# Flow Sensor

## For suction verification of very small workpieces

The flow sensor enables more reliable suction verification than a pressure sensor.

**New**

**A measuring flow rate range of 0.0 to 0.1 l/min (-X502) has been added.**

**Flow Sensor**
**PFMV5 Series** p. 6


**New**

**3-Screen Display**

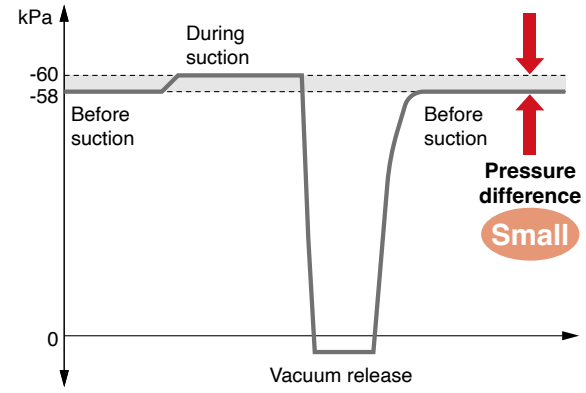
**Digital Flow Monitor**
**PFGV301 Series** p. 13

- Voltage display/flow rate display
  Sensor voltage display/flow rate display can be selected in the settings.
- Settable switch output
  It is possible to change the settings while checking the measured value.
- Dedicated monitor for the PFMV5


### Pressure Sensor

**Pressure difference** Small

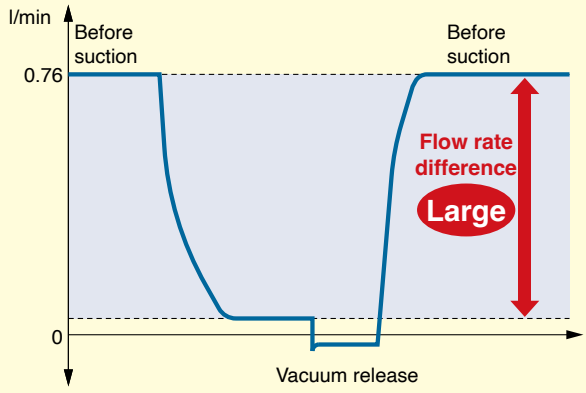
Unstable detection due to pressure fluctuations




### Flow Sensor

**Flow rate difference** Large

Stable detection with fewer detection mistakes




(Comparison with a nozzle diameter of Ø 0.3 at a vacuum pressure of -60 kPa)

- **Repeatability: ±2 % F.S.**
- **Response speed: 5 ms or less**
- **Withstand pressure: 500 kPa**
- **Grease-free**

| Model | | Range | Rated flow range [l/min] |
|---|---|---|---|
| | | | -3.0 / -1.0 / -0.5 / 0 / 0.1 / 0.5 / 1.0 / 3.0 |
| PFMV  | New 505-X502 | 0.1 l/min | |
| | 505 | 0.5 l/min | |
| | 510 | 1.0 l/min | |
| | 530 | 3.0 l/min | |
| | 505F | ±0.5 l/min | |
| | 510F | ±1.0 l/min | |
| | 530F | ±3.0 l/min | |

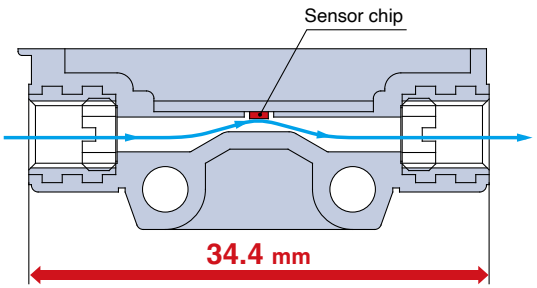
# *PFMV5/PFGV301 Series*

CAT.EUS100-67D-UK

# Flow Sensor
## *PFMV5 Series* p. 6

## Compact and Lightweight

The taper-shaped flow passage in front of the sensor chip enables stable sensing.





## Space-saving piping

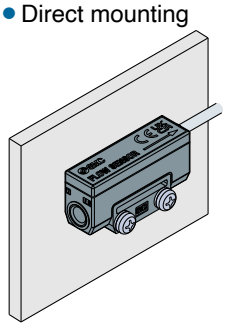
The product is mountable in locations with limited space as piping space is not required.


∗ When using a One-touch fitting (KQ2L04-M5N)

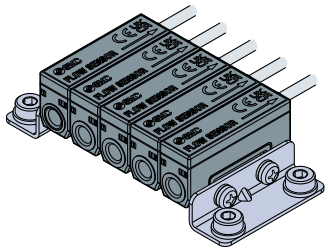
## With a bend-resistant cable

## Mounting

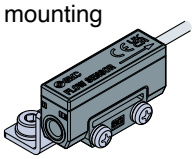
- Direct mounting



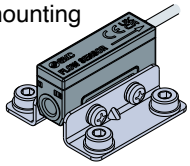
- Manifold mounting



- Single-side bracket mounting



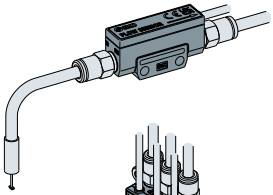
- Both-side bracket mounting



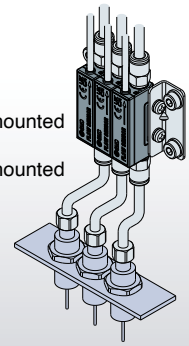
## Applications

- For suction verification of very small workpieces

· Suction of small components can be verified.
· Highly applicable to small nozzles.
· Nozzle clogging and crushing can be detected.

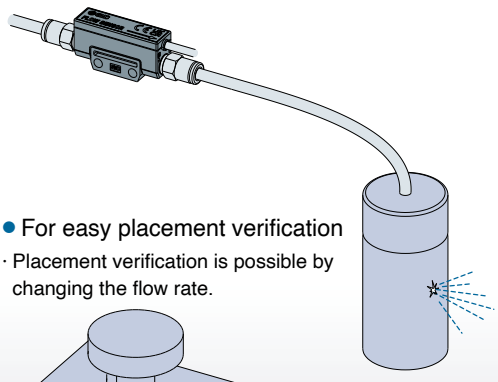


· Sensors can be mounted on a manifold.
· Sensors can be mounted near pads.



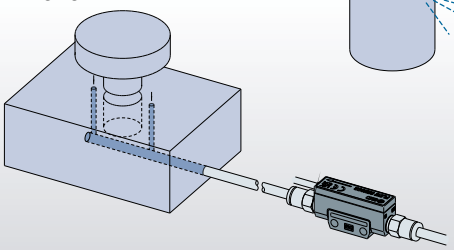
- For leakage testing of 0.1 l/min or less

· Pin holes in molded parts can be easily detected.



- For easy placement verification

· Placement verification is possible by changing the flow rate.



## Related Equipment

p. 12

### Compact Suction Filter

Filtration: 3 □m (Nominal)
Applicable tubing (O.D./I.D.): Ø 6/Ø 4

∗ Needs to be ordered separately.

IN/OUT: M5

∗ Needs to be ordered separately.

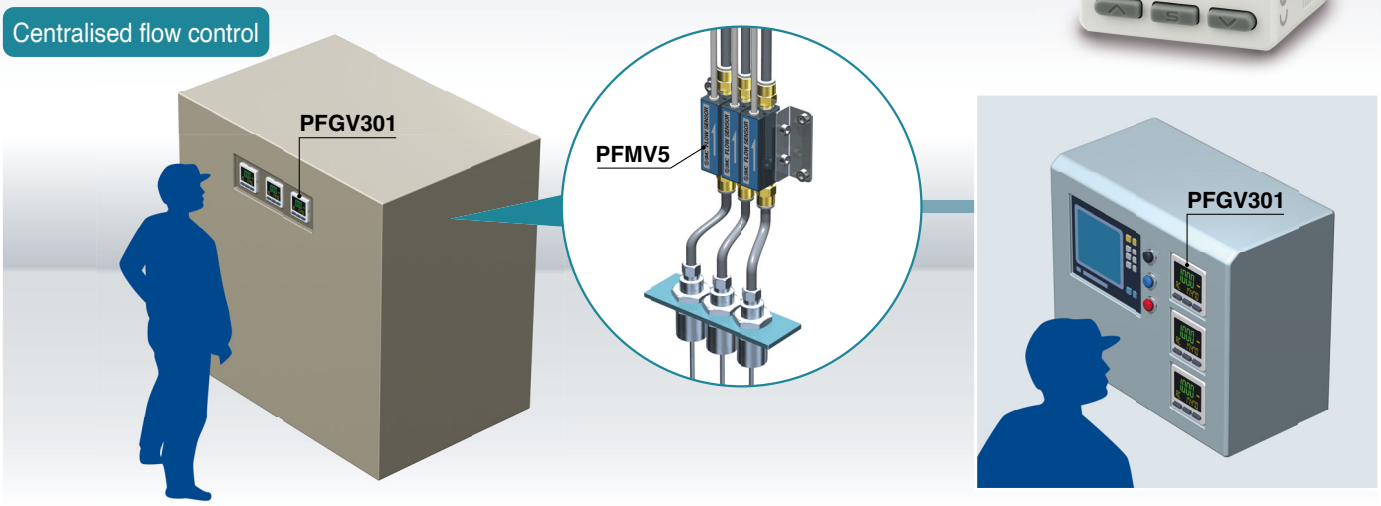
IN: Ø 6 barb fitting OUT: M5

# 3-Screen Display Digital Flow Monitor

## *PFGV301 Series* p. 13

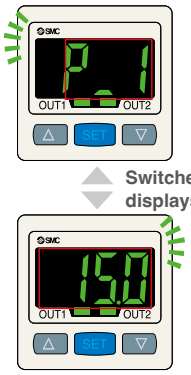
## Allows for the monitoring of remote lines

Centralised flow control




## Visualization of settings

Existing model

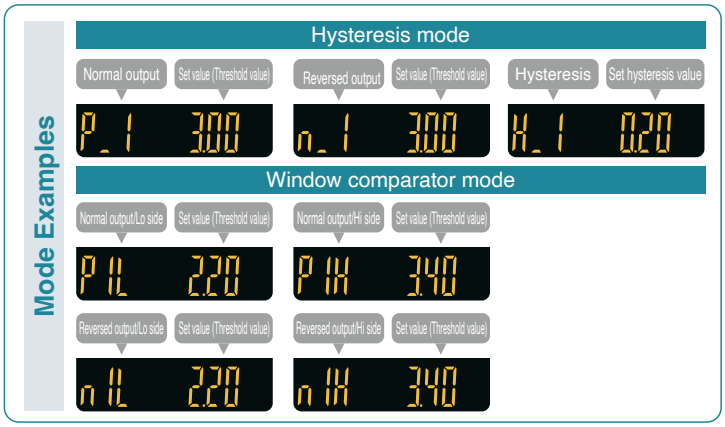



The sub screen (label) shows the item to be set.

New

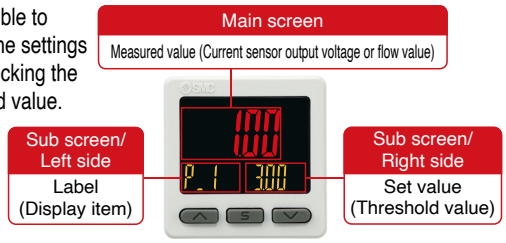
PFGV301

Always displayed on one screen

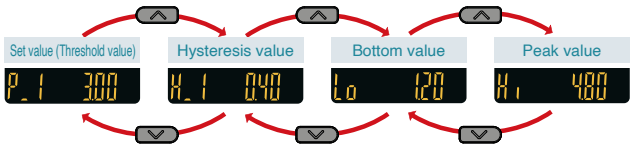



## Easy screen switching

It is possible to change the settings while checking the measured value.



