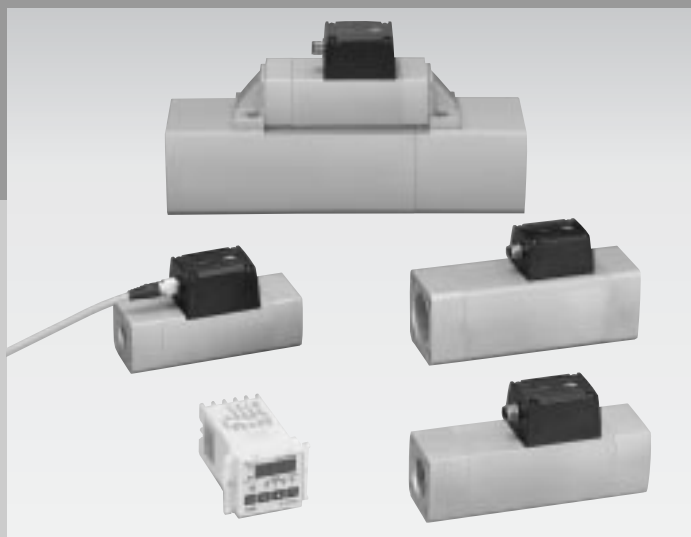


Flow sensor for compressed air

PFD/PFK (display separate type flow sensor)

■ Sensor / flow sensor



C O N T E N T S

Product introduction	1432
Applications	1434
⚠ Safety precautions	1435
● Flow sensor (PFD)display separate type	1440
● Tester kit (PFK)	1446
Electric wiring	1450
Monitor section functional explanation and operation explanation	1452

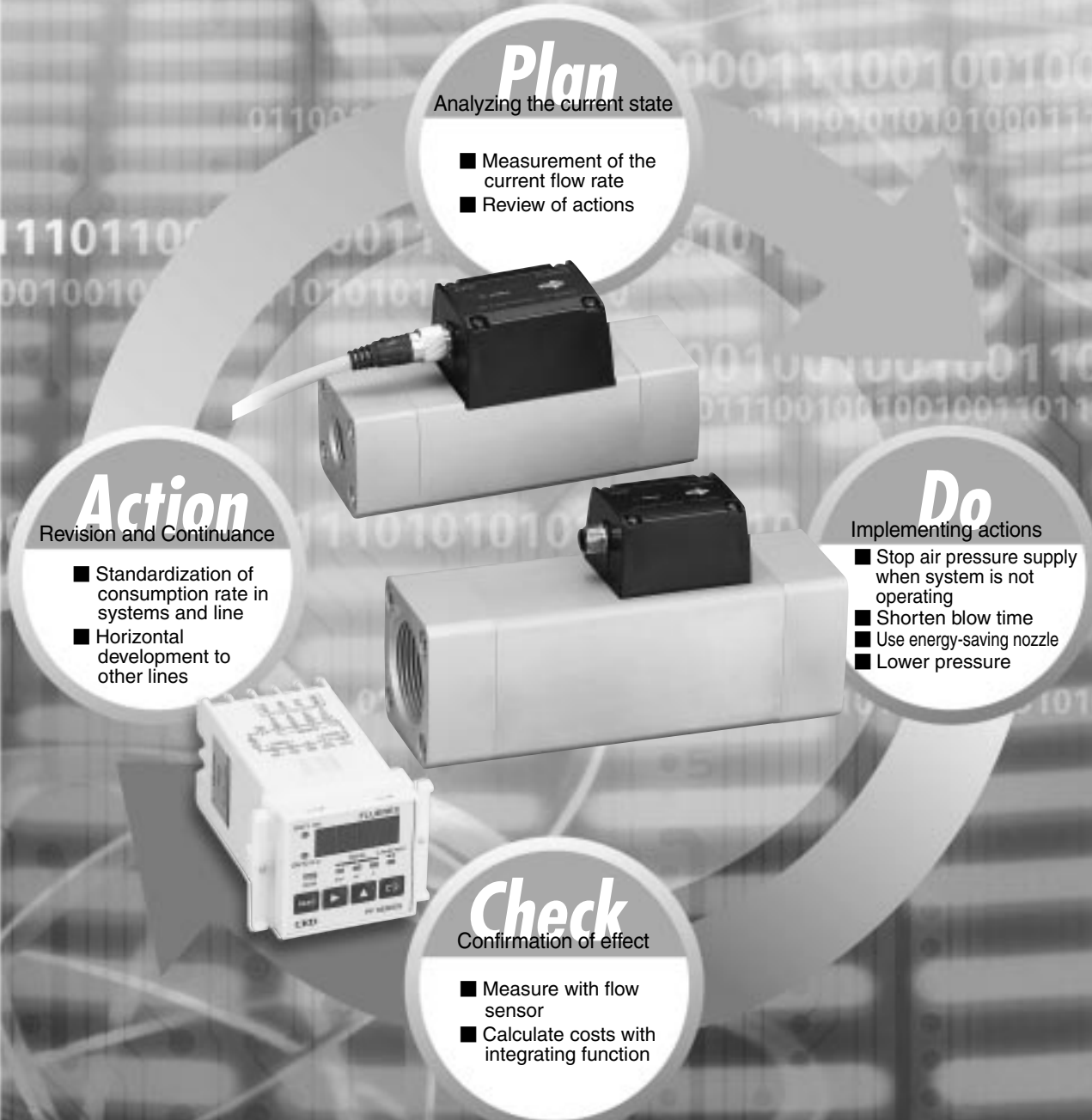
Refrigerating type dryer
Desiccant type dryer
High polymer membrane type dryer
Air filter
Auto. drain / others
F.R.L. (Module unit)
F.R.L. (Separate)
Compact F.R.
Precise regulator
F.R.L. (Related products)
Clean F.R.
Electro pneumatic regulator
Air booster
Speed control valve
Silencer
Check valve / others
Joint / tube
Vacuum filter
Vacuum regulator
Suction plate
Magnetic spring buffer
Mechanical pressure SW
Electronic pressure SW
Contact / close contact cont. SW
Air sensor
Pressure SW for coolant
Small flow sensor
Small flow controller
Flow sensor for air
Flow sensor for water
Total air system
Total air system (Gamma)

Ending

Display separate type for compressed air
Flow sensor

Refrigerating type dryer
Desiccant type dryer
High polymer membrane type dryer
Air filter
Auto. drain / others
F.R.L. (Module unit)
F.R.L. (Separate)
Compact F.R.
Precise regulator
F.R.L. (Related products)
Clean F.R.
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Air booster
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Check valve / others
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Vacuum filter
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Electronic pressure SW
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Air sensor
Pressure SW for coolant
Small flow sensor
Small flow controller
Flow sensor for air
Flow sensor for water
Total air system
Total air system (Gamma)
Ending

Contributing to the global environment with energy saving control.



Plan
Analyzing the current state

- Measurement of the current flow rate
- Review of actions

Action
Revision and Continuance

- Standardization of consumption rate in systems and line
- Horizontal development to other lines

Do
Implementing actions

- Stop air pressure supply when system is not operating
- Shorten blow time
- Use energy-saving nozzle
- Lower pressure

Check
Confirmation of effect

- Measure with flow sensor
- Calculate costs with integrating function

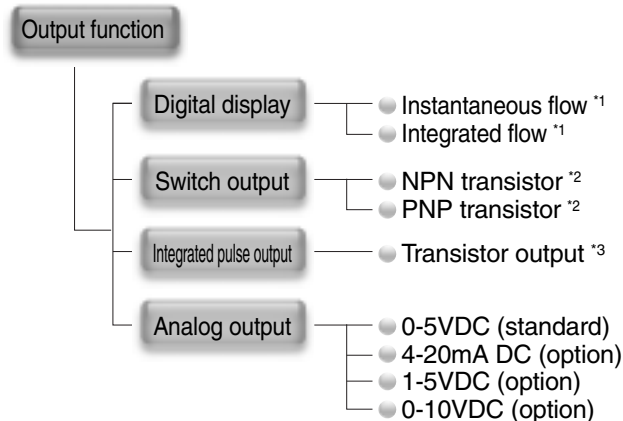
Flow sensor for compressed air

FLUEREX PFD Series



PFD Series flow sensor for compressed air assists in analyzing current energy consumption and confirming the effect.

Ample output variations



- *1. Switch between the instantaneous flow and integrated flow with a single touch.
 *2. Select NPN or PNP for the switch output. **New**
 Two output points are provided. (PFK series has 1 point)
 *3. Change one of the switch outputs to an integrated pulse output with easy operations. **New**

RoHS Directive compliant

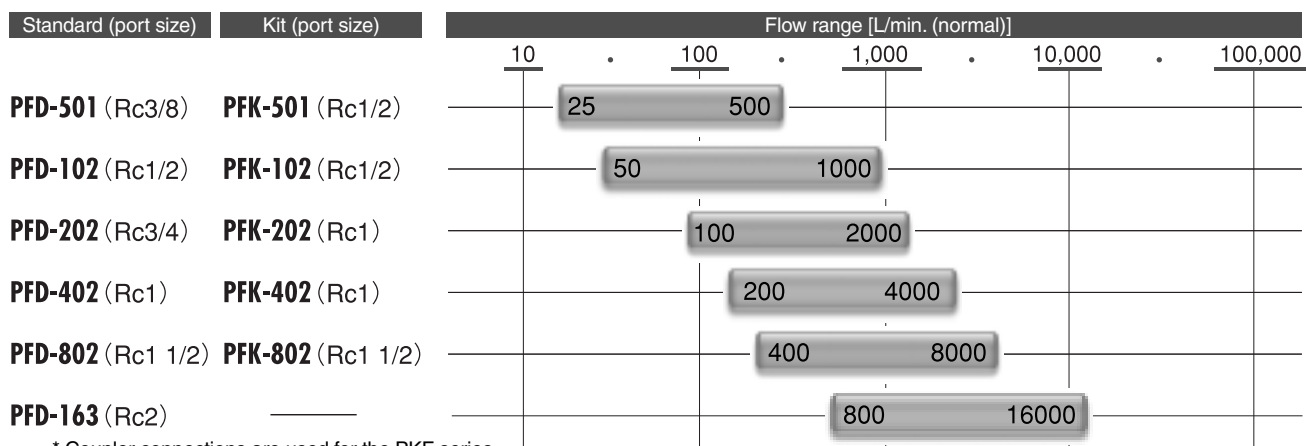
All substances, such as lead and hexavalent chrome, which could adversely affect the global environment, have been completely eliminated from the materials used in this controller.

RoHS

Optimum for ISO 14001 acquisition

The lineup includes a large flow type, which supports energy saving control in factory units. This device is essential for acquiring ISO14001, the International Standardization Standard for environment management systems.

Covering a wide range of flow rates with 11 types



* Coupler connections are used for the PKF series.

Directly read digital displays with no need for calibration

Since bothersome pressure compensation and temperature compensation are not required, the digitally display value can be read and used.

- Pressure compensation not required
Method of detecting weight flow adopted
 - Temperature compensation not required
Automatic temperature compensation function built in
-

High precision with general precision of ±4%F.S.

