2-Color Display Digital Flow Switch

- Flow rate range: 10, 25, 50,100 ℓ/min.
- Minimum unit setting: 0.01 ℓ/min.
  (0.1 ℓ/min when the flow rate range is 25, 50, 100 ℓ/min.)
- Repeatability: ±1%F.S. or less
- Grease-free
- Flow adjustment valve is integrated.
  (Reduced piping and space saving)
- Response time:
  Either 50 msec., 0.5 sec., 1 sec.
  or 2 sec. can be chosen.

Fluid

Air, N_2, Ar, CO_2

2-color display

Irregular value at a glance

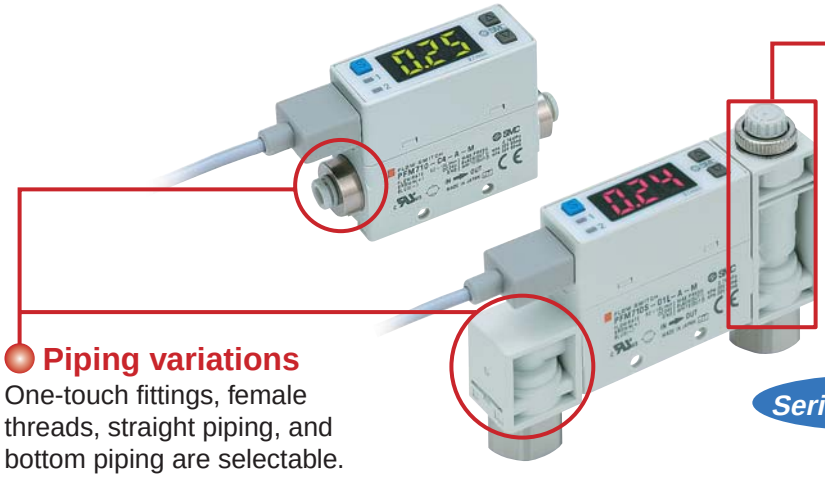
c UL us CE

Series PFM

SMC

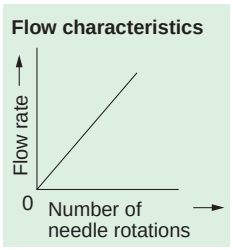
CAT.ES100-63B

2-Color Display Digital Flow Switch



Integrated flow adjustment valve

Reduces piping installation work and space requirements. Special design provides smooth adjustment to match needle rotations.



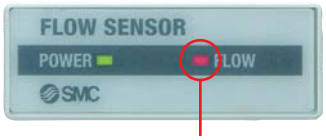
Piping variations

One-touch fittings, female threads, straight piping, and bottom piping are selectable.

Series PFM7

Indicator function

Flashing speed varies according to flow rate. Color changes from green to red when rated flow rate is exceeded. Can be used as a simple monitor.



Flashing

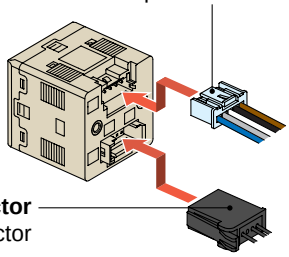
Flashing speed	Flow rate
Fast	High
Slow	Low

Series PFM5

Connectors

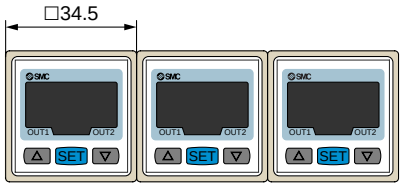
Connection and removal of wiring is easy.

Series PFM3

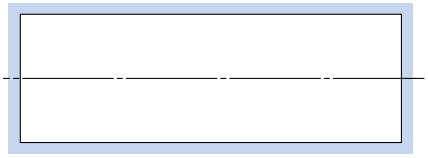


Support for vertical and horizontal secure mounting (panel mount)

A single panel opening is sufficient.
Reduces panel fitting work and enables space-savings.



Panel opening

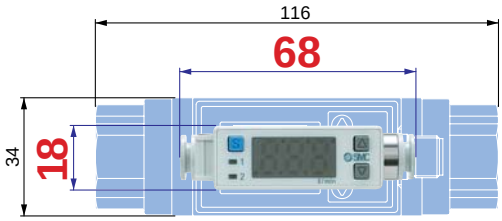


	Integrated type	Remote type	
			
Measurement flow range (ℓ/min)	Model	Model	
		Sensor unit	Display unit
0.2 to 10 (0.2 to 5)	PFM710	PFM510	PFM3□□
0.5 to 25 (0.5 to 12.5)	PFM725	PFM525	
1 to 50 (1 to 25)	PFM750	PFM550	
2 to 100 (2 to 50)	PFM711	PFM511	

( ): Fluid: CO_2

Compact

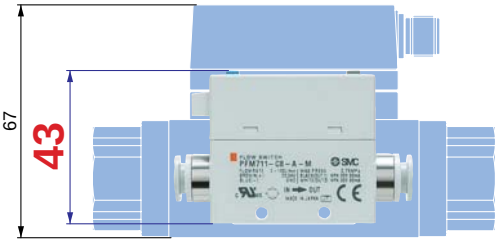
Same size even when the model with different flow rate range (10, 25, 50, 100 ℓ/min) is chosen.



Lightweight: 55 g (PFM711)

(With one-touch fitting, without flow adjustment valve)

Conventional model PF2A711: 290 g

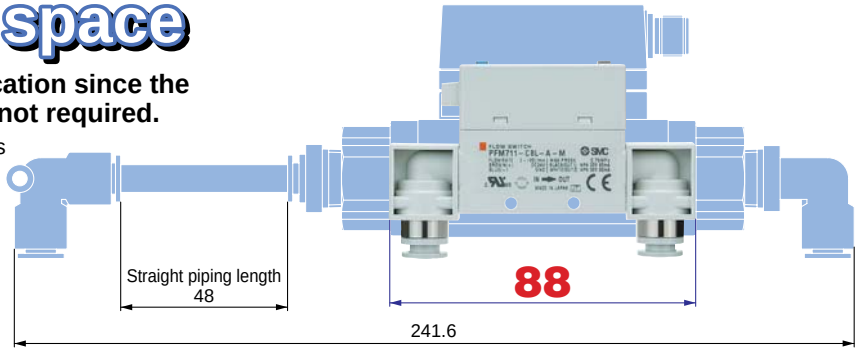


Comparison with the conventional model PF2A711 (10 to 100 ℓ/min)

Reduced piping space

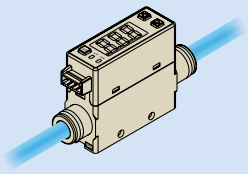
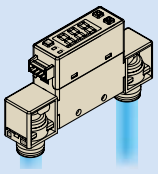
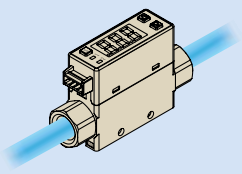
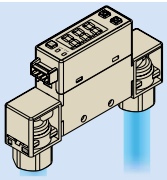
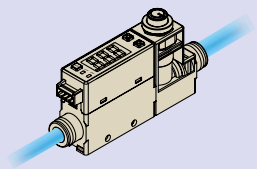
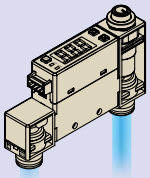
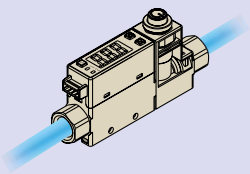
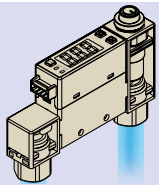
Mountable in a narrow location since the straight piping length* is not required.

* A straight piping length of 8 times the piping diameter is required for the conventional model.

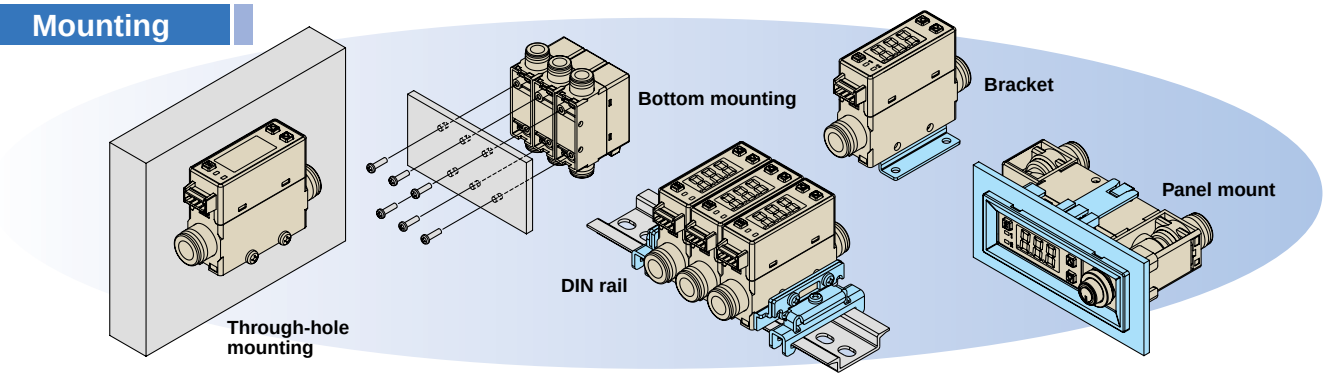


Comparison with the conventional model PF2A711 (10 to 100 ℓ/min) when ø6 one-touch fittings are attached.

Piping Variations

	One-touch fitting: ø4, ø6, ø8, ø1/4		Female thread: Rc 1/8, 1/4 • NPT 1/8, 1/4 • G 1/8, 1/4	
	Straight	Bottom	Straight	Bottom
Without flow adjustment				
With flow adjustment				

Mounting



Main Functions

Selection of fluid

Air, Nitrogen (N_2), Argon (Ar) or Carbon dioxide (CO_2) can be selected using the buttons.

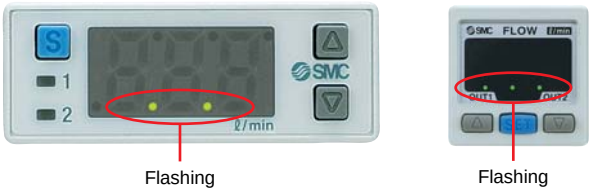
Secret code setting function

The user must input a secret code to cancel the keylock mode. This ensures that only authorized persons can operate the switch.

For details and other functions, refer to page 33.

Power-saving mode

Turning off the display can save power consumption.



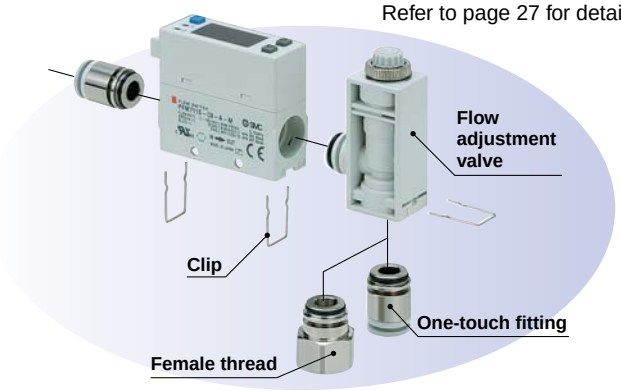
The decimal point indicators flash in power-saving mode.

Selection of indication unit	User can select between ANR and Nℓ/min for each fluid. [ANR] Indicates the flow rate converted to a volume under standard conditions: 20°C, 1 atm (atmosphere), 65%RH [Nℓ/min] Indicates the flow rate converted to a volume under normal conditions: 0°C, 1 atm (atmosphere).
External input	Can be selected from accumulated value external reset, auto-shift and auto-shift zero.
Indication resolution	Minimum unit setting can be selected from 1 ℓ/min, 0.1 ℓ/min and 0.01 ℓ/min. Depends on the model. Refer to the specifications (P. 33) for details.

Several Combinations

Depending on the installation conditions, it is possible to add or remove the **flow adjustment valve**, change the **fitting type** and the **piping direction** as desired.

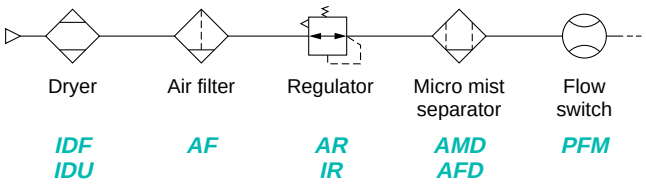
Refer to page 27 for details.



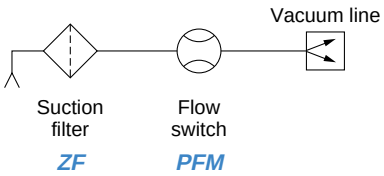
The accuracy may fluctuate by 2 to 3% just after replacement. (Repeatability does not change.)

Recommended Air Circuits

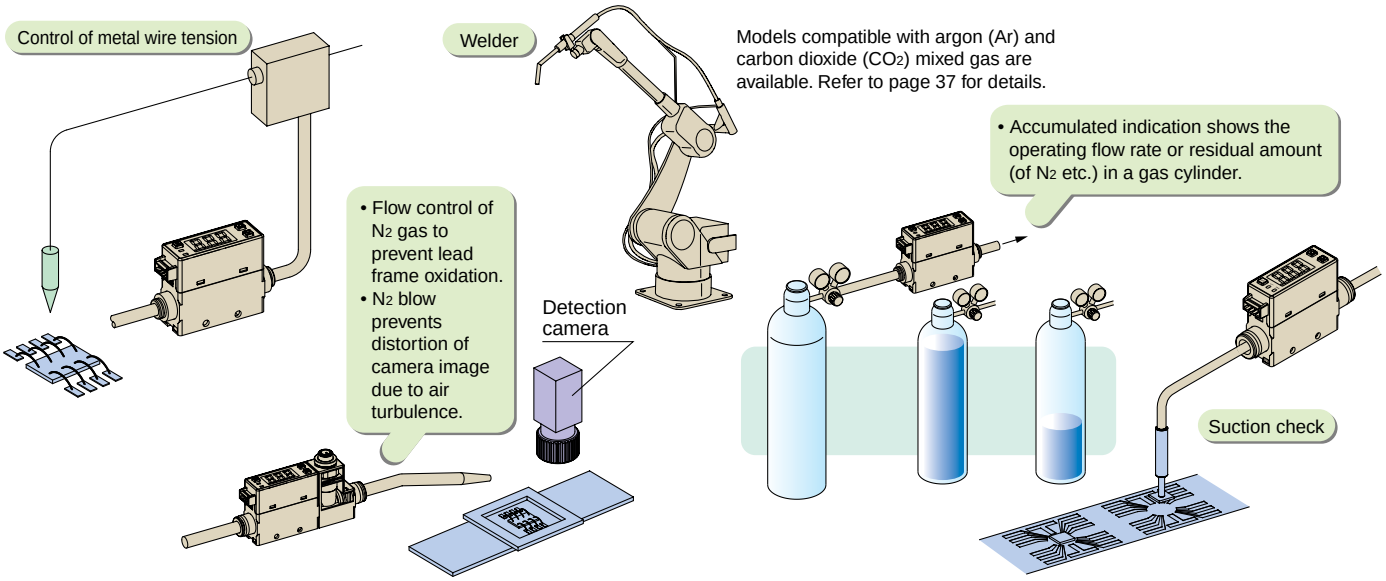
Compressed air line



Vacuum line

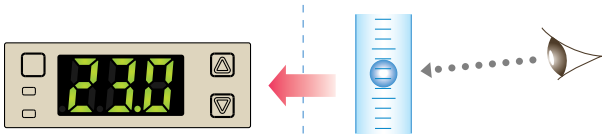


Applications



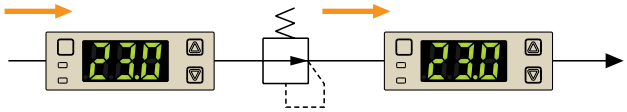
Comparison with Float Type Flow Meter

Digital display

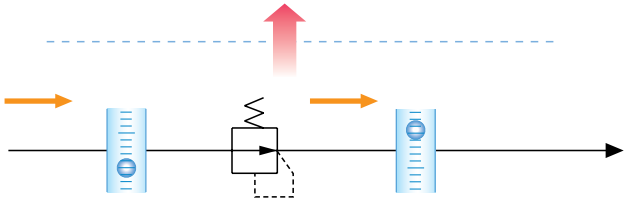


Indicated value depends on the viewing angle.

Not subject to pressure variations

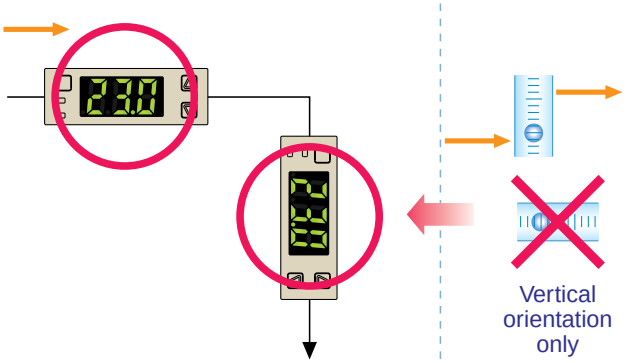


Indicated value is the same at any installation position. (No conversion is needed.)



Indicated value depends on installation position. (Conversion is required.)

Free mounting orientation



Mounting orientation is not limited.

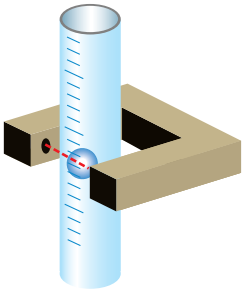
With switch output and analog output

Control by sensor output ← Visual control

With switch output and analog output

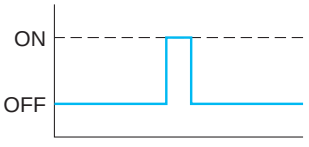
Without output function

A photoelectric switch, or similar, must be prepared separately.



Can detect whether greater or less than set flow rate. The flow condition can be controlled all the time.

Can only detect when float passes. Cannot detect whether greater or less than set flow rate.



Accumulated flow display

Able to confirm the total air consumption per day (Max. 999999 ℓ)
Accumulated pulse output is also equipped.

Not displayable

SMC Digital Flow Switch Variations

For Air

Measurement flow range ℓ/min	Integrated type	Remote type		
				
	Model	Model		
		Sensor unit	Monitor	4-channel flow monitor
1 to 10	**PF2A710**	**PF2A510**	**PF2A30□**	**PF2A20□**
5 to 50	**PF2A750**	**PF2A550**		
10 to 100	**PF2A711**	**PF2A511**	**PF2A31□**	
20 to 200	**PF2A721**	**PF2A521**		
50 to 500	**PF2A751**	**PF2A551**		
150 to 3000	**PF2A703H**	—	—	—
300 to 6000	**PF2A706H**			
600 to 12000	**PF2A712H**			

For Water

Measurement flow range ℓ/min	Integrated type	Remote type		
				
	Model	Model		
		Sensor unit	Monitor	4-channel flow monitor
0.5 to 4	**PF2W704(T)**	**PF2W504(T)**	**PF2W30□**	**PF2W20□**
2 to 16	**PF2W720(T)**	**PF2W520(T)**		
5 to 40	**PF2W740(T)**	**PF2W540(T)**		
10 to 100	**PF2W711**	**PF2W511**	**PF2W33□**	

For Deionized Water and Chemicals

For details, refer to the individual catalog (CAT.ES100-54).

Measurement flow range ℓ/min	Remote type		
			
	Model		
	Sensor unit	Monitor	4-channel flow monitor
0.4 to 4	**PF2D504**	**PF2D30□**	**PF2D20□**
1.8 to 20	**PF2D520**		
4.0 to 40	**PF2D540**		

2-Color Display Digital Flow Switch

2-Color Display Digital Flow Switch

Series PFM7

Integrated display

How to Order

Integrated display **PFM 7 10 □ – C4 □ – A – M □ □ – □ □ – □**

Type

7	Integrated display

Rated flow range (Flow rate range)

10	0.2 to 10 (5) ℓ/min
25	0.5 to 25 (12.5) ℓ/min
50	1 to 50 (25) ℓ/min
11	2 to 100 (50) ℓ/min

∗ ( ): Fluid: CO_2

Flow adjustment valve

Nil	None
S	Yes

Port size

Symbol	Description	Flow rate range			
		10	25	50	11
01	Rc1/8	●	●	●	
02	Rc1/4				●
N01	NPT1/8	●	●	●	
N02	NPT1/4				●
F01	G1/8	●	●	●	
F02	G1/4				●
C4	ø4 (5/32") one-touch fitting	●			
C6	ø6 one-touch fitting	●	●	●	●
C8	ø8 (5/16") one-touch fitting		●	●	●
N7	ø1/4 one-touch fitting		●	●	●

Piping entry direction

Nil	Straight
L	Bottom

∗ Different combinations of piping entry directions for IN and OUT side are available as made-to-order. (Refer to page 35.)

Output specification

A	2 NPN outputs
B	2 PNP outputs
C	1 NPN output + Analog (1 to 5 V)
D	1 NPN output + Analog (4 to 20 mA)
E	1 PNP output + Analog (1 to 5 V)
F	1 PNP output + Analog (4 to 20 mA)
G	1 NPN output + External input Note 3)
H	1 PNP output + External input Note 3)

Note 3) User can select from accumulated value external reset, auto-shift and auto-shift zero.

Unit specification

M	Fixed SI unit Note 1)
Nil	With unit switching function Note 2)

Note 1) Fixed unit: Real-time flow rate: ℓ/min
Accumulated flow: ℓ

Note 2) This product is for overseas use only according to the new Measurement Law. (The SI unit is provided for use in Japan.)

Instruction manual

Nil	With instruction manual (Leaflet: Japanese and English)
N	None

Calibration certificate

Nil	None
A	With calibration certificate

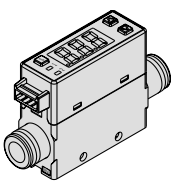
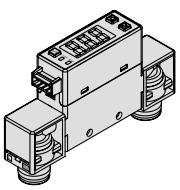
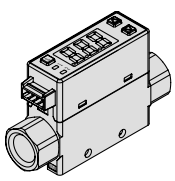
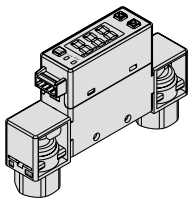
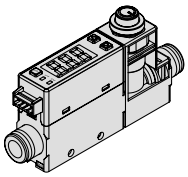
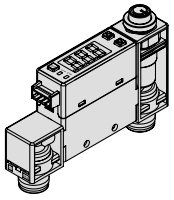
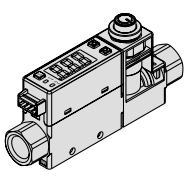
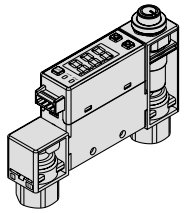
∗ The certificate is written in English and Japanese. Other languages are available as specials.

Option 1
(Refer to page 2.)

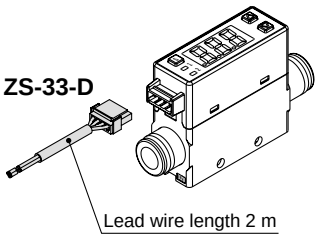
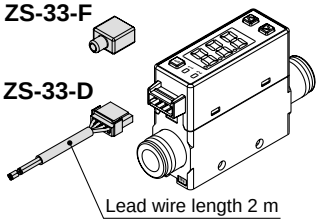
Option 2
(Refer to page 2.)

Made to Order
(Refer to page 2 and 35.)

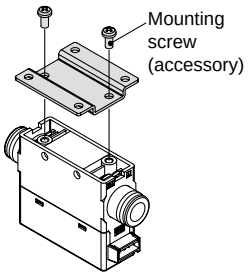
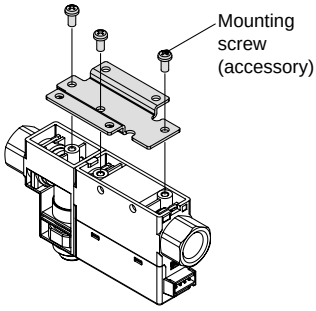
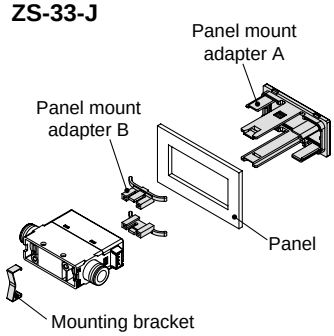
Piping Variations

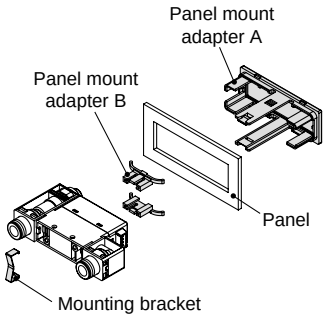
	With one-touch fittings (C4, C6, C8, N7)		Female thread (01, 02, N01, N02, F01, F02)	
	Straight (Nil)	**Bottom (L)**	**Straight (Nil)**	**Bottom (L)**
Without flow adjustment valve (Nil)				
With flow adjustment valve (S)				

Option 1

Nil	W	Z
With lead wire with connector (2 m) **ZS-33-D**  	With lead wire with connector (2 m) + Rubber cover for connector (silicon rubber) **ZS-33-F** **ZS-33-D**  	Without lead wire with connector

Option 2

Nil	R	S	T
None	Bracket (For without flow adjustment valve) **ZS-33-M**  	Bracket (For with flow adjustment valve) **ZS-33-MS**  Piping direction: Cannot be mounted with bottom piping type.	Panel mount adapter (For without flow adjustment valve) **ZS-33-J** 

V
Panel mount adapter (For with flow adjustment valve) **ZS-33-JS** 

Each option is not assembled with the product, but shipped together.

Made to Order

Symbol	Specification/Description
X693	Change of piping entry direction combination
X694	
X731	Compatible with argon (Ar) and carbon dioxide (CO_2) mixed gas

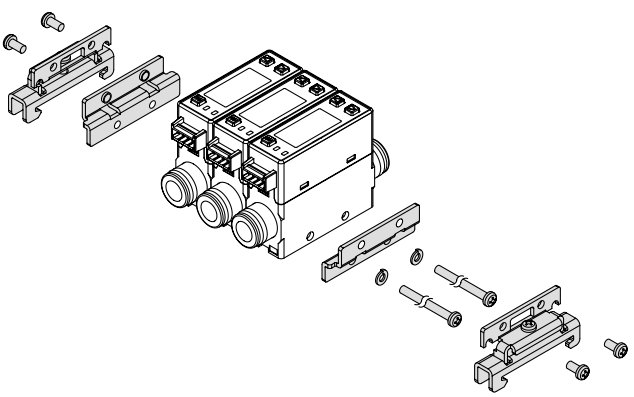
For details, refer to page 35 through to 37.

DIN Rail Mounting Bracket (Order Separately)

ZS − 33 − R□

Stations

1	1 station
2	2 stations
3	3 stations
4	4 stations
5	5 stations



- DIN rail (supplied by customers)
- Port size F02: G1/4 cannot be mounted on the DIN rail.

