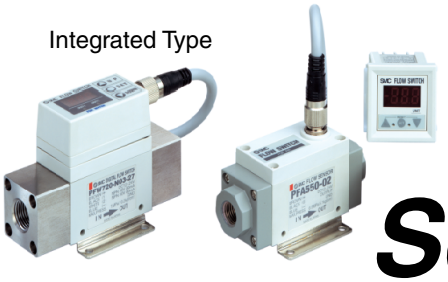
CAT.ES100-31

SMC

Integrated Type

Remote Type



Digital Flow Switch

For Air For Water

Series PFA/PFW

High flow rate type added to Series PFA (3000, 6000, 12000l)

Digital Flow Switch

Flow rate setting and detection are possible on digital display.

Bright and easy to read LED display/digital setting

A new LCD display is used for the high flow rate types (PFA703H/706H/712H) in order to reduce the power consumption without losing visibility.

Two types for different applications

Integrated and remote type displays

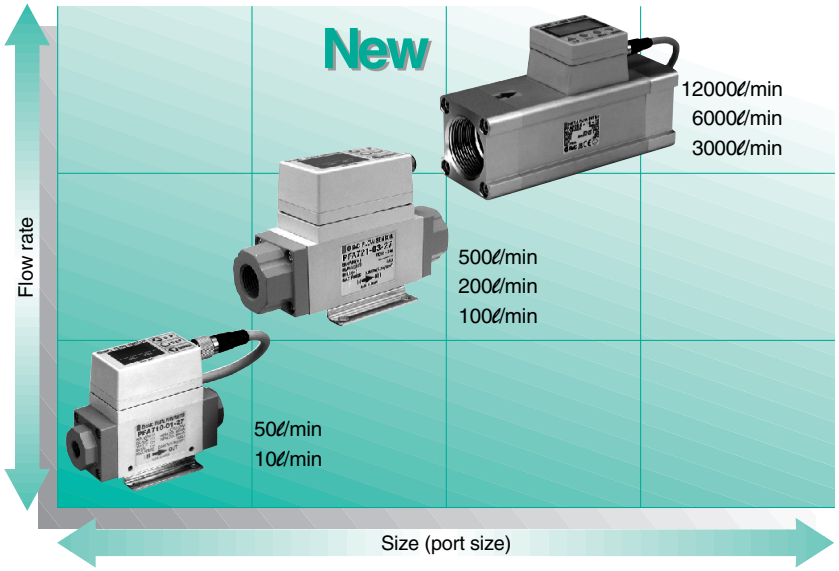
Water resistant construction equivalent to IP65

Two independent flow rate settings are possible.

Can be switched from real-time flow rate to accumulated flow.

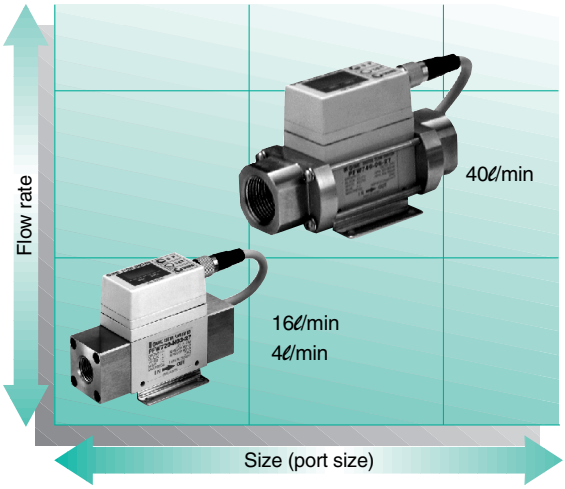
Digital Flow Switch **for Air**

Series PFA



Digital Flow Switch **for Water**

Series PFW



For Air Series variations

Integrated display type	Remote type		Flow rate measurement range ℓ/min	Output specifications			Port size (Rc, NPT, G)						
	Display unit	Sensor unit		Switch output	Analog output	Accumulated pulse output	1/8	1/4	3/8	1/2	1	1 1/2	2
PFA710	PFA30□	PFA510	1 to 10	●			●	●					
750		550	5 to 50	●			●	●					
711	31□	511	10 to 100	●	●				●				
721		521	20 to 200	●	●				●				
751		551	50 to 500	●	●					●			
703H	—	—	150 to 3000	●	●	●					●		
706H			300 to 6000	●	●	●						●	
712H			6000 to 12000	●	●	●							●

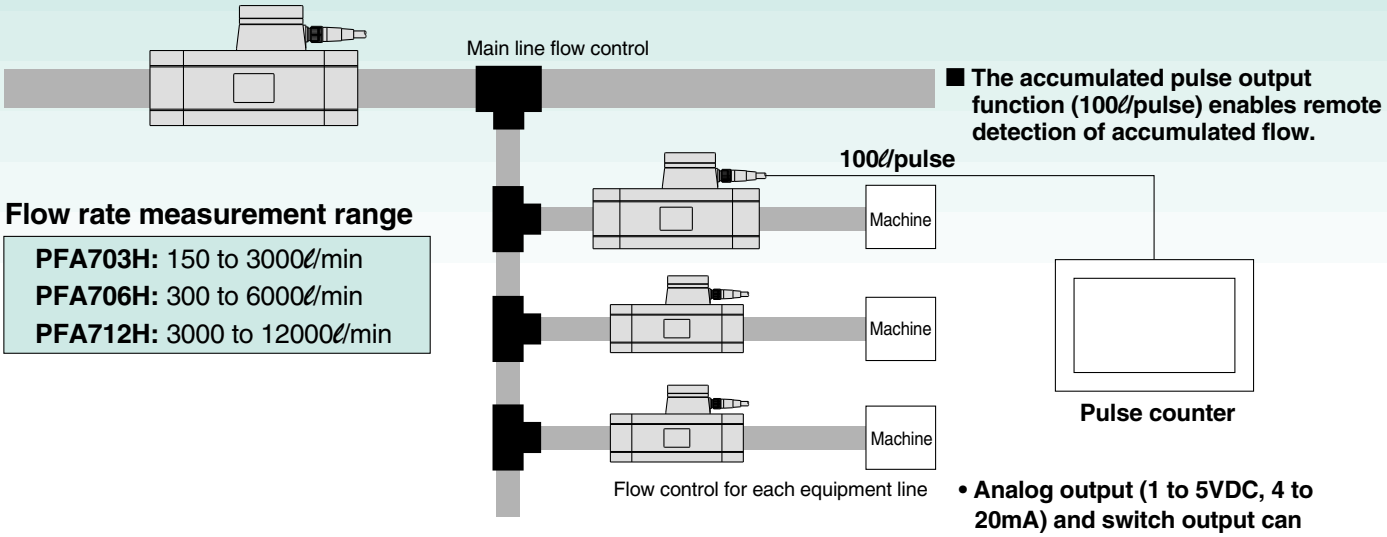
For Water Series variations

Integrated display type	Remote type		Flow rate measurement range ℓ/min	Output specification	Port size (Rc, NPT, G)		
	Display unit	Sensor unit		Switch output	3/8	1/2	3/4
PFW704	PFW31□	PFW504	0.5 to 4	●	●		
720	30□	520	2 to 16	●	●	●	
740	32□	540	5 to 40	●		●	●

Maximum Flow Rate

3000, 6000, 12000ℓ/min types have been newly released!

The addition of the high flow rate types supports energy saving measures.
Air flow rates can be controlled from the main line to each equipment line.



■ **The accumulated pulse output function (100ℓ/pulse) enables remote detection of accumulated flow.**

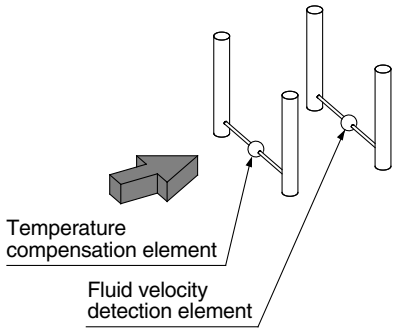
Flow rate measurement range

PFA703H: 150 to 3000ℓ/min
PFA706H: 300 to 6000ℓ/min
PFA712H: 3000 to 12000ℓ/min

- **Analog output (1 to 5VDC, 4 to 20mA) and switch output can also be applied.**

Detection principle of digital flow switch for air

A heated thermistor is installed in the passage, and the fluid absorbs heat from the thermistor as it flows past it. The thermistor's resistance value increases as heat is absorbed, and since the increase ratio has a uniform relationship to the fluid velocity, it is possible to detect the fluid velocity by measuring this resistance value. To further compensate the fluid and ambient temperatures, there is also a built-in temperature sensor, which allows stable measurement within the operating temperature range.



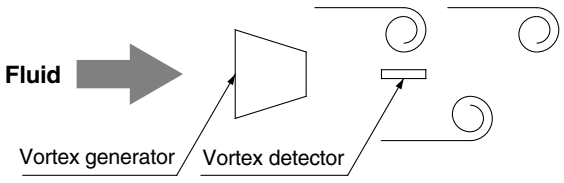
This flow switch uses "ℓ/min" as the flow rate indicator unit, and the mass flow is converted and notated under conditions of 0°C and 101.3kPa.
The conversion conditions can be switched to 20°C and 101.3kPa for the high flow rate types.

Detection principle of digital flow switch for water

When a bar shaped object (vortex generator) is placed in the flow, reciprocal vortexes are generated on the downstream side. These vortexes are stable under certain conditions, and their frequency is proportional to the flow velocity, resulting in the following formula.

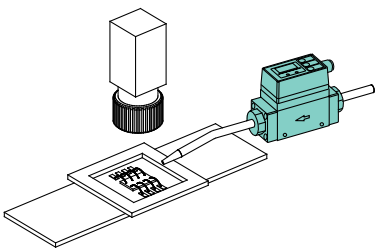
$$f = k \times v$$

f: Frequency of vortexes, v: Flow velocity, k: Proportional constant (determined by the vortex generator's dimensions, shape, etc.) Therefore, the flow rate can be measured by detecting this frequency.

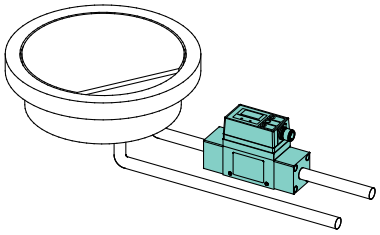


Application examples

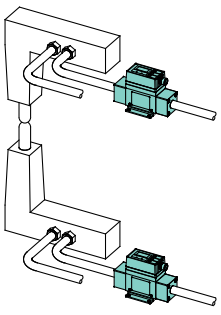
Flow control of N_2 gas to prevent detection camera shimmering and lead frame oxidation



Flow control of high frequency electric power supply cooling water, for wafer temperature regulation



Flow control of cooling water for welding gun



For Air

Digital Flow Switch

Series PFA

How to order

Integrated display type **PFA7 10 – □ 01 – 27 □ – □**

Flow rate range

10	1 to 10*l*/min
50	5 to 50*l*/min
11	10 to 100*l*/min
21	20 to 200*l*/min
51	50 to 500*l*/min

Thread type

Nil	Rc
N	NPT
F	G

Port size

Symbol	Size	Flow rate (*l*/min) 10	50	100	200	500	Applicable model
01	1/8	●	●				PFA710, 750
02	1/4	●	●				
03	3/8			●	●		PFA711, 721
04	1/2					●	PFA751

Wiring specification

Nil	3m lead wire with connector
N	Without lead wire

Output specification

Nil	Output specification	Applicable model
27	NPN open collector 2 outputs	PFA710, 750 PFA711, 721, 751
28	NPN open collector 1 output + Analog output (1 to 5V)	PFA711, 721, 751
67	PNP open collector 2 outputs	PFA710, 750 PFA711, 721, 751
68	PNP open collector 1 output + Analog output (1 to 5V)	PFA711, 721, 751

Unit specification

Nil	With unit switching function
M	Fixed SI unit Note)

Note) Fixed units:
Real-time flow rate: *l*/min
Accumulated flow: *l*

Specifications

Model		PFA710	PFA750	PFA711	PFA721	PFA751
Measured fluid		Dry air, N_2				
Detection type		Heater type				
Flow rate measurement range		1 to 10*l*/min	5 to 50*l*/min	10 to 100*l*/min	20 to 200*l*/min	50 to 500*l*/min
Minimum setting unit		1% of maximum flow rate				
Display units (Note 1)	Real-time flow rate	*l*/min, CFM x 10^{-2}		*l*/min, CFM x 10^{-1}		
	Accumulated flow	*l*, ft^3 x 10^{-1}				
Operating pressure range		0 to 0.5MPa				
Withstand pressure		1.0MPa				
Pressure loss		3kPa (at 50*l*/min)		3kPa (at 100*l*/min)	10kPa (at 200*l*/min)	30kPa (at 500*l*/min)
Accumulated flow range		0 to 999999*l*				
Operating temperature range		0 to 50°C (with no condensation)				
Linearity		± 5% F.S. or less				
Repeatability		±1% F.S. or less		±2% F.S. or less		
Temperature characteristics		±3% F.S. or less (15 to 35°C), ±5% F.S. or less (0 to 50°C)				
Output specifications (Note 2)	Switch output	NPN open collector	Maximum load current: 80mA, Internal voltage drop: 1V or less (with load current of 80mA) Maximum applied voltage: 30V			
		PNP open collector	Maximum load current: 80mA Internal voltage drop: 1.5V or less (with load current of 80mA)			
	Analog output	—		Output voltage: 1 to 5V Load impedance: 100kΩ or more		
Indicator lights		**27, 67**: Lights up when ON, OUT1: Green, OUT2: Red		**27, 67**: Lights up when ON, OUT1: Green, OUT2: Red **28, 68**: Lights up when ON, OUT1: Green, OUT2: None		
Response time		1s or less				
Hysteresis		Hysteresis mode: Variable (can be set from 0), Window comparator mode: Fixed (3 digits) (Note 3)				
Power supply voltage		12 to 24VDC (ripple ±10% or less)				
Current consumption		150mA or less		160mA or less		170mA or less
Withstand voltage		1000VAC for 1 min. between external terminal block and case				
Insulation resistance		50MΩ (500VDC) between external terminal block and case				
Noise resistance		1000Vp-p, Pulse width 1μs, Rise time 1ns				
Vibration resistance		10 to 500Hz at the smaller of amplitude 1.5mm or acceleration 98m/s² in X, Y, Z directions, 2 hours each				
Impact resistance		490m/s² in X, Y, Z directions, 3 times each				
Weight		250g (without lead wire)		290g (without lead wire)		
Enclosure		Equivalent to IP65				
Port size (Rc, NPT, G)		1/8, 1/4		3/8		1/2

Note 1) For the type with unit switching function [The type without the unit switching function will have a fixed SI unit (*l*/min or *l*).]
Note 2) The output functions operate only for the real-time flow rate display, and do not operate for the accumulated flow display.
Note 3) Window comparator mode — Since hysteresis is 3 digits, separate P1 and P2 by 7 digits or more. 1 digit is the minimum setting unit (refer to the table above).
Note 4) The flow rate unit is based on 0°C and 101.3kPa.

How to Order

Remote Type Display Unit

PFA3 0 0 — A — □

Flow rate range

0	10, 50/min
1	100, 200, 500/min

Mounting

A	Panel mount
B	DIN rail, wall mount

Unit specification

Nil	With unit switching function
M	Fixed SI unit Note)

Note) Fixed units:
Real-time flow rate: /min
Accumulated flow:

Output specification

Nil	Output specification	Applicable model
0	NPN open collector 2 outputs	PFA30□, 31□
1	PNP open collector 2 outputs	
2	NPN open collector 1 output + Analog output (1 to 5V)	PFA31□
3	PNP open collector 1 output + Analog output (1 to 5V)	

∗ PFA302 and 303 combinations are not available.

