Dual color with sub display at a glance

Easy-to-read 2-color display with sub display
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.

Setting values and setting items can be checked at the same time.

Easy to see with the sub display!

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 3

Si substrate

New rectification mechanism

Si sensor chip

When there is flow

Flow

Link to output 1

Link to output 2

Dual color display at a glance

The display color changes in accordance with output ON / OFF operations.

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

Suction

Vacuum breakdown

Si sensor detects both directions
FM-200 SERIES LINE-UP

Low flow rate type

FM-252-4(-P) / FM-213-4(-P)
FM-253-4(-P) / FM-214-4(-P)
- Port size: ø4 mm ø0.157 in push-in
- Size: W17 × H37 × D64 mm W0.669 × H1.457 × D2.520 in
- Body material: Resin

Medium flow rate type

FM-254-8(-P)
FM-215-8(-P)
- Port size: ø8 mm ø0.315 in push-in
- Size: W17 × H43 × D70.6 mm W0.669 × H1.693 × D2.780 in
- Body material: Resin

High flow rate type

FM-255-AR2(-P) / FM-255-AG2-P
FM-216-AR2(-P) / FM-216-AG2-P
- Port size: Rc½ female thread, G½ female thread
- Size: W30 × H50 × D80 mm W1.181 × H1.969 × D3.150 in
- Body material: Aluminum

Images represent original sizes

Flow rate range

0.5 ℓ/min. Smallest type
1 ℓ/min.
5 ℓ/min.
10 ℓ/min.
50 ℓ/min.
100 ℓ/min.
500 ℓ/min.
1,000 ℓ/min. Largest type

Industry's smallest in size

Based on research conducted by SUNX as of March 2008
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

- Controls N2 charging volumes for electronic components
- Controls air blowing volumes, etc.

When the volume of flow of the gas being measured reaches the set integrated value, output switches to ON or OFF.

Integrated pulse output mode

Cost management

- Controls N2 purge volumes in reflow furnaces
- Controls overall volumes of air consumed by equipment, etc.

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.

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.
The rectification method used by the new mechanism makes straight pipes unnecessary at both the intake and exhaust sides.

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

Tight installation of multiple sensors on the panel in vertical direction is possible.

Quick connection is possible with a cover-attached connector.

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 photoelectric sensors. The nozzle can be extended for detection even in places where oil spatter 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).

**Applications**

**Flow sensors**
- Can be used for stable detection of transparent objects.
- Nozzle can be extended for detection even in places where oil spatter occurs.

**Checking seating**
- Flow sensors can be used for stable detection of transparent objects.
- Nozzle can be extended for detection even in places where oil spatter occurs.

**Checking suction**
- Detection of objects is possible even on conveyors with low suction pressures.

**No straight pipes needed**

**Flexible installation direction**

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

**Panel mounting bracket (Available soon)**
Tight installation of multiple sensors on the panel in vertical direction is possible.

**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**
  - 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.
## 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 (Note) Compressed air (Note) Nitrogen gas</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>500 ml/min.</td>
<td>FM-252-4</td>
<td>ø4 ø0.157</td>
<td>NPN Open-collector transistor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>FM-252-4-P</td>
<td>push-in</td>
<td>PNP Open-collector transistor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1,000 ml/min.</td>
<td>FM-213-4</td>
<td></td>
<td>NPN Open-collector transistor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>FM-213-4-P</td>
<td></td>
<td>PNP Open-collector transistor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5 l/min.</td>
<td>FM-253-4</td>
<td></td>
<td>NPN Open-collector transistor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>FM-253-4-P</td>
<td></td>
<td>PNP Open-collector transistor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10 l/min.</td>
<td>FM-214-4</td>
<td></td>
<td>NPN Open-collector transistor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>FM-214-4-P</td>
<td></td>
<td>PNP Open-collector transistor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>50 l/min.</td>
<td>FM-254-8</td>
<td>ø8 ø0.315</td>
<td>NPN Open-collector transistor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>FM-254-8-P</td>
<td>push-in</td>
<td>PNP Open-collector transistor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>100 l/min.</td>
<td>FM-215-8</td>
<td></td>
<td>NPN Open-collector transistor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>FM-215-8-P</td>
<td></td>
<td>PNP Open-collector transistor</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></td>
<td>FM-255-AR2-P</td>
<td></td>
<td>PNP Open-collector transistor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>FM-255-AG2-P</td>
<td>G1/2 female thread</td>
<td>PNP Open-collector transistor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1,000 l/min.</td>
<td>FM-216-AR2</td>
<td>Rc1/2 female thread</td>
<td>NPN Open-collector transistor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>FM-216-AR2-P</td>
<td></td>
<td>PNP Open-collector transistor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>FM-216-AG2-P</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