Specifications

Model			PFM710	PFM725	PFM750	PFM711
Applicable fluid			Dry air, N_2, Ar, CO_2 (Air quality grade is JIS B8392.1-1, 1.2 to 1.6.2 and ISO8573.1-1, 1.2 to 1.6.2.)			
Rated flow range (Flow rate range)		**Dry air, N_2, Ar**	0.2 to 10 ℓ/min	0.5 to 25 ℓ/min	1 to 50 ℓ/min	2 to 100 ℓ/min
		CO_2	0.2 to 5 ℓ/min	0.5 to 12.5 ℓ/min	1 to 25 ℓ/min	2 to 50 ℓ/min
Displayable range Note 1)		**Dry air, N_2, Ar**	0.2 to 10.5 ℓ/min	0.5 to 26.3 ℓ/min	1 to 52.5 ℓ/min	2 to 105 ℓ/min
		CO_2	0.2 to 5.2 ℓ/min	0.5 to 13.1 ℓ/min	1 to 26.2 ℓ/min	2 to 52 ℓ/min
Settable range Note 1)		**Dry air, N_2, Ar**	0 to 10.5 ℓ/min	0 to 26.3 ℓ/min	0 to 52.5 ℓ/min	0 to 105 ℓ/min
		CO_2	0 to 5.2 ℓ/min	0 to 13.1 ℓ/min	0 to 26.2 ℓ/min	0 to 52 ℓ/min
Minimum unit setting Note 2)			0.01 ℓ/min	0.1 ℓ/min	0.1 ℓ/min	0.1 ℓ/min
Accumulated pulse flow rate exchange value			0.1 ℓ/pulse	0.1 ℓ/pulse	0.1 ℓ/pulse	1 ℓ/pulse
Indication unit Note 3)			Real-time flow rate ℓ/min, CFM x 10^{-2} Accumulated flow ℓ, ft^3 x 10^{-1}			
Linearity			Display accuracy: ±3%F.S. or less (Fluid: Dry air) Analog output accuracy: ±5%F.S. or less			
Repeatability			±1%F.S. or less (Fluid: Dry air) Analog output accuracy: ±3%F.S. or less			
Pressure characteristics			±5%F.S. or less (based on 0.35 MPa)			
Temperature characteristics			±2%F.S. (15 to 35°C) ±5%F.S. (0 to 50°C)			
Operating pressure range			–100 kPa to 750 kPa			
Rated pressure range			–70 kPa to 750 kPa			
Proof pressure			1 MPa			
Accumulated flow range			Max. 999999 ℓ Note 4)			
Switch output			NPN or PNP open collector output			
	Maximum load current		80 mA			
	Maximum applied voltage		28 VDC (at NPN output)			
	Internal voltage drop		NPN output: 1 V or less (at 80 mA) PNP output: 1.5 V or less (at 80 mA)			
	Response time		1 s (50 ms, 0.5 s, 2 s can be selected.)			
	Output protection		Short-circuit protection, Overcurrent protection			
Accumulated pulse output			NPN or PNP open collector output (Same as switch output)			
Analog output Note 5)		**Response time**	1.5 s or less (90% response)			
		Voltage output	Voltage output: 1 to 5 V Output impedance: 1 kΩ			
		Current output	Current output: 4 to 20 mA Max. load impedance: 600 Ω, Min. load impedance: 50 Ω			
Hysteresis Note 6)		**Hysteresis mode**	Variable			
		Window comparator mode	Variable			
External input			No-voltage input (Reed or Solid state) Input 30 ms or more			
Display method			3-digit, 7-segment LED 2-color display (Red/Green) Renewed cycle: 10 times/sec			
Status LED's			OUT1: Illuminates when output is turned ON (Green). OUT2: Illuminates when output is turned ON (Red).			
Power supply voltage			24 VDC ± 10%			
Current consumption			55 mA or less			
Environ-mental resistance	**Enclosure**		IP40			
	Operating fluid temperature		0 to 50°C (with no freezing and condensation)			
	Operating temperature range		Operating: 0 to 50°C Stored: –10 to 60°C (with no freezing and condensation)			
	Operating humidity range		Operating, Stored: 35 to 85%R.H. (with no condensation)			
	Withstand voltage		1000 VAC for 1 min. between external terminal and case			
	Insulation resistance		50 MΩ or more (500 VDC Mega) between external terminal and case			
	Vibration resistance		Without orifice: 10 to 500 Hz with a 1.5 mm amplitude or 98 m/s^2 acceleration, in each X, Y, Z direction for 2 hrs, whichever is smaller. With orifice: 10 to 150 Hz with a 1.5 mm amplitude or 19.6 m/s^2 acceleration, in each X, Y, Z direction for 2 hrs, whichever is smaller.			
	Impact resistance		490 m/s^2 in X, Y, Z directions 3 times each			

Note 1) When the minimum unit setting 0.01 ℓ/min is selected for 10 ℓ/min type, the indication upper limit will be [9.99 ℓ/min].
When the minimum unit setting 0.1 ℓ/min is selected for 100 ℓ/min type, the indication upper limit will be [99.9 ℓ/min].

Note 2) User can select between 0.01 ℓ/min and 0.1 ℓ/min for the PFM710, and between 0.1 ℓ/min and 1 ℓ/min for the PFM711 respectively.
If the indication unit is selected to "CFM", the minimum unit setting cannot be changed.
At the time of shipment from the factory, the minimum unit setting is set to 0.1 ℓ/min for the PFM710 and 1 ℓ/min for the PFM711 respectively.

Note 3) Set to "ANR" at the time of shipment from the factory.
"ANR" is used for standard conditions: 20°C, 1 atm and 65%R.H.
"Nℓ/min" is used for normal conditions: 0°C and 1 atm.
When equipped with a unit switching function. (The SI unit (ℓ/min or ℓ) is fixed for types with no unit switching function.)

Note 4) Cleared when the power supply is turned off. Hold function can be selected. (Interval of 2 min or 5 min can be selected).
If the 5 min interval is selected, the life of the memory element (electronic part) is limited to 1 million cycles. (If energized for 24 hours, life is calculated as 5 min x 1 million = 5 million min = 9.5 years). Therefore, if using the hold function, calculate the memory life for your operating conditions, and use within this life.

Note 5) Set to 1.5 s (90%), can be changed to 100 ms.

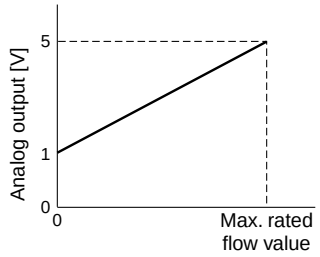
Note 6) Set to hystresis mode at the time of shipment from the factory. Can be changed to window comparator mode using push-buttons.

Piping Specifications / Weight

Part no.	01	02	N01	N02	F01	F02	C4	C6	C6	N7
Port size	Rc 1/8	Rc 1/4	NPT 1/8	NPT 1/4	G1/8	G1/4	ø4 (5/32") one-touch fitting	ø6 one-touch fitting	ø8 (5/16") one-touch fitting	1/4 one-touch fitting
Weight	Straight Without orifice: 95 g Bottom Without orifice: 105 g Straight With orifice: 135 g Bottom With orifice: 145 g					Straight Without orifice: 125 g Bottom Without orifice: 135 g Straight With orifice: 165 g Bottom With orifice: 175 g		Straight Without orifice: 55 g Bottom Without orifice: 65 g Straight With orifice: 95 g Bottom With orifice: 105 g		
Wetted parts material	LCP, PBT, Brass (Electroless nickel plated), HNBR (+ Fluoro coated), FKM (+ Fluoro coated), Silicon, Au, Stainless steel 304									

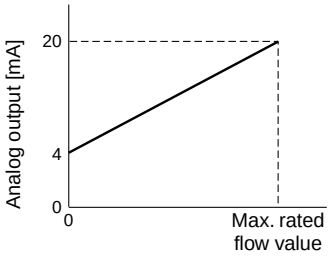
Analog Output

Note: Analog output at maximum rated flow rate when CO_2 is selected is 3 [V] for the voltage output type and 12 [mA] for the current output type.



Analog Voltage Output (1 to 5 V)

Model	Max. rated flow value [ℓ/min]
PFM710-□-C/E	10
PFM725-□-C/E	25
PFM750-□-C/E	50
PFM711-□-C/E	100



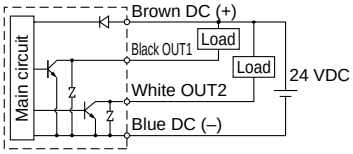
Analog Current Output (4 to 20 mA)

Model	Max. rated flow value [ℓ/min]
PFM710-□-D/F	10 (5)
PFM725-□-D/F	25 (12.5)
PFM750-□-D/F	50 (25)
PFM711-□-D/F	100 (50)

∗ ( ): Fluid: CO_2

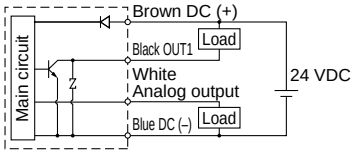
Internal Circuits and Wiring Examples

2 NPN outputs type
PFM7□□□-□□-A-□□



Max. 28 V, 80 mA
Internal voltage drop 1 V or less

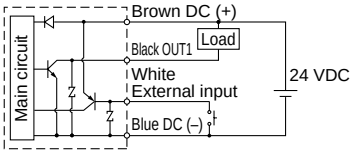
NPN + Analog output type
PFM7□□□-□□-C-□□
NPN + Analog output type
PFM7□□□-□□-D-□□



Max. 28V, 80 mA
Internal voltage drop 1 V or less

C: Analog output 1 to 5 V
Output impedance 1 kΩ
D: Analog output 4 to 20 mA
Load impedance 50 to 600 Ω

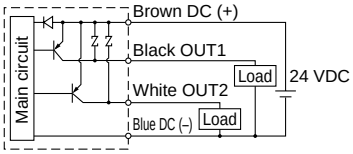
NPN + External input type
PFM7□□□-□□-G-□□



Max. 28 V, 80 mA
Internal voltage drop 1 V or less

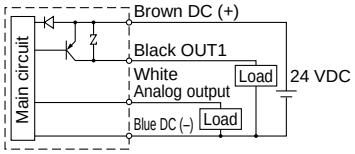
External input: No-voltage input
Reed switch or solid state switch input
30 msec or more

2 PNP outputs type
PFM7□□□-□□-B-□□



Max. 80 mA
Internal voltage drop 1.5 V or less

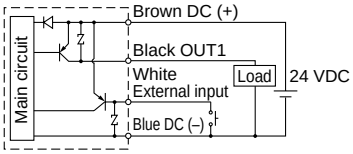
PNP + Analog output type
PFM7□□□-□□-E-□□
PNP + Analog output type
PFM7□□□-□□-F-□□



Max. 80 mA
Internal voltage drop 1.5 V or less

E: Analog output 1 to 5 V
Output impedance 1 kΩ
F: Analog output 4 to 20 mA
Load impedance 50 to 600 Ω

PNP + External input type
PFM7□□□-□□-H-□□

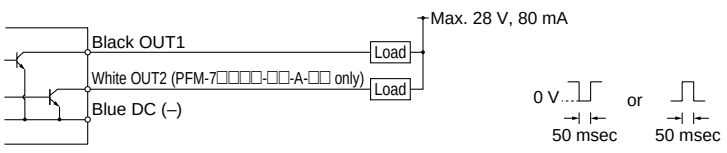


Max. 80 mA
Internal voltage drop 1.5 V or less

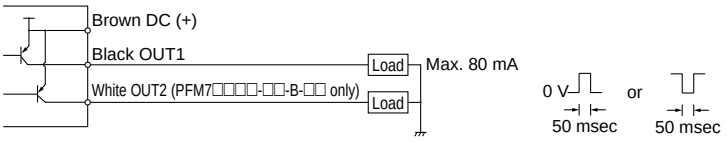
External input: No-voltage input
Reed switch or solid state switch input
30 msec or more

Accumulated pulse output wiring examples

2 NPN outputs type
PFM7□□□-□□-A-□□
NPN + Analog output type
PFM7□□□-□□-C-□□/PFM7□□□-□□-D-□□
NPN + External input type
PFM7□□□-□□-G-□□

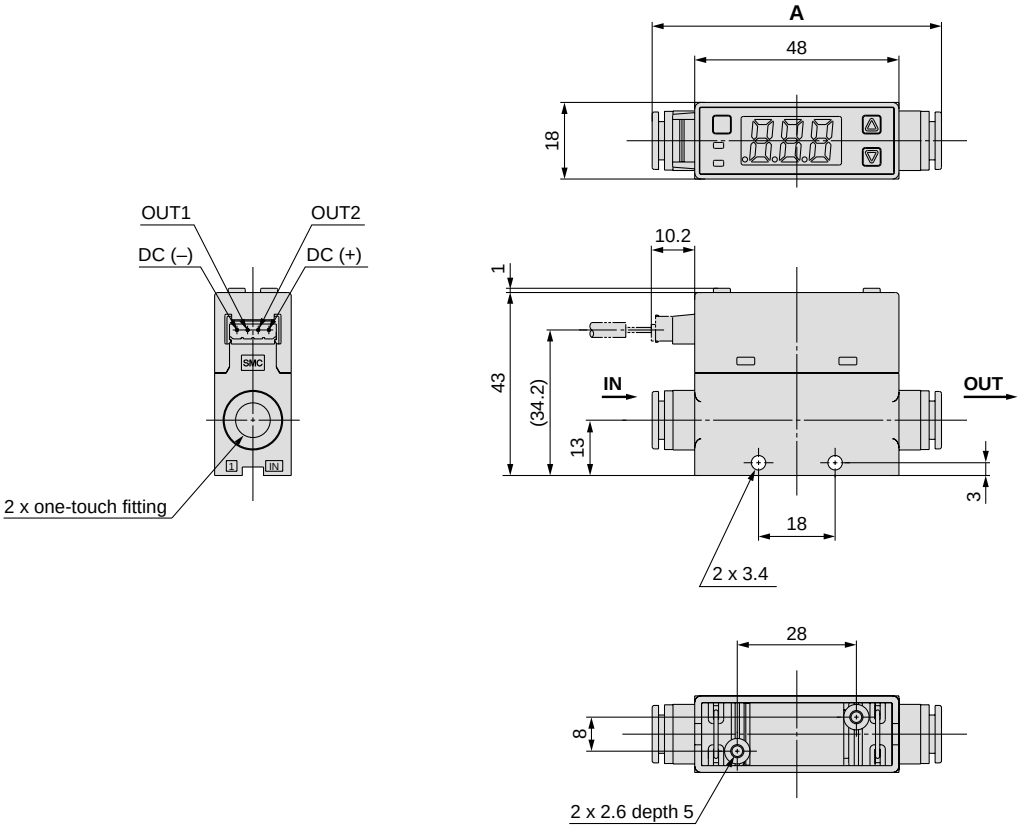


2 PNP outputs type
PFM7□□□-□□-B-□□
PNP + Analog output type
PFM7□□□-□□-E-□□/PFM7□□□-□□-F-□□
PNP + External input type
PFM7□□□-□□-H-□□



Dimensions

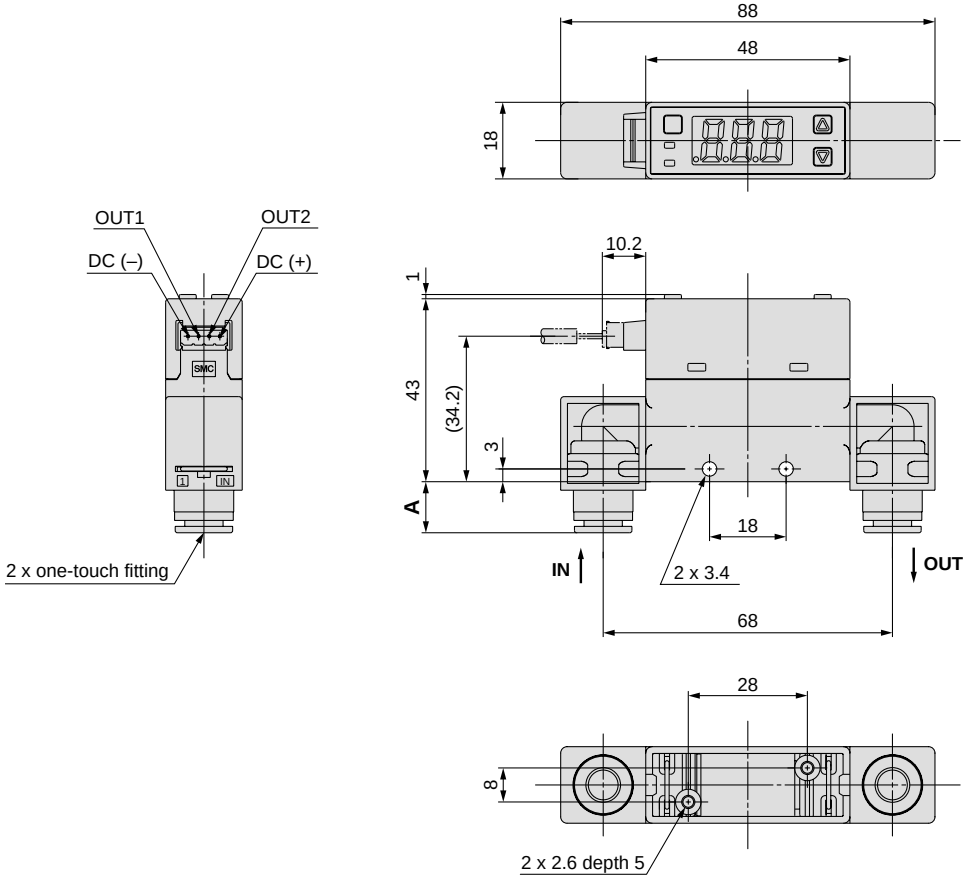
PFM7□□-C4/C6/C8/N7



(mm)

One-touch fitting Applicable tube O.D.	A
ø4 (5/32")	64.2
ø6	64.6
ø8 (5/16")	68
ø1/4	64.6

PFM7□□-C4L/C6L/C8L/N7L

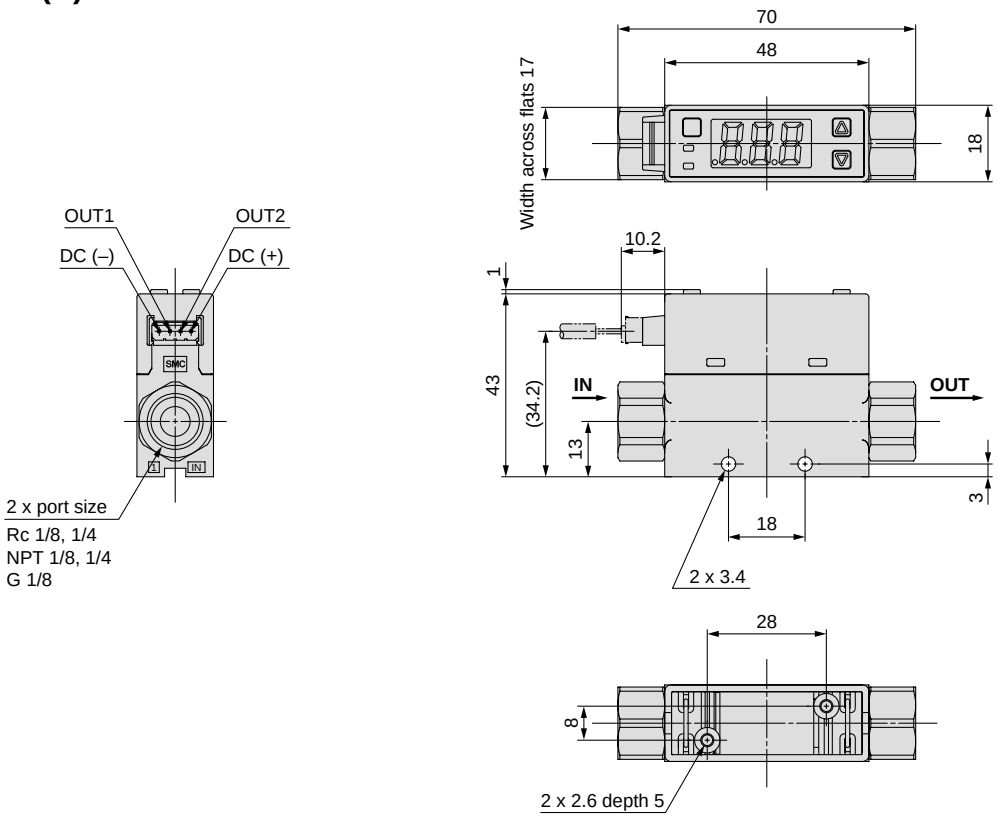


(mm)

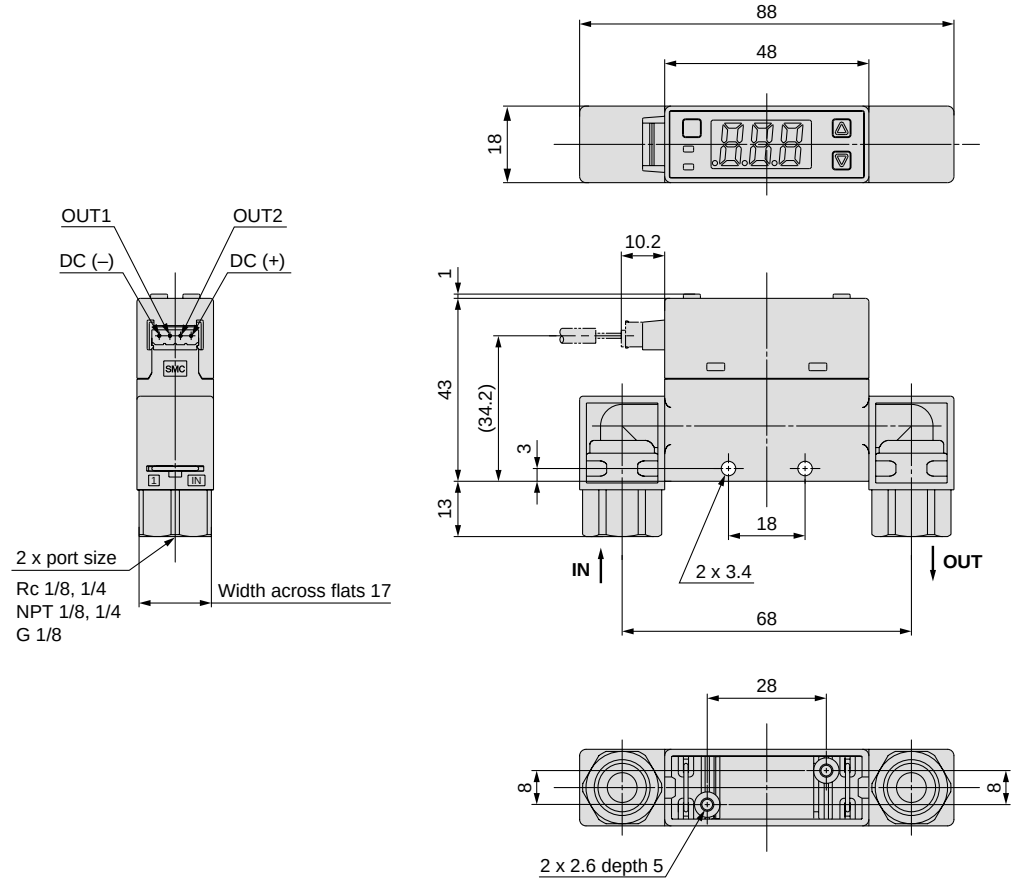
One-touch fitting Applicable tube O.D.	A
ø4 (5/32")	10.1
ø6	10.3
ø8 (5/16")	12
ø1/4	10.3

