



ORIGINAL INSTRUCTIONS

Instruction Manual

Digital Flow Switch – Integrated display

PFMC7501-L / PFMC7102-L / PFMC7202-L



The intended use of the digital flow switch is to monitor and display flow information while connected to the IO-Link communication 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<sup>1)</sup>), and other safety regulations.

- <sup>1)</sup> 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 10218-1: Manipulating industrial robots - Safety, etc.
- 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.

<b>Caution</b>	Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
<b>Warning</b>	Warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
<b>Danger</b>	Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious 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.
- This product is class A equipment intended for use in an industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments due to conducted or radiated disturbances.
- Refer to the operation manual on the SMC website (URL: <https://www.smcworld.com>) for more safety instructions.

2 Specifications

Models	PFMC7501	PFMC7102	PFMC7202
Applicable fluid	Air, N <sub>2</sub> (Air quality: ISO8573-1 1.1.2 to 1.6.2)		
Operating fluid temperature	0 to 50 °C		
Detection method	Heating sensor		
Rated flow range	5 to 500 L/min	10 to 1000 L/min	20 to 2000 L/min
Set point range	Instantaneous flow	5 to 525 L/min	10 to 1050 L/min
	Accumulated flow	0 to 999,999,990 L	
Min. resolution	Instantaneous flow	1 L/min	
	Accumulated flow	10 L	
Accumulated volume per pulse (Pulse width = 50 ms)	1 L/pulse	10 L/pulse	
Accumulated value hold	2 minutes or 5 minutes		
Rated pressure range	0 to 0.8 MPa		
Proof pressure	1.2 MPa		
Pressure loss	Refer to the pressure loss graph		
Pressure Characteristics	±5%F.S. (0 to 0.8 MPa, 0.6 MPa standard)		
Power supply voltage	Used as switch output device	12 to 24 VDC ±10%	
	Used as IO-Link device	18 to 30 VDC ±10%	
Current consumption	55 mA or less		
Protection	Polarity protection		
Display accuracy	±3% F.S.		
Analogue output accuracy	±3% F.S.		
Repeatability	±1% F.S. (±2% F.S. when response time is set to 0.05 sec)		
Temperature characteristics	±5% F.S. (0 to 50°C, 25°C standard)		
Output type	Select from NPN or PNP open collector output		
Output mode	Select from Hysteresis mode, Window comparator mode, Accumulated output mode, Accumulated pulse output mode, Error output or Switch OFF.		
Switch operation	Normal or reversed output		
Maximum load current	80 mA		
Maximum applied voltage	30 VDC (NPN output)		
Internal voltage drop (Residual voltage)	1.5 V or less (Load current 80 mA)		
Digital filter	Select from 0.05 s, 0.5 s, 0.15 s, 1.0 s, 2.0 s or 5.0 s		
Hysteresis	Variable		
Protection	Short circuit protection		
Delay time	3.4 ms or less Variable at 0 to 60 s / 0.01 step		
Output type	Voltage output: 1 to 5 V, 0 to 10 V (when supply is 24 VDC), Current output: 4 to 20 mA (refer to analogue output graph)		
	Impedance	Output impedance approx. 1 kΩ	
Current output	Max. load impedance:	600 Ω at 24 VDC	
	Min. load impedance:	300 Ω at 12 VDC 50 Ω	
Response time	Linked with the response time of the switch output		
Input specification	Input voltage: NPN: 0.4 V or less (reed or solid state), PNP: DC(+)-1 V or more		
	Input mode	Accumulated flow external reset or peak/bottom hold value	

2 Specifications (continued)

Models	PFMC7501	PFMC7102	PFMC7202
Reference condition	Normal or Standard condition		
Units	Instantaneous	L/min, cfm (ft <sup>3</sup> /min)	
	Accumulated	L, ft <sup>3</sup>	
Display	Display	LCD with 2 displays (Main display and Sub display) Colour: Red and green for main display, White for sub display Digits: 4 digits 7 segments main display, 9 digits 11 segments sub display (7 segment for 5th digit)	
	Indicator LED	LED is ON when switch output is ON (OUT1/OUT2: Orange)	
	Protection	IP65	
Environmental	Withstand voltage	250 V AC for 1 minute between live parts and housing	
	Insulation resistance	2 MΩ between live parts and housing (with 50 VDC megger)	
	Operating temperature range	Operation: 0 to 50 °C, Storage: -10 to 60 °C (no condensation or freezing)	
	Operating humidity range	Operation, Storage: 35 to 85%RH (no condensation)	
Piping port size	Rc1/2, NPT1/2, G1/2	Rc3/4, NPT3/4, G3/4	
Fluid contact materials	SUS304, PPS, Aluminium alloy, HNBR, Si, Au, GE4F		
Weight	With Rc ports	160 g	240 g
	With NPT ports	160 g	240 g
	With G ports	170 g	245 g
	Lead wire	+80 g	
	Bracket	+25 g	+30 g

