



Operation Manual

Flow sensor

PRODUCT NAME

PFM5## Series

MODEL / Series

SMC Corporation

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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 service to the Product.

■ Safety Instructions

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 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 (of class 2) which is of maximum 30Vrms (42.4V peak), with UL 1310 class 2 power supply unit or UL 1585 class 2 transformer.
The Flow sensor 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.
 - 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 14 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 980m/s²) 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.

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

It can damage the sensor causing failure or malfunction.

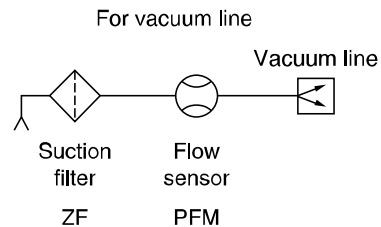
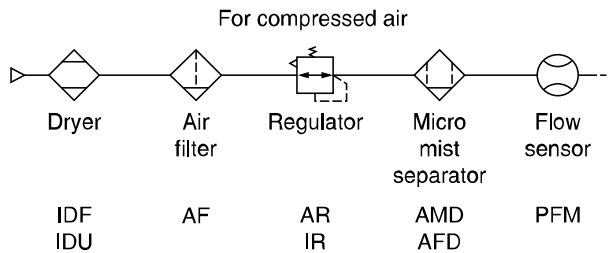
- Never mount a product in a location that will be used as a foothold.

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 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.

The fluid temperature range and 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.

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

- Do not short-circuit the load.

When the product load is short circuit, generated excess current lead to cause the damage of the product.

- Supply the power when there is no flow.

There will be a drift on the analog output of approximate +/- 2 to 3% immediately after the power supply is turned on.

*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.

- 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.

*Other

- If it has a restrictor, the flow adjustment valve may rotate due to vibration and change the flow rate.

- Accuracy may vary by 2 to 3% if the customer removes or replaces the piping port themselves.

Model Indication Method

PFM □ □ □ - □ □ - □ - □ □ - □ □

Type

Model	Contente
5	Separate type sensor part

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

*: Value in () is the flow rate when CO₂ is used.

Flow adjustment valve

Model	Contente
Nil	No valve
S	Valve

Option2 (Refer to page 10)

Option1 (Refer to page 10)

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

Output specification

Model	Contente	Applicable model
1	Analog (1 to 5 V)	PFM30□ series
2	Analog (4 to 20 mA)	PFM31□ series

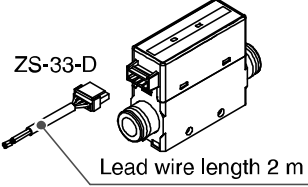
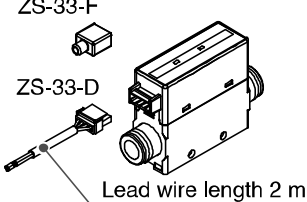
Piping inlet

Model	Contente
Nil	Straight direction
L	Back

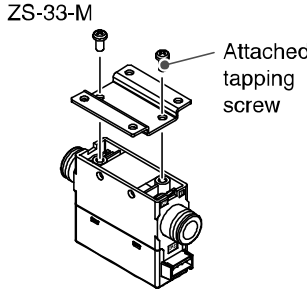
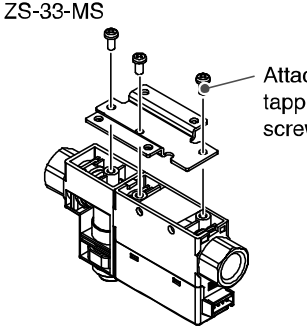
Thread type (Connect port)

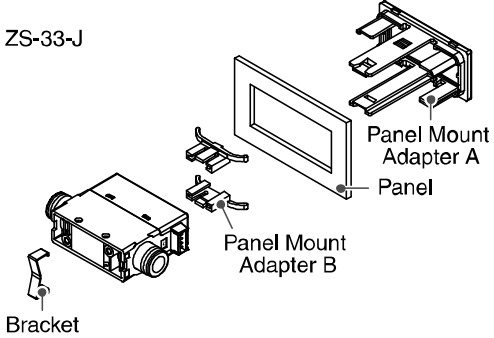
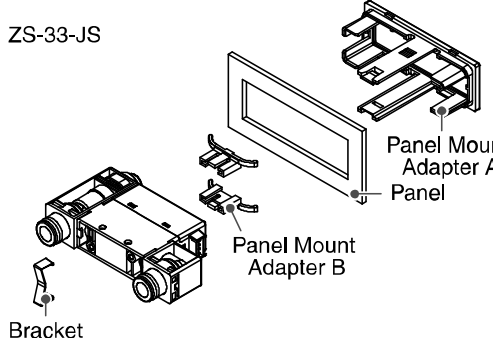
Model	Contente	Flow range			
		10	25	50	11
01	Rc1/8	●	●	●	-
02	Rc1/4	-	-	-	●
N01	NPT1/8	●	●	●	-
N02	NPT1/4	-	-	-	●
F01	G1/8	●	●	●	-
F02	G1/4	-	-	-	●
C4	φ 4(5/32") One-touch fitting	●	-	-	-
C6	φ 6 One-touch fitting	●	●	●	●
C8	φ 8(5/16") One-touch fitting	-	●	●	●
N7	φ 1/4 One-touch fitting	-	●	●	●

Option 1

Nil	W	Z
<p>Lead wire connector (2 m)</p>  <p>ZS-33-D Lead wire length 2 m</p>	<p>Lead wire connector (2m) + Connector cover (Silicone rubber)</p>  <p>ZS-33-F ZS-33-D Lead wire length 2 m</p>	<p>Without lead wire connector</p>

Option 2

Nil	R	S
<p>None</p>	<p>Bracket (Without flow adjustment valve)</p>  <p>ZS-33-M Attached tapping screw</p>	<p>Bracket (With flow adjustment valve)</p>  <p>ZS-33-MS Attached tapping screw</p> <p>Piping direction: Not mounted to rear surface type</p>

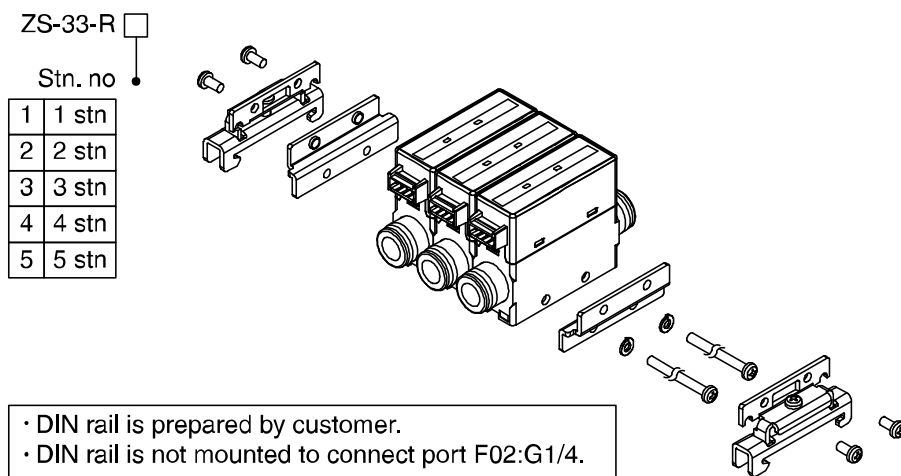
T	V
<p>Panel Mount Adapter (Without flow adjustment valve)</p>  <p>ZS-33-J Bracket Panel Mount Adapter B Panel Mount Adapter A Panel</p>	<p>Panel Mount Adapter (With flow adjustment valve)</p>  <p>ZS-33-JS Bracket Panel Mount Adapter B Panel Mount Adapter A Panel</p>

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

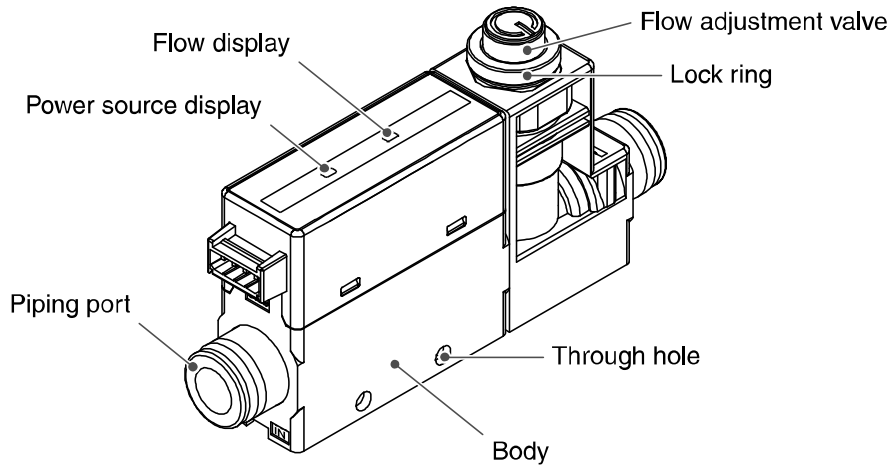
Part number for options

Model No.	Option
ZS-33-D	Lead wire connector
ZS-33-F	Connector 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)



