Digital Flow Switch for Deionized Water and Chemicals

Series PF2D

Body and Sensor

New PFA

Tube

Super PFA

Three types of flow range

0.4 to 4 ℓ/min (PF2D504)
1.8 to 20 ℓ/min (PF2D520)
4.0 to 40 ℓ/min (PF2D540)

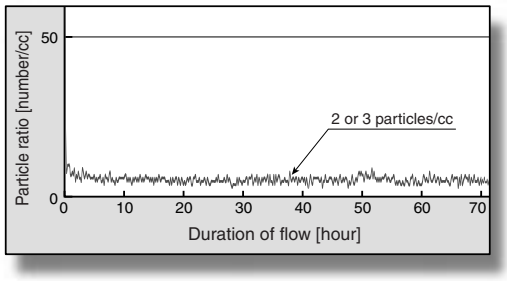
A single controller can monitor the flow rate of 4 different sensors.

4-channel Flow Monitor
Series PF2D200

Dust generation of 3 particles/cc or less (average number)

Karman vortex eliminates moving parts and allows low dust generation.

Particle characteristics (reference)

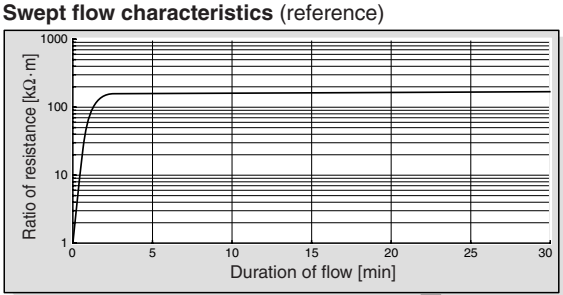


The data was obtained by performing an actual 10 minutes' supersonic cleaning using an average 16 MΩ·cm of deionized water at class 10000 clean room (1 ℓ/min flow rate).
The diameter of the measured particles ranges from 0.1 to 0.5 μm. The flow rate used during measuring is 100 cc/min.

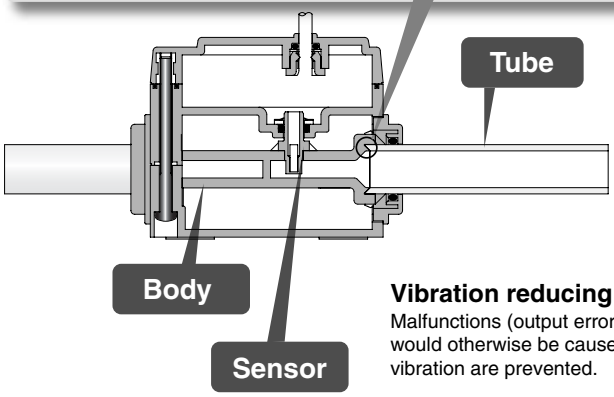
Swept flow characteristics

Tapered side seal minimizes dead volume to reduce accumulation of liquid pool.

Swept flow characteristics (reference)

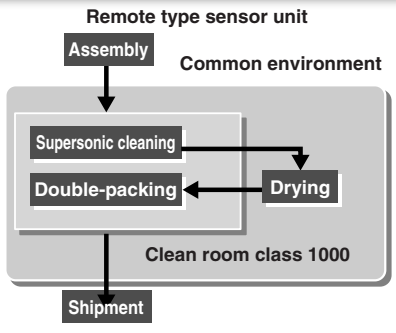


Fill the flow path with sulfuric acid and leave it for 30 minutes.
After disposing the sulfuric acid, flush the flow path out with deionized water and measure the resistance rate of the fluid that is discharged from the downstream side.
A quick recovery time indicates little liquid pool.



Vibration reducing seals
Malfunctions (output errors) that would otherwise be caused by vibration are prevented.

Processing chart for Series PF2D



For Deionized Water and Chemicals

Digital Flow Switch

Series PF2D

How to Order

Remote Type Sensor Unit

PF2D5 20 – 13 – 1 – C

Flow rate range

04	0.4 to 4 ℓ/min
20	1.8 to 20 ℓ/min
40	4 to 40 ℓ/min

Port size: (inch)

11	3/8	PF2D504
13	1/2	PF2D520
19	3/4	PF2D540

Output specification

Symbol	Specification	Applicable monitor unit (monitor) model
1	Output for monitor unit + analog output (1 to 5 V)	Series PF2D200/300
2	Output for monitor unit + analog output (4 to 20 mA)	Series PF2D300

Option (Refer to page 1026.)

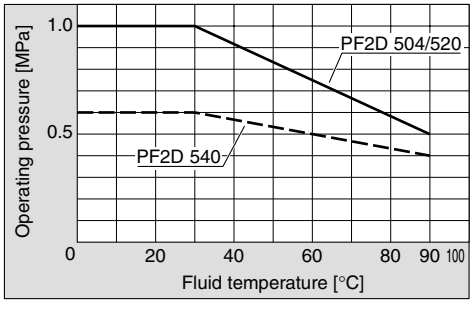
Nil	None
C	e-con connector x 1 pc.

The cable and connector are shipped unassembled.

Specifications for Sensor Unit

Model		PF2D504	PF2D520	PF2D540
Measured fluid		Liquid not to corrode nor erode deionized water and/or Teflon®. Viscosity: 3mPa·s (3cP) or less		
Detection style		Karman vortex		
Rated flow range		0.4 to 4 ℓ/min	1.8 to 20 ℓ/min Note 1)	4 to 40 ℓ/min
Operating pressure range Note 2)		0 to 1 MPa		0 to 0.6 MPa
Proof pressure Note 3)		1.5 MPa		0.9 MPa
Operating fluid temperature		0 to 90°C		
Linearity Note 4)		±2.5% F.S. or less (at 25°C water)		
Repeatability		±1% F.S. or less (at 25°C water)		
Temperature characteristics		±5% F.S. or less (0 to 50°C, based on 25°C)		
Output specifications	Pulse output	Pulse output, N channel, open drain, output for monitor unit PF2D 300/301 (Specifications: Maximum load current of 10 mA; Maximum applied voltage of 30 V)		
	Analog output	Voltage output Note 5) 1 to 5 V Linearity: ±2% F.S. or less, allowable load resistance: 100 kΩ or more		
		Current output Note 6) 4 to 20 mA Linearity: ±2% F.S.or less, allowable load resistance: 300 Ω or less with 12 VDC, 600 Ω or less with 24 VDC		
Power supply voltage		12 to 24 VDC (ripple ±10% or less)		
Current consumption		20 mA or less (without load)		
Environmental resistance	Enclosure	IP65		
	Operating temperature range	Operating: 0 to 50°C, Stored: –25 to 85°C in stock (with no condensation and freezing)		
	Voltage resistance	1000 VAC for 1 min. between external terminals and case		
	Insulation resistance	50M Ω or more (500 VDC Mega) between external terminals and case		
	Vibration resistance	4.9 m/s^2 (De-energized)		
	Impact resistance	490 m/s^2 to X,Y,Z directions 3 times for each (De-energized)		
	Noise resistance	1000 Vp-p, Pulse width: 1 μs, Rise time: 1 ns		
Mass		140 g (without lead wire)		225 g (without lead wire)
Port size		3/8 inch tube	1/2 inch tube	3/4 inch tube
Wetted material		Body: New PFA, Sensor: New PFA, Tube: Super PFA		

Note 1) 1.6 to 20 ℓ/min (0.1 MPa) with viscosity of 1 mPa·s (1 cP) or less
Note 2) The operating pressure range drops according to the fluid temperature. See attached graph.
Note 3) 1.5 times of the maximum operating pressure and varying with fluid temperature.
Note 4) The system accuracy when combined with PF2D30□.
Note 5) When the voltage output is selected.
Note 6) When the current output is selected.
Note 7) The sensor unit conforms to the CE marking.



