

Flow sensor for compressed air

PF-F/PFU (display integrated type flow sensor)

■ Sensor / flow sensor

Overview

Compressed air consumption could reach 1/5 of energy used in manufacturing plant. Controlling air is very important for energy saving. This flow rate sensor enables air control easily.

Features

Pressure/temperature compensation not required
 Bothering compensation is not required. Flow rate can be directly read with digital display (L/min. (normal) display).

Precision with practical accuracy $\pm 3\%$ F.S.

Integrating function provided as standard

Air consumption per device is easily measured.

Integrated pulse output provided (option)

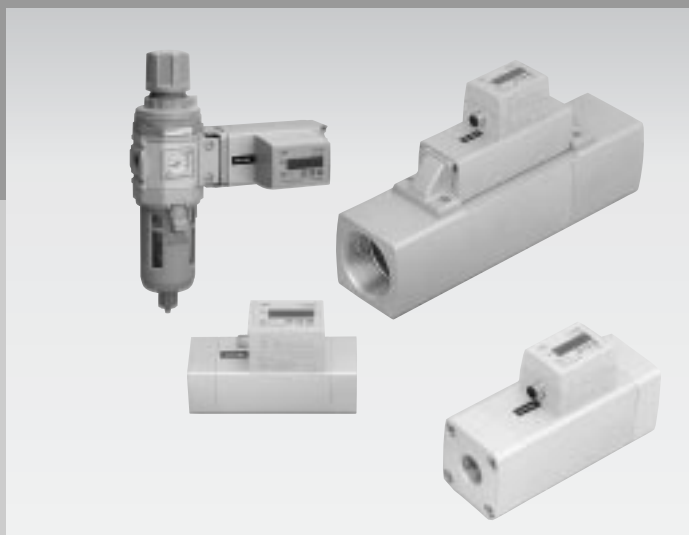
Convenient function are provided for integrated flow control or network control using personal computers and programmable controllers.

Heavy-duty design

The sturdy design is robust against drainage (water drops).

Free installation attitude

Compact without straight piping section.
 Both vertical and horizontal installation are available.



C O N T E N T S

Product introduction	1406
Applications	1408
▲ Safety precautions	1410
● Medium flow (PF500F to PF4000F)	1414
● Large flow (PF8000F/PF16000F)	1418
● Module design type (PFU500F to PFU2000F)	1422
Electric wiring	1425
Monitor function and operation explanation	1428

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)

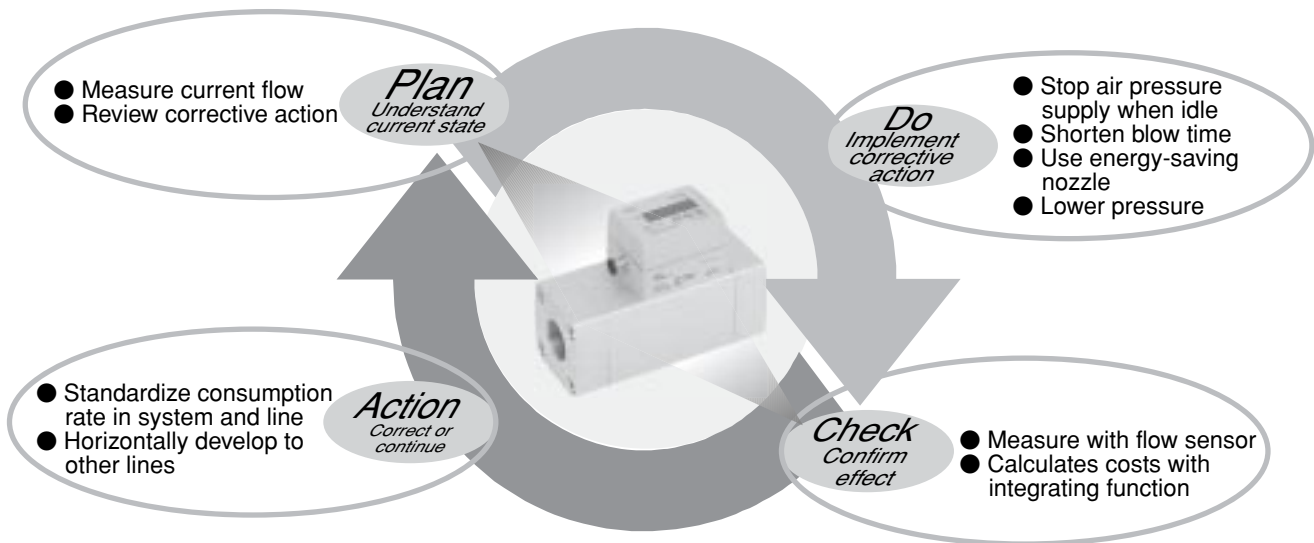
Ending

Display integrated type for compressed air
 Flow sensor

Strongly supporting energy conservation

Flow sensor PF Series

Useful for understanding and confirming current energy consumption



High performance

High practical precision at $\pm 3\%$ F.S.

A practical precision of 3%F.S. is realized without correction at temperatures from 0 to 40°C and pressures from 0.1 to 1.0MPa.

Pressure loss 0.005MPa (primary pressure: 0.7MPa) is realized *1

The laminated rectifier filter suppresses pressure loss to 0.005 MPa.
(*1. Excluding some models)

Straight piping not required *2

Functions of the rectifier filter are not affected even if an elbow or T-shape socket is piped immediately before the sensor.

(*2: Excluding PF8000/PF16000F)

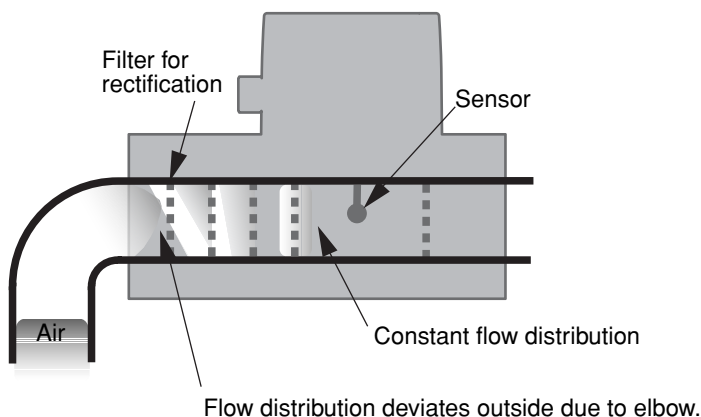
Reliability

Heavy-duty design

- The sturdy design is robust against drainage (water drops).
(Environment resistance doubled over conventional models)
 - Platinum membrane sensor water resistance is increased with a special coating.
 - Abnormal sensor overheating is prevented with a protection circuit.

Equivalent to protective structure IP64

This series is used safely in an adverse environment with high levels of dust or water sprayed from different directions.



Series

Model	Port size Rc						Flow rate range L/min.(normal)					
	3/8 -10	1/2 (15)	3/4 (20)	1 -25	1 1/2 -40	2 (50)	0	10	100	1000	10000	100000
Standard type	PF500F	●	●						25	500		
	PF1000F	●	●						50	1000		
	PF2000F		●	●					100	2000		
	PF4000F			●	●				200	4000		
	PF8000F					●			400	8000		
	PF16000F						●		800	16000		
Module type	PFU500F	●							25	500		
	PFU1000F	●							50	1000		
	PFU2000F		●						100	2000		

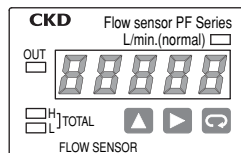
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F.R.L. (Related products)
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Electro pneumatic regulator
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Mechanical pressure SW
Electronic pressure SW
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Pressure SW for coolant
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Small flow controller
Flow sensor for air
Flow sensor for water
Total air system
Total air system (Gamma)

Easy to use

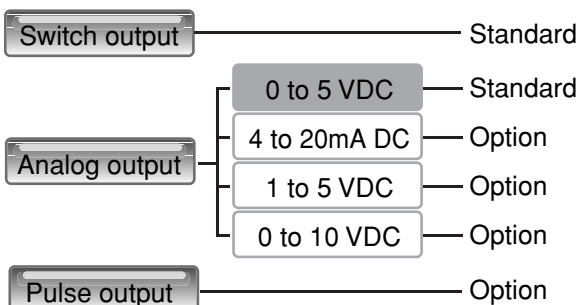
Eliminate compensation - read directly with a digital gauge
 Botherome pressure compensation and temperature correction are not required.