Specifications

Model		PFA300	PFA301	PFA310	PFA311	PFA312	PFA313
Flow rate measurement range Note 1)		1 to 10, 5 to 50/min		10 to 100/min, 20 to 200/min 50 to 500/min			
Minimum setting unit		1% of maximum flow rate					
Display units Note 2)	Real-time flow rate	/min, CFM x 10^{-2}		/min, CFM x 10^{-1}			
	Accumulated flow	, ft³ x 10^{-1}					
Accumulated flow range		0 to 999999					
Operating temperature range		0 to 50°C (with no condensation)					
Linearity Note 3)		±5% F.S. or less					
Repeatability		±1% F.S. or less Note 3)		±1% F.S. or less			
Temperature characteristics		±1% F.S. or less (15 to 35°C) ±2% F.S. or less (0 to 50°C)					
Output Specifications Note 4)	Switch output	NPN open collector	Maximum load current: 80mA Maximum applied voltage: 30V Internal voltage drop: 1V or less (with load current of 80mA)				
		PNP open collector	Maximum load current: 80mA Internal voltage drop: 1.5V or less (with load current of 80mA)				
	Analog output	—		Output voltage: 1 to 5V Load impedance: 100kΩ or more			
Indicator lights		Lights up when On, OUT1: Green, OUT2: Red		Lights up when ON, OUT1: Green, OUT2: Red		Lights up when ON, OUT1: Green, OUT2: None	
Response time		1s or less					
Hysteresis		Hysteresis mode: Variable (can be set from 0), Window comparator mode: Fixed (3 digits) Note 4)					
Power supply voltage		12 to 24VDC (ripple ±10% or less)					
Current consumption		50mA or less		60mA or less			
Enclosure		Equivalent to IP40					
Weight		45g					

Note 1) The flow rate measurement range can change depending on the setting.
Note 2) For the type with unit switching function [The type without the unit switching function will have a fixed SI unit (/min or).]
Note 3) The system accuracy when combined with sensor unit.
Note 4) The output functions operate only for the real-time flow rate display, and do not operate for the accumulated flow display.
Note 5) Window comparator mode — Since hysteresis is 3 digits, separate P1 and P2 by 7 digits or more. 1 digit is the minimum setting unit (refer to the table above).
Note 6) The flow rate unit is based on 0°C and 101.3kPa.

How to Order

Remote Type Sensor Unit

PFA5 10 — □ 01 □

Flow rate range

10	1 to 10/min
50	5 to 50/min
11	10 to 100/min
21	20 to 200/min
51	50 to 500/min

Thread type

Nil	Rc
N	NPT
F	G

Wiring specification

Nil	3m lead wire with connector
N	Without lead wire

Port size

Symbol	Size	Flow rate (/min) 10	50	100	200	500	Applicable model
01	1/8	●	●				PFA510, 550
02	1/4	●	●				
03	3/8			●	●		PFA511, 521
04	1/2					●	PFA551

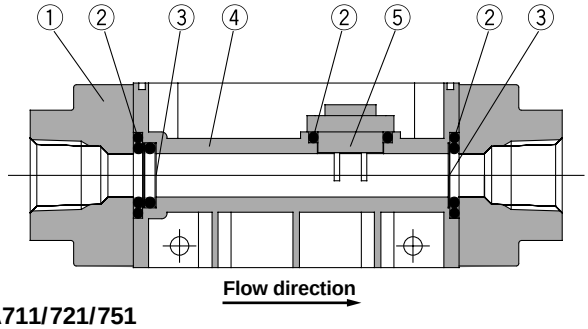
Specifications

Model	PFA510	PFA550	PFA511	PFA521	PFA551
Measured fluid	Dry air, N_2				
Detection type	Heater type				
Flow rate measurement range	1 to 10/min	5 to 50/min	10 to 100/min	20 to 200/min	50 to 500/min
Operating pressure range	0 to 0.5MPa				
Withstand pressure	1.0MPa				
Pressure loss	3kPa (at 50/min)		3kPa (at 100/min)	10kPa (at 200/min)	30kPa (at 500/min)
Operating temperature range	0 to 50°C (with no condensation)				
Linearity Note 1)	±25% F.S. or less		±20% F.S. or less		
Repeatability	±1% F.S. or less Note 2)		±1% F.S. or less		
Temperature characteristics	±2% F.S. or less (15 to 35°C) ±3% F.S. or less (0 to 50°C)				
Power supply voltage	12 to 24VDC (ripple ±10% or less)				
Current consumption	100mA or less				110mA or less
Weight	200g (without lead wire)		240g (without lead wire)		
Enclosure	Equivalent to IP65				
Port size (Rc, NPT, G)	1/8, 1/4		3/8		1/2

Note 1) The system accuracy will be adjusted to ±5% F.S. or less when combined with PFA3□□.
Note 2) The system accuracy will be adjusted to ±1% F.S. or less when combined with PFA30□.
Note 3) The flow rate unit is based on 0°C and 101.3kPa.

Sensor Unit Construction

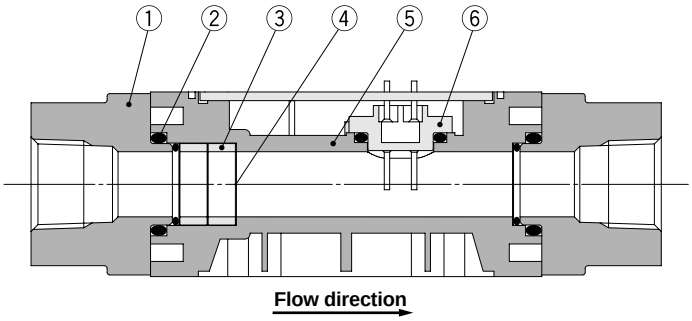
PFA710/750
PFA510/550



Parts list

No.	Description	Material
1	**Attachment**	ADC
2	**Seal**	NBR
3	**Mesh**	Stainless steel
4	**Body**	PBT
5	**Sensor**	PBT

PFA711/721/751
PFA511/521/551



Parts list

No.	Description	Material
1	**Attachment**	ADC
2	**Seal**	NBR
3	**Spacer**	PBT
4	**Mesh**	Stainless steel
5	**Body**	PBT
6	**Sensor**	PBT

Operating Unit Descriptions

RESET Buttons

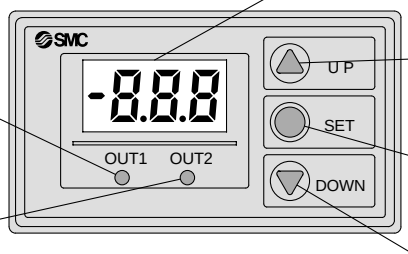
Pressing the UP and DOWN buttons simultaneously activates the RESET function.
This clears the unit when an abnormality occurs and clears the accumulated flow display to "0".

Output (OUT1) Indicator/Green

Lights up when OUT1 is ON.
It also blinks when an overcurrent error occurs on OUT1.

Output (OUT2) Indicator/Red

Lights up when OUT2 is ON.
It also blinks when an overcurrent error occurs on OUT2.



LED Display

Displays the real-time flow rate, accumulated flow, and setting value. The ➡ mark blinks when the accumulated flow is being measured.

UP Button (▲ Button)

Use when increasing a setting value.

SET Button (● Button)

Use when changing a setting value or any of the modes.

DOWN Button (▼ Button)

Use when decreasing a setting value.

Error Correction

Take the following corrective actions when errors occur.

LED display	Problem	Corrective action
Er 1	A current of more than 80mA is flowing to OUT1.	Check the load and wiring for OUT1.
Er 2	A current of more than 80mA is flowing to OUT2.	Check the load and wiring for OUT2.
Er 4	The setting data has changed due to some influence.	Perform the RESET operation, and set all data again.
- - -	The flow rate is over the flow rate measurement range. (For air only)	Reduce the flow rate until it is within the flow rate measurement range, using an adjustment valve, etc.

Connectors

Since the connectors (female contacts) shown below can be used, please refer to the respective manufacturers.

Connector size	Number of pins	Manufacturer	Applicable series
M12	4	C. CORRENS & CO., LTD.	VA-4D
		OMRON Corporation	XS2
		Yamatake-Honeywell Co., Ltd.	PA5-4I
		Hirose Electric Company	HR24
		DDK Ltd.	CM01-8DP4S

Note) C. CORRENS & CO., LTD. is the general agent in Japan for Hirschmann.

Flow Rate Setting

Setting procedure

Initial setting
Initial setting: Sets the display mode (real-time flow rate/accumulated flow), unit mode, and output mode (non-inverted/inverted).

Manual flow rate setting
Performs setting of the flow rate which performs switch output.

Auto preset
Performs setting of the flow rate automatically.

Manual flow rate setting
Can perform fine adjustment of data which is automatically set with the auto preset.

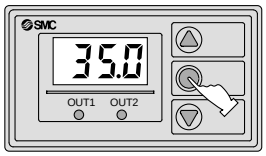
Key lock mode
Does not perform mode switching even if the button is pressed during operation.

Normal operation
Displays the flow rate and performs switch operation.

Initial setting

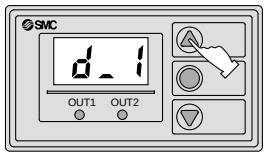
Note) Operation is the same for the integrated display type and the remote type (display unit).

1. Initial Setting Mode



Press the SET button for 1 second or more. Since the display will change from F_1 to d_1 or d_2, release the SET button after it has changed.

2. Selection of the Display Mode



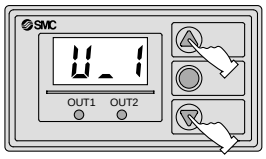
Performs setting of the display mode. Switches with the ▲ button.
d_1: Real-time flow rate display
d_2: Accumulated flow display

Press the SET button.

SET

For -M (fixed SI unit)

3. Selection of Display Units

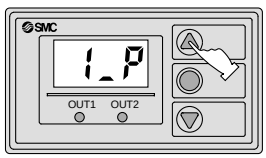


Performs setting of display units.[Note 1)]
Switches with the ▲ button and ▼ button.
U-□ Unit number
(Refer to Table 1.)

Press the SET button.

SET

4. Selection of OUT1 Output Mode

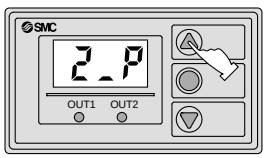


Performs setting of the OUT1 output mode. Switches the OUT1 output mode with the ▲ button.
1_P: Non-inverted output
1_n: Inverted output
(Refer to Table 2.)

SET

Press the SET button.

5. Selection of OUT2 Output Mode



Performs setting of the OUT2 output mode. Switches the OUT2 output mode with the ▲ button.
2_P: Non-inverted output
2_n: Inverted output

SET

Setting is completed when the SET button is pressed.

Table 1 Note 1)

For air

Display	Real-time flow rate	Accumulated flow
U_1	/min	/
U_2	CFM x 10^{-2}	ft^3 x 10^{-1}

CFM = ft^3/min

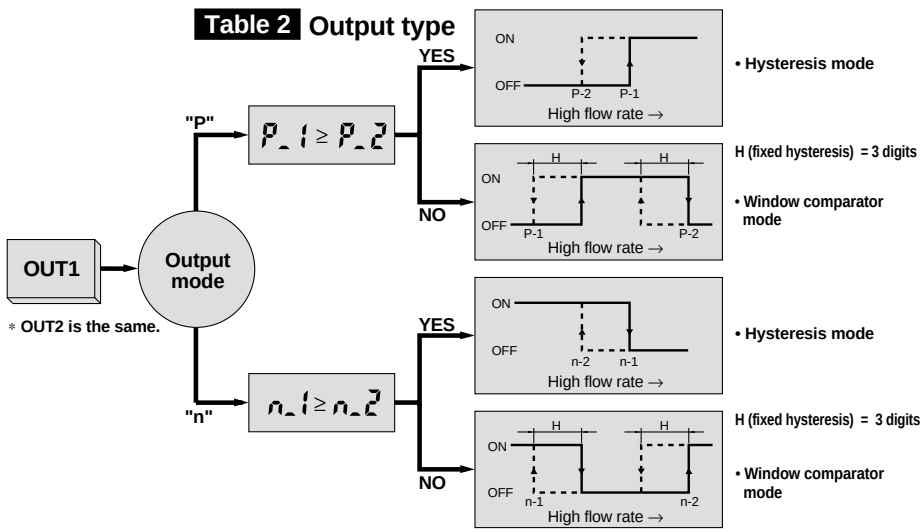
For water

Display	Real-time flow rate	Accumulated flow
U_1	/min	/
U_2	GPM	gal (US)

GPM = gal (US)/min

Note 1) For the type with unit switching function
[The type without the unit switching function will have a fixed SI unit (/min or /).]

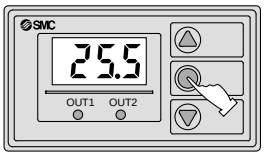
Table 2 Output type



Flow Rate Setting

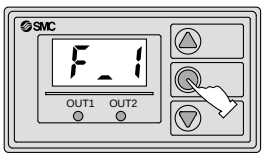
Flow rate setting mode (manual)

1. Setting Value Input Mode (Manual)



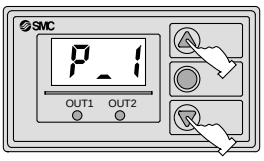
Press the SET button.
(Refer to Table 2 for the relationship of each value to the switch output.)

2. Setting in the Manual Mode



The display shows F_1.
Press the SET button.

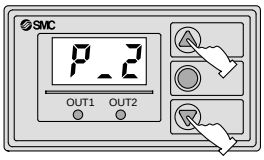
3. OUT1 Setting Value (1) Input



Press the SET button.

Display changes to input of OUT1 setting value (1).
The setting value and P_1 (or n_1) are displayed alternately.
▲ Button: Increases the setting value
▼ Button: Decreases the setting value

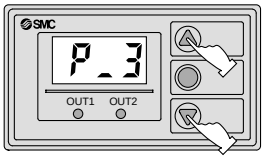
4. OUT1 Setting Value (2) Input



Press the SET button.

Display changes to input of OUT1 setting value (2).
The setting value and P_2 (or n_2) are displayed alternately.
▲ Button: Increases the setting value
▼ Button: Decreases the setting value

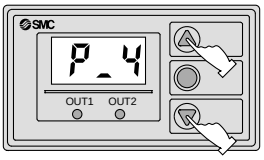
5. OUT2 Setting Value (1) Input



Press the SET button.

Display changes to input of OUT2 setting value (1).
The setting value and P_3 (or n_3) are displayed alternately.
▲ Button: Increases the setting value
▼ Button: Decreases the setting value

6. OUT2 Setting Value (2) Input

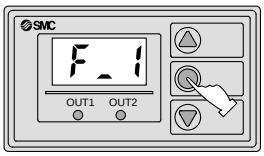


Setting is completed when the SET button is pressed.

Display changes to input of OUT2 setting value (2).
The setting value and P_4 (or n_4) are displayed alternately.
▲ Button: Increases the setting value
▼ Button: Decreases the setting value

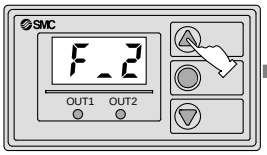
Flow rate setting mode (auto preset)

1. Setting Value Input Mode



Press the SET button, and then release it when F_1 is displayed.

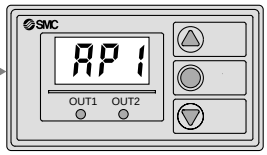
2. Setting in the Auto Preset Mode



Press the SET button.

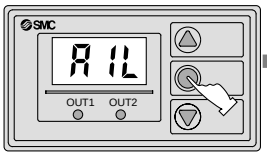
Press the ▲ button to switch the display to F_2.

3. Auto Preset Preparations



In this condition, preparations are performed on equipment for the OUT1 setting, and flow is started.
(In case the OUT1 setting is not required, press the ▲ button and the ▼ button simultaneously while in this condition.)

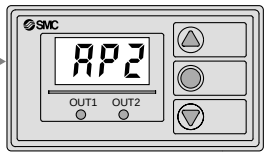
4. OUT1 Auto Preset



Press the SET button.

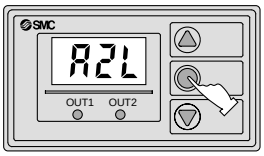
When the SET button is pressed at this point, the flow rate values are read automatically, and the optimum setting value is input.
A1L and the input value are displayed alternately.

