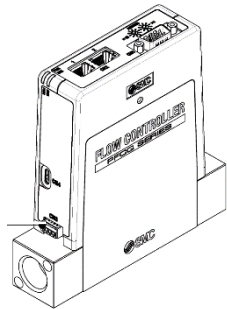




ORIGINAL INSTRUCTIONS

Instruction Manual  
Flow Controller for Air with Preset inputs /  
Serial communication  
PFCQ531-04-P series



The intended use of the Flow controller for air is to monitor and control air flow while connected to either preset inputs or serial communication.

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 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: Robots and robotic devices - Safety requirements for industrial robots - Part 1: 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.

	<b>Danger</b>	Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious 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>Caution</b>	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.
- 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

2.1 General specifications

Model		PFCQ531-04-P*
Applicable fluid		Dry air, N2 (Air quality classes: JIS B8392-1 1.1.2 to 1.6.2; ISO8573-1 1.1.2 to 1.6.2)
Flow rate	Detection type	Hot wire anemometer
	Rated controlled flow rate range	9 to 300 L/min
Pressure	Set controlled flow rate range	3 to 300 L/min
	Standard operation differential pressure	300 kPa
	Differential pressure range	50 to 500 kPa
	Operating pressure range	50 to 800 kPa
Environmental	Withstand pressure	1.0 MPa
	Mounting orientation	Upright (downward orientation not permitted)
	External leakage	10 cm <sup>3</sup> / min or less
	Protection class	IP40
Weight	Withstand voltage	1000 VAC for 1 minute, between terminals and housing
	Insulation resistance	50 MΩ or more between terminals and housing (with 500 VDC megger)
	Operating temperature range	Operation: 5 to 45°C (guaranteed accuracy: 15 to 35°C) Storage: -10 to 60 °C (no condensation or freezing)
	Operating humidity range	Operation and storage: 35 to 85 %RH (no condensation)
Standards		CE, UKCA, RoHS
Piping port		Rc1/2
Materials of parts in contact with fluid		PPS, FKM, SUS303, SUS304, SUS316, electroless nickel plating, Si, Au, GE4F, DLC
Weight	Body	850 g
	Power supply cable	210 g
	Bracket	30 g

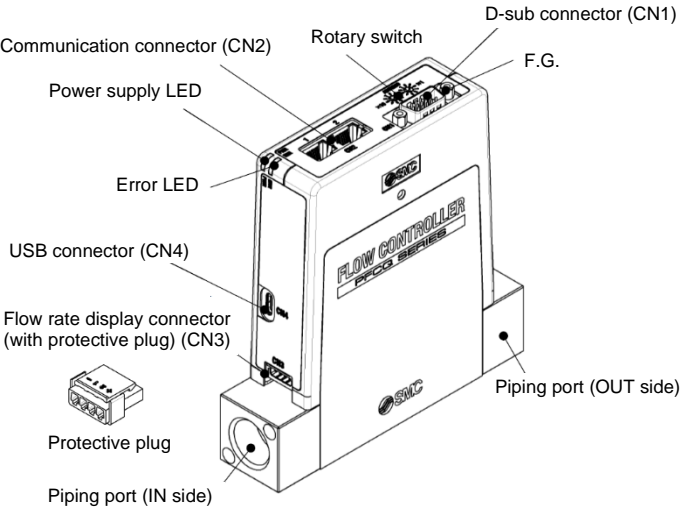
2.2 Electrical specifications

Model		PFCQ531-04-P*	
Supply	Power supply voltage		Main power supply: 24 VDC ±10% Signal power supply: 24 VDC ±10%
	Current consumption		Main power supply: 0.5 A or less Signal power supply: 0.05 A or less
	Protection		Polarity protection
Control	Valve driving actuator		Linear motor
	Control accuracy		±3% F.S. (at an operating differential pressure 0.3 MPa and at 25 °C)
	Repeatability		+/-1% F.S.
	Temperature characteristics		±2% F.S. (15 to 35 °C; 25 °C basis) ±5% F.S. (0 to 50 °C; 25 °C basis)
	Pressure characteristics		±2% F.S. (standard operating differential pressure)
	Settling time		0.5 s or less
	Control command method		Preset input / Serial communication
	De-energized State		Closed (Normally closed)
Analog output	Output mode		Flow rate output signal
	Voltage	Output type	1 to 5 V
		Output impedance	Approx. 1 kΩ
	Current	Output type	4 to 20 mA
		Output impedance	50 to 600 Ω

