Conforming to EMC Directive Recognition

EX-Z SERIES

Amplifier Built-in
Ultra-minute Photoelectric Sensor

The World’s No. 1 in Compactness

* Among photoelectric sensors with built-in amplifier, as of June 2015 (survey by our company)
The World’s Smallest* Size

* Among photoelectric sensors with built-in amplifier, as of June 2015 (survey by our company)

Unit volume ratio reduced by about 50%*

* As compared to EX-10 series

The world’s thinnest* sensor dimension of 3 mm 0.118 in has been achieved by utilizing new semiconductor packaging technology that does not use wire bonding. The small unit size allows installation of sensors in a narrow space where only a conventional fiber sensor head could be installed before. The built-in amplifier also saves on installation space.

* Among photoelectric sensors with built-in amplifier, as of June 2015 (survey by our company)

<table>
<thead>
<tr>
<th>Front sensing type</th>
<th>Side sensing type</th>
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<tbody>
<tr>
<td>EX-Z1□F</td>
<td>EX-Z1□S</td>
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<tr>
<td>Sensing range: 50 mm 1.969 in</td>
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<td>Repeatability: 0.05 mm 0.002 in or less</td>
<td></td>
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<tr>
<td>Minimum sensing object: ø1.0 mm ø0.039 in opaque object</td>
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</tr>
<tr>
<td>Approx. 50% smaller in volume ratio than EX-10</td>
<td></td>
</tr>
<tr>
<td>Approx. 35% smaller in volume ratio than EX-10</td>
<td></td>
</tr>
</tbody>
</table>

Small-object sensing capability

A slit is provided on the front side of the main sensor body. The sensor can detect a ø0.3 mm ø0.012 in object (the smallest-object sensing capability in the industry*) without using an optional slit.

* Among photoelectric sensors with built-in amplifier, as of June 2015 (survey by our company)

EX-Z1□: Sensing of end of thin pipe
Silt diameter: 0.3 mm ø0.012 in

EX-Z11□: Sensing range: 50 mm 1.969 in
Repeatability: 0.05 mm 0.002 in or less
Minimum sensing object:
ø0.3 mm ø0.012 in opaque object

EX-Z12□: Sensing range: 200 mm 7.874 in
Repeatability: 0.05 mm 0.002 in or less
Minimum sensing object:
ø0.5 mm ø0.020 in opaque object

EX-Z13□: Sensing range: 500 mm 19.685 in
Repeatability: 0.05 mm 0.002 in or less
Minimum sensing object:
ø1.0 mm ø0.039 in opaque object

Capability to sense a small ø1.0 mm ø0.039 in object over long distance [EX-Z13□]

The high-brightness 4-element red LED provides strong light emission stably over a long period of time. In spite of the extremely small size, both front sensing and side sensing units can sense a small ø1.0 mm ø0.039 in object from a long distance of 500 mm 19.685 in. Since the spotlight is clearly visible, the sensing position can be easily confirmed.

Clearly visible spotlight
A wide range of applications

Inflection resistant cable type available for all models

Inflection resistant cable type with improved flex resistance is available for all models. Select the model suitable for your specific application. The standard type comes with lead wires with the same diameter as previous models, but the outside diameter of the cable is 2.0 mm 0.079 in and thinner than the cables of the EX-10 series. This facilitates cable routing.

IP67 protective structure

The sensors feature an IP67 protective structure to allow their use in process lines where water is used or splashed. Rust-resistant stainless steel sensor mounting brackets and screws are available.

Note: If water splashes on the sensor during sensing operation, it may sense water as an object.

Options

A variety of mounting brackets are available!

A spacer for mounting at the back (1 type) for through-wall sensing and sensor mounting brackets (3 types) are available to meet a diversity of sensor installation needs.

Examples of applications

Detection of parts in parts feeder

Detection of presence / absence of test tube tray

Detection of LED lead
## ORDER GUIDE

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<td>EX-Z12FB</td>
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<td></td>
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<td>500 mm 19.685 in</td>
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<td>EX-Z12FB-P</td>
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<td>EX-Z13FA-P</td>
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<td>EX-Z12FB-P-R</td>
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<td>EX-Z13FA-P-R</td>
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<td></td>
<td>EX-Z13FB-P-R</td>
<td>Dark-ON</td>
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<td>Side sensing</td>
<td></td>
<td>50 mm 1.969 in</td>
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<td></td>
<td></td>
<td>EX-Z11B-R</td>
<td>Dark-ON</td>
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<tr>
<td></td>
<td></td>
<td>200 mm 7.874 in</td>
<td>EX-Z12A-R</td>
<td>Light-ON</td>
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<td></td>
<td></td>
<td>EX-Z12B-R</td>
<td>Dark-ON</td>
</tr>
<tr>
<td></td>
<td>Inflection resistant cable</td>
<td>500 mm 19.685 in</td>
<td>EX-Z13A-R</td>
<td>Light-ON</td>
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<td></td>
<td>EX-Z13B-R</td>
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<td>50 mm 1.969 in</td>
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<td>EX-Z11A-P</td>
<td>Light-ON</td>
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<td>Light-ON</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>EX-Z13B-P</td>
<td>Dark-ON</td>
</tr>
</tbody>
</table>

Note: Mounting bracket is not supplied with the sensor. Please select from the range of optional sensor mounting brackets (MS-EXZ-□).