Names and Functions of Individual Parts



Name	Description
Power source display (green)	Turns on when power is supplied.
Flow display (green)	Flashing interval depends on the flow value. As flow increases, flash interval is shortened. The light turns to red when rated flow is exceeded.
Body	Product itself.
Flow adjustment valve	Orifice mechanism to adjust 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

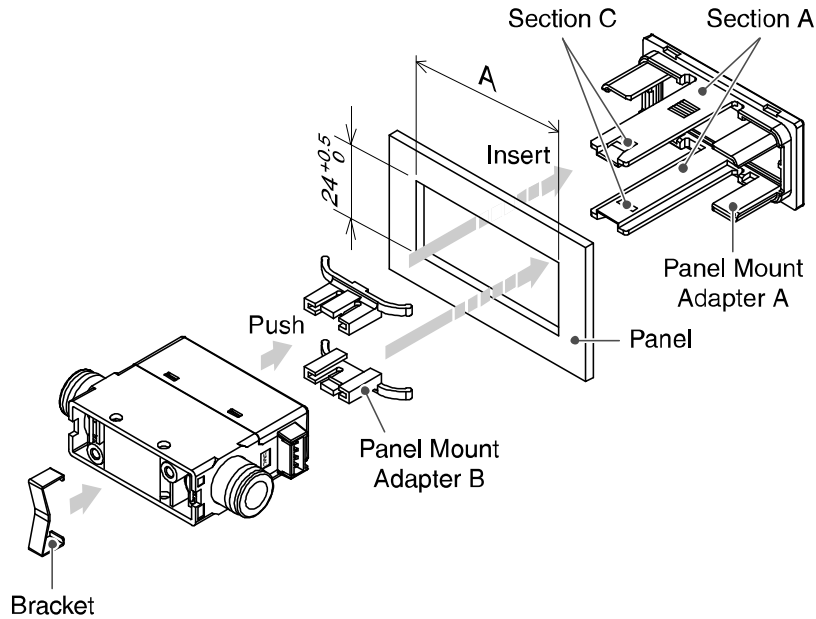
	Terminology	Definition
F	F.S. (Full span, Full scale)	It reads "full span" or "full scale", and indicates varied analog output range at rated value. For example, when analog output is 1 to 5 V, F.S. = 5[V] - 1[V] = 4[V], (ref. 1%F.S. = 4[V]x1% = 0.04[V])
N	Non-linear output	Indicates non linear output.
O	Operating fluid temp.	Flow temperature range which can be applied to the product.
	Operating humidity range	Humidity range in which product can be stored without being damaged while power supply and flow not applied.
	Operating pressure range	Pressure range in which (PFMV5) is operable.
	Operating temp. Range	Ambient temperature range in which product is operable.
P	Pressure characteristic	Varied amount of analog output when the line pressure is changed.
	Pressure rate	Pressure range that satisfies product specification.
	Proof pressure	Burst pressure at which the Product is electrically or mechanically damaged.
R	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	Storage temp. range	Temperature range in which product can be stored without being damaged while power supply and flow not applied.
T	Temperature characteristic	Analog output change when ambient temp. is changed.

Mounting and Installation

Installation

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 until 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 out dimensions.

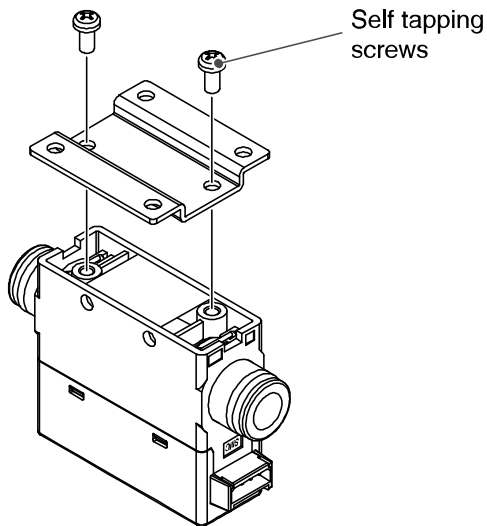


	Dimension A	Adapter
Without flow adjustment valve	$54^{+0.5}_0$	ZS-33-J
With flow adjustment valve	$74^{+0.5}_0$	ZS-33-JS

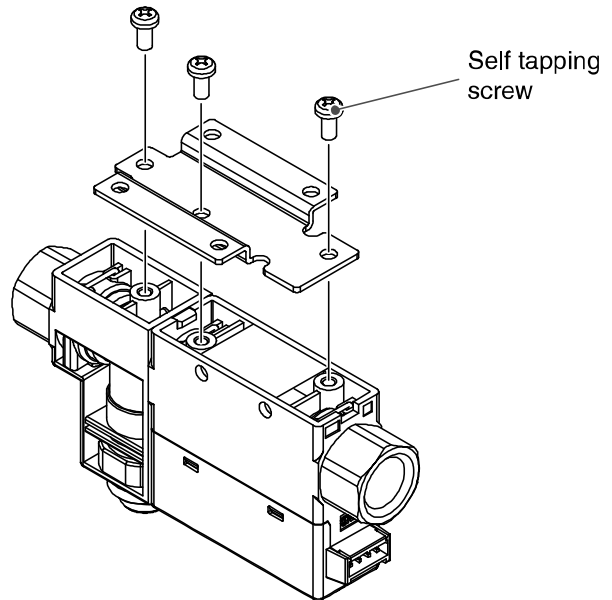
Bracket mounting

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

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

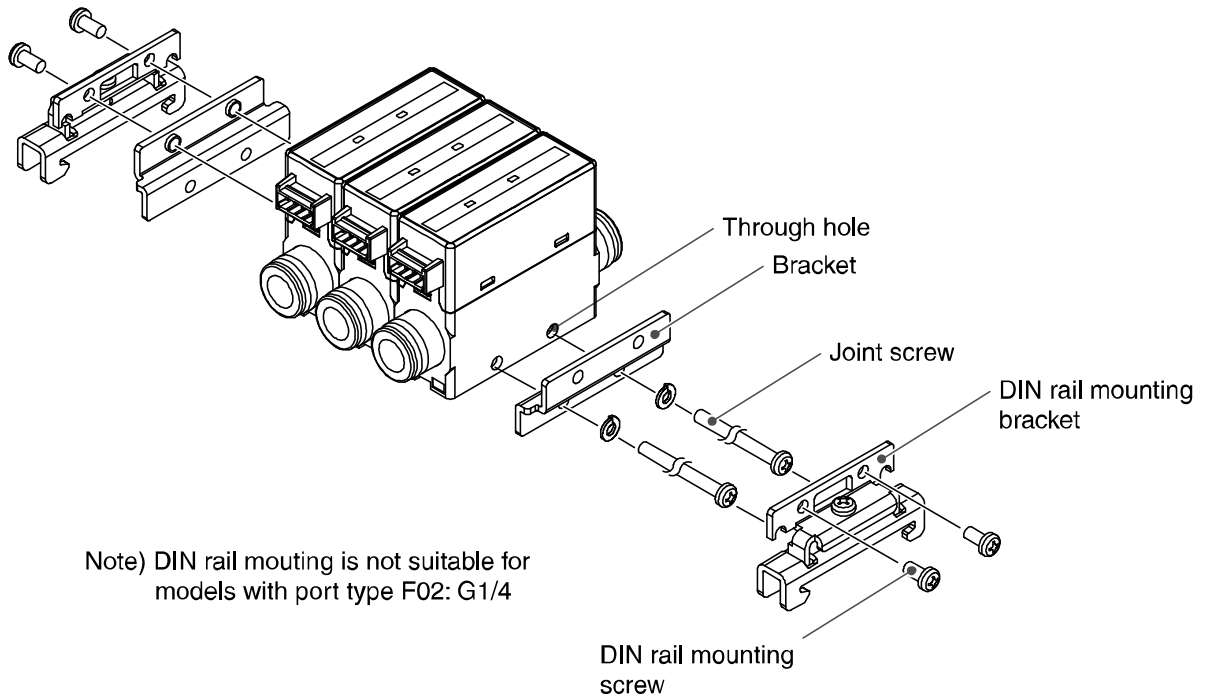


With flow adjustment valve
(using ZS-33-MS)



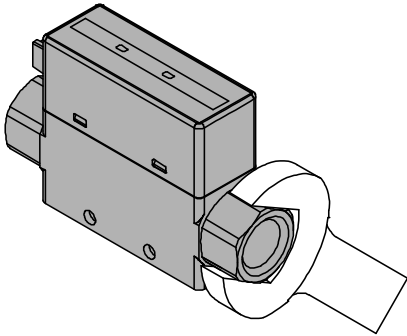
DIN rail mounting

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



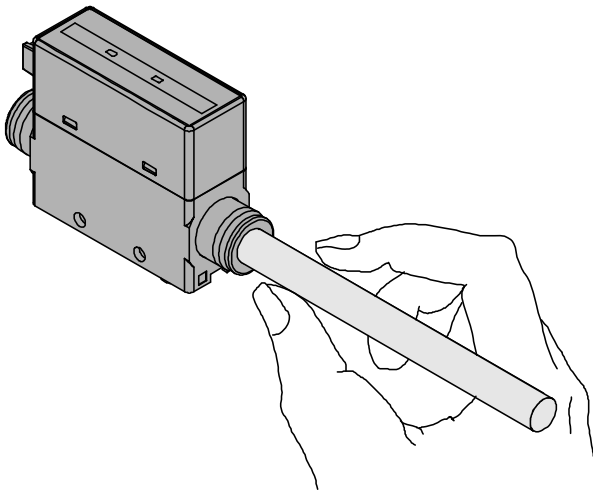
■ Piping

- Ensure tightening torque is correct when installing piping.
- Refer to the following table for the appropriate torque values.
- Hold the metal part with a 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 is not pulled off.
- 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 is 1.0 MPa.



