Ultra-compact Laser Sensor

Introducing ultra-compact amplifier built-in laser sensor

Ultra-compact

Due to the customized IC and optical design, high precision detection is fulfilled with directivity and visibility achievable only by laser. The laser adopted is Class 1 (IEC / JIS / FDA) laser that is safe to use, so that there is no need to separate the areas of sensor usage.

THRU-BEAM TYPE

Minute object detection type

Spread the beam and lower its density, thus even a minute object can be detected with a small change in the light received intensity. Spot size: 6 x 4 mm 0.236 x 0.157 in approx. (Visual reference value at a sensing distance of 1 m 3.281 ft)

Long sensing range type

A long range detection of 3 m 9.843 ft is achieved. High precision detection with minimum beam spread is possible even in a long range. Spot size: 8 x 5.5 mm 0.315 x 0.217 in approx. (Visual reference value at a sensing distance of 1 m 3.281 ft)

REFLECTIVE TYPE

Long sensing range type

Achieving ease of installation and 4 m 13.123 ft long sensing range. Spot size: 6 x 4 mm 0.236 x 0.157 in approx. (Visual reference value at a sensing distance of 1 m 3.281 ft)

SPOT REFLECTIVE TYPE

Minute object detection type

Highly precise sensing with minimum 0.01 mm 0.0004 in diameter. Many applications are possible due to the 300 mm 11.811 in long sensing range. Spot size: ø1 mm ø0.039 in (Visual reference value at a sensing distance of 300 mm 11.811 in)
APPLIEDICATIONS

Detecting ICs that are out of position in multiple palettes

Confirming arrival of substrate

Determining cutting position of sheet

Sensing unevenly-colored workpieces

Sensing glossy or curved-surface workpiece, such as metallic pipes

Detecting O-ring

APPLICATIONS

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Detecting O-ring

CONVERGENT REFLECTIVE TYPE

Spot type

Highly precise sensing with minimum 0.01 mm 0.0004 in diameter. Not affected by the background, and able to reliably sense unevenly-colored workpieces.

Spot size: ø1 mm ø0.039 in (Visual reference value at a sensing distance of 50 mm 1.969 in)

Line spot type

Able to sense thin, glossy or curved-surface workpieces due to line beam.

Spot size: 5 × 1 mm 0.197 × 0.039 in approx. (Visual reference value at a sensing distance of 50 mm 1.969 in)

Sensing range

Spot type (EX-L261): 20 mm to 50 mm 0.787 in to 1.969 in

Line spot type (EX-L262): 20 mm to 70 mm 0.787 in to 2.756 in
HIGH PRECISION

**Highly accurate detection**  EX-L211/L221
Suitable for positioning and minute object detection

A repeatability of 0.02 mm \(0.0008\) in or less at a range of from 100 to 200 mm \(3.937\) to \(7.874\) in makes this type best suitable for positioning applications (EX-L221). Moreover, it boasts a top-class detection precision in the compact laser sensor category with the gold wire of \(0.01\) mm \(0.0004\) in.

<table>
<thead>
<tr>
<th>Model No.</th>
<th>Minimum sensing object (Typical)</th>
<th>Repeatability (Typical)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EX-L211 (Thru-beam type)</td>
<td>ø0.3 mm ø0.012 in</td>
<td>0.01 mm (0.0004) in or less</td>
</tr>
<tr>
<td>EX-L221 (Spot reflective type)</td>
<td>ø0.01 mm ø0.0004 in</td>
<td>0.02 mm (0.0008) in or less</td>
</tr>
</tbody>
</table>

* Typical values when the sensitivity adjuster is optimally adjusted.

**Dependable technology yields high precision**
Incorporating a high-precision aspheric glass lens

Light aberrations are reduced and a high definition laser spot is possible by incorporating a molded aspheric glass lens.

The secret to high precision
Molded aspheric glass lenses

**Stable convergent distance sensing**
For sensing when background object presents

Due to convergent distance sensing, the background has very little effect, enabling stable sensing. Sensitivity adjuster allows you to adjust sensitivity to avoid sensing background objects when the distance between the workpiece and background objects is small.

**Small receiver aperture for precision detection**
EX-L211/L212

Errant beams are eliminated by the ø0.5 mm ø0.020 in receiver aperture. Only beams entering the aperture are used, making for high-precision sensing.

