PHOTOELECTRIC SENSORS
E3FA/E3RA/E3FB/E3RB

A new generation in sensing performance

- Simplicity
  - Simple selection
  - Simple installation
- One family for all
  - All standard applications covered
  - A wide variety of models
  - Models designed for special applications
- Non-stop detection
  - High quality and reliability
  - High EMC protection
  - High light immunity
  - Robust and waterproof housing

Refer to Safety Precautions on page 15.

Features

Simplicity

Omron’s compact E3FA series of photoelectric sensors is simple and quick to mount, as well as easy and intuitive to set-up. The large and robust adjuster makes life much easier for installers to adjust the sensor, as does the bright, high-power red LED, which is clearly visible for easy alignment, even over longer distances. Similarly, the sensor’s LED status indicator can be viewed from long distances and wide angles.

One family for all

Typically installed in industrial plants ranging from food and beverage, textiles, ceramics and brick production, through to logistics, there’s always an E3FA model to fit your application.

This extensive photoelectric sensor series with high reliability and enhanced performance includes through-beam, retroreflective and diffuse-reflective types in straight and radial versions. Straight versions are also available with background-suppression, limited-reflective detection, and transparent object detection types for special applications.

Non-stop detection

Especially designed for machines that never stop, the rugged E3FA series offers completely reliable sensing in a robust and waterproof housing that can withstand even high-pressure cleaning. Exceeding market standards, this series also has high EMC protection and light immunity. In addition, there is the added benefit of the high-power LED, which contributes to high sensing stability even in environments with dust or vibrations.

For the most recent information on models that have been certified for safety standards, refer to your OMRON website.
## Ordering Information

**Sensors (E3FA Plastic housing)** [Refer to Dimensions on page 16.]

<table>
<thead>
<tr>
<th>Sensor type</th>
<th>Sensing distance</th>
<th>Connection method</th>
<th>Model</th>
<th>NPN output</th>
<th>PNP output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Through-beam *1.</td>
<td></td>
<td>pre-wired</td>
<td>set E3FA-TN11 2M E3FA-TN11-L 2M E3FA-TN11-D 2M</td>
<td>set E3FA-TP11 2M E3FA-TP11-L 2M E3FA-TP11-D 2M</td>
<td></td>
</tr>
<tr>
<td>Retro-reflective with MSR function *2.</td>
<td>0.1 to 4 m with E39-R1S</td>
<td>pre-wired</td>
<td>E3FA-RN11 2M E3FA-RP11 2M</td>
<td>E3FA-RN21 E3FA-RP21</td>
<td></td>
</tr>
<tr>
<td>Coaxial Retro-reflective with MSR function *2.</td>
<td>0 to 500 mm with E39-R1S</td>
<td>pre-wired</td>
<td>E3FA-RN12 2M E3FA-RP12 2M</td>
<td>E3FA-RN22 E3FA-RP22</td>
<td></td>
</tr>
<tr>
<td>Diffuse-reflective</td>
<td>100 mm</td>
<td>pre-wired</td>
<td>E3FA-DN11 2M E3FA-DP11 2M</td>
<td>E3FA-DN21 E3FA-DP21</td>
<td></td>
</tr>
<tr>
<td></td>
<td>300 mm</td>
<td>pre-wired</td>
<td>E3FA-DN12 2M E3FA-DP12 2M</td>
<td>E3FA-DN22 E3FA-DP22</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 m</td>
<td>pre-wired</td>
<td>E3FA-DN13 2M E3FA-DP13 2M</td>
<td>E3FA-DN23 E3FA-DP23</td>
<td></td>
</tr>
<tr>
<td>BGS (background suppression)</td>
<td>100 mm</td>
<td>pre-wired</td>
<td>E3FA-LN11 2M E3FA-LP11 2M</td>
<td>E3FA-LN21 E3FA-LP21</td>
<td></td>
</tr>
<tr>
<td></td>
<td>200 mm</td>
<td>pre-wired</td>
<td>E3FA-LN12 2M E3FA-LP12 2M</td>
<td>E3FA-LN22 E3FA-LP22</td>
<td></td>
</tr>
<tr>
<td>Limited distance reflective</td>
<td>10 to 50 mm</td>
<td>pre-wired</td>
<td>E3FA-VN11 2M E3FA-VP11 2M</td>
<td>E3FA-VN21 E3FA-VP21</td>
<td></td>
</tr>
<tr>
<td>Transparent detected with P-opaquing function *2.</td>
<td>100 to 500 mm with E39-RP1</td>
<td>pre-wired</td>
<td>E3FA-BN11 2M E3FA-BP11 2M</td>
<td>E3FA-BN21 E3FA-BP21</td>
<td></td>
</tr>
<tr>
<td>Transparent detected with P-opaquing function *2.</td>
<td>0.1 to 2 m with E39-RP1</td>
<td>pre-wired</td>
<td>E3FA-BN12 2M E3FA-BP12 2M</td>
<td>E3FA-BN22 E3FA-BP22</td>
<td></td>
</tr>
</tbody>
</table>