### Designation | Model No. | Description
--- | --- | ---
Sensor mounting bracket | MS-FM2-1 | Allows resin body type sensor to be installed on the flooring.
| MS-FM2-2 | Allows aluminum body type sensor to be installed on the flooring.
Panel mounting bracket | MS-FM2-3 | Allows resin body type sensor to be installed to panels. Multiple sensors can also be mounted closely.

### Sensor mounting bracket
- **MS-FM2-1**
- **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.
### Individual specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Resin body type</th>
<th>Resin body type</th>
<th>Resin body type</th>
<th>Resin body type</th>
<th>Resin body type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>FM-252-4(-P)</td>
<td>FM-213-4(-P)</td>
<td>FM-253-4(-P)</td>
<td>FM-214-4(-P)</td>
<td>FM-254-8(-P)</td>
</tr>
<tr>
<td>Full scale flow rate</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>
</tr>
<tr>
<td>Display range</td>
<td>-550 to +550 mℓ/</td>
<td>-1,100 to +1,100 mℓ/</td>
<td>-5.5 to +5.5 ℓ/</td>
<td>-11 to +11 ℓ/</td>
<td>-55 to +55 ℓ/</td>
</tr>
<tr>
<td>Display range</td>
<td>0.01 ℓ/min.</td>
<td>0.01 ℓ/min.</td>
<td>0.1 ℓ/min.</td>
<td>0.1 ℓ/min.</td>
<td>0.1 ℓ/min.</td>
</tr>
<tr>
<td>Display range</td>
<td>±99999.99 m ℓ</td>
<td>±99999.99 ℓ</td>
<td>±99999.9 ℓ</td>
<td>±99999.9 ℓ</td>
<td>±99999.9 ℓ</td>
</tr>
<tr>
<td>Specified integrated value</td>
<td>5 m ℓ</td>
<td>10 ℓ</td>
<td>0.05 ℓ</td>
<td>0.1 ℓ</td>
<td>0.5 ℓ</td>
</tr>
<tr>
<td>Weight</td>
<td>Net weight: 50 g approx., Gross weight: 115 g approx.</td>
<td>Net weight: 70 g approx., Gross weight: 135 g approx.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Aluminum body type</th>
<th>Aluminum body type</th>
<th>Aluminum body type</th>
<th>Aluminum body type</th>
<th>Aluminum body type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>FM-255-AR2(-P)</td>
<td>FM-255-AG2-P</td>
<td>FM-216-AR2(-P)</td>
<td>FM-216-AG2-P</td>
<td></td>
</tr>
<tr>
<td>Full scale flow rate</td>
<td>500 ℓ/min.</td>
<td>1,000 ℓ/min.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display range</td>
<td>-550 to +550 ℓ/</td>
<td>-1,100 to +1,100 ℓ/</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display range</td>
<td>1 ℓ/min.</td>
<td>1 ℓ/min.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display range</td>
<td>±99999 ℓ</td>
<td>±99999 ℓ</td>
<td>±99 ℓ</td>
<td>±99 ℓ</td>
<td></td>
</tr>
<tr>
<td>Specified integrated value</td>
<td>5 ℓ</td>
<td>10 ℓ</td>
<td>0.1 ℓ</td>
<td>0.1 ℓ</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>RC1/8 female thread</td>
<td>G1/4 female thread</td>
<td>RC1/8 female thread</td>
<td>G1/4 female thread</td>
<td></td>
</tr>
</tbody>
</table>

