Integrated Display Type Digital Flow Sensor  For Gas

FM-200 SERIES

Dual color with sub display at a glance

Easy-to-see dual color with sub display!

The setting conditions are displayed on the sub display, making it much easier to keep track of operations. In addition, the digital display which switches between 2 colors lets you check the status of sensor operation at a glance.

Easy to see with the sub display!
Setting values and setting items can be checked at the same time.

Dual color display at a glance
The display color changes in accordance with output ON / OFF operations.
APPLICATIONS

Controlling purge gas and air blowing
By controlling purge gas and air blowing, performance and quality of the products can be maintained, while contributing to cost reduction.

Checking seating
Flow sensors can be used for stable detection of transparent objects which were difficult to detect using photodetectors. The nozzle can be extended for detection in places where oil splatter occurs.

Checking suction
Detection of objects is possible even on conveyors with low suction pressures where air is flowing constantly (such as collet conveyors and network conveyors).

High precision of ±3 % F.S.
A new rectification mechanism and Micro Electro Mechanical System (MEMS) technology allow the sensor to be mounted on a Si sensor chip (3 × 3.5 mm 0.118 × 0.138 in). This provides an extremely small heat capacity, high precision of ±3 % F.S. and high-speed response. The two temperature sensors on each side of the heater detect the heat distribution to make bidirectional detection possible.

Principle of Si sensor chip
When there is no flow
Temperature distribution
Temperature sensor 1  Heater  Temperature sensor 2
Si substrate
New rectification mechanism
Si sensor chip
When there is flow
Flow

No straight pipes needed
The rectification method used by the new mechanism makes straight pipes unnecessary at both the intake and exhaust sides.

Connection
Quick connection is possible with a cover-attached connector.

Flexible installation direction
Other than the ability to carry out bidirectional detection, there are no limitations on the installation direction, making the installation very flexible.

Equipped with a wide variety of functions for greater ease of use
- Integrated value reset function
  During integrated mode, external input allows reset of the integrated value.
- Analog voltage output
  1 to 5 V analog voltage output is incorporated.
- Key lock function
  Key operation can be disabled to prevent mis-operation.
- Rattle prevention function (Response time setting)
  The response time can be set to one of seven steps from 50 ms to approximately 1,500 ms. This prevents rattling from rapid changes in flow or from noise.
- Display rate setting
  The display update period for the digital display can be changed to 250 ms, 500 ms or 1,000 ms in order to eliminate display flickering.
- ECO mode
  After approx. one minute of no operation, sensor will be switched to ECO mode. Backlight will be turned off to reduce power consumption.

One sensor for both intake and exhaust
A single sensor can detect flows bidirectionally. In addition, it can be set to detect flows in either the forward or reverse direction only, making it suitable for a variety of applications.

For example, using a single sensor to check chip suction

Flexible printed circuit board
Collet
Lead frame

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- Rattle prevention function (Response time setting)
  The response time can be set to one of seven steps from 50 ms to approximately 1,500 ms. This prevents rattling from rapid changes in flow or from noise.
Suitable for cost and quality control! Integrated output mode incorporated

The FM-200 series can control and manage flows in a wide variety of output modes such as integrated output mode, depending on the required application.

INTEGRATED FLOW RATE DISPLAY

- Integrated output mode
  Quality control
  When the volume of flow of the gas being measured reaches the set integrated value, output switches to ON or OFF.
  - Controls N₂ charging volumes for electronic components
  - Controls air blowing volumes, etc.

- Integrated pulse output mode
  Cost management
  The pulse output is generated once at every specified integrated value*. This lets you know the amount of air consumed per unit of time easily.
  - Controls N₂ purge volumes in reflow furnaces
  - Controls overall volumes of air consumed by equipment, etc.

* Integrated values are specified by range and can vary. For details, refer to "SPECIFICATIONS".

Energy-saving and environmental-friendly

The pulse output from the flow sensor can be inputted to the pulse counter of an Eco-Power Meter so that air consumption and power consumption can both be measured simultaneously.