2 Specifications (continued)

Model		PFCQ531-04-P*
Switch input	Input type	4 points (photo coupler isolation)
	Input mode	Valve fully open command, Preset data
	Internal resistance	5 kΩ
Switch output	Output type	3 points (NPN open collector, PNP open collector)
	Output mode	ERROR (Error output), AREA1-3 (Range output), TOLERANCE (Tolerance output), ALWAYS OFF (output OFF)
	Switch operation	Normal and Reversed output (Default: Normal output)
	Maximum load current	80 mA
	Maximum applied voltage (NPN only)	30 VDC
	Internal voltage drop (residual voltage)	1.5 V or less (at 80 mA load current)
	Delay time	5 ms or less
	Protection	Switch output polarity protection, Over current protection
Flow rate output	Output mode	For connection with the digital flow monitor PFG310
	Output type	4 to 20 mA
	Load impedance	50 to 600 Ω
LED indicators		2 points (power supply, error)

3 Names and function of parts



Name	Description
Power supply (PWR) LED	LED turns ON and flashes when 24 V power is supplied and the system starts operating.
Error (ERR) LED	LED turns ON and flashes when fully open or when an error occurs.
D-sub connector (CN1)	Connector for power supply, flow rate command signal, switch input signal, flow rate output signal, and switch output signal.
Communication connector (CN2)	Connector for serial communication. 2 connector ports provided for daisy chain connection.
Flow rate display connector (CN3)	Connector for digital flow monitor PFG310 (optional) to display the flow rate. When not using the digital flow monitor, mount the protective plug on the connector.
USB connector (CN4)	Connected to PC to make settings such as target flow rate values using dedicated software.
Piping port	Connection port for piping. The IN side is for inlet and the OUT side is for outlet.
F.G.	Frame ground. A grounding cable must be connected to F.G.

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.

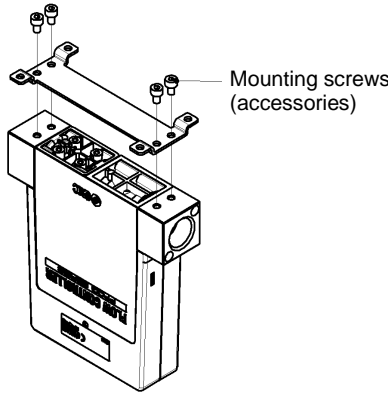
4.2 Environment

**Warning**

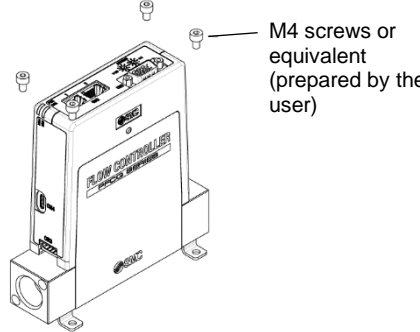
- Do not use in an environment where corrosive gases, chemicals, salt water or steam are present.
- Do not use in an explosive atmosphere.
- Do not expose to direct sunlight. Use a suitable protective cover.
- Do not install in a location subject to vibration or impact in excess of the product's specifications.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

4.3 Bracket mounting

- Mount the bracket to the product using hexagon socket head cap screws (4 pcs.).
- Apply a tightening torque of 1.4 to 1.6 N•m.

