No.PF##-OMJ0006

Operation Manual

Digital Flow Switch

PRODUCT NAME

PFM7## Series

MODEL / Series

SMC Corporation

Table of Contents

Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage.
These instructions indicate the level of potential hazard with the labels of "Caution", "Warning" or "Danger".
They are all important notes for safety and must be followed in addition to International standards (ISO/IEC), Japan Industrial Standards (JIS)[*1)] and other safety regulations[*2)].

*1) ISO 4414: Pneumatic fluid power - - General rules relating to systems.
ISO 4413: Hydraulic fluid power - - General rules relating to systems.
IEC 60204-1: Safety of machinery - -Electrical equipment of machines. (Part 1: General requirements)
ISO 10218-1992: Manipulating industrial robots -Safety.
JIS B 8370: General rules for pneumatic equipment.
JIS B 8361: General rules for hydraulic equipment.
JIS B 9960-1: Safety of machinery - Electrical equipment of machines. (Part 1: General requirements)
JIS B 8433-1993: Manipulating industrial robots - Safety.
etc.
*2) Labor Safety and Sanitation Law, etc.

⚠ Caution : CAUTION indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

⚠ Warning : WARNING indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.

⚠ Danger : DANGER indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

⚠ Warning

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

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

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

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

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

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

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

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

⚠ Caution

1. The product is provided for use in manufacturing industries.
The product herein described is basically provided for peaceful use in manufacturing industries.
If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary.
If anything is unclear, contact your nearest sales branch.

Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following "Limited warranty and Disclaimer" and "Compliance Requirements".
Read and accept them before using the product.

Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered.*3)
   Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.
2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.
   This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.
3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.

*3) Vacuum pads are excluded from this 1 year warranty.
A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.
Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

Compliance Requirements

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

Operator

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

■Precautions

⚠Warning

■Do not disassemble, modify (including changing the printed circuit board) or repair.
An injury or failure can result.

■Do not operate the product outside of the specifications.
Do not use for flammable or harmful fluids.
Fire, malfunction, or damage to the product can result.
Verify the specifications before use.

■Do not operate in an atmosphere containing flammable or explosive gases.
Do not operate in an atmosphere containing flammable, explosive or corrosive gas.
Fire or an explosion can result.
A fire, explosion or corrosion can result.
This product is not designed to be explosion proof.

■Do not use the product for flammable fluid.
A fire or explosion can result.
Only dry air, N2, CO2 and Ar are applicable.

■Do not use the product in a place where static electricity is a problem.
Otherwise it can cause failure or malfunction of the system.

■If using the product in an interlocking circuit:
- •Provide a double interlocking system, for example a mechanical system.
- •Check the product regularly for proper operation

Otherwise malfunction can result, causing an accident.

■The following instructions must be followed during maintenance :
- •Turn off the power supply
- •Stop the air supply, exhaust the residual pressure and verify that the air is released before performing maintenance work.

Otherwise an injury can result.

⚠Caution

■Do not touch the terminals and connectors while the power is on.
Otherwise electric shock, malfunction or damage to the product can result.

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

■NOTE

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

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

∗Product specifications

- The direct current power supply to combine should be UL approved as follows.
  Circuit (class 2) which is of maximum 30Vrms (42.4 V peak), with UL 1310 class 2 power supply unit or UL 1585 class 2 transformer.
  The Flow switch is a UL approved product only if it has a UL mark on the body.
- Use the specified voltage.
  Otherwise failure or malfunction can result.
  Insufficient supply voltage may not drive a load due to a voltage drop inside the Flow sensor.
  Verify the operating voltage of the load before use.
- Do not exceed the specified maximum allowable load.
  Otherwise it can cause damage or shorten the lifetime of the product.
- Design the product to prevent reverse current when the circuit is opened or the product is forced to operate for operational check.
  Reverse current can cause malfunction or damage to the product.
- Input data to the product is not deleted, even if the power supply is cut off.
  (Writing time: 1000000 times, Data duration: 20 years after power off.)
- Applicable operating fluid depends on product.
  Check the details of the specifications before using.
- Confirm the pressure loss at the sensor according to the flow rate characteristics (pressure loss) graph before designing piping.
  Confirm detection condition of sensor electrified potential.
- For the details of compressed air quality, refer to ISO 8573-1, 1.1.2 to 1.6.2.
- Use the specified measurement flow rate and operating pressure.
  Otherwise it can cause damage to the product or inability to measure correctly.
- Reserve a space for maintenance.
  Allow sufficient space for maintenance when designing the system.

●Product handling

∗Installation

•Tighten to the specified tightening torque.

If the tightening torque is exceeded the mounting screws and brackets may be broken.

If the tightening torque is insufficient, the product can be displaced and loosen the mounting screws.

(Refer to "Mounting and Installation" on page 15)

•Do not apply excessive stress to the product when it is mounted with a panel mount.

Otherwise damage to the product and disconnection from the panel mount can result.

•Be sure to ground terminal FG when using a commercially available switch-mode power supply.

•Do not drop, hit or apply excessive shock (over 490 m/s^2) to the product.

Otherwise damage to the internal parts can result, causing malfunction.

•Do not pull the lead wire forcefully, not lift the product by pulling the lead wire. (Tensile force 49 N or less)

Hold the body when handling to avoid the damage of the product which lead to cause the failure and malfunction.

•For piping of the product, hold the piping with a spanner on the metal part of the piping (Piping attachment).

Holding other part with spanner leads to damage the product.

•Eliminate any dust left in the piping by air blow before connecting the piping to the product.

Otherwise it can cause damage or malfunction.

•Refer to the flow direction of the fluid indicated on the model number plate for installation and piping.

Remaining air can cause inability to measure accurately.

•Do not mount the body with the bottom facing upwards.

Remaining air can cause inability to measure accurately.

•Do not insert metal wires or other foreign matter into the flow path.

It can damage the sensor causing failure or malfunction.

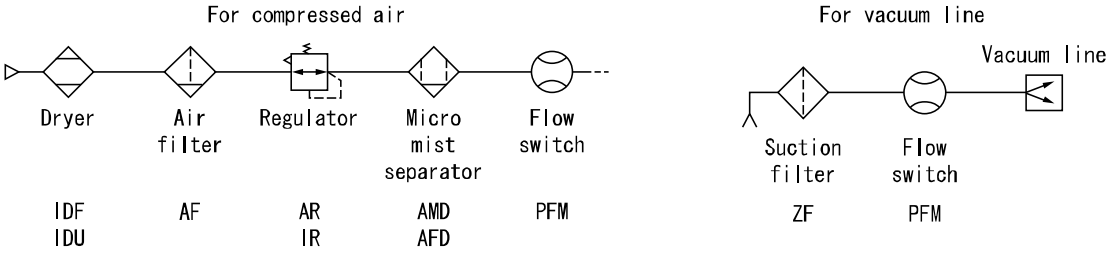
•Never mount a product in a location that will be used as a foothold.

The product may be damaged if excessive force is applied by stepping or climbing onto it

•If the entering of foreign material to the fluid is possible, install and pipe the filter or the mist separator to the inlet to avoid failure and malfunction.

See the figure below for recommended pneumatic circuit.

Recommended pneumatic circuit



∗Wiring

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

∗Environment

- Do not use the product in area that is exposed to corrosive gases, chemicals, sea water, water or steam.
  Otherwise failure or malfunction can result.
- Do not use in a place where the product could be splashed by oil or chemicals.
  If the product is to be used in an environment containing oils or chemicals such as coolant or cleaning solvent, even for a short time, it may be adversely affected (damage, malfunction, or hardening of the lead wires)
- Do not use in an area where surges are generated.
  If there is equipment which generates a large amount of surge (solenoid type lifter, high frequency induction furnace, motor, etc.) close to the product, this may cause deterioration or breakage of the internal circuit of the product.
  Avoid source
- Do not use a load which generates surge voltage.
  When a surge-generating load such as a relay or solenoid is driven directly, use a product with a built-in surge absorbing element.
- The product is CE marked, but not immune to lightning strikes. Take measures against lightning strikes in the system.
- Mount the product in a place that is not exposed to vibration or impact.
  Otherwise failure or malfunction can result.
- Do not use the product in the presence of a magnetic field.
  This may lead to the malfunction of the product.
- Prevent foreign matter such as remnant of wires from entering the product.
  Take proper measures for the remnant not to enter the product in order to prevent failure or malfunction.
- Do not use the product in an environment that is exposed to temperature cycle.
  Heat cycles other than ordinary changes in temperature can adversely affect the inside of the product.
- Do not expose the product to direct sunlight.
  If using in a location directly exposed to sunlight, shade the product from the sunlight.
  Otherwise failure or malfunction can result.
- Keep within the specified fluid and ambient temperatures range.
  The fluid temperature range and ambient temperature range is 0 to 50 ^{o}C.
  Operation under low temperature leads to cause damage or operation failure due to frozen moist in the fluid or air.
  Protection against freezing is necessary.
  Air dryer is recommended for elimination of drain and water.
  Avoid sudden temperature change even within specified temperature.
- Do not operate close to a heat source, or in a location exposed to radiant heat.
  Otherwise malfunction can result.

∗Adjustment and Operation

- Turn the power on after connecting a load.
  Otherwise it can cause excess current causing instantaneous breakage of the product.
- Do not short-circuit the load.
  Although error is displayed when the product load is short circuit generated excess current lead to cause the damage of the product.
- Do not press the setting buttons with a sharp pointed object.
  It may damage the setting buttons.
- Supply the power when there is no flow.
  There will be a drift on the display and the analog output of approximate +/- 2 to 3% immediately after the power supply is turned on.
- The product is compulsory turned off for 3 seconds after power supplied.
  For 3 seconds after supplying power, the measurement output is turned off.
- Perform settings suitable for the operating conditions.
  Incorrect setting can cause operation failure.
  For details of each setting, refer to page 21 to 45 of this manual.
- During the initial setting and flow rate setting, the product will switch the measurement output with the condition before setting.
  Confirm the output has no adverse effect on machinery and equipment before setting.
  Stop the control system before setting if necessary.
- Do not touch the LCD during operation.
  The display can vary due to static electricity.

∗Maintenance

- Turn off the power supply and stop the flow before performing maintenance.
  There is a risk of unexpected malfunction.
- Perform regular maintenance and inspections.
  There is a risk of unexpected malfunction.
- Perform drainage regularly.
  If condensate enters the secondary side, it can cause operating failure of pneumatic equipment.
- Do not use solvents such as benzene, thinner etc. to clean the product.
  They could damage the surface of the body and erase the markings on the body.
  Use a soft cloth to remove stains. For heavy stains, use a cloth soaked with diluted neutral detergent and fully squeezed, then wipe up the stains again with a dry cloth.

Model Indication and how to order

PFM □□□ - □□ - □ - □□□ - □□ - □

Made to order (Refer to page 12)

Option2

Option1 (Refer to page 11)

Proofreading certificate

Model	Contente
Nil	Without proofreading certificate
A	With proofreading certificate*2

*2: Written in Japanese and English together.
Other language is available as special request.

Operation manual

Model	Contente
Nil	With operation manual (Booklet : in Japanese and English)
N	Without operation manual

Unit specification

Model	Contente
Nil	Unit selection function*3
M	SI unit only*4

*3: Since the unit for japan is fixed to SI due to new measurement law, this option is for overseas.
*4: Fixed unit Real-time flow: L/min Accumulated flow: L

Output specification

Model	Contente
A	NPN2 output
B	PNP2 output
C	NPN (1 output) + Analog (1 to 5 V)
D	NPN (1 output) + Analog (4 to 20 mA)
E	PNP (1 output) + Analog (1 to 5 V)
F	PNP (1 output) + Analog (4 to 20 mA)
G	NPN (1 output) + External input*5
H	PNP (1 output) + External input*5

*5: External reset auto shift and auto shift zero are selectable.

Piping inlet

Model	Contente
Nil	Straight direction
L	Back

*6: Combination of piping direction of IN side and OUT side are specified to order.

Thread type (Connect port)

Model	Contente	Flow range			
		10	25	50	11
01	Rc1/8	●	●	●	-
02	Rc1/4	-	-	-	●
N01	NPT1/8	●	●	●	-
N02	NPT1/4	-	-	-	●
F01	G1/8	●	●	●	-
F02	G1/4	-	-	-	●
C4	ϕ4 (5/32") One-touch fitting	●	-	-	-
C6	ϕ6 One-touch fitting	●	●	●	●
C8	ϕ8 (5/16") One-touch fitting	-	●	●	●
N7	ϕ1/4 One-touch fitting	-	●	●	●

Type

Model	Contente
7	Display integated

Rated flow range (Flow range)

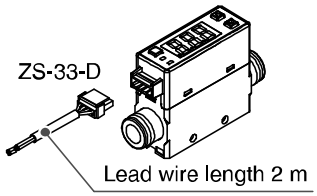
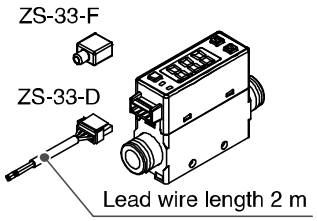
Model	Contente
10	0.2 to 10 (5) L/min
25	0.5 to 25 (12.5) L/min
50	1 to 50 (25) L/min
11	2 to 100 (50) L/min

*1: Value in ( ) is the flow rate When CO_2 is used.

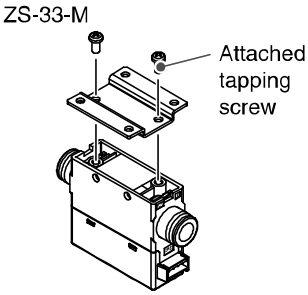
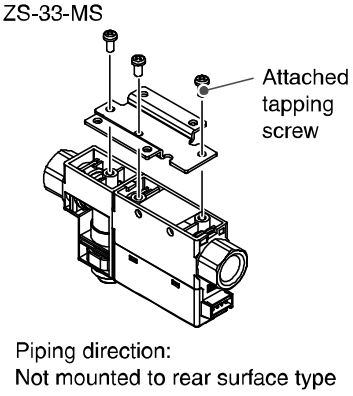
Flow adjustment valve

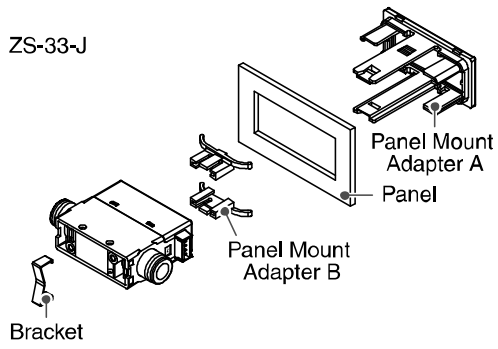
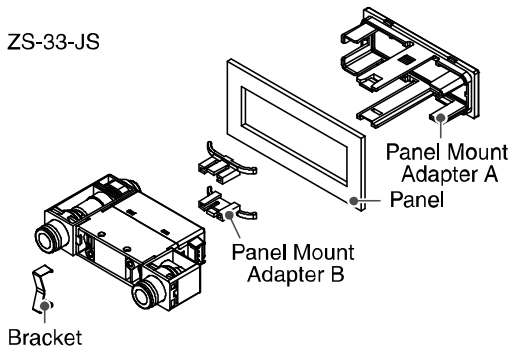
Model	Contente
Nil	No valve
S	With valve

Option1

Nil	W	Z
Lead wire connector (2 m) 	Lead wire connector (2 m) + Connecter cover (Silicone rubber) 	Without lead wire connector

Option2

Nil	R	S
None	Bracket (Wthout flow adjustment valve) 	Bracket (Wth flow adjustment valve) 

T	V
Panel Mount Adapter (Wthout flow adjustment valve) 	Panel Mount Adapter (Wth flow adjustment valve) 

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

Made to Order

Symbol	Content	Corresponding page
X693	Combination change of piping direction of IN and OUT side … IN side: Straight/OUT side: Rear surface	See page 67
X694	Combination change of piping direction of IN and OUT side … IN side: Rear surface/OUT side: Straight	See page 67
X731	For gas mixed with Argon (Ar), and carbon dioxide (CO_2) … Mixture ratio Ar : CO_2 = 92 : 8, 90 : 10, 80 : 20, 70 : 30, 60 : 40 are available	See page 69

Part number for options

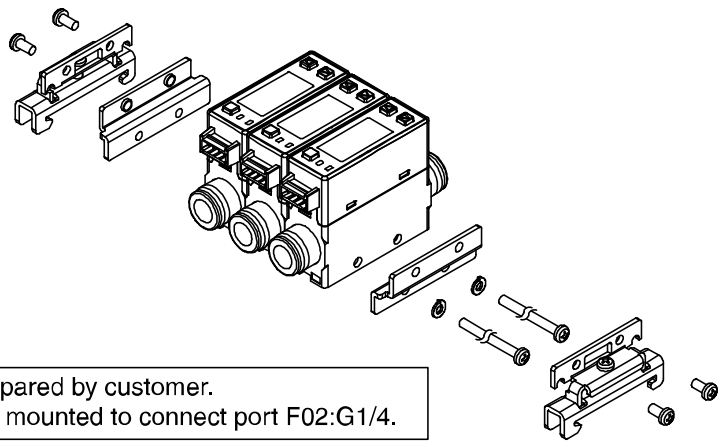
Model No.	Option
ZS-33-D	Lead wire connector
ZS-33-F	Connecter cover (Silicone rubber)
ZS-33-J	Panel Mount Adapter (Without flow adjustment valve)
ZS-33-JS	Panel Mount Adapter (With flow adjustment valve)
ZS-33-M	Bracket (Without flow adjustment valve)
ZS-33-MS	Bracket (With flow adjustment valve)
ZS-33-R□	DIN rail mount parts *: See drawing below

DIN rail mount bracket (Ordered separately)

ZS-33-R□

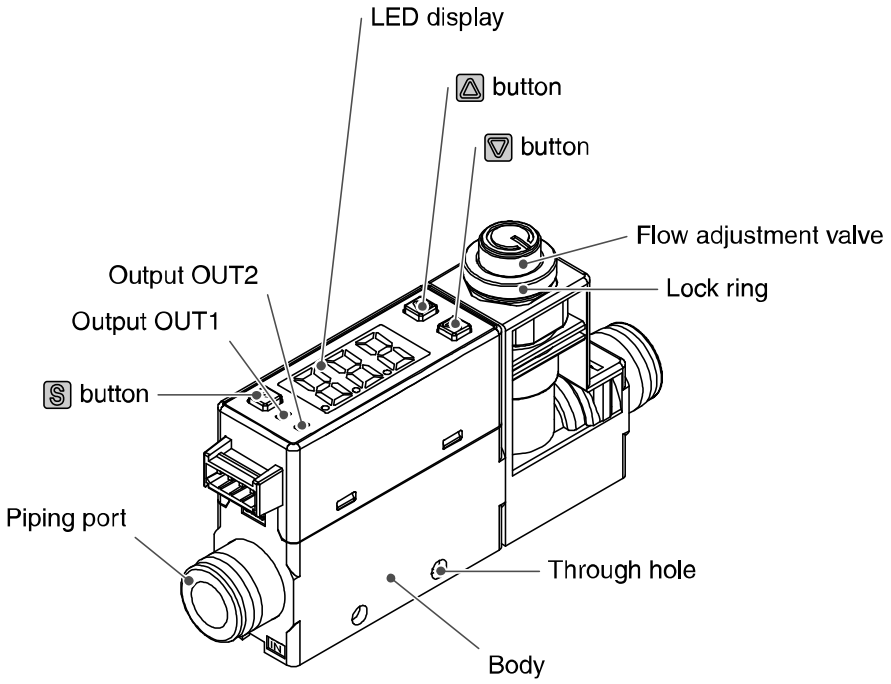
Stn. no

1	1 stn
2	2 stn
3	3 stn
4	4 stn
5	5 stn



・DIN rail is prepared by customer.
・DIN rail is not mounted to connect port F02:G1/4.

Names and Functions of Product



Description	Function
Output (OUT1) display (Green)	Light is on when output OUT1 is on. Flashes when overcurrent error occurs.
Output (OUT2) display (Red)	Light is on when output OUT2 is on. Flashes when overcurrent error occurs.
LED display	Displays flow value, set mode condition, and error code. Indication color is selectable from Red and Green depending on output (OUT1) condition.
button	Selects the mode and increases the mode ON/OFF set value. Press this button to change to the peak display mode.
button	Selects the mode and decreases the mode or ON/OFF set value. Press this button to change to the bottom display mode.
button	Press this button to change to each mode and to select a set value.
Reset	Press the and bottons simultaneously to start reset function. This is to clear the condition when an abnormality occurs.
Body	Product itself.
Flow adjustment valve	Orifice mechanism to abjust the flow.
Piping port	Connection port for piping.
Lock ring	Used to lock the flow adjustment valve.
Through hole	Used to mount the product on a DIN rail or a panel directly.

