

Product Specifications	FZ01-390E1	1 / 12
Compact Electromagnetic Flow sensor	Model	VN□□S・M

1. Specifications

Basic specifications

Model		VN05M	VN05S	VN10S	VN20S
Nominal diameter		5 mm		10 mm	20 mm
Accuracy guaranteed flow-rate range [L/min]		0.01~0.20	0.05~1.0	0.5~10	3.0~100
Flow rate at measurement start [L/min] (low flow cutoff)		0.005	0.025	0.25	1.5
Measurable fluid		Water (tap water)			
Fluid conductivity range		50μS/cm or more			
Fluid temperature range		0°C to +60°C (no freezing)			
Working ambient temperature/humidity range		-20°C to +60°C, 35 to 85%RH (no condensation)			
Storage ambient temperature range		-20°C to +70°C			
Maximum working pressure		1MPa (fluid temperature of 25°C)			
Pressure loss (maximum accuracy guaranteed flow-rate)		0.02MPa or less			0.05MPa or less
Standard installation position		The LED display to be parallel or vertical to the ground (upward flow) (no air entrapment)			
Flow direction		Arrow direction indicated on the product			
Pipe connection		R1/4		R1/2	R1
Power		21.6 to 26.4VDC (24VDC±10%) *It is recommended to supply power from an isolated power source and connect one power source per VN.			
Current consumption		100mA or less (excluding the current from PNP)			
Response performance		63%-response damping time (Standard): Nominal diameter 5mm, 10mm → 0.5 sec., Nominal diameter 20mm → 2.0 sec. Settable in increments of 0.1 sec. between 0.1 sec. and 600 sec. before shipment			
Cable	Basic specifications		Cable length: 0.5m, 4 cores, AWG28, outer diameter φ2.8, shielded		
	Terminal processing		Remove the coating and twist the core wires.		
	Wiring		Red: Power +, Blue: GND, White: Output 1, Yellow: Output 2		
Protection structure		IP64 or equivalent (indoor specification)			
Mass		Approx. 190g			Approx. 290g
Main material Note 1 (The parts with ○ are wetted.)		Top/bottom cover	PPS		
	○	Body casing	m-PPO	PPS	
	○	Electrode	SUS316L		
	○	Grounding ring	SUS316		
	○	O-ring	FKM		
Others		CE marking, UKCA marking, RoHS directive compliant, positive list-compliant Note 2			

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Note 1: Description of material symbols

PPS	Polyphenylene sulfide
m-PPO	Polyphenylene oxide
FKM	Fluoro rubber
SUS316L	Stainless steel
SUS316	Stainless steel

Note 2: The materials are compliant with the positive list under the Food Sanitation Act enforced in June 2020.

Wetted resin part	Usable food					Max. temperature I. ≤ +70°C II. ≤ +100°C III. ≥ +101°C
	Acidic	Oily and fatty	Milk and milk product	Alcoholic beverage	Others	
Body casing	○	○	○	○	○	III

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◇ Standard accuracy Note3

・VN05M, VN05S, VN10S

Output pulse	Flow-rate range	
	5% to 20% of upper-limit accuracy guaranteed flow-rate	20% to 100% of upper-limit accuracy guaranteed flow-rate
Unit pulse	±0.4%F.S.	±2.0%RD
Frequency pulse	±0.5%F.S.	±2.5%RD

・VN20S

Output pulse	Flow-rate range	
	3% to 12% of upper-limit accuracy guaranteed flow-rate	12% to 100% of upper-limit accuracy guaranteed flow-rate
Unit pulse	±0.24%F.S.	±2.0%RD
Frequency pulse	±0.3%F.S.	±2.5%RD

◇ Temperature characteristics

< Fluid temperature >

Changes in meter errors at the unit pulse outputs at fluid temperatures of +5°C to +60°C

Model	Upper-limit accuracy guaranteed flow-rate	Change in meter error (25°C)
VN05M, VN05S, VN10S	5% to 20%	±0.4%F.S.
	20% to 100%	±2.0%RD
VN20S	3% to 12%	±0.24%F.S.
	12% to 100%	±2.0%RD