SMC

How to Order

Remote Type Monitor Unit

PF2D30 [0] – [A] – [M]

Output specification

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

Mounting

A	Panel mounting

Unit specification

Nil	With unit switching function
M	Fixed SI unit Note)

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

Specifications for Monitor Unit

Model		**PF2D300/301**		
Flow rate measurement range Note 1)		0.25 to 4.5 ℓ/min	1.3 to 21.0 ℓ/min	2.5 to 45 ℓ/min
Set flow rate range Note 1)		0.25 to 4.5 ℓ/min	1.3 to 21.0 ℓ/min	2.5 to 45 ℓ/min
Minimum set unit Note 1)		0.05 ℓ/min	0.1 ℓ/min	0.5 ℓ/min
Accumulated pulse flow rate exchange value (Pulse width: 50ms) Note 1)		0.05 ℓ/pulse	0.1 ℓ/pulse	0.5 ℓ/pulse
Note 2) **Display units**	**Real-time flow rate**	ℓ/min, gal (US)/min		
	Accumulated flow	ℓ, gal (US)		
Accumulated flow range Note)		0 to 999999 ℓ		
Linearity Note 3)		±2.5% F.S. or less		
Repeatability		±0.5% F.S. or less		
Temperature characteristics		±1% F.S. or less (15 to 35°C, based on 25°C) ±2% F.S. or less (0 to 50°C, based on 25°C)		
Current consumption (No load)		60 mA or less		
Mass		45 g		
Note 4) **Output specifications**	**Switch output**	NPN open collector (PF2D300)	Maximum load current: 80 mA Internal voltage drop: 1 V or less (with load current of 80 mA) Maximum applied voltage: 30 V 2 outputs	
		PNP open collector (PF2D301)	Maximum load current: 80 mA Internal voltage drop: 1.5 V or less (with load current of 80 mA) 2 outputs	
	Accumulated pulse output	NPN open collector or PNP open collector (same as switch output)		
Environmental resistance	**Enclosure**	IP40		
	Operating temperature range	Operating: 0 to 50°C, Stored: –25 to 85°C (with no condensation and freezing)		
	Voltage resistance	1000 VAC for 1 min. between external terminal and case		
	Insulation resistance	50M Ω or more (500 VDC Mega) between external terminal and case		
	Vibration resistance	10 to 500 Hz with a 1.5 mm amplitude or 98 m/s^2 acceleration in each X, Y, Z direction for 2 hrs., whichever is smaller. (De-energized)		
	Impact resistance	490 m/s^2 to X, Y, Z directions 3 times for each (De-energized)		
	Noise resistance	1000 Vp-p, Pulse width: 1 μs, Rise time: 1 ns		
Indicator light		3-digits 7-segment LED		
Status LED's		ON: when light is on, OUT1: Green; OUT2: Red		
Power supply voltage		12 to 24 VDC (ripple ±10% or less)		
Response time		1sec. or less		
Hysteresis		Hysteresis mode: adjustable (can be set from 0) Window comparator mode Note 5): fixed (3 digits)		

Note 1) The value varies depending on set flow range
Note 2) For digital flow switch with unit switching function. (Fixed SI unit [ℓ/min or ℓ] will be set for switch types without the unit switching function.)
Note 3) The system accuracy when combined with PF2D5□□.
Note 4) Switch output and accumulated pulse output can be selected using the control button operation during initial setting.

	1	2	3	4
Output 1	Switch output	Switch output	Accumulated pulse output	Accumulated pulse output
Output 2	Switch output	Accumulated pulse output	Switch output	Accumulated pulse output

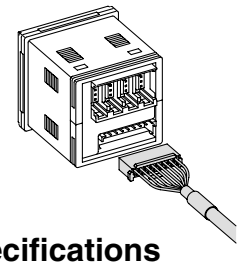
Note 5) Window comparator mode: Since hysteresis (H) will reach 3 digits, keep P_1 and P_2 or n_1 and n_2 apart by 7 digits more. (In case of output OUT2, n_1, 2 to be n_3, 4 and P_1, 2 to be P_3, 4.)
Note 6) The monitor unit conforms to the CE marking.
Note) Accumulated flow rate is reset when the power supply turns OFF.

How to Order

4-channel Flow Monitor
Remote Type
Monitor Unit

PF2D20 □ – M □ □

Accessory / Power supply output cable (2 m)



Output specification

0	NPN4 outputs
1	PNP4 outputs

Unit specification

Nil	With unit switching function
M	Fixed SI unit Note)

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

Option 1 (Refer to page 1026.)

Nil	None
A	Panel mounting
B	Front protective cover + Panel mounting

Option 2 (Refer to page 1026.)

Nil	None
4C	Sensor connector (4 pc.)

Connectable remote type sensor part is PF2D5□□-□-1 (with analog output 1 to 5 V).

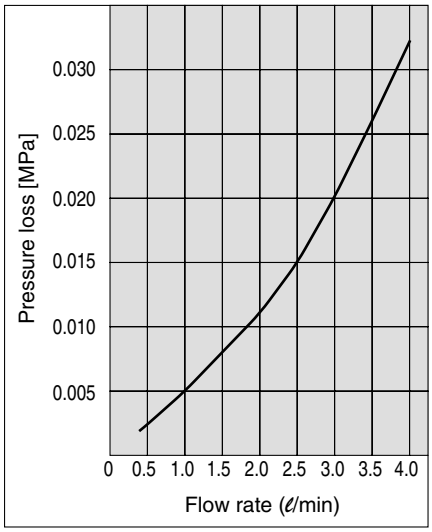
Specifications

Model		PF2D200/201		
Applicable flow rate sensor		PF2D504-□-1	PF2D520-□-1	PF2D540-□-1
Flow rate measurement range Note 1)		0.25 to 4.50 ℓ/min	1.3 to 21.0 ℓ/min	2.5 to 45.0 ℓ/min
Set flow rate range Note 1)		0.25 to 4.50 ℓ/min	1.3 to 21.0 ℓ/min	2.5 to 45.0 ℓ/min
Minimum set unit Note 1)		0.05 ℓ/min	0.1 ℓ/min	0.5 ℓ/min
Accumulated pulse flow rate exchange value (Pulse width: 50ms) Note 1)		0.05 ℓ/pulse	0.1 ℓ/pulse	0.5 ℓ/pulse
Display units Note 1)	Real-time flow rate	ℓ/min, gal(US)/min		
	Accumulated flow	ℓ, gal(US)		
Accumulated flow range Note 1)		0 to 999999 ℓ, 0 to 999999 gal(US)		
Power supply voltage		24 VDC (ripple ±10% or less) (With power supply polarity protection)		
Current consumption		55 mA or less (Not including the current consumption of the sensor)		
Power supply voltage for sensor		Same as [Power supply voltage]		
Power supply current for sensor Note 2)		Max. 110 mA (However, the total current for the 4 inputs is 440 mA maximum or less.)		
Sensor input		1 to 5 VDC (Input impedance: Approx. 800K Ω)		
Output specifications Note 3)	No. of inputs	4 inputs		
	Input protection	Excess voltage protection		
	Switch output (Real-time switch output, Accumulated switch output)	NPN open collector (PF2D200)	Maximum load current: 80 mA Internal voltage drop: 1 V or less (with load current of 80 mA) Maximum applied voltage: 30 V	
		PNP open collector (PF2D201)	Maximum load current: 80 mA Internal voltage drop: 1 V or less (with load current of 80 mA)	
	Accumulated pulse output	NPN open collector or PNP open collector (same as switch output)		
	No. of outputs	4 outputs (1 output per 1 sensor input)		
	Output protection	Short circuit protection		
Hysteresis		Hysteresis mode: Variable (can be set from 0), Window comparator mode: Fixed (3-digits)		
Response time Note 4)		1s or less		
Linearity Note 4)		±5% F.S. or less		
Repeatability Note 4)		±3% F.S. or less		
Temperature characteristics		±2% F.S. or less (0 to 50°C, based on 25°C)		
Display method		For measured value display: 4-digits, 7-segment LED (Orange) For channel display: 1-digit, 7-segment LED (Red)		
Status LED's		Illuminates when output is ON OUT1: Red		
Resistance	Enclosure	IP65 for the front face only, the rest is IP40.		
	Operating temperature range	Operating: 0 to 50°C, Stored: –10 to 60°C (with no freezing and condensation)		
	Operating humidity range	Operating or Stored: 35 to 85%RH (with no condensation)		
	Vibration resistance	10 to 500 Hz with a 1.5 mm amplitude or 98 m/s^2 acceleration, in each X, Y, Z direction for 2 hrs., whichever is smaller. (de-energized)		
	Impact resistance	980 m/s^2 in X, Y, Z directions 3 times each (de-energized)		
	Noise resistance	500 Vp-p, Pulse width 1 μs, Rise time 1 ns		
Connection		Power supply / Output connection: 8P connector, Sensor connection: 4P connector (e-con)		
Material		Housing: PBT, Monitor: PET, Backside rubber: CR		
Mass		60 g (Except for any accessories that are shipped together.		

