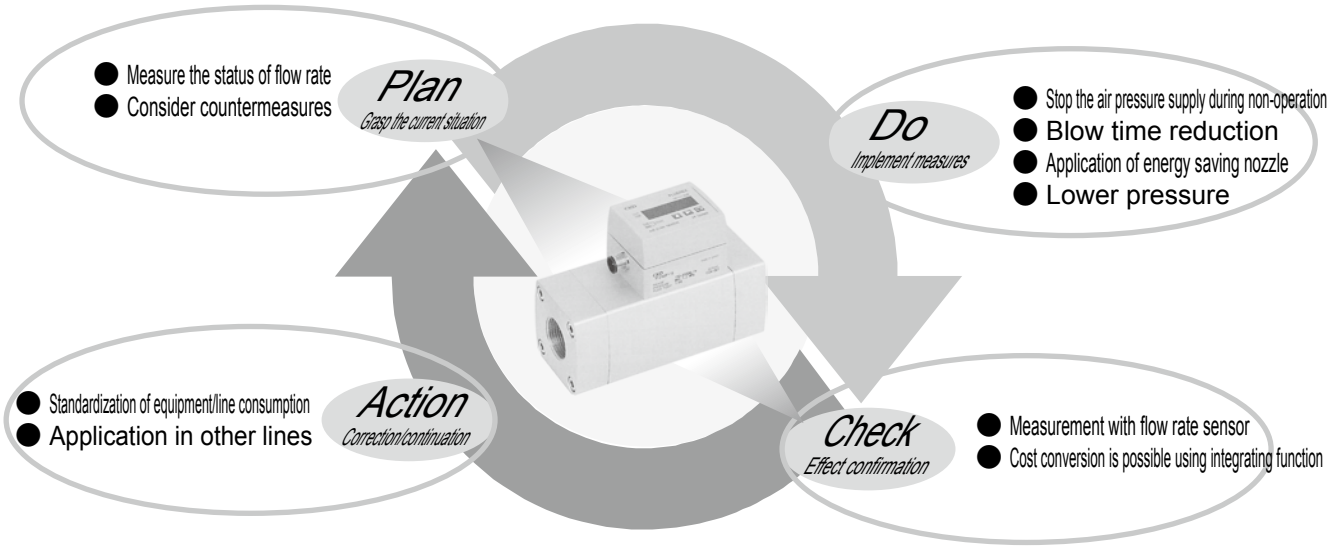
Strongly supports energy-saving activities

Flow sensor for compressed air PF Series

Very useful in grasping the current situation and confirming the effect of energy



High performance

High precision of practical precision ±3% F.S.

With no need for correction, practical precision ±3% F.S. is realized at temperature 0 to 40°C and pressure 0.1 to 1.0 MPa.

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

By laminating the rectification filter, pressure loss is reduced to 0.005 MPa.
(*1: Applicable models only)

Straight piping section not required *2

Thanks to the rectifier, there is no impact even if the elbow and T-shaped socket are piped just before the sensor.
(*2: Excluding PF8000/PF16000F)

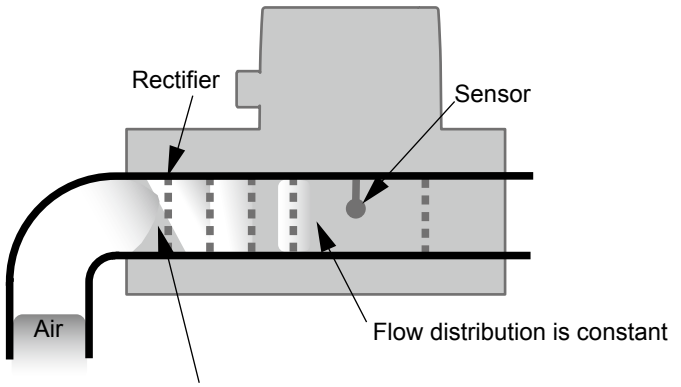
Reliable

Heavy duty design

- Secure design that is hard to break even with drain (water drops) (double the environment-resistance compared to conventional products)
  ·Improved water resistance by applying a special coating to the platinum thin-film sensor.
  ·Overheating of the sensor element is prevented by a protection circuit.

Degree of protection IP64 equivalent

It can be safely used even in harsh environments such as dust and water splashing from all directions.



Flow rate distribution leans towards the outer circumferential direction due to the elbow.

Series

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

Easy to use

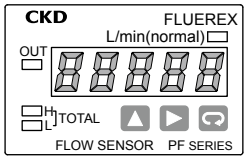
Digital direct-reading, correction not needed

Correction of pressure/temperature is not required.

·No need for pressure correction = Due to the mass detection method used, there is no effect due to pressure change. Hence, pressure correction is not required. Displays the flow rate converted to atmospheric pressure (1 atm).
·No need for temperature correction = Fluid temperature is detected by the platinum thin film temperature sensor, and is always displayed after being converted to flow rate at 0°C.

The display and sensor are housed in one compact body.

Easily visible LED is used. Integrating flow 5-digit display. Integrating flow and instantaneous flow rate displays can be switched with a single operation.

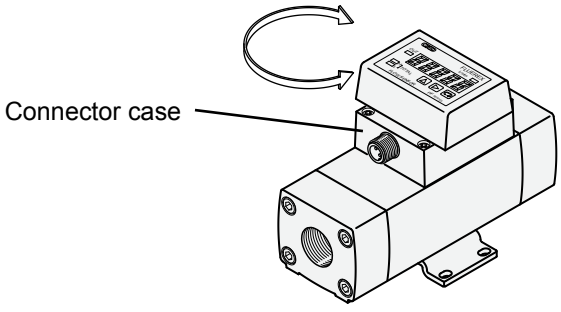


A wide range of output variations

- Switch output — Standard
- Analog output
  - 0 to 5 VDC — Standard
  - 4 to 20 mADC — Option
  - 1 to 5 VDC — Option
  - 0 to 10 VDC — Option
- Pulse output — Option

Unrestricted installation

■ Pipes can be installed in any orientation, vertical, horizontal, etc.
·The display unit can be rotated up to 270° as desired.
·Connector wires can be drawn out along the piping and do not occupy space.
·Connector wires can be drawn from either IN or OUT side by rotating the connector case 180°.



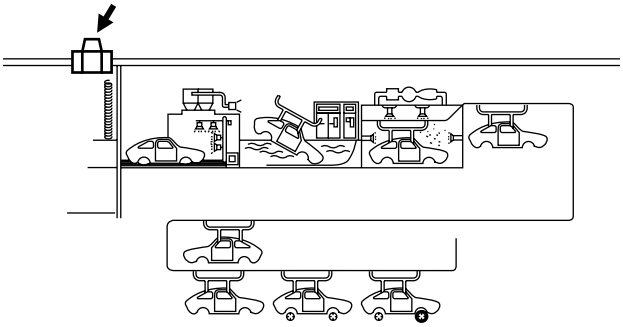
* Be careful not to catch the lead wires during operation.

Filter and regulator are integrated into a unit by modular design (PFU500F,PFU1000F,PFU2000F)

·Maintenance and measurement of air quality available in one unit.
·Piping space/piping processes can be reduced.

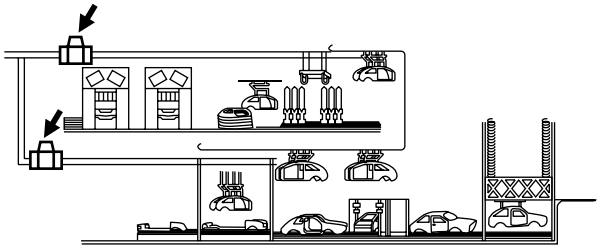
Applications

For flow rate management of paint line



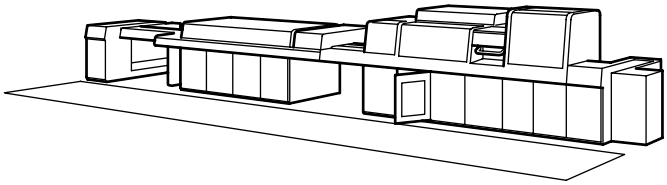
For flow rate management of line of an auto plant

- For flow rate management of each line!
- Cost conversion is possible using integrating flow display

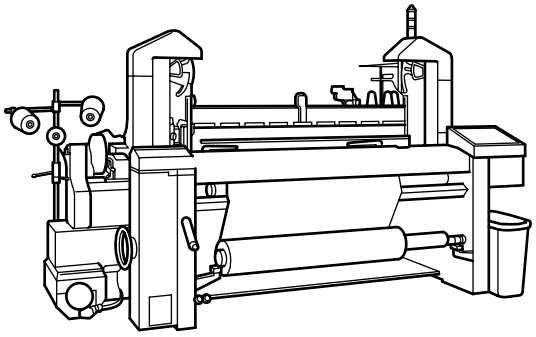


For semiconductor manufacturing equipment

- For flow rate management of expensive low dew-point air! Also for early detection of trouble such as "excessive flow rate"!

