no condensate)
Atmospheric pressure	Operation: 80 kPa to 108 kPa (under 2000 m) Storage: 66 kPa to 108 kPa (under 3500 m)
Vibration resistance	5 Hz to 8.4 Hz (constant amplitude) 3.5 mm peak, 8.4 Hz to 500 Hz (constant acceleration) 10 m/s ² peak to EN 60068-2-6.
Impact resistance	15 g with a pulse duration of 11 ms in all three axes to EN 60068-2-27.
Operating environment	No corrosive gas
Internal over temperature switch	110 °C
Altitude	2000 m max.
Dimensions (W x L x H)	28.2 x 102.4 x 78.0
Enclosure	IP67 to IEC 60529 (when fully installed or fitted with protective cover).
Weight	200 g
Standard	CE / UKCA / UL/cUL

2.2 Electrical specifications

Item		Specifications
PWR (US1) for Logic	Operating voltage	20.4 V DC to 28.8 V DC
	Max. current	150 mA
PWR(V) (US2) for Valve	Operating voltage	20.4 V DC to 28.8 V DC (input voltage at the power connector).
	Max. current	1.30 A
	Internal voltage drop	1.2 V maximum at 24 VDC
Reverse polarity protection		Yes for PWR and PWR(V)
Galvanic isolation		Between PWR and PWR(V)

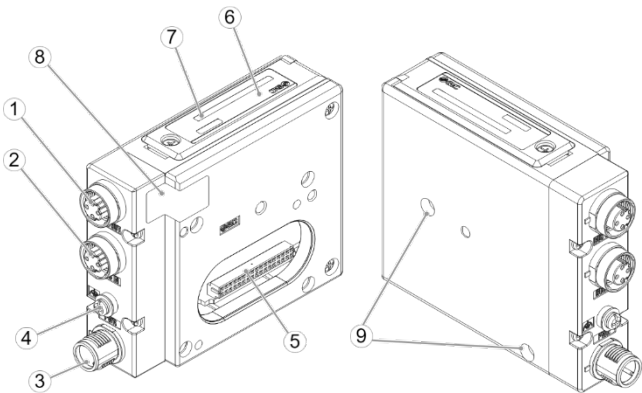
2.3 Solenoid valve specification

Item	Specifications
Connected load	Solenoid valve with surge voltage suppressor of 24 VDC and 0.95 W or less (manufactured by SMC)
Applicable valve series	SY3000/5000/7000, JSY1000/3000/5000, VQC1000/2000/4000/5000
Maximum number of solenoid valves	32 valve coils
Output type of solenoid	PNP (negative common)
Over current protection	Yes

2.4 Fieldbus specification

Item	Specifications
Bus protocol	EtherCAT & FSoE
Sync mode	Free run (EtherCAT only), DC
Fast Hot Connect	No
Vendor ID	0x00000114
Product code	0x01000052
ESI file	SMC EX260-FSEx_vzz.xml
Reaction time	4 ms
Fault reaction time	<= Watchdog time

3 Name and Function of Parts



No.	Part	Description
1	EtherCAT OUT connection (BUS OUT)	EtherCAT downstream connection M12 4-pin socket, D-coded
2	EtherCAT IN connection (BUS IN)	EtherCAT input connection M12 4-pin socket, D-coded
3	Power supply connection	Power supply for valves and for SI unit Logic, M12 4-pin plug, A-coded
4	FE terminal	Functional Earth terminal (M3 screw)
5	Output connector	Output connection for valve manifold
6	FSoE address switch	DIP Switch provided for the FSoE address setting (under switch cover)
7	LED indicators	LED display to indicate SI Unit status
8	Security label	To prevent hardware modification
9	Mounting hole	Mounting hole for connection to the valve manifold