5. Auto Preset Preparations



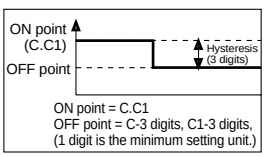
Preparations are performed on equipment for the OUT2 setting, and flow is started.
(In case the OUT2 setting is not required, press the ▲ button and the ▼ button simultaneously while in this condition.)

6. OUT2 Auto Preset



Setting is completed when the SET button is pressed.

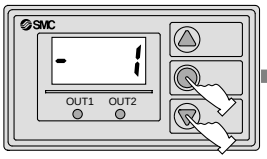
When the SET button is pressed at this point, the flow rate values are read automatically, and the optimum setting value is input.
A2L and the input value are displayed alternately.



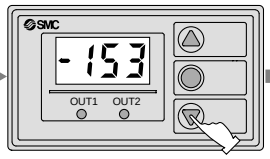
Other functions

• Accumulated flow function

Start of Accumulation



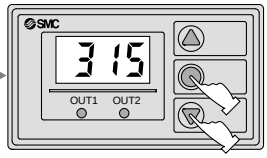
Accumulation start
Press the SET button while pressing the ▼ button.
The - mark blinks and accumulation begins.



The value can be accumulated to 999999, but normally only the lower 3 digits are displayed. Press the ▼ button to confirm the upper 3 digits.

By pressing the ▲ button, the real-time flow rate can be confirmed during accumulation.

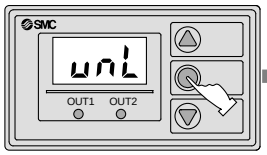
Stopping Accumulation



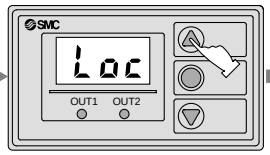
Press the SET button while pressing the ▼ button.
The display holds the value accumulated up to the present and stops. To start further accumulation from this point, press the SET button while pressing the ▼ button.
The display can be cleared by pressing the ▲ button and the ▼ button simultaneously for 2 seconds or more.

• Key lock mode ---------- Prevents misoperation of buttons.

Start of Key Locking



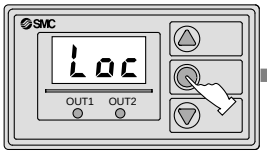
Press the SET button continuously for 3 seconds or more.
The display changes from F.1 to d.1, and when it shows unL, release the SET button.



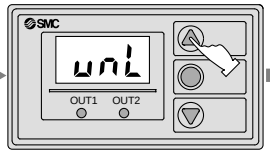
Using the ▲ button, set the display to Loc.

Setting is completed when the SET button is pressed.

Release of Key Locking



Press the SET button continuously for 3 seconds or more.
Release the SET button when the display shows Loc.

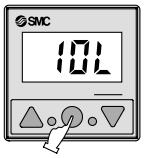


Using the ▲ button, set the display to unL.

Setting is completed when the SET button is pressed.

• Switching the flow rate range of the remote type (for air)

Flow Rate Range Switching



When the SET button is pressed continuously for 4 seconds or more, the display changes as shown in Table 3.

Press the ▲ button to match with the flow rate range being used.

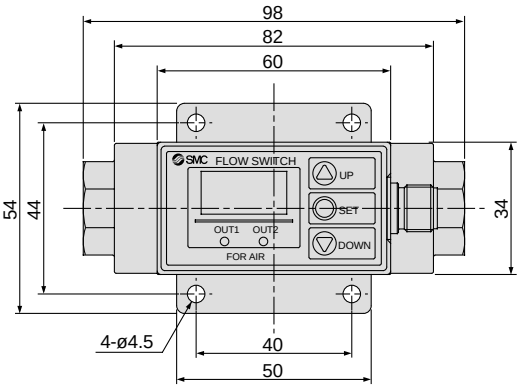
Setting is completed when the SET button is pressed.

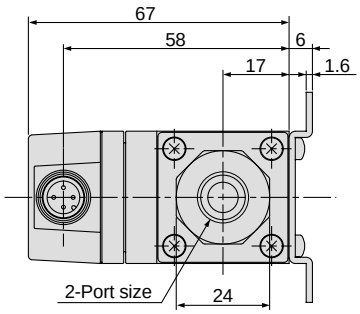
Table 3

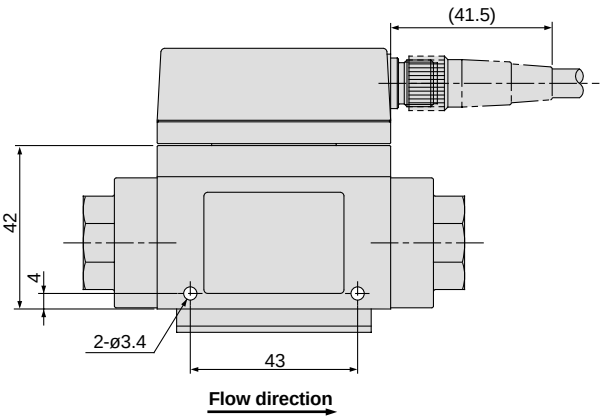
Display	Flow rate range	Applicable model
10L	1 to 10/min	For PFA30□
50L	5 to 50/min	
1 0L	10 to 100/min	For PFA31□
2 0L	20 to 200/min	
5 0L	50 to 500/min	

Dimensions/Integrated Display Type for Air

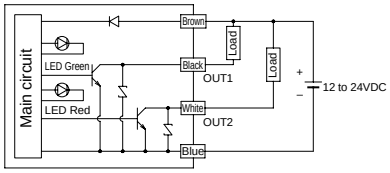
PFA710/750



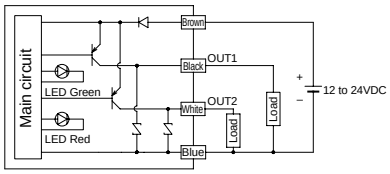




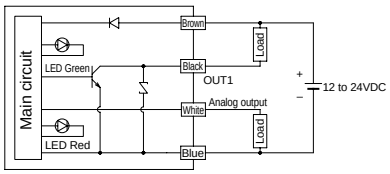
Internal circuit and wiring examples



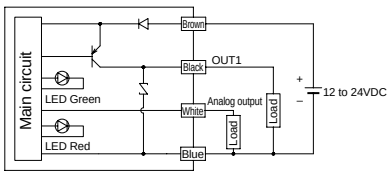
PFA7□□-□□-27□(-M)



PFA7□□-□□-67□(-M)

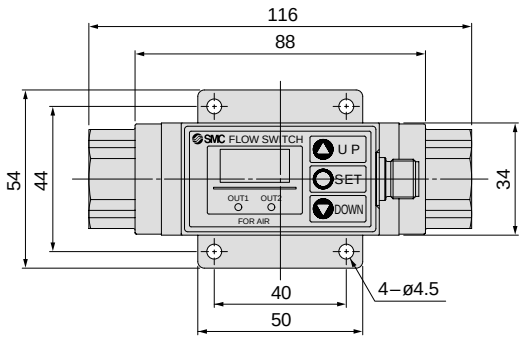


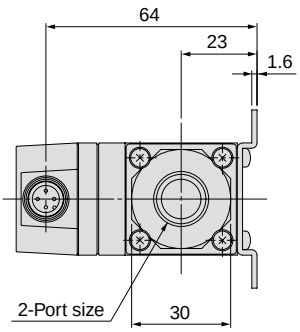
PFA7□1-□□-28□(-M)

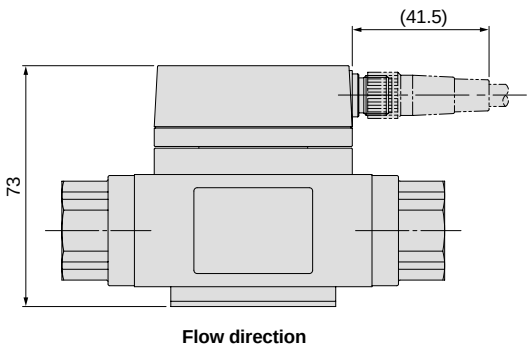


PFA7□1-□□-68□(-M)

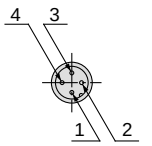
PFA711/721/751







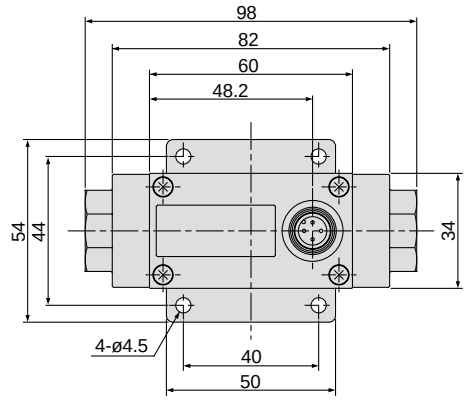
Connector pin numbers

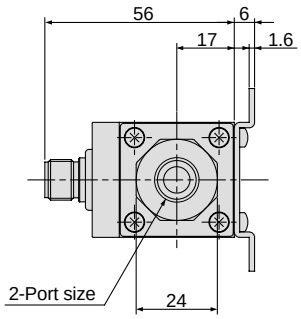


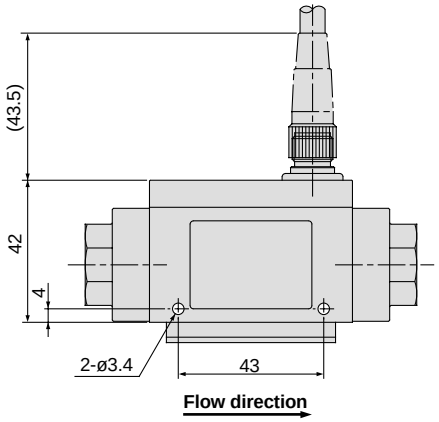
Pin no.	Pin description
1	DC (+)
2	OUT2/Analog output
3	DC (–)
4	OUT1

Dimensions/Remote Type Sensor Unit for Air

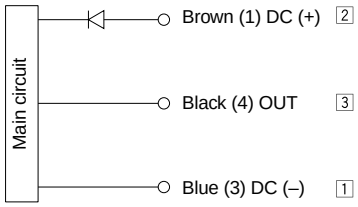
PFA510/550





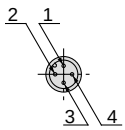


Wiring



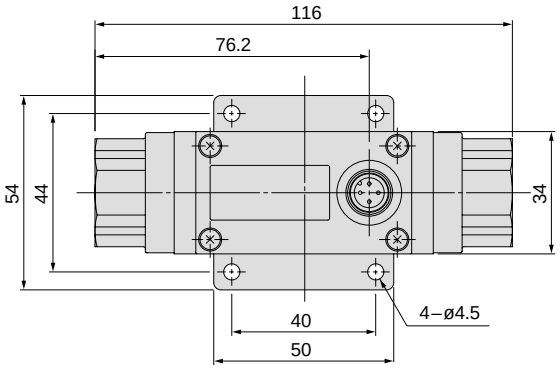
∗ Use this sensor by connecting it with the SMC remote type display unit series PFA3□□.
(1), (3), and (4) are connector pin numbers.
1, 2, and 3 are the series PFA3□□ terminal numbers.

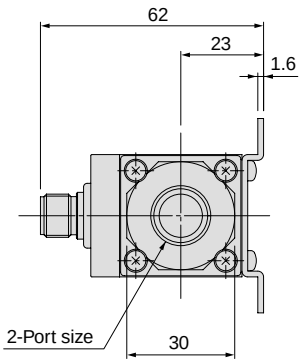
Connector pin numbers

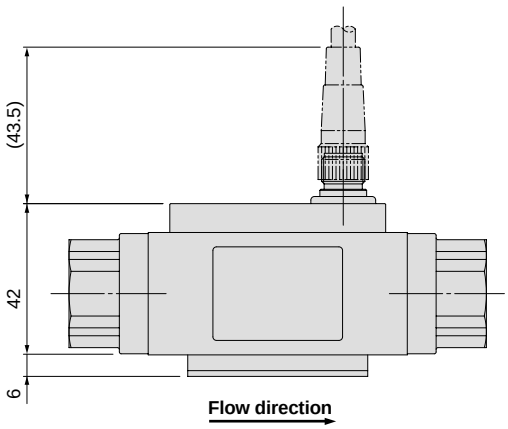


Pin no.	Pin description
1	DC (+)
2	NC
3	DC (–)
4	OUT

PFA511/521/551

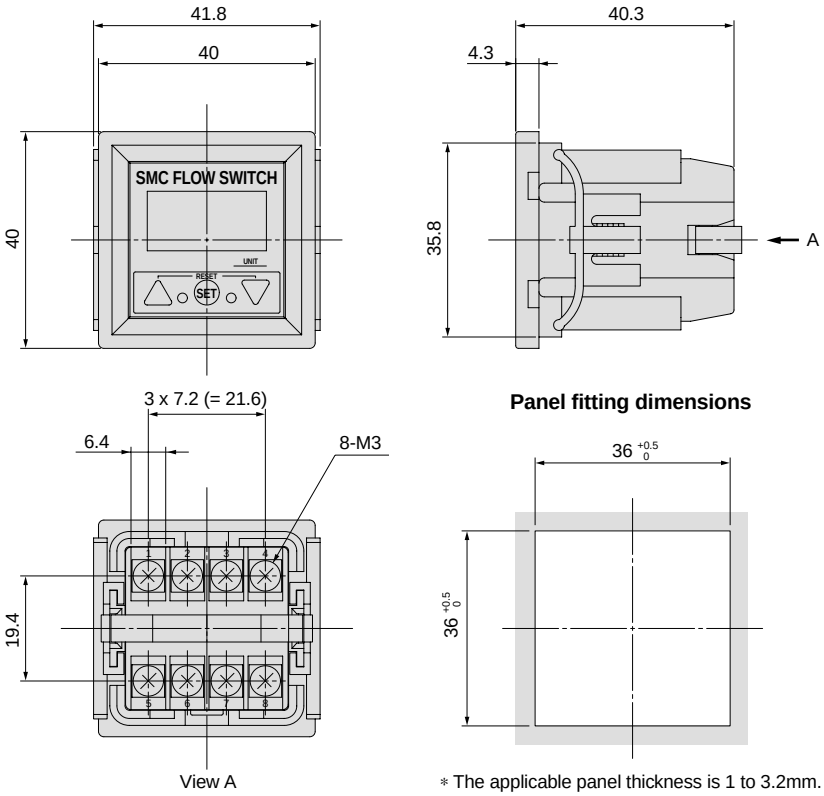






Dimensions/Remote Type Display Unit for Air

PFA3□□-A
Panel mount type

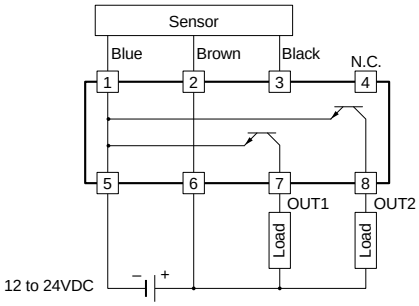


Panel fitting dimensions

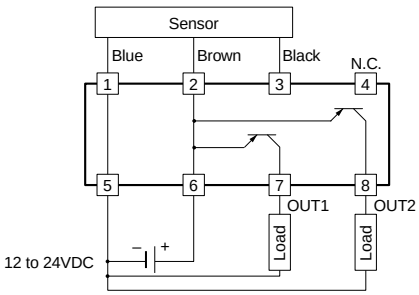
∗ The applicable panel thickness is 1 to 3.2mm.

Internal circuit and wiring examples

1 to 8 are terminal numbers.