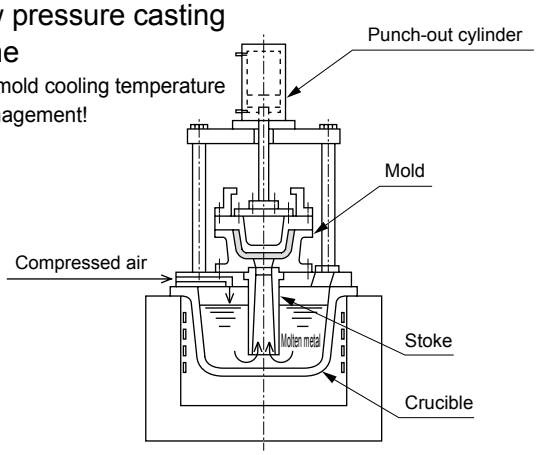


For flow rate management of weaving machine plant

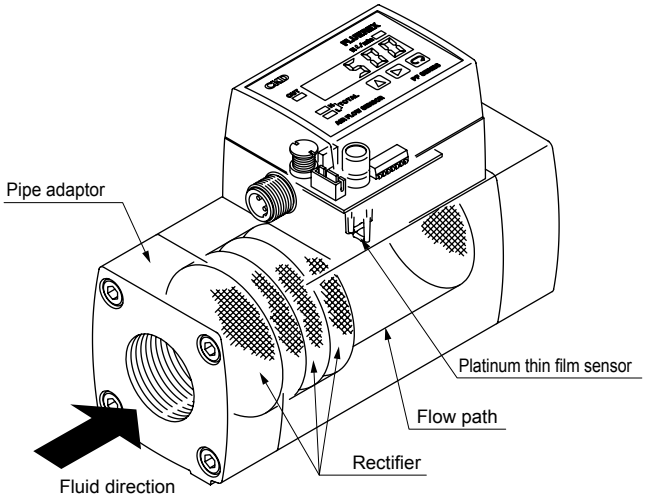


For low pressure casting machine

- For mold cooling temperature management!



Functions



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

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Flow sensor for compressed air (FLUEREX)
Medium flow rate

PF500F to PF4000F Series

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

RoHS CAD

Specifications

Descriptions		PF500F-10	PF500F-15	PF1000F-10	PF1000F-15	PF2000F-15	PF2000F-20	PF4000F-20	PF4000F-25
Specs	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	Applicable fluid	Compressed air, nitrogen							
	Air quality	JIS B8392-1: 2012 (ISO 8573-1: 2010) [1:1:1 - 1:6:1] (*1)							
	Max. working pressure MPa	1.0 (≈150 psi, 10 bar)							
	Min. working pressure MPa	0.1 (≈15 psi, 1 bar)							
	Proof pressure MPa	1.5 (≈220 psi, 15 bar)							
	Ambient temperature °C	0 (32°F) to 50 (122°F)							
	Ambient humidity	85% RH or less							
	Fluid temperature °C	0 (32°F) to 40 (104°F)							
Accuracy	Linearity	±1.5% FS (0.7 MPa (≈100 psi, 7 bar), 20°C (68°F))							
	Pressure characteristics	±1.5% F.S. (0.1 (≈15 psi, 1 bar) to 1.0 MPa (≈150 psi, 10 bar), 0.7 MPa (≈100 psi, 7 bar) reference)							
	Temperature characteristics	±2.0% F.S. (0 (32°F) to 40°C (104°F), 20°C (68°F) reference)							
	Pressure loss MPa	0.005 (≈0.73 psi, 0.05 bar) or less (max. flow rate, 0.7 MPa (≈100 psi, 7 bar))							
	Response time sec	2.5							
	Display	5-digit LED display Display unit: ℓ/min (normal)							
	Min. displayed flow rate (*2)	10		20		30		50	
	Display resolution	1		10					
	Integrating flow	Max. 9 digits (however, H and L are split displayed).							
Output	Analog output	Standard: 0 to 5 VDC Option: 4 to 20 mADC, 1 to 5 V, 0 to 10 V							
	Switch output (*3)	1 piece (transistor open collector) Green LED turns ON when switch is ON							
	Pulse output (option) (*4)	10 L(normal)/pulse							
	Power supply voltage V	24 DC (8 W or less)							
	Cable	Included (with 3 m connector/0.5 mm^2 conductor)							
	Set value hold function (*5)	Semi-permanent due to EEPROM							
Mounting	Mounting orientation	Unrestricted in vertical/horizontal direction							
	Straight piping section	Not required							
	Degree of protection	IP64 or equivalent							
	Weight kg	0.85						1.4	
	Bracket weight g	60 g (including screws)						84 g (including screws)	

*1 : If the compressed air contains foreign substances, water or oil, the flow rate cannot be detected and this causes "sensor error".
Install a filter, refrigeration air dryer, and oil mist filter on the upstream side of the flow rate sensor.
*2 : When the flow rate is below the min. flow rate range, the display becomes 0. The display value out of the flow rate range is outside the guaranteed precision.
*3 : Note that the switch output is not available if option "A1" (4 to 20 mADC) or "A6" (integrated pulse) is selected.
*4 : Refer to descriptions of integrated pulse output on page 1383 for details of pulse output.
*5 : Note that the integrating flow value is reset when the power supply is turned OFF.

How to order

PF 2000F - 15 - A1 B

- Ⓐ Flow rate range
- Ⓑ Port size
- Ⓒ Output *1
- Ⓓ Bracket

Code	Content	Model No. PF500F	PF1000F	PF2000F	PF4000F
Ⓐ 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)				●
Ⓑ Port size					
10	Rc3/8	●	●		
15	Rc1/2	●	●	●	
20	Rc3/4			●	●
25	Rc1				●
Ⓒ Output					
Blank	Analog output 0 to 5 VDC (standard)	●	●	●	●
A1	Analog output 4 to 20 mADC	●	●	●	●
A2	Analog output 1 to 5 VDC	●	●	●	●
A3	Analog output 0 to 10 VDC	●	●	●	●
A6	Integrated pulse output	●	●	●	●
Ⓓ Bracket					
Blank	No bracket	●	●	●	●
B	With bracket (with thread)	●	●	●	●

⚠ Precautions for model No. selection

*1

Code		Std.	(Option) A1	A2	A3	A6
Analog output	Blank (0 to 5V)	●				●
	A1 (4 to 20 mA)		●			
	A2 (1 to 5 V)			●		
	A3 (0 to 10 V)				●	
A6 (Pulse output)						●
Switch output		●		●	●	

* For combinations not listed in the table, contact your CKD branch or dealer.

Model No. of single bracket

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

[Example of model No.]

PF2000F-15-A1B

Model : PF2000F
Ⓐ Flow rate range : 100 to 2000 L/min (normal)
Ⓑ Port size : Rc1/2
Ⓒ Output : Analog output 4 to 20 mADC
Ⓓ Bracket : Supplied (with M4 thread)

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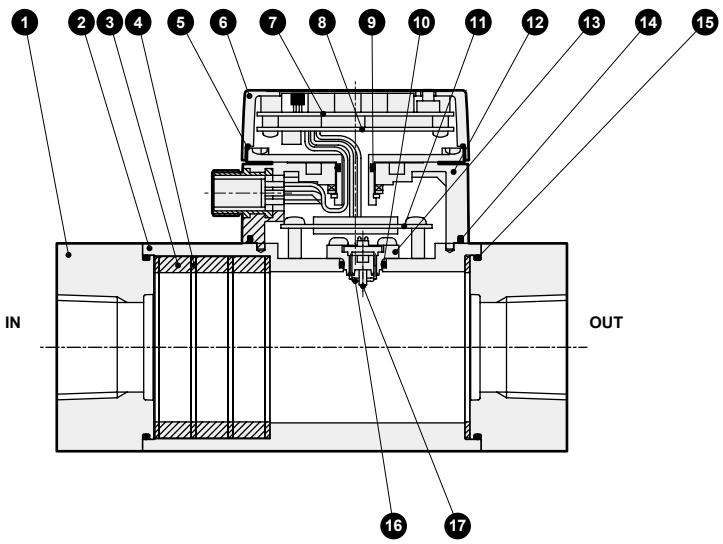
PF500F to PF4000F Series

Internal structure and parts list

● PF500F to PF4000F

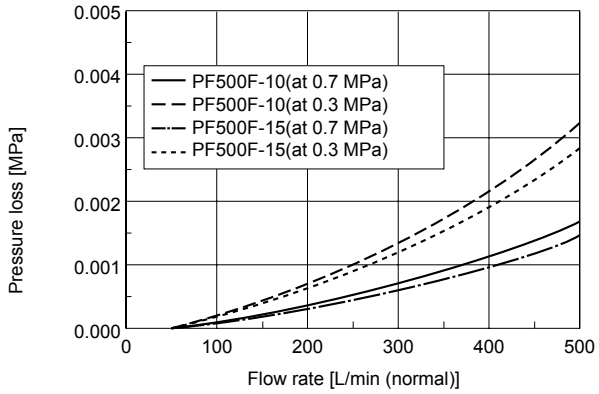


No.	Part name	Material	
1	Pipe adaptor	A6063	Aluminum alloy
2	Body	A6063	Aluminum alloy
3	Collar	A5056	Aluminum alloy
4	Mesh	SUS304	Stainless steel
5	Packing	NBR	Nitrile rubber
6	Case A	ABS	ABS resin
7	Display board		
8	CPU board		
9	O-ring	NBR	Nitrile rubber
10	O-ring	NBR	Nitrile rubber
11	Sensor board		
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		

