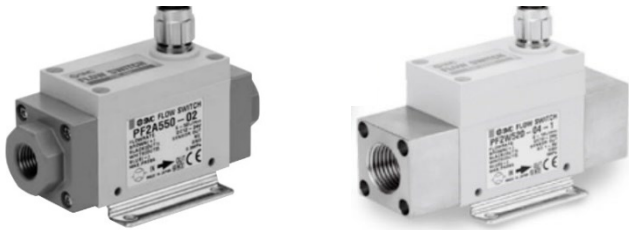




ORIGINAL INSTRUCTIONS

Instruction Manual
Digital Flow Switch – Remote type
PF2A5## / PF2W5##(T) series



The intended use of the digital flow sensor is to monitor and control flow and provide an output signal.

1 Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of “Caution,” “Warning” or “Danger.” They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC) ^{*)}, and other safety regulations.

^{*)} ISO 4414: Pneumatic fluid power - General rules relating to systems.
ISO 4413: Hydraulic fluid power - General rules relating to systems.
IEC 60204-1: Safety of machinery - Electrical equipment of machines. (Part 1: General requirements)
ISO 10218-1: Manipulating industrial robots -Safety. etc.

- Refer to product catalogue, Operation Manual and Handling Precautions for SMC Products for additional information.
- Keep this manual in a safe place for future reference.

	Caution	Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
	Warning	Warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
	Danger	Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

Warning

- Always ensure compliance with relevant safety laws and standards.
- All work must be carried out in a safe manner by a qualified person in compliance with applicable national regulations.
- This product is class A equipment intended for use in an industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments due to conducted or radiated disturbances.
- Refer to the operation manual on the SMC website (URL: <https://www.smcworld.com>) for more safety instructions.

2 Specifications

2.1 General specifications

Item		Specifications
Environment	Enclosure	IP65 (IEC 60529)
	Operating temperature	Operating: 0 to 50 °C : Storage: -25 to 85 °C (no freezing or condensation)
	Humidity range	35 to 85% R.H. (no condensation)
	Withstand voltage	1000 VAC for 1 min. between charged part and case
	Insulation resistance	50 MΩ min (500 VDC Mega) between charged part and case
Materials in contact with fluid		PF2A5##: ADC, NBR, SUS, PBT, Lead glass, PtIr, FeNi, OFC. PF2W5##(T): PPS, SUS, NBR or FKM.

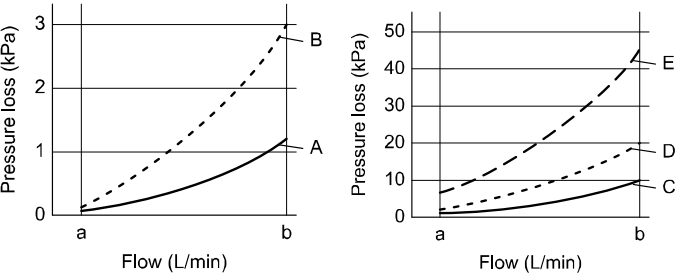
2 Specifications (continued)

2.2 PF2A5## specifications (for Air)

Model		PF2A 510	PF2A 550	PF2A 511	PF2A 521	PF2A 551
Applicable fluid		Air and Nitrogen				
Detection method		Calorimetry				
Fluid temperature		0 to 50 °C (no condensation or freezing)				
Rated flow range (L/min)		1 to 10	5 to 50	10 to 100	20 to 200	50 to 500
Pressure	Rated pressure range	-50 kPa to 0.5 MPa		-50 kPa to 0.75 MPa		
	Proof pressure	1.0 MPa				
Linearity		±5% F.S. or less				
Repeatability		±1% F.S. or less				
Output for PF2A3##		Analogue voltage output (non-linear), Output impedance: 1 kΩ				
Analogue output	Voltage output	1 to 5 V				
	Output impedance	1 kΩ				
	Current output	4 to 20 mA				
	Load impedance	Power supply voltage 12 V: 300 Ω Power supply voltage 24 V: 600 Ω				
	Accuracy	±5%F.S. max.				
	Repeatability	±1% F.S. max. (connected to PF2A3##), ±3% F.S. max. (connected to PF2A2##)				
	Response time	1 s or less				
Supply voltage		12 to 24 VDC ±10%				
Power consumption (no load)		100 mA max.				110 mA max.
Temperature characteristics		±3% F.S. max. (15 to 35 °C, 25°C reference) ±5% F.S. max. (0 to 50 °C, 25°C reference)				
Port size (Rc, NPT, G)		1/8, 1/4		3/8		1/2
Weight		200 g		240 g		

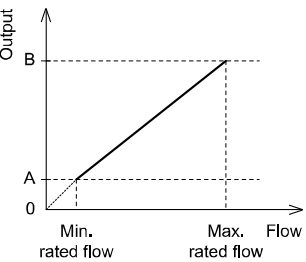
2.3 Flow characteristics (pressure loss)

