**Ultra-slim Photoelectric Sensor**  
**EX-10 SERIES Ver.2**

### Amplifier built-in extraordinarily small and slim size

**Smallest body, just 3.5 mm 0.138 in thick**

It can be mounted in a very small space as its size is just W10 × H14.5 × D3.5 mm W0.394 × H0.571 × D0.138 in (thru-beam, front sensing type).

**Flexible mounting**

The diffuse reflective type sensor is front sensing and is so thin that it gives an impression of being just pasted on the mounting base. The thru-beam type is available as front sensing type, as well as, side sensing type, allowing flexible mounting.

- **Thru-beam**
  - Front sensing type
  - Side sensing type
- **Diffuse reflective**
  - Front sensing type

### A wide variety of narrow-beam type! Light diffusion is approx. 1/2 of standard type.

**Less interference with no slit, narrow-pitch can be set.**

The pitch of installation is 1/2 of conventional models, so that the close-installation is possible. No cost is necessary to purchase or install a slit.

**Possible to sense a minute object less than ø0.5 mm ø0.039 in with no slit.**

The series is applicable to sense a minute object without any cost.

**Long sensing range of 1 m 3.281 ft with narrow beam**

A long 1 m 3.281 ft sensing range is possible with narrow beam.
**APPLICATONS**

**Positioning of PCBs**

**Detecting ICs**

**Detecting PCB rack**

**Detecting wafer cassette**

**Detecting thin ring**

**Checking for absence of capacitor in tray**

**BASIC PERFORMANCE**

**Electric power saving**

The EX-10 series achieves reductions in power consumption of up to 65%. These sensors contribute to environmental friendliness.

* Effective from production in October 2010.

**High-speed response time: 0.5 ms**

The sensor is suitable for detecting small and high-speed traveling objects.

**Minimum sensing object: ø1 mm ø0.039 in**

EX-11□, EX-11E□, EX-15□, EX-15E□ are incorporated with ø1 mm ø0.039 in slit masks so that ø1 mm ø0.039 in, or more, object can be detected. Hence, they are suitable for precise positioning or small parts detection.

**Long sensing range: 1 m 3.281 ft**

A sensing range of 1 m 3.281 ft has been realized with a slim size of just 3.5 mm 0.138 in. It can be used to detect even wide IC trays.

**Background suppression**

**Hardly affected by background**

Even a specular background separated by 100 mm 3.937 in, or more, is not detected. (However, the background should be directly opposite. A spherical or curved background may be detected.)

**Black object reliably detected**

It can reliably detect dark color objects since it is convergent reflective type.
ENVIRONMENTAL RESISTANCE

Incorporated an inverter countermeasure circuit *

The EX-10 series become significantly stronger against inverter light and other extraneous light.

Waterproof IP67

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

Bending durability

Bending-resistant cable type EX-□-R is available. It is most suitable for moving parts, such as robot arm, etc.

MOUNTING / SIZE

Mountable with M3 screws

Non-corrosive stainless steel type sensor mounting bracket is also available.

- **MS-EX10-1**
  - Cold rolled carbon steel (SPCC)

- **MS-EX10-11**
  - Stainless steel (SUS304)
  - Mounting bracket for the front

- **MS-EX10-2**
  - Cold rolled carbon steel (SPCC)

- **MS-EX10-12**
  - Stainless steel (SUS304)
  - Mounting bracket for the side

- **MS-EX10-3**
  - Cold rolled carbon steel (SPCC)
  - L-shaped mounting bracket

**Note:** Sensor mounting brackets can not be used for the narrow beam type (EX-□S□).

Red beam makes beam alignment easy

The red LED beam projected from the emitter helps you to align the sensor heads.

FUNCTIONS

Bright 2-color indicator

A convenient 2-color indicator has been incorporated in the miniature body.

![2-color indicator](image)

Operation mode switch

Thru-beam type sensor incorporated with an operation mode switch on the bifurcation is also available. It helps you to test the operability before start-up.