2.1 IO-Link specifications

IO-Link type	Device	
IO-Link version	V1.1	
Communication speed	COM2 (38.4 kbps)	
Min. cycle time	3.4 ms	
Process data length	Input Data: 4 bytes, Output Data: 0 byte	
On request data communication	Available	
Data storage function	Available	
Event function	Available	
Vendor ID	131 (0x0083)	
Device ID	PFMC7501-**-L*	0x021D (541)
	PFMC7501-**-L2*	0x021E (542)
	PFMC7501-**-L3*	0x021F (543)
	PFMC7501-**-L4*	0x0220 (544)
	PFMC7102-**-L*	0x0221 (545)
	PFMC7102-**-L2*	0x0222 (546)
	PFMC7102-**-L3*	0x0223 (547)
	PFMC7102-**-L4*	0x0224 (548)
	PFMC7202-**-L*	0x0225 (549)
	PFMC7202-**-L2*	0x0226 (550)
PFMC7202-**-L3*	0x0227 (551)	
PFMC7202-**-L4*	0x0228 (552)	
IODD file	SMC-PFMC7**-L**-***-yyyymmdd-IODD1.1	

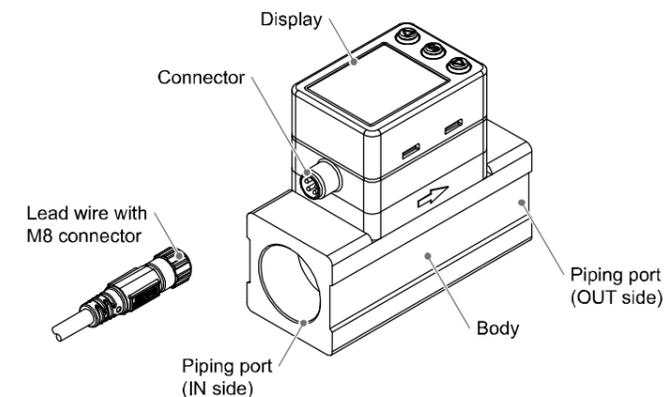
- The IODD configuration file can be downloaded from the SMC website (URL: <https://www.smcworld.com>).

**Warning**

Special products (-X) might have specifications different from those shown in this section. Contact SMC for specific drawings.

3 Names of Individual parts

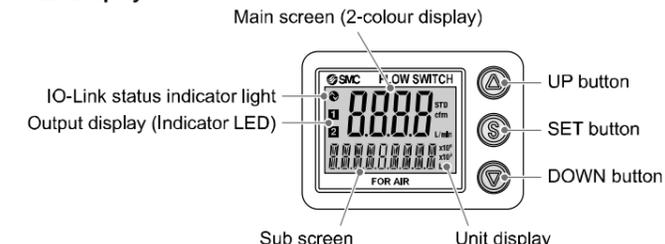
3.1 PFMC7###-L



Element	Description
Display	See below
Connector	M8 connector for electrical connections.
Lead wire with M8 connector	Lead wire for power supply and output signals.
Piping port	Port to connect the fluid inlet at IN and fluid outlet at OUT.
Body	Body of the product.

\*: A protective tape is affixed to the display. Please remove it before use.

3.2 Display



Element	Description
Main screen	Displays the flow, the setting mode and error codes (2 colour display).
Sub screen	Displays the accumulated flow, set value, peak/bottom value and line names. In measurement mode the setting status is displayed.
Output display (indicator LED)	Displays the output status of OUT1 and OUT2. When ON: Orange LED is ON.
Units display	Displays the unit selected.
UP button	Selects the mode and the display on the sub screen and increases the ON/OFF set value.
SET button	Press this button to select the mode and to confirm a set value.
DOWN button	Selects the mode and the display on the sub screen and decreases the ON/OFF set value.
IO-Link status indicator light	LED is ON when OUT1 is used in IO-Link mode. (LED is OFF in SIO mode).

