



# Installation & Maintenance Manual Digital Flow Switch (Sensor Part)

For Pure Water / Chemical Fluid  
Series **PF2D 504**  
**PF2D 520**  
**PF2D 540**



## Safety Instructions

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 confirm 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 and understand the operation manuals of related apparatus 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.

<b>⚠ WARNING</b>	Indicates a potentially hazardous situation which could result in death or serious injury if you do not follow instructions.
<b>⚠ CAUTION</b>	Indicates a potentially hazardous situation which if not avoided, may result in minor injury or moderate injury.
<b>NOTE</b>	Gives you helpful information.

## Safety Instructions (continue)

### ⚠ 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 after confirming 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.

**Do not use with a combustible fluid.**

Otherwise, a fire or an explosion or damage may potentially result.

**This flow switch is solely for use with pure water or selected chemical fluids.**

See the specification for the complete information. See "MSDS" for the liquid in tended to use.

### ⚠ CAUTION

**Do not touch the pipe joining parts or the pipe of the flow switch.**

Otherwise, a burn may occur. Touch after confirming the product has sufficiently cooled.

**Check for fluid leakage after installing the flow switch.**

Neglecting fluid leakage may cause a burn or damage to the machines and equipment.

### NOTE

- Follow the instructions given below when handling the flow switch. Otherwise, the switch may be damaged or may fail, thereby resulting in malfunction.
- Do not drop, bring into collision with other objects or apply excessive shock to the unit (490m/s<sup>2</sup> or more).
  - Do not pull the lead wire with force or lift the main unit by holding the lead wire. (Pulling strength less than 49N)
  - Connect wires and cables correctly.
  - Do not perform wiring while power is on.
- Although the flow switch complies with the CE marking, it does not have lightning surge protection, therefore please apply the necessary protection to the equipment.
- Although the flow switch complies with the CE marking, it should be protected against any source of surge (electro-magnetic lifter, high frequency induction furnace, motors, etc..) around the flow switch.
- 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 chemical splashes may occur.
  - Use only chemicals listed as suitable in the specification.
  - Install a filter on the primary side (inlet side) if foreign matter is feared to mix in the fluid.
  - Design the piping and switch setting so that the fluid always fills the detection passage and flows correctly.
  - When the switch is mounted vertically, flow the fluid from bottom to top.
  - Install and connect the pipe according to the fluid flowing direction marked on the switch body.
  - Install straight tubes longer than 50mm on the primary side (inlet side) of the flow switch.

## Specification

Model	PF2D 504	PF2D 520	PF2D 540
Fluid to be Measured	Pure water or fluids that will not corrode Teflon. The fluid viscosity must be 3mPa.s (3cP) or less.		
Detecting Method	Karman Vortex Method		
Rated Flow Range	0.4 to 4 l/min	1.8 to 20 l/min (*1)	4 to 40 l/min
Operating Pressure Range (*2)	0 to 1MPa		0 to 0.6MPa
Withstand Pressure (*2)	1.5MPa (*3)		0.9MPa (*3)
Operating Fluid Temperature	0 to 90°C		
Ambient Temperature Range	Operation: 0 to 50°C, Storage: -25 to 85°C (No condensation or Freezing)		
Linearity	±2%F.S. or less (With 25°C water)		
Repeatability	±1%F.S. or less (With 25°C water)		
Temperature Characteristic	±5%F.S. or less (0 to 50°C, 25°C standard)		
Mass (Weight)	140g (Lead wire not included)		
Enclosure	IP65 (IEC 60529)		
Piping Specification	3/8 inch tube	1/2 inch tube	3/4 inch tube
Material of Wet Part	Body: newPFA, sensor: newPFA, tube: superPFA		
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	4.9m/s <sup>2</sup>		
Impact Proof	490m/s <sup>2</sup> , 3 times each directions of X, Y and Z respectively		

\*1: 1.6 to 20 l/min if viscosity is 1mPa.s (1cP) or less. @ 0.1MPa

\*2: The operating pressure range will reduce depending on fluid temperature. See the operating pressure graph.