**Stable convergent distance sensing**
For sensing thin, glossy or curved-surface workpieces (Line spot type EX-L262)

Able to sense glossy or curved-surface workpieces, such as PCB and metallic pipes, due to a wide line laser beam.

**For sensing unevenly-colored workpieces**
Able to reliably sense unevenly-colored workpieces.
EASY ALIGNMENT

Easy beam-axis alignment

Visual positioning is easy due to silhouetting a sensing object against a receiver. Visually confirm the optimal receiver position, adjusting the beam axis by aligning the objects while watching the red spot on the beam alignment screen. The diagram on the right shows an example with the lead of a mechanical pencil being detected through visual adjustment.

EASY SETTING

Same mounting pitch as ultra-compact photoelectric sensor

EX-L200 series has the same mounting pitch as ultra-compact photoelectric sensor EX-20 series so that the time taken in designing is saved.

EASY TO USE

M3 screw used for secure tightening

The mounting holes have metal sleeves inserted to prevent damage to the sensor due to over tightening of the screws. (Tightening torque: 0.5 N·m)

Conductor thickness 1.5 times increased to make wiring easier

The lead wire conductor’s thickness is increased to 0.15 mm² from 0.1 mm² of the conventional ultra-compact photoelectric sensor. This makes it easier to perform crimping work on the cables for better workability. In addition, the tensile strength of the crimping area has become stronger.

ENVIRONMENTAL RESISTANCE

Strong against water and dust with protection structure IP67

The sensor can be used even in environment where water or dust present because of its protection structure IP67.

Conductive thickness 1.5 times greater

The lead wire conductor’s thickness is increased to 0.15 mm² from 0.1 mm² of the conventional ultra-compact photoelectric sensor. This makes it easier to perform crimping work on the cables for better workability. In addition, the tensile strength of the crimping area has become stronger.

Sensitivity adjuster (excluding EX-L212□)

A sensitivity adjuster of world smallest size is incorporated to offer strong performance in minute detection or high precision detection.

Low current consumption

The laser light source contributes to low current consumption, as it is approx. 5 mA lower than a LED light source.

Switchable output operation

The output operation switching input enables the switching of Light-ON or Dark-ON in one unit. This prevents ordering mistake and reduces the maintenance of spare parts.
### ORDER GUIDE

<table>
<thead>
<tr>
<th>Type</th>
<th>Appearance</th>
<th>Sensing range</th>
<th>Model No.</th>
<th>Emission spot size</th>
<th>Sensitivity adjuster</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thru-beam</td>
<td></td>
<td>1 m 3.281 ft</td>
<td>EX-L211</td>
<td>6 × 4 mm 0.236 × 0.157 in (at a sensing distance of 1 m 3.281 ft)</td>
<td>Incorporated</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 m 9.843 ft</td>
<td>EX-L212</td>
<td>8 × 5.5 mm 0.315 × 0.217 in (at a sensing distance of 1 m 3.281 ft)</td>
<td></td>
</tr>
<tr>
<td>Retroreflective</td>
<td></td>
<td>4 m 13.123 ft</td>
<td>EX-L291</td>
<td>6 × 4 mm 0.236 × 0.157 in (at a sensing distance of 1 m 3.281 ft)</td>
<td>Incorporated</td>
</tr>
<tr>
<td>Spot reflective</td>
<td>45 to 300 mm</td>
<td>1.772 to 11.811 in</td>
<td>EX-L221</td>
<td>Φ1 mm ø0.039 in or less (at a sensing distance of 300 mm 11.811 in)</td>
<td>Incorporated</td>
</tr>
<tr>
<td>Spot</td>
<td>20 to 50 mm</td>
<td>0.787 to 1.969 in (Note 5) (Convergent point: 22 mm 0.866 in)</td>
<td>EX-L261</td>
<td>Φ1 mm ø0.039 in or less (at a sensing distance of 50 mm 1.969 in)</td>
<td>Incorporated</td>
</tr>
<tr>
<td>Spot</td>
<td>20 to 70 mm</td>
<td>0.787 to 2.796 in (Note 5) (Convergent point: 22 mm 0.866 in)</td>
<td>EX-L262</td>
<td>Φ1 mm ø0.039 in or less (at a sensing distance of 50 mm 1.969 in)</td>
<td>Incorporated</td>
</tr>
</tbody>
</table>

Notes:
1) 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.
2) The sensing range is the value for RF-330 reflector. The sensing range represents the actual sensing range of the sensor. The sensing ranges itemized in “A” of the table below may vary depending on the shape of sensing object. Be sure to check the operation with the actual sensing object.
3) Refer to “OPTIONS” (p.233) for the polarization filter PF-EXL2-1 and the reflector RF-210.
4) When positioning the reflector nearby, the angular characteristic become more narrow. Adjust the angle of a sensor or reflector.
5) The sensing range is specified for white non-glossy paper (100 × 100 mm 3.937 × 3.937 in) as the object.

