



**FM/FMS SERIES**  
**ELECTROMAGNETIC FLOWMETER**  
OPERATING MANUAL

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## Small Size Electromagnetic Flowsensor

# Model FM/FMS Series Operating Manual




|   |   |
|---|---|
| <b>Danger</b><br>  | Failure to follow instructions may lead to death or serious injury.                     |
| <b>Warning</b><br> | Failure to follow instructions may lead to injury.                                      |
| <b>Caution</b><br> | Failure to follow instructions may lead to product damage (Product malfunctions, etc.). |


#### Precautions in use

|  |  |
|--|--|
| <b>Danger</b><br> | <ol style="list-style-type: none"> <li>1. Do not use the FM Series for applications that requires safety, such as any nuclear, railroad, aircraft, vehicle, playground equipment, etc.</li> <li>2. Do not modify the FM Series.</li> <li>3. The FM Series is not designed to sanitary specifications. Do not use the product for drinks, foods, or medical liquids, etc.</li> <li>4. The FM Series is not designed to explosion-proof specifications. Do not use the product in an environment with flammable gas or something similar.</li> <li>5. Do not use the FM Series for corrosive liquids.</li> </ol> |
|--|--|


#### Operating environments • Liquid to be measured




|   |  |
|---|--|
| <b>Caution</b><br> | <ol style="list-style-type: none"> <li>1. The measurable liquid is <b>uniform water with electric conductivity not less than 50 <math>\mu</math>S/cm</b>. Ensure to follow this electric conductivity. In particular, note that the product cannot be used for a liquid with low conductivity such as pure water, oil, etc.</li> <li>2. Ensure not to install the FM Series at places where liquid to be measured may freeze or, to the contrary, liquid temperature may exceed 60°C</li> <li>3. Trying to measure liquid in which electric current is flowing may lead to abnormality of operation/function.</li> <li>4. Use the FM Series within the <b>pressure range (Not more than 1MPa)</b>.</li> <li>5. The FM Series <b>is IP64 equivalent</b> and is not 100% waterproof structure. Do not install the product in locations where it may become submerged.</li> <li>6. Do not bring a strong magnet or magnetic field close to the FM Series</li> </ol> |
|---|--|

#### Caution in application

|   |  |
|---|--|
| <b>Caution</b><br> | 20 seconds after supplying power to the FM Series is its start-up time. Do not use outputs from and the display of the flow sensor during this period. |
|---|--|

#### Piping

|   |   |
|---|---|
| <b>Caution</b><br> | <ol style="list-style-type: none"> <li>1. <b>Do not use the FM Series at the place air bubbles enter</b> or for measurement of the liquid containing air bubbles. And, do not install the flow sensor in the locations where air collects easily (Upstream side of a downward elbow, etc.). After installation of the flow</li> </ol> |
|---|---|

