# Safety Precautions

Be sure to read this section before use.
For general pneumatic components precautions, refer to Intro 17 for details.

Product-specific cautions: Miniature flow rate sensor FSM-X/FSM-V Series

## Design / Selection

### Working fluids

**⚠ DANGER**

■Never use this product with flammable fluids.

**⚠ WARNING**

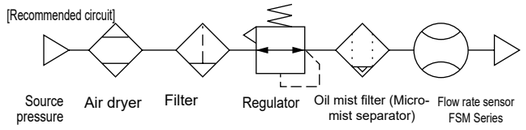
■This product cannot be used as a billing meter. Do not use this product for commercial transactions as it is not compliant with the Measurement Act. Intended applications include industrial sensors.

■Do not use fluids other than the applicable fluids, because accuracy cannot be guaranteed.

■Use dry gas which does not contain corrosive elements such as chlorine, sulfur or acids, and which is clean and does not contain dust or oil mist.

■When installing the product during piping or fitting assembly, use the above clean gas for the fluid used to blow out for cleaning. Check that foreign matter does not enter the product from the port of the product. When using compressed air in this process, use clean air compliant with the air quality listed in the following item (ISO 8573-1 Class 2010 1.1.1 to 1.6.2).

■When using compressed air, use clean air that complies with ISO 8573-1 2010 Class 1.1.1 to 1.6.2. Since compressed air from the compressor contains drainage (water, oil oxides, foreign matter, etc.), attach a filter, an air dryer and an oil mist filter (Micro-mist separator) to the primary side (upstream) of the sensor. The sensor's mesh rectifies flow in the pipe. It does not filter out foreign matter, so provide a filter.




■Depending on the fluid, retaining the fluid for long periods could adversely affect the performance. Do not seal the fluid in the pipe for long periods of time.

■When using a valve on the primary side of the sensor, use only valves with oil-prohibited specifications. This sensor could malfunction or fail if exposed to splattering grease, oil, etc. As friction powder may be generated depending on the valve, mount a filter to prevent the powder from entering the sensor.

### Working environment

**⚠ DANGER**

■Flammable environment
Never use this product in an explosive gas atmosphere. The structure is not explosion-proof, and explosions or fires could occur.

**⚠ WARNING**

■Corrosive environment
Do not use this product in an atmosphere containing corrosive gases such as sulfur dioxide.

■Ambient/fluid temperatures
Use at ambient/fluid temperatures within the specified range of 0 to 50°C. Even if the temperature is within the specified range, do not use this product if the ambient temperature and fluid temperature could suddenly change and cause dew to condense.

■Working pressure / flow rate range
Applications exceeding the max. working pressure and specified flow rate range may result in breakdown. Use this product only within the specified range.

■Drip-proof environment
Degree of protection is equivalent to IP40. Do not install this product where water, salt, dust, or swarf is present or in a pressurized or depressurized environment. The product cannot be used with large temperature variations or high temperature/humidity since condensation may occur inside the body.

**⚠ CAUTION**

■CE-compliance working conditions
This product is CE-marked, indicating conformity with the EMC Directives. The standard for the immunity for industrial environments applied to this product is EN61000-6-2; the following requirements must be satisfied in order to conform to this standard:
Conditions
- The evaluation of this product is performed by using a cable that has a power supply line and a signal line paired to assess the product's performance.
- This product is not equipped with surge protection. Implement surge protection measures on the system side.

### Flow rate unit

**⚠ CAUTION**

■This product's flow rate is measured at a mass flow rate unaffected by temperature or pressure. The unit is L/min, but this is an indication of the mass flow rate converted to volume flow rate at 20°C, 1 atm (101 kPa), and 65% relative humidity.





### Proof pressure

**⚠ CAUTION**

■Proof pressure differs depending on the series. Take note at selection.

### Overflow

**⚠ CAUTION**

■For each series, there is no problem with the sensor even if the overflow is about twice the measuring range. However, if dynamic pressure is applied near the maximum operating pressure (when the secondary side is open and pressure is applied to the primary side), there is a possibility that the sensor will malfunction. When dynamic pressure is applied, such as when filling a workpiece for leakage inspection, be sure to provide a bypass circuit or a squeezer to prevent dynamic pressure from being applied to the sensor.

### Use for suction confirmation, etc.

**⚠ CAUTION**

■When the product is used to confirm suction, etc., select the flow rate range based on the operating vacuum pressure and suction nozzle. Refer to separate sheet "Selection guide for flow rate sensor" on page 392 .

■When using the filter to confirm suction, etc., provide an air filter (Degree of filtration 30 μm or less) upstream from suction to prevent the entry of foreign matter. (We recommend the miniature inline filter dedicated for FSM and FSM-V. Refer to P. 394 for details.)

