



Operation Manual

Flow sensor

PRODUCT NAME

PFMV5##

MODEL/ Series

SMC Corporation

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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), Japan Industrial Standards (JIS)^{*1)} and other safety regulations^{*2)}.

*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 10218-1992: Manipulating industrial robots -Safety.
JIS B 8370: General rules for pneumatic equipment.
JIS B 8361: General rules for hydraulic equipment.
JIS B 9960-1: Safety of machinery - Electrical equipment of machines. (Part 1: General requirements)
JIS B 8433-1993: Manipulating industrial robots - Safety.
etc.

*2) Labor Safety and Sanitation Law, etc.

- | | |
|---|---|
|  | 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

1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results. The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product. This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly. The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.

1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.
2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.
3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.
3. An application which could have negative effects on people, property, or animals requiring special safety analysis.
4. Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.

Caution

1. The product is provided for use in manufacturing industries.

The product herein described is basically provided for peaceful use in manufacturing industries.

If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary.

If anything is unclear, contact your nearest sales branch.

Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following "Limited warranty and Disclaimer" and "Compliance Requirements".

Read and accept them before using the product.

Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered.*³⁾
Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.

2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.

This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.

3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.

*3) Vacuum pads are excluded from this 1 year warranty.

A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.

Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

Compliance Requirements

When the product is exported, strictly follow the laws required by the Ministry of Economy, Trade and Industry (Foreign Exchange and Foreign Trade Control Law).

Operator

- ◆ This operation manual has been written for those who have knowledge of machinery and apparatus that use pneumatic equipment and have full knowledge of assembly, operation and maintenance of such equipment.
- ◆ Please read this operation manual carefully and understand it before assembling, operating or providing maintenance service to the product.

■ Safety Instructions

Warning

- Do not disassemble, modify (including changing the printed circuit board) or repair.
An injury or failure can result.
- Do not operate the product outside of the specifications.
Do not use for flammable or harmful fluids.
Fire, malfunction, or damage to the product can result.
Verify the specifications before use.
- Do not operate in an atmosphere containing flammable or explosive gases.
Fire or an explosion can result.
This product is not designed to be explosion proof.
- Do not use the product for flammable fluid.
A fire or explosion can result.
Only dry air, N₂, CO₂ and Ar are applicable.
Do not use the product in a place where static electricity is a problem.
Otherwise it can cause failure or malfunction of the system.
- If using the product in an interlocking circuit:
Provide a double interlocking system, for example a mechanical system.
Check the product regularly for proper operation
Otherwise malfunction can result, causing an accident.
- The following instructions must be followed during maintenance :
Turn off the power supply
Stop the air supply, exhaust the residual pressure and verify that the air is released before performing maintenance work.
Otherwise an injury can result.

Caution

- Do not touch the terminals and connectors while the power is on.
Otherwise electric shock, malfunction or damage to the product can result.
- After maintenance is complete, perform appropriate functional inspections and leak tests.
Stop operation if the equipment does not function properly or there is a leakage of fluid.
When leakage occurred from other parts except piping, the product itself might break.
Cut off power supply and stop supplying fluid.
Do not apply fluid at leaking condition.
Safety cannot be assured in the case of unexpected malfunction.

■NOTE

○Follow the instructions given below when designing, selecting and handling the product.

●The instructions on design and selection (installation, wiring, environment, adjustment, operation, maintenance, etc.) described below must also be followed.

*Product specifications

●The direct current power supply to combine should be UL approved as follows.

Circuit (of class 2) which is of maximum 30 Vrms (42.4 V peak) or less, with UL 1310 class 2 power supply unit or UL 1585 class 2 transformer.

The Flow sensor is a UL approved product only if it has a UL mark on the body.

●Use the specified voltage.

Otherwise failure or malfunction can result.

Insufficient supply voltage may not drive a load due to a voltage drop inside the product.

Verify the operating voltage of the load before use.

●Do not exceed the specified maximum allowable load.

Otherwise it can cause damage or shorten the lifetime of the product.

●Applicable operating fluid depends on product.

Check the details of the specifications before using.

●Confirm the pressure loss at the sensor according to the flow rate characteristics (pressure loss) graph before designing piping.

Confirm detection condition of sensor electrified potential.

●For the details of compressed air quality, refer to ISO 8573-1, 1.1.2 to 1.6.2.

●Use the specified measurement flow rate and operating pressure.

Otherwise it can cause damage to the product or inability to measure correctly.