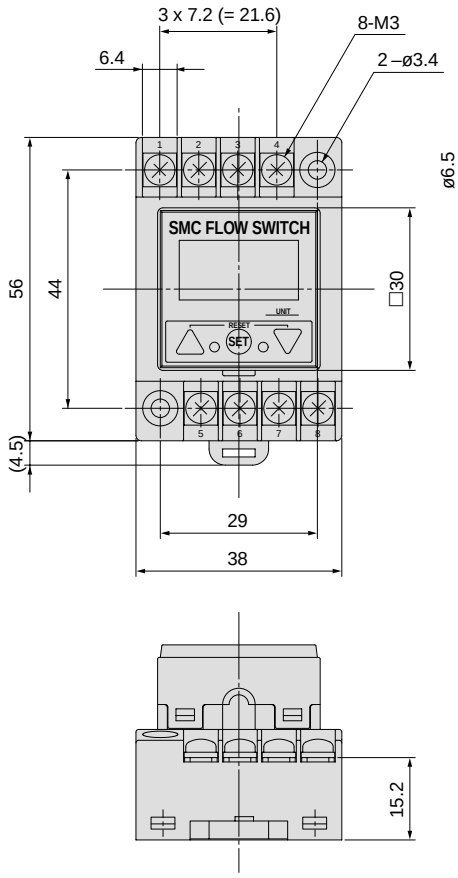


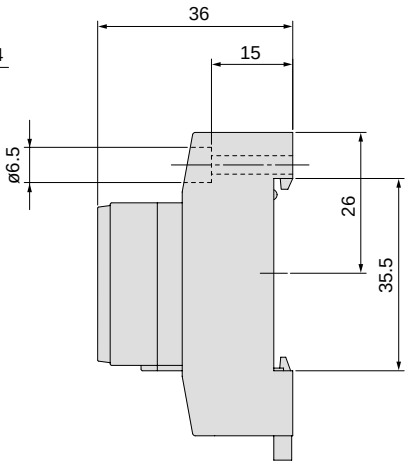
PFA3□0-□(-M)

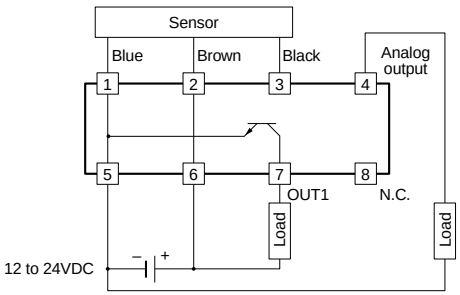


PFA3□1-□(-M)

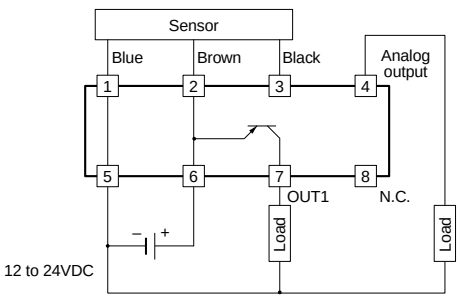
PFA3□□-B
DIN rail type







PFA312-□(-M)



PFA313-□(-M)

For Air

Digital Flow Switch/High Flow Rate Type

Series PFA

How to order

Integrated display type

PFA7 □ H — □ □ — □ □ — □

Flow rate range

03	150 to 3000/min
06	300 to 6000/min
12	600 to 12000/min

High flow rate type

Port specification

Nil	Rc
N	NPT
F	G

Port size

Symbol	Port size	Flow rate (/min) 3000	6000	12000	Applicable model
10	1	●			PFA703H
14	1 1/2		●		PFA706H
20	2			●	PFA712H

Output specification

28	NPN open collector 1 output + Analog output (1 to 5V)
29	NPN open collector 1 output + Analog output (4 to 20mA)
68	PNP open collector 1 output + Analog output (1 to 5V)
69	PNP open collector 1 output + Analog output (4 to 20mA)

Switching of switch output and cumulative pulse output is possible with NPN or PNP open collector outputs.

Wiring specification

Nil	3m lead wire with connector
N	Without lead wire

Unit specification

Nil	With unit switching function
M	Fixed SI unit Note)

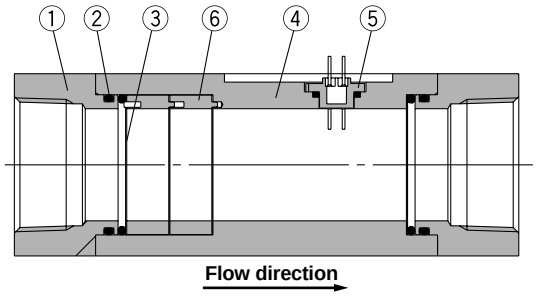
Note) Fixed units:
Real-time flow rate: /min
Accumulated flow: , m³, m³ x 10³

Specifications

Model		PFA703H	PFA706H	PFA712H
Measured fluid		Dry air		
Detection type		Heater type		
Flow rate measurement range Note 5)		150 to 3000/min	300 to 6000/min	600 to 12000/min
Minimum setting unit Note 5)		5/min	10/min	
Display units Note 1)	Real-time flow rate	/min, CFM		
	Accumulated flow	, m³, m³ x 10³, ft³, ft³ x 10³, ft³ x 10⁶		
Operating pressure range		0.1 to 1.5MPa		
Withstand pressure		2.25MPa		
Pressure loss		20kPa (at maximum flow rate)		
Accumulated flow range		0 to 9,999,999,999		
Operating temperature range		0 to 50°C (with no condensation)		
Linearity Note 2)		±1.5% F.S. or less (0.7MPa, at 20°C)		
Repeatability		±1.0% F.S. or less (0.7MPa, at 20°C)		
Pressure characteristics		±1.5% F.S. or less (0.1 to 1.5MPa, based on 0.7MPa)		
Temperature characteristics		±2.0% F.S. or less (0 to 50°C, based on 25°C)		
Output specifications	Switch output Note 3)	NPN open collector Max. load current: 80mA, Max. applied voltage: 30V, Internal voltage drop: 1V or less (with load current of 80mA)		
		PNP open collector Max. load current: 80mA, Internal voltage drop: 1.5V or less (with load current of 80mA)		
	Accumulated pulse output Note 3)	NPN or PNP open collector Flow rate per pulse: 100/pulse, 10.0ft³/pulse ON time per pulse: 50msec/pulse		
	Analog output Note 4)	Output voltage: 1 to 5V, Load impedance: 100kΩ or more		
		Output current: 4 to 20mA, Load impedance: 250kΩ or more		
Response time		1s or less		
Hysteresis		Hysteresis mode: Variable (can be set from 0), Window comparator mode: (can be set from 0 to 3% F.S.)		
Power supply voltage		24VDC (ripple ±10% or less)		
Current consumption		150mA or less		
Withstand voltage		1000VAC for 1 min. between external terminal block and case		
Insulation resistance		50MΩ (500VDC) between external terminal block and case		
Noise resistance		1000Vp-p, Pulse width 1μs, Rise time 1ns		
Vibration resistance		10 to 500Hz at the smaller of amplitude 1.5mm or acceleration 98m/s² in X, Y, Z directions, 2 hours each		
Impact resistance		490m/s² in X, Y, Z directions, 3 times each		
Weight		1.1kg (without lead wire)	1.3kg (without lead wire)	2.0kg (without lead wire)
Enclosure		Equivalent to IP65		
Port size (Rc, NPT, G)		1	1 1/2	2

Note 1) For the type with unit switching function [The type without the unit switching function will have a fixed SI unit (/min, or , m³ or m³ x 10³).]
Note 2) The high flow rate type is with CE marking. However, the linearity with applied noise is ±5% F.S. or less.
Note 3) Switch output and accumulated pulse output selections are made by button operation.
Note 4) The analog output operates only for real-time flow rate, and does not operate for accumulated flow.
Note 5) Flow rate display can be switched between the basic condition of 0°C, 101.3kPa and the standard condition (ANR) of 20°C, 101.3kPa, 65% RH.

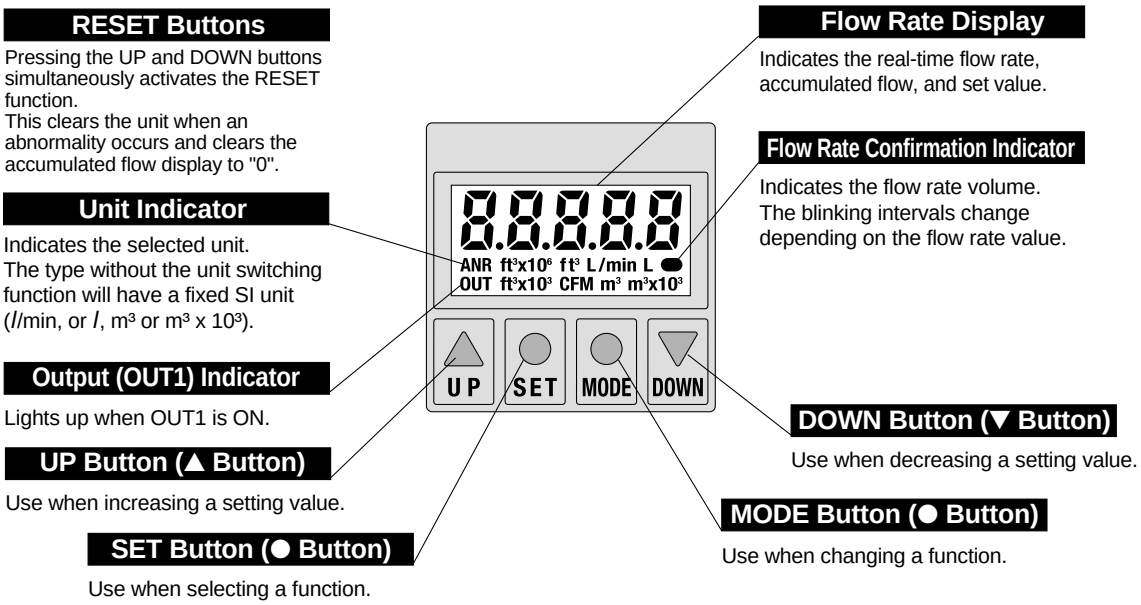
Construction



Parts list

No.	Description	Material	Note
1	**Attachment**	Aluminum alloy	Anodized
2	**Seal**	H, NBR	—
3	**Mesh**	Stainless steel	—
4	**Body**	Aluminum alloy	Anodized
5	**Sensor**	PPS	—
6	**Spacer**	PBT	—

Operating Unit Descriptions



Error Correction

Take the following corrective actions when errors occur.

LED display	Problem	Corrective action
Err-1	A current of more than 80mA is flowing to OUT1.	Check the load and wiring for OUT1.
Err-3	The setting data has changed due to some influence.	Perform the RESET operation, and set all data again.
-----	The flow rate is over the flow rate measurement range.	Reduce the flow rate until it is within the flow rate measurement range, using an adjustment valve, etc.

Connectors

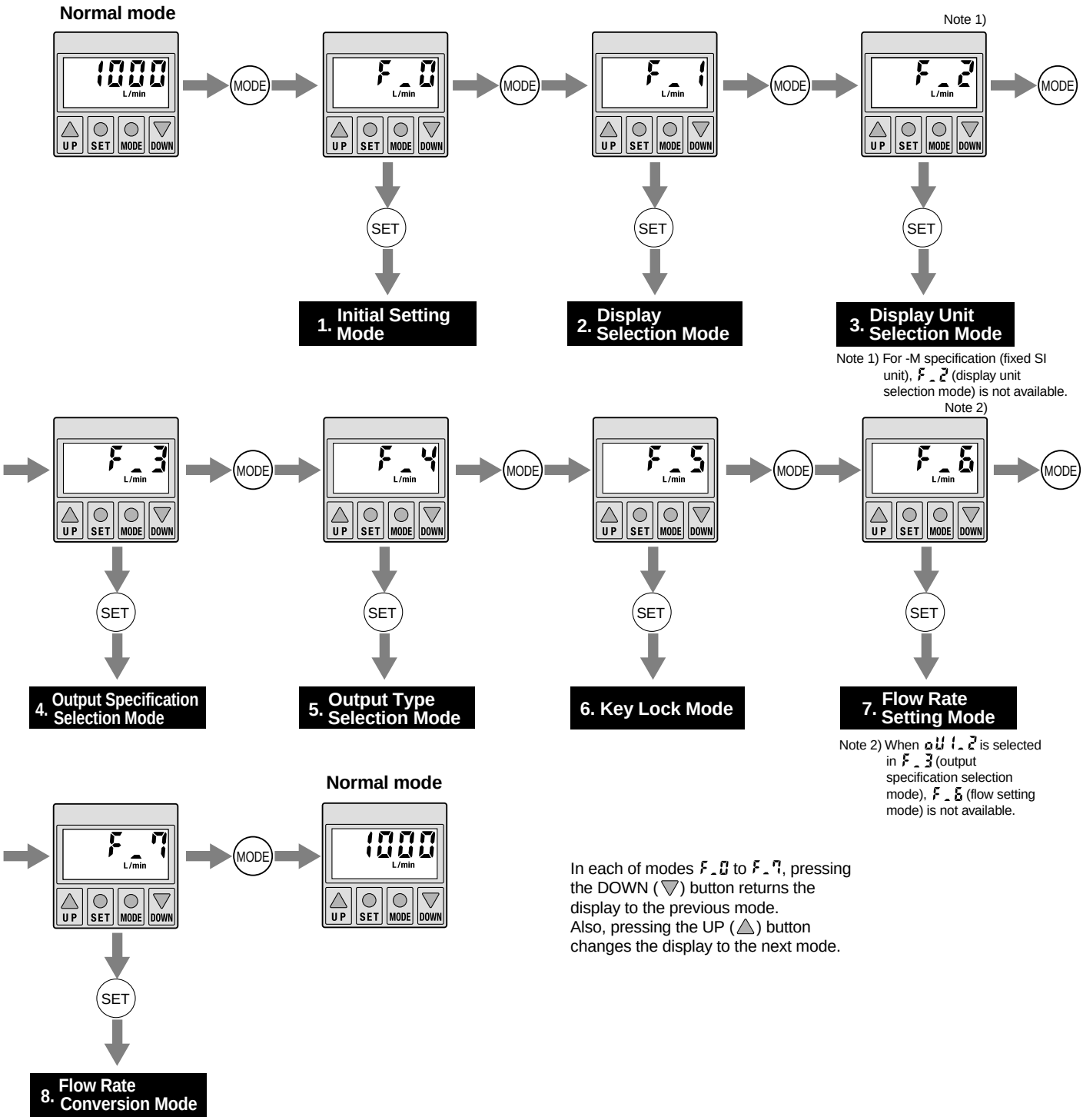
Since the connectors (female contacts) shown below can be used, please refer to the respective manufacturers.

Connector size	Number of pins	Manufacturers	Applicable series
M12	4	C. CORRENS & CO., LTD.	VA-4D
		OMRON Corporation	XS2
		Yamatake-Honeywell Co., Ltd.	PA5-4I
		Hirose Electric Company	HR24
		DDK Ltd.	CM01-8DP4S

Note) C. CORRENS & CO., LTD. is the general agent in Japan for Hirschmann.