A general precision of ±4%F.S. is realized in a temperature range of 10 to 30°C and pressure range of 0.2 to 0.7MPa even without calibration.

$$\text{Total precision} = \pm \sqrt{(\text{linearity})^2 + (\text{temperature characteristics})^2 + (\text{pressure characteristics})^2}$$

(Note) The general precision is the reference value including all errors including the errors from temperature or pressure variation and the linearity, etc.

Convenient portable kit available

Five types of tester kits consisting of a sensor section, monitor section and piping, etc., in a trunk case are available.

- Piping and wiring can be exchange with a single touch.



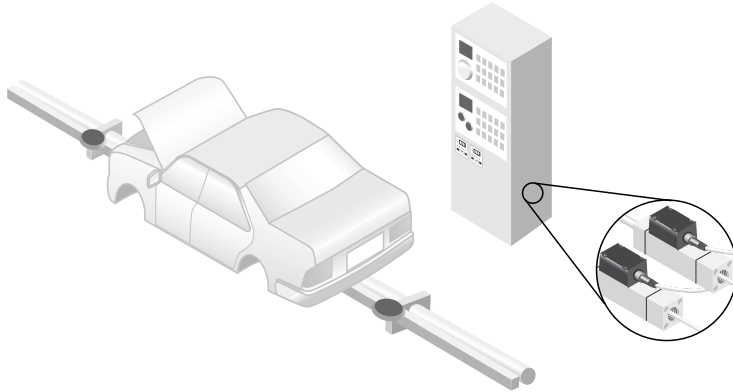
- Refrigerating type dryer
- Desiccant type dryer
- High polymer membrane type dryer
- Air filter
- Auto. drain / others
- F.R.L. (Module unit)
- F.R.L. (Separate)
- Compact F.R.
- Precise regulator
- F.R.L. (Related products)
- Clean F.R.
- Electro pneumatic regulator
- Air booster
- Speed control valve
- Silencer
- Check valve / others
- Joint / tube
- Vacuum filter
- Vacuum regulator
- Suction plate
- Magnetic spring buffer
- Mechanical pressure SW
- Electronic pressure SW
- Contact / close contact cont. SW
- Air sensor
- Pressure SW for coolant
- Small flow sensor
- Small flow controller
- Flow sensor for air
- Flow sensor for water
- Total air system
- Total air system (Gamma)

Ending
Display separate type for compressed air
Flow sensor

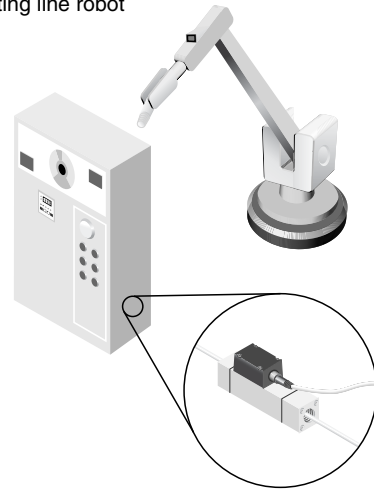
Flow sensor for compressed air applications

Controlling flow rate in automobile manufacturing lines

■ Automobile line control

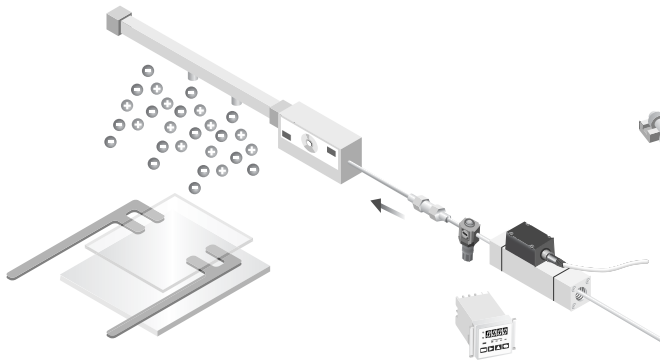


■ Painting line robot

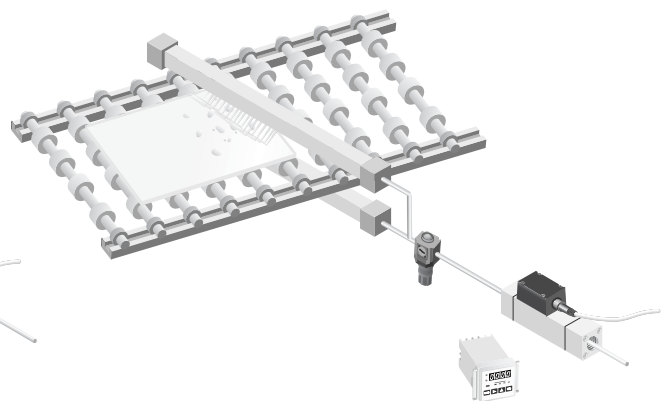


Controlling flow in FPD manufacturing

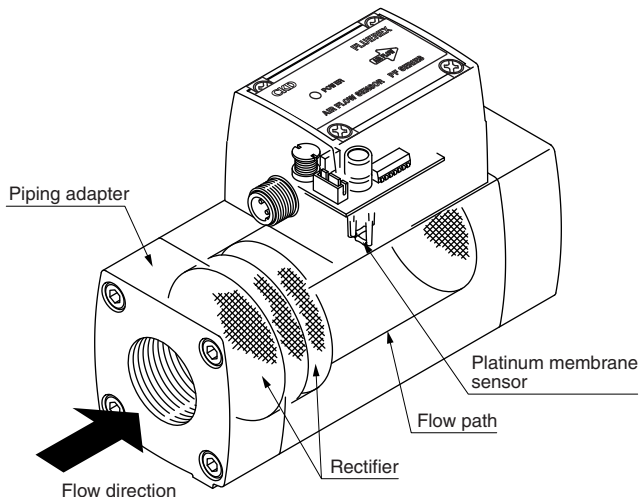
■ Ionizer



■ Air knife



Functional explanation



The flow sensor consists of a rectifier passing even amounts of compressed air and a platinum membrane resistor that detects flow. Inserting a bent pipe such as an elbow just before the sensor evens the rectifier flow. Using multiple rectifier plates suppresses pressure loss, enabling a rectifier effect.

When compressed air is not flowing, the platinum membrane sensor that detects flow is heated to a set temperature by the fluid temperature. When compressed air flows, heat is lost proportional to air, so a current flows to the platinum membrane sensor circuit that detects flow. The display receives this current as the flow signal and indicates the practical atmospheric pressure, instant flow of air converted to 0°C, and integrated flow. Compressed air temperature is measured and compensated for by the platinum membrane sensor that detects the fluid temperature.

Refrigerating type dryer
Desiccant type dryer
High polymer membrane type dryer
Air filter
Auto. drain / others
F.R.L. (Module unit)
F.R.L. (Separate)
Compact F.R.
Precise regulator
F.R.L. (Related products)
Clean F.R.
Electro pneumatic regulator
Air booster
Speed control valve
Silencer
Check valve / others
Joint / tube
Vacuum filter
Vacuum regulator
Suction plate
Magnetic spring buffer
Mechanical pressure SW
Electronic pressure SW
Contact / close contact cont. SW
Air sensor
Pressure SW for coolant
Small flow sensor
Small flow controller
Flow sensor for air
Flow sensor for water
Total air system
Total air system (Gamma)
Ending



Pneumatic components (sensors)

Safety precautions

Always read this section before starting use.

Refer to Intro 67 for general precautions, and to "⚠ Safety Precautions" in this section for details on each series.

Flow sensor for compressed air PFD Series

Design & Selection

1. Specifications confirmation

⚠ DANGER

- Do not use this product for flammable fluids.

⚠ WARNING

- Use this product in accordance with the specifications range.

Products in this catalog are for use only in a compressed air system. Using this product at a pressure or temperature exceeding specifications could cause ruptures or malfunctions.

- This product cannot be used as a business meter. This product does not comply with Measurement Laws, and cannot be used for commercial business. Use this as an industrial sensor.

- Compressed air or nitrogen can be used. Do not use other fluids or the precision cannot be guaranteed.

2. Design for Safety

⚠ WARNING

- Take measures to protect personnel and equipment against injury or damage if this product fails.

⚠ CAUTION

- Understand compressed air features before designing a pneumatic circuit.

- Pop-out, air discharge, or leakage due to air compression and expansion could occur.
- Design the circuit so that compressed air in the system is exhausted.

- Check the leakage current to prevent malfunction caused by current leaking from other controllers.

- When using a programmable controller, etc., the leakage current could cause this product to malfunction.

- The sensor and monitor of this product are independent and can be exchanged if the flow range is within the same model.

- Sections cannot be exchanged for different flow ranges.
- The sensor and monitor must be used as a set. Using only one will not ensure correct functions.

- The flow sensor has no moving parts but if the solenoid valve is repeatedly turned on or off, the rectifier's mesh or fixed section could move slightly and generate particles. Be sure to provide a filter on the secondary side (downstream) of the flow sensor for applications susceptible to particle generation.

3. Design per applications

⚠ CAUTION

- This product is designed for compressed air, and will tolerate small amounts of leakage. Contact CKD when no leaks are tolerable.

4. Working environment

⚠ DANGER

- Do not use this product in flammable atmosphere. It does not have an explosion-proof structure, so flame or fires could occur.

- There is a risk of oxygen deficiency if nitrogen gas is used for the applicable fluid. Observe the following points when handling:

- Use this product in a well-ventilated place.
- Ventilate the area while using nitrogen gas.
- Regularly check nitrogen gas piping for leaks.

⚠ WARNING

- Do not use the product where the product is exposed to direct-sunlight or may come in contact with water or rain.

- Do not use in a corrosive environment. Use in the environment like this could result in damage or malfunction.

- Consult with CKD if ozone could occur in supplied air.

- Avoid use in ozone occurring environments.

- Keep the fluid temperature within 0 to 40°C. Even if the temperature is within the specified range, do not use this product if the temperature could suddenly change and cause dew to condense.

- This product fails if pressure exceeding the maximum working pressure is used. Check that the pressure is less than the maximum working pressure.

Refrigerating type dryer
Desiccant type dryer
High polymer membrane type dryer
Air filter
Auto. drain / others
F.R.L. (Module unit)
F.R.L. (Separate)
Compact F.R.
Precise regulator
F.R.L. (Related products)
Clean F.R.
Electro pneumatic regulator
Air booster
Speed control valve
Silencer
Check valve / others
Joint / tube
Vacuum filter
Vacuum regulator
Suction plate
Magnetic spring buffer
Mechanical pressure SW
Electronic pressure SW
Contact / close contact cont. SW
Air sensor
Pressure SW for coolant
Small flow sensor
Small flow controller
Flow sensor for air
Flow sensor for water
Total air system
Total air system (Gamma)

Ending

Display separate type for compressed air
Flow sensor

Refrigerating type dryer
Desiccant type dryer
High polymer membrane type dryer
Air filter
Auto. drain / others
F.R.L. (Module unit)
F.R.L. (Separate)
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Vacuum regulator
Suction plate
Magnetic spring buffer
Mechanical pressure SW
Electronic pressure SW
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Air sensor
Pressure SW for coolant
Small flow sensor
Small flow controller
Flow sensor for air
Flow sensor for water
Total air system
Total air system (Gamma)
Ending

- The sensor is dust-proof and drip-proof, so problems do not occur if water gets on the sensor during maintenance or cleaning. The sensor should not be exposed to water for long periods or used in places where water and oil scatter with force.