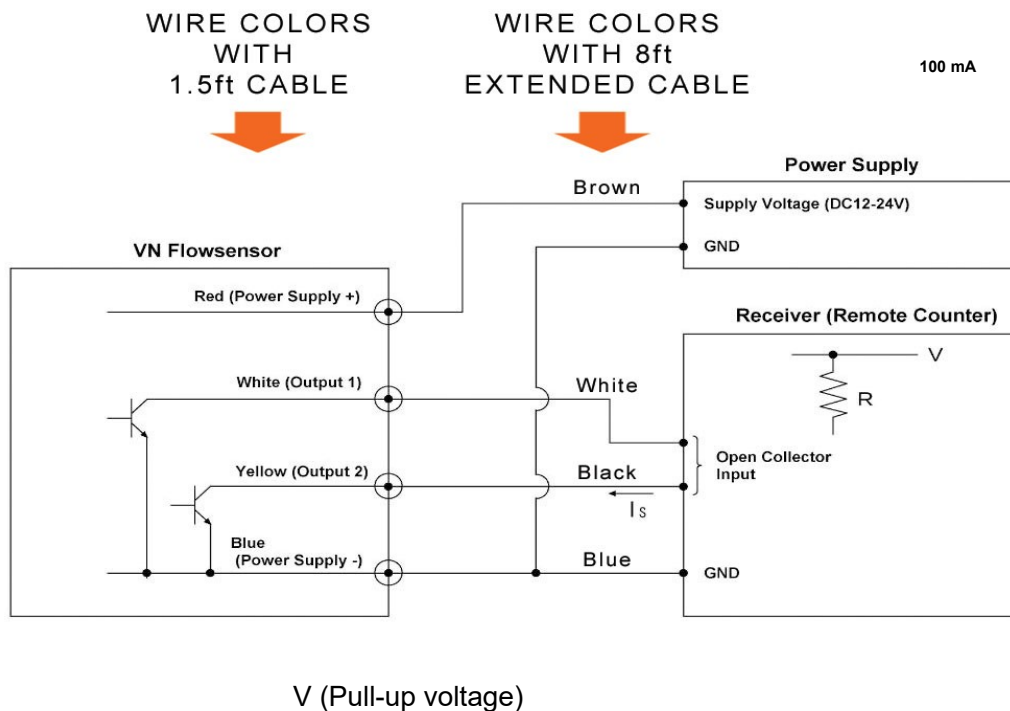
|   |   |
|---|---|
|   | <p>sensor, make sure to perform sufficient air elimination before its operation.</p> <ol style="list-style-type: none"> <li>Although installation position of the FM Series is free, to avoid influence of air bubbles, dart, etc., we recommend the direction of installation that <b>LED seal-face is parallel to the ground or flow direction is vertically upward.</b></li> <li>In case a flow-regulating valve, etc., that causes turbulence of flow is to be installed, its location must be at the downstream side of the flow sensor.</li> <li>Do not install the FM Series in the piping system to which impact pressure, such as water hammer, is applied.</li> <li>In case of new piping, install the FM Series after sufficient cleaning.</li> <li>Arrange piping so that the flow direction conforms to the direction of the arrow indicated on the flow sensor body.</li> <li>Do not install the FM Series in locations where strong compressive force, tensile force, or load is applied after its installation.</li> <li>Make sure that sealing tape or adhesive agent does not protrude from the threaded portion of piping.</li> <li>For the upstream and downstream pipes just before the FM Series to which the flow sensor is to be connected, ensure there is no fins, etc., of thread machining exists at the edges and end-faces of the pipes.</li> <li>Do not drop the FM Series, bang it against something, or apply excessive force. Handle the product by holding its body, not to hold its cable.</li> </ol> |
| <p><b>Warning</b></p>  <p><b>FM only</b></p> | <ol style="list-style-type: none"> <li>Regarding the tightening torque to piping, refer to the value given below for the each the model, and <b>do not apply higher torque to the flow sensor than specified.</b> The flow sensor's connection thread portion(s) may be damaged and the liquid inside the piping may leak consequently. Also, <b>2-3 times of wrapping with sealing tape is indispensable.</b> <p> <b>FM05: <math>3.0 \pm 0.5 \text{ Nm}</math></b><br/> <b>FM10: <math>5.0 \pm 0.5 \text{ Nm}</math></b><br/> <b>FM20: <math>12 \pm 1 \text{ Nm}</math></b> </p> <p>If leakage occurs although piping is done with the torque shown above, do not perform additional tightening. Instead, check for flaws in the threaded portion or sealing tape.</p> </li> <li>Do not install the FM Series in locations used as footholds.</li> </ol>   |
| <b>Wiring</b>   |   |
| <p><b>Danger</b></p>                       | <ol style="list-style-type: none"> <li><b>Operating supply voltage of the FM Series is DC12~24V. Connecting AC100V may cause fire.</b></li> <li>At the time of wiring, ensure to follow instructions of this handling manual to perform wiring.</li> <li>Use the FM Series within the rated voltage range. Do not use the product by applying excessive load that is over the allowable load.</li> </ol>  |
| <b>Caution</b>  |   |
| <p><b>Caution</b></p>                      | <ol style="list-style-type: none"> <li>Do not place the FM Series' cable together with or near to power supply lines or power lines, etc.</li> <li>Isolate the FM Series' cable as far as possible from any source of noise.</li> <li>Electrical isolation of the power supply, a remote counter (a receiver), etc., from others is recommended.</li> <li>Do not apply excessive tensile force to the cable.</li> <li>Ensure that the cable tip is not soaked in water during wiring work.</li> </ol>   |