PF2A5## for Air



Model	Graph	a(L/min)	b(L/min)
PF2A510	A	1	10
PF2A550	B	5	50
PF2A511	C	10	100
PF2A521	D	20	200
PF2A551	E	50	500

2.4 Analogue output characteristics



Model	Rated flow range [L/min]	
	Min.	Max.
PF2A510	1	10
PF2A550	5	50
PF2A511	10	100
PF2A521	20	200
PF2A551	50	500

2 Specifications (continued)

2.5 PF2W5## specifications (for Water)

Model		PF2W 504	PF2W 520	PF2W 540	PF2W 511
Applicable fluid		Water			
Detection method		Karmen Vortex			
Rated flow range (L/min)		0.5 to 4	2 to 16	5 to 40	10 to 100
Fluid temperature		0 to 50 °C			
Linearity		±5% F.S. or less			±3% F.S. or less
Repeatability		±2% F.S. or less			±1% F.S. or less
Temperature characteristics		±2% F.S. max. (15 to 35 °C, 25°C reference) ±3% F.S. max. (0 to 50 °C, 25°C reference)			
Pressure	Operating pressure range	0 to 1 MPa			
	Proof pressure	1.5 MPa			
Sensor output		Nch open drain output for PF2W3## display (10 mA load current, 30 V max. voltage)			
Analogue output	Voltage output		1 to 5 V		
	Linearity		±5% F.S. max.		
	Load impedance		100 kΩ		
	Current output		4 to 20 mA		
	Linearity		±5% F.S. max.		
	Load impedance		300 Ω max. (at 12 V) 600 Ω max. (at 24 V)		
Supply voltage		12 to 24 VDC ±10%			
Power consumption		20 mA max. (no load)			
Port size (Rc,NPT,G)		3/8	3/8, 1/2	1/2, 3/4	3/4, 1
Weight		410 g	470 g	650 g	1.1 kg

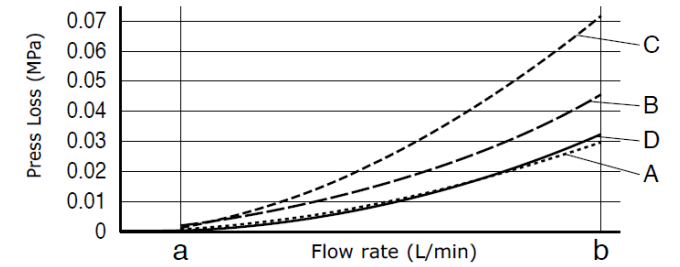
2.6 PF2W5##T specifications (for High Temperature Fluid)

Model		PF2W504T	PF2W520T	PF2W540T
Applicable fluid		Water, or mixture of 50% water and 50% ethylene glycol		
Detection method		Karmen Vortex		
Rated flow range (L/min)		0.5 to 4	2 to 16	5 to 40
Fluid temperature		0 to 90 °C (no cavitation)		
Linearity		±5% F.S. or less		
Repeatability		±2% F.S. or less		
Temperature characteristics		±5% F.S. max. (0 to 90 °C, 25°C reference)		
Pressure	Operating pressure range	0 to 1 MPa		
	Proof pressure	1.5 MPa		
Sensor output		Nch open drain output for PF2W3## display (10 mA load current, 30 V max. voltage)		
Analogue output	Voltage output		1 to 5 V	
	Linearity		±5% F.S. max.	
	Load impedance		100 kΩ	
	Current output		4 to 20 mA	
	Linearity		±5% F.S. max.	
	Load impedance		300 Ω max. (at 12 V) 600 Ω max. (at 24 V)	
Supply voltage		12 to 24 VDC ±10%		
Power consumption		20 mA max. (no load)		
Port size (Rc,NPT,G)		3/8	3/8, 1/2	1/2, 3/4
Weight		410 g	470 g	650 g

2 Specifications (continued)

2.7 Flow characteristics (Pressure loss)

PF2W5##(T) for Water / Fluid



Model	Graph	a (L/min)	b (L/min)
PF2W504 / 504T	A	0.5	4
PF2W520 / 520T	B	2	16
PF2W540 / 540T	C	5	40
PF2W511	D	10	100

