

Integrated Indicator Type for Gas Flow Sensor FM-200 Series

D2-255025-A

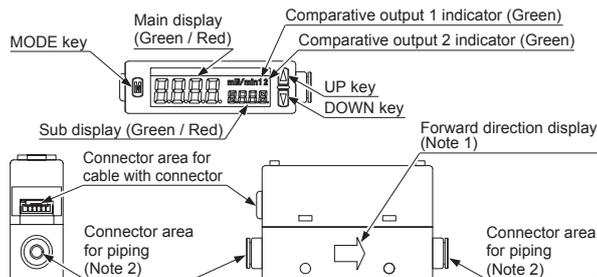
ME-FM200 No.0071-73V

Thank you very much for purchasing Panasonic products. Please read this Instruction Manual carefully and thoroughly for the correct and optimum use of this product. Kindly keep this manual in a convenient place for quick reference.

⚠ WARNING

- Never use this product in a device for personnel protection.
- In case of using devices for personnel protection, use products which meet laws and standards, such as OSHA, ANSI or IEC etc., for personnel protection applicable in each region or country.
- This product is used for noncorrosive gas. The product shall not be used for liquid or corrosive gas. Never use fluids having inflammability, toxicity, etc., that affect the human body, either.

1 PART DESCRIPTION



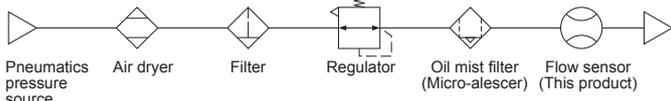
Notes: 1) Direction of the arrow indicates the forward direction of flow rate when setting the flow direction to bi-direction or one-side forward direction. When setting the flow direction to one-side reverse direction, a direction opposite to the forward direction display will be the forward direction of the flow rate. For setting flow direction, refer to "Flow direction setting" in "PRO MODE".
2) ø4 push-in joint / ø8 push-in joint is incorporated into FM-□-4(P) / FM-□-8(P), respectively. The push-in joint is not incorporated into the aluminum body type.

2 PIPING

- The following specified tube should be used to insert to the push-in joint type product.
- Before using the product, make sure to check that the tube is firmly inserted.

Material of tube	Tube diameter	Allowable diameter
Polyamid	ø4, ø8	Within ±0.1mm
	ø4	Within ±0.1mm
Polyurethane	ø4	Within ±0.1mm
	ø8	Within +0.1 / -0.15mm

- Install a filter, an air dryer and an oil mist filter (micro-alescer) onto the primary side (upstream) of the product since the compressed air from the compressor contains drain (water, oil oxide and foreign materials, etc.). Mesh (wire net) in the product is used to rectify the flow in the pipe. Always install a filter to the primary side of the product since this mesh is not a filter to remove foreign materials, etc.

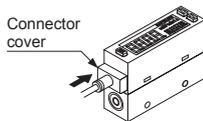


- When using a valve on the primary side of the product, only use an oil-prohibit specification valve. The product may malfunction or break if subject to splattering grease or oil, etc.
- When using the product with adsorption verification, etc., always install an air filter whose filtration property is 10µm or less onto the suction side to prevent suction of foreign materials and water. Furthermore, consider atmospheric dew point and ambient temperature of the product, use the product under the conditions that dew condensations will not be formed in the inside of pipe.
- In case of mounting commercial joint to the aluminum body type, apply a spanner on the metal part of this product and tighten by the tightening torque of 16 to 18N·m. If excessive torque is applied, the commercial joint or the main body may break.
- When piping, care must be taken that foreign materials such as sealing tape and adhesive must not enter into the inside. If the foreign materials are entered, the product may malfunction or break.
- Make sure to mount the joint when using the product with its secondary side (downstream) is open to the air. If the joint is not mounted, the port filter of the product may fall off.

3 WIRING

Connection method

- Insert the cable with connector **CN-F15-C1** (accessory) into the connector area of this product and mount the connector cover.

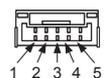


Disconnection method

- Remove the connector cover and pressing the release lever of the cable with connector, pull out the connector.

Note: Do not pull by holding the cable without pressing the release lever, as this can cause cable break or connector break.

<Terminal arrangement> (Sensor body)



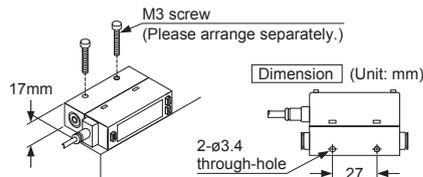
Terminal No.	Color code of the cable with connector	Terminal name
1	Brown	+V
2	Black	CH1 (comparative output 1)
3	White	CH2 (comparative output 2 / external input)
4	Gray	Analogue voltage output
5	Blue	0V

4 MOUNTING

Horizontal mounting

- Use M3 screw and the tightening torque should be 0.5N·m.