■Definition and terminology

	Terminology	Definition
A	Accumulated flow	The total amount of fluid that has passed through the device. If an instantaneous flow of 10 L/min lasts for 5 minutes, the accumulated flow will be 5×10=50 L.
	Accumulated flow external reset	A function to reset the accumulated flow to zero by using an external signal.
	Accumulated pulse output	A type of output where a pulse is generated every time a predefined accumulated flow passes. It is possible to calculate the total accumulated flow by counting the pulses.
	Analog output	A type of variable output that has a value proportional to the measured quantity. When the analog output is in the range of 1 to 5 V or 4 to 20 mA, it will vary continuously, following the change of flow.
	Auto-preset	This functio calculates and sets a rough set value automatically based on the on-going operation.
	Auto-shift	This function outputs the amount of variation relative to the instantaneous flow rate when the signal is input
	Auto-shift zero	This function outputs the amount of variation relative to the instantaneous flow rate when the signal is input, and resets the displayed value to zero when the signal is input.
C	Chattering	The problem of the switch output turning ON and OFF repeatedly around the set value at high frequency due to the effect of pulsation.
D	Display range	The range which can be displayed by the product with a digital display.
F	F.S. (Full span, Full scale)	It reads "full span" or "full scale", and indicates varied analog output range at rated value. For example, when analog output is 1 to 5 V, F.S. = 5[V] - 1[V] = 4[V], (ref. 1%F.S. = 4[V]x1% = 0.04[V])
H	Holding function of accumulated flow	This function memorizes the accumulated flow at regular intervals using the internal memory device. When the power supply is turned on, the memorized flow value will be read out, and accumulation will be started with that value. The time interval for memorizing can be selected from 2 or 5 minutes.
	Hysteresis	The difference between ON and OFF points used to prevent chattering. Hysteresis can be effective in avoiding the effects of pulsation.
	Hysteresis mode	Mode where the switch output will turn ON when the flow is greater than the set value, and will turn off when the flow falls below (set value – hysteresis value).
I	Instantaneous flow rate	The flow passing per unit of time. If it is 10 L/min, there is a flow of 10 L passing through the device in 1 minute.
	Internal voltage drop	The voltage that appears in the output when the switch output is on. It depends on the present load current and ideally should be "0".

	Terminology	Definition
K	Key-lock function	This function prevents the set value from being changed by mishandling.
M	Min. setting unit	The fineness of the set value and display value. If the minimum setting unit is 1L/min, the flow can be displayed by 1L/min at a time, i.e. 10, 11, 12.
O	Operating fluid temp	Flow temperature range which can be applied to the product.
	Operating pressure range	Pressure range in which product is operable.
	Operating temp. range	Ambient temperature range in which product is operable.
P	Power saving mode	The condition in which the numerical display turns off and current consumption is reduced.
	Pressure characteristic	Varied amount of analog output or value on display when the line pressure is changed.
	Proof pressure	Burst pressure at which the product is electrically or mechanically damaged.
R	Rated flow range	The flow range within which the product will meet all published specifications.
	Repeatability	Analog output repeatability when flow increases/decrease.
	Response time (Response 90%)	Time for analog output reaches 90% of target voltage from when target flow is applied.
	Ripple	Indicates pulsation.
S	Setting range	The range of settable ON and OFF points (thresholds) of the product with switch output.
	Storage temp. range	Temperature range in which product can be stored without being damaged while power supply and flow not applied.
	Storage humidity. range	Humidity range in which product can be stored without being damaged while power supply and flow not applied.
	Switch output	Output type that has only 2 conditions, ON or OFF. When in the ON condition an indicator light will show, and any connected load will be powered. When in the OFF condition, there will be no indicator light and no power supplied to the load.
T	Temperature characteristic	Analog output or value on display change when ambient temp. is changed.
U	Unit conversion function	A function to select display units other than the international unit (SI unit) specified in the new Japanese measurement law. Flow can only be displayed by SI units in Japan. The product is not equipped with this function.
W	Window comparator mode	An operating mode in which the switch output is turned on and off depending on whether the flow is inside or outside the range of two set values.

Mounting and Installation

■Installation

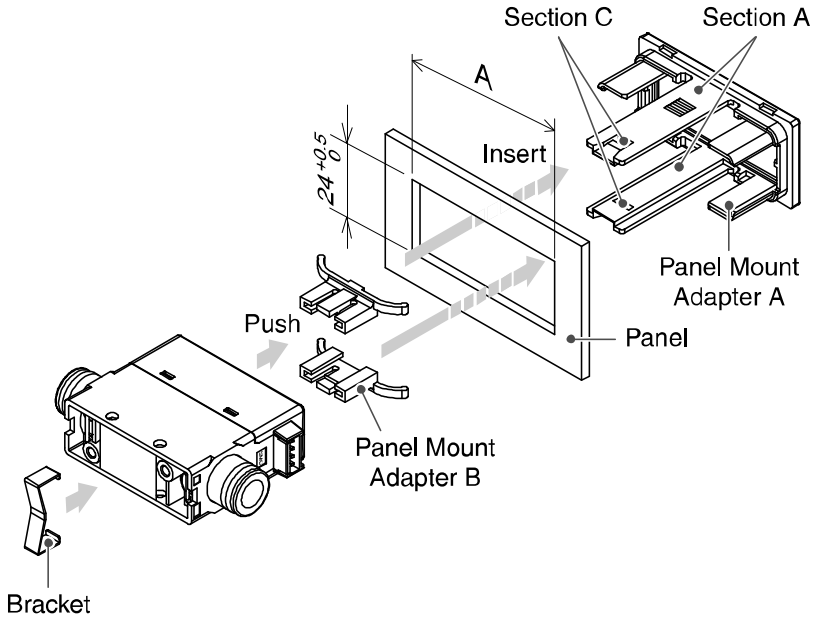
How to mount

Panel mounting

•Insert Panel Mount Adapter B (supplied as an accessory) into Section A of Panel Mount Adapter A. Push Panel Mount Adapter B from behind till the display is fixed onto the panel. The pin of Panel Mount Adapter B engages the notched part of Panel Adapter C to fix the display.

•The switch can be mounted on a panel with a thickness of 1 to 3.2 mm.

•See the illustration below for panel cut dimensions.

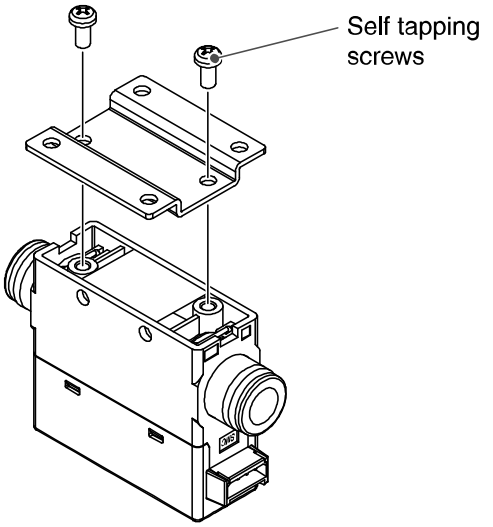


	Dimension A	Adapter
Without flow adjustment valve	54 $^{+0.5}_{0}$	ZS-33-J
With flow adjustment valve	74 $^{+0.5}_{0}$	ZS-33-JS

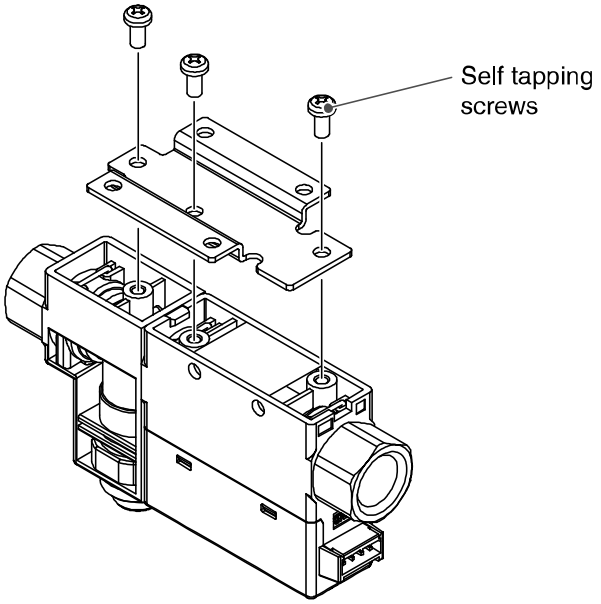
Bracket mounting

•Fasten the bracket mounting screws to a torque of 0.5±0.05 Nm.

Without flow adjustment valve
(using ZS-33-M)

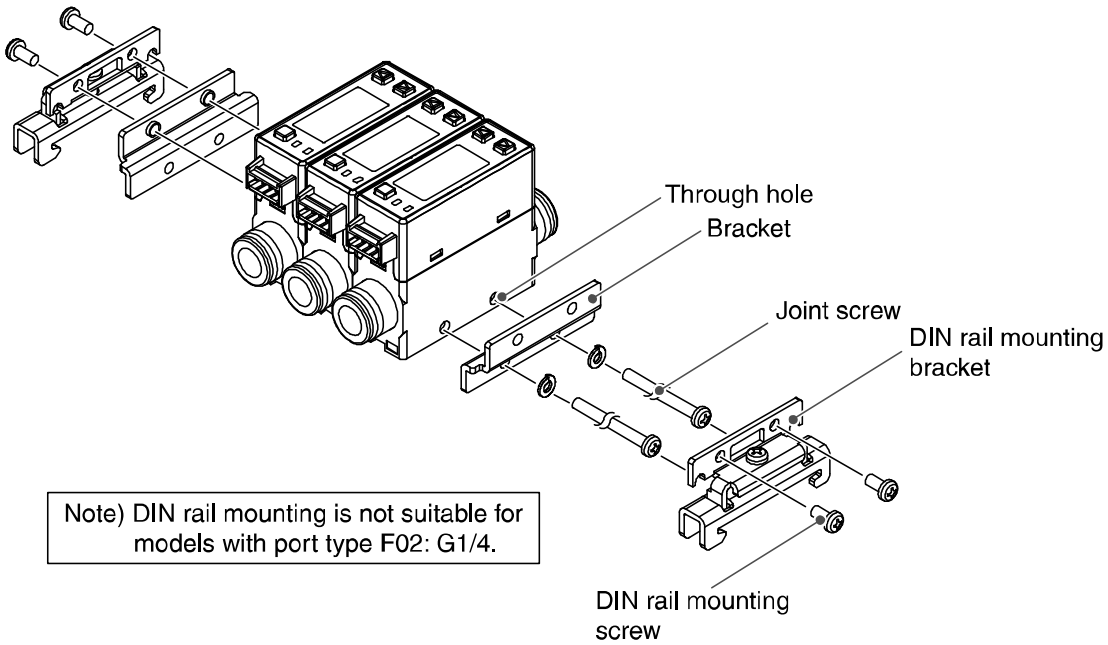


With flow adjustment valve
(using ZS-33-MS)



DIN rail mounting

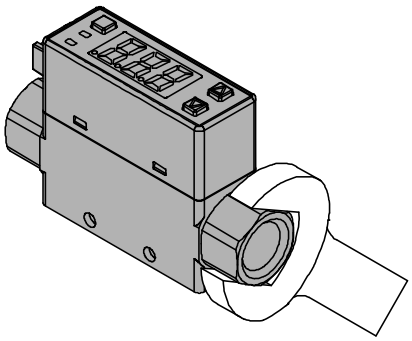
•The tightening torque for DIN rail mounting screws and joint screws should be 0.4±0.05 Nm.



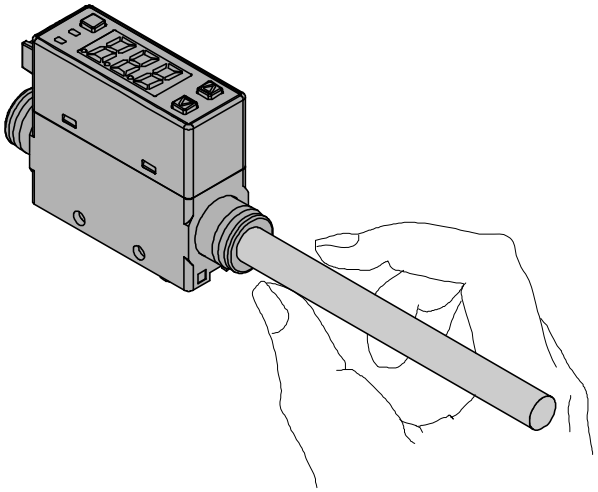
Note) DIN rail mounting is not suitable for models with port type F02: G1/4.

■Piping

•Ensure tightening torque is correct when installing piping.
•Refer to the following table for the appropriate torque values.
•Hold the metal part with the spanner when piping.



Nominal size of screws	Appropriate torque Nm
Rc1/8	7 to 9
Rc1/4	12 to 14



•For one-touch fitting, insert the tube to the end so that it cannot be pulled out.
•Insertion with excessive force can cause damage.
•Ensure there is no leakage after piping.
•Use this product within the specified operating pressure range and operating temperature range.
•Withstand pressure are 1.0 MPa.

■Wiring

Connection

•Make connection after turning the power off.

•Use a separate route when installing wire. Malfunction stemming from noise may occur if wire is installed in the same route as that of power or high-voltage cable.

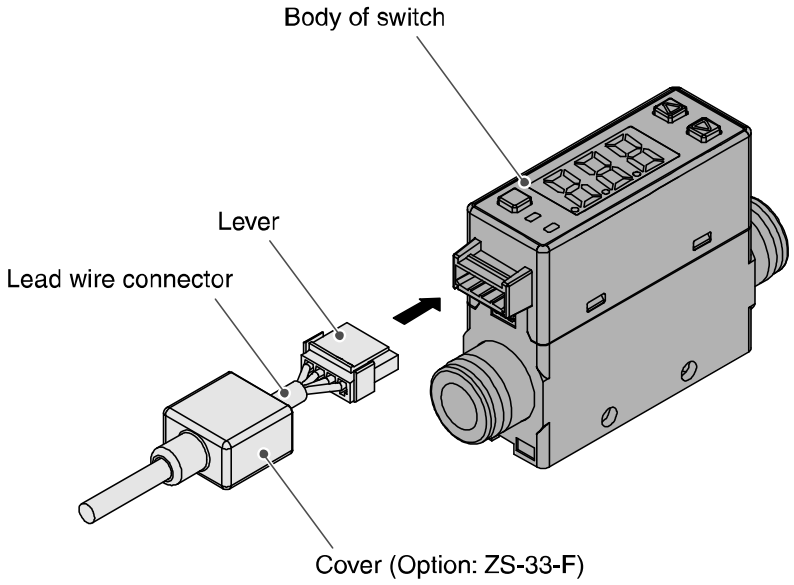
•Be sure to ground terminal FG when using a switching regulator obtained on the market. If analogue output is performed connecting to a switching regulator obtained on the market, switching noise will be superimposed and product specification can no longer be met. This can be prevented by inserting a noise filter, such as a line noise filter and a ferrite element, between the switching regulator and the pressure switch, or by using a seriespower supply instead of a switching regulator.

Connector

Connecting/Disconnecting

•When connecting the connector, insert it straight onto the pin holding the lever and connector body between fingers and lock the connector by pushing the lever claw into the square groove body between fingers and lock the connector by pushing the lever claw into the square groove in the body of the switch.

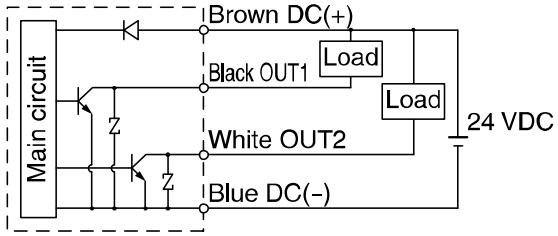
•When disconnecting the connector, push down the lever by thumb to disengage the lever claw from the square groove. Then pull the connector straight out.



Internal circuit and wiring example

NPN2 output type

PFM7□□-□□-A-□□□

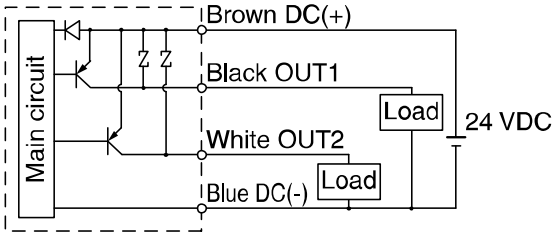


Max.28 V, 80 mA

Internal voltage drop 1 V or less

PNP2 output type

PFM7□□-□□-B-□□□



Max.80 mA

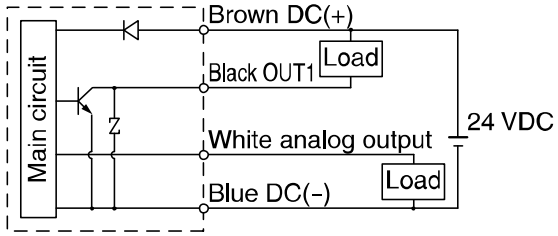
Internal voltage drop 1.5 V or less

NPN + Analog output type

PFM7□□-□□-C-□□□

NPN + Analog output type

PFM7□□-□□-D-□□□



Max. 28 V, 80 mA

Internal voltage drop 1 V or less

C: Analog output 1 to 5 V

Output inpedance 1 kΩ

D: Analog output 4 to 20 mA

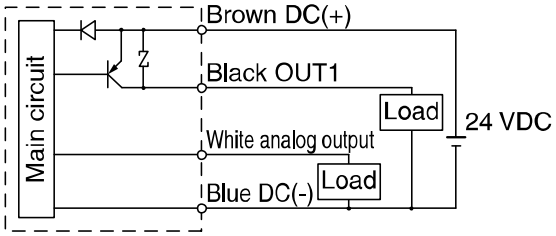
Load inpedance 50 to 600 Ω

PNP + Analog output type

PFM7□□-□□-E-□□□

PNP + Analog output type

PFM7□□-□□-F-□□□



Max. 80mA

Internal voltage drop 1.5 V or less

E: Analog output 1 to 5 V

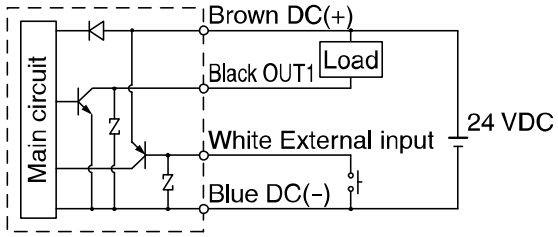
Output inpedance 1 kΩ

F: Analogue output 4 to 20 mA

Load inpedance 50 to 600 Ω

NPN + External input type

PFM7□□-□□-G-□□□



Max.28 V, 80 mA

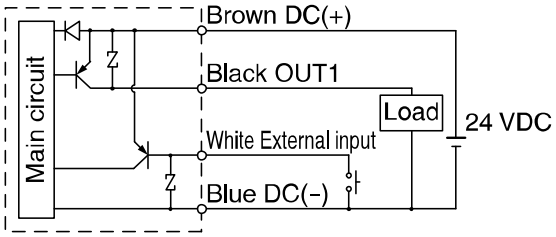
Internal voltage drop 1 V or less

External input: No voltage input

Reed switch or solid state switch input 30 ms or more

PNP + External input type

PFM7□□-□□-H-□□□



Max. 80 mA

Internal voltage drop 1.5 V or less

External input: No voltage input

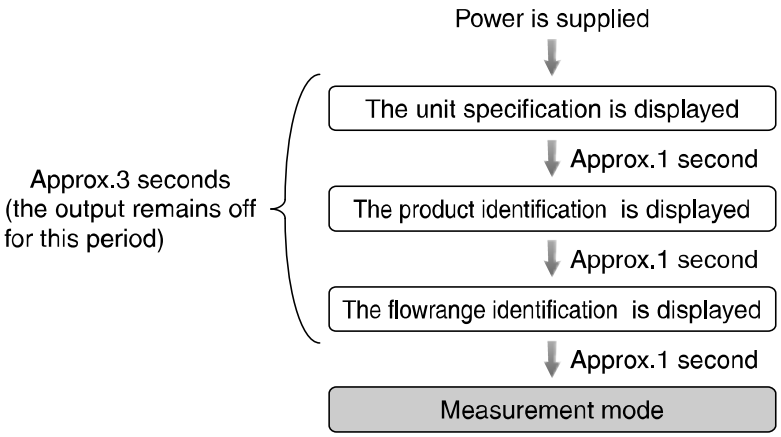
Reed switch or solid state switch input 30 ms or more

Flow Setting

What is measurement mode?