■ Wiring

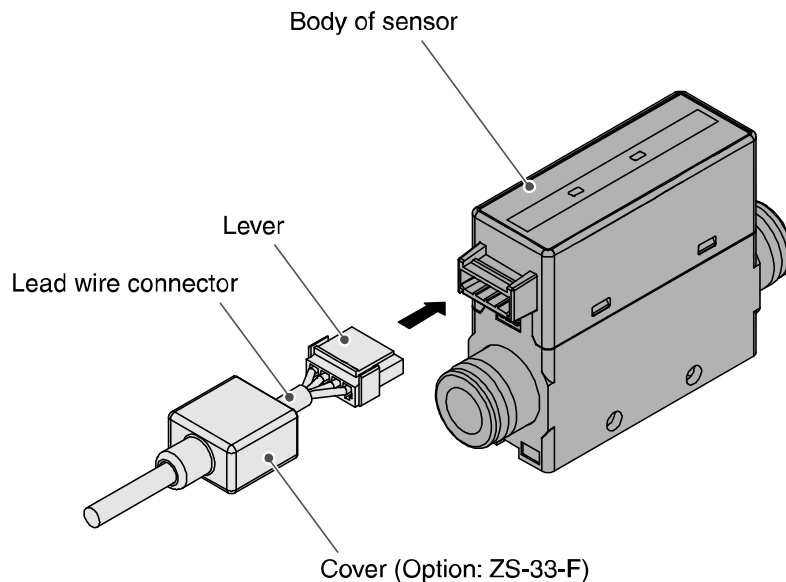
Connection

- 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 analog 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 series power supply instead of a switching regulator.

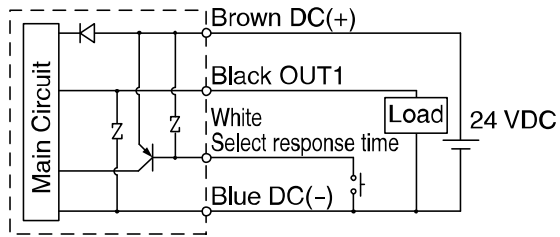
Connector

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 in the body of the sensor.
- 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



•OUT1

PFM5□-□-1-□

Analog output 1 to 5 V
Output impedance 1 k Ω

PFM5□-□-2-□

Analog output 4 to 20 mA
Max. Load impedance 600 Ω (24 VDC)
Min. load impedance 50 Ω

Select response time: No voltage input

Reed switch or solid state switch input 30 ms or more

Select response speed

- To reduce ripple by slowing the response speed when ripple of analog output is large due to the effect of pulsation.

How to select

- Connect input line (white) to GND. While connected, response speed is 1.0s. (50 ms when not input)

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 product 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 output	Indication is not shown	Wiring failure	Check that brown line and blue line are connected to DC (+) and DC (-) respectively.	Have correct wiring.
		Connector is not shown	Check the connection of the connectors.	Connect the connectors.
		The flow adjustment valve is closed.	Check the flow adjustment valve.	Open the flow adjustment valve and adjust the flow.
	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 Flow switch.
		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.
		Pulsation in the flow.	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 fluctuation. Change the pressure source to one which has less pulsation.
		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.
		noise	Check if there is a power line or a high voltage line which generates noise in the wiring route.	Route wiring separately from power lines and high voltage lines.

Fault	Status	Possible cause	Item to check	Countermeasure
Display light failure	Display does not light up.	Wiring failure	Check that brown line and blue line are connected to DC (+) and DC (-) respectively.	Have correct wiring.
	Flow checking display light is unstable.	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 Flow switch.
		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.
		Pulsation in the flow.	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 fluctuation. Change the pressure source to one which has less pulsation.
		noise	Check if there is a power line or a high voltage line which generates noise in the wiring route.	Route wiring separately from power lines and high voltage lines.
Improper operation of the flow adjustment valve	Adjustment 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 12)
		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 occurs.

Error Name	Error Display	Error Content	Troubleshooting
Flow Error	 <p>Flow display is red.</p>	Flow exceeds rated flow range.	Apply flow within rated flow range.
System Error	 <p>Power supply display is red.</p>	System error. Possible damage of internal circuit.	Turn off the power supply clear the error. Then supply the power again.

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

Specification

■ Specifications

Model		PFM510	PFM525	PFM550	PFM511
Measured 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
Accuracy		±3%F.S. or less			
Repeatability		±1%F.S. or less (Fluid: Dry air)			
Pressure characteristic		±5%F.S. or less (0.35 MPa reference)			
Temperature characteristics		±2%F.S. or less (15 to 35 °C) ±5%F.S. or less (0 to 50 °C)			
Operating pressure range		-70 kPa to 750 kPa			
Proof pressure		1 MPa			
Analog output*	Response time	50 msec. or 1 s. (Response time selecting function: 1s. is set when no voltage is input.)			
	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			
Indicator light		Power ON indicator: Light is lit up while power is supplied (Green) Fluid indicator: Light flashes on and off while flow is running (Green)			
Source voltage		24 VDC±10%			
Power consumption		35 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)				

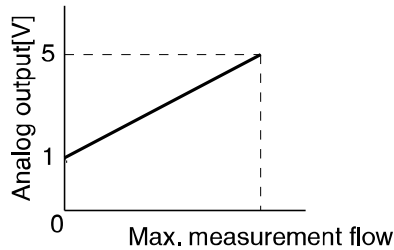
*: The reference of the flow unit is the standard condition (20°C, 1 atm, 65%R.H.).

Port specification

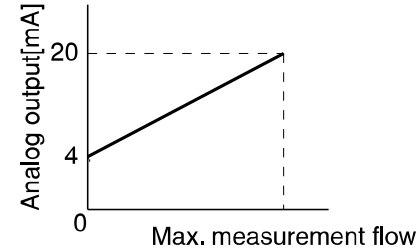
Model		01	02	N01	N02	F01	F02	C4	C6	C8	N7
Port size		Rc 1/8	Rc 1/4	NPT 1/8	NPT 1/4	G 1/8	G 1/4	φ4 (5/32") One- touch fitting	φ6 One- touch fitting	φ8 (5/16") One- touch fitting	φ1/4 One- touch fitting
Weight	Straight piping without flow adjustment valve	95 g				125 g		55 g			
	Rear piping without flow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

Output characteristics

Analog voltage output (1 to 5 V)



Analog current output (4 to 20 mA)



Model	Max. measurement flow [L/min]
PFM510-□-1	10
PFM525-□-1	25
PFM550-□-1	50
PFM511-□-1	100

