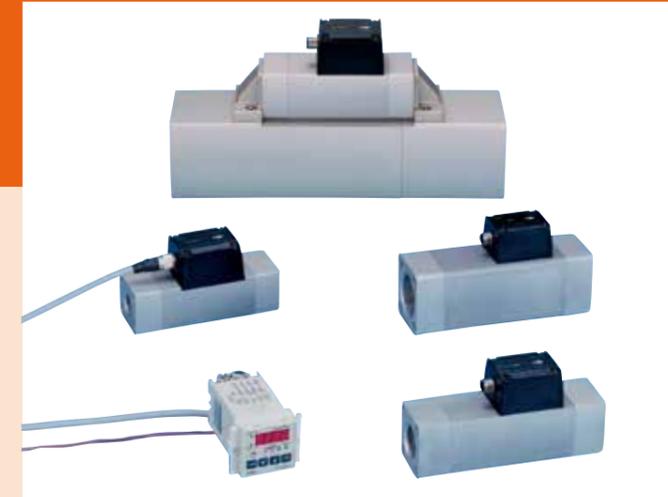


# Compressed air flow rate sensor

## Separated display FLUEREX flow sensor ® PFD

■ Flow rate sensor



### CONTENTS

Product Introduction	404
FLUEREX flow sensor (PFD) separated display	406
Electric wiring	412
Functions/operations for monitor	414
⚠ Safety Precautions	415

## Contributing to carbon neutrality with energy-saving management



Flow rate sensor

Compact flow sensor (gas)

Compact flow sensor (air)

Compact flow sensor (liquid)

Water Manifold Unit

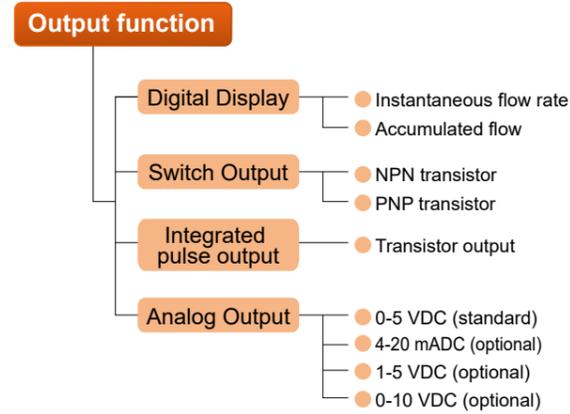
### Grasp the current situation → Implement measures → Effect confirmation → Correction / Continuation

- |   |   |  |   |
|---|---|--|---|
| <ul style="list-style-type: none"> <li>Measure the status of flow rate</li> <li>Consider countermeasures</li> </ul> | <ul style="list-style-type: none"> <li>Stop the air pressure supply during non-operation</li> <li>Blow time reduction</li> <li>Application of energy saving nozzle</li> <li>Lower pressure</li> </ul> | <ul style="list-style-type: none"> <li>Measurement with flow rate sensor</li> <li>Cost conversion is possible with integrating function</li> </ul> | <ul style="list-style-type: none"> <li>Standardized consumption of equipment and lines</li> <li>Application in other lines</li> </ul> |
|---|---|--|---|

### Cover a wide range of flow rates with 6 varieties

Model No. (port size)	Flow rate range [ L /min (normal)]				
	10	100	1,000	10,000	100,000
PFD-501 (Rc3/8)		25	500		
PFD-102 (Rc1/2)		50	1000		
PFD-202 (Rc3/4)		100	2000		
PFD-402 (Rc1)		200	4000		
PFD-802 (Rc1 1/2)		400	8000		
PFD-163 (Rc2)		800	16000		

### A wide range of output variations



### Digital direct-reading, correction not needed

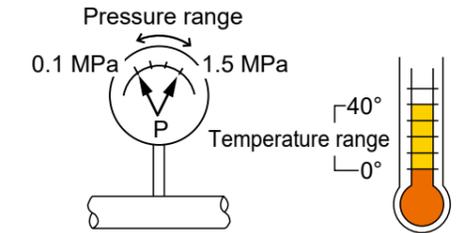
The digital display value does not require complicated pressure and temperature correction, and can be read as is.

#### ● No need for pressure correction

Method of detecting the mass flow rate

#### ● Temperature correction not required

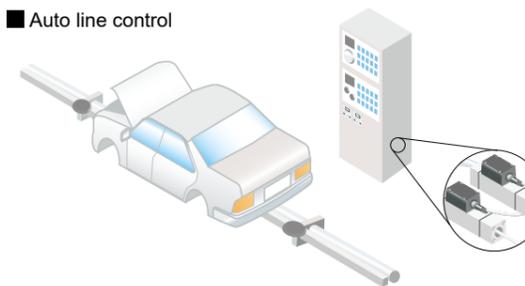
Built-in automatic temperature correction function



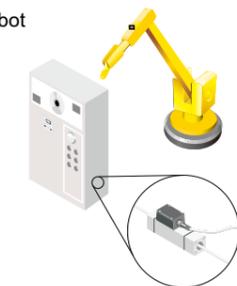
### Examples of applications

#### For flow rate management of production line of an auto plant

##### Auto line control

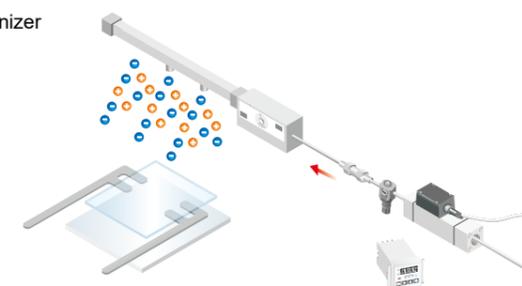


##### Paint line robot

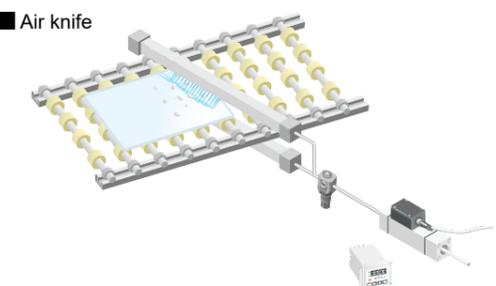


#### For flow rate management of FPD manufacturing equipment

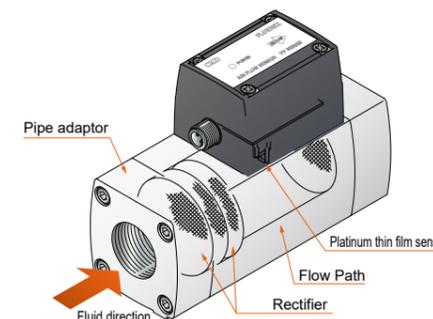
##### Ionizer



##### Air knife



### Functions



The sensor of FLUEREX consists of a rectifier that converts the compressed air to a uniform flow and a platinum thin film resistor that detects the flow rate. The rectifier works to make the flow uniform when a bent pipe such as an elbow is installed immediately before the sensor. Through the use of multiple rectification plates, the pressure loss is suppressed and an adequate rectification effect is realized. When the compressed air does not flow, the platinum thin film sensor that detects the flow rate is heated from the fluid temperature to a certain constant temperature. When the compressed air flows, the amount of heat proportional to the weight of air is detracted and the current that intends to maintain the constant temperature flows in the circuit inside the platinum thin film sensor that detects the flow rate. By receiving this current as a flow rate signal, the display section displays a practical atmospheric pressure, instantaneous flow rate or accumulated flow of the air converted to 0°C. In addition, by the platinum thin film sensor that detects the fluid temperature, the temperature of the compressed air is measured and the temperature correction is performed.