The measurement mode is the condition where the flow is detected and indicated, and the switch function is operating.

This is the basic mode, other modes should be selected for set-point and other function setting change.



Set ON and OFF points of the Flow switch.

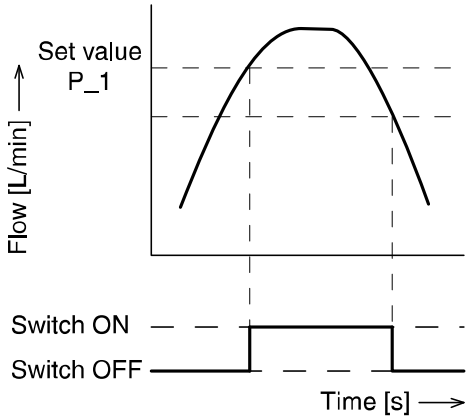
Switch operation

When a flow rate exceeds a setting point, the switch will be turned on.

When the flow rate falls below the setting point by hysteresis or more, the switch will be turned off.

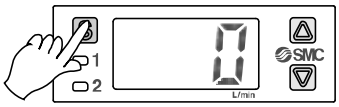
The switch is adjusted such that it will be turned on with the center point of a flow rate setting range for each product specification.

If the operation shown below doesn't cause any problem, do not change the settings.

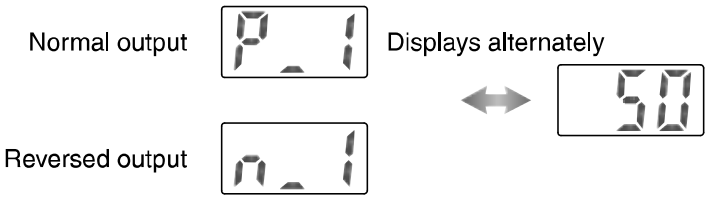


<How to perform> *: The Product will also output during setting.

1. Press the [S] button once in the measurement mode.



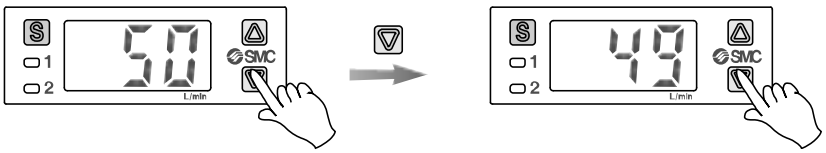
2. [P_1] or [n_1] and the set value are displayed alternately.



3. Press the [△] or [▽] button to change the set value.
   The [△] button is to increase and the [▽] button is to decrease the set value.

   •Press the [△] button once to increase by one digit to press and hold to continuously increase.

   •Press the [▽] button once to decrease by one digit to and press and hold to continuously decrease.



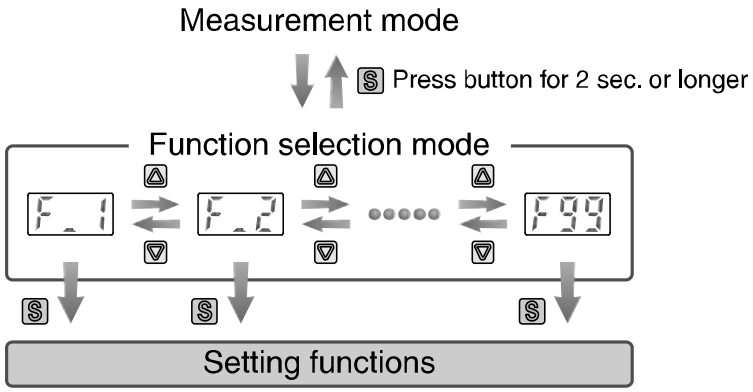
4. Press the [S] button to finish the setting.
   If 2 outputs specification is selected, [P_2] or [n_2] is displayed.
   Continue the setting operation.

Zero clear of indication
Indication is reset to zero when [△] and [▽] are pressed simultaneously for 1 second.
For initial use, implementation of zero clear is recommended.

Function setting

Function selection mode

It measurement mode, press the Ⓢ button for 2 seconds or longer to display [F 1] ([F 0] is displayed for unit changeable type). Display [F□□], and point the mode to change the setting of each fuction.
Press the Ⓢ button for 2 seconds or longer at function selection mode to return to measurement mode.



■Default setting

At the time of shipment, the settings are performed as follows.
If the setting is acceptable, keep it for use.

Caution for handling

When the setting is changed, since the different setting item appears in order depending on how many times the Ⓢ button is pressed, confirm the item which needs to be set appears to prevent undesired settings.

●[F 1] Operation of OUT1→See page 25

Item	Explanation	Default setting
Output mode	Select output for instantaneous flow (hysteresis mode, window comparator mode) accumulated flow or accumulated pulse	Hysteresis mode
Reversed output	To select reversed output	Normal output
Flow setting	To set ON point or OFF point of the switch output	Medium value of flow setting range
Hysteresis	Chattering can be prevented by setting hysteresis.	3%
Indication colour	Select the display colour.	ON: Green OFF: Red

●[F 2] Operation of OUT2→See page 28.
Same setting as [F 1] OUT1.
Display color depends on the setting of OUT1.

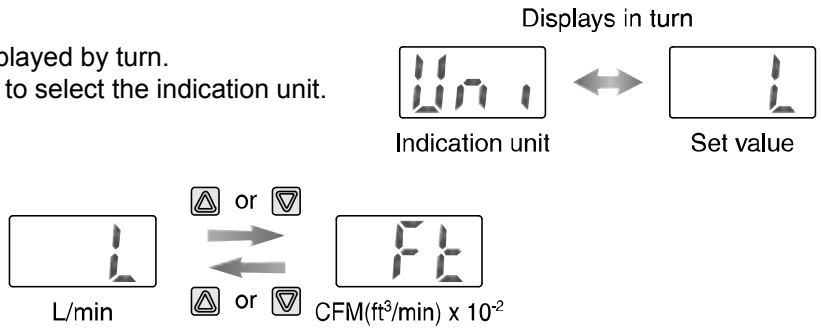
Item	Corresponding page	Default setting
[F 3] Select operating fluid	See page 28	dry air•N_2
[F 4] Display unit selection	See page 29	Standard condition(ANR)
[F 5] Setting of response time	See page 30	1 second
[F 6] Select display mode	See page 31	Instantaneous flow
[F 7] External input	See page 32	Integrated value external reset
[F 8] Select display resolution	See page 34	100-split
[F 9] Set auto pre-set	See page 35	Manual
[F10] Hold accumulated value	See page 37	OFF
[F11] Select analogue output filter	See page 38	ON
[F12] Select power saving mode	See page 39	OFF
[F13] Set security code input	See page 40	OFF

■[F 0] Unit conversion function
This function is available for unit changeable type.

<Operation>
Press the △ or ▽ button at function selection mode to display [F 0].

Press the S button. ↓ Move on to unit conversion function.

Select Indication Unit
[Uni] and Set value are displayed by turn.
Press the △ or ▽ button to select the indication unit.



Press the S button to set. ↓ Retern to function selection mode.

Setting of [F 0] Unit conversion function completed

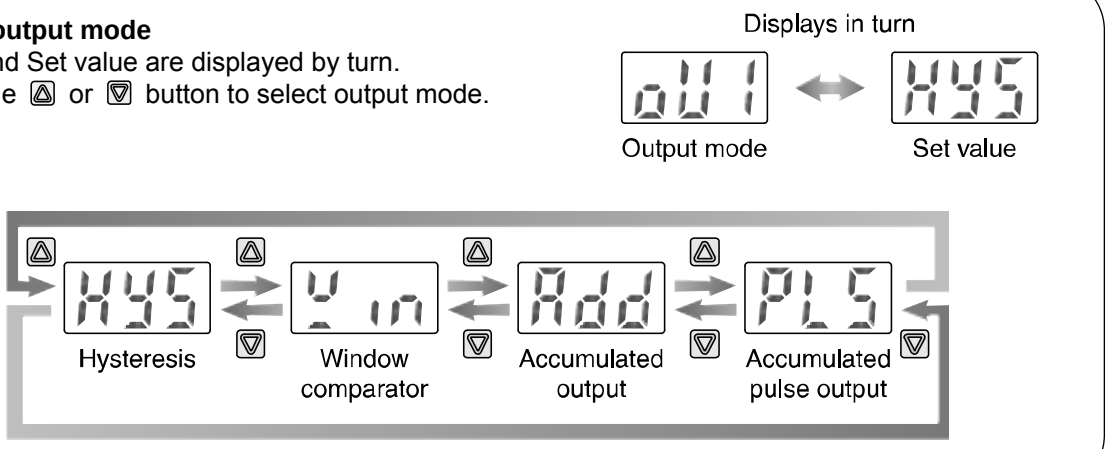
■[F 1] Operation of OUT1

Set output method of OUT1.
Output turns on when the flow exceeds the set value.
Set value is the medium value of set flow range specified for each product.
Display color depends on OUT1 output condition.
In the default setting, Green lights when output is turned on. Red lights when output turned off.

<Operation>
Press the ▲ or ▼ button at function selection mode to display [F 1].

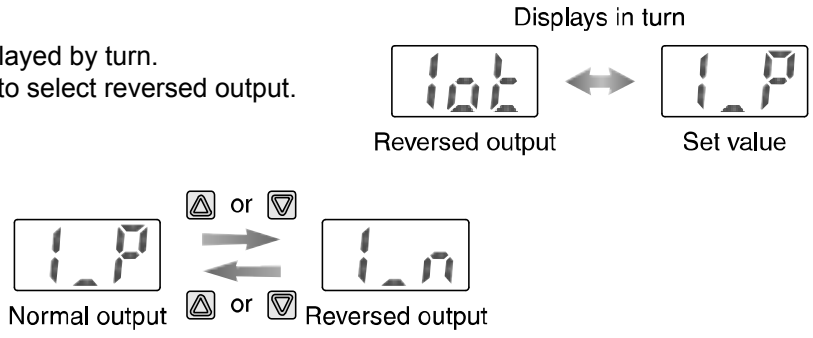
Press the S button. ↓ Move on to select output mode.

Select output mode
[oU1] and Set value are displayed by turn.
Press the ▲ or ▼ button to select output mode.



Press the S button to set. ↓ Move on to select reversed output.

Select reversed output
[1ot] and Set value are displayed by turn.
Press the ▲ or ▼ button to select reversed output.



Press the S button to set. ↓ Move on to flow setting (to be continued).

Flow setting
Set flow based on setting procedure on page 21.
Hysteresis mode: [P_1]
Window comparator mode: [P1L] [P1H]
Accumulated output mode: [P1.1] [P1.2]
Upper 3 digits are set in [P1.1], lower 3 digits are set in [P1.2].
Accumulated pulse output mode: Omitted
*: At reversed output, P becomes n.

Press the (S) button to set. ⇩ Move on to hysteresis change.

Hysteresis change
[H_1] and Set value are displayed by turn.
Press the (△) or (▽) button to select hysteresis.

Displays in turn

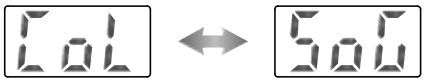
Hysteresis　　Set value

This process is omitted for accumulated output mode, accumulated pulse output mode.

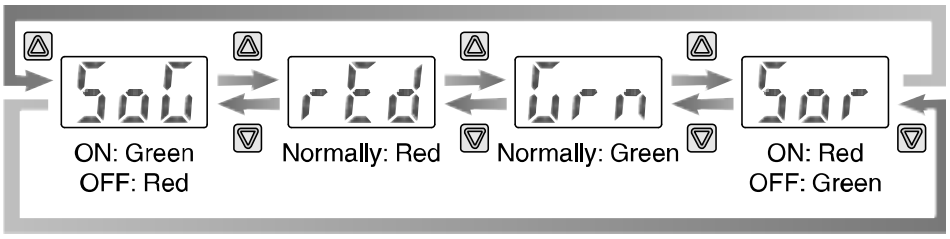
Press the (S) button to set. ⇩ Move on to display color setting.

Display color setting
[CoL] and Set value are displayed by turn.
Press the (△) or (▽) button to select display color.

Displays in turn



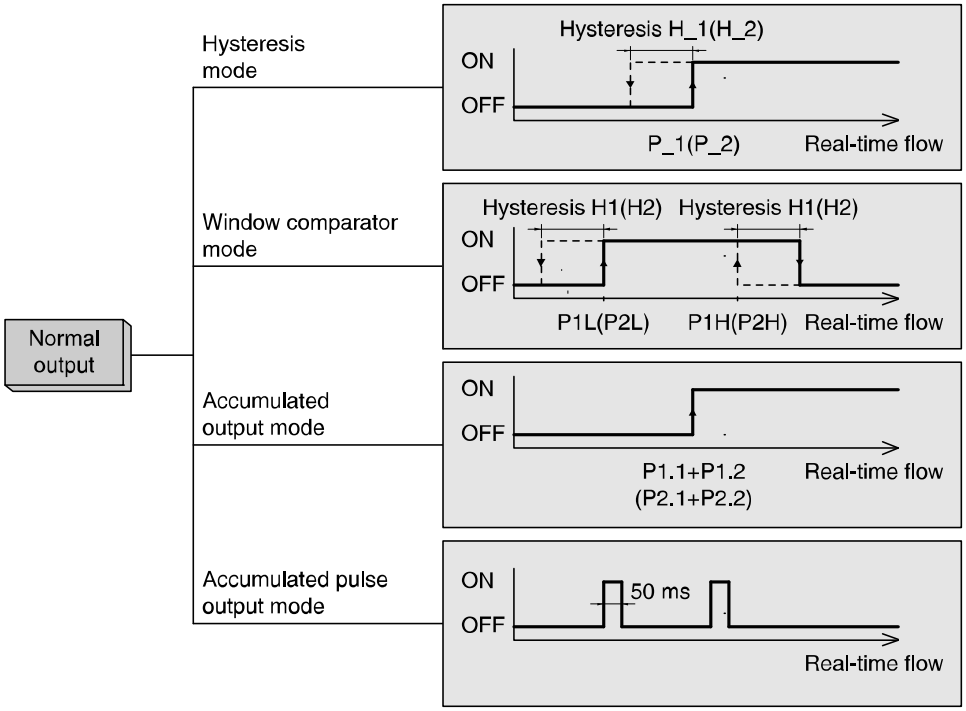
Display color　　Set value

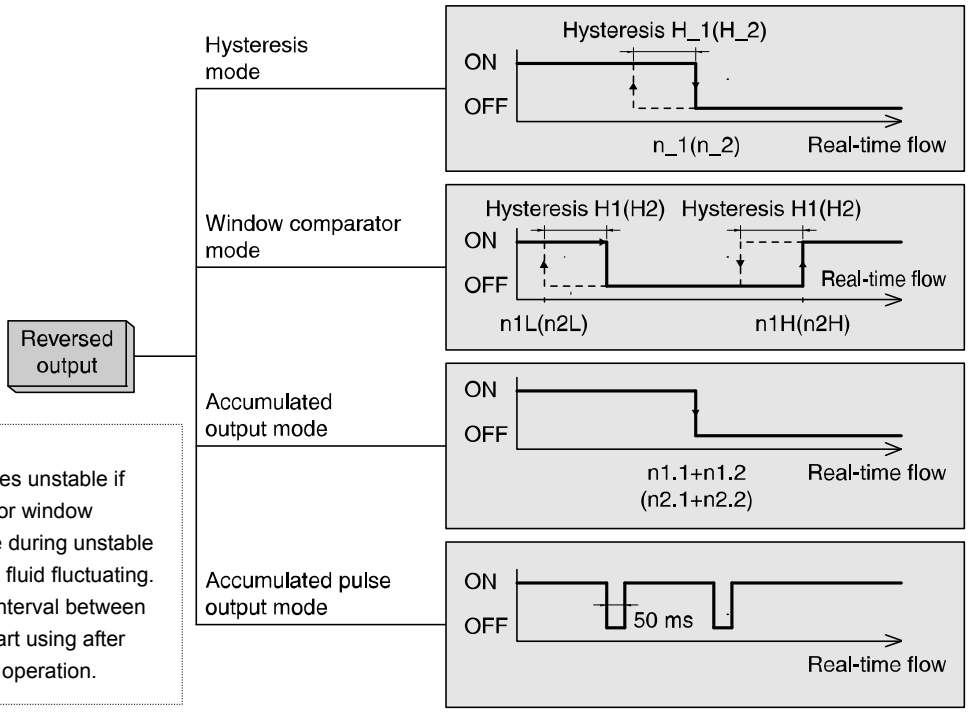


Press the (S) button to set. ⇩ Return to function selection mode.

Setting of [F 1] operation of OUT1 completed

●List of output mode





*:
Operation becomes unstable if hysteresis mode or window comparator mode during unstable condition such as fluid fluctuating. This case, keep interval between set values and start using after confirming stable operation.

■[F 2] Operation of OUT2

Set output method of OUT2.
Display color depends on OUT1 output, and is not set with this function.

<Operation>
Press the ▲ or ▼ button at function selection mode to display [F 2].

Press the S button. ↓ Move on to select output mode.

Set based on [F 1] operation of OUT1 (page25-26)

*: When product with analog output function and external input function are used, this function is not available and [---] is displayed.

■[F 3] Select operating fluid

PFM is supposed to used with dry air or N_2. Setting change is necessary when Argon (Ar) or carbon dioxide (CO_2) is used.

*: When CO_2 is selected, the upper limit of measurement flow range becomes half of other fluid's.

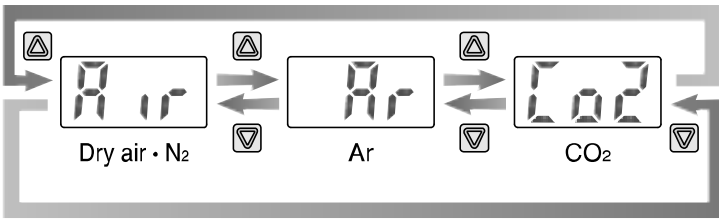
<Operation>
Press the ▲ or ▼ button at function selection mode to display [F 3].

Press the S button. ↓ Move on to select operating fluid.

Select operating fluid
[FLU] and Set value are displayed by turn.
Press the ▲ or ▼ button to select operating fluid.

Displays in turn

Operating fluid　　Set value



Dry air・N_2　　Ar　　CO_2

Press the S button to set. ↓ Return to function selection mode.

Setting of [F 3] operation fluid completed

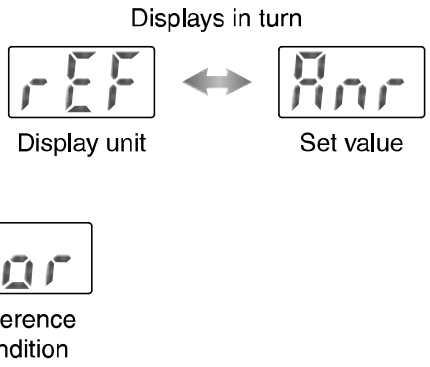
■[F 4] Display unit selection

Standard condition or reference condition is selectable for the display unit.
Standard condition (ANR) and reference condition (NOR) are defined as follows:
Standard condition: Flow display which is converted in atmospheric pressure at 20 C°.
Reference condition: Flow display which is converted in atmospheric pressure at 0 C°.

<Operation>
Press the ▲ or ▼ button at function selection mode to display [F 4].

Press the S button. ↓ Move on to display unit selection.

Display unit selection
[rEF] and Set value are displayed by turn.
Press the ▲ or ▼ button to select display unit selection.



Press the S button to set. ↓ Return to function selection mode.

Setting of [F 4] Display unit selection completed

■[F 5] Setting of response time

Select response time.

Output chattering is prevented by setting the response time.

<Operation>

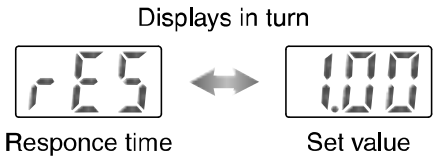
Press the ▲ or ▼ button at function selection mode to display [F 5].

