No.PF##-OMJ0018

Operation Manual

Flow Monitor

PRODUCT NAME

PFM3## 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.
Fire or an explosion can result.
This product is not designed to be explosion proof.

■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.

■NOTE

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

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

∗Product specifications

- The direct current power supply to combine should be UL approved as follows.
  Circuit (of class 2) which is of maximum 30Vrms (42.4 V peak) or less, with UL 1310 class 2 power supply unit or UL 1585 class 2 transformer.
  The Flow monitor is a UL approved product only if it has a UL mark on the body.
- Use the specified voltage.
  Otherwise failure or malfunction can result.
  Insufficient supply voltage may not drive a load due to a voltage drop inside the product.
  Verify the operating voltage of the load before use.
- Do not exceed the specified maximum allowable load.
  Otherwise it can cause damage or shorten the lifetime of the product.
- 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.)
- Reserve a space for maintenance.
  Allow sufficient space for maintenance when designing the system.

∗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 to 16.)
- 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 100 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.
- 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.

∗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 ouside 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.
- Design the system to prevent reverse current when the product is forced to operate for operational check.
  Depending on the circuit used, insulation may not be maintained when operation is forced, allowing reverse current to flow, which can cause malfunction and damage the product.
- Keep wiring as short as possible to prevent interference from electromagnetic noise and surge voltage.
  Do not use a cable longer than 10 m.
  Wire the DC (-) line (blue) as close as possible to the power supply.
- When analog output is used, install a noise filter (line noise filter, ferrite element, etc.) between the switch-mode power supply and this product.

∗Environment

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

Type

Model	Contents
3	Separate type monitor

Input specification

Model	Contents	Applicable model
0	Voltage input	PFM5□□(S)-□-1-□
1	Current input	PFM5□□(S)-□-2-□

Output specification

Model	Contents
0	NPN2 output + 1 to 5 V
1	NPN2 output + 4 to 20 mA
2	NPN2 output + External input*1
3	PNP2 output + 1 to 5 V
4	PNP2 output + 4 to 20 mA
5	PNP2 output + External input*1

*1: External reset auto-shift and auto-shift zero are selectable.

Unit specification

Model	Contents
Nil	Unit selection function*3
M	SI units 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

Option 1
(Refer to page10)

Option 2
(Refer to page10)

Option 3
(Refer to page11)

Operation manual

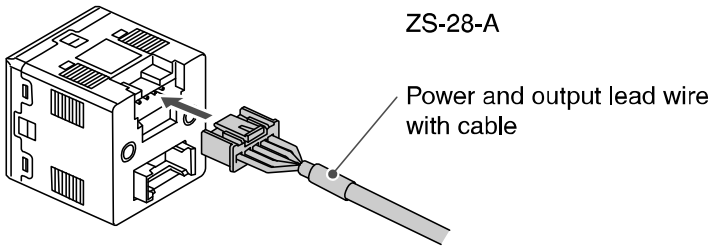
Model	Contents
Nil	With operation manual (Booklet: in Japanese and English)
N	Without operation manual

Proofreading certificate

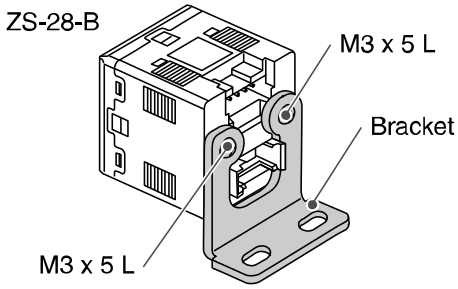
Model	Contents
Nil	Without proofreading certificate
A	With proofreading certificate*2

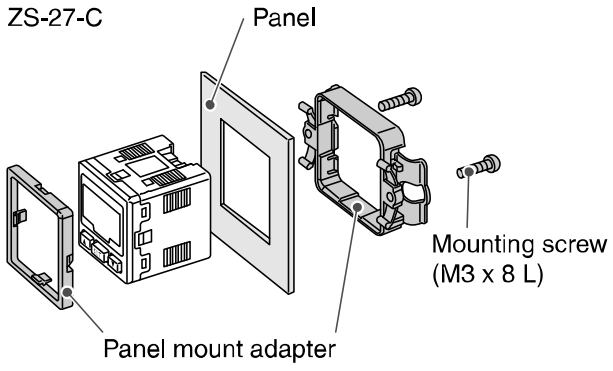
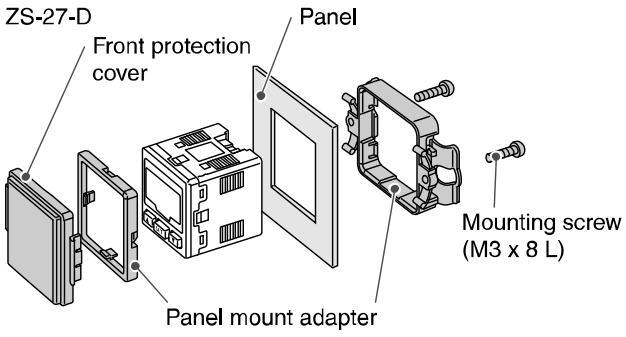
*2: Written in Japanese and English together. Other language is available as special request.

Option 1

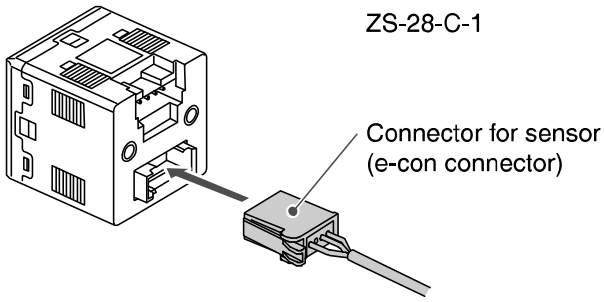
Nil	L
None	Power and output lead wire with cable 

Option 2

Nil	E
None	Bracket 

B	D
Panel mount adapter  	Panel mount adapter + Front protection cover 

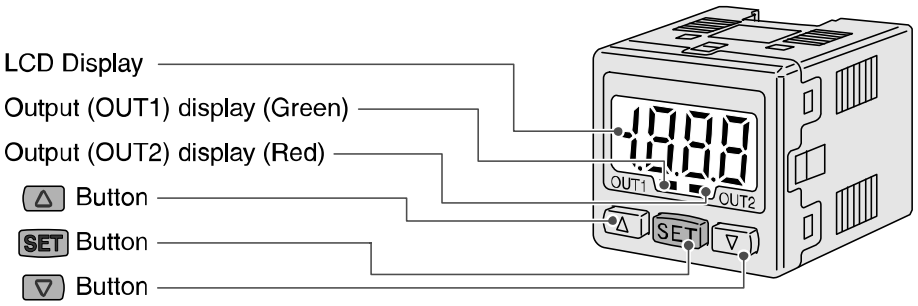
Option 3

Nil	F
None	Connector for sensor 

Part number for options

Model No.	Option	Remarks
ZS-28-A	Power and output lead wire with cable (2 m)	
ZS-28-B	Bracket	M3 x 5 L (2 pcs.)
ZS-28-C-1	Connector for sensor	1 pc.
ZS-27-C	Panel mount adapter	M3 x 8 L (2 pcs.)
ZS-27-D	Panel mount adapter + Front protection cover	M3 x 8 L (2 pcs.)
ZS-27-01	Front protection cover	

Names and Functions of Product



Output (OUT1) Display (Green): Light is on when output OUT1 is on.
Output (OUT2) Display (Red): Light is on when output OUT2 is on.
LCD Display: Displays the current status of flow, setting mode, selected indication unit and error code. Four display modes can be selected: display always in red or green only, or changing from green to red linked to the output.
△ Button: Selects the mode and increases the set ON/OFF value. Press this button to change to the peak display mode.
▽ Button: Selects the mode and decreases the set ON/OFF value. Press this button to change to the bottom display mode.
SET Button: Press this buttonto change to each mode and to select a set value.

■Definition and terminology

	Terminology	Definition
A	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.
	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.
	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.
	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	Detecting method	The physical principle used to measure flow.
	Display range	The range which can be displayed by the product with a digital display.
E	Enegy saving mode	The condition in which the numerical display turns off and current consumption is reduced.
H	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".
K	Key-lock function	This function prevents the set value from being changed by mishandling.

	Terminology	Definition
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 temp. range	Ambient temperature range in which product is operable.
R	Rated flow range	The flow range that can satisfy the specifications indicated in the catalog.
	Repeatability	Analog output repeatability when flow increases/decrease.
	Response time	Time for analog output reaches 90% of target voltage from when target flow is applied.
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 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

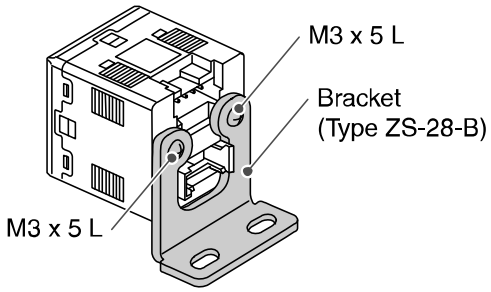
How to mount

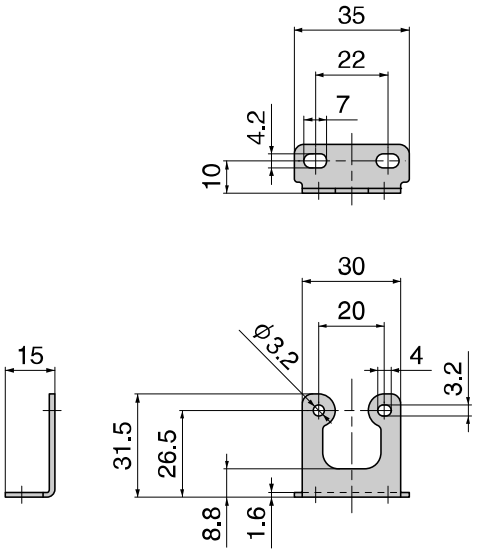
•Mount the optional bracket and panel mount adapter to the controller.

