Before Use

Digital Flow Switch

PFMB7201/7501/7102/7202

Thank you for purchasing an SMC PFMB7 series Digital Flow Switch.
Please read this manual carefully before operating the product and make sure you understand its capabilities and limitations. Please keep this manual handy for future reference.

To obtain the operation manual about this product and control unit, please refer to the SMC website (URL http://www.smcworld.com) or contact SMC directly.

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.

⚠ **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.

Operator

- The operation manual is intended for those who have knowledge of machinery using pneumatic equipment, and have sufficient knowledge of assembly, operation and maintenance of such equipment. Only those persons are allowed to perform assembly, operation and maintenance.
- Read and understand the operation manual carefully before assembling, operating or providing maintenance to the product.

■Safety Instructions

⚠ Warning

■Do not disassemble, modify (including changing the printed circuit board) or repair.
An injury or failure can result.

■Do not operate the product outside of the specifications.
Do not use for flammable or harmful fluids.
Fire, malfunction or damage to the product can result.
Verify the specifications before use.

■Do not operate in an atmosphere containing flammable, explosive or corrosive gas.
Fire, explosionor corrosion can result.
This product is not designed to be explosion proof.

■Do not use the product for flammable fluid.
Fire or explosion can result.
Only air, N_2, are applicable.

■Do not use the product in a place where static electricity is a problem.
Otherwise it can cause failure or malfunction of the system.

■If using the product in an interlocking circuit:
•Provide a double interlocking system, for example a mechanical system
•Check the product regularly for proper operation
Otherwise malfunction can result, causing an accident.

■The following instructions must be followed during maintenance:
•Turn off the power supply
•Stop the air supply, exhaust the residual pressure and verify that the air is released before performing maintenance work
Otherwise an injury can result.

⚠ Caution

■Do not touch the terminals and connectors while the power is on.
Otherwise electric shock, malfunction or damage to the product can result.

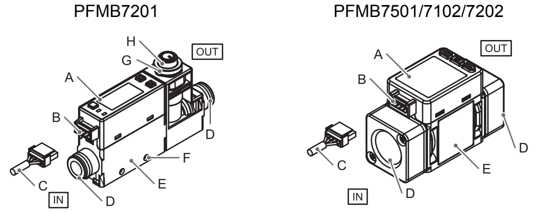
■After maintenance is complete, perform appropriate functional inspections and leak tests.
Stop operation if the equipment does not function properly or there is a leakage of fluid.
When leakage occurs from parts other than the piping, the product might be faulty.
Disconnect the power supply and stop the fluid supply.
Do not apply fluid under leaking conditions.
Safety cannot be assured in the case of unexpected malfunction.

■NOTE

- The direct current power supply used should be UL approved as follows. Circuit (class 2) of maximum 30 Vrms (42.4 V peak) or less, with UL 1310 class 2 power supply unit or UL 1585 class 2 transformer.
- The product is a UL approved product only if it has a c UL us mark on the body.

Summary of Product parts

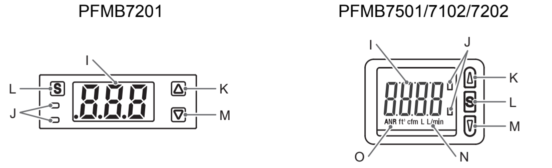
Body



Symbol	Name	Description
A	Display	See below.
B	Connector	Connector for electrical connections.
C	Lead wire with connector	Lead wire for power supply and outputs.
D	Piping port	For piping connections. Connected to the fluid inlet at IN and to the fluid outlet at OUT.
E	Body	The body of the product.
F	Through hole	Used to mount the product on a DIN rail or directly to a panel.
G	Lock ring ∗	Used to lock the flow adjustment valve.
H	Flow adjustment valve ∗	Orifice mechanism to adjust the flow rate.

∗: The table lists the parts when a flow adjusting valve is included.