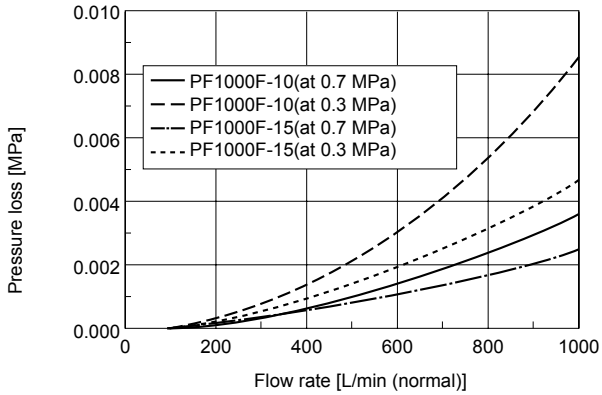
Cannot be disassembled

Pressure loss

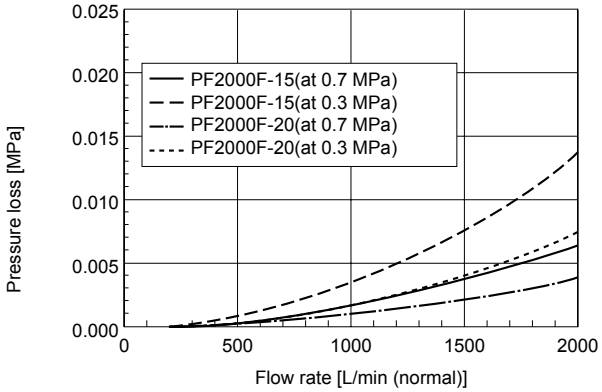
● PF500F



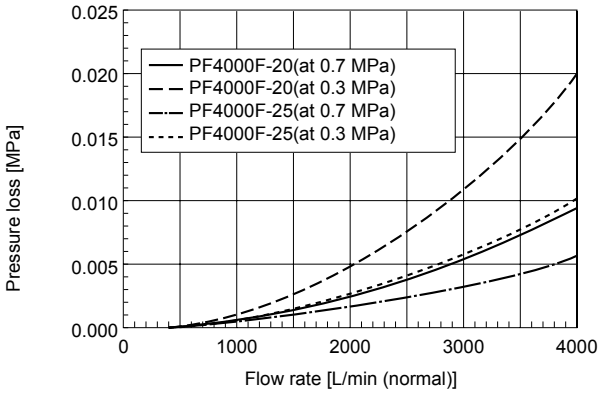
● PF1000F



● PF2000F

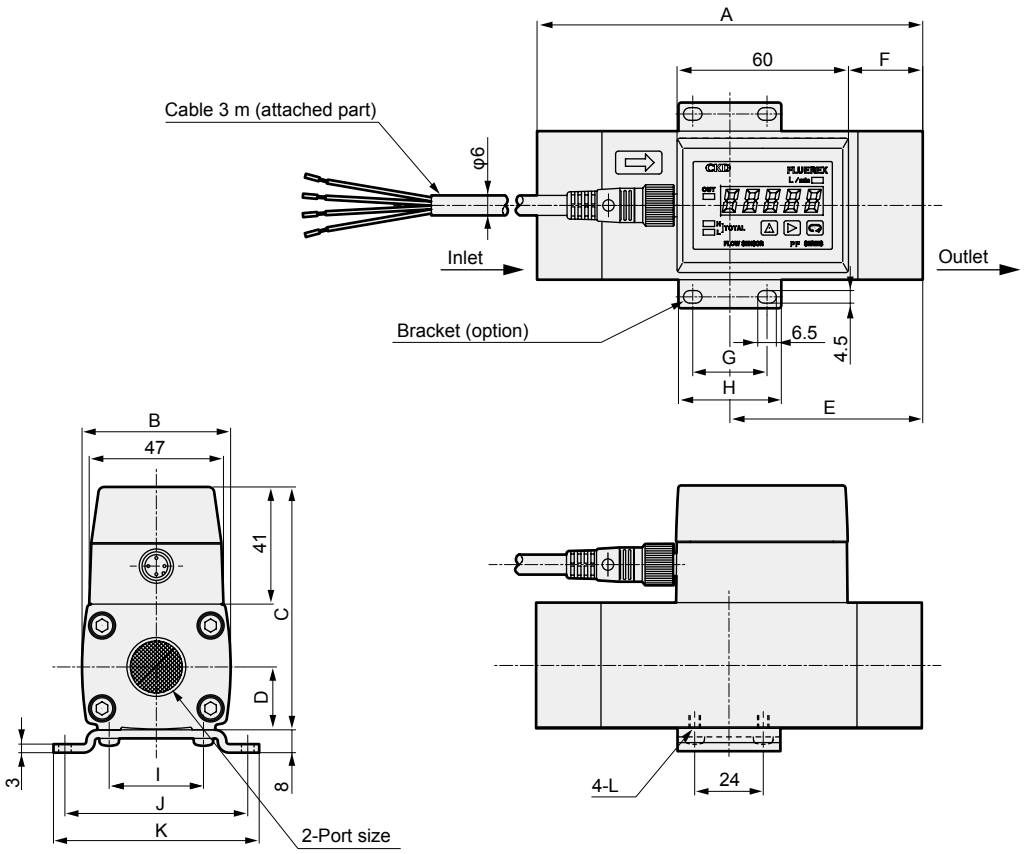


● PF4000F



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 depth 4.5
PF2000F	135	55	96	27.5	67.5	26	26	36	33	64	72	M4 depth 4.5
PF4000F	176	65	109	34	88	46.5	28	40	42	74	84	M5 depth 5.5

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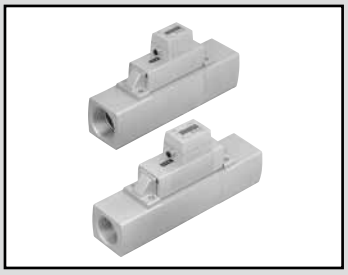


Flow sensor for compressed air (FLUEREX)
Large flow rate

PF8000F/PF16000F Series

● Flow rate range: 0.40 to 8.00, 0.80 to 16.00 m³/min (normal)

RoHS CAD

Specifications

Descriptions		PF8000F-40	PF16000F-50
Specs	Flow rate range m³/min (normal)	0.40 to 8.00	0.80 to 16.00
	Port size	Rc1 1/2	Rc2
Working conditions	Applicable fluid	Compressed air, nitrogen	
	Air quality	JIS B8392-1: 2012 (ISO 8573-1: 2010) [1:1:1 - 1:6:1] (*1)	
	Max. working pressure MPa	1.0 (≈150 psi, 10 bar)	
	Min. working pressure MPa	0.1 (≈15 psi, 1 bar)	
	Proof pressure MPa	1.5 (≈220 psi, 15 bar)	
	Ambient temperature °C	0 (32°F) to 50 (122°F)	
	Ambient humidity	85% RH or less	
	Fluid temperature °C	0 (32°F) to 40 (104°F)	
Accuracy	Linearity	±2.5% FS (0.7 MPa (≈100 psi, 7 bar), 20 °C (68°F))	
	Pressure characteristics	±1.5% F.S. (0.1 (≈15 psi, 1 bar) to 1.0 MPa (≈150 psi, 10 bar), 0.7 MPa (≈100 psi, 7 bar) reference)	
	Temperature characteristics	±2.0% F.S. (0 (32°F) to 40°C (104°F), 20°C (68°F) reference)	
	Pressure loss MPa	0.005 (≈0.73 psi, 0.05 bar) or less (max. flow rate, 0.7 MPa (≈100 psi, 7 bar))	
	Response time sec	2.5	
	Display	5-digit LED display Display unit: m³/min (normal)	
	Min. displayed flow (*2) m³/min (normal)	0.1	0.2
	Display resolution	0.01	0.10
	Integrating flow	Max. 9 digits (however, H and L are split displayed).	
Output	Analog output	Standard: 0 to 5 VDC Option: 4 to 20 mADC, 1 to 5 V, 0 to 10 V	
	Switch output (*3)	1 piece (transistor open collector) Green LED turns ON when switch is ON	
	Pulse output (option) (*4)	0.10 m³ (normal)/pulse	
	Power supply voltage V	24 DC (8 W or less)	
	Cable	Included (with 3 m connector/0.5 mm² conductor)	
	Set value hold function (*5)	Semi-permanent due to EEPROM	
Mounting	Mounting orientation	Unrestricted in vertical/horizontal direction	
	Straight piping section	Upstream side 10D/downstream side 5D	
	Degree of protection	IP64 or equivalent	
	Weight kg	3.8	4.0

*1 : If the compressed air contains foreign substances, water or oil, the flow rate cannot be detected and this causes "sensor error". Install a filter, refrigeration air dryer, and oil mist filter on the upstream side of the flow rate sensor.
*2 : When the flow rate is below the min. flow rate range, the display becomes 0. The display value out of the flow rate range is outside the guaranteed precision.
*3 : Note that the switch output is not available if option "A1" (4 to 20 mADC) or "A6" (integrated pulse) is selected.
*4 : Refer to descriptions of integrated pulse output on page 1383 for details of pulse output.
*5 : Note that the integrating flow value is reset when the power supply is turned OFF.

