Water Detection Sensor

**EZ-10 SERIES**

Detects water...reliably!

**Strong penetration power**
As the penetration power is strong, its beam can pass through not only translucent containers (PFA tanks, etc.) but also opaque containers of shampoo bottles, etc., and can reliably detect the liquid inside.

**Penetration in case of an empty container (Typical)**

- **Transparent container**
- **Milk-white container**
- **Colored bottle**
- **Opaque container**
- **Shampoo bottle**

*The graph above is merely a guideline. Penetration power changes due to container material, thickness and color. We strongly recommend that you conduct verification tests prior to use.*

**Not affected by drops, bubbles or froth**
It is possible to set its sensitivity adjuster so that water drops, bubbles in the water, or froth on the water surface are not detected.

**IP67 protection**
The sensor can be hosed down because of its IP67 construction and the non-corrosive stainless steel sensor mounting bracket.

*Note: However, take care that if it is exposed to water splashes during operation, it will detect the splashed water itself.*

**Adjacent sensor mounting possible**
Several sensors can be mounted adjacently by fitting optional slit masks. Further, they can detect the liquid level accurately.

**Plug-in connector type is available**
Plug-in connector type which enables connection / disconnection of the cable by one-touch is available. Anyone can easily replace the sensor in a minute.
Applications

Detecting level of aqueous solution in resin tank
It can reliably detect a liquid even in an opaque container.

Detecting the boundary between water and oil
Since it does not detect oil, it can reliably detect the boundary between water and oil.

Detecting presence of liquid in colored bottle
Aqueous liquids in translucent colored bottles can be reliably detected.

Order Guide

<table>
<thead>
<tr>
<th>Type</th>
<th>Appearance</th>
<th>Sensing range (Note 1)</th>
<th>Model No. (Note 2)</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPN output</td>
<td></td>
<td>5m (without container)</td>
<td>EZ-11</td>
<td>NPN open-collector</td>
</tr>
<tr>
<td>PNP output</td>
<td></td>
<td>5m (without container)</td>
<td>EZ-11-PN</td>
<td>PNP open-collector</td>
</tr>
</tbody>
</table>

Note: Mounting bracket is not supplied with the sensor. Please select from the range of optional sensor mounting brackets (five types).

5 m 16.404 ft cable length type and plug-in connector type

5 m 16.404 ft cable length type (standard: 2 m 6.562 ft) and plug-in connector type (standard: cable type) are also available. (5 m 16.404 ft cable length type is not available for the EZ-11-PN.) When ordering this type, suffix “-C5” for 5 m 16.404 ft cable length type, “-J” for plug-in connector type to the model No. (e.g.) Plug-in connector type of EZ-11-PN is “EZ-11-PN-J”.

Mating cable for plug-in connector type (2 cables are required)

<table>
<thead>
<tr>
<th>Type</th>
<th>Model No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight</td>
<td>CN-24E-C2</td>
<td>Length: 2 m 6.562 ft</td>
</tr>
<tr>
<td></td>
<td>CN-24E-C5</td>
<td>Length: 5 m 16.404 ft</td>
</tr>
<tr>
<td>Elbow</td>
<td>CN-24EL-C2</td>
<td>Length: 2 m 6.562 ft</td>
</tr>
<tr>
<td></td>
<td>CN-24EL-C5</td>
<td>Length: 5 m 16.404 ft</td>
</tr>
</tbody>
</table>

0.2 mm² 4-core cabtyre cable with connector on one end
Cable outer diameter: Φ3.7 mm Φ0.146 in
## OPTIONS

