

Digital Flow Switch (Sensor Part) Operation Manual



For Air

PF2A 510/550 Series

PF2A 511/521/551 Series

For Water

PF2W 504/520/540 Series

PF2W 511 Series

For Water (High Temperature Fluid Type)

PF2W 504T/520T/540T Series



PF2A511

PF2W511

SMC Corporation

URL <http://www.smcworld.com>

Thank you for purchasing the SMC PF2*5** Series Digital Flow Switch.

Please read this manual carefully before operating digital flow switch and understand digital flow switch, its capabilities and limitations.

Please keep this manual handy for future reference.

OPERATOR

- This operation manual has been written for those who have knowledge of machinery and apparatus that use pneumatic equipment and have full knowledge of assembly, operation and maintenance of such equipment.
- Please read this operation manual carefully and understand it before assembling, operating or providing maintenance service to the flow switch.

• About display part

The type of the display part combined with a sensor part is indicated to be PF2*3** with this manual.

Refer to the following correspondence table for the display part type combined with each sensor part.

Sensor Part	Display Part
PF2A 510/550	PF2A 300 or PF2A 301
PF2A 511/521/551	PF2A 310 or PF2A 311
PF2W 504/520/540	PF2W 300 or PF2W 301
PF2W 504T/520T/540T	PF2W 300 or PF2W 301
PF2W 511	PF2W 330 or PF2W 331

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To facilitate recycling, this manual is printed using biodegradable soy ink, which can easily be de-inked.



This manual is printed in the "non-water system", which does not output toxic liquid waste.

SAFETY

The Digital Flow Switch and this manual contain essential information for the protection of users and others from possible injury and property damage and to ensure correct handling. Please check that you fully understand the definition of the following messages (signs) before going on to read the text, and always follow the instructions.

Please read the operation manuals of related apparatus and understand it before operating the flow switch.

IMPORTANT MESSAGES

Read this manual and follow its instructions. Signal words such as WARNING, CAUTION and NOTE, will be followed by important safety information that must be carefully reviewed.

⚠WARNING

Indicates a potentially hazardous situation which could result in death or serious injury if you do not follow instructions.

⚠CAUTION

Indicates a potentially hazardous situation which if not avoided, may result in minor injury or moderate injury.

NOTE

Gives you helpful information.

⚠WARNING

Do not disassemble, remodel (including change of printed circuit board) or repair.

An injury or failure can result.

Do not operate beyond specification range.

Fire, malfunction or switch damage can result.

Please use it after confirming the specification.

Do not operate in atmosphere of an inflammable, an explosive and corrosive gas.

Fire or an explosion can result.

This flow switch is not an explosion proof type.

Prepare the double interlock by another system (Mechanical interlock etc.) and check operating normally, when using this flow switch for an interlock circuit.

An accident by a malfunction may potentially result.

Do not use with an inflammable, an explosive and combustible fluid.

Otherwise, a fire or an explosion or damage may potentially result. (The detector of the flow switch for air is heated by 150°C)

⚠CAUTION

Check fluid leak after installing the flow switch.

Neglecting fluid leak may cause a damage to the machines and equipment. A burn may potentially be inflicted for high temperature model for water.

Do not touch the pipe joining parts. (High temperature model for water)

Otherwise, a burn may potentially be inflicted.

Touch it after confirming that the part is sufficiently cool.

NOTE

Follow the instructions given below when handling your flow switch. Otherwise, the switch may be damaged or may fail, thereby resulting in malfunction.

- Do not drop it, bring it into collision with other objects or apply excessive shock (490m/s^2 or more).
- Do not pull the lead wire with force nor lift the main unit by holding the lead wire. (Pulling strength less than 49N)
- Wiring correctly.
- Do not wiring while power is on.
- Although the flow switch complies with the CE Marking, since it does not have the thunder serge protection, please carry out protection to thunder serge by the equipment side.
- Although the flow switch complies with the CE Marking, since the equipment and apparatus which are made to generate the serge (Electro-magnetic lifter, High frequency induction furnace, Motor etc.) around the flow switch should perform measure against serge come out.
- Do not use with power cable or high-voltage cable in the same wire route.
- Do not use in a place in which oil or a chemical splashes.
- Turn on the power supply of a flow switch for Air, when flow is zero. Some initial drift occurs during ten minutes after turning the power on.
- Start measurement by the flow switch three seconds after turning on the power. (Also in momentary interception of the power supply by reset etc.)
Please take a measure by the program of equipment etc.
- Install a filter on the primary side (inlet side) if foreign matter is feared to mix in a fluid.
- Use this flow switch under the specified operating pressure range. Design the pipe and set the switch for water so that the pressure beyond the specified pressure range by the water hammer may not be impressed.
- Do not attach the flow switch for air the bottom of a body upward.