How to order

PF 8000F - 40 - A1

- Ⓐ Flow rate range
- Ⓑ Port size
- Ⓒ Output *1

Code	Content	Model No. PF8000F	Model No. PF16000F
Ⓐ Flow rate range			
8000F	0.40 to 8.00 m³/min (normal)	●	
16000F	0.80 to 16.00 m³/min (normal)		●
Ⓑ Port size			
40	Rc1 1/2	●	
50	Rc2		●
Ⓒ Output			
Blank	Analog output 0 to 5 VDC (standard)	●	●
A1	Analog output 4 to 20 mADC	●	●
A2	Analog output 1 to 5 VDC	●	●
A3	Analog output 0 to 10 VDC	●	●
A6	Integrated pulse output	●	●

⚠ Precautions for model No. selection

*1

Code		Std.	(Option) A1	A2	A3	A6
Analog output	Blank (0 to 5V)	●				●
	A1 (4 to 20 mA)		●			
	A2 (1 to 5 V)			●		
	A3 (0 to 10 V)				●	
A6 (Pulse output)						●
Switch output		●		●	●	

* For combinations not listed in the table, contact your CKD branch or dealer.

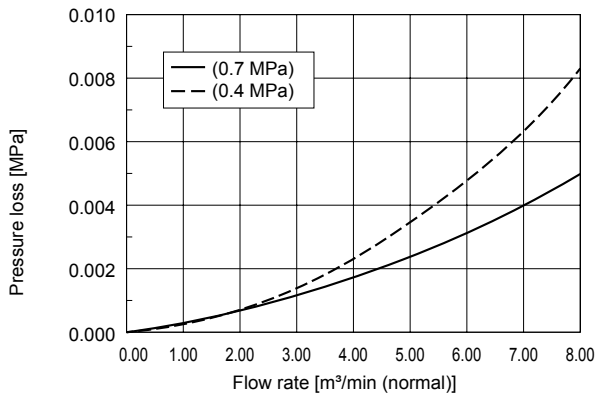
[Example of model No.]

PF8000F-40-A1

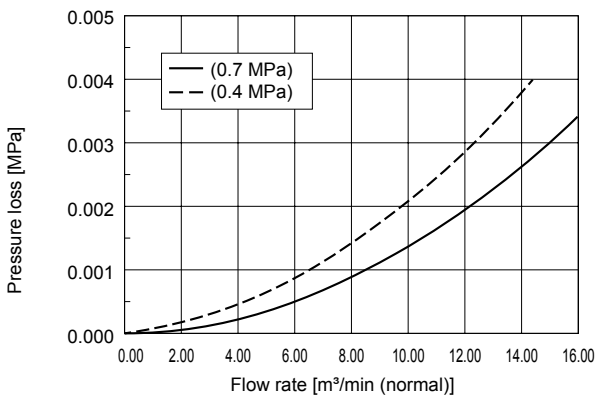
Model : PF8000F
Ⓐ Flow rate range : 0.40 to 8.00 m³/min (normal)
Ⓑ Port size : Rc1 1/2
Ⓒ Output : Analog output 4 to 20 mADC

Pressure loss

● PF8000F-40

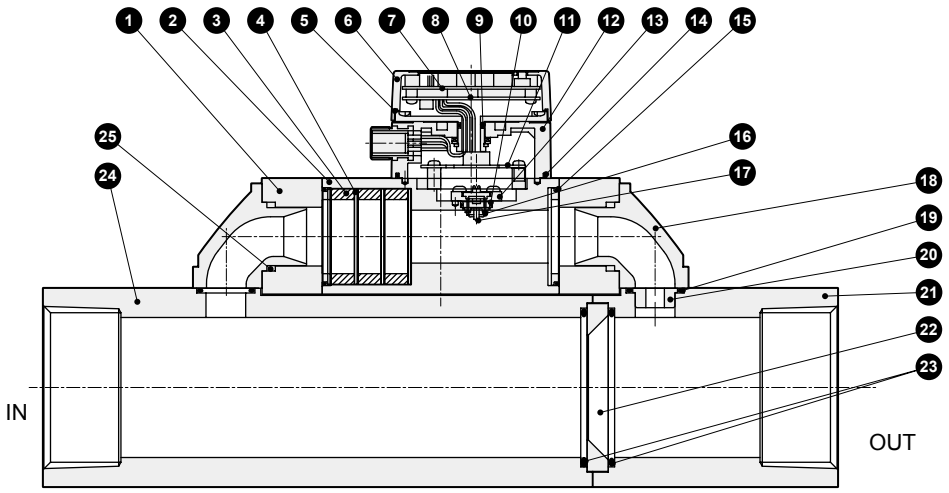


● PF16000F-50



Internal structure and parts list

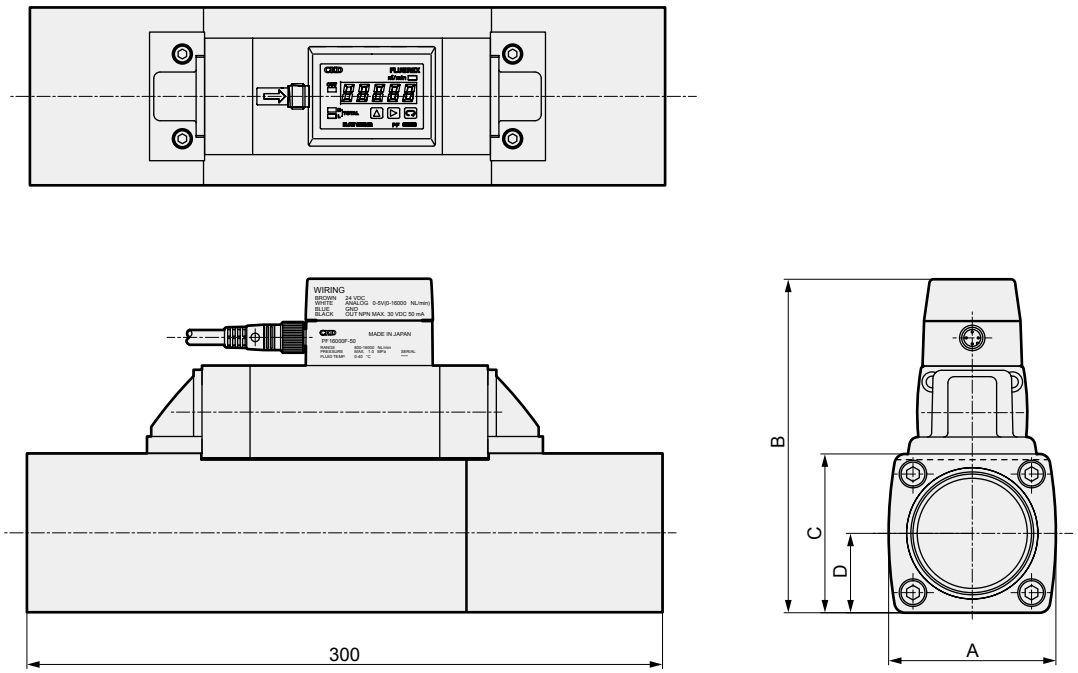
● PF8000F/PF16000F



Cannot be disassembled

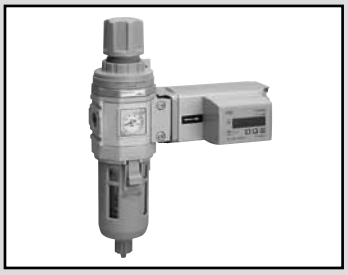
No.	Part name	Material		No.	Part name	Material	
1	Attachment	A6063	Aluminum alloy	14	Gasket	NBR	Nitrile rubber
2	Body	A6063	Aluminum alloy	15	O-ring	NBR	Nitrile rubber
3	Collar	A5056	Aluminum alloy	16	Platinum thin film thermo sensor		
4	Mesh	SUS304	Stainless steel	17	Platinum thin film flow rate sensor		
5	Packing	NBR	Nitrile rubber	18	Sub-attachment	SCS13	Stainless steel
6	Case A	ABS	ABS resin	19	O-ring	NBR	Nitrile rubber
7	Display board			20	Aspirator	C3604	Free cutting copper alloy
8	CPU board			21	Main body 2	A6063	Aluminum alloy
9	O-ring	NBR	Nitrile rubber	22	Orifice	C3604	Free cutting copper alloy
10	O-ring	NBR	Nitrile rubber	23	O-ring	NBR	Nitrile rubber
11	Sensor 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

停产产品



Flow sensor for compressed air (FLUEREX)
modular connection

PFU500F to PFU2000F Series

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

RoHS CAD

Specifications

Descriptions		PFU500F-10	PFU1000F-10	PFU2000F-15
Specs	Flow rate range L/min(normal)	25 to 500	50 to 1000	100 to 2000
	Port size	Rc3/8		Rc1/2
Working conditions	Applicable fluid	Compressed air, nitrogen		
	Air quality	JIS B8392-1: 2012 (ISO 8573-1: 2010) [1:1:1 - 1:6:1] (*1)		
	Max. working pressure MPa	1.0 (≈150 psi, 10 bar)		
	Min. working pressure MPa	0.1 (≈15 psi, 1 bar)		
	Proof pressure MPa	1.5 (≈220 psi, 15 bar)		
	Ambient temperature °C	0 (32°F) to 50 (122°F)		
	Ambient humidity	85% RH or less		
	Fluid temperature °C	0 (32°F) to 40 (104°F)		
Accuracy	Linearity	±1.5% FS (0.7 MPa (≈100 psi, 7 bar), 20 °C (68°F))		
	Pressure characteristics	±1.5% F.S. (0.1 (≈15 psi, 1 bar) to 1.0 MPa (≈150 psi, 10 bar), 0.7 MPa (≈100 psi, 7 bar) reference)		
	Temperature characteristics	±2.0% F.S. (0 (32°F) to 40°C (104°F), 20°C (68°F) reference)		
	Pressure loss MPa	0.005 (≈0.73 psi, 0.05 bar) or less (max. flow rate, 0.7 MPa (≈100 psi, 7 bar))		
	Response time sec	2.5		
	Display	5-digit LED display Display unit: L/min (normal)		
	Min. displayed flow rate (*2)	10	20	30
	Display resolution	1	10	
	Integrating flow	Max. 9 digits (however, H and L are split displayed).		
Output	Analog output	Standard: 0 to 5 VDC Option: 4 to 20 mADC, 1 to 5 V, 0 to 10 V		
	Switch output (*3)	1 piece (transistor open collector) Green LED turns ON when switch is ON		
	Pulse output (option) (*4)	10 L(normal)/pulse		
	Power supply voltage V	24 DC (8 W or less)		
	Cable	Included (with 3 m connector/0.5 mm^2 conductor)		
	Set value hold function (*5)	Semi-permanent due to EEPROM		
Mounting	Mounting orientation	Unrestricted in vertical/horizontal direction		
	Straight piping section	Not required		
	Connection module	W3000-10		W4000-15
	Degree of protection	IP64 or equivalent		
	Weight kg	1.5		1.8