●Reserve a space for maintenance.

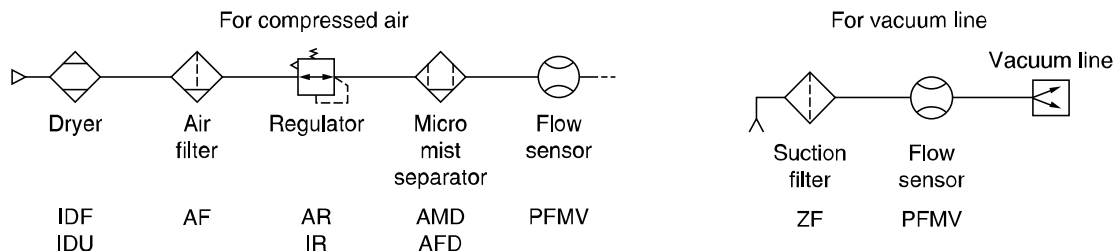
Allow sufficient space for maintenance when designing the system.

●Product handling

*Installation

- Tighten to the specified tightening torque.
If the tightening torque is exceeded the mounting screws and brackets may be broken.
If the tightening torque is insufficient, the product can be displaced and loosen the mounting screws.
(Refer to "Mounting and Installation" on page 12 to 13.)
- Be sure to ground terminal FG when using a commercially available switch-mode power supply.
- Do not drop, hit or apply excessive shock (over 980 m/s²) to the product.
Otherwise damage to the internal parts can result, causing malfunction.
- Do not pull the lead wire forcefully, not lift the product by pulling the lead wire.(Tensile force 49 N or less)
Hold the body when handling to avoid the damage of the product which lead to cause the failure and malfunction.
- For piping of the product, hold the piping with a spanner on the metal part of the piping (Piping attachment).
Holding other part with spanner leads to damage the product.
- Eliminate any dust left in the piping by air blow before connecting the piping to the product.
Otherwise it can cause damage or malfunction.
- Refer to the flow direction of the fluid indicated on the model number plate or the body for installation and piping.
Remaining air can cause inability to measure accurately.
- Do not mount the body with the bottom facing upwards.
- Do not insert metal wires or other foreign matter into the flow path.
It can damage the sensor causing failure or malfunction.
- Never mount a product in a location that will be used as a foothold.
The product may be damaged if excessive force is applied by stepping or climbing onto it.
- If the entering of foreign material to the fluid is possible, install and pipe the filter or the mist separator to the inlet to avoid failure and malfunction.
See the figure below for recommended pneumatic circuit.

Recommended pneumatic circuit



*Wiring

- Do not pull the lead wires.
In particular, never lift a product equipped with fitting and piping by holding the lead wires.
Otherwise damage to the internal parts can result, causing malfunction.
- Avoid repeatedly bending or stretching the lead wire, or placing heavy load on them.
Repetitive bending stress or tensile stress can cause the sheath of the wire to peel off, or breakage of the wire.
If the lead wire can move, fix it near the body of the product.
The recommended bend radius of the lead wire is 6 times the outside diameter of the sheath, or 33 times the outside diameter of the insulation material, whichever is larger.
Replace the damaged lead wire with a new one.
- Wire correctly.
Incorrect wiring can break the product.
- Do not perform wiring while the power is on.
Otherwise damage to the internal parts can result, causing malfunction.
- 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.
- 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.
- Keep wiring as short as possible to prevent interference from electromagnetic noise and surge voltage.
Do not use a cable longer than 10 m.
Wire the DC (-) line (blue) as close as possible to the power supply.
- When analog output is used, install a noise filter (line noise filter, ferrite element, etc.) between the switch-mode power supply and this product.

*Environment

- Do not use the product in area that is exposed to corrosive gases, chemicals, sea water, water or steam.
Otherwise failure or malfunction can result.
- 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, or hardening of the lead wires)
- Do not use in an area where surges are generated.
If there is equipment which generates a large amount of surge (solenoid type lifter, high frequency induction furnace, motor, etc.) close to the product, this may cause deterioration or breakage of the internal circuit of the product. Avoid source.
- Do not use a load which generates surge voltage.
When a surge-generating load such as a relay or solenoid is driven directly, use a product with a built-in surge absorbing element.
- The product is CE marked, but not immune to lightning strikes. Take measures against lightning strikes in the system.
- Mount the product in a place that is not exposed to vibration or impact.
Otherwise failure or malfunction can result.
- Do not use the product in the presence of a magnetic field.
This may lead to the malfunction of the product.
- Prevent foreign matter such as remnant of wires from entering the product.
Take proper measures for the remnant not to enter the product in order to prevent failure or malfunction.
- Do not use the product in an environment that is exposed to temperature cycle.
Heat cycles other than ordinary changes in temperature can adversely affect the inside of the product.