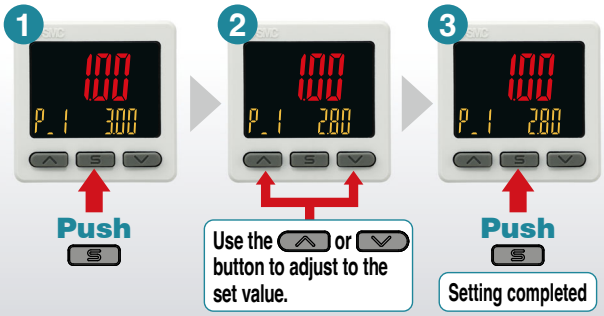

The sub screen can be switched by pressing the up/down buttons.




* Either “Input of line name” or “Display OFF” can be added via the function settings.

## Simple 3-step setting

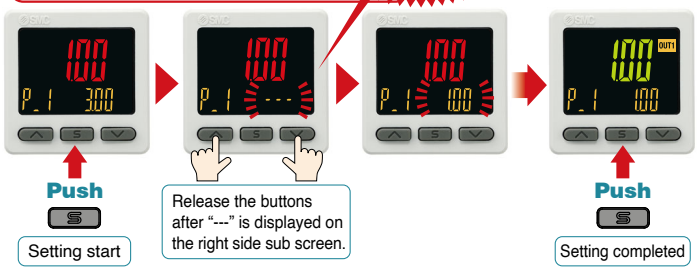
When the S button is pressed and the set value (P_1) is being displayed, the set value (threshold value) can be set. When the S button is pressed and the hysteresis (H_1) is being displayed, the hysteresis value can be set.




### With a snap shot function for set value reading

Pressing the ▲ and ▼ buttons simultaneously for a minimum of 1 second will make the set value (threshold value) the same as the current flow value.

Snap shot function

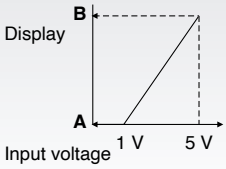


## NPN/PNP switch function

The number of stock items can be reduced.


NPN PNP

## Input range selection (for Pressure/Flow rate)



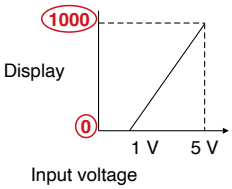

The displayed value to the sensor input can be set as required.
(Voltage input: 1 to 5 V)
Pressure switch/Flow switch can be displayed.

A is displayed for 1 V.
B is displayed for 5 V. The range can be set as required.

## Analogue output of 0 to 10 V is also available.

| | | |
|---|---|---|
| Voltage output | 1 to 5 V | Switchable |
| | 0 to 10 V | |
| Current output | 4 to 20 mA | Fixed |

■ Pressure Sensor for General Fluids/PSE570



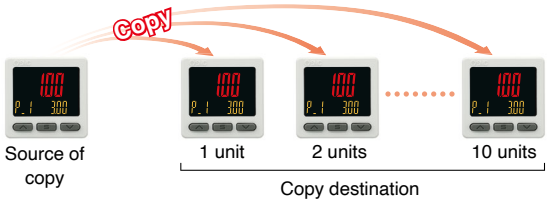

| | A | B |
|---|---|---|
| PSE570 | 0 | 1000 |
| PSE573 | -100 | 100 |
| PSE574 | 0 | 500 |

Set A and B to the values shown in the table above.

## Convenient functions

### Copy function

The set values of the monitor can be copied.




### Security code

The key locking function keeps unauthorised people from tampering with the settings.

### Power saving function

Power consumption is reduced by turning off the monitor.

| Current consumption*1 | Reduction rate*2 |
|---|---|
| 25 mA or less | Approx. 50 % reduction |

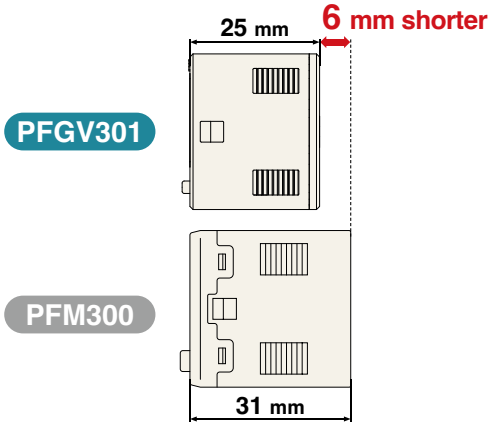
*1 During normal operation *2 In power saving mode

### External input function

The accumulated value, peak value, and bottom value can be reset remotely.

## Compact & Lightweight

- **Compact: Max. 6 mm shorter**
- **Lightweight: Max. 5 g lighter (30 g → 25 g)**



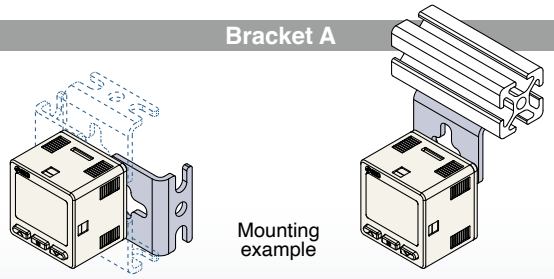

## Functions

- Output operation
- Simple setting mode
- Display colour
- Delay time setting
- Digital filter setting
- FUNC output switching function
- Selectable analogue output function
- External input function
- Auto-shift function
- Forced output function
- Peak/Bottom value display
- Setting of a security code
- Key-lock function
- Reset to the default settings
- Display with zero cut-off setting
- Auto-preset function
- Selection of the display on the sub screen
- Analogue output free range function
- Error display function
- Copy function
- Selection of power saving mode

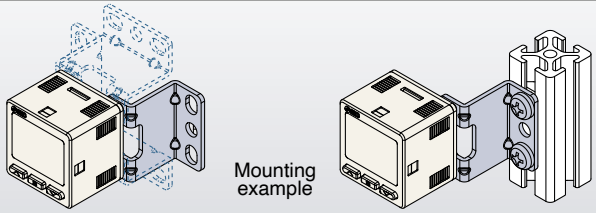
## Mounting

Bracket configuration allows for mounting in four orientations.

### Bracket A




### Bracket B

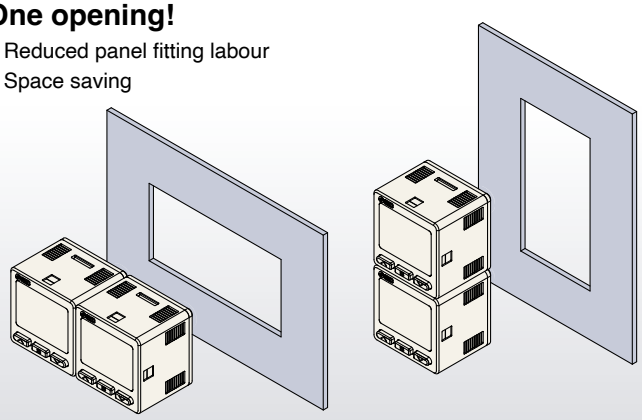



### Panel mounting

Mountable side by side without clearance

**One opening!**

- Reduced panel fitting labour
- Space saving



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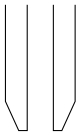
## Flow Sensor *PFMV5 Series*
## 3-Screen Display Digital Flow Monitor *PFGV301 Series*

# *PFMV Series*
# Model Selection

## Nozzle Diameter and Flow Rate Characteristics (Approximate values)

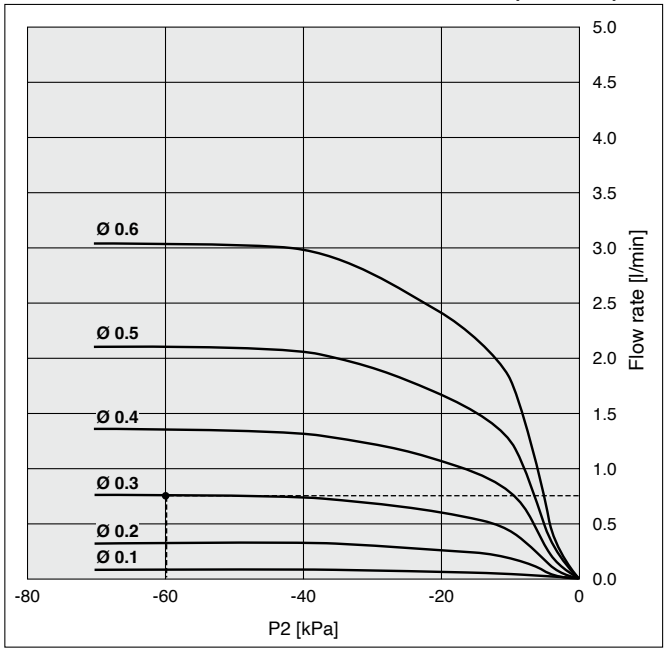
Use the following graphs as a reference to select sensor measuring range.

P2: Nozzle internal pressure

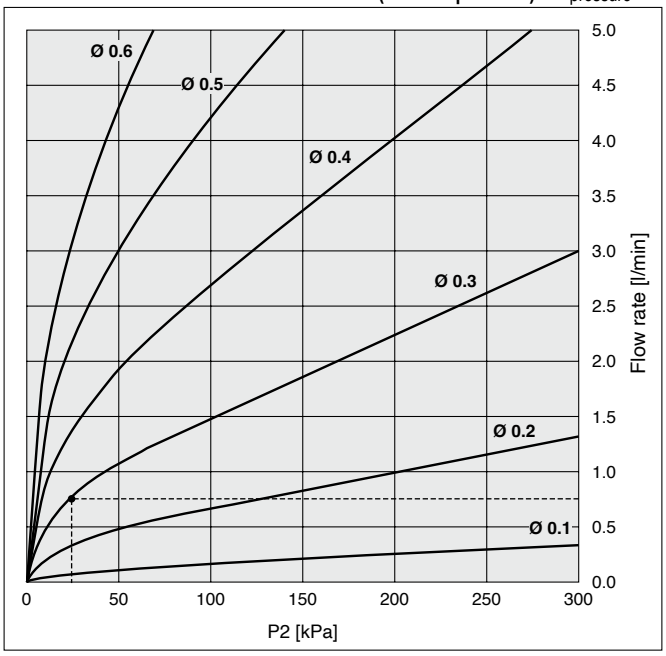


P1: Atmospheric pressure

**Nozzle Diameter – Flow Rate Characteristics (Vacuum)**




**Nozzle Diameter – Flow Rate Characteristics (Positive pressure)**

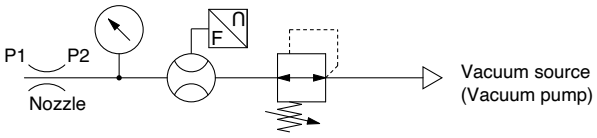



### Example (Vacuum)

Selecting conditions:

Nozzle diameter: Ø 0.3 P1: 0 [kPa]
P2: -60 [kPa]

The flow rate will be 0.7 to 0.8 [l/min] based on the graph.
→ Select the PFMV510-1.