Display



Symbol	Name	Description
I	LED display	Displays the flow, the status of setting mode and error indication. (2–colour display)
J	Indicator LED	Displays the output status of OUT1 and OUT2. When the accumulated pulse output mode is selected, the LED will turn OFF. LED is ON when the output is ON.
K	UP (△) button ∗	Selects the mode and increases the ON/OFF set value.
L	SET (S) button	Press this button to change the mode and to set a value.
M	DOWN (▽) button ∗	Selects the mode and decreases the ON/OFF set value.
N	Unit display	Indicates the unit currently selected.
O	Reference condition indicator	Indicates the reference condition selected. LED is ON (red) when standard condition is selected.

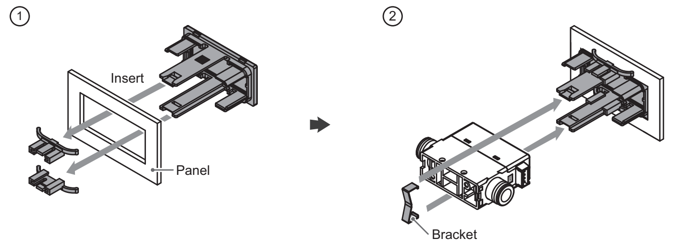
∗: When the reversed display is used, the function of the △ and ▽ buttons is reversed.

Mounting and Installation

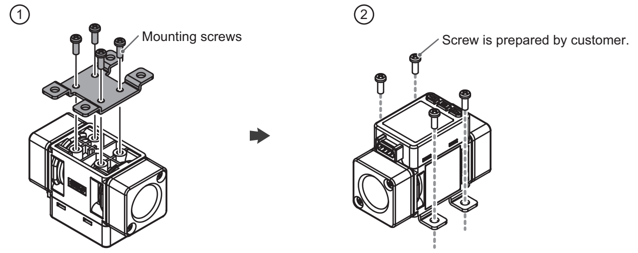
Mounting
•Never mount the product in a place where it will be used as a mechanical support.
•Mount the product so that the fluid flows in the direction indicated by the arrow on the side of the body.

■Installation

Panel mounting (Only PFMB7201)
•Refer to the diagram and table below for mounting details.
•Refer to the dimension from SMC website (URL http://www.smcworld.com) for panel thickness and panel mount cut–out dimensions.

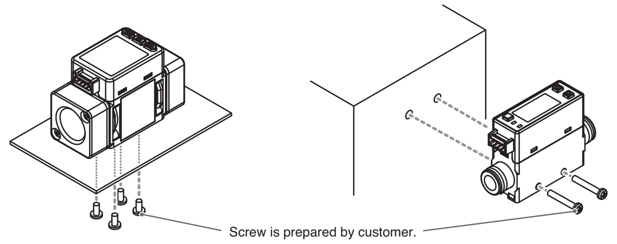


Bracket mounting
•Refer to the diagram and table below for mounting details.
•Refer to the dimension from SMC website (URL http://www.smcworld.com) for bracket thickness and mounting hole dimensions.



Model	Mounting bracket		Mounting to equipment
	Mounting screws	Tightening torque	Screw
PFMB7201	Accessory	0.45 to 0.55 Nm	M3 screws (4 pcs.)
PFMB7501		0.5 to 0.7 Nm	M4 screws (4 pcs.)
PFMB7102			
PFMB7102			

Direct mounting
•Refer to the diagram and table below for mounting details.
•Refer to the dimension from SMC website (URL http://www.smcworld.com) for mounting hole size.

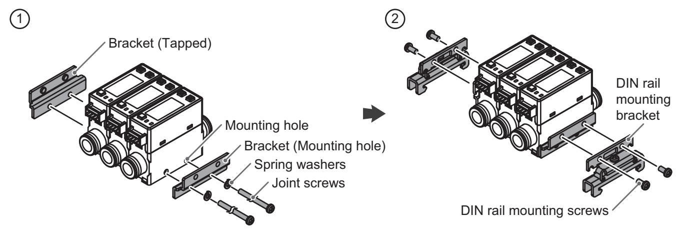


Model	Direct mounting	
	Screw	Tightening torque
PFMB7501	Self tapping screws (Nominal size: 3.0 x 4 pcs.)	0.5 to 0.7 Nm
PFMB7102		
PFMB7102		

Model	Direct mounting	
	Screw	Tightening torque
PFMB7201	M3 screws (2 pcs.)	0.35 to 0.45 Nm

DIN rail mounting (Only PFMB7201)
•Refer to the diagram and table below for mounting details.