Mounting with bracket

•Fix the bracket to the controller with the set screws M3 x 5 L (2 pcs.) attached.

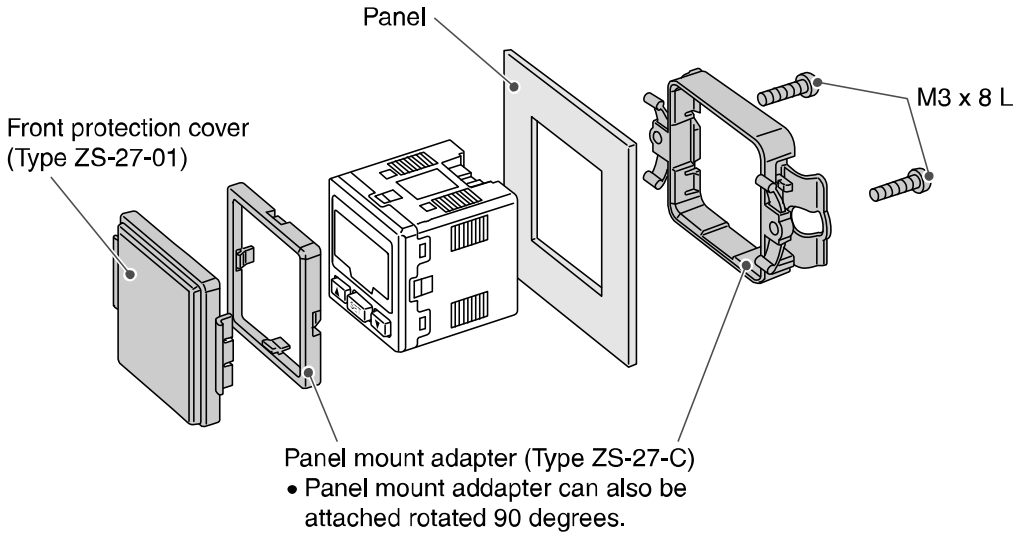
•The tightening torque must be 0.5 to 0.7Nm.





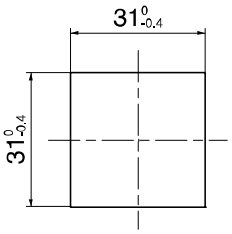
Mounting with panel mount adapter

•Fix the panel mount adapter to the controller with the set screws M3 x 8 L (2 pcs.) as attached.



Panel cut dimensions Panel thickness: 0.5 to 6 mm

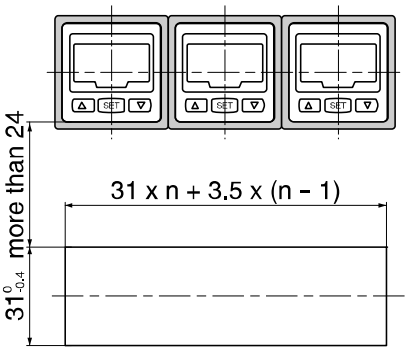
Separate



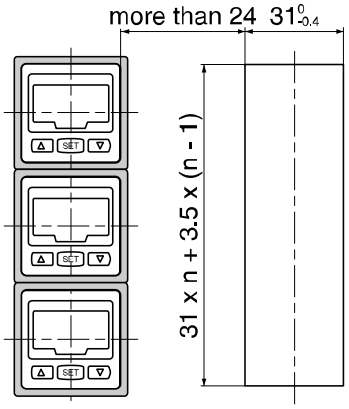
Corner: R2 or less

Two or more in row
n: The number of products

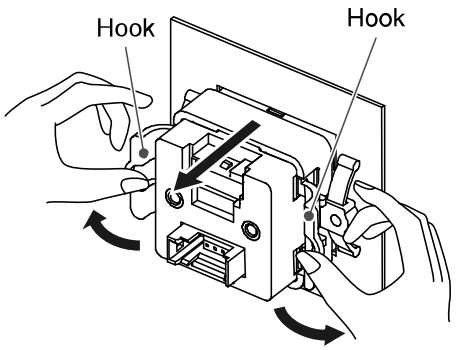
Horizontal



Vertical



Notice when removing the flow monitor
The flow monitor with adapter for panel mounting can be removed from facility by making hook of the product wide as illustration after removing two screws. The product and panel mount adapter may be damaged.



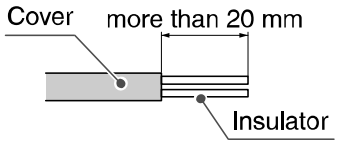
■Wiring

Connection

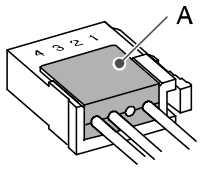
- Make connection after turning the power off.
- Install the lead wire separately from the route for power cable or high-voltage cable. Otherwise, malfunction may potentially result due to noise.
- Be sure to ground Terminal FG when using a switching regulator obtained on the commercial market. If analogue 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 product, or by using a series power supply instead of a switching regulator.

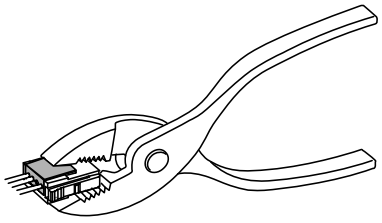
Attaching the connector to the lead wire

- Sensor wire is stripped as shown in the right figure.
- Do not cut the insulator.
- The core of the corresponding color shown in the following table is put into the pin of the number stamped on the connector for sensor connection to the back.



Pin no.	Wire color
1	Brown (DC+)
2	NC
3	Blue (DC-)
4	Black (IN (1 to 5 V))



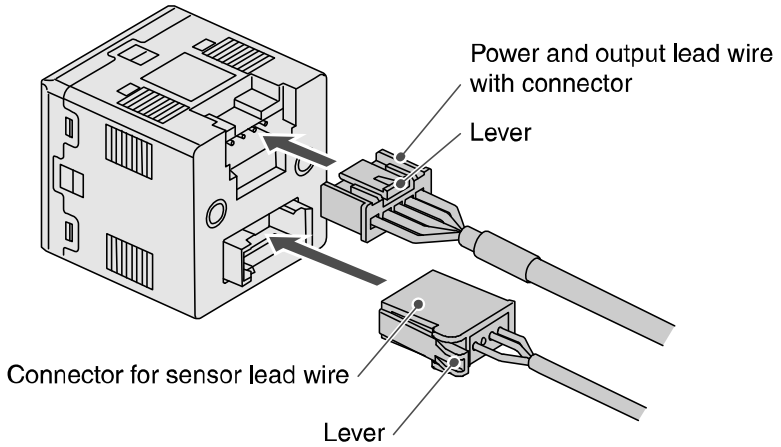


- It checks that the above-mentioned preparation work has been performed correctly, and A part shown in right figure is pushed by hand and makes temporary connection.
- A part center is straightly pushed in by tools, such as pliers.
- Re-use cannot be performed once it connects the connector for sensor connection completely. When you fail in the connection mistake of a core and a pin, or the plug of wire, please use the new connector for sensor connection.
- When the sensor is not connected correctly “LLL” or “HHH” can be displayed.

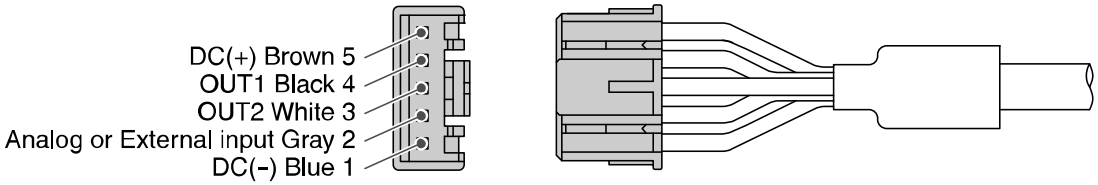
Connector

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 in the housing until connector clicks.
- 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.

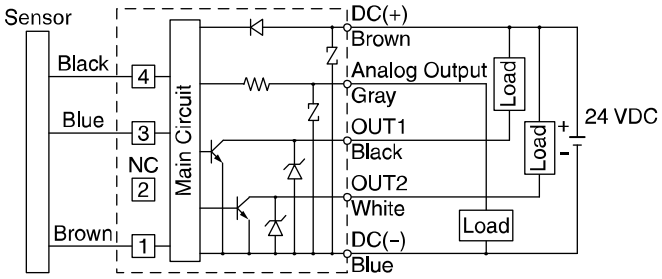


Pin no. of the connector for power and output lead wire

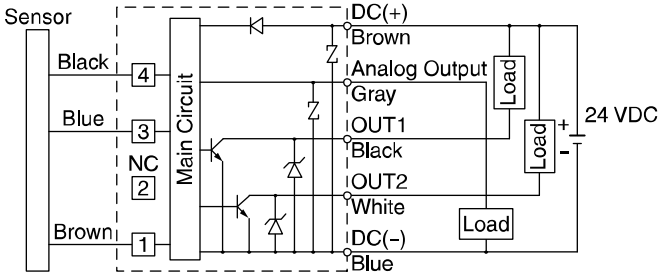


Internal circuit and wiring example
When the lead wire with SMC power and output lead wire (type ZS-28-A) is used, the colors of wire (Brown, Black, White, Gray, Blue) will apply as shown on circuit diagram.