INSTANT FLOW RATE DISPLAY (FACTORY SETTING)

- Window comparator mode
  This mode is used for setting comparative output to ON or OFF at flow rates within the setting range.
- Hysteresis mode
  This mode is used for setting comparative output hysteresis to the desired level and for carrying out ON / OFF control.
- Output OFF mode
  Comparative output is forcibly maintained at OFF regardless of the setting value.

Notes: 1) Displayed value data is not outputted.
        2) For details, please refer to Eco-Power Meter KW8M pages.
## ORDER GUIDE

<table>
<thead>
<tr>
<th>Type</th>
<th>Appearance</th>
<th>Applicable fluid</th>
<th>Flow rate range</th>
<th>Model No.</th>
<th>Port size</th>
<th>Comparative output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resin body type</td>
<td>Clean air</td>
<td>Clean air (Note)</td>
<td>500 ml/min.</td>
<td>FM-252-4</td>
<td>ø4 ø0.157 push-in</td>
<td>NPN Open-collector transistor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Compressed air (Note)</td>
<td>1,000 ml/min.</td>
<td>FM-213-4</td>
<td>NPN Open-collector transistor</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nitrogen</td>
<td>Nitrogen gas</td>
<td>5 l/min.</td>
<td>FM-253-4</td>
<td>PNP Open-collector transistor</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10 l/min.</td>
<td>FM-214-4</td>
<td>NPN Open-collector transistor</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>50 l/min.</td>
<td>FM-254-8</td>
<td>NPN Open-collector transistor</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>100 l/min.</td>
<td>FM-215-8</td>
<td>NPN Open-collector transistor</td>
<td></td>
</tr>
<tr>
<td>Aluminum body type</td>
<td></td>
<td></td>
<td>500 l/min.</td>
<td>FM-255-AR2</td>
<td>Rc1/2 female thread</td>
<td>NPN Open-collector transistor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1,000 l/min.</td>
<td>FM-216-AR2</td>
<td>G1/2 female thread</td>
<td>PNP Open-collector transistor</td>
</tr>
</tbody>
</table>

- **Note:** 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.

### Accessory
- **CN-F15-C1** (Connector attached cable 1 m 3.281 ft)

## OPTIONS

<table>
<thead>
<tr>
<th>Designation</th>
<th>Model No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor mounting bracket</td>
<td>MS-FM2-1</td>
<td>Allows resin body type sensor to be installed on the flooring.</td>
</tr>
<tr>
<td></td>
<td>MS-FM2-2</td>
<td>Allows aluminum body type sensor to be installed on the flooring.</td>
</tr>
</tbody>
</table>

### Sensor mounting bracket
- **MS-FM2-1**
  - M3 screw 
  - M3 (length 6 mm 0.236 in) screw with washers
    - (Attached to MS-FM2-1)
- **MS-FM2-2**
  - M3 screw 
  - M3 (length 6 mm 0.236 in) screw with washers
    - (Attached to MS-FM2-2)

### Recommended vacuum filter
- Manufactured by Nihon Pisco Co., Ltd.
  - VFU1-44-15P (Element length 15 mm 0.591 in)
  - VFU1-44-25P (Element length 25 mm 0.984 in)
  - VFE015B01 Filter element for refill, length 15 mm 0.591 in
  - VFE025B01 Filter element for refill, length 25 mm 0.984 in

- **Note:** Contact the manufacturer for details of the recommended products.
## SPECIFICATIONS