- Do not expose the product to direct sunlight.

If using in a location directly exposed to sunlight, shade the product from the sunlight.

Otherwise failure or malfunction can result.

- Keep within the specified fluid and ambient temperatures range.

The fluid temperature range and ambient temperature range is 0 to 50 °C.

Operation under low temperature leads to cause damage or operation failure due to frozen moist in the fluid or air.

Protection against freezing is necessary.

Air dryer is recommended for elimination of drain and water.

Avoid sudden temperature change even within specified temperature.

- Do not operate close to a heat source, or in a location exposed to radiant heat.

Otherwise malfunction can result.

*Adjustment and Operation

- Do not short-circuit the load.

When the product load is short circuit, generated excess current lead to cause the damage of the product.

- Supply the power when there is no flow.

There will be a drift on the analog output of approximate +/- 2 to 3% immediately after the power supply is turned on.

*Maintenance

- Turn off the power supply, stop the supplied air, exhaust the residual pressure and verify the release of air before performing maintenance.

There is a risk of unexpected malfunction.

- Perform regular maintenance and inspections.

There is a risk of unexpected malfunction.

- Perform drainage regularly.

If condensate enters the secondary side, it can cause operating failure of pneumatic equipment.

- Do not use solvents such as benzene, thinner etc. to clean the product.

They could damage the surface of the body and erase the markings on the body.

Use a soft cloth to remove stains.

For heavy stains, use a cloth soaked with diluted neutral detergent and fully squeezed, then wipe up the stains again with a dry cloth.

Model Indication Method

PFM □ □ - □ - □ □

Type

Model	Contents
V5	Remote type sensor

Measurement flow range

Model	Contents
05	0.0 to 0.5 L/min
10	0.0 to 1.0 L/min
30	0.0 to 3.0 L/min
05F	-0.5 to 0.5 L/min
10F	-1.0 to 1.0 L/min
30F	-3.0 to 3.0 L/min

Output specification

Model	Contents
1	Analog (1 to 5 V)

Operation manual

Model	Contents
Nil	With Operation manual (in Japanese and English)
N	Without Operation manual

Option(Included in the same package)

Model	Contents
Nil	Without L-type bracket
A	With 2 L-type brackets and 2 mount screws M3 x 15 L included for 1 station

L-type bracket

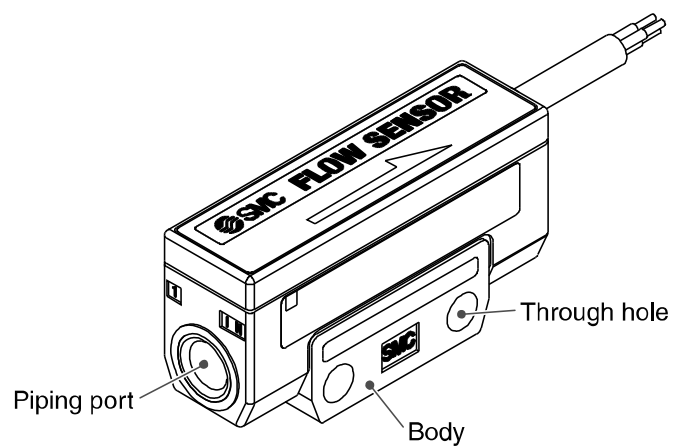
When optional part is needed by part alone, or to be mounted to the manifold, please order by part number below.

ZS - 36 - A □

Stations

1	1 stn	2 L-type brackets, 2 mount screws M3 x 15 L included
2	2 stns	2 L-type brackets, 2 mount screws M3 x 25 L included
3	3 stns	2 L-type brackets, 2 mount screws M3 x 35 L included
4	4 stns	2 L-type brackets, 2 mount screws M3 x 45 L included
5	5 stns	2 L-type brackets, 2 mount screws M3 x 55 L included

Names of Individual Parts



Piping port: Connection port for piping.

Body: Flow switch itself.

Through hole: Used to mount the flow switch on a DIN rail or a panel directly.