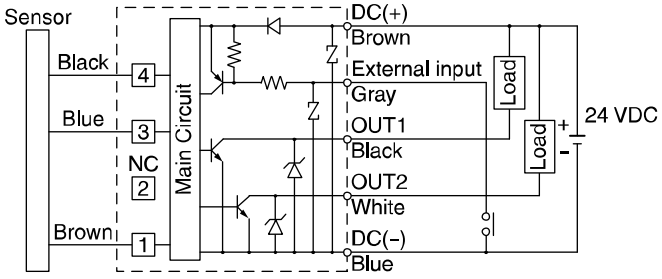
PFM3□0
NPN open collector output: 2 outputs
Max. 30 V, 80 mA
Residual voltage 1 V or less
Analog output: 1 to 5 V
Output impedance: Approx. 1 kΩ



PFM3□1
NPN open collector output: 2 outputs
Max. 30 V, 80 mA
Residual voltage 1 V or less
Analog output: 4 to 20 mA
Max. load impedance: 600 Ω (24 VDC)
Min. load impedance: 50 Ω

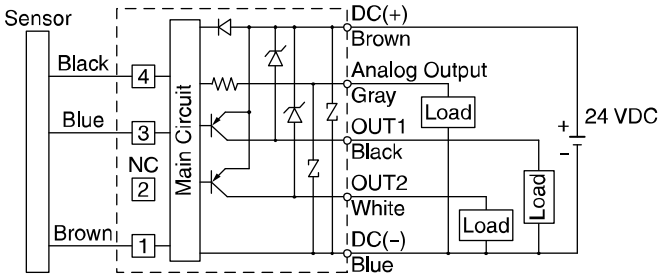


PFM3□2
External input
NPN open collector output: 2 outputs
Max. 30V, 80 mA
Residual voltage 1 V or less



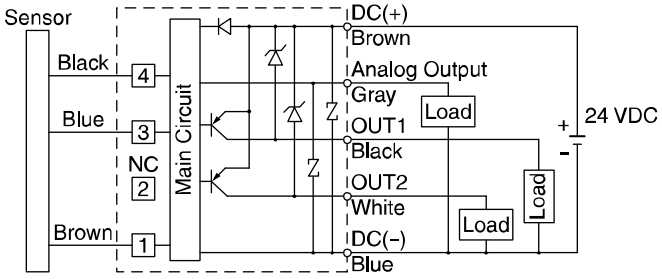
PFM3□3

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



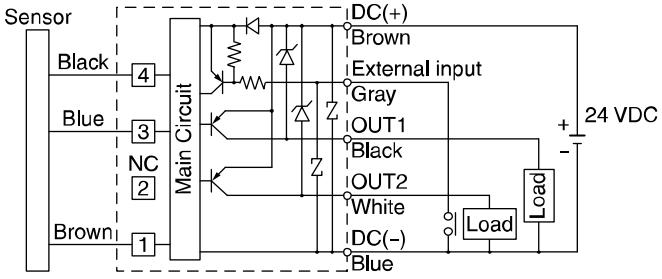
PFM3□4

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



PFM3□5

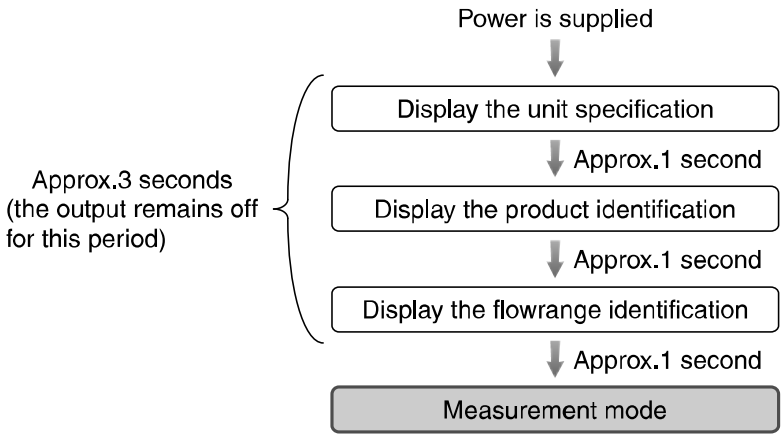
External input
PNP open collector output: 2 outputs
Max. 80 mA
Residual voltage 1 V or less



Flow Setting

What is measurement mode?

The measurement mode is the condition where the flow is detected and indicated, and the switch function is working. This is the basic mode where the setting change and other function settings are available as necessary.

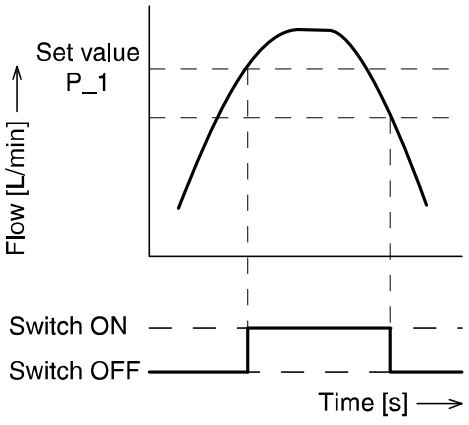


∗: The display will show [LLL] when the sensor is not connected.

Set ON point and OFF point of the switch.
Select connected sensor at initial setting.

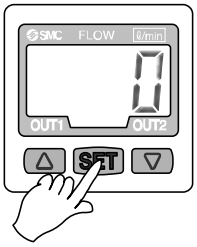
Switch operation

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 centre 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.



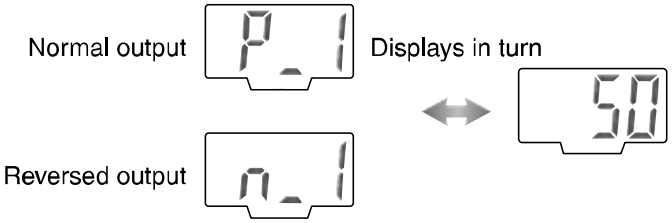
<How to perform> ∗: The flow monitor will also output during setting.

1. Press the SET button once in the measurement mode.



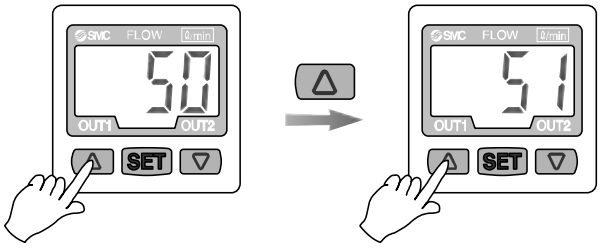
[LLL] is displayed during measurement mode when the sensor is not connected.

2. [P_1] or [n_1] and set value are displayed by turn.

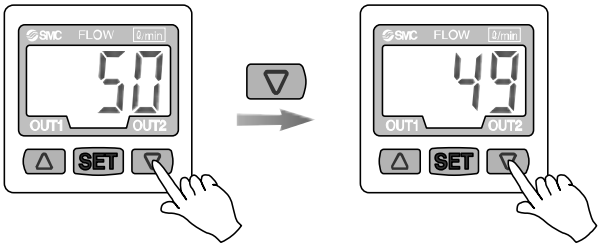


3. Press △ the or ▽ button to change the set value.
The △ button is for increase and the ▽ button is for decrease.

•Press the △ button once to increase by one figure and press it continuously to keep set figure increased.



•Press the ▽ button once to decrease by one figure and press it continuously to keep set figure decreased.



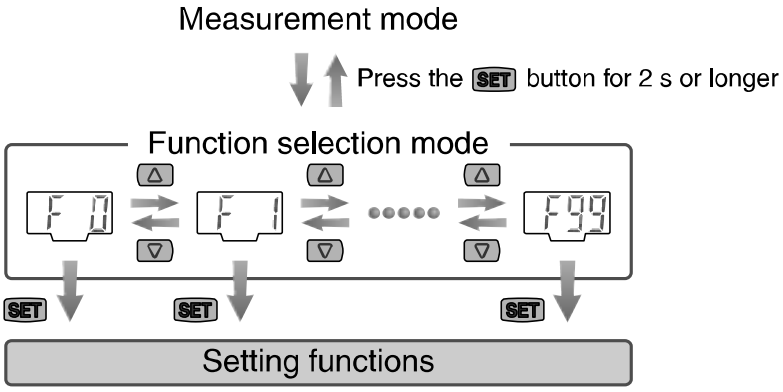
4. Press the SET button to finish the setting of OUT1.
   [P_2] is displayed to continue with settings for OUT2 as above.

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

In measurement mode, press the SET button for 2 seconds or longer to display [F 0].
Display [F□□], and point the mode to change the setting of each function.
Press the SET button for 2 seconds or longer at function selection mode to return to measurement mode.



■Setting at the shipment from a factory

At the time of shipment, the settings are performed as follows. Be sure to select the connected sensor before use. For other items, keep their values for use if acceptable.

Caution for handling

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

●[F 0] Unit selection function →See page 26 (At the time of shipment from the factory: 10 L/min)

●[F 1] Operation of OUT1→See page 27

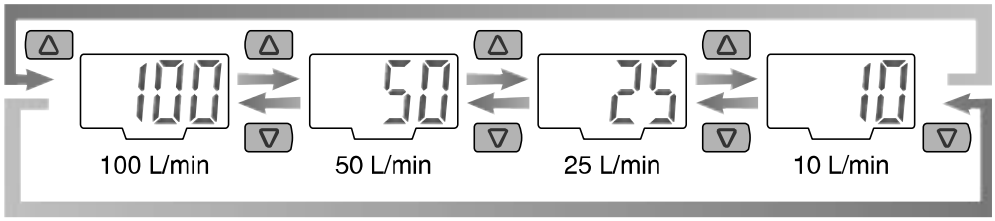
Item	Explanation	Default setting
Output mode	Select output for instantaneous flow (hysteresis mode, window comparator mode) accumulated flow or accumulated pulse.	Hysteresis mode
Reversed output	To select reversed output.	Normal output
Flow setting	To set ON point or OFF point of the switch output.	Medium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

●[F 2] Operation of OUT2→See page 30
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 30	Dry air, N_2
[F 4] Display unit selection	See page 31	Standard condition (ANR)
[F 5] Setting of response time	See page 32	1 second
[F 6] Select display mode	See page 33	Instantaneous flow
[F 7] External input	See page 34	Integrated value external reset
[F 8] Select display resolution	See page 37	100-split
[F 9] Set auto preset	See page 38	Manual
[F10] Hold accumulated value	See page 40	OFF
[F11] Select analog output filter	See page 41	ON
[F12] Select power saving mode	See page 42	OFF
[F13] Set security code input	See page 43	OFF

Initial setting
[F 0] Select connected sensor
The range of the flow sensor to be connected is selectable.
When the product with its unit can be changed is used, select the flow range first, and set the unit change function.