*1. The set type includes the emitter and receiver.

*2. The Reflector is sold separately. Select the Reflector model most suited to the application.
Sensors (E3RA Plastic housing) [Refer to Dimensions on page 16.]

<table>
<thead>
<tr>
<th>Sensor type</th>
<th>Sensing distance</th>
<th>Connection method</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Through-beam</strong> <em>1.</em>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>15 m</td>
<td>pre-wired</td>
<td>set E3RA-TN11 2M set E3RA-TP11 2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Emitter E3RA-TN11-L 2M Emitter E3RA-TP11-L 2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Receiver E3RA-TN11-D 2M Receiver E3RA-TP11-D 2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>set E3RA-TN21 set E3RA-TP21</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Emitter E3RA-TN21-L Emitter E3RA-TP21-L</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Receiver E3RA-TN21-D Receiver E3RA-TP21-D</td>
</tr>
<tr>
<td>*<em>Retro-reflective with MSR function <em>2.</em></em></td>
<td>0.1 to 3 m with E39-R1S</td>
<td>pre-wired</td>
<td>E3RA-RN11 2M E3RA-RP11 2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>M12 connector</td>
</tr>
<tr>
<td><strong>Diffuse-reflective</strong></td>
<td>100 mm</td>
<td>pre-wired</td>
<td>E3RA-DN11 2M E3RA-DP11 2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>M12 connector</td>
</tr>
<tr>
<td></td>
<td>300 mm</td>
<td>pre-wired</td>
<td>E3RA-DN12 2M E3RA-DP12 2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>M12 connector</td>
</tr>
<tr>
<td></td>
<td>700 mm</td>
<td>pre-wired</td>
<td>E3RA-DN13 2M E3RA-DP13 2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>M12 connector</td>
</tr>
</tbody>
</table>

*1. The set type includes the emitter and receiver.

*2. The Reflector is sold separately. Select the Reflector model most suited to the application.
### Sensors (E3FB/E3RB Metal housing) [Refer to Dimensions on page 17.]