Dimensions

PFM7□□-(N)01/(N)02/F01

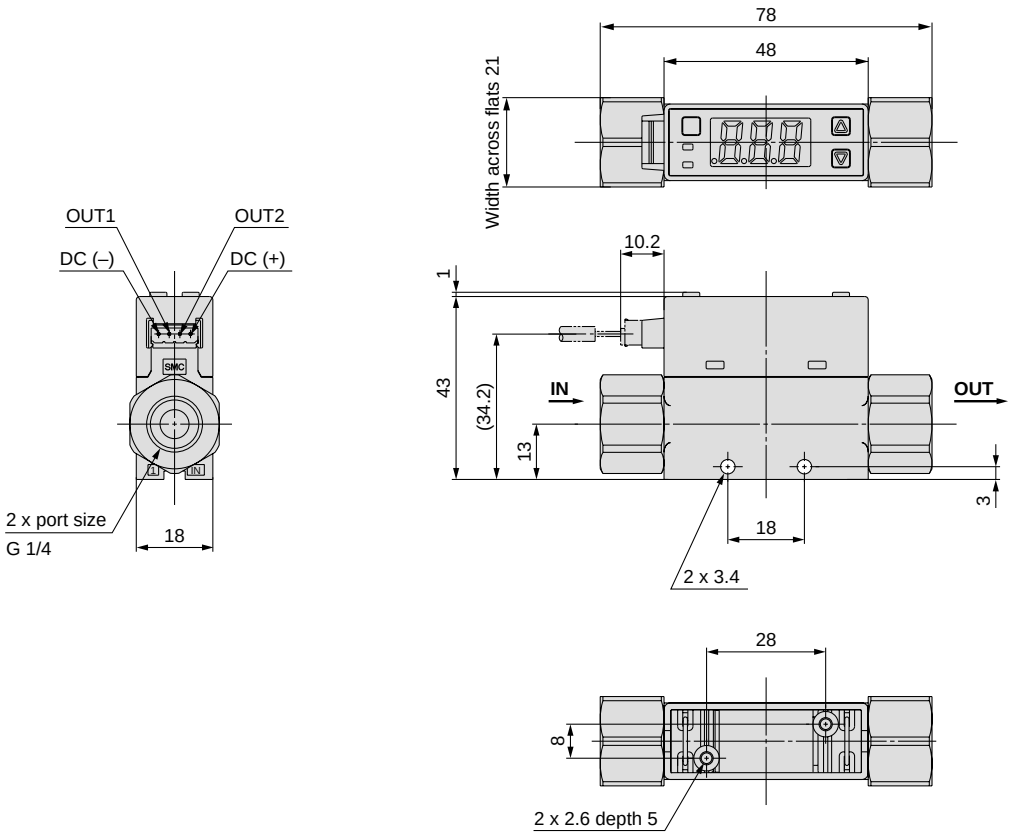


PFM7□□-(N)01L/(N)02L/F01L

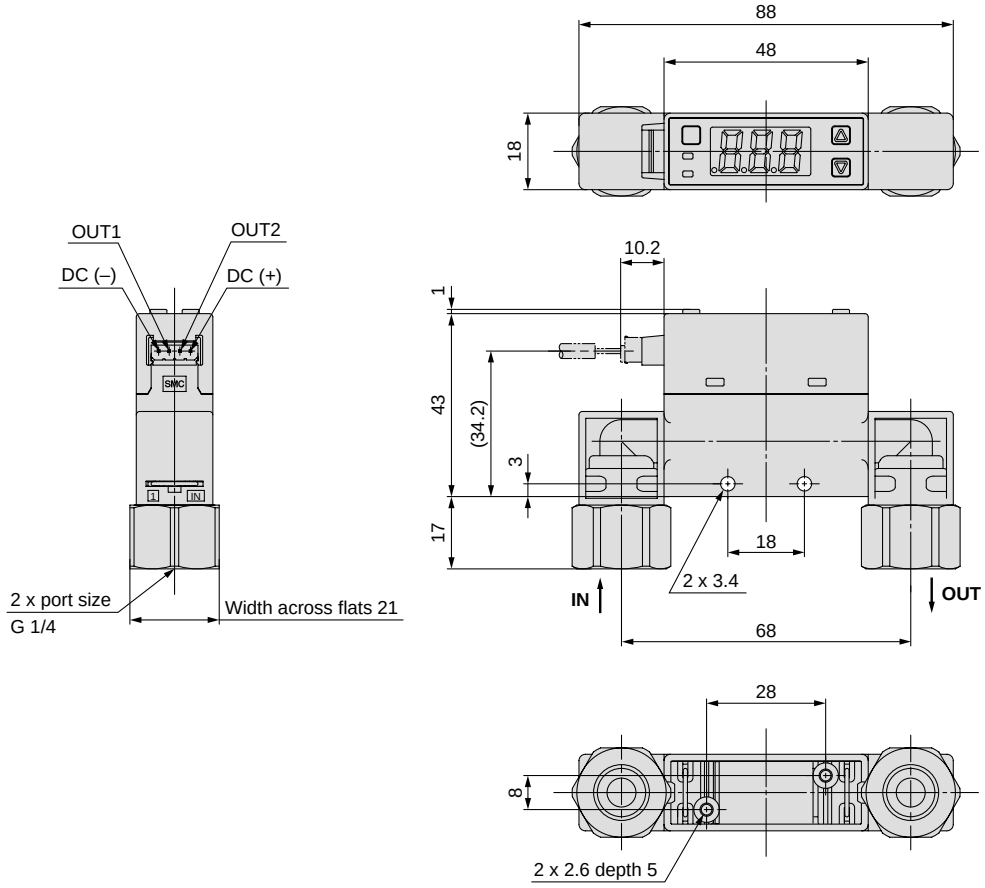


Dimensions

PFM7□□-F02

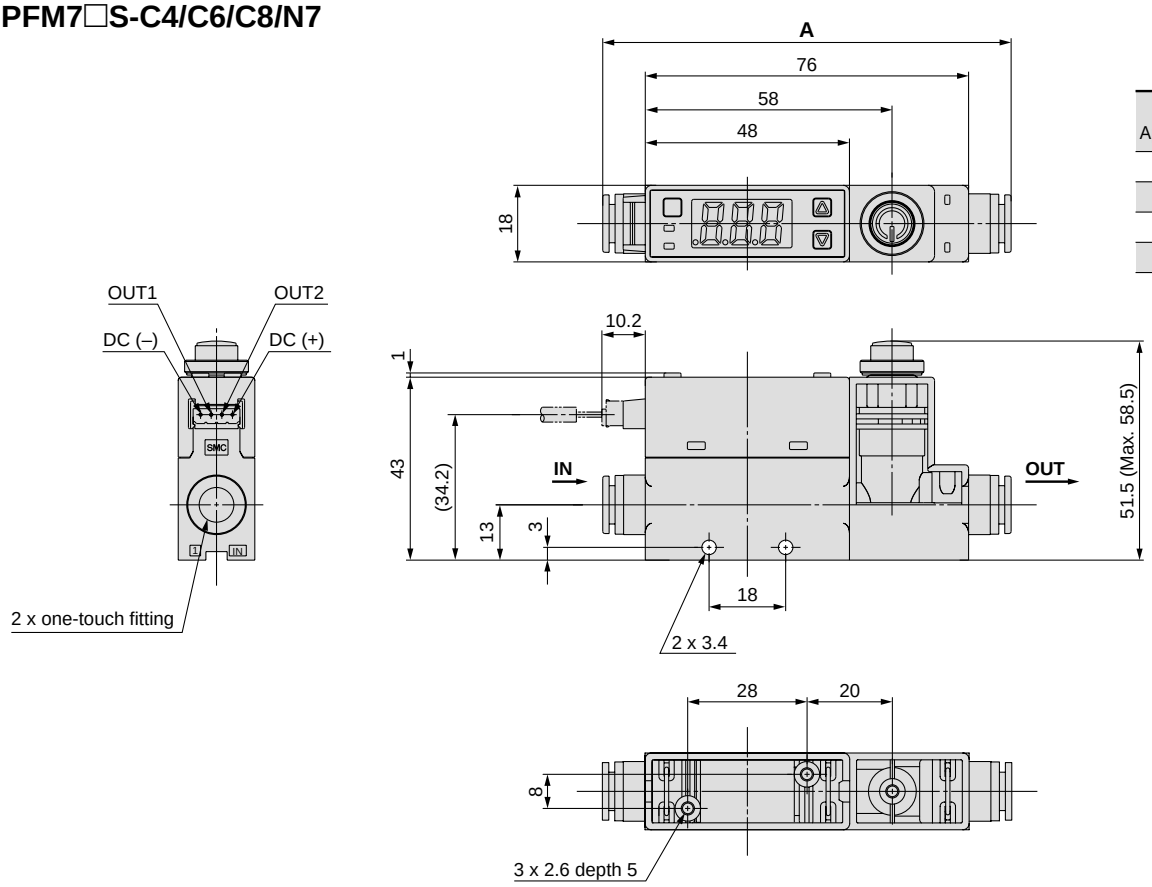


PFM7□□-F02L



Dimensions

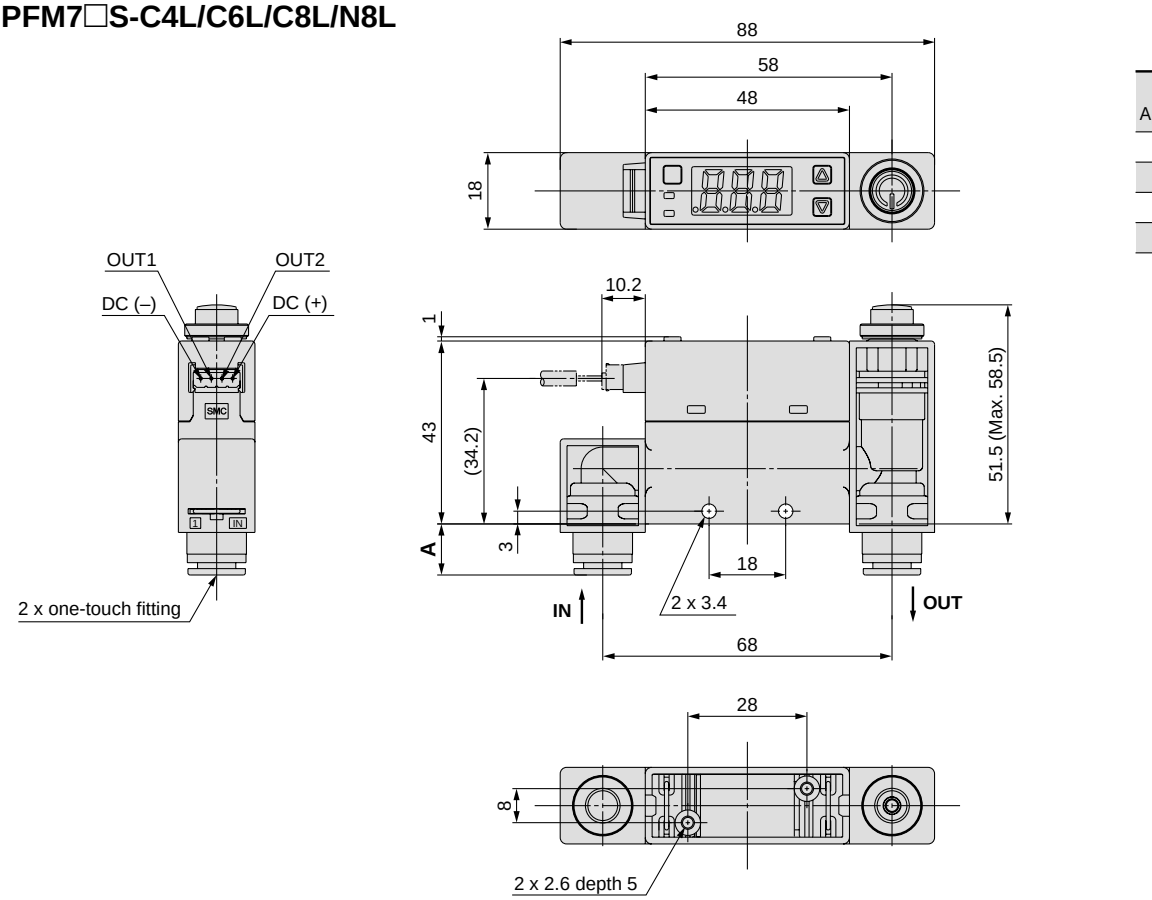
PFM7□S-C4/C6/C8/N7



(mm)

One-touch fitting Applicable tube O.D.	A
ø4 (5/32")	92.2
ø6	92.6
ø8 (5/16")	96
ø1/4	92.6

PFM7□S-C4L/C6L/C8L/N8L

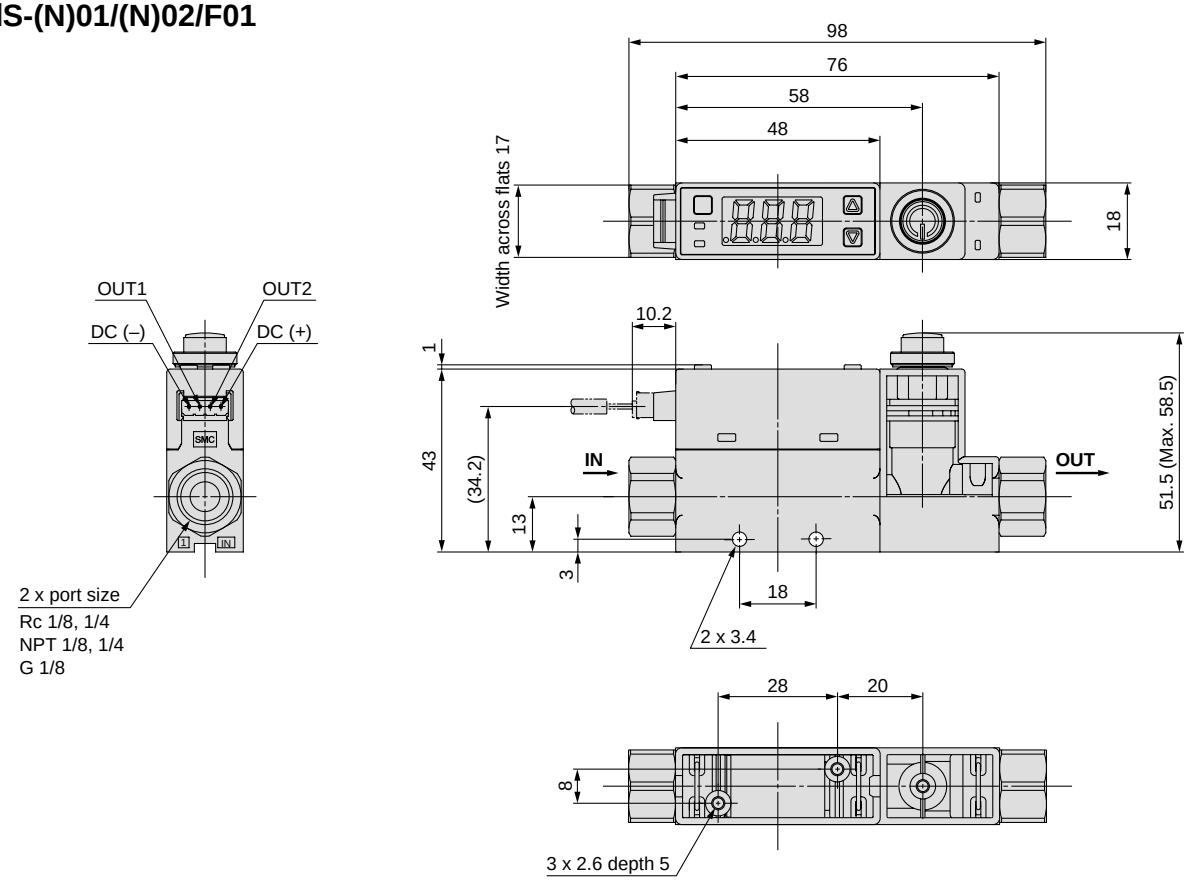


(mm)

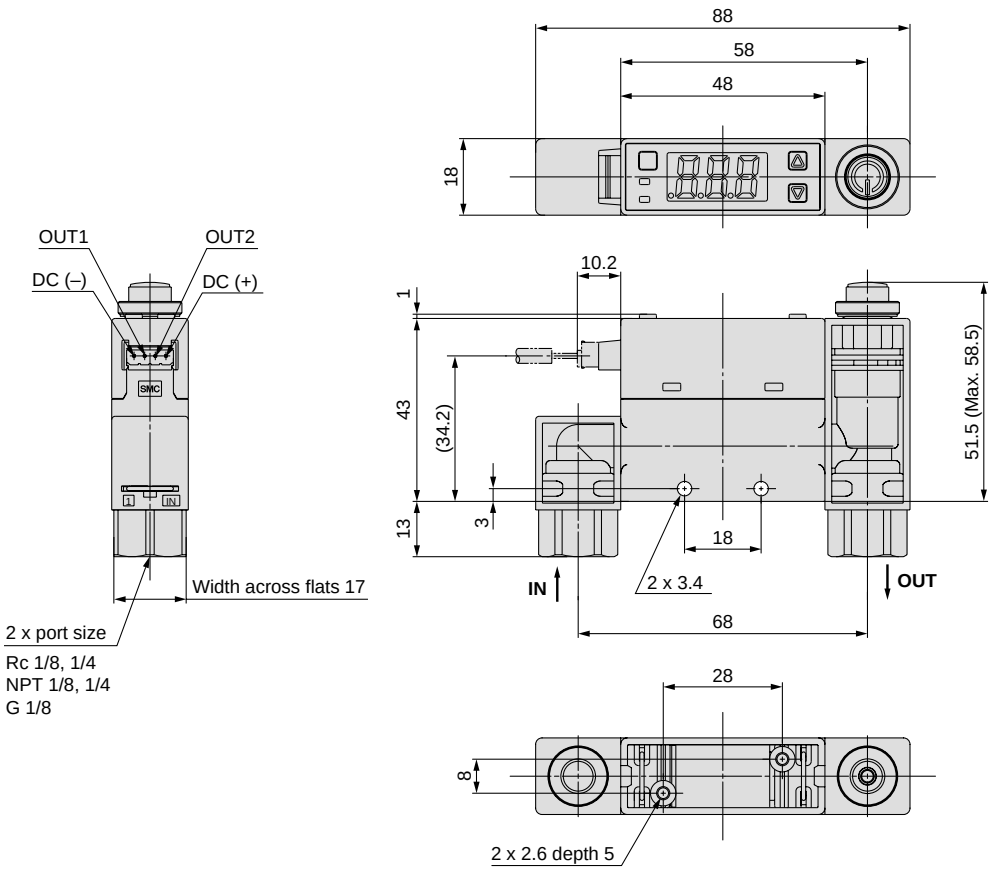
One-touch fitting Applicable tube O.D.	A
ø4 (5/32")	10.1
ø6	10.3
ø8 (5/16")	12
ø1/4	10.3

Dimensions

PFM7□S-(N)01/(N)02/F01

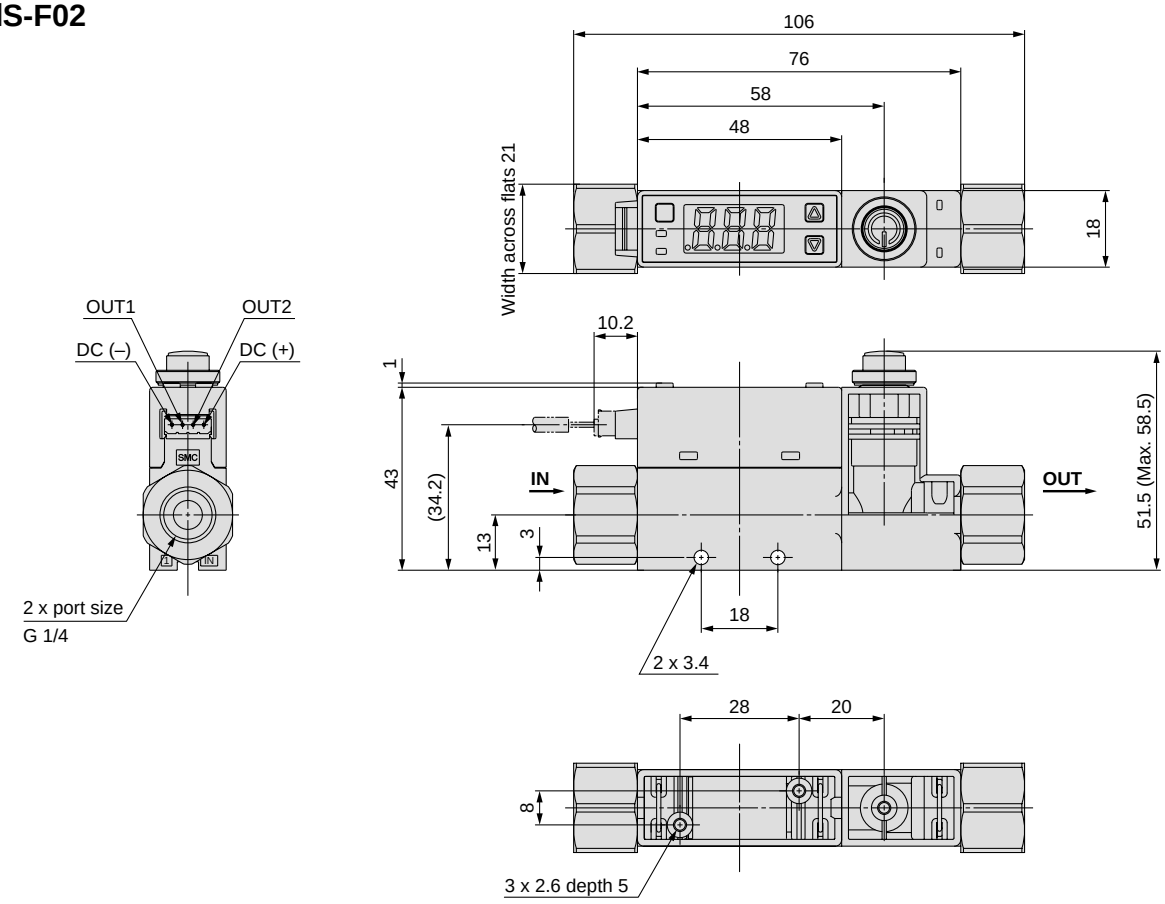


PFM7□S-(N)01L/(N)02L/F01L

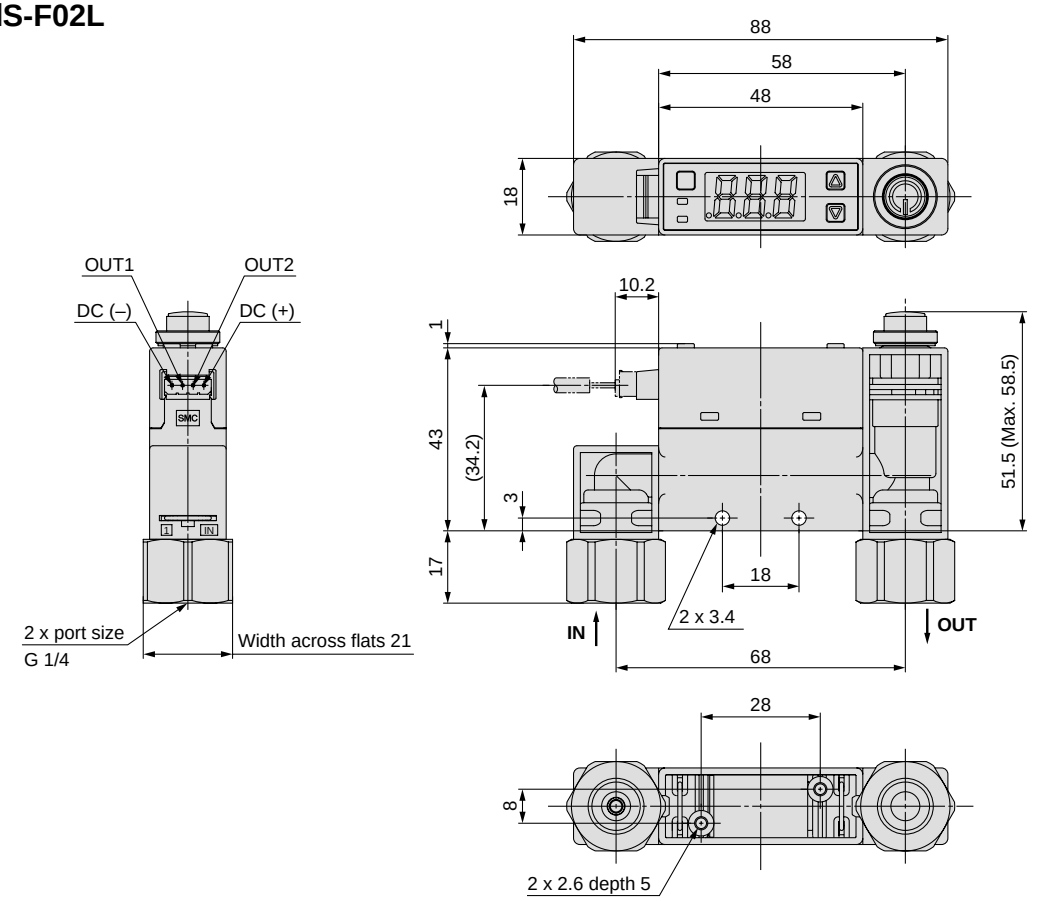


Dimensions

PFM7□S-F02



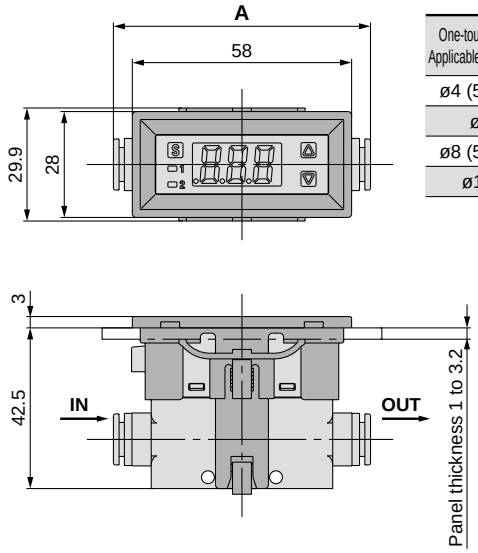
PFM7□S-F02L



Dimensions

Panel mount / Without flow adjustment valve / Straight

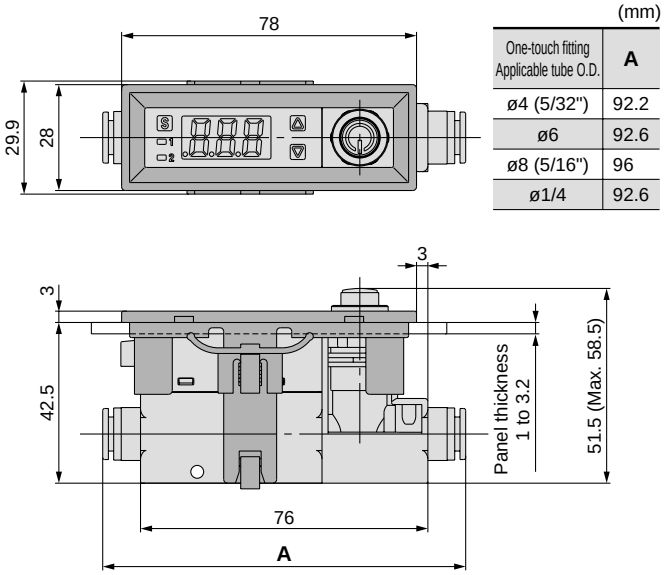
(mm)



One-touch fitting Applicable tube O.D.	A
ø4 (5/32")	64.2
ø6	64.6
ø8 (5/16")	68
ø1/4	64.6

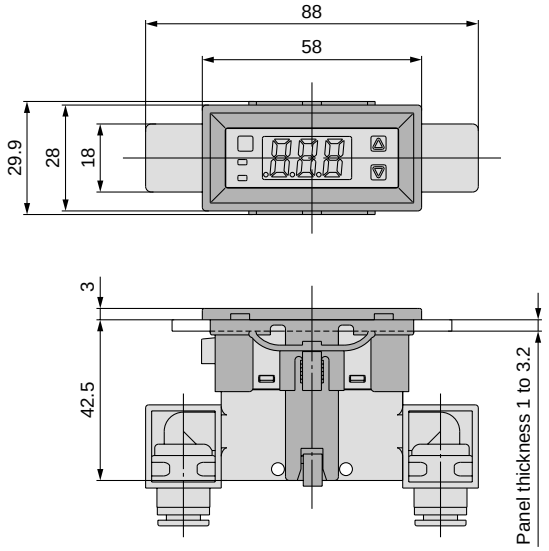
Panel mount / With flow adjustment valve / Straight

(mm)

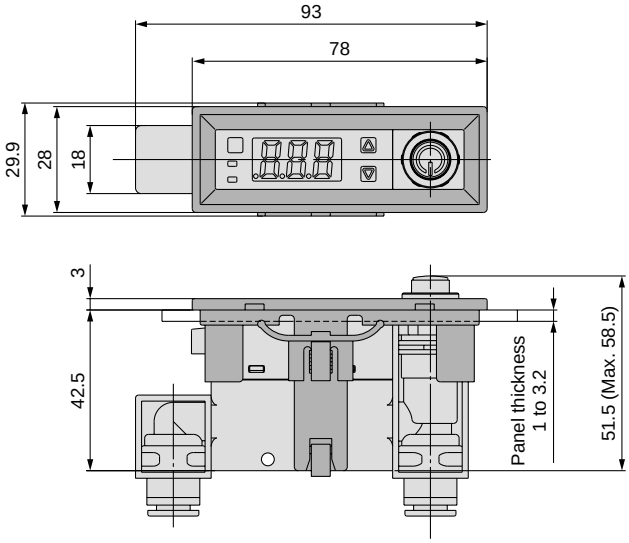


One-touch fitting Applicable tube O.D.	A
ø4 (5/32")	92.2
ø6	92.6
ø8 (5/16")	96
ø1/4	92.6

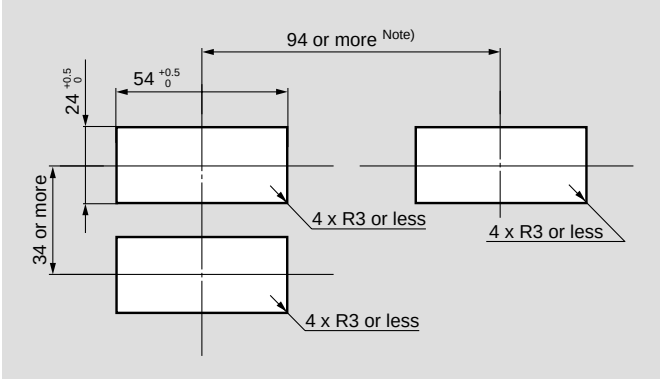
Panel mount / Without flow adjustment valve



Panel mount / With flow adjustment valve



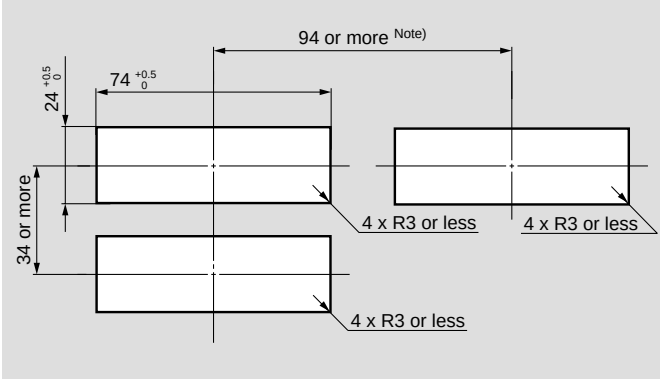
Panel Fitting Dimensions



Panel thickness 1 to 3.2 mm

Note) Piping entry direction: Minimum dimensions for bottom side piping. If using straight piping, the piping material and tubing need to be taken into consideration when designing the system. If a bend (R) is used, limit it to R3 or less.

Panel Fitting Dimensions

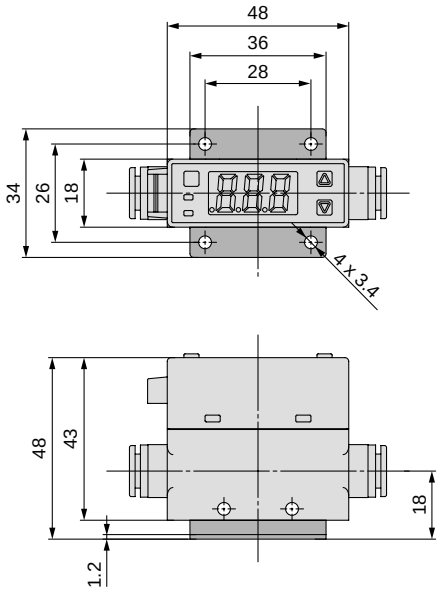


Panel thickness 1 to 3.2 mm

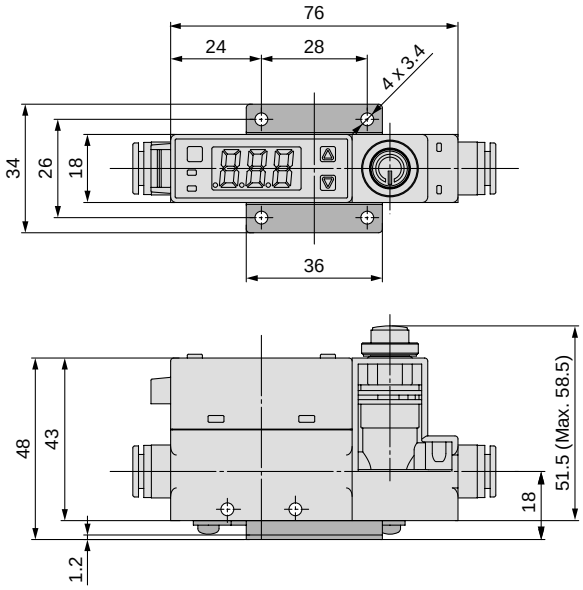
Note) Piping entry direction: Minimum dimensions for bottom side piping. If using straight piping, the piping material and tubing need to be taken into consideration when designing the system. If a bend (R) is used, limit it to R3 or less.