- Mass detection prevents reading from being adversely affected by changes in pressure, and pressure compensation is not needed. Flow converted to atmospheric pressure (1 atm) is displayed.
- Temperature compensation not required. The platinum membrane temperature sensor detects the fluid temperature, and converts the reading to the flow at 0°C at all times.

Compact, integrated display and sensor
 Easy-to-read 5-digit LED showing integrated flow.
 The display can be switched between integrated flow and instant flow in one touch.

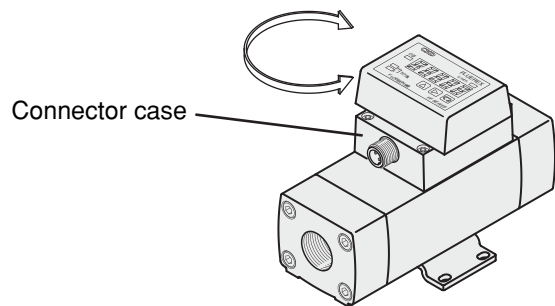


Ample output variations



Different installation styles

- This unit is installable vertically, horizontally, or otherwise.
- The display is freely rotated 270°.
- Connector wiring follows piping and does not need extra space.
- Switching the connector case to 180° lets connector wiring be led from either in or out.



Module design uses a filter and regulator (PFU500F, PFU1000F, PFU2000F)

- Air quality is maintained, controlled, and measured with a single unit.
- Piping space and piping work hours are reduced.

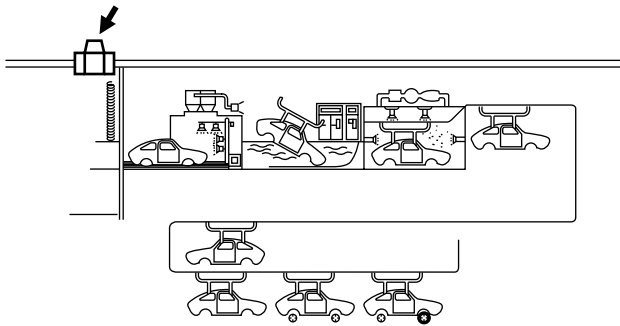


Display integrated type for compressed air
FLOW SENSOR

Applications

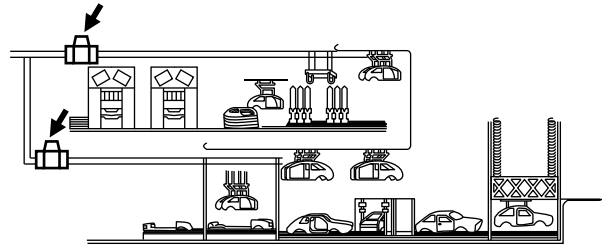
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Total air system (Gamma)
Ending

For flow control of paint lines



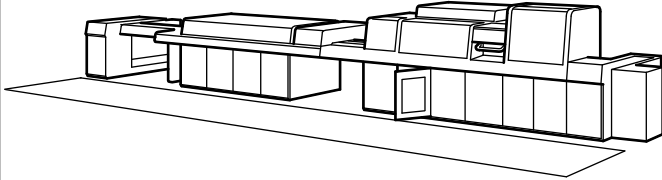
For flow control in automobile manufacturing lines

- For flow controls per each line!
- Cost conversion by integrating flow rate display

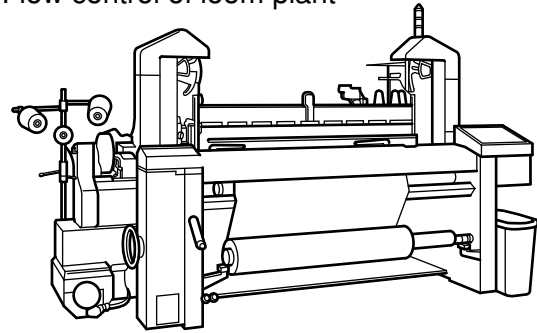


For semiconductor manufacturing equipment

- Flow control of expensive air at low dew point!
- Ready detection of trouble such as "overflow", etc.

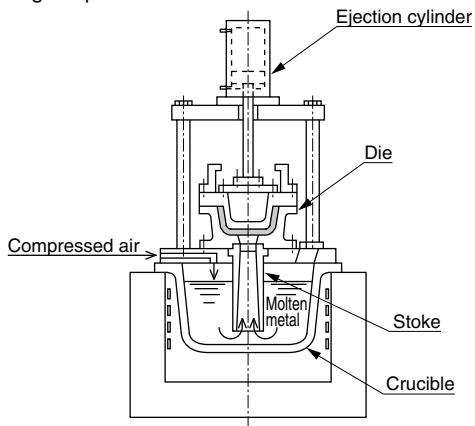


Flow control of loom plant

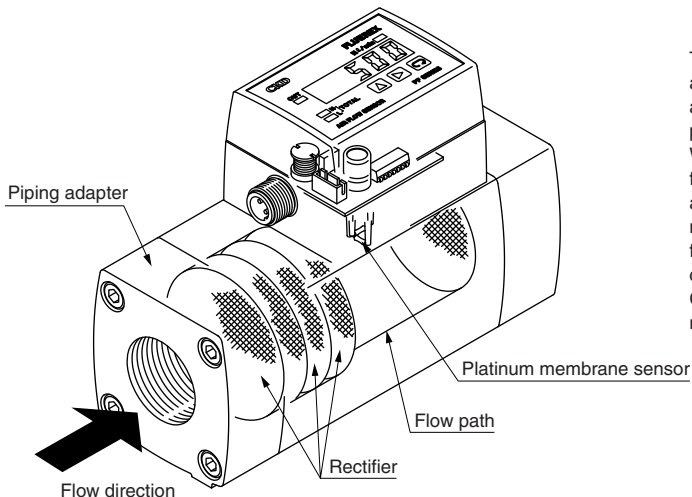


For low pressure casting devices

- For die cooling temperature control!



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.



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 PF-F/PFU 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 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.

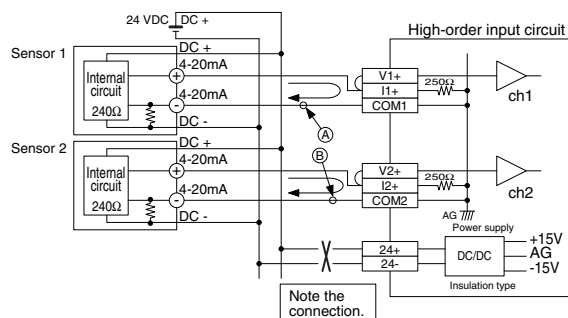
3. Design per applications

⚠ CAUTION

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

- The separated display PFD Series monitor cannot be connected to the PF-F or PFU Series. Otherwise, damage could occur.

- Precautions for analog output "A1"



If more than one analog output 4-20mA sensor is connected to the same common input circuit (host computer, programmable controller, etc.) as shown above, signals will interfere and operation will not be correct. In this case, use voltage output type (standard, A2, A3).

* A and B point voltage are connected inside the input circuit, and have the same potential. This will cause an error in analog output.

If the host input circuit power supply (24 VDC) is not insulated, separate the input circuit and sensor power.

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.
- 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. Over current protection: Approximate 70mA

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Flow sensor for air
Flow sensor for water
Total air system
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Ending

Display integrated type for compressed air
Flow sensor

Installation & Adjustment

CAUTION

- 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.

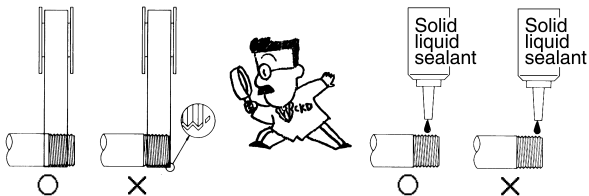
- Use the enclosed cable (3 m). Check with CKD when a longer cable is required.

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.

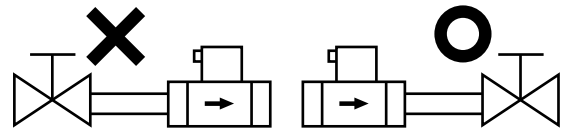
- Apply adequate torque when connecting pipes.

- 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.

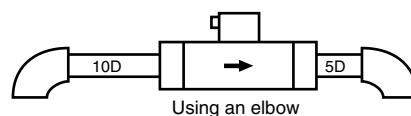
- Select a pressure reduction valve having sufficient flow for maximum sensor flow.