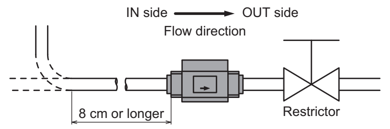
·DIN rail is prepared by customer.
·DIN rail is not suitable for port size F02 (G1/4).



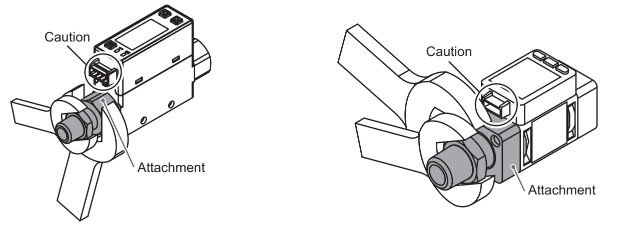
Model	Bracket		DIN rail mounting bracket	
	Screw	Tightening torque	Screw	Tightening torque
PFMB7201	Joint screws	0.35 to 0.45 Nm	DIN rail mounting screws	0.35 to 0.45 Nm

■Piping

•Never mount the product upside down.
•The straight piping length shall be 8 cm or longer.
Otherwise, if a straight section of piping is not installed, the accuracy varies by approximately ±2%F.S.
•Avoid sudden changes in 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 the piping connected.
If the product is used with the piping port released to atmosphere, the accuracy may vary.



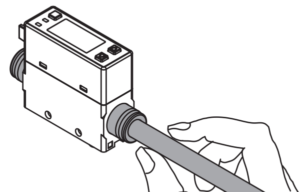
Piping for the metal attachment
•Tighten to the specified torque. Refer to the table below for the required torque values.
•Use a suitable spanner for the appropriate torque. Do not use a spanner 40 cm or longer.
•If the tightening torque is exceeded, the product can be broken.
If the tightening torque is insufficient, the fitting may become loose.
•Avoid any sealing tape getting inside the flow path.
•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.



Model	Required torque
PFMB7201	12 to 14 Nm
PFMB7501	28 to 30 Nm
PFMB7102	
PFMB7202	

Model	Nominal thread size	Width across flats of attachment
PFMB7201	Rc1/4, NPT1/4	17 mm
	G1/4	21 mm
PFMB7501	1/2	30 mm
PFMB7102		
PFMB7202	3/4	35 mm

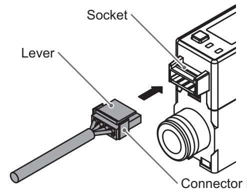
Piping for the One–touch fitting
•Insert the tube all the way into the fitting so that it cannot be pulled out.
•Insertion with excessive force can cause damage.
•Ensure there is no leakage after piping.
•Use the product within the specified operating pressure and temperature range.



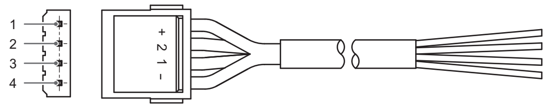
■Wiring

Connection
•Connections should only be made with the power supply turned off.
•Use a separate route for the product wiring and any power or high voltage wiring. Otherwise, malfunction may result due to noise.
•Ensure that the FG terminal is connected to ground when using a commercially available switch–mode power supply. When a switch–mode power supply is connected to the product, 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.

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)



Connector pin numbers	Wire colour	Description
1	Brown	DC(+)
2	White	OUT2/Analogue output/External input
3	Black	OUT1
4	Blue	DC(–)

Outline of settings

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.

Press the S button once.	Press the S button for 2 seconds or longer.	
Flow setting (3 step setting mode)	**Function setting (Function selection mode)**	**Other functions**

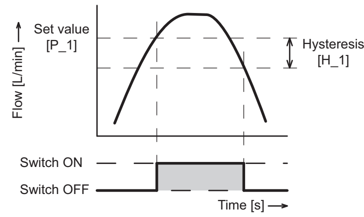
∗: The outputs will continue to operate during setting.
∗: If a button operation is not performed for 30 seconds during the setting, the display will flash.
(This is to prevent the setting from remaining incomplete if, for instance, an operator were to leave during setting)
∗: 3 step setting mode and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

Flow Setting (set value only) of OUT1 · OUT2

■3 step setting mode

In this mode, only the set values can be input, in just 3 steps.