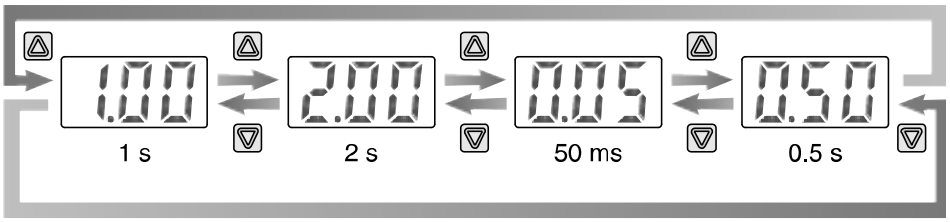
Press the S button. ↓ Move on to setting of response time.

Setting of response time

[rES] and Set value are displayed by turn.

Press the ▲ or ▼ button n to select response time.





Press the S button to set. ↓ Return to function selection mode.

Setting of [F 5] Response time completed

■[F 6] Select display mode

Select instantaneous flow of accumulated flow.

<Operation>

Press the ▲ or ▼ button at function selection mode to display [F 6].

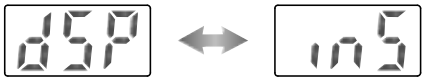
Press the S button. ⇩ Move on to select display mode.

Select display mode

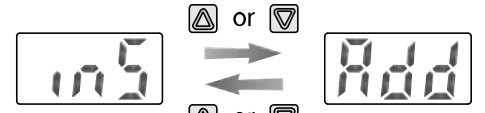
[dSP] and Set value are displayed by turn.

Press the ▲ or ▼ button to select display mode.

Displays in turn



Display mode　　Set value



Instantaneous flow　　Accumulated flow

Press the S button to set. ⇩ Return to function selection mode.

Setting of [F 6] Select display mode

•Accumulation starts when accumulation flow display is selected.

•Although Acuumulated value is displayed up to 999999 L, normaly lower 3 digts are displayed.

Press the S button to check upper 3 digits. Upper 3 digits are displayed while the S button is pressed.

■[F 7] External input

This function available when external input function is equipped.
When the input signal is applied, accumulated value is reset at "0".
(Input signal: Connect input like to GND for 30 ms or longer)
External reset: When the input signal is applied, accumulated value is reset at "0".
Auto-shift: Function to perform output to relative change referring the instantaneous flow when signal is input.
Auto-shift zero: Function to perform output to relative change and clear the display value as zero referring the instantaneous flow when signal is input.

*: PFM without external input function displays [---] and the function can not be set.

Relatively, minus value of flow display and set value are expressed by turning on the leftmost decimal point.

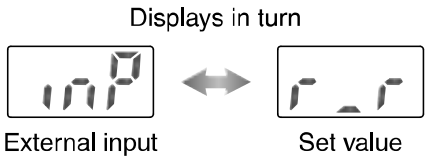
<Operation>

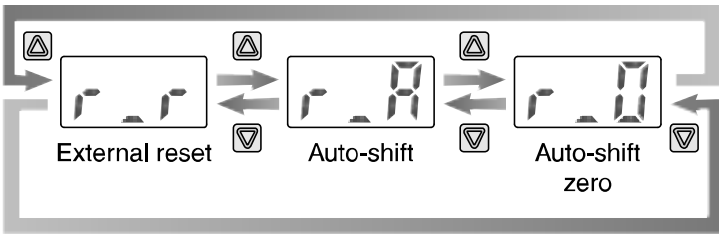
Press the ▲ or ▼ button at function selection mode to display [F 7]

Press the S button. ↓ Move on to select external input.

Select external input

[inP] and Set value are displayed by turn.
Press the ▲ or ▼ button to select external input.





Press the S button to set. ↓ Return to function selection mode.

Setting of [F 7] External input completed

●External input–Auto shift, auto shift zero function

Auto-shift and auto-shift zero are function to output for relative change amount referring instantaneous flow, when external signal is input, as a base. If auto-shift zero is set, display value is zero when external signal is input.

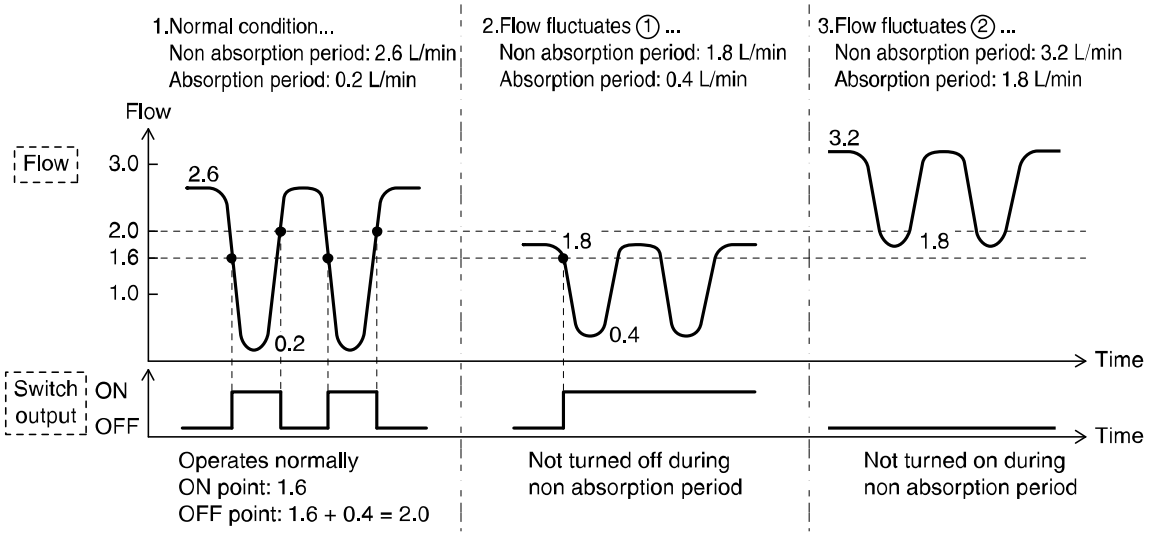
See Operation example below.

<Ex.>This function is used during the confirmation of adsorption/release as a solution for flow rate change due to source pressure fluctuation or nozzle diameter change. When auto-shift is not used, even if the work is absorbed, switching operation is not made when the flow amount fluctuates. Auto-shift function is useful for this case. If auto-shift function is used, switching operation is made based on the time when auto-shift signal is input as a reference. Therefore, switching operation is available without a fail as long as auto-shift signal is input during non-absorption period.

•When auto-shift is not used

Product: PFM710, switch set value: n_1 = 1.6, H_1 = 0.4 (Revers output, hysteresis mode)

ON/OFF point of this setting …•ON point: n_1 •OFF point: (n_1) + (H_1)



•When auto-shift is used

Product: PFM710, Switch set value: n_1 = −1.0, H_1 = 0.4 (Reverse output, hysteresis mode)

ON/OFF point of this setting …•ON point: (Flow when auto-shift is input) + (n_1)

•OFF point: (Flow when auto-shift is input) + (n_1) + (H_1)

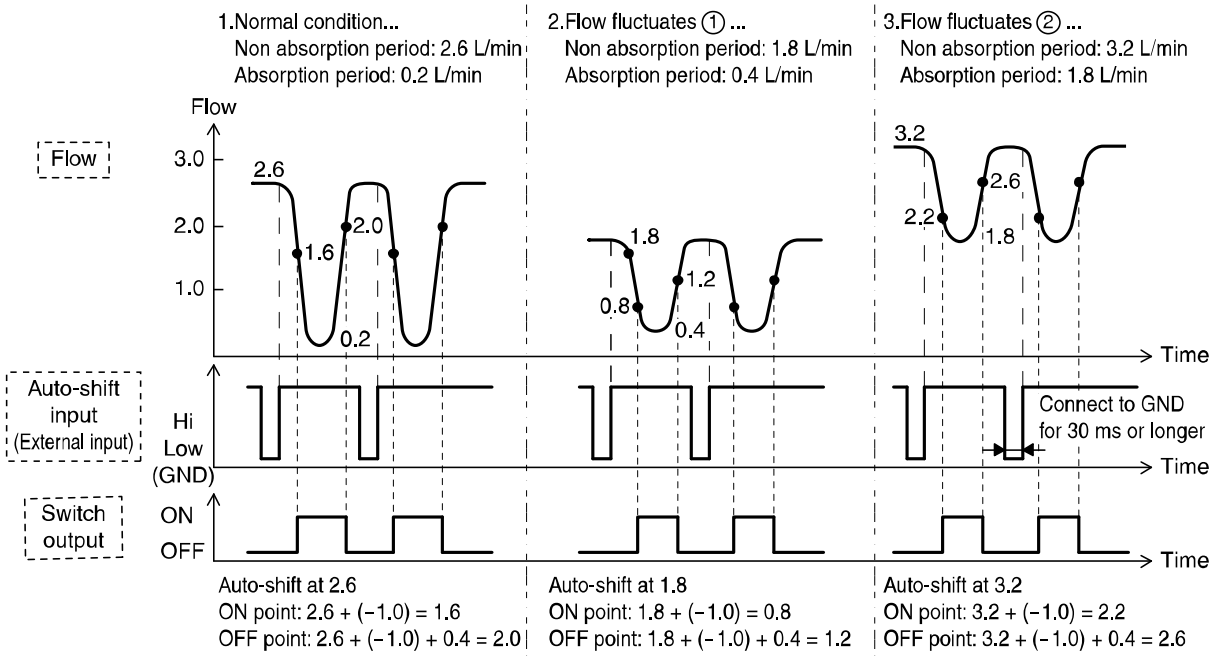


Table below shows the example of the flow display when auto-shift zero is selected.
Here, takes normal condition as an example.

•Operation example: Flow display before/after auto-shift zero at normal condition.

	Flow display [L/min]							
Before auto-shift	0	1.0	2.6	3.0	•••	8.0	9.0	10.0
Input auto-shift at 2.6	↓	↓	↓	↓		↓	↓	↓
After auto-shift	.2.6*	.1.6*	0	0.4	•••	5.4	6.4	7.4

*: When the flow value is negative, decimal point at far left is turned on to indicate "-".

Set flow range when auto-shift or auto-shift zero is selected is as follows.

•Set flow range when auto-shift or auto-shift zero is selected

Model no.	PFM710	PFM725	PFM750	PFM711
Set flow range	−10.5 to 10.5 L/min	−26.3 to 26.3 L/min	−52.5 to 52.5 L/min	−105 to 105 L/min

■[F 8] Select display resolution

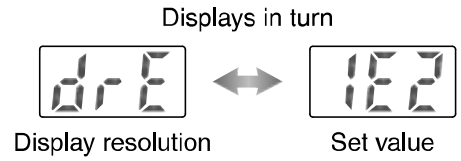
Only PFM71□ series is available.
In the default setting, PFM711 series indicates flow rate every 1 L/min, and PFM710 series indicates it every 0.1 L/min.

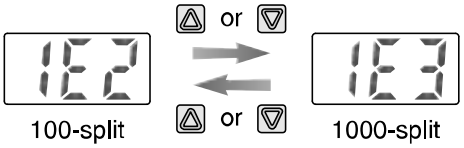
*: When the series other than PFM71□ series are used, [---] is indicated and this function setting is not available.

<Operation>
Press the △ or ▽ button at function selection mode to display [F 8].

Press the S button. ↓ Move on to select display resolution.

Select display resolution
[drE] and Set value are displayed by turn.
Press the △ or ▽ button to select display resolution.





Press the S button to set. ↓ Return to function selection mode.

Setting of [F 8] Display resolution completed

■[F 9] Select auto pre-set

This function is capable of calculating the rough set value automatically based on the on-going operation. (OUT1 only)

<Operation>

Press the ▲ or ▼ button at function selection mode to display [F 9].

Press the S button. ↓ Move on to set auto pre-set.

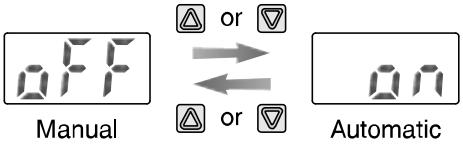
Set auto pre-set

[PrS] and Set value are displayed by turn.

Press the ▲ or ▼ button to select auto pre-set.

Displays in turn

Auto pre-set　　Set value



Manual　　Automatic

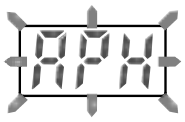
Press the S button to set. ↓ Return to function selection mode.

Setting of [F 9] Auto pre-set completed

Press the S button during measurement mode to display [APH].

([APW] in case of window comparator mode)

Press the S button again, and change the flow rate while the display is flashing.



Hysteresis mode

Window comparator mode

Set value is automatically calculated by pressing the S button. The mode is changed to measurement mode.

Once setting is performed, auto preset mode is turned off. It becomes possible to confirm the set value by pressing the S button and perform fine adjustment of set value.

●Switch set value during auto pre-set function mode

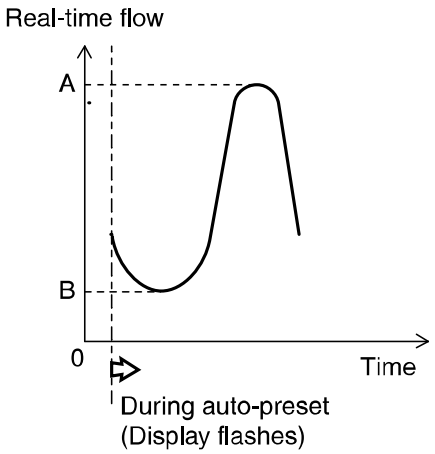
Auto preset is the function to automatically calculate the approximate set value according to actual operating condition.

If the S button is pressed during measurement mode after auto-preset function is selected, table below is shown.

•Display during Auto-preset

Output mode	Normal output		Reverse output	
	Hysteresis mode	Window comparator mode	Hysteresis mode	Window comparator mode
Display during auto-preset	APH	APy	AnH	Any

Display flashes if the S button is pressed. Change the flow while the display is flashing.



A: Max. flow during auto-preset mode
B: Min. flow during auto-preset mode

Set value is automatically calculated by pressing the S button. Then, auto-preset mode is completed and returns to measurement mode.

Set value of auto-preset mode is as follows.

•Auto-preset set value

	Hysteresis mode	Window comparator mode
Set value	•P_1 = A – (A – B)/4 •H_1 = (A – B)/2 ($n\_1 = B + \frac{A - B}{4}$ in reverse output mode)	•P1L = B •P1H = A •H_1 = 5 digit 1 digit means set minimum unit (In reverse output, P1L, P1H become n1L, n1H respectively)

See page 27 output mode list for the operation of hysteresis mode and window comparator mode

■[F10] Hold accumulated value

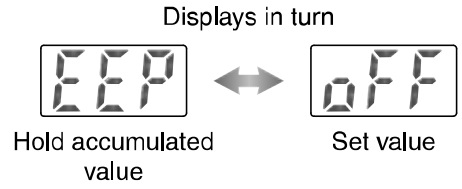
Initial setting is to clear accumulated value when the power supply is turned off.
It can be set so that the accumulated value is memorized every 2 minutes or 5 minutes.
The life of memory element is 1 million times of access.
If the Product is used 24 hours a day, the life will be,

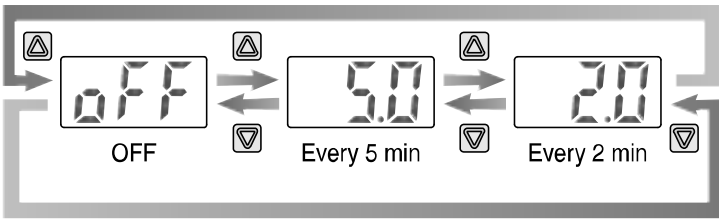
Every 5 minutes to memorize --- 5 minutes x 1 million times = 500 million minutes = 9.5 years
Every 2 minutes to memorize --- 2 minutes x 1 million times = 200 million minutes = 3.8 years

<Operation>
Press the △ or ▽ button at function selection mode to display [F10].

Press the Ⓢ button. ↓ Move on to hold accumulated value.

Set hold accumulated value
[EEP] and Set value are displayed by turn.
Press the △ or ▽ button n to select hold accumulated value.





Press the Ⓢ button to set. ↓ Return to function selection mode.

Setting of [F10] Hold accumulated value completed

*: When external reset is repeatedly input, wait for the time longer than interval to store the memory.

■[F11] Select analog output filter

This function can be used when analog output function is installed in the products. Faster response signal is available with turning off the filter of the analog output.

*: If the analog output function is not installed in the products, [---] is indicated and this function is not available.

<Operation>

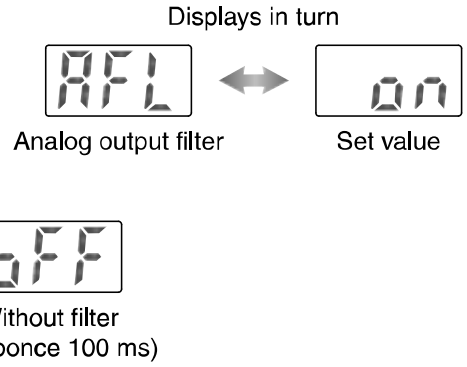
Press the ▲ or ▼ button at function selection mode to display [F11].

Press the S button. ↓ Move on to select analog output filter.

Select analog output filter

[AFL] and Set value are displayed by turn.

Press the ▲ or ▼ button to select analog output filter.



Press the S button to set. ↓ Return to function selection mode.

Setting of [F11] Analog output filter completed

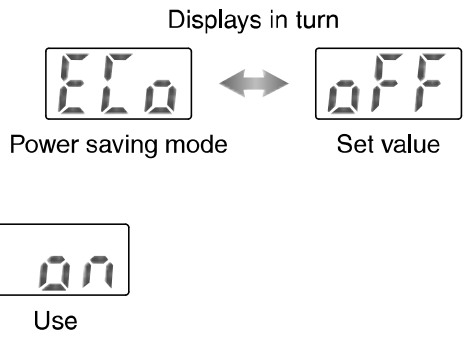
■[F12] Select power saving mode

Power-saving mode is selectable.
When the product is left for 30 seconds without any operation, it's shifted to power-saving mode.
In the default setting, power saving mode is OFF (normal mode).
(The decimal point blinks during the operation.)

<Operation>
Press the ▲ or ▼ button at function selection mode to display [F12].

Press the S button. ↓ Move on to select power saving mode.

Select power saving mode
[ECo] and Set value are displayed by turn.
Press the ▲ or ▼ button to select power saving mode.

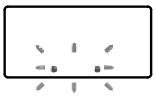


Press the S button to set. ↓ Return to function selection mode.

Setting of [F12] power saving mode completed

In the power saving mode, the key-in operation can return the normal display.
Without key-in operation for 30 seconds, the power saving mode is returned again.
(Only in the measurement mode.)

During power saving mode, decimal points flash as in the drawing right.



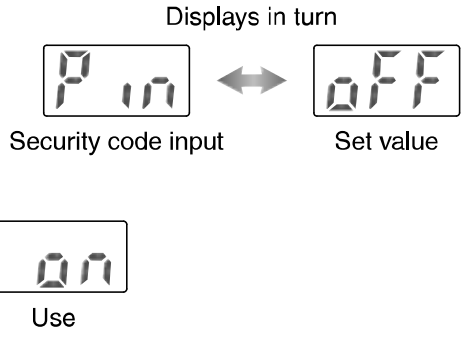
■[F13] Set security code input

Pin number can be entered during the key-lock state.
See page 44 for key lock function.
In the default setting, security code entry is not necessary.

<Operation>
Press the ▲ or ▼ button at function selection mode to display [F13].

Press the S button. ↓ Move on to set security code input.

Set secret code input
[Pin] and Set value are displayed by turn.
Press the ▲ or ▼ button to select security code input.



Press the S button to set. ↓ Return to function selection mode.

Setting of [F13] secret code input completed

With security code input, it becomes necessary to input the security code to release key lock. The security code can be decided optionally by the operator. At the time of shipment, the security code is set to [000].

With security code input, refer to page 45.

■F98, F99 Special function setting

●[F98] All functions can be set

Functions can be set in turn.

<Operation>

Press the ▲ or ▼ button at function selection mode to display [F98].

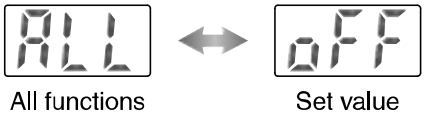
Press the S button. ↓ Move on to all function can be set.