Dimensions

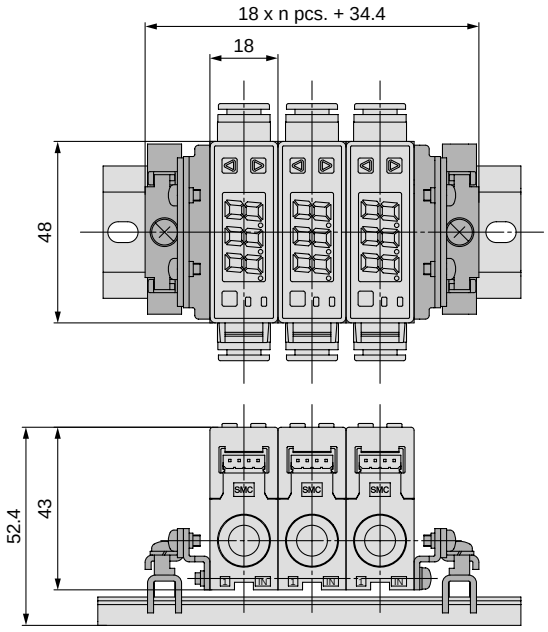
With bracket / Without flow adjustment valve



With bracket / With flow adjustment valve

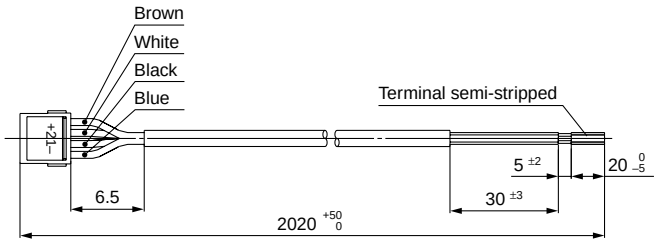


DIN rail mounting



- DIN rail (supplied by customers)
- Port size, F02: G1/4 cannot be mounted on the DIN rail.

Lead wire with connector ZS-33-D



Cable Specifications of Lead Wire with Connector

Rated temperature		80°C
Rated voltage		30 V
Number of wires		4
Conductor	Nominal cross section area	AWG26
	Material	Soft copper wire
	Construction	28 / 0.08 mm
	External diameter	Approx. 0.50 mm
Insulation	Material	Cross-linked vinyl chloride resin compound
	External diameter	Approx. 1.00 mm
	Colors	Brown, White, Black, Blue
Sheath	Material	Oil-resistant vinyl chloride resin compound
	Color	Light gray
Finished external diameter		ø3.5 +0.10 −0.25

2-Color Display Digital Flow Switch

Series PFM5

Remote sensor unit

How to Order

Remote sensor unit

PFM 5 10 □ – C4 □ – 1 – □ □ – □ □ – □

Type

5	Remote sensor unit

Rated flow range (Flow rate range)

10	0.2 to 10 (5) ℓ/min
25	0.5 to 25 (12.5) ℓ/min
50	1 to 50 (25) ℓ/min
11	2 to 100 (50) ℓ/min

∗ ( ): Fluid: CO_2

Flow adjustment valve

Nil	None
S	Yes

Port size

Symbol	Description	Flow rate range			
		10	25	50	11
01	Rc1/8	●	●	●	
02	Rc1/4				●
N01	NPT1/8	●	●	●	
N02	NPT1/4				●
F01	G1/8	●	●	●	
F02	G1/4				●
C4	ø4 (5/32") one-touch fitting	●			
C6	ø6 one-touch fitting	●	●	●	●
C8	ø8 (5/16") one-touch fitting		●	●	●
N7	ø1/4 one-touch fitting		●	●	●

Piping entry direction

Nil	Straight
L	Bottom

∗ Different combinations of piping entry directions for IN and OUT side are available as made-to-order. (Refer to page 35.)

Output specification

No.	Description	Applicable display unit
1	Analog output (1 to 5 V)	PFM30□
2	Analog output (4 to 20 mA)	PFM31□

Instruction manual

Nil	With instruction manual (Leaflet: Japanese and English)
N	None

Calibration certificate

Nil	None
A	With calibration certificate

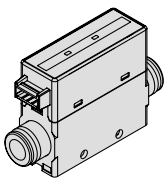
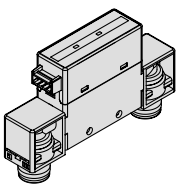
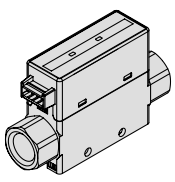
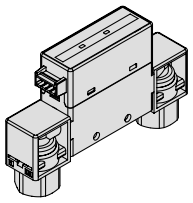
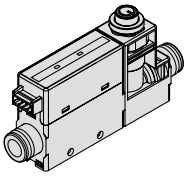
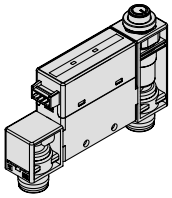
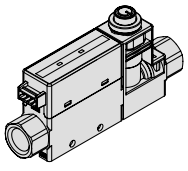
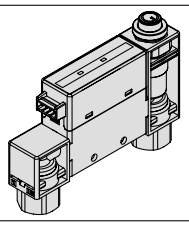
∗ The certificate is written in English and Japanese. Other languages are available as specials.

Option 1
(Refer to page 14.)

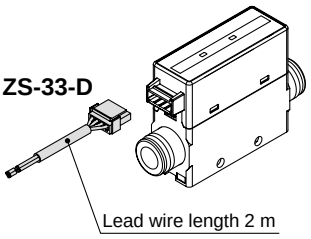
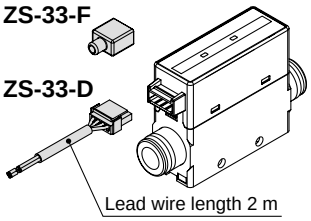
Option 2
(Refer to page 14.)

Made to Order
(Refer to page 14 and 35.)

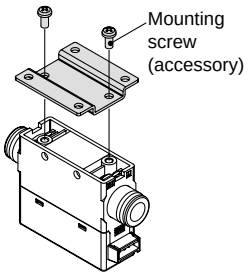
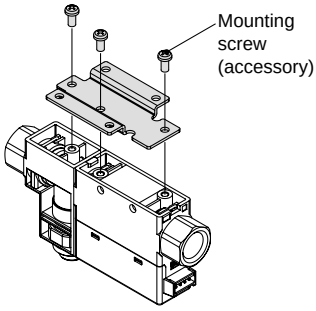
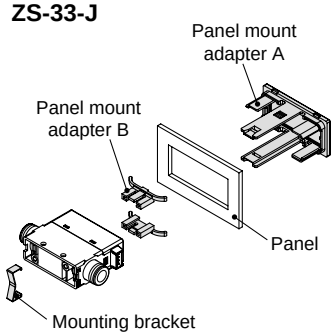
Piping Variations

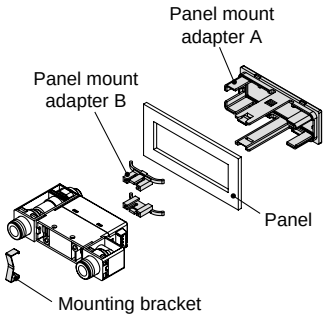
	With one-touch fittings (C4, C6, C8, N7)		Female thread (01, 02, N01, N02, F01, F02)	
	Straight (Nil)	**Bottom (L)**	**Straight (Nil)**	**Bottom (L)**
Without flow adjustment valve (Nil)				
With flow adjustment valve (S)				

Option 1

Nil	W	Z
With lead wire with connector (2 m) **ZS-33-D**  	With lead wire with connector (2 m) + Rubber cover for connector (silicon rubber) **ZS-33-F** **ZS-33-D**  	Without lead wire with connector

Option 2

Nil	R	S	T
None	Bracket (For without flow adjustment valve) **ZS-33-M**  	Bracket (For with flow adjustment valve) **ZS-33-MS**  Piping direction: Cannot be mounted with bottom piping type.	Panel mount adapter (For without flow adjustment valve) **ZS-33-J** 

V
Panel mount adapter (For with flow adjustment valve) **ZS-33-JS** 

Each option is not assembled with the product, but shipped together.

Made to Order

Symbol	Specification/Description
X693	Change of piping entry direction combination
X694	

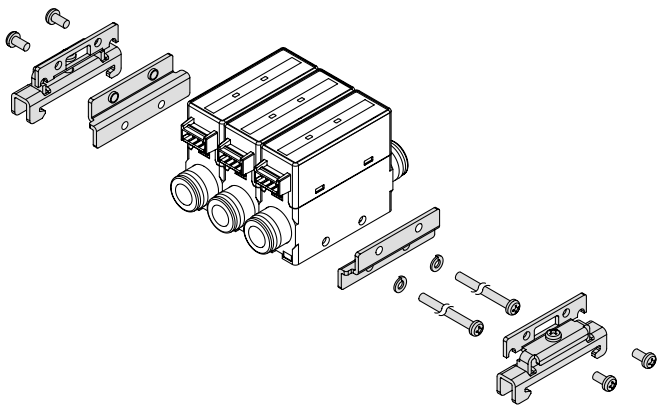
For details, refer to page 35 and 36.

DIN Rail Mounting Bracket (Order Separately)

ZS − 33 − R□

Stations

1	1 station
2	2 stations
3	3 stations
4	4 stations
5	5 stations



- DIN rail (supplied by customers)
- Port size F02: G1/4 cannot be mounted on the DIN rail.

Specifications

Model		PFM510	PFM525	PFM550	PFM511
Applicable fluid		Dry air, N_2, Ar, CO_2 (Air quality grade is JIS B8392.1-1, 1.2 to 1.6.2 and ISO8573.1-1, 1.2 to 1.6.2.)			
Rated flow range Note) **(Flow rate range)**	**Dry air, N_2, Ar**	0.2 to 10 ℓ/min	0.5 to 25 ℓ/min	1 to 50 ℓ/min	2 to 100 ℓ/min
	CO_2	0.2 to 5 ℓ/min	0.5 to 12.5 ℓ/min	1 to 25 ℓ/min	2 to 50 ℓ/min
Accuracy		±3%F.S. or less			
Repeatability		±1%F.S. or less (Fluid: Dry air)			
Pressure characteristics		±5%F.S. or less (based on 0.35 MPa)			
Temperature characteristics		±2%F.S. (15 to 35°C) ±5%F.S. (0 to 50°C)			
Operating pressure range		–100 kPa to 750 kPa			
Rated pressure range		–70 kPa to 750 kPa			
Proof pressure		1 MPa			
Analog output	**Response time**	50 msec or 1 s (with response time selection function: 1 s at no-voltage input) → Refer to the internal circuits and wiring examples on page 16.			
	Voltage output	Voltage output: 1 to 5 V Output impedance: 1 kΩ			
	Current output	Current output: 4 to 20 mA Max. load impedance: 600 Ω, Min. load impedance: 50 Ω			
Status LED's		Power ON indicator: Lights when power is turned on (Green). Flow rate indicator: Flashes when flow is applied (Green).			
Power supply voltage		24 VDC ± 10%			
Current consumption		35 mA or less			
Environ-mental resistance	**Enclosure**	IP40			
	Operating fluid temperature	0 to 50°C (with no freezing and condensation)			
	Operating temperature range	Operating: 0 to 50°C Stored: –10 to 60°C (with no freezing and condensation)			
	Operating humidity range	Operating, Stored: 35 to 85%R.H. (with no condensation)			
	Withstand voltage	1000 VAC for 1 min. between external terminal and case			
	Insulation resistance	50 MΩ or more (500 VDC Mega) between external terminal and case			
	Vibration resistance	Without orifice: 10 to 500 Hz with a 1.5 mm amplitude or 98 m/s² acceleration, in each X, Y, Z direction for 2 hrs, whichever is smaller. With orifice: 10 to 150 Hz with a 1.5 mm amplitude or 19.6 m/s² acceleration, in each X, Y, Z direction for 2 hrs, whichever is smaller.			
	Impact resistance	490 m/s² in X, Y, Z directions 3 times each			

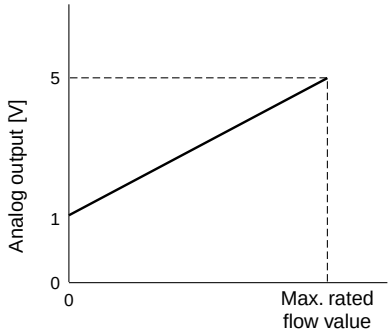
Note: Flow rate unit is based on standard conditions (20°C, 1 atm, 65% RH).

Piping Specifications / Weight

Part no.	01	02	N01	N02	F01	F02	C4	C6	C6	N7
Port size	Rc 1/8	Rc 1/4	NPT 1/8	NPT 1/4	G1/8	G1/4	ø4 (5/32") one-touch fitting	ø6 one-touch fitting	ø8 (5/16") one-touch fitting	1/4 one-touch fitting
Weight	Straight Without orifice: 95 g Bottom Without orifice: 105 g Straight With orifice: 135 g Bottom With orifice: 145 g					Straight Without orifice: 125 g Bottom Without orifice: 135 g Straight With orifice: 165 g Bottom With orifice: 175 g	Straight Without orifice: 55 g Bottom Without orifice: 65 g Straight With orifice: 95 g Bottom With orifice: 105 g			
Wetted parts material	LCP, PBT, Brass (Electroless nickel plated), HNBR (+ Fluoro coated), FKM (+ Fluoro coated), Silicon, Au, Stainless steel 304									

Analog Output

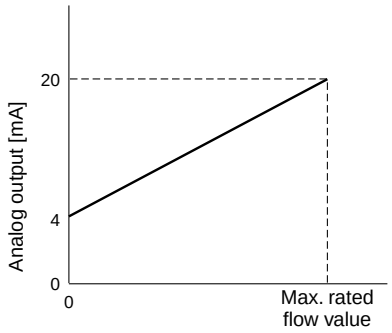
Note: Analog output at maximum rated flow rate when CO_2 is selected is 4.57 [V] for the voltage output type and 18.28 [mA] for the current output type.



Analog Voltage Output (1 to 5 V)

Model	Max. rated flow value [ℓ/min]
PFM510-□-1	10 (5)
PFM525-□-1	25 (12.5)
PFM550-□-1	50 (25)
PFM511-□-1	100 (50)

∗ ( ): Fluid: CO_2



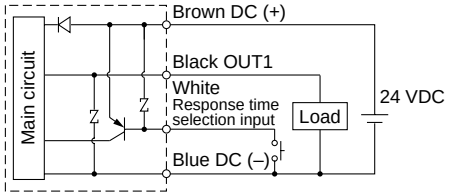
Analog Current Output (4 to 20 mA)

Model	Max. rated flow value [ℓ/min]
PFM510-□-2	10 (5)
PFM525-□-2	25 (12.5)
PFM550-□-2	50 (25)
PFM511-□-2	100 (50)

∗ ( ): Fluid: CO_2

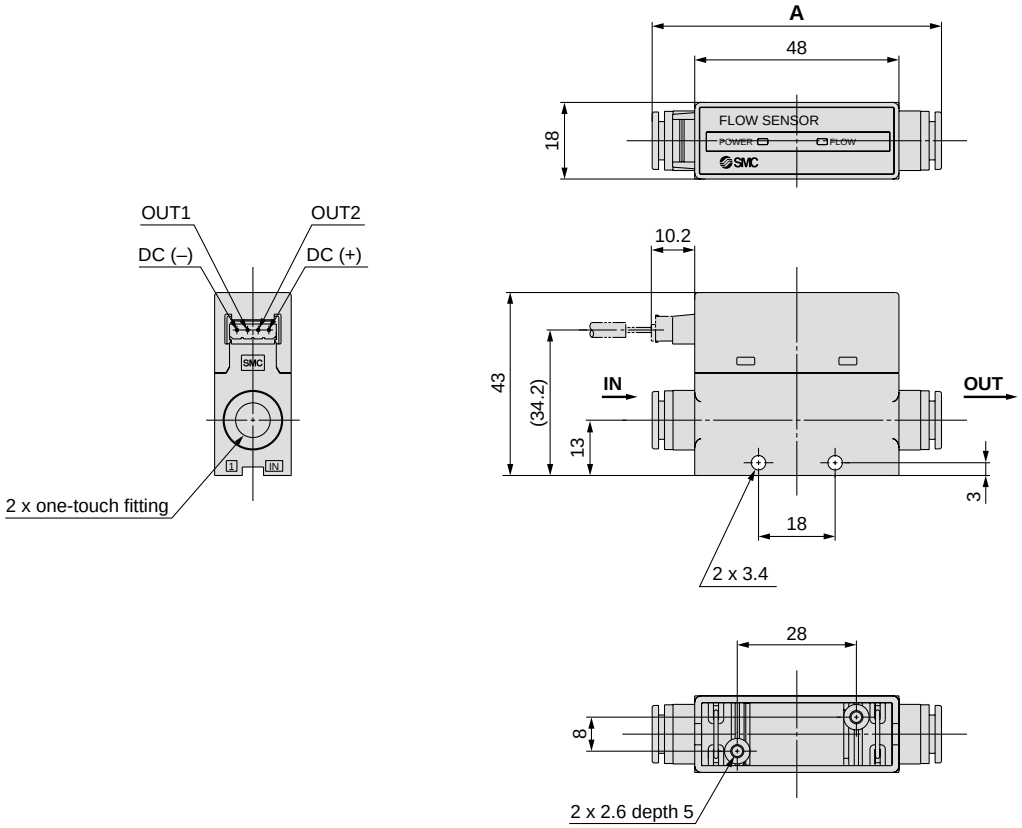
Internal Circuits and Wiring Examples

PFM5□□



Dimensions

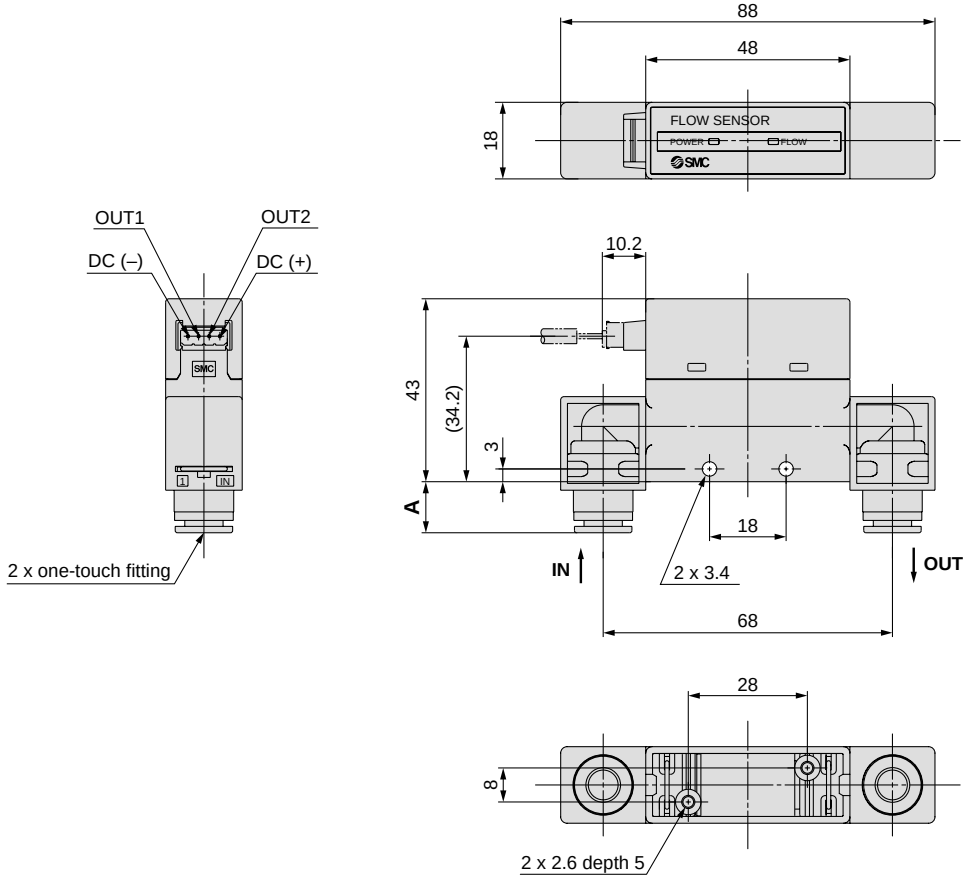
PFM5□□-C4/C6/C8/N7



(mm)

One-touch fitting Applicable tube O.D.	A
ø4 (5/32")	64.2
ø6	64.6
ø8 (5/16")	68
ø1/4	64.6

PFM5□□-C4L/C6L/C8L/N7L

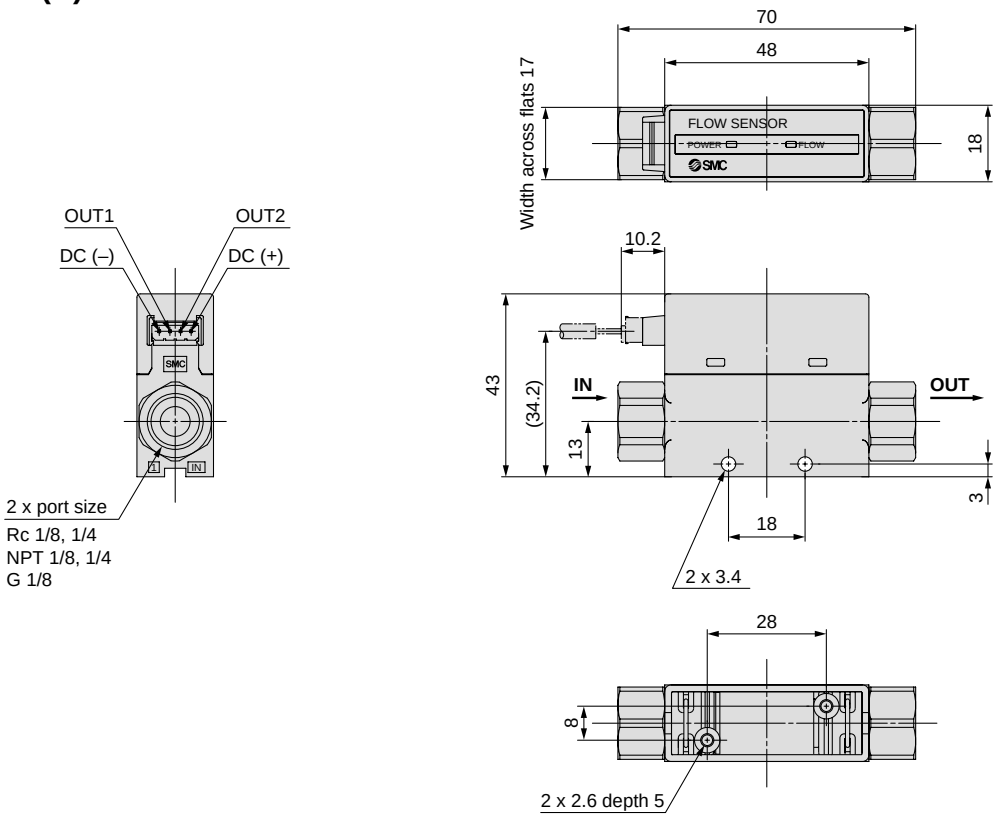


(mm)

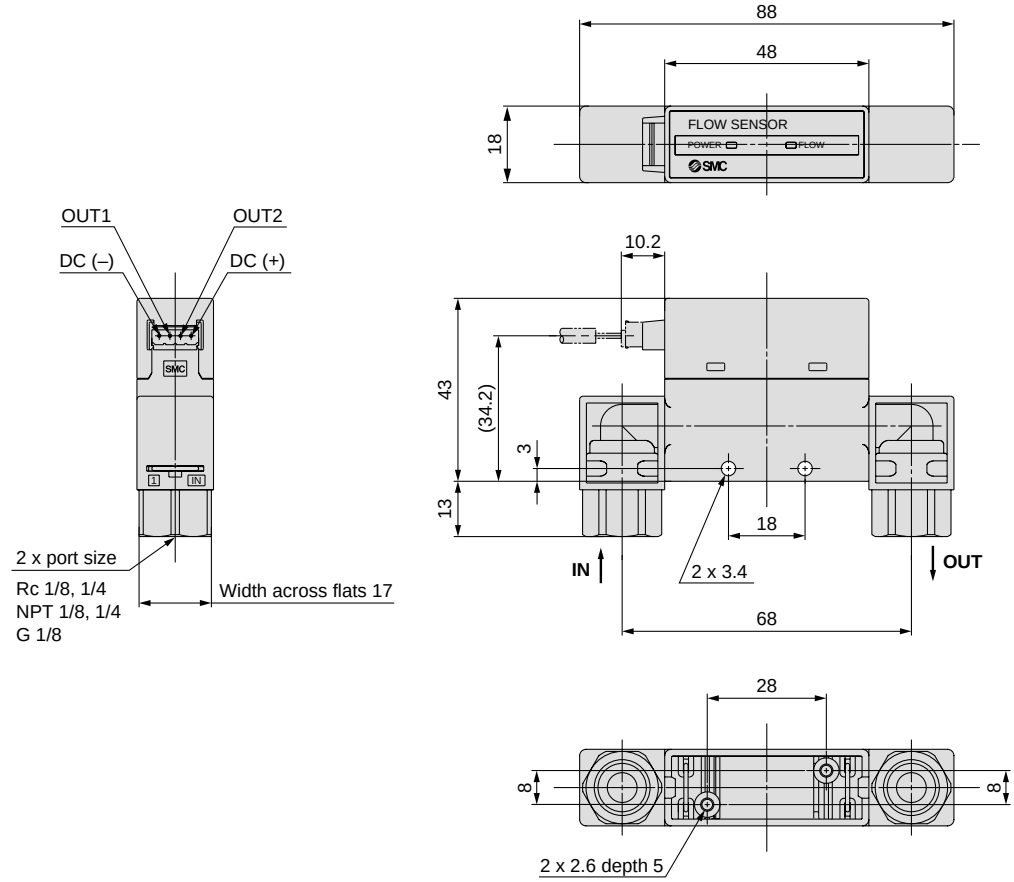
One-touch fitting Applicable tube O.D.	A
ø4 (5/32")	10.1
ø6	10.3
ø8 (5/16")	12
ø1/4	10.3