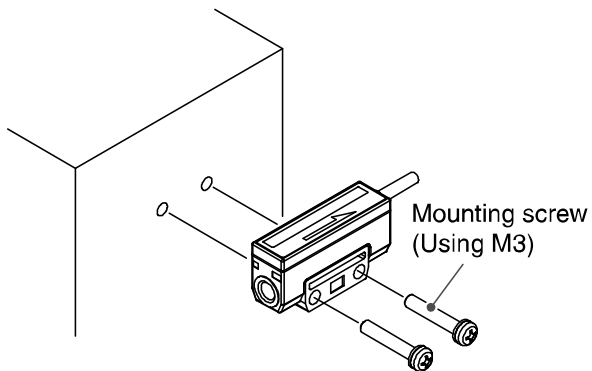
■ Definition and terminology

Initial	Terms	Meaning
F	F.S. (Full span, Full scale)	It reads “full span” or “full scale”, and indicates varied analog output range at rated value. For example, when analog output is 1 to 5V, F.S. =5[V]-1[V]=4[V], (ref. 1%F.S.=4[V]x1%=0.04[V])
N	Non-linear output	Indicates non linear output.
O	Operating fluid temp.	Flow temperature range which can be applied to the product.
	Operating humidity range	Humidity range in which product can be stored without being damaged while power supply and flow not applied.
	Operating pressure range	Pressure range in which (PFMV5) is operable.
	Operating temp. Range	Ambient temperature range in which product is operable.
P	Pressure characteristic	Varied amount of analog output when the line pressure is changed.
	Pressure rate	Pressure range that satisfies product specification.
	Proof pressure	Burst pressure at which the product is electrically or mechanically damaged.
R	Repeatability	Analog output repeatability when flow increases/decrease.
	Response time (Response 90%)	Time for analog output reaches 90% of target voltage from when target flow is applied.
	Ripple	Indicates pulsation.
S	Storage temp. range	Temperature range in which product can be stored without being damaged while power supply and flow not applied.
T	Temperature characteristic	Analog output change when ambient temp. is changed.