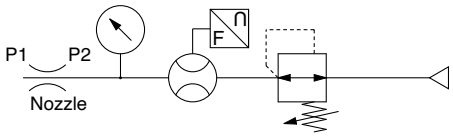



### Example (Positive pressure)

Selecting conditions:

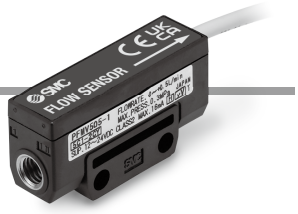
Nozzle diameter: Ø 0.3 P1: 0 [kPa]
P2: 20 [kPa]

The flow rate will be 0.7 to 0.8 [l/min] based on the graph.
→ Select the PFMV510-1.




* Since the calculated value may not meet the approximate value due to leakage and pressure loss in the piping system, please check the result by using actual equipment.

# Flow Sensor
# *PFMV5* Series



## How to Order

**Measurement flow range (l/min)**

| | |
|---|---|
| 0.0 to 0.1 | PFMV505 −1−□□−X502 |
| 0.0 to 0.5 | |
| 0.0 to 1.0 | |
| 0.0 to 3.0 | PFMV5□□−1−□□ |
| -0.5 to 0.5 | |
| -1.0 to 1.0 | |
| -3.0 to 3.0 | |

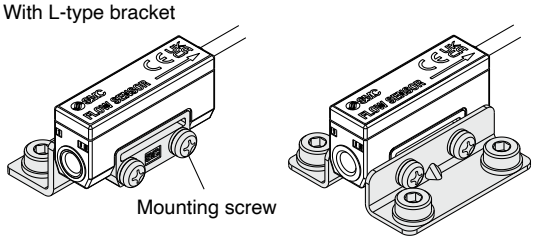
**Measurement flow range**

| | |
|---|---|
| 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 specifications**

| | |
|---|---|
| 1 | Analogue output (1 to 5 V) |

**Option (Shipped together)**

| | |
|---|---|
| — | None |
| A | With L-type bracket   |

∗ 2 L-type brackets (with 2 mounting screws) are included.

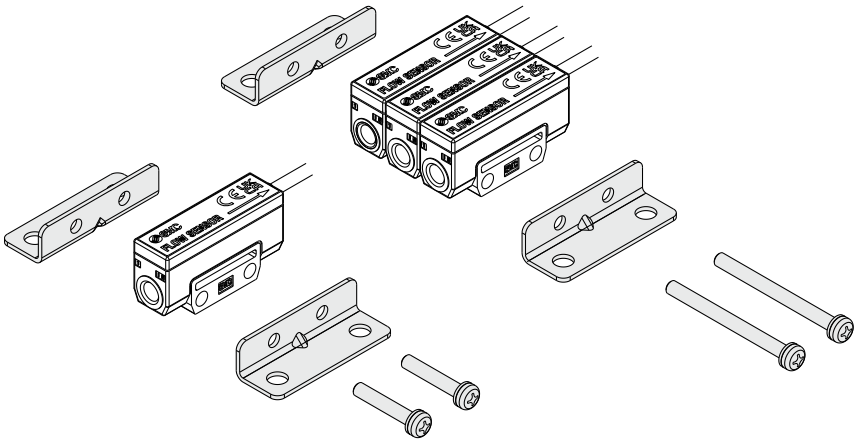
**Operation manual**

| | |
|---|---|
| — | With operation manual (Japanese and English) |
| N | None |

## Option/Part Nos.

If a single option or manifold mounting are required, order sensors with the part numbers below separately.

| Part no. | Stations | Note |
|---|---|---|
| **ZS-36-A1** | For 1 station (for single unit) | 2 L-type brackets, 2 mounting screws M3 x 15L |
| **ZS-36-A2** | For 2 stations | 2 L-type brackets, 2 mounting screws M3 x 25L |
| **ZS-36-A3** | For 3 stations | 2 L-type brackets, 2 mounting screws M3 x 35L |
| **ZS-36-A4** | For 4 stations | 2 L-type brackets, 2 mounting screws M3 x 45L |
| **ZS-36-A5** | For 5 stations | 2 L-type brackets, 2 mounting screws M3 x 55L |



## Specifications

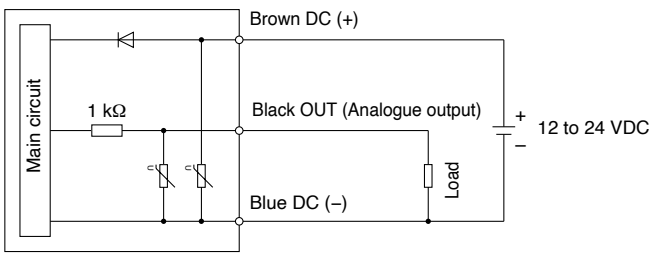
**For flow switch precautions and specific product precautions, refer to the "Operation Manual" on the SMC website.**

| Model | | PFMV505-X502 | PFMV505 | PFMV510 | PFMV530 | PFMV505F | PFMV510F | PFMV530F |
|---|---|---|---|---|---|---|---|---|
| **Applicable fluid** | | Dry air, $N_2$ | | | | | | |
| | | (JIS B 8392-1 1.1.2 to 1.6.2: 2003, ISO 8573-1 1.1.2 to 1.6.2) | | | | | | |
| **Rated flow range (Flow rate range)** *1 | | 0 to 0.1 l/min | 0 to 0.5 l/min | 0 to 1 l/min | 0 to 3 l/min | -0.5 to 0.5 l/min*2 | -1 to 1 l/min*2 | -3 to 3 l/min*2 |
| **Accuracy** | | ±5 % F.S.*3 | | | | | | |
| **Repeatability** | | ±2 F.S.*3 | | | | | | |
| **Pressure characteristics (0 kPa reference*4)** | | ±2 % F.S. (0 to 300 kPa)<br>±5 % F.S. (-70 to 0 kPa) | | | | | | |
| **Temperature characteristics (25 °C reference)** | | ±2 % F.S. (15 to 35 °C)<br>±5 % F.S. (0 to 50 °C) | | | | | | |
| **Rated pressure range*5** | | -70 kPa to 300 kPa | | | | | | |
| **Operating pressure range*6** | | -100 kPa to 400 kPa | | | | | | |
| **Proof pressure** | | 500 kPa | | | | | | |
| **Analogue output (Non-linear output)** | | Voltage output: 1 to 5 V, Output impedance: Approx. 1 kΩ | | | | | | |
| **Response time** | | 5 ms or less (90 % response) | | | | | | |
| **Power supply voltage** | | 12 to 24 VDC ± 10 % (With polarity protection) | | | | | | |
| **Current consumption** | | 16 mA or less | | | | | | |
| **Environment** | **Enclosure** | IP40 | | | | | | |
| | **Fluid temperature** | 0 to 50 °C (No freezing and condensation) | | | | | | |
| | **Operating temperature range** | 0 to 50 °C (No freezing and condensation) | | | | | | |
| | **Stored temperature range** | -10 to 60 °C (No freezing and condensation) | | | | | | |
| | **Operating humidity range** | 35 to 85 % R.H. (No condensation) | | | | | | |
| | **Stored humidity range** | 35 to 85 % R.H. (No condensation) | | | | | | |
| | **Withstand voltage** | 1000 VAC for 1 minute between terminals and housing | | | | | | |
| | **Insulation resistance** | 50 MΩ or more (500 VDC measured via megohmmeter) between terminals and housing | | | | | | |
| | **Port size** | M5 x 0.8 (Tightening torque: Approx. 0.5 to 1.0 N·m) | | | | | | |
| | **Wetted parts material** | PPS, Si, Au, Stainless steel 316, C3604 (Electroless nickel plating) | | | | | | |
| **Standards** | | CE/UKCA marking, UL (CSA) | | | | | | |
| **Lead wire** | | Vinyl cabtire cord, 3 cores Ø 2.6, 0.15 mm², 2 m | | | | | | |
| **Weight** | | 10 g (Excluding lead wire) | | | | | | |

*1 The flow rate given in the specifications is the value under standard conditions.
*2 Analogue output indicates 3 V when the flow rate is 0. When the flow direction is from IN to OUT, the output is changed to 5 V, and when it's from OUT to IN, the output is changed to 1 V.
*3 The unit % F.S. is based on the full scale of analogue 4 V (1-5 V).
*4 0 kPa indicates the atmospheric release.
*5 Pressure range that satisfies the product specifications
*6 Applicable pressure range
* For wiring, refer to the "Operation Manual" on the SMC website, https://www.smc.eu
* Products with tiny scratches, marks, or display colour or brightness variations which do not affect the performance of the product are verified as conforming products.

## Internal Circuits and Wiring Examples

**-1**
**Analogue voltage output**

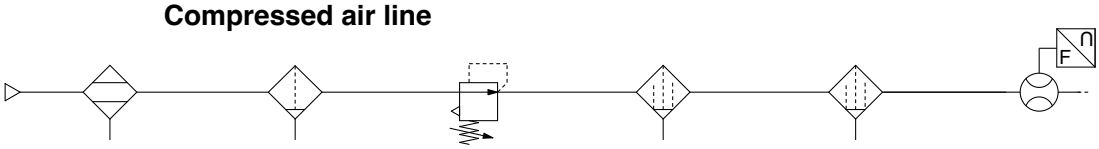



### Lead Wire Specifications

| | | |
|---|---|---|
| **Conductor** | **Nominal cross section area** | AWG26 |
| | **External diameter** | 0.58 mm |
| **Insulator** | **External diameter** | 0.88 mm |
| | **Colours** | Brown, Blue, Black |
| **Sheath** | **Material** | Oil-resistant/Heat-resistant PVC |
| **Finished external diameter** | | 2.6 |

## Recommended Pneumatic Circuits

**Compressed air line**




| Dryer | Air filter | Regulator | Mist separator | Micro mist separator | Flow sensor |
|---|---|---|---|---|---|
| **IDFA**<br>**IDH** | **AF** | **AR**<br>**IR** | **AFM**<br>**AM** | **AFD**<br>**AMD** | **PFMV** |

## Recommended Fittings

**One-touch Fitting/KQ2 Series**

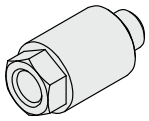
| Type | Tubing O.D. [mm] | Port size | Model |
|---|---|---|---|
| Male connector | 4 | M5 x 0.8 | KQ2H04-M5A |
| Male elbow | | | KQ2L04-M5A |

**Miniature Fitting/M Series**

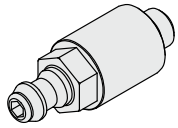
| Type | Tubing O.D. [mm] | Port size | Model |
|---|---|---|---|
| Barb fitting for nylon tube | 4 | M5 x 0.8 | M-5AN-4 |
| | 6 | | M-5AN-6 |

## Compact Suction Filter p. 12

| Part no. | Connection type |
|---|---|
| **ZFC050-M5X68** | IN/OUT: M5 |
| **ZFC050-AU6X68** | IN: Ø 6 barb fitting OUT: M5 |
| **ZFC-EL013-A** | Element (10 pcs.) |

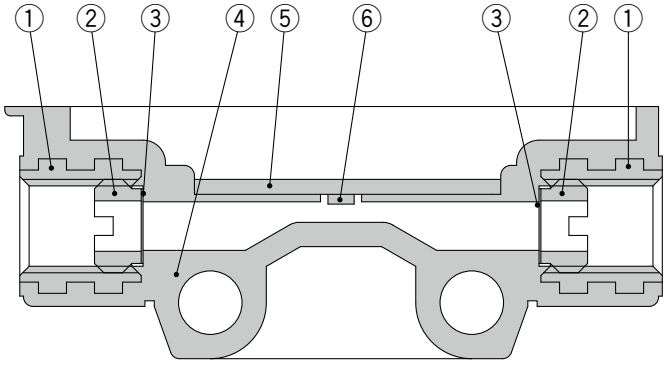


**ZFC050-M5X68**



**ZFC050-AU6X68**

## Wetted Parts Construction

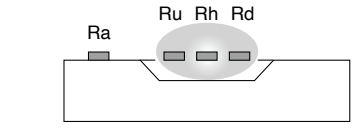



**Component Parts**

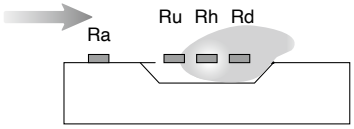
| No. | Description | Material |
|---|---|---|
| **1** | **Fitting for piping** | C3604 (Electroless nickel plating) |
| **2** | **Mesh holding screw** | |
| **3** | **Mesh** | Stainless steel 316 |
| **4** | **Body** | PPS |
| **5** | **Print circuit board** | GE4F |
| **6** | **Sensor chip** | Si, Au |

## Detection Principle

This MEMS sensor chip consists of upstream temperature measuring sensor (Ru) and downstream temperature measuring sensor (Rd), which are placed symmetrically from the centre of a platinum thin film coated heater (Rh) mounted on a membrane, and an ambient temperature sensor (Ra) for measuring gas temperature.
The principle is shown as the diagram on the right. (a) When the gas is static, the temperature distribution of heated gas centred around Rh is uniform, and Ru and Rd have the same resistance. (b) When the gas flows from the left side, it upsets the balance of the temperature distribution of heated gas, and the resistance of Rd becomes greater than that of Ru.
The difference in resistance between Ru and Rd is proportional to the flow velocity, so measurement and analysis of the resistance can show the flow direction and velocity of the gas.
Ra is used to compensate the gas and/or ambient temperature.