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

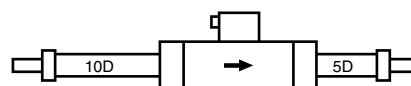
- When using an elbow or bushing in piping, install 10 D or larger straight piping on the primary side and 5 D or larger straight piping on the secondary side.

- Be sure to provide straight piping when using the PF8000F/ PF16000F Series.

- Note that the bore can be changed up to one rank upward with the bushing.



Using an elbow



Using a bushing

Model no.	D dimension
PF8000F	40mm
PF16000F	50mm

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

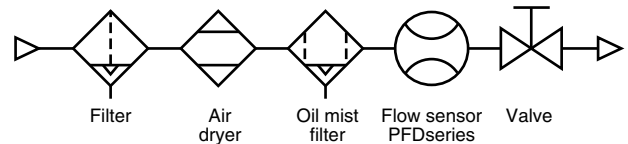
4. Pneumatics pressure source

⚠ CAUTION

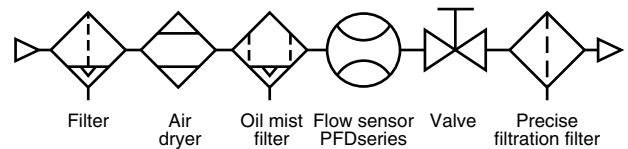
- Install an air filter just before the pneumatic component in the circuit.
- When supplying compressed air for the first time after connecting pipes, do not apply high pressure suddenly.
 - Piping connection could deviate and cause piped tubing to pop off and lead to accidents.

■ 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. Slight heating (40°C) of the display section is not problem.
- 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

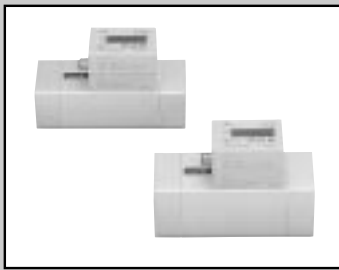
⚠ CAUTION

- Do not apply excessive torque to the display. The display can be freely rotated 270° so turn it to an easy-to-see position. The stopper could be damaged if the display is rotated with excessive force.
- 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.

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High polymer membrane type dryer
Air filter
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Ending

Display integrated type for compressed air
FLOW sensor



Flow sensor for compressed air
Medium flow type

PF500F to PF4000F series

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



Specifications

Descriptions	PF500F-10	PF500F-15	PF1000F-10	PF1000F-15	PF2000F-15	PF2000F-20	PF4000F-20	PF4000F-25
Specifications	25 to 500		50 to 1000		100 to 2000		200 to 4000	
Flow rate range L/min.(normal)	25 to 500		50 to 1000		100 to 2000		200 to 4000	
Port size	Rc3/8	Rc1/2	Rc3/8	Rc1/2	Rc1/2	Rc3/4	Rc3/4	Rc1
Working conditions	Compressed air, nitrogen							
Working fluid	Compressed air, nitrogen							
Working air quality	Atmospheric dew point -17°C or less, no dew condensation (Note 1)							
Max. working pressure MPa	1.0							
Min. working pressure MPa	0.1							
Withstanding pressure MPa	1.5							
Ambient temperature and humidity	0 to 50°C, 85%RH or less							
Fluid temperature °C	0 to 40							
Precision	±1.5%FS (0.7MPa, 20°C)							
Linearity	±1.5%FS (0.7MPa, 20°C)							
Pressure characteristics	±1.5%FS (0.1 to 1.0MPa, 0.7MPa reference)							
Temperature characteristics	±2.0%FS (0 to 40°C, 20°C reference)							
Pressure loss MPa	0.005 or less (maximum flow rate, 0.7MPa)							
Responsiveness sec	2.5							
Output	5 digit LED display unit: L/min. (normal)							
Indicator	5 digit LED display unit: L/min. (normal)							
Min. display flow (Note 2)	10		20		30		50	
Display resolution	1				10			
Installation	Max. 9 digits (H and L separately displayed)							
Integrated flow	Max. 9 digits (H and L separately displayed)							
Analog output	Standard: 0 to 5 VDC Option: 4DC to 20mA, 1 to 5 V, 0 to 10 V							
Switch output (Note 3)	1 point (transistor open collector) green LED lighting during operation							
Pulse output (option) (Note 4)	10L (normal)/pulse							
Power voltage V	24DC (8W or less)							
Cable	Enclosed (with 3m connector, 0.5mm ² conductor)							
Set value holding function (Note 5)	Semi permanent due to EEPROM							
Installation	Horizontal or vertical							
Installation attitude	Horizontal or vertical							
Strait piping section	Not required							
Protective structure	IP64 or equivalent							
Weight kg	0.85						1.4	

Note 1: If foreign matter, moisture or oil is contained in the compressed air, detecting flow rate is failed, so "sensor error" is displayed.
Install a filter, refrigerating type dryer and oil mist filter before a flow sensor.

Note 2: If lower than min. flow rate range, 0 is indicated. Also, for indicated value under flow rate range, accuracy is not guaranteed.

Note 3: If option "A1" (4 to 20mA DC) or "A6" (integrating pulse) is selected, switch output cannot be used.

Note 4: Refer to descriptions of integrated pulse output on page 1425 for details of pulse output.

Note 5: The integrated flow value is reset when power is turned OFF.

How to order

PF **2000F** - **15** - **A1** **B**

A Flow rate range

B Port size

C Output
Note 1

D Bracket

		Model no.			
		PF500F	PF1000F	PF2000F	PF4000F
Symbol	Descriptions				
A Flow rate range					
500F	25 to 500 L/min.(normal)	●			
1000F	50 to 1000 L/min.(normal)		●		
2000F	100 to 2000 L/min.(normal)			●	
4000F	200 to 4000 L/min.(normal)				●
B Port size					
10	Rc3/8	●	●		
15	Rc1/2	●	●	●	
20	Rc3/4			●	●
25	Rc1				●
C Output					
Blank	Analog output 0 to 5 VDC (standard)	●	●	●	●
A1	Analog output 4 to 20mA DC	●	●	●	●
A2	Analog output 1 to 5 VDC	●	●	●	●
A3	Analog output 0 to 10 VDC	●	●	●	●
A6	Integrated pulse output	●	●	●	●
D Bracket					
Blank	Without bracket	●	●	●	●
B	With bracket (with screw)	●	●	●	●

⚠ Note on model no. selection

Note 1

Symbol	Standard	(Option)			
		A1	A2	A3	A6
Blank (0-5V)	●				●
A1(4-20mA)		●			
A2(1-5V)			●		
A3(0-10V)				●	
A6 (pulse output)					●
Switch output	●		●	●	

* Consult with CKD for other combinations.

<Example of model number>

PF2000F-15-A1B

Model : PF2000F

A Flow rate range : 100 to 2000 L/min.(normal)

B Port size : Rc1/2

C Output : Analog output 4 to 20mA DC

D Bracket : With bracket (with M4 screw)

Discrete bracket model no.

Model no.	Bracket model no.
PF500F/PF1000F/PF2000F	PF-FL307499
PF4000F	PF-FL307500

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)