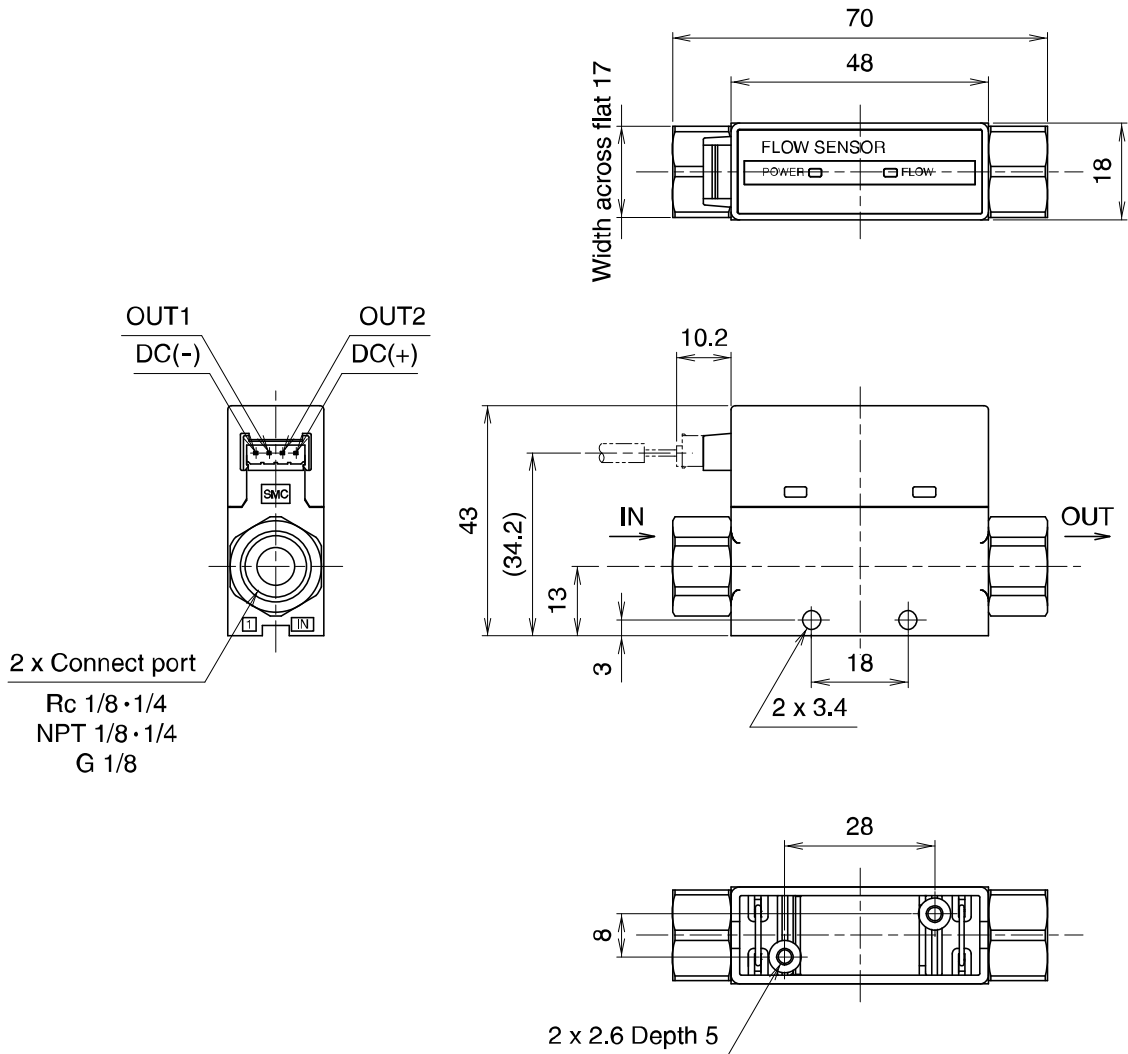
Model	Max. measurement flow [L/min]
PFM510-□-2	10
PFM525-□-2	25
PFM550-□-2	50
PFM511-□-2	100

Cable Specifications: Lead wire with connector (ZS-33-D)

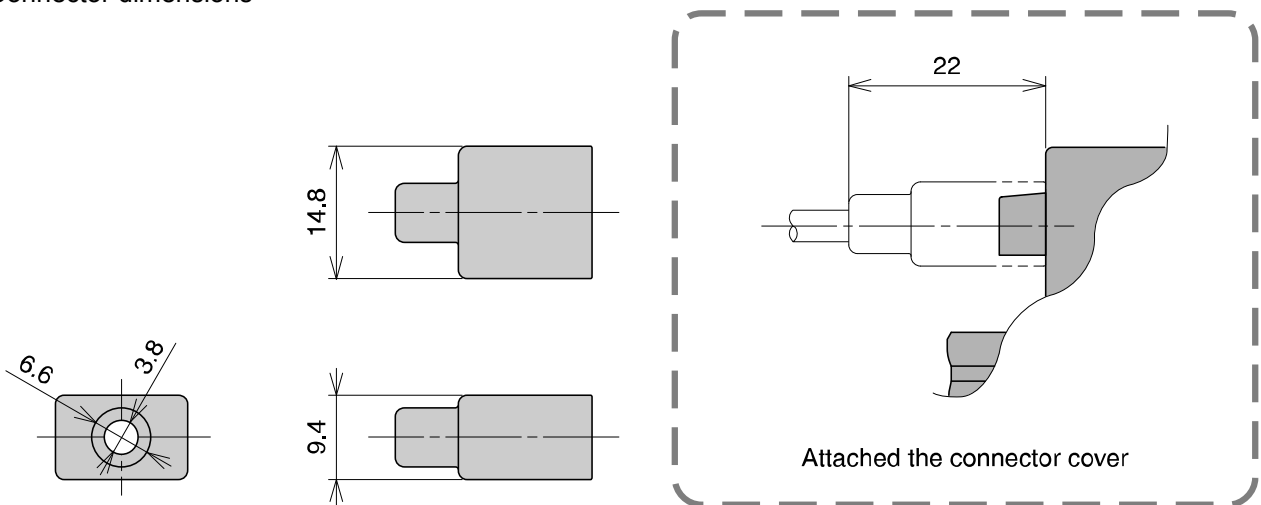
Conductor	Nominal cross section area	AWG26
	Outside diameter	Approx. 0.50 mm
Insulator	Material	Cross-linked vinyl chloride resin compound