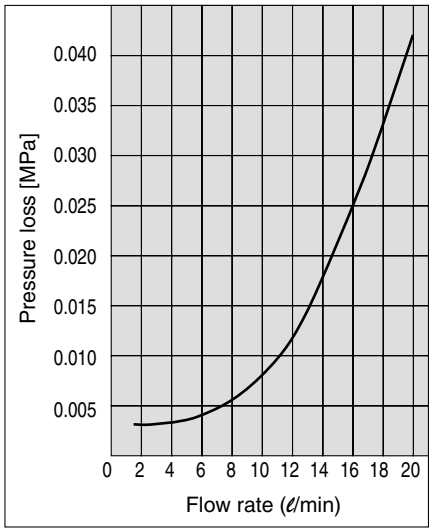
Note 1) Fixed SI unit [ℓ/min or ℓ] will be set for switch types without the unit switching function. ("-M" is suffixed at the end of part number.) Accumulated flow is reset when the power supply turns OFF.
Note 2) If Vcc side on sensor input connector part is short-circuited with the 0V side, the flow monitor inside will be damaged.
Note 3) Switch output and accumulated pulse output can be selected during initial setting.
Note 4) The system accuracy when combined with an applicable flow sensor.
Note 5) This product conforms to the CE marking.

Flow Characteristics (Pressure Characteristics)

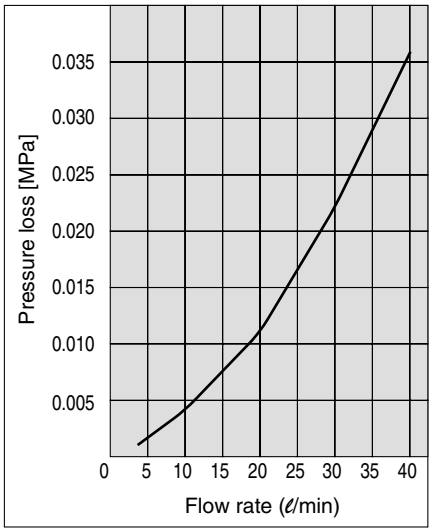
PF2D504



PF2D520

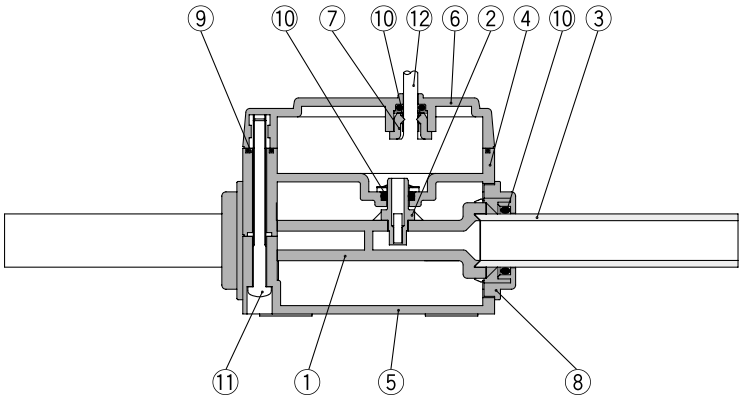


PF2D540



Construction

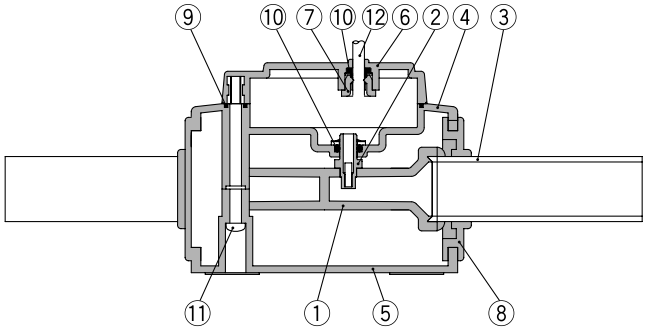
PF2D504/520



Parts list

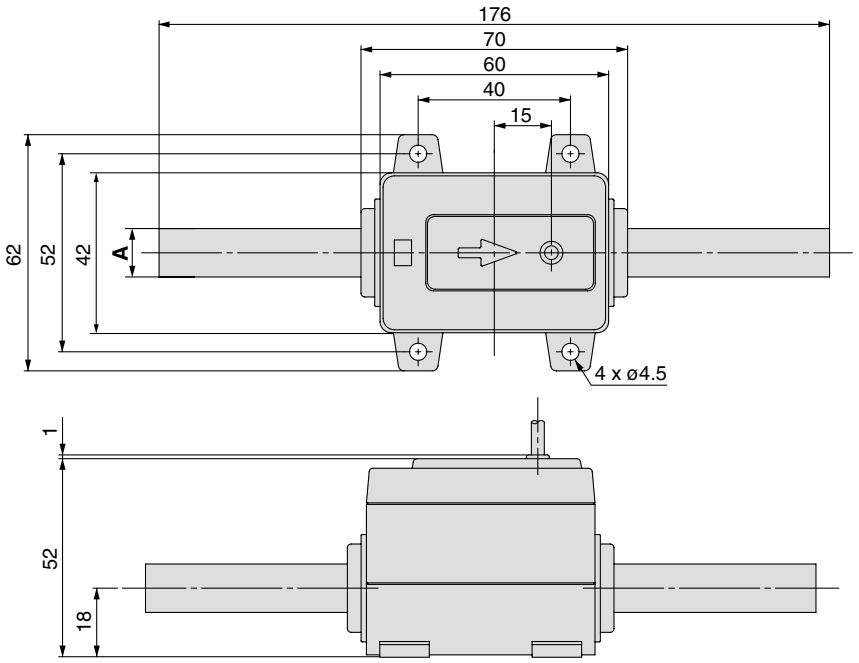
Number	Parts	Material
1	**Body**	New PFA
2	**Sensor**	New PFA
3	**Tube**	Super PFA
4	**Housing A**	PPS
5	**Housing B**	PPS
6	**Housing C**	PPS
7	**Bushing**	POM
8	**Cap**	PPS
9	**Gasket**	FKM
10	**O-ring**	FKM
11	**Thread**	Stainless steel 304
12	**Lead wire**	PVC

