PF##-TF2Z079EN

ORIGINAL INSTRUCTIONS

Instruction Manual
Digital Flow Sensor – Remote Monitor
PFM3 series

The intended use of the remote flow monitor is to monitor and display flow information provided from a digital flow sensor.

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

2.1 General specifications

Item		Specifications
Environment	Enclosure	IP40
	Operating temperature	Operating: 0 to 50 °C; stored: -10 to 60 °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
Material		Front and rear case: PBT
Weight		30 g (without lead wire) 85 g (with lead wire)

2 Specifications (continued)

2.2 PFM3 specifications

Model			PFM3##			
Applicable sensor			PFM510	PFM525	PFM550	PFM511
Rated flow range (L/min)		Dry air, N_2, Ar	0.2 to 10	0.5 to 25	1 to 50	2 to 100
		CO_2	0.2 to 5	0.5 to 12.5	1 to 25	2 to 50
Instantaneous flow	Display flow range (L/min)	Dry air, N_2, Ar	0.2 to 10.5	0.5 to 26.3	1 to 52.5	2 to 105
		CO_2	0.2 to 5.2	0.5 to 13.1	1 to 26.2	2 to 52
	Set flow range (L/min)	Dry air, N_2, Ar	0 to 10.5	0 to 26.3	0 to 52.5	0 to 105
		CO_2	0 to 5.2	0 to 13.1	0 to 26.2	0 to 52
	Setting / Display unit (L/min)		0.01 min.	0.1 min.		
Accumulated flow	Setting / Display flow range		0 to 1999999 L			
	Setting / display unit		1 L min.			
Accumulated flow volume / pulse			0.1 L/Pulse			1.0 L/Pulse
Display unit			Instantaneous flow : L/min, CFM x 10^{-2} Accumulated flow : L, ft^3 x 10^{-1}			
Reference condition			Standard condition (ANR), Normal condition (NOR)			
Temperature characteristics			±0.5% F.S. max. (at 25 °C)			
Switch output			NPN or PNP open collector output			
	Load current		80 mA max.			
	Load voltage		30 VDC max. (NPN output)			
	Internal volt drop		1 V max. (80 mA load current)			
	Response time		1 s (50 ms / 0.5 s / 2 s selectable)			
	Output protection		Short circuit protection			
	Output mode		Hysteresis mode, Window comparator mode, Accumulated output mode, Accumulated pulse output mode			
	Hysteresis		Variable			
Repeatability			±0.1%F.S. max. (Fluid: Dry air) Analogue output accuracy: ±0.3%F.S. max.			
Analogue output	Response time		1.5 s (100 ms)			
	Voltage output		Output voltage: 1 to 5 VDC Output impedance: 1 kΩ			
	Current output		Output current: 4 to 20 mA Max. load impedance: 600 Ω (24 VDC) Min. load impedance: 50 Ω			
	Accuracy		±1%F.S. max.			
Sensor input	Voltage input (PFM30#)		Voltage input: 1 to 5 VDC Input impedance: 1 MΩ			
	Current input (PFM31#)		Current input: 4 to 20 mA Input impedance: 250 Ω			
External input			Voltage free input (reed or solid-state switch), 30 msec or more			
Display accuracy			±0.5% F.S. ±1 digit max.			
Display			3+1/2 digits, 7 segment, dual colour display (red/green)			
Indicator LED			LED is ON when output is ON OUT1: Green, OUT2: Red			
Supply voltage			24 VDC ±10% (protected against reverse connection)			
Power consumption			50 mA or less			

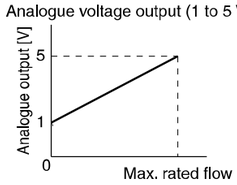
2.3 Cable specifications

Conductor	Nominal cross section area	approx. 0.2 mm^2
	Individual wire diameter	approx. 0.58 mm
Insulator	Outside diameter	approx. 1.12 mm
	Colours	Brown, Black, White, Grey, Blue
Sheath	Material	Oil-resistant vinyl chloride resin compound
	Outer diameter	approx. ϕ4.1 mm

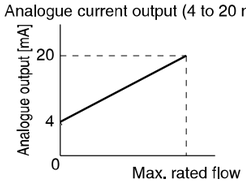
2 Specifications (continued)

2.4 Analogue Output characteristics

Analogue voltage output (1 to 5 V)