Select the flow range and press the SET button.



Press the SET button to set.

When unit changeable type is used
Move on to unit selection function (to be continued)

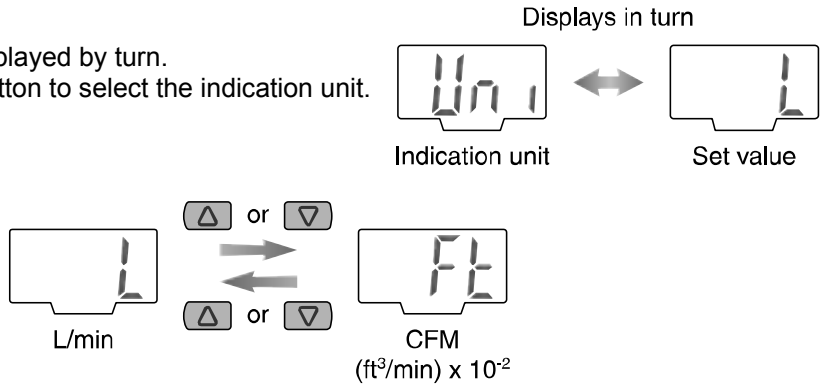
Initial setting completed

■[F 0] Unit selection function

Be sure to select a sensor to be connected before use.
In measurement mode, when the SET button is pressed for 2 seconds or longer, [F 0] is displayed on the screen.

Select Indication unit

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



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

Setting of [F 0] Unit selection function completed

If the range of connected flow sensor is changed by initial setting, accumulated value (incl. set value), peak-bottom value, and zero clear function are reset to their ex-factory condition.

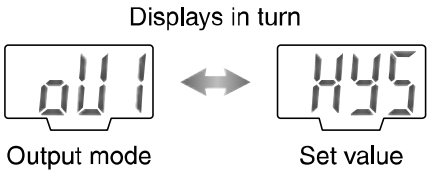
■[F 1] Operation of OUT1

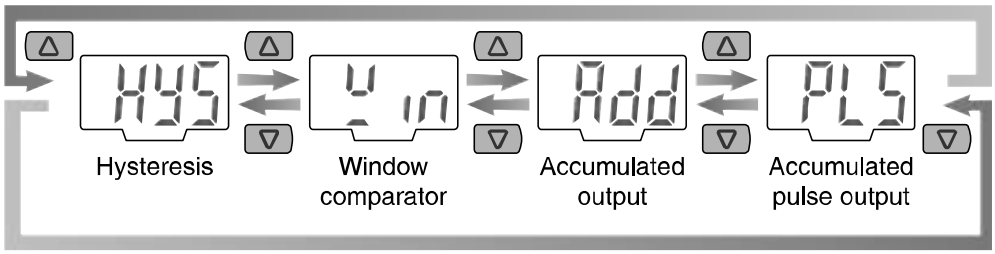
Set output method of OUT1.
Output turns on when the flow exceeds the set value. Set value is the medium value of set flow range specified for each product. Display color depends on OUT1 output condition.
In the default setting, green lights when output is turned on. Red lights when output turned off.

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

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

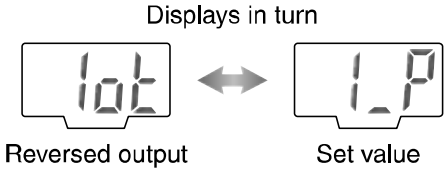
Select output mode
[oU1] and set value are displayed by turn.
Press the △ or ▽ button to select output mode.

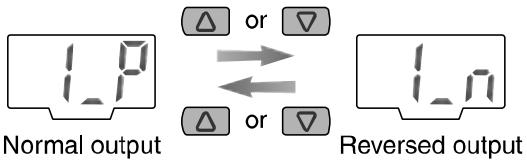




Press the SET button to set. ↓ Move on to select reversed output.

Select reversed output
[1ot] and set value are displayed by turn.
Press the △ or ▽ button to select reversed output.



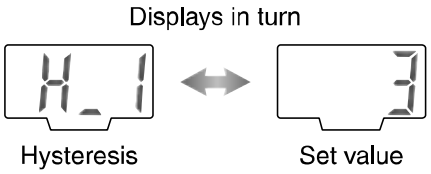


Press the SET button to set. ↓ Move on to flow setting (to be continued).

Flow setting
Set flow based on setting procedure on page 28.
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 SET button to set. ⇩ Move on to hysteresis change.

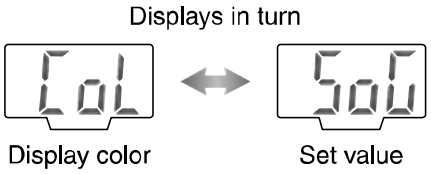
Hysteresis change
[H_1] and set value are displayed by turn.
Press the △ or ▽ button to select hysteresis.

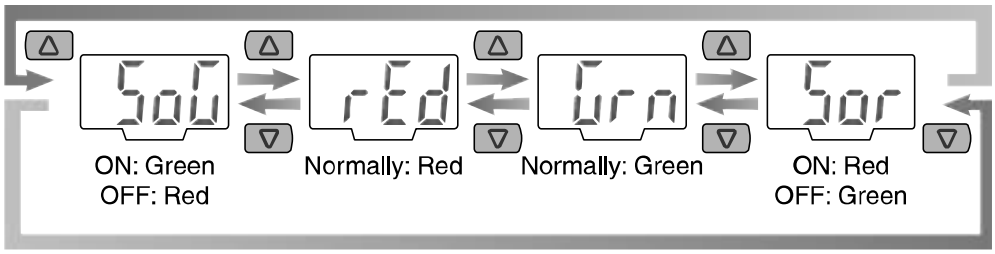


This process is omitted for accumulated output mode, accumulated pulse output mode.

Press the SET 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.

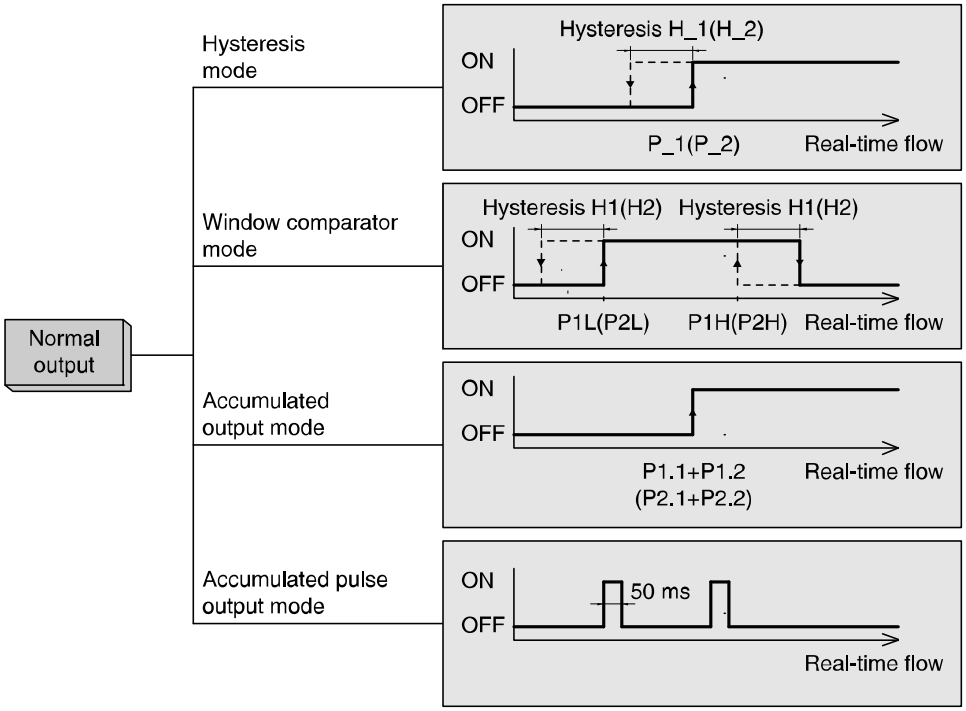


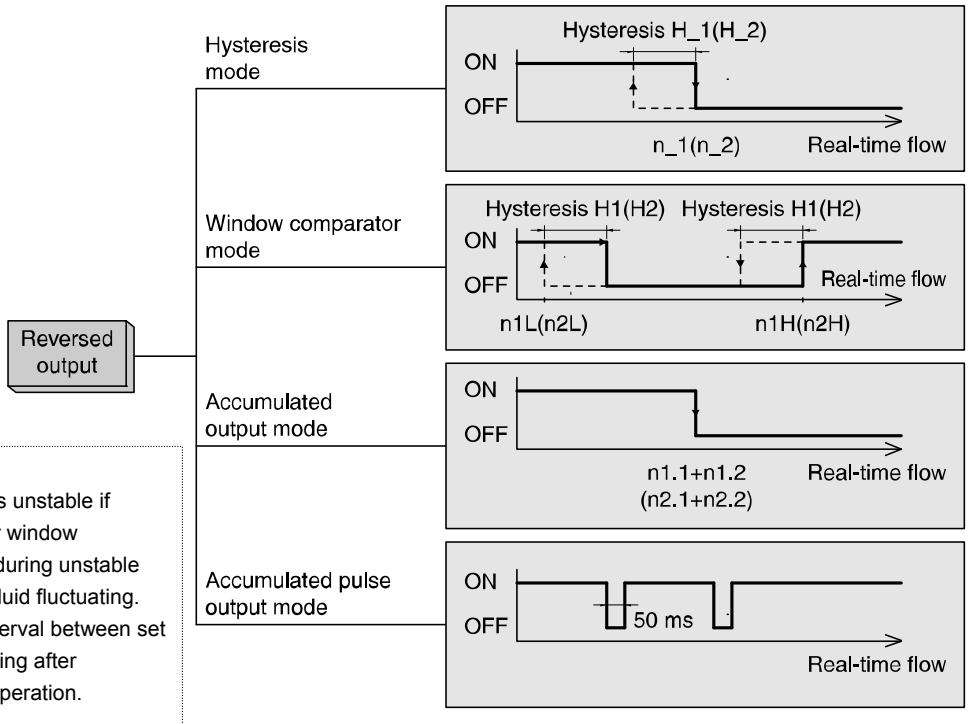


Press the SET button to set. ⇩ Return to function selection mode.