<table>
<thead>
<tr>
<th>Sensor type</th>
<th>Sensing distance</th>
<th>Connection method</th>
<th>Model</th>
<th>NPN output</th>
<th>PNP output</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Through-beam&quot;1.&quot;</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Image]</td>
<td>20 m</td>
<td>pre-wired</td>
<td>set E3FB-TN11 2M</td>
<td>set E3FB-TN11 2M Emitter</td>
<td>set E3FB-TN11 2M Receiver</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>E3FB-TN11-L 2M</td>
<td>E3FB-TN11-D 2M Receiver</td>
<td>E3FB-TN11-D 2M Receiver</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>set E3FB-TP11</td>
<td>set E3FB-TP11 2M Emitter</td>
<td>set E3FB-TP11 2M Receiver</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>E3FB-TP11-L</td>
<td>E3FB-TP11-D Receiver</td>
<td>E3FB-TP11-D Receiver</td>
</tr>
<tr>
<td><strong>Retro-reflective with MSR function &quot;2.&quot;</strong></td>
<td>0.1 to 4 m with E39-R1S</td>
<td>pre-wired</td>
<td>E3FB-RN11 2M</td>
<td>E3FB-RP11 2M</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3FB-RN12 2M</td>
<td>E3FB-RP12 2M</td>
<td></td>
</tr>
<tr>
<td><strong>Coaxial Retro-reflective with MSR function &quot;2.&quot;</strong></td>
<td>0 to 500 mm with E39-R1S</td>
<td>pre-wired</td>
<td>E3FB-RN21</td>
<td>E3FB-RP21</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3FB-RN22</td>
<td>E3FB-RP22</td>
<td></td>
</tr>
<tr>
<td><strong>Diffuse-reflective</strong></td>
<td>100 mm</td>
<td>pre-wired</td>
<td>E3FB-DN11 2M</td>
<td>E3FB-DP11 2M</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3FB-DN12 2M</td>
<td>E3FB-DP12 2M</td>
<td></td>
</tr>
<tr>
<td></td>
<td>300 mm</td>
<td>pre-wired</td>
<td>E3FB-DN21</td>
<td>E3FB-DP21</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3FB-DN22</td>
<td>E3FB-DP22</td>
<td></td>
</tr>
<tr>
<td><strong>BGS (background suppression)</strong></td>
<td>100 mm</td>
<td>pre-wired</td>
<td>E3FB-LN11 2M</td>
<td>E3FB-LP11 2M</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3FB-LN21</td>
<td>E3FB-LP21</td>
<td></td>
</tr>
<tr>
<td></td>
<td>200 mm</td>
<td>pre-wired</td>
<td>E3FB-LN12 2M</td>
<td>E3FB-LP12 2M</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3FB-LN22</td>
<td>E3FB-LP22</td>
<td></td>
</tr>
<tr>
<td><strong>Limited distance reflective</strong></td>
<td>10 to 50 mm</td>
<td>pre-wired</td>
<td>E3FB-VN11 2M</td>
<td>E3FB-VP11 2M</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3FB-VN21</td>
<td>E3FB-VP21</td>
<td></td>
</tr>
<tr>
<td><strong>Transparent detected with P-opaquing function &quot;2.&quot;</strong></td>
<td>100 to 500 mm with E39-RP1</td>
<td>pre-wired</td>
<td>E3FB-BN11 2M</td>
<td>E3FB-BP11 2M</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3FB-BN21</td>
<td>E3FB-BP21</td>
<td></td>
</tr>
<tr>
<td><strong>Transparent detected with P-opaquing function &quot;2.&quot;</strong></td>
<td>0.1 to 2 m with E39-RP1</td>
<td>pre-wired</td>
<td>E3FB-BN12 2M</td>
<td>E3FB-BP12 2M</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3FB-BN22</td>
<td>E3FB-BP22</td>
<td></td>
</tr>
<tr>
<td><strong>Through-beam&quot;1.&quot;</strong></td>
<td>15 m</td>
<td>pre-wired</td>
<td>set E3RB-TN11 2M</td>
<td>set E3RB-TN11 2M Emitter</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>E3RB-TN11-L 2M</td>
<td>E3RB-TN11-D 2M Receiver</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>set E3RB-TN21</td>
<td>set E3RB-TN21 2M Emitter</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>E3RB-TN21-L</td>
<td>E3RB-TN21-D Receiver</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>set E3RB-TP11</td>
<td>set E3RB-TP11 2M Emitter</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>E3RB-TP11-L</td>
<td>E3RB-TP11-D Receiver</td>
<td></td>
</tr>
<tr>
<td><strong>Retro-reflective with MSR function &quot;2.&quot;</strong></td>
<td>0.1 to 3 m with E39-R1S</td>
<td>pre-wired</td>
<td>E3RB-RN11 2M</td>
<td>E3RB-RP11 2M</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3RB-RN21</td>
<td>E3RB-RP21</td>
<td></td>
</tr>
<tr>
<td><strong>Diffuse-reflective</strong></td>
<td>100 mm</td>
<td>pre-wired</td>
<td>E3RB-DN11 2M</td>
<td>E3RB-DP11 2M</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3RB-DN12 2M</td>
<td>E3RB-DP12 2M</td>
<td></td>
</tr>
<tr>
<td></td>
<td>300 mm</td>
<td>pre-wired</td>
<td>E3RB-DN21</td>
<td>E3RB-DP21</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3RB-DN22</td>
<td>E3RB-DP22</td>
<td></td>
</tr>
<tr>
<td></td>
<td>700 mm</td>
<td>pre-wired</td>
<td>E3RB-DN13 2M</td>
<td>E3RB-DP13 2M</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3RB-DN23</td>
<td>E3RB-DP23</td>
<td></td>
</tr>
</tbody>
</table>

*1. The set type includes the emitter and receiver.
*2. The Reflector is sold separately. Select the Reflector model most suited to the application.
Reflectors [Refer to Dimensions on page 18.]
Reflectors required for Retro-reflective Sensors: A Reflector is not provided with the Sensor. Be sure to order a Reflector separately.