Note: The model No. with “E” shown on the label affixed to the thru-beam type sensor is the emitter, “D” shown on the label is the receiver.

## OPTIONS

<table>
<thead>
<tr>
<th>Designation</th>
<th>Model No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor mounting bracket</td>
<td>MS-EXZ-1</td>
<td>L-shaped mounting bracket (SUS304) for front sensing and side sensing types (2 sets are required)</td>
</tr>
<tr>
<td></td>
<td>MS-EXZ-2</td>
<td>Mounting bracket (SUS304) for front sensing type (2 sets are required)</td>
</tr>
<tr>
<td></td>
<td>MS-EXZ-3</td>
<td>Mounting bracket (SUS304) for side sensing type (2 sets are required)</td>
</tr>
<tr>
<td>Spacer for mounting at the back</td>
<td>MS-EXZ-4</td>
<td>Spacer for mounting at the back (polyacetal) for front sensing type</td>
</tr>
</tbody>
</table>

### Sensor mounting bracket
- **MS-EXZ-1**
  - Material: Stainless steel (SUS304)
  - Two M2 (length 4 mm 0.157 in) pan head screws and two M2 (length 8 mm 0.315 in) pan head screws are attached.

### Spacer for mounting at the back
- **MS-EXZ-4**
  - Material: Polyacetal
  - M2 (length: 10 mm 0.394 in) screws, nuts, spring washers and flat washers are attached. (20 pieces each)
## SPECIFICATIONS

<table>
<thead>
<tr>
<th>Model No. (Note 2)</th>
<th>Type</th>
<th>Thru-beam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light-ON</td>
<td>Front sensing</td>
<td>EX-Z11FA(-P)(-R)</td>
</tr>
<tr>
<td></td>
<td>Side sensing</td>
<td>EX-Z11A(-A)(-P)(-R)</td>
</tr>
<tr>
<td>Dark-ON</td>
<td>Front sensing</td>
<td>EX-Z12FA(-P)(-R)</td>
</tr>
<tr>
<td></td>
<td>Side sensing</td>
<td>EX-Z12A(-A)(-P)(-R)</td>
</tr>
<tr>
<td></td>
<td>Front sensing</td>
<td>EX-Z13FA(-P)(-P)(-R)</td>
</tr>
<tr>
<td></td>
<td>Side sensing</td>
<td>EX-Z13A(-A)(-P)(-R)</td>
</tr>
</tbody>
</table>

### Sensing distance
- Front sensing: 50 mm (1.969 in)
- Side sensing: 200 mm (7.874 in)
- Front sensing: 500 mm (19.685 in)

### Minimum sensing object
- Ø0.3 mm ±0.012 in opaque object
- Ø0.5 mm ±0.02 in opaque object
- Ø1.0 mm ±0.039 in opaque object

### Repeatability (Perpendicular to sensing axis)
- 0.02 mm ±0.001 in or less
- 0.03 mm ±0.001 in or less
- 0.05 mm ±0.002 in or less

### Supply voltage
- 12 to 24 V DC ±10 % Ripple P-P: 10 % or less

### Current consumption
- Emitter: 10 mA or less
- Receiver: 10 mA or less

### Output
- **NPN output type**
  - Open-collector transistor
  - Maximum sink current: 20 mA
  - Applied voltage: 30 V DC or less (between output and 0 V)
  - Residual voltage: 1.5 V or less (at 20 mA sink current)

- **PNP output type**
  - Open-collector transistor
  - Maximum source current: 20 mA
  - Applied voltage: 30 V DC or less (between output and +V)
  - Residual voltage: 1.5 V or less (at 20 mA source current)

### Short-circuit protection
- Incorporated

### Environment resistance
- Protection: IP67 (IEC)
- Ambient temperature: -10 to +55 °C (14 to +131 °F)
- Ambient humidity: 35 to 85 % RH
- Ambient illumination: Incandescent light: 5,000 ℓx at the light-receiving face
- Voltage withstandability: 1,000 V AC for one min.
- Insulation resistance: 20 MΩ or more, with 250 V DC megger between all supply terminals connected together and enclosure
- Vibration resistance: 10 to 500 Hz frequency, 3 mm 0.118 in amplitude in X, Y and Z directions for two hours each
- Shock resistance: 500 m/s² acceleration (50 G approx.) in X, Y and Z directions for three times each
- Light emitting element: Red LED (Peak emission wavelength: 650 nm 0.0266 mil, modulated)

### Grounding
- Floating

### Material
- Enclosure: PBT, Lens: Polycarbonate, Metallic part: Stainless steel (SUS304) (SUS301 for rear side of front sensing type)

### Cable (Note 3)
- 0.1 mm² 3-core (emitter: 2-core) cable, 2 m 6.562 ft long

### Accessories
- M2 mounting screws: 1 set (front sensing type: 6 mm 0.236 in in length; side sensing type: 10 mm 0.394 in in length)

### Notes:
1. Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23°C 73°F.
2. Model Nos. having the "-P" are PNP output type and model Nos. having the "-R" are inflection resistant cable type.
3. The inflection resistant cable type has a 0.1 mm² 3-core (thru-beam type emitter: 2-core) flexible cable type, 2 m 6.562 ft long.