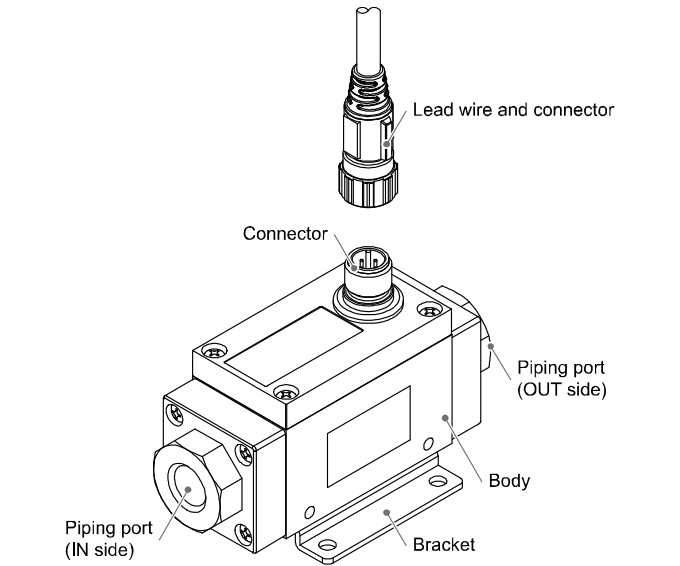
2.8 Cable specifications

Conductor	Nominal cross section	AWG23
	Individual wire diameter	approx. 0.72 mm
Insulator	Outside diameter	approx. 1.14 mm
	Colours	Brown, White, Black, Blue
Sheath	Material	oil resistant PVC
	Outer diameter	approx. φ4 mm

Warning

- Special products (-X) might have specifications different from those shown in this section. Contact SMC for specific drawings.

3 Name and function of parts



Item	Description
Lead wire and connector	Lead wire to supply power and transmit output signals.
Connector	Connector for electrical connections.
Piping port	Connected to the fluid inlet at IN and to the fluid outlet at OUT.
Bracket	Bracket for mounting the product.
Body	The body of the product.

4 Installation

4.1 Installation

Warning

- Do not install the product unless the safety instructions have been read and understood.
- Use the product within the specified operating rated flow, operating pressure and temperature range.
- Tighten to the specified tightening torque.
If the tightening torque is exceeded the mounting screws, brackets and the product can be broken. Insufficient torque can cause displacement of the product from its correct position.
- Do not drop, hit or apply excessive shock to the product.

4.2 Environment

Warning

- Do not use in an environment where corrosive gases, chemicals, salt water or steam are present.
- Do not use in an explosive atmosphere.
- Do not expose to direct sunlight. Use a suitable protective cover.
- Do not install in a location subject to vibration or impact in excess of the product's specifications.
- Do not mount in a location exposed to radiant heat that would result in temperatures in excess of the product's specifications.

4.3 Mounting

- Never mount the product in a location that will be used as a foothold.
- Mount the product so that the fluid flows in the direction indicated by the arrow on the body.

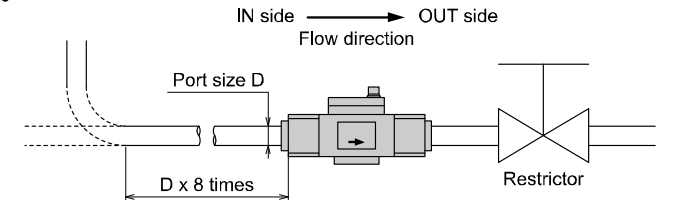
4.3.1 Bracket mounting

- Mount the bracket (Part No. ZS-29-T) on to the product using the mounting screws supplied.
- The required tightening torque is 0.5 ±0.05 N•m.
- Install the product (with bracket) using M4 screws (4 pcs.).
- Bracket thickness is approximately 1.6 mm.

Refer to the operation manual on the SMC website (URL: <https://www.smcworld.com>) for mounting hole dimensions.

4.4 Piping

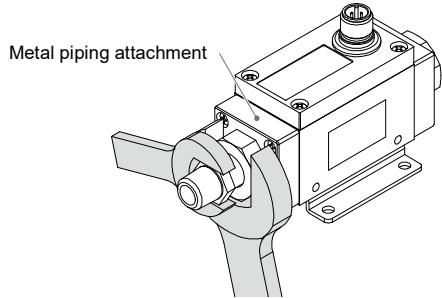
- Connect the piping to the fittings.
- Mount the product so that the fluid direction is the same as the arrow indicated on the product.
- Never mount the product upside down.
- The piping on the IN side must have a straight section of piping whose length is 8 times the piping diameter or more.
- Avoid sudden changes in the piping size on the IN side of the product.
-



Caution

- Before connecting piping make sure to clean up chips, cutting oil, dust etc.
- When installing piping or fittings, ensure sealant material (tape) does not enter inside the port.
- When connecting the piping, hold the metal piping attachment of the body with a spanner. Using a spanner on other parts may damage the product.
- The required tightening torque of the fittings is given in the table below. If the tightening torque is exceeded, the product can be damaged. If the correct tightening torque is not applied, the fittings may become loose.
- Ensure there is no leakage after piping.