⚠ CAUTION

- Confirm that the product will withstand the working environment.

- This product cannot be used in environments where functional obstacles could occur. Such environments include high temperatures, a chemical atmosphere, or where chemicals, vibration, moisture, water drip, coolant or gas are present; Where ozone is generated.

- Use within an ambient temperature range 0 to 50°C.

- Avoid using in areas where vibration exceeds 49m/s² and impact 294m/s².

5. Securing of space

⚠ CAUTION

- Ensure space around the pneumatic component for installation, removal, wiring, and piping work.

Installation & Adjustment

1. Installation

⚠ DANGER

- Use power voltage and output within the specified voltage. If voltage exceeding the specified voltage is applied, the sensor could malfunction or be damaged, or electrical shock or fire could occur.

⚠ WARNING

- Check the wire color and terminal numbers when wiring. Incorrect wiring connections could result in sensor damage, problems, and malfunctions. Check wire color and terminal numbers against the instruction manual before wiring. Insert a noise filter if required.

- Check wiring insulation. Check that wires do not contact other circuits and that there are no ground faults or insulation faults across terminals. Overcurrent could flow in and damage the sensor.

- Separate the monitor from high-voltage wires, high voltage devices, and powered devices such as motors.

- Check that there are no swarf or wire scraps on the monitor's gland and sensor connectors before wiring.

⚠ CAUTION

- Do not remove air compressor packaging or the dust-proof cap on the piping port until just before the product is piped.

- If the piping port cap is removed from the piping port before piping work is started, foreign matter could enter the pneumatic component from the piping port and result in faults or faulty operation.

- Do not install pneumatic components with a method that supports with pipes.

2. Operation pre-confirmation

⚠ CAUTION

- When supplying compressed air after connecting piping, be sure to check for air leaks at all sections where piping is connected.

- Apply a leakage detection agent on pipe connections with a brush, and check for air leaks. Check that leak detection fluid does not get on resin parts. Otherwise resin could be damaged.

- Separate the cable from sources of noise such as power distribution wires. Failure to do so could result in malfunctions caused by noise.

- Do not short-circuit the output contact. If the load is short-circuited, the overcurrent protection circuit protects the output transistor. If left as is too long, the output transistor could break.

- Do not use this product for loads generating surge voltage. When directly driving a load that generates a surge, such as a relay or solenoid valve, use a sensor with integrated surge absorbing element. Similarly, use surge countermeasures if there is a source of surge in the power supply line.

- This product cannot withstand lightning surges. This product complies with CE Marking, but is not resistant to lightning surges. Protection must be provided on the system side.

- Do not repeatedly bend or tension to leads or wires could disconnect.

- Use the enclosed cable (3m) to wire the sensor to the monitor. Check with CKD when a longer cable is required.

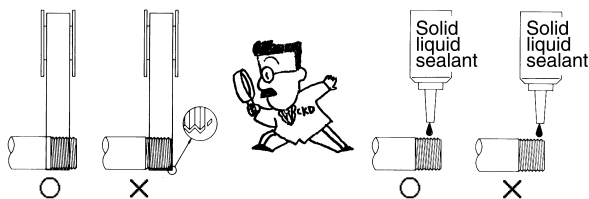
Installation & Adjustment

3. Piping

CAUTION

When connecting pipes, wrap sealing tape in the opposite direction from threads starting 2 mm inside from the end of piping threads.

- If sealing tape protrudes from pipe threads, it could be cut when screwed in. This could cause the tape to enter the solenoid valve and lead to faults.



- When using a liquid sealing agent, check that it does not get on resin parts. Otherwise resin could be damaged.

Check that the pipe connected to the pneumatic component is not dislocated due to vibration, loosening, or pulling.

- Dislocation of piping will cause hazards.

Observe the following precautions when using nylon tubes or urethane tubes for piping material.

- Use a flame resistance tube or steel pipe when using in an environment where spatter could scatter.
- When using the standard pushin joint for spiral tubing, fix the base of tubing in place with a hose band. Holding will drop if tubing rotates.

Connect piping so that connections are not dislocated by system movement, vibration, or tension.

Always flush just before piping pneumatic component.

- Check that foreign matter entering during piping does not get into the air compressor.

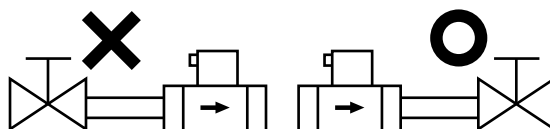
Apply adequate torque when connecting pipes.

- To prevent air leakage and screw damage.
- First tighten the screw by hand to prevent damage to screw threads, then use a tool.

(Recommended value)

Port thread	Tightening torque N·m
Rc3/8	22 to 24
Rc1/2	28 to 30
Rc3/4	31 to 33
Rc1	36 to 38
Rc1 1/2	48 to 50
Rc2	54 to 56

When adjusting the flow with a metering valve (globe valve, ball valve, etc.), install the metering valve on the secondary side of the sensor (downstream). If the metering valve is installed on the primary side, drift (turbulent flow) could occur and result in an error.



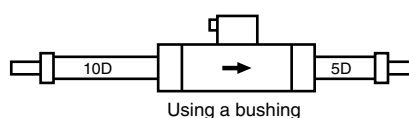
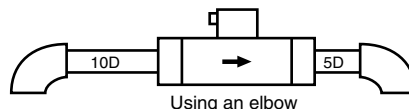
Do not install a regulator before the sensor. Incorrect flow could cause errors.

- When installing a pressure reduction valve on the primary side, be sure to include straight piping having an inner diameter of 10 D or more.
 - * D indicates the pipe's inner diameter.
- Select a pressure reduction valve having sufficient flow for maximum sensor flow.

Check that the fluid direction and the direction indicated on the sensor are the same when piping. Otherwise reading will not be correct.

When using an elbow or bushing in piping, install 10 D or larger straight piping on the primary side and 5 D or larger straight piping on the secondary side.

- Be sure to provide straight piping when using the PFD-163 Series.
- Note that the bore can be changed up to one rank upward with the bushing.



Check that force is not applied to resin parts when piping.

4. Pneumatics pressure source

CAUTION

Install an air filter just before the pneumatic component in the circuit.

When supplying compressed air for the first time after connecting pipes, do not apply high pressure suddenly.

- Piping connection could deviate and cause piped tubing to pop off and lead to accidents.

- Refrigerating type dryer
- Desiccant type dryer
- High polymer membrane type dryer
- Air filter
- Auto. drain / others
- F.R.L. (Module unit)
- F.R.L. (Separate)
- Compact F.R.
- Precise regulator
- F.R.L. (Related products)
- Clean F.R.
- Electro pneumatic regulator
- Air booster
- Speed control valve
- Silencer
- Check valve / others
- Joint / tube
- Vacuum filter
- Vacuum regulator
- Suction plate
- Magnetic spring buffer
- Mechanical pressure SW
- Electronic pressure SW
- Contact / close contact cont. SW
- Air sensor
- Pressure SW for coolant
- Small flow sensor
- Small flow controller
- Flow sensor for air
- Flow sensor for water
- Total air system
- Total air system (Gamma)

Ending

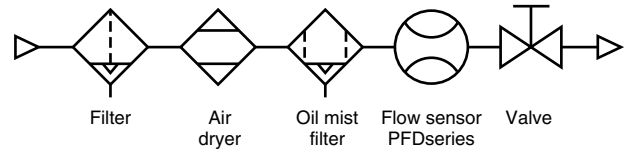
Display separate type for compressed air Flow sensor

Refrigerating type dryer
Desiccant type dryer
High polymer membrane type dryer
Air filter
Auto. drain / others
F.R.L. (Module unit)
F.R.L. (Separate)
Compact F.R.
Precise regulator
F.R.L. (Related products)
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Air sensor
Pressure SW for coolant
Small flow sensor
Small flow controller
Flow sensor for air
Flow sensor for water
Total air system
Total air system (Gamma)
Ending

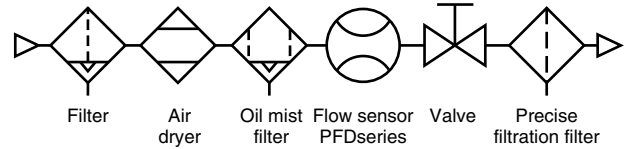
Quality of air

- Use a CKD clean air system depending on the application.
- Use compressed air free of oxidized oil, tar, or carbon from the air compressor.
- Use compressed air free of solid foreign matter.

- Install a filter, air dryer, and oil mist filter on the primary side (upper stream side) of the sensor. The sensor's meshing rectifies flow in the pipe. It does not filter out foreign substances, so provide a filter.



- When requiring ultra clean air



During Use & Maintenance

1. During use

⚠ WARNING

- A flow several times higher than the rated flow occurs if the valve connected to the sensor is suddenly opened. This can damage the platinum membrane sensor or rectifying unit and cause fluid to flow to the secondary side. Gradually open the valve connected to the sensor while checking that the monitor display does not exceed the rated flow.

⚠ CAUTION

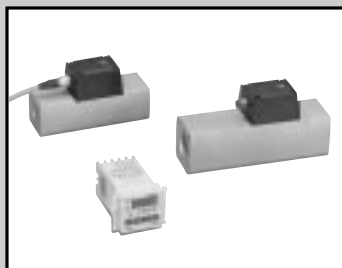
- If a problem occurs during operation, immediately turn power off, stop use, and contact your dealer.
- Internal settings, such as the hardware check, are made in the first 10 seconds after power is turned ON. The display and output do not function correctly during this time. If an interlock circuit is established with control system devices using switch output, an abnormal stop could occur, so mask the output during this time.
- If the output setting value is changed, control system devices could operate unintentionally. Stop devices before changing settings.

- When an interlock circuit is used, use a double interlock circuit and regularly check that operations are correct.

2. Maintenance and inspection

⚠ CAUTION

- Be sure to turn power off, stop supplied compressed air, and check that there is no residual pressure before starting maintenance.
 - This is required to ensure safety.
- Inspect the sensor at least once a year and confirm that it operates correctly.
- Do not disassemble or modify this product. Doing so could result in faults.



Flow sensor

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)



Features

- Detect flow with a general accuracy of $\pm 4\%$ F.S.
- Compensation is not required for pressure or temperature fluctuation.
- Flow is converted to a reference (0°C, 101.3 kPa) and displayed.
- Use either integrated display or integrated pulse output.
- Diverse functions and variations available for flow ranges and electric output.