Flow rate sensor

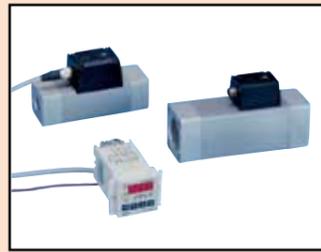
Compact flow sensor (gas)

Compact flow sensor (air)

Compact flow sensor (liquid)

Water Manifold Unit

Ending



Pneumatic flow rate sensor FLUEREX

# PFD Series

- Flow rate range: 25 to 500, 50 to 1000, 100 to 2000, 200 to 4000, 400 to 8000, 800 to 16000 L/min (normal)

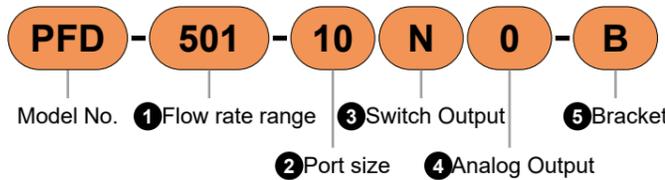


Refer to the CKD website for detailed compatible model Nos.

## Features

- Correction due to pressure fluctuation or temperature fluctuation is not required.
- The flow rate converted to the reference state (0°C, 101.3 kPa) is displayed.
- Integration display and integrated value pulse output are possible.
- A wide range of functions and variations such as flow rate range and various electric outputs.

### Model No. Notation Method



Note: The product consists of sensor, monitor and cable.  
The description on the plate is as follows.  
The model No. is not indicated on the cable.

Product: PFD-(1)-(2)(3)(4)-(5)  
Sensor section: PFD-(1)-(2)  
Monitor section: PFD-(1)-(3)(4)

#### 1 Flow rate range

Code	Description
501	25 to 500 L/min (normal)
102	50 to 1000 L/min (normal)
202	100 to 2000 L/min (normal)
402	200 to 4000 L/min (normal)
802	400 to 8000 L/min (normal)
163	0.80 to 16.00 m <sup>3</sup> /min (normal)

Note: Bracket option is not available for PFD-163.

#### 3 Switch Output

Code	Description
N	NPN transistor output x 2
P	PNP transistor output x 2

#### 5 Bracket

Code	Description
Blank	None Standard
B	Bracket included Option

Note: Bracket option is not available for PFD-163.

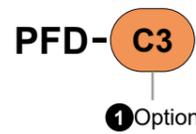
#### 2 Port size

Code	Description	1 Flow rate range					
		501	102	202	402	802	163
10	Rc3/8	●					
15	Rc1/2		●				
20	Rc3/4			●			
25	Rc1				●		
40	Rc1-1/2					●	
50	Rc2						●

#### 4 Analog Output

Code	Description
0	0 to 5 VDC Standard
1	4 to 20 mA DC Option
2	1 to 5 VDC Option
3	0 to 10 VDC Option

- Discrete option model No.



#### 1 Option

Code	Description
C3	Standard cable
B	Bracket (for 501/102/202/402)
B1	Bracket (for 802)

## Specifications

Item	PFD-501-10	PFD-102-15	PFD-202-20	PFD-402-25	PFD-802-40	PFD-163-50
Flow rate range L/min (normal)	25 to 500	5 to 50	100 to 2000	100 to 200	400 to 8000	800 to 16000
Port size	Rc3/8	Rc1/2	Rc3/4	Rc1	Rc1-1/2	Rc2
Applicable fluid	Compressed clean air/nitrogen gas					
Air quality	ISO 8573-1: 2010 [1:1:1 to 1:6:1] *1					
Max. Working Pressure MPa	1.0					
Min. working pressure MPa	0.1					
Proof pressure MPa	1.5					
Ambient temperature °C	0 to 50					
Ambient humidity	85%R.H. or less (no condensation)					
Fluid temperature °C	0 to 40					
Linearity	±3.0% F.S. (0.5 MPa, at 20°C)					
Pressure characteristics	±2.0% F.S. (0.5 MPa reference, at 0.2 to 0.7 MPa)					
Temperature characteristics	±2.0% F.S. (20°C reference, at 10 to 30°C)					
Pressure loss MPa	0.015 or less (max. flow rate, at 0.5 MPa)					
Response time sec	2.5 or less					
Indicator	Instant/accumulated flow 4-digit LED display					
Resolution L/min (normal)	1	5	5	10	20	50
Min. displayed flow rate L/min (normal)	10	20	40	80	160	320
Accumulated flow	Max. 9 digits (switching display using change key) *2					
Analog Output	Standard: 0 to 5 VDC, option: 4 to 20 mA DC, 1 to 5 V, 0 to 10 V					
Switch Output	2 points (NPN/PNP transistor output: selection)					
Pulse output *3	10 L (normal) / pulse			100 L (normal) / pulse		
Power supply voltage V	24 VDC (6 W or less/excluding load current of switch output)					
Cable	Accessory (3 m, 4-conductor, final diameter ø6, core wire 0.5 mm <sup>2</sup> , insulator outer diameter 1.72 mm, with connector)					
Mounting orientation	Unrestricted in vertical/horizontal directions					
Straight piping section	IN side: 10D, OUT side: 5D, these are recommended *4					
Degree of Protection	IP64 equivalent (only for sensor)					
Weight kg	1.1	1.1	1.3	1.4	1.7	4.5
Bracket weight g	61 (including screws)				92 (including screws)	

\*1: Note that condensation may be formed when used in a state in which the ambient temperature is lower than the fluid temperature. Note that detection failure may occur if transmitted oil is accumulated. Because this kit does not have clean specifications for equipment, the generation of particles occurs on the secondary side. When ultra clean air is required, it is recommended to install a filter for precise filtration on the end side.