VARIES

Less resources used *

Based on environmental considerations, simplified packaging is used in order to reduce waste. In addition, the bag is made from polyethylene which produces no toxic gases even when burned.

* Effective from production in October 2010.
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<th>Type</th>
<th>Appearance</th>
<th>Sensing range</th>
<th>Model No.(Note 2)</th>
<th>Output operation</th>
<th>Output</th>
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<td>EX-11A</td>
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<td></td>
<td></td>
<td>500 mm 19.685 in</td>
<td>EX-11B</td>
<td>Dark-ON</td>
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<tr>
<td></td>
<td></td>
<td>1 m 3.281 ft</td>
<td>EX-13A</td>
<td>Light-ON</td>
<td>NPN output</td>
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<td></td>
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<td>EX-13B</td>
<td>Dark-ON</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>150 mm 5.906 in</td>
<td>EX-15</td>
<td>—</td>
<td>NPN open-collector-transistor or PNP open-collector-transistor</td>
</tr>
<tr>
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<td></td>
<td>500 mm 19.685 in</td>
<td>EX-17</td>
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<tr>
<td></td>
<td>Thru-beam</td>
<td>150 mm 5.906 in</td>
<td>EX-11EA</td>
<td>Light-ON</td>
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<tr>
<td></td>
<td></td>
<td>500 mm 19.685 in</td>
<td>EX-11EB</td>
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<tr>
<td></td>
<td></td>
<td>1 m 3.281 ft</td>
<td>EX-13EA</td>
<td>Light-ON</td>
<td>NPN output</td>
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<td></td>
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<td>EX-13EB</td>
<td>Dark-ON</td>
<td>PNP output</td>
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<tr>
<td></td>
<td></td>
<td>150 mm 5.906 in</td>
<td>EX-15E</td>
<td>—</td>
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<tr>
<td></td>
<td></td>
<td>500 mm 19.685 in</td>
<td>EX-17E</td>
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<tr>
<td></td>
<td>Side sensing</td>
<td>150 mm 5.906 in</td>
<td>EX-14A</td>
<td>Light-ON</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>500 mm 19.685 in</td>
<td>EX-14B</td>
<td>Dark-ON</td>
<td>PNP output</td>
</tr>
<tr>
<td></td>
<td>Convergent reflective</td>
<td>2 to 25 mm 0.079 to 0.984 in (Note 1) (Convergent point: 10 mm 0.394 in)</td>
<td>EX-11SA</td>
<td>Light-ON</td>
<td>NPN output</td>
</tr>
<tr>
<td></td>
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<td>EX-11SB</td>
<td>Dark-ON</td>
<td>PNP output</td>
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<tr>
<td></td>
<td></td>
<td>150 mm 5.906 in</td>
<td>EX-13SA</td>
<td>Light-ON</td>
<td>NPN output</td>
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<tr>
<td></td>
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<td>EX-13SB</td>
<td>Dark-ON</td>
<td>PNP output</td>
</tr>
<tr>
<td></td>
<td></td>
<td>150 mm 5.906 in</td>
<td>EX-15SA</td>
<td>—</td>
<td>NPN open-collector-transistor or PNP open-collector-transistor</td>
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<tr>
<td></td>
<td></td>
<td>500 mm 19.685 in</td>
<td>EX-15SB</td>
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<tr>
<td></td>
<td></td>
<td>1 m 3.281 ft</td>
<td>EX-19SA</td>
<td>Light-ON</td>
<td>NPN output</td>
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<tr>
<td></td>
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<td></td>
<td>EX-19SB</td>
<td>Dark-ON</td>
<td>PNP output</td>
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<tr>
<td></td>
<td></td>
<td>150 mm 5.906 in</td>
<td>EX-11SE</td>
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<tr>
<td></td>
<td></td>
<td>500 mm 19.685 in</td>
<td>EX-17E</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Narrow beam type</td>
<td>Front sensing</td>
<td>150 mm 5.906 in</td>
<td>EX-11SA</td>
<td>Light-ON</td>
<td>NPN output</td>
</tr>
<tr>
<td></td>
<td></td>
<td>500 mm 19.685 in</td>
<td>EX-11SB</td>
<td>Dark-ON</td>
<td>PNP output</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 m 3.281 ft</td>
<td>EX-13SA</td>
<td>Light-ON</td>
<td>NPN output</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td>Dark-ON</td>
<td>PNP output</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>EX-15SA</td>
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</tr>
<tr>
<td></td>
<td></td>
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<td>EX-15SB</td>
<td>—</td>
<td>—</td>
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<tr>
<td></td>
<td></td>
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<tr>
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<td>150 mm 5.906 in</td>
<td>EX-11SE</td>
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</tr>
<tr>
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<td>—</td>
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<tr>
<td></td>
<td></td>
<td>1 m 3.281 ft</td>
<td>EX-19SE</td>
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<td></td>
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<tr>
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<td>—</td>
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<tr>
<td></td>
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<td>EX-17E</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 m 3.281 ft</td>
<td>EX-19SA</td>
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<td>NPN output</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>EX-19SB</td>
<td>Dark-ON</td>
<td>PNP output</td>
</tr>
</tbody>
</table>