Dimensions

PFM5□□-(N)01/(N)02/F01

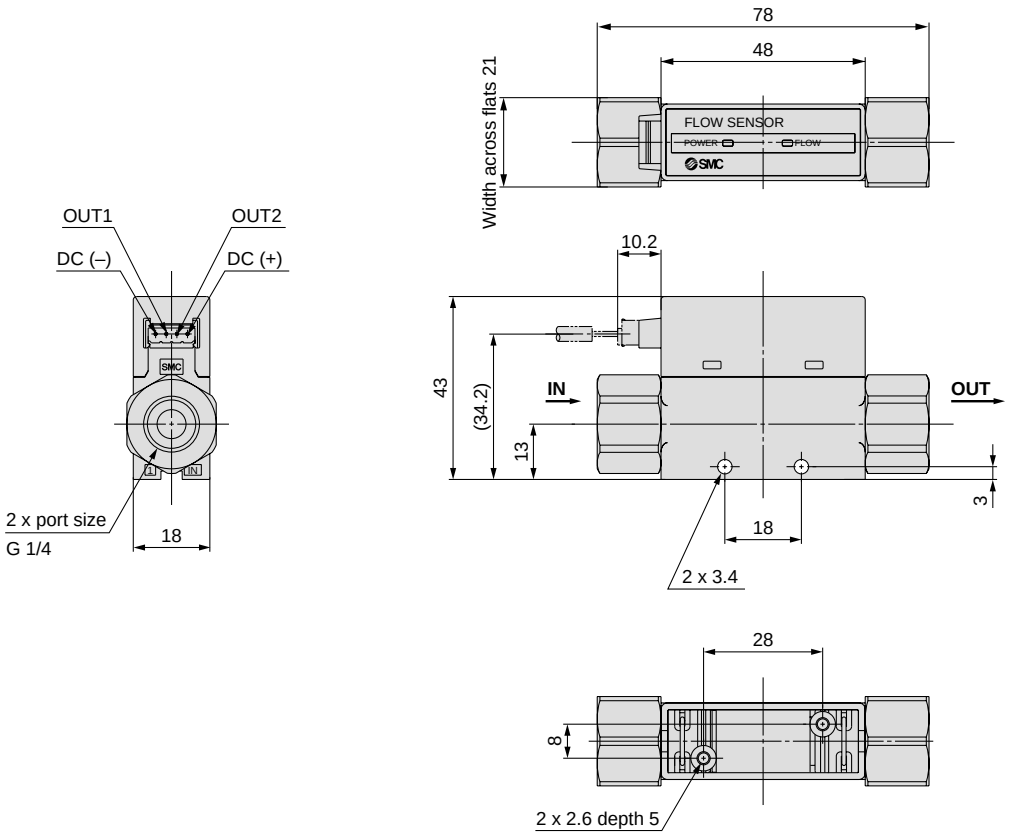


PFM5□□-(N)01L/(N)02L/F01L

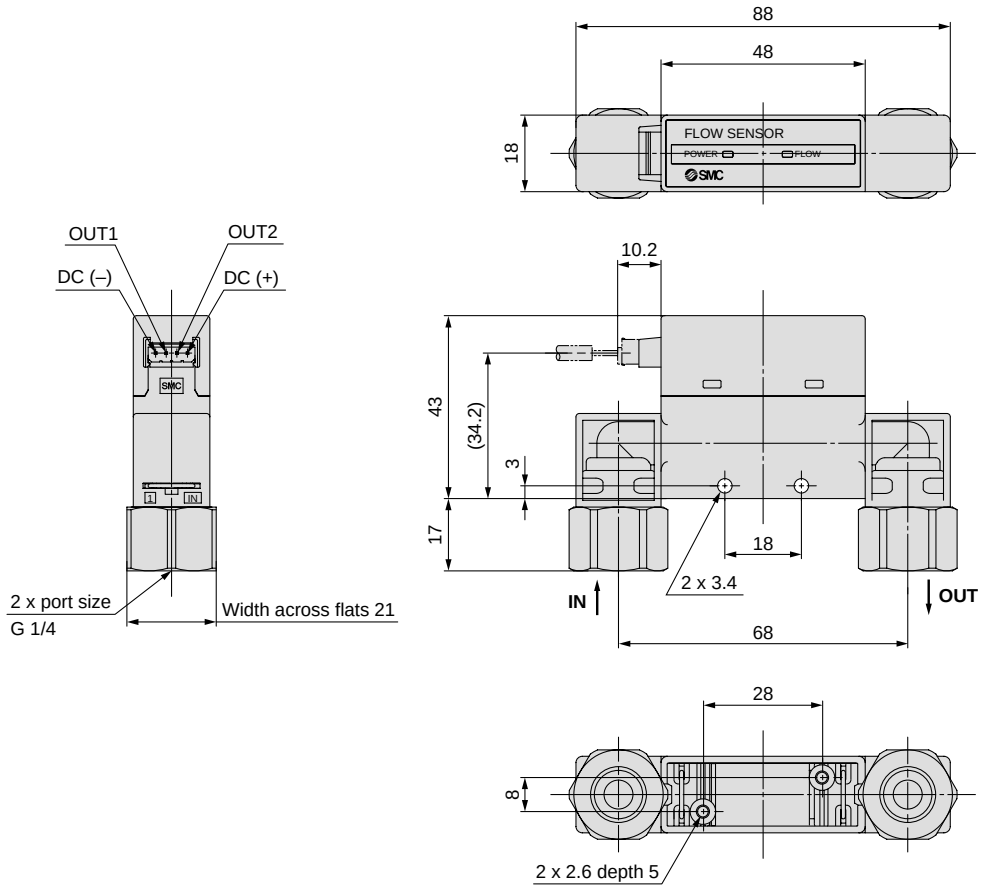


Dimensions

PFM5□□-F02

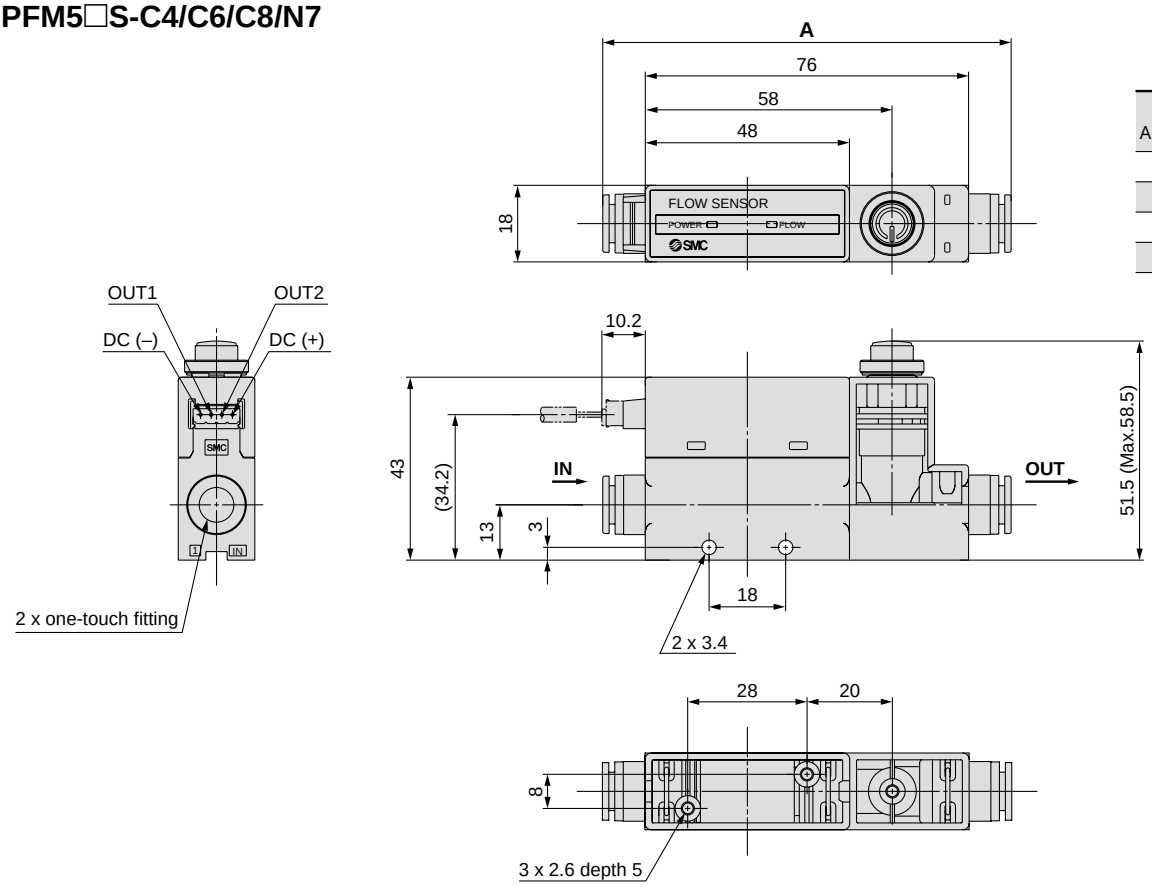


PFM5□□-F02L



Dimensions

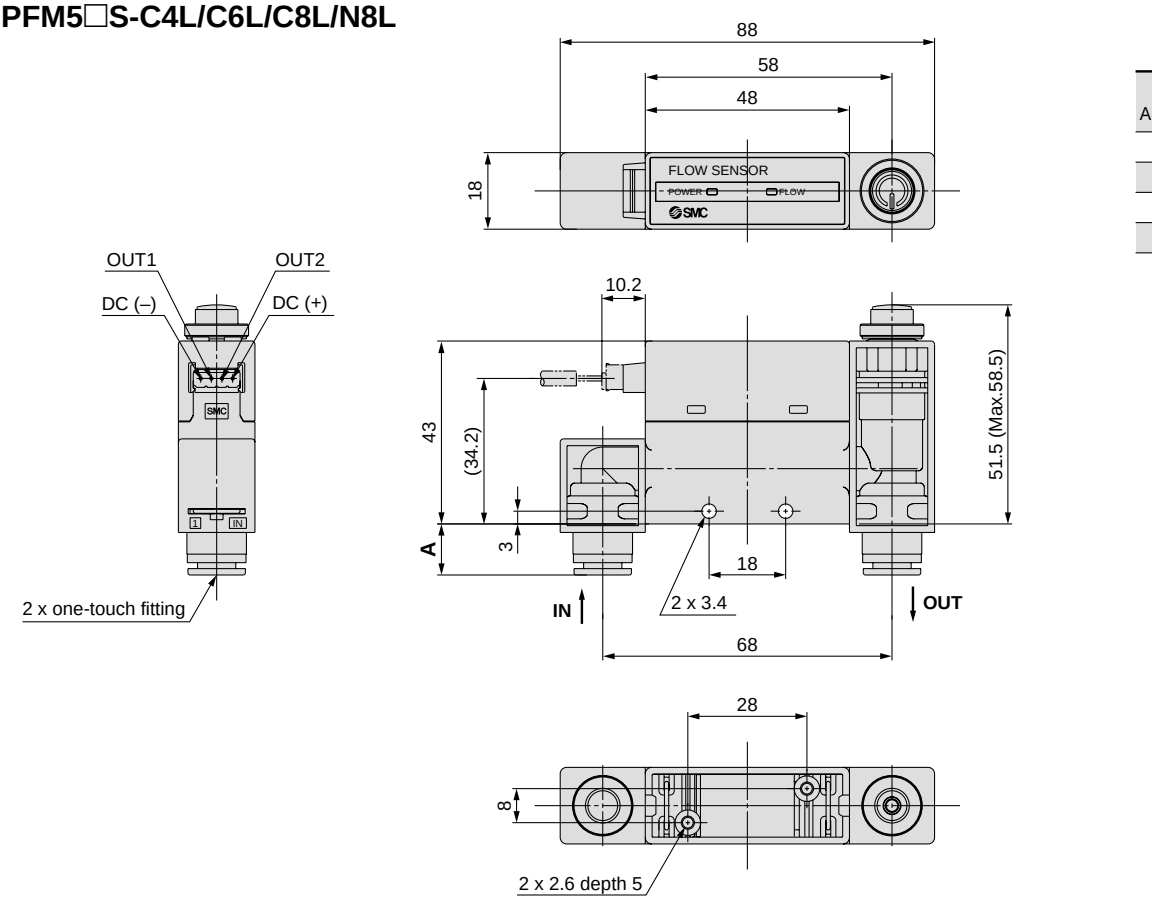
PFM5□S-C4/C6/C8/N7



(mm)

One-touch fitting Applicable tube O.D.	A
ø4 (5/32")	92.2
ø6	92.6
ø8 (5/16")	96
ø1/4	92.6

PFM5□S-C4L/C6L/C8L/N8L

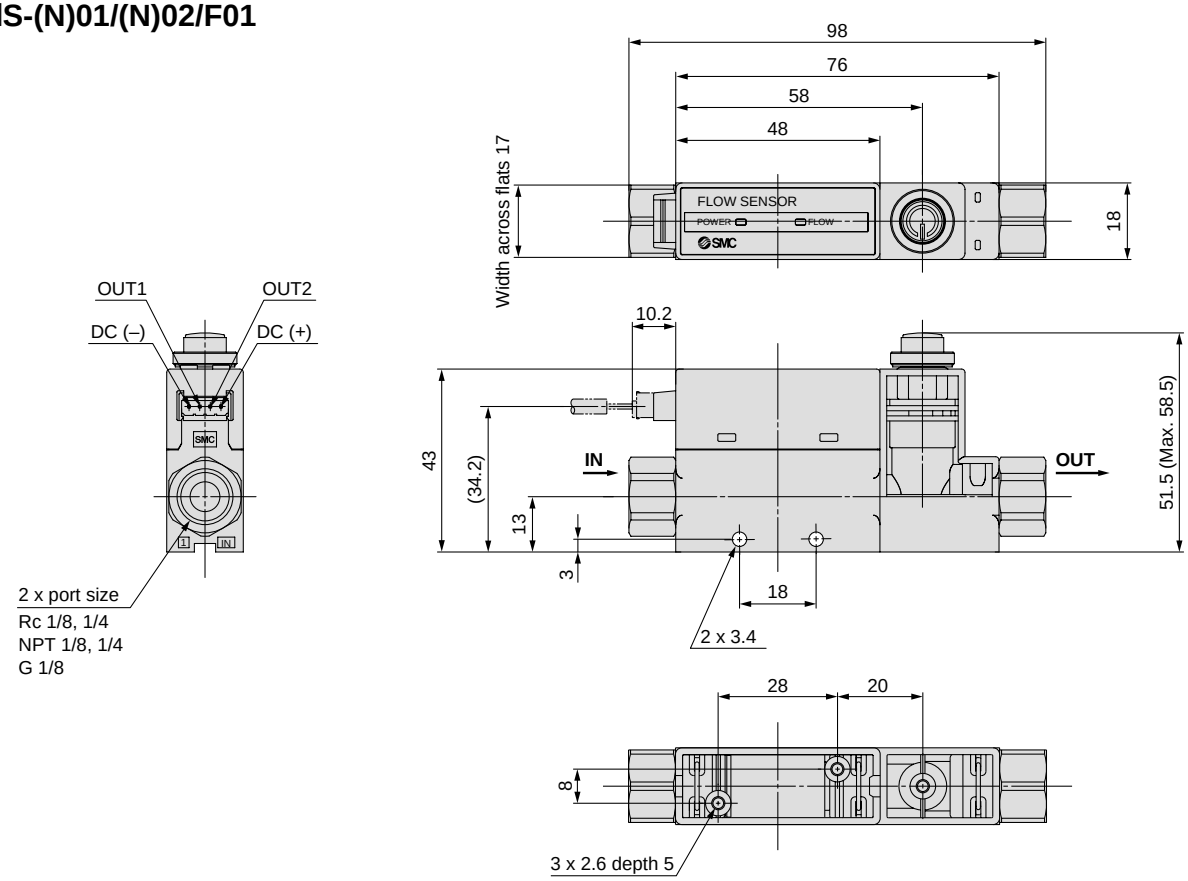


(mm)

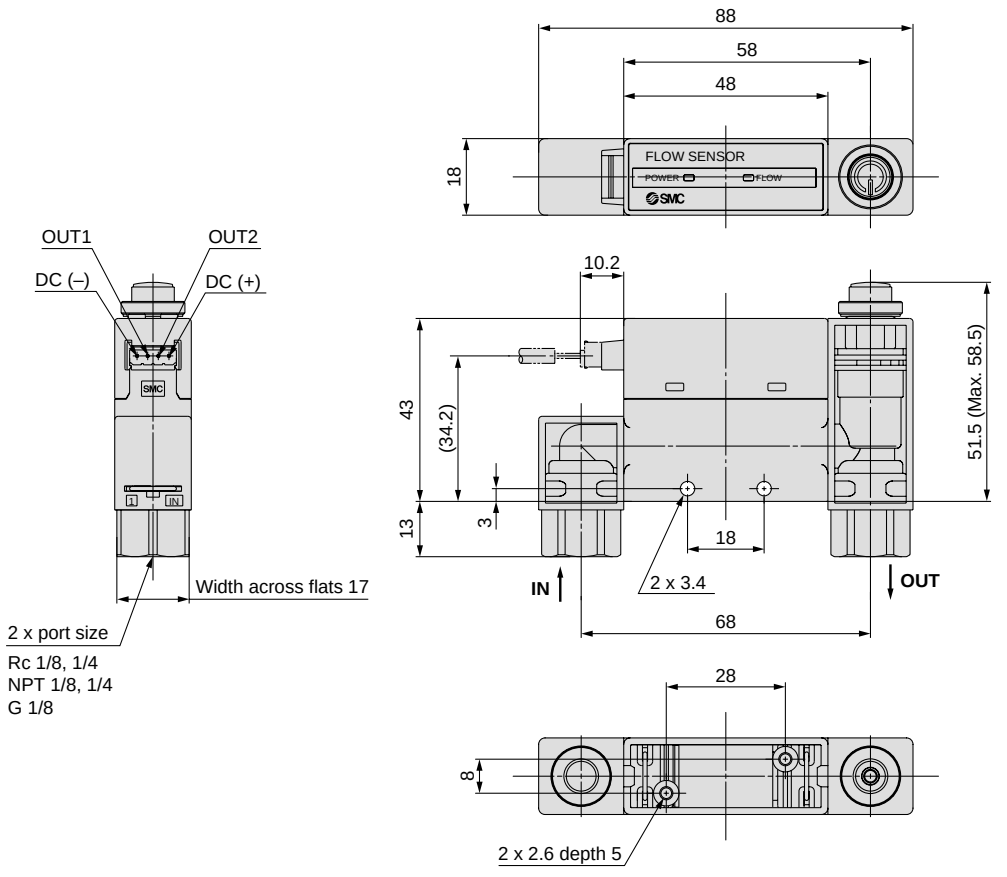
One-touch fitting Applicable tube O.D.	A
ø4 (5/32")	10.1
ø6	10.3
ø8 (5/16")	12
ø1/4	10.3

Dimensions

PFM5□S-(N)01/(N)02/F01

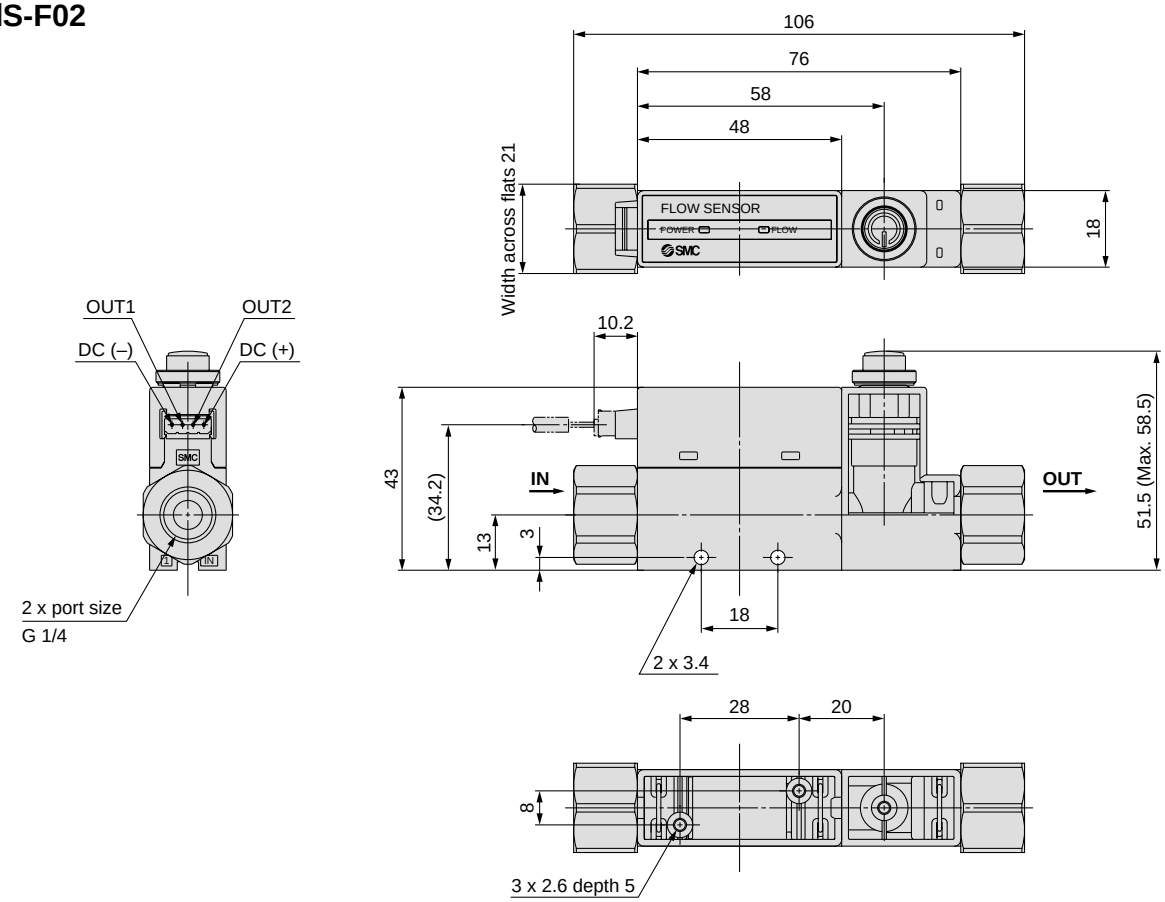


PFM5□S-(N)01L/(N)02L/F01L

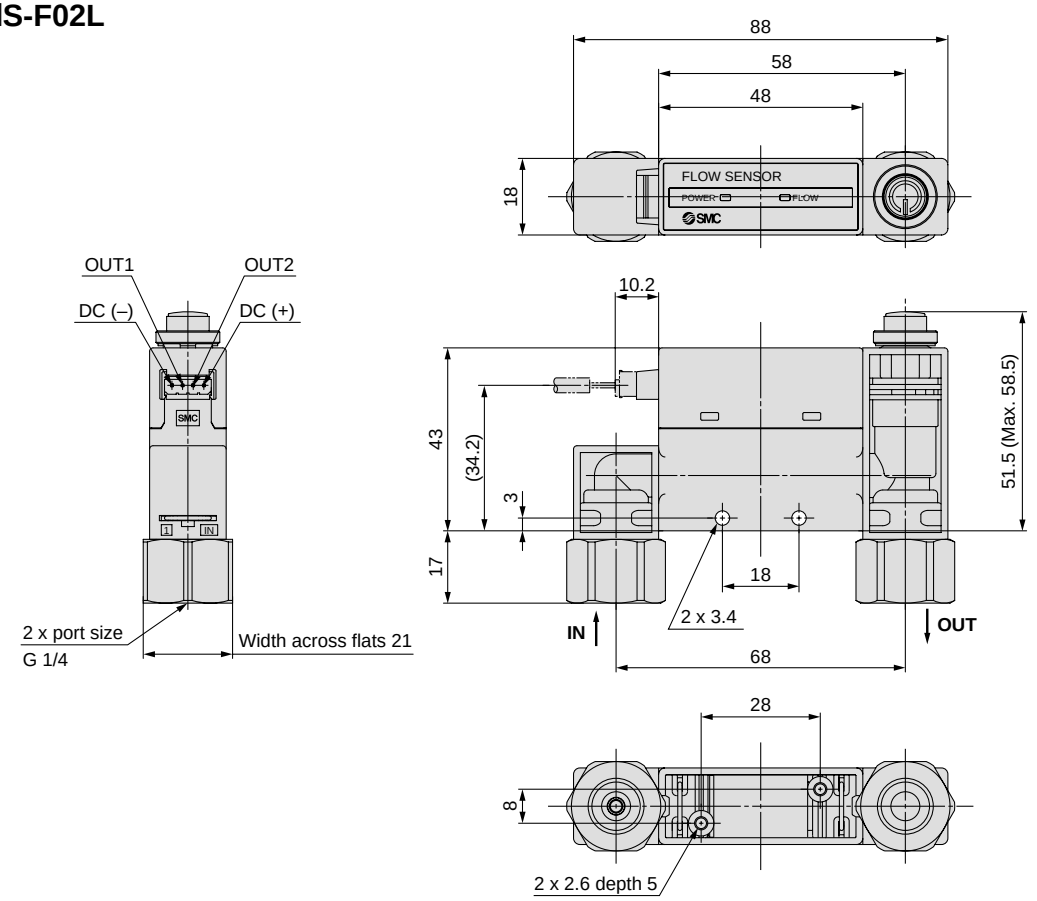


Dimensions

PFM5□S-F02



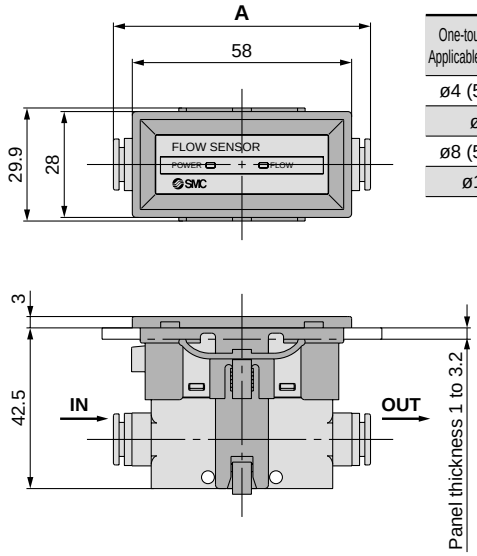
PFM5□S-F02L



Dimensions

Panel mount / Without flow adjustment valve / Straight

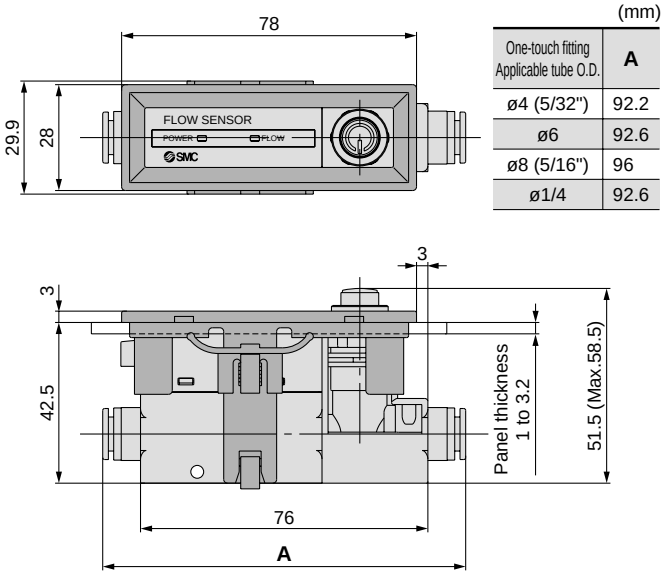
(mm)



One-touch fitting Applicable tube O.D.	A
ø4 (5/32")	64.2
ø6	64.6
ø8 (5/16")	68
ø1/4	64.6

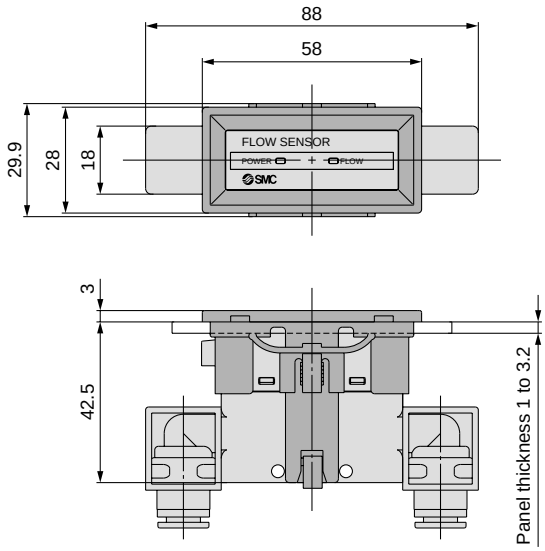
Panel mount / With flow adjustment valve / Straight

(mm)

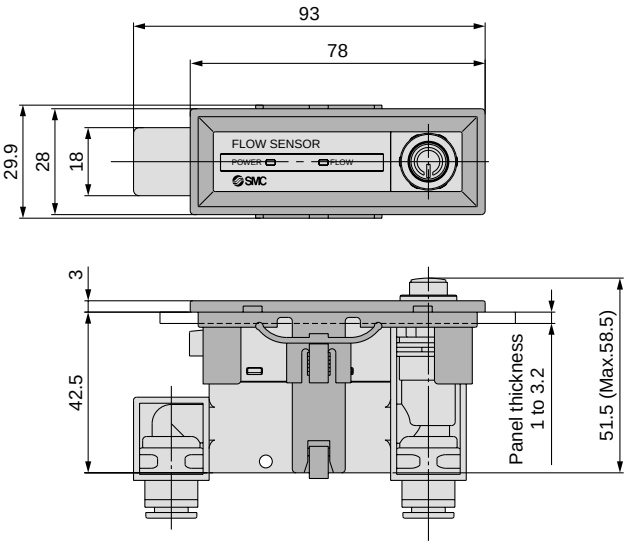


One-touch fitting Applicable tube O.D.	A
ø4 (5/32")	92.2
ø6	92.6
ø8 (5/16")	96
ø1/4	92.6

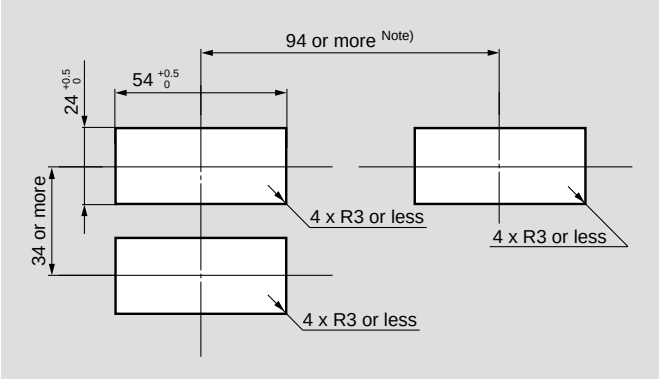
Panel mount / Without flow adjustment valve



Panel mount / With flow adjustment valve



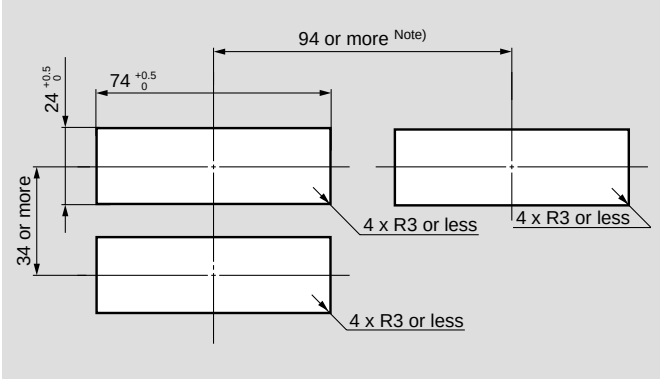
Panel Fitting Dimensions



Panel thickness 1 to 3.2 mm

Note) Piping entry direction: Minimum dimensions for bottom side piping. If using straight piping, the piping material and tubing need to be taken into consideration when designing the system. If a bend (R) is used, limit it to R3 or less.