PF2D540



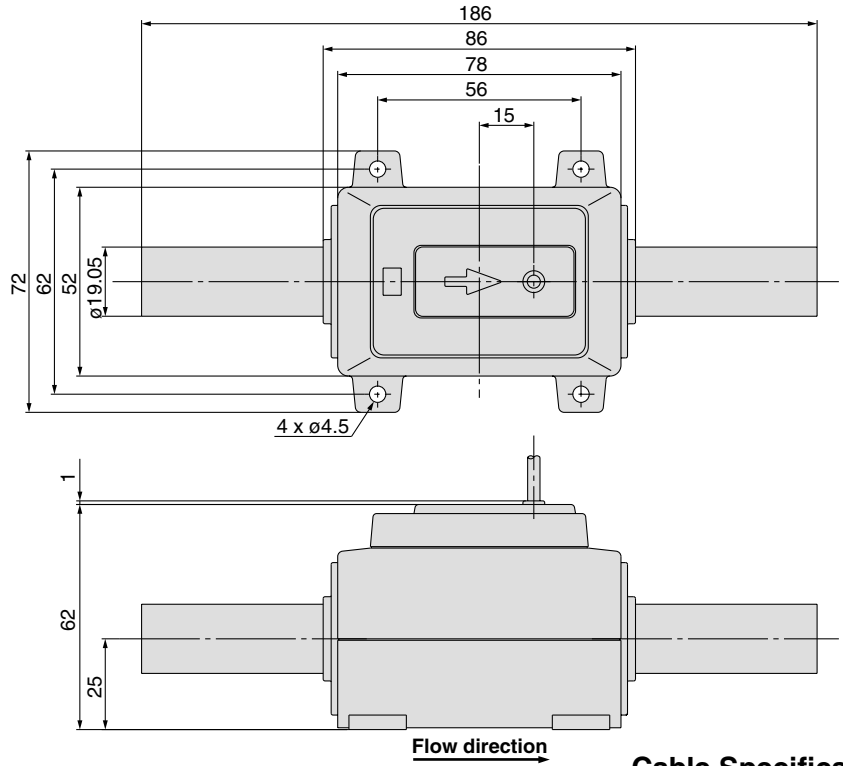
Dimensions: Remote Type Sensor Unit

PF2D504-11/520-13



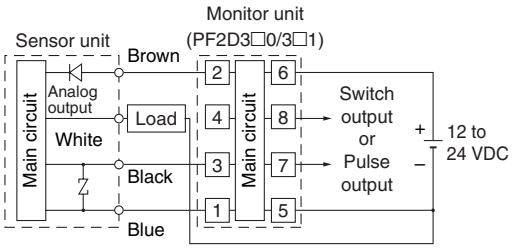
Model	A
PF2D504	ø9.52
PF2D520	ø12.7

PF2D540-19

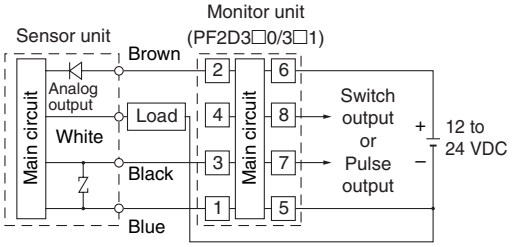


Internal circuits and wiring examples

1 to 8 are the terminal numbers.

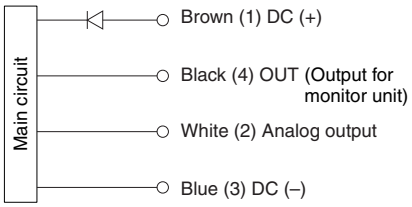


Load is an analog input equipment such as a voltmeter.
PF2D5□□-□-1 (With voltage output type)



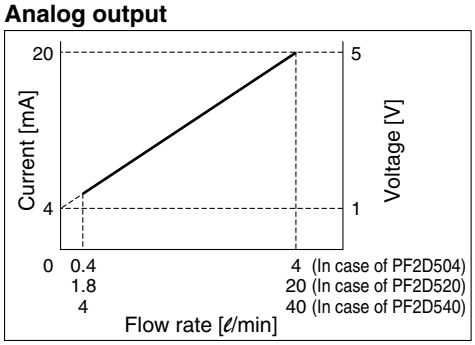
Load is an analog input equipment such as a voltmeter.
PF2D5□□-□-2 (With voltage output type)

Wiring



∗ Use this sensor by connecting it to a SMC remote type display unit Series PF2D2□□/3□□.

Analog output

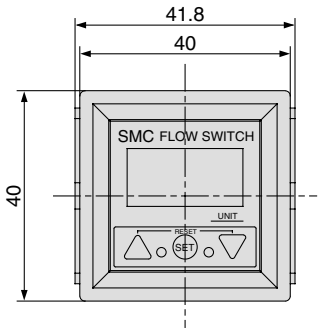


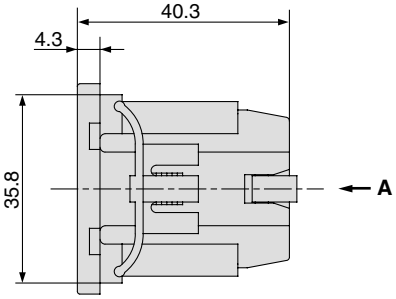
Cable Specifications

No. of cable wire		4
Conductor	**Nominal cross-sectional area**	0.15 mm^2
	Dimension	Approx. 0.5 mm
Insulator	**Dimension**	Approx. 0.9 mm Brown, White, Blue, Black
Sheath	**Material**	Oil-resistant PVC
	O.D.	3.5mm

Dimensions: Remote Type Monitor Unit

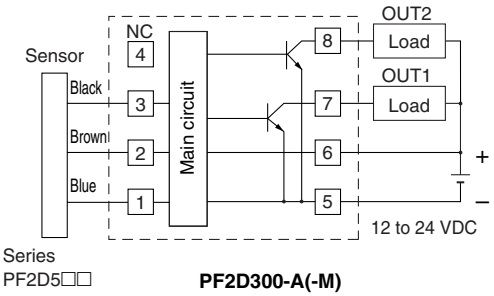
PF2D30[0/1]-A
Panel mounting type



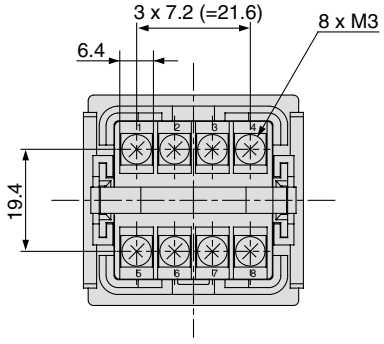


Internal circuits and wiring examples

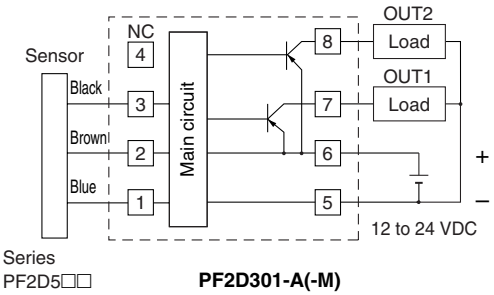
1 to 8 are the terminal numbers.



PF2D300-A(-M)



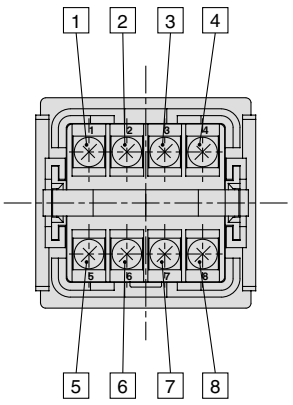
View A



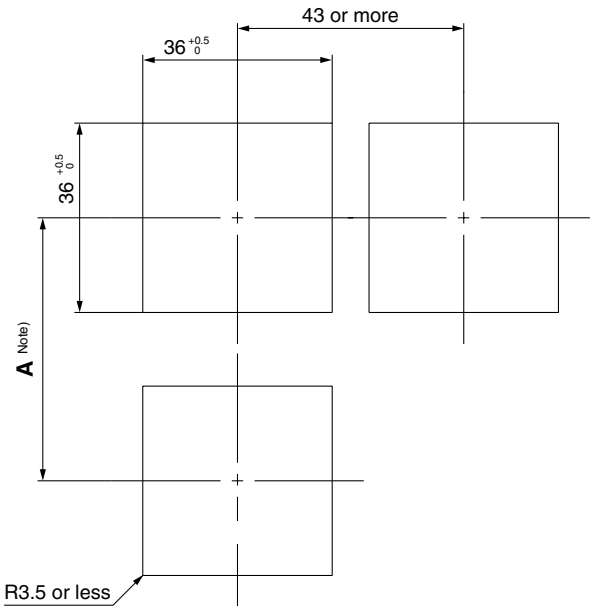
PF2D301-A(-M)

∗ Do not connect the white wire of the sensor to 3 of the monitor unit.