All function can be set

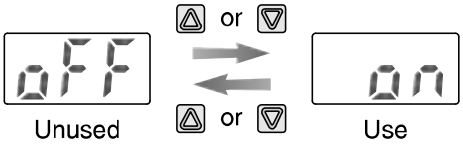
[ALL] and Set value are displayed by turn.

Press the ▲ or ▼ button to select all function can be set.

Displays in turn



All functions　　Set value



Unused　　Use

When "oFF" (Not to use) is selected

Press the S button to set

Return to function selection mode

When "on" (To use) is selected

Set functions*1

Return to "oFF" (Not to use), the press the S button to set.

Return to function selection mode

Press the S button for 2 seconds or longer

Setting of [F98] all function can be set completed

Measurement mode

*1: Setting of functions

Every time [S] button is pressed, function turns in order below. Set by the [△] or [▽] button.

Refer each paragraph for the detail of setting.

Function of setting

Order	Function	Applicable model
1	Selection of display unit	Model with unit change function
2	Select output mode (OUT1)	All models
3	Select reversed output (OUT1)	All models
4	Flow setting (OUT1)	All models
5	Hysteresis change (OUT1)	All models
6	Display color setting	All models
7	Select output mode (OUT2)	Product with NPN2 output, PNP2 output
8	Select reversed output (OUT2)	
9	Flow setting (OUT2)	
10	Hysteresis change (OUT2)	
11	Select operating fluid	All models
12	Display unit selection	All models
13	Setting of response time	All models
14	Select display mode	All models
15	External input	Product with external input
16	Select display resolution	10 [L/min] type and 100 [L/min] type
17	Set auto pre-set	All models
18	Hold accumulated value	All models
19	Select analog output filter	Product with analog output
20	Select power saving mode	All models
21	Set secret code input	All models

●[F99] Reset to the default setting

Press the [△] or [▽] button to display [ON], and press the [S] button and the [▽] button at the same time for 5 seconds or longer. With this action, the mode is returned to ex-factory mode when currently operating mode becomes unknown.

Other settings

●Peak/Bottom value indication

The maximum (minimum) flow from when the power is supplied to this moment is detected and updated.
In the peak/bottom indication mode, the flow is indicated.
As the peak indication, when the △ button is pressed for 1 second or longer, the maximum flow starts flashing and is held.
To release holding the indication of the maximum flow, press the △ button for 1 second or longer again.
The measurement mode is returned.
As the bottom indication, when the ▽ button is pressed for 1 second or longer, the minimum flow starts flashing and is held.
To release holding the indication of the minimum flow, press the ▽ button for 1 second or longer again.
The measurement mode is returned.
If the △ and ▽ buttons are pressed simultaneously for 1 second or longer while the flow is being held, the maximum (minimum) value is initialized.

●Zero Clear

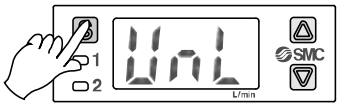
A displayed value can be adjusted to zero when flow to be measured is within ±10%F.S. of the flow at the time of shipment from the factory.
(The range of ±1 digit setting is different depending on the individual product difference)
Press continuously △ and ▽ buttons for 1 second or longer simultaneously, display is cleared as "0".
Return to the measurement mode automatically.
Accumulated value is zero when accumulated flow is displayed.

●Key Lock

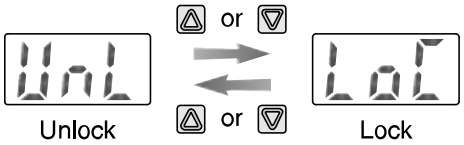
A wrong operation performed unintentionally such as change of set value can be prevented.
If the button operation is performed while key lock setting is being performed, [LoC] is indicated for approximate 1 second.

<Operation -Without secret code input->

1. Keep pressing Ⓢ button for 5 seconds or longer in the measurement mode.
   The current setting [LoC] or [UnL] is indicated.
   (Releasing key lock can be done in the same way.)



2. Press the △ or ▽ button to select locking or unlocking of the key.

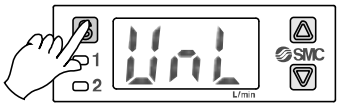


3. Press the Ⓢ button to enter the setting.

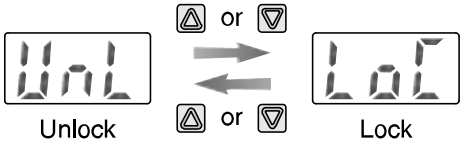
<Operation -With secret code input->

•Locking

1. Keep pressing the Ⓢ button for 5 seconds or longer in the measurement mode. [UnL] is indicated.



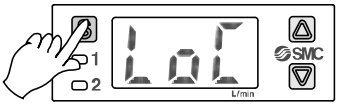
2. Press the △ or ▽ button to select locking of the key [LoC].



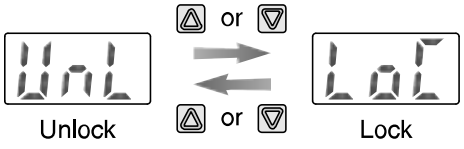
3. Press the Ⓢ button to enter the setting.

•Unlocking

1. Keep pressing the Ⓢ button for 5 seconds or longer in the measurement mode. [LoC] is indicated.



2. Press the △ or ▽ button to select unlocking of the key [UnL].



3. When the Ⓢ button is pressed, the input of secret code is asked.
   For how to input the secret code, refer to [How to input and change the secret code] on page 45.

4. If inputted secret code is correct, the indication changes to [UnL], and pressing one of the △, Ⓢ or ▽ button releases key lock and returns the measurement mode.
   If inputted secret code is wrong, [FAL] is indicated and the secret input mode is returned.
   If the wrong secret code is inputted three times, [LoC] is indicated and the measurement mode is returned.

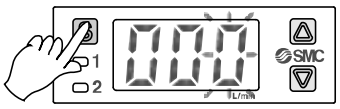
●How to change the security code
At the time of shipment, the security code is set to [000], but can be changed to optional one.

<Operation>

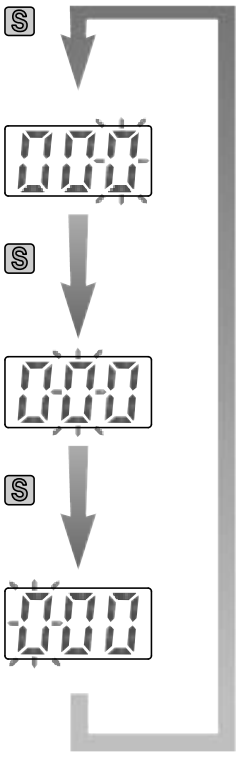
1. After the lock setting is finished (page 44), perform all three steps in the unlock setting procedure. (page 44).

2. After the secret code is inputted and the indication changes to [UnL], keep pressing S and ▽ buttons simultaneously for 5 seconds or longer.
[000] is indicated and the change of security code is asked.
For how to input the secret code, refer to [How to input and change the security code].
Changed security code is indicated.

3. After check it is as desired, press the S button.
The measurement mode is returned.
At this time, if the △ or ▽ button is pressed, changed secret code is not entered and the change of secret code is asked.



How to input and change the secret code
The first digit starts flashing.
Press the △ or ▽ button to set the value.
Pressing the S button starts flashing the second digit.
(If S button is pressed at the uppermost digit, the first digit starts flashing again.)
After the setting is finished, keep pressing S button for 1 second or longer.
(If the operation is not performed for 30 seconds during input and change of the secret code,the measurement mode is returned.)



Troubleshooting

●Troubleshooting

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

●Possible cause and countermeasure

Fault.	Status	Possible cause	Item to check	Countermeasure
Wrong display	Indication is not shown	Wiring failure	Check that brown line and blue line are connected to DC (+) and DC (−) respectively.	Have correct wiring.
	Indication is blinking	Peak/bottom Indicating function	Check whether or not flow rate indication is in peak value (bottom value) indication mode.	See "Peak/bottom value indication", and remove the setting if unnecessary. (Refer to page 43)
	Indication is not stable	Foreign matter was got in or attached.	(1) Possibility of foreign matter to be got in. (2) Possibility of foreign matter to be attached. Check whether or not mesh got foreign matter.	Set up filter or mist separator at upstream side of product.
		Piping in the reverse direction	Check that the mounting direction of the product is same as the flow direction	Match the mounting direction with the flow direction.
		Flow is pulsing	Check if there is supply pressure fluctuation or pressure pulsation due to the characteristics of the compressor or pump acting as the pressure source	Install a tank to reduce the pressure fluctutation. Change the pressure source to one which has less pulsation.
	Incorrect display	Foreign matter was got in or attached.	(1) Possibility of foreign matter to be got in. (2) Possibility of foreign matter to be attached. Check whether or not mesh got foreign matter.	Set up filter or mist separator at upstream side of product.
		Piping in the reverse direction	Check that the mounting direction of the product is same as the flow direction	Match the mounting direction with the flow direction.
		An incorrect flow unit was selected	Check the selection of the flow unit	Select the appropriate flow unit.

Fault	Status	Possible cause	Item to check	Countermeasure
Wrong display	Incorrect display	An incorrect flow range was selected for the product to be connected	Check the selection of the flow range	Select the appropriate flow range.
		Air leakage	Check if there is air leakage because of insufficient screwing in of the pipes or insufficient sealing, etc	Reconnect the pipes with the specified tightening torque and rewrap the sealant tape.
	Fluid does not flow	The flow adjustment valve is closed	Check the flow adjustment valve	Open the flow adjustment valve and adjust the flow
Wrong output	No output	Wiring failure	Check that brown line and blue line are connected to DC (+) and DC (−) respectively.	Have correct wiring.
		Connector is come off	Check the connection of the connectors.	Connect the connectors.
	Indication is not stable	Foreign matter was got in or attached.	(1) Possibility of foreign matter to be got in. (2) Possibility of foreign matter to be attached. Check whether or not mesh got foreign matter.	Set up filter or mist separator at upstream side of product.
		Piping in the reverse direction.	Check that the mounting direction of the product is same as the flow direction.	Match the mounting direction with the flow direction.
		Flow is pulsing	Check if there is supply pressure fluctuation or pressure pulsation due to the characteristics of the compressor or pump acting as the pressure source.	Install a tank to reduce the pressure fluctutation. Change the pressure source to one which has less pulsation.
		Small hysteresis	Check the hysteresis set value.	Increase the hysteresis.
Inoperable with the push button	No reaction when the buttons are pushed.	The keys are locked.	Check if it displays “Loc” when the buttons are pushed.	Release the key lock. (Refer to page 44)

Fault	Status	Possible cause	Item to check	Countermeasure
External input does not operate	It does not accept the input (no reaction)	Wiring failure	Check that the brown line (DC+) and the blue line DC(-) are connected to the black line (OUT1) and the white line (OUT2) respectively	Have correct wiring.
		The input time is too short	Check whether or not a white line is connected to GND for 30 ms or more	If external input is added, the white line should be connected to GND for 30 ms or more.
Improper operation of the flow adjustment valve	Adjutment failure with the flow adjustment valve	The flow adjustment valve is locked.	Check the lock ring of the flow adjustment valve.	Loosen the lock ring, and then adjust the flow adjustment valve. (Refer to page 13)
		Insufficient supply pressure	Check the supply pressure and the flow characteristics of the flow adjustment valve.	Increase the supply pressure.

■Error indication

This function is to display error location and content when a problem or an error occures.

Error Name	Error Display	Error type	Trobleshooting
Flow error		Flow exceeds the upper limit of the flow display range.	Reduce the flow.
		5% or more flow in the reverse direction.	Direct the flow to the proper direction.
Overcurrent error		Load current of the switch output (OUT1) exceeds 80 mA.	Turn off the power supply and eliminate the cause of excess current. Then supply the power again.
		Load current of the switch output (OUT2) exceeds 80 mA.	
System error		Condition is that of before the adjustment at factory. Internal circuit ispossibly damaged.	Stop operation immediately and contact SMC.
		System error. Failed to memorize the data, or internal circuit is possibly damaged.	Reset using reset function.
Zero clear error		If fluid flows during zero clear setting (pressing △ and ▽ buttons simultaneously for less than 1 second), "Er4" is indicated on the screen for 1 second.	Please check that fluid doesn't flow at the time of zero clear setting.
Flow error	 Accumulated Flow displayed	Accumulated flow range is exceeded.	Clear the accumulated flow. (If accumulated flow is not used, this is not a problem.)

If the error cannot be reset after the above measures are taken, then please contact SMC.

Specification

■Specifications

Model		PFM710	PFM725	PFM750	PFM711
Applicable fluid		Dry air, N_2, Ar, CO_2 (Air quality class is JIS B8392-1 1.1.2 to 1.6.2, ISO8573-1 1.1.2 to 1.6.2)			
Rated flow range (measurement 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
Display flow rate range[*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
Set flow rate range[*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 set unit[*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
Display unit[*3]		Real-time flow rate L/min Accumulated flow L			
Accuracy		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: 5%F.S. or less			
Pressure characteristic		±5%F.S. or less (0.35 MPa reference)			
Temperature characteristics		±2%F.S. (15 to 35 °C) ±5%F.S. (0 to 50 °C)			
Operating pressure range		−70 kPa to 750 kPa			
Proof pressure		1 MPa			
Accumulated flow range[*4]		Max.999999 L			
Switch output		NPN or PNP open collector output			
	Max. load current	80 mA			
	Max. load voltage	28 VDC (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 are selectable)			
	Output protection	Short circuit protection, excess current			
Analog output[*5]	Response time	1.5 s or less (Response 90%)			
	Voltage output	Output voltage: 1 to 5 V Output impedance: 1 kΩ			
	Current output	Output current: 4 to 20 mA Max. load impedance: 600 Ω, Min. load impedance: 50 Ω			

Model		PFM710	PFM725	PFM750	PFM711
Hysteresis[*6]	Hysteresis mode	Variable			
	Window comparator mode	Variable			
External input		No voltage input (Reed switch or solid state) Input 30 ms or more			
Display		3 digits 7 segment display 2 color indication (Red/Green) Update cycle: 10 times/s			
Indicator light		OUT1: ON when light is on (Green) OUT2: ON when light is on (Red)			
Source voltage		24 VDC±10%			
Power consumption		55 mA or less			
Resistance	Enclosure	IP40			
	Operating fluid temp.	0 to 50 °C (No freezing or condensation)			
	Operating temp. range	Operating: 0 to 50 °C, Stored: −10 to 60 °C (No freezing or condensation)			
	Operating humidity range	Operating, stored 35 to 85% R.H. (No condensation)			
	Withstand voltage	1000 VAC, 1 min. Between external terminals and case			
	Insulation resistance	50 MΩ or more (500 VDC Mega) Between external terminals and case			
	Vibration resistance	Without flow adjustment valve: 10 to 500 Hz at whichever smaller 1.5 mm amplitude or 98 m/s^2 acceleration in X, Y, Z directions for 2 hours each (un-powered) With flow adjustment valve: 10 to 150Hz at whichever smaller 1.5 mm amplitude or 19.6 m/s^2 acceleration in X, Y, Z directions for 2 hours each(un-powered)			
	Impact resistance	490 m/s^2 X,Y,Z directions 3 times for each (un-powered)			

Port specification

Model		01	02	N01	N02	F01	F02	C4	C6	C8	N7
Port size		Rc 1/8	Rc 1/4	NPT 1/8	NPT 1/4	G 1/8	G 1/4	φ4 (5/32") One-touch fitting	φ6 One-touch fitting	φ8 (5/16") One-touch fitting	φ1/4 One-touch fitting
Weight	Straight without flow adjustment valve	95 g					125 g	55 g			
	Rear entry without flow adjustment valve	105 g					135 g	65 g			
	Straight with flow adjustment valve	135 g					165 g	95 g			
	Rear entry with flow adjustment valve	145 g					175 g	105 g			
Fluid contact material		LCP, PBT, brass (electroless nickel plating), HNBR (+fleon coating), silicone, Au, SUS304									

*1: If min. set unit (0.01 L/min.) is selected for 10 L/min type, upper limit of the display is [9.99 L/min.]
If min. set unit (0.1 L/min.) is selected for 100 L/min. type, upper limit of the display is [99.9 L/min.]

*2: With PFM710, 0.01 L/min. and 0.1 L/min. are selectable. With PFM711, 0.1 L/min. and 1 L/min. are selectable. When CFM is selected as display unit, set minimum unit can not be changed.
With ex-factory conditions, PFM710 is set at 0.1 L/min, and PFM711 is set at 1 L/min.

*3: <ANR> at ex-factory.
<ANR> means standard condition at 20 centigrade, 1 atm 65% R.H..N L/min means reference condition at 0 centigrade, at 1 atm.
When unit change function is equipped (For type without unit change function, the unit is fixed to SI (L/min. or L)).

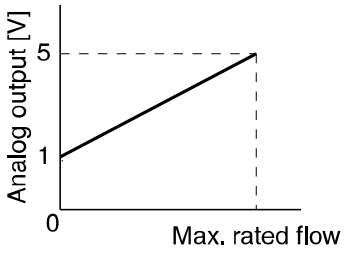
*4: Cleared by turning off the power. Possible to select the holding function (with interval of 2 minutes or 5 minutes).
If 5 minutes is selected, and when the life of memory element (electronic component) is 1million cycles (energized for 24 hours/day), the life will be (5 minutes x 1 million cyelces = 5 million min. =) 9.5 years at the longest. When this function is used, calculate the life based on operating condition and use within the life range.

*5: Response time is set at 1.5 s (90%) with ex-factory conditions. 100 ms is selectable as well.

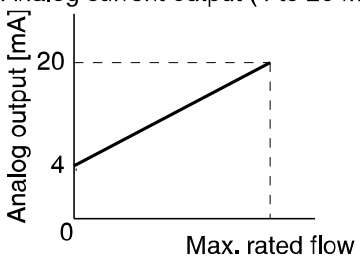
*6: With ex-factory conditions, the mode is hysteresis mode. Window comparator mode is selectable by button.