### Common specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>NPN output type</th>
<th>PNP output type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated pressure</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-10 % 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 (Comparative output 1 / Comparative output 2)</td>
<td>NPN open-collector transistor</td>
<td>PNP open-collector transistor</td>
</tr>
<tr>
<td>Comparative outputs (Comparative output 1 / Comparative output 2)</td>
<td>• Maximum sink current: 50 mA or less</td>
<td>• Maximum source current: 50 mA or less</td>
</tr>
<tr>
<td>Comparative outputs (Comparative output 1 / Comparative output 2)</td>
<td>• Applied voltage: 26.4 V DC or less (between comparative output and 0 V)</td>
<td>• Applied voltage: 26.4 V DC or less (between comparative output and +V)</td>
</tr>
<tr>
<td>Comparative outputs (Comparative output 1 / Comparative output 2)</td>
<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>
</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 voltage output</td>
<td>Output voltage: 1 to 5 V, Output impedance: 1 kΩ approx. [Refer to &quot;Analog voltage output&quot; (p.7) for more details.]</td>
<td></td>
</tr>
<tr>
<td>Repeatability</td>
<td>Within ±1 % 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>External input</td>
<td>OFF voltage: +5 V to +V, or open</td>
<td>OFF voltage: 0 to +0.6 V, or open</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 MD, 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 / Shock resistance</td>
<td>10 to 150 Hz, 0.75 g max. amplitude at 49 µs max. acceleration, 0.8 X and Z directions (for two hours each) / 200 ms acceleration (10 G approx. in X, Y and Z directions by three times each)</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 ±59 to +95 °F ambient temperature range</td>
<td></td>
</tr>
<tr>
<td>Pressure characteristics</td>
<td>Within ±5 % F.S. (From -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 4)</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, Display port: Stainless steel (used for the gas contact area), Sensor chip: Silicon, Gasket: Fluorine rubber</td>
<td></td>
</tr>
<tr>
<td>Connecting method</td>
<td>Connector</td>
<td></td>
</tr>
<tr>
<td>Cable length</td>
<td>Total length up to 10 m 32,808 ft is possible with 0.3 mm², or more, cable.</td>
<td></td>
</tr>
<tr>
<td>Accessory</td>
<td>CN-F15-C1 (Connector attached cable 1 m 3.281 ft): 1 pc.</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
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 8392-1.1.1 to 5.6.2, and the compressed air complies with JIS B 8392-1.1.1 to 1.6.2.
4. 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**

**I/O circuit diagram**

- **FM-2□**: NPN output type
- **FM-2□-P**: PNP output type

### Wiring diagram

**FM-2□**

- **Terminal No.**
- **Color code of connector attached cable**
- **Load**
- **Brown (+V)**
- **Black (CH1 Comparative output 1)**
- **Gray (CH2 Comparative output 2) / External input**
- **Approx. 1 kΩ**
- **Varistor**

**FM-2□-P**

- **Terminal No.**
- **Color code of connector attached cable**
- **Load**
- **Brown (+V)**
- **Black (CH1 Comparative output 1)**
- **Gray (CH2 Comparative output 2) / External input**
- **Approx. 1 kΩ**
- **Varistor**

### 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.

### Analog voltage output

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

**Symbols...**

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

**Symbols...**

- **D1 to D4**: Reverse supply polarity protection diode
- **Tr1, Tr2**: PNP output transistor
- **Tr3**: NPN input transistor
■ PRESSURE LOSS CHARACTERISTICS (TYPICAL)

- FM-252-4(-P)
- FM-213-4(-P)
- FM-253-4(-P)
- FM-214-4(-P)
- FM-254-8(-P)
- FM-215-8(-P)
- FM-255-A-2(-P)
- FM-216-A-2(-P)

■ 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 piping (Note 2)
- Connector area for connector attached cable
- Connector area for connector attached cable
- Connector area for connector attached cable
- Connector area for connector attached cable
- Connector area for connector attached cable
- Connector area for connector attached cable
- Connector area for connector attached cable

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-□-4(-P) / FM-□-8(-P), respectively. The push-in joint is not incorporated in the aluminum body type.