Terminal block numbers



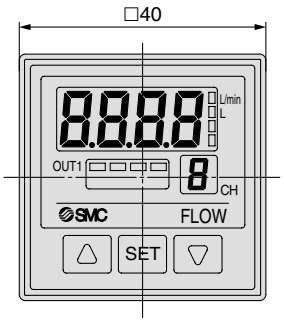
Panel fitting dimensions

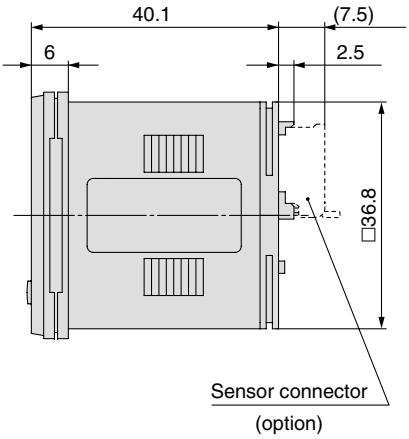


Note) Decide the length of A taking into account the size of terminal you use.
∗ The applicable panel thickness is 1 to 3.2 mm.
Corner: R3.5 or less

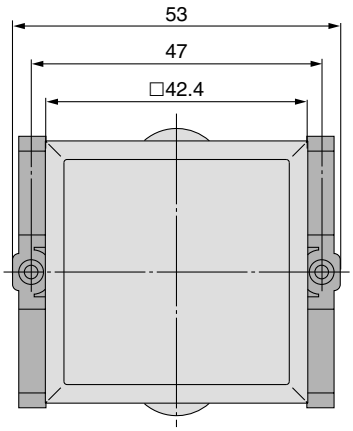
Dimensions: Remote Type Monitor Unit for Deionized Water and Chemicals (4-channel Controller)

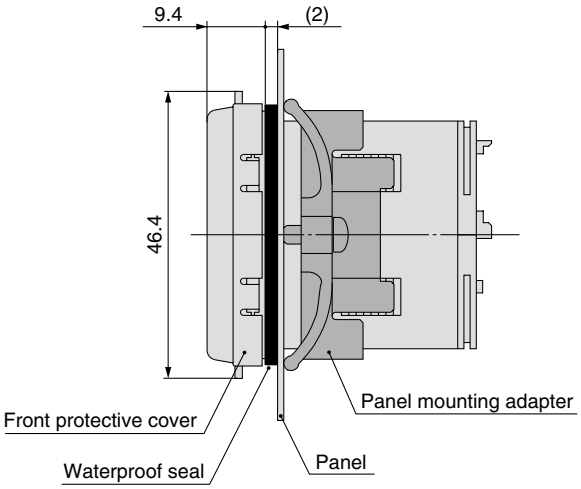
PF2D200/201



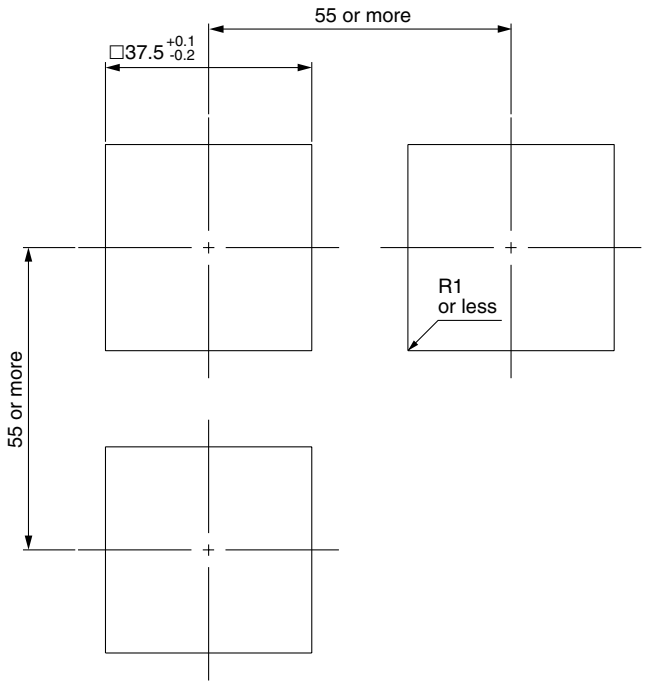


Front protective cover + Panel mounting



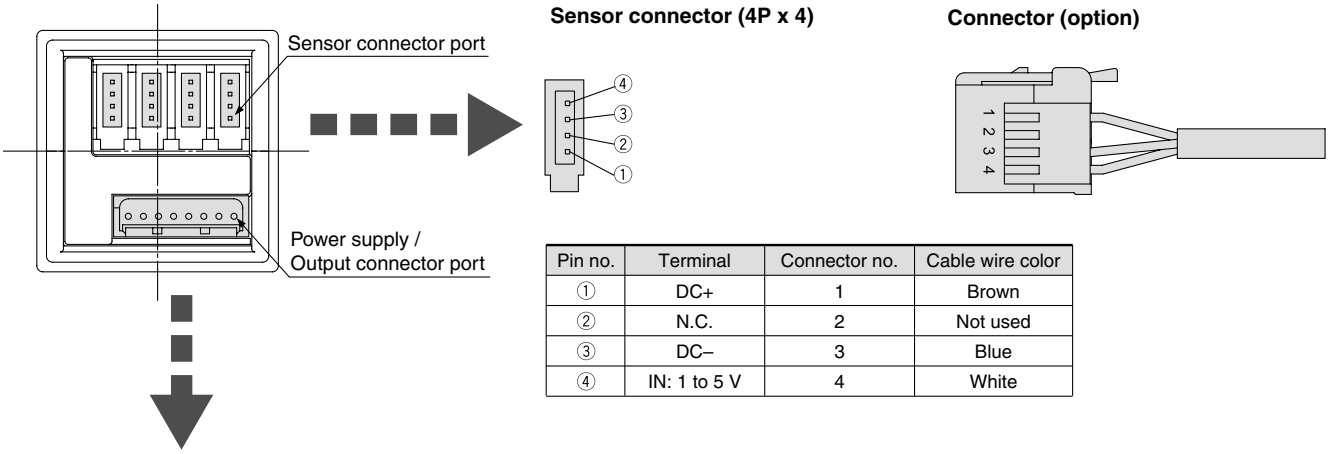


Panel fitting dimensions



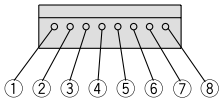
*Applicable panel thickness: 0.5 to 8 mm

Dimensions: Remote Type Monitor Unit for Deionized Water and Chemicals (4-channel Controller)



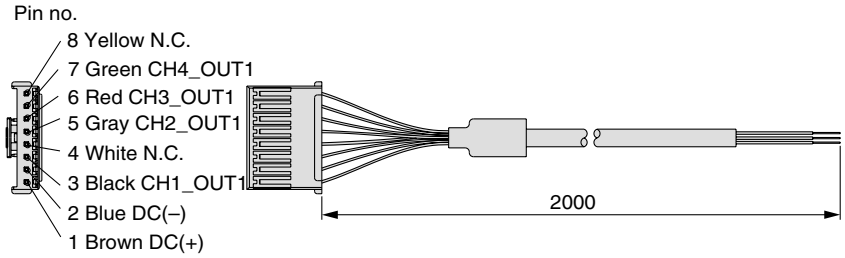
Pin no.	Terminal	Connector no.	Cable wire color
①	DC+	1	Brown
②	N.C.	2	Not used
③	DC–	3	Blue
④	IN: 1 to 5 V	4	White

Power supply / Output connector (8P)



Pin no.	Terminal
①	DC (+)
②	DC (–)
③	CH1_OUT1
④	N.C.
⑤	CH2_OUT1
⑥	CH3_OUT1
⑦	CH4_OUT1
⑧	N.C.

Power supply / Output connector (accessory)

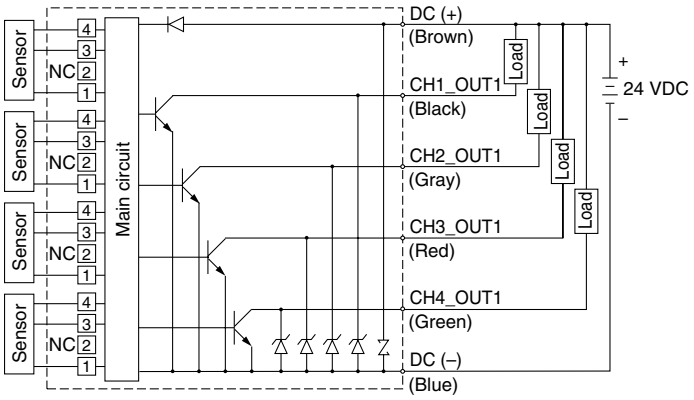


Cable Specifications

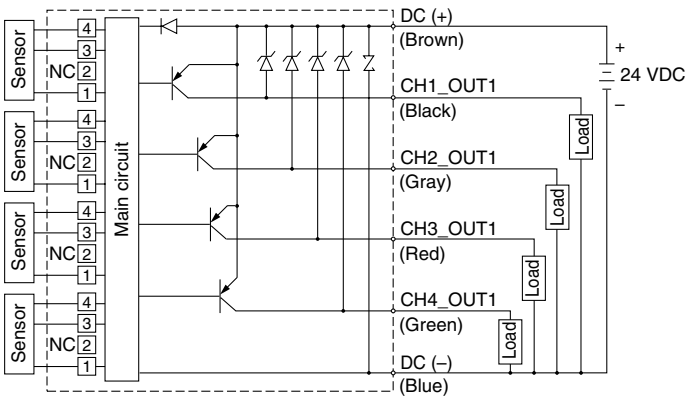
No. of cable wire		8
Conductor	**Nominal cross-sectional area**	0.15 mm^2
	Dimension	Approx. 0.5 mm
Insulator	**Dimension**	Approx. 0.9 mm Brown, White, Blue, Black, Gray, Red, Green Yellow
Sheath	**Material**	Heat-resistant polyethylene
	O.D.	4.8 mm