Accessories

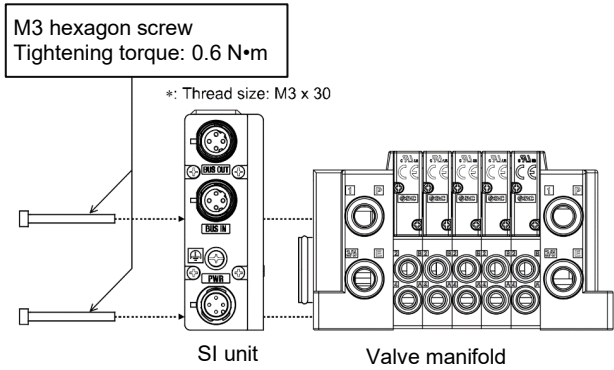
Part	Description
Hex. socket head cap screw	M3 x 30 mm screw for connection to the valve manifold (2 pcs.)
Seal cap	Seal cap for unused connector (1 pc.)

4 Installation

4.1 Installation

Warning

- Do not install the product unless the safety instructions have been read and understood.
- Connect the SI unit to the valve manifold using the 2 screws on the SI Unit (hexagonal socket wrench size 2.5).
Tighten the screws alternately with the recommended tightening torque: 0.6 N•m.
- Assembly of the SI unit to the Valve manifold.



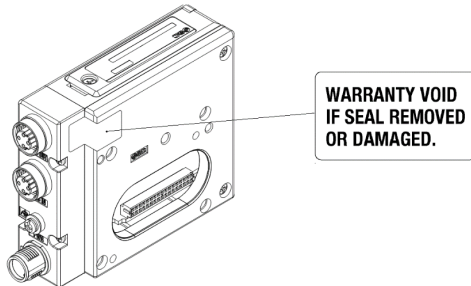
Caution

- To prevent damage, all supply voltages to the SI Unit must be turned OFF (i.e. de-energized) before the modules are installed or removed.
- Check there is no foreign matter inside the SI unit.
- Check there is no damage and no foreign matter on the gasket.
- If the SI unit is not assembled correctly, the internal PCBs may be damaged or liquid and/or dust may enter inside the unit.
- To ensure a protection rating of IP67 the recommended tightening torque must be applied.

4 Installation (continued)

4.2 Before installation

- Before installation check that the product has been transported and stored within the specifications. Visually inspect the product to confirm it is not damaged before installation.
- Check that the warranty seal is not broken.



Note if the seal is removed the warranty is void. Removing the seal leaves the word “VOID” marked on the product.

4.3 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 mount in a location exposed to radiant heat that would result in temperatures in excess of the product's specifications.
- If using in an environment exposed to water splashes, take measures such as using a cover.
- Do not use in an environment where moisture or water vapor are present.
- 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 in an area where electrical surges are generated.
- 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.
- Do not mount the product in a place exposed to vibration or impact.
- Do not use the product in an environment exposed to temperature cycles. Heat cycles other than ordinary changes in temperature can adversely affect the product.
- Use with caution at altitudes above 2000 m, as the reduction in atmospheric pressure reduces the withstand voltage performance and noise immunity (lightning surge, electro-static discharge).
- Do not use the product under the following conditions:
 - a) Under the influence of ionizing radiation (exceeding the natural background radiation)
 - b) In corrosive environments (a corrosive environment exists when corrosion damage becomes apparent).
 - c) In an environment that leads to impermissible contamination of the product.

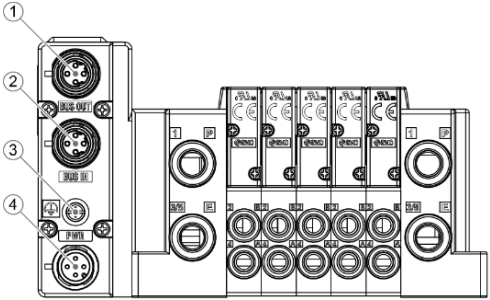
5 Wiring

- Do not perform wiring connections with the power turned ON.
- Avoid repeatedly bending or stretching the cables, or placing heavy loads on them. Repeated bending or tensile stress can cause damage to the cable.
- Wire correctly. Incorrect wiring can damage the product.
- Do not route wires and cables together with power or high voltage cables.
Otherwise the SI unit and/or input or output devices can malfunction due to interference of noise and surge voltage from power and high voltage cables to the signal line.
- 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.