Specifications

Descriptions		PFD-501-10	PFD-102-15	PFD-202-20	PFD-402-25	PFD-802-40	PFD-163-50
Specifications	Flow rate range L/min.(normal)	25 to 500	50 to 1000	100 to 2000	200 to 4000	400 to 8000	800 to 16000
	Port size	Rc3/8	Rc1/2	Rc3/4	Rc1	Rc11/2	Rc2
Working conditions	Working fluid	Clean compressed air/nitrogen gas					
	Working air quality	JIS B8392-1:2003/1.1.1 to 1.6.1 (Note 1)					
	Max. working pressure MPa	1.0					
	Min. working pressure MPa	0.1					
	Withstanding pressure MPa	1.5					
	Ambient temperature/humidity	0 to 50 , 85%R.H. or less (no dew)					
Precision	Fluid temperature °C	0 to 40					
	Linearity	$\pm 3.0\%$ F.S. (0.5MPa, 20°C)					
	Pressure characteristics	$\pm 2.0\%$ F.S. (0.5MPa reference, 0.2 to 0.7MPa)					
Output	Temperature characteristics	$\pm 2.0\%$ F.S. (at 20°C reference, 10 to 30°C)					
	Pressure loss MPa	0.015 or less (maximum flow rate, 0.5MPa)					
Output	Responsiveness sec	2.5 or less					
	Indicator	Instantaneous/integrated flow 4 digit LED display					
	Resolution L/min.(normal)	1	5	5	10	20	50
	Min. display flow L/min. (normal)	10	20	40	80	160	320
	Integrated flow	Max. 9 digits (display switched by change key) (Note 4)					
Installation	Analog output	Standard: 0 to 5 VDC /option: 4 to 20mA, 1 to 5 V, 0 to 10 VDC					
	Switch output	2 points (NPN/PNP transistor output: selection type)					
	Pulse output (Note 2)	10L (normal)/pulse				100L (normal)/pulse	
Installation	Power voltage V	24 VDC (6 W or less, excluding switch output load current)					
	Cable	Enclosed (3 m, 4-conductor, finished outer diameter of 6, conductor wire 0.5 mm ² , insulator outer diameter of 1.72 mm, with connector)					
	Installation attitude	Both vertical and horizontal					
	Straight piping section	IN side: 10D, OUT side: 5D recommended (Note 3)					
Total air system (Gamma)	Protective structure	Equivalent to IP64 (only sensor section)					
	Weight kg	1.1	1.1	1.3	1.4	1.7	4.5

Note 1: Dew could collect if ambient temperature is lower than working fluid temperature.

Defection faults could occur if oil accumulates.

This product does not have clean device specifications, so particles could form on the secondary side.

If ultra-clean air is required, a precision filtration filter should be installed on the end.

Note 2: Pulse output is used with switch output. Switch the function before use.

Note 3: A straight pipe should be installed to eliminate the effect of piping conditions. D indicates the piping bore size.

Note 4: Integrated flow is backed up regularly and can also be backed up with operation.

Refer to Explanation of Functions and Operations on page 1452 for details.

How to order

- Display separate type

PFD - **501** - **10** **N** **0** - **B**

A Flow rate range

B Port size

C Switch output

D Analog output

E Bracket (Note 1)

Symbol	Descriptions					
A Flow rate range						
501	25 to 500 L/min. (normal)					
102	50 to 1000 L/min. (normal)					
202	100 to 2000L /min. (normal)					
402	200 to 4000L /min. (normal)					
802	400 to 8000L /min. (normal)					
163	0.80 to 16.00m ³ /min. (normal)					
B Port size						
Flow rate range	501	102	202	402	802	163
10 Rc3/8	●					
15 Rc1/2		●				
20 Rc3/4			●			
25 Rc1				●		
40 Rc11/2					●	
50 Rc2						●
C Switch output						
N	NPN transistor output × 2					
P	PNP transistor output × 2					
D Analog output						
0	0 to 5 VDC	Standard				
1	4 to 20mA DC	Option				
2	1 to 5 VDC	Option				
3	0 to 10 VDC	Option				
E Bracket						
Blank	None	Standard				
B	Bracket attached	Option				

⚠ Note on model no. selection

Note 1: The bracket option is not available for PFD-163.

Note 2: This product consists of a sensor, monitor, and cable.

The following are indicated on the nameplate.
The model is not indicated on the cable.

Product : PFD - (A) - (B) (C) (D) - (E)

Sensor : PFD - (A) - (B)

Monitor : PFD - (A) - (C)- (D)

<Example of model number>

PFD-501-10N0-B

Model: PFD

A Flow rate range : 25 to 500 L/min. (normal)

B Port size : Rc3/8

C Switch output : NPN transistor output

D Analog output : 0 to 5 VDC

E Bracket : Bracket attached

- Discrete option model no.

PFD-C3

Symbol	Descriptions
C3	Standard cable
CW	Extension cable
B	Bracket (501/102/202/402)
B1	Bracket (802)

Refrigerating type dryer

Desiccant type dryer

High polymer membrane type dryer

Air filter

Auto. drain / others

F.R.L. (Module unit)

F.R.L. (Separate)

Compact F.R.

Precise regulator

F.R.L. (Related products)

Clean F.R.

Electro pneumatic regulator

Air booster

Speed control valve

Silencer

Check valve / others

Joint / tube

Vacuum filter

Vacuum regulator

Suction plate

Magnetic spring buffer

Mechanical pressure SW

Electronic pressure SW

Contact / close contact cont. SW

Air sensor

Pressure SW for coolant

Small flow sensor

Small flow controller

Flow sensor for air

Flow sensor for water

Total air system

Total air system (Gamma)

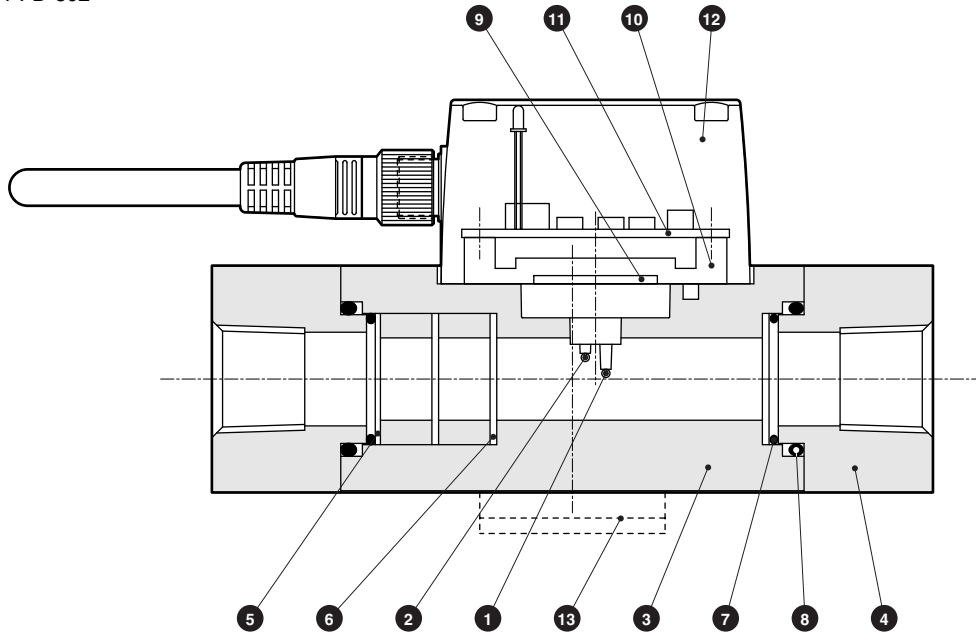
Ending

Display separate type for compressed air

Flow sensor

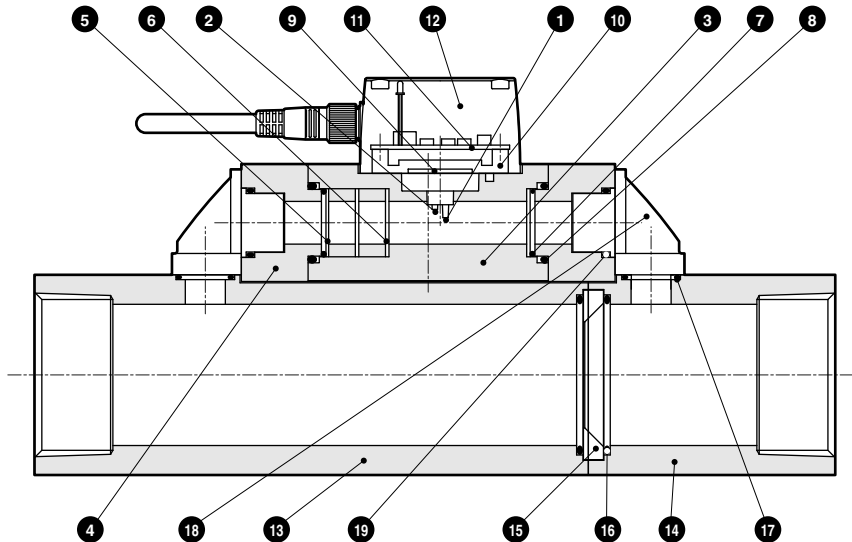
Internal structure and parts list

● PFD-501 to PFD-802



No.	Parts name	Material	No.	Parts name	Material
1	Platinum thin membrane sensor 1	Alumina/platinum	7	O ring	NBR : Nitrile rubber
2	Platinum thin membrane sensor 2	Alumina/platinum	8	O ring	NBR : Nitrile rubber
3	Body	A6063S Aluminum alloy	9	Sensor base circuit board	Glass epoxy
4	Adaptor	A6063S Aluminum alloy	10	Sensor base	PBT
5	Rectification plate	SUS304 Stainless steel	11	Sensor circuit board	Glass epoxy
6	Mesh	SUS304 Stainless steel	12	Guard	ABS : ABS resin
			13	Bracket	SUS304 : Stainless steel

● PFD-163

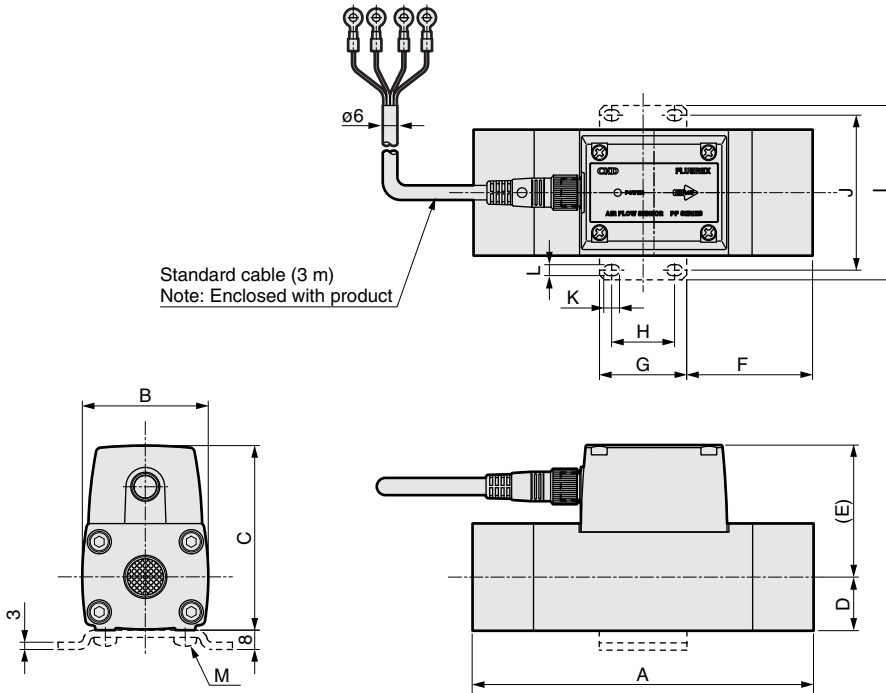


No.	Parts name	Material	No.	Parts name	Material
1	Platinum thin membrane sensor 1	Alumina/platinum	11	Sensor circuit board	Glass epoxy
2	Platinum thin membrane sensor 2	Alumina/platinum	12	Guard	ABS : ABS resin
3	Body	A6063S Aluminum alloy	13	Flow path 1	A6063S Aluminum alloy
4	Separate flow adaptor	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 circuit board	Glass epoxy	19	O ring	NBR : Nitrile rubber
10	Sensor base	PBT			