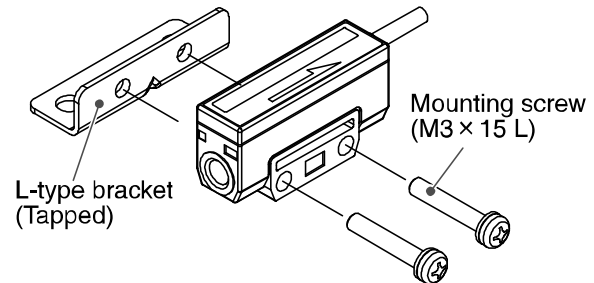
Mounting and Installation

■ Installation

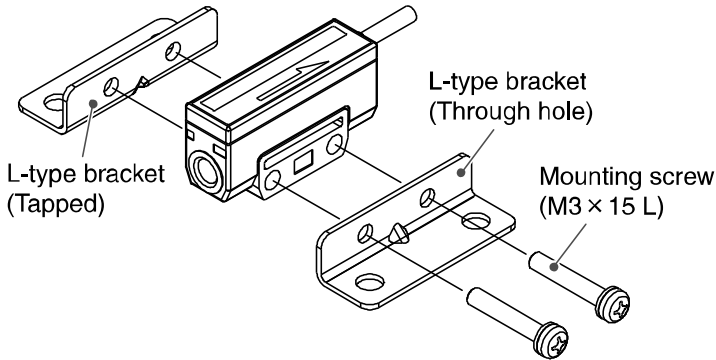
Direct mounting



Mounting on one side

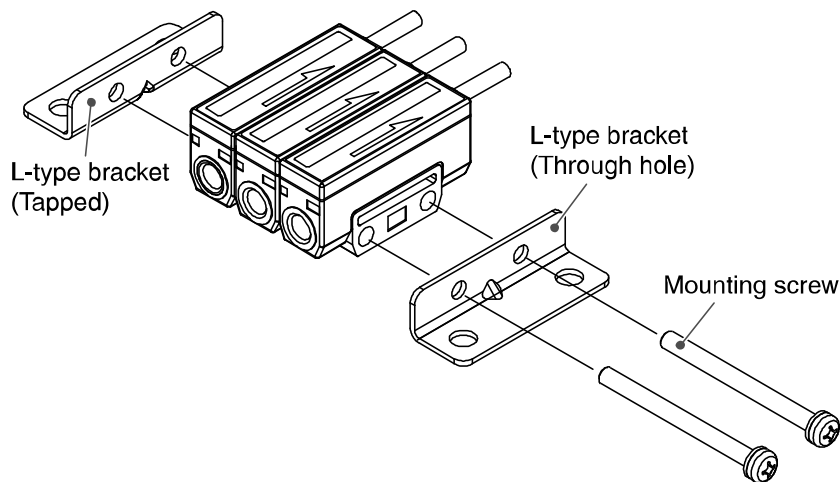


Mount on both sides



- Mount with the set screws M3 (2 pcs.) for direct installation.
- Thread tightening torque is 0.32 ± 0.02 Nm

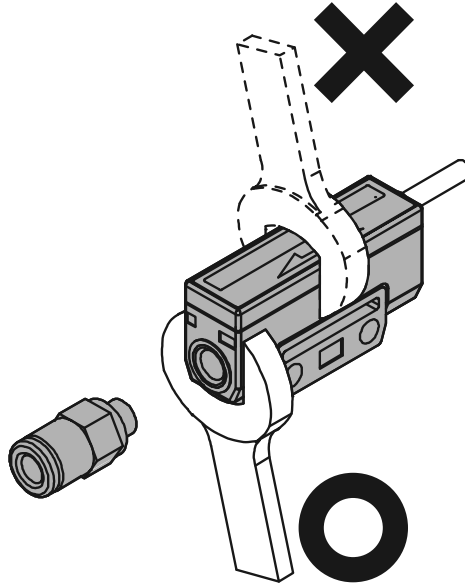
Manifold mounting (using ZS-36-A□)



- Thread tightening torque is 0.32 ± 0.02 Nm
- Mounting in series using the mounting brackets is not suitable for all models, depending on which fitting type is used.

■Piping

During installation of the product to the pipe, hold the body with specified spanner.



•Tightening torque to mount the fitting is 1 to 1.5 Nm.

PFMV5 series recommended fitting list

One-Touch fitting

- Male Connector (One-Touch Male Connector)/KQ2H04-M5
- Hexagon Socket head Male Connector/KQ2S04-M5
- Male Elbow/KQ2L04-M5

One-Touch mini fittings

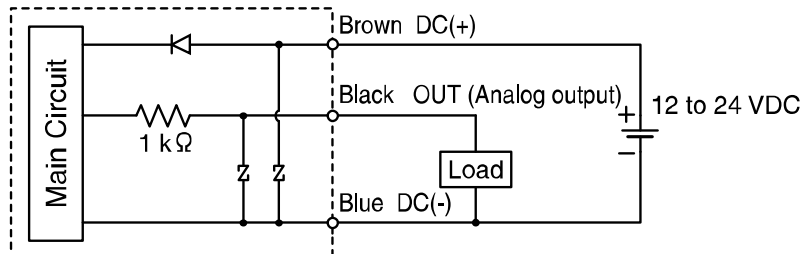
- Male Connector/KJH04-M5
- Hexagon Socket head Male Connector/KJS04-M5
- Male Elbow/KJL04-M5

Miniature fitting

- Barb fittings for nylon tubing/M-5AN-4/M-5AN-6

■Wiring

•Internal Circuit



Analog output: 1 to 5 V
Output impedance: Approx. 1 kΩ

Troubleshooting

Troubleshooting

Applicable product: PFMV5

If operation failure happens at a product, please seek a cause of your trouble with the following chart by tracing failure applicable to your case. If the cause you reached seems not to be applicable to your case, and the product operates normally after replacing the failed one with a new one, the product would be broken. A product can be broken due to the operating environment. If your product seems to be broken, please contact us.

•Possible cause and countermeasure

Fault	Status	Possible cause	Item to check	Countermeasure
Wrong output	No output	Wiring failure	Check that brown line and blue line are connected to DC (+) and DC (-) respectively.	Have correct wiring
		Connector is come off	Check the connection of the connectors.	Connect the connectors
	Indication/voltage is not stable	Foreign matter was got in or attached.	(1) Possibility of foreign matter to be got in. (2) Possibility of foreign matter to be attached. Check whether or not mesh got foreign matter.	Set up filter or mist separator at upstream side of product.
		Mounting direction of the product and signal output direction do not match.	Check that the mounting direction of the product and the analog voltage output direction are the same as the flow direction.	Mounting direction of the product, analog signal output direction and fluid flow direction should be the same.(Refer to 16)
		Pulsation in the flow.	Check if there is supply pressure fluctuation or pressure pulsation due to the characteristics of the compressor or pump acting as the pressure source.	Install a tank to reduce the pressure fluctuation. Change the pressure source to one which has less pulsation.
		Vibration	Check if there is vibration in the place where the sensor is installed.	Do not apply vibration to the sensor.
		Air leakage	Check if there is air leakage because of insufficient screwing in of the pipes or insufficient sealing, etc.	Reconnect the pipes with the specified tightening torque and rewrap the sealant tape.
		noise	Check if there is a power line or a high voltage line which generates noise in the wiring route.	Route wiring separately from power lines and high voltage lines.