< Working ambient temperature >

Changes in meter errors at the unit pulse outputs at working ambient temperatures of -20°C to +60°C

Model	Upper-limit accuracy guaranteed flow-rate	Change in meter error (25°C)
VN05M, VN05S, VN10S	5% to 20%	±0.2%F.S.
	20% to 100%	±1.0%RD
VN20S	3% to 12%	±0.12%F.S.
	12% to 100%	±1.0%RD

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◇ Conductivity characteristics

Changes in meter errors at the unit pulse outputs at fluid conductivities of 50 to 300 μ S/cm

Model	Upper-limit accuracy guaranteed flow-rate	Change in meter error (200 μ S/cm)
VN05M	5% to 20%	$\pm 0.4\%$ F.S.
	20% to 100%	$\pm 2.0\%$ RD
VN05S, VN10S	5% to 20%	$\pm 0.3\%$ F.S.
	20% to 100%	$\pm 1.5\%$ RD
VN20S	3% to 12%	$\pm 0.18\%$ F.S.
	12% to 100%	$\pm 1.5\%$ RD

Note 3: Accuracy requirements

Except for VN05M unless otherwise specified, accuracy is specified based on the errors of the accumulated amounts in 4 minutes under the conditions in the table below.

For VN05M, the accuracy is specified based on the errors of the accumulated amounts in 10 minutes under the conditions in the table below.

Measurable fluid	Water
Fluid temperature	25°C
Ambient temperature	25°C
Fluid conductivity	200 μ S/cm
Piping	Straight pipe length: Upstream side 5D or more, Downstream side 0

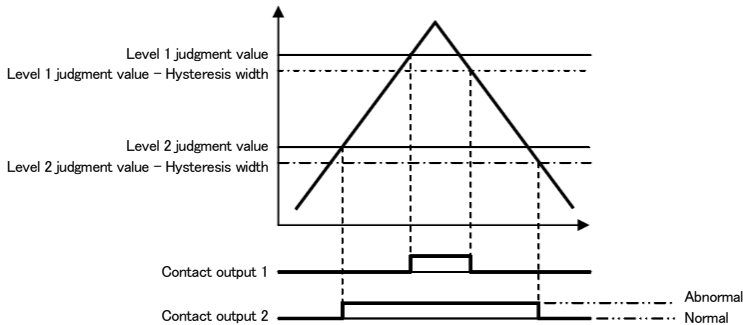
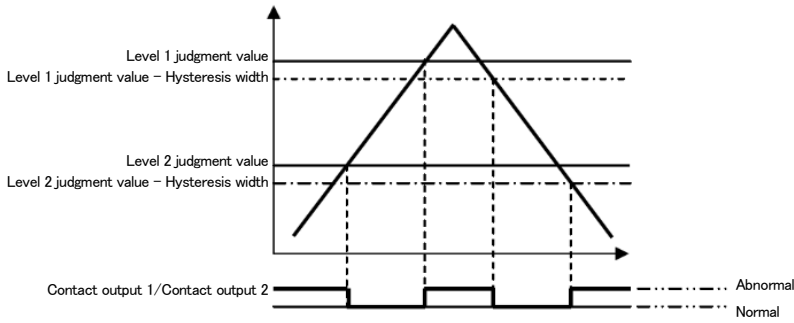
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Output Specifications