	Outside diameter	Approx 1.00 mm
	Colours	Brown, White, Black, Blue
Sheath	Material	Oil-resistant vinyl chloride resin compound
Finished outside diameter		$\phi 3.5^{+0.10}_{-0.25}$

■ Dimensions

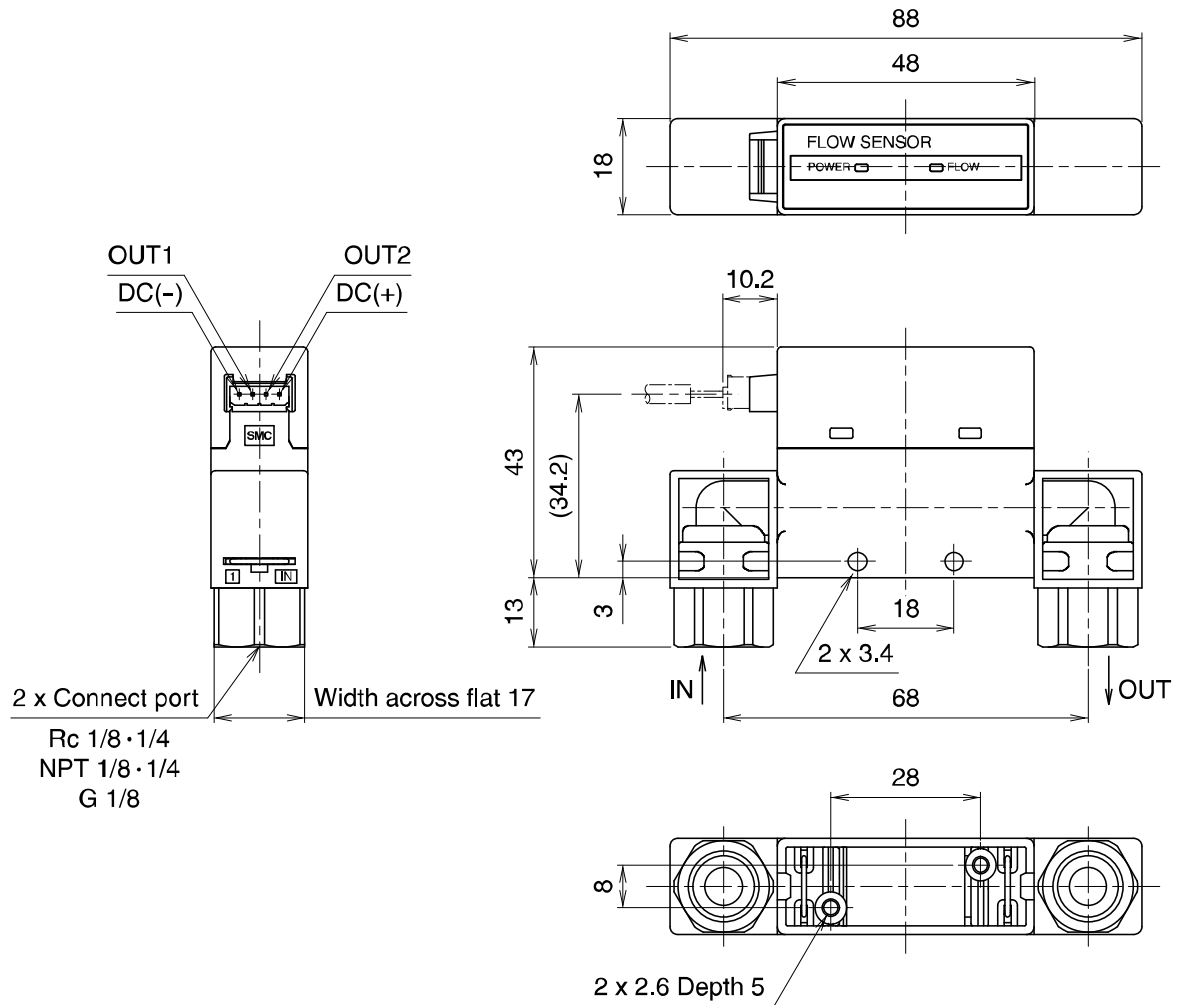
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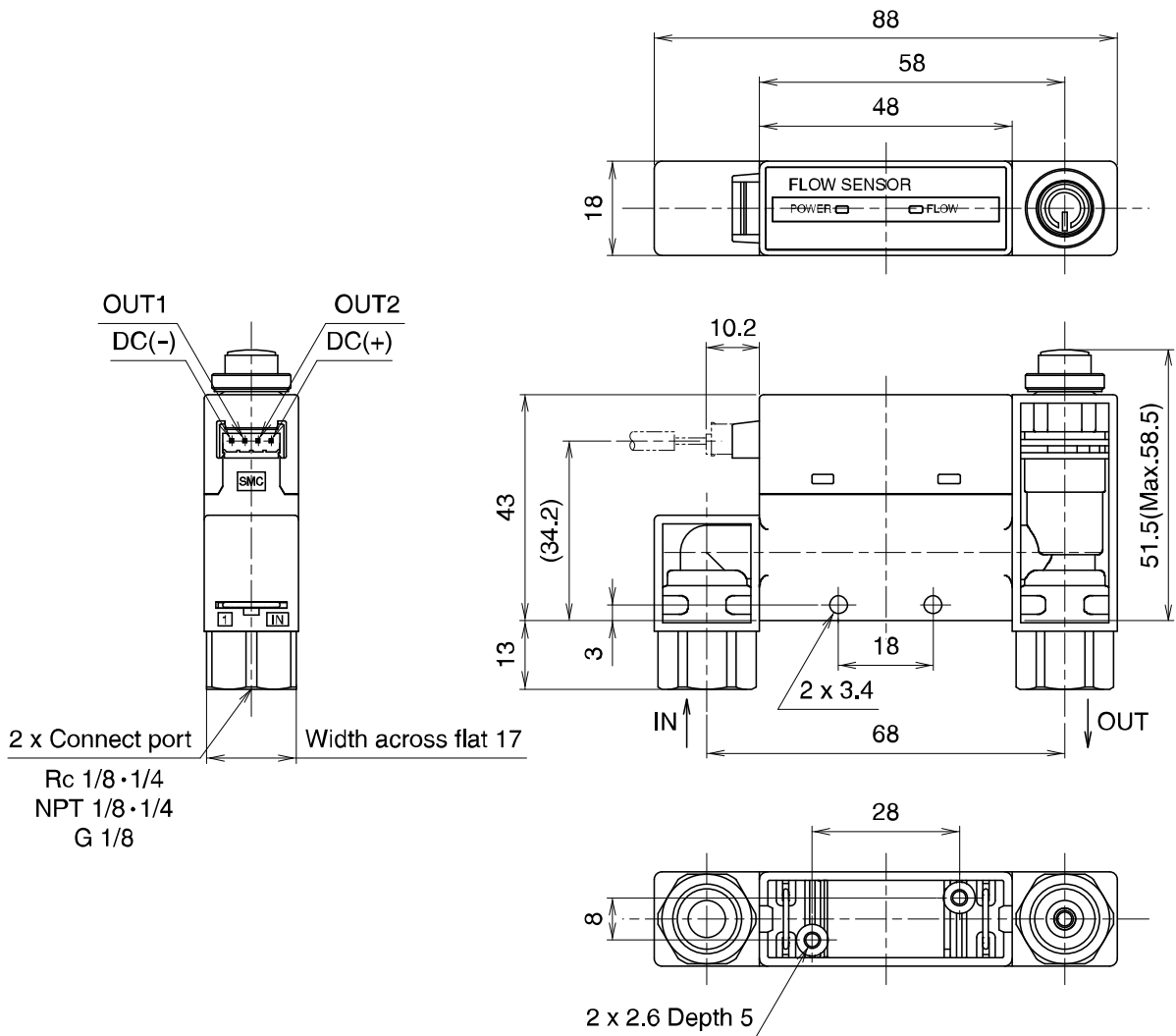
● Connector dimensions