*1 : If the compressed air contains foreign substances, water or oil, the flow rate cannot be detected and this causes "sensor error".
Install a filter, refrigeration air dryer, and oil mist filter on the upstream side of the flow rate sensor.
*2 : When the flow rate is below the min. flow rate range, the display becomes 0. The display value out of the flow rate range is outside the guaranteed precision.
*3 : Note that the switch output is not available if option "A1" (4 to 20 mADC) or "A6" (integrated pulse) is selected.
*4 : Refer to descriptions of integrated pulse output on page 1383 for details of pulse output.
*5 : Note that the integrating flow value is reset when the power supply is turned OFF.

How to order

PFU 2000F - 15 - 4W - A1 X

- Ⓐ Flow rate range
- Ⓑ Port size
- Ⓒ Connection module *1
- Ⓓ Output *2
- Ⓔ Option *1

Code	Content	Model No. PFU500F	PFU1000F	PFU2000F
Ⓐ Flow rate range				
500F	25 to 500 L/min(normal)	●		
1000F	50 to 1000 L/min(normal)		●	
2000F	100 to 2000 L/min(normal)			●
Ⓑ Port size				
10	Rc3/8	●	●	
15	Rc1/2			●
Ⓒ Connection module				
3W	W3000-10	●	●	
4W	W4000-15			●
Ⓓ Output				
Blank	Analog output 0 to 5 VDC (standard)	●	●	●
A1	Analog output 4 to 20 mADC	●	●	●
A2	Analog output 1 to 5 VDC	●	●	●
A3	Analog output 0 to 10 VDC	●	●	●
A6	Integrated pulse output	●	●	●
Ⓔ Option				
Blank	No option			
X	IN/OUT flow direction reversed (right to left)	●	●	●
N	Non-relief	●	●	●

⚠ Precautions for model No. selection

*1: For combinations with CKD F.R.L. unit module of the filter/regulator W*000 Series. For the combinations with other F.R.L. unit, contact your CKD branch or dealer.

*2

Code		Std.	(Option) A1	A2	A3	A6
Analog output	Blank (0 to 5V)	●				●
	A1 (4 to 20 mA)		●			
	A2 (1 to 5 V)			●		
	A3 (0 to 10 V)				●	
A6 (Pulse output)						●
Switch output		●		●	●	

* For combinations not listed in the table, contact your CKD branch or dealer.

[Example of model No.]

PFU2000F-15-4W-A1X

Model : PFU2000F modular connection
Ⓐ Flow rate range : 100 to 2000 L/min (normal)
Ⓑ Port size : Rc1/2
Ⓒ Connection module : W4000-15
Ⓓ Output : Analog output 4 to 20 mADC
Ⓔ Option : IN/OUT flow direction reversed (right to left)

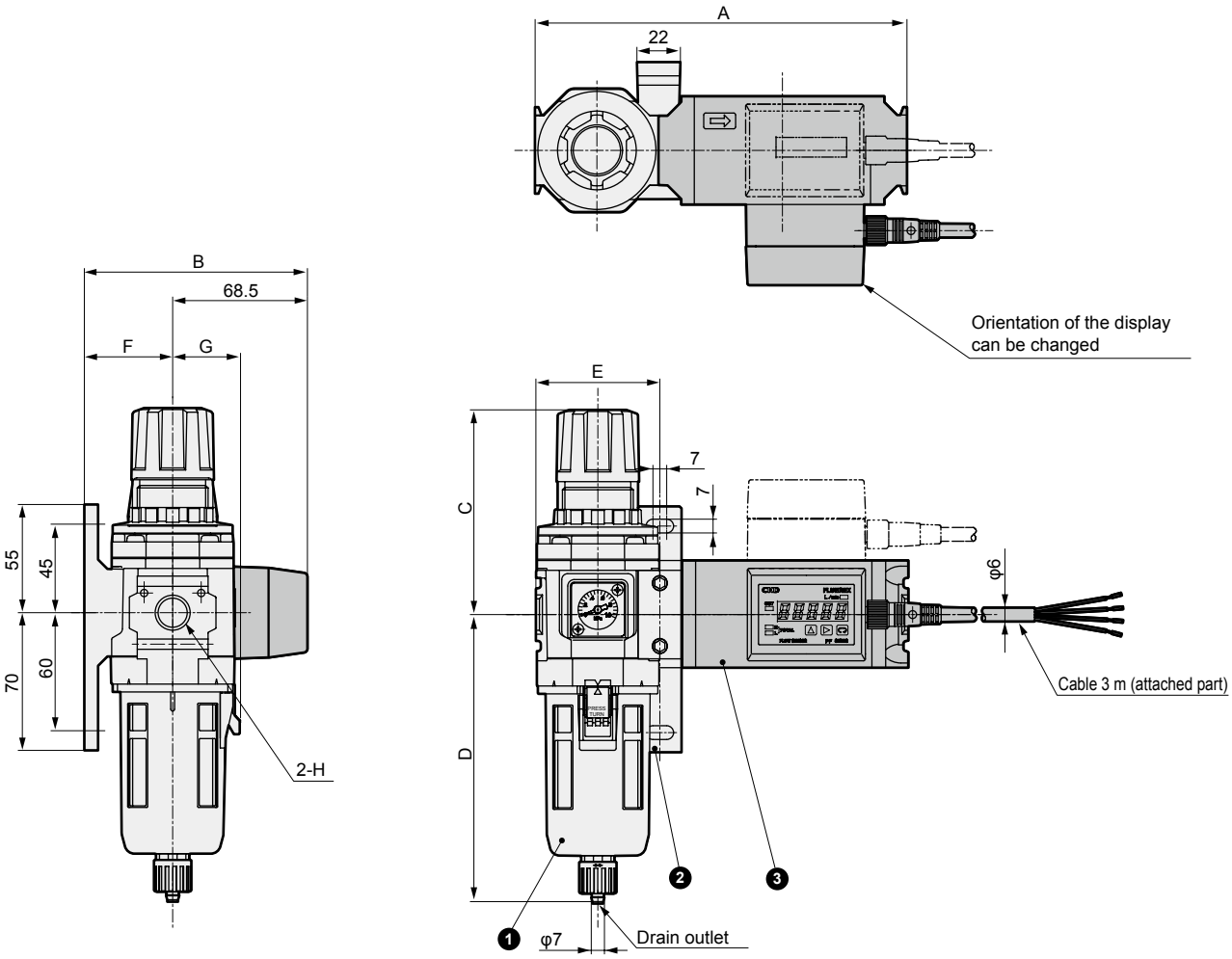
Internal structure and parts list

Refer to page 1374.

PFU500F to PFU2000F Series

Dimensions CAD

● PFU500F to PFU2000F

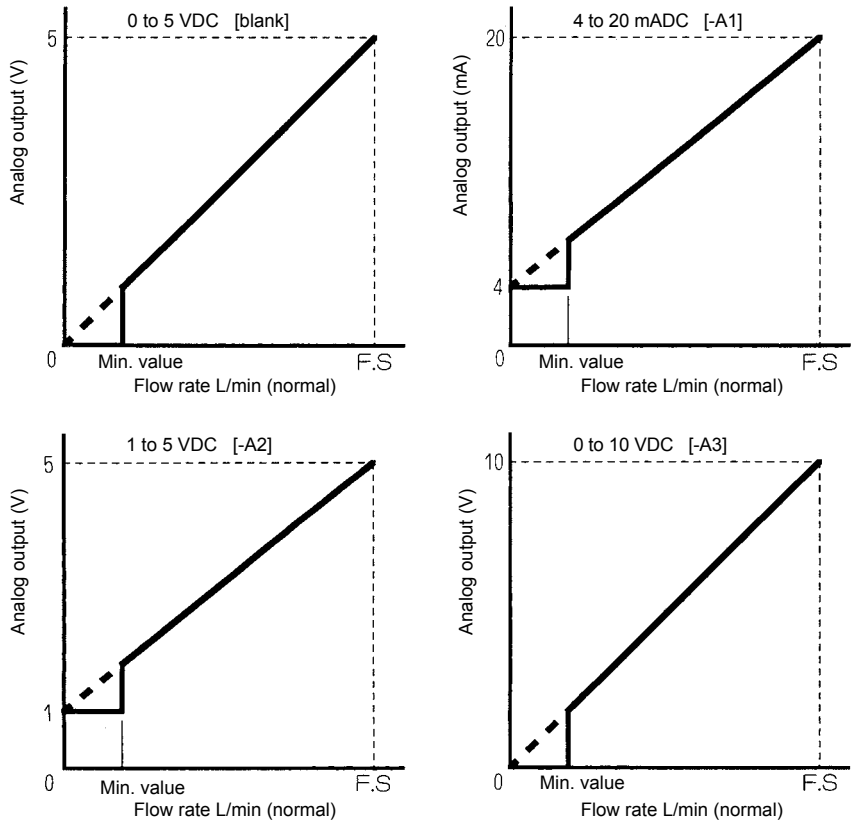


No.	Part name	Remarks
1	Filter/regulator	W3000-10/W4000-15
2	T type bracket set	B310/B410
3	Flow rate meter	PFU500F/PFU1000F/PFU2000F