Operation

Function configuration



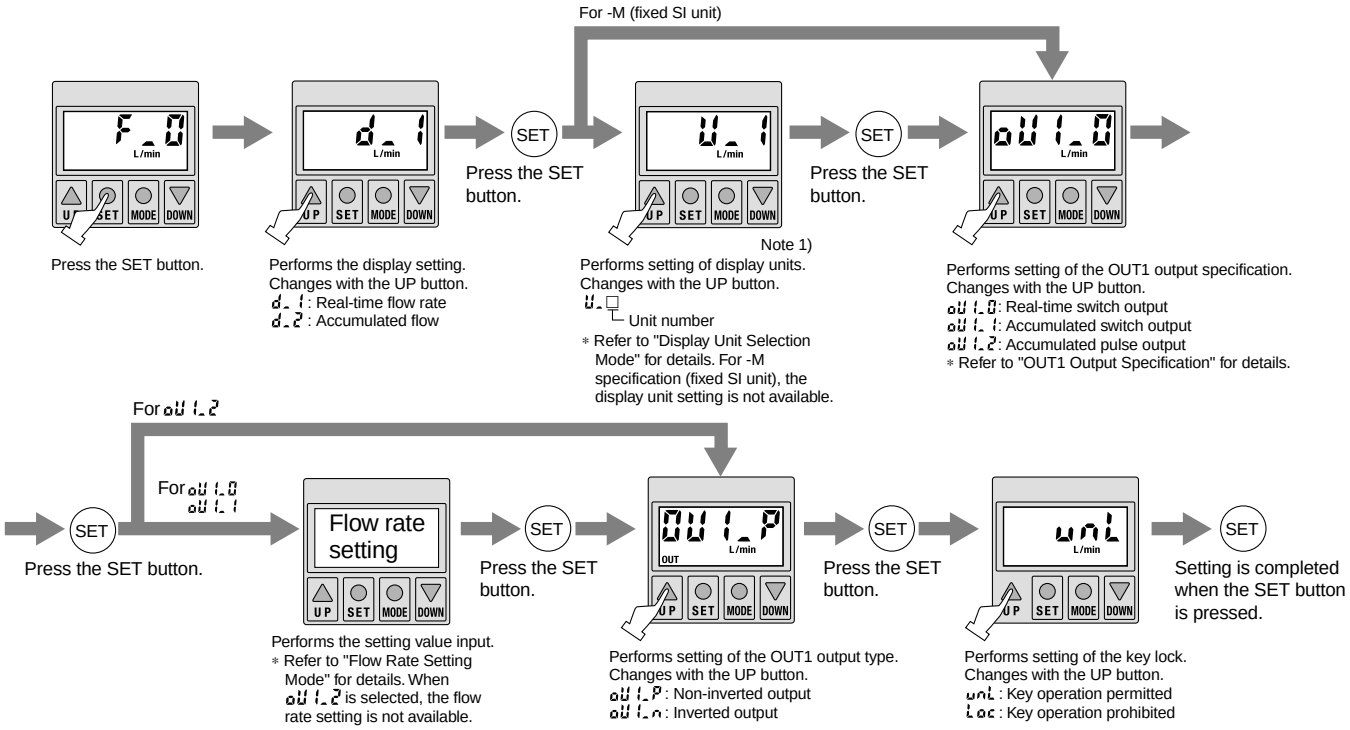
Note 1) For -M specification (fixed SI unit), F_2 (display unit selection mode) is not available.

Note 2) When out1_2 is selected in F_3 (output specification selection mode), F_6 (flow setting mode) is not available.

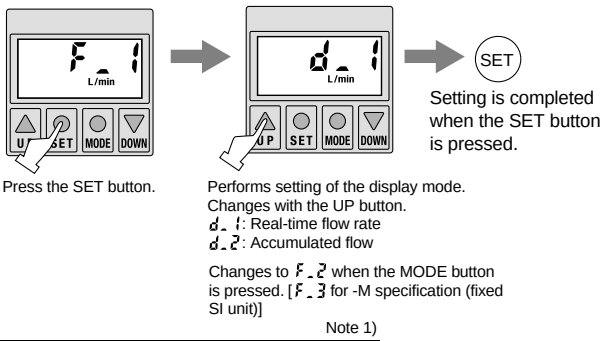
In each of modes F_0 to F_7, pressing the DOWN (▽) button returns the display to the previous mode.
Also, pressing the UP (△) button changes the display to the next mode.

Operation

1. Initial Setting Mode



2. Display Selection Mode



3. Display Unit Selection Mode

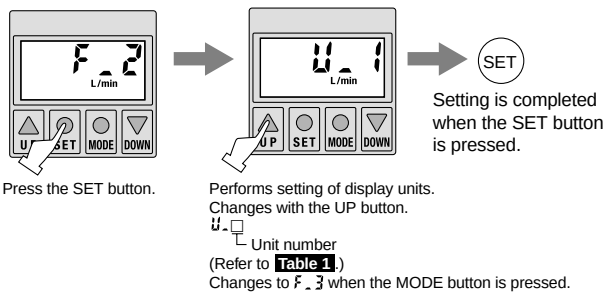
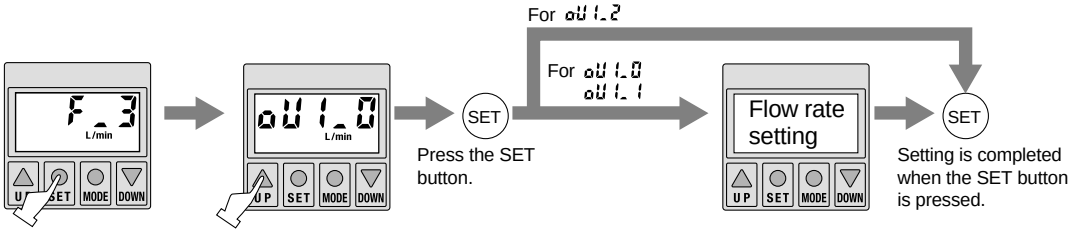


Table 1

Display	Real-time flow rate	Accumulated flow
U_1	l/min	l, m³, m³ x 10³
U_2	CFM	ft³, ft³ x 10³, ft³ x 10⁶

Note 1) For the type with unit switching function
[The type without the unit switching function will have a fixed SI unit (l/min, or l, m³ or m³ x 10³)].

4. Output Specification Selection Mode

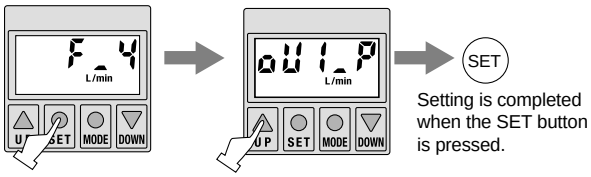


Press the SET button.

Performs setting of the OUT1 output specification.
Changes with the UP button.
oU1_0 : Real-time switch output
oU1_1 : Accumulated switch output
oU1_2 : Accumulated pulse output
Refer to the OUT1 output specifications.
Changes to F_4 when the "MODE" button is pressed.

Performs the setting value input.
* Refer to "Flow Rate Setting Mode" for details. When oU1_2 is selected, the flow rate setting is not available.

5. Output Type Selection Mode



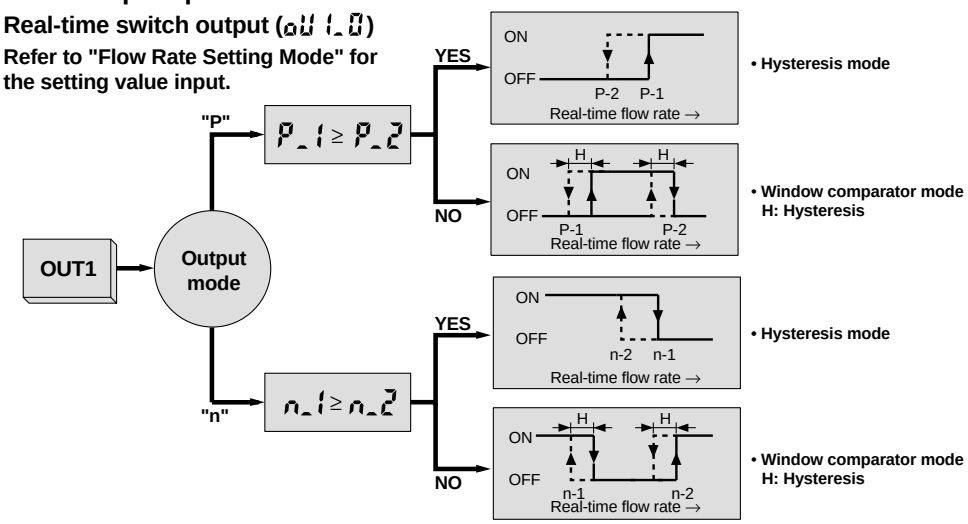
Press the SET button.

Performs setting of the OUT1 output type.
Changes with the UP button.
oU1_P : Non-inverted output
oU1_n : Inverted output
Changes to F_5 when the MODE button is pressed.

OUT1 output specifications

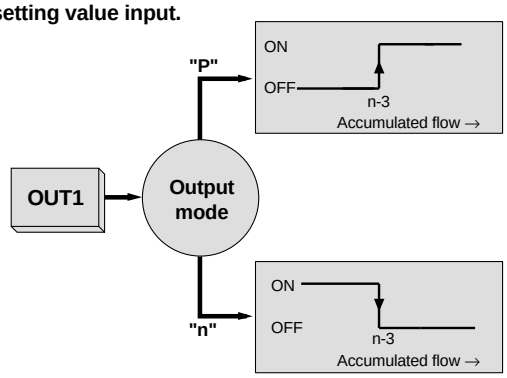
Real-time switch output (oU1_0)

Refer to "Flow Rate Setting Mode" for the setting value input.



Accumulated switch output (oU1_1)

Refer to "Flow Rate Setting Mode" for the setting value input.



Accumulated pulse output (oU1_2)

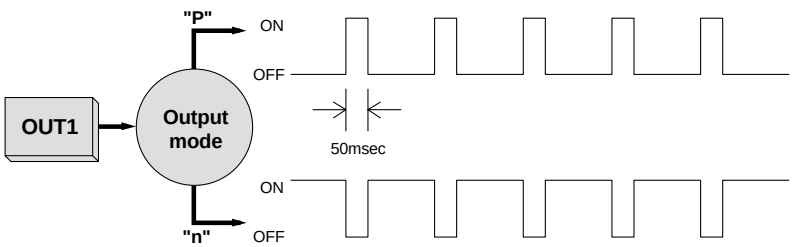


Table 2 Flow rate value per pulse Note 1)

Display	Accumulated flow
U_1	100ℓ/pulse
U_2	10.0ft³/pulse

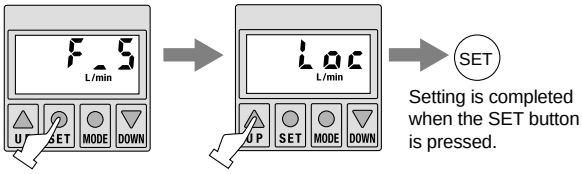
Note 1) For the type with unit switching function
[The type without the unit switching function will have a fixed SI unit (ℓ/min, or ℓ, m³ or m³ x 10³).]

Operation

6. Key Lock Mode

Prevents the misoperation of buttons.

Start of key locking

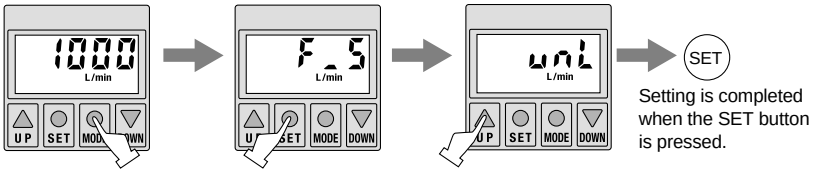


Press the SET button.

Changes with the UP button.
unL : Key operation permitted
Loc : Key operation prohibited
Changes to F_6 when the MODE button is pressed.
(Changes to F_7 when oUt_2 is selected in F_3.)

Setting is completed when the SET button is pressed.

Release of key locking



Press the MODE button continuously for 3 seconds or more.

Press the SET button.

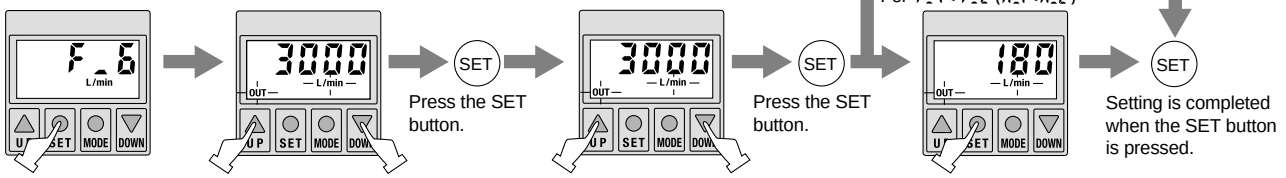
Using the UP button, set the display to unL.

Setting is completed when the SET button is pressed.

7. Flow Rate Setting Mode

Performs the setting value input.
The input method depends on the OUT1 output specification.

Real-time switch output (oUt_0)



For P_1 ≥ P_2 (n_1 ≥ n_2)

For P_1 < P_2 (n_1 < n_2)

Press the SET button.

Enter the setting value.
The setting value and P_1 (or n_1) are displayed alternately.
UP Button: Increases the setting value
DOWN Button: Decreases the setting value

Press the SET button.

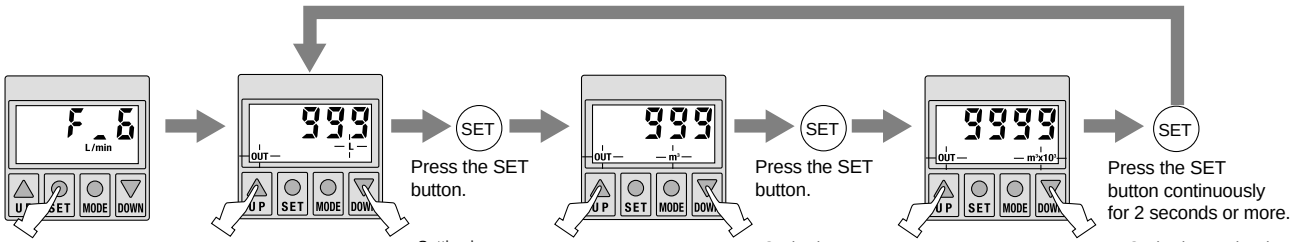
Enter the setting value.
The setting value and P_2 (or n_2) are displayed alternately.
UP Button: Increases the setting value
DOWN Button: Decreases the setting value

Setting is completed when the SET button is pressed.

P_1 < P_2 (n_1 < n_2): Window comparator mode
Performs setting of the hysteresis value.
The hysteresis value and HIS are displayed alternately.
UP Button: Increases the setting value
DOWN Button: Decreases the setting value
The hysteresis value can be set between 0 to 3% of the rated flow rate value. However, if the difference between P_1 (n_1) and P_2 (n_2) is less than 6% of the rated flow rate value, the difference between P_1 (n_1) and P_2 (n_2) will be half for the maximum hysteresis setting value.

P_1 ≥ P_2 (n_1 ≥ n_2): Hysteresis mode
Hysteresis value setting is not available.

Accumulated switch output (oUt_1)



Press the SET button.
The setting value can be set up to 9,999 [m³ x 10^3], 999 [m³] or 999 [ℓ].

Enter the setting value.
The setting value and P_3 (or n_3) are displayed alternately.
UP Button: Increases the setting value
DOWN Button: Decreases the setting value

Press the SET button.

Setting is completed when the SET button is pressed continuously for 2 seconds or more.

Enter the setting value.
The setting value and P_3 (or n_3) are displayed alternately.
UP Button: Increases the setting value
DOWN Button: Decreases the setting value

Press the SET button.

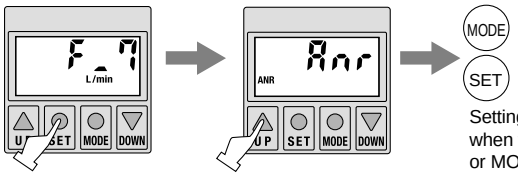
Setting is completed when the SET button is pressed continuously for 2 seconds or more.

Enter the setting value.
The setting value and P_3 (or n_3) are displayed alternately.
UP Button: Increases the setting value
DOWN Button: Decreases the setting value

Press the SET button continuously for 2 seconds or more.

Setting is completed when the SET button is pressed continuously for 2 seconds or more.

8. Flow Rate Conversion Mode



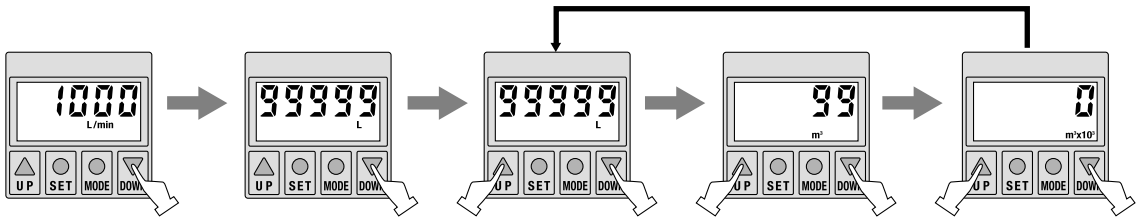
Press the SET button.