- Refer to the operation manual on the SMC website (URL: <https://www.smcworld.com>) for more details of the IO-Link indicator light operation and display.

## 4 Installation

### 4.1 Installation

#### Warning

- Do not install the product unless the safety instructions have been read and understood.
- Use the product within the specified operating pressure and temperature range.

### 4.2 Environment

#### Warning

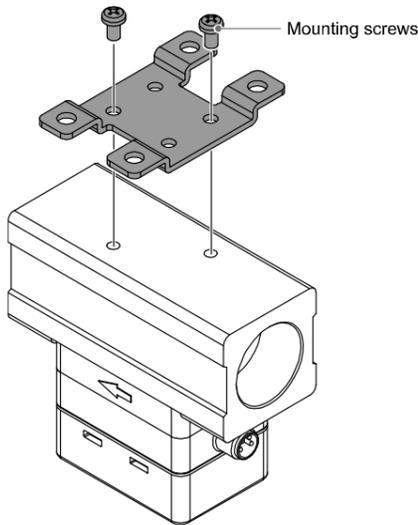
- Do not use in an environment where corrosive gases, chemicals, salt water or steam are present.
- Do not use in an explosive atmosphere.
- Do not expose to direct sunlight. Use a suitable protective cover.
- Do not install in a location subject to vibration or impact in excess of the product's specifications.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

### 4.3 Mounting

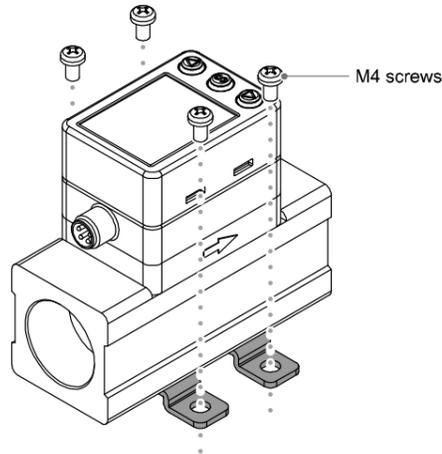
- Never mount the product in a location where it will be used as a mechanical support.
- Mount the product so that the fluid flows in the direction indicated by the arrow on the side of the body.
- Do not mount the product upside down.
- The monitor with integrated display can be rotated. It can be positioned at 45 ° and 90 ° intervals, clockwise and anti-clockwise. Rotating the display with excessive force will damage the end stop.

#### Bracket mounting

- Mount the bracket to the product using the mounting screws (2 pcs.).
- Fasten the bracket mounting screws to a torque of 0.5 to 0.7 N•m.



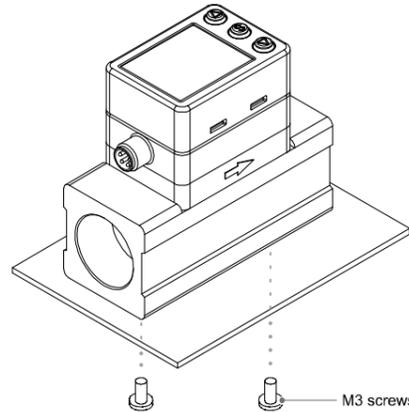
- Mount the product with bracket using M4 screws (4 pcs.) or equivalent. The screws should be prepared by the user.



## 4 Installation (continued)

### Direct mounting

- For direct mounting use M3 screws (2 pcs.) or equivalent.

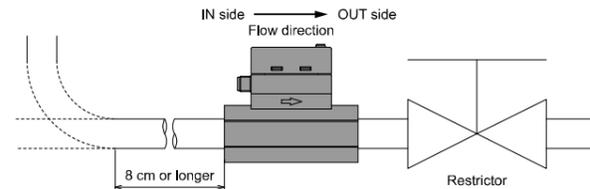


Refer to the operation manual on the SMC website (URL: <https://www.smcworld.com>) for mounting hole details and outline dimensions.