5 Wiring (continued)

- Take appropriate measures against noise, such as using a noise filter, when the Fieldbus system is incorporated into equipment.
- Connect the EtherCAT® cables, Power cable and the Functional Earth (FE) cable.

- ① M12 connector, EtherCAT® OUT connection
- ② M12 connector, EtherCAT® IN connection
- ③ M3 Functional Earth (FE) terminal screw (torque : 0.6 N•m)
- ④ M12 connector, Power supply connection.



5.1 Fieldbus Interface Connector

The SI Unit has two EtherCAT® communication connectors. If only one connector is used, cover the unused connector with a seal cap so that the protection rating of IP67 is maintained.

BUS IN / OUT: M12 4-pin socket, D-coded

No.	Designation	Description
1	TD+	Transmit Data +
2	RD+	Receive Data +
3	TD-	Transmit Data -
4	RD-	Receive Data -

- All remote I/O hardware interfaces mandatorily support auto-crossover capability, therefore straight cables as well as crossover cables, can be used within EtherCAT® networks.

5.2 Power supply connector layout

PWR: M12 4-pin plug, A-coded

No.	Designation	Description
1	24 V	24 V PWR(V)
2	0 V	0 V PWR(V)
3	24 V	24 V PWR
4	0 V	0 V PWR

Caution

- Seal caps must be fitted to all unused BUS connector ports to ensure an IP67 rating.
- IP67 rating must be maintained to guarantee product functionality.
- For reasons of EMC a secure connection to the cable shield must be established on the M12 EtherCAT® connectors (BUS IN / BUS OUT).
- Power and EtherCAT® cables must be installed correctly.
- The 24 V supply for logic (PWR connector) and the 24 V supply for the valves (PWR(V) connector) should be protected with an external fuse.
- All external supplies should have the 0 V connected to Functional Earth (FE) according to EN 60204-1.
- A functional earth cable must be connected to the M3 terminal.
- If this product is connected using power cables that are more than 30 m long or go outside of a building then external protection devices should be added to protect against electrical surge damage.
- Select the correct cables to mate with the connectors on the SI unit. Cable accessory details can be found in the operation manual on the SMC website (URL: <https://www.smcworld.com>).

5.3 Ground (FE) Connection

The SI Unit must be connected to FE (Functional Earth) to divert electromagnetic interference. Connect a grounding cable from the FE terminal screw on the SI Unit to the nearest functional earth point. The grounding cable should be as thick and short as possible.

6 Settings

6.1 FSoE Address setting

The product is delivered with the FSoE address set to “0”. This must be set to a value in the range 1 to 1023, selected using the 10-bit DIP switch. The address 0 is not a valid FSoE address.

The 10-position DIP switch for address setting is located under the switch cover on the top of the SI Unit.



DIP switch										FSoE Address
1	2	3	4	5	6	7	8	9	10	
ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	1
OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	2
ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	3
OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	4
ON	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	5
OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	6
ON	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	7
....										
ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	1023

Warning

An FSoE address may only occur once within the same network or configuration. Ensure that the FSoE address is not duplicated.

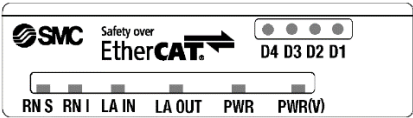
6.2 Configuration

To configure the SI Unit with your EtherCAT® master software, the dedicated ESI (EtherCAT® Slave Information) file is required. The ESI file contains all necessary information to configure the SI Unit on your master's software.

- ESI file name : SMC EX260-FSEx_Vzz.xml

The ESI file can be downloaded from the SMC website (URL: <https://www.smcworld.com>).

