



Instruction Manual

Digital Flow Switch – Integrated display
PFMB7501 / PFMB7102 / PFMB7202



The intended use of the digital flow switch is to monitor and display flow information 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)⁽¹⁾, and other safety regulations.

- ⁽¹⁾ 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

Models	PFMB7501	PFMB7102	PFMB7202		
Applicable fluid	Air, N ₂ (Air quality: ISO8573-1 1.1.2 to 1.6.2)				
Operating fluid temperature	0 to 50 °C				
Flow	Detection method	Heating sensor			
	Rated flow range	5 to 500 L/min	10 to 1000 L/min	20 to 2000 L/min	
	Set flow rate range	Instantaneous flow	5 to 525 L/min	10 to 1050 L/min	20 to 2100 L/min
		Accumulated flow	0 to 999,999,990 L		
	Min. setting unit	Instantaneous flow	1 L/min		
		Accumulated flow	10 L		
	Accumulated volume per pulse (Pulse width = 50 ms)	1 L/pulse	10 L/pulse		
Accumulated value hold	2 or 5 minutes				
Pressure	Rated pressure range	0 to 0.8 MPa			
	Proof pressure	1.2 MPa			
	Pressure loss	Refer to the pressure loss graph			
	Pressure Characteristics	±5% F.S. (0 to 0.8 MPa, 0.6 MPa standard)			
Electrical	Power supply voltage	12 to 24 VDC ±10% Ripple (p-p) 10% or less			
	Current consumption	55 mA or less			
	Protection	Polarity protection			
Accuracy	Display accuracy	±3% F.S.			
	Analogue output accuracy	±3% F.S.			
	Repeatability	±1% F.S. (±2% F.S. when response time is set to 0.05 sec)			
	Temperature characteristics	±5% F.S. (0 to 50°C, 25°C standard)			
Switch output	Output type	NPN or PNP open collector output			
	Output mode	Select from Hysteresis mode, Window comparator mode, Accumulated output mode, Accumulated pulse output mode.			
	Switch operation	Normal or reversed output			
	Maximum load current	80 mA			
	Maximum applied voltage	28 VDC (NPN output)			
	Internal voltage drop (Residual voltage)	NPN output: 1.0 V or less (at 80 mA) PNP output: 1.5 V or less (at 80 mA)			
	Digital filter	0.05 s / 0.1 s / 0.5 s / 1.0 s / 2.0 s			
	Hysteresis	Variable			
	Protection	Short circuit protection			
	Output type	Voltage output: 1 to 5 V, Current output: 4 to 20 mA (refer to analogue output graph)			
Analogue Output	Impedance	Voltage output	Output impedance approx. 1 kΩ		
		Current output	Max. load impedance: 600 Ω at 24 VDC 300 Ω at 12 VDC Min. load impedance: 50 Ω		
	Response time	Linked to the response time of the switch output			
External Input specification	Input voltage: 0.4 V or less (reed or solid state), Input time: 30 msec. minimum				
External Input mode	Accumulated flow external reset or peak/bottom hold value				

2 Specifications (continued)

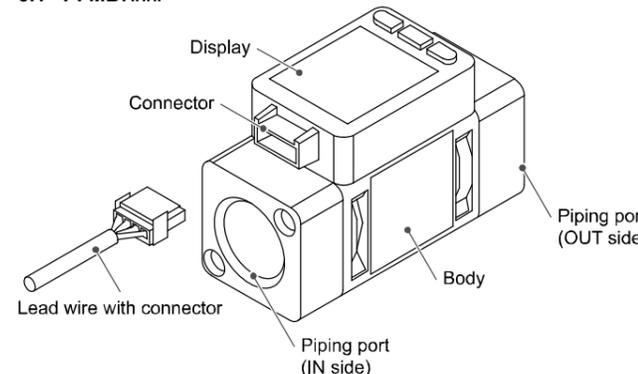
Models	PFMB7501	PFMB7102	PFMB7202	
Display	Reference condition	Normal or Standard condition		
	Units	Instantaneous	L/min, cfm	
		Accumulated	L, ft ³	
	Display	4 digits, 7 segment, dual colour LCD display (red/green)		
Indicator LED	LED is ON when switch output is ON (OUT1/OUT2: Orange)			
Environmental	Protection	IP40		
	Withstand voltage	1000 V AC for 1 minute between live parts and housing		
	Insulation resistance	50 MΩ between live parts and housing (with 50 VDC megger)		
	Operating temperature range	Operation: 0 to 50 °C, Storage: -10 to 60 °C (no condensation or freezing)		
	Operating humidity range	Operation, Storage: 35 to 85%RH (no condensation)		
Piping port size	Rc1/2, NPT1/2, G1/2	Rc3/4, NPT3/4, G3/4		
Fluid contact materials	ADC, PPS, SUS304, gold, HNBR, silicone, Glass-cloth epoxy resin			
Weight	All port sizes	100 g	155 g	
	Lead wire	+35 g		
	Bracket	+25 g	+30 g	