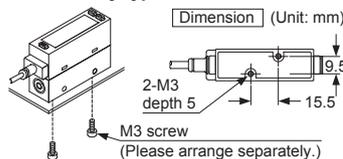
<Resin body type>



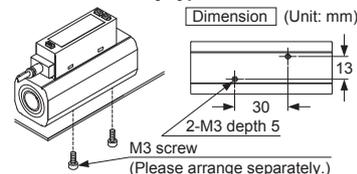
Vertical mounting

- Use M3 screw and the tightening torque should be 0.5N·m.

<Resin body type>



<Aluminum body type>

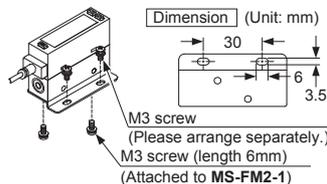


When using sensor mounting bracket

- When mounting the product on the sensor mounting bracket **MS-FM2-1** (optional) or **MS-FM2-2** (optional), use the M3 screw (length 6mm) attached to the sensor mounting bracket. The tightening torque should be 0.5N·m.
Use M3 screw to mount the sensor mounting bracket on a sensing surface.

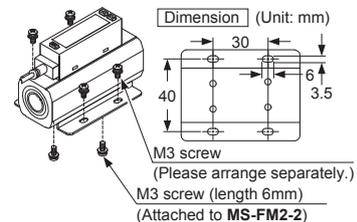
<Resin body type>

Use **MS-FM2-1**



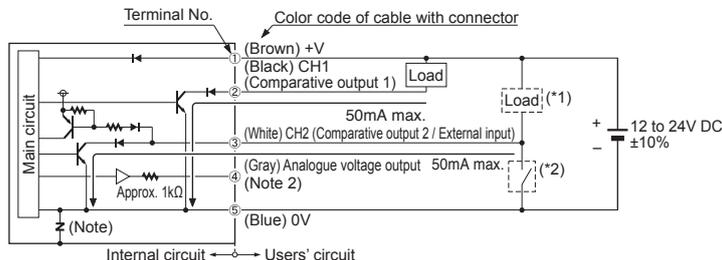
<Aluminum body type>

Use **MS-FM2-2**

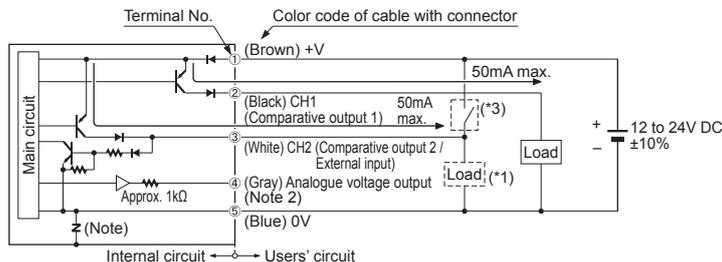


5 I/O CIRCUIT DIAGRAMS

• NPN output type



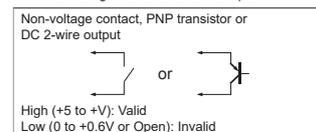
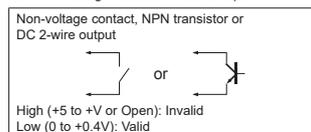
• PNP output type



*1: When using CH2 as a comparative output 2

*2: When using CH2 as an external input

*3: When using CH2 as an external input



Notes: 1) As for the aluminum body type, variable resistor (clamping voltage: approx. 40V) is connected between the internal power circuit and the metal body to prevent breakdown of the sensor. Connect the metal body to +V of power supply or frame ground (F.G.) of a device that is connected to 0V. High potential and insulation resistance tests between the internal power circuit and the metal body must not be done.
2) Short-circuit protection is not incorporated into the analogue voltage output.
Do not connect the power supply or capacitive load directly to the analogue voltage output.

6 OUTPUT MODE

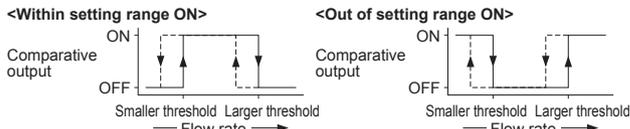
- The output OFF mode, window comparator mode, hysteresis mode, integrated output mode or integrated pulse output mode can be selected as the output mode for comparative output 1 and comparative output 2. Refer to "Output mode and threshold value setting mode" in "MENU SETTING MODE" for details.

Output OFF mode

- In this mode, the comparative output can always be OFF.

Window comparator mode

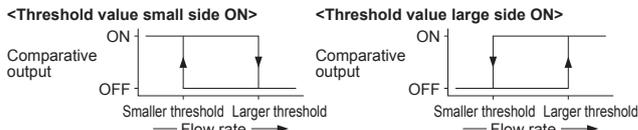
- In this mode, the ON / OFF state of the comparative output is controlled with a flow rate in the set range.