■When using the fiber tube model within the flow rate range of ±5 L/min, or ±10 L/min in the FSM-V Series, the required flow rate may not flow due to large pressure loss depending on the operating pressure.

■When the product is used to confirm suction, etc., consider the atmospheric dew point and this product's ambient temperature, and use the product under conditions in which dew does not condense in pipes.

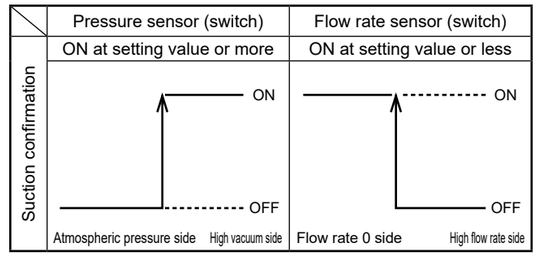
■When used to confirm suction, etc., response time may be delayed by the piping volume between the suction nozzle and this product. In this case, take countermeasures to reduce piping capacity.

### When used for leakage inspection

■The working pressure range is -0.09 to 0.2 MPa. In particular, if the sensor is energized in a vacuum of -0.09 MPa or less, the heat dissipation of the sensor will be poor, leading to deterioration of the sensor.

■When this product is used for vacuum applications such as air supply, do not bend the tube near the push-in fitting. If stress is applied to the tube near the push-in fitting, insert an insert ring into the tube, and connect the tube to the push-in fitting.

■When the suction confirmation sensor is switched from a pressure sensor (switch) to a flow rate sensor (switch), sensor output (switch output) logic will be reversed. (Refer to the drawing below.) Note that the PLC sequence program must be changed or revised. If source pressure or vacuum source is not supplied when device power is turned ON, "flow rate 0" = "sensor output (switch output) ON" status is set at the flow rate sensor (switch). Check that this occurs with the PLC sequence program, etc.




■FSM-X Series
- Because the flow rate-output characteristics may vary depending on the flow path structure, when preparing the flow path block, use after checking the actual flow rate-output characteristics.
- Depending on the fluid, retaining the fluid in the flow path for long periods could adversely affect the performance. Do not seal the fluid in the pipe for long periods of time.

### Wiring

**⚠ WARNING**

■Use a DC stabilized power supply within the specified rating, insulated from the AC power supply. A non-isolated power supply could result in electrical shock. If power is not stabilized, the peak value in summer could exceed the rating and damage the product or reduce precision.

■Stop the control device and equipment and turn power OFF before wiring. Starting operation suddenly could cause unpredictable and dangerous operation. Conduct an energized test with controls and machine devices stopped, and set target switch data. Be sure to discharge any accumulated electrostatic charge among personnel, tools, or equipment before and during work. Connect and wire bend-resistant material, such as robot wire material, for movable sections.

■Install this product and wiring as far away as possible from sources of noise such as power distribution wires. Provide separate countermeasures for surge applied to the power cable.

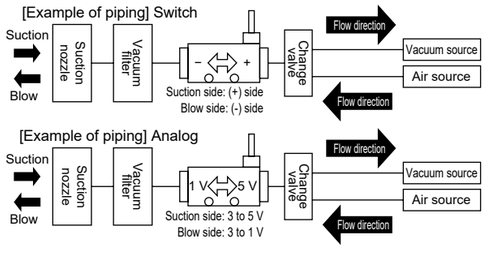
## ⚠CAUTION

■The power supply for the metal body (stainless steel body, aluminum body) type is a DC stabilized power supply completely isolated from the AC primary side. Connect either the + side or - side of the power to the FG. Between the metal body internal power circuit and metal body, a varistor (limit voltage approx. 40 V) is connected to prevent dielectric breakdown of the sensor. Do not conduct a withstand voltage test or insulation resistance test between the internal power circuit and metal body. Disconnect wiring first if this testing is required. An excessive potential difference between power and metal body will burn internal parts. After installing, connecting and wiring the metal body, electrical welding of the equipment/frame or short-circuit accidents, etc., could cause welding current, excessive high voltage caused by welding, or surge voltage, etc., to run through the wiring, ground wire, or fluid path connected between such devices, damaging wires or devices. Conduct any work such as electrical welding after removing this device and disconnecting all electric wires connected to the FG.

## Piping

## ⚠CAUTION

■Before installation of piping and FSM-V, check the direction of arrow on the body and consider the fluid direction and switch operation.




■About FSM-X

- Make sure that the lead wire is free of repeated bends and tension. Otherwise, this could lead to disconnection.
- Make sure that no external force is applied to the connector section during use. The internal base or body may be deformed, resulting in output deviation or external leakage.
- Bi-direction (uni-direction) indicates 3 V (1 V) when the flow rate is 0, and changes to 5 V when the fluid flows to the right (when the connector is to the right of the body).