Terminal arrangement diagram

Terminal arrangement of the connectors of this product (sensor body)

<table>
<thead>
<tr>
<th>Connector pin No.</th>
<th>Color code of the connector attached cable</th>
<th>Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Brown</td>
<td>+V</td>
</tr>
<tr>
<td>2</td>
<td>Black</td>
<td>CH1 (comparative output 1)</td>
</tr>
<tr>
<td>3</td>
<td>White</td>
<td>CH2 (comparative output 2 / external input)</td>
</tr>
<tr>
<td>4</td>
<td>Gray</td>
<td>Analog voltage output</td>
</tr>
<tr>
<td>5</td>
<td>Blue</td>
<td>0 V</td>
</tr>
</tbody>
</table>
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 of product with M3 screw]

**<Aluminum body type>**

- [Image of product with M3 screw]

**Vertical mounting**

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

**<Resin body type>**

- [Image of product with M3 screw]

**<Aluminum body type>**

- [Image of product with M3 screw]

**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 aensing surface.

**<Resin body type>**

- Use MS-FM2-1

- [Image of product with M3 screw]

**<Aluminum body type>**

- Use MS-FM2-2

- [Image of product with M3 screw]

**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, ø8 ø0.315</td>
<td>Within ±0.1 mm ±0.004 in</td>
</tr>
<tr>
<td>Polyurethane</td>
<td>ø4 ø0.157</td>
<td>Within ±0.1 mm ±0.004 in</td>
</tr>
<tr>
<td></td>
<td>ø8 ø0.315</td>
<td>Within ±0.15 mm ±0.004 in / ±0.006 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 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.

![Filter, air dryer, oil mist filter diagram]

- 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.

**Wiring**

- Make sure that the power supply is OFF durring 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.

**Others**

- This product has been developed / produced for industrial use only.

- This product is for use in air and nitrogen only. Do not use this product for other fluids since the sensing accuracy cannot be guaranteed.
## PRECAUTIONS FOR PROPER USE

- 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.
- 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.

## 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 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.

### Calculation example

The flow calculation value for a nozzle diameter of ø0.1 to ø0.2 mm ø0.004 to ø0.008 in when P2 is varied is shown in the table below.