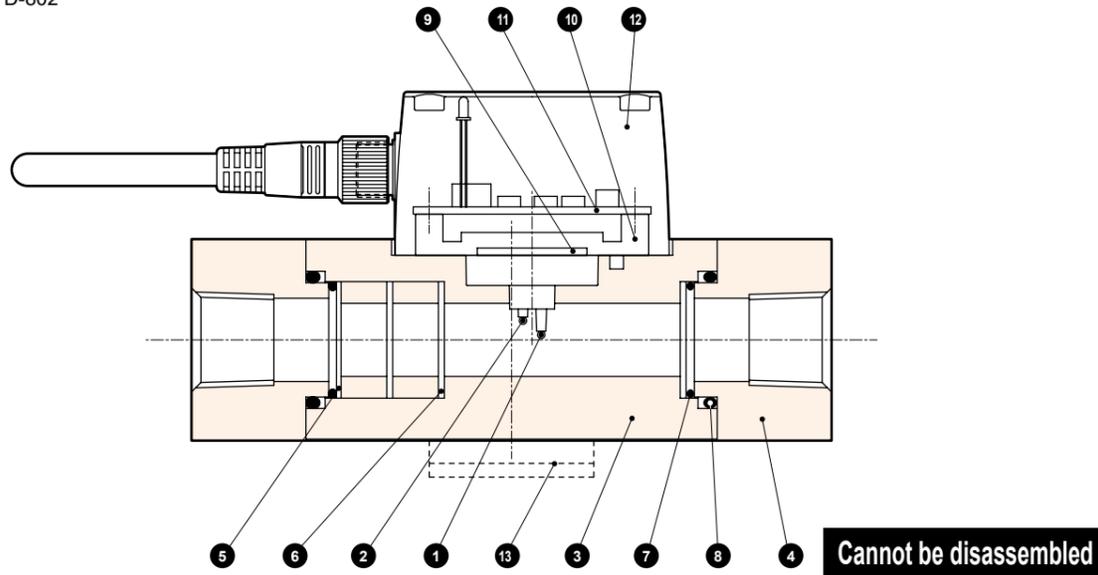
\*2: The data of accumulated flow value is backed up regularly.

\*3: The pulse output is shared with the switch output. Use this output by switching the function.

\*4: Installing straight pipes is recommended so that the piping conditions do not affect the performance (D is inner diameter of the pipe).

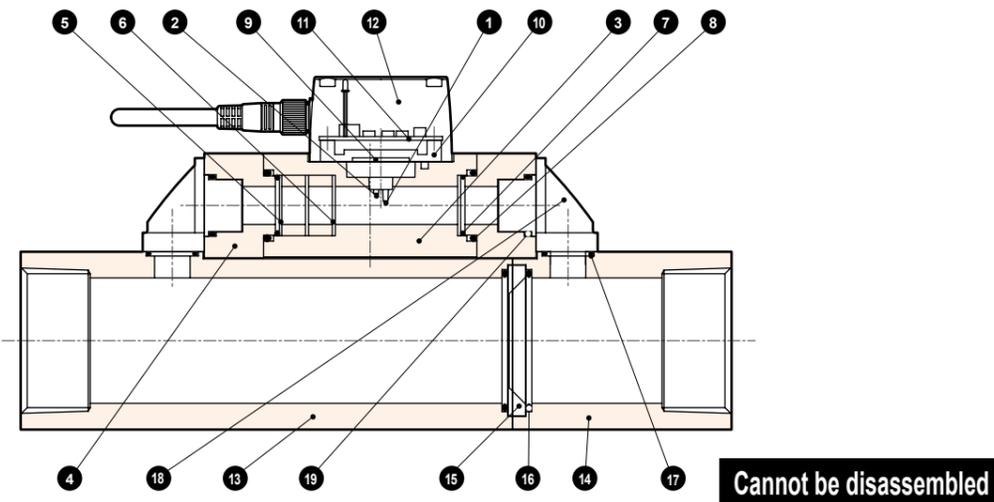
Internal Structure Diagram / Material

●PFD-501 to PFD-802



Part No.	Part name	Material	Part No.	Part name	Material
1	Platinum thin film sensor 1	Aluminum/platinum	8	O-ring	NBR :Nitrile Rubber
2	Platinum thin film sensor 2	Aluminum/platinum	9	Sensor base board	Glass epoxy
3	Body	A6063S :Aluminum alloy	10	Sensor base	PBT :Polybutylene terephthalate
4	Adapter	A6063S :Aluminum alloy	11	Sensor board	Glass epoxy
5	Rectification plate	SUS304 :Stainless steel	12	Cover	ABS :ABS resin
6	Mesh	SUS304 :Stainless steel	13	Bracket	SUS304 :Stainless steel
7	O-ring	NBR :Nitrile Rubber			

