ORIGINAL INSTRUCTIONS

Instruction Manual
Voltage Monitor
PFMV3 series

The intended use of the voltage 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 PFMV3 specifications

Item		Specifications					
Applicable sensor		PFMV 505	PFMV 510	PFMV 530	PFMV 505F	PFMV 510F	PFMV 530F
Voltage	Rated voltage range	1.00 to 5.00 V					
	Display voltage range Set voltage range	0.70 to 5.10 V					
	Minimum setting unit	0.01V					
Flow	Rated flow range (L/min)	0 to 0.5	-0.05 to 1.05	0 to 3	0.5 to 0.5	-1 to 1	-3 to 3
	Set flow range (L/min)	-0.025 to 0.525	-0.05 to 1.05	-0.15 to 3.15	-0.525 to 0.525	-1.05 to 1.05	-3.15 to -3.15
	Minimum setting unit	0.001 L/min	0.01 L/min		0.001 L/min	0.01 L/min	
Indication unit		Voltage: V Instantaneous flow: L/min, CFH (ft³/h)					
Repeatability		Switch output: ±0.1% F.S. max., Analogue output: ±0.3% F.S. max.					
Temperature characteristics		±0.5% F.S. max. (reference 25 °C)					
Switch output		NPN or PNP open collector output: 2 outputs					
	Max. load current	80 mA					
	Max. load voltage	30 VDC (at NPN output)					
	Residual voltage	1 V or less (at load current 80 mA)					
	Output protection	Short-circuit protection					
	Output mode	Hysteresis mode, window comparator mode					
	Response time	2 ms (10 ms, 50 ms, 0.5 s, 1 s)					
	Hysteresis	Variable					
Analogue output	Voltage output	1 to 5 V Output impedance: 1 kΩ					
	Current output	4 to 20 mA Max. load impedance: 600 Ω (24 VDC)					
	Accuracy	±1% F.S. max. (relative to display value)					
	Response time	0.1 s or less					
External input		Voltage free input (reed or solid-state switch), 5 ms or more					
Display accuracy [*3]		±0.5% F.S. max. ±1 digit					
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		12 to 24 VDC (ripple ±10% max.) with polarity protection					
Power consumption		50 mA or less					

2.3 Cable specifications

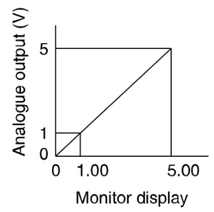
Conductor	Nominal cross section area	approx. 0.2 mm²
	Individual wire diameter	approx. 0.58 mm
Insulator	Outside diameter	approx. 1.12 mm
	Colours	Brown, White, Black, Grey, Blue
Sheath	Material	Oil-resistant vinyl chloride resin compound
	Outer diameter	approx. ϕ4.1 mm

2 Specifications (continued)

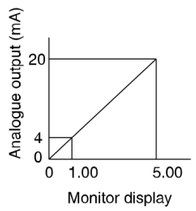
2.4 Analogue Output characteristics

- **Voltage Display**

Analogue voltage output (1 to 5 V)

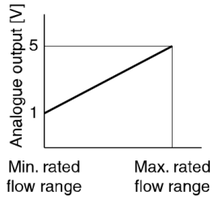


Analogue voltage output (4 to 20 mA)

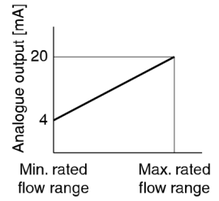


- **Flow Display**

Analogue voltage output (1 to 5 V)

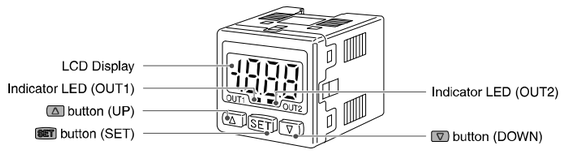


Analogue current output (4 to 20 mA)



Model	Min. rated flow	Max. rated flow
PFMV505	0 L/min	0.5 L/min
PFMV510	0 L/min	1.0 L/min
PFMV530	0 L/min	3.0 L/min
PFMV505F	-0.5 L/min	0.5 L/min
PFMV510F	-1.0 L/min	1.0 L/min
PFMV530F	-3.0 L/min	3.0 L/min

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 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.
Indicator LED OUT2	Indicates the output status of OUT2. LED is ON (Red) when OUT2 is ON.
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.**

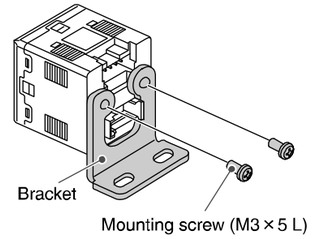
4.2 Environment

⚠ 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

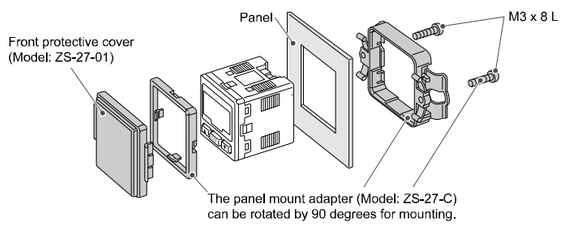
- Fix the bracket (part number ZS-28-B) to the monitor using the screws M3 x 5 L (2 pcs.) supplied, then mount in the required position.
  ∗ Tighten the bracket mounting screws to a torque of 0.5 to 0.7 N•m.



- 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.

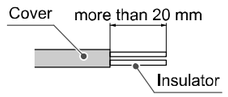
5 Wiring

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.