Internal circuits and wiring examples

PF2D200

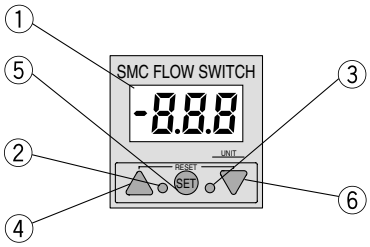


PF2D201



Description

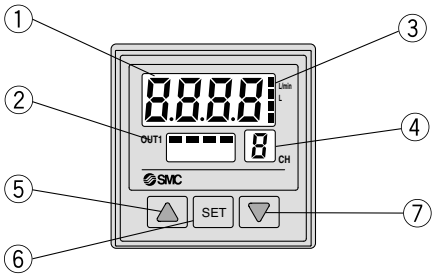
Remote Type/Monitor Unit
PF2D300, 301



RESET button (▲ + ▼ button)
If the UP and DOWN buttons are pressed simultaneously, the RESET function will activate. In case of an emergency, please clear the display. The display of the accumulated flow will be reset to zero.

①	LED display/Red	Displays the measured flow rate, each setting condition, and error code.
②	Output (OUT1) display/Green	Displays the output condition of OUT1. Illuminates when turned ON.
③	Output (OUT2) display/Red	Displays the output condition of OUT2. Illuminates when turned ON.
④	UP button (▲ button)	Use to change the mode or to increase the set value.
⑤	SET button (● button)	Use this button to set the value or the set mode.
⑥	DOWN button (▼ button)	Use to change the mode or decrease the set value.

4-channel Flow Monitor (Remote type/Monitor unit)
PF2D200, 201



①	LED display/Orange	Displays the measured flow rate, each setting condition, and error code.
②	Switch output display/Red	Displays the output condition of OUT1 (CH1 to 4). Lights up when turned ON.
③	Unit display/Orange	Illuminates the selected unit. Use after putting the unit label other than ℓ/min, ℓ.
④	Channel display/Red	Displays the selected channel.
⑤	UP button (▲ button)	Use to change the mode or to increase the set value.
⑥	SET button	Use this button to set the value or the set mode.
⑦	DOWN button (▼ button)	Use to change the mode or decrease the set value.

Functions/PF2D

Refer to the "Instruction Manual" for information on setting and operating.

Flow rate measurement selection

Real-time flow rate and accumulated flow rate can be selected.
A flow rate of up to 999999 can be accumulated.
The accumulated flow rate is reset when the power supply turns OFF.

Unit switching

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

GPM = gal (US)/min

Note) Fixed SI unit (ℓ/min, ℓ, m^3 or m^3x10) will be set for the type without the unit switching function.

Flow rate measuring unit confirmation

This function allows to confirm the accumulated flow rate when real-time flow rate is selected and to confirm the real-time flow rate when accumulated flow rate is selected.

Error correction

For PF2D300/301

LED display	Contents	Solution
Er 1	A current of more than 80 mA is flowing to OUT1.	Check the load and the wiring for OUT1.
Er2	A current of more than 80 mA is flowing to OUT2.	Check the load and the wiring for OUT2.
Er4	The set data has changed for some reason.	Perform the RESET operation, and reset all the data again.
- - -	The flow rate is over the flow rate measurement range.	Use an adjustment valve, etc. to reduce the flow rate until it is within the flow rate range.

For PF2D200/201

LED display	Contents	Solution
Er 1	Over current is flowing to the load of a switch output.	Shut off the power supply. After eliminating the output factor that caused the excess current, turn the power supply back on.
Er0	Internal data error.	Contact SMC.
Er7	Internal data error.	
Er10	Internal data error.	
Er5	Internal data error.	Shut off the power supply and then reset the switch.
Er6	Internal data error.	
- - -	The flow rate is over the flow rate measurement range.	Use an adjustment valve, etc. to reduce the flow rate until it is within the flow rate range.

Key lock

This function prevents incorrect operations such as changing the set value accidentally.

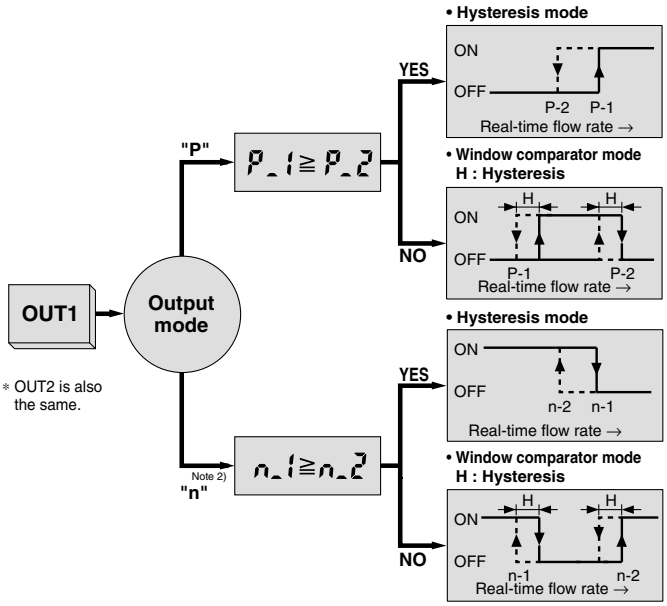
Accumulation clearance

This is to clear the accumulated value.

Output types

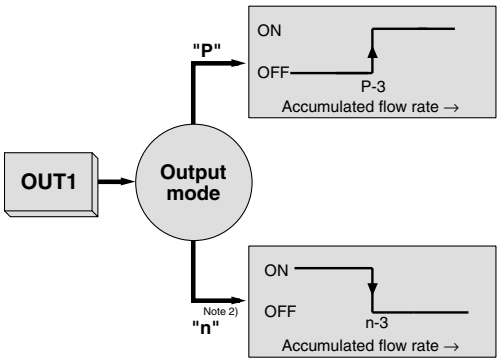
Real-time switch output, accumulated switch output, or accumulated pulse output can be selected as an output type.

Real-time switch output



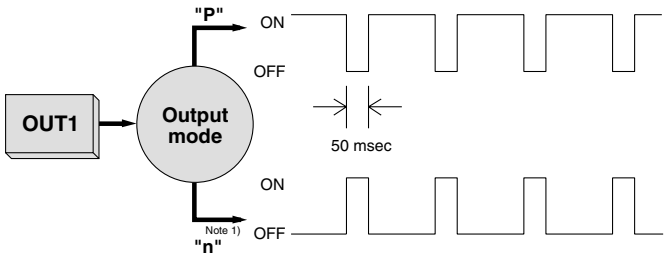
Note 2) Output mode is set to inverted output at the factory before shipment.

Accumulated switch output



Note 2) Output mode is set to inverted output at the factory before shipment.

Accumulated pulse output



Note1) Refer to the specifications of monitor unit for the flow rate value per pulse.

Functions

Copy function (PF2D200, 201 only)

Information to be copied is:
① **Flow rate range**
② **Display mode**
③ **Display unit (Only available when the unit specification is nil.)**
④ **Output method**
⑤ **Output mode**
⑥ **Flow rate value**

Peak hold, Bottom hold display function (PF2D200, 201 only)

The maximum or minimum value can be held in the case where the real-time flow rate display mode is selected during the initial setting. The hold value is reset when the power supply turns OFF or the hold is released.