Specification

■ Specifications

Model	PFMV505	PFMV510	PFMV530	PFMV505F	PFMV510F	PFMV530F
Measured fluid	Dry air, N ₂ (Air quality class is ISO8573-1 1.1.2 to 1.6.2 : 2001)					
Flow rate L/min ^{*1} (measurement range)	0 to 0.5	0 to 1	0 to 3	-0.5 to 0.5 ^{*2}	-1 to 1 ^{*2}	-3 to 3 ^{*2}
Repeatability	±2%F.S. or less ^{*3}					
Pressure characteristic (0 kPa reference ^{*4})	±2%F.S. or less (0 to 300 kPa) ±5%F.S. or less (-70 to 0 kPa)					
Temperature characteristic (25 °C reference)	±2%F.S. or less (15 to 35 °C) ±5%F.S. or less (0 to 50 °C)					
Pressure rate ^{*5}	-70 kPa to 300 kPa					
Operating pressure range ^{*6}	-100 kPa to 400 kPa					
Proof pressure	500 kPa					
Analog output (Non-linear output)	At voltage output: 1 to 5 V Output impedance: approx. 1 kΩ					
Response time	5 ms or less (Response 90%)					
Source voltage	12 to 24 VDC±10%, ripple(p-p) 10% or less (Protected against inverse connection)					
Power consumption	16 mA or less					
Resistance	Enclosure	IP40				
	Operating fluid temp	0 to 50 °C (No freezing or condensation)				
	Operating temp range	0 to 50 °C (No freezing or condensation)				
	Storage temp range	-10 to 60 °C (No freezing or condensation)				
	Operating humidity range	35 to 85%R.H. (No condensation)				
	Storage humidity range	35 to 85%R.H. (No condensation)				
	Withstand voltage	1000 VAC, 1 min Between battery and the body				
	Insulation resistance	50 MΩ or more (500 VDC Mega) between battery and the body				
	Vibration resistance	10 to 150 Hz 1.5 mm amplitude 98 m/s ² acceleration in X, Y, Z directions for 2 hours (un-powered)				
	Impact resistance	980 m/s ² X, Y, Z directions 3 times for each (un-powered)				
Port size	M5 x 0.8 (tightening torque: 1 to 1.5 N·m or less)					
Fluid contact material	PPS, Si, Au, SUS316, C3604 (Electroless nickel plating)					
Lead wire	3 core vinyl cabtire cable φ2.6, 0.15 mm ² , 2 m					
Weight	10 g (without lead wire)					

*1: Converted value of volume flow at ANR (20 °C, 101.3 kPa, 65%R.H.)

*2: Analog output shows 3 V when flow is zero. Changes to 5 V side when flow direction is IN→OUT. 1 V side when OUT→IN.

*3: %F.S. in the table takes 4 V (1-5 V) as a full scale.

*4: 0 kPa means release to the atmosphere.

*5: Applicable pressure range.

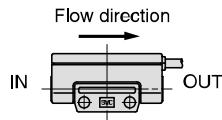
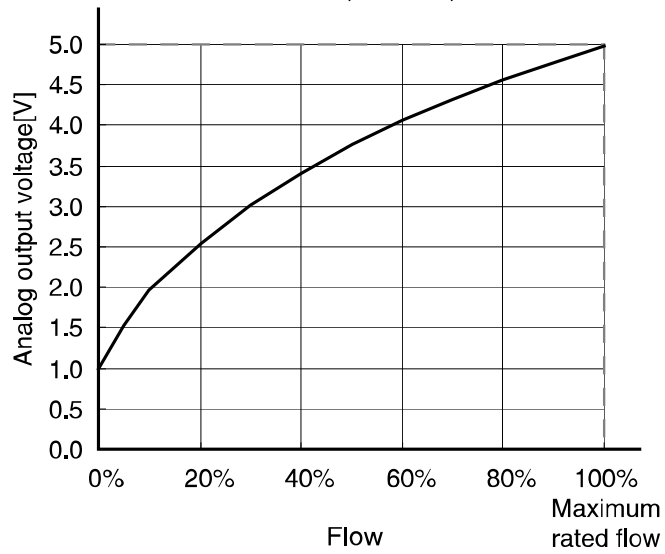
*6: Pressure range satisfies product specification.