■Establish the installation method, piping order, and fitting assembly method from the design stage before use. Check that sealing tape, sealant, and foreign matter do not enter the product during installation and fitting assembly. In particular, freshly piped sections may contain unexpected foreign matter. Be sure to discharge air with air blow, etc., before installing this product.

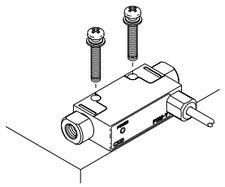
## Mounting

## ⚠CAUTION

■The sensor can be installed in any direction; top, bottom, left, or right.

■FSM-V Series

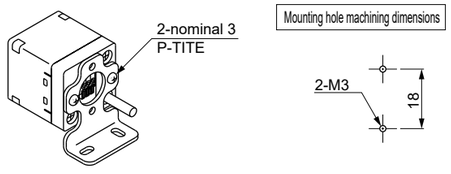
■For miniature flow rate sensor Discrete
Install using the 2 through holes (ø3.2) on the side.



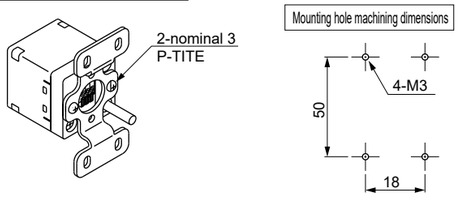
■Do not install multiple product bodies in close contact. The generation of heat on each part could cause the product's temperature to rise, hastening changes in characteristics or deterioration of the resin material. When using the products in a row, set intervals of distance of 10 mm and over.

■Separated display FSM-H-D□, FSM-V-D□ common
Mounting brackets/kits (optional) for installing and mounting the separated display are available.

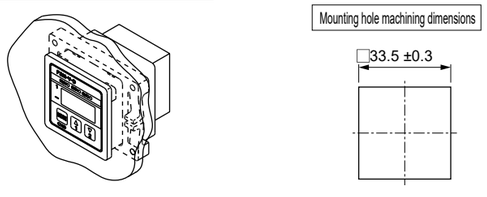
Mounting bracket model No.: PPD3-KL-D : One-side mounting foot (L-shaped mounting)



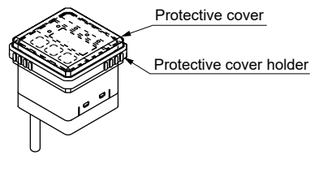

Mounting bracket model No.: PPD3-KD-D : Two-side mounting foot (parallel mounting)




Mounting bracket model No.: PPD3-KHS-D : Panel mounting bracket set, with panel cover




Mounting bracket model No.: PPD3-KC : Operation protective cover




## Other

## ⚠WARNING

■Output accuracy is affected by temperature characteristics and heat generated when energized. Provide a standby time (5 minutes or more after energizing) before use.

■Immediately after power is turned ON, flow rate detection switch operation is not performed for approx. 2 seconds to complete self-diagnosis. Provide a control circuit/program that ignores signals for at least two seconds after power is turned ON.

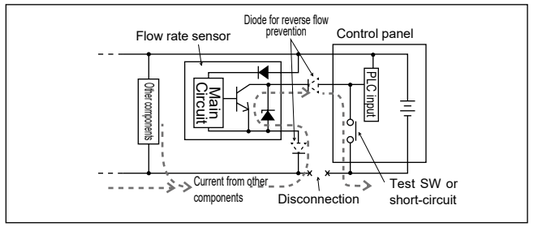
## ⚠CAUTION

■Use the product within the rated flow range.

■Use within the working pressure.

■The accuracy may vary from the initial status depending on the working environment or working conditions. It is recommended to check the operation of the product periodically.

■Pay attention to reverse currents caused by disconnected wires and wiring resistance. If other devices, including a flow rate sensor, are connected to the same power supply as the flow rate sensor, and the switch output wire and power cable negative (-) side are short-circuited to check the operation of the control panel input unit, or if the power cable negative (-) side is disconnected, reverse current could flow to the flow rate sensor's switch output circuit and cause damage.

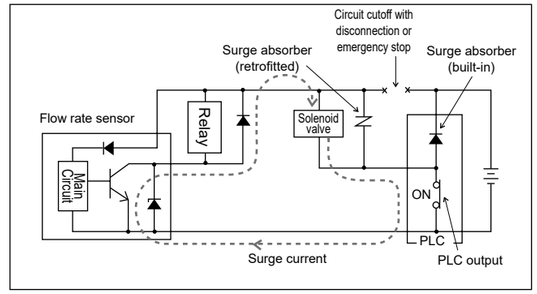



Take the following measures to prevent damage caused by reverse current:

①Avoid centralizing current at the power cable, especially the minus side power cable, and use as thick a cable as possible.
②Limit the number of devices connected to the same power source as the flow rate sensor.
③Insert a diode parallel to the flow rate sensor's output line to prevent reverse current.
④Insert a diode parallel to the flow rate sensor power wire's negative (-) side to prevent reverse current.