**NOTE:** Mounting bracket is not supplied with the sensor. Please select from the range of optional sensor mounting brackets (MS-EX10-□). Sensor mounting brackets (MS-EX10-□) can not be used for the narrow beam type (EX-□S□).

**Notes:**
1. The sensor does not detect even a specular background if it is separated by 100 mm 3.937 in or more. (However, the background should be directly opposite. A spherical or curved background may be detected.)
2. The model No. with "P" shown on the label affixed to the thru-beam type sensor is the emitter, "D" shown on the label is the receiver.

**Bending-resistant cable type**
Bending-resistant cable type is also available for NPN output type. (excluding narrow beam type EX-□S□ and sensor with operation mode switch on the bifurcation EX-15□/17□)
When ordering this type, suffix "-R" to the model No. (e.g.) Bending-resistant cable type of EX-11A is "EX-11A-R".

**5 m 16.404 ft cable length type**
5 m 16.404 ft cable length type (standard: 2 m 6.562 ft) is also available for NPN output type. (excluding narrow beam type EX-□S□ and bending-resistant cable type)
When ordering this type, suffix "-CS" to the model No. (e.g.) 5 m 16.404 ft cable length type of EX-11A is "EX-11A-CS".
### Options

#### Sensor mounting bracket (Note 1)

<table>
<thead>
<tr>
<th>Designation</th>
<th>Model No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS-EX10-1</td>
<td>Mounting bracket for the front sensing type sensor [Cold rolled carbon steel (SPCC)] (The thru-beam type sensor needs two brackets.)</td>
<td></td>
</tr>
<tr>
<td>MS-EX10-2</td>
<td>Mounting bracket for the side sensing type sensor [Cold rolled carbon steel (SPCC)] (The thru-beam type sensor needs two brackets.)</td>
<td></td>
</tr>
<tr>
<td>MS-EX10-3</td>
<td>L-shaped mounting bracket sensor [Cold rolled carbon steel (SPCC)] (The thru-beam type sensor needs two brackets.)</td>
<td></td>
</tr>
<tr>
<td>MS-EX10-11</td>
<td>Mounting bracket for the front sensing type sensor [Stainless steel (SUS304)] (The thru-beam type sensor needs two brackets.)</td>
<td></td>
</tr>
<tr>
<td>MS-EX10-12</td>
<td>Mounting bracket for the side sensing type sensor [Stainless steel (SUS304)] (The thru-beam type sensor needs two brackets.)</td>
<td></td>
</tr>
<tr>
<td>MS-EX10-13</td>
<td>L-shaped mounting bracket [Stainless steel (SUS304)] (The thru-beam type sensor needs two brackets.)</td>
<td></td>
</tr>
<tr>
<td>OS-EX10-12</td>
<td>Slit mask • Sensing range: 600 mm 23.62 in [EX-19□] 250 mm 9.84 in [EX-13□, EX-17□] • Min. sensing object: ø2 mm ø0.079 in</td>
<td></td>
</tr>
<tr>
<td>OS-EX10-15</td>
<td>Slit mask • Sensing range: 800 mm 31.49 in [EX-19□] 350 mm 13.78 in [EX-13□] • Min. sensing object: ø2 mm ø0.079 in</td>
<td></td>
</tr>
<tr>
<td>OS-EX10E-12</td>
<td>Slit mask • Sensing range: 400 mm 15.75 in [EX-19□] 200 mm 7.87 in [EX-13□, EX-17□] • Min. sensing object: ø1.2 mm ø0.047 in</td>
<td></td>
</tr>
</tbody>
</table>