Model		VN05M、VN05S、VN10S、VN20S																													
Output type		NPN output			PNP output																										
Maximum load		30VDC 20mA			26.4VDC (Power is supplied from the main body.) 20mA																										
Residual voltage when ON		1V or less			2.4V or less																										
Number of outputs		2ch			2ch																										
Contact output	Output form	Standard: Normally open, Option: Normally closed Output 1 and 2 can be individually set.																													
	Combination	For the combination of output 1 and 2, refer to the contact output selection table below. ◎: Recommended ○: Selectable x: Not selectable <u>Standard</u> Output 1: Frequency pulse Output 2: Alarm																													
		<table><tr><td colspan="2" rowspan="2"></td><td colspan="3">Output 2</td></tr><tr><td>Alarm</td><td>Switch</td><td>Unit pulse</td></tr><tr><td rowspan="4">Output 1</td><td>Frequency pulse</td><td>◎</td><td>◎</td><td>◎</td></tr><tr><td>Unit pulse</td><td>◎</td><td>◎</td><td>◎</td></tr><tr><td>Switch</td><td>◎</td><td>◎</td><td>○</td></tr><tr><td>Alarm</td><td>x</td><td>○</td><td>○</td></tr></table>						Output 2			Alarm	Switch	Unit pulse	Output 1	Frequency pulse	◎	◎	◎	Unit pulse	◎	◎	◎	Switch	◎	◎	○	Alarm	x	○	○	
		Output 2																													
		Alarm	Switch	Unit pulse																											
Output 1	Frequency pulse	◎	◎	◎																											
	Unit pulse	◎	◎	◎																											
	Switch	◎	◎	○																											
	Alarm	x	○	○																											
Flow-rate output	Frequency pulse	Duty ratio: 50±10% Frequency of upper-limit accuracy guaranteed flow-rate (span frequency): Standard: 200Hz Option: 20 to 400Hz, settable in increments of 0.1Hz																													
	Unit pulse	<table><tr><td>Nominal diameter</td><td colspan="4">Pulse unit (Duty 50±10% unless otherwise specified)</td></tr><tr><td>5mm</td><td>0.05mL/P Duty 50±30%</td><td>0.001L/P (Standard)</td><td>0.01L/P</td><td>0.1 L/P</td></tr><tr><td>10mm</td><td></td><td>0.01L/P (Standard)</td><td>0.1L/P</td><td>1L/P</td></tr><tr><td>20mm</td><td></td><td>0.1L/P (Standard)</td><td>1L/P</td><td>10L/P</td></tr></table>					Nominal diameter	Pulse unit (Duty 50±10% unless otherwise specified)				5mm	0.05mL/P Duty 50±30%	0.001L/P (Standard)	0.01L/P	0.1 L/P	10mm		0.01L/P (Standard)	0.1L/P	1L/P	20mm		0.1L/P (Standard)	1L/P	10L/P					
Nominal diameter	Pulse unit (Duty 50±10% unless otherwise specified)																														
5mm	0.05mL/P Duty 50±30%	0.001L/P (Standard)	0.01L/P	0.1 L/P																											
10mm		0.01L/P (Standard)	0.1L/P	1L/P																											
20mm		0.1L/P (Standard)	1L/P	10L/P																											

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Output Specifications (continued)

Switch output	<p>Select either level judgment or window judgment. Output 1 and 2 can be individually selected. Either normally open (standard) or normally closed can be selected. Level 1 and 2 judgment values and hysteresis width (common for level 1 and 2) can be set in increments of 1% between 0% and 100% of upper-limit accuracy guaranteed flow-rate. *If the value of (level judgment value - hysteresis width) is below 0, it cannot be set.</p>
Level judgment	<p>Flow rate is judged to determine whether it is equal to or less than the level judgment value or is greater than the value. Output 1 is compared to the level 1 judgment value, and output 2 is compared to the level 2 judgment value. When a flow rate is equal to or less than the level determination value, it is judged to be normal, and when it is greater than the value, it is judged to be abnormal.</p> 
Window judgment	<p>Flow rate is judged to determine whether it is between the upper limit and the lower limit or is out of that range. When a flow rate is equal to or less than the upper limit and is equal to or above the lower limit, it is judged to be normal. When it is greater than the upper limit or less than the lower limit, it is judged to be abnormal. The upper limit and the lower limit can be set based on either the level 1 judgment value or the level 2 judgment value.</p> 

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Output Specifications (continued)