### M8 pigtailed type and 5 m 16.404 ft cable length type

The M8 pigtailed type and 5 m 16.404 ft cable length type (standard: 2 m 6.562 ft) are also available. When ordering these types, suffix “-J” for the M8 pigtailed type, “-C5” for the 5 m 16.404 ft cable length type to the model No. Please order the mating cable for the M8 pigtailed type separately.

(e.g.) M8 pigtailed type of EX-L211-P is “EX-L211-P-J” 5 m 16.404 ft cable length type of EX-L211-P is “EX-L211-P-C5”

### Mating cable (2 cables are required for the thru-beam type.)

<table>
<thead>
<tr>
<th>Type</th>
<th>Model No.</th>
<th>Cable length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight</td>
<td>CN-24A-C2</td>
<td>2 m 6.562 ft</td>
</tr>
<tr>
<td></td>
<td>CN-24A-C5</td>
<td>5 m 16.404 ft</td>
</tr>
<tr>
<td>Elbow</td>
<td>CN-24AL-C2</td>
<td>2 m 6.562 ft</td>
</tr>
<tr>
<td></td>
<td>CN-24AL-C5</td>
<td>5 m 16.404 ft</td>
</tr>
</tbody>
</table>

### Package without reflector

Retroreflective type is also available without the reflector.

<table>
<thead>
<tr>
<th>Type</th>
<th>Model No.</th>
<th>NPN output</th>
<th>PNP output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retroreflective type</td>
<td>EX-L291-Y</td>
<td>EX-L291-P-Y</td>
<td></td>
</tr>
<tr>
<td>M8 pigtailed type</td>
<td>EX-L291-J-Y</td>
<td>EX-L291-J-P-Y</td>
<td></td>
</tr>
<tr>
<td>5 m 16.404 ft cable length type</td>
<td>EX-L291-C5-Y</td>
<td>EX-L291-C5-P-Y</td>
<td></td>
</tr>
</tbody>
</table>

### Accessories

- MS-EXL2-2 (Mounting plate for thru-beam type): 1 pc.
- MS-EXL2-3 (Mounting plate for retroreflective / spot reflective / convergent reflective type): 1 pc.
- RF-330 (Reflector): 1 pc.
## SPECIFICATIONS

<table>
<thead>
<tr>
<th>Item</th>
<th>Thru-beam</th>
<th>Retroreflective</th>
<th>Spot reflective</th>
<th>Convergent reflective</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model No.</strong></td>
<td>EX-L211</td>
<td>EX-L212</td>
<td>EX-L291</td>
<td>EX-L221</td>
</tr>
<tr>
<td>Sensing range</td>
<td>1 m ± 0.032 ft</td>
<td>3 m ± 0.094 ft</td>
<td>4 m ± 0.133 ft</td>
<td>45 to 300 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.772 to 11.811 in</td>
</tr>
<tr>
<td>Emission spot size</td>
<td>Approx. 6 mm × 4 mm</td>
<td>Approx. 4 mm × 3 mm</td>
<td>Approx. 4 mm × 3 mm</td>
<td>Approx. 4 mm × 3 mm</td>
</tr>
<tr>
<td>Sensing object</td>
<td>Opaque object</td>
<td>Opaque object</td>
<td>Opaque object</td>
<td>Opaque, translucent or transparent object</td>
</tr>
<tr>
<td>Minimum sensing object</td>
<td>Opaque object</td>
<td>Gold wire of ø0.01 mm</td>
<td>ø0.01 mm</td>
<td>ø0.01 mm</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>20 % of operation distance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeatability (Typical)</td>
<td>Perpendicular to sensing axis: 0.05 mm</td>
<td>Perpendicular to sensing axis: 0.2 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeatability (Typical)</td>
<td>0.0020 mm or less</td>
<td>0.00080 in or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply voltage</td>
<td>12 to 24 V DC ±10 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current consumption</td>
<td>15 mA or less</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output</td>
<td>&lt;NPN output type&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NPN open-collector transistor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maximum current: 50 mA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Residual voltage: 2 V or less (at 50 mA sink current)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 V or less (at 16 mA sink current)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output operation</td>
<td>Light-ON / Dark-ON selectable by the output operation switching input</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short-circuit protection</td>
<td>Incorporated (short-circuit protection / inverse polarity protection)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Response time</td>
<td>0.5 ms or less</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operation indicator</td>
<td>Green LED (lights up when the power is ON)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stability indicator</td>
<td>Green LED (lights up when the output is ON)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power indicator</td>
<td>Green LED (lights up when the power is ON) (incorporated on the emitter)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Automatic-interference prevention function</td>
<td>Incorporated (Two sensors can be mounted close together.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensitivity adjuster</td>
<td>Continuously variable adjuster (receiver)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Environmental resistance**