Output characteristics

Analog voltage output (1 to 5 V)



Analog current output (4 to 20 mA)



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

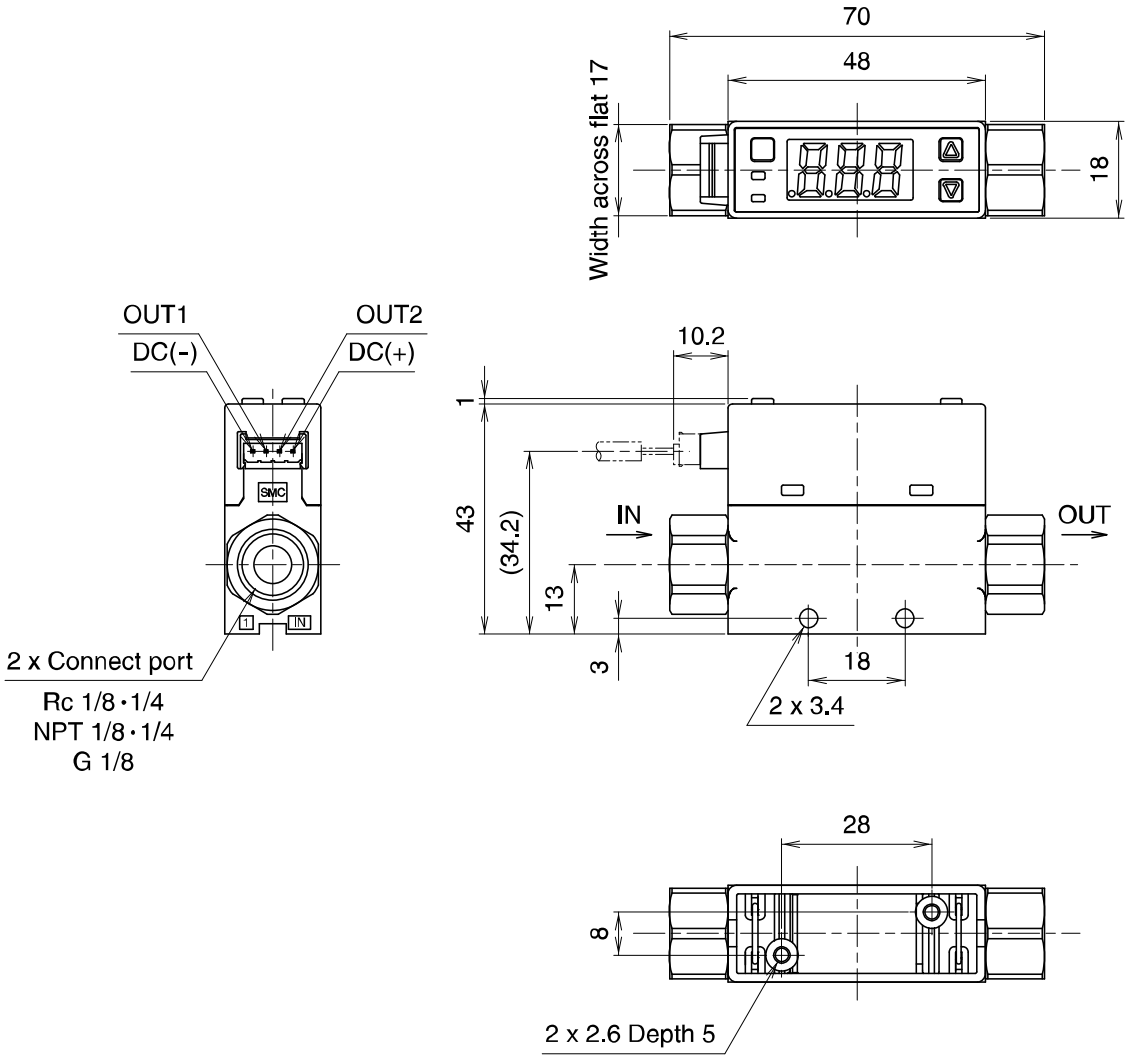
Model	Max. rated flow [L/min]
PFM710-□-D/F	10
PFM725-□-D/F	25
PFM750-□-D/F	50
PFM711-□-D/F	100

Cable Specifications: Power supply/Output connector (ZS-33-D)

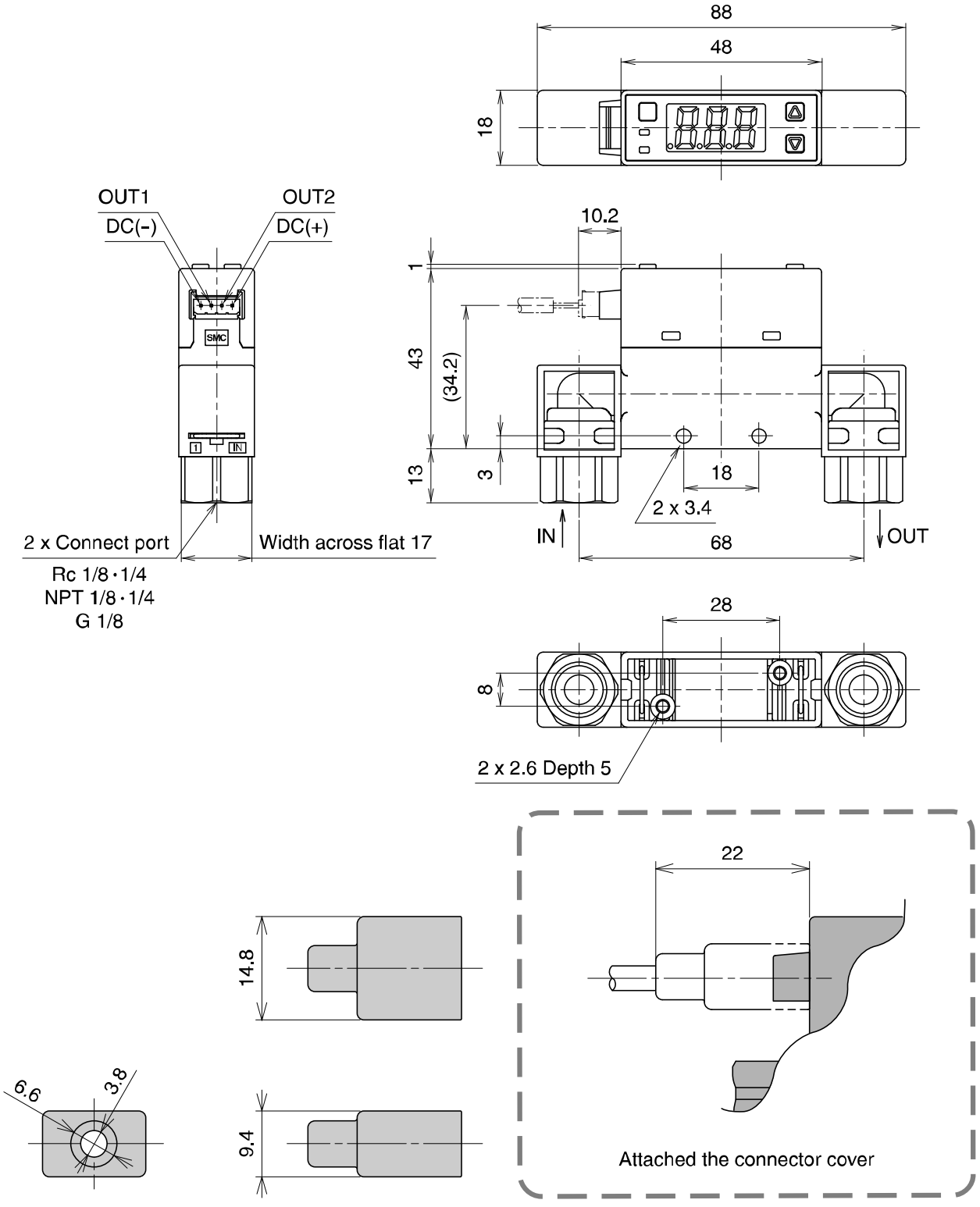
Conductor	Nominal cross section area	AWG26
	Outside diameter	Approx. 0.50 m
Insulator	Material	Cross-linked vinyl chloride resin compound
	Outside diameter	Approx 1.00 mm
	Colours	Brown, White, Black, Blue
Sheath	Material	Oil-resistant vinyl chloride resin compound
Finished outside diameter		$\phi 3.5^{+0.10}_{-0.25}$