7 LED Display



7.1 Diagnostic indicators

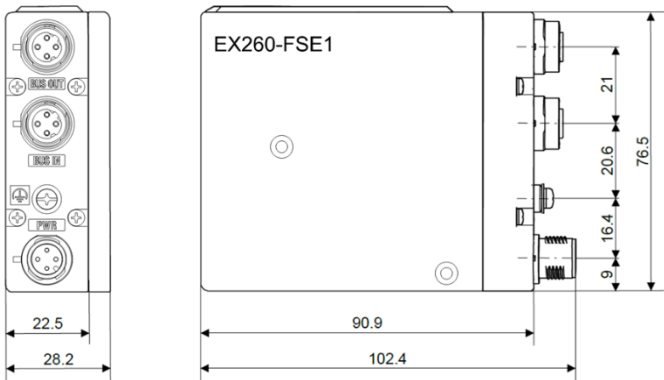
D1 (Diag1)	D2 (Diag2)	D3 (Diag3)	D4 (Diag4)	Meaning
OFF	OFF	OFF	OFF	SI unit has no power supply for PWR.
Green ON	OFF	OFF	OFF	No diagnostic errors are detected.
Green ON	Red Flickering & flashing	-	-	Internal tests are outside of valid range. Diag2 outputs a Logic error code.
OFF	Red Flickering & flashing	-	-	Environmental conditions are outside of valid range. Diag2 outputs an environment error code.
-	Red ON	Red ON OFF	OFF Red ON	Global shutdown.
-	OFF	Red ON OFF	OFF Red ON	Global fault.
-	Red Flickering	-	-	Safe Power Supply Error is present.

7 LED Display (continued)

7.2 Error indicators

LED	Name	Function
RN S	Run Safety	Indicates the status of the Safety IO Control
		Green : Green On Operational status
		Green/White : Flashing fast Pre-Operational status
		Green/White : Flashing slow (0.5 Hz) Safe-Operational status
RN I	Run IO	Indicates the status of the standard IO Control
		Green : Green On Operational status
		Green/White : Flashing fast Pre-Operational status
		Green/White : Flashing slow (0.5 Hz) Safe-Operational status
LA IN	Link / Act IN	Indicates the status of EtherCAT® IN
		Green : Green On Connection to previous EtherCAT® module
		Green/White : Flickering Communication with previous EtherCAT® module
		White : OFF No connection to previous EtherCAT® module
LA OUT	Link / Act OUT	Indicates the status of EtherCAT® OUT
		Green : Green On Connection to the following EtherCAT® module
		Green/White : Flickering Communication with following EtherCAT® module
		White : LED OFF No connection to the following EtherCAT® module
PWR	PWR Control	Indicates the status of the control voltage PWR (US1) which supplies the internal logic.
		Green : Green On Power is present
PWR (V)	PWR Valves	White : LED OFF Power is not present or not in the operating voltage range
		Indicates the status of the voltage PWR(V) (US2) which supplies Valve outputs
		Green : Green On PWR(V) is within the operating voltage range, and safe output is switched ON
		Green/White : Flickering PWR(V) is present but safe output is switched OFF
PWR (V)	PWR Valves	White : OFF Power is not present or not in the operating voltage range

8 Outline Dimensions (mm)



9 How to Order

Refer to the product catalogue available on the SMC website (URL: <https://www.smcworld.com>) for the 'How to Order' details.

10 Maintenance

10.1 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.
- Stop operation if the product does not function correctly.

11 Limitations of Use

11.1 Limited warranty and Disclaimer/Compliance Requirements

Refer to Handling Precautions for SMC Products.

Operate the SI Unit exclusively for the intended activities defined in the operation manual, taking into account the prescribed values. FSoE products are designed for machine safety functions and directly associated industrial automation tasks. This product is intended for use in applications requiring safe disconnection of electrical power of pneumatic valves mounted to manifolds. It is the user's responsibility to determine if this product is suitable for the intended application and to specify the pneumatic valve arrangement accordingly to achieve the required safety function. FSoE products are therefore only approved for applications with a defined Fail-safe state. This safe state is the power off state.

12 Product Disposal

This product shall 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.

13 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
Specifications are subject to change without prior notice from the manufacturer.
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