Panel Fitting Dimensions

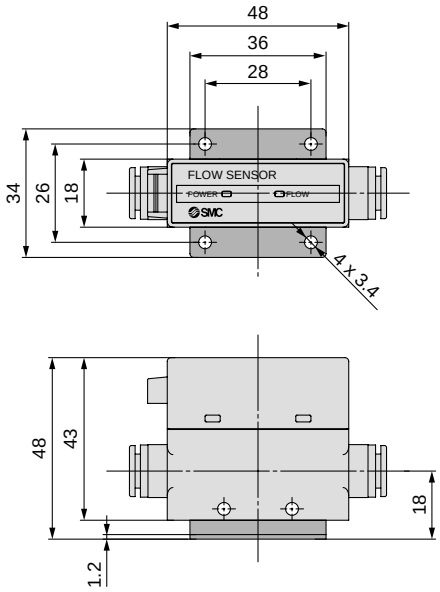


Panel thickness 1 to 3.2 mm

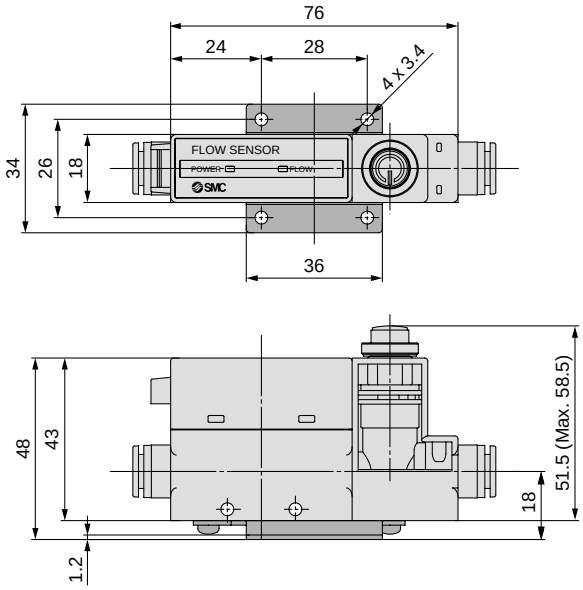
Note) Piping entry direction: Minimum dimensions for bottom side piping. If using straight piping, the piping material and tubing need to be taken into consideration when designing the system. If a bend (R) is used, limit it to R3 or less.

Dimensions

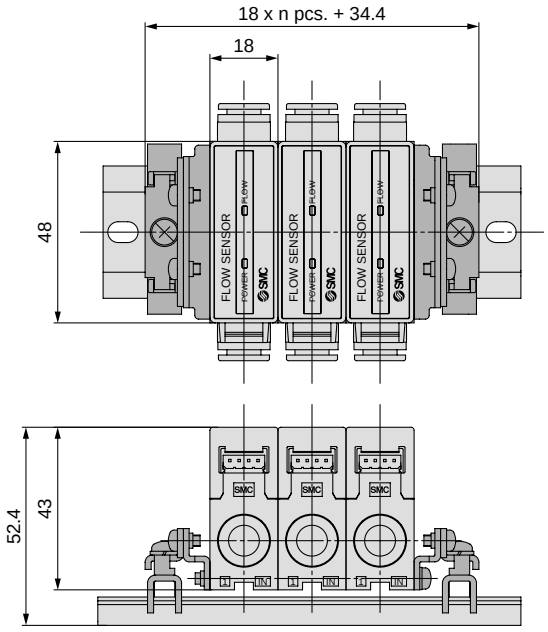
With bracket / Without flow adjustment valve



With bracket / With flow adjustment valve

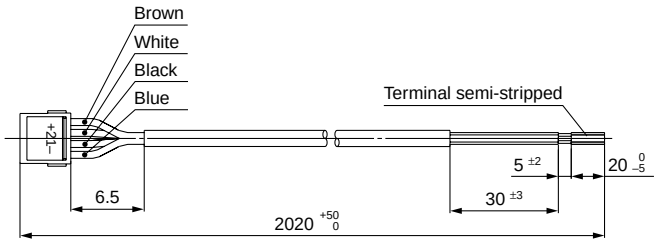


DIN rail mounting



- DIN rail (supplied by customers)
- Port size, F02: G1/4 cannot be mounted on the DIN rail.

Lead wire with connector ZS-33-D



Cable Specifications of Lead Wire with Connector

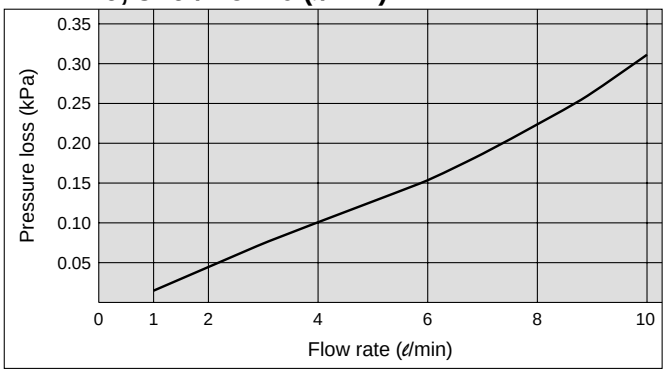
Rated temperature		80°C
Rated voltage		30 V
Number of wires		4
Conductor	Nominal cross section area	AWG26
	Material	Soft copper wire
	Construction	28 / 0.08 mm
	External diameter	Approx. 0.50 mm
Insulation	Material	Cross-linked vinyl chloride resin compound
	External diameter	Approx. 1.00 mm
	Colors	Brown, White, Black, Blue
Sheath	Material	Oil-resistant vinyl chloride resin compound
	Color	Light gray
Finished external diameter		ø3.5 +0.10 −0.25

∗ Connects to the PFM3□□ series.

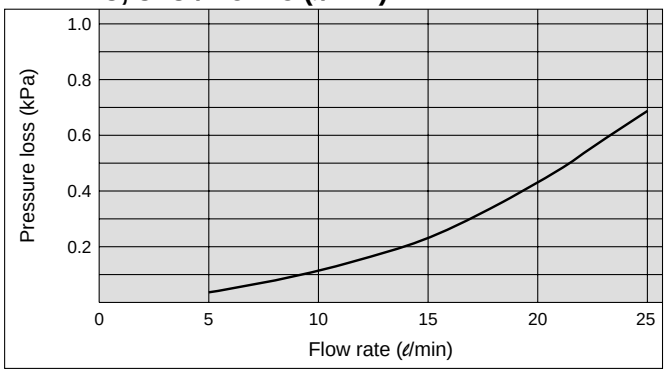
Common Specifications

Pressure Loss (Pressure: 350 [kPa])

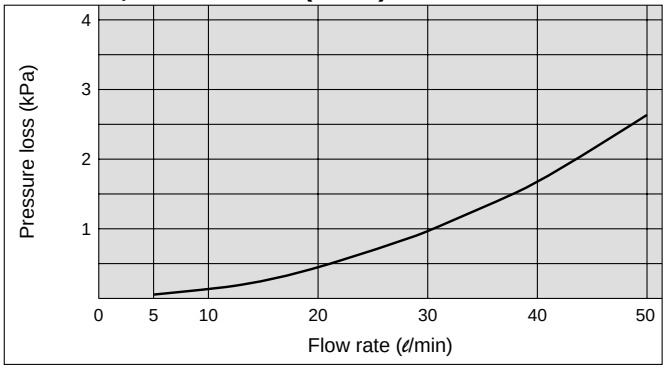
PFM710, 510 / For 10 (ℓ/min)



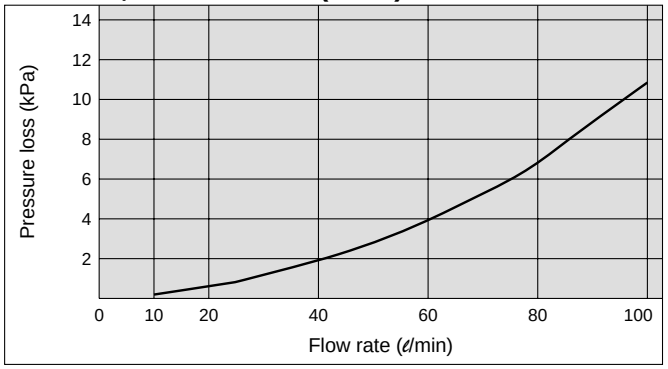
PFM725, 525 / For 25 (ℓ/min)



PFM750, 550 / For 50 (ℓ/min)

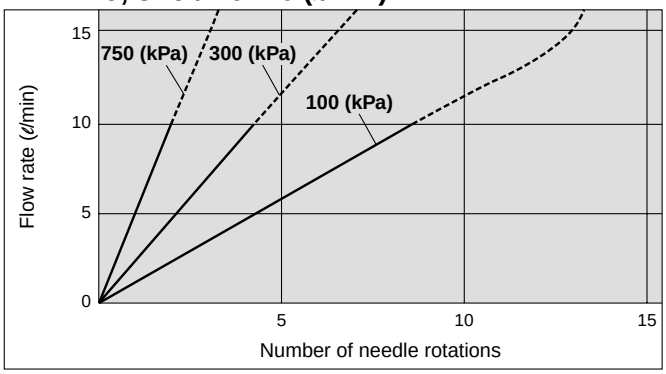


PFM711, 511 / For 100 (ℓ/min)

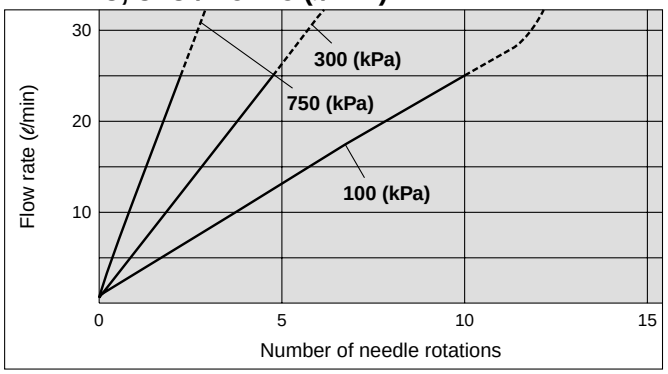


Flow Characteristics

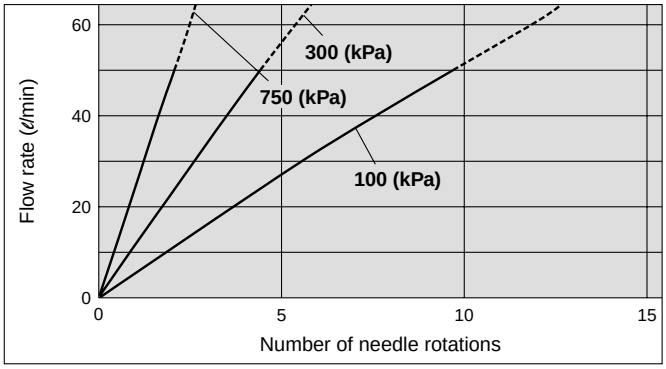
PFM710, 510 / For 10 (ℓ/min)



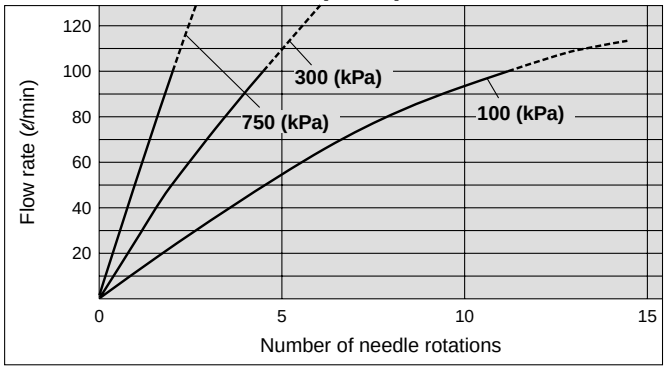
PFM725, 525 / For 25 (ℓ/min)



PFM750, 550 / For 50 (ℓ/min)

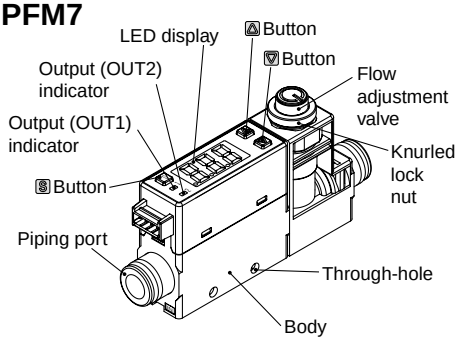


PFM711, 511 / For 100 (ℓ/min)

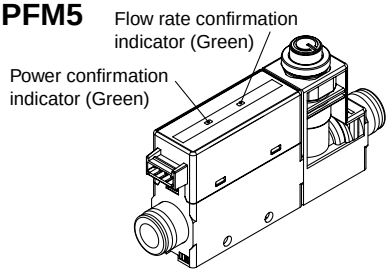


Parts Description

PFM7

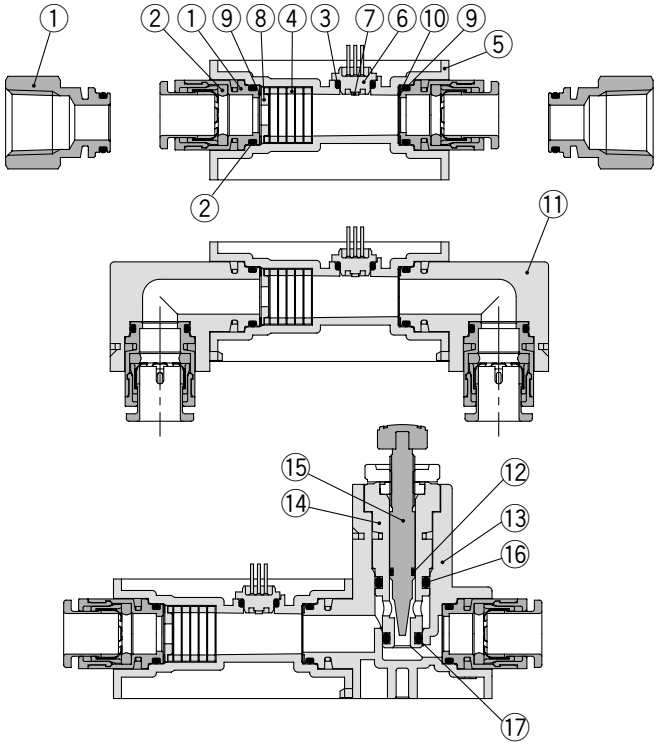


PFM5



Description	Item
Output (OUT1) indicator (Green)	Illuminates when the output (OUT1) is turned on. Flashes when overcurrent error occurs.
Output (OUT2) indicator (Red)	Illuminates when the output (OUT2) is turned on. Flashes when overcurrent error occurs.
LED display	Indicates the flow rate, set mode state and error code. The display color can be selected between red and green according to the output (OUT1) status.
△ Button	Selects the operation mode and increases the set value for ON and OFF. Used to transfer to peak indication mode.
▽ Button	Selects the operation mode and decreases the set value for ON and OFF. Used to transfer to bottom indication mode.
Ⓢ Button	Used to make changes in each mode and to enter the set value.
Reset	Reset function is activated by pressing △ and ▽ buttons simultaneously. Returns the indicated value to zero and clears errors.
Body	Main body of the flow switch
Flow adjustment valve	Orifice mechanism to adjust the flow rate
Piping port	Connection port for piping
Knurled lock nut	Used to fix the needle.
Power confirmation indicator (Green)	Illuminates when power is supplied.
Flow rate confirmation indicator (Green)	Flashing interval changes according to flow rate. Flashes faster when flow rate is increased. Color changes to red when exceeding the rated flow rate.

Construction



Component Parts

No.	Description	Material	Note
1	**Fitting for piping**	Brass	Electroless nickel plated
2	**O-ring**	FKM	Fluoro coated
3	**O-ring**	HNBR	Fluoro coated
4	**Rectifying module**	Stainless steel 304	
5	**Body**	PBT	
6	**Sensor housing**	LCP	
7	**Sensor chip**	Silicon	
8	**Orifice**	Brass	Electroless nickel plated
9	**Seal**	FKM	Fluoro coated
10	**Mesh**	Stainless steel 304	
11	**Bottom piping adapter**	PBT	
12	**O-ring**	HNBR	Fluoro coated
13	**Flow adjustment valve assembly**	PBT	
14	**Body B**	Brass	Electroless nickel plated
15	**Needle**	Brass	Electroless nickel plated
16	**O-ring**	HNBR	Fluoro coated
17	**O-ring**	HNBR	Fluoro coated

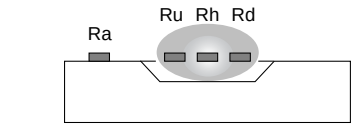
Detection Principle

This MEMS sensor chip consists of upstream temperature measuring sensor (Ru) and downstream temperature measuring sensor (Rd), which are placed symmetrically from the center of a platinum thin film coated heater (Rh) mounted on a membrane, and an ambient temperature sensor (Ra) for measuring gas temperature.

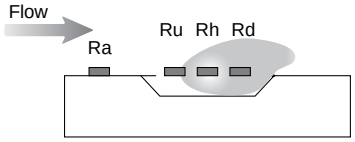
The principle is as shown in the diagram on the right. (a) When the gas is static, the temperature distribution of heated gas centered around Rh is uniform, and Ru and Rd have the same resistance. (b) When the gas flows from the left side, it upsets the balance of the temperature distribution of heated gas, and the resistance of Rd becomes greater than that of Ru.

The difference in resistance between Ru and Rd is proportional to the gas 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.



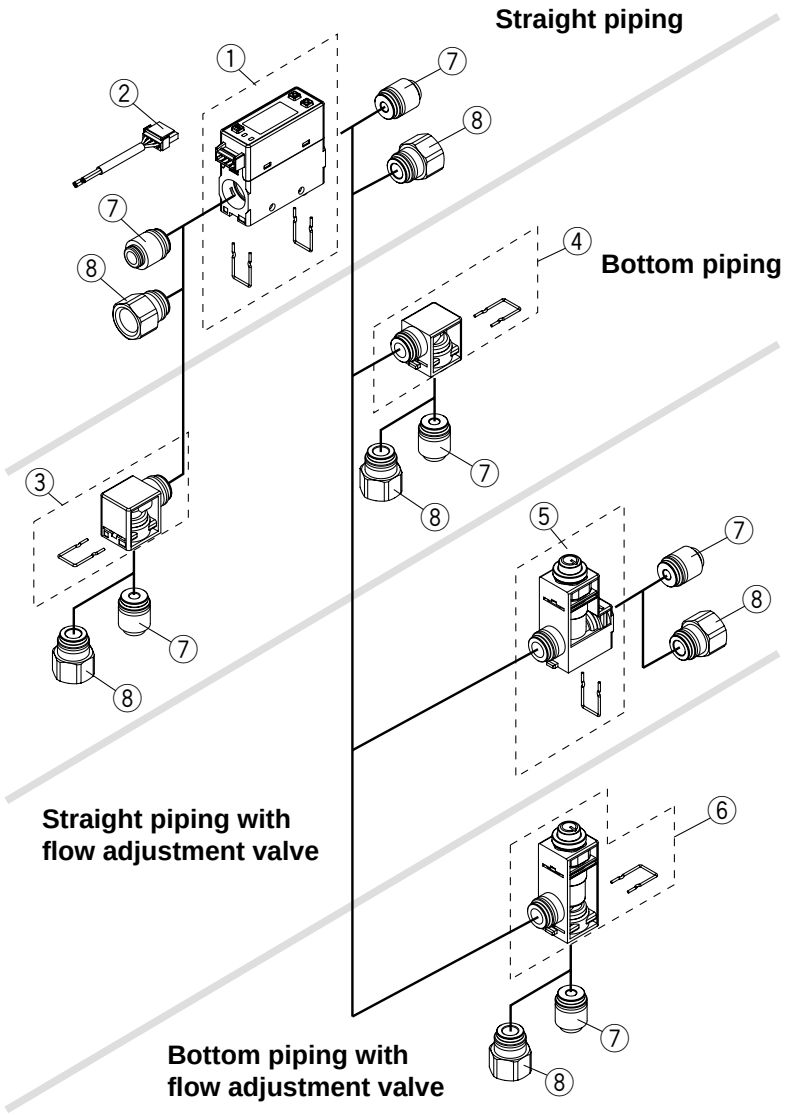
(a) The gas is static.



(b) The gas flows from the left side.

Component Parts

No.	Description		Model
1	Body		
2	Lead wire with connector (2 m)		ZS-33-D
3	IN side Bottom piping adapter (with pin)		ZS-33-P1L
4	OUT side Bottom piping adapter (with pin)		ZS-33-P2L
5	For straight piping Flow adjustment valve assembly (with pin)	For 10 ℓ/min	ZS-33-10N
		For 25 ℓ/min	ZS-33-25N
		For 50 ℓ/min	ZS-33-50N
		For 100 ℓ/min	ZS-33-11N
6	For bottom piping Flow adjustment valve assembly (with pin)	For 10 ℓ/min	ZS-33-10NL
		For 25 ℓ/min	ZS-33-25NL
		For 50 ℓ/min	ZS-33-50NL
		For 100 ℓ/min	ZS-33-11NL
7	One-touch fitting	ø4 (5/32")	ZS-33-C4
		ø6	ZS-33-C6
		ø8 (5/16")	ZS-33-C8
		ø1/4	ZS-33-N7
8	Female thread	Rc 1/8	ZS-33-01
		NPT 1/8	ZS-33-N01
		G 1/8	ZS-33-F01
		Rc 1/4	ZS-33-02
		NPT 1/4	ZS-33-N02
		G 1/4	ZS-33-F02



Flow Sensor Monitor
Series PFM3

How to Order

Output specification

0	2 NPN outputs + 1 to 5 V output
1	2 NPN outputs + 4 to 20 mA output
2	2 NPN outputs + External input Note)
3	2 PNP outputs + 1 to 5 V output
4	2 PNP outputs + 4 to 20 mA output
5	2 PNP outputs + External input Note)

Note) User can select from accumulated value external reset, auto-shift and auto-shift zero.

Instruction manual

Nil	With instruction manual (Leaflet: Japanese and English)
N	None

Calibration certificate

Nil	None
A	With calibration certificate

The certificate is written in English and Japanese. Other languages are available as specials.

PFM3 0 0 − M L □ □ − □ □

Type

3	Remote display unit

Input specification

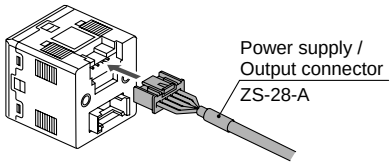
Symbol	Content	Applicable remote type sensor unit
0	Voltage input	PFM5□□(S)-□-1-□
1	Current input	PFM5□□(S)-□-2-□

Unit specification

Nil	With unit switching function Note 1)
M	Fixed SI unit Note 2)

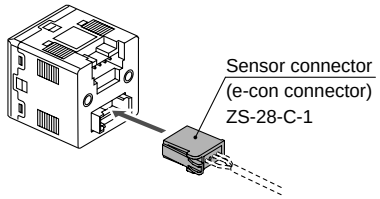
Note 1) This product is for overseas use only according to the new Measurement Law. (The SI unit is provided for use in Japan.)
Note 2) Fixed unit: Real-time flow rate: ℓ/min
Accumulated flow: ℓ

Option 1

Nil	None
L	Power supply / Output connector 

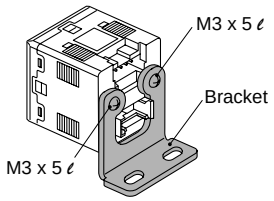
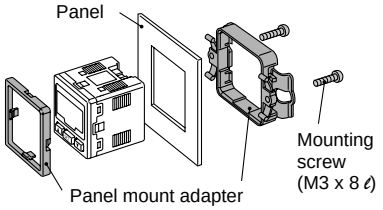
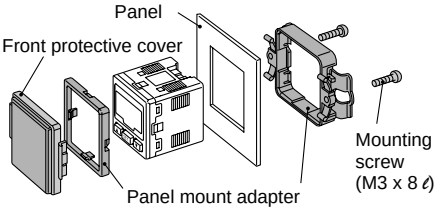
Note) Cable is not connected, but shipped together.

Option 3

Nil	None
F	With sensor connector 

Note) Connector is not connected, but shipped together.

Option 2

Nil	None
E	Bracket 
B	Panel mount adapter 
D	Panel mount adapter + Front protective cover 

Note) Options are not assembled, but shipped together.

Option / Part No.

Description	Part no.	Note
Power supply / Output connector (2 m)	ZS-28-A	
Bracket	ZS-28-B	With M3 x 5 ℓ (2 pcs.)
Sensor connector	ZS-28-C-1	1 pc.
Panel mount adapter	ZS-27-C	With M3 x 8 ℓ (2 pcs.)
Panel mount adapter + Front protective cover	ZS-27-D	With M3 x 8 ℓ (2 pcs.)