Body

Flow switch sensor body

The arrow on the side of the body indicates the direction of flow.

Piping port

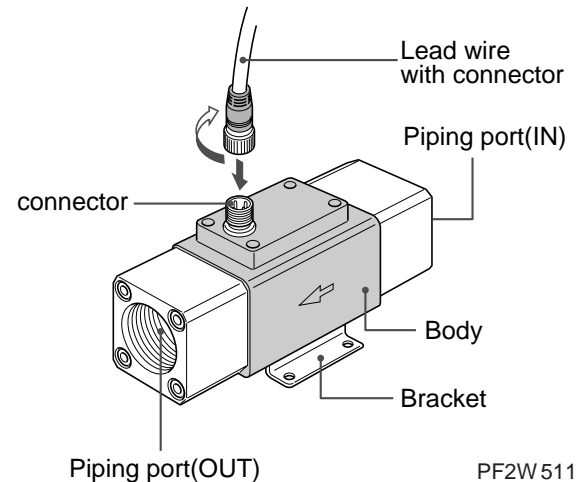
This port connects with pipeline.

Use a pipe fitting to connect with external pipeline.

Accessories

(When no symbol is specified for optional wiring in the type specification.)

Lead wire with connector on one end (3m in length).



PF2W 511

Model Indication Method

Sensor Part

PF2□ 5□□□□□□□

Fluid

A: Air

W: Water

Output Specification

No Symbol: Pulse output (Direct Sensor output)

-1: Pulse output + Analog output (1 to 5V)

-2: Pulse output + Analog output (4 to 20mA)

Lead Wire Specification

No Symbol: Lead wire with connector

-N: None Lead wire with connector

Pipe Port Size (Refer to table below)

01: Port Size 1/8

02: Port Size 1/4

03: Port Size 3/8

04: Port Size 1/2

06: Port Size 3/4

10: Port Size 1

Port Screw Type

No Symbol: Rc

N: NPT

F: G

Temperature Range (Indicated for high temperature type)

T: 0 to 90°C

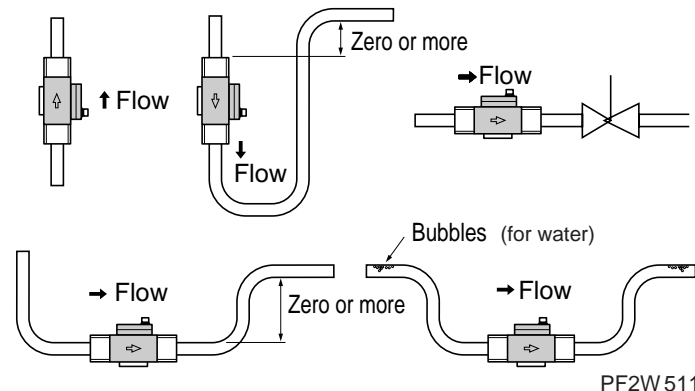
Type	Flow Rate	Pipe Port Size
PF2A 5	10: 1 to 10 l/min	01, 02
	50: 5 to 50 l/min	01, 02
	11: 10 to 100 l/min	03
	21: 20 to 200 l/min	03
PF2W 5	51: 50 to 500 l/min	04
	04: 0.5 to 4 l/min	03
	20: 2 to 16 l/min	03, 04
	40: 5 to 40 l/min	04, 06
	11: 10 to 100 l/min	06, 10

Installation

Before you mount a flow switch, read "SAFETY " and "Installation" described in this chapter carefully to obtain safe and correct measurement.

Mounting

- Use this flow switch under the specified operating pressure range.
- Use this flow switch under the specified operating temperature range.
- Withstand pressure are 1.0MPa for air and 1.5MPa for water.
- Do not install a flow switch at a foothold position.
- Bubbles may be generated depending on the piping design. Refer to an example of recommended piping system. (For water)



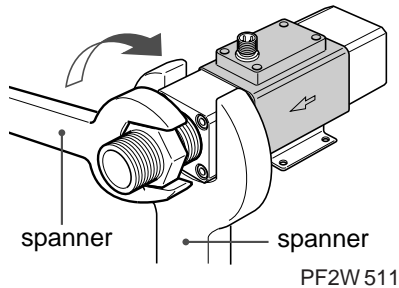
- Install a flow switch so that the flow direction agrees with the arrow direction on the side of the body.
- Provide a straight pipe length of more than eight times the pipe diameter to the primary side (inlet side) of the flow switch.
- To start designing piping system, check the pressure loss at the operating flow rate using the flow rate characteristic (pressure loss) curve.