<table>
<thead>
<tr>
<th>Designation</th>
<th>Model No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round slit mask</td>
<td>OS-CX-05 (Slit size 0.5 mm) 0.020 in</td>
<td>Slit on one side  Sensing range: 200 mm 7.874 in</td>
</tr>
<tr>
<td></td>
<td>OS-CX-1 (Slit size 0.5 mm) 0.020 in</td>
<td>Slit on both sides  Sensing range: 10 mm 0.394 in</td>
</tr>
<tr>
<td></td>
<td>OS-CX-2 (Slit size 0.5 mm) 0.020 in</td>
<td>Slit on one side  Sensing range: 400 mm 15.748 in</td>
</tr>
<tr>
<td></td>
<td>OS-CX-05-6 (Slit size 0.5 × 6 mm) 0.020 × 0.236 in</td>
<td>Slit on both sides  Sensing range: 800 mm 31.496 in</td>
</tr>
<tr>
<td>Rectangular slit mask</td>
<td>OS-CX-1-6 (Slit size 0.5 × 6 mm) 0.020 × 0.236 in</td>
<td>Slit on one side  Sensing range: 1.3 m 4.265 ft</td>
</tr>
<tr>
<td></td>
<td>OS-CX-2-6 (Slit size 0.5 × 6 mm) 0.020 × 0.236 in</td>
<td>Slit on both sides  Sensing range: 2 m 6.562 ft</td>
</tr>
<tr>
<td>MS-CX-2-1</td>
<td>Foot angled mounting bracket (Two brackets are required.)</td>
<td></td>
</tr>
<tr>
<td>MS-CX-2-2</td>
<td>Foot biangled mounting bracket (Two brackets are required.)</td>
<td></td>
</tr>
<tr>
<td>MS-CX-2-4</td>
<td>Protective mounting bracket (Two brackets are required.)</td>
<td></td>
</tr>
<tr>
<td>MS-CX-2-5</td>
<td>Back biangled mounting bracket (Two brackets are required.)</td>
<td></td>
</tr>
<tr>
<td>MS-CX-3</td>
<td>Back angled mounting bracket (Two brackets are required.)</td>
<td></td>
</tr>
</tbody>
</table>

**Sensor mounting bracket (Note 1)**

<table>
<thead>
<tr>
<th>Designation</th>
<th>Model No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS-AJ1</td>
<td>Horizontal mounting type</td>
<td>Basic assembly</td>
</tr>
<tr>
<td>MS-AJ2</td>
<td>Vertical mounting type</td>
<td></td>
</tr>
<tr>
<td>MS-AJ1-A</td>
<td>Horizontal mounting type</td>
<td></td>
</tr>
<tr>
<td>MS-AJ2-A</td>
<td>Vertical mounting type</td>
<td></td>
</tr>
</tbody>
</table>

**Universal sensor mounting stand (Note 2)**

<table>
<thead>
<tr>
<th>Designation</th>
<th>Model No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS-AJ1</td>
<td>Horizontal mounting type</td>
<td></td>
</tr>
<tr>
<td>Elevation angle: ±45°</td>
<td>Swivels: 360° rotation</td>
<td>Height adjustment: 150 mm 5.906 in approx.</td>
</tr>
<tr>
<td>Mounting hole for M6 screw</td>
<td>360° rotation</td>
<td></td>
</tr>
<tr>
<td>MS-AJ2</td>
<td>Vertical mounting type</td>
<td></td>
</tr>
<tr>
<td>Elevation angle: ±45°</td>
<td>Swivels: 360° rotation</td>
<td>Height adjustment: 150 mm 5.906 in approx.</td>
</tr>
<tr>
<td>Mounting hole for M6 screw</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS-AJ1-A</td>
<td>Horizontal mounting type</td>
<td></td>
</tr>
<tr>
<td>Forward / back adjustment: 130 mm 5.118 in approx.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Angle adjustment: ±45°</td>
<td>Swivels: 360° rotation</td>
<td></td>
</tr>
<tr>
<td>Height adjustment: 150 mm 5.906 in approx.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mounting hole for M6 screw</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS-AJ2-A</td>
<td>Vertical mounting type</td>
<td></td>
</tr>
<tr>
<td>Forward / back adjustment: 130 mm 5.118 in approx.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Angle adjustment: ±45°</td>
<td>Swivels: 360° rotation</td>
<td></td>
</tr>
<tr>
<td>Height adjustment: 150 mm 5.906 in approx.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mounting hole for M6 screw</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Round slit mask**

- **OS-CX-5**
  - Used for narrowing the beam for cases when detecting water or other substances inside slender pipes.
  - Fitted on the front face of the sensor with one-touch.

**Rectangular slit mask**

- **OS-CX-6**
  - Used for narrowing the beam for cases when detecting water or other substances inside slender pipes.
  - Fitted on the front face of the sensor with one-touch.