Contact output alarms	<ul style="list-style-type: none"> - Types of contact output alarms ※1: <ul style="list-style-type: none"> (1) Internal error (2) No-water detection (3) Excessive fluid noise detection (4) Reverse flow detection (5) Excessive flow rate detection (6) Low power voltage detection - Normal state is when no error is detected, and abnormal state is when any error is detected. <ul style="list-style-type: none"> - Standard: (1) Internal error, (2) No-water detection, and (6) Low power voltage detection is enabled. - Option: (1) to (5) can be individually enabled/disabled. <li style="padding-left: 40px;">*(6) is requisite and cannot be disabled.
LED display	<p>A 2-color LED (green/red) is provided on the sensor body.</p> <p>Green: Indicates flow rates with flashing lights at 3-stage speeds.</p> <p>Red: Indicates errors by the number of flashing times.</p> <p>For details, refer to "Chapter 4 LED Display."</p>

※1 : Description of error

Internal error	When an error has occurred in the internal data or circuit
No-water detection	When the flow sensor's measuring pipe portion is not fulfilled with water
Excessive fluid noise detection	When correct fluid measurement is not possible because electricity is flowing through the fluid or bubble is contained in the fluid
Reverse-flow detection	When the fluid is flowing in the direction opposite to the arrow on the flow sensor
Excessive flow-rate detection	When the flow rate exceeds 125% of the upper limit of the accuracy guaranteed flow rate
Low power voltage detection	When the power supply voltage has gone lower

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2. Selection Sheet

* Check ☒ of each item to select or enter a value as necessary.

Model		<input type="checkbox"/> VN05M <input type="checkbox"/> VN05S <input type="checkbox"/> VN10S <input type="checkbox"/> VN20S		
Output type		<input type="checkbox"/> NPN output <input type="checkbox"/> PNP output		
Low flow cutoff (In case flow-rate is lower than the specified flow-rate, it is calculated as 0.)		<input type="checkbox"/> Yes (Standard) <input type="checkbox"/> No For "Yes": VN05M:0.005 L/min, VN05S:0.025 L/min, VN10S:0.25 L/min, VN20S:1.5 L/min		
Dumping (Enter the number of seconds.)		<div style="border: 1px solid black; padding: 2px; display: inline-block;"> <div style="border: 1px solid black; width: 40px; height: 20px; margin: 0 auto;"></div> sec </div>	Choose from 0.1 to 600 seconds (Standard: VN05S/M, VN10S:0.5 seconds VN20S:2 seconds) ★Enter a value in 0.1-second steps.	
*2 Output 1	Output format	<input type="checkbox"/> Normal Open (N.O.: Standard) <input type="checkbox"/> Normal Close (N.C.)		
	Output type Choose one of the options. * Standard is frequency pulse.	<input type="checkbox"/> Frequency pulse*1 (Standard)	<div style="border: 1px solid black; padding: 2px; display: inline-block;"> <div style="border: 1px solid black; width: 40px; height: 20px; margin: 0 auto;"></div> Hz </div> 20.0 to 400.0Hz (Standard: 200.0Hz) ★ The frequency is selectable by 0.1Hz steps.	
		<input type="checkbox"/> Unit pulse (Duty 50±10% unless otherwise specified)	・VN05: <input type="checkbox"/> 0.05mL/P(Duty50±30%) <input type="checkbox"/> 0.001L/P(Standard) <input type="checkbox"/> 0.01L/P <input type="checkbox"/> 0.1L/P ・VN10: <input type="checkbox"/> 0.01L/P(Standard) <input type="checkbox"/> 0.1L/P <input type="checkbox"/> 1L/P ・VN20: <input type="checkbox"/> 0.1L/P(Standard) <input type="checkbox"/> 1L/P <input type="checkbox"/> 10L/P	
		<input type="checkbox"/> Alarm*3	For each alert judgment item, the state is normal if nothing is detected and abnormal if any item is detected. Choose items to trigger alerts in 2-1. Alarm Judgment Items below. * In case Alarm is selected for Output 1, choose other than Alarm for Output 2.	
		<input type="checkbox"/> Switch level judgment	This is to judge as normal condition when flow-rate is not more than the set Level1 Judgment Value and as abnormal condition when flow-rate is above the set Level 1 Judgment Value. → Enter the level judgment values in 2-2.Level Judgment Values. 	
		<input type="checkbox"/> Switch window judgment*4	This is to detect whether flow-rate is within the set upper limit and the set lower limit or falls outside the range, and to judge as normal condition when flow-rate is not more than the set upper limit and not less than the set and as abnormal condition when flow-rate falls outside of the range. Setting of the upper limit value and the lower limit value can be with either of Level 1 Judgment Value and Level 2 Judgment Value. → Enter the level judgment values in 2-2.Level Judgment Values. 	