Warning

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

3 Names of Individual parts

3.1 PFMB7###

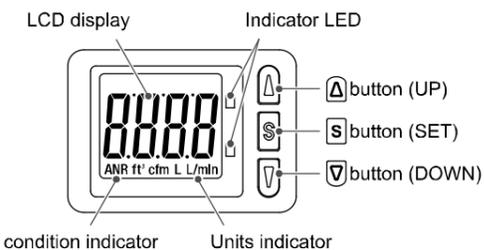


Element	Description
Display	See below
Connector	Connector for electrical connections.
Lead wire with connector	Lead wire for power supply and output signals.
Piping port	Port to connect the fluid inlet at IN and fluid outlet at OUT.
Body	Body of the product.

*: A protective tape is affixed to the display. Please remove it before use.

3 Names of Individual parts (continued)

3.2 Display



Element	Description
LCD display	Displays the flow, the setting mode and error codes.
Indicator LED	Displays the output status of OUT1 and OUT2. LED is ON (Orange) when the output is ON. When the accumulated pulse output mode is selected, the LED will turn OFF.
Units indicator	Displays the unit selected.
UP button	Selects the mode and increases the ON/OFF set value. Press this button to change to the peak display mode.
SET button	Press this button to select the mode and to confirm a set value.
DOWN button	Selects the mode and decreases the ON/OFF set value. Press this button to change to the bottom display mode.

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 pressure and temperature range.

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.

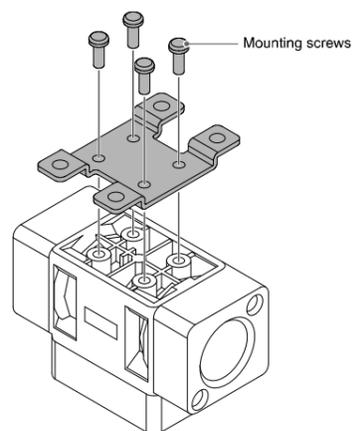
4.3 Mounting

- Never mount the product in a location where it will be used as a mechanical support.
- Mount the product so that the fluid flows in the direction indicated by the arrow on the side of the body.
- Never mount the product upside down.

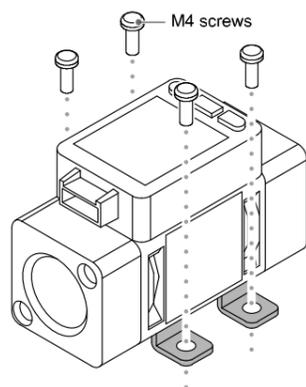
4 Installation (continued)

Bracket mounting

- Mount the bracket to the product using the mounting screws (4 pcs.).
- Fasten the bracket mounting screws to a torque of 0.5 to 0.7 N•m.
- Self tapping screws are used and should not be re-used several times.