#### Sensor checker

<table>
<thead>
<tr>
<th>Designation</th>
<th>Model No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHX-SC2</td>
<td>It is useful for beam alignment of thru-beam type sensors. The optimum receiver position is given by indicators, as well as an audio signal.</td>
<td></td>
</tr>
</tbody>
</table>

#### Mounting screw

<table>
<thead>
<tr>
<th>Designation</th>
<th>Model No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS-M2</td>
<td>Mounting screws with washers (50 pcs. lot). It can mount securely as it is spring washer attached.</td>
<td></td>
</tr>
</tbody>
</table>

#### Notes:

1) Can not be used for the narrow beam type (EX-□-S□).
2) Refer to p.959 for the sensor checker CHX-SC2.
3) Since EX-19□ has a built-in ø1 mm ø0.039 in slit in the emitter, be sure to mount it in the receiver.

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### Ultra-slim Photoelectric Sensor EX-10 SERIES Ver.2

#### Example of mounting (OS-EX10E-12)

Tighten along with the sensor mounting bracket.

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**Sensor checker**

- **CHX-SC2**

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**Sensor mounting bracket**

- **MS-EX10-1** Material: Cold rolled carbon steel (SPCC) (Uni-chrome plated) Two M2 (length 4 mm 0.157 in) pan head screws are attached.
- **MS-EX10-2** Material: Stainless steel (SUS304) Two M2 (length 8 mm 0.315 in) pan head screws attached.
- **MS-EX10-3** Material: Cold rolled carbon steel (SPCC) (Uni-chrome plated) Two M2 (length 4 mm 0.157 in) pan head screws are attached.
- **MS-EX10-11** Material: Stainless steel (SUS304) Two M2 (length 8 mm 0.315 in) pan head screws [stainless steel (SUS304)] are attached.
- **MS-EX10-12** Material: Stainless steel (SUS304) Two M2 (length 8 mm 0.315 in) pan head screws [stainless steel (SUS304)] are attached.
- **MS-EX10-13** Material: Stainless steel (SUS304) Two M2 (length 8 mm 0.315 in) pan head screws [stainless steel (SUS304)] are attached.
# SPECIFICATIONS

<table>
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<tr>
<th>Model No. (Note 2)</th>
<th>Type</th>
<th>Sensing range</th>
<th>Min. sensing object</th>
<th>Hysteresis</th>
<th>Stability indicator</th>
<th>Sensing element</th>
<th>Ambient temperature</th>
<th>Pollution degree</th>
<th>Protection</th>
<th>Ambient humidity</th>
<th>Insulation resistance</th>
<th>Vibration resistance</th>
<th>Shock resistance</th>
<th>Emitter</th>
<th>Material</th>
<th>Accessories</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>Light-ON</td>
<td>Thru-beam standard type</td>
<td>150 mm 5.906 in</td>
<td>ø1 mm ø0.039 in opaque object (Completely beam interrupted object)</td>
<td>0.05 mm 0.002 in or less</td>
<td>Green LED</td>
<td>Red LED [Peak emission wavelength: 680 nm 0.027 mil (EX-19E:: 624 nm 0.025 mil), modulated]</td>
<td>-25 to +55 °C -13 to +131 °F (No dew condensation or icing allowed), Storage: -30 to +70 °C -22 to +158 °F</td>
<td>3 (Industrial environment)</td>
<td>IP67 (IEC)</td>
<td>35 to 85 % RH, Storage: 35 to 85 % RH</td>
<td>20 MQ, or more, with 250 V DC megger between all supply terminals connected together and enclosure</td>
<td>10 to 500 Hz frequency, 3 mm 0.118 in double amplitude in X, Y and Z directions for two hours each</td>
<td>500 m/s² acceleration (50 G approx.) in X, Y and Z directions three times each</td>
<td>Red LED</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dark-ON</td>
<td>Thru-beam standard type</td>
<td>500 mm 19.685 in</td>
<td>ø2 mm ø0.079 in opaque object (Completely beam interrupted object)</td>
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<tr>
<td></td>
<td></td>
<td>1 m 3.281 ft</td>
<td>ø2 mm ø0.079 in opaque object (Completely beam interrupted object)</td>
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</tbody>
</table>