Performs the setting of flow rate conversion conditions. Changes with the UP button.
Anr : 20°C, 101.3kPa, 65% RH (ANR)
nor : 0°C, 101.3kPa

Setting is completed when the SET button or MODE button is pressed.

Flow rate display confirmation

Confirming the accumulated flow when real-time flow rate is selected.

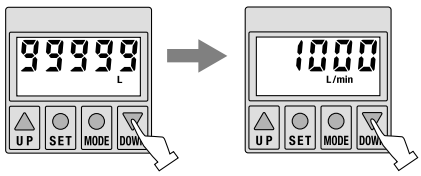


Press the DOWN button.

Displays the accumulated flow while the DOWN button is pressed.
(Returns to the real-time flow rate display when the DOWN button is released.)

Pressing the UP button while pressing the DOWN button changes the accumulated flow unit.

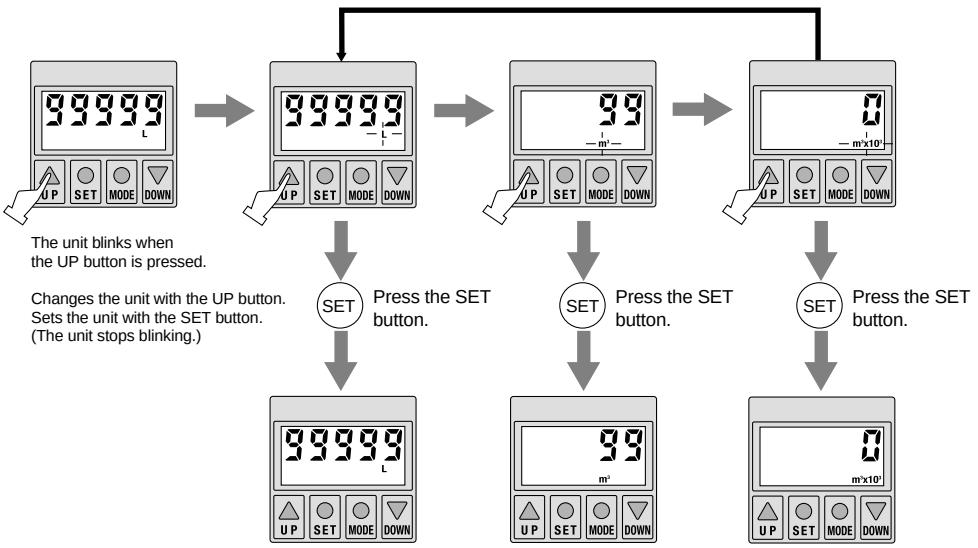
Confirming the real-time flow rate when accumulated flow is selected.



Press the DOWN button.

Displays the real-time flow rate while the DOWN button is pressed.
(Returns to the accumulated flow display when the DOWN button is released.)

Changing the accumulated flow unit (Sets the accumulated flow display unit when accumulated flow is selected.)



The unit blinks when the UP button is pressed.

Changes the unit with the UP button.
Sets the unit with the SET button.
(The unit stops blinking.)

Press the SET button.

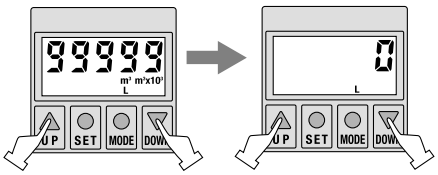
Press the SET button.

Press the SET button.

∗ When the buttons are not operated for 5 seconds, the unit stops blinking automatically and exits from changing of the accumulated flow display unit. The accumulated flow display unit does not change in this case.

Operation

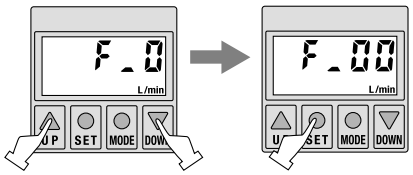
Clearing the accumulated value



Press the UP button while pressing the DOWN button.

The accumulated value clears when the buttons are pressed continuously for 5 seconds or more.

Initializing the setting



In the initial setting mode F_0, press the UP button and DOWN button for 2 seconds or more.

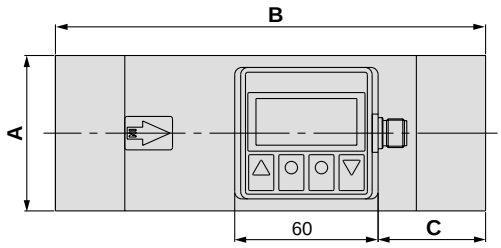
When the SET button is pressed, the setting returns to the factory setting.

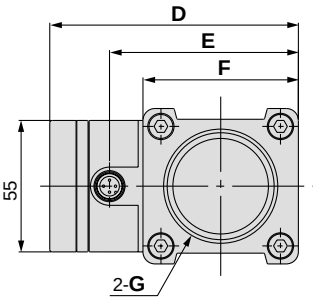
Factory setting
Display setting: Real-time flow rate (d_ 1)
Unit setting : l/min (U_ 1)
Switch specification: Real-time switch output (oU 1_0)
Output mode: Inverted output (oU 1_n)
Flow rate setting value: Real-time flow rate — Full range median value
Accumulated flow — 0
Key lock mode: Unlocked (unL)
Flow rate conversion conditions: 20°, 101.3kPa, 65% RH (ANR) (Rnr)

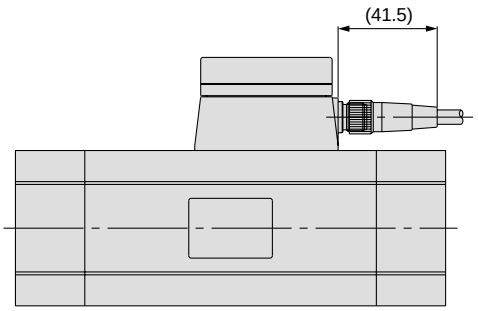
When the MODE button is pressed, the setting changes to F_0 instead of being initialized.

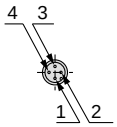
Dimensions

PFA703H/706H/712H



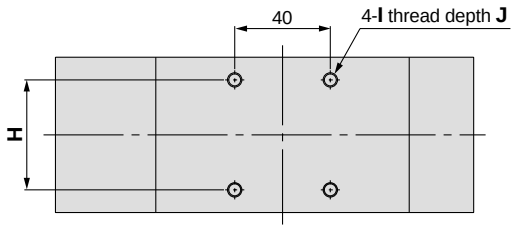




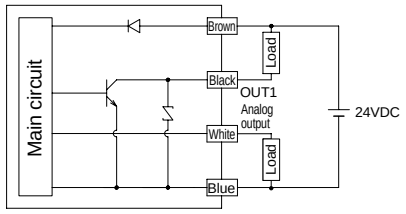


Connector pin numbers

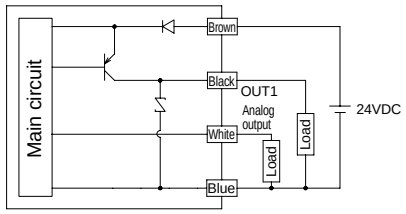
Pin no.	Pin description
1	DC (+)
2	Analog output
3	DC (–)
4	OUT1



Internal circuit and wiring examples

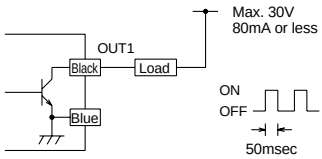


PFA7□□H-□□-$\frac{28}{29}$(-M)

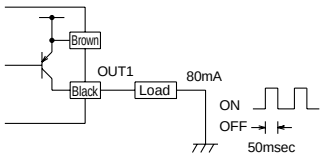


PFA7□□H-□□-$\frac{68}{69}$(-M)

Accumulated pulse output wiring examples



PFA7□□H-□□-$\frac{28}{29}$(-M)

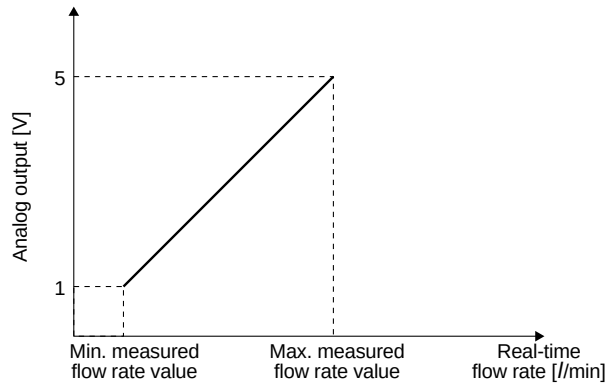


PFA7□□H-□□-$\frac{68}{69}$(-M)

Model	A	B	C	D	E	F	G	H	I	J
PFA703H	55	160	40	92	67	55	Rc 1, NPT 1, G 1	36	M5 x 0.8	8
PFA706H	65	180	45	104	79	65	Rc 1 1/2, NPT 1 1/2, G 1 1/2	46	M6 x 1	9
PFA712H	75	220	55	114	89	75	Rc 2, NPT 2, G 2	56	M6 x 1	9

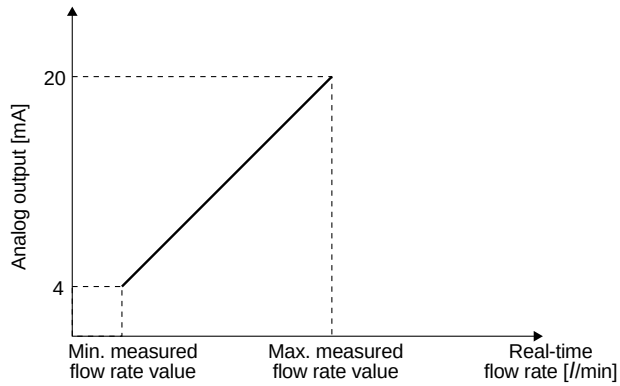
Analog output

1 to 5VDC



Part no.	Minimum measured flow rate value [l/min]	Maximum measured flow rate value [l/min]
PFA703H-□-28 **PFA703H-□-68**	150	3000
PFA706H-□-28 **PFA706H-□-68**	300	6000
PFA712H-□-28 **PFA712H-□-68**	600	12000

4 to 20mADC

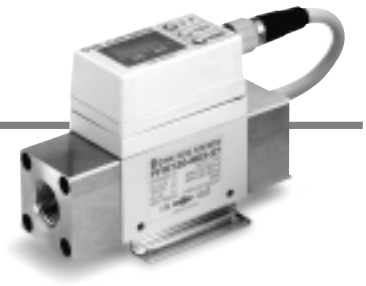


Part no.	Minimum measured flow rate value [l/min]	Maximum measured flow rate value [l/min]
PFA703H-□-29 **PFA703H-□-69**	150	3000
PFA706H-□-29 **PFA706H-□-69**	300	6000
PFA712H-□-29 **PFA712H-□-69**	600	12000

For Water

Digital Flow Switch

Series PFW



How to order

Integrated display type

PFW7 20 — □ 03 — 27 □ — □

Flow rate range

04	0.5 to 4 l/min
20	2 to 16 l/min
40	5 to 40 l/min

Thread type

Nil	Rc
N	NPT
F	G

Port size

Symbol	Size	Flow rate (l/min) 4	16	40	Applicable model
03	3/8	●	●		PFW704, PFW720
04	1/2		●	●	PFW720, PFW740
06	3/4			●	PFW740

Output specification

27	NPN open collector 2 outputs
67	PNP open collector 2 outputs

Wiring specification

Nil	3m lead wire with connector
N	Without lead wire

Unit specification

Nil	With unit switching function
M	Fixed SI unit Note)

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

Specifications

Model		PFW704	PFW720	PFW740
Measured fluid		Water		
Detection type		Karman vortex		
Flow rate measurement and setting range		0.5 to 4 (setting is 0.6 to 4) l/min	2 to16l/min	5 to 40l/min
Minimum setting unit		0.05l/min	0.1l/min	0.5l/min
Display units Note 1)	Real-time flow rate	l/min, gal (US)/min		
	Accumulated flow	l, gal (US)		
Operating pressure range		0 to 1MPa		
Withstand pressure		1.5MPa		
Accumulated flow range		0 to 999999l		
Operating temperature range		0 to 50°C (with no condensation)		
Linearity		±5% F.S. or less		
Repeatability		±3% F.S. or less		
Temperature characteristics		±5% F.S. or less (0 to 50°C)		
Output specifications Note 2)	Switch output	NPN open collector	Maximum load current: 80mA, Internal voltage drop: 1V or less (with load current of 80mA) Maximum applied voltage: 30V	
		PNP open collector	Maximum load current: 80mA Internal voltage drop: 1.5V or less (with load current of 80mA)	
Indicator lights		Lights up when ON, OUT1: Green, OUT2: Red		
Response time		1s or less		
Hysteresis		Hysteresis mode: Variable (can be set from 0), Window comparator mode: Fixed (3 digits) Note 3)		
Power supply voltage		12 to 24VDC (ripple ±10% or less)		
Current consumption		70mA or less		
Withstand voltage		1000VAC for 1 min. between external terminal block and case		
Insulation resistance		50MΩ (500VDC) between external terminal block and case		
Noise resistance		1000Vp-p, Pulse width 1μs, Rise time 1ns		
Vibration resistance		10 to 500Hz at the smaller of amplitude 1.5mm or acceleration 98m/s² in X, Y, Z directions, 2 hours each		
Impact resistance		490m/s² in X, Y, Z directions, 3 times each		
Weight		460g (without lead wire)	520g (without lead wire)	700g (without lead wire)
Enclosure		Equivalent to IP65		
Port size (Rc, NPT, G)		3/8	3/8, 1/2	1/2, 3/4

Note 1) For the type with unit switching function [The type without the unit switching function will have a fixed SI unit (l/min or l).]
Note 2) The output functions operate only for the real-time flow rate display, and do not operate for the accumulated flow display.
Note 3) Window comparator mode — Since hysteresis is 3 digits, separate P1 and P2 by 7 digits or more. 1 digit is the minimum setting unit (refer to the table above).

How to order

Remote Type Display Unit

PFW3 0 0 — A — □

Flow rate range

1	0.5 to 4 l/min
0	2 to 16 l/min
2	5 to 40 l/min

Output specification

0	NPN open collector 2 outputs
1	PNP open collector 2 outputs

Mounting

A	Panel mount
B	DIN rail, wall mount

Panel mount adapter part no.

Description	Panel adapter B
Part No.	ZS-22-02

Unit specification

Nil	With unit switching function
M	Fixed SI unit Note)

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

Specifications

Model		PFW310	PFW311	PFW300	PFW301	PFW320	PFW321
Flow rate measurement and setting range		0.5 to 4 (setting is 0.6 to 4) l/min		2 to 16 l/min		5 to 40 l/min	
Minimum setting unit		0.05 l/min		0.1 l/min		0.5 l/min	
Display units Note 1)	Real-time flow rate	l/min, gal (US)/min					
	Accumulated flow	l, gal (US)					
Accumulated flow range		0 to 999999 l					
Operating temperature range		0 to 50°C (with no condensation)					
Linearity Note 2)		±5% F.S. or less					
Repeatability Note 2)		±3% F.S. or less					
Temperature characteristics Note 2)		±5% F.S. or less (0 to 50°C)					
Output specifications Note 3)	Switch output	NPN open collector: Maximum load current: 80mA; Maximum applied voltage: 30V; Internal voltage drop: 1V or less (with load current of 80mA)					
		PNP open collector: Maximum load current: 80mA; Internal voltage drop: 1.5V or less (with load current of 80mA)					
Indicator lights		Lights up when ON, OUT1: Green, OUT2: Red					
Response time		1s or less					
Hysteresis		Hysteresis mode: Variable (can be set from 0) Window comparator mode: Fixed (3 digits) Note 4)					
Power supply voltage		12 to 24VDC (ripple ±10% or less)					
Current consumption		50mA or less					
Weight		45g					
Enclosure		Equivalent to IP40					

Note 1) For the type with unit switching function [The type without the unit switching function will have a fixed SI unit (l/min or l).]
Note 2) The system accuracy when combined with PFW5□□.
Note 3) The output functions operate only for the real-time flow rate display, and do not operate for the accumulated flow display.
Note 4) Window comparator mode — Since hysteresis is 3 digits, separate P1 and P2 by 7 digits or more. 1 digit is the minimum setting unit (refer to the table above).