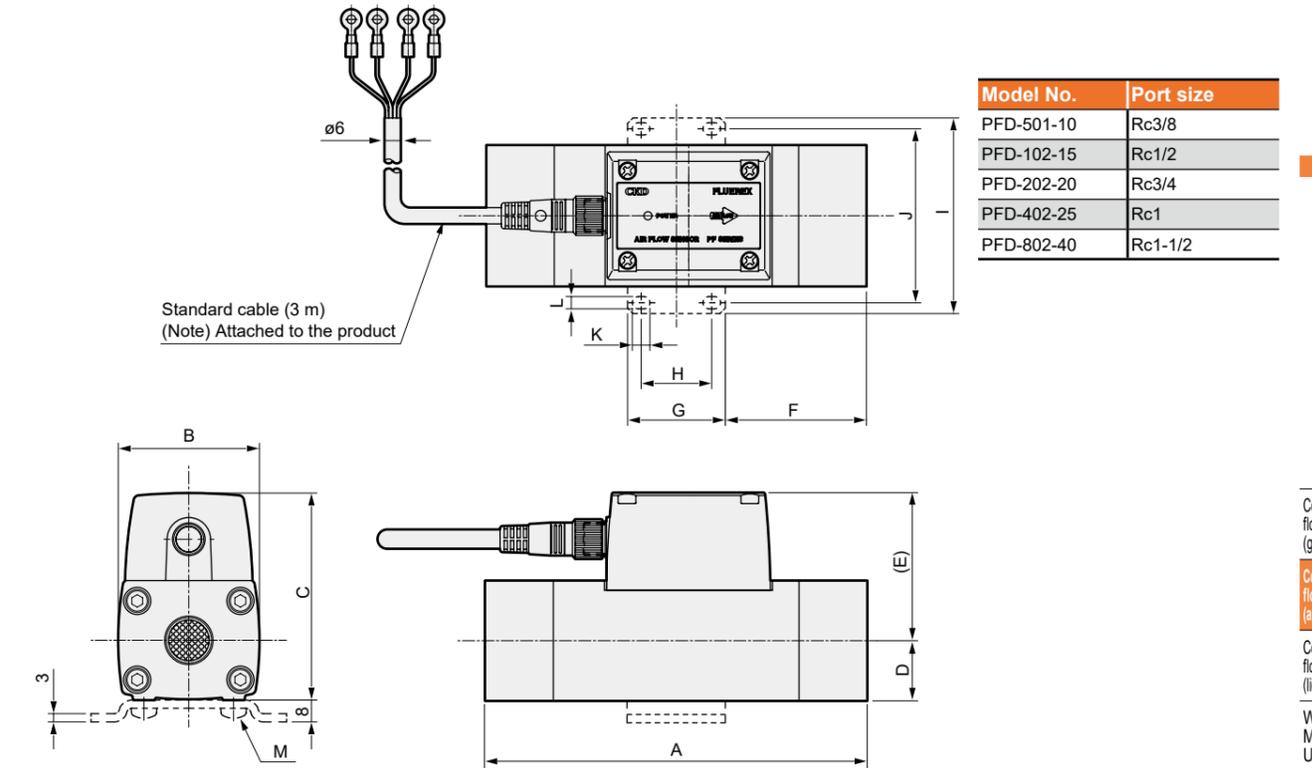
●PFD-163



Part No.	Part name	Material	Part No.	Part name	Material
1	Platinum thin film sensor 1	Aluminum/platinum	11	Sensor board	Glass epoxy
2	Platinum thin film sensor 2	Aluminum/platinum	12	Cover	ABS :ABS resin
3	Body	A6063S :Aluminum alloy	13	Flow path 1	A6063S :Aluminum alloy
4	Split-flow adaptor	A6063S :Aluminum alloy	14	Flow path 2	A6063S :Aluminum alloy
5	Rectification plate	SUS304 :Stainless steel	15	Orifice	C3604BD :Brass
6	Mesh	SUS304 :Stainless steel	16	O-ring	NBR :Nitrile Rubber
7	O-ring	NBR :Nitrile Rubber	17	O-ring	NBR :Nitrile Rubber
8	O-ring	NBR :Nitrile Rubber	18	Sub-attachment	SCS13 :Stainless steel
9	Sensor base board	Glass epoxy	19	O-ring	NBR :Nitrile Rubber
10	Sensor base	PBT :Polybutylene terephthalate			

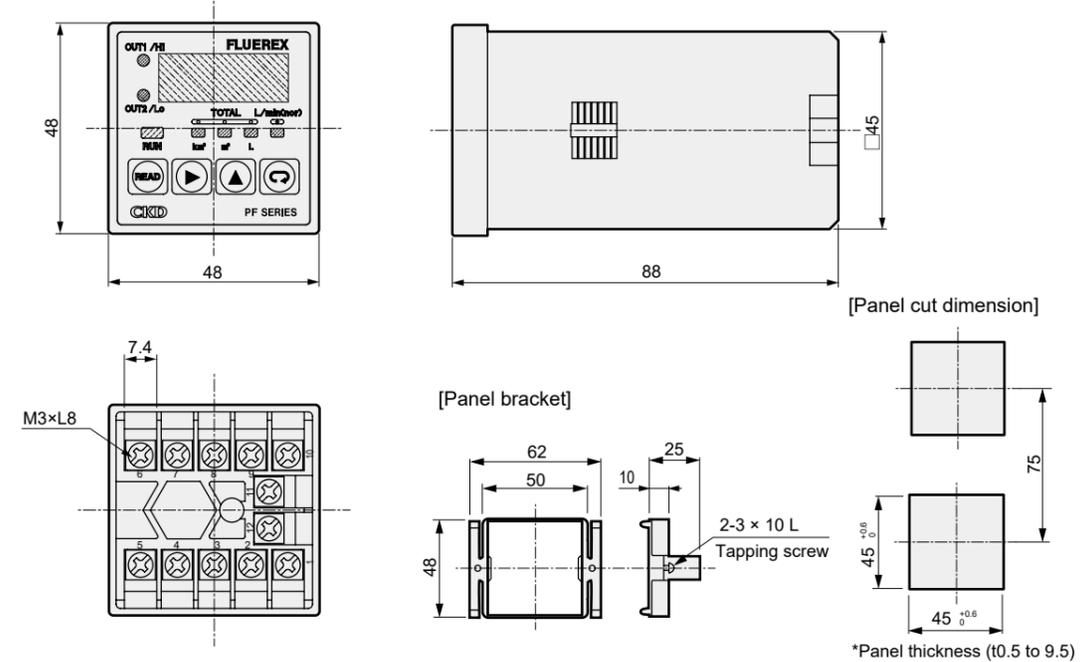
Dimensions

●PFD-501 to 802



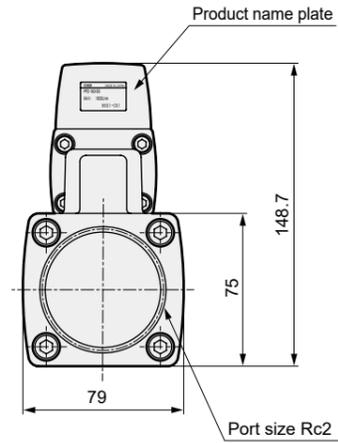
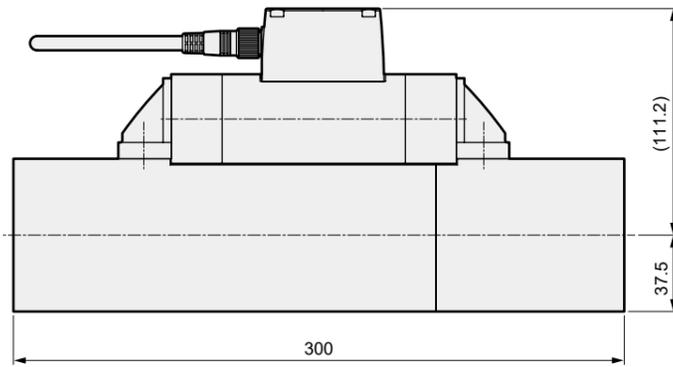
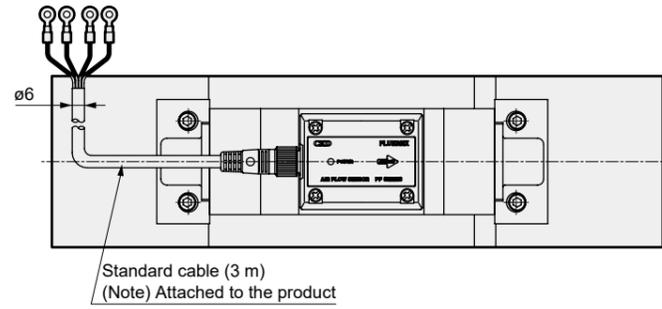
Model No.	A	B	C	D	(E)	F	G	H	I	J	K	L	M
PFD-501/102	140	52	76.2	22	54.2	52	36	26	72	64	6.5	4.5	M4 thread depth 6
PFD-202	150	55	87.2	27.5	59.7	57	36	26	72	64	6.5	4.5	M4 thread depth 6
PFD-402	175	55	90.7	27.5	63.2	69.5	36	26	72	64	6.5	4.5	M4 thread depth 6
PFD-802	190	65	103.7	34	69.7	75	40	26	94	80	8	6	M5 thread depth 8