**Output**

- <NPN output type>
  - NPN open-collector transistor
  - Maximum sink current: 50 mA
  - Applied voltage: 30 V DC or less (between output and 0 V)
  - Residual voltage: 2 V or less (at 50 mA sink current) 1 V or less (at 16 mA sink current)

- <PNP output type>
  - PNP open-collector transistor
  - Maximum source current: 50 mA
  - Applied voltage: 30 V DC or less (between output and +V)
  - Residual voltage: 2 V or less (at 50 mA source current) 1 V or less (at 16 mA source current)

**Utilization category**

- DC-12 or DC-13

**Short-circuit protection**

- Incorporated

**Response time**

- 0.5 ms or less

**Operation indicator**

- Orange LED (lights up when the output is ON)

**Incident beam indicator**

- Green LED (lights up under stable light received condition or stable dark condition)

**Notes**

1. Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C +73.4 °F.
2. Model Nos. having the suffix "-PN" are PNP output type.
3. The bending-resistant cable type (model Nos. having suffix "-R") has a 0.1 mm³ 3-core (thru-beam type emitter: 2-core) bending-resistant cable, 2 m 6.562 ft long.
## SPECIFICATIONS

<table>
<thead>
<tr>
<th>Item</th>
<th>Thru-beam - narrow beam type</th>
<th>Convergent/reflective (Focus beam type)</th>
<th>Thru-beam - with operation mode switch on bifurcation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model No. (Note 2)</td>
<td>Light-ON: EX-11SA-PN, EX-11SE-PN</td>
<td>Dark-ON: EX-11SB-PN, EX-11SB-PN</td>
<td>EX-15 (Note 3)</td>
</tr>
<tr>
<td>Sensing range</td>
<td>150 mm 5.906 in</td>
<td>150 mm 5.906 in</td>
<td>2 to 25 mm 0.079 in (Note 4) to 150 mm 5.906 in</td>
</tr>
<tr>
<td>Min. sensing object</td>
<td>α0.5 mm ø0.002 in opaque object (Completely beam interrupted object) (Note 5)</td>
<td>α2.5 mm ø0.010 in opaque object (Completely beam interrupted object) (Note 5)</td>
<td>α0.5 mm ø0.002 in opaque object (Completely beam interrupted object) (Note 5)</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>5 % or less of operation distance (Note 4)</td>
<td>5 % or less of operation distance (Note 4)</td>
<td>5 % or less of operation distance (Note 4)</td>
</tr>
<tr>
<td>Receptivity (perpendicular to sensing axis)</td>
<td>0.05 mm 0.002 in or less</td>
<td>0.05 mm 0.002 in or less</td>
<td>0.05 mm 0.002 in or less</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>Emitter: 10 mA or less, Receiver: 10 mA or less</td>
<td>13 mA or less</td>
<td>25 mA or less</td>
</tr>
<tr>
<td>Output</td>
<td>&lt;NPN output type&gt; NPN open-collector transistor • Maximum sink current: 50 mA • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 2 V or less (at 50 mA sink current) 1 V or less (at 15 mA sink current)</td>
<td>&lt;PNP output type&gt; PNP open-collector transistor • Maximum source current: 50 mA • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 2 V or less (at 50 mA source current) 1 V or less (at 10 mA source current)</td>
<td>NPN open-collector transistor • Maximum sink current: 100 mA • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 2 V or less (at 100 mA sink current) 1 V or less (at 10 mA sink current)</td>
</tr>
<tr>
<td>Current consumption</td>
<td>Emitter: 10 mA or less, Receiver: 10 mA or less</td>
<td>13 mA or less</td>
<td>25 mA or less</td>
</tr>
<tr>
<td>Short-circuit protection</td>
<td>DC-12 or DC-13</td>
<td>Incorporate</td>
<td></td>
</tr>
<tr>
<td>Response time</td>
<td>0.5 ms or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operation indicator</td>