**Sensor mounting bracket**

- **MS-CX2-1**
  - Two M3 (length 12 mm 0.472 in) screws with washers are attached.

- **MS-CX2-2**
  - Two M3 (length 12 mm 0.472 in) screws with washers are attached.

- **MS-CX2-4**
  - Two M3 (length 14 mm 0.551 in) screws with washers are attached.

- **MS-CX2-5**
  - Two M3 (length 12 mm 0.472 in) screws with washers are attached.

- **MS-CX2-3**
  - Two M3 (length 12 mm 0.472 in) screws with washers are attached.

**Notes:**
1. The plug-in connector type sensor does not allow use of some sensor mounting brackets because of the protrusion of the connector.
2. Refer to p.979 for details of the universal sensor mounting stand MS-AJ series.

**Circular slit mask**

- **OS-CX-5**
  - For using the beam for cases when detecting water or other substances inside slender pipes.
  - Fitted on the front face of the sensor with one-touch.

**Rectangular slit mask**

- **OS-CX-6**
  - Used for narrowing the beam for cases when detecting water or other substances inside slender pipes.
  - Fitted on the front face of the sensor with one-touch.

**Sensor mounting bracket**

- **MS-CX2-1**
  - Two M3 (length 12 mm 0.472 in) screws with washers are attached.

- **MS-CX2-2**
  - Two M3 (length 12 mm 0.472 in) screws with washers are attached.

- **MS-CX2-4**
  - Two M3 (length 14 mm 0.551 in) screws with washers are attached.

- **MS-CX2-5**
  - Two M3 (length 12 mm 0.472 in) screws with washers are attached.

- **MS-CX2-3**
  - Two M3 (length 12 mm 0.472 in) screws with washers are attached.

**Sensor mounting bracket**

- **MS-CX2-1**
  - Two M3 (length 12 mm 0.472 in) screws with washers are attached.

- **MS-CX2-2**
  - Two M3 (length 12 mm 0.472 in) screws with washers are attached.

- **MS-CX2-4**
  - Two M3 (length 14 mm 0.551 in) screws with washers are attached.

- **MS-CX2-5**
  - Two M3 (length 12 mm 0.472 in) screws with washers are attached.

- **MS-CX2-3**
  - Two M3 (length 12 mm 0.472 in) screws with washers are attached.
**SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Item</th>
<th>NPN output</th>
<th>PNP output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>EZ-11</td>
<td>EZ-11-PN</td>
</tr>
<tr>
<td>Sensing range</td>
<td>5 m 16.404 ft (without container or pipe)</td>
<td>12.4 ft</td>
</tr>
<tr>
<td>Sensing object</td>
<td>ø12 mm ø0.472 in or more liquid which contains water, or opaque object</td>
<td>2.44 mm ø0.095 in</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>12 to 24 V DC ±10 % Ripple P-P 10 % or less</td>
<td>24 V DC ±10 %</td>
</tr>
<tr>
<td>Current consumption</td>
<td>Emitter: 25 mA or less, Receiver: 25 mA or less</td>
<td>25 mA or less</td>
</tr>
</tbody>
</table>

**Output**
- NPN open-collector transistor
  - Maximum sink current: 100 mA
  - Applied voltage: 30 V DC or less (between output and 0 V)
  - Residual voltage: 1.5 V or less (at 100 mA sink current)
  - 0.4 V or less (at 16 mA sink current)
- PNP open-collector transistor
  - Maximum source current: 100 mA
  - Applied voltage: 30 V DC or less (between output and V)
  - Residual voltage: 1.5 V or less (at 100 mA source current)
  - 0.4 V or less (at 16 mA source current)

**Utilization category**
- DC-12 or DC-13

**Operation indicator**
- Orange LED (lights up when the output is ON), located on the receiver

**Stability indicator**
- Green LED (lights up under stable light received condition or stable dark condition), located on the receiver