Refrigerating type dryer
Desiccant type dryer
High polymer membrane type dryer
Air filter
Auto. drain / others
F.R.L. (Module unit)
F.R.L. (Separate)
Compact F.R.
Precise regulator
F.R.L. (Related products)
Clean F.R.
Electro pneumatic regulator
Air booster
Speed control valve
Silencer
Check valve / others
Joint / tube
Vacuum filter
Vacuum regulator
Suction plate
Magnetic spring buffer
Mechanical pressure SW
Electronic pressure SW
Contact / close contact cont. SW
Air sensor
Pressure SW for coolant
Small flow sensor
Small flow controller
Flow sensor for air
Flow sensor for water
Total air system
Total air system (Gamma)
Ending

Dimensions

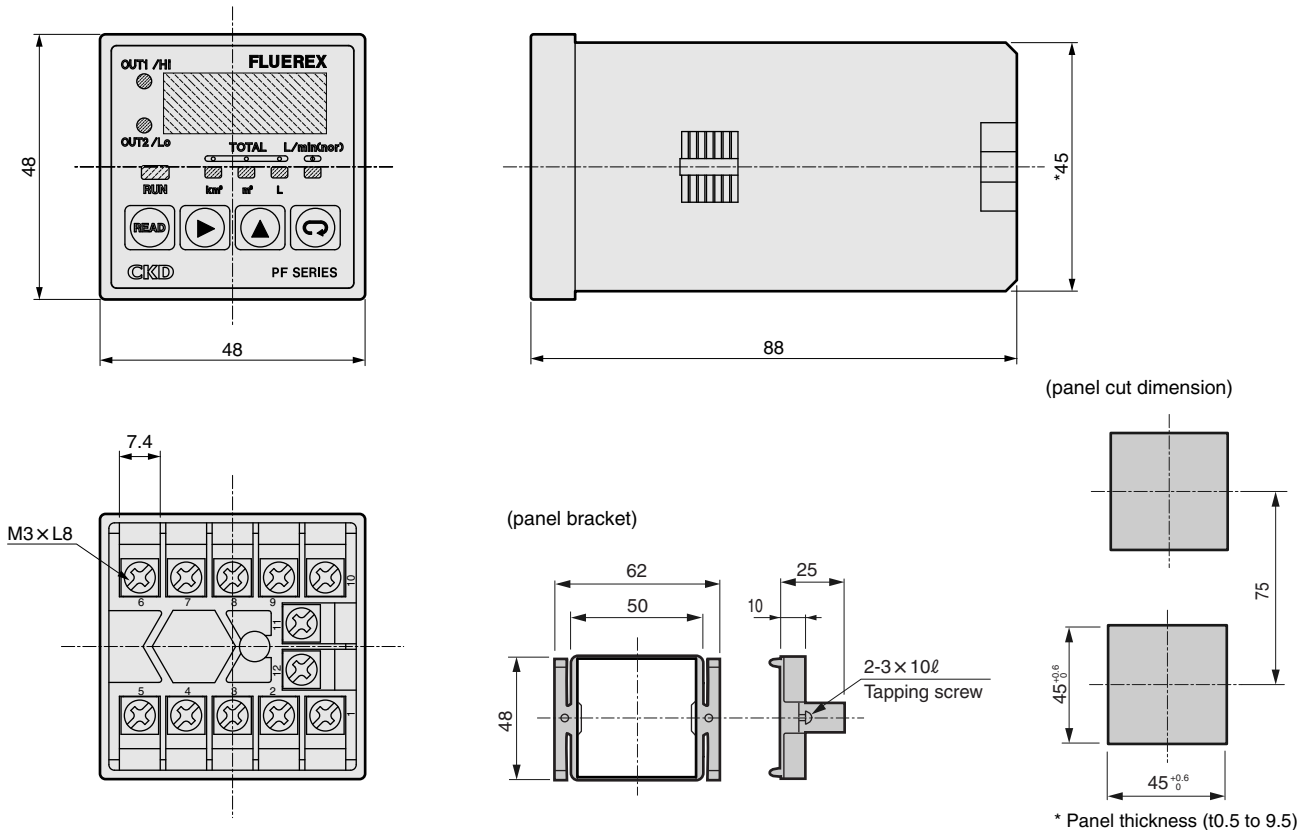
● PFD-501 to 802



Model no.	Port size
PFD-501-10	Rc3/8
PFD-102-15	Rc1/2
PFD-202-20	Rc3/4
PFD-402-25	Rc1
PFD-802-40	Rc1 1/2

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 screw depth 6
PFD-202	150	55	87.2	27.5	59.7	57	36	26	72	64	6.5	4.5	M4 screw depth 6
PFD-402	175	55	90.7	27.5	63.2	69.5	36	26	72	64	6.5	4.5	M4 screw depth 6
PFD-802	190	65	103.7	34	69.7	75	40	26	94	80	8	6	M5 screw depth 8

● Monitor

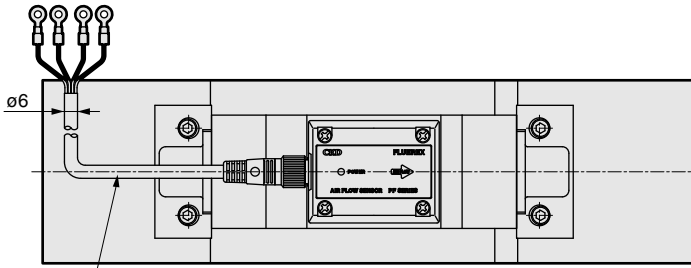


Refrigerating type dryer
Desiccant type dryer
High polymer membrane type dryer
Air filter
Auto. drain / others
F.R.L. (Module unit)
F.R.L. (Separate)
Compact F.R.
Precise regulator
F.R.L. (Related products)
Clean F.R.
Electro pneumatic regulator
Air booster
Speed control valve
Silencer
Check valve / others
Joint / tube
Vacuum filter
Vacuum regulator
Suction plate
Magnetic spring buffer
Mechanical pressure SW
Electronic pressure SW
Contact / close contact cont. SW
Air sensor
Pressure SW for coolant
Small flow sensor
Small flow controller
Flow sensor for air
Flow sensor for water
Total air system
Total air system (Gamma)
Ending
Display separate type for compressed air
FLOW sensor

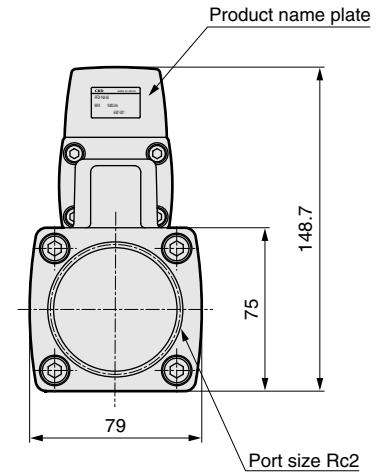
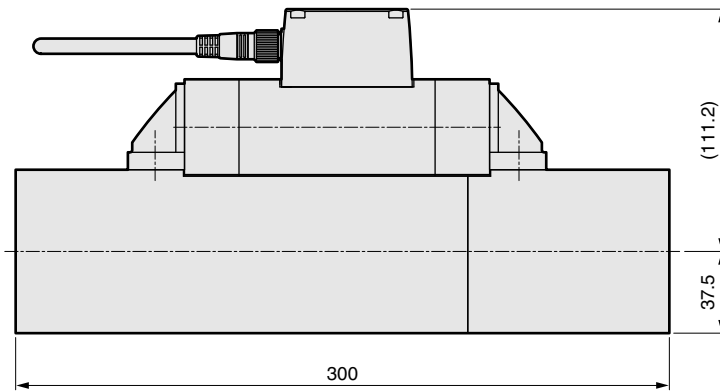
Dimensions



● PFD-163



Standard cable (3 m)
Note: Enclosed with product



Refrigerating type dryer
Desiccant type dryer
High polymer membrane type dryer
Air filter
Auto. drain / others
F.R.L. (Module unit)
F.R.L. (Separate)
Compact F.R.
Precise regulator
F.R.L. (Related products)
Clean F.R.
Electro pneumatic regulator
Air booster
Speed control valve
Silencer
Check valve / others
Joint / tube
Vacuum filter
Vacuum regulator
Suction plate
Magnetic spring buffer
Mechanical pressure SW
Electronic pressure SW
Contact / close contact cont. SW
Air sensor
Pressure SW for coolant
Small flow sensor
Small flow controller
Flow sensor for air
Flow sensor for water
Total air system
Total air system (Gamma)
Ending

Tester kit

PFK Series

Air flow rate measuring component kit is available to measure the flow rate instantly at workshop.

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



Specifications

Descriptions		PFK-501-15NO	PFK-102-15NO	PFK-202-25NO	PFK-402-25NO	PFK-802-40NO
Specifications	Flow rate range L/min.(normal)	25 to 500	50 to 1000	100 to 2000	200 to 4000	400 to 8000
	Port size	Rc1/2		Rc1		Rc1 1/2
Working conditions	Working fluid	Clean compressed air/nitrogen gas				
	Working air quality	JIS B8392-1:2003/1.1.1 to 1.6.1(Note 1)				
	Max. working pressure MPa	1.0				
	Min. working pressure MPa	0.1				
	Withstanding pressure MPa	1.5				
	Ambient temperature/humidity	0 to 50 , 85%R.H. or less (no dew)				
Precision	Fluid temperature °C	0 to 40				
	Linearity	±3.0%F.S. (0.5MPa, 20°C)				
	Pressure characteristics	±2.0%F.S. (0.5MPa reference, 0.2 to 0.7MPa)				
Output	Temperature characteristics	±2.0%F.S. (20°C reference, 10 to 30°C)				
	Pressure loss MPa	0.015 or less (maximum flow rate, 0.5MPa)				
Installation	Responsiveness sec	2.5 or less				
	Indicator	Instantaneous/integrated flow 4 digit LED display				
	Resolution L/min.(normal)	1	5	5	10	20
	Min. display flow L/min.(normal)	10	20	40	80	160
	Integrated flow	Max. 9 digits (display switched by change key) (Note 4)				
	Analog output	0 to 5 VDC				
	Switch output	1 point (NPN transistor output) (Note 5)				
Pulse output (Note 2)	10L (normal)/pulse				100L (normal)/pulse	
Installation	Power voltage V	100 VAC (6 W or less, excluding switch output load current)				
	Cable	Enclosed (3 m for connection between sensor and monitor, 2.5 power cord)				
	Installation attitude	Both vertical and horizontal				
	Straight piping section	IN side: 10D, OUT side: 5D recommended (Note 3)				
Air sensor	Protective structure	Equivalent to IP64 (only sensor section)				
	Weight kg	6.0		7.5		9.5

Note 1: Dew could collect if ambient temperature is lower than working fluid temperature.