Channel select function (PF2D200, 201 only)

Every pushing the △ button, channel selection "1→2→3→4→1..." is available. The flow rate measurement of each selected channel is shown in the monitor unit.

Channel scan function (PF2D200, 201 only)

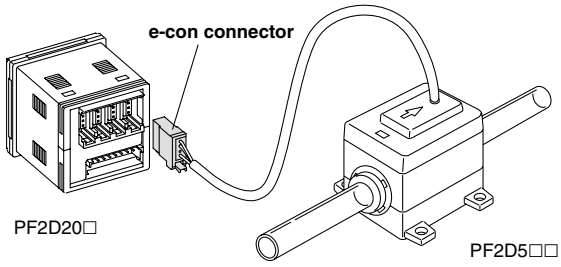
Changes displaying the channel shown every about 2 seconds and its detected flow rate.

Option

When only optional parts are required, order with the part numbers listed below.

e-con connector

Part no.	Qty.
ZS-28-CA-2	1



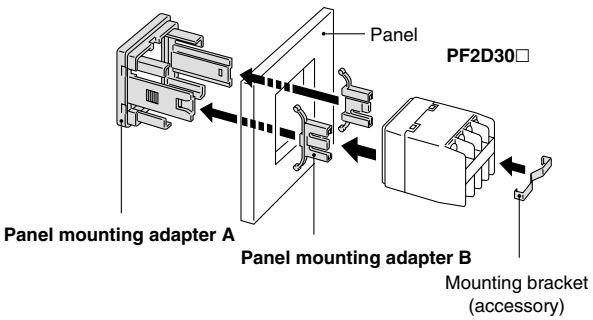
In addition to the connector shown above, those listed below (female contact) can be connected.

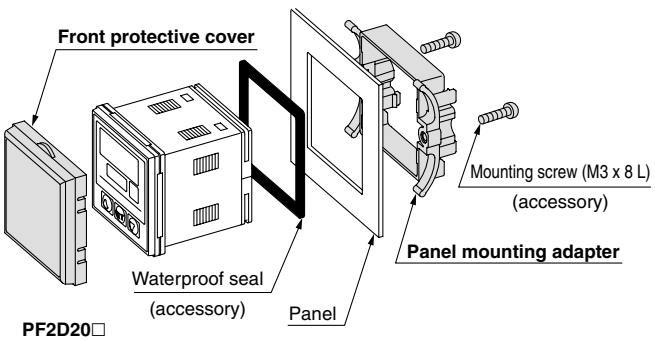
Manufacturer	Model
Sumitomo 3M Limited	37104-3101-000FL
Tyco Electronics AMP K.K.	1-1473562-4
OMRON Corp.	XN2A-1430

Panel mounting

Pin no.	Description	Note
ZS-22-E	Panel mounting adapter A, B	With mounting bracket

Part no.	Description	Note
ZS-26-B	Panel mounting adapter	With waterproof seal, mounting screw
ZS-26-C	Front protective cover + Panel mounting adapter	With waterproof seal, mounting screw





Applicable Fluid

Compatibility checklist: Between the digital flow switch sensor material for deionized water and chemicals and the fluid selected.

Fluid		Compatibility
Acetone		○
Ammonium hydroxide		○
Isobutyl alcohol		×
Isopropyl alcohol		○
Hydrochloric acid		○
Ozone		×
Hydrogen peroxide	Concentration 50% or less 50°C or less	○
Ethyl acetate		○
Butyl acetate		○
Nitric acid (except fuming nitric acid)	Concentration 10% or less	○
Deionized water		○
Sodium hydroxide		×
Ultra deionized water		○
Toluene		○
Hydrofluoric acid	Concentration 50% or less	○
Sulfuric acid (except fuming sulfuric acid)	Concentration 20% or less	○
Phosphoric acid	Concentration 30% or less	○

Note 1) The material and fluid compatibility check list provides reference values as a guide only.
Note 2) It is possible that some fluids are permeable depending on the type of fluid, its density and temperature. Any permeated fluid may affect the products life.
Thus, when using these fluid types, verify the fluid in advance by testing it, prior to making a decision to use it.

Table symbols ○ : Can be used
: Can be used under certain conditions
× : Cannot be used

· Compatibility is indicated for fluid temperatures at 90°C or less.
· The product does not have an explosion proof construction. Be sure to take measures to prevent the area around the product from becoming filled with an explosive gas, when using an explosive fluid.

Series PF2D
Specific Product Precautions 1

Be sure to read before handling. Refer to front matters 58 and 59 for Safety Instructions and pages 892 to 896 for Flow Switch Precautions.

Design and Selection

⚠Warning

1. Operate the switch only within the specified voltage.

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

2. Do not exceed the maximum allowable load specification.

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

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

Although the circuit at the output side of the switch is surge protected, damage may still occur if a voltage surge is applied repeatedly. When a load which generates a surge, such as from a relay or solenoid valve is directly driven, use a switch with a built-in surge absorbing element.

4. Be sure to verify the applicable fluid.

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

5. Monitor the internal voltage drop of the switch.

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

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

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

Operating beyond the specified flow rate and operating pressure can damage the switch. Especially avoid the application of pressure through a water hammer, which is above the specification.

<Examples of pressure reduction measures>

a) Use a device such as a water hammer relief valve to slow the valve's closing speed.

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

c) Keep the piping length as short as possible.

7. Design the system so that the fluid always fills the detection passage.

Especially for vertical mounting, introduce the fluid from the bottom to the top.

8. Operate within the flow rate measurement range.

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

9. Never use inflammable fluids and/or permeable fluids.

They may cause a fire, an explosion or corrosion.

∗ Refer to the MSDS (material safety data sheet) when using chemicals.

Design and Selection

⚠Caution

1. Data from the flow switch is stored even after the power supply is off.

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

2. Accumulated flow rate is reset when it is turned OFF.

Mounting

⚠Warning

1. Monitor the flow direction of the fluid.

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

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

3. Do not drop or bump.

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

4. Hold the body of the switch when handling.

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

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

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

6. Never mount a switch in a place that will be used as a step stool during piping.

7. Be sure to allow straight pipe length that is minimum 8 times the port size upstream and downstream of the switch piping.

When abruptly reducing the size of piping or when there is a restriction such as a valve on the inlet side, the pressure distribution in the piping changes and makes accurate measurement impossible. Therefore, flow restriction measures such as these should be implemented on the outlet side of the switch.

Also, leaving the outlet side open or bringing about excessive flow volume will increase the risk of cavitation and may make accurate measurement impossible. Increasing the fluid pressure is one means of reducing cavitation. Try a procedure such as mounting a throttle on the outlet side of the switch. Check to make sure there is no malfunction before using.

Series PF2D
Specific Product Precautions 2

Be sure to read before handling. Refer to front matters 58 and 59 for Safety Instructions and pages 892 to 896 for Flow Switch Precautions.

Wiring

⚠Warning

1. Verify the color and the terminal number when wiring.

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

2. Avoid repeatedly bending or stretching of the lead wire.

Repeatedly applying bending stress or stretching force to the lead wire will cause it to break.

3. Confirm proper insulation of wiring.

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

4. Do not wire in conjunction with power lines or high voltage lines.

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

5. Do not allow loads to short circuit.

Although a switch indicate excess current error if a load is short circuited, all incorrect wiring connections such as power supply polarity cannot be protected. Take precautions to avoid incorrect wiring.

Usage

⚠Warning

1. When using a switch for high temperature fluid, the switch itself also becomes hot due to the high temperature fluid. Avoid touching the switch directly as this may cause a burn.

Operating Environment

⚠Warning

1. Never use in the presence of explosive gases.

The switches do not have an explosion proof rating. Never use in the presence of an explosive gas as this may cause a serious explosion.

2. Mount the switch in a location where there is no vibration (Monitor: greater than 98 m/s², Sensor: 4.9 m/s² or less), or no impact greater than 490 m/s².

3. Do not use in an area where surges are generated.

When there are units that generate a large amount of surge in the area around a pressure switch, (e.g., solenoid type lifters, high frequency induction furnaces, motors, etc.) this may cause deterioration or damage to the switch's internal circuitry. Avoid sources of surge generation and crossed lines.