### Individual specifications

<table>
<thead>
<tr>
<th>Type</th>
<th>Resin body type</th>
<th>FM-252-4(P)</th>
<th>FM-213-4(P)</th>
<th>FM-253-4(P)</th>
<th>FM-214-4(P)</th>
<th>FM-254-8(P)</th>
<th>FM-215-8(P)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full scale flow rate (Note 1)</td>
<td>500 mℓ/min</td>
<td>1,000 mℓ/min</td>
<td>5 ℓ/min</td>
<td>10 ℓ/min</td>
<td>50 ℓ/min</td>
<td>100 ℓ/min</td>
<td></td>
</tr>
<tr>
<td>Display range (Note 2)</td>
<td>-550 to +550 mℓ/min</td>
<td>-1,100 to +1,100 mℓ/min</td>
<td>-5.5 to +5.5 ℓ/min</td>
<td>-11 to +11 ℓ/min</td>
<td>-55 to +55 ℓ/min</td>
<td>-110 to +110 ℓ/min</td>
<td></td>
</tr>
<tr>
<td>Setting and display resolution</td>
<td>1 mℓ</td>
<td>0.01 mℓ/min</td>
<td>0.1 mℓ/min</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display range (Note 2)</td>
<td>±999999 mℓ</td>
<td>±999999 ℓ</td>
<td>±999999.9 ℓ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Setting and display resolution</td>
<td>1 ℓ</td>
<td>0.1 ℓ</td>
<td>1 ℓ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specified integrated value</td>
<td>5 ℓ</td>
<td>10 ℓ</td>
<td>0.05 ℓ</td>
<td>0.1 ℓ</td>
<td>0.5 ℓ</td>
<td>1 ℓ</td>
<td></td>
</tr>
<tr>
<td>Port size</td>
<td>ø4 ø0.107 push-in</td>
<td>ø8 ø0.315 push-in</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Common specifications

<table>
<thead>
<tr>
<th>Type</th>
<th>NPN output type</th>
<th>PNP output type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated pressure range</td>
<td>-0.09 to +0.7 MPa</td>
<td></td>
</tr>
<tr>
<td>Pressure withstandability</td>
<td>1 MPa</td>
<td></td>
</tr>
<tr>
<td>Applicable fluid</td>
<td>Clean air (Note 3), compressed air (Note 3), nitrogen gas</td>
<td></td>
</tr>
<tr>
<td>Supply voltage</td>
<td>12 to 24 V DC ±10 %</td>
<td>Ripple P-P10 % or less</td>
</tr>
<tr>
<td>Current consumption</td>
<td>Normal mode: 60 mA or less, ECO mode: 40 mA or less</td>
<td></td>
</tr>
<tr>
<td>Comparative outputs</td>
<td>PNP open-collector transistor</td>
<td>PNP open-collector transistor</td>
</tr>
<tr>
<td>• Maximum sink current: 50 mA or less</td>
<td>• Maximum source current: 50 mA or less</td>
<td></td>
</tr>
<tr>
<td>• Applied voltage: 28.4 V DC or less (between comparative output and 0 V)</td>
<td>• Applied voltage: 28.4 V DC or less (between comparative output and +V)</td>
<td></td>
</tr>
<tr>
<td>• Residual voltage: 2.4 V or less (at 50 mA sink current)</td>
<td>• Residual voltage: 2.4 V or less (at 50 mA source current)</td>
<td></td>
</tr>
<tr>
<td>Output modes</td>
<td>Output OFF mode, window comparator mode, hysteresis mode, integrated output mode, integrated pulse output mode</td>
<td></td>
</tr>
<tr>
<td>Short-circuit protection</td>
<td>Incorporated</td>
<td></td>
</tr>
<tr>
<td>Hysteresis</td>
<td>Window comparator mode: 1 to 8 % F.S. approx. (variable) (Factory settings: approx. 1 % F.S.), Hysteresis mode: Variable (minimum 1 digit)</td>
<td></td>
</tr>
<tr>
<td>Response time</td>
<td>50 ms, 80 ms, 120 ms, 200 ms, 400 ms, 800 ms, 1,500 ms, selectable by key operation</td>
<td></td>
</tr>
<tr>
<td>Analog output voltage</td>
<td>Output voltage: 1 to 5 V, Output impedance: 1 kΩ approx.</td>
<td></td>
</tr>
<tr>
<td>Repeatability</td>
<td>Within ±1 % F.S.</td>
<td></td>
</tr>
<tr>
<td>Assurance accuracy range (Note 4)</td>
<td>Bi-direction: -100 to -3 % F.S., +3 to +100 % F.S., One-side direction: +3 to +100 % F.S.</td>
<td></td>
</tr>
<tr>
<td>External input</td>
<td>ON voltage: 0 to +0.4 V</td>
<td>ON voltage: +5 V to +V</td>
</tr>
<tr>
<td></td>
<td>OFF voltage: +5 V to +V, or open</td>
<td>OFF voltage: 0 to +0.8 V, or open</td>
</tr>
<tr>
<td></td>
<td>Input time: 80 ms or more</td>
<td>Input time: 80 ms or more</td>
</tr>
<tr>
<td>Linearity</td>
<td>Within ±3 % F.S. (Ambient temperature +25 °C ±77 °F, flow rate range 3 to 100 % F.S., atmospheric criteria on secondary side)</td>
<td></td>
</tr>
<tr>
<td>Display</td>
<td>4 digits + 4 digits 2-color LCD display (Display refresh rate: 250 ms, 500 ms, 1,000 ms, selectable by key operation)</td>
<td></td>
</tr>
<tr>
<td>Protection</td>
<td>IP40 (IEC)</td>
<td></td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>0 to +50 °C (+32 to +122 °F) (No dew condensation allowed), Storage: -10 to +60 °C (+14 to +140 °F)</td>
<td></td>
</tr>
<tr>
<td>Ambient humidity</td>
<td>35 to 90 % RH, Storage: 35 to 90 % RH</td>
<td></td>
</tr>
<tr>
<td>Voltage withstandability</td>
<td>1,000 V AC for one min. between all supply terminals connected together and enclosure (Excluding the aluminum body type)</td>
<td></td>
</tr>
<tr>
<td>Insulation resistance</td>
<td>10 MO, or more, with 500 V DC megger between all supply terminals connected together and enclosure (Excluding the aluminum body type)</td>
<td></td>
</tr>
<tr>
<td>Vibration resistance</td>
<td>±900/60 Hz (max. 100 % amplitude, for 30 min. each, 3 directions)</td>
<td></td>
</tr>
<tr>
<td>Temperature characteristics</td>
<td>Within ±0.2 % F.S./°C (+25 °C ±77 °F criteria), +15 to +35 °C (+69 to +95 °F ambient temperature range)</td>
<td></td>
</tr>
<tr>
<td>Pressure characteristics</td>
<td>Within ±5 % F.S. (-0.09 to +0.7 MPa, +25 °C ±77 °F, atmospheric criteria on secondary side)</td>
<td></td>
</tr>
<tr>
<td>Enclosure earthing</td>
<td>Floating (Note 5)</td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>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 chip: Silicon, Gasket: Fluorine rubber</td>
<td></td>
</tr>
</tbody>
</table>