Note: Hysteresis of the window comparator mode is approx. 1% F.S. (factory setting). The hysteresis can be changed in the range of approx. 1 to 8% F.S. For details, refer to "Hysteresis setting" in "PRO MODE."

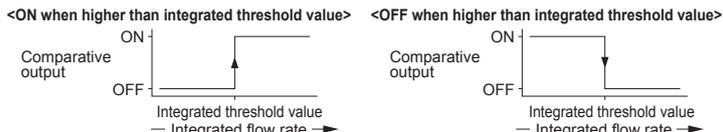
Hysteresis mode

- The comparative output ON / OFF state can be controlled with randomly set hysteresis in this mode.



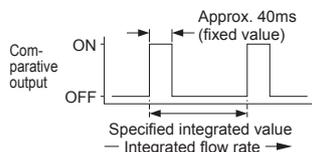
Integrated output mode

- The comparative output ON / OFF state can be controlled with randomly set integrated threshold value in this mode.



Integrated pulse output mode

- In this mode, pulse can be outputted with each specified integrated value. For the specified integrated value, refer to "SPECIFICATIONS."
- Take care that if fluid flows in the direction opposite to the set flow direction, the integrated pulse is outputted as well.

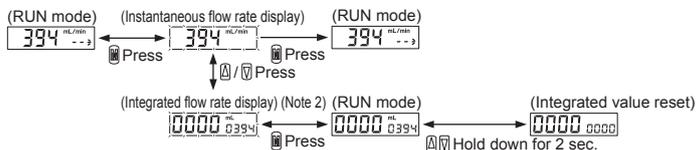


7 RUN MODE

- In this mode, flow rate display mode, confirmation of the set value, peak / bottom hold function and key lock function are available. In the flow rate display mode, color of the digital display changes in green or red in conjunction with the comparative output. The color of the main display can be changed in conjunction with the comparative output 1, while the color of the sub display can be changed in conjunction with the comparative output 2.
- For setting color of the digital display, refer to "Display color setting" in "PRO MODE."

Flow rate display mode

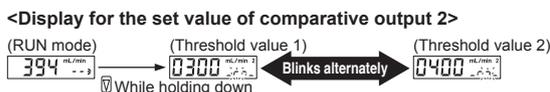
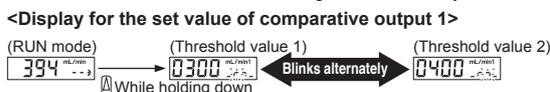
- Either instantaneous flow rate or integrated flow rate can be indicated on the digital display.
- The integrated value can be reset by key operation or external input while the integrated flow rate is indicated. (Note 1)
- At the instantaneous flow rate display, 4-digit instantaneous flow rate value is indicated on the main display, while the flow direction is indicated on the sub display.
- When setting flow direction to bi-direction or one-side forward direction, if fluid flows in the direction opposite to the forward direction display on the main body, the flow rate value is indicated negatively. In case of one-side reverse direction, if the fluid flows in the same direction to the forward direction display, the flow rate value is indicated negatively.
- At the integrated flow rate display, 7-digit integrated flow rate value is indicated on the main display and the sub display.
- When setting flow direction to bi-direction, if fluid flows in the direction to the forward direction display on the main body, the integrated value will be counted up. While if fluid flows in the opposite direction, the integrated value will be counted down. Further, in case of one-side forward direction and one-side reverse direction, if fluid flows in the direction opposite to the set flow direction by mistake, the integrated value will be counted down.



Notes: 1) When resetting the integrated value, first set to the integrated value reset input function, then conduct key operation or input an external signal. For setting the integrated value reset input function, refer to "CH2 setting" in "PRO MODE."
2) The integrated value will be reset when the power is supplied again at the integrated flow rate display.

Confirmation of the set value

- The threshold value of the comparative output 1 and the output mode can be checked while holding down UP key when the flow rate is indicated. Meanwhile, the threshold value of the comparative output 2, the output mode and the integrated value reset input function can be checked while holding down DOWN key when the flow rate is indicated.



When CH2 is set to the integrated value reset input function

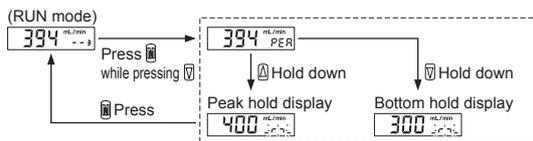


Notes: 1) When CH2 is set to the teaching function, the set value cannot be checked.

2) For details of the output mode, refer to "Output mode and threshold value setting mode" in "MENU SETTING MODE."