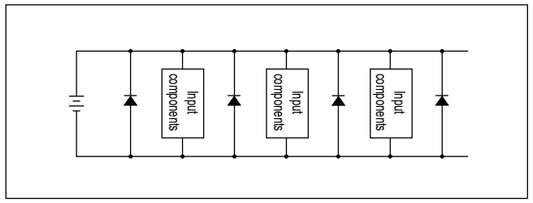


■Pay attention to surge current flow-around. When flow rate sensor power is shared with an inductive load that generates surges, such as a solenoid valve or relay, if the circuit is cut off while the inductive load is functioning, surge current could enter the switch output circuit and cause damage depending on where the surge absorber is installed.




Take the measures below to prevent damage from sneak surge current.

①Separate the power supply for output including the inductive load, such as the solenoid valve and relay, and input, such as the flow rate sensor.
②If a separate power supply cannot be used, directly install a surge absorber for all inductive loads. Consider that the surge absorber connected to the PLC, etc., protects only the individual device.
③Connect a surge absorber to places on the power wiring shown in the figure below, as a measure against disconnections in unspecified areas.




When the devices are connected to a connector, the output circuit could be damaged by the above phenomenon if the connector is disconnected while the power is ON. Turn power OFF before connecting or disconnecting the connector.

■Analog output continues even if the flow rate range is exceeded. Indicatored is the "Hi" display. Note that this is outside the guaranteed precision. Analog output continues even if the flow is reversed. (Note that this is outside the guaranteed precision. Excluding the FSM-V Series.) When confusion with the forward direction signal occurs, use the PLC sequence program to avoid trouble.

Product-specific cautions: Miniature inline filter FSM-VFM Series

## Design / Selection

### ⚠CAUTION

■Do not use this product for vacuum circuits that could come in contact with acids, alkalis, carboxylic acids, other organic compounds, screw-lock agents, solvents, alcohol solutions, or air containing these substances. The body may be damaged, which is dangerous.

■Use the designated tube and plastic plug.
Tube outer diameter accuracy
- Polyamide tube.....Within ±0.1 mm
- Polyurethane tube
  (≤ ø6).....Within ±0.1 mm
  (ø8 ≤)..... Within $^{+\ 0.1}_{-\ 0.15}$ mm

CKD recommended model No.

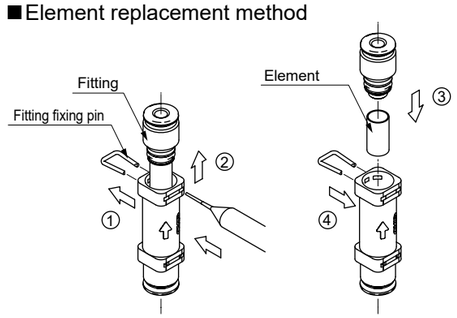
| | |
|---|---|
| Plastic plug | GWP□-B Series |
| Soft nylon tube | F15□ □ Series |
| Polyurethane tube | U95□ □ Series |
| New urethane tube | NU-04, 06 Series |

■For cautions regarding push-in fittings, also read "Safety precautions for fittings/tubes".

■To check the polyamide case for cracks, damage, and other deterioration, perform periodical inspection/cleaning/replacement.

■As a clogged filter element may cause degradation of the vacuum source, perform periodical inspection/cleaning/replacement of the element.

■Element replacement method




①Remove the fitting fixing pin using a jig with a pointed tip, etc. (Make sure not to lose the fitting fixing pin because it will be used again.)
②Pull out the fitting.
③Replace the element and push in the fitting.
④Push in the fitting fixing pin to fix the fitting.

■When the body is detached to clean or replace the filter element, the bowl pressure must be reduced to atmospheric pressure before starting work. Because the flow direction has orientation, check the arrow display on body before reassembly. After reassembly, check if the required degree of vacuum is reached.

■Rinse the body with water after washing with household neutral detergent.

■If small objects with small particle diameter such as dust during the suction enter the flow path, the foreign matter may flow to the secondary side without being filtered. Select a filter suited to the purpose.

For precautions during mounting, installation, adjustment, use and maintenance, refer to the CKD Components Product Site (https://www.ckd.co.jp/kiki/en/) → "Model No.→ Instruction Manual

MEMO