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Sensing distance</th>
<th>Appearance</th>
<th>Model</th>
<th>Quantity</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>E3FA-R□1 E3FB-R□1</td>
<td>0.1 to 4 m</td>
<td>![Image]</td>
<td>E39-R1S</td>
<td>1</td>
<td>for E3FA-R□1, E3RA-R□1, E3FB-R□1, and E3RB-R□1</td>
</tr>
<tr>
<td>E3FA-R□2 E3FB-R□2</td>
<td>0 to 500 mm</td>
<td>![Image]</td>
<td>E39-RP1</td>
<td>1</td>
<td>for E3FA-B□2 and E3FB-B□2</td>
</tr>
<tr>
<td>E3FA-B□1 E3FB-B□1</td>
<td>100 to 500 mm</td>
<td>![Image]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E3FA-B□2 E3FB-B□2</td>
<td>0.1 to 2 m</td>
<td>![Image]</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mounting brackets [Refer to Dimensions on page 18.]
A Mounting Bracket is not enclosed with the Sensor. Order a Mounting Bracket separately if required.

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Appearance</th>
<th>Model (Material)</th>
<th>Quantity</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>all types</td>
<td>![Image]</td>
<td>E39-L183 (SUS304)</td>
<td>1</td>
<td>Mounting bracket</td>
</tr>
<tr>
<td>E3FA-□ E3RA-□</td>
<td>![Image]</td>
<td>E39-L182 (POM)</td>
<td>1</td>
<td>Flush mounting bracket</td>
</tr>
</tbody>
</table>

Sensor I/O connectors
Models for Connectors: A Connector is not provided with the Sensor. Be sure to order a Connector separately.

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Size</th>
<th>Cable</th>
<th>Appearance</th>
<th>Cable type</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>M12 connector types</td>
<td>M12</td>
<td>Standard</td>
<td>Straight</td>
<td>2 m</td>
<td>XS2F-M12PVC4S2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Angle</td>
<td>5 m</td>
<td>XS2F-M12PVC4S5M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 m</td>
<td>XS2F-M12PVC4A2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5 m</td>
<td>XS2F-M12PVC4A5M</td>
</tr>
</tbody>
</table>

Model Number Legend

**E3□-□□□□-(□□□□)**

1. Series name
   FA: Cylindrical, Straight type, Plastic housing
   RA: Cylindrical, Radial type, Plastic housing
   FB: Cylindrical, Straight type, Metal housing
   RB: Cylindrical, Radial type, Metal housing

2. Sensing method
   T: Through-beam
   R: Retro-reflective with MSR function
   D: Diffuse-reflective
   L: Background suppression
   V: Limited distance reflective
   B: Transparent detected with P-opaquing function

3. Output
   P: PNP
   N: NPN

4. Connection
   1: Cable
   2: Connector, M12, 4-pin

5. Difference of sensing distance, difference of light source
   Sequential number

6. Emitter/Receiver
   D: Receiver
   L: Emitter

7. Cable length
   Blank: Connector type

**e.g., E3FA-TP11 2M;**
   Cylindrical, Straight type, Plastic housing/ Through-beam/ PNP/ Cable/ Difference of Sensing distance/ Cable length of 2M
   E3RA-TN21-D;
   Cylindrical, Radial type, Plastic housing/ Through-beam/ NPN/ Connector, M12, 4-pin/ Difference of Sensing distance/ Receiver/ Connector type
   E3FA-VP21;
   Cylindrical, Straight type, Plastic housing/ Limited distance reflective/ PNP/ Connector, M12, 4-pin/ Difference of Sensing distance/ Connector type
### Ratings and Specifications

**Straight type (E3FA/E3FB)**

<table>
<thead>
<tr>
<th>Model</th>
<th>Sensing method</th>
<th>Through-beam</th>
<th>Retro-reflective with MSR function</th>
<th>Coaxial Retro-reflective with MSR function</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPN output</td>
<td>Pre-wired M12 Connector</td>
<td>E3FA-TN11 2M</td>
<td>E3FA-TN12 2M</td>
<td>E3FA-RN11 2M</td>
</tr>
<tr>
<td>PNP output</td>
<td>Pre-wired M12 Connector</td>
<td>E3FA-TP11 2M</td>
<td>E3FA-TP12 2M</td>
<td>E3FA-RP11 2M</td>
</tr>
</tbody>
</table>

**Sensing distance**

- 20 m
- 15 m
- 0.1 to 4 m (with E39-R1S)
- 0 to 500 mm (with E39-R1S)

**Spot diameter (reference value)**

- —

**Standard sensing object**

- Opaque: 7 mm dia.min.
- Opaque: 75 mm dia.min.