4 Installation (continued)



Nominal Thread size	Tightening torque
Rc (NPT) 1/8, G1/8	7 to 9 N•m
Rc (NPT) 1/4, G1/4	12 to 14 N•m
Rc (NPT) 3/8, G3/8	22 to 24 N•m
Rc (NPT) 1/2, G1/2	28 to 30 N•m

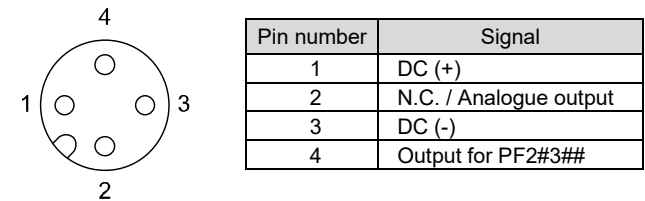
5 Wiring

5.1 Wiring

Caution

- Wiring should only be performed with the power supply turned OFF.
- Confirm proper insulation of wiring.
- Use separate routes for the product wiring and any power or high voltage wiring. Otherwise, malfunction may result due to noise.
- Keep wiring as short as possible to prevent interference from electromagnetic noise and surge voltage.
- Ensure that the FG terminal is connected to ground when using a commercially available switch-mode power supply. Switching noise will be superimposed and the product specification can no longer be met. This can be prevented by inserting a noise filter, such as a line noise filter and ferrite core, between the switch-mode power supply and the product, or by using a series power supply instead of a switch-mode power supply.

5.1.1 M12 Connector Pin numbers (on the product)

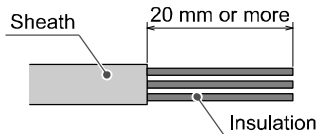


5.1.2 Connecting

- Align the lead wire M12 connector with the connector key groove and insert vertically.
- Connection is complete when the knurled part is fully tightened. Check that the connection is not loose.

5.1.3 Sensor Connector

- Strip the lead wire as shown. Do not cut the insulator.

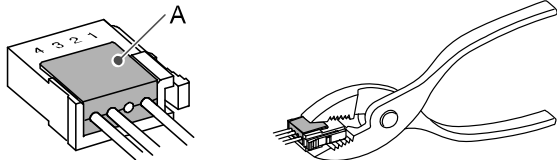


- Insert the corresponding wire colour into the pin number printed on the e-CON sensor connector (SMC Part number ZS-28-CA-4) to the bottom.

Pin number	Wire colour	Signal
1	Brown	DC (+)
2	-	N.C.
3	Blue	DC (-)
4	Black	IN: 1 to 5 VDC

5 Wiring (continued)

- Check that the above preparation has been performed correctly, then part A shown should be pressed in by hand to make temporary connection.



- Part A should then be pressed in using a suitable tool, such as pliers.
- The connector cannot be re-used once it has been fully crimped.
- In case of connection failure such as incorrect order of wires or incomplete insertion, use a new e-CON connector.

6 How to Order

Refer to the operation manual or catalogue on the SMC website (URL: <https://www.smcworld.com>) for How to order information.

7 Outline Dimensions (mm)

Refer to the operation manual or catalogue on the SMC website (URL: <https://www.smcworld.com>) for Outline Dimensions.

8 Maintenance

8.1 General Maintenance

Caution

- Not following proper maintenance procedures could cause the product to malfunction and lead to equipment damage.
 - If handled improperly, compressed air can be dangerous.
 - Maintenance of pneumatic systems should be performed only by qualified personnel.
-
- Before performing maintenance, turn off the power supply and be sure to cut off the supply pressure. Confirm that the air is released to atmosphere.
 - After installation and maintenance, apply operating pressure and power to the equipment and perform appropriate functional and leakage tests to make sure the equipment is installed correctly.
 - If any electrical connections are disturbed during maintenance, ensure they are reconnected correctly and safety checks are carried out as required to ensure continued compliance with applicable national regulations.
 - Do not make any modification to the product.
 - Do not disassemble the product, unless required by installation or maintenance instructions.
-
- How to reset the product after a power cut or when the power has been unexpectedly removed**
The settings of the product are retained from before the power cut or de-energizing.
The output condition also recovers to that before the power cut or de-energizing, but may change depending on the operating environment. Therefore, check the safety of the whole system before operating the product.

9 Limitations of Use

9.1 Limited warranty and Disclaimer/Compliance Requirements

Refer to Handling Precautions for SMC Products.

10 Product disposal

This product should not be disposed of as municipal waste. Check your local regulations and guidelines to dispose of this product correctly, in order to reduce the impact on human health and the environment.

11 Contacts

Refer to www.smcworld.com or www.smc.eu for your local distributor / importer.

SMC Corporation

URL: <https://www.smcworld.com> (Global) <https://www.smceu.com> (Europe)
SMC Corporation, 4-14-1, Sotokanda, Chiyoda-ku, Tokyo 101-0021, Japan
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