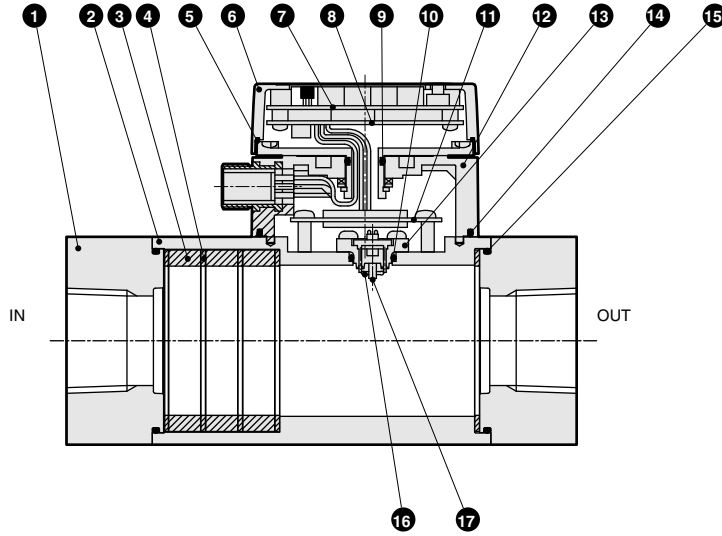
Ending

Display integrated type for compressed air
Flow sensor

PF500F to PF4000F Series

Internal structure and parts list

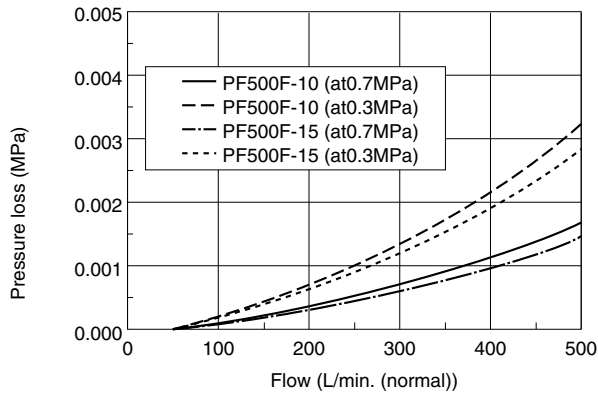
● PF500F to PF4000F



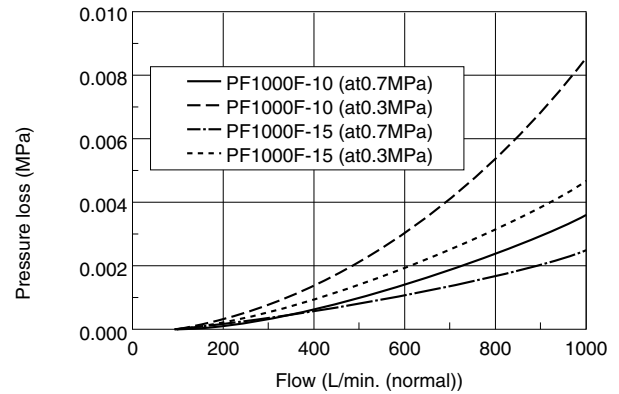
No.	Parts name	Material	
1	Piping adapter	A6063	Aluminum alloy
2	Body	A6063	Aluminum alloy
3	Collar	A5056	Aluminum alloy
4	Mesh	SUS304	Stainless steel
5	Packing seal	NBR	Nitrile rubber
6	Case A	ABS	ABS resin
7	Display circuit board		
8	CPU circuit board		
9	O ring	NBR	Nitrile rubber
10	O ring	NBR	Nitrile rubber
11	Sensor circuit board		
12	Connector case 2	ABS	ABS resin
13	Sensor assembly	PPS	Polyphenylene sulfide
14	Gasket	NBR	Nitrile rubber
15	O ring	NBR	Nitrile rubber
16	Platinum thermo sensor		
17	Platinum flow sensor		

Pressure loss

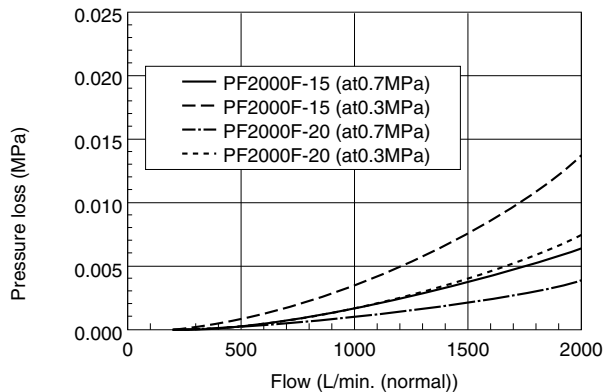
● PF500F



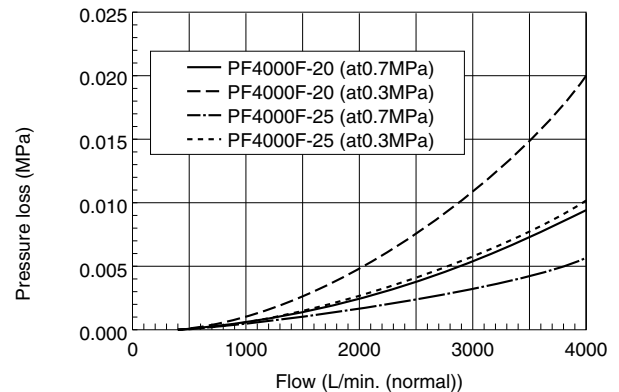
● PF1000F



● PF2000F



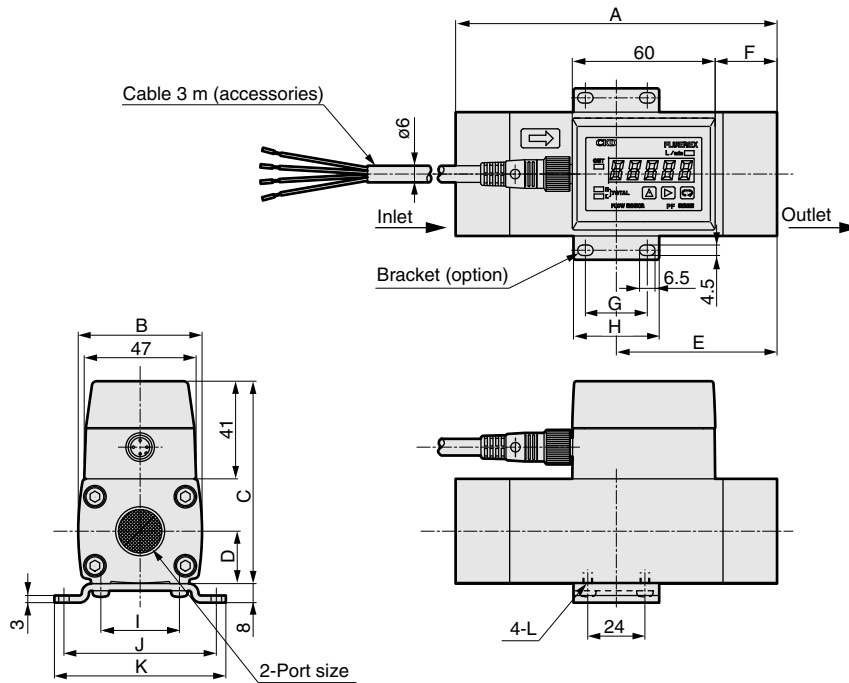
● PF4000F



Dimensions



● PF500F to PF4000F



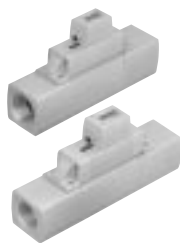
Model no.	Port size
PF*00F-10	Rc3/8
PF*00F-15	Rc1/2
PF*00F-20	Rc3/4
PF*00F-25	Rc1

Model no.	A	B	C	D	E	F	G	H	I	J	K	L
PF500F/PF1000F	135	52	85	22	67.5	26	26	36	33	64	72	M4 screw depth 4.5
PF2000F	135	55	96	27.5	67.5	26	26	36	33	64	72	M4 screw depth 4.5
PF4000F	176	65	109	34	88	46.5	28	40	42	74	84	M5 screw depth 5.5

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 integrated type for compressed air
Flow sensor



Flow sensor for compressed air
Large flow rate type

PF8000F to PF16000F series

• Flow rate range: 400 to 8000, 800 to 16000 L/min. (normal)



Specifications

Descriptions		PF8000F-40	PF16000F-50
Specifications	Flow rate range L/min.(normal)	400 to 8000	800 to 16000
	Port size	Rc1 1/2	Rc 2
Working conditions	Working fluid	Compressed air, nitrogen	
	Working air quality	Atmospheric dew point -17°C or less, no dew condensation (Note 1)	
	Max. working pressure MPa	1.0	
	Min. working pressure MPa	0.1	
	Withstanding pressure MPa	1.5	
	Ambient temperature and humidity	0 to 50°C , 85%RH or less	
	Fluid temperature °C	0 to 40	
Precision	Linearity	±2.5%FS (0.7MPa, 20°C)	
	Pressure characteristics	±1.5%FS (0.1 to 1.0MPa, 0.7MPa reference)	
	Temperature characteristics	±2.0%FS (0 to 40°C, 20°C reference)	
	Pressure loss MPa	0.005 or less (maximum flow rate, 0.7MPa)	
	Responsiveness sec	2.5	
	Indicator	5 digit LED display unit: m ³ /min. (normal)	
	Min. display flow (Note 2)m ³ /min.(normal)	0.1	0.2
	Display resolution	0.01	0.10
	Integrated flow	Max. 9 digits (H and L separately displayed)	
Output	Analog output	Standard: 0 to 5 VDC Option: 4DC to 20mA, 1 to 5 V, 0 to 10 V	
	Switch output (Note 3)	1 point (transistor open collector) green LED lighting during operation	
	Pulse output (option) (Note 4)	100L (normal)/pulse	
	Power voltage V	24DC (8W or less)	
	Cable	Enclosed (with 3m connector, 0.5mm ² conductor)	
	Set value holding function (Note 5)	Semi permanent due to EEPROM	
Installation	Installation attitude	Horizontal or vertical	
	Strait piping section	Upstream 10D/down stream 5D	
	Protective structure	IP64 or equivalent	
	Weight kg	3.8	4.0

Note 1: If foreign matter, moisture or oil is contained in the compressed air, detecting flow rate is failed, so "sensor error" is displayed.
Install a filter, refrigerating type dryer and oil mist filter before a flow sensor.