**Light source (wavelength)**

- Red LED (624 nm)
- Infrared LED (850 nm)
- Red LED (624 nm)

**Power supply voltage**

- 10 to 30 VDC (include voltage ripple of 10%(p-p) max.)

**Current consumption**

- 40 mA max.
- (Emitter 25 mA max. Receiver 15 mA max.)
- 25 mA max.

**Control output**

- NPN/PPN (open collector)
- Load current: 100 mA max. (Residual voltage: 3 V max.), Load power supply voltage: 30 VDC max.

**Operation mode**

- Light-ON/Dark-ON selectable by wiring

**Indicator**

- Operation indicator (orange)
- Stability indicator (green)
- Power indicator (green); only Emitter of Through-beam

**Protection circuits**

- Power supply reverse polarity protection, Output short-circuit protection, and Output reverse polarity protection

**Response time**

- 0.5 ms

**Ambient illumination (Receiver side)**

- Incandescent lamp: 3,000 lx max./ Sunlight: 10,000 lx max.

**Ambient temperature range**

- Operating: -25 to 55°C/ Storage: -40 to 70°C (with no icing or condensation)

**Insulation resistance**

- 20 MΩ min. at 500 VDC

**Dielectric strength**

- 1,000 VAC at 50/60 Hz for 1 min. between current-carrying parts and case

**Vibration resistance**

- Destruction: 10 to 55 Hz, 1.5 mm double amplitude for 2 hours each in X, Y and Z directions

**Shock resistance**

- Destruction: 500 m/s² 3 times each in X, Y and Z directions

**Degree of protection**

- IEC: IP67, DIN 40050-9: IP69K *

**Weight (packed state/only sensor)**

- Pre-wired cable (2M)
  - E3FA: Approx. 110 g/ Approx. 50 g, respectively
  - E3FB: Approx. 175 g/ Approx. 65 g, respectively
- Connector
  - E3FA: Approx. 30 g/ Approx. 10 g, respectively
  - E3FB: Approx. 85 g/ Approx. 20 g, respectively

**Material**

- Case
  - E3FA: ABS, E3FB: Nickel-brass
- Lens and Display
  - PMMA
- Adjuster
  - POM
- Nut
  - E3FA: POM, E3FB: Nickel-brass

**Accessories**

- Instruction sheet
- M18 nuts (4 pcs)
- Instruction sheet
- M18 nuts (2 pcs)

---

*IP69K Degree of Protection Specifications

IP69K is a protection specification stipulated by DIN 40050 Part 9 of the German standards. The test item is sprayed with 80°C water from a nozzle of a specified shape at a water pressure of 80 to 100 bar. The amount of water is 14 to 16 liters per minute. The distance between the test item and the nozzle is 10 to 15 cm. The water is discharged at angles of 0°, 30°, 60°, and 90° from the horizontal plane for 30 seconds at each angle while the test item is rotated horizontally.
## Straight type (E3FA/E3FB)

<table>
<thead>
<tr>
<th>Model</th>
<th>Sensing method</th>
<th>Diffuse-reflective</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPN output</td>
<td>Pre-wired</td>
<td>E3FA-DN11 2M</td>
</tr>
<tr>
<td>Item</td>
<td>M12 Connector</td>
<td>E3FA-DN21</td>
</tr>
<tr>
<td>Sensing distance</td>
<td>100 mm</td>
<td>300 mm</td>
</tr>
<tr>
<td>(white paper: 300 × 300 mm)</td>
<td>(white paper: 300 × 300 mm)</td>
<td>(white paper: 300 × 300 mm)</td>
</tr>
<tr>
<td>Spot diameter (reference value)</td>
<td>40 × 45 mm</td>
<td>40 × 50 mm</td>
</tr>
<tr>
<td>Sensing distance of 100 mm</td>
<td></td>
<td>Sensing distance of 300 mm</td>
</tr>
<tr>
<td>Sensing distance of 100 mm</td>
<td></td>
<td>Sensing distance of 300 mm</td>
</tr>
<tr>
<td>Sensing distance of 100 mm</td>
<td></td>
<td>Sensing distance of 300 mm</td>
</tr>
<tr>
<td>Sensing distance of 100 mm</td>
<td></td>
<td>Sensing distance of 300 mm</td>
</tr>
</tbody>
</table>