■Dimensions

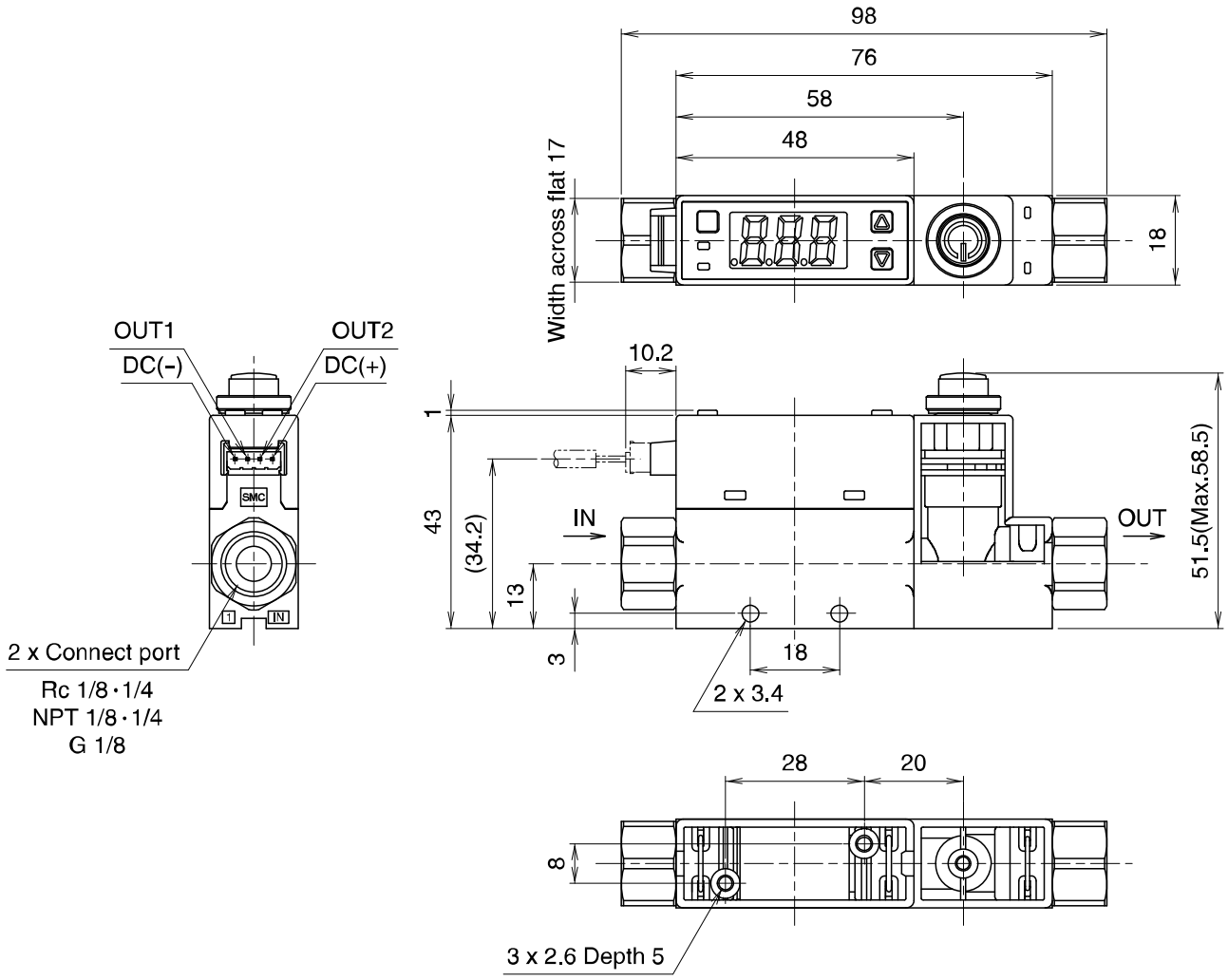
PFM7**-(N)01/(N)02/F01



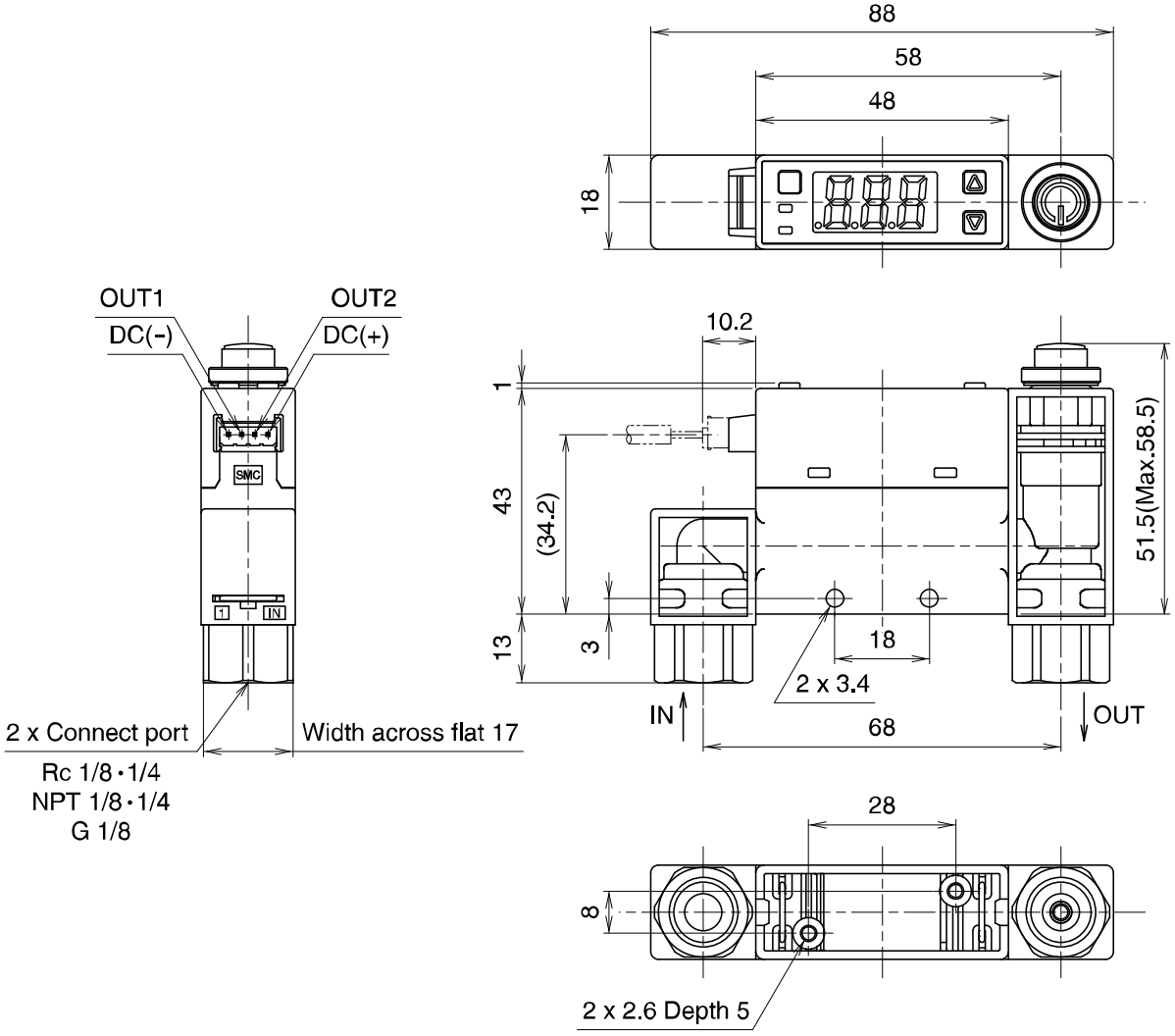
PFM7**-(N)01L/(N)02L/F01L



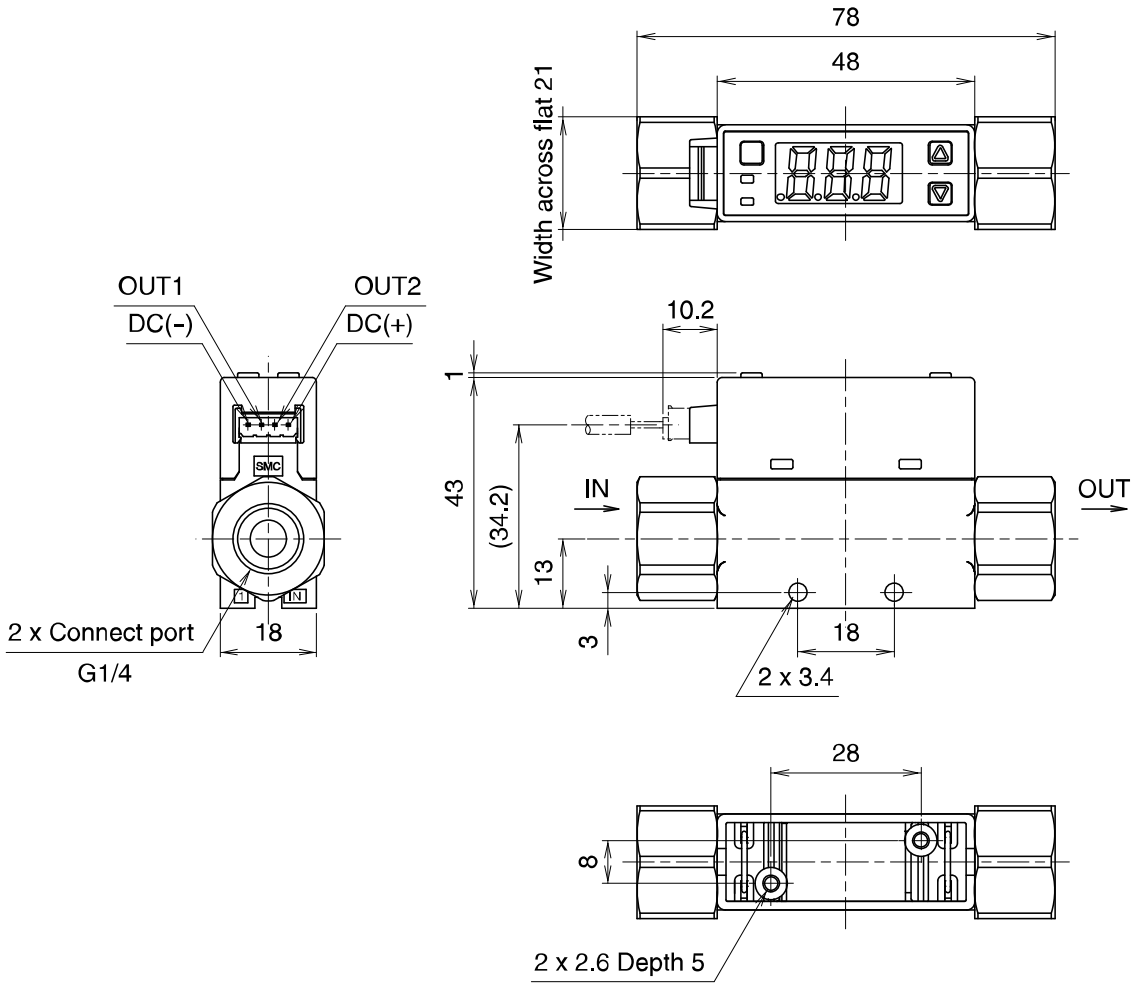
PFM7*S-(N)01/(N)02/F01



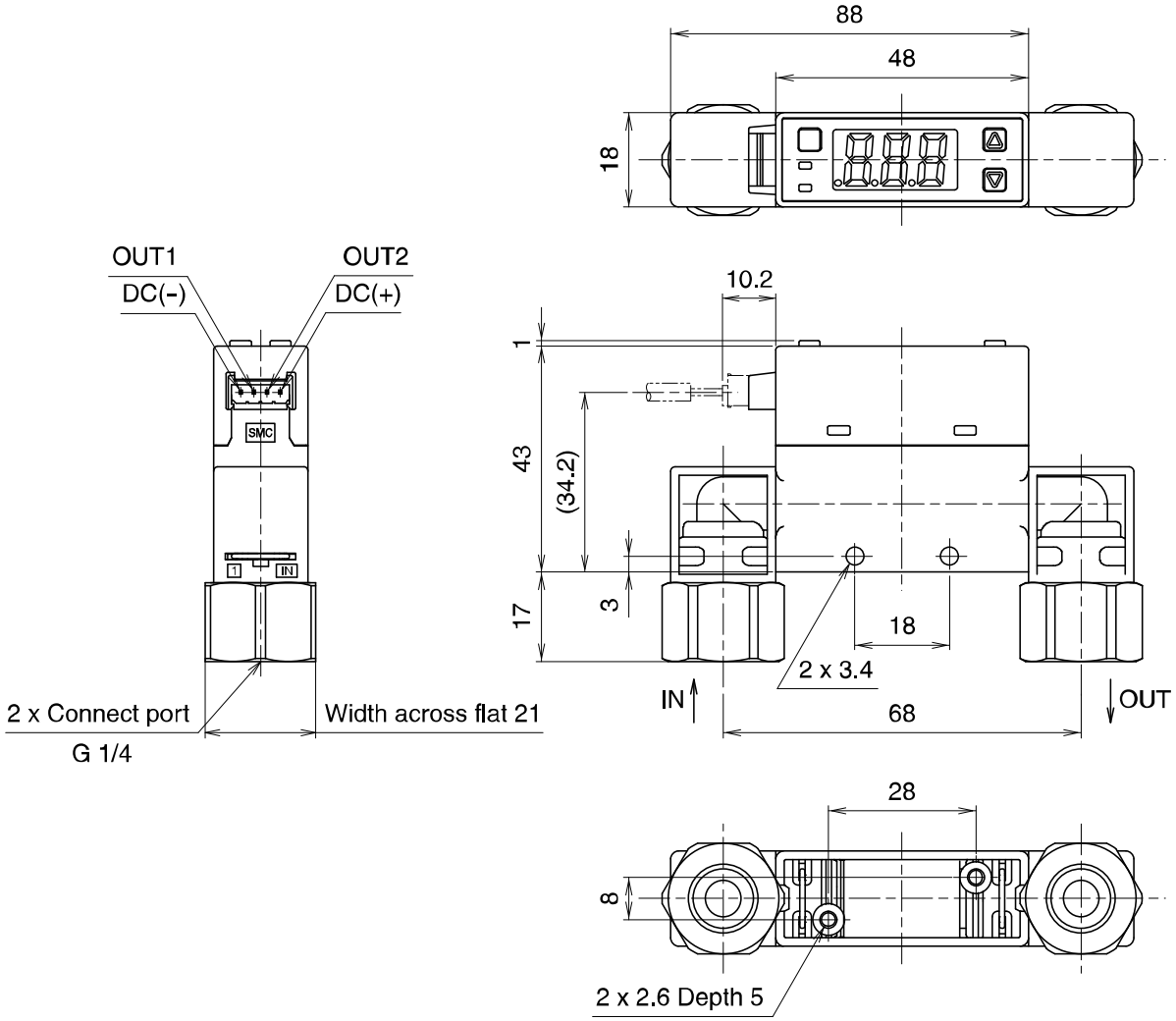
PFM7*S-(N)01L/(N)02L/F01L



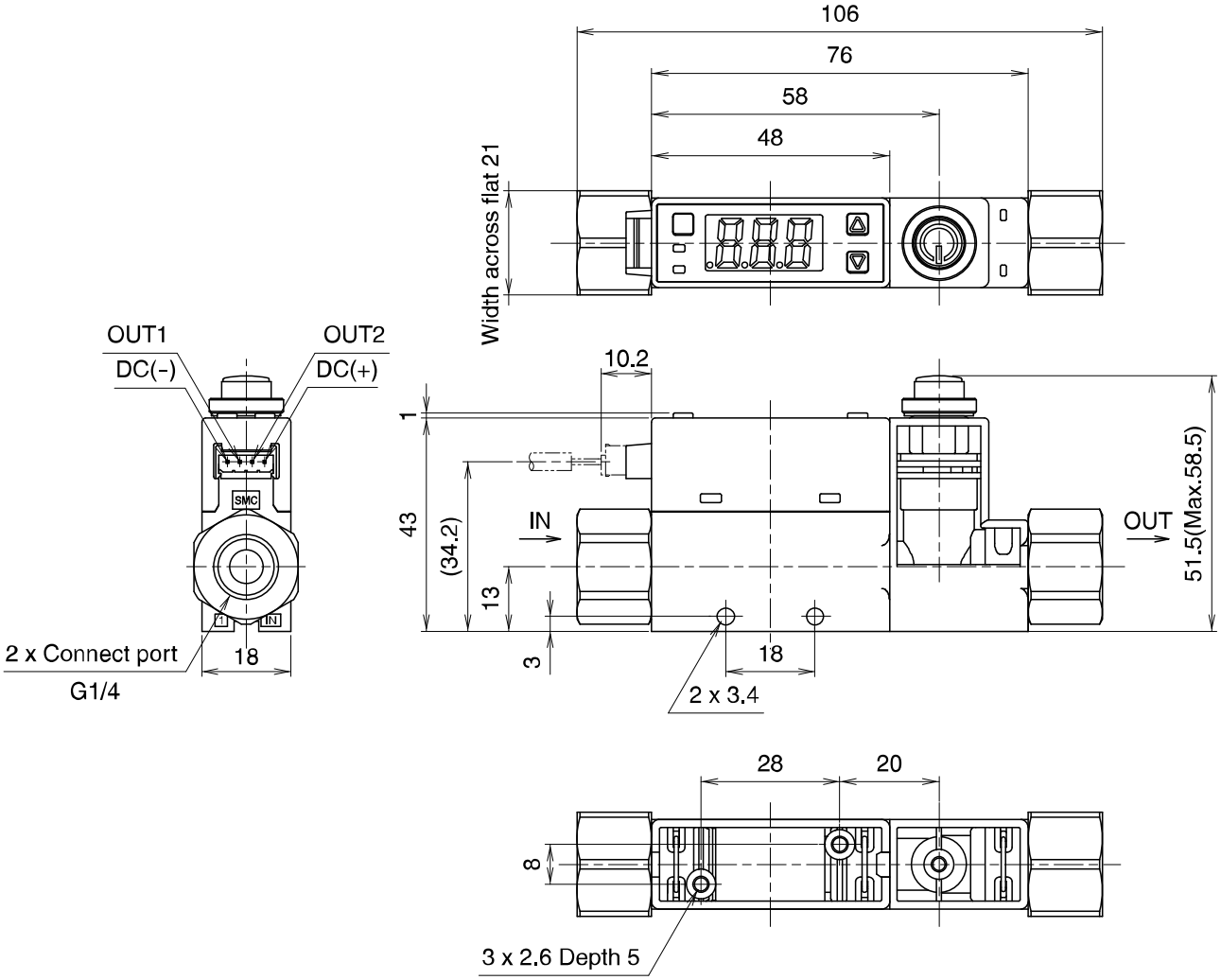
PFM7**-F02


78
48
Width across flat 21
OUT1
DC(-)
OUT2
DC(+)
10.2
1
43
(34.2)
13
3
IN
OUT
2 x Connect port
G1/4
18
18
2 x 3.4
28
8
2 x 2.6 Depth 5

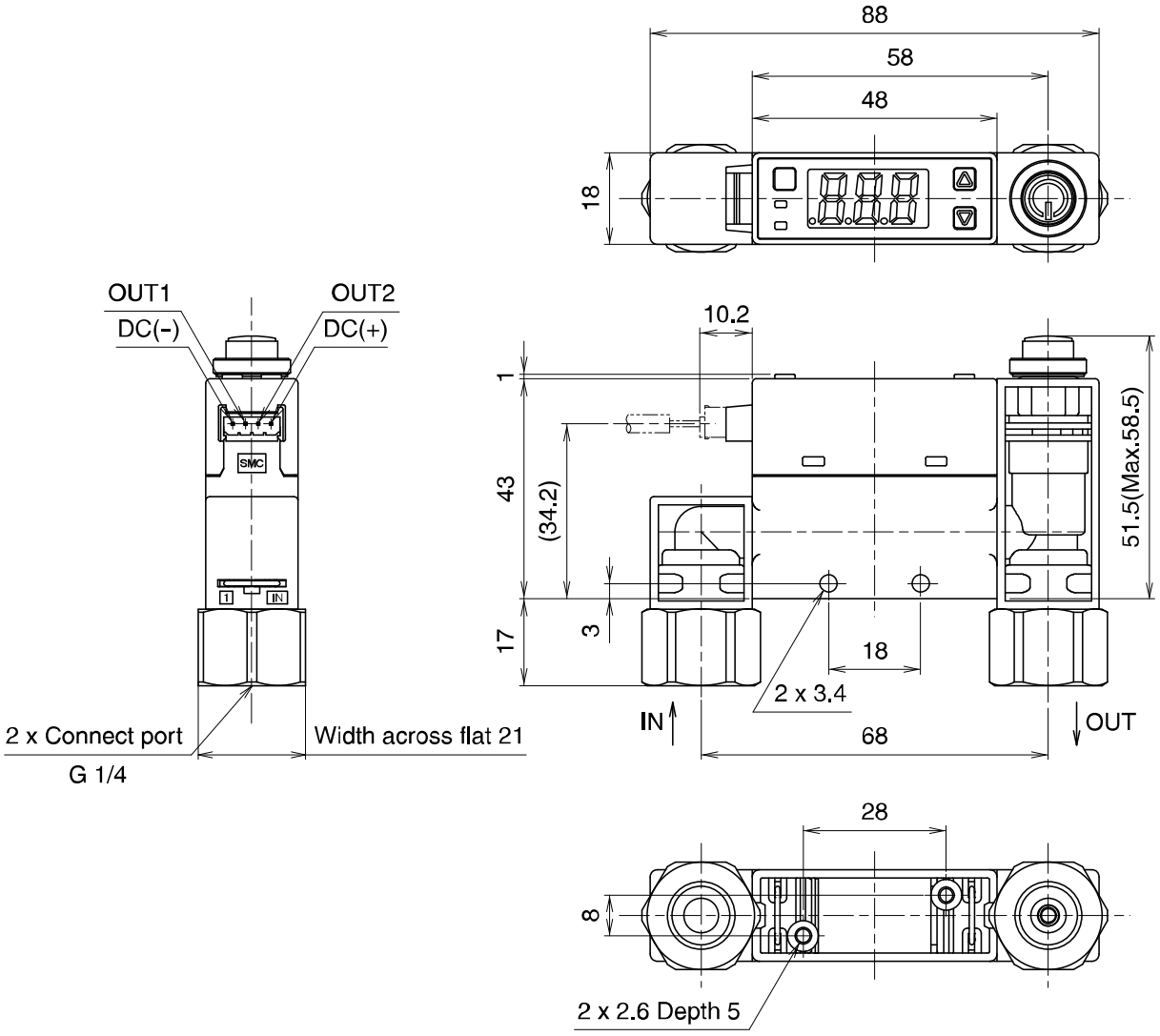
PFM7**-F02L


88
48
18
OUT1
DC(-)
OUT2
DC(+)
SMC
1
IN
2 x Connect port
G 1/4
Width across flat 21
10.2
1
43
(34.2)
17
3
18
2 x 3.4
IN
68
OUT
28
8
2 x 2.6 Depth 5

PFM7*S-F02

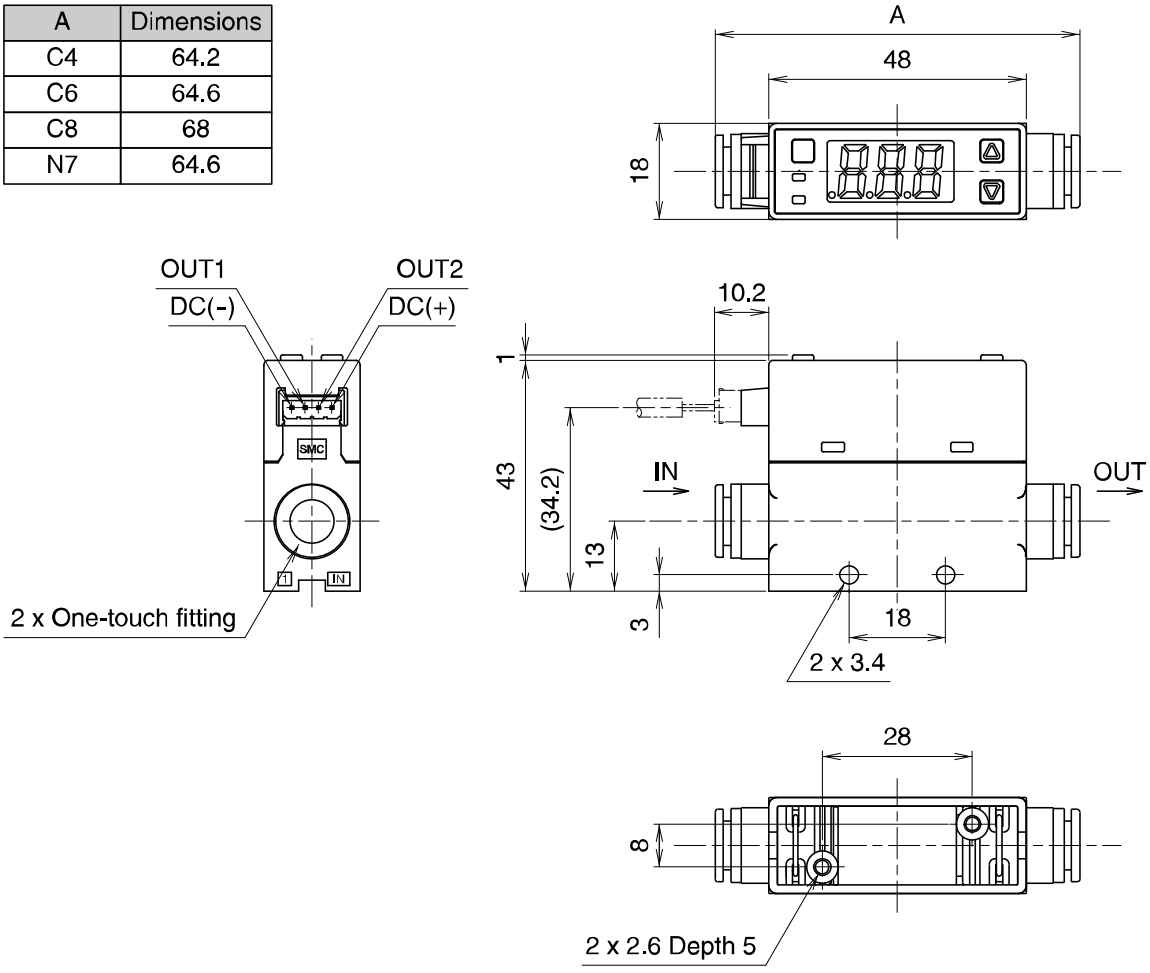

106
76
58
48
Width across flat 21
OUT1
DC(-)
OUT2
DC(+)
10.2
1
43
(34.2)
13
3
IN
OUT
51.5(Max.58.5)
2 x Connect port
G1/4
18
18
2 x 3.4
28
20
8
3 x 2.6 Depth 5

PFM7*S-F02L


88
58
48
18
OUT1
DC(-)
OUT2
DC(+)
SMC
1
IN
2 x Connect port
G 1/4
Width across flat 21
10.2
1
43
(34.2)
17
3
18
2 x 3.4
IN
68
OUT
51.5(Max.58.5)
28
8
2 x 2.6 Depth 5