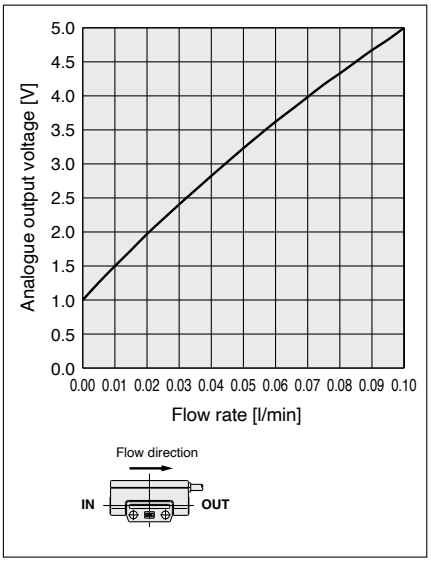

(a) The gas is static.



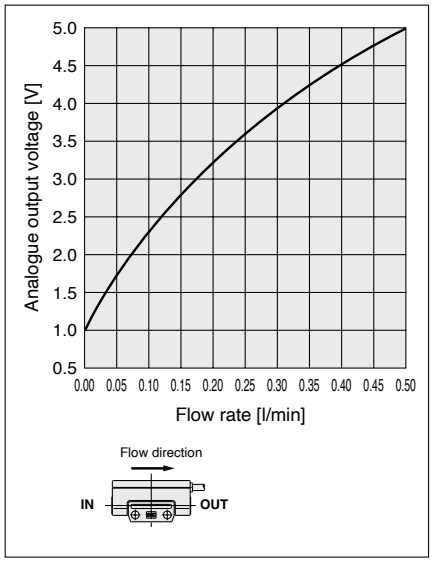

(b) The gas flows from the left side.

## Analogue Output (Non-linear output)

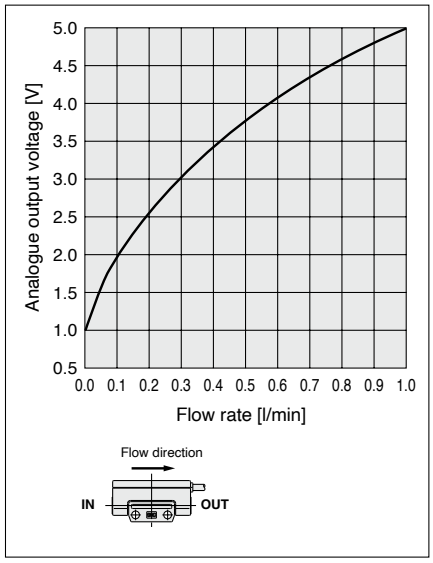
### PFMV505-1-X502



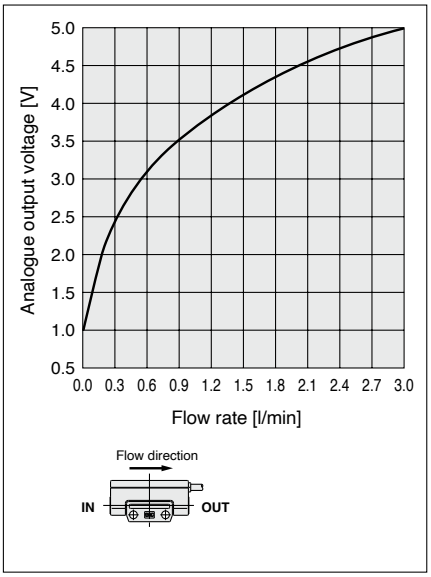

### PFMV505-1



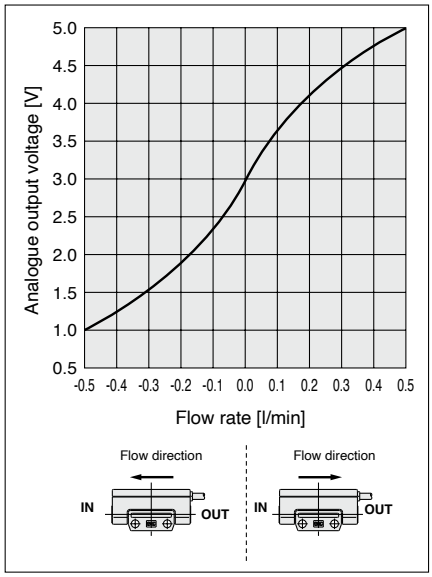

### PFMV510-1



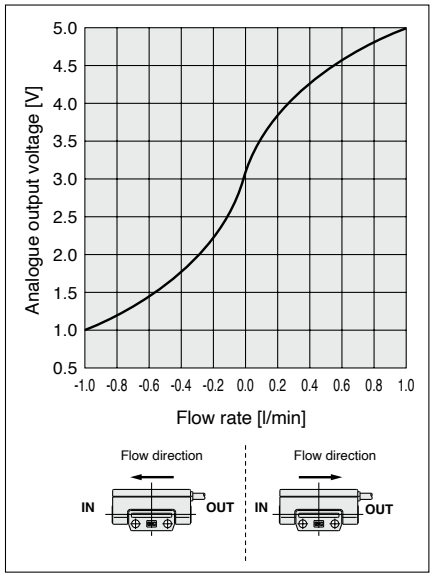

### PFMV530-1



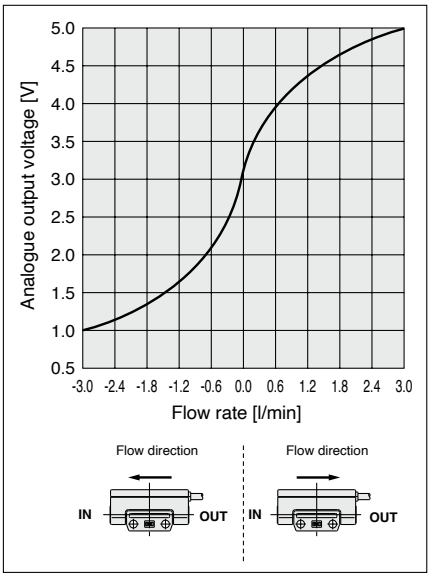

### PFMV505F-1




### PFMV510F-1



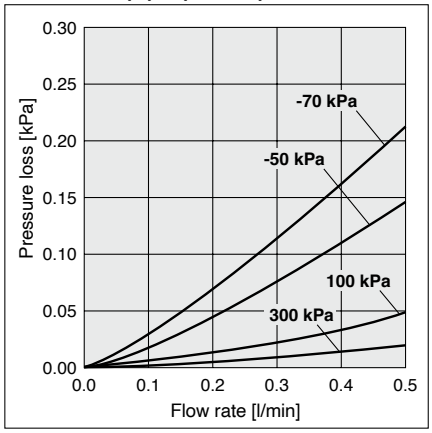

### PFMV530F-1



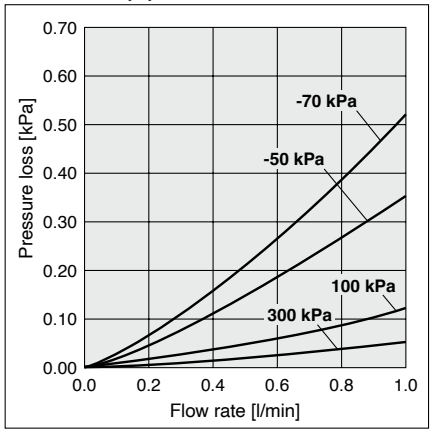

* Use these graphs as a reference for calculating the flow rate value.
* Due to slight differences between individual products, the values may not match the values shown in the graphs. Confirm with the actual product before use.