Analogue current output (4 to 20 mA)

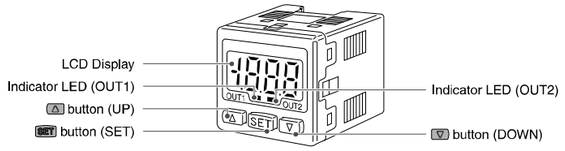


Model	Max. rated flow (L/min)
PFM510-#-1	10 (5)
PFM525-#-1	25 (12.5)
PFM550-#-1	50 (25)
PFM511-#-1	100 (50)

Model	Max. rated flow (L/min)
PFM510-#-2	10 (5)
PFM525-#-2	25 (12.5)
PFM550-#-2	50 (25)
PFM511-#-2	100 (50)

∗: Values for CO_2 shown in brackets ( ).

3 Name and function of parts



Part	Description
LCD display	Displays the flow value, setting mode, and error indication. Four display modes can be selected: display always in red or green, or display changing from green to red, or red to green, according to the output status (OUT1).
Indicator LED OUT1	Indicates the output status of OUT1. LED is ON (Green) when OUT1 is ON. When the accumulated pulse output mode is selected, the indicator LED will turn OFF.
Indicator LED OUT2	Indicates the output status of OUT2. LED is ON (Red) when OUT2 is ON. When the accumulated pulse output mode is selected, the indicator LED will turn OFF.
UP button	Selects the mode or increases the ON/OFF set value. Press this button to change to the peak display mode.
SET button	Press this button to change to another mode and to set a value.
DOWN button	Selects the mode or 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.**
- **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.**
  Otherwise damage to the internal parts can result, causing malfunction.
- **Do not pull the lead wire forcefully, and do not lift the product by pulling the lead wire.**

3 Installation (continued)

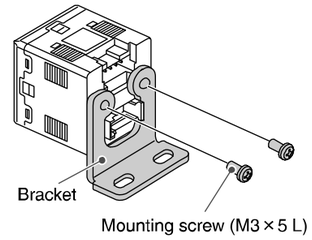
4.2 Environment

⚠ Warning

- Do not use in an environment where corrosive gases, oil, 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 with Bracket

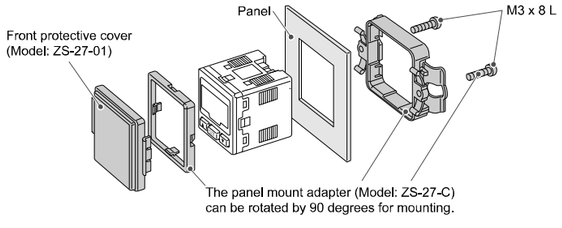
- Fix the bracket (Part number ZS-28-B) to the monitor using the screws M3 x 5 L (2 pcs.) supplied, then mount in the required position.
  ∗ Tighten the bracket mounting screws to a torque of 0.5 to 0.7 N•m.



- Install the monitor (with bracket) using M4 screws (2 pcs.).
- Bracket thickness required is approximately 1.6 mm.

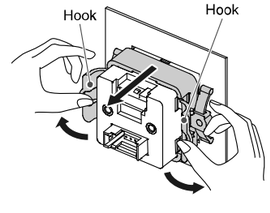
4.4 Mounting with Panel mount adapter

- Mount the panel mount adapter to the front of the monitor. Then insert the monitor with adapter into the panel until it comes into contact with the panel front surface.
- Next, mount the rear part to the controller and insert it until it comes into contact with the panel. Panel thickness: 0.5 to 6.0 mm.
- Fix the panel mount adapter to the product using the screws M3 x 8 L (2 pcs.) supplied.
- Panel mount adapter + Front protective cover (Part No.: ZS-27-D).



4.5 Removing the panel mounted monitor

- The monitor with panel mount adapter can be removed from the installation by removing the 2 screws and releasing the hooks at the sides.
- Take care not to damage the product and panel mount adapter.



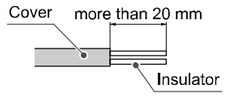
5 Wiring

5.1 Wiring Connection

- Connections should be made with the power supply turned OFF. Do not insert or remove the sensor connector with the power ON.
- 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.