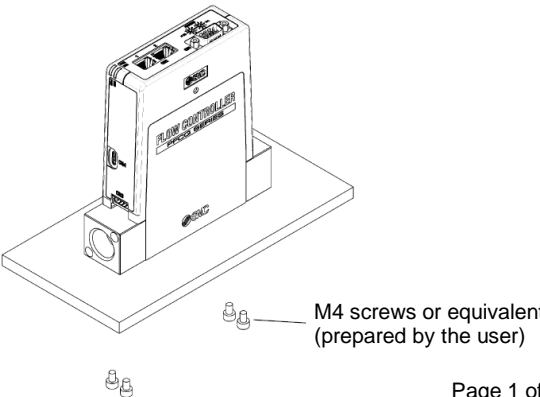


- To mount the product with the bracket, use M4 screws or equivalent (4 pcs.). The screws should be prepared by the user.
- Refer to the operation manual on the SMC website (URL: <https://www.smcworld.com>) for the bracket thickness and the mounting hole locations.



4.4 Direct mounting

- Use M4 screws or equivalent (4 pcs.) for mounting.
- The screws should be prepared by the user.





4 Installation (continued)

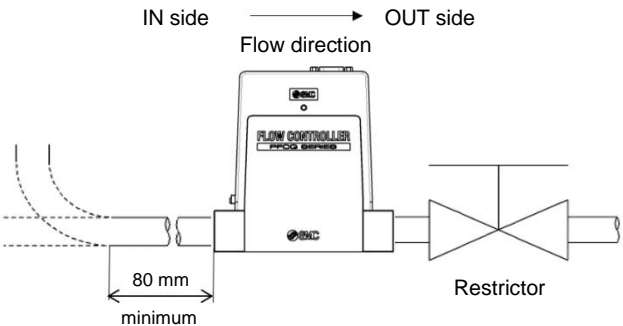
4.5 Mounting location

- Give consideration to the size of the control panel and the installation method so that the surrounding of the product will be 45°C or below (or 35°C or below when using the product within the guaranteed accuracy range).
- When mounting the products side by side, be sure to take measures against overheating by providing a 20 mm or more space between them.

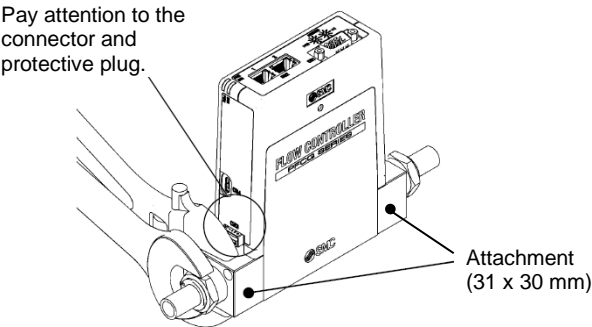
4.6 Piping

Caution

- Before connecting piping make sure to clean up chips, cutting oil, dust etc.
- Do not mount the product in an orientation with the product bottom surface facing upward (upside down). The product accuracy may vary.
  - Do not release the OUT side piping port of the product directly to the atmosphere without a piping connection. The accuracy may vary.
  - Mount the product so that the fluid flows in the direction indicated on the side of the product.
  - Avoid sudden changes to the piping size on the IN side of the product. The piping on the IN side must have a straight piping section length of at least 80 mm.



- Apply the correct tightening torque when mounting the product. Refer to the table below for the required torque.
- Use a wrench suitable for the required torque. Do not use a wrench with an overall length of 400 mm or longer.
- If the screw is tightened at a torque exceeding the tightening torque range, the product may be damaged. If the screw is tightened at a torque less than the tightening torque range, the connection thread may loosen.
- Make sure that sealant tape does not enter the flow path.
- After completing the piping, confirm that there is no leakage.
- When mounting a fitting, apply a wrench or adjustable wrench to the metal part (attachment) to mount the fitting. Applying the wrench at other parts may cause damage to the product. Specifically, make sure that the wrench or other tools will not be applied to the flow rate display connector or the protective plug mounted to the flow rate display connector. If a lead wire with connector is mounted to the flow rate display connector, remove the wire first before performing the piping.