### Confirmation of the specifications

- Please confirm the descriptions on the upside of the packing box and on the backside of the flow sensor conform to the ordered specifications.
- As there are 2 channels of outputs, please also confirm the specification of the each of 1CH and 2CH is correct.

### Wiring

- The wiring method is as the following diagram.  
NOTE: FMS Series power supply requires 24VDC 100mA (+/- 10%). FM Series power supply operates from 12-24VDC 100mA (+/- 10%).



$$I_s \text{ (Absorbing current of output)} = \frac{V \text{ (Pull-up voltage)}}{R \text{ (Pull-up resistance)}} \leq 20\text{mA}$$

Pull-up voltage shall be not more than 30V, and  $I_s$  (Absorbing current of output) shall be not more than 20mA for the each.

### LED display

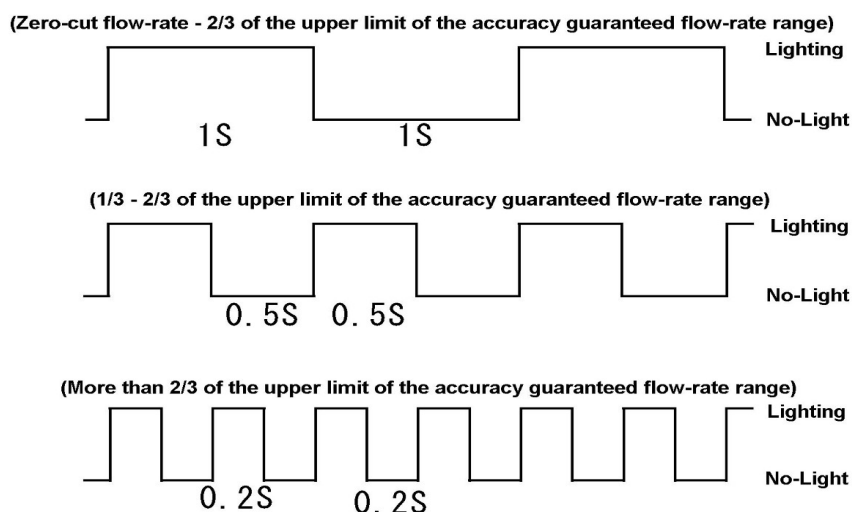
- With 2-colors LED of green and red, either of flow-rate status or alarm information is displayed. Alarm information by error detection has priority of indication. And, only the information that has the highest priority is displayed.

Green: Status of flow-rate is indicated with 4 patterns, which are combination of 3 steps for flashing and lighting.  
Red: Content of alarm (error detection) is indicated with 6 patterns that are combinations of 4 steps for flashing, lighting, and No-light.

## 1. Flow information (Green)

- Flow-rate ranges and patterns of indications

| Flow-rate range   | Patterns of indication  |
|---|---|
| Less than zero-cut flow-rate  | Continuous LIGHTING   |
| Zero-cut flow-rate $\sim$ 1/3 of the upper limit of the accuracy guaranteed flow-rate range | Flashing of 2 seconds cycle. Repeating of 1 second LIGHTING and 1 second of NO-LIGHT.       |
| 1/3 $\sim$ 2/3 of the upper limit of the accuracy guaranteed flow-rate range                | Flashing of 1 seconds cycle. Repeating of 0.5 second LIGHTING and 0.5 second of NO-LIGHT.   |
| More than 2/3 of the upper limit of the accuracy guaranteed flow-rate range                 | Flashing of 0.4 seconds cycle. Repeating of 0.2 second LIGHTING and 0.2 second of NO-LIGHT. |