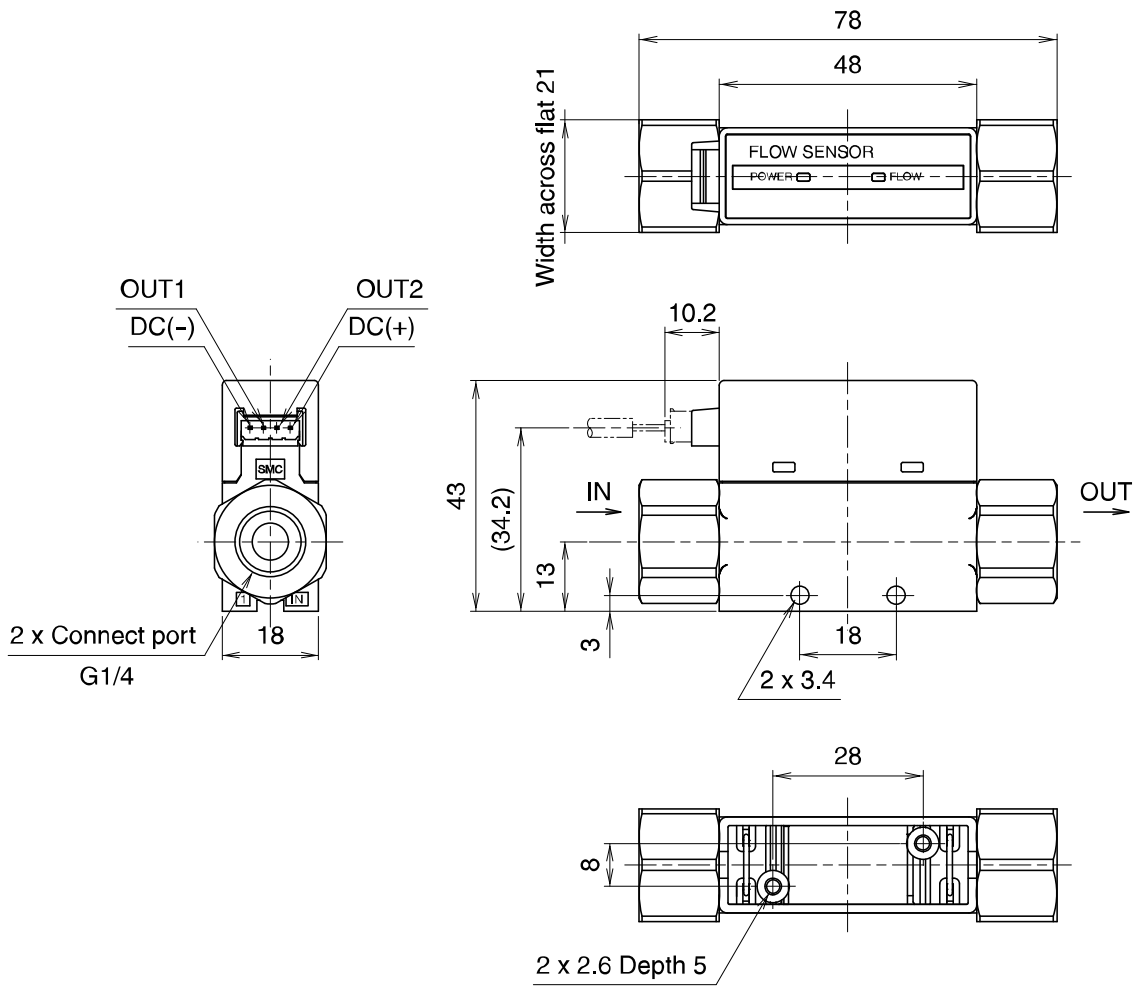
PFM5**-(N)01L/(N)02L/F01L-1/2



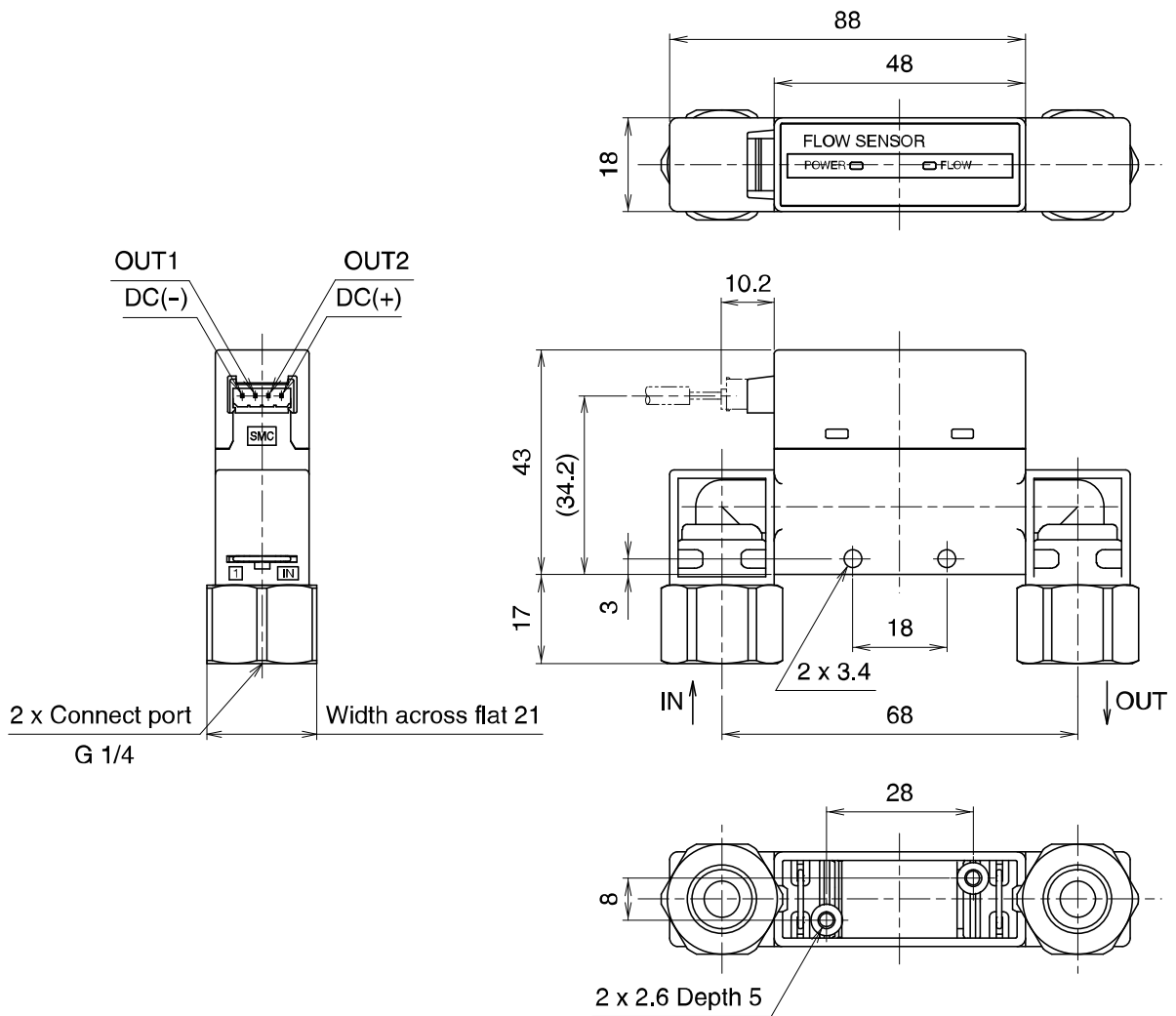
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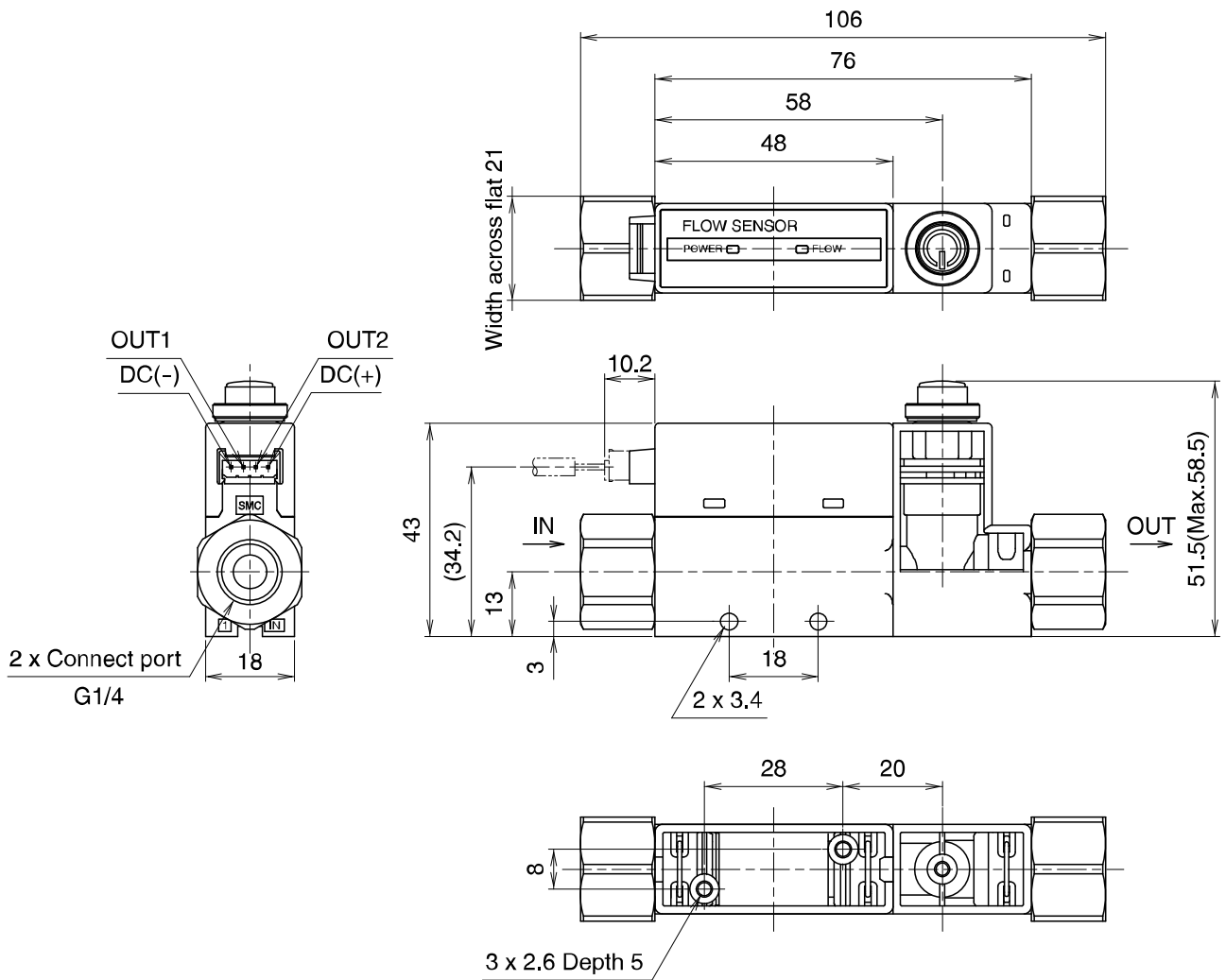
PFM5**-F02-1/2