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 SET button. ↓ Move on to output mode selection.

Set based on [F 1] operation of OUT1 (page26 to 28)

■[F 3] Select operating fluid

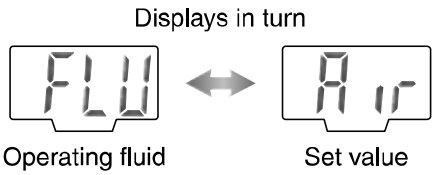
PFM is supposed to use with dry air or N_2. Setting change is necessary when Argon (Ar) or carbon dioxide (CO_2) is used.

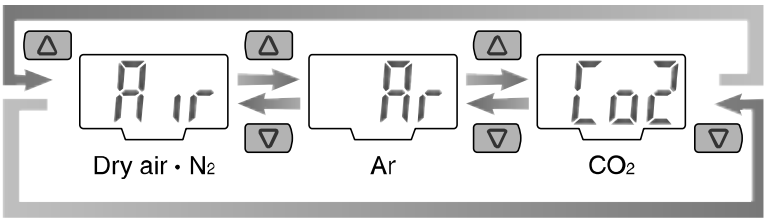
∗: When CO_2 is selected, the upper limit of measurement flow range becomes half of other fluids.

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

Press the SET 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.





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

Setting of [F 3] operating 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>

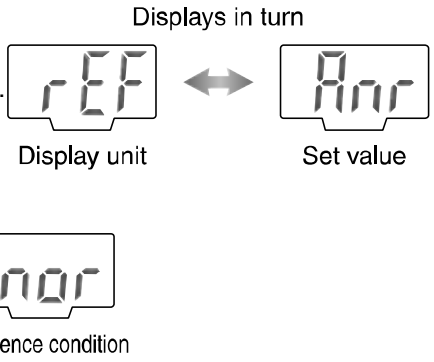
Press the △ or ▽ button at function selection mode to display [F 4].

Press the SET 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 SET 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>

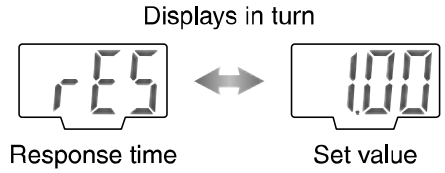
Press the △ or ▽ button at function selection mode to display [F 5].

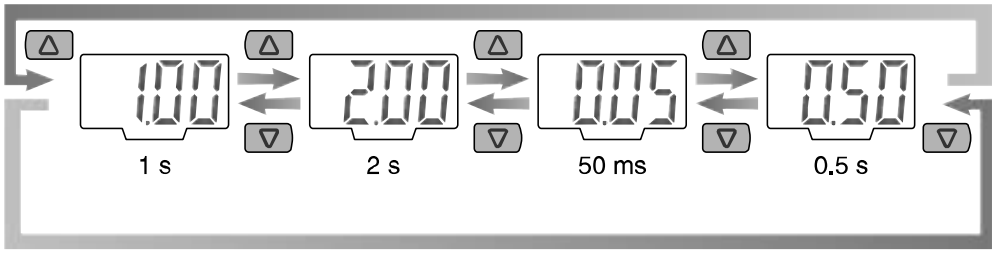
Press the SET button. ↓ Move on to setting of response time.

Setting of response time

[rES] and set value are displayed by turn.

Press the △ or ▽ button to select response time.





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

Setting of [F 5] Response time completed

■[F 6] Select display mode

Select instantaneous flow or accumulated flow.

<Operation>

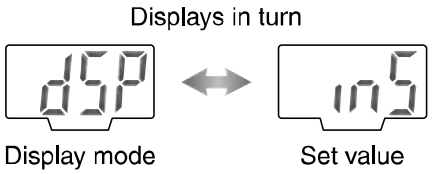
Press the △ or ▽ button at function selection mode to display [F 6].

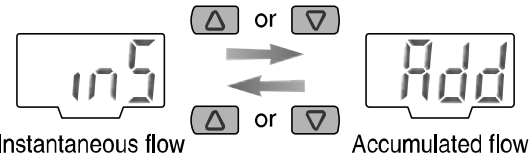
Press the SET button. ↓ Move on to select display mode.

Select display mode

[dSP] and set value are displayed by turn.

Press the △ or ▽ button to select display mode.





Press the SET 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 1999999, normaly lower 3 digits are displayed.
Press the △ button to check upper digits. Upper digits are displayed while the △ 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)

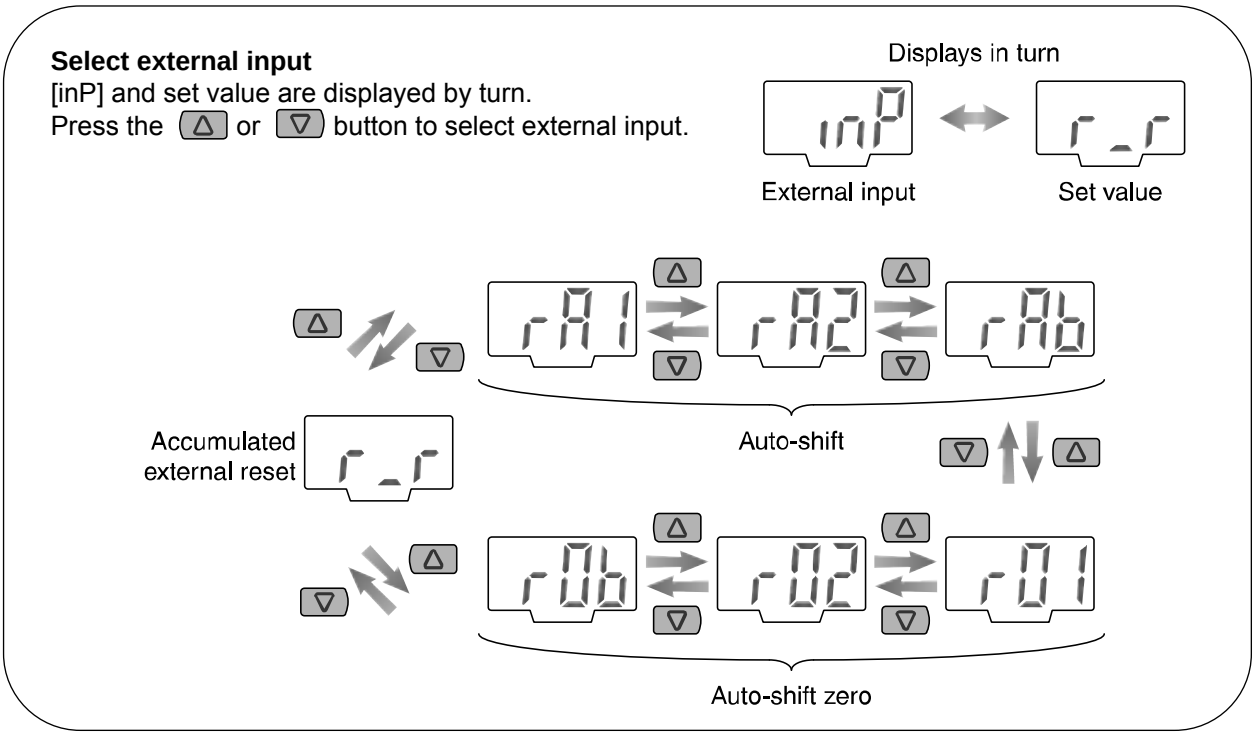
External reset: When the input signal is applied, accumulated value is reset at "0".
Auto-shift: Function to perform output to relative change referring the instantaneous flow when signal is input.
Auto-shift zero: Function to perform output to relative change and clear the display value as zero referring the instantaneous flow when signal is input.

∗: PFM without external input function displays [---] and the function can not be set.
The flow and the set value on the negative side is relatively indicated by blinking the leftmost decimal point.

<Operation>
Press the △ or ▽ button at function selection mode to display [F 7].

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

Setting of [F 7] External input completed

[rA1] or [r01]: Only OUT1 is valid
[rA2] or [r02]: Only OUT2 is valid
[rAb] or [r0b]: Both OUT1, OUT2 are valid

●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.