Defection faults could occur if oil accumulates.

This product does not have clean device specifications, so particles could form on the secondary side.

If ultra-clean air is required, a precision filtration filter should be installed on the end.

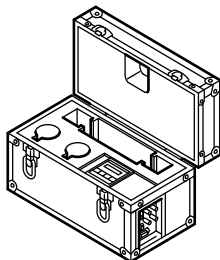
Note 2: Pulse output is used with switch output. Switch the function before use.

Note 3: A straight pipe should be installed to eliminate the effect of piping conditions. D indicates the piping bore size.

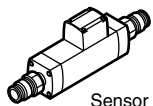
Note 4: Integrated flow is backed up regularly and can also be backed up with operation. Refer to Explanation of Functions and Operations on page 1452 for details.

Note 5: Only OUT2 can be used. OUT1 can be set, but no output terminal is available.

Product configuration



Case (Monitor)



Sensor



Coupler (2 pcs.)



Cable (3m)

Power cable (2.5m)

How to order

- Tester kit

PFK - **402** - **25** N 0

A Flow rate range

B Port size

C Switch output

D Analog output

Symbol	Descriptions				
A Flow rate range					
501	25 to 500 L/min. (normal)				
102	50 to 1000 L/min. (normal)				
202	100 to 2000L /min. (normal)				
402	200 to 4000L /min. (normal)				
802	400 to 8000L /min. (normal)				
B Port size					
	Flow rate range				
	501	102	202	402	802
15	Coupler for 15A	●	●		
25	Coupler for 25A			●	●
40	Coupler for 40A				●
C Switch output					
N	NPN transistor output Note 1				
D Analog output					
0	0 to 5 VDC				

⚠ Note on model no. selection

Note 1: Only OUT2 can be used. OUT1 can be set, but no output terminal is available.

Note 2: The sensor, monitor, cable, and coupler for this product are enclosed in a dedicated trunk.

Product: PFK-(A)-(B)N0

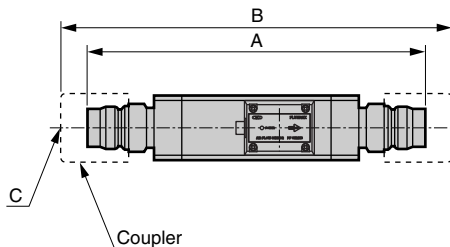
<Example of model number>

PFK-402-25N0

- A** Flow rate range : 200 to 4000L /min. (normal)
- B** Port size : Coupler for 25A
- C** Switch output : NPN transistor output
- D** Analog output : 0 to 5 VDC

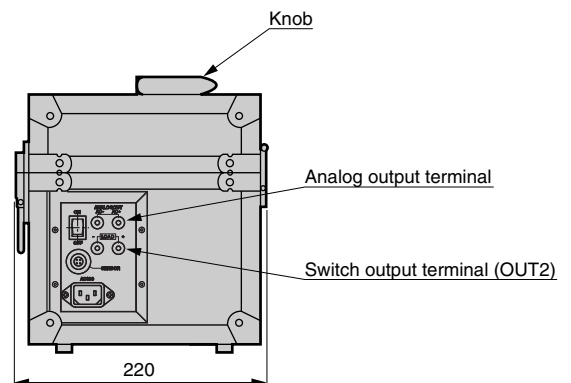
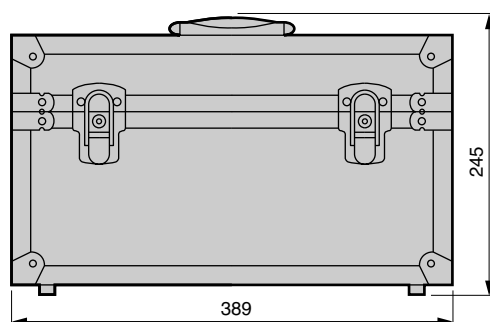
Dimensions

- PFK Sensor



	A	B	C
Sensor for PFK-501 to 102	228	264	Rc1/2
Sensor for PFK-202	285	331	Rc1
Sensor for PFK-402	300	346	Rc1
Sensor for PFK-802	350	402	Rc11/2

Case



Refrigerating type dryer
Desiccant type dryer
High polymer membrane type dryer
Air filter
Auto. drain / others
F.R.L. (Module unit)
F.R.L. (Separate)
Compact F.R.
Precise regulator
F.R.L. (Related products)
Clean F.R.
Electro pneumatic regulator
Air booster
Speed control valve
Silencer
Check valve / others
Joint / tube
Vacuum filter
Vacuum regulator
Suction plate
Magnetic spring buffer
Mechanical pressure SW
Electronic pressure SW
Contact / close contact cont. SW
Air sensor
Pressure SW for coolant
Small flow sensor
Small flow controller
Flow sensor for air
Flow sensor for water
Total air system
Total air system (Gamma)

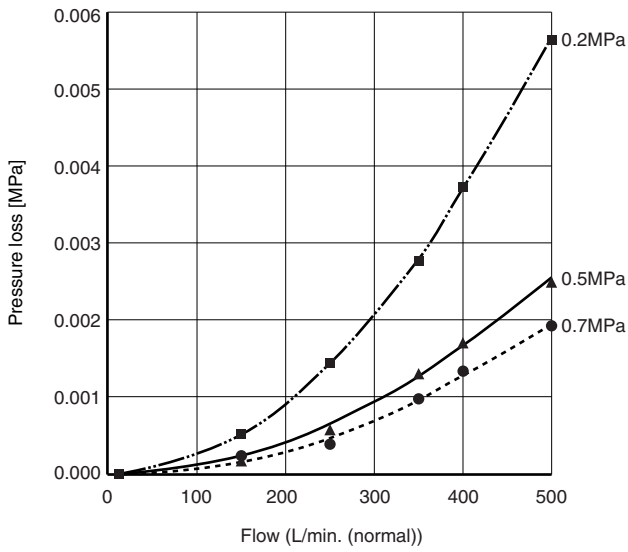
Ending

Display separate type for compressed air
FLOW sensor

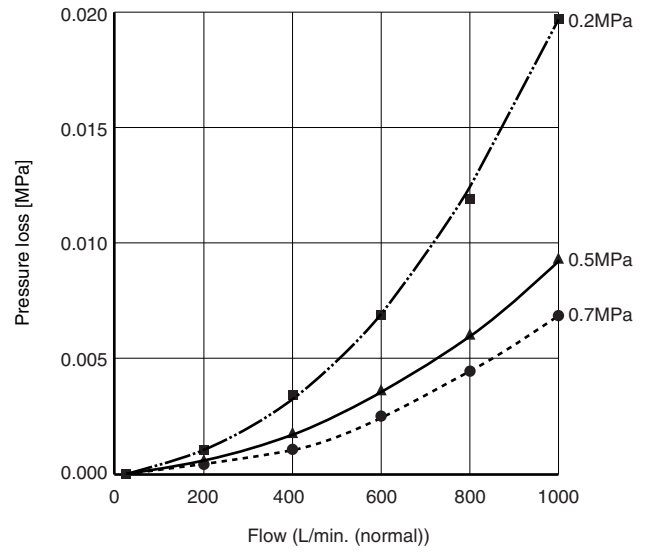
Pressure loss characteristics

Refrigerating type dryer
Desiccant type dryer
High polymer membrane type dryer
Air filter
Auto. drain / others
F.R.L. (Module unit)
F.R.L. (Separate)
Compact F.R.
Precise regulator
F.R.L. (Related products)
Clean F.R.
Electro pneumatic regulator
Air booster
Speed control valve
Silencer
Check valve / others
Joint / tube
Vacuum filter
Vacuum regulator
Suction plate
Magnetic spring buffer
Mechanical pressure SW
Electronic pressure SW
Contact / close contact cont. SW
Air sensor
Pressure SW for coolant
Small flow sensor
Small flow controller
Flow sensor for air
Flow sensor for water
Total air system
Total air system (Gamma)
Ending

