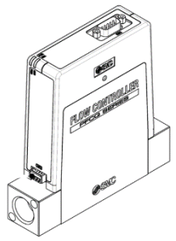
PFCQ531-TF223-021EN

ORIGINAL INSTRUCTIONS

Instruction Manual
Flow Controller for Air
PFCQ531 series



The intended use of the Flow controller for air is to monitor and control air flow 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) *1), and other safety regulations.

*1) 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.

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

⚠ 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-A*
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*1)
Flow rate	Detection type		Hot wire anemometer
	Rated controlled flow rate range		9 to 300 L/min
	Set controlled flow rate range		3 to 300 L/min
Pressure	Standard operation differential pressure		300 kPa
	Differential pressure range		50 to 500 kPa
	Operating pressure range		50 to 800 kPa
	Withstand pressure		1.0 MPa
Mounting orientation			Upright (downward orientation not permitted)
External leakage			10 cm³/min or less
Environmental	Protection class		IP40
	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 45ºC (guaranteed accuracy: 15 to 35 ºC) Storage: -10 to 60 ºC (no condensation or freezing)
	Operating humidity range		Operation and storage: 35 to 85 %RH (no condensation)
Standards			CE, UKCA, EAC, 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		250 g
	Bracket		30 g

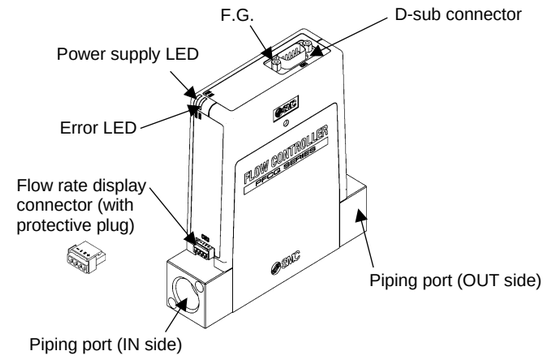
2.2 Electrical specifications

Model			PFCQ531-04-A*
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 differential pressure 0.3 MPa and at 25 ºC)
	Repeatability		+/-1% F.S.
	Temperature characteristics		±2% F.S. (15 to 35 ºC; 25 ºC basis) ±5% F.S. (0 to 50 ºC; 25 ºC basis)
	Pressure characteristics		±2% F.S. (standard operating differential pressure)
	Settling time		0.5 s or less
	Control command method		Analog input
	De-energized State		Closed (Normally closed)
Analog input	Input mode		Flow rate command signal
	Voltage	Input type	1 to 5 V
		Input impedance	Approx. 1 MΩ
	Current	Input type	4 to 20 mA
		Input impedance	250 Ω or less

2 Specifications (continued)

Model			PFCQ531-04-A*
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
		Load impedance	50 to 600 Ω
Switch input	Input type		1 point (photo coupler isolation)
	Input mode		Valve fully open command
	Internal resistance		5 kΩ
Switch output	Output type		1 point (NPN open collector, PNP open collector)
	Output mode		Error output
	Switch operation		Inverted 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.
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.
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.

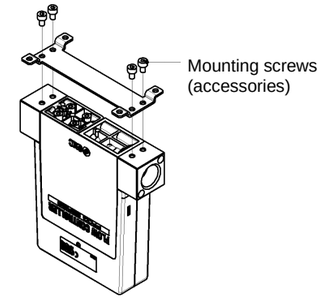
4.2 Environment

⚠ Warning

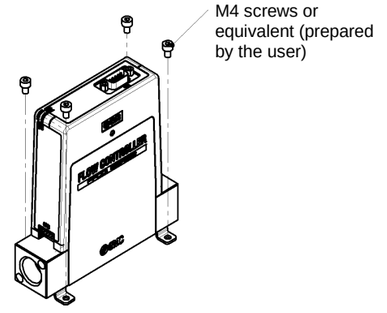
- Do not use in an environment where corrosive gases, chemicals, salt water or steam are present.
- Do not use in an explosive atmosphere.
- Do not expose to direct sunlight. Use a suitable protective cover.
- Do not install in a location subject to vibration or impact in excess of the product’s specifications.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

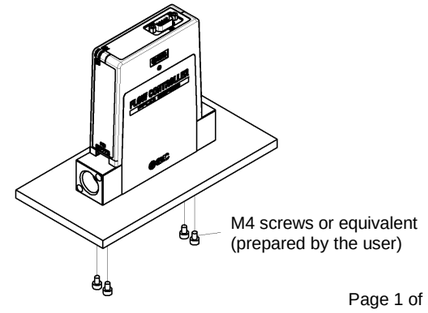


- To mount the product with the bracket, use M4 screws or equivalent (4 pcs.). The screws should be prepared by the user.
- Refer to the Operation manual on the SMC website (URL: https://www.smcworld.com) for the bracket thickness and the mounting hole locations.