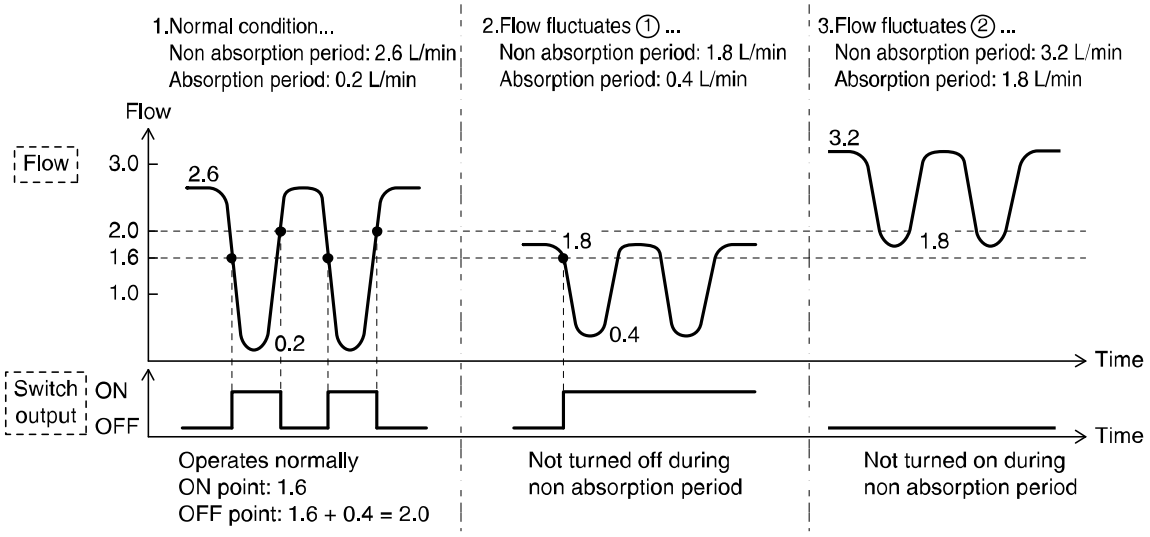
See Operation example below.

<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 in not used

Product: Flow sensor ··· PFM510, Flow monitor (PFM3) 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 in used

Flow sensor ··· PFM510, Flow monitor (PFM3) switch set value: n_1=−1.0, H_1=0.4 (Revers 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)

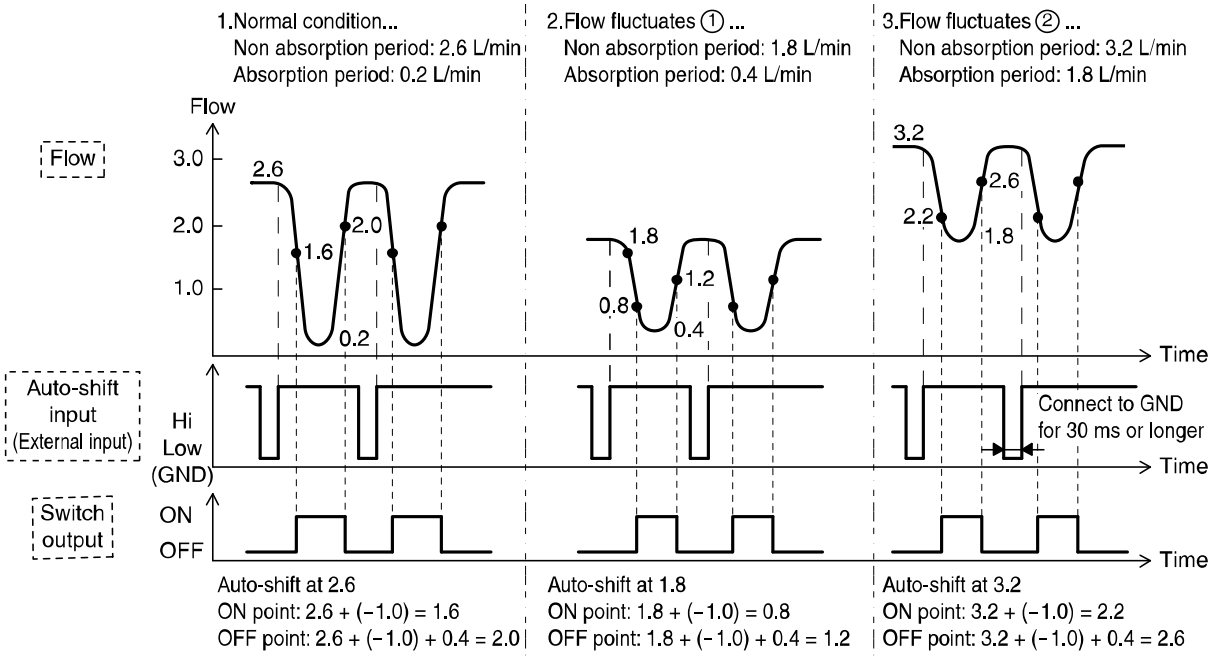


Table below shows the example of the flow display when auto-shift zero is selected.
Here, takes normal condition as an example.

•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

*: As for the flow on the negative side, the leftmost decimal point is blinked to show that it is a "–" value.

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.	PFM510	PFM525	PFM550	PFM511
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

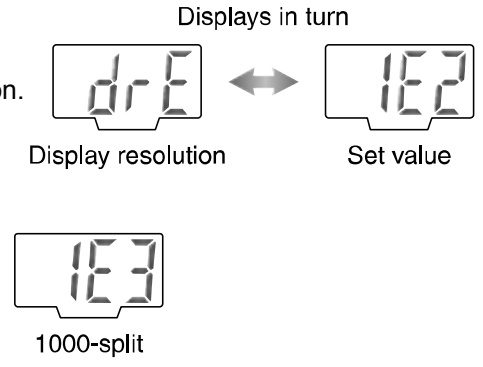
Available for PFM511, 510 series.
Flow increment display for PFM511 series is by 1 L/min, 0.1 L/min. for PFM510 series.

*: When the series other than PFM511, 510 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 SET 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 SET button to set. ↓ Return to function selection mode.

Setting of [F 8] Display resolution completed

■[F 9] Set auto preset

This function is capable of calculating the specified set value automatically based on the on-going operation.

<Operation>

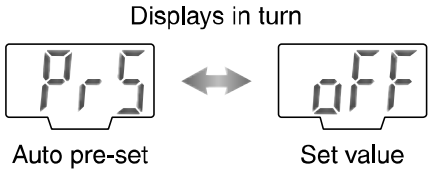
Press the △ or ▽ button at function selection mode to display [F 9].

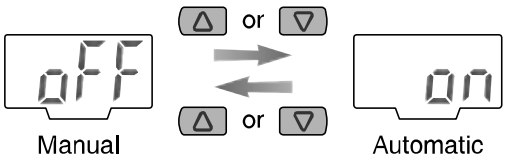
Press the SET button. ↓ Move on to set auto preset.

Set auto preset

[PrS] and set value are displayed by turn.

Press the △ or ▽ button to select auto preset.





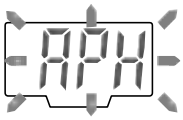
Press the SET button to set ↓ Return to function selection mode

Setting of [F 9] Auto preset completed

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

([APW] in case of window comparator mode)

Press the 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 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 button and perform fine adjustment of set value.

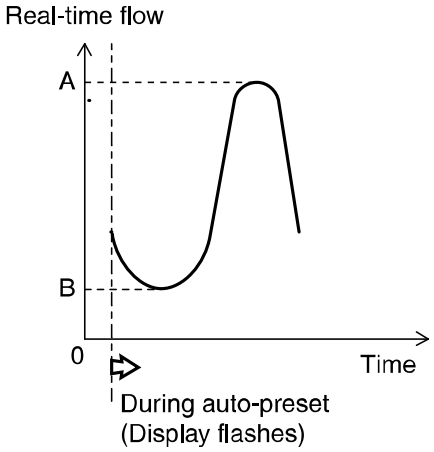
●Switch set value during auto preset function mode

Auto preset is capable of calculating the specified set value automatically based on the on-going operation. If the button is pressed during measurement mode after auto pre-set 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				

Display flashes if the 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 button. Then, auto preset mode is completed and returns to measurement mode.

Set value of auto pre-set mode is as follows.

•Auto pre-set 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 output mode list for the operation of hysteresis mode and window comparator mode.

■[F10] Hold accumulated value

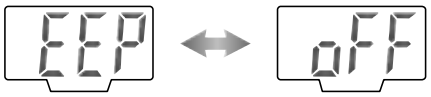
Initial setting is to clear accumulated value when the power supply is turned off.
It can be set so that the accumulated value is memorized every 2 minutes or 5 minutes.
The life of memory element is 1 million times of access.
If the flow switch is used 24 hours a day, the life will be,
Every 5 minutes to memorize ··· 5 minutes x 1 million times = 5 million minutes = 9.5 years
Every 2 minutes to memorize ··· 2 minutes x 1 million times = 2 million minutes = 3.8 years

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

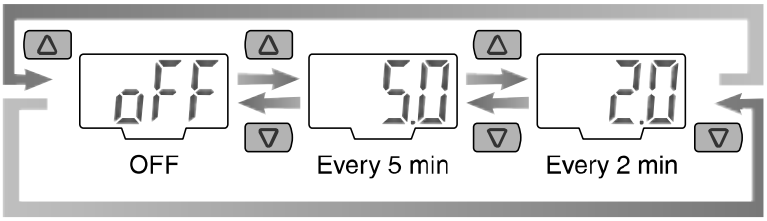
Press the SET button ↓ Move on to hold accumulated value

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

Displays in turn



Hold accumulated value　　Set value



Press the SET 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>

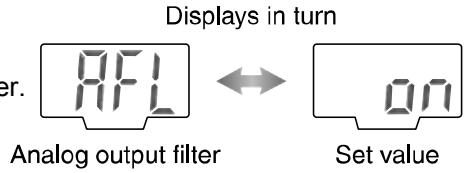
Press the △ or ▽ button at function selection mode to display [F11].