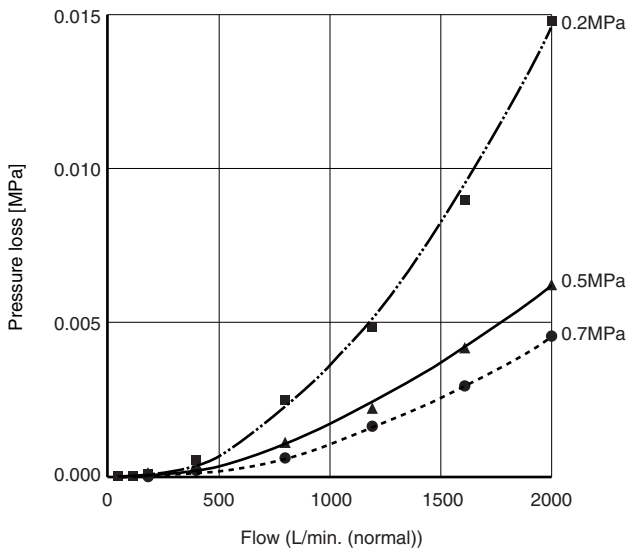
● PFD-501-10



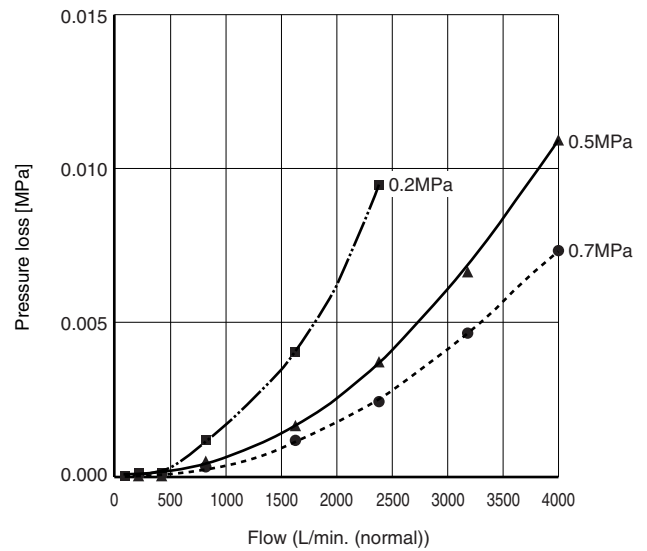
● PFD-102-15



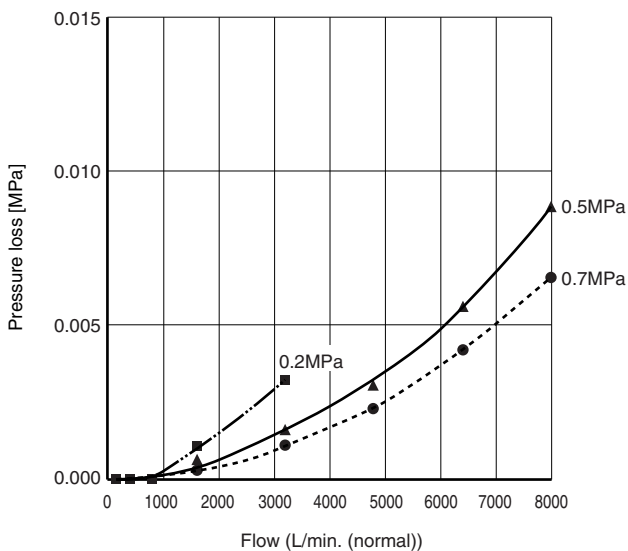
● PFD-202-20



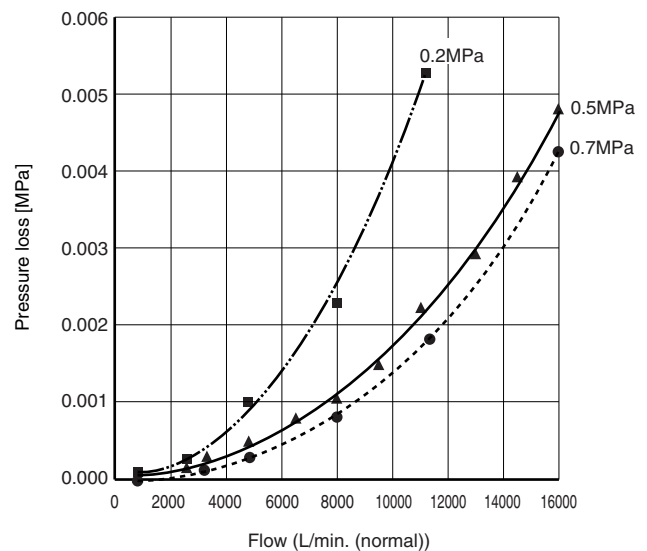
● PFD-402-25



● PFD-802-40

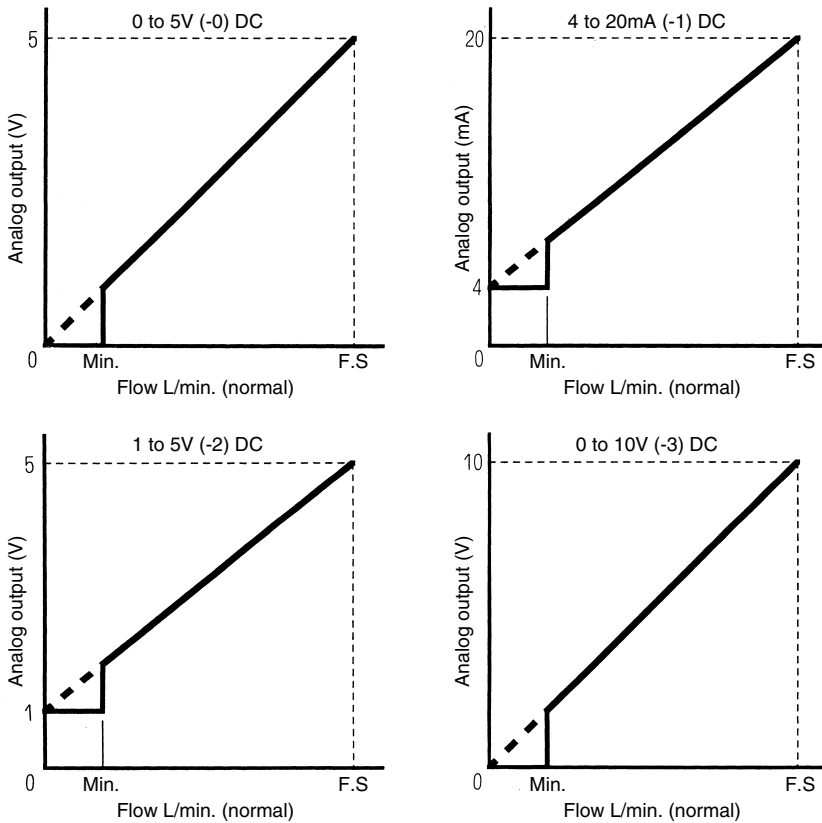


● PFD-163-50



PFD Series electric wiring

1 Analog output (option symbol: -0 (standard), -1, -2, -3)



Load resistance of analog output

Analog output	Descriptions	Load resistance
0 to 5 VDC		50KΩ and over
4 to 20mA DC		300Ω or less
1 to 5 VDC		50KΩ and over
0 to 10 VDC		50KΩ and over

Model no.	Min. 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

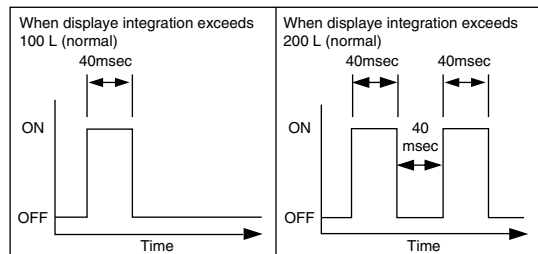
- The relation of the flow and analog output is shown in the graph at left. Analog output is not output correctly when lower than the minimum.
- Do not short-circuit the analog output terminal with other terminals. Failure to observe this could result in problems.
- Keep wiring short to prevent the effect of noise. Separate the wire from sources of noise such as power distribution cables.

2 Integrated pulse output. (Change with switch output. Only OUT2 is used.)

- The integrated pulse outputs the pulse at the following integrated value. L(normal)

Model no.	PFD-501 PFK-501	PFD-102 PFK-102	PFD-202 PFK-202	PFD-402 PFK-402	PFD-802 PFK-802	PFD-163
Integrated flow per pulse	10				100	

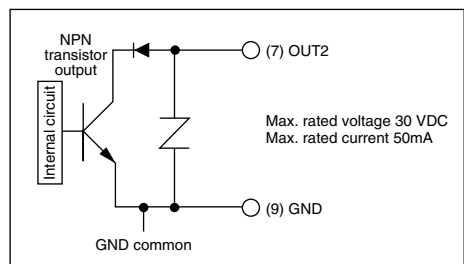
(Example) The pulse waveform for the PFD-802 is shown below.



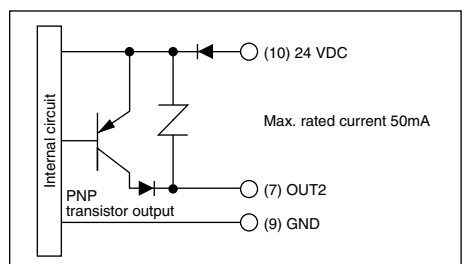
Note that the integrated display is updated at 1 sec. intervals.

- Output circuit

◆ NPN output

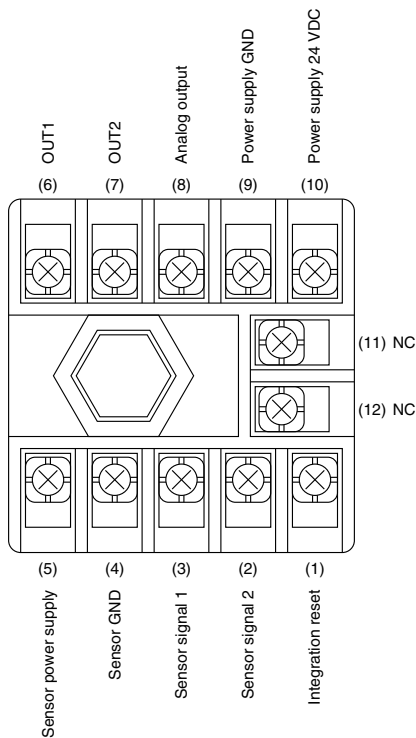


◆ PNP output



3 Wiring the sensor and monitor

- Observe the following precautions when wiring.



- Use the enclosed cable for wiring.

[Specifications]

With 4-conductor connector for DC

Finished outer diameter of 6

Conductor size 0.5 mm²

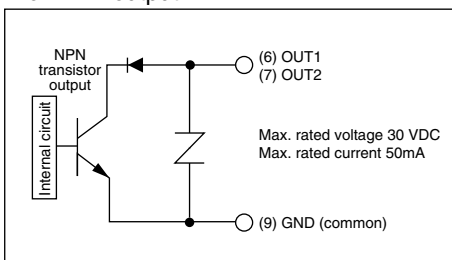
Insulator outer diameter of 1.72

- Check with CKD before extending the cable.

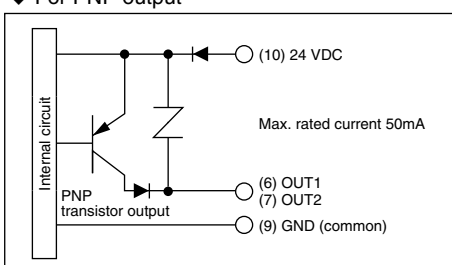
No.	Function	
1	Integration reset	Integrated flow is cleared by connecting this terminal to the (9) GND terminal.
2	Sensor signal 2	Connect to enclosed cable (black)
3	Sensor signal 1	Connect to enclosed cable (white)
4	Sensor GND	Connect to enclosed cable (blue)
5	Sensor power supply	Connect to enclosed 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 0 VDC power supply
10	Power supply 24 VDC	Connect to 24 VDC power supply
11	NC	Do not connect anything.
12	NC	Do not connect anything.