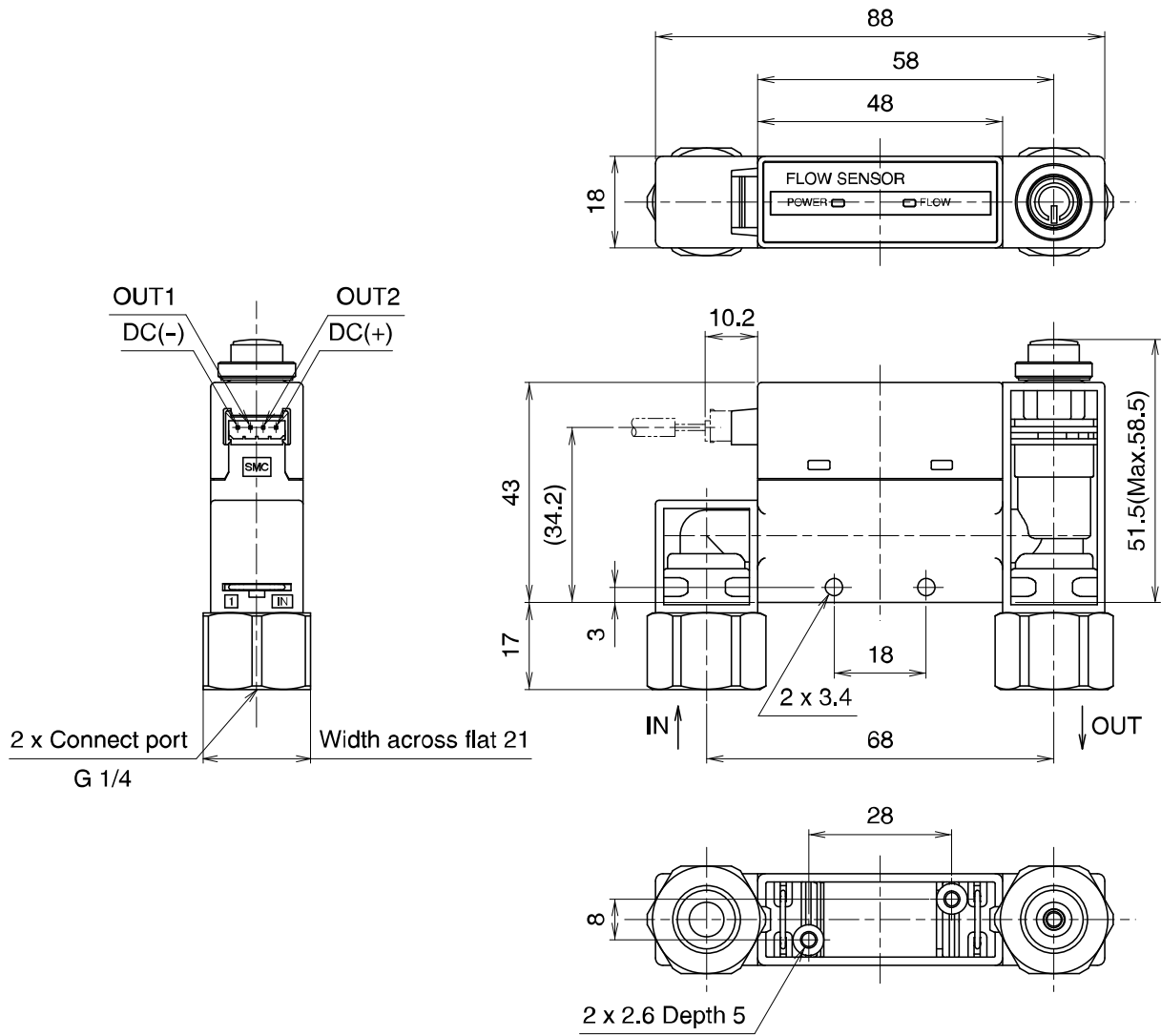
PFM5**-F02L-1/2



PFM5*S-F02-1/2

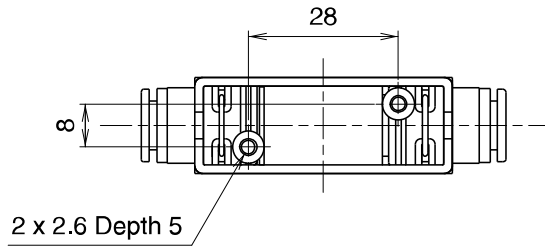
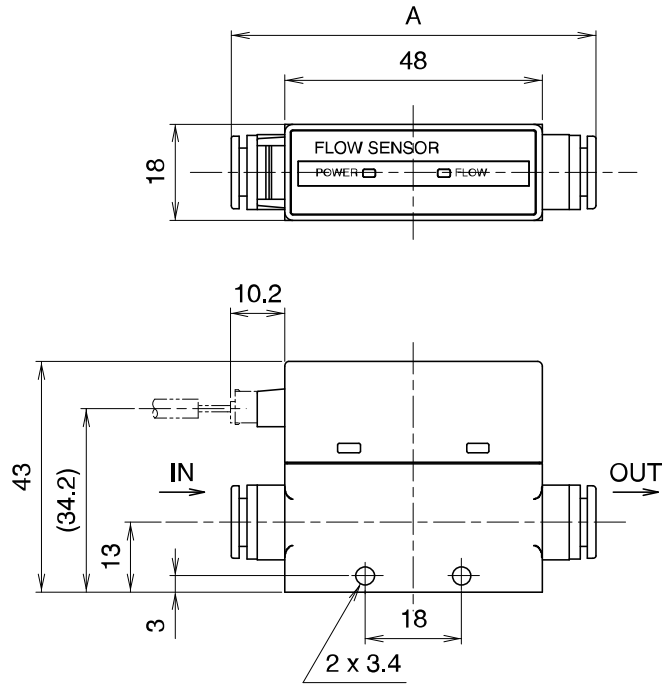
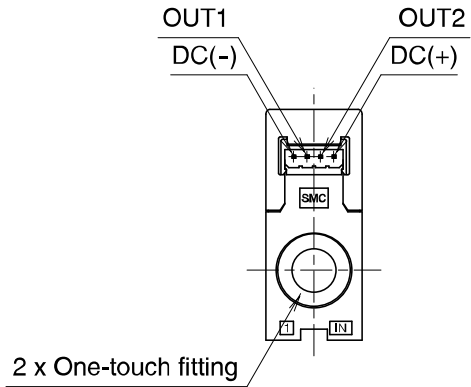


PFM5*S-F02L-1/2



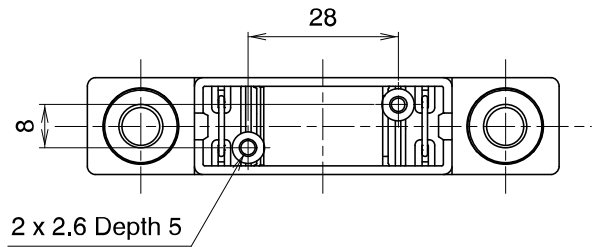
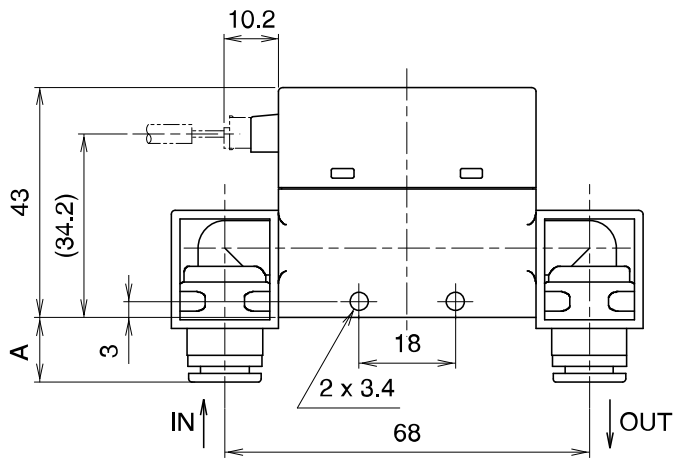
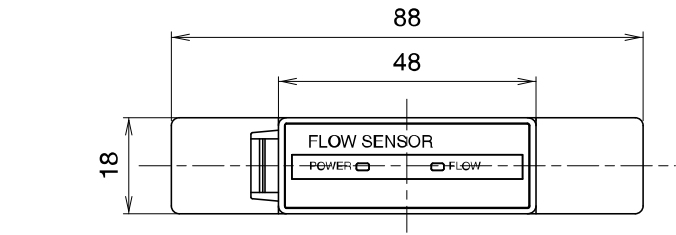
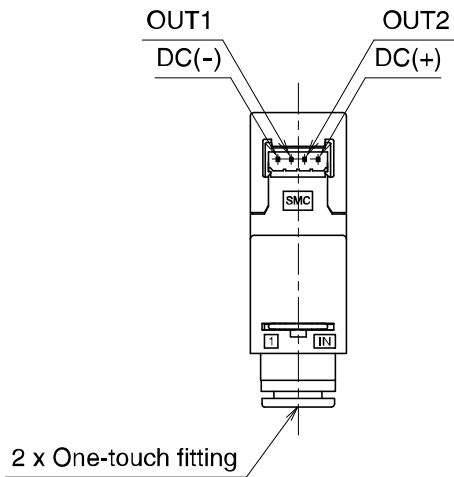
PFM5**-C/N*-1/2

A	Dimensions
C4	64.2
C6	64.6
C8	68
N7	64.6



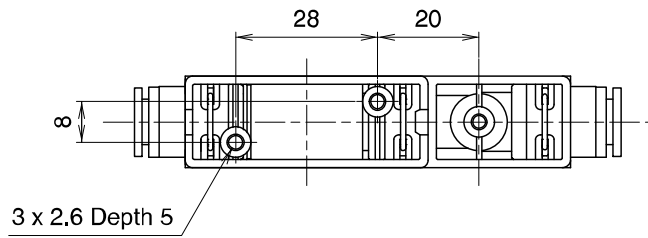
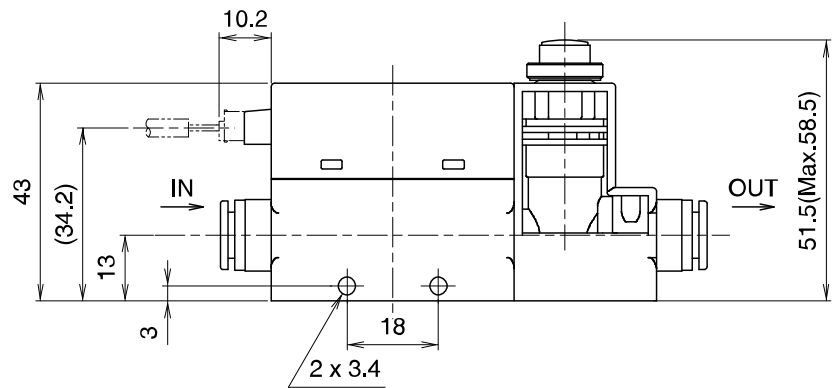
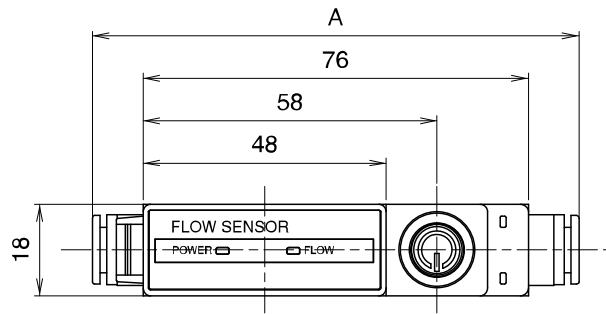
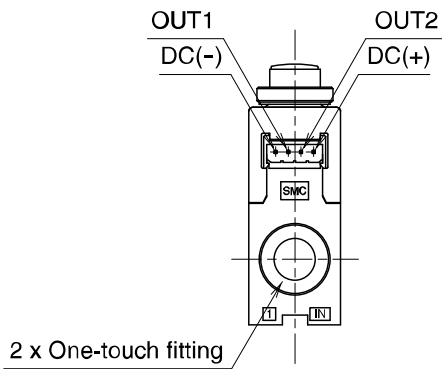
PFM5**-C/N*L-1/2