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

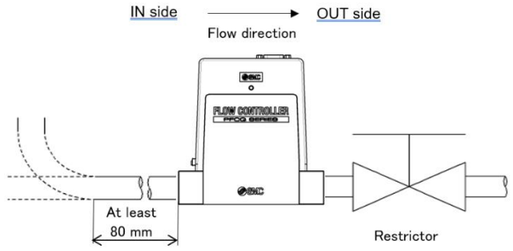
- Give consideration to the size of the control panel and the installation method so that the surrounding of the product will be 45 ºC or below (or 35 ºC or below when using the product within the guaranteed accuracy range).
- When mounting the products side by side, be sure to take measures against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

4.6 Piping

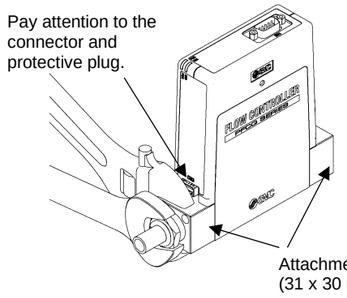
⚠ Caution

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 at the metal part (attachment) to mount the fitting. Applying the wrench at other parts may cause damage to the product.
  Specifically, make sure that a 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

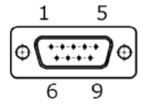
5.1 Wiring

⚠ 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.

5.2 D-sub connector

- 9 pin D type plug (#4-40 UNC)



Pin No.	Input/Output	Name	Description
1	Input	IN1	Refer to the details of the switch input IN1.
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	Input	INA	Flow rate command signal
7	Input/Output	COM	INA and OUTA 0 VDC *1, *3
8	Input	DC2(-)	Signal power supply 0 VDC *2, *3
9	Output	OUT1	Refer to the details of the switch output OUT1.

*1: The main power supply 0 VDC (Pin No. 4) and the INA and 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 INA and OUTA 0 VDC (Pin No. 7) are connected inside the product.

⚠ Caution

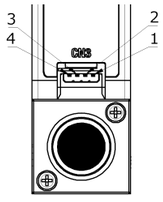
- **Do not short-circuit the main power supply 0 VDC (DC1(-)) and INA and OUTA 0 VDC (COM).**
- Otherwise, the specified product accuracy may not be satisfied due to the current flowing through the main power supply.

5.3 Flow rate display connector

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

6 How to Order

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

7 Outline Dimensions (mm)

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

8 LED display

8.1 Normal operation

Name	Power supply LED	Error LED	Description	Measures
Analog input	Green LED is ON	Green LED is ON	Analog input operation	-
Valve fully open	Green LED is ON	Green LED flashing	Valve fully open operation	-
Valve closed	Green LED is ON	LED is OFF	Analog input is less than 1.04 VDC (4.16 mA), the current to the motor is OFF and the valve is closed.	-
Power OFF	LED is OFF	LED is OFF	Internal error (valve closed) because main power supply is not ON or the voltage is too small (2.16 VDC or less).	Apply a voltage of 24 VDC ±10% to main power supply

8.1 Error generation

Name	Power supply LED	Error LED	Description	Measures
Switch input error	Red LED is ON	LED is OFF	Switch input ON at end of analog input operation. ⇒Turns off current to the linear motor and closes the valve.	Reset the signal. Alternatively, turn on main power supply again when the analog input is set to 1 VDC (4 mA) or less and switch input is OFF.
Analog input error	Red LED is ON	LED is OFF	Analog input is larger than 1.04 VDC (4.16 mA) at end of valve open operation. ⇒Turns off current to the linear motor and closes the valve.	Reset the signal. Alternatively, turn on the main power supply again when the analog input is set to 1 VDC (4 mA) or less and switch input is OFF.
Input error at power ON	Red LED is ON	LED is OFF	Analog input is 1.04 VDC (4.16 mA) or more when power supply or switch input is 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 analog input is set to 1 VDC (4 mA) or less and switch input is OFF.
Switch output over current error	Red LED is ON	Green LED is ON	The switch output current 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.

8 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.
Temp. error	Red LED is ON	Red LED flashing	The product temperature exceeded the specified value. ⇒Turns off current to the linear motor and closes the valve.	Reset the signal or turn on the power supply after the surface temperature has reached the same level as the ambient temperature.
Device 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.

9 Maintenance

9.1 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.

10 Limitations of Use

8.1 Limited warranty and Disclaimer/Compliance Requirements

Refer to Handling Precautions for SMC Products.

11 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.

12 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.smceu.com (Europe)
SMC Corporation, 4-14-1, Sotokanda, Chiyoda-ku, Tokyo 101-0021, Japan

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