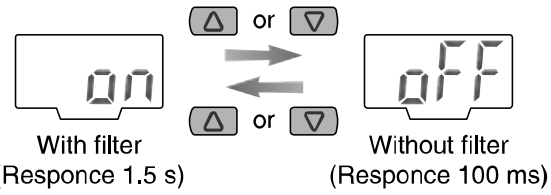
Press the SET button ↓ Move on to select analog output filter

Select analog output filter

[AFL] and set value are displayed by turn.

Press the △ or ▽ button to select analog output filter.





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

Setting of [F11] Analog output filter completed

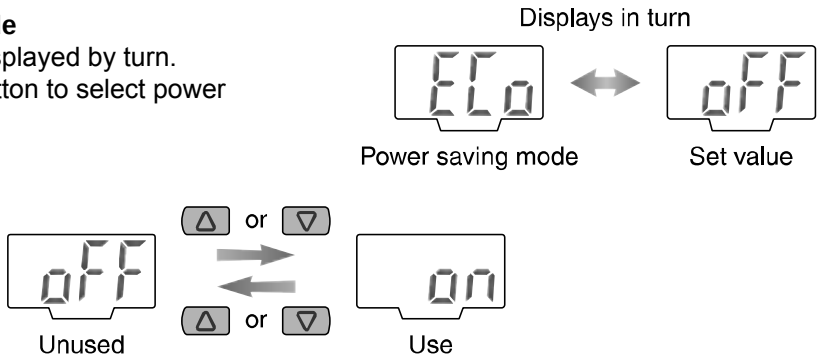
■[F12] Select power saving mode

Energy-saving mode is selectable.
When the product is left for 30 seconds without any operation, it's shifted to energy-saving mode.
It's set in normal mode (energy-saving mode is OFF).
(The decimal point blinks during the operation.)

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

Press the SET 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.

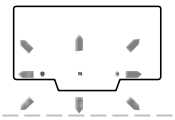


Press the SET button to set ⇩ Return to function selection mode

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.



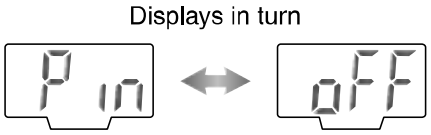
■[F13] Set security code input

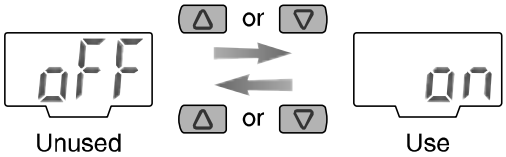
Pin number can be entered during the key-lock state.
See page 47 for key lock function.
Code number is not necessary at initial setting.

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

Press the SET button ↓ Move on to set secret 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 SET button to set ↓ Return to function selection mode

Setting of [F13] Secret code input completed

With secret code input, it becomes necessary to input the secret code to release key lock. The secret code can be decided optionally by the operator. In the default setting, the secret code is set to [000].

With secret code input, refer to page 49.

●Special function setting

■[F98] All function can be set

Functions can be set in turn.

<Operation>

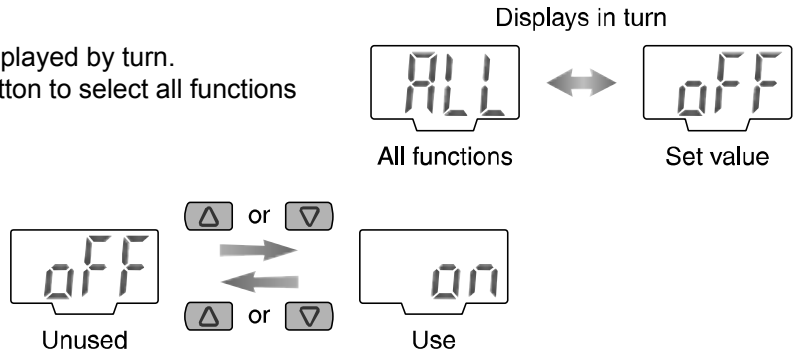
Press the △ or ▽ button at function selection mode to display [F98].

Press the SET button ↓ Move on to all functions can be set

All functions can be set

[ALL] and set value are displayed by turn.

Press the △ or ▽ button to select all functions can be set.



When [oFF] (Not to use) is selected

Press the SET button to set

Retern to function selection mode

When [on] (To use) is selected

Set functions*1

Retern to [oFF](Not to use), the press the SET button to set

Retern to function selection mode

Press the SET button for 2 seconds or longer

Setting of [F98] all function can be set completed

Measurement mode

∗1: Setting of functions
Every time SET button is pressed, function turns in order below. Set by △ or ▽ button.
Refer each paragraph for the detail of setting.

Function of setting

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

■[F99] Reset to the default setting
Press the △ or ▽ button to display [ON], and press SET and ▽ buttons 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

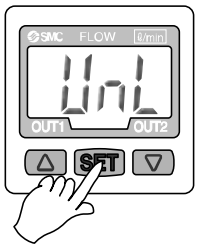
The maximum (minimum) flow from when the power is supplied to this moment is detected and updated.
In the peak/bottom indication mode, the flow is indicated.
As the peak indication, when the △ button is pressed for 1 second or longer, the maximum flow starts flashing and is held.
To release holding the 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 rate to be measured is within ±10% F.S. of the flow rate at the time of shipment from the factory.
(The range of ±1 digit setting is different depending on the individual product difference)
Press continuously the △ and ▽ buttons for 1 second more simultaneously, display is cleared as "0". Return to the measurement mode automatically. Accumulated value is zero when accumulated flow is displayed.

●Key Lock

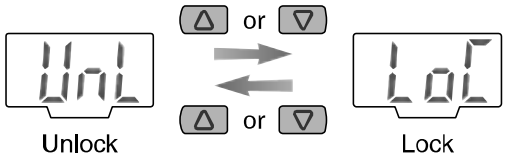
A wrong operation performed unintentionally such as change of set value can be prevented.
If the button operation is performed while key lock setting is being performed, [LoC] is indicated for approx. 1 second.



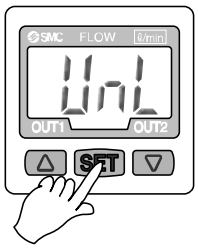
<Operation-Without secret code input->

(1) Keep pressing the SET 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 SET button to enter the setting.

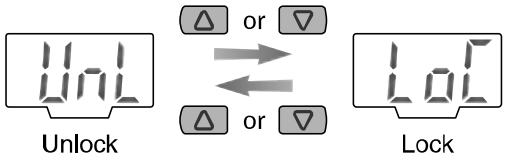


<Operation-With secret code input->

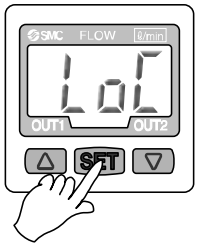
●**Locking**

(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].



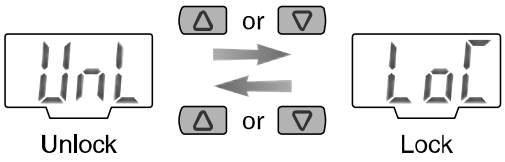
(3) Press the button to enter the setting.

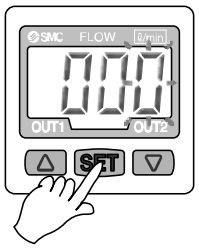


•Unlocking

(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 security code is asked. For how to input the secret code, refer to [How to input and change the security code] on page 49.

(4) If inputted security code is correct, the indication changes to [UnL], and pressing one of △, or ▽ button releases key lock and returns the measurement mode. If inputted security code is wrong, [FAL] is indicated and the security input mode is returned. If the wrong security 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 47), perform all three steps in the unlock setting procedure. (page 47,(3)).

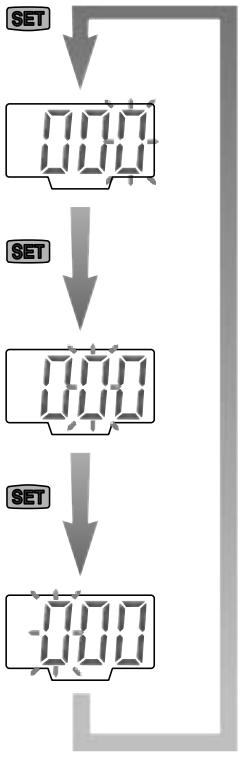
(2) After the security code is inputted and the indication changes to [UnL], keep pressing SET and ▽ buttons simultaneously for 5 seconds or longer. [000] is indicated and the change of security ode is asked. For how to input the security code, refer to [How to input and change the security code]. Changed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

(3) After check it is as desired, press the SET button. The measurement mode is returned. At this time, if the △ or ▽ button is pressed, changed security code is not entered and the change of security 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 SET button starts flashing the second digit.
(If the SET button is pressed at the uppermost digit, the first digit starts flashing again.)

After the setting is finished, keep pressing the SET button for 1 second or longer.
(If the operation is not performed for 30 seconds on longer during input and change of the secret code, the measurement mode is returned.



Troubleshooting

●Troubleshooting

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

●Possible cause and countermeasure

Fault	Status	Possible cause	Item to check	Countermeasure
Wrong display	Indication is not shown	Wiring failure	Check that brown line and blue line are connected to DC (+) and DC (−) respectively.	Have correct wiring.
		Connctor is come off	Check the connection of the connectors	Connect the connectors
	Indication is blinking	Peak/bottom Indicating function	Check whether or not flow rate indication is in peak value (bottom value) indication mode.	"Peak/bottom value indication", and remove the setting if unnecessary. (Refer to page 46)
	Indication is blinking	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 the 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 the 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.
Wrong output	No output	Wiring failure	Check that brown line and blue line are connected to DC (+) and DC (−) respectively.	Have correct wiring.
		Connctor is come off	Check the connection of the connectors	Connect the connectors
	Indication is blinking	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 the 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 48)
External input does not function	It does not accept the input (no reaction)	Wiring failure	Check that the brown line (DC+) and blue line (DC-) are connected to the black line (OUT1), white line (OUT2) and gray line (analogue output).	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.