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Output 2*2	Output format	<input type="checkbox"/> Normal Open (N.O.: Standard) <input type="checkbox"/> Normal Close (N.C.)	
	Kind of output Choose one of the options. * Standard is Alert.	<input type="checkbox"/> Alarm*3 (Standard)	Same as Output 1
		<input type="checkbox"/> Unit pulse (Duty 50±10% unless otherwise specified)	・VN05 : <input type="checkbox"/> 0.05mL/P (Duty50±30%) <input type="checkbox"/> 0.001L/P (Standard) <input type="checkbox"/> 0.01L/P <input type="checkbox"/> 0.1L/P ・VN10 : <input type="checkbox"/> 0.01L/P (Standard) <input type="checkbox"/> 0.1L/P <input type="checkbox"/> 1L/P ・VN20 : <input type="checkbox"/> 0.1L/P (Standard) <input type="checkbox"/> 1L/P <input type="checkbox"/> 10L/P
		<input type="checkbox"/> Switch level judgment	Same as Output 1
		<input type="checkbox"/> Switch window judgment*4	Same as Output 1

2-1. Alert Judgment Items

No-water detection	LED operation	<input type="checkbox"/> Active (Standard)	<input type="checkbox"/> Inactive
	Switch output	<input type="checkbox"/> Active (Standard)	<input type="checkbox"/> Inactive
Excessive fluid noise detection	LED operation	<input type="checkbox"/> Active (Standard)	<input type="checkbox"/> Inactive
	Switch output	<input type="checkbox"/> Active (Standard)	<input type="checkbox"/> Inactive
Reverse-flow detection	LED operation	<input type="checkbox"/> Active (Standard)	<input type="checkbox"/> Inactive
	Switch output	<input type="checkbox"/> Active (Standard)	<input type="checkbox"/> Inactive
Excessive flow-rate detection	LED operation	<input type="checkbox"/> Active (Standard)	<input type="checkbox"/> Inactive
	Switch output	<input type="checkbox"/> Active	<input type="checkbox"/> Inactive (Standard)

2-2. Level Judgment Values*5

Level 1 judgment value	<input type="text" value=" % "/>	0 to 100% (Standard: 50%) ★This is selectable by 1% steps.
Level 2 judgment value	<input type="text" value=" % "/>	0 to 100% (Standard: 30%) ★This is selectable by 1% steps.
Hysteresis	<input type="text" value=" % "/>	0 to 9% (Standard: 3%) ★This is selectable by 1% steps.

*1: Indicates the frequency at the maximum accuracy guaranteed flow rate.

*2: Output 1 and 2 values and selected items are fixed at factory and cannot be changed after installation.

*3: Alarm can be selected for either Output 1 or Output 2 only.