Peak / bottom hold function

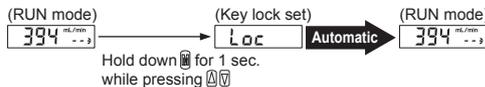
- The peak / bottom hold function displays the peak value and bottom value of the fluctuating flow rate.



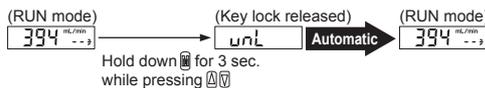
Key lock function

- The key lock function prevents key operations so that the conditions set in each setting mode are not inadvertently changed.
- After setting the key lock, "Loc" will be displayed on the digital display.

How to set

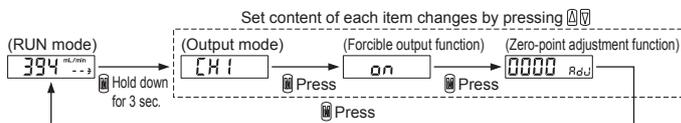


How to release



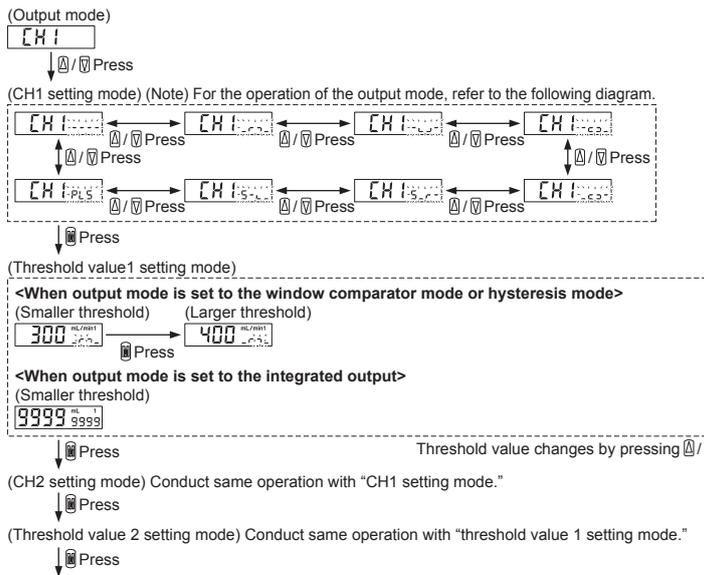
8 MENU SETTING MODE

- In this mode, the output mode (threshold value setting mode), forcible output function and zero-point adjustment function can be set.



Output mode and threshold value setting mode

- Output mode and threshold value can be set.



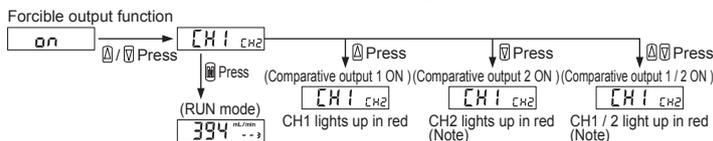
Note: If the teaching function is selected at CH2 setting in PRO mode, jumps to the "Selection of method for loading input value" at "CH2 setting" under PRO mode.

Output mode operation

Sub display	Output mode	Operation
---	Output OFF mode (Factory setting)	Output OFF
- - -	Window comparator mode	Within setting range ON
- L -		Out of setting range ON
- C -	Hysteresis mode	Smaller threshold value side ON
- C -		Larger threshold value side ON
- S -	Integrated output mode	ON when higher than integrated threshold value
- S -		OFF when higher than integrated threshold value
PLS	Integrated pulse output mode	Pulse output

Forcible output function

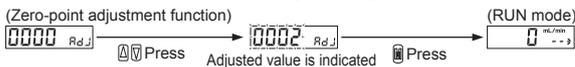
- The forcible output function is used to turn ON the comparative output forcibly regardless of output mode or threshold value.
- The comparative output turns ON while pressing UP / DOWN key.



Note: When CH2 is set to the external input, the comparative output 2 does not operate. For the setting method of CH2, refer to "CH2 setting" in "PRO MODE."

Zero-point adjustment function

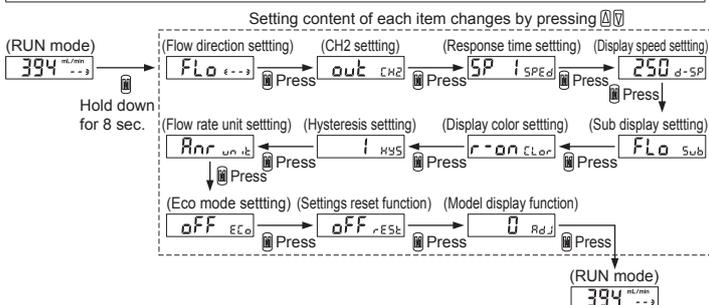
- The zero-point adjustment function is used to adjust the gap of the zero-point between the display and the analogue voltage output.