●Monitor section



Dimensions

●PFD-163



Compact flow sensor (gas)

Compact flow sensor (air)

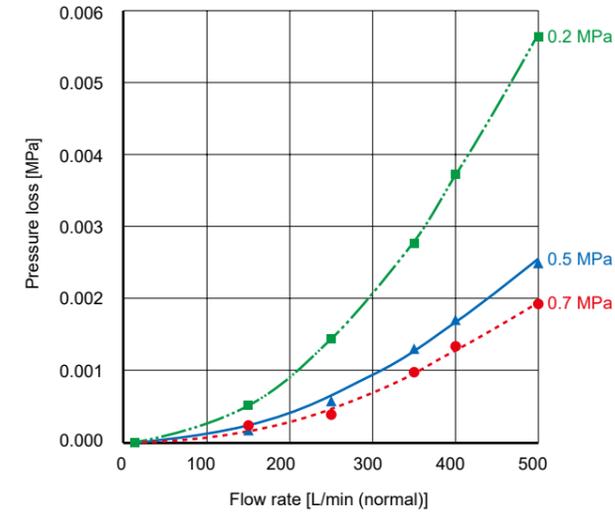
Compact flow sensor (liquid)

Water Manifold Unit

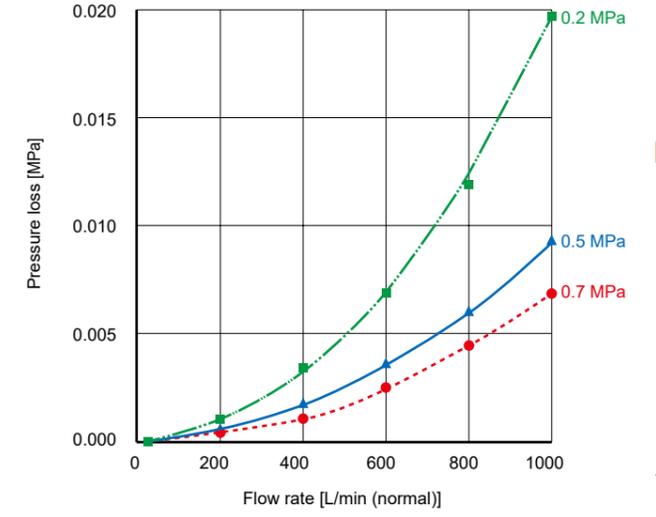
Pressure loss characteristics

Pressure loss characteristics

●PFD-501-10



●PFD-102-15



Flow rate sensor

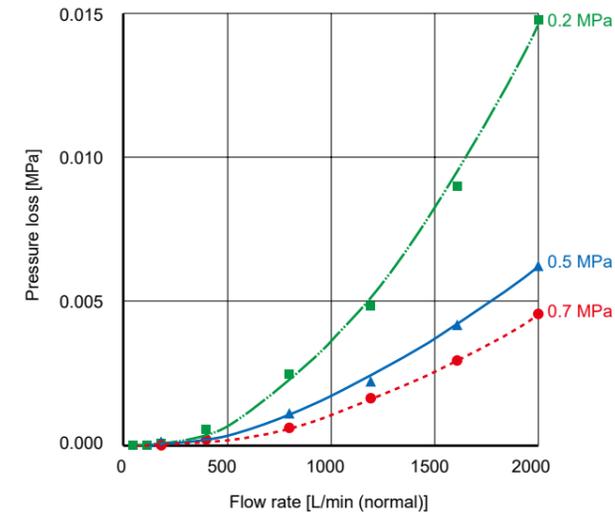
Compact flow sensor (gas)

Compact flow sensor (air)

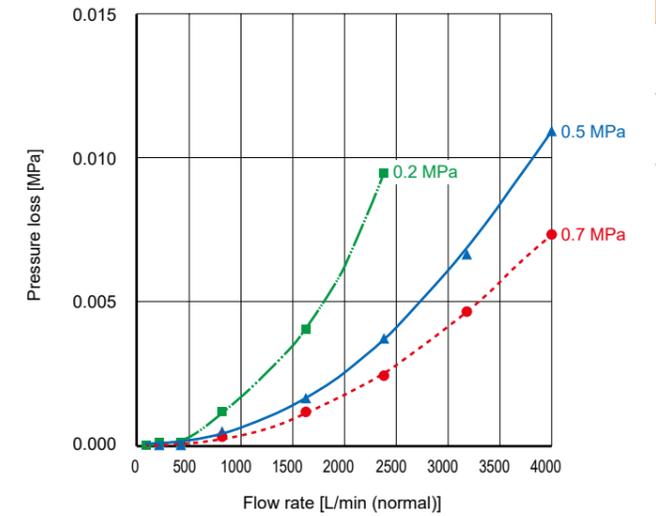
Compact flow sensor (liquid)