## Pressure Loss (Reference Data)

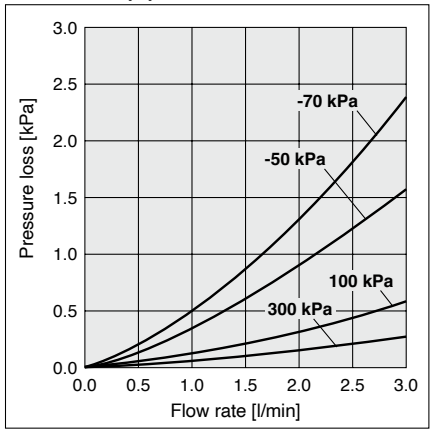
**PFMV505(F)-1(-X502)**




**PFMV510(F)-1**

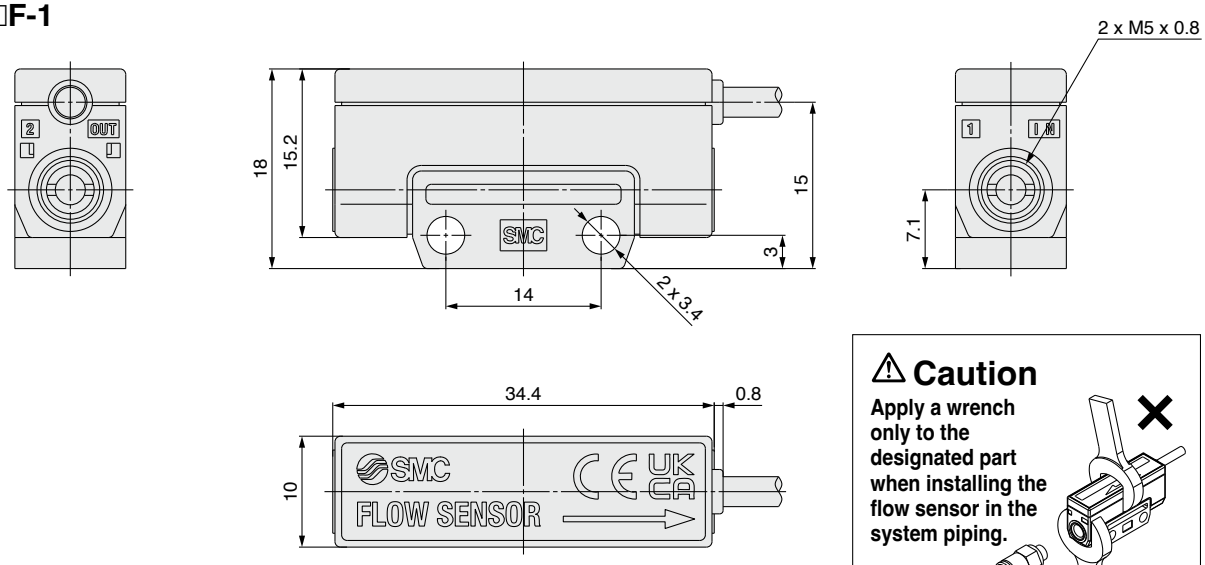



**PFMV530(F)-1**



## Dimensions

**PFMV5□□-1**
**PFMV5□□F-1**



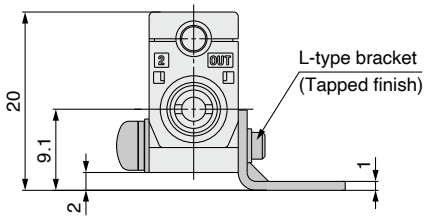

**⚠ Caution**

**Apply a wrench only to the designated part when installing the flow sensor in the system piping.**

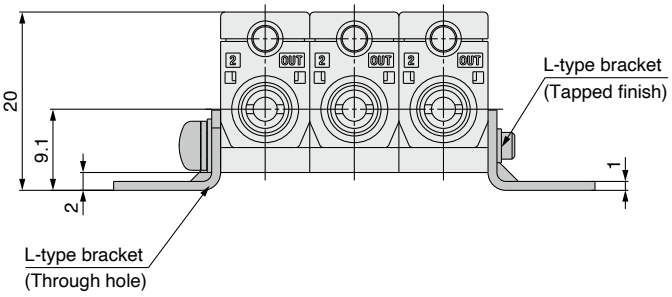


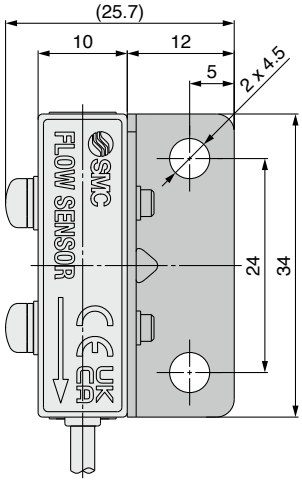
After tightening by hand, use a tightening tool to tighten an additional 1/4 turn.(Approx. 0.5 to 1.0 N·m)

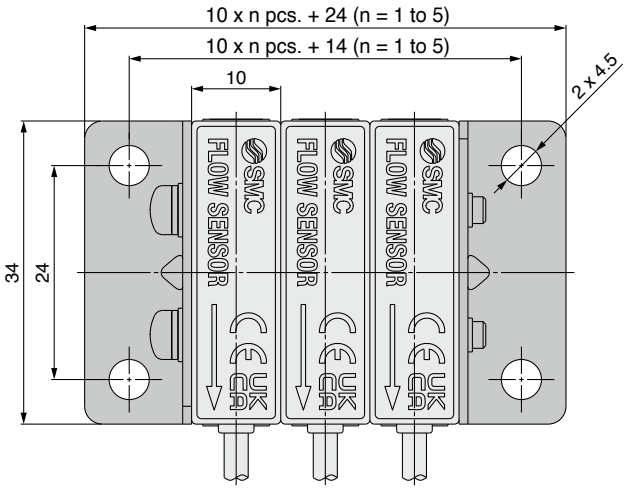
### One-side bracket




### Both-side bracket



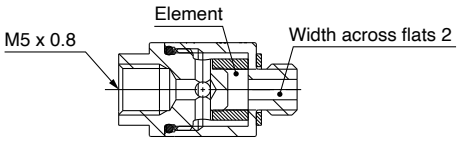




The dimensions show the PFMV5□□-1. The PFMV5□□F-1 has the same dimensions

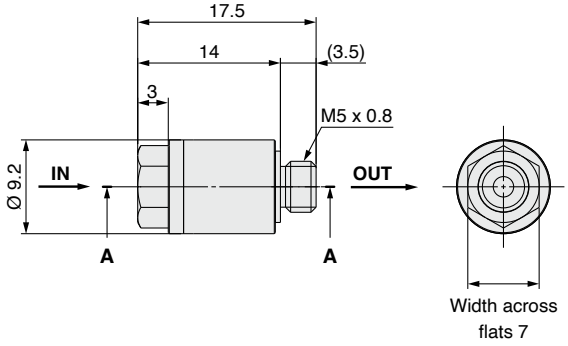
# *ZFC050*
# Related Equipment

## Compact Suction Filter

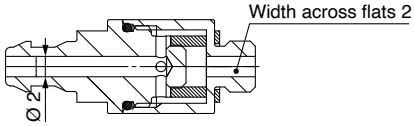
### ZFC050-M5X68



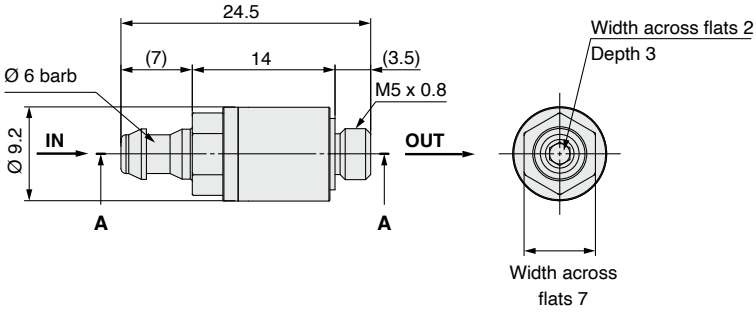

**Section diagram A-A**



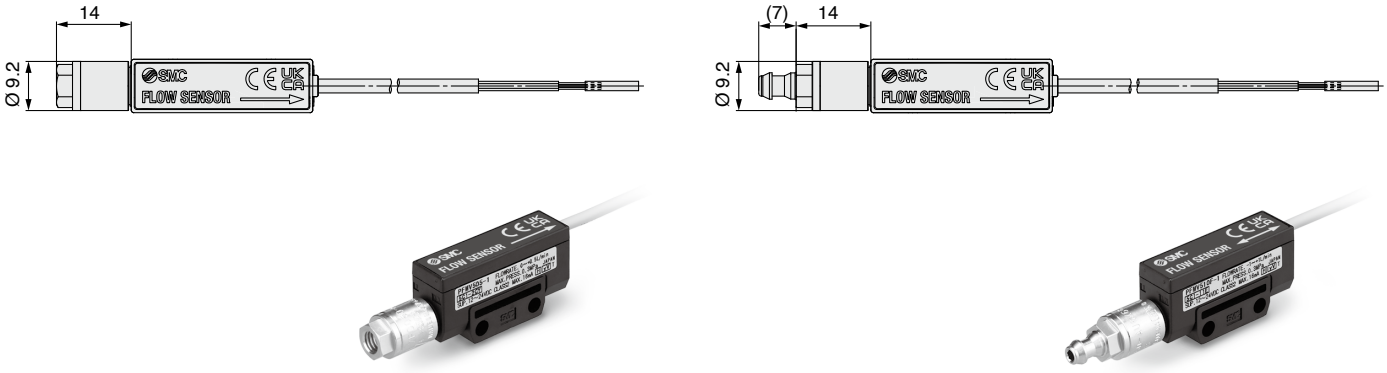

### ZFC050-AU6X68




**Section diagram A-A**




### Example of mounting to the flow sensor PFMV series (For suction verification)




### Specifications

| | |
|---|---|
| **Filtration degree** | 3 □m (Nominal) |
| **Fluid** | Air |
| **Operating pressure range** | -100 to 600 kPa |
| **Ambient temperature** | 0 to 60 °C (No freezing) |
| **Applicable tubing material** | Soft nylon, Polyurethane |
| **Applicable tubing O.D./I.D.** | Ø 6/Ø 4 |

**Replacement element part no.···ZFC-EL013-A**

## ⚠Caution

1. To screw in OUT side port (M5 male thread), tighten by hand before giving it an additional 1/4 turn with a tightening tool.
2. When replacing the element, remove the IN side body using the hexagon surface on the IN side, then replace the element. After replacing the element, tighten the IN side body with the tightening torque 0.5 to 0.7 N·m.
3. As a rule, replace the element when the pressure drops by 20 kPa.
4. The response time of the single flow sensor is 5 msec. However, take great care since the response may be delayed depending on the element clogged conditions.

3-Screen Display

# Digital Flow Monitor

# *PFGV301 Series*

## How to Order

**PFGV 3 0 1 – RT – M – L □ □ □**

**Type**

| | |
|---|---|
| **3** | Remote type monitor unit |

**Input specification**

| Symbol | Description | Applicable flow switch model |
|---|---|---|
| **0** | Voltage input | PFMV5 series |

**Output specification**

| | |
|---|---|
| **RT** | 2 outputs (NPN/PNP switching type) + Analogue voltage output*1, 2 |
| **SV** | 2 outputs (NPN/PNP switching type) + Analogue current output*2 |
| **XY** | 2 outputs (NPN/PNP switching type) + Copy function |

*1 Can switch between 1 to 5 V and 0 to 10 V
*2 Can be switched to external input or copy function

**Unit specification**

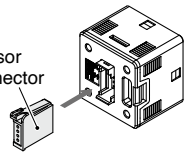
| | |
|---|---|
| **—** | Unit selection function |
| **M** | SI unit only*3 |

*3 Fixed units: Instantaneous flow: l/min
Accumulated flow: L

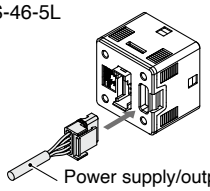
**Option 4**

| | Operation manual | Calibration certificate |
|---|---|---|
| **—** | ○ | — |
| **Y** | — | — |
| **K** | ○ | ○ |
| **T** | — | ○ |

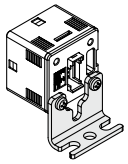
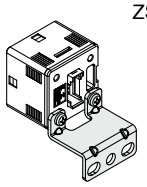
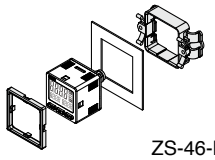
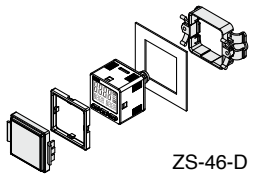
**Option 3**

| | |
|---|---|
| **—** | None |
| **C** | ZS-28-C<br>  |

**Option 1**

| Symbol | Description | |
|---|---|---|
| **—** | Without lead wire | |
| **L** | Power supply/output connection lead wire (Lead wire length: 2 m) | ZS-46-5L<br>  |

**Option 2**

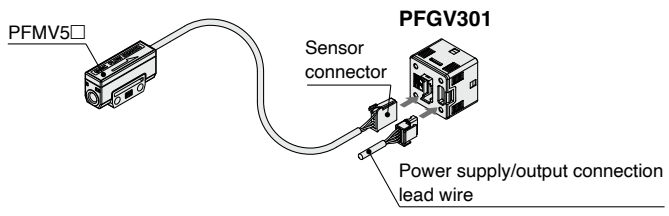
| Symbol | Description | |
|---|---|---|
| **—** | None | |
| **A1** | Bracket A (Vertical mounting) | ZS-46-A1<br>  |
| **A2** | Bracket B (Horizontal mounting) | ZS-46-A2<br>  |
| **B** | Panel mount adapter |  <br>ZS-46-B |
| **D** | Panel mount adapter + Front protection cover |  <br>ZS-46-D |

### Options/Part Nos.

When only optional parts are required, order with the part numbers listed below.