Note 2: If lower than min. flow rate range, 0 is indicated. Also, for indicated value under flow rate range, accuracy is not guaranteed.

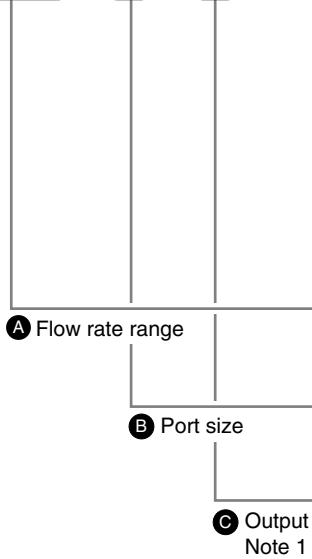
Note 3: If option "A1" (4 to 20mA DC) or "A6" (integrating pulse) is selected, switch output cannot be used.

Note 4: Refer to descriptions of integrated pulse output on page 1425 for details of pulse output.

Note 5: The integrated flow value is reset when power is turned OFF.

How to order

PF **8000F** - **40** - **A1**



		Model no.	
		PF8000F	PF16000F
Symbol	Descriptions		
A Flow rate range			
8000F	400 to 8000 L/min.(normal)	●	
16000F	800 to 16000 L/min.(normal)		●
B Port size			
40	Rc1 1/2	●	
50	Rc2		●
C Output			
Blank	Analog output 0 to 5 VDC (standard)	●	●
A1	Analog output 4 to 20mA DC	●	●
A2	Analog output 1 to 5 VDC	●	●
A3	Analog output 0 to 10 VDC	●	●
A6	Integrated pulse output	●	●

Note on model no. selection

Note 1

Symbol	Standard	(Option)			
		A1	A2	A3	A6
Blank (0-5V)	●				●
A1 (4-20mA)		●			
A2 (1-5V)			●		
A3 (0-10V)				●	
A6 (pulse output)					●
Switch output	●		●	●	

* Consult with CKD for other combinations.

<Example of model number>

PF8000F-40-A1

Model : PF8000F

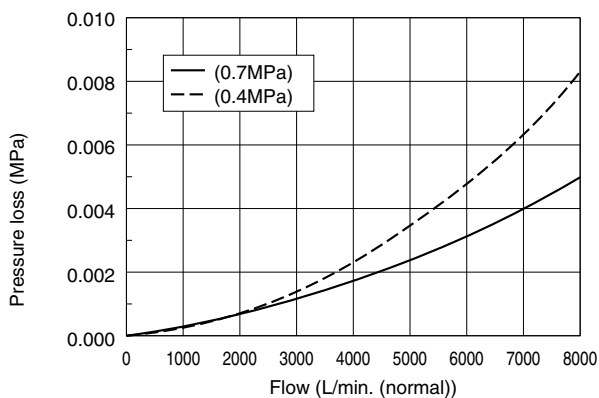
A Flow rate range : 400 to 8000 L/min.(normal)

B Port size : Rc1 1/2

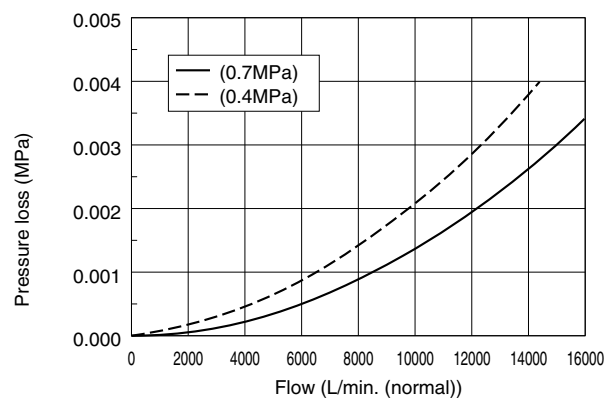
C Output : Analog output 4 to 20mA DC

Pressure loss

● PF8000F-40



● PF16000F-50



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

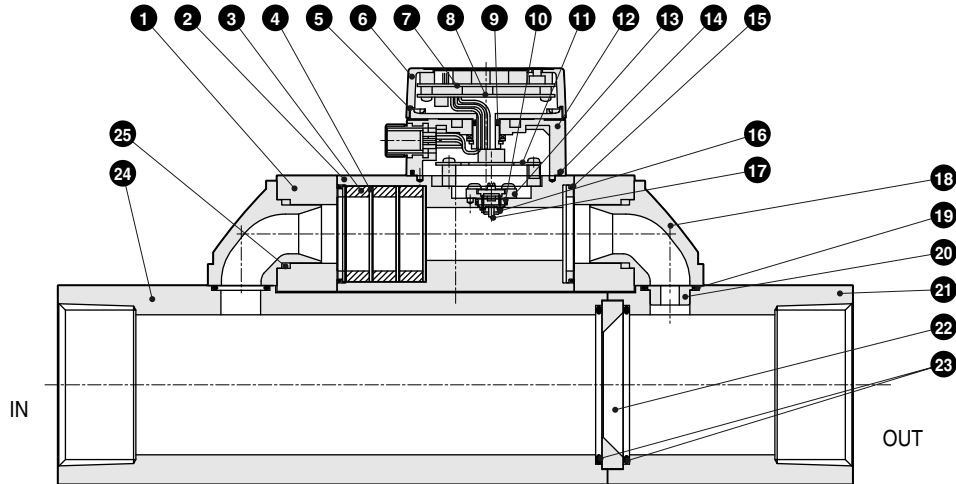
Ending

Display integrated type for compressed air
Flow sensor

PF8000F / PF16000F Series

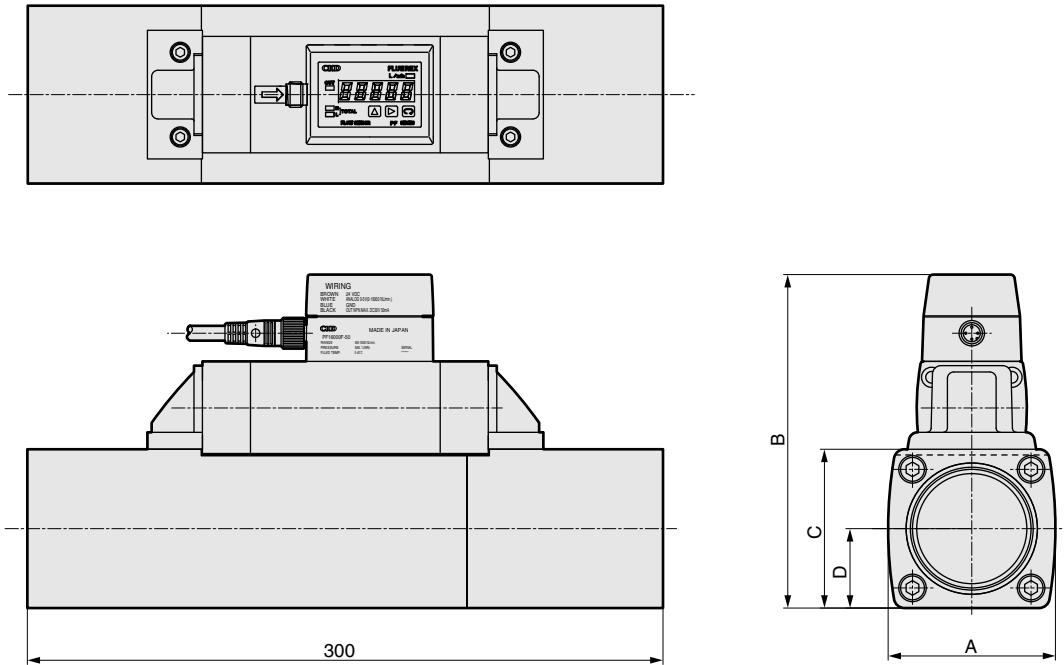
Internal structure and parts list

● PF8000F/PF16000F



No.	Parts name	Material	No.	Parts name	Material
1	Attachment	A6063 Aluminum alloy	14	Gasket	NBR Nitrile rubber
2	Body	A6063 Aluminum alloy	15	O ring	NBR Nitrile rubber
3	Collar	A5056 Aluminum alloy	16	Platinum thin membrane thermo sensor	
4	Mesh	SUS304 Stainless steel	17	Platinum thin membrane flow sensor	
5	Packing seal	NBR Nitrile rubber	18	Sub-attachment	SCS13 Stainless steel
6	Case A	ABS ABS resin	19	O ring	NBR Nitrile rubber
7	Display circuit board		20	Aspirator	C3604 Free cutting brass
8	CPU circuit board		21	Main body 2	A6063 Aluminum alloy
9	O ring	NBR Nitrile rubber	22	Orifice	C3604 Free cutting brass
10	O ring	NBR Nitrile rubber	23	O ring	NBR Nitrile rubber
11	Sensor circuit board		24	Main body 1	A6063 Aluminum alloy
12	Connector case 2	ABS ABS resin	25	O ring	NBR Nitrile rubber
13	Sensor assembly	PPS Polyphenylene sulfide			