<table>
<thead>
<tr>
<th>Protection</th>
<th>IP67 (IEC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature</td>
<td>–10 to +55 °C +14 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 illumination</td>
<td>Incandescent light: 3,000 lx at the light-receiving face</td>
</tr>
<tr>
<td>Voltage withstandable</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 MO. 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, 1.5 mm 0.059 in amplitude (10 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>
</tbody>
</table>

**Emitting element**

Red semiconductor laser Class 1 (IEC / JIS / FDA) (Note 6)

**Material**

Enclosure: Polybutylene terephthalate, Front cover: Acrylic, Lens: Glass

**Cable**

0.15 mm² 4-core (emitter of a thru-beam sensor: 2-core) cable, black cable, 2 m 6.5 ft long

**Cable extension**

Extension up to total 50 m 164.042 ft is possible with 0.3 mm², or more, cable (thru-beam type). Total 100 m 328.084 ft both emitter and receiver.

**Weight**

Net weight: 45 g approx., Gross weight: 60 g approx.

**Accessories**

MS-EXL2-2 (Metal plate): 2 pcs.

**Notes:**

1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C ±3.4 °C.  
2) The sensing range is the value for RF-330 reflector. The sensing range represents the actual sensing range of the sensor. The sensing ranges itemized in “A” of the table below may vary depending on the shape of sensing object. Be sure to check the operation with the actual sensing range.

3) The sensing range is specified for white non-glossy paper (100 × 100 mm 3.937 × 3.937 in) as the object.

4) EX-L212: In the case sensing distance is 3 m 9.843 ft, the emission spot size is H 17 × W 11 mm H 0.669 × W 0.433 in (visual reference value).  

5) PF-EXL2-1 (Note 1) (Typical): the angle of a sensor or reflector.  

6) This product complies with 21 CFR 1040.10 and 1040.11 Laser Notice No. 50, dated June 24, 2007, issued by CDHR (Center for Devices and Radiological Health) under the FDA (Food and Drug Administration). For details, refer to the Laser Notice No. 50.  

7) Make sure to confirm detection with an actual sensor before use.

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**Options**

- For the polarizing filter PF-EXL2-1 and the reflector RF-210 (Note 2)  
- Manufacturer’s recommended filters (PF-EXL2-4 polarizing filters)  
- Manufacturer’s recommended filters (PF-EXL2-1 polarizing filters)
**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-EXL2-1</td>
<td>Foot angled mounting bracket (The thru-beam type sensor needs two brackets.)</td>
</tr>
<tr>
<td></td>
<td>MS-EXL2-6</td>
<td>Compatible bracket for thru-beam type A bracket to easily mount EX-L21.5 on the 25.4 mm 1.000 in pitch sensor mounting bracket. Use with the mounting plate attached to the sensor. Two brackets are needed when used for the emitter and the receiver.</td>
</tr>
<tr>
<td>Universal sensor mounting bracket</td>
<td>MS-EXL2-4</td>
<td>It can adjust the height and the angle of the sensor. (The thru-beam type sensor needs two brackets.)</td>
</tr>
<tr>
<td>Polarizing filter</td>
<td>PF-EXL2-1</td>
<td>For retroreflective type EX-L21.5 Stabilizes sensitivity of the reflective surface.</td>
</tr>
<tr>
<td>Reflector</td>
<td>RF-210</td>
<td>For retroreflective type EX-L21.5 Protects the reflector from damage and maintains alignment.</td>
</tr>
<tr>
<td>Reflector mounting bracket</td>
<td>MS-RF21-1</td>
<td>Protective mounting bracket for RF-210 It protects the reflector from damage and maintains alignment.</td>
</tr>
</tbody>
</table>

Note: Set the distance between the reflector and sensor to be at least 0.16 m 0.525 in. Refer to “ORDER GUIDE” (p.231) for details.