■Error indication function

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

Error Name	Error Display	Error type	Troubleshooting
Flow error	HHH	Flow exceeds the upper limit of the flow display range.	Reduce the flow rate.
	LLL	(1)5% or more flow in the reverse direction. (2)A sensor may be disconnected or wired incorrectly.	(1)Direct the flow to the proper direction. (2)Check connection and wiring of a sensor.
Overcurrent error	Er1	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.
	Er2	Load current of the switch output (OUT2) exceeds 80 mA.	
System error	Er0	Condition is that of before the adjustment at factory. Internal circuit is possibly damaged.	Stop operation immediately and contact SMC.
	Er3	System error. Failed to memorize the data, or internal circuit is possibly damaged.	Reset using reset function.
Zero clear error	Er4	If fluid flows during zero clear setting (pressing UPand Down buttons simultaneously for less than 1 second), “Er4” is displayed for 1 second.	Please check that fluid doesn't flow at the time of zero clear setting.
Flow error	999 Accumulated flow displayed	Accumulated flow range is exceeded.	Clear the accumulated flow. (If accumulated flow is not used, this is not a problem.)

In the error can not be reset after the above measures are taken, then please contact SMC.

Specification

■Specifications

Model		PFM3□□□			
Rated flow range (measurement range)*1	Dry air, N_2, Ar	0.2 to 10 L/min	0.5 to 25 L/min	1 to 50 L/min	2 to 100 L/min
	CO_2	0.2 to 5 L/min	0.5 to 12.5 L/min	1 to 25 L/min	2 to 50 L/min
Displayable range*2	Dry air, N_2、Ar	0.2 to 10.5 L/min	0.5 to 26.3 L/min	1 to 52.5 L/min	2 to 105 L/min
	CO_2	0.2 to 5.2 L/min	0.5 to 13.1 L/min	1 to 26.2 L/min	2 to 52 L/min
Settable range *2	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 CFM x 10^{-2} Accumulated flow L ft^3 x 10^{-1}			
Accumulated flow range*4		1999999 L			
Source voltage		24 VDC ripple 10% or less (Protected against inverse connection)			
Power consumption		50 mA or less			
Sensor input Input number 1		PFM30□: Voltage input 1 to 5 VDC (Input impedance 1 MΩ) PFM31□: Current input 4 to 20 mA (Input impedance 250 Ω)			
Hysteresis*5	Hysteresis mode	Variable			
	Window comparator mode	Variable			
Switch output		NPN or PNP open collector output: 2 outputs			
	Max. load current	80 mA			
	Max. load voltage	30 VDC (NPN output)			
	Residual voltage	1 V or less (80 mA load current)			
	Output protection	Excess current protection			
Accumulated pulse output		NPN or PNP open collector output (Same as the switch output)			
Response time		1 s(50 ms/0.5 s/2 s are selectable)			
Repeatability		±0.1%F.S. or less, Analog output ±0.3%F.S. or less			
Analog output	Voltage output	1 to 5 VDC (0 L/min to Max. rated flow)			
	Output impedance	Approx. 1 kΩ			
	Current output	4 to 20 mA (0 L/min to Max. rated flow)			
	Max. load impedance	600 Ω(24 VDC)			
	Min. load impedance	50 Ω			
	Accuracy	±1%F.S. or less (Value to displayed value)			

Model		PFM3□□
Display unit		±0.5%F.S.±1digit or less
Display		3+1/2 digits 7segment display, 2 color indication (Red/Green) Update cycle: 10 times/1 s
Indicator light		OUT1: ON when light is on (Green), OUT2: ON when light is on (Red)
External input∗6		No voltage input (Reed switch or solid state), LOW level input 30 msec or more, LOW level 0.4 V or less
Resistance	Enclosure	IP40
	Operating temp range	Operating: 0 to 50 C°, Stored: -10 to 60 C° (No freezing or condensation)
	Operating hamidity range	Operating, Stored 35 to 85%R.H.(No condensation)
	Withstand voltage	1000 VAC, 1 min Between whole changing part and live part
	Insulation resistance	50 MΩ or more (500 VDC Mega) Between whole changing part and live part
	Vibration resistance	10 to 150 Hz at whichever smaller 1.5 mm amplitude or 98 m/s^2 acceleration in X, Y, Z directions for 2 hours each
	Impact resistance	100 m/s^2 in X, Y, Z directions for 3 times each (De-energizing)
Temperature characteristics		±0.5%F.S. or less (Reference 25 C°)
Connection		Power supply, output connect: 5P connector, Sensor connect: 4P connector
Material		Front case, rear case: PBT
Weight		30 g (Cable not included), 85 g (Cable included)

∗1: At initial setting, select flow range for the sensor to connect.

∗2: When connect sensor of 10 L/min and minute set unit of 0.01 L/min are selected, the upper limit is 10.50 L/min.
When connect sensor of 100 L/min and minute set unit of 0.1 L/min are selected, the upper limit is 105.0 L/min.
At ex-factory, connect sensor is set at 10 L/min, minute set unit at 0.1 L/min.

∗3: 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 1 million cycles (energized for 24 hours/day), the life will be (5 minutes x 1 million cyelces = 5 million minute =) 9.5 years at the longest. When this function is used, calculate the life based on operating condition and use within the life range.

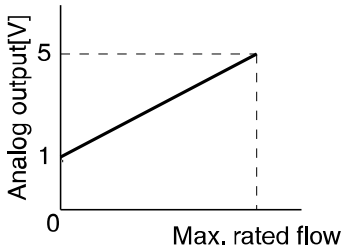
∗5: With ex-factory conditions, the mode is hysteresis mode. Window comparator mode is selectable by button.

∗6: At ex-factory, accumulation externally reset function is assigned. Auto-shift and auto-shift zero functions are selectable by button operation.

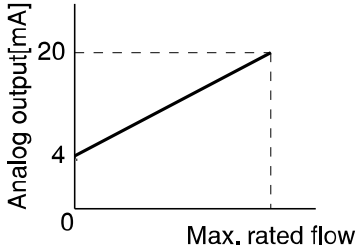
Output characteristics

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

Analog voltage output (1 to 5 V)



Analog current output (4 to 20 mA)



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

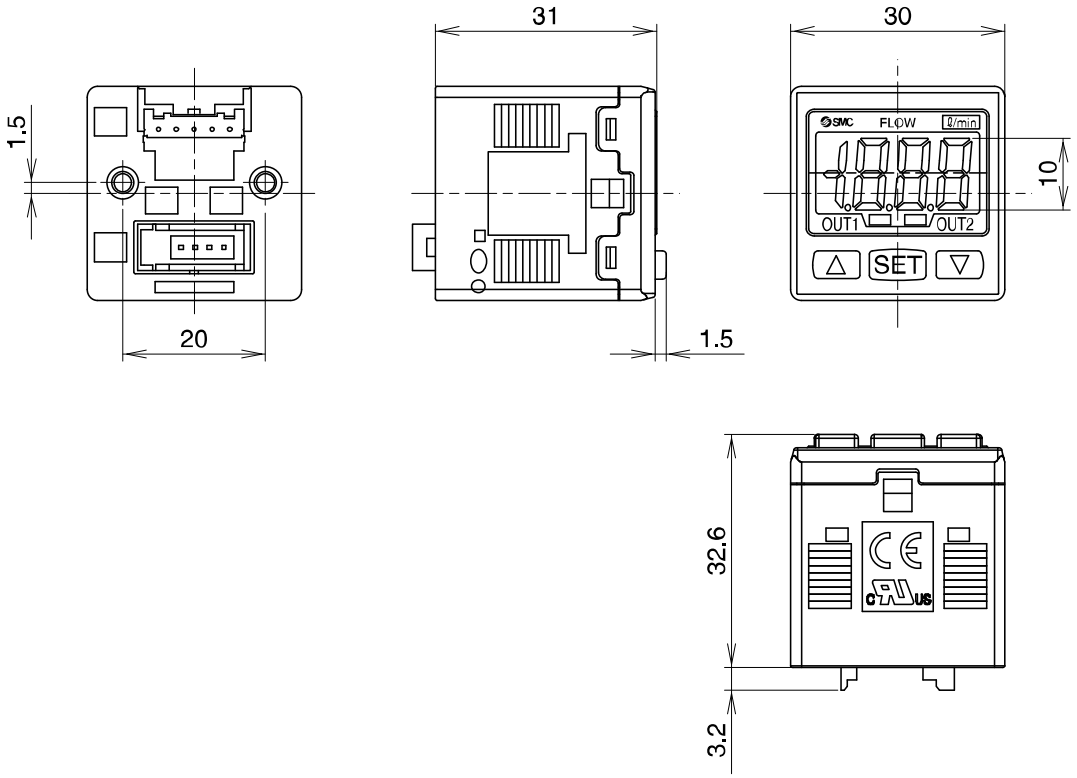
*( ) :Fluid : CO_2

Cable Specifications: Power supply/Output connector (ZS-28-A)

Conductor	Nominal cross section area	0.2 mm^2
	Outside diameter	0.58 mm
Insulator	Material	Cross-linked vinyl chloride resin compound
	Outside diameter	Approx 1.12 mm
	Colours	Brown, Black, White, Grey, Blue
Sheath	Material	Oil-resistant vinyl chloride resin compound
Finished outside diameter		ϕ4.1

■Dimensions

PFM3□□□



Revision history

SMC Corporation URL http://www.smcworld.com

4-14-1, Sotokanda, Chiyoda-ku, Tokyo 102-0021 Japan

Tel:+81 3 5207 8249 Fax:+81 3 5298 5362

No.PF##-OMJ0018