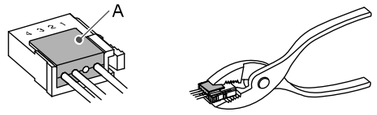
5.2 Sensor Connector wiring

- Attaching the sensor wire. The sensor wire should be stripped as shown. Do not cut the insulator. Insert the corresponding wire colour shown in the table into the pin number printed on the sensor connector, to the bottom.



Pin no.	Wire colour	Description
1	Brown	DC (+)
2	N.C.	-
3	Blue	DC (-)
4	Black	IN (1 to 5 V)

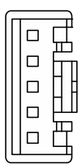
- Check that the above-mentioned wire preparation has been performed correctly, then part A shown in the figure is pushed in by hand to make temporary connection.



- Part A centre should be pressed straight in using a suitable tool, such as pliers. The e-CON connector cannot be re-used once it has been completely crimped.
- In case of connection failure or when a pin is mis-wired, always use a new e-CON connector.
- If the connector is not wired correctly "LLL" or "HHH" will be displayed.
- The wire colours are applicable for an SMC sensor lead wire.

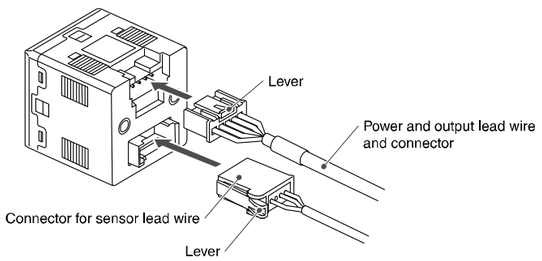
5.3 Power and Output Connector pin layout

Pin no.	Wire colour	Description
1	Brown	DC (+)
2	Black	OUT1
3	White	OUT2
4	Grey	Anal. output / Ext. input
5	Blue	DC (-)



5.4 Connecting / Disconnecting

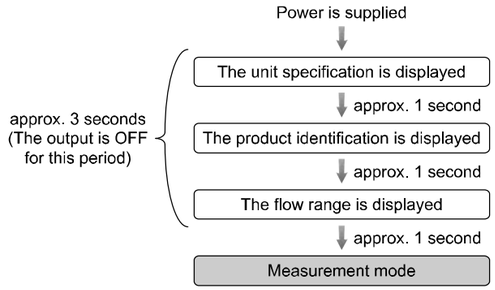
- When mounting the connector, insert it straight into the socket, holding the lever and connector body, and push the connector until the lever hooks into the housing, and locks.
- When removing the connector, press down the lever to release the hook from the housing and pull the connector straight out.



6 Flow Setting

6.1 Measurement mode

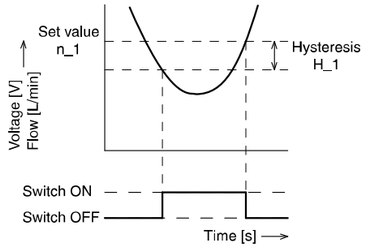
- Measurement mode is the mode in which the flow is detected and displayed, and the switch function is operating.
- This is the basic operating mode; other modes should be selected for set-point and other Function Setting changes.



∗: The display will indicate [LLL] if a sensor is not connected.

6.2 Switch operation

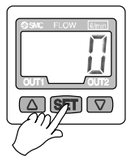
- When the flow (or voltage) falls below the set value by the amount of hysteresis or more, the switch will turn ON.
- When the flow (or voltage) exceeds the set value, the switch will turn OFF.
- If this condition is acceptable then keep these settings.



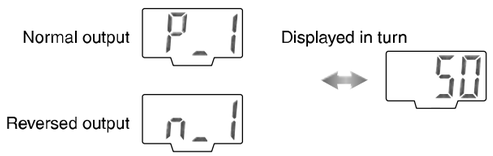
<Operation>

∗: The Product outputs will continue operating during setting.

1. Press the SET button in measurement mode to display the set values.



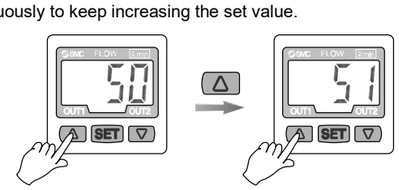
[P_1] or [n_1] and the set value are displayed in turn.



∗: [LLL] is displayed in measurement mode if a sensor is not connected.

2. Press the UP or DOWN button to change the set value.

The UP button is to increase and the DOWN button to decrease the set value.
Press the UP button once to increase by one digit or press it continuously to keep increasing the set value.