\*3: 1.5 times the maximum operating pressure. Varies depending on fluid temperature.

## Model Indication Method

PF2D 5□ - □ - □ - □

**e-con connector**

No Symbol: No connector

C: e-con connector 1pc

(supplied not assembled)

**Output Specification**

1: Pulse output + Analogue output (1 to 5V)

2: Pulse output + Analogue output (4 to 20mA)

**Tube Specification**

11: 3/8 inch (flow rate 0.4 to 4 l/min)

13: 1/2 inch (flow rate 1.8 to 20 l/min)

19: 3/4 inch (flow rate 4 to 40 l/min)

**Flow Rate Range**

04: 0.4 to 4 l/min

20: 1.8 to 20 l/min

40: 4 to 40 l/min

Model	PF2D 504	PF2D 520	PF2D 540
Output Specification	Pulse Output	Nch Open Drain, Output for Display Part PF2D 300/301 (Reference : Maximum load current 10mA, maximum applied voltage 30V)	
	Analogue Output	Voltage Output (*4) 1 to 5V (Within rated flow rate range) Linearity: ±2%F.S. or less, permissible load impedance: 100kΩ or more  Current Output (*5) 4 to 20mA (Within rated flow rate range) Linearity: ±2%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 (No load)		

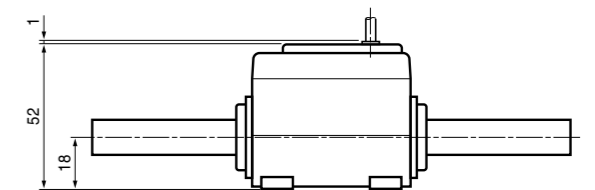
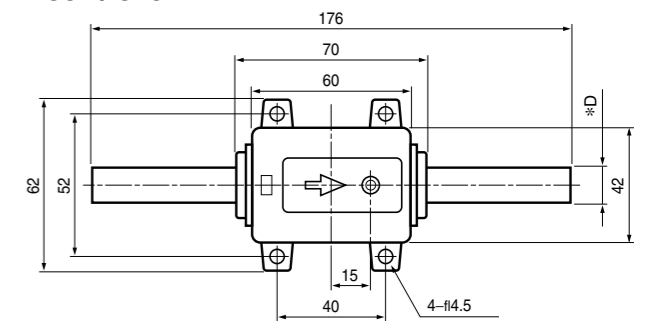
\*4: Applicable when voltage output is selected.

\*5: Applicable when current output is selected.

\*6: The flow switch conforms entirely to the CE standard.

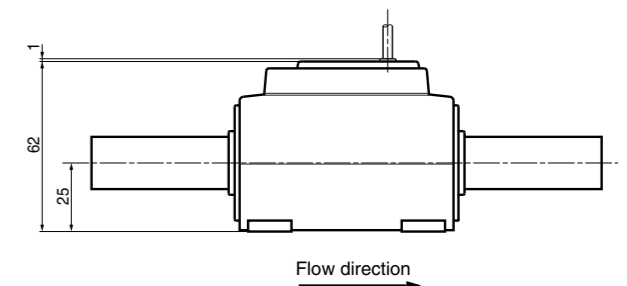
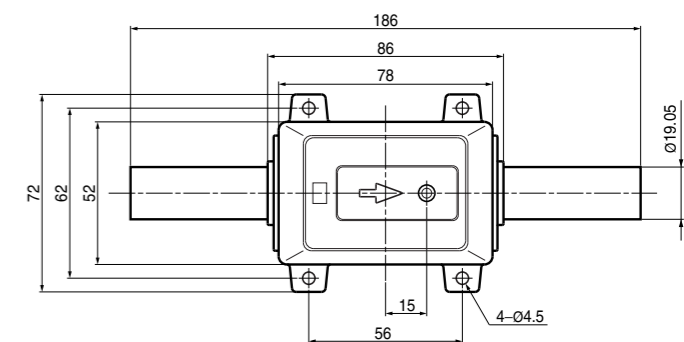
## Outline with Dimensions (in mm)