Nominal thread size	Port size	Required torque
Rc1/2	1/2 "	28 to 30 N·m

5 Wiring

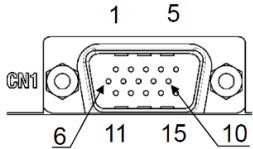
5.1 Wiring

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. Otherwise the product 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 product separately from power or high voltage cables.
- Ensure that the FG terminal is connected to ground when using a commercially available switch-mode power supply.
- Be sure to prepare the main power supply and the signal power supply separately. If one power supply is shared between them, malfunction due to noise may be caused or the specified characteristics may not be satisfied.
- Do not short-circuit the main power supply 0 VDC (DC1(-)) and OUTA 0 VDC (COM). Otherwise, the specified product accuracy may not be satisfied due to the current flowing through the main power supply.
- When the power supply input is out of range or a switch output overcurrent error has occurred, the OUT1 to OUT3 outputs are fixed to OFF to protect the circuit.

5.2 D-sub connector (CN1)

- 15 pin D type plug (#4-40 UNC) connector



Pin No.	Input/Output	Name	Description
1	Input	IN1	Refer to the operation manual on the SMC website (URL: <a href="https://www.smcworld.com">https://www.smcworld.com</a> ) for switch input IN1 details.
2	Output	OUTA	Flow rate output signal.
3	Input	DC1(+)	Main power supply 24 VDC
4	Input	DC1(-)	Main power supply 0 VDC *1, *2
5	Input	DC2(+)	Signal power supply 24 VDC
6	N.C.	N.C.	-
7	Input/Output	COM	OUTA 0 VDC *1, *3
8	Input	DC2(-)	Signal power supply 0 VDC *2, *3
9	Output	OUT1	Switch output 1
10	Output	OUT2	Switch output 2
11	Output	OUT3	Switch output 3
12	Input	IN2	Preset (refer to preset data)
13	Input	IN3	Preset (refer to preset data)
14	Input	IN4	Preset (refer to preset data)
15	N.C.	N.C.	-

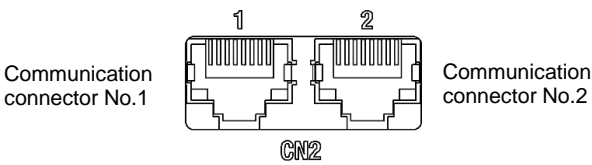
\*1: The main power supply 0 VDC (Pin No. 4) and the OUTA 0 VDC (Pin No. 7) are isolated inside the product.  
\*2: The main power supply 0 VDC (Pin No. 4) and the signal power supply 0 VDC (Pin No. 8) are isolated inside the product.  
\*3: The signal power supply 0 VDC (Pin No. 8) and the OUTA 0 VDC (Pin No. 7) are connected inside the product.

5.3 Communication connector (CN2)

- The communication connector is used when the flow controller is connected to a host device (PLC) and operated using the serial communication mode.
- The product can be connected to up to 16 devices using a daisy chain connection.
- The communication connector has 2 connection ports, one for input from the upper devices and upper flow controller and the other for output to the lower flow controller.
- The RJ45 LAN cable (straight connection) is not supplied with the product.

5 Wiring (continued)

- 8 pin RJ45 connector (2 sockets)



Pin No.	Input / Output	Signal name
1	-	N.C.
2	-	N.C.
3	Input / Output	SD+
4	Input / Output	SD-
5	-	N.C.
6	-	N.C.
7	-	N.C.
8	Input	GND

5.3.1 Communication specifications

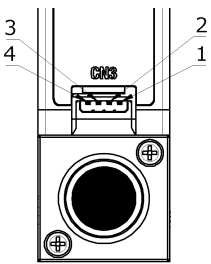
Item	Specification
Protocol	Modbus
Transmission mode	RTU
Frame size	Variable length
Communication method	RS-485 (asynchronous)
Communication speed	9,600 bps, 19,200 bps (default) 38,400 bps, 57,600 bps, 115,200 bps
Data bit	8 bit
Start bit	1 bit
Stop bit	1 bit
Parity	Even number
Endian	Big endian
Flow control	Without

5.4 Flow rate display connector (CN3)

The dedicated output connector for the Digital flow monitor PFG310-XY-M-Y-X105 (optional).