Model No.	A	B	C	D	E	F	G	H
PFU500F/PFU1000F	189	113.5	104	148	63	45	34.5	Rc3/8
PFU2000F	206	123.5	110	171	80	55	42.5	Rc1/2

PF series electric wiring

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



Load resistance of analog output

Analog output \ Descriptions	Load resistance
0 to 5 VDC	50 kΩ or more
4 to 20 mADC	500 Ω or less
1 to 5 VDC	50 kΩ or more
0 to 10 VDC	50 kΩ or more

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 (0.40 m³/min)	8000 (80.00 m³/min)
PF16000F	800 (0.80 m³/min)	16000 (16.00 m³/min)

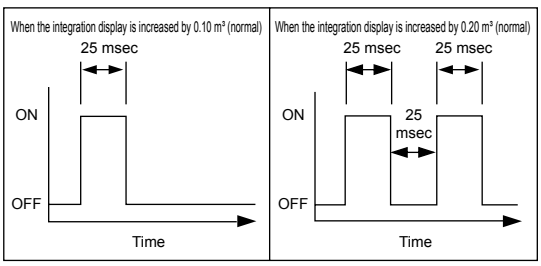
- The relation between the flow rate and the analog output is as in the figure on the left. Note that the analog output is not output normally at the min. value or less. However, the flow rate display in the monitor is displayed even at the min. value or less.
- Never make a short circuit between the analog output terminal (ANO) and another terminal. This may lead to failure.
- Make the cable short so as not to be affected by noise and keep it away from all noise sources such as power distribution wires.
- When extending the cable,
  Product name: Extension cable
  Model No. : PF-FL-280775
  Use (length of 3 m).
  Use the cable with total length of 10 m or less.

2 Integrated pulse output (option code: -A6)

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

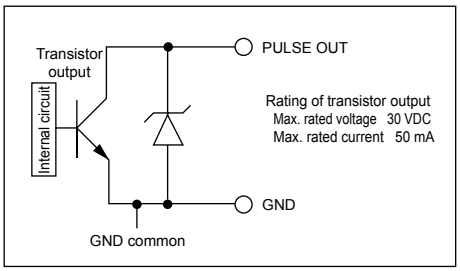
Model No.	PF500F	PF1000F	PF2000F	PF4000F	PF8000F	PF16000F
Integrating flow per pulse	10				100 (0.10m³)	

(Example) When using PF8000F, the pulse wave shape is as below.



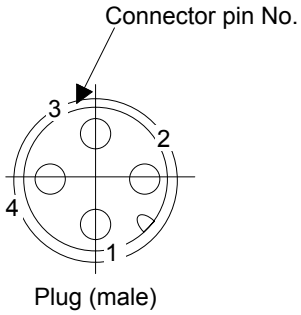
The integration display is updated at intervals of approx. 1 sec.

- Electrical specification
  - Output circuit

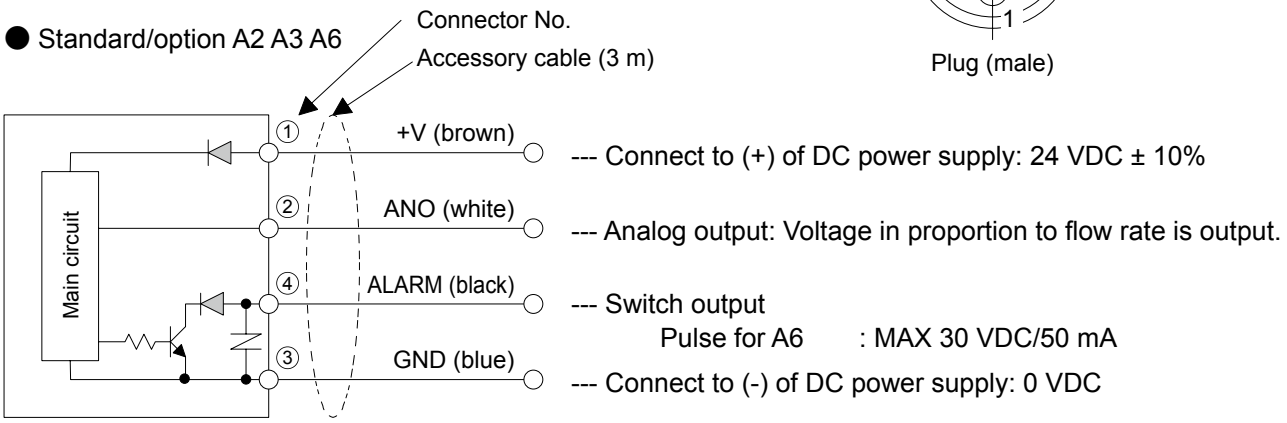


Electric wiring

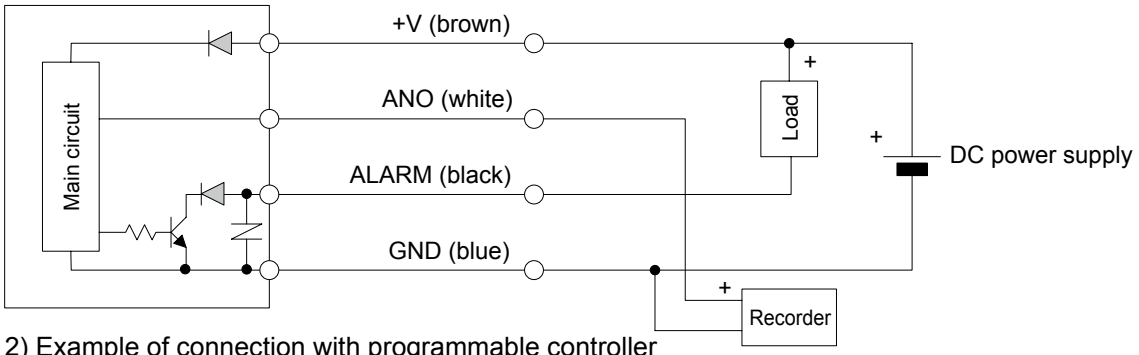
·Middle flow rate PF500F/PF1000F/PF2000F/PF4000F
·Large flow rate PF8000F/PF16000F



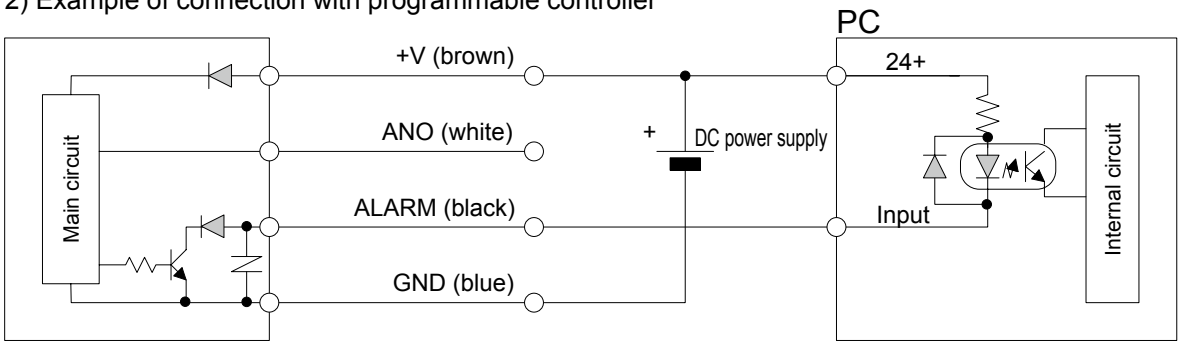
● Standard/option A2 A3 A6



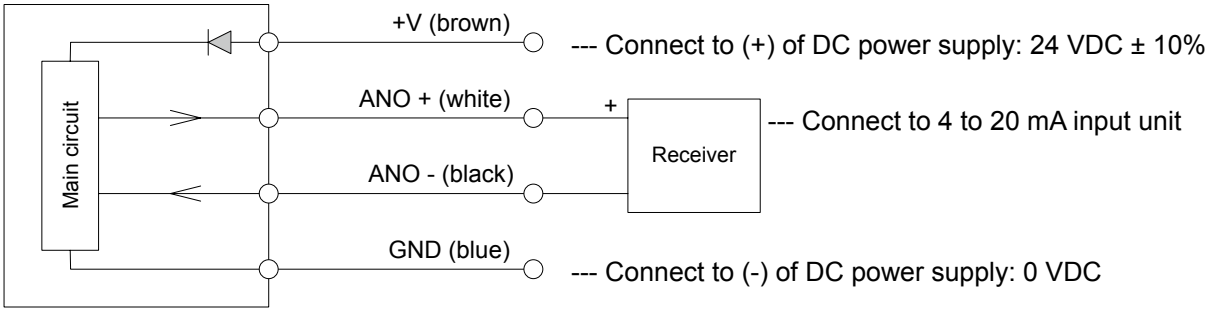
1) Example of connection with relay/resistance load/recorder



2) Example of connection with programmable controller

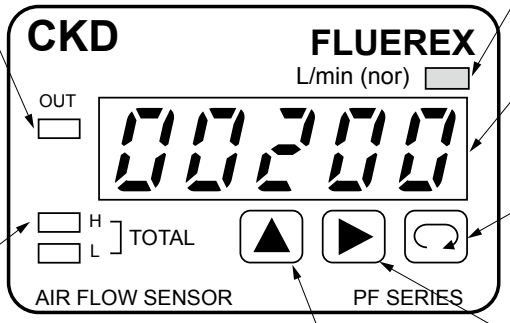


● Option A1 4 to 20 mA output



· Switch output is not available if 4 to 20 mA output is selected.