### PF2D 504 / 520



Model	*D
PF2D 504	ø9.53
PF2D 520	ø12.7

### PF2D 540



## Applicable Fluid

Compatibility checklist:  
Between the digital flow switch material for deionized water and chemicals and the fluid selected.

Fluid	Compatibility
Acetone	○
Ammonium hydroxide	○
Isobutyl alcohol	×
Isopropyl alcohol	○
Hydrochloric acid	○
Ozone	×
Hydrogen peroxide	○
Concentration 50% or less	50°C or less
Ethyl acetate	○
Butyl acetate	○
Nitric acid (except fuming nitric acid)	○
Concentration 10% or less	○
Deionized water	○
Sodium hydroxide	×
Ultra deionized water	○
Toluene	○
Hydrofluoric acid	○
Concentration 50% or less	○
Sulfuric acid (except fuming sulfuric acid)	○
Concentration 20% or less	○
Phosphoric acid	○
Concentration 30% or less	○

Note 1) The material and fluid compatibility check list provides reference values as a guide only.

Note 2) It is possible that some fluids are permeable depending on the type of fluid, its density and temperature. Any permeated fluid may affect the products life. Thus, when using these fluid types, verify the fluid in advance by testing it, prior to making a decision to use it.

- Compatibility is indicated for fluid temperatures at 90°C or less.
- The product does not have an explosion proof construction. Be sure to take measures to prevent the area around the product from becoming filled with an explosive gas, when using an explosive fluid.

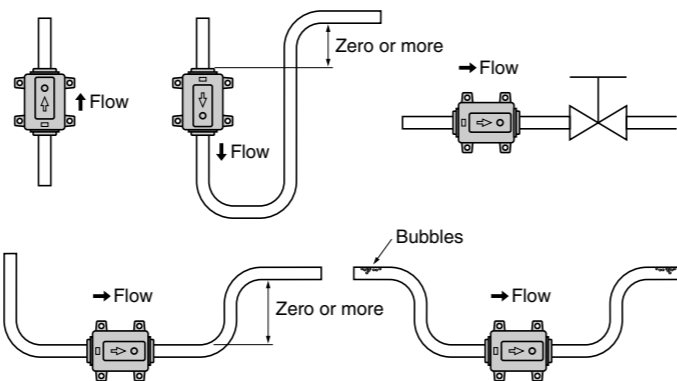
Table symbols ○ : Can be used  
○ : Can be used under certain conditions  
× : Cannot be used

## Installation

Install the flow sensor after carefully reading "Safety Instructions" and "Installation" described in this manual to ensure safe and correct measurement.

### Mounting

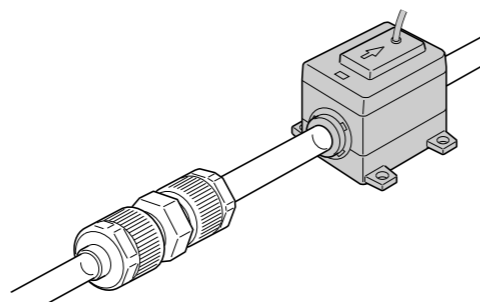
- Be sure to use the flow switch within the operating pressure range. The fluid temperature reduces lowers the operating pressure. Check the fluid temperature and carefully consult the operating pressure graph.
- Use the flow switch within the operating temperature range.
- Pressure resistance is 1.5 times the maximum operating temperature.
- Do not install the switch at a foothold position.
- Cavitation (bubbles) will be generated depending on the piping design. Refer to the example of a recommended piping system.