### Standard sensing object

- Differential travel: 20% max.
- directional angle: —

### Light source (wavelength)

- Red LED (624 nm)
- Infrared LED (850 nm)

### Power supply voltage

- 10 to 30 VDC (include voltage ripple of 10%(p-p) max.)

### Current consumption

- 25 mA max.

### Control output

- NPN/PNP (open collector)
- Load current: 100 mA max. (Residual voltage: 3 V max.), Load power supply voltage: 30 VDC max.

### Operation mode

- Light-ON/Dark-ON selectable by wiring

### Indicator

- Operation indicator (orange)
- Stability indicator (green)

### Protection circuits

- Power supply reverse polarity protection, Output short-circuit protection, and Output reverse polarity protection

### Response time

- 0.5 ms

### Sensitivity adjustment

- One-turn adjuster

### Ambient illumination (Receiver side)

- Incandescent lamp: 3,000 lx max./ Sunlight: 10,000 lx max.

### Ambient temperature range

- Operating: -25 to 55°C/ Storage: -40 to 70°C (with no icing or condensation)

### Ambient humidity range

- Operating: 35 to 85%/ Storage: 35 to 95% (with no condensation)

### Insulation resistance

- 20 MΩ min. at 500 VDC

### Dielectric strength

- 1,000 VAC at 50/60 Hz for 1 min. between current-carrying parts and case

### Vibration resistance

- Destruction: 10 to 55 Hz, 1.5 mm double amplitude for 2 hours each in X, Y and Z directions

### Shock resistance

- Destruction: 500 m/s² 3 times each in X, Y and Z directions

### Degree of protection

- IEC: IP67, DIN 40050-9: IP69K *

### Weight (packed state/only sensor)

- Pre-wired cable (2M) E3FA: Approx. 60 g/ Approx. 50 g, E3FB: Approx. 95 g/ Approx. 65 g
- Connector E3FA: Approx. 20 g/ Approx. 10 g, E3FB: Approx. 50 g/ Approx. 20 g

### Material

- Case E3FA: ABS, E3FB: Nickel-brass
- Lens and Display PMMA
- Adjuster POM
- Nut E3FA: POM, E3FB: Nickel-brass

### Accessories

- Instruction sheet M18 nuts (2 pcs)

---

* IP69K Degree of Protection Specifications
* IP69K is a protection specification stipulated by DIN 40050 Part 9 of the German standards.
* The test item is sprayed with 80°C water from a nozzle of a specified shape at a water pressure of 80 to 100 bar. The amount of water is 14 to 16 liters per minute.
* The distance between the test item and the nozzle is 10 to 15 cm. The water is discharged at angles of 0°, 30°, 60°, and 90° from the horizontal plane for 30 seconds at each angle while the test item is rotated horizontally.
### Straight type (E3FA/E3FB)

<table>
<thead>
<tr>
<th>Model</th>
<th>Sensing method</th>
<th>BGS (Background suppression)</th>
<th>Limited distance reflective</th>
<th>Transparent detected with P-opaquing function</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPN output</td>
<td>Pre-wired</td>
<td>E3F-LN11 2M</td>
<td>E3F-LN12 2M</td>
<td>E3F-VN11 2M</td>
</tr>
<tr>
<td>PNP output</td>
<td>Pre-wired</td>
<td>E3F-LP11 2M</td>
<td>E3F-LP12 2M</td>
<td>E3F-VP11 2M</td>
</tr>
</tbody>
</table>

#### Sensing distance
- **100 mm** (white paper: 300 × 300 mm)
- **200 mm** (white paper: 300 × 300 mm)
- **10 to 50 mm** (glass: t = 1.0 mm; 150 × 150 mm)
- **100 to 500 mm** (with E39-RP1)
- **0.1 to 2 m** (with E39-RP1)