Dimensions



Model no.	A	B	C	D	Port size
PF8000F-40	74	148	65	32.5	Rc1 1/2
PF16000F-50	79	158	75	37.5	Rc2

- 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 integrated type for compressed air
Flow sensor



Flow sensor for compressed air
Modular design type

PFU500F to PFU2000F series

• Flow rate range: 25 to 500, 50 to 1000, 100 to 2000 L/min. (normal)



Specifications

Descriptions	PFU500F-10	PFU1000F-10	PFU2000F-15
Specifications			
Flow rate range L./min. (normal)	25 to 500	50 to 1000	100 to 2000
Port size	Rc3/8		Rc1/2
Working conditions			
Working fluid	Compressed air, nitrogen		
Working air quality	Atmospheric dew point -17°C or less, no dew condensation (Note 1)		
Max. working pressure MPa	1.0		
Min. working pressure MPa	0.1		
Withstanding pressure MPa	1.5		
Ambient temperature and humidity	0 to 50°C, 85%RH or less		
Fluid temperature °C	0 to 40		
Precision			
Linearity	±1.5%FS (0.7MPa, 20°C)		
Pressure characteristics	±1.5%FS (0.1 to 1.0MPa, 0.7MPa reference)		
Temperature characteristics	±2.0%FS (0 to 40°C, 20°C reference)		
Pressure loss MPa	0.005 or less (maximum flow rate, 0.7MPa)		
Responsiveness sec	2.5		
Output			
Indicator	5 digit LED display unit: L/min. (normal)		
Min. display flow (Note 2)	10	20	30
Display resolution	1	10	
Integrated flow	Max. 9 digits (H and L separately displayed)		
Analog output	Standard: 0 to 5 VDC Option: 4DC to 20mA, 1 to 5 V, 0 to 10 V		
Switch output (Note 3)	1 point (transistor open collector) green LED lighting during operation		
Pulse output (option) (Note 4)	10L (normal)/pulse		
Power voltage V	24DC (8W or less)		
Cable	Enclosed (with 3m connector, 0.5mm ² conductor)		
Set value holding function (Note 5)	Semi permanent due to EEPROM		
Installation			
Installation attitude	Horizontal or vertical		
Strait piping section	Not required		
Connection module	W3000-10		W4000-15
Protective structure	IP64 or equivalent		
Weight kg	1.5		1.8

Note 1: If foreign matter, moisture or oil is contained in the compressed air, detecting flow rate is failed, so "sensor error" is displayed.

Install a filter, refrigerating type dryer and oil mist filter before a flow sensor.

Note 2: If lower than min. flow rate range, 0 is indicated. Also, for indicated value under flow rate range, accuracy is not guaranteed.

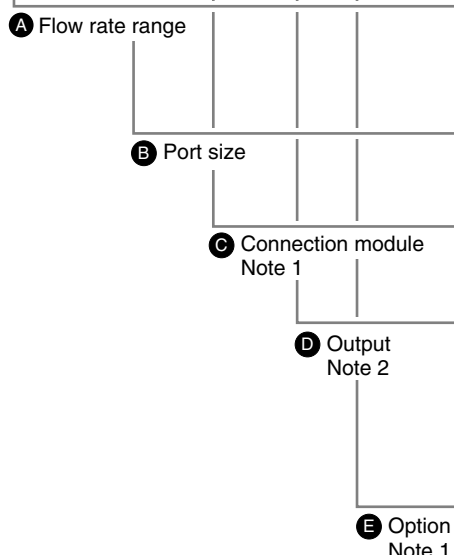
Note 3: If option "A1" (4 to 20mA DC) or "A6" (integrating pulse) is selected, switch output cannot be used.

Note 4: Refer to descriptions of integrated pulse output on page 1425 for details of pulse output.

Note 5: The integrated flow value is reset when power is turned OFF.

How to order

PFU **2000F** - **15** - **4W** - **A1** **X**



Symbol	Descriptions	PFU500F	PFU1000F	PFU2000F
A Flow rate range				
500F	25 to 500 L/min.(normal)	●		
1000F	50 to 1000 L/min.(normal)		●	
2000F	100 to 2000 L/min.(normal)			●
B Port size				
10	Rc3/8	●	●	
15	Rc1/2			●
C Connection module				
3W	W3000-10	●	●	
4W	W4000-15			●
D Output				
Blank	Analog output: 1 to 5 VDC (standard)	●	●	●
A1	Analog output: 4 to 20mA DC	●	●	●
A2	Analog output: 1 to 10 VDC	●	●	●
A3	Analog output: 1 to 10 VDC	●	●	●
A6	Integrated pulse output	●	●	●
E Option				
Blank	No option			
X	IN/OUT reverse flow (left from right)	●	●	●
N	Nonrelief	●	●	●

⚠ Note on model no. selection

Note 1: Combined with CKD F.R.L. module filter regulator W*000 Series. Consult with CKD for combinations with other F.R.L. units.

Note 2

Symbol	Standard	(Option)			
		A1	A2	A3	A6
Blank (0-5V)	●				●
A1 (4-20mA)		●			
A2 (1-5V)			●		
A3 (0-10V)				●	
A6 (pulse output)					●
Switch output	●		●	●	

* Consult with CKD for other combinations.

<Example of model number>

PFU2000F-15-4W-A1X

- Model : PFU2000F modular design type
A Flow rate range : 100 to 2000L/min. (normal)
B Port size : Rc1/2
C Connection module : W4000-15
D Output : Analog output 4 to 20mA DC
E Option : IN and OUT reverse flow (left from right)

Internal structure and parts list

Refer to page 1416.

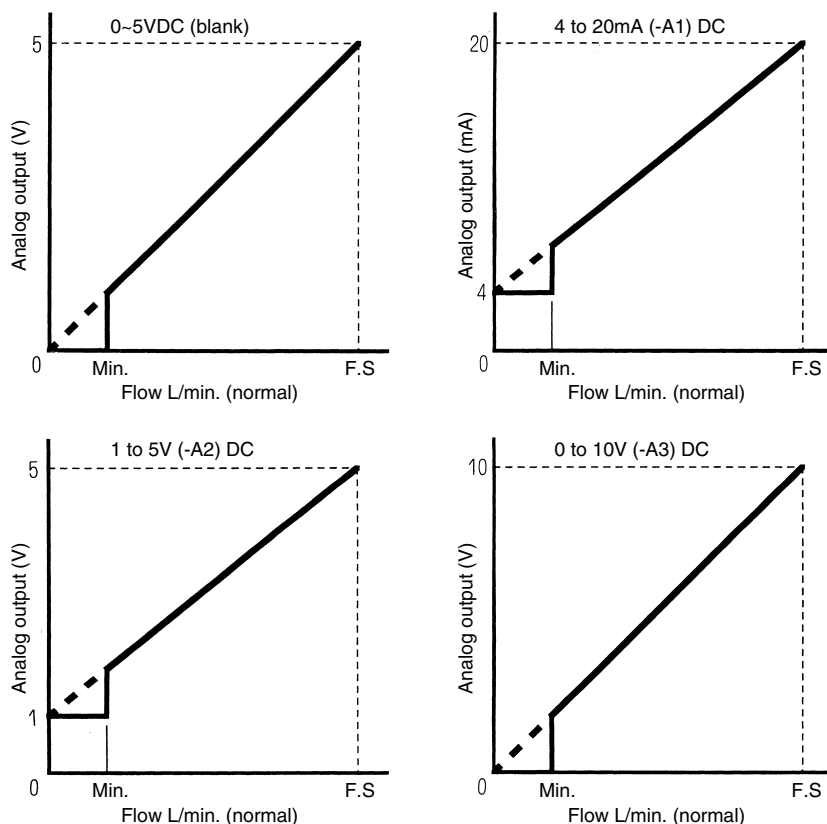
Model no.	PFU500F	PFU1000F	PFU2000F
Refrigerating type dryer			
Desiccant type dryer			
High polymer membrane type dryer			
Air filter			
Auto. drain / others			
F.R.L. (Module unit)			
F.R.L. (Separate)			
Compact F.R.			
Precise regulator			
F.R.L. (Related products)			
Clean F.R.			
Electro pneumatic 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 integrated type for compressed air
Flow sensor