How to order

Remote Type Sensor Unit

PFW5 20 — □ 03 □

Flow rate range

04	0.5 to 4ℓ/min
20	2 to 16ℓ/min
40	5 to 40ℓ/min

Wiring specification

Nil	3m lead wire with connector
N	Without lead wire

Thread type

Nil	Rc
N	NPT
F	G

Port size

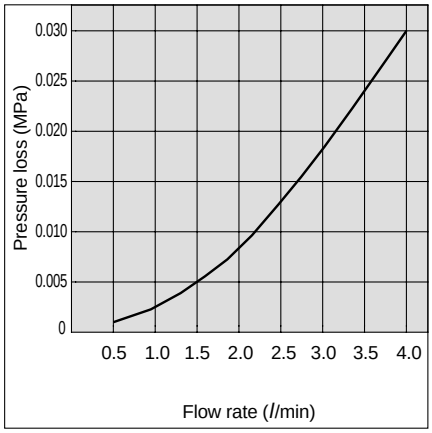
Symbol	Size	Flow rate (ℓ/min)			Applicable model
		4	16	40	
03	3/8	●	●		PFW504, 520
04	1/2		●	●	PFW520, 540
06	3/4			●	PFW540

Specifications

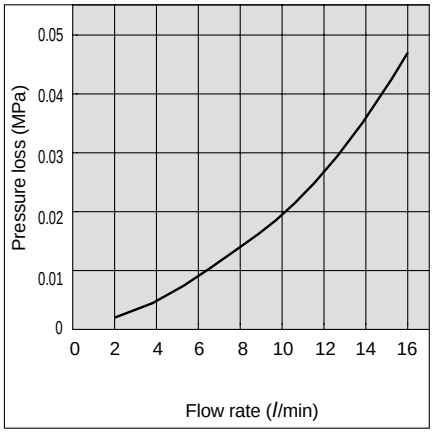
Model	PFW504	PFW520	PFW540
Measured fluid	Water		
Detection type	Karman vortex		
Flow rate measurement range	0.5 to 4ℓ/min	2 to 16ℓ/min	5 to 40ℓ/min
Operating pressure range	0 to 1MPa		
Withstand pressure	1.5MPa		
Operating temperature range	0 to 50°C (with no condensation)		
Power supply voltage	12 to 24VDC (ripple ±10% or less)		
Current consumption	20mA or less		
Weight	410g (without lead wire)	470g (without lead wire)	650g (without lead wire)
Enclosure	Equivalent to IP65		
Port size (Rc, NPT, G)	3/8	3/8, 1/2	1/2, 3/4

Flow Characteristics (Pressure Loss)

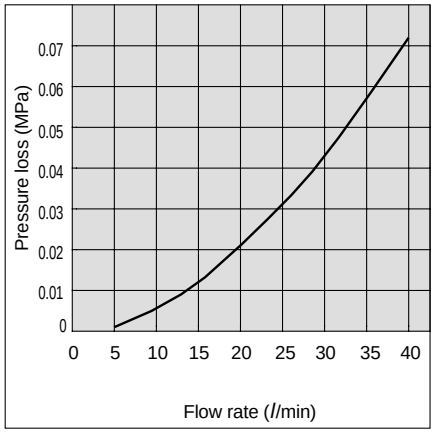
PFW704, 504



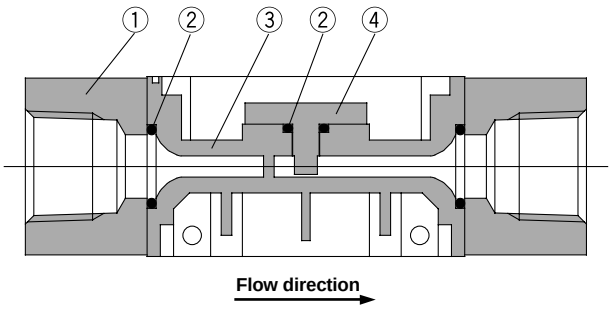
PFW720, 520



PFW740, 540



Sensor Unit Construction



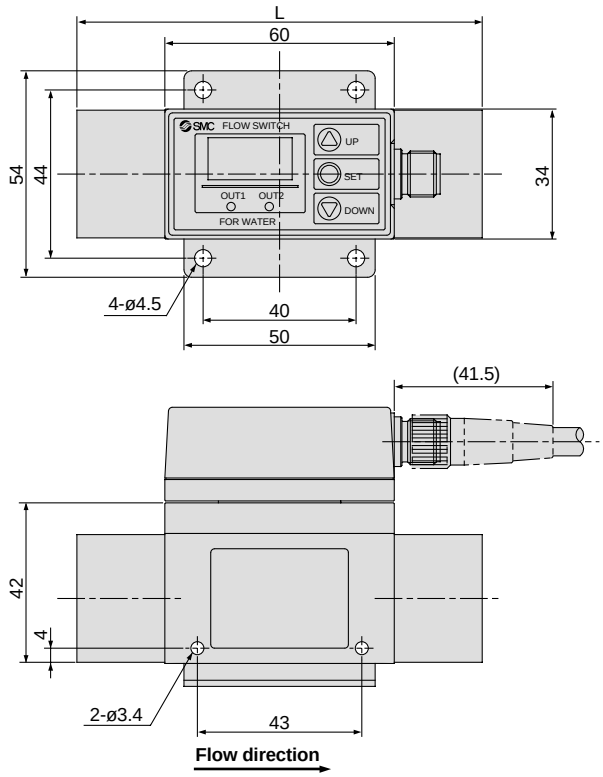
Parts list

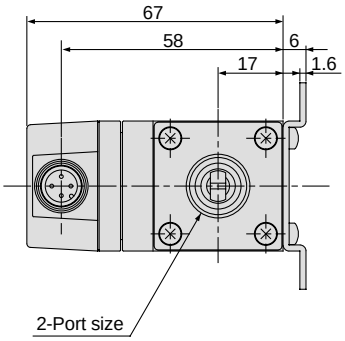
No.	Description	Material
1	**Attachment**	Stainless steel
2	**Seal**	NBR
3	**Body**	PPS
4	**Sensor**	PPS

Error correction, connectors, operating part descriptions, and flow rate setting are the same as series PFA for air. Refer to pages 1 through 7.

Dimensions/Integrated Display Type for Water

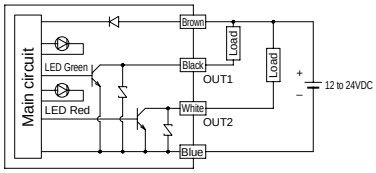
PFW704/720



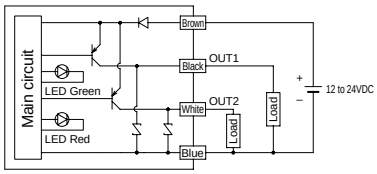


Model	Dimension L
PFW704	100
PFW720	106

Internal circuit and wiring examples

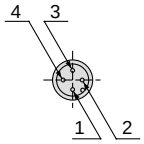


PFW7□□-□□-27□ (-M)



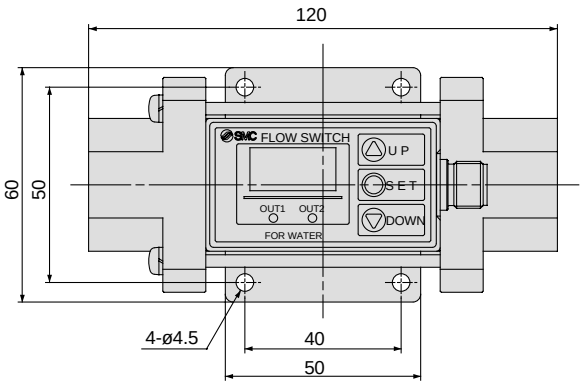
PFW7□□-□□-67□ (-M)

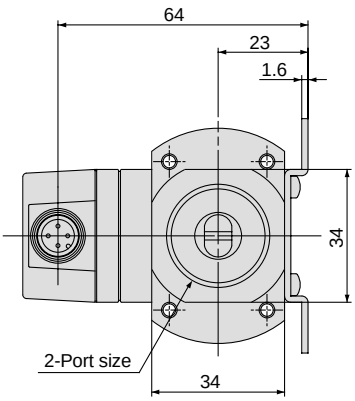
Connector pin numbers

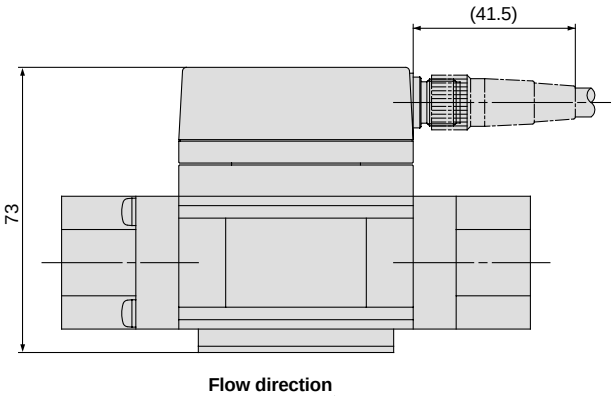


Pin no.	Pin description
1	DC (+)
2	OUT2
3	DC (–)
4	OUT1

PFW740

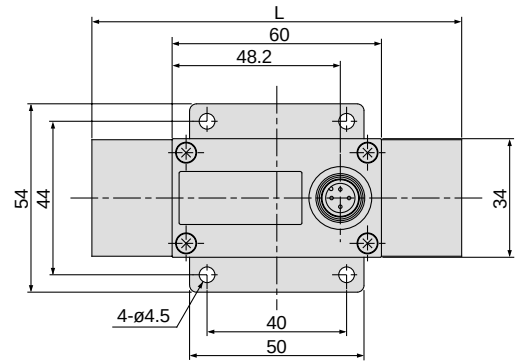


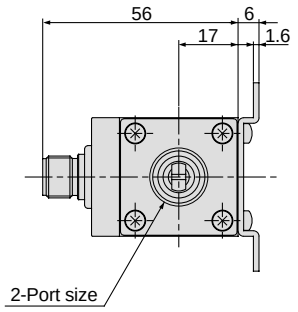


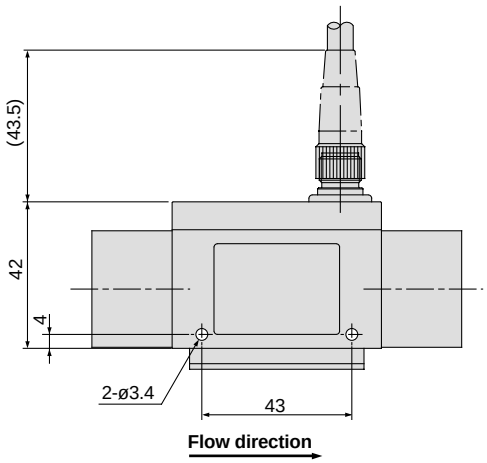


Dimensions/Remote Type Sensor Unit for Water

PFW504/520

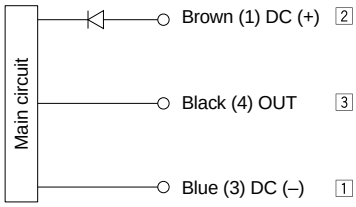






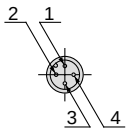
Model	Dimension L
PFW504	100
PFW520	106

Wiring



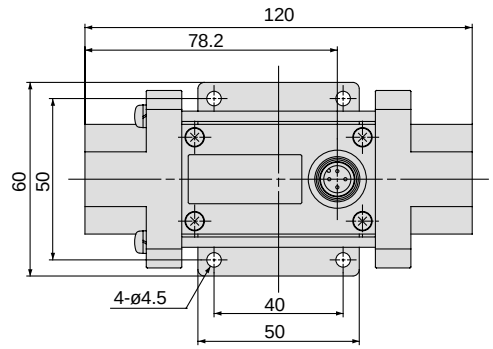
∗ Use this sensor by connecting it with the SMC remote type display unit series PFW3□□.
(1), (3), and (4) are connector pin numbers.
1, 2, and 3 are the series PFW3□□ terminal numbers.

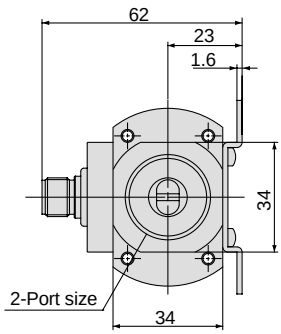
Connector pin numbers

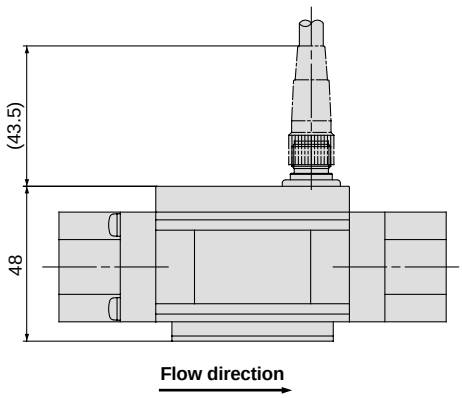


Pin no.	Pin description
1	DC (+)
2	N C
3	DC (–)
4	OUT

PFW540

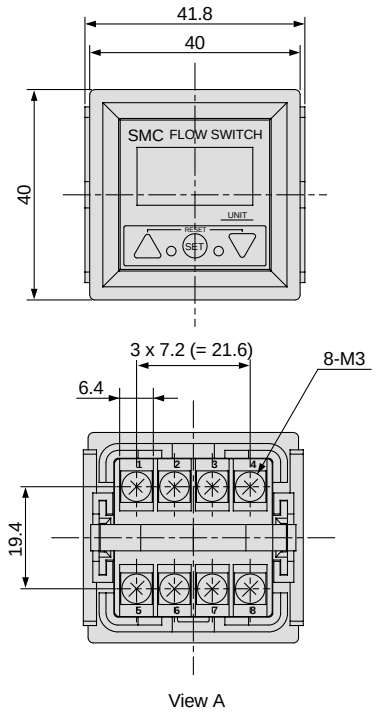




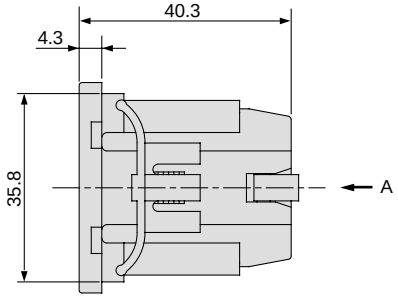


Dimensions/Remote Type Display Unit for Water

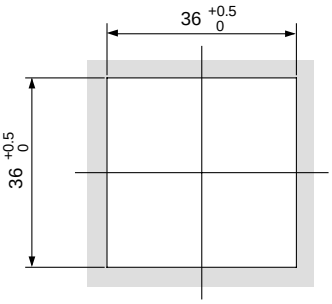
PFW3□□-A
Panel mount type



View A

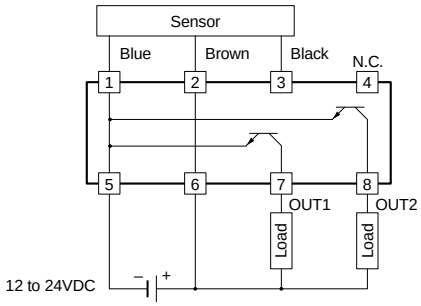


Panel fitting dimensions

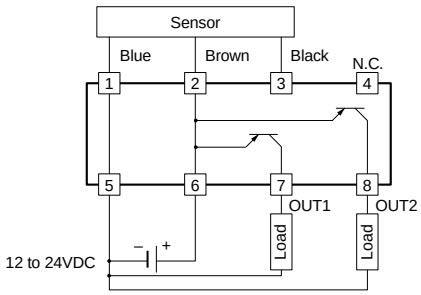


∗ The applicable panel thickness is 1 to 3.2mm.