### FM-200 SERIES

1. Converted to volumetric flow at +20 °C ±68 °F and 1 atmospheric pressure (101 kPa).
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 10 % of the full-scale (F.S.).
3. The clean air complies with JIS B 8392-1.1 to 5.6.2, and the compressed air complies with JIS B 8392-1.1 to 1.6.2.
4. Take care that if fluid flows in the vicinity of zero-point which is out of the accuracy assurance range, the instant flow rate value may forcibly display "zero", or the integrated flow display value may not be counted up, or the integrated pulse output may not be outputted.
5. As a varistor (clamping voltage: approx. 40 V) is connected to the aluminum body type, do not apply voltage higher than the rated voltage of the sensor.
I/O CIRCUIT AND WIRING DIAGRAMS

FM-2□

I/O circuit diagram

Terminal No. Color code of connector attached cable

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>Reverse supply polarity protection diode</td>
</tr>
<tr>
<td>Tr1, Tr2</td>
<td>PNP output transistor</td>
</tr>
<tr>
<td>Tr3</td>
<td>NPN input transistor</td>
</tr>
</tbody>
</table>

Internal circuit

Notes:
1) As for the aluminum body type, varistor (clamping voltage approx. 40 V) 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 to frame ground (F.G.) of a device that is connected to 0 V. 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 analog voltage output. Do not connect the power supply or capacitive load directly to the analog voltage output.