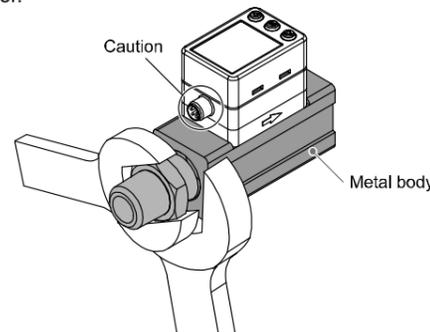
### 4.4 Piping

#### Caution

- Before connecting piping make sure to clean up chips, cutting oil, dust etc.
- When installing piping or fittings, ensure sealant material does not enter inside the port.
- The piping on the IN side must have a straight section of piping whose length is 8 times the piping diameter minimum. If a straight section of piping is not installed, the accuracy will vary by approximately ±2% F.S.
- Avoid sudden changes to the piping size on the IN side of the product.
- Do not release the OUT side piping port of the product directly to the atmosphere without connecting piping. The accuracy may vary.



- Use the correct tightening torque for piping. (Refer to the table below for the required torque values).
- If the tightening torque is exceeded, the product can be damaged. If the tightening torque is insufficient, the fittings may become loose.
- Ensure there is no leakage after piping.
- When mounting the fitting, a spanner should be used on the metal body and the fitting only. Holding other parts of the product with a spanner may damage the product. Specifically, make sure that the spanner does not damage the connector.



Nominal thread size	Required torque	Width across flats
Rc1/2, NPT1/2	28 to 30 N•m	30 mm
Rc3/4, NPT3/4	28 to 30 N•m	35 mm

## 4 Installation (continued)

### 4.5 Piping with One-touch fitting

- For the one-touch fitting, use tubing with a tube inside diameter of 9 mm minimum. Accuracy can vary approximately ±2%F.S. if such tubing is not used.

### 4.6 Wiring

#### Caution

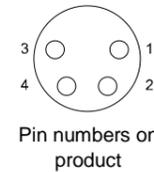
- Do not perform wiring while the power is on.
- Confirm proper insulation of wiring.
- Do not route wires and cables together with power or high voltage cables. The product can malfunction due to interference of noise and surge voltage from power and high voltage cables. Route the wires of the product separately from power or high voltage cables.
- Keep wiring as short as possible to prevent interference from electromagnetic noise and surge voltage. Do not use a cable longer than 20 m.
- Ensure that the FG terminal is connected to ground when using a commercially available switch-mode power supply.

#### Connecting/Disconnecting

- Align the lead wire connector with the connector key groove, and insert it straight in. When the knurled part is fully tightened check that the connection is not loose.
- When removing the connector, unlock the knurled part and pull out the connector straight.

#### When used as switch output device

No.	Name	Wire colour	Function
1	DC(+)	Brown	12 to 24 VDC
2	N.C. / OUT2	White	Not connected / Switch output 2 (SIO) / Analogue output / External input
3	DC(-)	Blue	0 V
4	OUT1	Black	Switch output



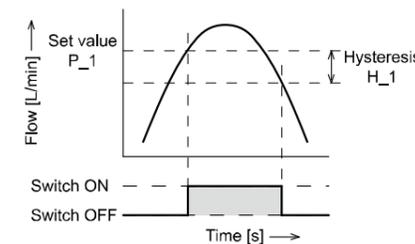
#### When used as IO-Link device

No.	Name	Wire colour	Function
1	L+	Brown	18 to 30 VDC
2	N.C. / OUT2	White	Not connected / Switch output 2 (SIO) / Analogue output / External input
3	L-	Blue	0 V
4	C/Q	Black	IO-Link data / Switch output 1 (SIO)

## 5 Flow Setting

### 5.1 Switch operation

When the flow exceeds the set value [P\_1], the switch will be turned ON. When the flow falls below the set value by the amount of hysteresis [H\_1] or more, the switch will be turned OFF. If the operation shown below is acceptable, keep this setting.



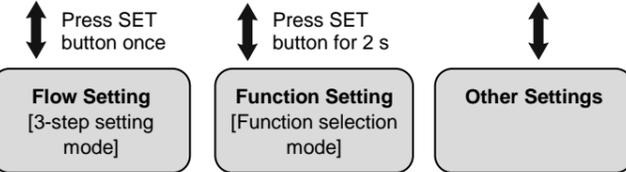
## 6 Outline of Settings [Measurement mode]

### Power is supplied

The output will not operate for 3 seconds after supplying power. The identification code of the product is displayed.