●Default settings
The default settings are shown below.
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 turn OFF.
If the operation shown in the diagram below is acceptable, then keep these settings.
For more detailed settings, set each function in the function selection mode.

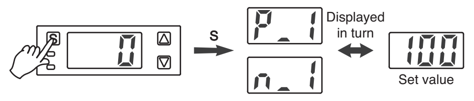


Item	PFMB7201	PFMB7501	PFMB7102	PFMB7202
[P_1] Set value of OUT1	100	250	500	1000
[H_1] Hysteresis of OUT1	10	25	50	100
[P_2] Set value of OUT2 ∗	100	250	500	1000
[H_2] Hysteresis of OUT2 ∗	10	25	50	100

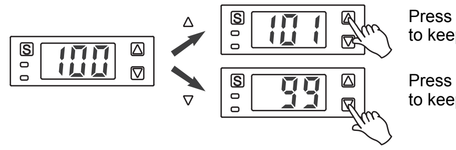
∗: Only available for models with switch outputs for both OUT1 and OUT2. [L/min]

<Operation> (The illustration shows PFMB7201, when not using the reversed display function.)

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



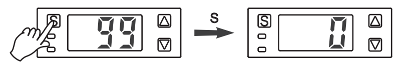
② Press the △ or ▽ button to change the set value.
The △ button is to increase and the ▽ button is to decrease the set value.



Press the △ button continuously to keep increasing the set value.

Press the ▽ button continuously to keep decreasing the set value.

③ Press the S button to complete the setting.
Return to measurement mode.

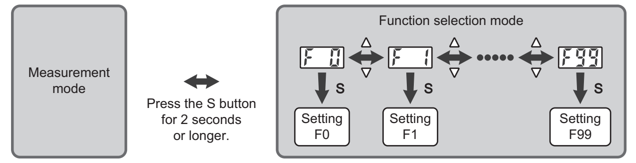


∗: For models with switch outputs for both OUT1 and OUT2, [P_2] or [n_2] will be displayed too.
Set as above.
∗: If a mode other than Hysteresis Mode is selected, refer to the operation manual from SMC website (URL http://www.smcworld.com) or contact SMC.
∗: Note that the set value and hysteresis settings are limited by each other.

Function Setting

■Function selection mode

In measurement mode, press the S button for 2 seconds or longer, to display [F 0].
The [F□□] indicates the mode for changing each Function Setting.
Press the S button for 2 seconds or longer in function selection mode to return to measurement mode.



To change setting, refer to the operation manual from SMC website (URL http://www.smcworld.com) or contact SMC.

■Default settings

Item		Default setting
[F 0]	[r EF] Reference condition	[Anr] Standard condition
	[Un i] Unit selection function ∗1	[L] L/min
[F 1]	[oU1] Output mode of OUT1	[HYS] Hysteresis mode
	[1ot] Switch operation of OUT1	[1_P] Normal output
	[P_1] Set value of OUT1	[100] 100 L/min (PFMB7201)
		[250] 250 L/min (PFMB7501)
		[500] 500 L/min (PFMB7102)
		[1000] 1000 L/min (PFMB7202)
	[H_1] Hysteresis of OUT1	[10] 10 L/min (PFMB7201)
		[25] 25 L/min (PFMB7501)
		[50] 50 L/min (PFMB7102)
		[100] 100 L/min (PFMB7202)
	[CoL] Display colour of OUT1	[SoG] Green when ON, Red when OFF
[F 2]	[oU2] Output mode of OUT2 ∗2	[HYS] Hysteresis mode
	[2ot] Switch operation of OUT2 ∗2	[2_P] Normal output
	[P_2] Set value of OUT2 ∗2	[100] 100 L/min (PFMB7201)
		[250] 250 L/min (PFMB7501)
		[500] 500 L/min (PFMB7102)
		[1000] 1000 L/min (PFMB7202)
	[H_2] Hysteresis of OUT2 ∗2	[10] 10 L/min (PFMB7201)
		[25] 25 L/min (PFMB7501)
		[50] 50 L/min (PFMB7102)
		[100] 100 L/min (PFMB7202)
[F 3]	[r ES] Response time	[1.0] 1 second
[F10]	[FLo] Display mode	[inS] Display instantaneous flow
[F13]	[r Ev] Reversed display mode	[oFF] Unused
[F20]	[inP] External input ∗3	[r AC] Accumulated flow external reset
[F22]	[F rE] Setting of analogue output ∗4	[oFF] Variable range OFF
[F30]	[SAv] Accumulated value hold	[oFF] Not held
[F31]	[PoS] Orientation	[Hor] Horizontal mounting
	[Pr S] Supply pressure	[m id] 0.4 MPa minimum, 0.6 MPa maximum
[F80]	[dSP] Display OFF mode	[on] Display ON
[F81]	[P in] Security code	[oFF] Not used
[F90]	[ALL] Setting of all functions	[oFF] Not used
[F98]	[tESt] Output check	[n] Normal output
[F99]	[in i] Reset to the default settings	[oFF] Reset OFF