**I/O CIRCUIT DIAGRAMS**

### NPN output type

**I/O circuit diagrams**

- **Color code of wire / Terminal No. of pigtailed type**
  - **Sensor circuit**
    - (Brown / 1) +V
    - (Pink / 2) Output operation switching input (Note 1, 2, 3)
    - (Black / 4) Output (Note 1)
  - **Beam-receiving part**
    - (Blue / 3) 0 V 50 mA max.
  - **Internal circuit**
    - User's circuit
  - **Output (Note)**
    - 12 to 24 V DC ±10 %

**Notes:**
1) The emitter of a thru-beam type does not incorporate output (black / 4) and output operation switching input (pink / 2).
2) Be able to select either Light-ON or Dark-ON by wiring the output operation switching input (pink / 2) as shown in the following table.

<table>
<thead>
<tr>
<th>Type</th>
<th>Light-ON</th>
<th>Dark-ON</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thru-beam, Retroreflective</td>
<td>Connect to 0 V</td>
<td>Connect to + V or, Open</td>
</tr>
<tr>
<td>Spot reflective / Convergent reflective</td>
<td>Connect to + V or, Open</td>
<td>Connect to 0 V</td>
</tr>
</tbody>
</table>

* Insulate the output operation switching input wire (pink / 2) when leaving it open.

3) When connecting the mating cable to the pigtailed type, color code of wire is “white”.

**Connector pin position (pigtailed type)**

- **2** Sensing mode selection input (Note)
- **3** Output (Note)
- **1** +V
- **0 V**

Note: The emitter of a thru-beam type does not incorporate output and output operation switching input.

### PNP output type

**I/O circuit diagrams**

- **Color code of wire / Terminal No. of pigtailed type**
  - **Sensor circuit**
    - (Brown / 1) +V
    - (Black / 4) Output (Note 1)
    - (Pink / 2) Output operation switching input (Note 1, 2, 3)
  - **Beam-receiving part**
    - (Blue / 3) 0 V 50 mA max.
  - **Internal circuit**
    - User's circuit
  - **Output (Note)**
    - 12 to 24 V DC ±10 %

**Notes:**
1) The emitter of a thru-beam type does not incorporate output (black / 4) and output operation switching input (pink / 2).
2) Be able to select either Light-ON or Dark-ON by wiring the output operation switching input (pink / 2) as shown in the following table.

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<tbody>
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<td>Connect to 0 V</td>
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<tr>
<td>Spot reflective / Convergent reflective</td>
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<td>Connect to 0 V</td>
</tr>
</tbody>
</table>

* Insulate the output operation switching input wire (pink / 2) when leaving it open.

3) When connecting the mating cable to the pigtailed type, color code of wire is “white”.

**Connector pin position (pigtailed type)**

- **2** Sensing mode selection input (Note)
- **3** Output (Note)
- **1** +V
- **0 V**

Note: The emitter of a thru-beam type does not incorporate output and output operation switching input.
### Ultra-compact Laser Sensor EX-L200 SERIES

#### SENSING CHARACTERISTICS (TYPICAL)

**EX-L211**
- **Thru-beam type**
- **Parallel deviation**
- **Angular deviation**

**EX-L212**
- **Thru-beam type**
- **Parallel deviation**
- **Angular deviation**

**EX-L291**
- **Retroreflective type**
- **Parallel deviation**
  - Horizontal direction
  - Vertical direction
- **Angular deviation**
  - Horizontal direction
  - Vertical direction

**EX-L221**
- **Spot reflective type**
- **Sensing field**
- **Correlation between sensing object size and sensing range**

**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 an enough margin because of slight variation in products.
- The graph is drawn for the maximum sensitivity setting.
- Lightness shown on the left may differ slightly from the actual object condition.
### Ultra-compact Laser Sensor EX-L200 SERIES

#### SENSING CHARACTERISTICS (TYPICAL)

**EX-L261**

**Sensing field**
- Horizontal (left and right) direction
- Vertical (up and down) direction

**Emitted beam**
- Convergent reflective

**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.

Lightness shown on the left may differ slightly from the actual object condition.