Pipe Connection

- Use a pipe fitting to connect pipeline with the flow switch.
- Observe the specified tightening torque when connecting pipes. Refer to the following table for the appropriate torque values.

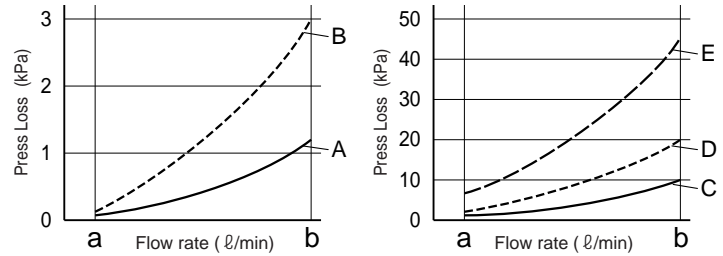
Nominal size of screws	Appropriate tightening torque N·m
Rc 1/8	7 to 9
Rc 1/4	12 to 14
Rc 3/8	22 to 24
Rc 1/2	28 to 30
Rc 3/4	28 to 30
Rc 1	36 to 38

- When connecting pipeline to the switch, apply a spanner to the metal part of the piping section for the switch.

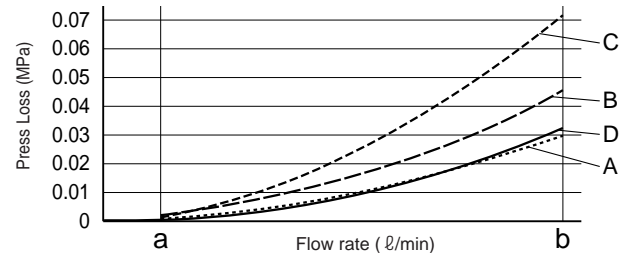


- Make sure that sealing tapes will not enter inside the pipe when connecting pipes.
- Connect pipes securely so that fluid will not leak from loose connections.

Flow rate characteristic (Pressure Loss)



Type	Graph	a (l/min)	b (l/min)
PF2A 510	A	1	10
PF2A 550	B	5	50
PF2A 511	C	10	100
PF2A 521	D	20	200
PF2A 551	E	50	500



Type	Graph	a (l/min)	b (l/min)
PF2W 504/504T	A	0.5	4
PF2W 520/520T	B	2	16
PF2W 540/540T	C	5	40
PF2W 511	D	10	100

Example of Internal Circuit and Wiring

The pulse output is output for flow rate display.

Be sure to combine the display part with the PF2*3*0/3*1 series manufactured by SMC.

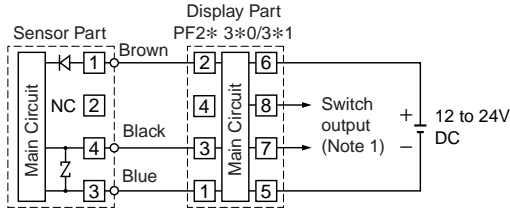
When the Lead wire with connector provided by SMC corporation is used the color of wire(Brown, White, Black, Blue) shown on circuit diagram will be applied.

Output Specification

No Symbol

Pulse Output

Nch Open Drain Output 1 Output (For PF2*3*0/3*1 Series)



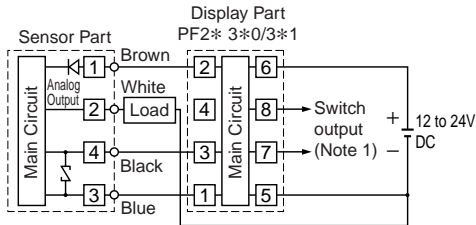
-1

Pulse Output

Nch Open Drain Output 1 Output (For PF2*3*0/3*1 Series)