### [Measurement mode]

Measurement mode is the condition where the flow is detected and displayed, and the switch function is operating. This is the basic mode; other modes should be selected for set-point changes and other function settings.

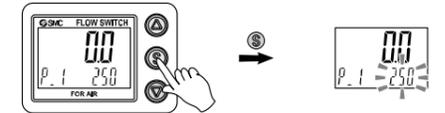


- The outputs will continue to operate during setting.
- If a button operation is not performed for 30 seconds during the setting, the display will flash. (This is to prevent the setting from remaining incomplete if, for instance, an operator were to leave during setting).
- The 3-step setting mode and function selection mode are reflected on each other.

## 7 3-step Setting mode

In this mode, only the set values can be input, in just 3 steps. Use this mode if the product is to be used straight away, after changing only the set values.

- Press the SET button once in measurement mode to display the set values. (The item to be changed is displayed on the sub display).. The set value on the sub display (right side) will start flashing.



- Press the UP or DOWN button to change the set value. The UP button is to increase and the DOWN button is to decrease.

- Press the UP button once to increase by one digit or press and hold to continuously increase.



- Press the DOWN button once to decrease by one digit or press and hold to continuously decrease.

- Press the SET button to finish the setting.

## 8 Simple Setting mode

In simple setting mode, the set value and hysteresis can be changed while checking the current flow value (main display).

- Press and hold the SET button for **1 to 3 seconds** in measurement mode. [SEt] is displayed on the main screen. When the button is released the current flow value is displayed on the main screen, [P\_1] or [n\_1] is displayed on the sub screen (left side), and the set value is displayed flashing on the sub screen (right side).

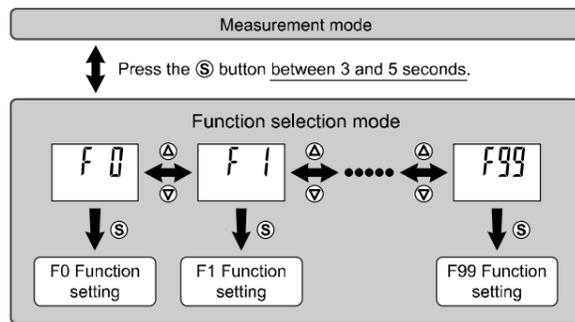


- Change the set value with the UP or DOWN button and press the SET button to set the value. Then, the setting moves to hysteresis setting. (The snap-shot function can be used).
- Change the set value with the UP or DOWN button and press the SET button to set the value. Then, the setting moves to the setting of OUT2. (The snap-shot function can be used).
- Press the SET button for **less than 2 seconds** to complete the OUT1 setting. [P\_2] or [n\_2] is displayed on the sub screen (left side). Continue with the setting of OUT2. Press and hold the SET button for **2 seconds or longer** to complete the setting. The product will return to measurement mode.

## 9 Function Settings

### 9.1 Function selection mode

In this mode, each function setting can be changed separately. In measurement mode, press the SET button for 3 to 5 seconds to display [F 0]. Press the UP or DOWN button to select the function to be changed.



Press and hold the SET button for 2 seconds or longer in function selection mode to return to measurement mode.