| Part no. | Option | Note |
|---|---|---|
| **ZS-28-C** | Sensor connector | For PFMV5□ |
| **ZS-46-A1** | Bracket A | Tapping screw: Nominal size 3 x 8 L (2 pcs.) |
| **ZS-46-A2** | Bracket B | Tapping screw: Nominal size 3 x 8 L (2 pcs.) |
| **ZS-46-B** | Panel mount adapter | |
| **ZS-46-D** | Panel mount adapter + Front protection cover | |
| **ZS-46-5L** | Power supply/output connection lead wire | 5-core, 2 m |
| **ZS-27-01** | Front protection cover | |
| **ZS-28-A-X538** | PFMV30□ → PFGV301 conversion cable | Made to Order (Refer to page 21.) |

### Connection Example



**For flow switch precautions and specific product precautions, refer to the "Operation Manual" on the SMC website.**

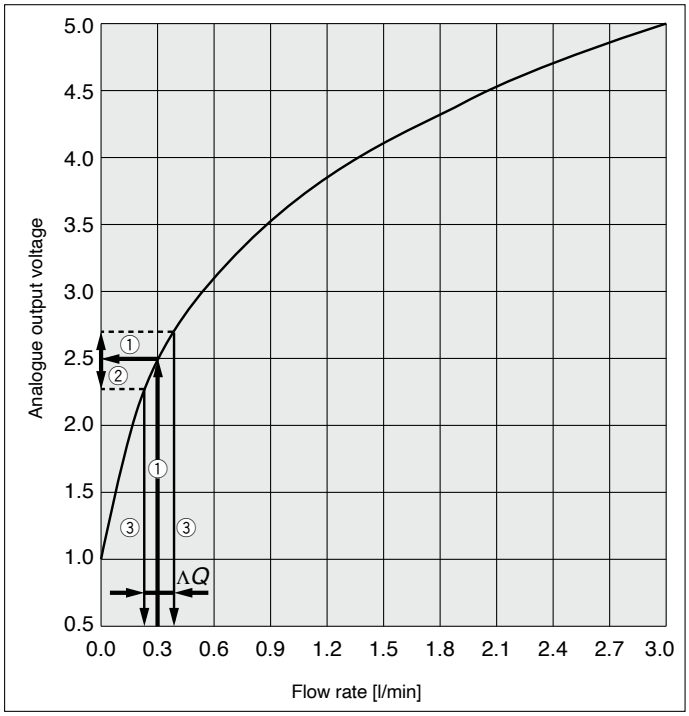
## Specifications

| Model | | | PFGV301 series | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Applicable flow sensor model | | | PFMV505-X502 | PFMV505 | PFMV510 | PFMV530 | PFMV505F | PFMV510F | PFMV530F |
| Voltage | Rated voltage range | | 1.00 to 5.00 V | | | | | | |
| | Set voltage range | | 0.80 to 5.20 V | | | | | | |
| | Smallest settable increment | | 0.01 V | | | | | | |
| Flow | Rated flow range*1 | | 0 to 0.1 l/min | 0 to 0.5 l/min | 0 to 1 l/min | 0 to 3 l/min | -0.5 to 0.5 l/min | -1 to 1 l/min | -3 to 3 l/min |
| | Set point range | | -0.005 to 0.105 l/min | -0.025 to 0.525 l/min | -0.05 to 1.05 l/min | -0.15 to 3.15 l/min | -0.525 to 0.525 l/min | -1.05 to 1.05 l/min | -3.15 to 3.15 l/min |
| | Smallest settable increment | | 0.001 l/min | | 0.01 l/min | | 0.001 l/min | 0.01 l/min | |
| Electrical | Power supply voltage | | 12 to 24 VDC ±10 % or less | | | | | | |
| | Current consumption | | 25 mA or less | | | | | | |
| | Protection | | Polarity protection | | | | | | |
| Accuracy*2 | Display accuracy | | ±0.5 % F.S. ± Min. display unit (Ambient temperature at 25 °C) | | | | | | |
| | Analogue output accuracy | | ±0.5 % F.S. (Ambient temperature at 25 °C) | | | | | | |
| | Repeatability | | ±0.1 % F.S. ± Min. display unit, Analogue output: 0.3 % F.S. or less | | | | | | |
| | Temperature characteristics | | ±0.5 % F.S. (Ambient temperature: 0 to 50 °C, 25 °C standard) | | | | | | |
| Switch output | Output type | | Select from NPN or PNP open collector output. | | | | | | |
| | Output mode | | Select from Hysteresis, Window comparator, Error output, or Switch output OFF modes. | | | | | | |
| | Switch operation | | Select from Normal or Reversed output. | | | | | | |
| | Max. load current | | 80 mA | | | | | | |
| | Max. applied voltage | | 30 V (NPN output) | | | | | | |
| | Internal voltage drop | | NPN output: 1 V or less (at load current of 80 mA), PNP output: 1.5 V or less (at load current of 80 mA) | | | | | | |
| | Response time*3 | | 3 ms or less | | | | | | |
| | Delay time*3 | | Select from 0, 0.05 to 0.10 s (increments of 0.01 s), 0.1 to 1.0 s (increments of 0.1 s), 1 to 10 s (increments of 1 s), 20 s, 30 s, 40 s, 50 s, or 60 s. | | | | | | |
| | Hysteresis*4 | | Variable from 0 | | | | | | |
| | Protection | | Short circuit protection | | | | | | |
| Analogue output*5 | Output type | | Voltage output: 1 to 5 V (0 to 10 V can be selected only when the power supply voltage is 24 VDC)*6, Current output: 4 to 20 mA | | | | | | |
| | Impedance | Voltage output | Output impedance: 1 kΩ | | | | | | |
| | | Current output | Max. load impedance: 300 Ω (at power supply voltage of 12 VDC), 600 Ω (at power supply voltage of 24 VDC) | | | | | | |
| | Response time*2 | | 50 ms or less | | | | | | |
| External input*7 | Peak/Bottom value reset | Input type | Input voltage: 0.4 V or less (Reed or Solid state) for 30 ms or longer | | | | | | |
| | | Input mode | Peak/Bottom value reset | | | | | | |
| | Auto-shift input | Input type | Input voltage: 0.4 V or less (Reed or Solid state) for 5 ms or longer | | | | | | |
| | | Input mode | Select from Auto-shift or Auto-shift zero. | | | | | | |
| Sensor input | Input type | | Voltage input: 1 to 5 VDC (Input impedance: 1 MΩ) | | | | | | |
| | Connection method | | Connector (e-CON) | | | | | | |
| | Protection | | Over voltage protection (Up to 26.4 VDC) | | | | | | |
| Display | Display mode | | Instantaneous flow display | | | | | | |
| | Unit*8 | | l/min, cfm (ft³/h) | | | | | | |
| | Display range | Voltage | 0.80 to 5.20 V | | | | | | |
| | | Flow | -0.005 to 0.105 l/min | -0.025 to 0.525 l/min | -0.05 to 1.05 l/min | -0.15 to 3.15 l/min | -0.525 to 0.525 l/min | -1.05 to 1.05 l/min | -3.15 to 3.15 l/min |
| | Min. display unit | Voltage | 0.01 V | | | | | | |
| | | Flow | 0.001 l/min | | 0.01 l/min | | 0.001 l/min | 0.01 l/min | |
| | Display type | | LCD | | | | | | |
| | Number of displays | | 3-screen display (Main screen, Sub screen) | | | | | | |
| | Display colour | | 1) Main screen: Red/Green, 2) Sub screen: Orange | | | | | | |
| | Number of display digits | | 1) Main screen: 5 digits (7 segments), 2) Sub screen: 9 digits (7 segments) | | | | | | |
| | Indicator LED | | LED ON when switch output is ON. OUT1/2: Orange | | | | | | |
| Digital filter*9 | | | Select from 0, 0.05 to 0.10 s (increments of 0.01 s), 0.1 to 1.0 s (increments of 0.1 s), 1 to 10 s (increments of 1 s), 20 s, or 30 s. | | | | | | |
| Environmental resistance | Enclosure | | IP40 | | | | | | |
| | Withstand voltage | | 1000 VAC for 1 min between terminals and housing | | | | | | |
| | Insulation resistance | | 50 MΩ or more (500 VDC measured via megohmmeter) between terminals and housing | | | | | | |
| | Operating temperature range | | Operating: 0 to 50 °C, Stored: -10 to 60 °C (No condensation or freezing) | | | | | | |
| | Operating humidity range | | Operating/Stored: 35 to 85 % RH (No condensation or freezing) | | | | | | |
| Standards | | | CE/UKCA marking | | | | | | |
| Weight | Body | | 25 g (Excluding the power supply/output connection lead wire) | | | | | | |
| | Lead wire with connector | | +39 g | | | | | | |

*1 Rated flow range of the applicable flow sensor. The flow rate stated in the specifications is for under normal conditions (20 °C, 101.3 kPa (absolute pressure), 65 % R.H.).
*2 The accuracy is with respect to the voltage display. When the flow rate display function is selected, the display accuracy and repeatability should be exactly like the graph on page 15.
*3 Value without digital filter (at 0 ms)
*4 If the flow fluctuates around the set value, be sure to keep a sufficient margin. Otherwise, chattering will occur.
*5 Setting is only possible for models with analogue output.
*6 When selecting 0 to 10 V, refer to the analogue output graph for the allowable load current.
*7 Setting is only possible for models with external input.
*8 Setting is only possible for models with the unit selection function.
*9 The response time indicates when the set value is 90 % in relation to the step input.
* Products with tiny scratches, marks, or display colour or brightness variations which do not affect the performance of the product are verified as conforming products.

## Display Accuracy and Repeatability when Combined with PFMV5. (Calculation Example)

**PFMV530-1**




**When the flow rate display function for the PFGV301 series is selected, calculate the repeatability from the analogue output characteristics graph (page 9).**

**Example) For PFMV530-1 (0 to 0.3 l/min)**

① When the actual flow rate is 0.3 l/min, the PFMV530-1 outputs approximately 2.5 V of analogue voltage (Arrow ① in the graph on the left).

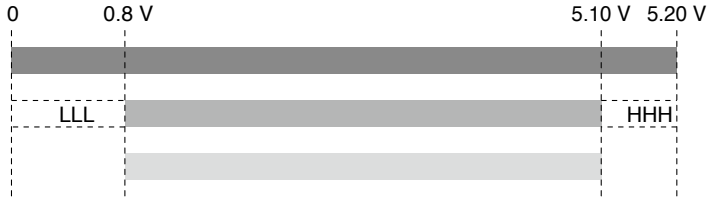
② The PFMV5 series has a repeatability of ±2 % F.S. (±80 mV) (Arrow ② in the graph on the left).

③ When this accuracy is converted to a flow rate, it becomes approximately ±3 % F.S. (±0.09 l/min), and this width becomes the repeatability when the flow rate is displayed (arrow ③, and the width of ΔQ, in the graph on the left).

The flow rate display accuracy can be also calculated from the PFMV5 series accuracy (±5 % F.S.).

## Settable Range and Voltage Input Range

The settable rate range is the range that can be set in the switch.
The inputtable range is the range that satisfies the switch specifications (accuracy, linearity, etc.).
It is possible to set a value outside of the inputtable range if it is within the settable range, however, the specification is not guaranteed.

| Item | Input voltage |
|---|---|
| Voltage input range<br>Display voltage range<br>Set voltage range |  |

The settable rate range is the flow range that can be set in the switch.
The rated flow range is the flow rate range that satisfies the switch specifications (accuracy, linearity, etc.).
It is possible to set a value outside of the rated flow range if it is within the settable range, however, the specification is not guaranteed.