Operations



● Output lamp

Indicates the switch output status.

● Unit lamp Integrating flow

[L]
· Displays the lower digits of integrating flow. (Unit: L liter)
[H]
· Displays the higher digits of integrating flow. (Unit: L liter)

Max. 9 digits of integrating flow
[H] Higher digits: 09999 [L] Lower digits: 99999

● Up key

[Measurement mode]
· Switches H and L of the integrating flow display.
[In write mode]
· Increases the blinking digits.

● Unit lamp Instantaneous flow rate

· When the lamp is ON, the 5-digit digital display displays the instantaneous flow rate.

● 5-digit digital display

· Displays the instantaneous flow rate/ integrating flow.
[In write mode]
· Displays the output setting value, etc.

● Change key

[Measurement mode]
· Switches the display between the instantaneous flow rate and integrating flow.
[In write mode]
· Use to confirm the setting.

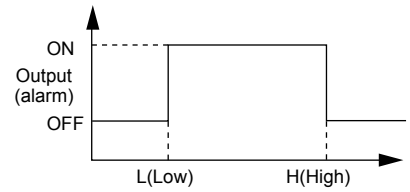
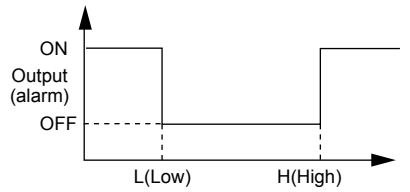
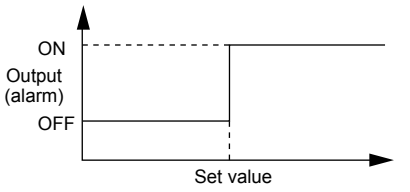
● Shift key

[Measurement mode]
· Switches the display to the write mode when held down for 2 seconds.
[In write mode]
· Moves the blinking digit to the right.

Note: Between PF500F to PF4000F/PFU500F to PFU2000F and PF8000F/PF16000F, the unit is different. In the explanation above, the explanation is made for the model No. of PF500F to PF4000F as a representative. For PF8000F/PF16000F, change the reading way of the unit.
PF500F to PF4000F/PFU500F to PFU2000F: L/min (normal)
PF8000F/PF16000F: m^3/min (normal) (the value becomes 1000 times of (L/min normal) and a decimal point is added.)

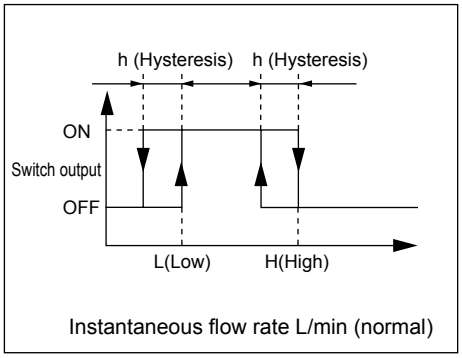
● Switch output parameters

· Three types of setting are available according to the application.

Parameter 0 (zero)	Parameter 1	Parameter 2
· Use to detect a disconnection error, etc	· Use to detect a flow rate error, etc.	· Output occurs when the integrating flow reaches the set value.
		
Instantaneous flow rate L/min (normal)	Instantaneous flow rate L/min (normal)	Integrating flow L (normal)

● Hysteresis

· Set when the flow rate pulsates, causing the switch output to chatter.



Instantaneous flow rate L/min (normal)

● To clear the integrating flow

1) In the write mode described on the right, clear with key operation.
2) Clear by turning the power OFF.

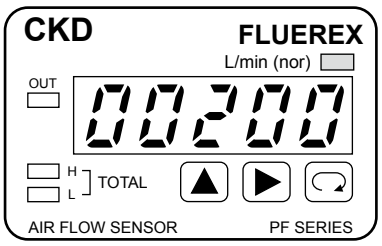
Note)
1) Switch output ON indicates that the transistor is energized.
2) For safety, set the output only when the upper level equipment is in stop state.
3) The settings of parameters 0 and 1 should satisfy the following conditions. Otherwise operation cannot be guaranteed.
   ● $0 < L < H$
   ● $0 < (L-h) \leq L < (H-h)$
   Note that the output is always OFF if L=H=h=0 (factory default).

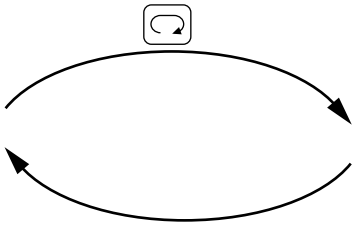
Measurement mode

● Measures the instantaneous flow rate/integrating flow. (when powered on)

Holding down for 2 seconds confirms the setting: the blinking light will change to a steady light and the display will constantly show an integrated value. As the measurement setting is retained even if the power is turned OFF, resetting is not necessary.
To return to the instantaneous flow rate display, hold down for 2 seconds again.

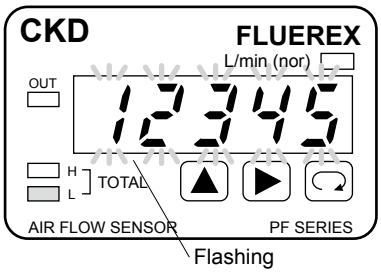
Instantaneous flow rate display





In 10 seconds, the light goes from blinking to steady and the display automatically returns to the instantaneous flow rate display.

Temporary integrating flow display



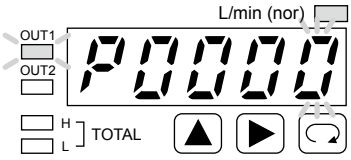
Note) Integrating flow is displayed in integers.

▶ Hold down for 2 seconds

Write mode

● Set the switch output.

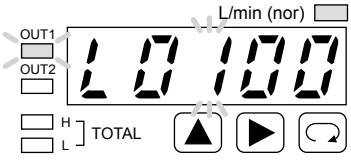
Note) In the example below, P (parameter) is set to 0, L (Low) to 100, H (High) to 200, and h (hysteresis) to 10 L/min (normal).



Parameter setting

· Set the parameter with the Up key.

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

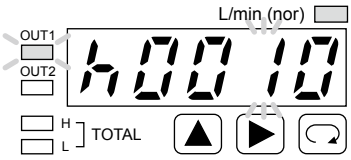


L (Low) setting

· Set the L (LOW) value with the Shift/Up keys.

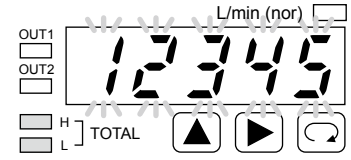
H (High) setting

· Set the H (High) value with the Shift/Up keys.



Hysteresis setting

· Set the h (hysteresis) value with the Shift/Up keys.



Clearing integrating value

· Hold down the Shift/Up keys together for 10 seconds to clear the integrating value.

To measurement mode

Safety Precautions

Be sure to read this section before use.
Refer to Intro Page 63 for general precautions regarding pneumatic components and refer to "⚠ Safety precautions" for detailed precautions for individual series.

Product-specific cautions: Flow sensor for compressed air PF-F/PFU series

Design/selection

1. Checking the specifications

⚠ DANGER

■ Never use with a flammable fluid.

⚠ WARNING

■ Use the product in the range of conditions specified for the product.
The product in this catalog is designed for use only in a compressed air system. Use with pressures or temperatures outside the specifications range may result in damage or operation failure.

■ This product cannot be used as a billing meter. Do not use this product for commercial transactions as it is not compliant with the Measurement Act. Intended applications include industrial sensors.

■ Because compressed air or nitrogen gas is used as an applicable fluid, do not use fluids other than these, because accuracy cannot be guaranteed.

2. Safety design

⚠ WARNING

■ Take measures to prevent physical harm or property damage in the event of failure of this product.

⚠ CAUTION

■ Understand the characteristics of compressed air before designing a pneumatic circuit.
- Pop-out, air discharge, or leakage due to air compression and expansion may occur.
- Design the circuit so that compressed air in the system is exhausted.

■ Check for leakage current to avoid malfunction caused by the leakage current.
- When using a programmable controller, leakage current may cause malfunction.