- Switch output circuit

- ◆ For NPN output

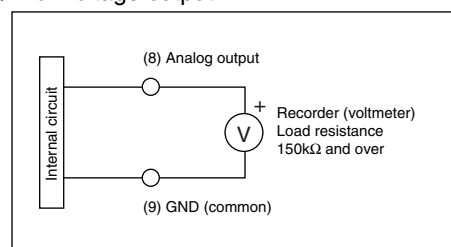


- ◆ For PNP output

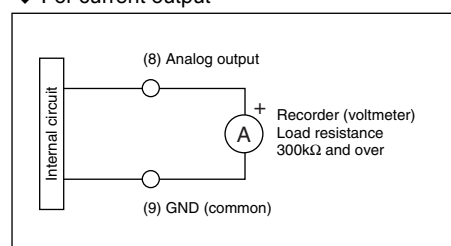


- Analog output circuit

- ◆ For voltage output



- ◆ For current output

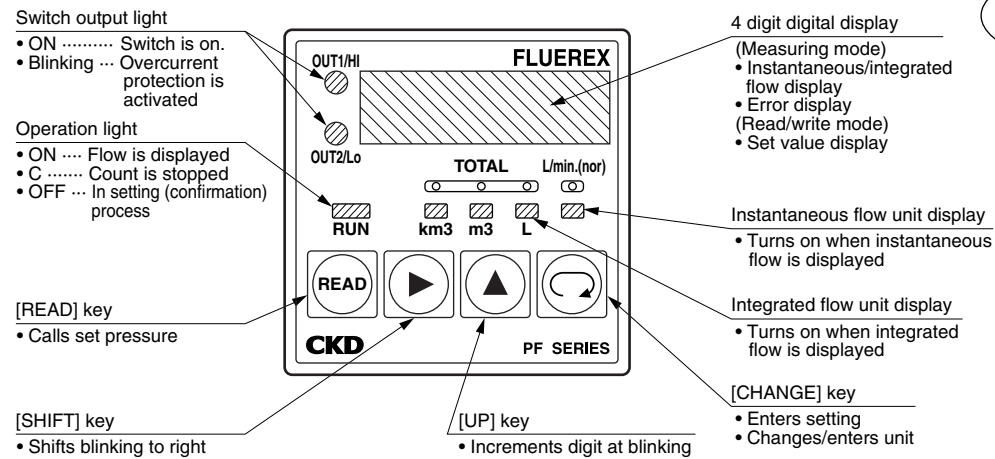


Refrigerating type dryer
Desiccant type dryer
High polymer membrane type dryer
Air filter
Auto. drain / others
F.R.L. (Module unit)
F.R.L. (Separate)
Compact F.R.
Precise regulator
F.R.L. (Related products)
Clean F.R.
Electro pneumatic regulator
Air booster
Speed control valve
Silencer
Check valve / others
Joint / tube
Vacuum filter
Vacuum regulator
Suction plate
Magnetic spring buffer
Mechanical pressure SW
Electronic pressure SW
Contact / close contact cont. SW
Air sensor
Pressure SW for coolant
Small flow sensor
Small flow controller
Flow sensor for air
Flow sensor for water
Total air system
Total air system (Gamma)

Ending

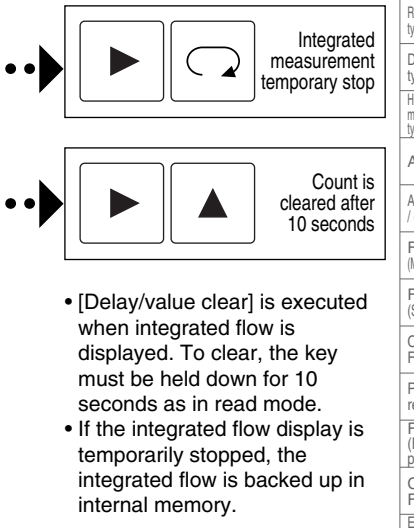
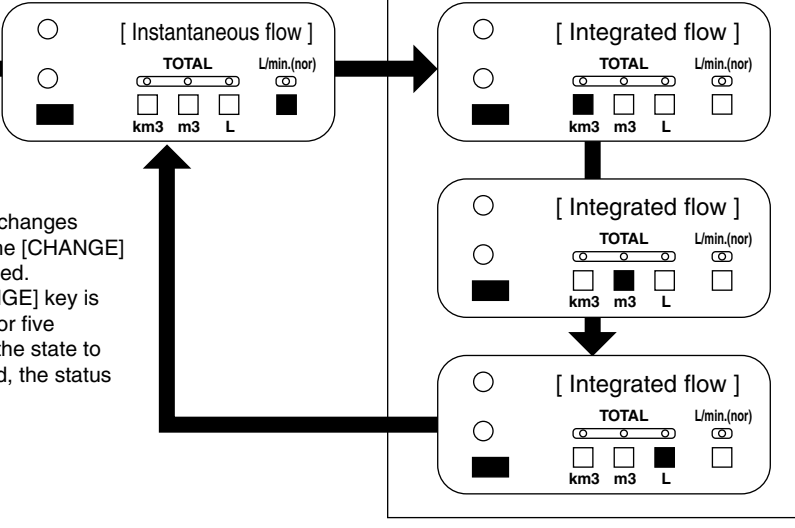
Display separate type for compressed air
FLOW SENSOR

Explanation of monitor functions and operations



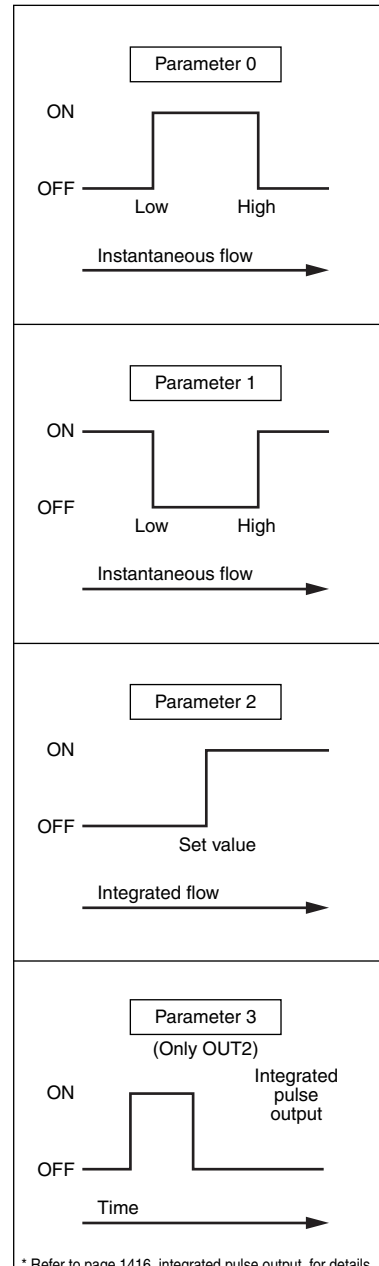
Measuring mode

- The display changes each time the [CHANGE] key is pressed.
- If the [CHANGE] key is held down for five seconds in the state to be displayed, the status is entered.



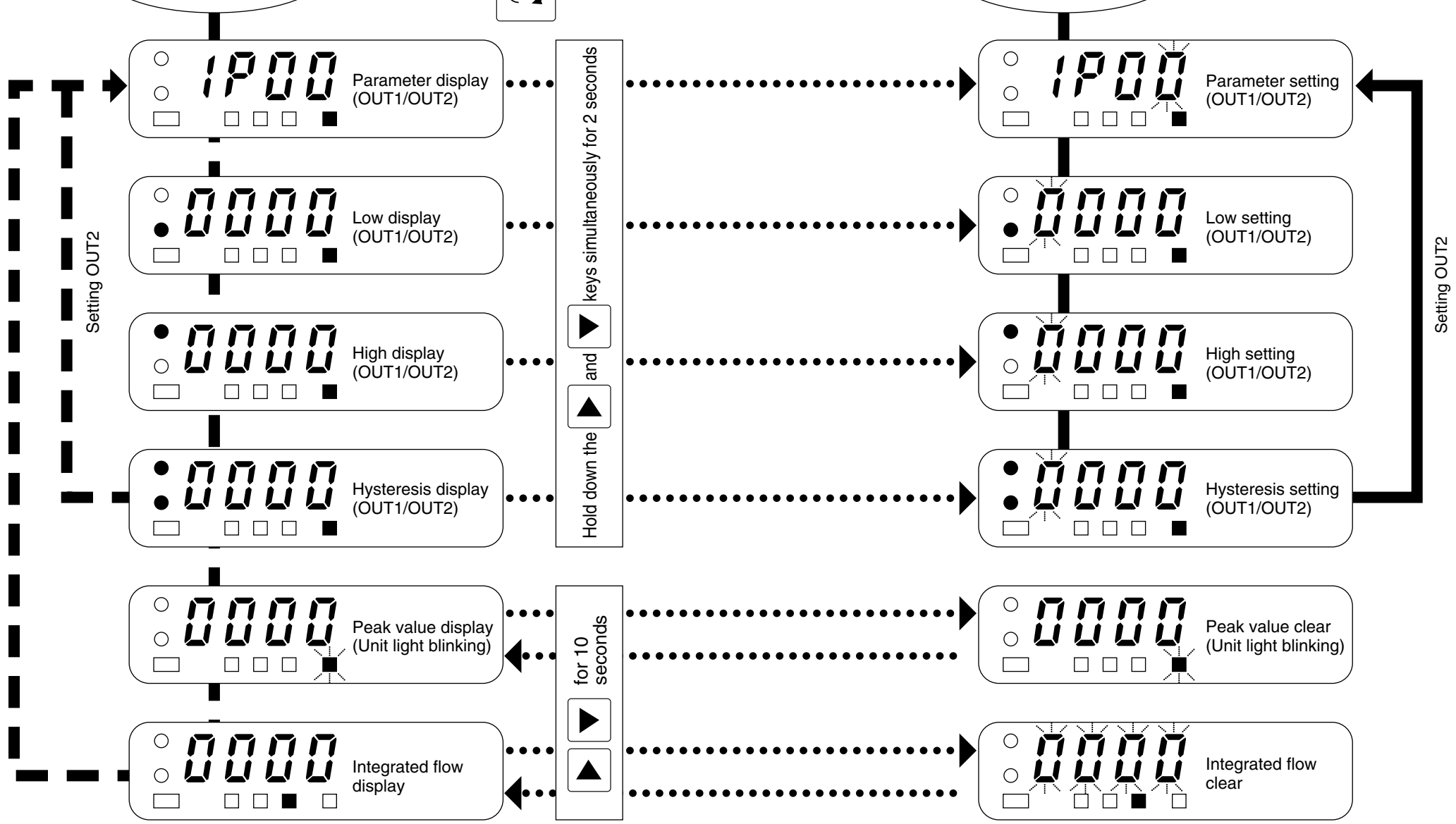
Switch parameter

Four types of setting are available based on the applications.

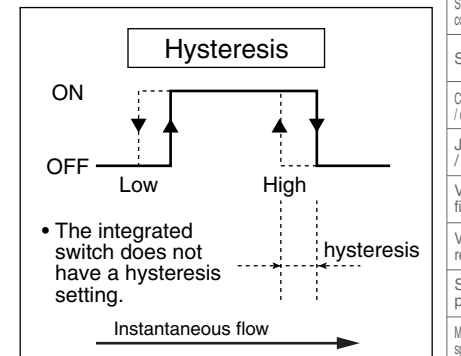


READ MODE

WRITE MODE



Hysteresis



Integrated pulse output

If the parameter is set to [3] when OUT2, switch output is changed to integrated pulse output. Note that OUT1 does not have integrated pulse output.

Backing up integrated flow and peak

- This product automatically backs up integrated flow and peak in internal memory. Data is saved even if power is turned off.
 - Data is backed up at the following timing:
 - When five or more minutes have passed from previous backup and the value changed from the previous integrated flow or peak.
 - When integrated flow stop was executed.
 - When the integrate value was cleared. (The peak value at that point is backed up. For the integrated value, the value after clearing is backed up.)
 - When the peak value was cleared. (The peak value after clearing is backed up, and the integrated value at that point is backed up.)
 - Data is not backed up in the following cases:
 - Less than five minutes have passed since data was backed up.
 - Previous data has not changed, even after five minutes.
- When power is turned on, the previously backed up value is displayed.

* For parameter 2, the integrated switch setting is used instead of (L) (H) and (h).
 * There are no setting modes for parameter 3, so in read mode the display goes to "peak value display" and in write mode to "parameter setting."
 * If [UP] (shift key) is pressed after setting or confirming integrated flow, the integrated flow display changes.

* The peak and integrated flow are cleared when [SHIFT] [UP] are held down at the same time for 10 seconds.