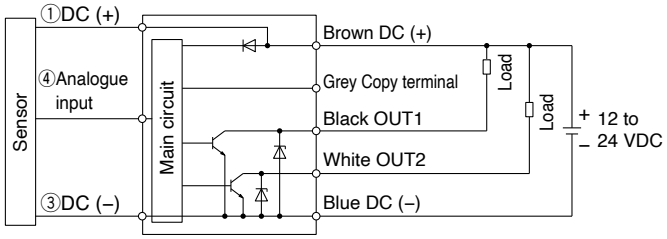
| Sensor | Flow rate range |
|---|---|
| | -3 l/min, -1 l/min, -0.5 l/min, 0, 0.1 l/min, 0.5 l/min, 1 l/min, 3 l/min |
| **PFMV505-X502** | 0 / 0.1 l/min<br>-0.005 l/min / 0.105 l/min<br>-0.005 l/min / 0.105 l/min |
| **PFMV505** | 0 / 0.5 l/min<br>-0.025 l/min / 0.525 l/min<br>-0.025 l/min / 0.525 l/min |
| **PFMV510** | 0 / 1 l/min<br>-0.05 l/min / 1.05 l/min<br>-0.05 l/min / 1.05 l/min |
| **PFMV530** | 0 / 3 l/min<br>-0.15 l/min / 3.15 l/min<br>-0.15 l/min / 3.15 l/min |
| **PFMV505F** | -0.5 l/min / 0.5 l/min<br>-0.525 l/min / 0.525 l/min<br>-0.525 l/min / 0.525 l/min |
| **PFMV510F** | -1 l/min / 1 l/min<br>-1.05 l/min / 1.05 l/min<br>-1.05 l/min / 1.05 l/min |
| **PFMV530F** | -3 l/min / 3 l/min<br>-3.15 l/min / 3.15 l/min<br>-3.15 l/min / 3.15 l/min |

The values shown on the graph are the displayed flow rate range and set flow rate range when PFMV5 series and PFGV301 series are connected.

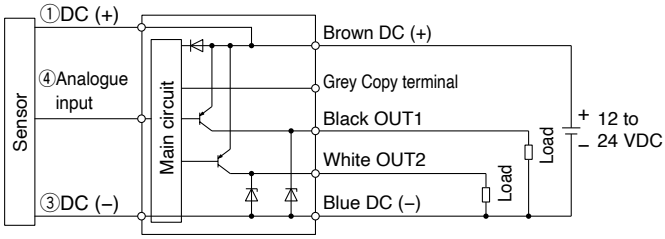
Rated flow range
Displayable flow range
Settable range

## Internal Circuits and Wiring Examples

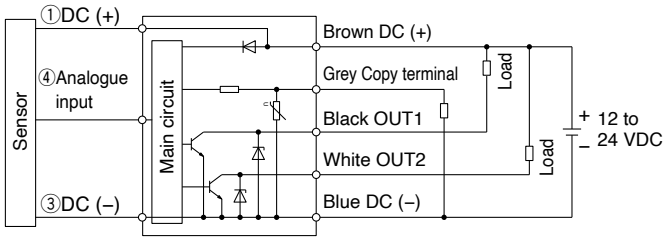
**-XY**
**-RT**
**-SV**
**NPN (2 outputs) + Copy function**



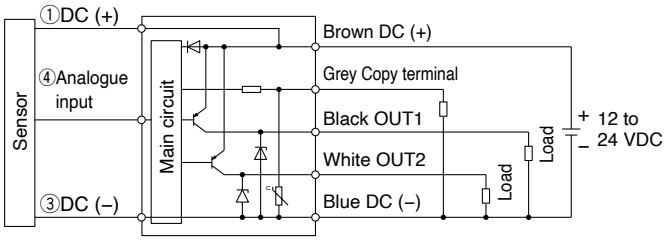

**-XY**
**-RT**
**-SV**
**PNP (2 outputs) + Copy function**



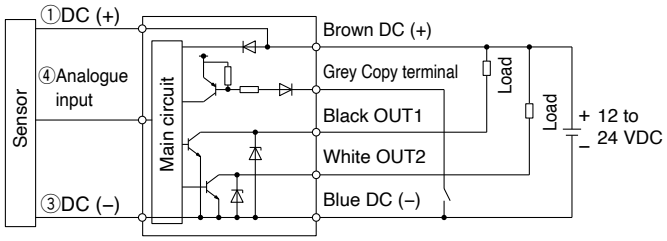

**-RT: NPN (2 outputs) + Analogue voltage output**
**-SV: NPN (2 outputs) + Analogue current output**



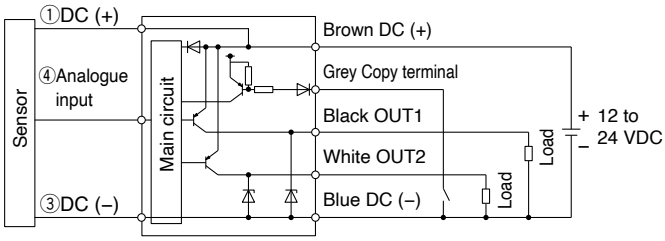

**-RT: PNP (2 outputs) + Analogue voltage output**
**-SV: PNP (2 outputs) + Analogue current output**



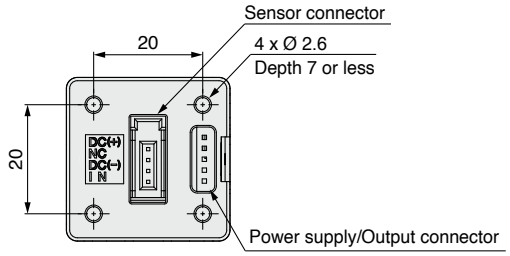

**-RT: NPN (2 outputs) + External input**
**-SV: NPN (2 outputs) + External input**

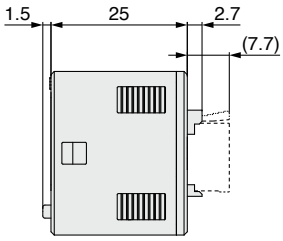


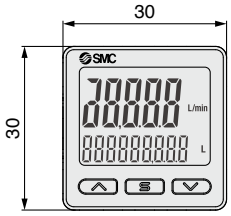

**-RT: PNP (2 outputs) + External input**
**-SV: PNP (2 outputs) + External input**



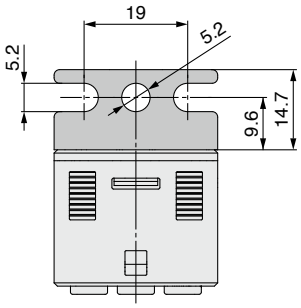
## Dimensions

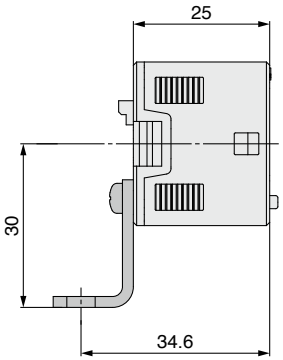


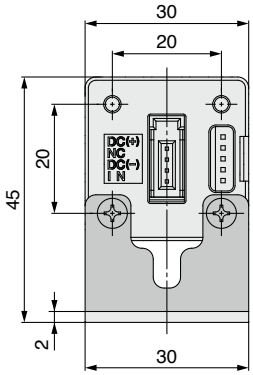



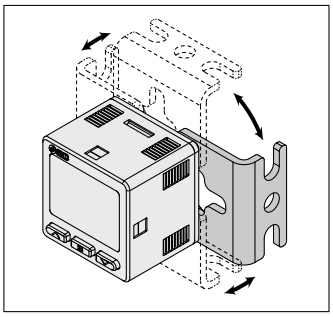




**Bracket A**
**(Part no.: ZS-46-A1)**



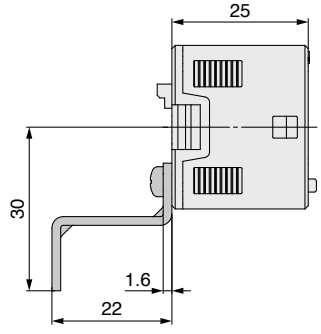



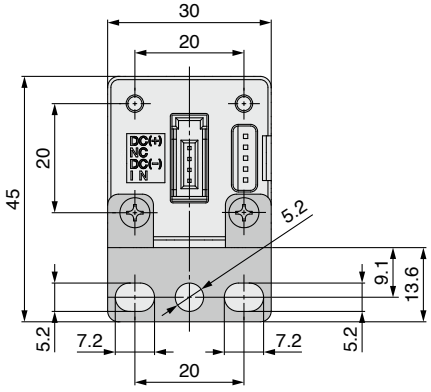



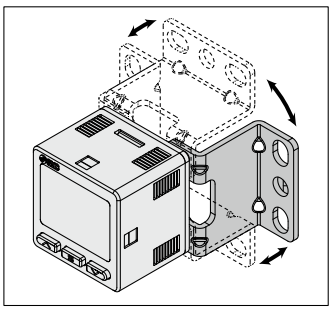



∗1 Bracket configuration allows for mounting in four orientations.

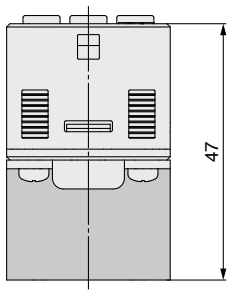
**Bracket B**
**(Part no.: ZS-46-A2)**



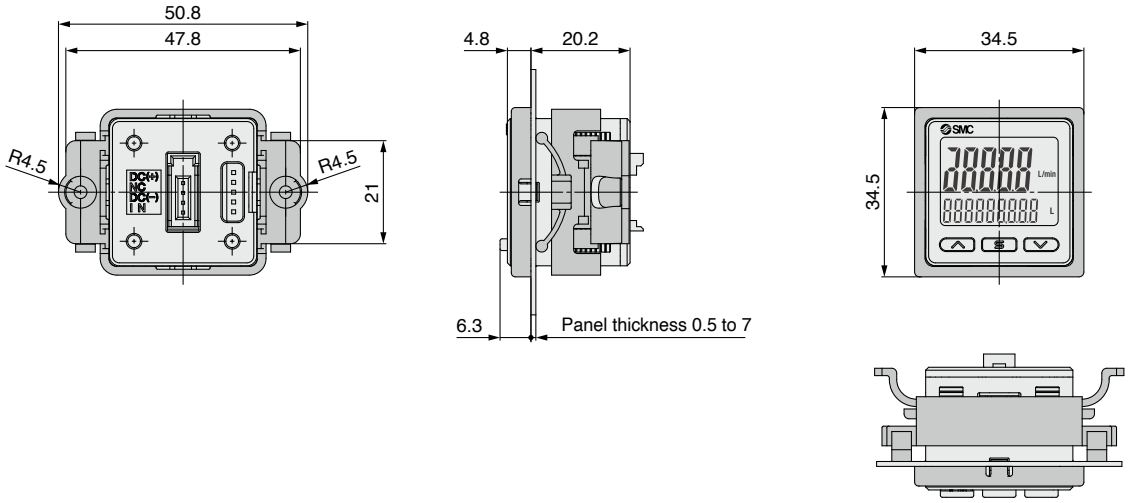



∗1 Bracket configuration allows for mounting in four orientations.