<td>Orange LED (lights up when the output is ON)</td>
<td>Orange LED (lights up when the output is ON), located on the bifurcation</td>
<td></td>
</tr>
<tr>
<td>Incident beam indicator</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stability indicator</td>
<td>Green LED (lights up under stable light received condition or stable dark condition)</td>
<td>Green LED (lights up under stable light received condition or stable dark condition), located on the receiver</td>
<td></td>
</tr>
<tr>
<td>Environmental resistance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protection</td>
<td>IP67 (IEC)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>−25 to +55 °C −13 to +131 °F (No dew condensation or icing allowed), Storage: −30 to +70 °C −22 to +131 °F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient humidity</td>
<td>35 to 85 % RH, Storage: 35 to 85 % RH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient illuminance</td>
<td>Incandescent light: 3,000 lx or less at the light-receiving face</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage withstandability</td>
<td>1,000 V AC for one min. between all supply terminals connected together and enclosure</td>
<td></td>
<td></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>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibration resistance</td>
<td>10 to 500 Hz frequency, 3 mm 0.118 in in double amplitude in X, Y and Z directions for two hours each</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shock resistance</td>
<td>500 m/s² acceleration (50 G approx.) in X, Y and Z directions three times each</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emitting element</td>
<td>Red LED (Peak emission wavelength: 650 nm 0.026 ml, modulated)</td>
<td>Red LED (Peak emission wavelength: 680 nm 0.027 ml, modulated)</td>
<td></td>
</tr>
<tr>
<td>Cable (Note 6)</td>
<td>0.1 mm² 3-core (thru-beam type emitter: 2-core) cable, 2 m 6.562 ft long</td>
<td>0.2 mm² 3-core cable, 2 m 6.562 ft long (beyond bifurcation; from emitter / receiver to bifurcation: 0.5 m 1.640 ft long)</td>
<td></td>
</tr>
<tr>
<td>Cable extension</td>
<td>Extension up to total 50 m 164 ft is possible with 0.3 mm², or more, cable (thru-beam type: emitter and receiver)</td>
<td>Extension up to total 100 m 328 ft is possible with 0.3 mm², or more, cable</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>Net weight (each emitter and receiver): 20 g approx.</td>
<td>Net weight: 20 g approx.</td>
<td></td>
</tr>
<tr>
<td>Accessories</td>
<td>Mounting screws: 1 set</td>
<td>Mounting screws: 1 set, Adjusting screwdriver: 1 pc.</td>
<td></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) Model Nos. having the suffix “-PN” are PNP output type. 3) Either Light-ON or Dark-ON can be selected by the operation mode switch. 4) The range and the hysteresis of convergent reflective type sensor are specified for white non-glossy paper (50 × 50 mm 1.969 × 1.969 in) as the object. 5) The min. sensing objects are specified in case the emitter / receiver sensing range is to set the maximum. 6) The bending-resistant cable type (model Nos. having suffix “-R”) has a 0.1 mm² 3-core (thru-beam type emitter: 2-core) bending-resistant cable, 2 m 6.562 ft long.
I/O CIRCUIT AND WIRING DIAGRAMS

EX-11, EX-11S, EX-13, EX-13S, EX-19, EX-19S, EX-14

**I/O circuit diagram**

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

- **Internal circuit**
  - Users' circuit

- **Note**: The emitter of the thru-beam type sensor does not incorporate the output.