Lead Wire Specifications

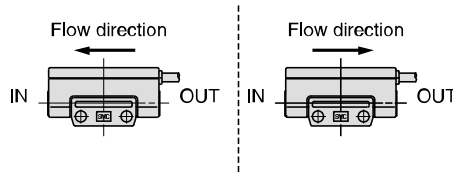
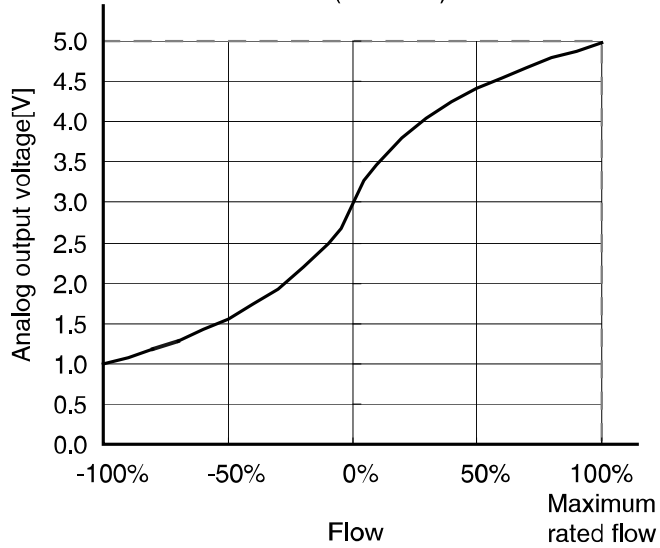
Conductor	Outside diameter	0.58 mm
Insulator	Material	Cross-linked vinyl chloride (XL-PVC)
	Outside diameter	0.88 mm
	Colours	Brown, Blue, Black
Sheath	Material	Oil-resistant/Heat resistant vinyl
Finished outside diameter		$\phi 2.6 \begin{matrix} +0.1 \\ -0.15 \end{matrix}$

Flow characteristic chart

PFMV5 (05/10/30)