A	Dimensions
C4L	10.1
C6L	10.3
C8L	12
N7L	10.3



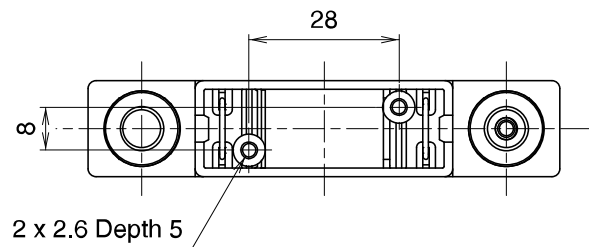
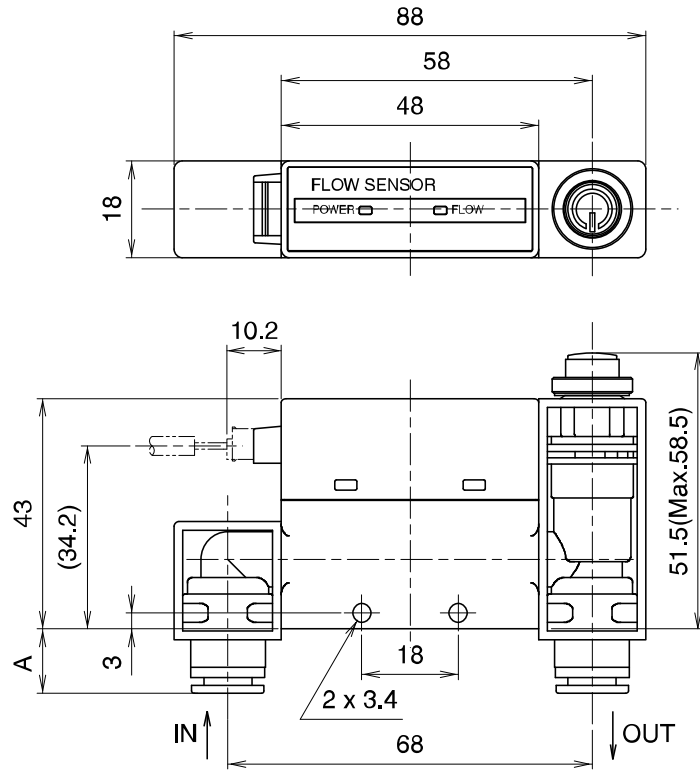
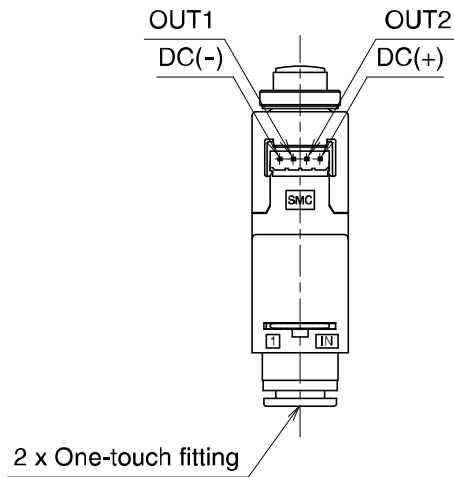
PFM5*S-C/N*-1/2

A	Dimensions
C4	92.2
C6	92.6
C8	96
N7	92.6



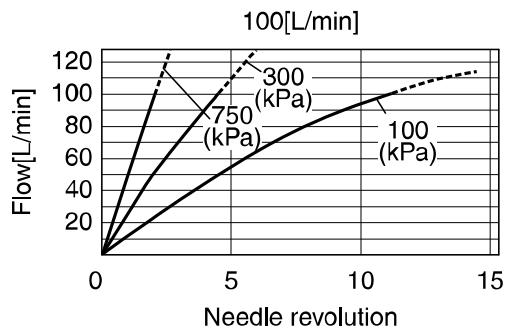
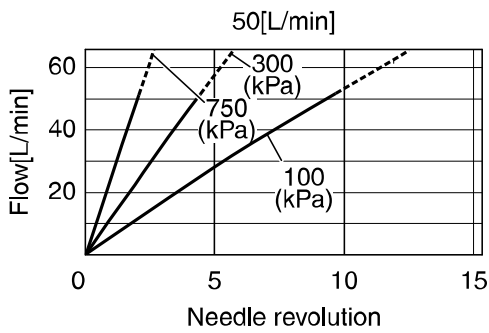
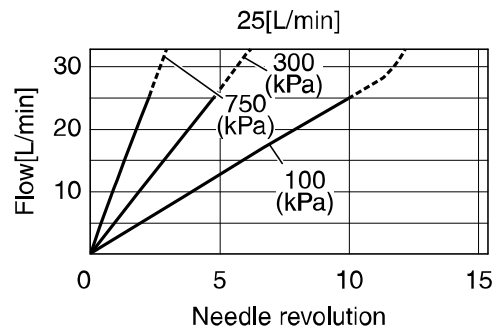
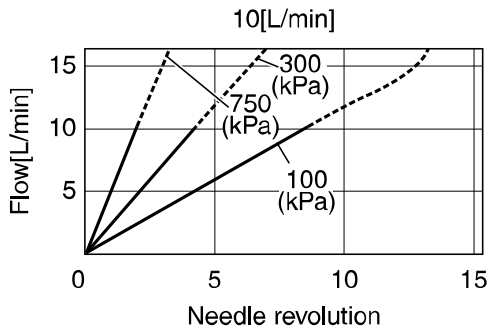
PFM5*S-C/N*L-1/2

A	Dimensions
C4L	10.1
C6L	10.3
C8L	12
N7L	10.3

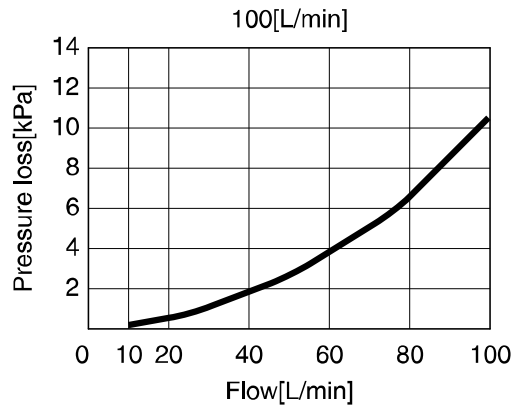
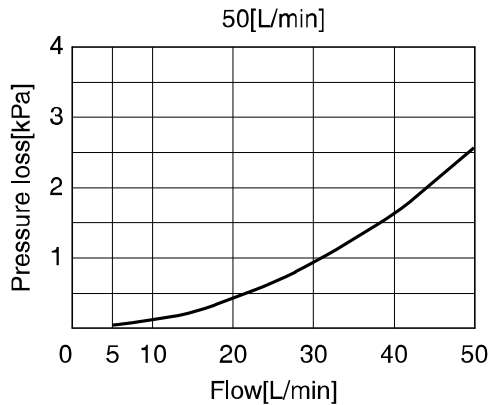
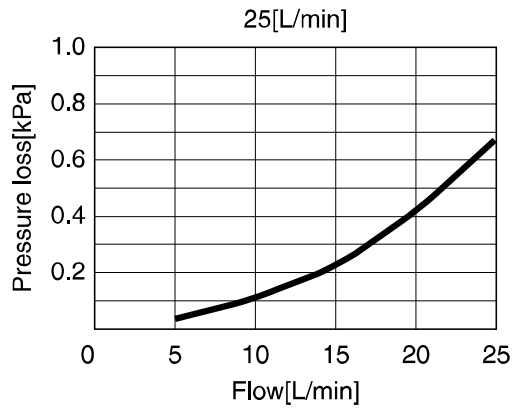
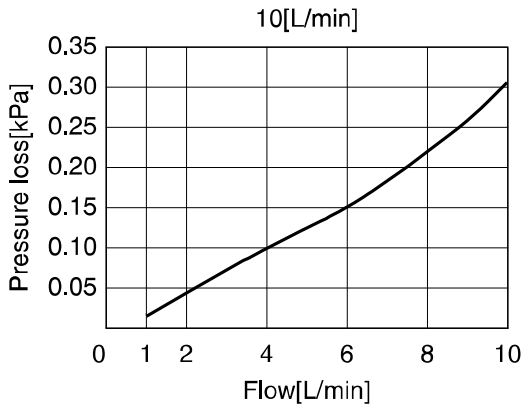


Characteristic data

• Needle revolution - Flow characteristics



• Pressure loss (at 350 [kPa])



Revision history

SMC Corporation

URL <http://www.smcworld.com>

Note: Specifications are subject to change without prior notice and any obligation on the part of the manufacturer.
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