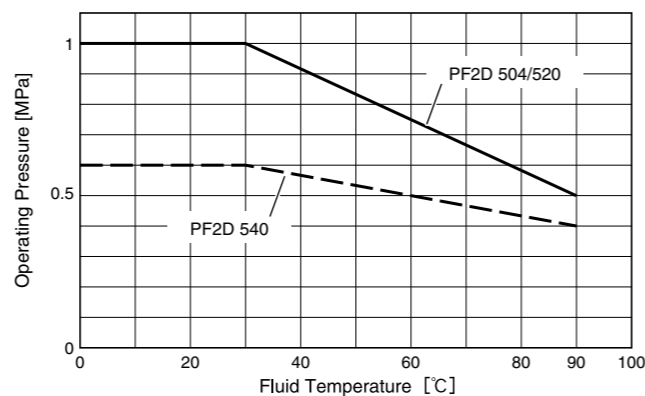
- Install the flow sensor so that the flow direction agrees with the arrow marked on the sensor body.
- Provide a straight tube length of more than 50mm on the primary side (inlet side) of the flow switch.

### Pipe Connection

- Use suitable joints when connecting with the flow sensor pipe. Note: Joint fitting SMC LQ series is recommended.
- Connect pipes securely so that the chemicals will not leak due to a loose joint during operation.



Operating Pressure Graph

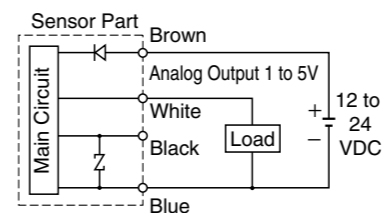


## Internal Circuit and Wiring

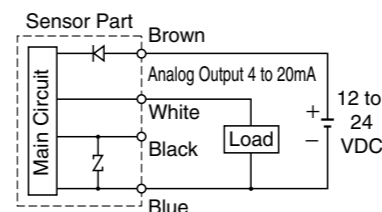
- The pulse output is output for flow rate display. Be sure to combine the flow sensor with the PF2D 300/301 series display unit manufactured by SMC.

### Output Specification

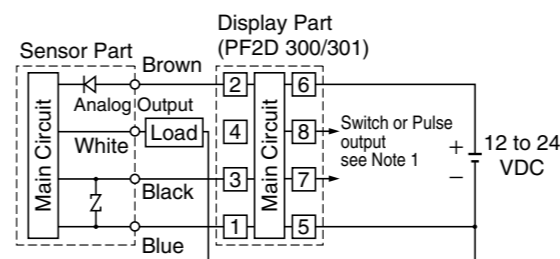
-1  
Pulse Output  
Nch Open Drain Output  
1 Output  
(For PF2D 300/301 Series)  
Analogue Output: 1 to 5V  
Load Impedance: 100kΩ or more



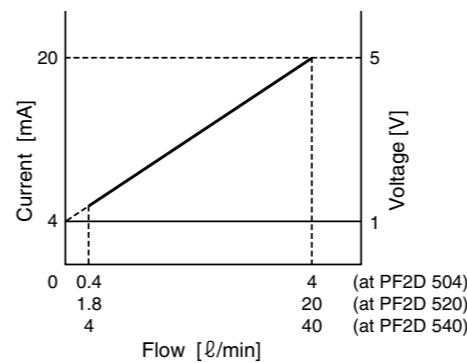
-2  
Pulse Output  
Nch Open Drain Output  
1 Output  
(For PF2D 300/301 Series)  
Analogue Output: 4 to 20mA  
Load Impedance:  
300Ω or less (@ 12VDC),  
600Ω or less (@ 24VDC)



### When both analogue output and pulse output are used



(Note1) See the operation manual of PF2D 300/301 series for the complete information of switch and pulse output.