Symbols... D1 to D4 : Reverse supply polarity protection diode
Tr1, Tr2 : PNP output transistor
Tr3 : NPN input transistor

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Tr1, Tr2 : PNP output transistor
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Wiring diagram

Non-voltage contact or NPN open-collector transistor

High (+5 V to +V, or Open): Valid
Low (0 to +0.4 V): Invalid

Analog voltage output

<Bi-direction detection> <One-side detection>

Output voltage (V)

<One-side detection>

Output voltage (V)

* 1: When using CH2 as a comparative output 2
* 2: When using CH2 as an external input
**PRESSES LOSS CHARACTERISTICS (TYPICAL)**

<table>
<thead>
<tr>
<th>FM-252-4(-P)</th>
<th>FM-213-4(-P)</th>
<th>FM-253-4(-P)</th>
<th>FM-214-4(-P)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Graph" /></td>
<td><img src="image2" alt="Graph" /></td>
<td><img src="image3" alt="Graph" /></td>
<td><img src="image4" alt="Graph" /></td>
</tr>
</tbody>
</table>

**PRECAUTIONS FOR PROPER USE**

- Never use this product as a sensing device for personnel protection.
- In case of using sensing 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.

**Part description**

- MODE key
- Main display (Green / Red)
- Comparative output 1 indicator (Green)
- Comparative output 2 indicator (Green)
- UP key
- DOWN key
- Forward direction display (Note 1)
- Connector area for connector attached cable
- Connector area for piping (Note 2)
- Connector area for piping (Note 2)

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.
2. ø4 mm ø0.157 in push-in joint / ø8 mm ø0.315 in push-in joint is incorporated in FM-2□-4(-P) / FM-2□-8(-P), respectively. The push-in joint is not incorporated in the aluminum body type.
**PRECAUTIONS FOR PROPER USE**

**Mounting**

- This product can be installed facing up or down or to the left or right.

**Horizontal mounting**

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

**<Resin body type>**

![](Image)

- M3 screw (Purchase separately.)

- 17 mm 0.669 in

**<Aluminum body type>**

![](Image)

- M3 screw (Purchase separately.)

**Vertical mounting**

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

**<Resin body type>**

![](Image)

- M3 screw (Purchase separately.)

**<Aluminum body type>**

![](Image)

- M3 screw (Purchase separately.)

**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 screws (length 6 mm 0.236 in) attached to the sensor mounting bracket. The tightening torque should be 0.5 N·m. Use M3 screws to mount the sensor mounting bracket on a sensing surface.

**<Resin body type>**

![](Image)

- Use MS-FM2-1

- M3 screw (Purchase separately.)

- M3 (length 6 mm 0.236 in) screw with washers (Attached to MS-FM2-1)

**<Aluminum body type>**

![](Image)

- Use MS-FM2-2

- M3 screw (Purchase separately.)

- M3 (length 6 mm 0.236 in) screw with washers (Attached to MS-FM2-2)

**Wiring**

- Make sure that the power supply is OFF during wiring.
- Take care that wrong wiring will damage this product.
- Take care if applying voltage exceeding the rated range, or connecting to AC power supply, this 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 sensor, connect the frame ground (F.G.) terminal of the equipment to an actual ground.
- 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.
- Extension up to total 10 m 32.808 ft is possible with 0.3 mm², or more, cable.
- Make sure that stress by forcible bend or pulling is not applied directly to the sensor cable joint.

**Piping**

- The following specified tube should be used to insert to the push-in joint type product.

<table>
<thead>
<tr>
<th>Material of tube</th>
<th>Tube diameter (mm in)</th>
<th>Allowable diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyamide</td>
<td>ø4 ø0.157, ø3 ø0.315</td>
<td>Within ø0.1 mm ±0.004 in</td>
</tr>
<tr>
<td>Polyurethane</td>
<td>ø4 ø0.157</td>
<td>Within ø0.1 mm ±0.004 in</td>
</tr>
<tr>
<td></td>
<td>ø8 ø0.315</td>
<td>Within ø0.1 / 0.15 mm ±0.004 in / -0.005 in</td>
</tr>
</tbody>
</table>

- Before using this product, make sure to check that the tube is firmly inserted.