#### Spot diameter (reference value)
- 10 × 10 mm
- 10 × 15 mm
- 10 × 10 mm
- —

#### Standard sensing object
- —
- glass (t = 1.0 mm): 150 × 150 mm

#### Differential travel
- 20% max.
- —

#### Directional angle
- —

#### Light source (wavelength)
- Red LED (624 nm)

#### Power supply voltage
- 10 to 30 VDC (include voltage ripple of 10% (p-p) max.)

#### Current consumption
- 25 mA max.

#### Control output
- NPN/PNP (open collector)
  - Load current: 100 mA max.
  - (Residual voltage: 3 V max.), Load power supply voltage: 30 VDC max.

#### Operation mode
- Light-ON/Dark-ON selectable by wiring

#### Indicator
- Operation indicator (orange)
- Stability indicator (green)

#### Protection circuits
- Power supply reverse polarity protection, Output short-circuit protection, and Output reverse polarity protection

#### Response time
- 0.5 ms

#### Sensitivity adjustment
- Fixed
- One-turn adjuster

#### Ambient illumination
- **(Receiver side)**
  - Incandescent lamp: 3,000 lx max./ Sunlight: 10,000 lx max.

#### Ambient temperature range
- Operating: -25 to 55°C/ Storage: -40 to 70°C (with no icing or condensation)

#### Ambient humidity range
- Operating: 35 to 85%/ Storage: 35 to 95% (with no condensation)

#### Insulation resistance
- 20 MΩ min. at 500 VDC

#### Dielectric strength
- 1,000 VAC at 50/60 Hz for 1 min. between current-carrying parts and case

#### Vibration resistance
- Destruction: 10 to 55 Hz, 1.5 mm double amplitude for 2 hours each in X, Y and Z directions

#### Shock resistance
- Destruction: 500 m/s² 3 times each in X, Y and Z directions

#### Degree of protection
- IEC: IP67, DIN 40050-9; IP69K *

#### Weight (packed state/only sensor)
- Pre-wired cable (2M)
  - E3FA: Approx. 60 g/ Approx. 50 g,
  - E3FB: Approx. 95 g/ Approx. 65 g
- Connector
  - E3FA: Approx. 20 g/ Approx. 10 g,
  - E3FB: Approx. 50 g/ Approx. 20 g

#### Material
- Case
  - E3FA: ABS, E3FB: Nickel-brass
- Lens and Display
  - PMMA
- Adjuster
  - POM
- Nut
  - E3FA: POM, E3FB: Nickel-brass

#### Accessories
- Instruction sheet
- M18 nuts (2 pcs)

---

*IP69K Degree of Protection Specifications
IP69K is a protection specification stipulated by DIN 40050 Part 9 of the German standards.
The test item is sprayed with 80°C water from a nozzle of a specified shape at a water pressure of 80 to 100 bar. The amount of water is 14 to 16 liters per minute.
The distance between the test item and the nozzle is 10 to 15 cm. The water is discharged at angles of 0°, 30°, 60°, and 90° from the horizontal plane for 30 seconds at each angle while the test item is rotated horizontally.
Radial type (E3RA/E3RB)