∗1: This setting is only available for models with the unit selection function.
∗2: This setting is only available for models with switch outputs for both OUT1 and OUT2.
∗3: This setting is only available for models with the external input.
∗4: This setting is only available for models with the analogue output.

Other Functions

○Peak/Bottom value display
The maximum (minimum) flow from when the power was supplied to this moment is detected and updated. In peak/bottom display mode, the maximum (minimum) flow is displayed
•For peak display, when the △ button is pressed for 1 second or longer, [the maximum flow] and [Hi] are displayed in turn.
To release holding the display of the maximum flow, press the △ button for 1 second or longer again to return to measurement mode.
•For bottom display, when the ▽ button is pressed for 1 second or longer, [the minimum flow] and [Lo] are displayed in turn.
To release holding the display of the minimum flow, press the ▽ button for 1 second or longer again to return to measurement mode.
If the △ and ▽ buttons are pressed simultaneously for 1 second or longer while the flow value is being held, the peak (bottom) values are reset.

○Reset operation
The accumulated flow value can be reset, when displaying the accumlated flow.
The reset the accumulated flow, press the △ and ▽ buttons simultaneously for 1 second or longer.
The peak/bottom value can be reset, when displaying the peak value (bottom value).
To reset the peak/bottom value, press the △ and ▽ buttons simultaneously for 1 second or longer.

○Key lock function
To use each of these functions, refer to the operation manual from SMC website (URL http://www.smcworld.com) or contact SMC.

Maintenance

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 power cut or de–energizing, but may change depending on the operating environment. Therefore, check the safety of the whole installation before operating the product.

Specifications / Dimensions

Refer to the product catalogue or operation manual from SMC website (URL http://www.smcworld.com) for more information about the product specifications and dimensions.

Troubleshooting

■Error indication

Error name	Error display	Description	Measures
Instantaneous flow error	HHH	The flow has exceeded the upper limit of the flow display range.	Reduce the flow.
	LLL	Fluid is flowing in the reverse direction by at least –5% of the maximum rated flow value.	Connect the fluid flow in the correct direction.
OUT1 over current error	Er 1	The switch output (OUT1) load current has exceeded 80 mA.	Turn the power OFF and remove the cause of the over current. Then turn the power ON again.
OUT2 over current error	Er 2	The switch output (OUT2) load current has exceeded 80 mA.	
System error	Er 0	An internal data error has occurred.	Turn the power OFF and turn it ON again.
	Er 4		
	Er 6		
	Er 8		
Accumulated flow error	999 Accumulated flow is displayed (Flashing)	The accumulated flow has exceeded the accumulated flow range. (For count up display)	Reset the accumulated flow. (Press the △ and ▽ buttons simultaneously for 1 second or longer)
	0 Accumulated flow is displayed (Flashing)	The accumulated flow has reached the set accumulated flow value. (For count down display)	

∗: If the error cannot be reset after the above measures are taken, then please contact SMC.

Refer to the operation manual from SMC website (URL http://www.smcworld.com) for more information about troubleshooting.

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