4. Switches are not equipped with surge protection against lightning.

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

5. Avoid using the switch in an environment where the likelihood of splashing or spraying of liquids exists.

The switches are dustproof and splashproof; however, avoid using in an environment where the likelihood of heavy splashing or spraying of water and/or oil exist. Since the monitor unit of the remote type switches featured here is not dust or splash proof, the use in an environment where water and/or oil splashing or spraying exists must be avoided.

Maintenance

⚠Warning

1. Perform periodical inspections to ensure proper operation of the switch.

Unexpected malfunctions may cause a possible danger.

2. Take precautions when using the switch for an interlock circuit.

When a pressure switch is used for the interlock circuit, devise a multiple interlock system to prevent trouble or malfunction. Verify the operation of the switch and the interlock function on a regular basis.

3. Do not disassemble or perform any conversion work on flow switches.

4. The following should be observed during regular maintenance to avoid damage and loss due to chemicals.

1) Do not touch the remaining chemicals in piping and/or digital flow switch.

2) Check the name and the nature of chemicals used and treat them accordingly.

Series PF2D
Specific Product Precautions 3

Be sure to read before handling. Refer to front matters 58 and 59 for Safety Instructions and pages 892 to 896 for Flow Switch Precautions.

Measured Fluid

⚠Warning

1. Check regulators and flow adjustment valves before introducing the fluid.

If pressure or flow rate beyond the specified range are applied to the switch, the sensor unit may be damaged.

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

If foreign matter adheres to the switch's vortex generator or vortex detector, accurate measurement will no longer be possible.

Others

⚠Warning

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

2. Perform settings after stopping control systems.

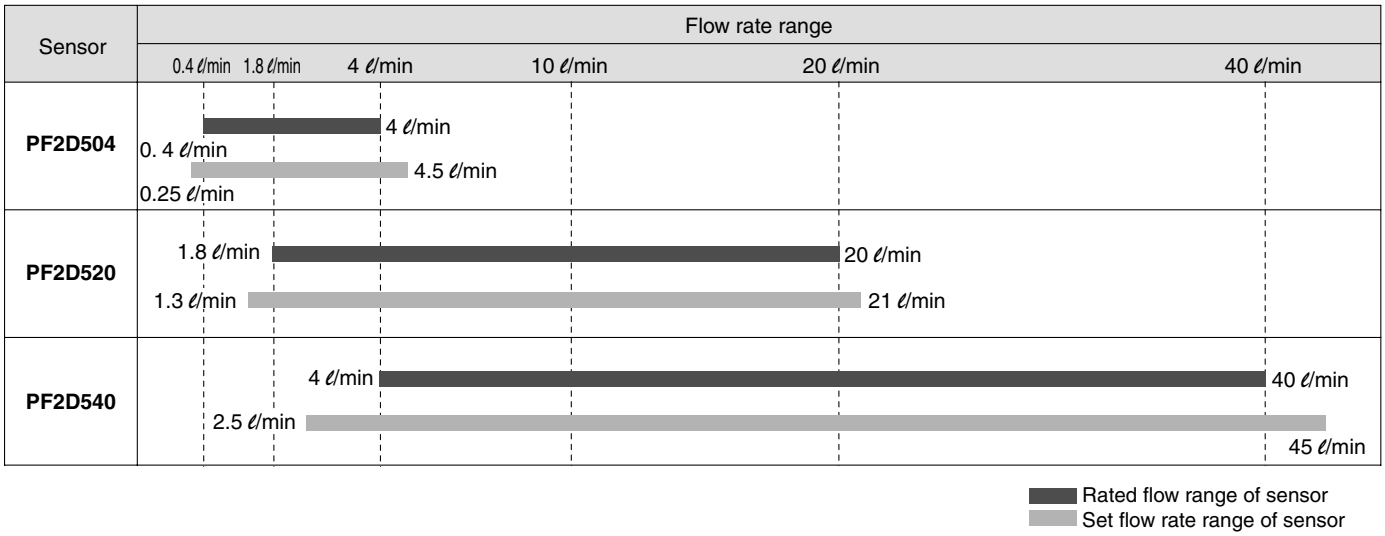
When the switch's initial setting and flow rate setting are performed, output maintains the condition prior to the settings. Output turns OFF when the switch's initial setting and flow rate setting are performed.

Set Flow Rate Range and Rated Flow Range

⚠Caution

Set the flow rate within the rated flow range.

The set flow rate range is the range of flow rate that can be set on the controller side.
The rated flow range is the range that satisfies the sensor's specifications (accuracy, linearity etc.).
It is possible to set a value outside off the rated flow range, however, the specification is not be guaranteed.



Series PF2D
Specific Product Precautions 4

Be sure to read before handling. Refer to front matters 58 and 59 for Safety Instructions and pages 892 to 896 for Flow Switch Precautions.

■ 4-channel Flow Monitor

Handling

⚠ Warning

1. Do not drop, bump, or apply excessive impacts (980 m/s²) while handling. Although the body of the flow monitor case may not be damaged, the inside of the flow monitor could be damaged and lead to a malfunction.

2. The tensile strength of the power supply/output connection cable is 50N and the sensor lead wire with a connector is 25N. Applying a greater pulling force than the applicable specified tensile strength to either of these components can lead to a malfunction. When handling, hold the body of the controller.

Connection

⚠ Warning

1. Incorrect wiring can damage the switch and cause a malfunction or erroneous switch output. Connections should be done while the power is turned off.

2. Do not attempt to insert or pull the flow rate sensor or its connector when the power is on. Switch output may malfunction.

3. Wire separately from power lines and high voltage lines, avoiding wiring in the same conduit with these lines. Malfunctions may occur due to noise from these other lines.

4. If a commercial switching power supply is used, make sure that the F.G. terminal is grounded.

Operating Environment

⚠ Warning

1. Our 4-channel flow monitor is CE marked, however it is not equipped with surge protection against lightning. Lightning surge countermeasures should be applied directly to system components as necessary.

2. Our 4-channel flow monitor does not have an explosion proof rating. Never use pressure sensors in the presence of inflammable or explosive gases.

3. Enclosure "IP65" applies only to the front face of the panel when mounting. Do not use in an environment where oil splashing or spraying are anticipated.

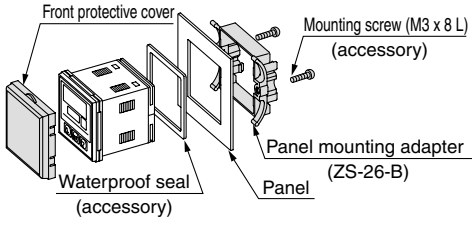
Mounting

⚠ Caution

The front face of the panel mount conforms to IP65, however there is a possibility of liquid infiltration if the panel mount adapter is not installed securely and properly. Securely fix the adapter with screws as shown below.

Front protective cover + Panel mounting

Tighten screws 1/4 to 1/2 turn after the heads are flush with the panel.

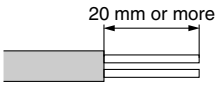


Wiring

⚠ Caution

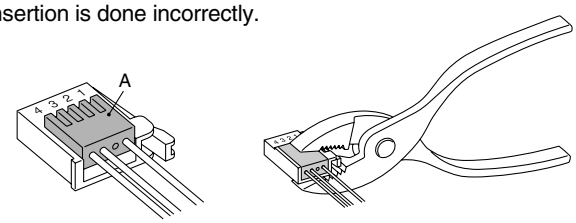
1. Connecting sensor cable and connector (ZS-28-CA-□)

- Cut the sensor cable as shown below.
- Insert each lead wire into the corresponding connector number by following the chart provided below.



Connector no.	Cable wire color
1	Brown (DC+)
2	Not used
3	Blue (DC–)
4	White (IN: 1 to 5 V)

- Make sure that the numbers on the connector and the wire colors match. After verifying that the wires are fully inserted, temporarily hold A down by hand.
- Using pliers, press the center of A straight down.
- Note that that connector cannot be taken apart for reuse once it is crimped. Use a new sensor connector if wiring or cable insertion is done incorrectly.



2. Inserting/Detaching of sensor connector, power supply/output connector

- Insert each connector straightforwardly until it clicks and locks onto the body.
- To remove the connector, pull it straight out while pushing the lever with your thumb.