Water Manifold Unit

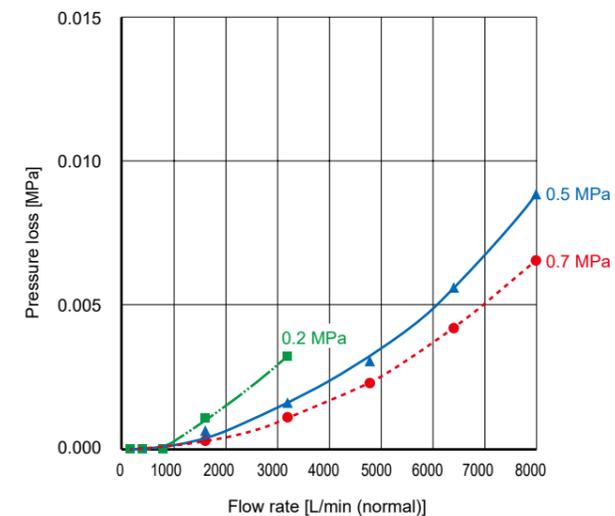
●PFD-202-20



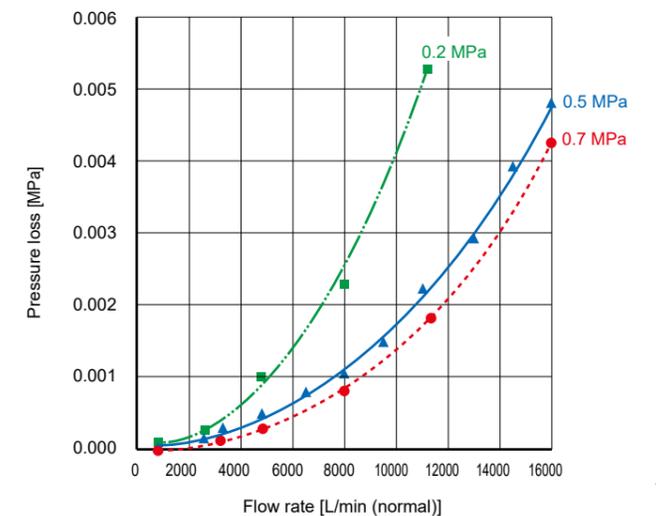
●PFD-402-25



●PFD-802-40



●PFD-163-50

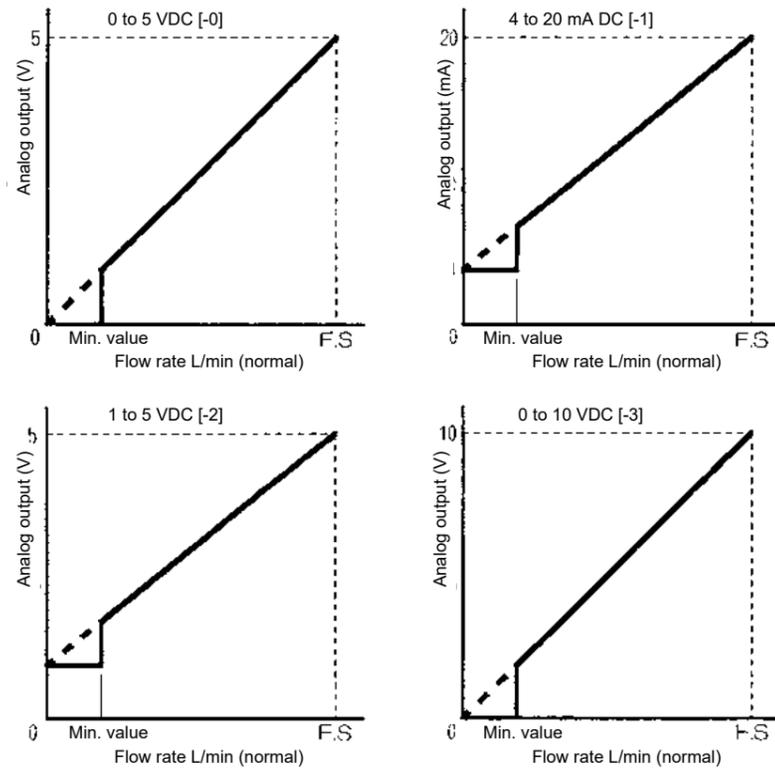


Ending

Ending

PFD Series electric wiring

1 Analog output [Option code: -0 (standard), -1, -2, -3]



Load resistance of analog output

Analog Output	Item	Load resistance
0 to 5 VDC		50 kΩ or more
4 to 20 mA DC		300 Ω or less
1 to 5 VDC		50 kΩ or more
0 to 10 VDC		50 kΩ or more

Model No.	Min. value L/min (normal)	FS L/min (normal)
PFD-501-10	25	500
PFD-102-15	50	1000
PFD-202-20	100	2000
PFD-402-25	200	4000
PFD-802-40	400	8000
PFD-163-50	800	16000

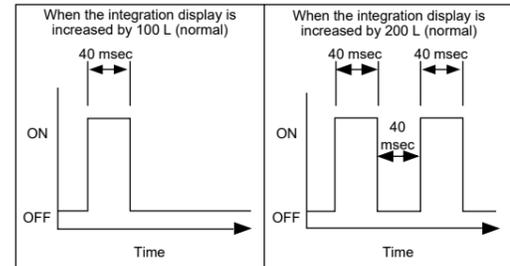
- The relation between the flow rate and the analog output is as in the figure on the left. Note that the analog output is not output normally at the min. value or less.
- Never make a short circuit between the analog output terminal and another terminal. This may lead to failure.
- Make the cable short so as not to be affected by noise and keep it away from all noise sources such as power distribution wires.

2 Integrated pulse output [Switching to switch output. Only OUT2 can be used]

● For the integrated pulse output, a pulse is output per the integrated value below. L (normal)

Model No.	PFD-501	PFD-102	PFD-202	PFD-402	PFD-802	PFD-163
Accumulated flow per pulse		10			100	

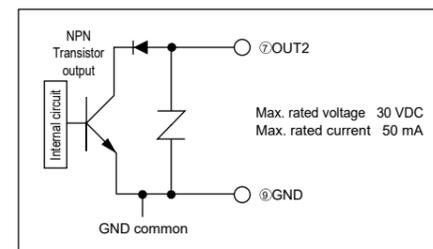
[ex] When using PFD-802, the pulse wave shape is as shown below.



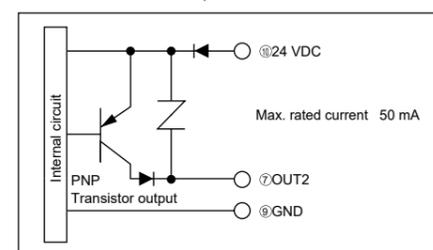
The integration display is updated at intervals of approx. 1 sec.

● Output circuit

◆ In case of NPN output

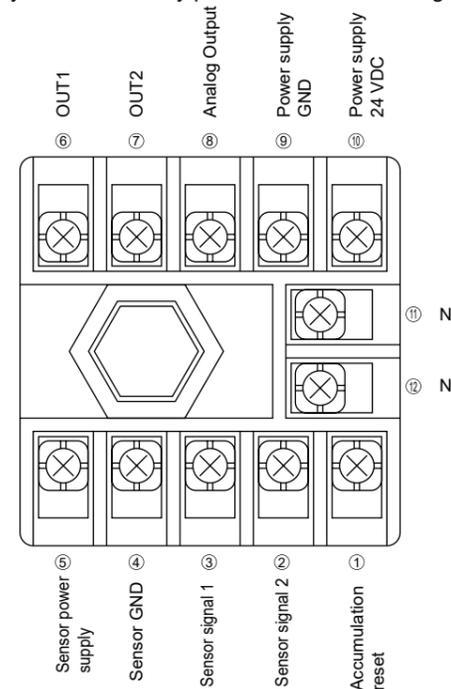


◆ In case of PNP output



3 Wiring method for sensor and monitor

● Always read the safety precautions before wiring.



● Use the cables attached to the product.