Analog Output: 1 to 5V

Load Impedance: 100kΩ or more



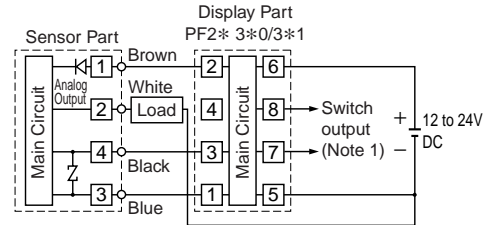
-2

Pulse Output

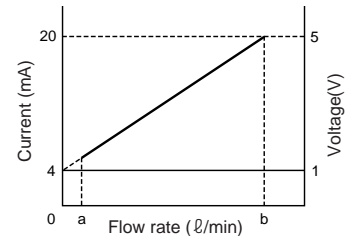
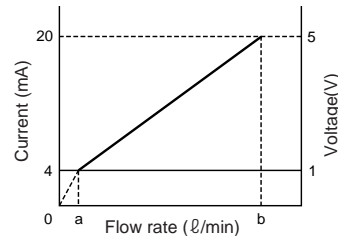
Nch Open Drain Output 1 Output (For PF2*3*0/3*1 Series)

Analog Output: 4 to 20mA

Load Impedance: 300Ω or less (@12VDC), 600Ω or less (@24VDC)



(Note 1) See the operation manual of PF2*3*0/3*1 series for complete information.



Type	a	b
PF2A 510	1	10
PF2A 550	5	50
PF2A 511	10	100
PF2A 521	20	200
PF2A 551	50	500

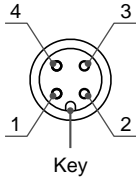
Type	a	b
PF2W 504	0.5	4
PF2W 520	2	16
PF2W 540	5	40
PF2W 511	10	100
PF2W 502T	0.5	4
PF2W 520T	2	16
PF2W 540T	5	40

Example of Internal Circuit and Wiring (continue)

How to connect connectors:

- Turn off power before connecting or disconnecting the connector.
- To insert the connector, push the connector socket of the lead wire to the key part of the switch connector after aligning them to each other and secure the connector with the lock nut.
- To disconnect the connector, unlock the connector lock nut and pull out the connector straight.
- Install the lead wire separately from the route for power cable or high-voltage cable. Otherwise, malfunction may potentially result due to noise.

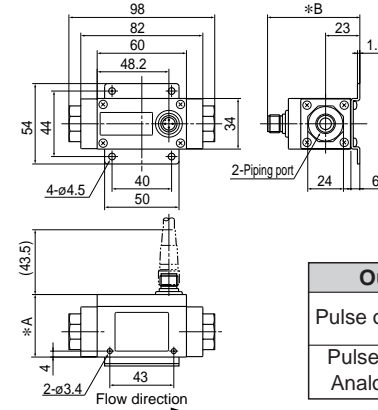
Connector pin number



Pin No.	Pin name	
	Pulse output only (No Symbol)	With analog output (-1 or -2)
1	DC (+)	DC (+)
2	NC	Analog output
3	DC (-)	DC (-)
4	Pulse output	Pulse output

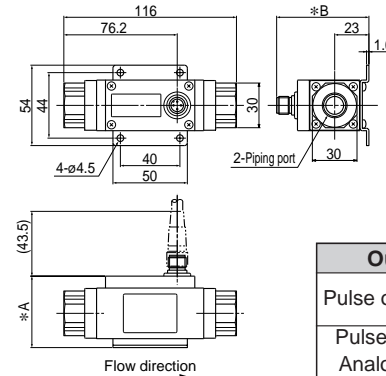
Outline with Dimensions (in mm)

PF2A 510 / 550



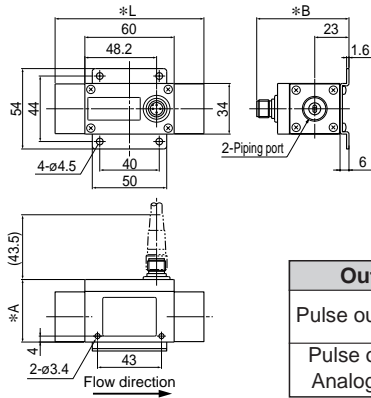
Output	*A	*B
Pulse output only	42mm	62mm
Pulse output & Analog output	52mm	72mm