Internal circuits and wiring

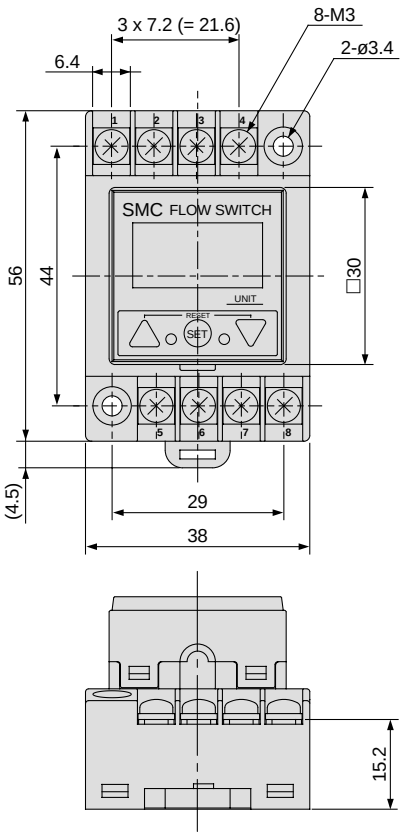


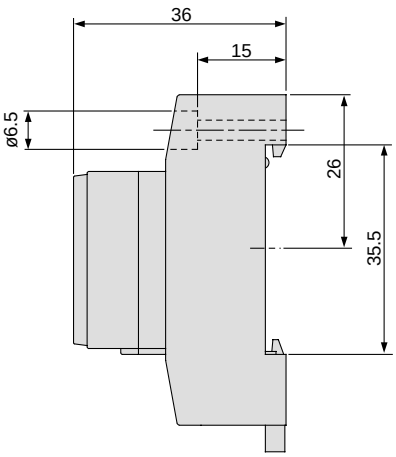
PFW3□0-□ (-M)



PFW3□1-□ (-M)

PFW3□□-B
DIN rail type





Series PFA/PFW
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 a label of **"Caution", "Warning" or "Danger"**. To ensure safety, be sure to observe these precautions.

⚠ Caution : Operator error could result in injury or equipment damage.

⚠ Warning : Operator error could result in serious injury or loss of life.

⚠ Danger : In extreme conditions, there is a possible result of serious injury or loss of life.

⚠ Warning

1. The compatibility of 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 after analysis and/or tests to meet your specific requirements.

2. Only trained personnel should operate machinery and equipment.

Equipment can be dangerous if an operator is unfamiliar with it. Assembly, handling or repair of systems should be performed by trained and experienced operators.

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 after confirmation of safe locked-out control positions.
2. When equipment is to be removed, first confirm that safety measures have been implemented.
3. Before machinery/equipment is restarted, confirm that safety measures have been implemented and proceed with caution.

4. Contact SMC if the product is to be used in any of the following conditions:

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, press applications, or safety equipment.
3. An application which has the possibility of having negative effects on people, property, or animals, requiring special safety analysis.

Series PFA/PFW
Specific Product Precautions 1

Be sure to read before handling.
Refer to page 27 for safety instructions.

Design and Selection

⚠Warning

1. Use with the specified voltage.

Use with voltage outside of the specifications can cause malfunction or switch damage, as well as electrocution and fire hazard, etc.

2. Never use a load which exceeds the maximum load capacity.

This can cause damage to switches.

3. Do not use loads which generate surge voltage.

The switch's output section is provided with a surge protection feature in its circuit, but repeated application can cause damage. When directly driving surge generating loads, such as relays and solenoid valves, etc., use a type of switch which has a built-in surge absorbing element.

4. Since the fluids which can be used differ depending on the product, be certain to confirm the specifications.

Since switches do not have explosion proof construction, do not use flammable gases or fluids. This may cause fire or explosion.

5. Take note of the switch's internal voltage drop.

When operated below the prescribed voltage, the load may not operate, even if the switch operates normally. Confirm the load's operating voltage and see that the following formula is satisfied.

Power supply voltage	−	Switch's internal voltage drop	>	Load operating voltage

[When used for air]

6. Be certain to observe specifications for the measured flow rate and operating pressure.

Operation at a flow rate exceeding the prescribed range can cause damage.
In addition, the switch will be damaged if operated above the maximum operating pressure.

[When used for water]

7. Be certain to observe specifications for the measured flow rate and operating pressure.

Operation at a flow rate exceeding the prescribed range can cause damage.
In addition, the switch will be damaged if operated above the maximum operating pressure. In particular, avoid application of pressure above the specifications caused by water hammer.

<Pressure Reduction Measure Examples>

a) Use a water hammer relief valve, etc., to slow the valve's closing speed.

b) Absorb impact pressure by using an accumulator, or elastic piping material such as rubber hose.

c) Make the length of piping as short as possible.

8. Design so that the flow of liquid always fills the detection passage.

Especially in the case of vertical mounting, set up so that flow moves from the bottom to the top.

9. Operate at a flow rate within the flow rate measurement range.

If operated outside of the flow rate measurement range, the Karman vortex will not be generated and normal measurement will become impossible.

Design and Selection

⚠Caution

1. The switch's data will not be cleared even if the power is turned off.

Since the input data is held in an EEPROM, it will not be cleared even if the power is turned off. (Rewriting is possible up to 10^5 times, and the data holding time is 20 years.)

Mounting

⚠Warning

1. Mount switches using the proper tightening torque.

The switch may be damaged if it is tightened above the tightening torque range. Also, if it is tightened below the tightening torque range, the connecting thread section may become loose.

Nominal size of threads	Proper tightening torque N·m
Rc 1/8	7 to 9
Rc 1/4	12 to 14
Rc 3/8	22 to 24
Rc 1/2	28 to 30
Rc 3/4	28 to 30
Rc 1	36 to 38
Rc 1 1/2	48 to 50
Rc 2	48 to 50

2. When connecting piping to the switch, do this by applying a wrench to the metal part which is integrated with the piping section.

Never apply a wrench to the portion which is made of resin, as this can cause damage to the switch.

3. Pay attention to the fluid flow direction.

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

4. Before connecting piping to the switch, remove dirt, etc., from inside the piping by blowing it out with air.

5. Do not drop or bump.

Do not drop, bump or apply excessive impacts (490m/s²) while handling. Although the body of the switch may not be damaged, the inside of the switch could be damaged and cause a malfunction.

6. Hold the product by the body when handling.

Since the tensile strength of the power cord is 49N, pulling it with a force greater than this can cause damage. Hold by the body when handling.

7. Use after confirming that equipment is operating properly.

After a new installation, system repair or renovation, connect the fluid and power, etc., and then perform appropriate function and leak tests to confirm that mounting has been done correctly.

8. Avoid mounting so that the bracket is on top.

The switch can be mounted vertically, horizontally or in any other orientation, but avoid mounting with the bracket on top.

[When used for air]

9. Never mount a switch in a place that will be used as a scaffold during piping work.

Damage may occur if subjected to an excessive load.

Series PFA/PFW
Specific Product Precautions 2

Be sure to read before handling.
Refer to page 27 for safety instructions.

Mounting

⚠Warning

10. Provide a length of straight pipe before and after a switch that is at least 8 times the pipe diameter.

In cases where there is an abrupt reduction in the size of piping or restriction due to a valve, etc., on the upstream side, the pressure distribution in the piping changes, and accurate measurement becomes impossible. Therefore, measures such as these should be implemented on the downstream side of the switch.

[When used for water]

11. Never mount a switch in a place that will be used as a scaffold during piping work.

Damage may occur if subjected to an excessive load. Especially when the switch supports piping, do not apply a load of 15N·m or more to the metal part of the switch.

12. Provide a length of straight pipe before and after a switch that is at least 8 times the pipe diameter.

In cases where there is an abrupt reduction in the size of piping or restriction due to a valve, etc., on the upstream side, the flow velocity distribution in the piping is disturbed, and accurate measurement becomes impossible. Therefore, measures such as these should be implemented on the downstream side of the switch.
Furthermore, when used with the downstream side open, use caution as there is a danger that cavitation will easily occur.

Wiring

⚠Warning

1. Confirm wire colors and terminal numbers when wiring is performed.

Since incorrect wiring can lead to damage or failure of the switch as well as malfunction, perform wiring after confirming wiring colors and terminal numbers with the instruction manual.

2. Avoid repeatedly bending or stretching lead wires.

Broken lead wires will result from repeatedly applying bending stress or stretching force to the lead wires.

3. Confirm proper insulation of wiring.

Be certain 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 with power lines or high voltage lines.

Wire separately from power lines or high voltage lines, avoiding parallel wiring or wiring in the same conduit with these lines. Control circuits containing switches may malfunction due to noise from these other lines.

5. Do not allow short circuiting of loads.

If a load is short circuited, an overcurrent error will be displayed by the switch. However, wiring should be performed carefully, as protection cannot be afforded against all miswiring errors (power supply polarity, etc.).

Operating Environment

⚠Warning

1. Never use in an atmosphere of explosive gases.

The construction of switches is not intended to prevent explosion. Never use in an atmosphere with an explosive gas since this may cause a serious explosion.

2. Mount switches in locations without vibration (98m/s^2 or less) or impact (490m/s^2 or less).

3. The flow switches are not lightning surge proof.

Although flow switches have the CE marking, they are not lightning surge proof. Protective measures against lightning surges should be made on the equipment.

4. Avoid use in locations where water or oil, etc., is splashed or sprayed.

Switches are dust proof and splash proof, but avoid use in locations where a large amount of water or oil is splashed or sprayed. Especially, the remote type display unit is an open type, and use in locations with water or oil splashes must be avoided.

[When used for air]

5. Observe the fluid and ambient temperature ranges.

The fluid and ambient temperatures are 0 to 50°C. Since moisture in the fluid can freeze when used at 5°C or below, causing damage and malfunction of switches, consider measures to prevent freezing. The installation of an air dryer is recommended to remove drainage and moisture from circuits.
Furthermore, even though the ambient temperature range remains within specifications, do not operate in locations where there are abrupt temperature changes.

[When used for water]

6. Observe the fluid and ambient temperature ranges.

The fluid and ambient temperatures are 0 to 50°C. Since the fluid can freeze when used at 5°C or below, causing damage and malfunction of switches, consider measures to prevent freezing.
Furthermore, even though the ambient temperature range remains within specifications, do not operate in locations where there are abrupt temperature changes.

Maintenance

⚠Warning

1. Perform inspections regularly to confirm normal operation.

It may otherwise not be possible to assure safety due to unexpected malfunction or misoperation, etc.

2. Use caution when using in an interlock circuit.

When used in an interlock circuit, provide multiple interlock circuits as a precaution against failure, and also perform regular inspections to confirm normal operation.

3. Do not disassemble or modify the unit.

Series PFA/PFW
Specific Product Precautions 3

Be sure to read before handling.
Refer to page 27 for safety instructions.

Measured Fluids

⚠Warning

1. Check regulators and flow adjustment valves before allowing the flow of fluid.

If a pressure or flow rate above the rating is applied to a switch, the sensor unit may be damaged.

[When used for air]

2. Measured fluids for the switch are nitrogen and air. However, only dry air can be measured with the high flow rate type.

Note that accuracy cannot be guaranteed for other fluids.

3. Never use flammable fluids.

The flow velocity sensor is heated to approximately 150°C.

4. In cases where there is a danger of drainage or foreign matter being mixed in the fluid, install a filter or mist separator on the upstream side.

Otherwise, the rectifying device built into the switch will become clogged and accurate measurement will not be possible.

[When used for water]

5. The measured fluid for the switch is water.

Note that accuracy cannot be guaranteed for other fluids.

6. Never use flammable fluids.

7. In cases where there is a possibility of foreign matter being mixed in the fluid, install a filter on the upstream side.

If foreign matter adheres to the switch's vortex generator or vortex detector, accurate measurement will become impossible.

Other

⚠Warning

1. Since switch output remains OFF while a message is displayed after power is turned ON, start measurement after a value is displayed.

2. Perform settings after stopping control systems.

When the switch's initial setting and flow rate setting are performed, output maintains the condition prior to the settings. In the case of 100, 200, and 500/m type switches for air, output turns OFF when the switch's initial setting and flow rate setting are performed.

3. Do not apply excessive rotational force to the display unit.

The integrated type display unit is able to rotate 360°. Rotation is controlled by a stopper, however, take note that the stopper may be damaged if the display is turned with excessive force.

[When used for air]

4. Be certain to turn on the power when the flow rate is at zero.

Allow an interval of 10 minutes after turning on the power, as there may be some changes in the display.

5. Flow rate units

The switch performs measurement at mass flow rates at which it will not be effected by temperature and pressure. The units used are /min, where this display substitutes the volumetric flow rate at 0°C and 101kPa for the mass flow rate. In case of the high flow rate type for air, the display can be switched to show the volumetric flow rate at 20°C, 101.3kPa, and 65% RH (ANR).

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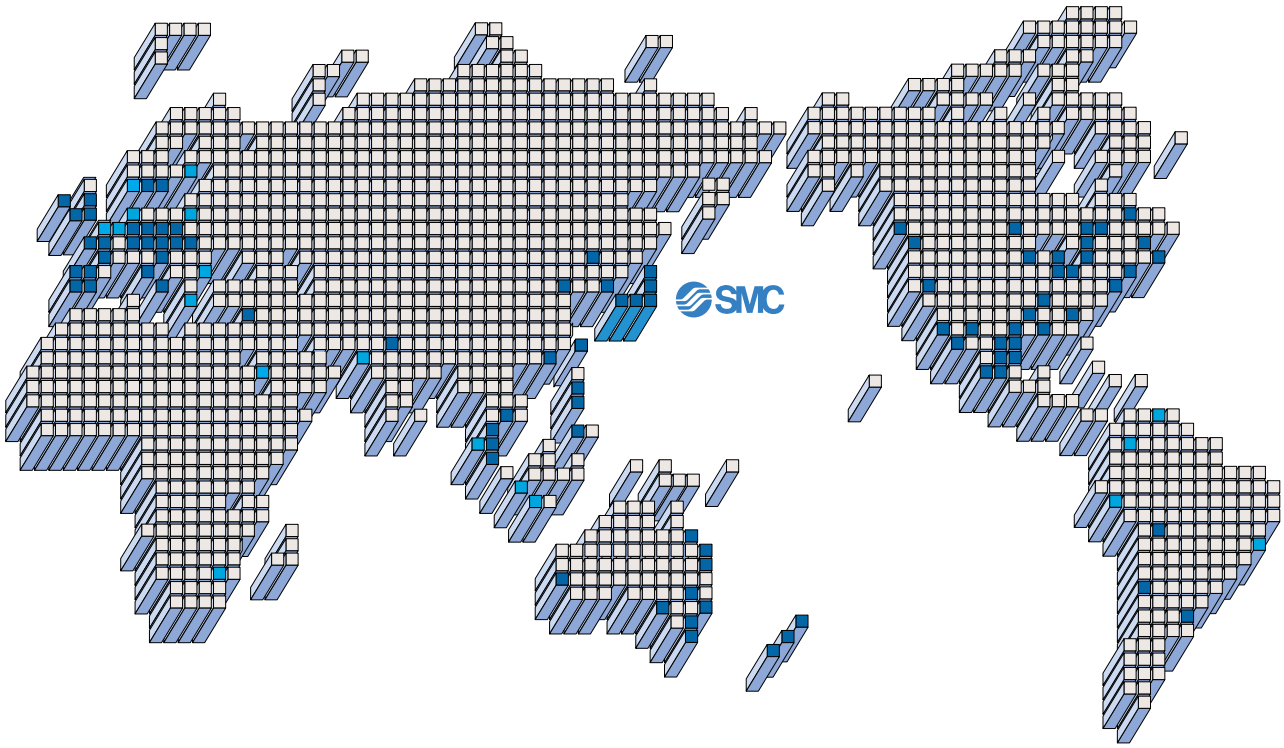

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