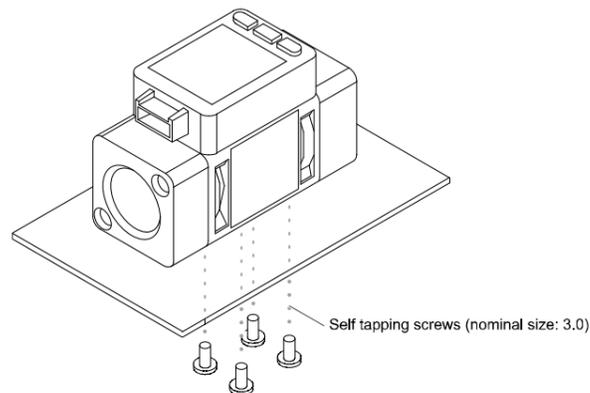


- Mount the product with bracket using M4 screws (4 pcs.) or equivalent. The screws should be prepared by the user.



Direct mounting

- For direct mounting use self-tapping screws (nominal size 3.0 x 4 pcs.).
- The screws should be prepared by the user.
- Tightening torque for the fixing screws is 0.5 to 0.7 N•m.
- Self tapping screws are used and should not be re-used several times.



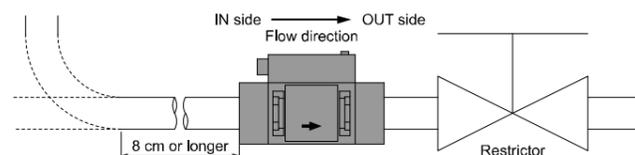
Refer to the operation manual on the SMC website (URL: <https://www.smcworld.com>) for mounting hole details and outline dimensions.

4 Installation (continued)

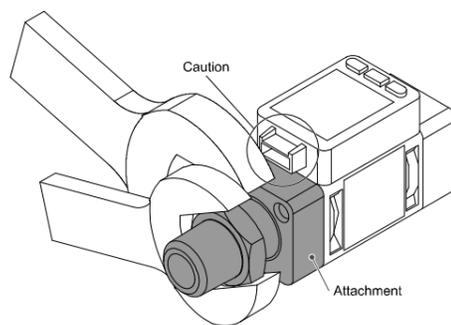
4.4 Piping

Caution

- Before connecting piping make sure to clean up chips, cutting oil, dust etc.
- When installing piping or fittings, ensure sealant material does not enter inside the port.
- The piping on the IN side must have a straight section of piping length of 8 cm minimum. If a straight section of piping is not installed, the accuracy will vary by approximately $\pm 2\%$ F.S. Refer to the straight inlet piping length and accuracy graph in the operation manual.
- Avoid sudden changes to the piping size on the IN side of the product.
- Do not release the OUT side piping port of the product directly to the atmosphere without connecting piping. The accuracy may vary.



- Use the correct tightening torque for piping. (Refer to the table below for the required torque values).
- If the tightening torque is exceeded, the product can be damaged. If the tightening torque is insufficient, the fittings may become loose.
- Use a suitable spanner for the appropriate torque. Do not use a spanner 40 cm or longer.
- Ensure there is no leakage after piping.
- When mounting the fitting, a spanner should be used on the metal part (attachment) of the fitting only. Holding other parts of the product with a spanner may damage the product. Specifically, make sure that the spanner does not damage the connector.



Nominal thread size	Required torque	Width across flats
Rc1/2, NPT1/2	20 to 25 N•m	30 mm
Rc3/4, NPT3/4	28 to 30 N•m	35 mm

4.5 Piping with One-touch fitting

- For the one-touch fitting, use tubing with a tube inside diameter of 9 mm minimum. Accuracy can vary approximately $\pm 2\%$ F.S. if such tubing is not used.

4 Installation (continued)

4.6 Wiring

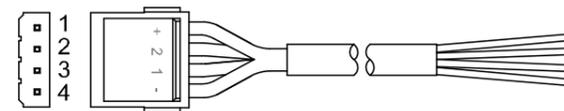
Caution

- Do not perform wiring while the power is on.
- Confirm proper insulation of wiring.
- Do not route wires and cables together with power or high voltage cables. The product can malfunction due to interference of noise and surge voltage from power and high voltage cables. Route the wires of the product separately from power or high voltage cables.
- Keep wiring as short as possible to prevent interference from electromagnetic noise and surge voltage. Do not use a cable longer than 20 m.
- Ensure that the FG terminal is connected to ground when using a commercially available switch-mode power supply.