9 PRO MODE

- In this mode, each detailed function can be set.

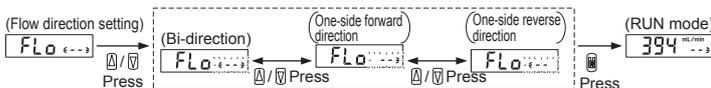
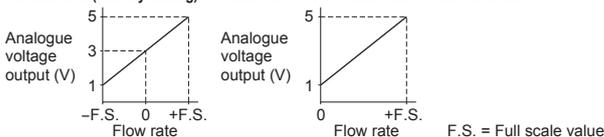
When pressing the MODE key after changing the set content of each item, the set content is confirmed and returns to RUN mode.



Flow direction setting

- Sets the flow direction of fluid. Either bi-direction, one-side forward direction or one-side reverse direction can be set. (Factory setting: bi-direction)
- When setting flow direction to bi-direction or one-side forward direction, if fluid flows in the direction opposite to the forward direction display on the main body, the flow rate value is indicated negatively. In case of one-side reverse direction, if the fluid flows in the same direction to the forward direction display, the flow rate value is indicated negatively.
- Zero-point and the span of the analogue voltage output change as follows depending on the set flow direction.

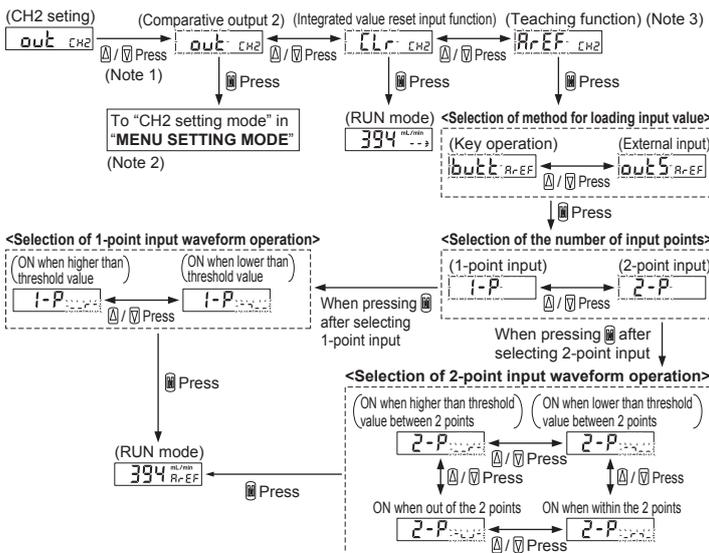
<Bi-direction (Factory setting)> <One-side forward / one-side reverse direction>



Note: If changing the flow direction setting, output mode (CH1 / CH2), threshold value (CH1 / CH2), zero-point adjustment value, integrated flow rate value and CH2 setting are all cleared, then returns to the factory setting.

CH2 setting

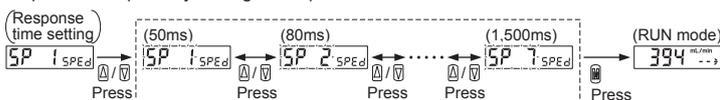
- Select whether CH2 is used as comparative output 2, integrated value reset input function or teaching function. (Factory setting: comparative output 2)
- When setting CH2 to the teaching function, select method for loading input value, the number of input points and input waveform operation.



Notes: 1) When setting CH2, the threshold value of the comparative output 1 may be reset. Therefore, confirm the threshold value of the comparative output 1 after setting CH2.
2) For CH2 setting mode, refer to "Output mode" in "MENU SETTING MODE."
3) For teaching function, refer to "TEACHING FUNCTION."

Response time setting

- Sets response time. The response time can be selected from seven levels: 50 to 1,500ms. Chattering and malfunction due to rapid change in the flow rate can be prevented. (Factory setting: 50ms)

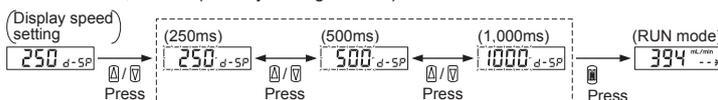


Display	SP 1	SP 2	SP 3	SP 4	SP 5	SP 6	SP 7
Response time	50ms	80ms	120ms	200ms	400ms	800ms	1,500ms

Note: The response time is applied to the sensor itself. Take care that the response time changes depending on piping.