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**EX-L262**

**Sensing field**
- Horizontal (left and right) direction
- Vertical (up and down) direction

**Emitted beam**
- Convergent reflective

**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.

Lightness shown on the left may differ slightly from the actual object condition.
PRECAUTIONS FOR PROPER USE

Refer to p.1458~ for general precautions and p.1499~ for information about laser beam.

- This catalog is a guide to select a suitable product. Be sure to read the instruction manual attached to the product prior to its 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.

Cautions for laser beams

- This product is classified as a Class 1 Laser Product in IEC / JIS standards and in FDA* regulations. Do not look at the laser beam through optical system such as a lens.
- The following label is attached to the cable. Handle the product according to the instruction given on the warning label.

*This product complies with 21 CFR 1040.10 and 1040.11 Laser Notice No. 50, dated June 24, 2007, issued by CDRH (Center for Devices and Radiological Health) under the FDA (Food and Drug Administration).

Safety standards for laser beam products

- A laser beam can harm human being’s eyes, skin, etc., because of its high energy density. IEC has classified laser products according to the degree of hazard and the stipulated safety requirements. EX-L200 series is classified as Class 1 laser.

Classification by IEC 60825-1

<table>
<thead>
<tr>
<th>Classification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1</td>
<td>Lasers that are safe under reasonably foreseeable conditions of operation, including the use of optical instruments for intra-beam viewing.</td>
</tr>
</tbody>
</table>

Safe use of laser products

- For the purpose of preventing users from suffering injuries by laser products, IEC 60825-1 (Safety of laser products). Kindly check the standards before use. (Refer to About laser beam.)

Mounting

- When mounting this sensor, use a mounting plate (MS-EXL2-2, MS-EXL2-3). Without using the mounting plate, beam misalignment may occur. Also, install the mounting plate in between the sensor and the mounting surface.
- The tightening torque should be 0.5 N·m or less.
- Note: The mounting direction of the mounting plate is fixed. Install in a way so that the bending shape is facing the sensor side.

Automatic interference prevention function

- Spot reflective type sensor incorporate this function. Up to two sets of sensor can be mounted closely. (Thru-beam type sensor does not have this function.)

Note: If two spot reflective type sensor are mounted facing each other, they should be angled so as not to receive the beam from the opposing sensor or to detect its front face.

Others

- Do not use during the initial transient time (approx. 50ms) after the power supply is switched ON.
- In case the load and this sensor are connected to different power supplies, be sure to turn ON the power from the sensor.
- The cable may break by applying excess stress in low temperature.
- Do not allow any water, oil fingerprints, etc., which may refract light, or dust, dirt, etc., which may block light, to stick to the emitting / receiving surfaces of the sensor head. In case they are present, wipe them with a clean, soft cloth or lens paper. Do not use this sensor in places having excessive vapor, dust, etc., or where it may come in contact with corrosive gas.
- Take care that the sensor does not come in direct contact with oil, grease, organic solvents, such as, thinner etc., or strong acid, and alkaline.
- Make sure that the power is OFF while cleaning the emitting / receiving windows of the sensor head.
- This device is using a laser which has high directional quality. Therefore the beam possibly be out of alignment by the mounting condition of this device or distortion of housing etc. Make sure to adjust the beam axe alignment before use.
The CAD data in the dimensions can be downloaded from our website.

**DIMENSIONS (Unit: mm in)**

**EX-L211(-P) EX-L212(-P)**

- Stability indicator (Green)
- Operation indicator (Orange) (Note 1)
- Sensitivity adjuster (Note 2)
- Beam axis
- ø3.7 ø0.146 cable, 2 m 0.562 ft long
- 4-core (emitter: 2-core) × 0.15 mm² insulator diameter: ø1.0 mm ø0.004 in
- 2-ø3.2 ø0.126 mounting holes

**EX-L211(-P) EX-L212(-P)**

- Stability indicator (Green)
- Operation indicator (Orange) (Note 1)
- Sensitivity adjuster (Note 2)
- Beam axis
- ø3.7 ø0.146 cable, 2 m 0.562 ft long
- 4-core (emitter: 2-core) × 0.15 mm² insulator diameter: ø1.0 mm ø0.004 in
- 2-ø3.2 ø0.126 mounting holes

Notes: 1) It is the laser radiation indicator (green) on the emitter.
2) It is incorporated in EX-L211(-P) only.