When using the Digital flow monitor, connect using the lead wire with connector (part number ZS-33-D) and the sensor connector (part number ZS-28-C-1).

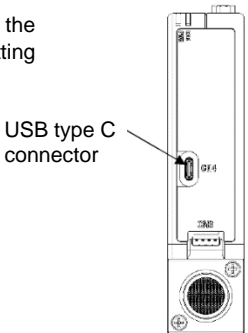
When not connecting the digital flow monitor, be sure to mount the protective plug (accessory).



Pin No.	Input / Output	Name	Description
1	Output	DC(+)	24 VDC for flow monitor
2	-	N.C.	Not used
3	Output	OUTM	Output
4	Output	DC(-)	0 VDC for flow monitor

5.5 USB connector (CN4)

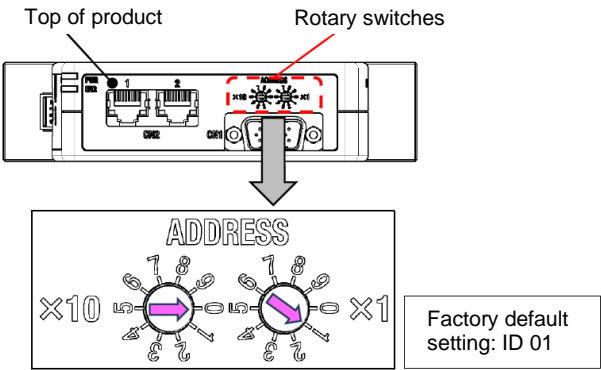
- The USB connector is used to connect the flow controller to a PC when using the setting software in the preset input mode.
- The connector is USB type C (USB 2.0 or higher).
- The USB cable is not supplied with the product.



6 Setting

6.1 ID setting

- The Flow controller can be assigned an ID using the rotary switches on the top face of the product. The ID is required when using the setting software in preset input mode or for serial communication connections.
- The ID is used to provide an individual identification for daisy chain connections.



6.1.1 Setting method

- The ID setting must be performed with the power supply turned OFF.
- The ID can be set from 01 to 32.
- The rotary switch marked "x10" sets the 1st digit and the switch marked "x1" sets the 2nd digit.
- After setting, turn ON the power supply to activate the ID.

Caution

- The ID setting must be performed with the power supply turned OFF. The ID setting will not change if the rotary switch is operated with the power supply ON.
- DC2 is turned ON within 0.5 seconds after DC1 is turned ON. If the power supply for the signal is turned ON late, the ID will be set to 00.
- When connecting products in a daisy chain, set a different ID for each product. If ID's are duplicated the communication will not be performed.

6.2 Function settings

The functions of this product which can be set using the setting software are as follows:

1. Target flow rate operation  
Seven target flow rate values (preset data) can be set using the setting software. Flow control is performed by a combination of ON/OFF switch inputs IN2 to IN4.
2. Switch output setting  
The following output signal settings for the three switch outputs OUT1 to OUT3 can be set using the setting software. ERROR signal, AREA signal, TOLERANCE signal and ALWAYS OFF signal.
3. Valve closed  
Turning OFF all switch inputs IN1 to IN4 will stop energizing the linear motor and close the valve.
4. Valve fully open  
When switch input IN1 is turned ON while the valve is closed, the valve will be fully opened. During a preset input operation the valve fully open function is not available. In that case, turn OFF the switch input IN2 to IN4 and then turn ON the switch input IN1.
5. Monitor mode and Test mode  
The setting software can be used to display the current flow rate and to control the flow rate by setting an arbitrary target flow rate.
6. Setting lock  
The basic settings can be locked using the setting software.
7. Initialization  
The basic settings can be initialized using the setting software.