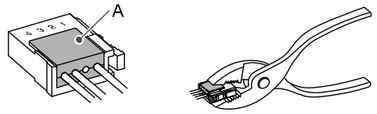
5.2 Sensor Connector wiring

- 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	NC	NC
3	Blue	DC-
4	Black	IN (1 to 5 V)

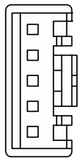
- Check that the above-mentioned wire preparation has been performed correctly, then part A shown in the figure is pushed in by hand to make temporary connection.



- 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.

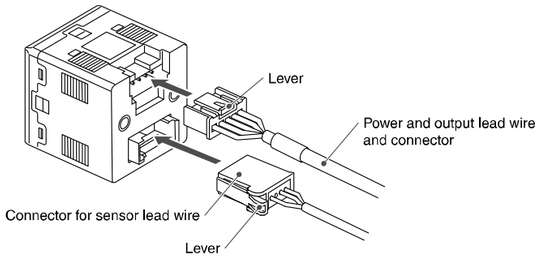
5.3 Power and Output Connector pin layout

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

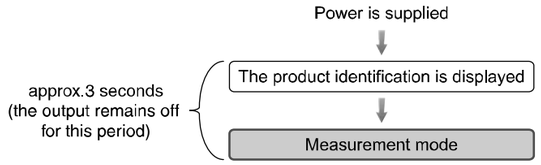
- When mounting the connector, insert it straight into the socket, holding the lever and connector body, and push the connector until the lever hooks into the housing, and locks.
- When removing the connector, press down the lever to release the hook from the housing and pull the connector straight out.



6 Flow Setting

6.1 Measurement mode

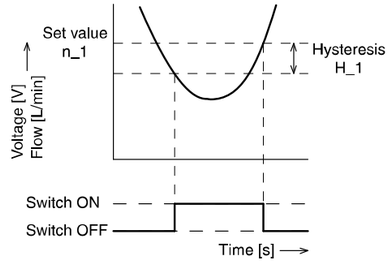
- Measurement mode is the mode in which the flow is detected and displayed, and the switch function is operating.
- This is the basic operating mode; other modes should be selected for set-point and other Function Setting changes.



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

- To use the product for flow rate indication, select the connected flow sensor using function [F95] before setting any other functions.

- **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.

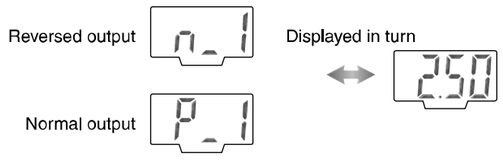


<Operation>

∗: The Product outputs will continue operating during setting.

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

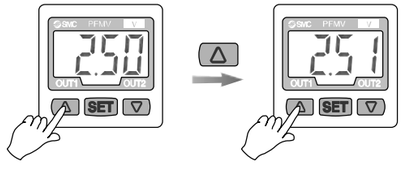
[P_1] or [n_1] and the set value are displayed in turn.



∗: [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.

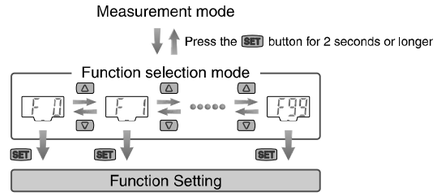
3. Press the SET button to finish the setting of OUT1.

[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]	Auto-preset	-
[F 1]	[oU1] Output mode (OUT1)	[HYS] Hysteresis mode
	[1ot] Reversed output (OUT1)	[1_n] Reversed output
	[n_1] Input of set value (OUT1)	[2.50] (Voltage display)
	[H_1] Hysteresis setting (OUT1)	[0.12] (Voltage display)
	[CoL] Display colour	[SoG] ON: Green OFF: Red
[F 2]	[oU2] Output mode (OUT2)	[HYS] Hysteresis mode
	[2ot] Reversed output (OUT2)	[2_n] Reversed output
	[n_2] Input of Set value (OUT2)	[2.50] (Voltage display)
	[H_2] Hysteresis setting (OUT2)	[0.12] (Voltage display)
[F 3]	[rES] Response time	[.002] 2 msec.
[F 4]	[inP] External input	[oFF] Unused
[F 5]	[Eco] Power saving mode	[oFF] Unused
[F 6]	[Pin] Security code	[oFF] Unused
[F95]	[rAn] Select connected sensor	[oFF] Unused
	[Uni] Unit selection function	[LPm] L/min
[F99]	[ini] Reset to default settings	[oFF] Unused

8 Other Functions

- **Standard value offset function**
- **Peak / Bottom hold function**
- **Indicated content check 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	Display	Type	Troubleshooting
Input voltage flow error	HHH	Flow (input voltage) exceeded the upper limit of the display range.	Reduce input voltage (= flow).
	LLL	Flow (input voltage) is less than the lower limit of the display range.	Increase input voltage (= flow).
		A sensor may be disconnected or wired incorrectly.	Check connection and wiring of the sensor.
Over current error	Er1	The switch output load current (OUT1) has exceeded 80 mA.	Turn off the power supply and remove the cause of the over current. Then supply the power again.
	Er2	The switch output load current (OUT2) has exceeded 80 mA.	
System error	Er0	The product has lost the factory adjustment settings. The internal circuit may be damaged.	Stop operation immediately and contact SMC.
	Er3	System error. The product has failed to store the data, or the internal circuit may be damaged.	Turn the power off and turn it on again, then repeat Function Setting.
Standard value offset error	Er4	The standard value offset function has been performed outside the effective range for correction.	Perform the standard value offset under no flow conditions.

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

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