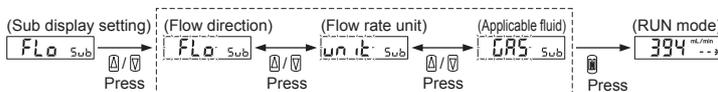
Display speed setting

- Updating cycle of the digital display can be selected from three levels: 250ms, 500ms or 1,000ms. (Factory setting: 250ms)



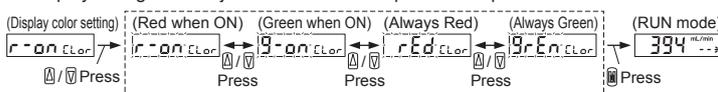
Sub display setting

- Flow direction, flow rate unit and applicable fluid can be indicated on the sub display. (Factory setting: flow direction)



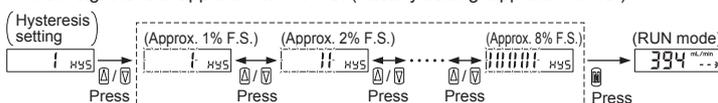
Display color setting

- Display color of the digital display can be set either: red when comparative output is ON, green when comparative output is ON, always red, or always green. (Factory setting: red when comparative output is ON)
- When setting either red when ON or green when ON, the color of the main display changes in conjunction with the comparative output 1, while the color of the sub display changes in conjunction with the comparative output 2.



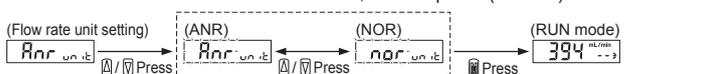
Hysteresis setting

- Sets hysteresis of the window comparator mode. The hysteresis can be selected from eight levels: approx. 1 to 8% F.S. (Factory setting: approx. 1% F.S.)



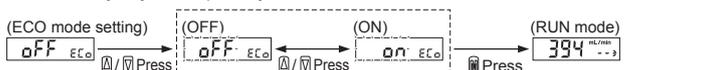
Flow rate unit setting

- Display unit can be set either ANR or NOR. (Factory setting: ANR)
ANR: Flow rate that is converted to +20°C, 1 atmosphere (101kPa) volume
NOR: Flow rate that is converted to 0°C, 1 atmosphere (101kPa) volume



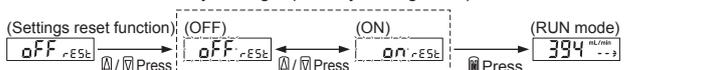
ECO mode setting

- If not operating the key for approx. 1 min. after setting ECO mode, the digital display turns OFF (only "L" is displayed) and the current consumption can be reduced. (Factory setting: OFF)
- Press any key to temporarily show the normal indication.



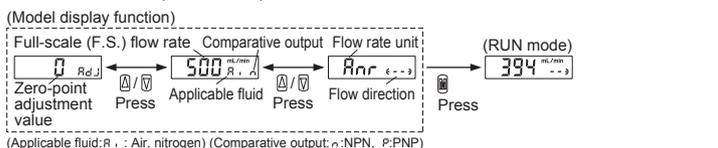
Settings reset function

- Returns to the factory settings. (Factory setting: OFF)



Model display function

- Displays the model. Zero-point adjustment value, full-scale (F.S.) flow rate, applicable fluid, comparative output, flow rate unit and flow direction can be checked.

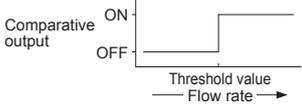


(Applicable fluid: R : Air, nitrogen) (Comparative output: n: NPN, P: PNP)

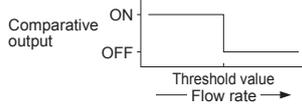
10 TEACHING FUNCTION

- In this function, sets the threshold value of the comparative output 1 based on the instantaneous flow rate value at the time of key operation or inputting external signal. For setting the teaching function, refer to "CH2 setting" in "PRO MODE."

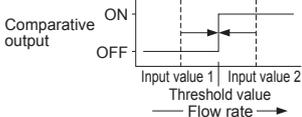
<1-point input, ON when higher than threshold value>



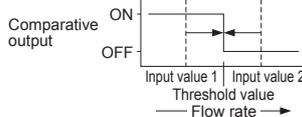
<1-point input, ON when lower than threshold value>



<2-point input, ON when higher than threshold value>



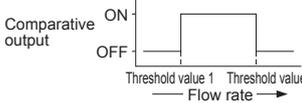
<2-point input, ON when lower than threshold value>



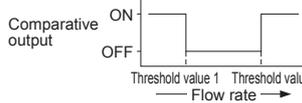
(Input value 1 + Input value 2) / 2 = Threshold value

(Input value 1 + Input value 2) / 2 = Threshold value

<2-point input, ON when within the 2 points>



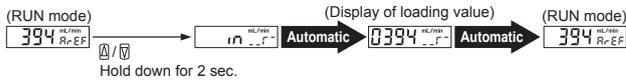
<2-point input, ON when out of the 2 points>



Note: The hysteresis of approx. 1% F.S. (factory setting) is set to the smaller threshold value side. The hysteresis can be changed in the range of approx. 1 to 8% F.S. For details, refer to "Hysteresis setting" in "PRO MODE."