PF series electric wiring

1 Analog output (option symbol: blank, -A1, -A2, -A3)



Load resistance of analog output

Analog output	Descriptions	Load resistance
0 to 5 VDC		50KΩ and over
4 to 20mA DC		500Ω 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)
PF500F/ PFU500F	25	500
PF1000F/ PFU1000F	50	1000
PF2000F/ PFU2000F	100	2000
PF4000F	200	4000
PF8000F	400	8000
PF16000F	800	16000

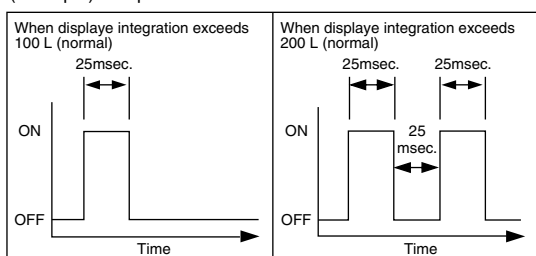
- The relation of the flow and analog output is shown in the graph at left. Analog output is not output correctly when lower than the minimum. Note that flow is displayed on the monitor even when less than the minimum.
- Do not short-circuit the analog output terminal (ANO) with other terminals. Failure 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.
- Use the following cable when extensions are required:
Part name: Extension cable
Model no.: PF-FL-280775.
Length: 3 m
Length must be 10 m or less.

2 Integrated pulse output (option symbol: -A6)

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

Model no.	PF500F	PF1000F	PF2000F	PF4000F	PF8000F	PF16000F
Integrated flow per pulse	10				100	

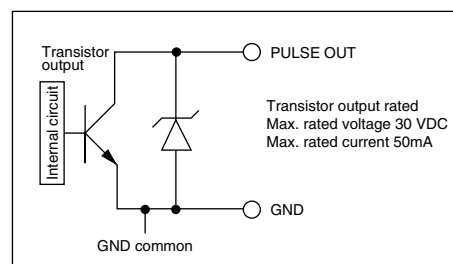
(Example) The pulse waveform for the PF8000F is shown below.



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

- Electric specifications

◆ Output circuit



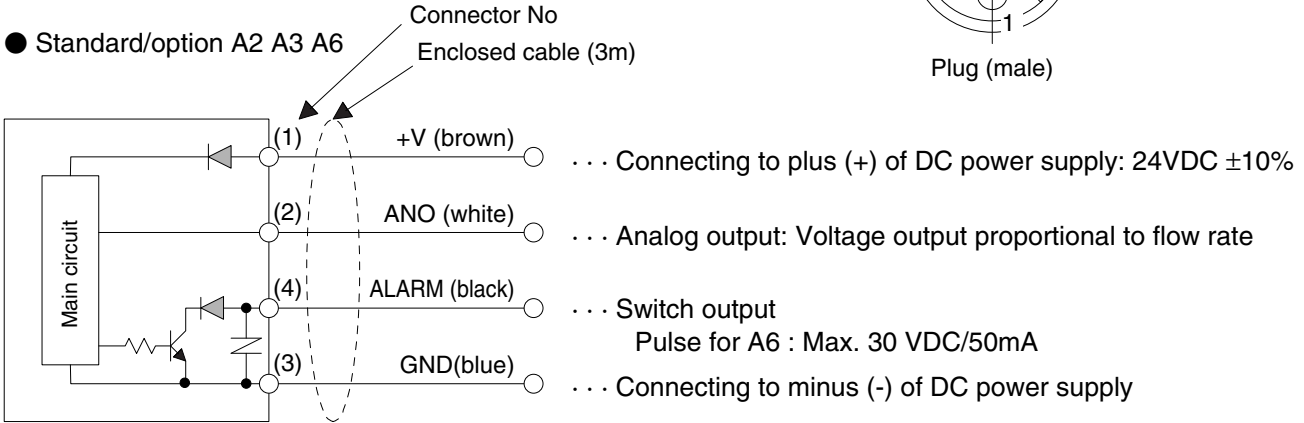
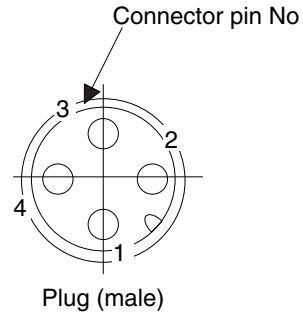
Refrigerating type dryer
Desiccant type dryer
High polymer membrane type dryer
Air filter
Auto. drain / others
F.R.L. (Module unit)
F.R.L. (Separate)
Compact F.R.
Precise regulator
F.R.L. (Related products)
Clean F.R.
Electro pneumatic regulator
Air booster
Speed control valve
Silencer
Check valve / 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 integrated type for compressed air
Flow sensor

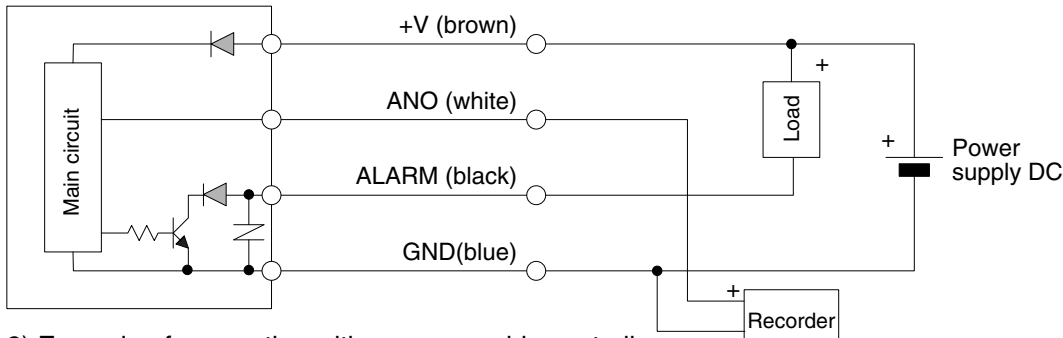
PF500F to PF16000F Series

Electric wiring

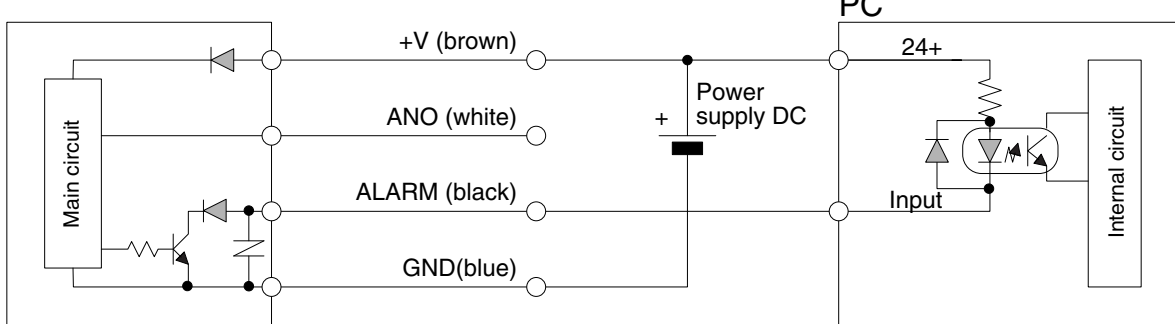
- Middle flow rate type FP500F/PF1000F/PF2000F/PF4000F
- Large flow rate type PF8000F/PF16000F