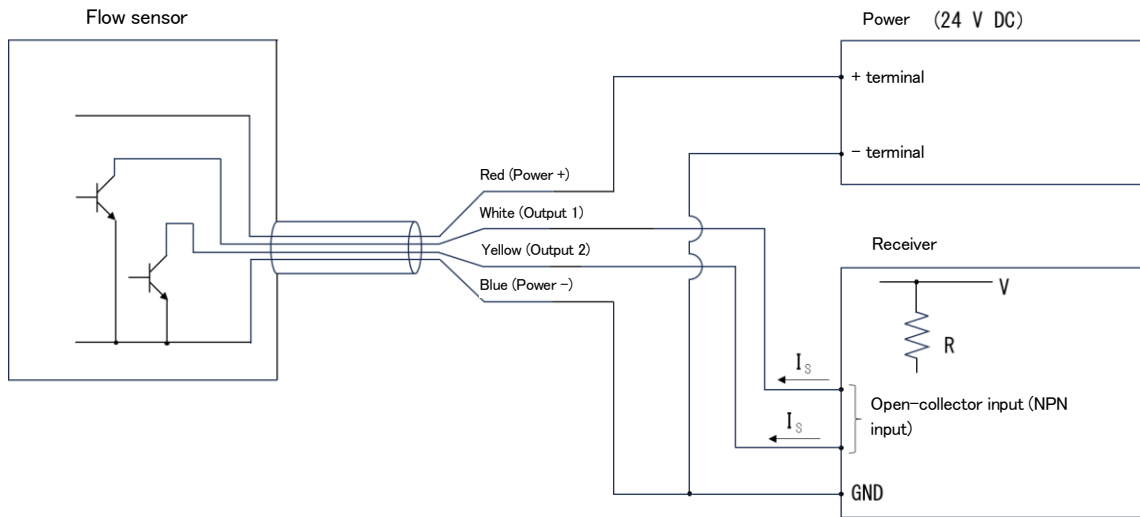
*4: Window judgment is calculated and output by using the set values for Output 1 and 2

*5: The maximum flow-rate of the accuracy guaranteed flow-rate range is 100%.

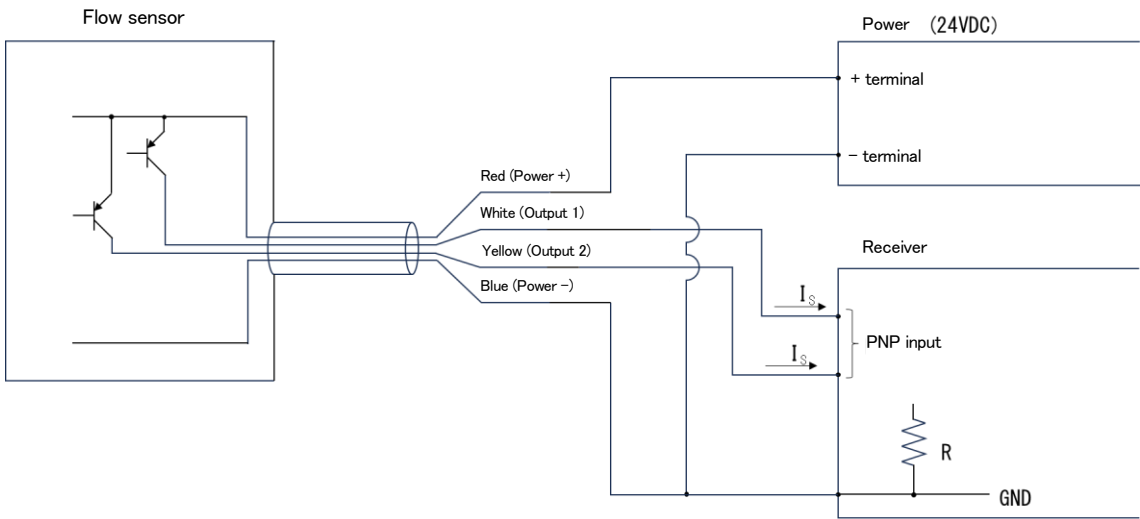
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3. Wiring Method

◇Wire diagram (NPN output)



◇Wire diagram (PNP output)



Lay the wiring in such a way that the pulse detection voltage and the output sink current fall within the values in the table below.