[How to load the reference instantaneous flow rate value]

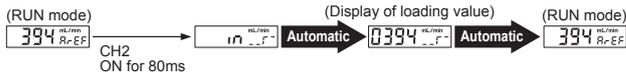
In case of key operation



In case of 1-point input: Hold down DOWN key for 2 sec. to load instantaneous flow rate value and set threshold value.

In case of 2-point input: Hold down UP key and DOWN key for 2 sec. to load the input values of 2 points. The threshold value is set automatically by discriminating the magnitude relation of the input values between 2 points.

In case of external input



In case of 1-point input: Turn ON the external input for 80ms to load instantaneous flow rate value and set threshold value.

In case of 2-point input: Turn ON the external input for 80ms to load the first input value. When turning ON the external input again for 80ms, loads the second input value. The threshold value is set automatically by discriminating the magnitude relation between the first point and the second point. When inputting the third point and the fourth point successively, the latest input value will be valid and the threshold value is set. The default loading value is 0.

Notes: 1) The threshold value set at the teaching function will be reset when turning ON the power again.
2) Loads the instantaneous flow rate value to the comparative output 1 by teaching. After the load is complete, ON / OFF pulses (approx. 40ms) are outputted after approx. 6 sec. at 1-point input, approx. 10 sec. at 2-point input.

11 ERROR INDICATION

Error indication	Cause	Remedy
E 02	Fluid flows during zero-point adjustment.	Make sure to check that fluid does not flow and conduct zero-point adjustment again.
E 03	Internal process error	Turn ON the power supply again. If not restoring normally, contact Panasonic Industrial Devices SUNX.
E 04		
H 1	Flow rate is exceeding upper limit of the display range.	The instantaneous flow rate should be brought within the display flow rate range.
L 0	Flow rate is exceeding lower limit of the display range.	
Operation indicator is blinking	Load is short-circuited causing an over-current to flow.	Turn OFF the power and check the load.

12 CAUTIONS

- This product has been developed / produced for industrial use only.
- This product is for use in air and nitrogen only. Do not use the product for other fluids since the sensing accuracy cannot be guaranteed.
- Take care that if foreign materials are mixed in the sensing part, the product may break.
- Do not use this product for commercial purposes since the product does not comply with International System of Units (SI).
- Do not apply pressure that is exceeding resistant-pressure.
- Make sure that the power supply is OFF while wiring.
- Take care that short-circuit of the load or wrong wiring may burn or damage the product.
- Take care that if applying voltage exceeding the rated range or connecting to AC power supply, the product may break or burn.
- If power is supplied from a commercial switching regulator, ensure that the frame ground (F.G.) terminal of the power supply is connected to an actual ground.
- In case noise generating equipment (switching regulator, inverter motor, etc.) is used in the vicinity of this product, connect the frame ground (F.G.) terminal of the equipment to an actual ground.
- Do not use during the initial transient time (approx. 5 sec.) after the power supply is switched ON.
- Do not run the wires together with high-voltage lines or power lines or put them in the same raceway. This can cause malfunction due to induction.
- The specification may not be satisfied in a strong magnetic field.
- Accuracy of the display and the analogue voltage output is influenced by self-heating by applying current other than the temperature characteristics. Standby time (5 min. or more after applying current) should be taken when using the product.

- Extension up to total 10m is possible with 0.3mm² or more, cable.
- Make sure that stress by forcible bend or pulling is not applied directly to the sensor cable joint.
- This product is suitable for indoor use only.
- Do not use this product in places having excessive vapor, dust, etc., or where it may come in contact with corrosive gas, etc.
- Take care that the product does not come in contact with water, oil, grease, or organic solvents such as thinner, etc., strong acid or alkaline.
- Do not drop the product or apply hard shock. This can cause product breakage.
- In the case multiple units are installed next to each other, do not allow them to contact each other. If the units are in contact, the heat generated by the products can cause a change in product characteristics or degradation of the material. Be sure to keep a distance of at least 10mm between the products when installing multiple units.
- This product adopts EEPROM. Settings cannot be done 100 thousand times or more because of the EEPROM's lifetime.