**Wiring diagram**

- **Brown**
- **Black (Note)**
- **Blue**

- **Load**: 12 to 24 V DC ±10%

**Symbols**
- D1: Reverse supply polarity protection diode
- D2: Reverse output polarity protection diode
- ZD: Surge absorption zener diode
- Tr: NPN output transistor

---

EX-11PN, EX-11S-PN, EX-13PN, EX-13S-PN, EX-19PN, EX-19S-PN, EX-14PN

**I/O circuit diagram**

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

- **Internal circuit**
  - Users' circuit

- **Note**: The emitter of the thru-beam type sensor does not incorporate the output.

**Wiring diagram**

- **Brown**
- **Black (Note)**
- **Blue**

- **Load**: 12 to 24 V DC ±10%

**Symbols**
- D1: Reverse supply polarity protection diode
- D2: Reverse output polarity protection diode
- ZD: Surge absorption zener diode
- Tr: PNP output transistor

---

EX-15, EX-15E, EX-17, EX-17E

**I/O circuit diagram**

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

- **Internal circuit**
  - Users' circuit

- **Symbols**
  - D1: Reverse supply polarity protection diode
  - D2: Reverse output polarity protection diode
  - ZD: Surge absorption zener diode
  - Tr: NPN output transistor

**EX-15□, EX-15E□, EX-17□, EX-17E□ wiring diagram**

- **Brown**
- **Black**
- **Blue**

- **Load**: 12 to 24 V DC ±10%

**Symbols**
- D1: Reverse supply polarity protection diode
- D2: Reverse output polarity protection diode
- ZD: Surge absorption zener diode
- Tr: NPN output transistor
**SENSING CHARACTERISTICS (TYPICAL)**

**EX-11□** | **EX-11E□** | **EX-15□** | **EX-15E□** | Thru-beam type
--- | --- | --- | --- | ---

**Parallel deviation**

**Angular deviation**

*Optical properties of side sensing types (EX-□E□)

Due to the optical properties of side sensing types, note that sensing may be affected if multiple sensors are positioned in such a way that optical axes intersect as shown in the diagram below.

Beam from Emitter 1 may be caught by Receiver 2.

There is no problem when sensors are installed in parallel (although the distance between sensors should be \( t \times 2 \) or more).

---

**EX-13□** | **EX-13E□** | **EX-17□** | **EX-17E□** | Thru-beam type
--- | --- | --- | --- | ---

**Parallel deviation**

**Angular deviation**

**Parallel deviation with slit masks (ø1.2 mm ø0.047 in)**

**Parallel deviation with slit masks (ø1.5 mm ø0.059 in)**

---

**EX-19□** | **EX-19E□** | Thru-beam type
--- | --- | ---

**Parallel deviation**

**Angular deviation**

**Parallel deviation with slit masks (ø1.2 mm ø0.047 in)**

**Parallel deviation with slit masks (ø1.5 mm ø0.059 in)**

---

**EX-Z** | **CY-100** | **EX-20** | **EX-30** | **EX-40** | **CX-440** | **EQ-30** | **EQ-500** | **MG-W** | **RX4320** | **RX** | **RT-610**
**SENSING CHARACTERISTICS (TYPICAL)**

**EX-14□**

**Sensing fields**

- Horizontal (left and right) direction
- Vertical (up and down) direction

**Correlation between lightness and sensing range**

The sensing region (typical) is represented by oblique lines in the left figure. However, the sensitivity should be set with enough margin because of slight variation in products.

**Correlation between material (50 × 50 mm 1.969 × 1.969 in) and sensing range**

The bars in the graph indicate the sensing range (typical) for the respective material. However, there is a slight variation in the sensing range depending on the product. Further, if there is a reflective object (conveyor, etc.) in the background of the sensing object, since it affects the sensing, separate it by more than twice the sensing range shown in the left graph.