**EX-L211(-J) EX-L212(-J)**

- Stability indicator (Green)
- Operation indicator (Orange) (Note 1)
- Sensitivity adjuster (Note 2)
- Beam axis
- ø3.7 ø0.146 cable
- 2-ø3.2 ø0.126 mounting holes

Notes: 1) It is the laser radiation indicator (green) on the emitter.
2) It is incorporated in EX-L211(-J) only.

**EX-L211(-P) EX-L212(-P)**

- Stability indicator (Green)
- Operation indicator (Orange) (Note 1)
- Sensitivity adjuster (Note 2)
- Beam axis
- ø3.7 ø0.146 cable, 2 m 0.562 ft long
- 4-core (emitter: 2-core) × 0.15 mm² insulator diameter: ø1.0 mm ø0.004 in
- 2-ø3.2 ø0.126 mounting holes

**Assembly dimensions with polarizing filter (PF-EXL2-1)**

Mounting drawing with EX-L291(-P)

**EX-L211(-J) EX-L212(-J)**

- Stability indicator (Green)
- Operation indicator (Orange) (Note 1)
- Sensitivity adjuster (Note 2)
- Beam axis
- ø3.7 ø0.146 cable
- 2-ø3.2 ø0.126 mounting holes

Notes: 1) It is the laser radiation indicator (green) on the emitter.
2) It is incorporated in EX-L211(-J) only.

**EX-L291(-P) EX-L221(-P)**

- Stability indicator (Green)
- Operation indicator (Orange)
- Sensitivity adjuster
- Beam axis
- ø3.7 ø0.146 cable
- 2-ø3.2 ø0.126 mounting holes

**EX-L291(-P) EX-L221(-P)**

- Stability indicator (Green)
- Operation indicator (Orange)
- Sensitivity adjuster
- Beam axis
- ø3.7 ø0.146 cable
- 2-ø3.2 ø0.126 mounting holes

**EX-L261(-P) EX-L262(-P)**

- Stability indicator (Green)
- Operation indicator (Orange)
- Sensitivity adjuster
- Beam axis
- ø3.7 ø0.146 cable, 2 m 0.562 ft long
- 4-core (emitter: 2-core) × 0.15 mm² insulator diameter: ø1.0 mm ø0.004 in
- 2-ø3.2 ø0.126 mounting holes
**DIMENSIONS (Unit: mm in)**

**RF-330** Reflector (Accessory for EX-L291□)

Material: Acrylic (Reflector)
ABS (Base)

Material: Stainless steel (SUS304)
Two M3 (length 12 mm 0.472 in) screws with washers are attached.

**MS-RF21-1** Reflector mounting bracket for RF-210 (Optional)

Material: Stainless steel (SUS304)
Two M3 (length 14 mm 0.551 in) screws with washers are attached.

**MS-EXL2-1** Sensor mounting bracket (Optional)

Material: Stainless steel (SUS304)
Two M3 (length 14 mm 0.551 in) screws with washers [stainless steel (SUS304)] are attached.
DIMENSIONS (Unit: mm in)

The CAD data in the dimensions can be downloaded from our website.

**MS-EXL2-2**
Mounting plate (Accessory for EX-L211□/L212□)

Assembly dimensions
Mounting drawing with the emitter

Material: Stainless steel (SUS304)
Note: Screws are not attached. Purchase separately.

* Without using the mounting plate, beam misalignment may occur.

**MS-EXL2-3**
Mounting plate (Accessory for EX-L291□/L221□/L26□)

Assembly dimensions
Mounting drawing with the emitter

Material: Stainless steel (SUS304)
Note: Screws are not attached. Purchase separately.

* Without using the mounting plate, beam misalignment may occur.

**MS-EXL2-4**
Universal sensor mounting bracket (Optional)

Assembly dimensions
Mounting drawing with the receiver of EX-L211□/L212□

Material: Die-cast zinc alloy
Two M3 (length 14 mm 0.551 in) screws with washers, one M3 (length 10 mm 0.394 in) hexagon socket-head bolt [stainless steel (SUS)], and one M3 hexagon nut [stainless steel (SUS304)] are attached.

**Assembly dimensions**
Mounting drawing with EX-L291□/L221□

Note: This is the adjustable range of the movable part.