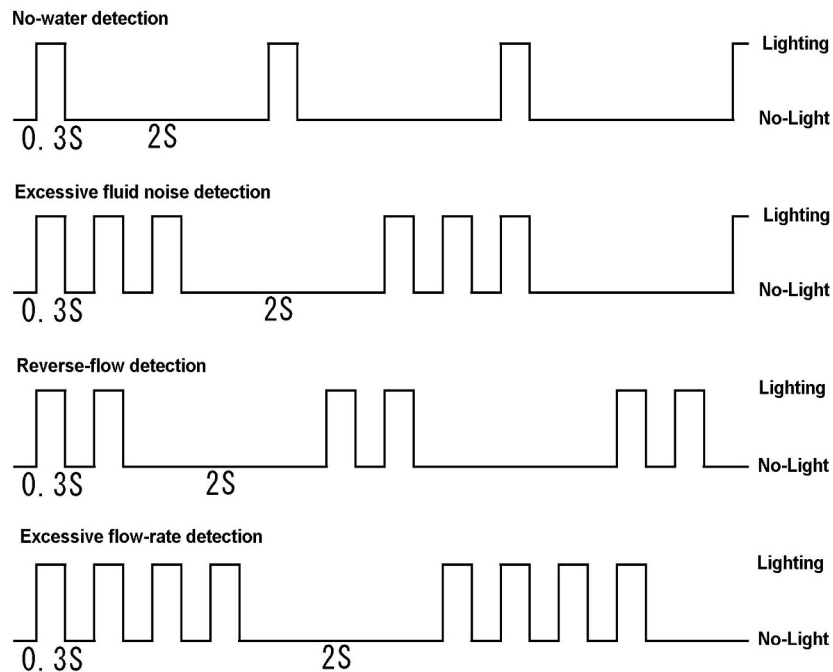
## 2. Alarm information (Red)

- Details of the alarm items

| Name of alarm                    | Content  |
|----------------------------------|--|
| Excitation error detection       | Electric current does not correctly flow through the excitation coil.  |
| Memory error detection           | Error of data at the memory is detected.   |
| Low power voltage detection      | Power voltage lower than minimum is detected.  |
| No-water detection               | The measuring pipe is not fulfilled with liquid to be measured (Partially filled condition).   |
| Excessive liquid noise detection | Condition that correct measuring is obstructed because abnormal current is flown on the liquid to be measured, the liquid contains air bubbles, etc.       |
| Reverse-flow detection           | Reverse flow (flow direction opposite to the arrow shown on the flow sensor body), which flow-rate is more than the zero-cut flow-rate point, is detected. |
| Excessive flow-rate detection    | Not less than 25% excess from the upper limit of the accuracy guaranteed flow-rate range is detected.  |

- **Error detection items and patterns of indications**

| Error detection item                                 | Priority | Patterns of indication  |
|--|----------|---|
| Low power voltage detection                          | 1        | No-LIGHTING of the both green and red   |
| Excitation error detection or Memory error detection | 2        | Continuous LIGHTING   |
| No-water detection                                   | 3        | Repeating of 1 time of 0.3 second LIGHTING and 2 second of NO-LIGHT                             |
| Excessive liquid noise detection                     | 4        | Repeating of 3 times of 0.3 second LIGHTING and 0.3 second of NO-LIGHT + 1.7 second of NO-LIGHT |
| Reverse-flow detection                               | 5        | Repeating of 2 times of 0.3 second LIGHTING and 0.3 second of NO-LIGHT                          |
| Excessive flow-rate detection                        | 6        | Repeating of 4 times of 0.3 second LIGHTING and 0.3 second of NO-LIGHT                          |