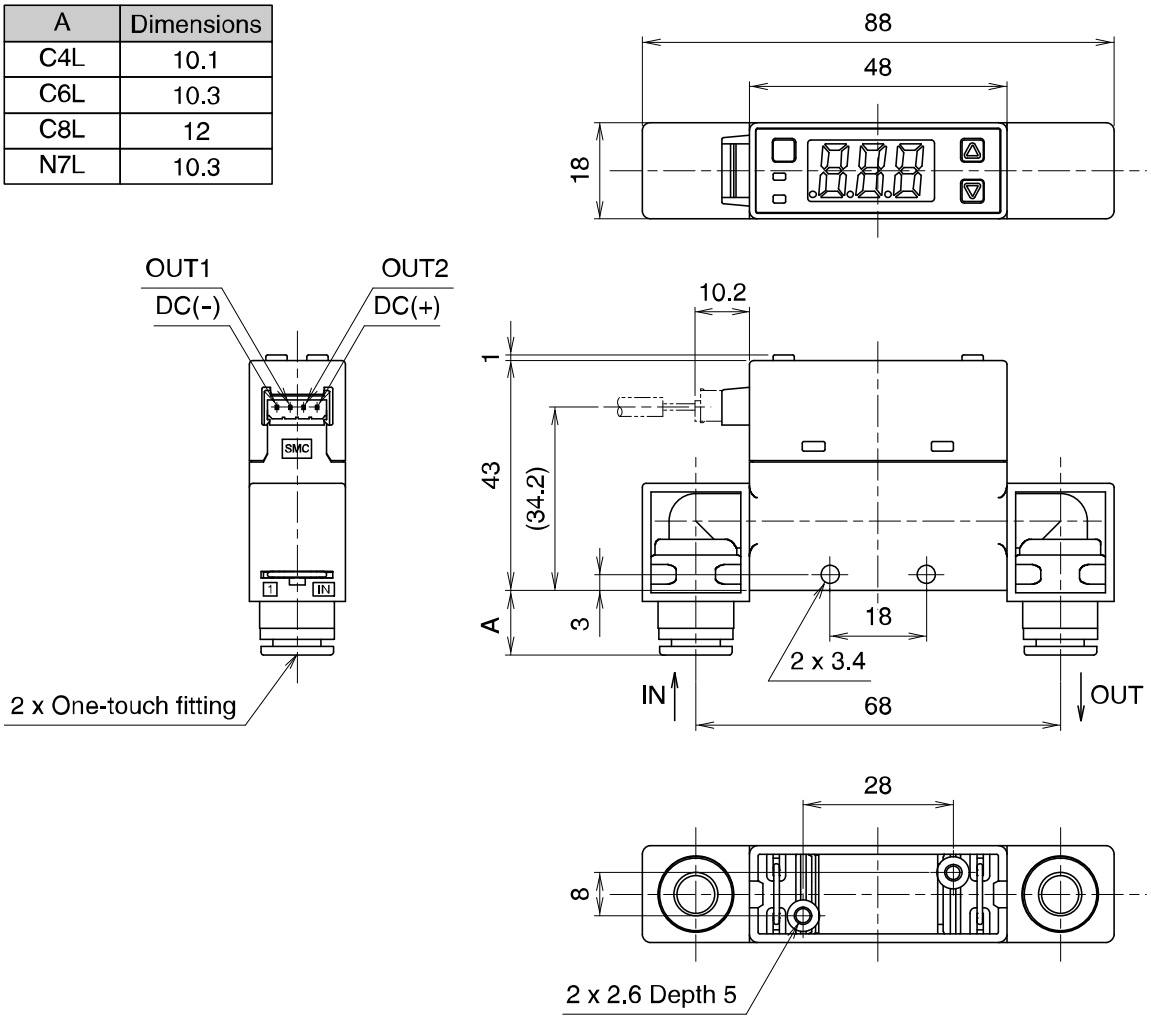
PFM7**-C4/C6/C8/N7

A	Dimensions
C4	64.2
C6	64.6
C8	68
N7	64.6



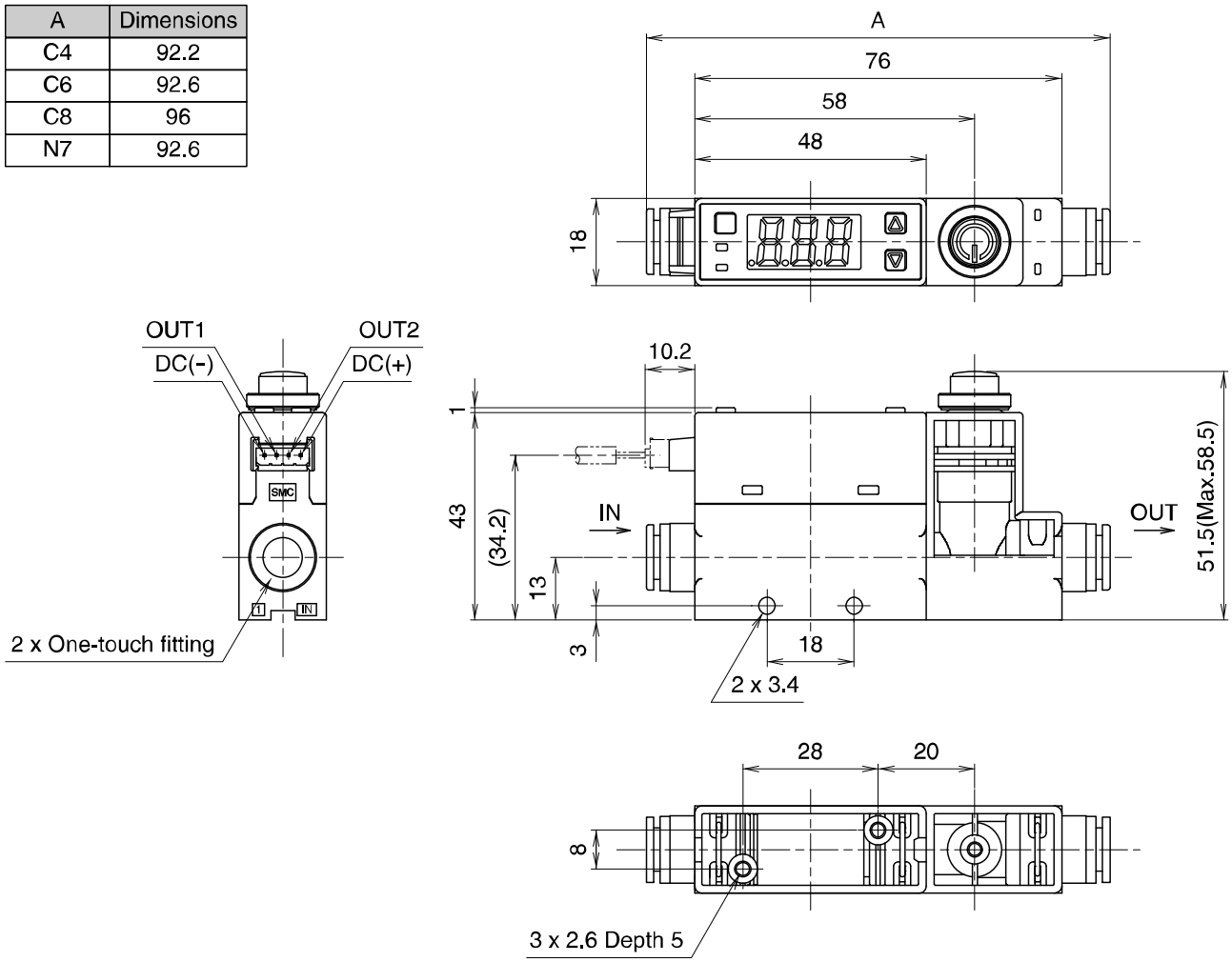
PFM7**-C4L/C6L/C8L/N7L

A	Dimensions
C4L	10.1
C6L	10.3
C8L	12
N7L	10.3



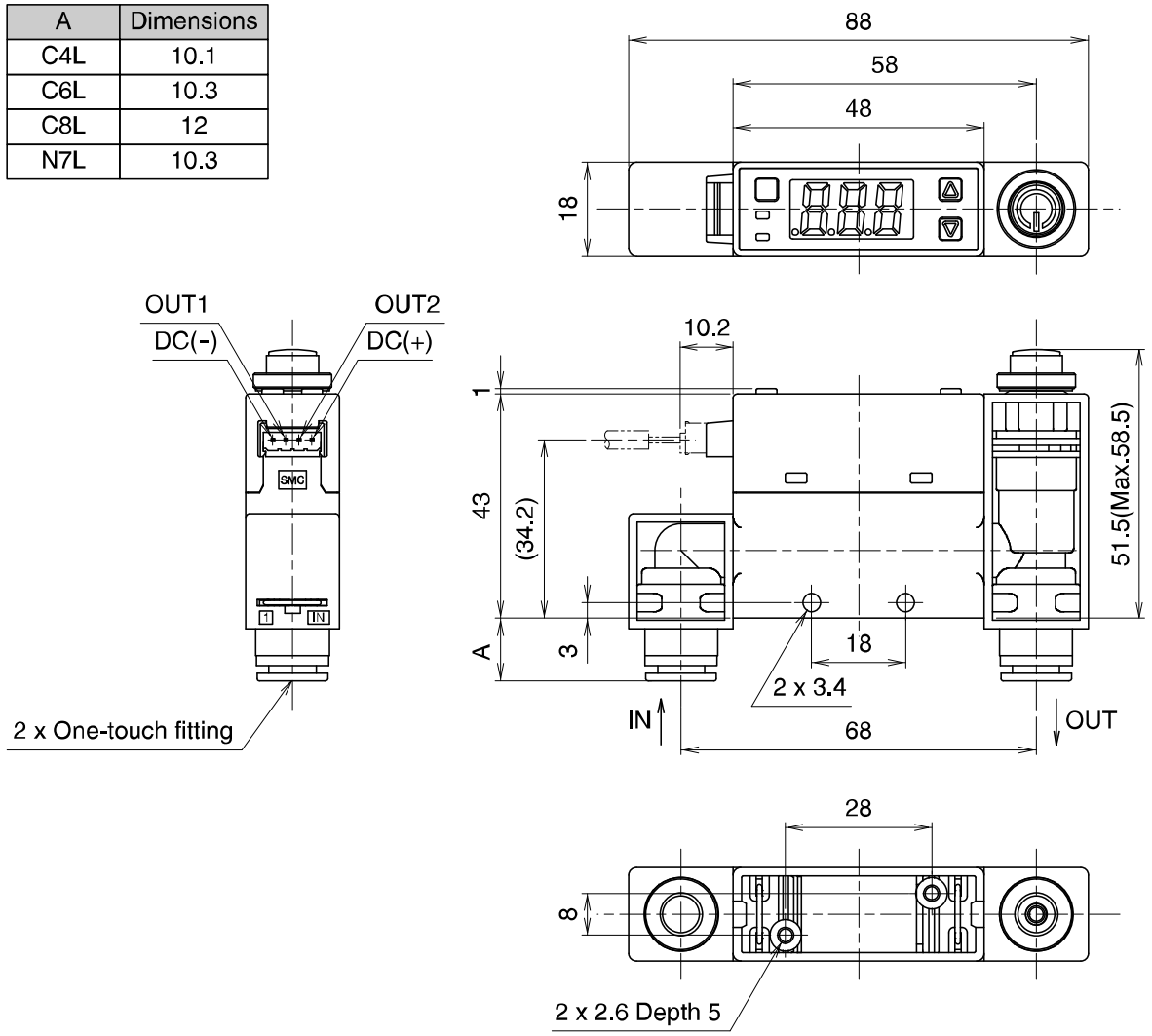
PFM7*S-C4/C6/C8/N7

A	Dimensions
C4	92.2
C6	92.6
C8	96
N7	92.6



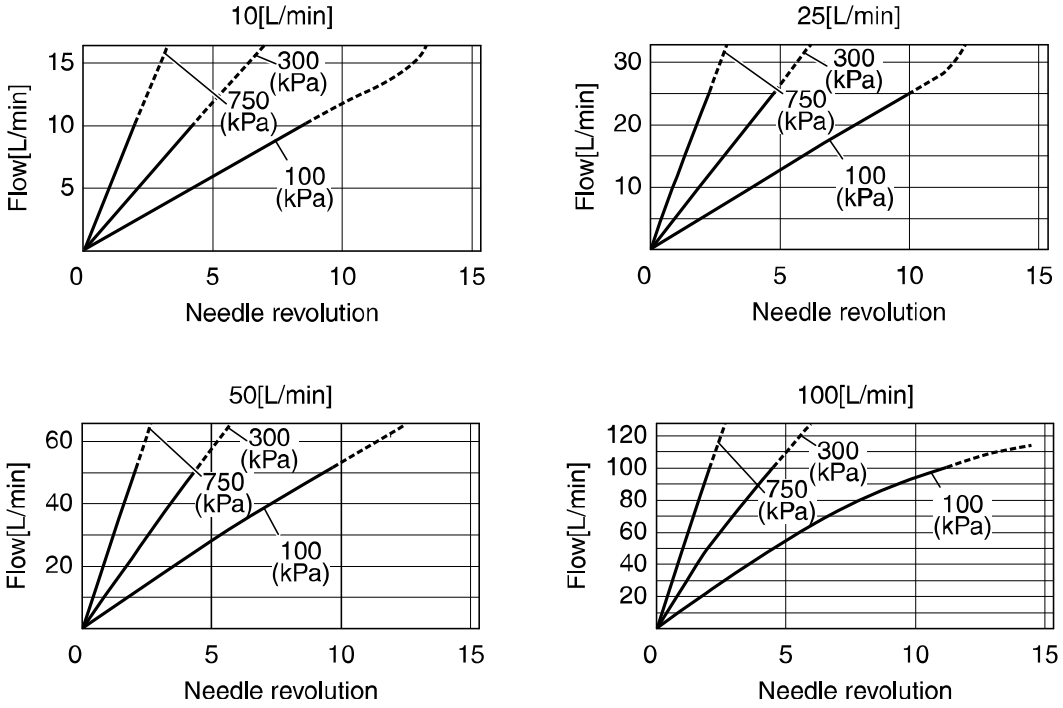
PFM7*S-C4L/C6L/C8L/N7L

A	Dimensions
C4L	10.1
C6L	10.3
C8L	12
N7L	10.3

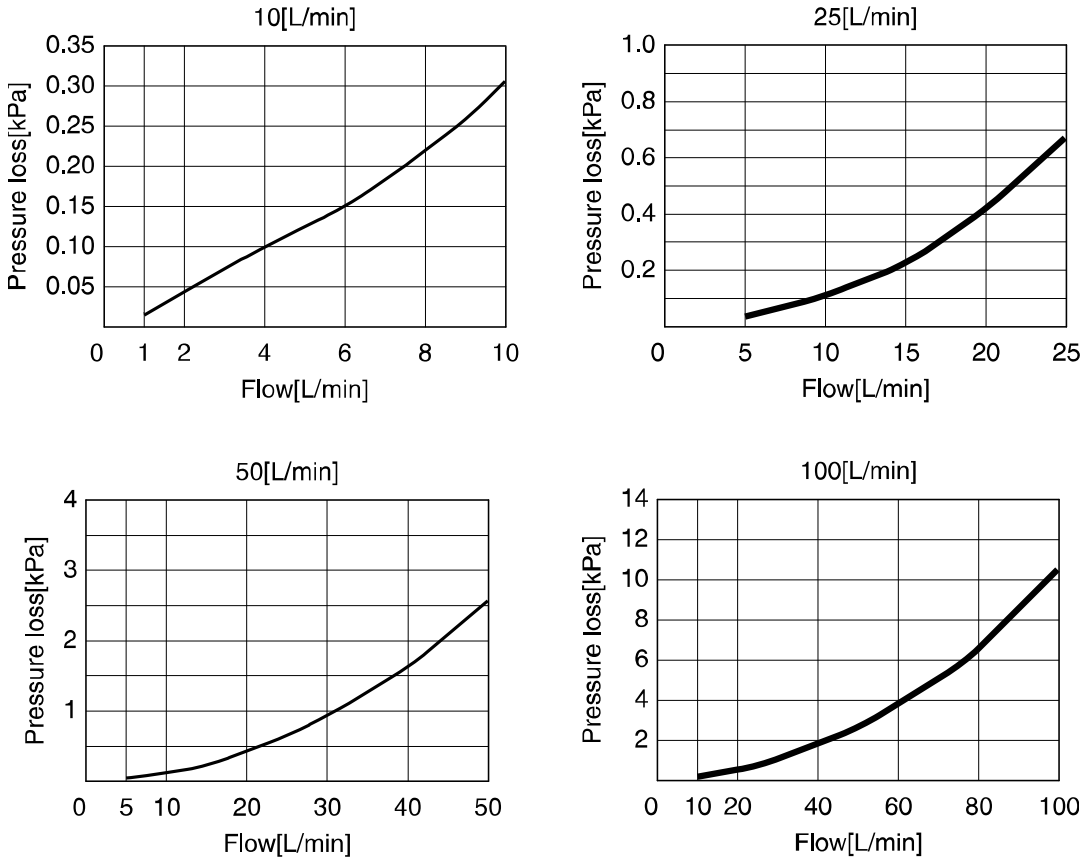


Characteristic data

●Needle revolution - Flow characteristics



●Pressure loss (at 350 [kPa])



Made to Order

●Combination of IN and OUT side piping direction

PFM7 □□ - □□ - □ - □□□ - X693

Type

Model	Content
7	Display integrated

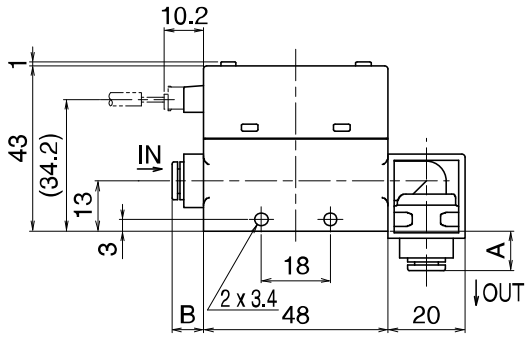
Piping direction
*: There is no symbol put.

See page 10 for how to order.

Piping direction combination

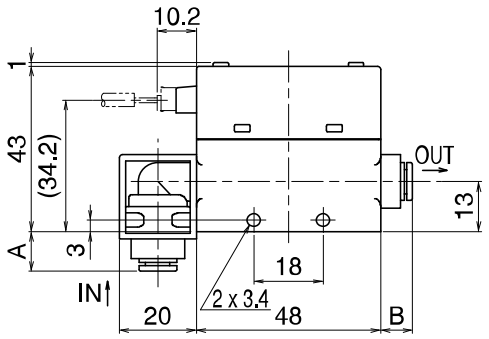
Model	Content
X693	IN side: Rear surface/OUT: Straight
X694	IN side: Straight/OUT: Rear surface

PFM7**-C4/C6/C8/N7-*-X693



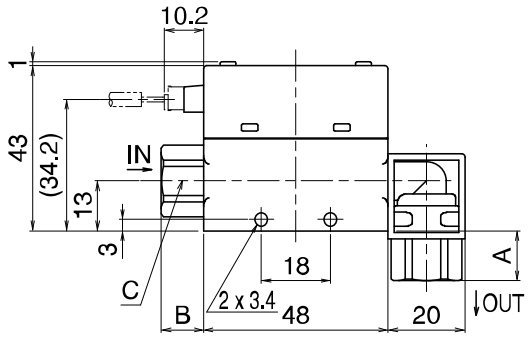
One-touch fitting		A	B
C4	φ4(5/32")	10.1	8.1
C6	φ6	10.3	8.3
C8	φ8(5/16")	12	10
N7	φ1/4	10.3	8.3

PFM7**-C4/C6/C8/N7-*-X694



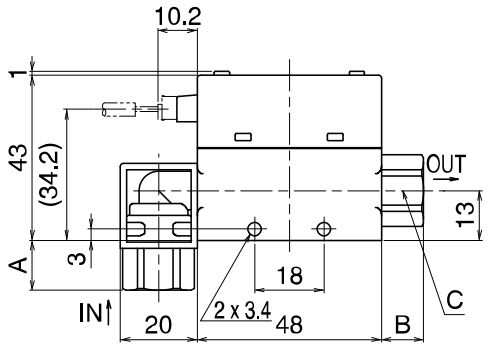
One-touch fitting		A	B
C4	φ4(5/32")	10.1	8.1
C6	φ6	10.3	8.3
C8	φ8(5/16")	12	10
N7	φ1/4	10.3	8.3

PFM7**-*01/02-*-X693



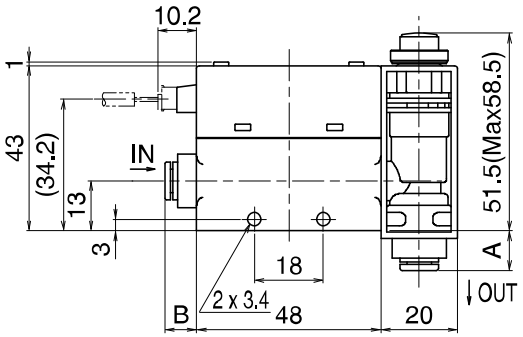
Connect port	A	B	C (Width across flat)
Rc 1/8・1/4 NPT 1/8・1/4 G 1/8	13	11	17
G 1/4	17	15	21

PFM7**-*01/02-*-X694



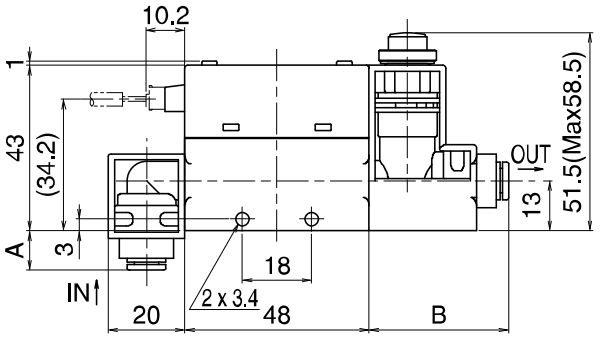
Connect port	A	B	C (Width across flat)
Rc 1/8・1/4 NPT 1/8・1/4 G 1/8	13	11	17
G 1/4	17	15	21

PFM7*S- C4/C6/C8/N7-*-X693



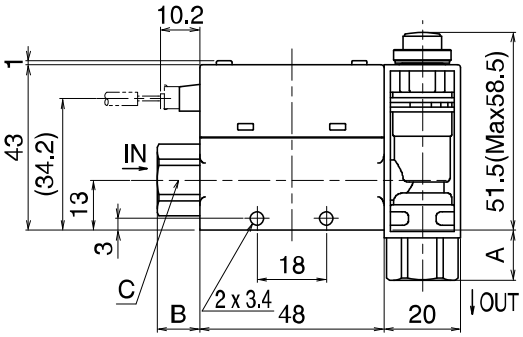
One-touch fitting		A	B
C4	ϕ4(5/32")	10.1	8.1
C6	ϕ6	10.3	8.3
C8	ϕ8(5/16")	12	10
N7	ϕ1/4	10.3	8.3

PFM7*S-C4/C6/C8/N7-*-X694



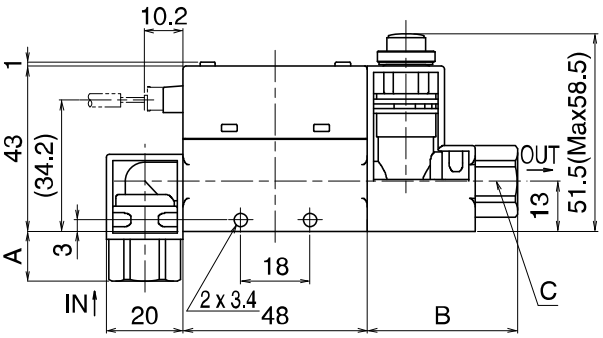
One-touch fitting		A	B
C4	ϕ4(5/32")	10.1	36.1
C6	ϕ6	10.3	36.3
C8	ϕ8(5/16")	12	37
N7	ϕ1/4	10.3	36.3

PFM7*S-*01/02-*-X693



Connect port	A	B	C (Width across flat)
Rc 1/8・1/4 NPT 1/8・1/4 G 1/8	13	11	17
G 1/4	17	15	21

PFM7*S-*01/02-*-X694



Connect port	A	B	C (Width across flat)
Rc 1/8・1/4 NPT 1/8・1/4 G 1/8	13	39	17
G 1/4	17	43	21

●For mixture gas of Argon (Ar) and carbon dioxide (CO_2)
Mixture ratio is selectable from Ar : CO2 = 92 : 8, 90 : 10, 80 : 20, 70 : 30, 60 : 40 by button operation.
External dimensions are the same as standard.

PFM7 □□ - □□ - □ - □□□ - X731

Type

Model	Content
7	Display integrated

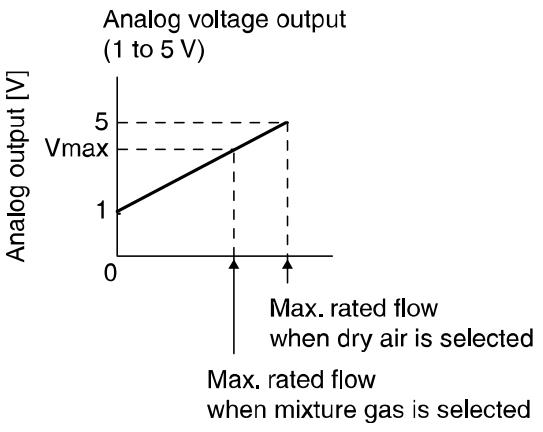
See page 10 for how to order.

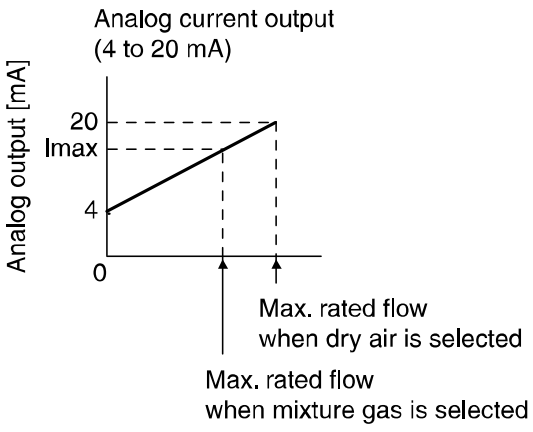
Mixture gas --- Rated flow range, possible display range, settable range, maximum analog output

Model	Ratio		Rated flow range	Possible display 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 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%					

Other specifications are the same as standard. See page 54.

Output characeteristic when mixture gas is selected.





●[F97] Setting of mixture gas

Mixture gas can be selected.

Mixture ratio of measured fluid can be selected depending on mixture gas setting.

Label	Set mixture gas type
92.8	Ar92%, $CO_2$8%
9.1	Ar90%, $CO_2$10%
8.2*1	Ar80%, $CO_2$20%
7.3	Ar70%, $CO_2$30%
6.4	Ar60%, $CO_2$40%
oFF	Other than mixture gas*2

*1: [8.2] is set at ex-factory.

*2: [F_3] Set (N_2), Ar (100%), CO_2 (100%) as an operating fluid.

<Operation>

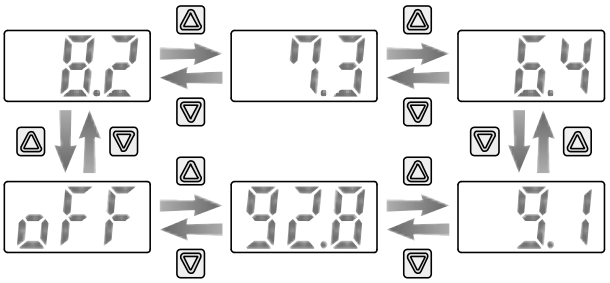
Press the ▲ or ▼ button at function selection mode to display [F97].

Press the S button ↓ Move on to Setting of mixture gas

Setting of mixture gas

Press the ▲ or ▼ button to select secret code input.

Displays in turn



Press the S button to set ↓ Return to function selection mode

Setting of [F97] Setting of mixture gas completed

Revision history

SMC Corporation

URL http://www.smcworld.com

No.PF##-OMJ0006