PF2A 511 / 521 / 551



Output	*A	*B
Pulse output only	48mm	62mm
Pulse output & Analog output	58mm	72mm

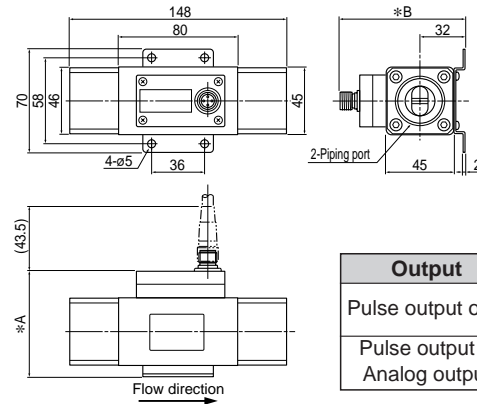
PF2W 504 / 520



Type	*L
PF2W 504	100mm
PF2W 520	106mm

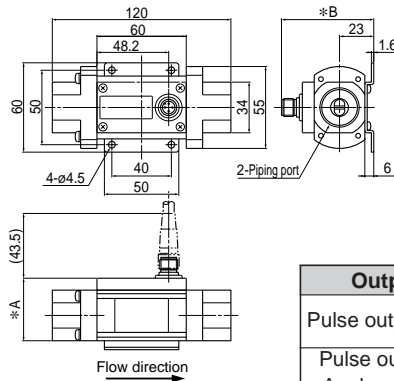
Output	*A	*B
Pulse output only	42mm	62mm
Pulse output & Analog output	52mm	72mm

PF2W 511



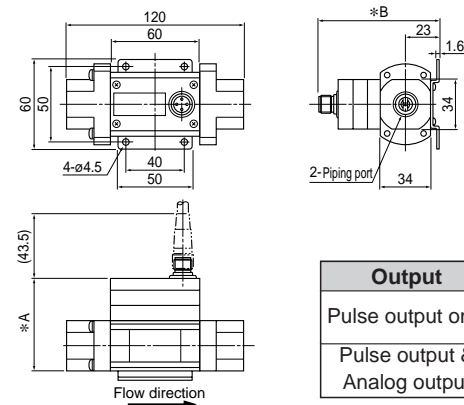
Output	*A	*B
Pulse output only	63mm	77mm
Pulse output & Analog output	73mm	87mm

PF2W 540



Output	*A	*B
Pulse output only	42mm	62mm
Pulse output & Analog output	52mm	72mm

PF2W 504T / 520T / 540T



Output	*A	*B
Pulse output only	52mm	72mm
Pulse output & Analog output	62mm	82mm

Specification

Model	PF2A 510	PF2A 550	PF2A 511	PF2A 521	PF2A 551
Rated Flow Range	1 to 10 ℓ/min	5 to 50 ℓ/min	10 to 100 ℓ/min	20 to 200 ℓ/min	50 to 500 ℓ/min
Operating Pressure Range	-50kPa to 0.5MPa		-50kPa to 0.75MPa		
Linearity (*1)	±5%F.S. or less				
Repeatability (*1)	±1%F.S. or less				
Temperature Characteristic	±2%F.S. or less (15 to 35°C, 25°C standard) ±3%F.S. or less (0 to 50°C, 25°C standard)				
Current Consumption (No load)	100mA or less				110mA or less
Mass (Weight) (*2)	200g		240g		
Piping Specification	1/8, 1/4		3/8		1/2
Material of Wet Part	Attachment: ADC Packing: NBR Mesh: SUS Internal Body: PBT Sensor-housing: PBT Sensor: Lead-glass/ PtIr/ FeNi/ OFC		Attachment: ADC Packing: NBR Spacer: PBT Mesh: SUS Internal Body: PBT Sensor-housing: PBT Sensor: Lead-glass/ PtIr/ FeNi/ OFC		

Common Specification	
Fluid to be Measured	Air, Nitrogen
Detecting Method	Calorimetry
Withstand Pressure	1.0MPa
Operating Fluid Temperature	0 to 50°C
Ambient Temperature Range	Operation: 0 to 50°C, Storage: -25 to 85°C (No condensation or Freezing)
Output Specification (*3)	Sensor Output
	Analog Output
Output impedance 1kΩ, (for Display Part PF2A 3**)	
Voltage Output 1 to 5V (Within rated flow rate range) Linearity: ±5%F.S. or less, Permissible load impedance: 100kΩ or more	
Current Output 4 to 20mA (Within rated flow rate range) Linearity: ±5%F.S. or less, Permissible load impedance: 300Ω or less (@12VDC), 600Ω or less (@24VDC)	
Power Supply Voltage	12 to 24VDC, ripple ±10% or less
Withstand Voltage	1000VAC 1 minute. Between group of external terminals and case
Insulation Resistance	50MΩ or more (@ 500VDC M). Between group of external terminals and case
Resistance to Noise	1000Vp-p pulse width 1μs, rise 1ns
Vibration proof	10 to 500Hz and amplitude 1.5mm or acceleration 98m/s ² whichever is smaller
Impact proof	490m/s ² , (3times each directions of X, Y and Z respectively)
Enclosure	IP65

*1: This is an overall accuracy combined with PF2A 3**.