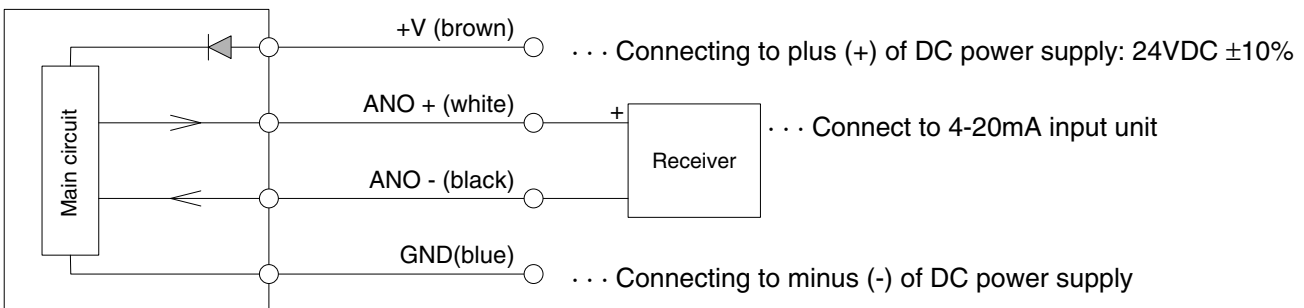
1) Example of connection with relay, resistance load and recorder



2) Example of connection with programmable controller



● Option A1 4-20mA output



• Switch output cannot be used when 4-20mA output is selected.

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

Operation explanation

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

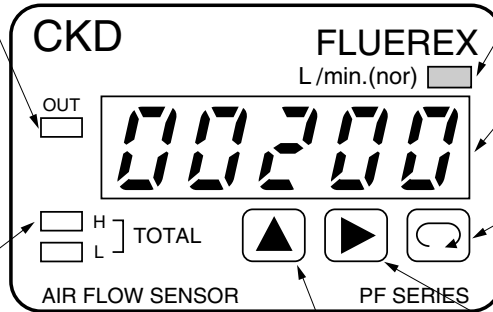
● Output light

Indicates the switch's output state.

● Unit light integrated flow

- <L>
- Indicates the low-order digit of the integrated flow. (Unit: L)
- <H>
- Indicates the high-order digit of the integrated flow. (Unit: L)

Integrated flow is expressed in up to 9 digits
(H) High-order digit : 09999
(L) Low-order digit : 99999



● Unit light instantaneous flow

- When ON, indicates that the 5-digit digital display is showing the instantaneous flow.

● 5 digit digital display

- Displays the instantaneous flow and integrated flow.
- <WRITE MODE>
- Displays output setting value, etc.

● Change key

- <MEASURING MODE>
- Changes between instantaneous and integrated flows.
- <WRITE MODE>
- Use to enter the setting.

● UP key

- <MEASURING MODE>
- Toggles between H and L when the integrated flow is displayed.
- <WRITE MODE>
- Increments the blinking digit.

● Shift key

- <MEASURING MODE>
- Changes to the WRITE MODE when held down for 2 seconds.
- <WRITE MODE>
- Shifts the blinking digit to the right.

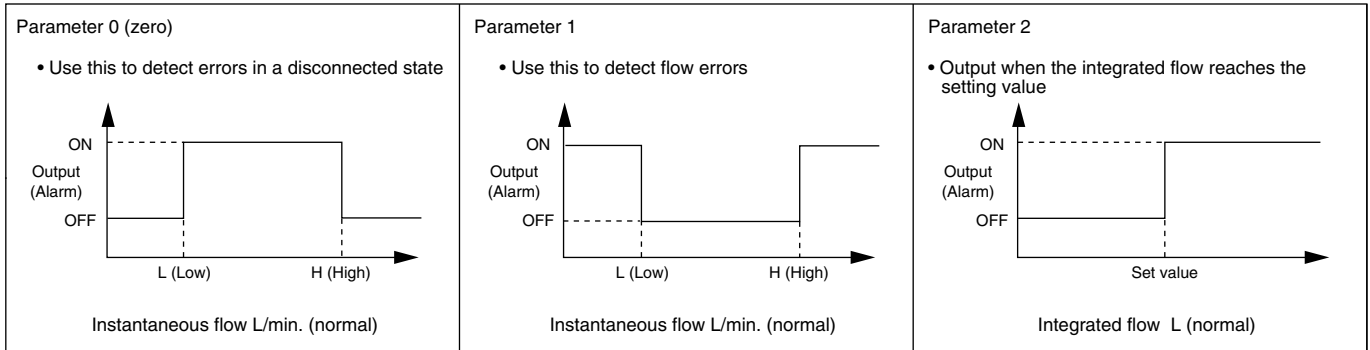
Note: The unit is different for PF500F to PF4000F, PFU500F to PFU2000F and PF8000F/PF16000F. The above explanation is for the PF500F to PF4000F models. Exchange the units when applying for the PF8000F/PF16000F.

PF500F to PF4000F, PFU500F to PFU2000F :L/min. (normal)

PF8000F/PF16000F :m³/min. (normal) (1000-fold of L/min. (normal), with decimal point.)

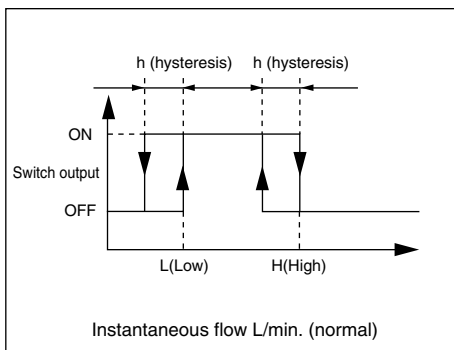
● Switch output parameter

- Three types of parameters are selected based on the applications.



● Hysteresis

- Set this when the flow pulses and the alarm chatters.



● Clear with integrated flow

- 1) Clear the value by pressing keys in WRITE MODE.
- 2) Clear the value by turning power OFF.

Note)

- 1) Switch output ON state indicates that transistor power is ON.
- 2) For safety, set output while the upper stream device is stopped.
- 3) Satisfy the following conditions when setting parameters 0 and 1.

Operation is not guaranteed when these conditions are not met.

- $0 < L < H$
- $0 < (L-h) \leq L < (H-h)$

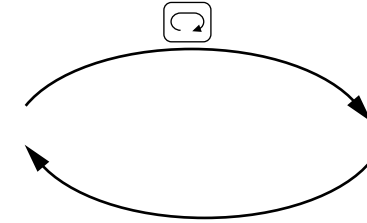
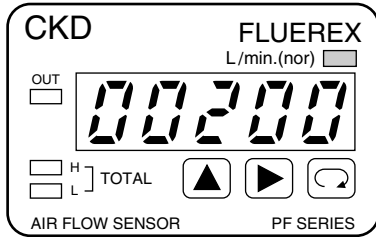
Note that output is always OFF when $L = H = h = 0$ (at shipment).

MEASURING MODE

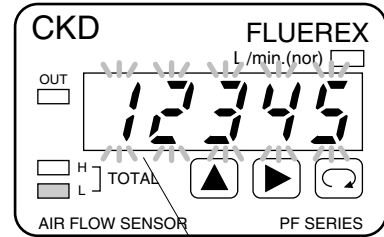
- Instantaneous and integrated flows are measured. (When power is ON)

The constant display of integration appears when held down for 2 seconds. Settings are saved even when power is turned OFF, so there is no need to reset these. Hold down the key for 2 seconds again to redisplay the instantaneous flow.

Instantaneous flow display



Temporary integrated flow display



After 10 seconds, blinking changes to continuously lit, and the instantaneous flow returns automatically.

Note) Decimal fractions are not displayed when the integrated flow is displayed.



Hold down for 2 secs.

WRITE MODE

- Set switch output.

Note) In the following example, P (parameter) is set to 0, L (Low) is set to 100, H (High) to 200, and h (hysteresis) to 10L/min.



Parameter setting

- Set parameter using the UP key.

Note) L, H and h are not displayed when parameter 2 is selected. Refer to the instruction manual for details.



L (low) setting

- Set the L (Low) value using SHIFT/UP keys.



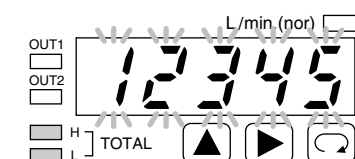
H (high) setting

- Set the H (High) value using SHIFT/UP keys.



Hysteresis setting

- Set the h (hysteresis) using SHIFT/UP keys.



Integration cleared

To clear the count, push shift key and up key at the same time for ten seconds.

To measuring mode

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 integrated type for compressed air FLOW SENSOR