[Specifications]

With DC 4-conductor connector

Finish diameter: ø6

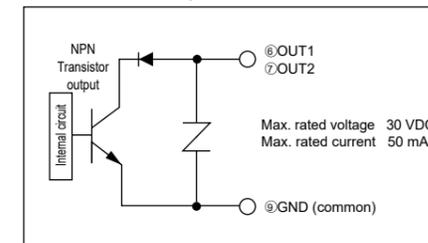
Core wire: 0.5 mm<sup>2</sup>

Insulator outer diameter: ø1.72 mm

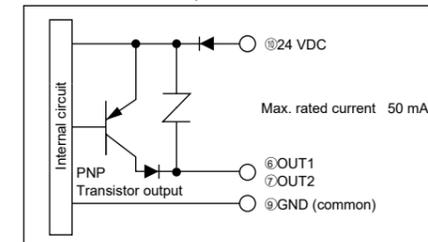
No.	Function	
1	Accumulation reset	Use this terminal. By connecting to GND terminal, the accumulated flow value can be cleared.
2	Sensor signal 2	Connect to accessory cable [BLACK]
3	Sensor signal 1	Connect to accessory cable [WHITE]
4	Sensor GND	Connect to accessory cable [BLUE]
5	Sensor power supply	Connect to accessory cable [BROWN]
6	OUT1	NPN/PNP transistor output
7	OUT2	NPN/PNP transistor output
8	Analog Output	Voltage/current output
9	Power supply GND	Connect to power supply 0 VDC
10	Power supply 24 VDC	Connect to power supply 24 VDC
11	NC	Connect nothing.
12	NC	Connect nothing.

● Switch output circuit

In case of NPN output

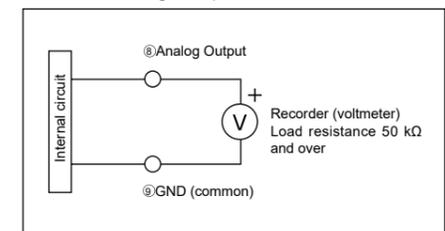


In case of PNP output

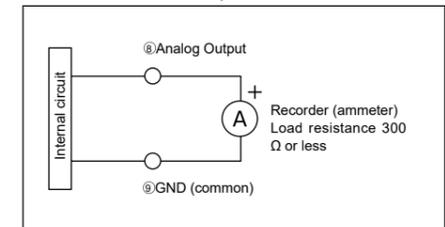


● Analog output circuit

In case of voltage output



In case of current output



Flow rate sensor

Compact flow sensor (gas)

Compact flow sensor (air)

Compact flow sensor (liquid)

Water Manifold Unit

Flow rate sensor

Compact flow sensor (gas)

Compact flow sensor (air)

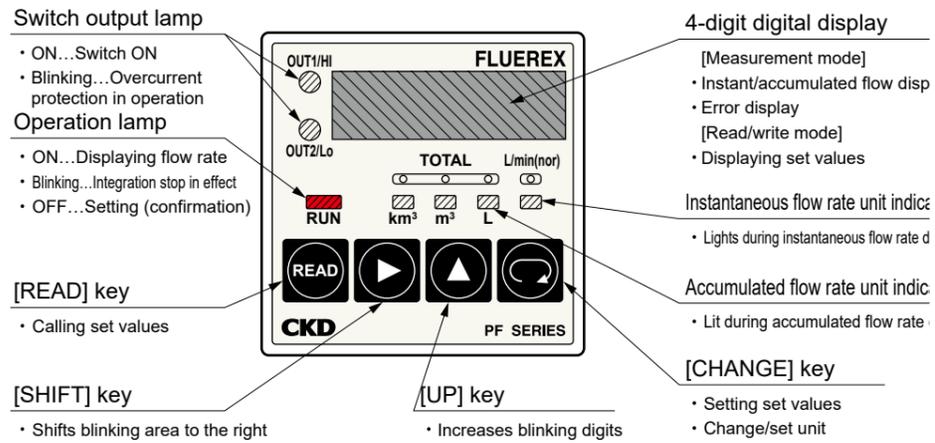
Compact flow sensor (liquid)

Water Manifold Unit

Ending

Ending

Functions and operations for monitor



Functions

Item	Description	Initial state
Switch output (OUT1, OUT2) operation can be set.	<ul style="list-style-type: none"> <li>●Parameter 0: Instantaneous flow rate ON when inside the range</li> <li>●Parameter 1: Instantaneous flow rate ON when outside the range</li> <li>●Parameter 2: Accumulated flow ON at setting value or more</li> <li>●Parameter 3 (OUT2 only): Integrated pulse output</li> </ul>	Parameter 0 for both OUT1 and OUT2 Low: 0000 High: 0000
Switch parameter setting	<ul style="list-style-type: none"> <li>●Low, High</li> <li>●Hysteresis setting</li> </ul>	
Peak value display	The max. value of flow rate display can be confirmed.	-
Instantaneous flow rate/accumulated flow display switching	The display can be changed between the instantaneous flow rate and accumulated flow.	Instantaneous flow rate
Integration measurement Halt/Integration clear	The pause/value can be cleared during accumulated flow display.	-

For details on operation and setting method, refer to CKD components product website (<https://www.ckd.co.jp/kiki/en/>) → "Model No." → [Instruction manual](#)



Pneumatic components (sensors)  
**Safety Precautions**

Be sure to read this section before use.  
For general pneumatic components precautions, refer to Intro Page 17.

Product-specific cautions: Pneumatic flow rate sensor PFD Series

Design / Selection

1. Checking the specifications

- DANGER**
- Never use this product with flammable fluids.
- WARNING**
- Use the product in the range of conditions specified for the product. The product in this catalog is designed for use only in a compressed air system. Use with pressures or temperatures outside the specifications range may result in damage or operation failure.
- This product cannot be used as a billing meter. Do not use this product for commercial transactions as it is not compliant with the Measurement Act. Intended applications include industrial sensors.
- Because compressed air or nitrogen gas is used as an applicable fluid, do not use fluids other than these, because accuracy cannot be guaranteed.

2. Safety Design

- WARNING**
- Take measures to prevent physical harm or property damage in the event of breakdown of this product.
- CAUTION**
- Understand compressed air features before designing a pneumatic circuit.
  - Pop-out, air discharge, or leakage due to air compression and expansion may occur.
  - Design the circuit so that compressed air in the system is exhausted.
- Check for leakage current to avoid malfunction caused by the leakage current. When using a programmable controller, leakage current may cause malfunction.
- Because both the sensor and monitor of this product are independent, they can be replaced with a model that has the same flow rate range.
  - They cannot be replaced with a model that has a different flow rate range.
  - The sensor and monitor must be used in a set. By using only either one of them, this kit does not operate.

- Although there is no movable section in the flow rate sensor, when repeating ON/OFF of the solenoid valve, the mesh section or fixed section of the rectifier may move slightly and this may result in the generation of particles. When the generation of particles must be eliminated, be sure to install a filter on the secondary side (downstream side) of the flow rate sensor.

3. Design by Application

- CAUTION**
- Exerts no influence on performance as it uses compressed air and a small amount of leakage is tolerable. Contact CKD if no-leakage is required.