**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 mounting on tapped holes (Unit: mm in)

**Side sensing**

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

**Front sensing**

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

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

**Side sensing**

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

**Front sensing**

- Nuts
- Spring washers
- The tightening torque should be 0.2 N·m or less.

**Operation mode switch (EX-15□, EX-15□□, EX-17□ and EX-17□□ only)**

<table>
<thead>
<tr>
<th>Switch position</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light-ON mode is set when the switch is turned fully clockwise (L side).</td>
<td></td>
</tr>
<tr>
<td>Dark-ON mode is set when the switch is turned fully counterclockwise (D side).</td>
<td></td>
</tr>
</tbody>
</table>

**Others**

- Do not use during the initial transient time (50 ms) after the power supply is switched on.
- Excess bending of the cable or stress applied to the cable may disconnect the internal lead wire.
## DIMENSIONS (Unit: mm in)

The CAD data can be downloaded from our website.

### EX-14a

<table>
<thead>
<tr>
<th>Component</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stability indicator (Green)</td>
<td>3.5</td>
</tr>
<tr>
<td>Operation indicator (Orange)</td>
<td>0.138</td>
</tr>
<tr>
<td>Beam-receiving part</td>
<td>2.75</td>
</tr>
<tr>
<td>Beam-emitting part</td>
<td>1.75</td>
</tr>
<tr>
<td>2-ø2.2 x ø0.087 mounting holes</td>
<td></td>
</tr>
</tbody>
</table>

Material: **Cold rolled carbon steel (SPCC)**

Two M2 (length 4 mm 0.157 in) pan head screws are attached.

### MS-EX10-1

<table>
<thead>
<tr>
<th>Component</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-M2 x 0.4 x 0.016 thru-hole threads</td>
<td>8</td>
</tr>
<tr>
<td>2-ø3.4 x ø0.134 mounting holes</td>
<td></td>
</tr>
</tbody>
</table>

Material: **Cold rolled carbon steel (SPCC)**

Two M2 (length 4 mm 0.157 in) pan head screws are attached.

### MS-EX10-2

<table>
<thead>
<tr>
<th>Component</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-M2 x 0.4 x 0.016 thru-hole threads</td>
<td>8</td>
</tr>
<tr>
<td>2-ø3.4 x ø0.134 mounting holes</td>
<td></td>
</tr>
</tbody>
</table>

Material: **Cold rolled carbon steel (SPCC)**

Two M2 (length 8 mm 0.315 in) pan head screws are attached.
**DIMENSIONS (Unit: mm in)**

**MS-EX10-3**

![Diagram of MS-EX10-3 assembly dimensions](image)

**Assembly dimensions**

Mounting drawing with EX-14□:

1. **Beam-receiving part**
   - (2.75) (0.108)
   - (0.7) (0.028)

2. **Beam-emitting part**
   - (3.5) 0.138
   - (3.2) 0.125

Material:
- Cold rolled carbon steel (SPCC) (Uni-chrome plated)
- 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-EX10-11**

![Diagram of MS-EX10-11 assembly dimensions](image)

**Assembly dimensions**

Mounting drawing with EX-14□:

1. **Beam-receiving part**
   - (2.75) (0.108)
   - (0.7) (0.028)

2. **Beam-emitting part**
   - (3.5) 0.138
   - (3.2) 0.125

Material:
- Stainless steel (SUS304)
- Two M2 (length 4 mm 0.157 in) pan head screws [stainless steel (SUS304)] are attached.

**MS-EX10-12**

![Diagram of MS-EX10-12 assembly dimensions](image)

**Assembly dimensions**

Mounting drawing with EX-11E and EX-13E:

1. **Beam-receiving part**
   - (2.3) (0.091)

Material:
- Stainless steel (SUS304)
- Two M2 (length 8 mm 0.315 in) pan head screws [stainless steel (SUS304)] are attached.
Material: Stainless steel (SUS304)

Two M2 (length 4 mm 0.157 in) pan head screws [stainless steel (SUS304)] and two M2 (length 8 mm 0.315 in) pan head screws [stainless steel (SUS304)] are attached.