*2: Lead wire not included.

(The one with analog output (either voltage or current output) is 20g heavier.)

*3: Select the output option by the Model indication Method.

*4: The flow unit is based on 0°C/ 101.3kPa.

*5: The sensor part conforms entirely to the CE standard.

Specification (continue)

Model	PF2W 504	PF2W 520	PF2W 540	PF2W 511
Fluid to be Measured	Water			
Rated Flow Range	0.5 to 4 ℓ/min	2 to 16 ℓ/min	5 to 40 ℓ/min	10 to 100 ℓ/min
Operating Fluid Temperature	0 to 50°C			
Linearity (*1)	±5%F.S. or less			±3%F.S. or less
Repeatability	±2%F.S. or less			±1%F.S. or less
Temperature Characteristic	±2%F.S. or less (15 to 35°C, 25°C standard) ±3%F.S. or less (0 to 50°C, 25°C standard)			
Mass (Weight) (*2)	410g	470g	650g	1,100g
Vibration proof	10 to 500Hz and amplitude 1.5mm or acceleration 98m/s ² whichever is smaller			4.9m/s ²
Piping Specification	3/8	3/8, 1/2	1/2, 3/4	3/4, 1
Material of Wet Part	Attachment: SUS, Packing: NBR, Internal Body: PPS, Sensor: PPS			

Model	PF2W 504T	PF2W 520T	PF2W 540T
Fluid to be Measured	Water, 50% of water and an ethylene glycol 50% fluid		
Rated Flow Range	0.5 to 4 ℓ/min	2 to 16 ℓ/min	5 to 40 ℓ/min
Operating Fluid Temperature	0 to 90°C (No cavitation)		
Linearity (*1)	±5%F.S. or less		
Repeatability	±2%F.S. or less		
Temperature Characteristic	±5%F.S. or less (0 to 90°C, 25°C standard)		
Mass (Weight) (*2)	660g		
Vibration proof	10 to 500Hz and amplitude 1.5mm or acceleration 98m/s ² whichever is smaller		
Piping Specification	3/8	3/8, 1/2	1/2, 3/4
Material of Wet Part	Attachment: SUS, Packing: FKM, Internal Body: PPS, Sensor: PPS		

Common Specification	
Detecting Method	Karman Vortex Method
Operating Pressure Range	0 to 1MPa
Withstand Pressure	1.5MPa
Ambient Temperature Range	Operation: 0 to 50°C, Storage: -25 to 85°C (No condensation or Freezing)
Output Specification (*3)	Pulse Output Nch Open Drain Output for Display Part PF2W 3*0/3*1 (Reference : Maximum load current 10mA, maximum applied voltage 30V)
	Analog Output Voltage Output 1 to 5V (Within rated flow rate range) Linearity: ±5%F.S. or less, permissible load impedance: 100kΩ or more Current Output 4 to 20mA (Within rated flow rate range) Linearity: ±5%F.S. or less, Permissible load impedance: 300Ω or less (@12VDC), 600Ω or less (@24VDC)
Power Supply Voltage	12 to 24V DC, ripple ±10% or less
Current Consumption	20mA or less (No load)
Withstand Voltage	1000VAC 1 minute. Between group of external terminals and case
Insulation Resistance	50MΩ or more (@ 500VDC M). Between group of external terminals and case
Resistance to Noise	1000Vp-p pulse width 1μs, rise 1ns
Vibration proof	10 to 500Hz and amplitude 1.5mm or acceleration 98m/s ² whichever is smaller
Impact proof	490m/s ² , (3times each directions of X, Y and Z respectively)
Enclosure	IP65

*1: This is an overall accuracy combined with PF2W 3**.

*2: Lead wire not included.

(The one with analog output (either voltage or current output) is 20g heavier.)

*3: Select the output option by the Model indication Method.

*4: The sensor part conforms entirely to the CE standard.