Connecting / Disconnecting

- When mounting the connector, insert it straight into the socket, holding the lever and connector body, and push the connector until the lever hooks into the housing, and locks.
- When removing the connector, press down the lever to release the hook from the housing and pull the connector straight out.

Connector pin numbers (lead wire)



No.	Name	Wire colour	Function
1	DC(+)	Brown	12 to 24 VDC
2	OUT2	White	Analogue output / External input
3	OUT1	Black	Switch output
4	DC(-)	Blue	0 V

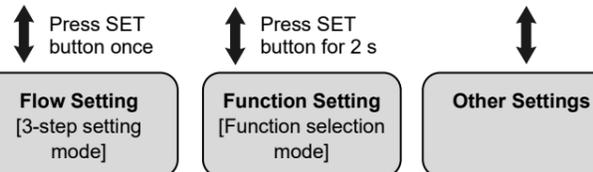
5 Outline of Settings [Measurement mode]

Power is supplied

The output will not operate for 3 seconds after supplying power. The identification code of the product is displayed.

[Measurement mode]

Measurement mode is the condition where the flow is detected and displayed, and the switch function is operating. This is the basic mode; other modes should be selected for set-point changes and other function settings.



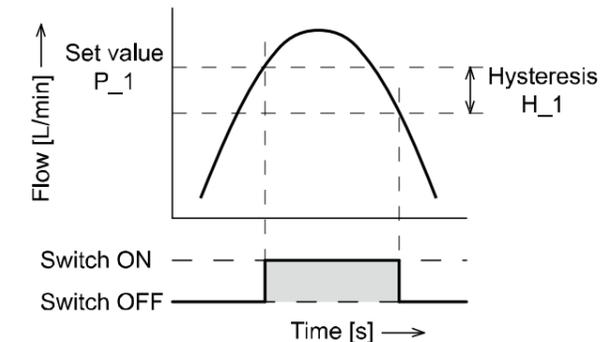
- The outputs will continue to operate during setting.
- If a button operation is not performed for 30 seconds during the setting, the display will flash. (This is to prevent the setting from remaining incomplete if, for instance, an operator were to leave during setting).
- The 3-step setting mode and function selection mode are reflected on each other.

6 Flow Setting

6.1 Switch operation

When the flow exceeds the set value [P_1], the switch will be turned ON. When the flow falls below the set value by the amount of hysteresis [H_1] or more, the switch will be turned OFF.

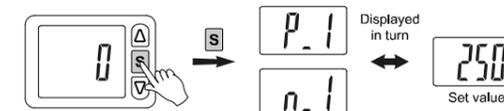
If the operation shown below is acceptable, keep this setting.



7 3-step Setting mode

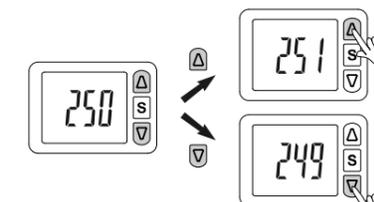
In this mode, only the set values can be input, in just 3 steps. Use this mode if the product is to be used straight away, after changing only the set values.

1. Press the SET button once in measurement mode. [P_1] or [n_1] and [the current set value] are displayed in turn.



2. Press the UP or DOWN button to change the set value. The UP button is to increase and the DOWN button is to decrease.

- Press the UP button once to increase by one digit or press and hold to continuously increase.



- Press the DOWN button once to decrease by one digit or press and hold to continuously decrease.

3. Press the SET button to finish the setting.

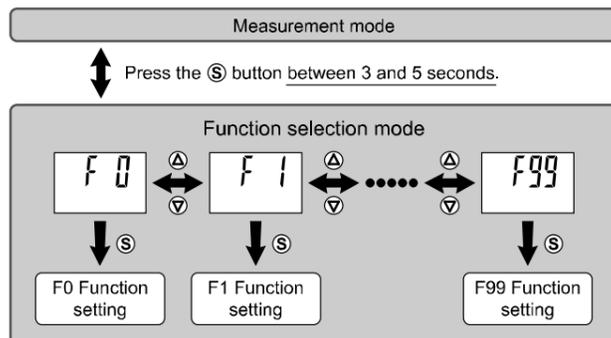
- For models with switch outputs for both OUT1 and OUT2, [P_2] or [n_2] will be displayed too. Set as above.
- For setting hysteresis, repeat the settings referring to [F 1] Setting of OUT1 and [F 2] Setting of OUT2.
- Note that the set value and hysteresis are limited by each other.
- For detailed settings, set each function in function selection mode.