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

- When using a valve on the primary side of the product, only use an oil-prohibit specification valve. This product may malfunction or break if subject to splattering grease or oil, etc.
- When using this product for suction verification, etc., always install an air filter whose filtration property is 10 µm 0.394 mil 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 18 N·m. If excessive torque is applied, the commercial joint or the main body may break.
- When piping, take care that foreign materials such as sealing tape and adhesive must not enter into the inside of the pipe. If 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) open to the air. If the joint is not mounted, the port filter of the product may fall off.

- When using sensor mounting bracket MS-FM2-1 (optional) or MS-FM2-2 (optional), use the M3 screws (length 6 mm 0.236 in) attached to the sensor mounting bracket. The tightening torque should be 0.5 N·m. Use M3 screws to mount the sensor mounting bracket on a sensing surface.
- Use MS-FM2-1
  - M3 screw (Purchase separately.)
  - M3 (length 6 mm 0.236 in) screw with washers (Attached to MS-FM2-1)
- Use MS-FM2-2
  - M3 screw (Purchase separately.)
  - M3 (length 6 mm 0.236 in) screw with washers (Attached to MS-FM2-2)

- When using this product, make sure to check that the tube is firmly inserted.
**FLOW SENSOR SELECTION**

- If using a flow sensor for tasks such as checking suction and release from suction nozzles and sensing leaks, use the flow rate range setting table as a guide. The effective cross-section area of the nozzle (pinhole) and the difference in pressure inside and outside the nozzle can be used to calculate the flow rate.

![Diagram of flow sensor selection](image)

**<Calculation example>**

The flow rate calculation value for a nozzle diameter of ø0.1 to ø2.0 mm ø0.004 to ø0.079 in when P2 is varied is shown in the table below.

<table>
<thead>
<tr>
<th>P1(MPa)</th>
<th>P2(MPa)</th>
<th>Calculated flow rate value (ℓ/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ø0.1 mm</td>
<td>ø0.004 in</td>
<td>ø0.020 mm</td>
</tr>
<tr>
<td>0.1013</td>
<td>0.0013</td>
<td>0.01013</td>
</tr>
</tbody>
</table>

**Notes:**
1. In case of any leakage from tubes, etc., actual values will differ greatly from calculated values. When measuring flows, make sure that there is no leakage from any tubes.
2. In case of any points in the tubes which are narrower than the diameter of the suction nozzle, flow rate will be restricted and may turn out to be lower than the calculated values.
3. In addition, suction verification may not be possible in such cases.
4. The effective cross-section area is a guide only. If the nozzle is long and narrow, the effective cross-section area may be smaller than the area at the tip of the nozzle.
5. Response times are determined by the internal volume of the tube from the flow sensor to the suction nozzle (pinhole). If carrying out high-speed sensing, reduce the internal volume of the tube as much as possible such as by locating the flow sensor close as possible to the suction nozzle.

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**PRECAUTIONS FOR PROPER USE**

Refer to General precautions.

**Others**

- Take care 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 exceed resistant-pressure.
- Do not use during the initial transient time (approx. 5 sec.) after the power supply is switched ON.
- The specifications may not be satisfied in a strong magnetic field.
- Accuracy of the display and the analog 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.
- These sensors are only for indoor use.
- 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.
DIMENSIONS (Unit:mm in)

The CAD data in the dimensions can be downloaded from our website.

FM-2□-4(-P)

Sensor mounting bracket (Optional)

Material: Cold rolled carbon steel (SPCC)(Nickel plated)
Two M3 (length 6 mm 0.236 in) screws with washers are attached.

Assembly dimensions
Mounting drawing with FM-252-4

MS-FM2-1

Sensor mounting bracket (Optional)

Material: Cold rolled carbon steel (SPCC)(Nickel plated)
Two M3 (length 6 mm 0.236 in) screws with washers are attached.

Assembly dimensions
Mounting drawing with FM-255-AR2

Note: FM-2□-AG2-P has G1/2 female thread.

MS-FM2-2

Sensor mounting bracket (Optional)

Material: Cold rolled carbon steel (SPCC)(Nickel plated)
Two M3 (length 6 mm 0.236 in) screws with washers are attached.