## 9 Function Settings (continued)

### 9.2 Default settings

Function (Main display)		Default Settings (Right sub display)
(Main display)	(Left sub display)	
[F 0]	[rEF] Reference condition	[Std] Standard condition
	[Unit] Units selection	[L] L/min
	[NorP] Output NPN/PNP	[PnP] PNP output
	[i_o] external input	[oUt] SW output
[F 1]	[oUt1] Output mode	[HYS] Hysteresis mode
	[1ot] Switch operation	[1_P] Normal output
	[P_1] Set value	50% of maximum rated flow
	[H_1] Hysteresis	5% of maximum rated flow
	[dtH1] ON Delay time	[0.00] 0.00 s
	[dtL1] OFF Delay time	[0.00] 0.00 s
	[CoL] Display colour	[1SoG] ON: Green OFF: Red (OUT1)
[F 2]	[oUt2] Output mode	[HYS] Hysteresis mode
	[2ot] Switch mode	[2_P] Normal output
	[P_2] Set value	50% of maximum rated flow
	[H_2] Hysteresis	5% of maximum rated flow
	[dtH2] ON Delay time	[0.00] 0.00 s
	[dtL2] OFF Delay time	[0.00] 0.00 s
	[CoL] Display colour	[1SoG] ON: Green OFF: Red (OUT1)
[F 3]	[FiL] Digital filter	[1.0] 1.0 second
[F10]	[SUB] Sub display	[dEF] Standard setting
[F14]	[CUt] Zero cut-off	[1.0] 1% F.S.
[F20]	[inP] External input	[rAC] Accumulated reset
[F22]	[AoUt] Analogue output	[1-5] 1 to 5 V (voltage) [4-20] 4 to 20 mA (current)
[F30]	[SAvE] Accumulated value hold	[oFF] Not held
[F80]	[diSP] Display OFF mode	[on] Display ON
[F81]	[Pin] Security code	[oFF] Not used
[F90]	[ALL] Setting of all functions	[oFF] Not used
[F96]	[S_in] Check of input signal	[ - - ] No setting
[F98]	[tESt] Output check	[n] Normal output
[F99]	[ini] Reset to default settings	[oFF] Reset OFF

### 10 Other Settings

- Snap shot function
- Peak / Bottom value display
- Key-lock function

Refer to the operation manual on the SMC website (URL: <https://www.smcworld.com>) for setting of other functions.

## 11 Troubleshooting

### 11.1 Error indication

Error name	Error display	Description	Measures
OUT1 over current error	Er 1	Load current on the switch output has exceeded the max. value (OUT1).	Turn the power off and remove the cause of the over current. Then supply the power again.
OUT2 over current error	Er 2	Load current on the switch output has exceeded the max. value (OUT2).	Turn the power off and remove the cause of the over current. Then supply the power again.
Instantaneous flow error	HHH	Flow has exceeded the upper limit of the flow display range.	Reduce the flow.
	LLL	Flow is in the reverse direction by at least -5% of the max. rated flow.	Connect the fluid flow in the correct direction.
Excess accumulated flow	9999	The accumulated flow range has been exceeded. (the decimal point position changes depending on the flow range).	Reset the accumulated flow once. (press the SET and DOWN button for 1 second or longer).
System error	Er 0	Displayed if an internal data error has occurred.	Turn the power off and on again. If the failure cannot be solved, contact SMC.
	Er 4		
	Er 6		
	Er 8		
	Er 16		
	Er 40		
Zero clear error	Er 3	During zero clear operation, the flow rate of greater than ±5% F.S. is applied.	Retry the zero clear operation without flow.
Version does not match	Er 15	Version of master and IO-Link does not match.	Align the master IO-Link version to the device.

If the error cannot be reset after the above measures are taken, or errors other than the above are displayed, please contact SMC.

Refer to the operation manual on the SMC website (URL: <https://www.smcworld.com>) for more detailed information about troubleshooting.

### 12 How to Order

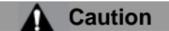
Refer to the catalogue on the SMC website (URL: <https://www.smcworld.com>) for the How to Order information.

### 13 Outline Dimensions (mm)

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

## 14 Maintenance

### 14.1 General Maintenance



- 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.
- **How to reset the product after a power cut or when the power has been unexpectedly removed**  
The settings of the product are retained from before the power cut or de-energizing. The output condition also recovers to that before the power cut or de-energizing, but may change depending on the operating environment. Therefore, check the safety of the whole system before operating the product.

## 15 Limitations of Use

- 15.1 Limited warranty and Disclaimer/Compliance Requirements  
Refer to Handling Precautions for SMC Products.

## 16 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.

## 17 Contacts

Refer to [www.smcworld.com](https://www.smcworld.com) or [www.smc.eu](https://www.smc.eu) for your local distributor / importer.

## SMC Corporation

URL: <https://www.smcworld.com> (Global) <https://www.smc.eu> (Europe)  
SMC Corporation, 4-14-1, Sotokanda, Chiyoda-ku, Tokyo 101-0021, Japan  
Specifications are subject to change without prior notice from the manufacturer.  
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