<table>
<thead>
<tr>
<th>P1 (MPa)</th>
<th>P2 (MPa)</th>
<th>P2 (MPa)</th>
<th>P2 (MPa)</th>
<th>Acoustic velocity</th>
<th>Sub-acoustic velocity</th>
<th>Acoustic velocity</th>
<th>Sub-acoustic velocity</th>
<th>Acoustic velocity</th>
<th>Sub-acoustic velocity</th>
<th>Acoustic velocity</th>
<th>Sub-acoustic velocity</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1013</td>
<td>0.0013</td>
<td>0.0013</td>
<td>-0.07</td>
<td>0.090</td>
<td>0.360</td>
<td>0.810</td>
<td>2.260</td>
<td>4.411</td>
<td>9.002</td>
<td>20.254</td>
<td>36.007</td>
</tr>
<tr>
<td>0.1013</td>
<td>0.0413</td>
<td>0.0413</td>
<td>-0.06</td>
<td>0.390</td>
<td>1.184</td>
<td>2.260</td>
<td>4.411</td>
<td>9.002</td>
<td>20.254</td>
<td>36.007</td>
<td></td>
</tr>
<tr>
<td>0.1013</td>
<td>0.0513</td>
<td>0.0513</td>
<td>-0.05</td>
<td>0.900</td>
<td>1.440</td>
<td>2.260</td>
<td>4.411</td>
<td>9.002</td>
<td>20.254</td>
<td>36.007</td>
<td></td>
</tr>
<tr>
<td>0.1013</td>
<td>0.0613</td>
<td>0.0613</td>
<td>-0.04</td>
<td>0.888</td>
<td>0.792</td>
<td>2.260</td>
<td>4.411</td>
<td>9.002</td>
<td>20.254</td>
<td>36.007</td>
<td></td>
</tr>
<tr>
<td>0.1013</td>
<td>0.0713</td>
<td>0.0713</td>
<td>-0.03</td>
<td>0.828</td>
<td>0.439</td>
<td>2.260</td>
<td>4.411</td>
<td>9.002</td>
<td>20.254</td>
<td>36.007</td>
<td></td>
</tr>
<tr>
<td>0.1013</td>
<td>0.0813</td>
<td>0.0813</td>
<td>-0.02</td>
<td>0.722</td>
<td>0.287</td>
<td>2.260</td>
<td>4.411</td>
<td>9.002</td>
<td>20.254</td>
<td>36.007</td>
<td></td>
</tr>
<tr>
<td>0.1013</td>
<td>0.0913</td>
<td>0.0913</td>
<td>-0.01</td>
<td>0.545</td>
<td>0.151</td>
<td>2.260</td>
<td>4.411</td>
<td>9.002</td>
<td>20.254</td>
<td>36.007</td>
<td></td>
</tr>
<tr>
<td>0.1113</td>
<td>0.0113</td>
<td>0.0113</td>
<td>0.057</td>
<td>0.509</td>
<td>0.905</td>
<td>2.260</td>
<td>4.411</td>
<td>9.002</td>
<td>20.254</td>
<td>36.007</td>
<td></td>
</tr>
<tr>
<td>0.1213</td>
<td>0.0213</td>
<td>0.0213</td>
<td>0.080</td>
<td>0.720</td>
<td>1.280</td>
<td>2.260</td>
<td>4.411</td>
<td>9.002</td>
<td>20.254</td>
<td>36.007</td>
<td></td>
</tr>
<tr>
<td>0.1413</td>
<td>0.0413</td>
<td>0.0413</td>
<td>0.113</td>
<td>0.453</td>
<td>1.018</td>
<td>2.260</td>
<td>4.411</td>
<td>9.002</td>
<td>20.254</td>
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</tr>
<tr>
<td>0.1613</td>
<td>0.0613</td>
<td>0.0613</td>
<td>0.139</td>
<td>0.554</td>
<td>1.247</td>
<td>2.260</td>
<td>4.411</td>
<td>9.002</td>
<td>20.254</td>
<td>36.007</td>
<td></td>
</tr>
<tr>
<td>0.1813</td>
<td>0.0813</td>
<td>0.0813</td>
<td>0.160</td>
<td>0.640</td>
<td>1.440</td>
<td>2.260</td>
<td>4.411</td>
<td>9.002</td>
<td>20.254</td>
<td>36.007</td>
<td></td>
</tr>
<tr>
<td>0.2013</td>
<td>0.1013</td>
<td>0.1013</td>
<td>0.179</td>
<td>0.716</td>
<td>1.610</td>
<td>2.260</td>
<td>4.411</td>
<td>9.002</td>
<td>20.254</td>
<td>36.007</td>
<td></td>
</tr>
<tr>
<td>0.3013</td>
<td>0.2013</td>
<td>0.2013</td>
<td>0.268</td>
<td>1.071</td>
<td>2.410</td>
<td>2.260</td>
<td>4.411</td>
<td>9.002</td>
<td>20.254</td>
<td>36.007</td>
<td></td>
</tr>
<tr>
<td>0.4013</td>
<td>0.3013</td>
<td>0.3013</td>
<td>0.357</td>
<td>1.426</td>
<td>3.209</td>
<td>2.260</td>
<td>4.411</td>
<td>9.002</td>
<td>20.254</td>
<td>36.007</td>
<td></td>
</tr>
<tr>
<td>0.5013</td>
<td>0.4013</td>
<td>0.4013</td>
<td>0.445</td>
<td>1.782</td>
<td>4.099</td>
<td>2.260</td>
<td>4.411</td>
<td>9.002</td>
<td>20.254</td>
<td>36.007</td>
<td></td>
</tr>
<tr>
<td>0.6013</td>
<td>0.5013</td>
<td>0.5013</td>
<td>0.534</td>
<td>2.137</td>
<td>4.809</td>
<td>2.260</td>
<td>4.411</td>
<td>9.002</td>
<td>20.254</td>
<td>36.007</td>
<td></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 addition, suction verification may not be possible in such cases.
3) 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.
4) 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 as close as possible to the suction nozzle.

## DIMENSIONS (Unit:mm in)

The CAD data in the dimensions can be downloaded from the SUNX website: http://www.sunx.com

![FM-2-4(P)](image1)

![FM-2-8(P)](image2)
The CAD data in the dimensions can be downloaded from the SUNX website: http://www.sunx.com

Note: FM-2--AG2-P has G½ female thread.

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

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

All information is subject to change without prior notice.