4. Working Environment

- DANGER**
- Never use this product in an explosive gas atmosphere. The structure is not explosion-proof, and explosions or fires could occur.
- When using nitrogen gas as an applicable fluid, oxygen deficiency could be caused. Observe the following instructions.
  - Use in well ventilated locations.
  - Ventilate the work area when nitrogen gas is being used.
  - Inspect nitrogen gas piping regularly to avoid leaks.
- WARNING**
- Install in a place where the product is not exposed to rain, water, or direct sunlight.
- Do not use this product in an environment where corrosion may occur. Use in such an environment could lead to damage or operation failure.
- Consult with CKD if ozone is generated in the supplied air.
- Avoid using this product in environments where ozone is generated.
- Use with fluid temperature within the range of 0 to 40°C. Even if the ambient temperature is within the specified range, do not use this product in a location where the temperature could suddenly change and cause condensation.
- Do not use at a pressure exceeding the max. working pressure, as excessive pressure can cause product failure.

Flow rate sensor

Flow rate sensor

Compact flow sensor (gas)  
Compact flow sensor (air)  
Compact flow sensor (liquid)  
Water Manifold Unit

Compact flow sensor (gas)  
Compact flow sensor (air)  
Compact flow sensor (liquid)  
Water Manifold Unit

Ending

Ending

■ The sensor section employs a dust-proof, drip-proof structure that provides reliability during maintenance and cleaning, during which it may be exposed to water splashing. However, avoid using this product in a location where it may be constantly exposed to water or intense splattering of water and/or oil.

**CAUTION**

■ Confirm before use that it will withstand the working environment. This product cannot be used in environments where functional obstacles could occur. Such environments include high temperatures, chemical atmospheres, or those where chemical liquids, vibration, moisture, dripping water, coolant or gas are present. Environments where ozone is generated.

■ Be sure to use within ambient temperature range of 0 to 50°C.

■ Avoid using the product for vibration of 49 m/s<sup>2</sup> or more and shock of 294 m/s<sup>2</sup> or more.

■ CE-compliance working conditions

This product is CE-marked, indicating conformity with the EMC Directives. The standard for the immunity for industrial environments applied to this product is EN61000-6-2; the following requirements must be satisfied in order to conform to this standard:

Conditions

- The power cable connected to the terminal block must be less than 3 m long.
- This product is not equipped with surge protection. Implement surge protection measures on the system side.

5. Securing of space

**WARNING**

■ Secure sufficient space around the pneumatic components for installation, removal, wiring, and piping work.

6. Others

**WARNING**

■ When suddenly opening the valve that connects to the sensor, fluid with a flow rate dozens of times greater than the rated flow rate may flow, and this can cause damage to the platinum thin film sensor or rectifier and flow out to the secondary side. When opening the valve that connects to the sensor, open it slowly so that the value in the monitor display may not exceed the rated flow rate.

■ Keep away from high voltage lines, high voltage components and power components such as motors.

**CAUTION**

■ After the power supply is turned ON, internal settings such as hardware check are performed for 10 seconds. During this time, the display/output cannot operate normally. Particularly, if a switch output is used in the control of an interlock circuit, an abnormal stop may occur. Mask the output during this period.

■ When using this product for an interlock circuit, provide multiple interlock circuits as a precaution against breakdown, and also perform regular inspections to confirm normal operation.

■ Even when the instantaneous flow rate display is 0, if there is a minimal flow rate signal (including error), the integrating flow rate (integration count) may be displayed. If measuring the integrating flow with the flow rate display at 0 will be a problem, use the integrating flow measurement start/stop function as required.

■ Keep the cable away from all noise sources, including power distribution wires. Noise can cause malfunctions.

■ Do not short-circuit the output transistor. When a load is short-circuited, overcurrent protection circuit is triggered to prevent damage to the output transistor; however, if this state persists, the output transistor could be damaged.

■ Do not use a load that can produce surge voltage. When directly running the load that generates a surge such as relay and solenoid valve, use a surge absorber built-in type. If there is a surge source on the same power supply line, similarly implement surge protection.

■ This product has no protection against lightning surge. This product is CE marking compliant but has no protection against lightning surge. For the protection against lightning surge, take countermeasures on the equipment side.

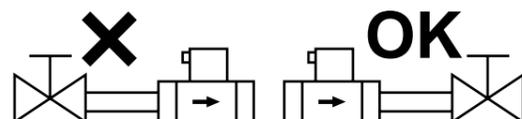
■ Regularly inspect the product at least once a year to check that it operates correctly.

■ Make sure that the lead wire is free of repeated bends and tension. This may lead to disconnection.

■ For the wiring to the sensor and monitor, use the accessory cable (3 m).

■ When mounting a pneumatic components, do not use a mounting method that relies on support from the piping.

■ When adjusting the flow rate using a metering valve (glove valve, ball valve, etc.), install the metering valve on the secondary side (downstream side) of the sensor. Generated drift (turbulence in the flow) could cause errors.



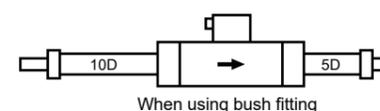
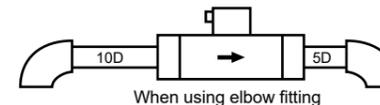
■ Do not install the regulator immediately before the sensor. Generated drift may cause errors.

- When installing the regulator on the primary side, provide a straight piping section of 10D and over.
- \* "D" here indicates the inner diameter of the piping material.
- Select a regulator that has sufficient margin of flow characteristics for the max. flow rate of the sensor.

■ Align the fluid flow direction to the direction indicated on the sensor when connecting the pipes. When connecting it in reverse, the larger value is displayed.

■ When using an elbow or bush in the piping, it is recommended to provide straight piping sections of 10D and over on the primary side and 5D and over on the secondary side.

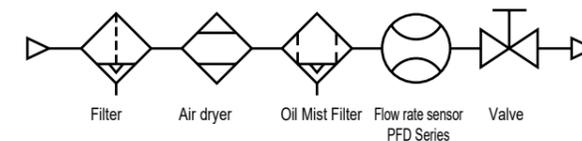
- For PFD-163 Series, be sure to provide straight piping sections.
- Bore size change by bush should be limited to one size.



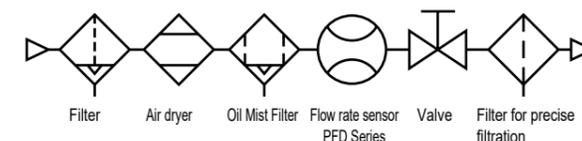
■ Install a pneumatic filter just before the pneumatic component in the circuit.

■ Air Quality

- Use CKD clean air system components appropriate for your application.
- Use compressed air that does not contain oil oxides, tar, carbon, etc., from the air compressor.
- Use compressed air that does not contain solid foreign matter.
- Install a filter, air dryer, and oil mist filter on the primary side (upstream side) of the sensor. The sensor's rectifier (mesh) rectifies the flow in the pipe. It does not filter out foreign matter, so provide a filter.



• When ultra clean air is required



For precautions during mounting, installation, adjustment, use and maintenance, refer to the CKD Components Product Site (<https://www.ckd.co.jp/kiki/en/>) → "Model No. → Instruction Manual"

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