## 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.

### Mounting

#### In case of using attached screws and nuts (Unit: mm in)

<table>
<thead>
<tr>
<th>Side sensing</th>
<th>Front sensing</th>
</tr>
</thead>
<tbody>
<tr>
<td>M2 screw (length 10 0.394) (accessory)</td>
<td>Nut Spring washer Flat washer</td>
</tr>
<tr>
<td>M2 × 0.4 0.16 hole tapped, 5.097 deep</td>
<td>Nut Spring washer Flat washer</td>
</tr>
<tr>
<td>M2 × 0.4 0.4 hole tapped, 7.276 deep</td>
<td>M2 screw (length 6 0.236) (accessory)</td>
</tr>
<tr>
<td>Thickness of mounting plate: 2 0.079 in or less</td>
<td>Sensing direction 0.335</td>
</tr>
</tbody>
</table>

The tightening torque should be 0.2 N·m or less.

### Other

- Do not use during the initial transient time (0.5 sec. approx.) after the power supply is switched on.
### I/O CIRCUIT DIAGRAMS

#### NPN output type

**I/O circuit diagram**

- **Color code**
  - Brown: +V
  - Black: Output (Note)
  - Blue: 0 V

- **Internal circuit**
  - Users' circuit

- **Notes**:
  - The emitter does not incorporate the output.
  - Symbols: D1: Reverse supply polarity protection diode
  - D2: Reverse output polarity protection diode
  - ZD: Surge absorption zener diode
  - Tr: NPN output transistor

#### PNP output type

**I/O circuit diagram**

- **Color code**
  - Brown: +V
  - Black: Output (Note)
  - Blue: 0 V

- **Internal circuit**
  - Users' circuit

- **Notes**:
  - The emitter does not incorporate the output.
  - Symbols: D1: Reverse supply polarity protection diode
  - D2: Reverse output polarity protection diode
  - ZD: Surge absorption zener diode
  - Tr: PNP output transistor

### SENSING CHARACTERISTICS (TYPICAL)

#### EX-Z11F□ EX-Z11□

**Thru-beam type**

- **Parallel deviation**

#### EX-Z12F□ EX-Z12□

**Thru-beam type**

- **Parallel deviation**

#### EX-Z13F□ EX-Z13□

**Thru-beam type**

- **Parallel deviation**

- **Angular deviation**

Note: The emitter does not incorporate the output.

Symbols: ... D1: Reverse supply polarity protection diode
D2: Reverse output polarity protection diode
ZD: Surge absorption zener diode
Tr: NPN output transistor
DIMENSIONS (Unit: mm in)

The CAD data can be downloaded from the website.

EX-Z11F  EX-Z12F  EX-Z13F

Sensor

EX-Z11  EX-Z12  EX-Z13

Sensor

MS-EXZ-1  Sensor mounting bracket (Optional)

Material: Stainless steel (SUS304)
Two M2 (length 4 mm 0.157 in) pan head screws and two M2 (length 8 mm 0.315 in) pan head screws are attached.

MS-EXZ-2  Sensor mounting bracket (Optional)

Material: Stainless steel (SUS304)
Two M2 (length 4 mm 0.157 in) pan head screws are attached.
**DIMENSIONS (Unit: mm in)**

<table>
<thead>
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<th>MS-EXZ-3</th>
<th>Sensor mounting bracket (Optional)</th>
<th>MS-EXZ-4</th>
<th>Spacer for mounting at the back (Optional)</th>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Material: Stainless steel (SUS304)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two M2 (length 8 mm 0.315 in) pan head screws are attached.</td>
</tr>
</tbody>
</table>

**EX Family Products**

- **EX-10SERIES Ver.2**
  - Ultra-slim Photoelectric Sensor
  - Amplifier Built-in
  - Ultra-thin dimension
    - Only 3.5 mm 0.138 in thick
    - Long sensing range of 1 m 3.281 ft
    - High speed response of 0.5 ms

- **EX-20SERIES Ver.2**
  - Ultra-compact Photoelectric Sensor
  - Amplifier Built-in
  - Easy installation with M3 screws
    - Equipped with sensitivity adjuster
    - Long sensing range of 2 m 6.562 ft
    - Red spotlight for easy confirmation of sensing point

- **EX-30SERIES Ver.2**
  - Threaded Miniature Photoelectric Sensor
  - Amplifier Built-in
  - One-point mounting
    - Simple design with sensing axis corresponding with mounting hole
    - Can be installed using the same thread size (M4 for thru-beam type, M6 for reflective type) as that of standard fiber

** Disclaimer **

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