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

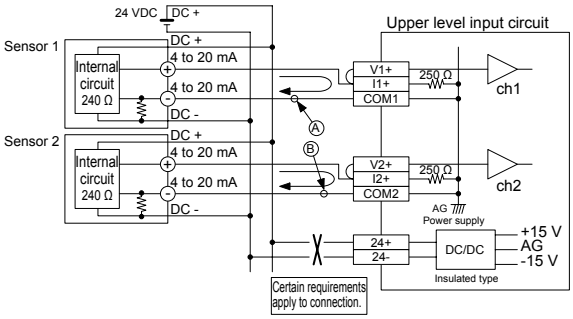
3. Design by application

⚠ CAUTION

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

■ The monitor of the display separated PFD Series cannot be connected to PF-F/PFU Series. When making the connection, this product could break.

■ Precautions for analog output "A1"



Connecting multiple analog output 4 to 20 mA sensors to the same common input circuit (host computer, PLC, etc.) as shown above causes interference between the signals, preventing correct operation. In this case, use the voltage output (standard, A2, A3).
* The voltage at point A and that at point B are connected inside the input circuit, which gives them the same electrical potential, creating an error in the respective analog outputs.

If the power supply (24 VDC) of the host input circuit is not isolated, install separate power supplies for the input circuit and the sensor.

4. Working environment

⚠ DANGER

■ Never use this product in an explosive gas atmosphere. The structure is not explosion-proof, and explosions or fires could occur.

■ When using nitrogen gas as an applicable fluid, oxygen deficiency could be caused. Observe the following instructions.
(1) Use in well ventilated locations.
(2) Ventilate the work area when nitrogen gas is being used.
(3) Inspect nitrogen gas piping regularly to avoid leaks.

⚠ WARNING

■ Install the product where it will not be exposed to rain, water or direct sunlight.

■ Do not use this product in a corrosive environment. Use in such an environment could lead to damage or operation failure.

■ Consult with CKD if ozone is generated in the supplied air.

■ Avoid using this product in environments where ozone is generated.

■ Fluid temperature should be in the range of 0 to 40°C. Even if the ambient temperature is within the specified range, do not use this product in a location where the temperature could suddenly change and cause dew to condense.

■ Do not use at a pressure exceeding the max. working pressure, as excessive pressure can cause product failure.

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

⚠ CAUTION

■ Confirm before use that the product will withstand the working environment.
- Cannot be used in environments where its functions will be impeded. Such environments include high temperatures, chemical atmospheres, or those where chemical liquids, vibration, moisture, dripping water, coolant or gas are present. Environments where ozone is generated.

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

■ Do not use this product in an environment exposed to vibration resistance of 49 m/s^2 and over or shock resistance of 294 m/s^2 and over.

■ Working conditions for CE compliance
This product is CE-marked, indicating conformity with the EMC Directives. The standard for the immunity for industrial environments applied to this product is EN61000-6-2; the following requirements must be satisfied in order to conform to this standard:
Conditions
- The assessment of this product is performed by using a cable pairing a power supply line and a signal line, assessing this cable as a signal line.
- This product is not equipped with surge immunity. Implement surge protection measures on the system side.

5. Securing of space

⚠ CAUTION

■ Around the pneumatic component, keep space for installation, removal, wiring, and piping work.

Mounting, installation and adjustment

1. Installation

⚠ DANGER

■ Use power supply 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. Do not use any load that exceeds the rated output. Otherwise, output damage or fire may result.

⚠ WARNING

■ Check the line color and terminal number when connecting wires. Incorrect wiring could result in sensor damage and malfunctions, so check wire color and terminal number against the instruction manual before wiring.
Install a noise filter if required.

■ Ensure that wires are properly insulated.
Check that wires do not come into contact with other circuits, that no ground faults occur, and that the insulator between terminals is not defective. Otherwise, overcurrent may flow into the sensor, causing damage.

■ Keep the product away from high voltage cables, high voltage equipment and power equipment such as motors.

■ Check that there are no cutting chips and wire dust on the connector of the sensor before wiring.

⚠ CAUTION

■ Do not remove the pneumatic component packaging and the piping port dust-proof cap until just before starting piping.
- Removing the piping port cap before piping work may cause foreign matter to enter the pneumatic components from the piping port, resulting in failure or malfunction.

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

2. Pre-operation confirmation

⚠ CAUTION

■ After connecting piping, always check all pipe connections for air leaks before supplying compressed air.
- Apply a leakage detection agent to pipe connections with a brush and check for air leaks. Make sure that the leak detection agent does not adhere to the resin parts. Otherwise resin parts could be damaged, which is dangerous.

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

■ Do not short-circuit the output transistor.
When a load is short-circuited, overcurrent protection circuit is triggered to prevent damage to the output transistor; however, if this state persists, the output transistor could be damaged.
Overcurrent protection...Approx.70 mA

Mounting, installation and adjustment

⚠CAUTION

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

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

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

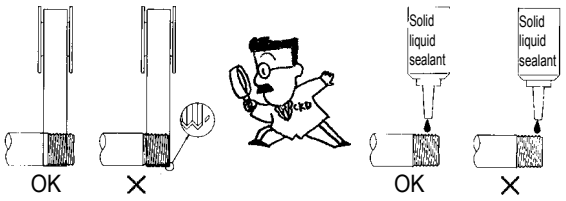
■ Use the accessory cable (3 m). When extending the cable, contact your CKD branch or dealer.

3. Piping

⚠CAUTION

■ When connecting pipes, wrap sealing tape in the opposite direction from the threading, from the inside position to within 2 mm from the pipe end.

● If sealing tape protrudes from the pipe threads, it could be cut when screwing the bolts in. This could cause the tape to enter the product, causing failures.



● When using a liquid sealant, make sure it does not adhere to resin parts. Otherwise resin parts could be damaged, which is dangerous.

■ Check that the piping connected to the pneumatic components is not dislocated due to vibration, looseness, or tension.

● Piping dislocation is dangerous.

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

● Use flame-resistant tubes or metal steel pipes in an environment where spattering may occur.

● When using the standard push-in fitting on the spiral tube, fix the base of the tube with a hose clamp. Rotation may occur, causing a reduction in holding force.

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

■ Always flush just before piping pneumatic components.

● Any foreign matter that has entered the pipes during piping must not enter the pneumatic components.

■ Use appropriate torque to tighten the pipes when connecting them.

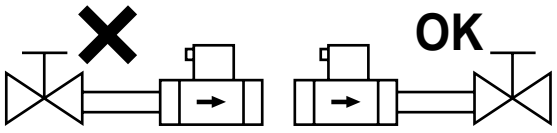
● The purpose is to prevent air leakage and damage to bolts.

● First tighten the bolts by hand to ensure that the threads are not damaged, then use a tool.

[Recommended values]

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



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

● When installing the regulator on the primary side, provide a straight piping section of 10D and over.

* Where "D" indicates the inner diameter of the piping material.

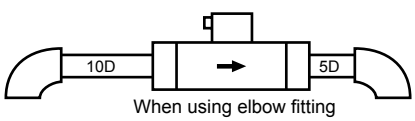
● Select a regulator that has sufficient margin of flow characteristics for the max. flow rate of the sensor.

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

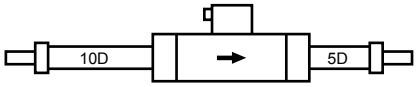
■ When using an elbow or bush in the piping, it is recommended to provide straight piping sections of 10D and over on the primary side and 5D and over on the secondary side.

● For PF8000F/PF16000F Series, be sure to provide straight piping sections.

● Bore size change by bush should be limited to one size.



When using elbow fitting



When using bush fitting

Model No.	Dimension D
PF8000F	40 mm
PF16000F	50 mm

■ Make sure that no force is applied to the resin parts when piping.

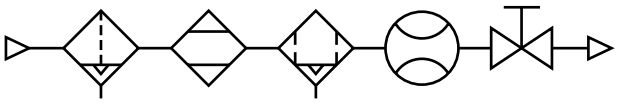
4. Pneumatic source

⚠ CAUTION

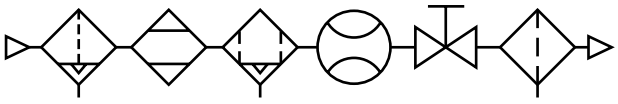
■ Install a pneumatic filter just before the pneumatic component in the circuit.

■ When supplying compressed air after connecting pipes, do not suddenly apply high pressure.
- The pipe connection could dislocate, causing the pipe tube to fly out, leading to accidents.

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



·When the ultra clean air is required



Use/maintenance

1. When using the product

⚠ WARNING

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

⚠ CAUTION

■ If a problem occurs during operation, immediately turn the power OFF, stop use, and contact your dealer. The display may become warm (approximately 40°C), but this is not an abnormality.

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

■ When changing the output set value, turn OFF the equipment first in order to prevent unexpected operation in the control system equipment.

■ If this product is used in an interlock circuit, provide multiple interlock circuits as a precaution against failure, and also perform regular inspections to confirm normal operation.

2. Maintenance and inspection

⚠ CAUTION

■ Do not apply excessive rotational force to the display.
The display rotates 270 degrees; turn it to your most convenient position. However, forcing the display to turn by using excessive force can cause the stopper to break.

■ Before conducting maintenance, turn the power OFF, stop the supply of compressed air and make sure that there is no residual pressure.
- Observe the conditions to ensure safety.

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

■ Do not disassemble or modify, as this may cause malfunction.