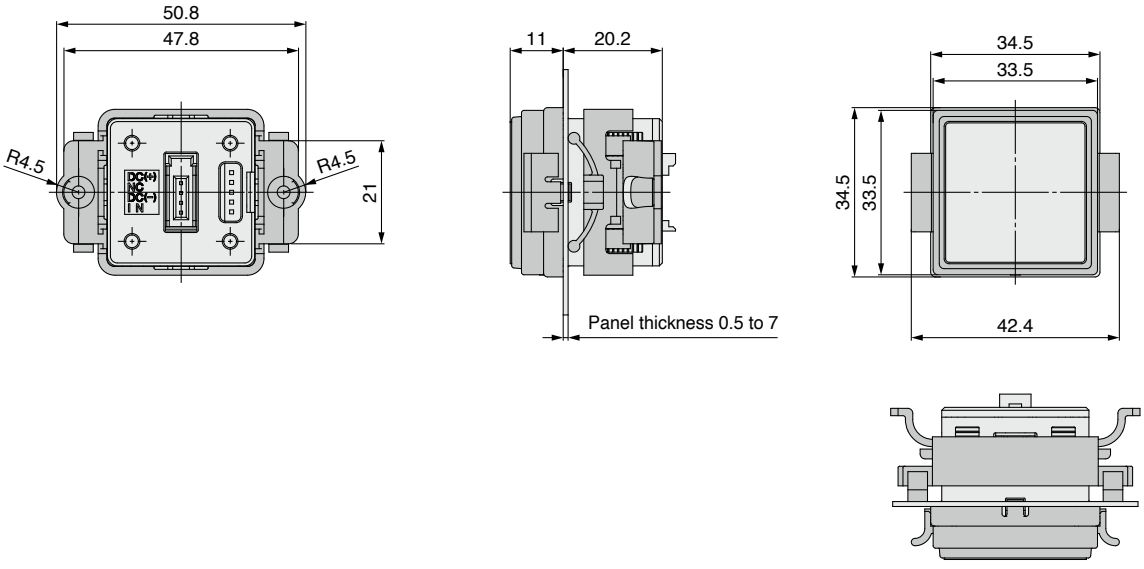


## Dimensions

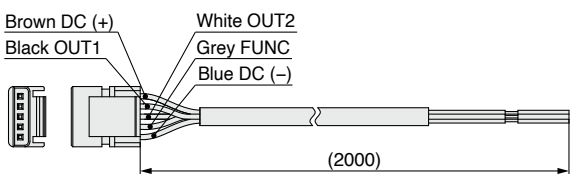
### Panel mount adapter
### (Part no.: ZS-46-B)




### Panel mount adapter + Front protection cover
### (Part no.: ZS-46-D)



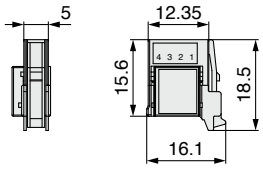

### Power supply/output connection lead wire
### (Part no.: ZS-46-5L)




### Sensor connector
### (Part no.: ZS-28-CA)

| Pin no. | Terminal |
|---|---|
| 1 | DC (+) |
| 2 | N.C. |
| 3 | DC (–) |
| 4 | IN∗1 |

∗1 1 to 5 V



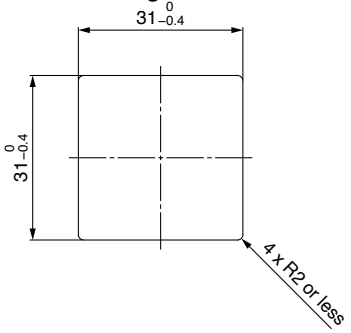

### Cable Specifications

| | | |
|---|---|---|
| **Conductor cross section** | | 0.15 mm² (AWG26) |
| **Insulator** | **Outside diameter** | 1.0 mm |
| | **Colour** | Brown, Blue, Black, White, Grey (5-core) |
| **Sheath** | **Finished outside diameter** | Ø 3.5 |

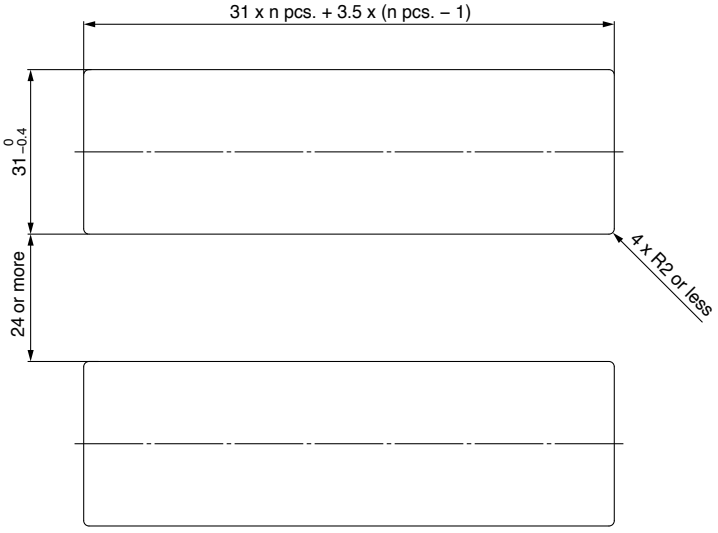
## Dimensions

### Panel fitting dimensions

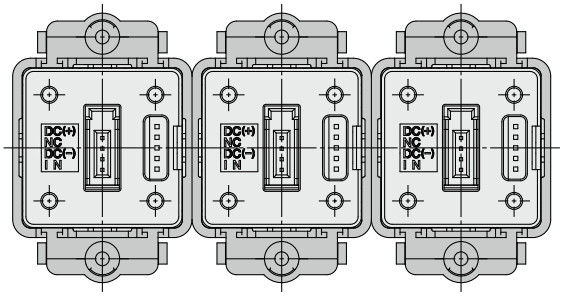
**Individual mounting**



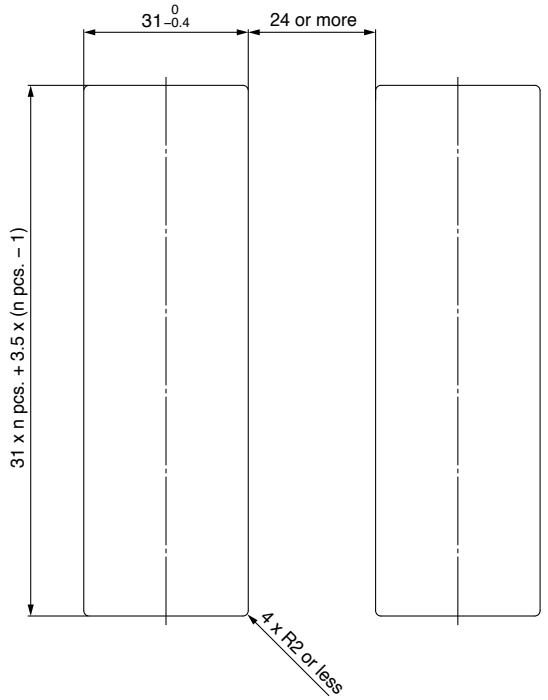

**Multiple (2 pcs. or more) secure mounting**
**<Horizontal>**



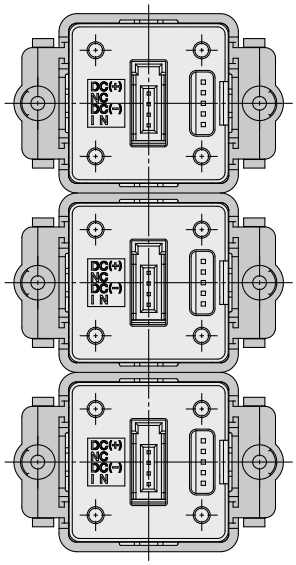

**Panel mount example**
**<Horizontal>**




**<Vertical>**




**Panel mount example**
**<Vertical>**



# *PFGV301 Series*
# Made to Order

Made to Order

**Please contact SMC for detailed dimensions, specifications, and delivery times.**

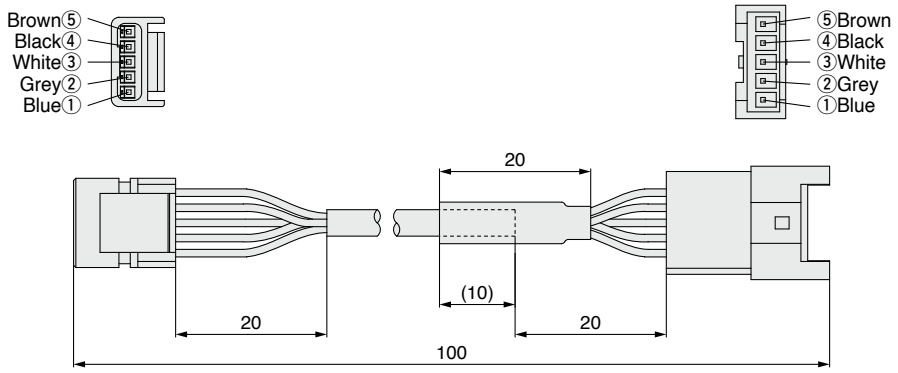
## 1 Conversion Cable for the PFMV30□ Lead Wire with Connector

The conversion cable allows for connection between the existing PFMV30□ lead wire with connector and the PFGV301.

**PFMV30□ → PFGV301 + Conversion Cable Correspondence Table**

| Existing flow monitor model | Output specification | ① Flow monitor part no. | ② Conversion cable part no. |
|---|---|---|---|
| **PFMV300-**□□□□-□□ | NPN 2 outputs + 1–5 V outputs | PFGV301-RT-□-□□□□ | ZS-28-A-X538 |
| **PFMV301-**□□□□-□□ | NPN 2 outputs + 4–20 mA output | PFGV301-SV-□-□□□□ | |
| **PFMV302-**□□□□-□□ | NPN 2 outputs + auto-shift input | PFGV301-XY-□-□□□□ | |
| **PFMV303-**□□□□-□□ | PNP 2 outputs + 1–5 V outputs | PFGV301-RT-□-□□□□ | |
| **PFMV304-**□□□□-□□ | PNP 2 outputs + 4–20 mA output | PFGV301-SV-□-□□□□ | |
| **PFMV305-**□□□□-□□ | PNP 2 outputs + auto-shift input | PFGV301-XY-□-□□□□ | |

### ZS-28-A-X538



## ⚠ 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.

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

1) 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.
etc.

## ⚠ 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 catalogue 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. Our products cannot be used beyond their specifications.**
**Our products are not developed, designed, and manufactured to be used under the following conditions or environments.**
**Use under such conditions or environments is not covered.**
1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
2. Use for nuclear power, railways, aviation, space equipment, ships, vehicles, military application, equipment affecting human life, body, and property, fuel equipment, entertainment equipment, emergency shut-off circuits, press clutches, brake circuits, safety equipment, etc., and use for applications that do not conform to standard specifications such as catalogues and operation manuals.
3. Use for interlock circuits, except for use with double interlock such as installing a mechanical protection function in case of failure. Please periodically inspect the product to confirm that the product is operating properly.

## ⚠ Caution

**We develop, design, and manufacture our products to be used for automatic control equipment, and provide them for peaceful use in manufacturing industries.**
**Use in non-manufacturing industries is not covered.**
Products we manufacture and sell cannot be used for the purpose of transactions or certification specified in the Measurement Act.
The new Measurement Act prohibits use of any unit other than SI units in Japan.

# 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, whichever is first. [2] 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 catalogue for the particular products.

2) 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

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited.
2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulations of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.

## SMC Corporation (Europe)

| | | | |
|---|---|---|---|
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| **Bulgaria** | +359 (0)2807670 | www.smc.bg | office@smc.bg |
| **Croatia** | +385 (0)13707288 | www.smc.hr | office@smc.hr |
| **Czech Republic** | +420 541424611 | www.smc.cz | office@smc.cz |
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