6 Flow Setting (continued)

Press the DOWN button once to decrease by one digit or press it continuously to keep decreasing the set value.

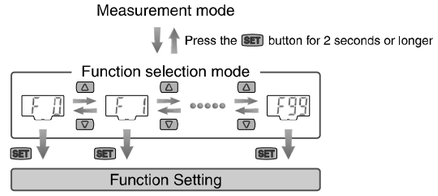
3. Press the SET button to finish the setting of OUT1.

[n_2] or [P_2] will be displayed. Set OUT2 as above.

7 Function Setting

7.1 Function selection mode

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



Item		Default setting
[F 0]	Selection of connected sensor	[10] 10 [L/min] (PFM510)
	[Uni] Unit selection function	[L] L/min
[F 1]	[oU1] Output mode (OUT1)	[HYS] Hysteresis mode
	[1ot] Reversed output (OUT1)	[1 P] Normal output
	[P_1] Input of set value (OUT1)	[ ] 50% of maximum rated flow 5.0 [L/min] (PFM510)
	[H_1] Setting of hysteresis (OUT1)	[ ] 3% of maximums rated flow 0.3 [L/min] (PFM510)
	[CoL] Display colour	[SoG] ON: Green, OFF: Red
[F 2]	[oU2] Output mode (OUT2)	[HYS] Hysteresis mode
	[2ot] Reversed output (OUT2)	[2 P] Normal output
	[P_2] Input of set value (OUT2)	[ ] 50% of maximums rated flow 5.0 [L/min] (PFM510)
	[H_2] Setting of hysteresis (OUT2)	[ ] 3% of maximums rated flow 0.3 [L/min] (PFM510)
[F 3]	[FLU] Operating fluid	[Air] dry air, N_2
[F 4]	[rEF] Reference condition	[Anr] Standard condition
[F 5]	[eES] Response time	[1.00] 1 second
[F 6]	[dSP] Display mode	[inS] Instantaneous flow
[F 7]	[inP] External input	[r_r] Accumulated flow external reset
[F 8]	[drE] Display resolution	[1E2] 100-split
[F 9]	[PrS] Auto-preset	[oFF] Manual
[F10]	[EEP] Accumulated value hold	[oFF] OFF
[F11]	[AFL] Analogue output filter	[on] With filter
[F12]	[Eco] Power saving mode	[oFF] Unused
[F13]	[Pin] Security code	[oFF] Unused
[F98]	[ALL] Setting of all functions	[oFF] Unused
[F99]	[ini] Reset to default settings	[oFF] Unused

8 Other Functions

- **Peak / Bottom hold function**
- **Key-lock function**

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

9 Outline Dimensions (mm)

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

10 How to Order

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

11 Limitations of Use

11.1 Limited warranty and Disclaimer/Compliance Requirements

Refer to Handling Precautions for SMC Products.

12 Troubleshooting

12.1 Error indication

Error Name	Display	Error	Troubleshooting
Flow error	HHH	Flow has exceeded the upper limit of the display flow range.	Reduce the flow.
	LLL	Flow of 5% or more in the wrong direction.	Ensure the flow is in the correct direction.
		A sensor may be disconnected or incorrectly wired.	Check connection and wiring of the sensor.
Over current error	Er1	Switch output load current (OUT1) has exceeded 80 mA.	Turn OFF power supply and remove the cause of the over current. Then supply the power again.
	Er2	Switch output load current (OUT2) has exceeded 80 mA.	
System error	Er0	Product has lost factory adjustment settings. Internal circuit may be damaged.	Stop operation immediately and contact SMC.
	Er3	System error. The product failed to store the data, or the internal circuit is damaged.	Turn the power OFF and ON again, then repeat Function Setting.
Zero clear error	Er4	Zero clear function has been performed while fluid is flowing. "Er4" will be displayed for 1 sec.	Perform the zero clear function again under no flow conditions.
Accumulated flow error	-999- (flashing)	Accumulated flow range has been exceeded.	Reset the accumulated flow (press UP and DOWN buttons simultaneously for 1 second or more).

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

13 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.

How to reset the product after power cut or forcible de-energizing

The setting of the product will be retained as it was before a power cut or de-energizing.
The output condition is also basically recovered to that before a 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.

14 Product disposal

This product shall 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.

15 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

Template DKP50047-F-085M