Specifications

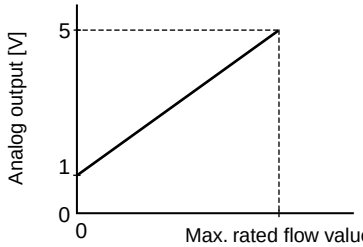
Model		PFM3□□			
Rated flow range (Flow rate range)	**Dry air, N_2, Ar**	0.2 to 10 ℓ/min	0.5 to 25 ℓ/min	1 to 50 ℓ/min	2 to 100 ℓ/min
	CO_2	0.2 to 5 ℓ/min	0.5 to 12.5 ℓ/min	1 to 25 ℓ/min	2 to 50 ℓ/min
Displayable range Note 1)	**Dry air, N_2, Ar**	0.2 to 10.5 ℓ/min	0.5 to 26.3 ℓ/min	1 to 52.5 ℓ/min	2 to 105 ℓ/min
	CO_2	0.2 to 5.2 ℓ/min	0.5 to 13.1 ℓ/min	1 to 26.2 ℓ/min	2 to 52 ℓ/min
Settable range Note 1)	**Dry air, N_2, Ar**	0 to 10.5 ℓ/min	0 to 26.3 ℓ/min	0 to 52.5 ℓ/min	0 to 105 ℓ/min
	CO_2	0 to 5.2 ℓ/min	0 to 13.1 ℓ/min	0 to 26.2 ℓ/min	0 to 52 ℓ/min
Minimum unit setting Note 2)		0.01 ℓ/min	0.1 ℓ/min	0.1 ℓ/min	0.1 ℓ/min
Accumulated pulse flow rate exchange value		0.1 ℓ/pulse	0.1 ℓ/pulse	0.1 ℓ/pulse	1 ℓ/pulse
Indication unit Note 3)		Real-time flow rate ℓ/min, CFM x 10^{-2} Accumulated flow ℓ, ft^3 x 10^{-1}			
Accumulated flow range Note 4)		1999999 ℓ			
Power supply voltage		24 VDC (ripple ± 10% or less) (With polarity protection)			
Current consumption		50 mA or less			
Sensor input **Number of inputs: 1**		PFM30□: Voltage input 1 to 5 VDC (input impedance: 1 MΩ) PFM31□: Current input 4 to 20 mADC (input impedance: 250 Ω)			
Hysteresis Note 5)		Hysteresis mode: Variable, Window comparator mode: Variable			
Switch output		NPN or PNP open collector output: 2 outputs Maximum load current: 80 mA, max. load voltage 30 VDC (at NPN output), Residual voltage 1 V or less (at load current 80 mA), With short-circuit protection			
Accumulated pulse output		NPN or PNP open collector output (Same as switch output)			
Response time		1 s (50 ms, 0.5 s, 2 s can be selected.)			
Repeatability		±0.1%F.S. or less, Analog output accuracy: ±0.3%F.S. or less			
Analog output		Voltage output: 1 to 5 VDC (0 ℓ/min to max. rated flow rate value) Output impedance: Approx. 1 kΩ, Accuracy: ±1%F.S. or less (relative to display value) Current output: 4 to 20 mADC (0 ℓ/min to max. rated flow rate value) Max. load impedance: 600 Ω (at 24 VDC), Min. load impedance: 50 Ω Accuracy: ±1%F.S. or less (relative to display value)			
Display accuracy		±0.5%F.S. ± 1 digit or less			
Display method		3+1/2-digit, 7-segment LED 2-color display (Red/Green) Sampling cycle: 10 times/sec			
Status LED's		OUT1: Illuminates when output is turned ON (Green). OUT2: Illuminates when output is turned ON (Red).			
External input Note 6)		No-voltage input (Reed or Solid state), LOW level input 30 msec or more, LOW level 0.4 V or less			
Enclosure		IP40			
Operating temperature range		Operating: 0 to 50°C Stored: –10 to 60°C (with no freezing and condensation)			
Operating humidity range		Operating, Stored: 35 to 85%R.H. (with no condensation)			
Withstand voltage		1000 VAC for 1 min. between whole charging part and live part			
Insulation resistance		50 MΩ or more (500 VDC Mega) between whole charging part and live part			
Vibration resistance		10 to 500 Hz with a 1.5 mm amplitude or 98 m/s^2 acceleration, in each X, Y, Z direction for 2 hrs, whichever is smaller. (de-energized)			
Impact resistance		100 m/s^2 in X, Y, Z directions 3 times each(de-energized)			
Temperature characteristics		±0.5%F.S. or less (based on 25°C)			
Connection		Power supply / Output connection: 5P connector, Sensor connection: 4P connector			
Material		Front case, Rear case: PBT			
Weight		30 g (Without cable) 85 g (With cable)			

Note 1) Select the sensor to connect in the initial setting. If CO_2 is selected as the operating fluid, the value is 1/2 on the maximum side.
Note 2) When 10 ℓ/min with a minimum unit setting of 0.01 ℓ/min is selected for the connected sensor, the upper limit of the display range is 10.50 ℓ/min.
When 100 ℓ/min with a minimum unit setting of 0.1 ℓ/min is selected for the connected sensor, the upper limit of the display range is 105.0 ℓ/min.
The setting at the time of shipment is 10 ℓ/min with a minimum unit setting of 0.01 ℓ/min for the connected sensor.
Note 3) When equipped with a unit switching function. (The SI unit (ℓ/min or ℓ) is fixed for types with no unit switching function.)
Note 4) The accumulated flow value is cleared to 0 when power is turned off. It is possible to select function that holds the accumulated flow value so it is not cleared. (The accumulated flow value can be held at 2- or 5-minute intervals.) The service life of the memory element (electronic component) is limited to 1 million overwrite cycles (assuming 24-hour operation, 5 minutes x 1 million cycles = 5 million minutes = 9.5 years) when 5-minute intervals are selected. Therefore, when using the holding function, calculate the service life based on the usage conditions, and use the switch within the service life. Applies to models equipped with a unit switching function. (The SI unit (ℓ/min or ℓ) is fixed for types with no unit switching function.)
Note 5) Set to hystresis mode at the time of shipment from the factory. Can be changed to window comparator mode using push-buttons.
Note 6) Accumulated external reset function at the time of shipment from the factory. Auto-shift or auto-shift zero function can be selected using push-buttons.

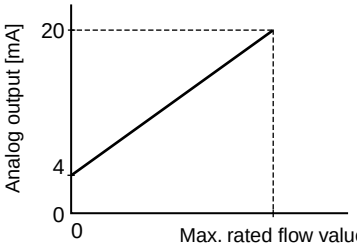
Analog Output

Note: Analog output at maximum rated flow rate when CO_2 is selected is 3 [V] for the voltage output type and 12 [mA] for the current output type.

1 to 5 VDC



4 to 20 mADC



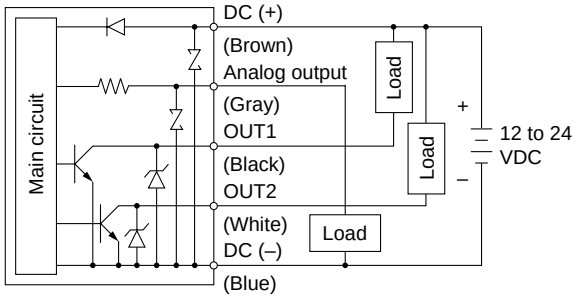
Rated flow range	Max. rated flow value [ℓ/min]
0.2 to 10 ℓ/min	10 (5)
0.5 to 25 ℓ/min	25 (12.5)
1 to 50 ℓ/min	50 (25)
2 to 100 ℓ/min	100 (50)

∗ ( ): Fluid: CO_2

Internal Circuits

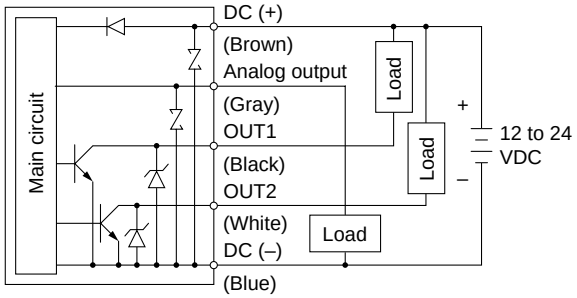
PFM3□0

NPN open collector output: 2 outputs
Max. 30 V, 80 mA, residual voltage 1 V or less
Analog output: 1 to 5 V
Output impedance: approx. 1 kΩ



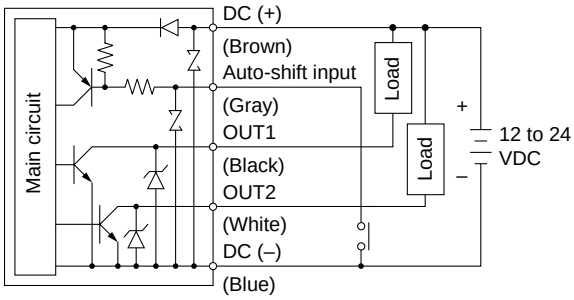
PFM3□1

NPN open collector output: 2 outputs
Max. 30 V, 80 mA, residual voltage 1 V or less
Analog output: 4 to 20 mA
Max. load impedance: 300 Ω (12 VDC) 600 Ω (24 VDC)
Min. load impedance: 50 Ω



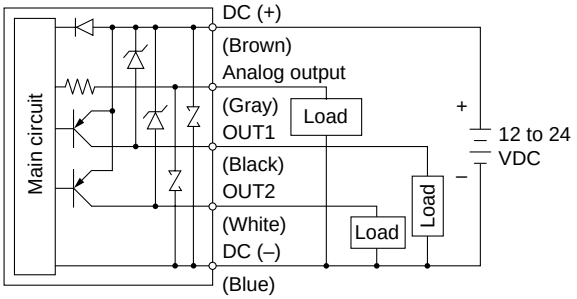
PFM3□2

NPN open collector output with external input: 2 outputs
Max. 30 V, 80 mA, residual voltage 1 V or less



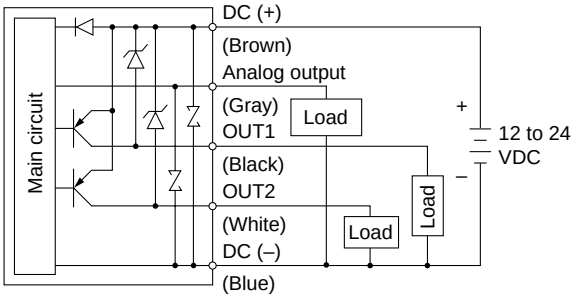
PFM3□3

PNP open collector output: 2 outputs
Max. 80 mA, residual voltage 1 V or less
Analog output: 1 to 5 V
Output impedance: approx. 1 kΩ



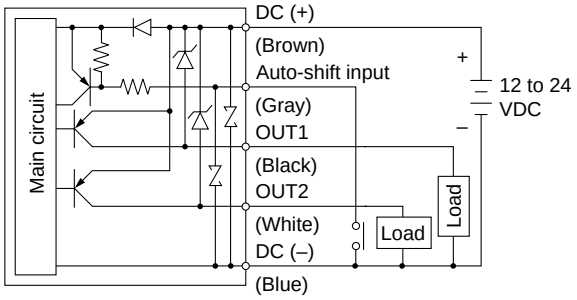
PFM3□4

PNP open collector output: 2 outputs
Max. 80 mA, residual voltage 1 V or less
Analog output: 4 to 20 mA
Max. load impedance: 300 Ω (12 VDC) 600 Ω (24 VDC)
Min. load impedance: 50 Ω

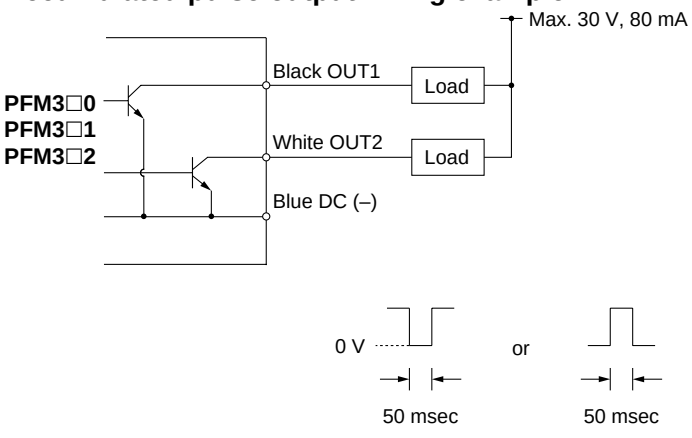


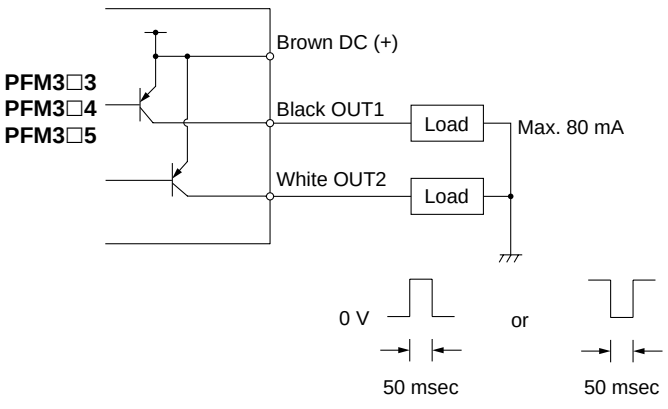
PFM3□5

PNP open collector output with external input: 2 outputs
Max. 80 mA, residual voltage 1 V or less



Accumulated pulse output wiring example





Descriptions

LCD Display

Shows the current flow rate, mode setting, selected display unit, and error code. Four display modes are available, some of which use indications that are fixed either red or green, and others use indications that change from green to red.

Output (OUT1) Indicator (Green)

Lights when the output (OUT1) is turned on.

△ Button

Used for mode selection and increasing the ON/OFF setting value. Also used to switch to peak display mode.

Output (OUT2) Indicator (Red)

Lights when the output (OUT2) is turned on.

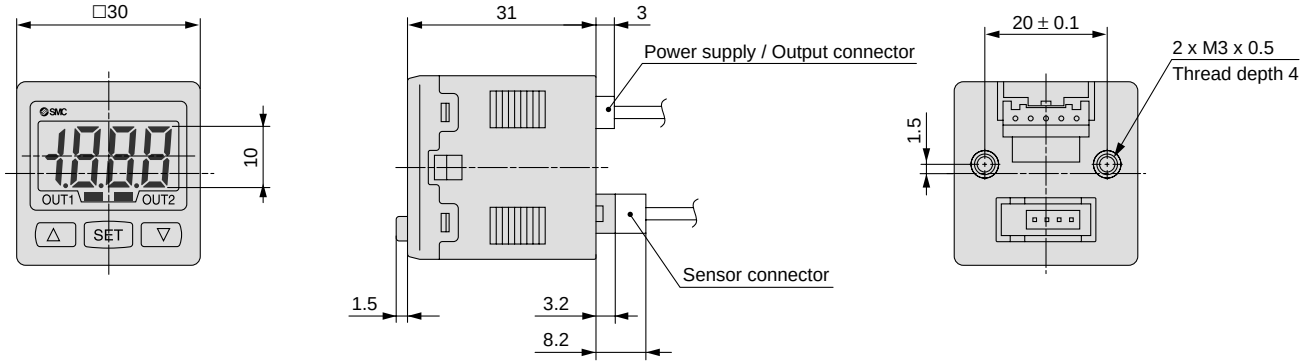
SET Button

Used to activate mode changes and new setting values.

▽ Button

Used for mode selection and decreasing the on/off setting value. Also used to switch to bottom display mode.

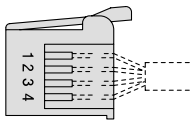
Dimensions



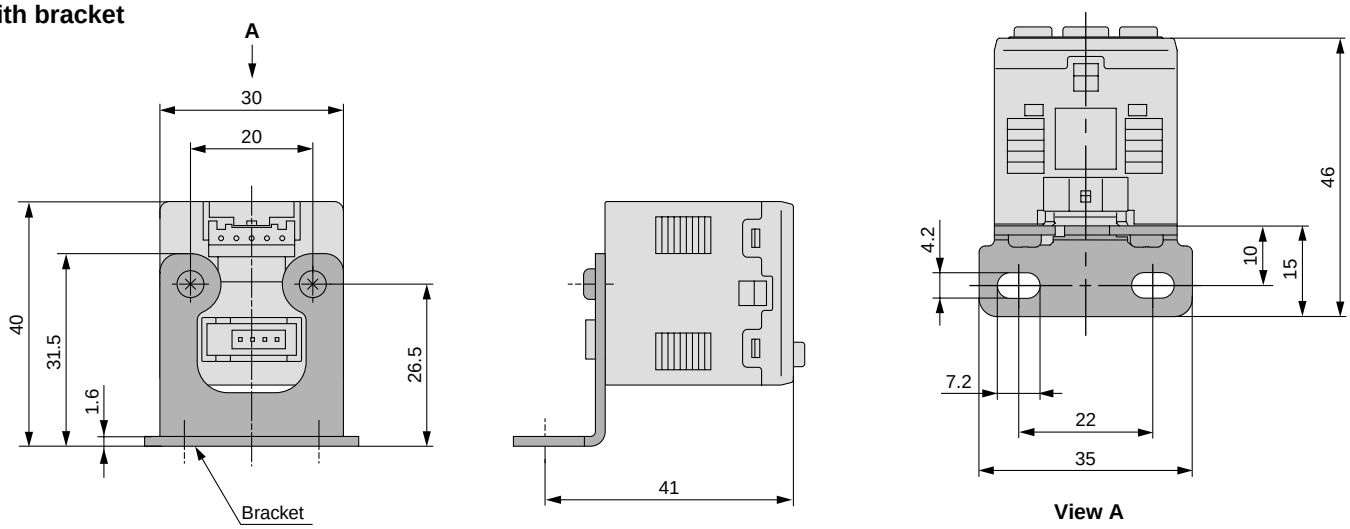
Sensor connector (ZS-28-C-1)

Pin no.	Terminal name
1	DC (+)
2	N.C.
3	DC (–)
4	IN*

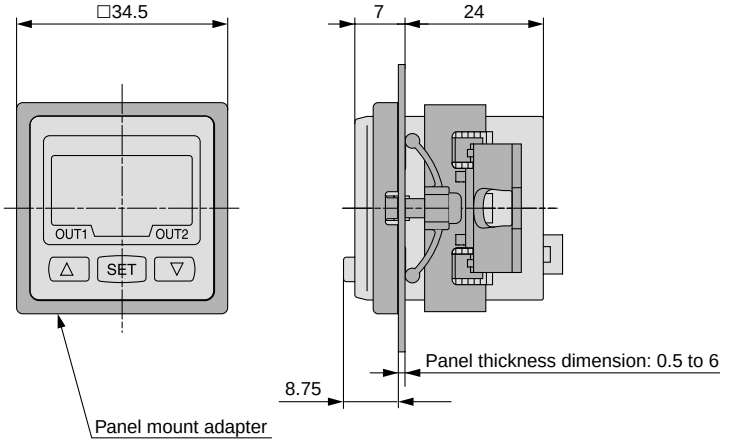
∗ 1 to 5 V or 4 to 20 mA



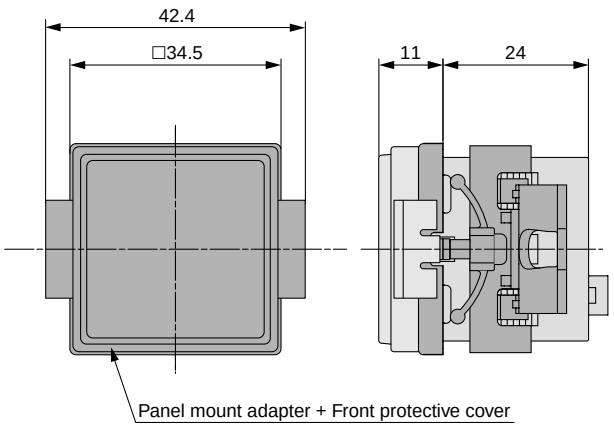
With bracket



With panel mount adapter



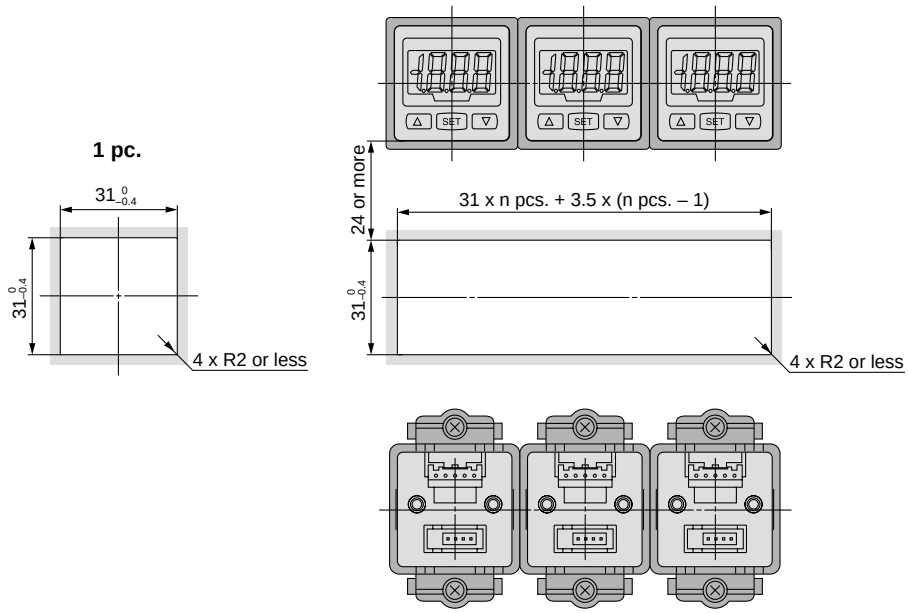
With panel mount adapter + Front protective cover



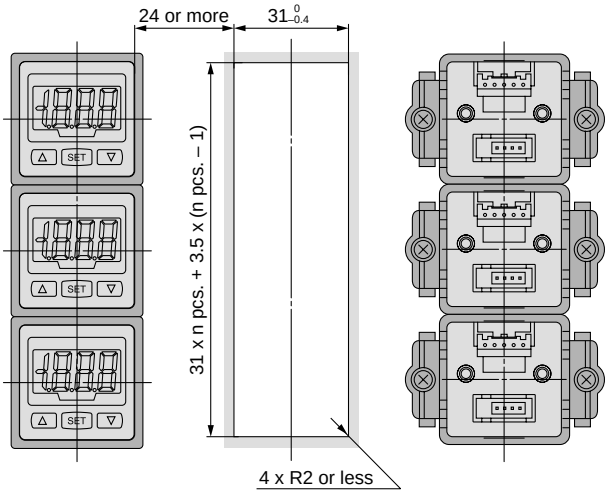
Dimensions

Panel fitting dimensions

Secure mounting of n (2 or more) switches (horizontal)

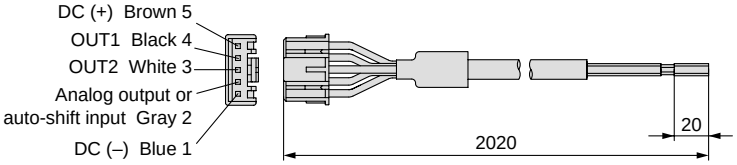


Secure mounting of n (2 or more) switches (vertical)



Note) If a bend (R) is used, limit it to R2 or less.

Power supply / Output connector (ZS-28-A)



Cable Specifications

Rated temperature		105°C
Rated voltage		300 V
Number of wires		5
Con-ductor	Nominal cross section area	0.2 mm^2
	Material	Soft copper wire
	Construction	40 / 0.08 mm
	External diameter	0.58 mm
Insula-tion	Material	Cross-linked vinyl chloride resin compound
	External diameter	Approx. 1.12 mm
	Standard thickness	0.27 mm
	Colors	Brown, Black, White, Gray, Blue
Sheath	Material	Oil-resistant vinyl chloride resin compound
	Standard thickness	0.5 mm
	Color	Light gray (Munsell N7)
Finished external diameter		ø4.1

Series PFM
Function Details

■ Output operation
The output operation can be selected from the following:
Output (hysteresis mode and window comparator mode) corresponding to real-time flow rate,
Output corresponding to accumulated flow,
Accumulated output pulse output

At the time of shipment from the factory, it is set to hysteresis mode and normal output.

■ Indication color
The indication color can be selected for each output condition. The selection of the indication color provides visual identification of abnormal values. (The indication color depends on OUT1 setting.)

Green for ON, Red for OFF
Red for ON, Green for OFF
Red all the time
Green all the time

■ Selection of operating fluid
The fluid can be selected. If argon (Ar) or carbon dioxide (CO_2) is used, the setting needs to be changed.

Dry air, N_2
Argon
CO_2

Note) When CO_2 is selected, the upper limit of the measured flow rate range will be 1/2 of that for other fluids.

■ Selection of indication unit reference
The indication unit reference can be selected between standard conditions and normal conditions.

Standard conditions: Flow rate converted to a volume at 20°C and 1atm (atmosphere)
Normal conditions: Flow rate converted to a volume at 0°C and 1atm (atmosphere)

■ Setting of response time
The flow rate may change momentarily during transition between ON (open) and OFF (closed) of the valve. It can be set so that this momentary change is not detected.

0.05 sec.
0.5 sec.
1 sec.
2 sec.

<Principle>
When the switch has been in ON area for a set period of time, the output will turn on (or off).

■ Indication mode
The indication mode can be selected between real-time flow rate and accumulated flow.

Real-time flow rate display
Accumulated flow display

■ External input function
The external input function can be selected from accumulated value external reset, auto-shift and auto-shift zero.
(Input signal: Connect input line to GND for 30 ms or more.)

External reset: This function resets the accumulated value to “0” when an input signal is applied.

Auto-shift: This function generates an output corresponding to the change in relation to real-time flow rate when an input signal is applied.

Auto-shift zero: This function displays real-time flow rate as “0” when a positive input signal is applied in the auto shift function described above.

Set values and flow rates that are relatively on the negative side are expressed by illumination of the decimal point on the far left.

■ Indication resolution
The indication resolution of the PFM710 and 711 series can be changed to enable values to be indicated in smaller steps.

100 resolution	PFM710 PFM711	by 0.1 ℓ/min by 1 ℓ/min
1000 resolution	PFM710 PFM711	by 0.01 ℓ/min by 0.1 ℓ/min

■ Accumulated value hold
Accumulated value is not cleared even when the power supply is turned off.
The accumulated value is memorized every 2 or 5 min. during measurement, and continues from the last memorized value when the power supply is turned on again.
The life time of the memory element is 1 million access cycles. Take this into consideration before using this function.

■ Selection of analog output filter
This selection is available when using a product with an analog output.
A signal with fast response speed can be generated by turning off the analog output filter.

■ Selection of power-saving mode
The power-saving mode can be selected.
With this function, if no buttons are pressed for 30 sec., it shifts to power-saving mode.
At the time of shipment from the factory, the product is set to the normal mode (the power-saving mode is turned off).
(When power-saving mode is activated, the decimal point flashes.)

■ Setting of secret code
The user can select whether a secret code must be entered to release key lock.
At the time of shipment from the factory, it is set such that the secret code is not required.

■ Peak/Bottom value indication
The maximum (minimum) flow rate is detected and updated from when the power supply is turned on. In peak (bottom) value indication mode, this maximum (minimum) flow rate is displayed.

■ Keylock function
Prevents operation errors such as accidentally changing setting values.

■ Zero clear function
Allows the user to adjust the measured flow rate indication to zero. The adjustment range is ±7%F.S. of the initial factory setting.

■ Error indication function
When an error or abnormality arises, the location and contents are displayed.

Description	Contents	Action
Flow rate error	The flow rate exceeds the upper limit of indicated flow rate range.	Decrease the flow rate.
	There is a reverse flow equivalent to –5% or more.	Turn the flow to correct direction.
Overcurrent error	Load current of 80 mA or more is applied to the switch output (OUT1).	Eliminate the cause of the overcurrent by turning off the power supply and then turn on it again.
	Load current of 80 mA or more is applied to the switch output (OUT2).	
System error	Possibility of internal circuit damage before factory adjustment.	Stop operation immediately and contact SMC.
	System error. Possibility of data memorizing failure or internal circuit damage.	Reset the unit, and carry out all settings again.
Zero clear error	If zero clear is performed (by holding down △ and ▽ buttons simultaneously for 1 sec.) while there is some flow, “Er4” will be displayed for 1 sec.	Perform zero clear of accumulated flow rate when there is no flow.
Flow rate error	The flow rate exceeds the accumulated flow rate range.	Clear the accumulated flow rate. (This error does not matter when the accumulated flow rate is not being used.)

If the error or abnormality cannot be solved by the action above, please contact SMC for further investigation.

Made to Order 1

Please contact SMC for detailed specifications, lead times and prices.