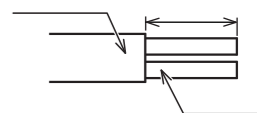
### Lead Wire Connection

- Turn the power off before making connection.
- Install the lead wire separately from the route for power cable or high-voltage cable. Otherwise, malfunction may potentially result due to noise.

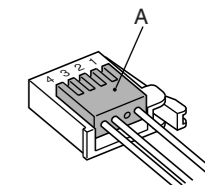
## Internal Circuit and Wiring (continue)

### Attaching connector to sensor lead wire

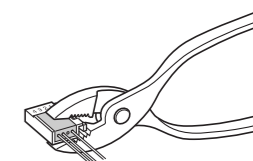
- Strip the sensor wire as shown in the right figure.
- The core of the corresponding color shown in the following table is put into the pin of the number printed on the e-con connector, and pushed to the back.



Pin No.	Color of Insulation
1	Brown (DC (+))
2	N.C.
3	Blue (DC (-))
4	Black (IN:1 to 5VDC)



- Check that the above-mentioned preparation work has been performed correctly, then part A shown in the figure is pushed in by hand to make temporary connection.
- Part A center is pressed straight in using a tool, such as pliers.
- Re-use cannot be performed once the e-con connector has been completely crimped.
- In case connection failure such as incorrect order of wires or incomplete insertion, please use the new e-con connector.



## Names and Functions of Individual Parts

### Sensor Part

#### Body

The sensor body of the flow switch.  
The arrow on the body indicates the fluid flow direction.

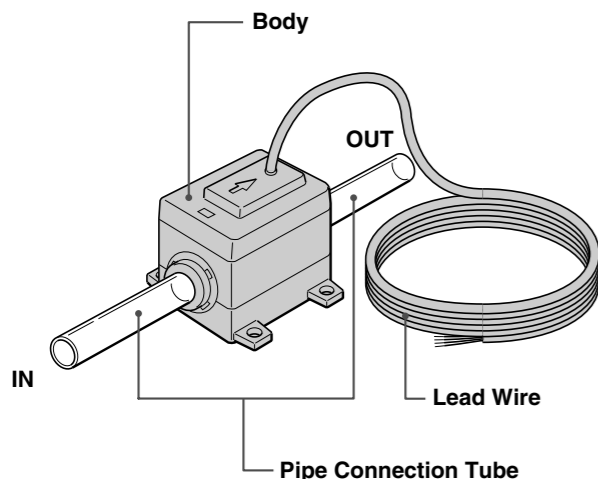
#### Pipe Connection Tube

The tube is for pipe connection. Use a suitable joint to connect the tube.

NOTE: Joint fitting SMC LQ series is recommended.

#### Lead Wire

Lead wire (3m long) to connect to the PF2D300/301 display unit.  
When e-con option is specified, 1pc e-con connector supplied not assembled (ZS-28-CA-2), for connecting to the display unit.



## Contact

AUSTRIA	(43) 2262 62280	NETHERLANDS	(31) 20 531 8888
BELGIUM	(32) 3 355 1464	NORWAY	(47) 67 12 90 20
CZECH REP.	(420) 541 424 611	POLAND	(48) 22 211 9600
DENMARK	(45) 7025 2900	PORTUGAL	(351) 21 471 1880
FINLAND	(358) 207 513513	SLOVAKIA	(421) 2 444 56725
FRANCE	(33) 1 6476 1000	SLOVENIA	(386) 73 885 412
GERMANY	(49) 6103 4020	SPAIN	(34) 945 184 100
GREECE	(30) 210 271 7265	SWEDEN	(46) 8 603 1200
HUNGARY	(36) 23 511 390	SWITZERLAND	(41) 52 396 3131
IRELAND	(353) 1 403 9000	UNITED KINGDOM	(44) 1908 563888
ITALY	(39) 02 92711		

## SMC Corporation

URL <http://www.smcworld.com> (Global) <http://www.smceu.com> (Europe)

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