**Power indicator**
- Orange LED (lights up when the power is ON), located on the emitter

**Sensitivity adjuster**
- Continuously variable adjuster

**Environmental resistance**

<table>
<thead>
<tr>
<th>Environmental resistance</th>
<th>PNP output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pollution degree</td>
<td>3 (Industrial environment)</td>
</tr>
<tr>
<td>Protection</td>
<td>IP67 (IEC)</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>0 to +55 °C +32 to +131 °F (No dew condensation or icing allowed), Storage: -30 to +70 °C -22 to +158 °F</td>
</tr>
<tr>
<td>Ambient humidity</td>
<td>35 to 85 % RH, Storage: 35 to 85 % RH</td>
</tr>
<tr>
<td>Ambient illuminance</td>
<td>Sunlight: 10,000 lx at the light-receiving face, Incandescent light: 3,000 lx at the light-receiving face</td>
</tr>
<tr>
<td>EMC</td>
<td>EN 50081-2, EN 50082-2, EN 60947-5-2</td>
</tr>
<tr>
<td>Voltage withstandability</td>
<td>1,000 V AC for one min. between all supply terminals connected together and enclosure</td>
</tr>
<tr>
<td>Insulation resistance</td>
<td>20 MΩ, or more, with 250 V DC megger between all supply terminals connected together and enclosure</td>
</tr>
<tr>
<td>Vibration resistance</td>
<td>10 to 500 Hz frequency, 3 mm 0.118 in amplitude (20 G max.) in X, Y and Z directions for two hours each</td>
</tr>
<tr>
<td>Shock resistance</td>
<td>500 m/s² acceleration (50 G approx.) in X, Y and Z directions for three times each</td>
</tr>
<tr>
<td>Emitting element</td>
<td>Infrared LED (modulated)</td>
</tr>
<tr>
<td>Material</td>
<td>Polycarbonate</td>
</tr>
<tr>
<td>Cable</td>
<td>0.2 mm² 3-core (emitter: 2-core) oil resistant cabtyre cable, 2 m, 6.6 ft long</td>
</tr>
<tr>
<td>Cable extension</td>
<td>Extension up to total 100 m 328.084 ft is possible, for both emitter and receiver, with 0.3 mm², or more, cable.</td>
</tr>
<tr>
<td>Weight</td>
<td>Emitter: 45 g approx., Receiver: 50 g approx.</td>
</tr>
</tbody>
</table>

**Notes:**
1. Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C +73.4 °F.
2. The sensing range shortens depending on the thickness, material, color, etc., of the container or pipe.
3. If there are two slit on both sides, the size of those slit represents the min. sensing object.
### I/O CIRCUIT DIAGRAMS

#### NPN output type

**I/O circuit diagram**

Color code / Connector pin No. of the plug-in connector type

![Sensor circuit diagram](image)

- (Brown / 1) + V
- (Black / 4) Output (Note 1)
- (Blue / 3) 0 V
- 100 mA max.
- + 12 to 24 V DC ±10%

**Internal circuit**

- Users' circuit

**Wiring diagram**

- Brown
- Black (Note 1)
- Blue
- Load

Note: The emitter does not incorporate the output.

1. When the mating cable is connected to the plug-in connector type sensor, the white wire of the mating cable is not connected.

**Connector pin position (plug-in connector type)**

![Connector pin position](image)

Notes: 1) The emitter does not incorporate the output.
2) When the mating cable is connected to the plug-in connector type sensor, the white wire of the mating cable is not connected.

**Symbols**:
- D: Reverse supply polarity protection diode
- Zd: Surge absorption zener diode
- Tr: NPN output transistor

#### PNP output type

**I/O circuit diagram**

Color code / Connector pin No. of the plug-in connector type

![Sensor circuit diagram](image)

- (Brown / 1) + V
- (Black / 4) Output (Note 1)
- (Blue / 3) 0 V
- 100 mA max.
- + 12 to 24 V DC ±10%

**Internal circuit**

- Users' circuit

**Wiring diagram**

- Brown
- Black (Note)
- Blue
- Load

Note: The emitter does not incorporate the black wire.

**Connector pin position (plug-in connector type)**

![Connector pin position](image)

Notes: 1) The emitter does not incorporate the output.
2) When the mating cable is connected to the plug-in connector type sensor, the white wire of the mating cable is not connected.