Made to Order

Symbol

Changing the piping entry direction combination for IN and OUT side — X693, X694

PFM 7 □□–□ _ –□–□□□–X693

Type

5	Remote sensor unit
7	Integrated display

Piping entry direction
Note) No symbol is entered.

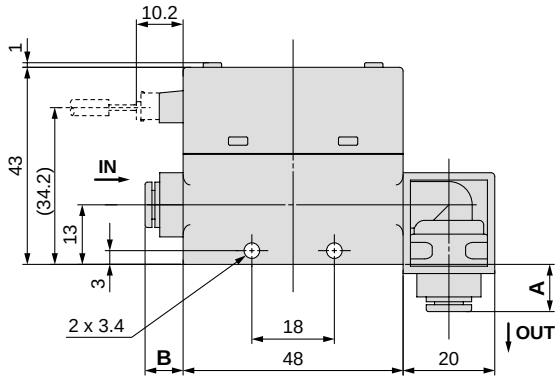
Changing the piping entry direction combination

X693	IN side: Straight / OUT side: Bottom
X694	IN side: Straight / OUT side: Bottom

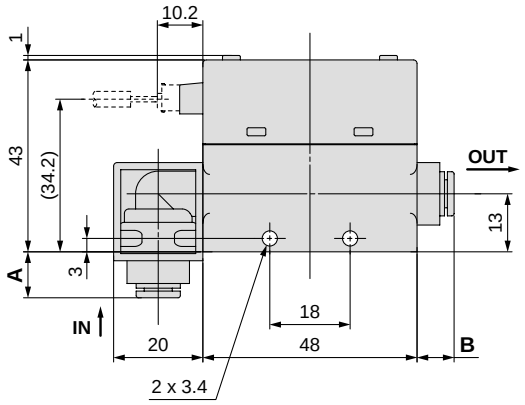
For details of How to Order, refer to page 1 and 13.

Dimensions

PFM$^{7}_{5}$□□-C4/C6/C8/N7-□-X693

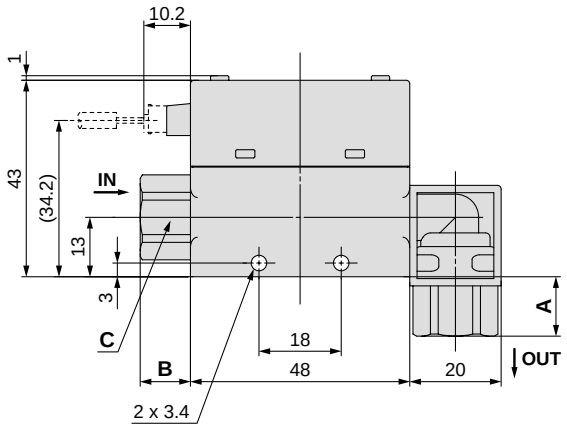


PFM$^{7}_{5}$□□-C4/C6/C8/N7-□-X694

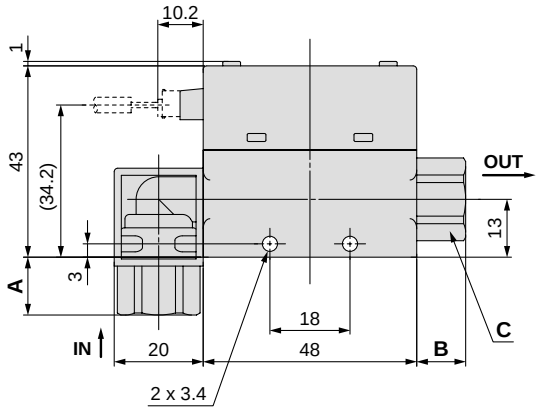


One-touch fitting Applicable tube O.D.		A	B
C4	ø4 (5/32")	10.1	8.1
C6	ø6	10.3	8.3
C8	ø8 (5/16")	12	10
N7	ø1/4	10.3	8.3

PFM$^{7}_{5}$□□-□01/02-□-X693



PFM$^{7}_{5}$□□-□01/02-□-X694



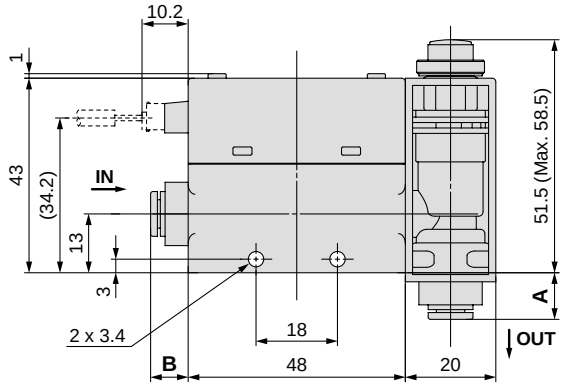
Port size	A	B	C (Width across flats)
Rc 1/8, 1/4 NPT 1/8, 1/4 G 1/8	13	11	17
G 1/4	17	15	21

Made to Order 2

Please contact SMC for detailed specifications, lead times and prices.

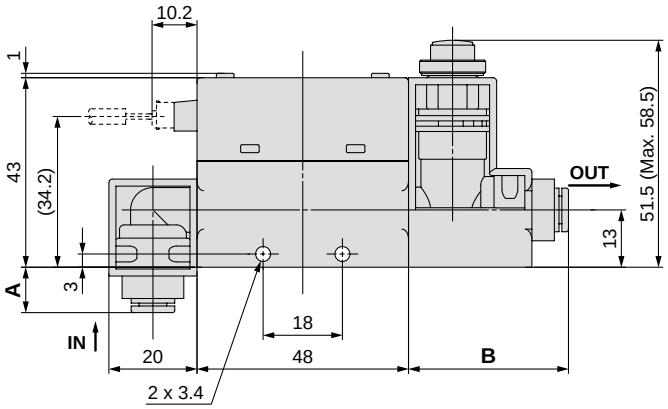
Dimensions

PFM$^{7}_{5}$□□S-C4/C6/C8/N7-□-X693



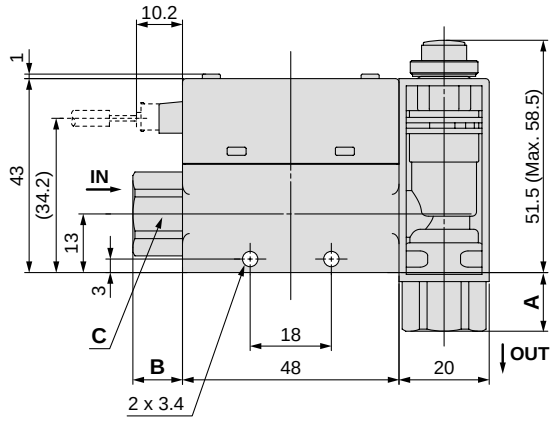
One-touch fitting Applicable tube O.D.	A	B
ø4 (5/32")	10.1	8.1
ø6	10.3	8.3
ø8 (5/16")	12	10
ø1/4	10.3	8.3

PFM$^{7}_{5}$□□S-C4/C6/C8/N7-□-X694



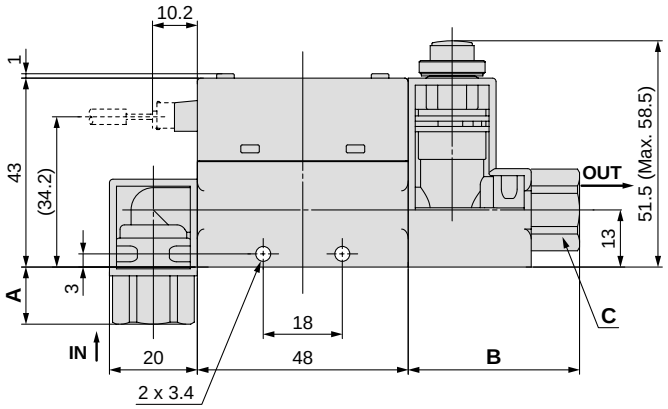
One-touch fitting Applicable tube O.D.	A	B
ø4 (5/32")	10.1	36.1
ø6	10.3	36.3
ø8 (5/16")	12	37
ø1/4	10.3	36.3

PFM$^{7}_{5}$□□S-□01/02-□-X693



Port size	A	B	C (Width across flats)
Rc 1/8, 1/4 NPT 1/8, 1/4 G 1/8	13	11	17
G 1/4	17	15	21

PFM$^{7}_{5}$□□S-□01/02-□-X694



Port size	A	B	C (Width across flats)
Rc 1/8, 1/4 NPT 1/8, 1/4 G 1/8	13	39	17
G 1/4	17	43	21

Made to Order 3

Please contact SMC for detailed specifications, lead times and prices.

Made to Order

Symbol

Compatibility with argon (Ar) and carbon dioxide (CO_2) mixed gas — X731

The argon–carbon dioxide gas ratio (Ar: CO_2) can be selected using the push-buttons from among the following: 92 : 8, 90 : 10, 80 : 20, 70 : 30, and 60 : 40. Dimensions are same as those of standard models.

PFM 7 □□-□□-□-□□□-X731

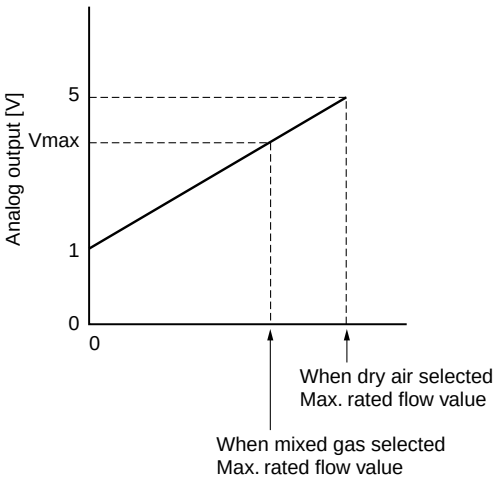
7	Integrated display

For details of How to Order, refer to page 1 and 13.

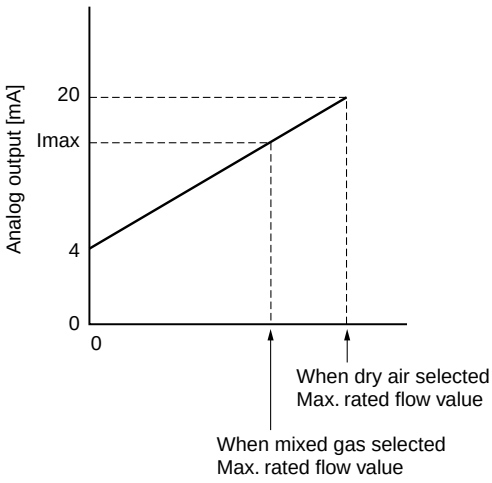
Model	Gas ratio		Rated flow range	Displayable range	Settable range	Max. analog output	
	Ar	CO_2				Voltage (Vmax)	Current (Imax)
PFM710	92%	8%	0.2 to 7.0 ℓ/min	0.2 to 7.4 ℓ/min	0 to 7.4 ℓ/min	3.80 V	15.2 mA
	90%	10%					
	80%	20%					
	70%	30%					
	60%	40%					
PFM725	92%	8%	0.5 to 25.0 ℓ/min	0.5 to 26.3 ℓ/min	0 to 26.3 ℓ/min	5.00 V	20.0 mA
	90%	10%					
	80%	20%	0.5 to 20.0 ℓ/min	0.5 to 21.0 ℓ/min	0 to 21.0 ℓ/min	4.20 V	16.8 mA
	70%	30%					
	60%	40%					
PFM750	92%	8%	1.0 to 50.0 ℓ/min	1.0 to 52.5 ℓ/min	0 to 52.5 ℓ/min	5.00 V	20.0 mA
	90%	10%					
	80%	20%	1.0 to 40.0 ℓ/min	1.0 to 42.0 ℓ/min	0 to 42.0 ℓ/min	4.20 V	16.8 mA
	70%	30%					
	60%	40%					
PFM711	92%	8%	2 to 100 ℓ/min	2 to 105 ℓ/min	0 to 105 ℓ/min	5.00 V	20.0 mA
	90%	10%					
	80%	20%	2 to 90 ℓ/min	2 to 95 ℓ/min	0 to 95 ℓ/min	4.60 V	18.4 mA
	70%	30%	2 to 80 ℓ/min	2 to 84 ℓ/min	0 to 84 ℓ/min	4.20 V	16.8 mA
	60%	40%					

Output characteristics using mixed gas

Analog voltage output (1 to 5 V)



Analog current output (4 to 20 mA)



Series PFM
Safety Instructions

These safety instructions are intended to prevent a hazardous situation and/or equipment damage. These instructions indicate the level of potential hazard by labels of **"Caution", "Warning"** or **"Danger"**. To ensure safety, be sure to observe ISO 4414 Note 1), JIS B 8370 Note 2) and other safety practices.

■Explanation of the Labels

Labels	Explanation of the labels
⚠ **Danger**	In extreme conditions, there is a possible result of serious injury or loss of life.
⚠ **Warning**	Operator error could result in serious injury or loss of life.
⚠ **Caution**	Operator error could result in injury Note 3) or equipment damage. Note 4)

Note 1) ISO 4414: Pneumatic fluid power – General rules relating to systems
Note 2) JIS B 8370: General Rules for Pneumatic Equipment
Note 3) Injury indicates light wounds, burns and electrical shocks that do not require hospitalization or hospital visits for long-term medical treatment.
Note 4) Equipment damage refers to extensive damage to the equipment and surrounding devices.

■Selection/Handling/Applications

1. The compatibility of the pneumatic equipment is the responsibility of the person who designs the pneumatic system or decides its specifications.
Since the products specified here are used in various operating conditions, their compatibility for the specific pneumatic system must be based on specifications or post analysis and/or tests to meet the specific requirements. The expected performance and safety assurance are the responsibility of the person who has determined the compatibility of the system. This person should continuously review the suitability of all items specified, referring to the latest catalog information with a view to giving due consideration to any possibility of equipment failure when configuring a system.

2. Only trained personnel should operate pneumatically operated machinery and equipment.
Compressed air can be dangerous if handled incorrectly. Assembly, handling or repair of pneumatic systems should be performed by trained and experienced operators. (Understanding JIS B 8370 General Rules for Pneumatic Equipment, and other safety rules are included.)

3. Do not service machinery/equipment or attempt to remove components until safety is confirmed.
1. Inspection and maintenance of machinery/equipment should only be performed once measures to prevent falling or runaway of the driven objects have been confirmed.
2. When equipment is removed, confirm that safety process as mentioned above. Turn off the supply pressure for this equipment and exhaust all residual compressed air in the system, and release all the energy (liquid pressure, spring, condenser, gravity).
3. Before machinery/equipment is restarted, take measures to prevent quick extension of a cylinder piston rod, etc.

4. If the equipment will be used in the following conditions or environment, please contact SMC first and be sure to take all necessary safety precautions.
1. Conditions and environments beyond the given specifications, or if product is used outdoors.
2. Installation on equipment in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverages, recreation equipment, emergency stop circuits, clutch and brake circuits in press applications, or safety equipment.
3. An application which has the possibility of having negative effects on people, property, requiring special safety analysis.
4. If the products are used in an interlock circuit, prepare a double interlock style circuit with a mechanical protection function for the prevention of a breakdown. And, examine the devices periodically if they function normally or not.

■Exemption from Liability

1. SMC, its officers and employees shall be exempted from liability for any loss or damage arising out of earthquakes or fire, action by a third person, accidents, customer error with or without intention, product misuse, and any other damages caused by abnormal operating conditions.

2. SMC, its officers and employees shall be exempted from liability for any direct or indirect loss or damage, including consequential loss or damage, loss of profits, or loss of chance, claims, demands, proceedings, costs, expenses, awards, judgments and any other liability whatsoever including legal costs and expenses, which may be suffered or incurred, whether in tort (including negligence), contract, breach of statutory duty, equity or otherwise.

3. SMC is exempted from liability for any damages caused by operations not contained in the catalogs and/or instruction manuals, and operations outside of the specification range.

4. SMC is exempted from liability for any loss or damage whatsoever caused by malfunctions of its products when combined with other devices or software.

Series PFM
Specific Product Precautions 1

Be sure to read this before handling.
Refer to the back of page 1 for Safety Instructions and "Precautions for Handling Pneumatic Devices" (M-03-E3A) for Common Precautions.

Design and Selection

⚠ Warning

1. Operate the switch only within the specified voltage.

Use of the switch outside of the specified voltage range can cause not only a malfunction and damage to the switch, but it can also cause electrocution and fire.

2. Do not exceed the maximum allowable load specification.

A load exceeding the maximum load specification can cause damage to the switch.

3. Do not use a load that generates surge voltage.

Although surge protectiion is installed in the circuit at the output side of the switch, damage may still occur if a surge is applied repeatedly. When working directly such an unit as relay, solenoid valve, etc., which generates surge, use a built-in surge absorbing element type.

4. Be sure to verify the applicable fluid.

The switches do not have an explosion proof rating. To prevent possible fire hazard, do not use with flammable gases or fluids.

5. Monitor the internal voltage drop of a switch.

When operating below the specified voltage, it is possible that a load may be ineffective, even though the pressure switch function is normal. Therefore, the formula below should be satisfied after confirming the voltage of the load.

Supply voltage	−	Internal voltage drop of switch	>	Minimum operating voltage of load

6. Use the switch within the specified flow rate measurement and operating pressure.

Operating beyond the specified flow rate and operating pressure can damage the switch.

7. Never use flammable fluids and/or permeable fluids.

They may cause a fire, an explosion or corrosion.

∗ Refer to the MSDS (Material Safety Data Sheet) when using chemicals.

8. To prevent damage due to failure and/or malfunction of the product, establish a backup system such as a fail-safe system which enables multiple-stage type operation of the equipment and machinery.

9. When the product is for an interlock circuit, the following points should be noted.

- Provide double interlocking through another system (mechanical protection function, etc.).
- Perform checks to ensure the product is operating properly, as there is a risk of injury.

⚠ Caution

1. Ensure sufficient space for maintenance activities.

Provide space required for maintenance.

2. The direct-current power supply to combine should be UL authorized power supply.

(1) Limited voltage current circuit in accordance with UL 508.
A circuit in which power is supplied by the secondary coil of a transformer that meets the following conditions.
- Maximum voltage (with no load):
  30 Vrms (42.4 V peak) or less
- Maximum current:
  (1) 8 A or less (including when short circuited)
  (2) limited by circuit protector (such as fuse) with the following ratings.

No load voltage (V peak)	Max. current rating
0 to 20 [V]	5.0
Above 20 to 30 [V]	$\frac{100}{\text{Peak voltage}}$

(2) A circuit using max. 30 Vrms or less (42.4 V peak), which is powered by UL 1310 or UL 1585 compatible Class-2 power supply.

3. Data of the switch are stored even after the power supply is turned off.

Input data is stored in an EEPROM so that the data will not be lost after the flow switch is turned off. (The data can be rewritten for up to one million times, and stored for up to 20 years.)

Mounting

⚠ Warning

1. Monitor the flow direction of the fluid.

Install and connect piping so that fluid flows in the direction of the arrow indicated on the body.

2. Remove dirt and dust from inside of the piping by means of air blow, before attaching to the switch.

3. Do not drop or bump.

Do not drop, bump, or apply excessive impacts (490 m/s^2) while handling. Although the external body of a switch (switch case) may not be damaged, the switch inside could be damaged and cause a malfunction.

4. Hold the body of the switch when handling.

The tensile strength of the cord is 49 N and applying a greater pulling force than this can cause a malfunction. When handling, hold the body of the switch.

5. Do not use until you can verify that equipment can operate properly.

Following mounting, repair, or retrofit, verify correct mounting by conducting suitable function and leakage tests after piping and power connections have been made.

6. Never mount the switch in a place that will be used as a scaffold during piping.

7. Apply a wrench only to the metal part of the piping when installing the flow switch in the system piping.

There is a risk of breakage of the switch.

Series PFM
Specific Product Precautions 2

Be sure to read this before handling.
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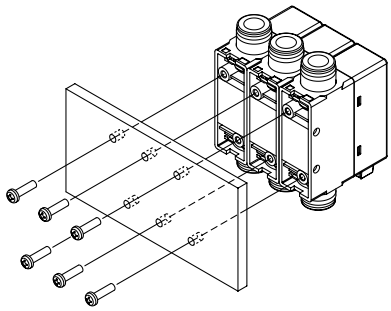
Mounting

⚠Caution

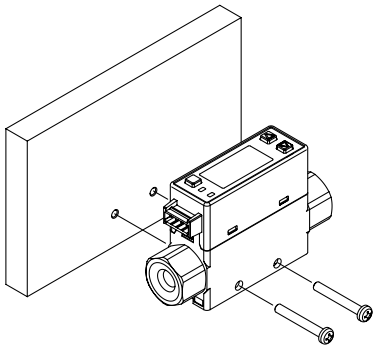
1. Observe the proper tightening torque.
When the switch is tightened beyond the specified tightening torque, the switch may be damaged.

2. Do not mount the switch in a place that will be used as a scaffold.
The switch could break if subjected to excessive load such as being accidentally stepped on.

3. Use a tapping screw (P-tite) with nominal diameter of 3 to mount the product by using the bracket mounting hole(s) at the bottom.
The length of the screw depends on the thickness of the plate to be fixed. Please select a screw whose length is the thickness of the plate + 4.8 mm. (The hole depth is 5 mm.)



4. When fixing the switch with screws using mounting holes, use a tightening torque of 0.3 N·m or less. If necessary, tighten the product to prevent it from loosening.



Wiring

⚠Warning

1. Verify the color and the terminal number when wiring.
Incorrect wiring can cause the switch to be damaged and malfunction. Verify the color and the terminal number in the instruction manual when wiring.

2. Use caution not to repeatedly apply bending or stretching forces to the lead wire.
Repeated pulling or bending of the lead wire may cause some of the wires to break.

Wiring

⚠Warning

3. Confirm proper insulation of wiring.
Make sure that there is no faulty wiring insulation (contact with other circuits, ground fault, improper insulation between terminals, etc.). Damage may occur due to excess current flow into a switch.

4. Do not wire in conjunction with power lines or high voltage lines.
Wire separately from power lines and high voltage lines, and avoid wiring in the same conduit with these lines. Control circuits, including switches, may malfunction due to noise from these lines.

5. Do not short-circuit a load.
Although the switch displays an overcurrent error if a load is short-circuited, there is not protection against incorrect wiring (power source polarity, etc.). Use caution to avoid wiring incorrectly.

6. Do not connect wiring while energizing the product.
The switch and any equipment connected to it could break and malfunction.

Operating Environment

⚠Warning

1. Never use in the presence of explosive gases.
The switch does not have an explosion proof construction. If it is used in an environment where explosive gases are used, it may cause an explosive disaster. Therefore, never use it in such an environment.

2. Mount the switch in a location where there is no vibration greater than 98 m/s², or no impact greater than 490 m/s².
With a switch with orifice, the adjusted flow rate value could be affected by vibration.

3. Do not use in an area where surges are generated.
When there are units that generate a large amount of surge in the area around a pressure switch, (e.g., solenoid type lifters, high frequency induction furnaces, motors, etc.) this may cause deterioration or damage to the switch's internal circuitry. Avoid sources of surge generation and crossed lines.

4. Switches are not equipped with surge protection against lightning.
The flow switches are CE compliant; however, they are not equipped with surge protection against lightning. Lightning surge protection measures should be applied directly to system components as necessary.

5. Avoid using the switch in an environment where the likelihood of splashing or spraying of liquids exists.
The switch is an open type and should not be used in an environment exposed to splashing of water and oil.

6. Do not use the product in an environment subject to a temperature cycle.
If the product is subject to a temperature cycle other than natural changes in air temperature, the internal components of the switch could be adversely affected.

7. Do not mount the product in locations where it is exposed to radiant heat.
This could result in damage and/or malfunction.

Series PFM
Specific Product Precautions 3

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Maintenance

⚠ Warning

1. Perform periodical inspections to ensure proper operation of the switch.
Unexpected malfunctions may cause possible danger.

2. Take precautions when using the switch for an interlock circuit.
When a pressure switch is used for the interlock circuit, devise a multiple interlock system to prevent trouble or malfunction, and verify the operation of the switch and interlock function on a regular basis.

3. Do not make any modifications (including exchanging the printed circuit boards) to the product.
It may cause human injuries and damage.

4. When maintenance work is performed, the following points should be noted.
- Turn off the power supply.
- Cut off the fluid supply, drain the fluid from the piping and ensure the fluid is released to atmosphere before carrying out maintenance. Otherwise, it could cause injury.

⚠ Caution

1. Do not wipe the product with chemicals such as benzene or thinner.
Such chemicals could damage the product.

2. The accuracy could change by 2 to 3% when the piping is removed or replaced.
The repeatability accuracy is ±1% F.S. when piping is replaced with piping of the same size. However, the accuracy could change by 2 to 3% if the size is different or when changing from straight to elbow or from elbow to straight piping.

3. Do not poke the inside of the piping port with a stick.
The rectifier could break, making the product unable to sustain the desired performance.

4. Do not touch terminals or connectors when energizing the product.
It could cause electric shock, malfunction, or damage to the switch.

Fluid

⚠ Warning

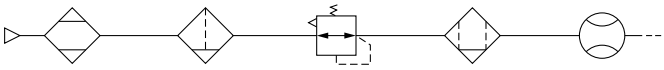
1. Check regulators and flow adjustment valves before introducing the fluid.
If pressure or flow rate beyond the specified range are applied to the switch, the sensor unit may be damaged.

2. Install a filter on the inlet side when there is a possibility of foreign matter being mixed with the fluid.

3. Use dry air of quality compliant with JIS B 8392-1 1.1.2 to 1.6.2: 2003 for this product.
If any mist or drainage present in the air attaches to the product, accurate measurement could be prevented. Also, the accuracy of the product could be degraded.

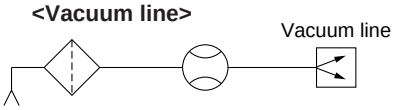
Recommended air circuits

<Compressed air line>



Dryer	Air filter	Regulator	Micro mist separator	Flow switch
IDF ***IDU***	***AF***	***AR*** ***IR***	***AMD*** ***AFD***	***PFM***

<Vacuum line>



Suction filter	Flow switch
ZF	***PFM***

Others

⚠ Warning

1. After the power is turned on, the switch's output remains off while a message is displayed. Therefore, start the measurement after a value is displayed.

2. Perform settings after stopping control systems.
Operation reflects the new values when settings are made. However, if the power is turned OFF in that state, the settings return to the values before the change when the power is turned ON again. Make sure to press the S button to save any setting changes before turning OFF the power.

Series PFM
Specific Product Precautions 4

Be sure to read this before handling.
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Settable Range and Rated Flow Range

⚠ Caution

Set the flow rate within the rated flow range.

The settable rate range is the range of flow rate that can be set in the switch.
The rated flow range is the 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 be guaranteed.
The flow range if using CO_2 is given in brackets.

Sensor	Flow range
PFM710 **PFM510**	0.2 ℓ/min — 10 ℓ/min (5 ℓ/min) 0.2 ℓ/min — 10.5 ℓ/min (5.2 ℓ/min) 10.5 ℓ/min (5.2 ℓ/min) 0
PFM725 **PFM525**	0.5 ℓ/min — 25 ℓ/min (12.5 ℓ/min) 0.5 ℓ/min — 26.3 ℓ/min (13.1 ℓ/min) 26.3 ℓ/min (13.1 ℓ/min) 0
PFM750 **PFM550**	1 ℓ/min — 50 ℓ/min (25 ℓ/min) 1 ℓ/min — 52.5 ℓ/min (26.2 ℓ/min) 52.5 ℓ/min (26.2 ℓ/min) 0
PFM711 **PFM511**	2 ℓ/min — 100 ℓ/min (50 ℓ/min) 2 ℓ/min — 105 ℓ/min (52 ℓ/min) 105 ℓ/min (52 ℓ/min) 0

0.2l/min 0.5l/min 1l/min 2l/min 10l/min 25l/min 50l/min 100l/min

Rated flow range
Displayable range
Settable range

In the case of the PFM5 series, the displayable and settable ranges are the same as the PFM3 series flow monitor.

Record of changes		
B edition	* Addition of remote type	
	* Number of pages from 28 to 52	LP

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