Refer to the Operation manual available on the SMC website (URL: <https://www.smcworld.com> ) for further details of settings using the setting software.

6.3 Serial Communication settings

The Flow controller can be set up and operated via serial communication. Refer to the Air Flow Controller Instruction manual (Serial Communication Modbus Protocol Edition) available on the SMC website (URL: <https://www.smcworld.com> ) for further details.



7 LED display

Based on the LED colour, turning ON or flashing, the product status can be displayed.

7.1 Normal operation

Name	Power supply LED	Error LED	Description	Measures
Preset input	Green LED is ON	Green LED is ON	Preset Input operation	-
Valve fully open	Green LED is ON	Green LED flashing	Valve fully open operation	-
Serial communi-cation	Green LED is ON	Green LED is ON	Serial communication operation	
Valve closed	Green LED is ON	LED is OFF	The switch inputs IN1 to IN4 are OFF, or the serial input is set to 0 L/min. The current to the motor is OFF and the valve is closed.	-
Power OFF	LED is OFF	LED is OFF	Internal circuit is not operating (valve closed) because the main power supply is not ON or the voltage is too small (21.6 VDC or less).	Apply a voltage of 24 VDC ±10% to the main power supply

7.2 Error generation

Name	Power supply LED	Error LED	Description	Measures
Switch input error	Red LED is ON	LED is OFF	The following operations were performed: <ul style="list-style-type: none"><li>• IN1 is ON at the end of preset operation</li><li>• IN2 to IN4 are ON at the end of valve fully open operation.</li><li>• IN1 to IN4 are ON at the transition from serial communication mode to preset input mode.</li></ul>	Reset the signal. Alternatively, turn on the main power supply again when the switch inputs are OFF.
Input error at power ON	Red LED is ON	LED is OFF	Switch input is ON when the power supply is turned ON. ⇒Turns off current to the linear motor and closes the valve.	Reset the signal. Alternatively, turn on the main power supply again when the switch inputs are OFF.
Switch output over current error	Red LED is ON	Green LED is ON	The current applied to the switch output exceeded the specified value. ⇒Turns off current to the linear motor and closes the valve.	Check the switch output circuit, take measures for the cause, and turn on the main power supply again.

7 LED display (continued)

Name	Power supply LED	Error LED	Description	Measures
Signal power supply outside the range	Red LED is ON	Green LED is ON	The signal power supply voltage is lower than the specified value. ⇒Turns off current to the linear motor and closes the valve	Apply a voltage of 24 VDC ±10% to the signal power supply and turn ON the main power supply.
Temper-ature error	Red LED is ON	Red LED is flashing	The product temperature exceeded the specified value. ⇒Turns off current to the linear motor and closes the valve.	After the product surface temperature has dropped to around the ambient temperature, reset the signal or turn on the power supply again.
Device abnormal error	Red LED is ON	Red LED is ON	Error in a device such as a sensor or motor. ⇒Turns off current to the linear motor and closes the valve.	Please contact your SMC sales representative.
Parame-ter setting error	Red LED is ON	Green LED is flashing	Flow control was performed with the set target flow range value outside of the settable range. ⇒Turns off current to the linear motor and closes the valve.	Set the target flow rate value to within the settable range and turn on the main power supply again.

8 How to Order

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

9 Outline Dimensions (mm)

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

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.

Do not allow foreign matter to enter the product or piping.

10 Maintenance (continued)

10.2 Regular Maintenance

Check the following points and contact SMC if any abnormalities are found.

- 1) Daily inspection
  - Turning ON and flashing of LED's
  - Changes in the control accuracy
  - Changes in the product surface temperature
- 2) Regular checks
  - Loosening of mounting screws
  - Loosening of connector mounting
  - Any leakage of air to atmosphere
  - Changes in the control accuracy or response time
  - Stains on the mesh
  - Whether the air filter is regularly drained

11 Limitations of Use

11.1 Limited warranty and Disclaimer/Compliance Requirements

Refer to Handling Precautions for SMC Products.

12 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.

13 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.smceu.com> (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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