**Symbols**:
- D: Reverse supply polarity protection diode
- Zd: Surge absorption zener diode
- Tr: PNP output transistor
**SENSING CHARACTERISTICS (TYPICAL)**

**Parallel deviation**

**Angular deviation**

**Parallel deviation with round slit masks (Φ2 mm Φ0.079 in)**

**Parallel deviation with rectangular slit masks (0.5×6 mm 0.020×0.236 in)**

**Parallel deviation with round slit masks (Φ0.5 mm Φ0.020 in)**

**Parallel deviation with rectangular slit masks (1×6 mm 0.039×0.236 in)**

**Parallel deviation with rectangular slit masks (2×6 mm 0.079×0.236 in)**

---

**PRECAUTIONS FOR PROPER USE**

Refer to p.1458~ for general precautions.

- 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.

**Mounting**

- The tightening torque should be 0.5 N·m or less.

**Wiring**

- When connecting the mating cable to the plug-in connector type sensor, the tightening torque should be 0.4 N·m or less.

**Stability indicator**

- The stability indicator (green) lights up when the incident light intensity has sufficient margin with respect to the operation level. If the incident light intensity level is such that the stability indicator lights up, stable sensing can be done without the light received operation and the light interrupted operation being affected by a change in ambient temperature or supply voltage.

**Others**

- Because these units use special emitter and receiver elements, they are susceptible to the effects of operating ambient temperature and humidity. Sensitivity adjustment should be performed in the environment in which they will actually be used.
- Do not use during the initial transient time (100 ms) after the power supply is switched on.
## DIMENSIONS (Unit: mm in)

### EZ-11 EZ-11-PN

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Stability indicator (Green)(Note 1)</th>
<th>Operation mode switch (Note 1)</th>
<th>Operation indicator (Orange)(Note 2)</th>
<th>Sensitivity adjuster (Note 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2-M3 × 0.5 0.020 thread hole threads</td>
<td>0.472</td>
<td>3.4</td>
<td>1.024</td>
</tr>
<tr>
<td>Beam axis</td>
<td>ø3.7 ø0.146 cable, 2 m 0.66 ft long</td>
<td>0.116</td>
<td>0.116</td>
<td>0.116</td>
</tr>
</tbody>
</table>

Notes: 1) Not incorporated on the emitter. 2) It is the power indicator (orange) on the emitter.

### MS-CX2-1

Material: Stainless steel (SUS304)

Two M3 (length 12 mm 0.472 in) screws with washers are attached.

### EZ-11-J EZ-11-PN-J

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Stability indicator (Green)(Note 1)</th>
<th>Operation mode switch (Note 1)</th>
<th>Operation indicator (Orange)(Note 2)</th>
<th>Sensitivity adjuster (Note 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2-M3 × 0.5 0.020 thread hole threads</td>
<td>0.472</td>
<td>3.4</td>
<td>1.024</td>
</tr>
<tr>
<td>Beam axis</td>
<td>ø3.4 ø0.134 holes</td>
<td>0.118</td>
<td>0.118</td>
<td>0.118</td>
</tr>
</tbody>
</table>

Notes: 1) Not incorporated on the emitter. 2) It is the power indicator (orange) on the emitter.

### MS-CX2-2

Material: Stainless steel (SUS304)

Two M3 (length 12 mm 0.472 in) screws with washers are attached.

### Assembly dimensions

Mounting drawing with the receiver of EZ-11(-PN)

Mounting drawing with the receiver of EZ-11(-PN)

The CAD data in the dimensions can be downloaded from our website.
**DIMENSIONS (Unit: mm in)**

**MS-CX2-4**

Assembly dimensions

Mounting drawing with the receiver of EZ-11(-PN)

Material: Stainless steel (SUS304)

Two M3 (length 14 mm 0.551 in) screws with washers are attached.

**MS-CX2-5**

Assembly dimensions

Mounting drawing with the receiver of EZ-11(-PN)

Material: Stainless steel (SUS304)

Two M3 (length 12 mm 0.472 in) screws with washers are attached.

**MS-CX3**

Assembly dimensions

Mounting drawing with the receiver of EZ-11(-PN)

Material: Stainless steel (SUS304)

Two M3 (length 12 mm 0.472 in) screws with washers are attached.