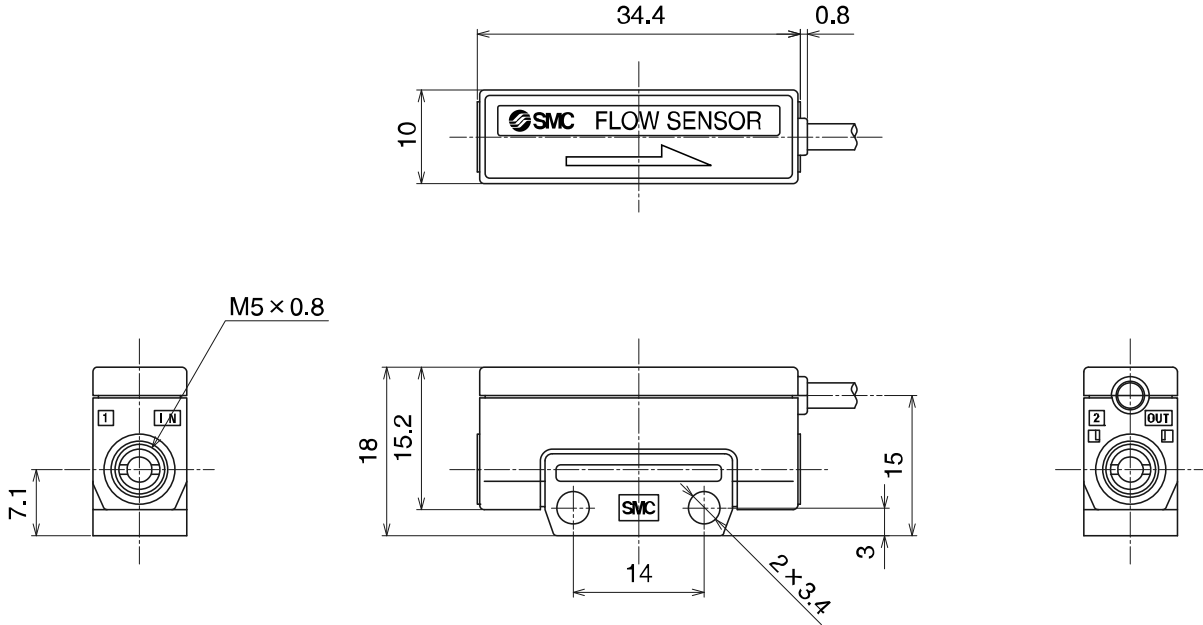


PFMV5 (05/10/30)/F

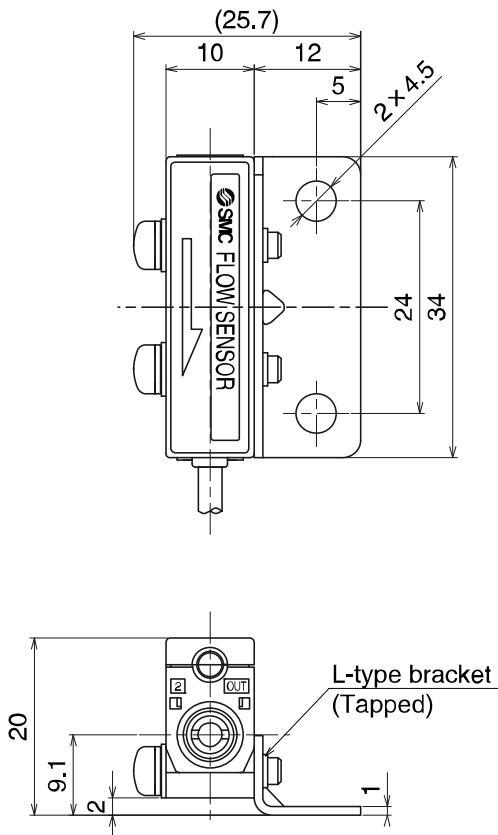


•Refer to catalog for details of flow characteristic.

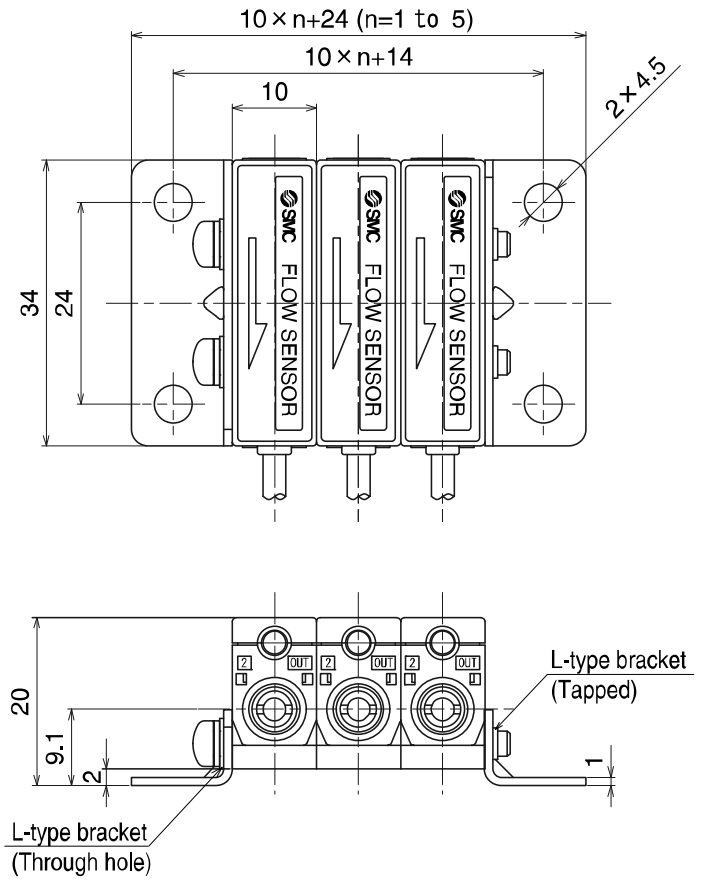
■Dimensions



With L-type bracket
Mount on one side



Mount on both sides



Revision history
A: Make an overall revision

SMC Corporation

URL <http://www.smcworld.com>

Note: Specifications are subject to change without prior notice and any obligation on the part of the manufacturer.
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No.EX##-OMK0004-B