13 SPECIFICATIONS

<Model-wise specifications>

Type	Resin body type					
Model No.	FM-252-4(-P)	FM-213-4(-P)	FM-253-4(-P)	FM-214-4(-P)	FM-254-8(-P)	FM-215-8(-P)
Full scale (F.S.) flow rate (Note 1)	500ml/min	1,000ml/min	5l/min	10l/min	50l/min	100l/min
Display flow rate range (Note 2)	-550 to +550ml/min	-1,100 to +1,100ml/min	-5.5 to +5.5l/min	-11 to +11l/min	-55 to +55l/min	-110 to +110l/min
Display resolution	1ml/min			0.1l/min		0.1l/min
Integrated flow rate range	±9999999ml			±99999.99l		±999999.9l
Specified integrated value	5ml	10ml	0.05l	0.1l	0.5l	1l
Port size	ø4 push-in				ø8 push-in	
Weight	Approx. 50g			Approx. 70g		

Type	Aluminum body type			
Model No.	FM-255-AR2(-P)	FM-255-AG2-P	FM-216-AR2(-P)	FM-216-AG2-P
Full scale (F.S.) flow rate (Note 1)	500l/min		1,000l/min	
Display flow rate range (Note 2)	-550 to +550ml/min		-1,100 to +1,100ml/min	
Display resolution	1l/min			
Integrated flow rate range	±9999999ml			
Specified integrated value	5l		10l	
Port size	Rc½	G½	Rc½	G½
Weight	Approx. 155g			

<Common specifications>

Type	NPN output type	PNP output type
Model No.	FM-□	FM-□-P
Accuracy assurance range (Note 3)	Bi-direction: -100 to -3% F.S., +3 to +100% F.S. One-side direction: +3 to +100% F.S.	
Rated pressure range	-0.09 to +0.7MPa	
Residual pressure	1MPa	
Applicable fluid	Clean air, compressed air and nitrogen gas (Note 4)	
Sensing element	Semiconductor type	
Supply voltage	12 to 24V DC±10% Ripple P-P10% or less	
Current consumption	Normal mode: 60mA or less, ECO mode: 40mA or less	
Comparative output (Comparative output 1 / 2)	NPN open-collector transistor • Maximum sink current: 50mA or less • Applied voltage: 26.4V DC or less (between comparative output and 0V) • Residual voltage: 2.4V or less (at 50mA sink current)	PNP open-collector transistor • Maximum source current: 50mA or less • Applied voltage: 26.4V DC or less (between comparative output and +V) • Residual voltage: 2.4V or less (at 50mA source current)
Output mode	Output OFF mode, window comparator mode, hysteresis mode, integrated output mode and integrated pulse output mode	
Short-circuit protection	Incorporated	
Hysteresis	Window comparator mode: Variable at approx. 1 to 8% F.S. Hysteresis mode: Variable	
Analogue voltage output	Output voltage: 1 to 5V, Output impedance: Approx. 1kΩ	
Repeatability	Within ±1% F.S.	
External input	• ON voltage: 0 to +0.4V • OFF voltage: +5 to +V or Open • Input time: 80ms or more	• ON voltage: +5 to +V • OFF voltage: 0 to +0.6V or Open • Input time: 80ms or more
Linearity	Within ±3% F.S. (+25°C, secondary atmospheric criteria)	
Temperature characteristics	Within ±0.2% F.S. / °C (+15 to +35°C, +25°C criteria)	
Pressure characteristics	Within ±5% F.S. (-0.09 to +0.7MPa, +25°C, secondary atmospheric criteria)	
Protection	IP40 (IEC)	
Ambient temperature	0 to +50°C (no dew condensation allowed), Storage: -10 to +60°C	
Ambient humidity	35 to 90% RH or less, Storage: 35 to 90% RH or less	
Material	Enclosure: ABS, Body: Polyamide (Aluminum body type: Aluminum) Switch: EPDM, Display: Acrylic, Mounting screw part (Resin body type): Brass Current plate / port filter: Stainless steel (used for the gas contact area) Sensor tip: Silicone, Gasket: Fluorine rubber	
Grounding method	Floating (Note 5)	
Accessory	CN-F15-C1 (Cable with connector, 1m long): 1 pc.	

- Notes: 1) Converted to volumetric flow at +20°C and 1 atmospheric pressure (101kPa).
2) The display flow rate range is the case when setting to bi-direction at the flow direction setting. When the flow direction is set to one-side forward direction or one-side reverse direction, the negative side of the display flow rate range shows up to 10% of the full-scale (F.S.).
3) Take care that if fluid flows in the vicinity of zero-point which is out of the accuracy assurance range, the instantaneous flow rate value may forcibly display "zero", or the integrated value may not be counted, or the integrated pulse output may not be outputted.
4) The clean air complies with JIS B 8392-1.1.1 to 5.6.2 and the compressed air complies with JIS B 8392-1.1.1 to 1.6.2.
5) As a variable resistor (clamping voltage: approx. 40V) is connected to the aluminum body type, do not apply voltage higher than the rated voltage of the sensor.

14 INTENDED PRODUCTS FOR CE MARKING

- The models listed under "13 SPECIFICATIONS" come with CE Marking. As for all other models, please contact our office.



Panasonic Corporation

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