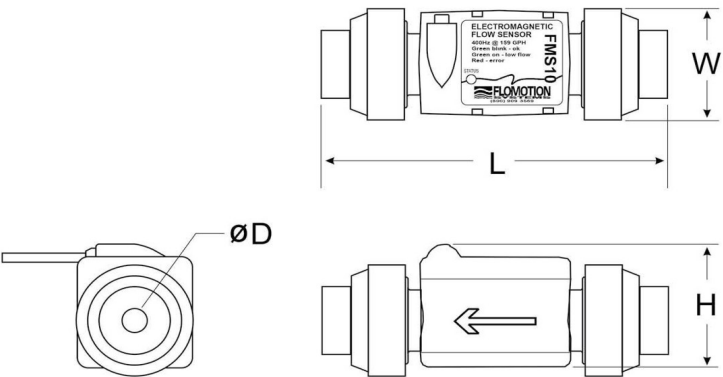
**Warranty period**

Period of warranty for the product is within 1 year from the date of shipment.

**NOTE:**

- The specifications are subject to change without notice.
- FM series conforms with CE marking, except EN61000-4-5 (Surge) because the series is intended to utilize as the built-in flow sensor of a machine, etc.

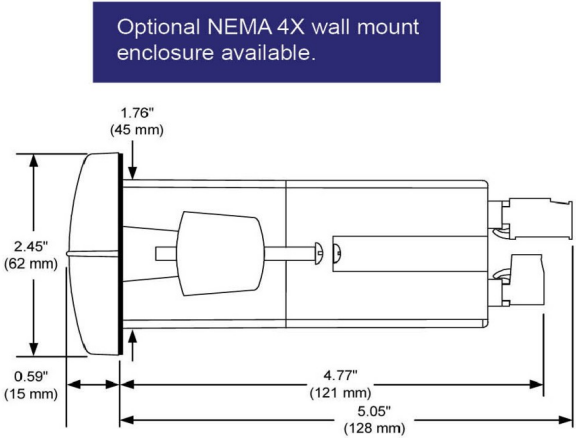
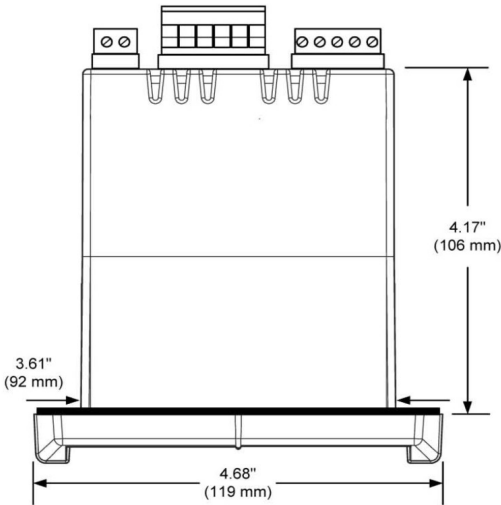
SENSOR DIMENSIONS



|             | FMS05          | FMS10         | FMS20         |
|-------------|----------------|---------------|---------------|
| FLOW GPH    | 0.5 - 15.8     | 5 - 159       | 45 - 950      |
| L**         | 5.55" (141mm)  | 5.55" (141mm) | 6.73" (171mm) |
| W           | 1.89" (48mm)   | 1.89" (48mm)  | 2.36" (60mm)  |
| H           | 2.01" (51mm)   | 2.09" (53mm)  | 2.52" (64mm)  |
| ØD          | 0.205" (5.2mm) | 0.394" (10mm) | 0.787" (20mm) |
| Connection* | 1/2" Union     | 1/2" Union    | 1" Union      |
| K-Factor    | 91139.241      | 9056.604      | 1515.79       |

\* NPT, compression or socket insert optional.  
\*\* Length (L) shown with NPT process connections

INDICATOR / TOTALIZER DIMENSIONS



Optional NEMA 4X wall mount enclosure available.

SENSOR WIRING