	NPN output	PNP output
Pulse detection voltage	30V or less	26.4V or less (Power is supplied from this product.)
Output sink current I_s^*	20mA or less	20mA or less

$$\times I_s (\text{Output sink current: mA}) = \frac{V (\text{Pulse detection voltage: V})}{R (\text{Current - limiting resistor: k}\Omega)}$$

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4. LED Display

Flow Rate (Green LED)

The display pattern changes according to flow rate as shown in the table and figures below.

Flow-rate range	Display pattern
Below the low flow cutoff flow-rate	Solid on
Between the low flow cutoff flow-rate and 1/3 of the upper-limit accuracy guaranteed flow-rate	2-second flashing cycle Repeat of 1-second solid on and 1-second off
1/3 to 2/3 of the upper-limit accuracy guaranteed flow-rate	1-second flashing cycle Repeat of 0.5-second solid on and 0.5-second off
2/3 or more of the upper-limit accuracy guaranteed flow-rate	0.4-second flashing cycle Repeat of 0.2-second solid on and 0.2-second off

Alarm (Red LED)

The display pattern changes according to the type of detected errors as shown in the table and figures below.

Error	Priority	Display pattern
Low power voltage detection	1	Green and red lights off
Internal error	2	Solid on
No-water detection	3	Repeat of 0.3-second solid on and 0.3-second off + 1.7-second off as a set
Excessive fluid noise detection	4	Repeat of 0.3-second solid on and 0.3-second off for 3 times + 1.7-second off as a set
Reverse flow detection	5	Repeat of 0.3-second solid on and 0.3-second off for 2 times + 1.7-second off as a set
Excessive flow rate detection	6	Repeat of 0.3-second solid on and 0.3-second off for 4 times + 1.7-second off as a set

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5. Precautions for handling

Before handling the product, be sure to read the handling manual carefully. And, use the product correctly.

5-1. Working environment, fluid to be measured

- (1) Ensure that the wetted parts' materials have corrosion resistance against fluid to be measured.
- (2) The product cannot be used for non-conducting fluid such as purified water, oil, etc.
- (3) Flowing of electric current in the fluid to be measured may leads to incorrect operation.
- (4) Keep the product away from a strong magnetic field or a source of electric noise.
- (5) The product is not explosion-proof specification. Do not use the product in an explosive atmosphere such as flammable gas, etc.
- (6) This product is not intended for sanitary use and must not be used for food, beverages, or medical solutions.
- (7) Do not use this product for applications requiring safety, such as nuclear, railroad, airplane, automobile, and recreational equipment.
- (8) Do not install the product in areas exposed to strong light such as direct sunlight or to heat radiation.
- (9) This product is not of a perfect waterproof structure. (IP64)
Do not install the product outdoors or where it may be submerged in water.

5-2. Precautions for piping

- (1) In case of parallel installation of plural pieces of the product, to decrease wavering of flow detection by electromagnetic interference, distance each of them 20cm or more.
- (2) No air shall be in the fluid to be measured. The measurement accuracy is to be affected.
Do not install the product at a place where air accumulation can easily occur (e.g. upstream side of a falling pipe.) Also, before start measurement, remove air sufficiently.
- (3) For the installation position of the flow sensor, to avoid influence of air bubbles, dust, dirt, etc., the orientation that makes the flow direction be from bottom to top is recommended.
- (4) Devices such as a flow-rate adjusting valve, etc., which disturb flow shall be installed in the downstream of the flow sensor.
- (5) Avoid installing the product where it is exposed to excessive pressure, such as water hummer, etc.
- (6) In case foreign substances, oil, etc., exist in the piping, install the flow sensor after cleaning inside of the pipe.
- (7) Make sure to align the flow direction of the fluid with the flow direction indicated by the arrow on the main body.
- (8) Around the place of installation, provide enough space for maintenance.
- (9) Lay the piping in such a way that it is always filled with fluid.

5-3. Wiring

- (1) Do not lay the wiring along with the power line, etc.
- (2) Lay the wiring as far away from the noise source as possible.
- (3) For a power supply and a remote counter, it is recommended to electrically isolate them from others.