8 Function Settings

8.1 Function selection mode

In this mode, each function setting can be changed separately. In measurement mode, press the SET button for 2 seconds or longer to display [F 0].

Press the UP or DOWN button to select the function to be changed.



Press and hold the SET button for 2 seconds or longer in function selection mode to return to measurement mode.

8.2 Default function settings

Function	Default Setting
[F 0]	[rEF] Reference condition [Anr] Standard condition
	[Uni] Units selection [L] L/min
[F 1]	[oU1] Output mode [HYS] Hysteresis mode
OUT1	[1o] Switch operation [1 P] Normal output
	[P 1] Set value 50% of maximum rated flow
	[H 1] Hysteresis 5% of maximum rated flow
	[CoL] Display colour [SoG] ON: Green OFF: Red (OUT1)
[F 2]	[oU2] Output mode [HYS] Hysteresis mode
OUT2	[2ot] Switch mode [2 P] Normal output
	[P 2] Set value 50% of maximum rated flow
	[H 2] Hysteresis 5% of maximum rated flow
[F 3]	[rES] Digital filter [1.00] 1.0 second
[F10]	[FLo] Display mode [inS] Instantaneous flow
[F13]	[rEv] Reversed display [oFF] Not reversed
[F20]	[inP] External input [rAC] Accumulated reset
[F22]	[FrE] Analogue output [oFF] Variable range OFF
[F30]	[SAv] Accumulated value hold [oFF] Not held
[F31]	[PoS] Orientation [Hor] Horizontal mounting
	[PrS] Supply pressure [Mid] 0.4 MPA minimum, 0.6 MPA maximum.
[F80]	[dSP] Display OFF mode [on] Display ON
[F81]	[Pin] Security code [oFF] Not used
[F90]	[ALL] Setting of all functions [oFF] Not used
[F98]	[tES] Output check [oFF] Normal output
[F99]	[ini] Reset to default settings [oFF] Reset OFF

9 Other Settings

- Peak / Bottom value display
- Reset function
- Key-lock function

Refer to the operation manual on the SMC website (URL: <https://www.smcworld.com>) for setting of other functions.

10 Troubleshooting

10.1 Error indication

Error name	Error display	Description	Measures
OUT1 over current error	Er 1	Load current on the switch output (OUT1) has exceeded 80 mA.	Turn the power off and remove the cause of the over current. Then supply the power again.
OUT2 over current error	Er 2	Load current on the switch output (OUT2) has exceeded 80 mA.	Turn the power off and remove the cause of the over current. Then supply the power again.
Instantaneous flow error	HHH	Flow has exceeded the upper limit of the flow display range.	Reduce the flow.
	LLL	Flow is in the reverse direction by at least -5% of the max. rated flow.	Connect the fluid flow in the correct direction.
Accumulated flow error	999	The accumulated flow range has been exceeded (for accumulated increment).	Reset the accumulated flow once. (press the UP and DOWN button for 1 second or longer).
	0	The accumulated flow has reached the set accumulated flow value (for accumulated increment).	
System error	Er 0 Er 4 Er 6 Er 8	An internal data error has occurred.	Turn the power off and on again. If the failure cannot be solved, contact SMC.

If the error cannot be reset after the above measures are taken, or errors other than the above are displayed, please contact SMC.

Refer to the operation manual on the SMC website (URL: <https://www.smcworld.com>) for more detailed information about troubleshooting.

11 How to Order

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

12 Outline Dimensions (mm)

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

13 Maintenance

13.1 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.

14 Limitations of Use

14.1 Limited warranty and Disclaimer/Compliance Requirements

Refer to Handling Precautions for SMC Products.

15 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.

16 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.smc.eu> (Europe)
SMC Corporation, 4-14-1, Sotokanda, Chiyoda-ku, Tokyo 101-0021, Japan
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