<table>
<thead>
<tr>
<th>Model</th>
<th>Sensing method</th>
<th>Through-beam</th>
<th>Retro-reflective with MSR function</th>
<th>Diffuse-reflective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
<td></td>
<td></td>
<td>E3RL-TN11 2M</td>
<td>E3RL-DN11 2M</td>
</tr>
<tr>
<td></td>
<td>Pre-wired</td>
<td>E3RL-RN11 2M</td>
<td>E3RL-DN12 2M</td>
<td>E3RL-DN13 2M</td>
</tr>
<tr>
<td></td>
<td>M12 Connector</td>
<td>E3RL-RP21</td>
<td>E3RL-DN22</td>
<td>E3RL-DN23</td>
</tr>
<tr>
<td></td>
<td>PNP output</td>
<td>E3RL-TP11 2M</td>
<td>E3RL-DP12 2M</td>
<td>E3RL-DP13 2M</td>
</tr>
<tr>
<td></td>
<td>Pre-wired</td>
<td>E3RL-TP21</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M12 Connector</td>
<td>E3RL-RP21</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Sensing distance**: 15 m, 0.1 to 3 m (with E3R-R1S)
- **Spot diameter (reference value)**: 35 ± 40 mm, 40 ± 45 mm, 90 ± 120 mm
- **Standard sensing object**: Opaque: 7 mm dia.min., 75 mm dia.min.
- **Differential travel**: 2° min., 20% max.
- **Light source (wavelength)**: Red LED (624 nm)
- **Power supply voltage**: 10 to 30 VDC (include voltage ripple of 10%(p-p) max.)
- **Current consumption**: 40 mA max. (Emitter 25 mA max., Receiver 15 mA max.), 25 mA max.
- **Control output**: NPN/PNP (open collector), Load current: 100 mA max. (Residual voltage: 2 V max.), Load power supply voltage: 30 VDC max.
- **Operation mode**: Light-ON/Dark-ON selectable by wiring
- **Indicator**: Operation indicator (orange), Stability indicator (green), Power indicator (green): only Emitter of Through-beam
- **Protection circuits**: Power supply reverse polarity protection, Output short-circuit protection, and Output reverse polarity protection
- **Response time**: 0.5 ms
- **Sensitivity adjustment**: One-turn adjuster
- **Ambient illumination (Receiver side)**: Incandescent lamp: 3,000 lx max., Sunlight: 10,000 lx max.
- **Ambient temperature range**: Operating: -25 to 55°C, Storage: -40 to 70°C (with no icing or condensation)
- **Ambient humidity range**: Operating: 35 to 85%, Storage: 35 to 95% (with no condensation)
- **Insulation resistance**: 20 MΩ min. at 500 VDC
- **Dielectric strength**: 1,000 VAC at 50/60 Hz for 1 min. between current-carrying parts and case
- **Vibration resistance**: Destruct: 10 to 55 Hz, 1.5 mm double amplitude for 2 hours each in X, Y and Z directions
- **Shock resistance**: Destruct: 500 m/s² 3 times each in X, Y and Z directions
- **Degree of protection**: IEC: IP67, DIN 40050-9: IP69K *

### Weight

- **Pre-wired cable (2M)**
  - E3RA: Approx. 110 g, Approx. 50 g, respectively,
  - E3RB: Approx. 175 g, Approx. 65 g, respectively
- **Connector**
  - E3RA: Approx. 30 g, Approx. 10 g, respectively,
  - E3RB: Approx. 85 g, Approx. 20 g, respectively

### Material

- **Case**: E3RA: ABS, E3RB: Nickel-brass
- **Lens and Display**: PMMA
- **Adjuster**: POM
- **Nut**: E3RA: POM, E3RB: Nickel-brass

### Accessories

- Instruction sheet
- M18 nuts (4 pcs)

---

*IP69K Degree of Protection Specifications

IP69K is a protection specification stipulated by DIN 40050 Part 9 of the German standards. The test item is sprayed with 80°C water from a nozzle of a specified shape at a water pressure of 80 to 100 bar. The amount of water is 14 to 16 liters per minute. The distance between the test item and the nozzle is 10 to 15 cm. The water is discharged at angles of 0°, 30°, 60°, and 90° from the horizontal plane for 30 seconds at each angle while the test item is rotated horizontally.
Engineering Data (Reference Value)

Parallel Operating Range
Through-beam Models
E3F-T, E3R-T

Retro-reflective Models (with MSR function)
E3F-R1, E3R-R1

Transparent detected with P-opauning function
E3F-B1

Operating Range
Diffuse-reflective Models
E3F-D1, E3F-D2
E3R-D1, E3R-D2

E3F-D3, E3R-D3

E3FA-D, E3FA-D5

BGS Models
E3F-L1, E3F-L2

Limited distance reflective
E3F-V
Excess Gain vs. Distance

Through-beam Models
E3F□-□, E3R□-□

Diffuse-reflective Models
E3F□-□, E3R□-□
E3R□-□, E3R□-□

Excess Gain Ratio (multiple)

Reflector: E39-RP1

Length d of sensing object (mm)

Sensing object: 100 × 100 (mm) white paper

Sensing object: 300 × 300 (mm) white paper

Transparent detected with P-opaquing function
E3F□-□, E3F□-□

Limited distance reflective
E3F□-□

Sensing Object Size vs. Distance

Diffuse-reflective Models
E3F□-□, E3R□-□
E3R□-□, E3R□-□

Sensing object: White paper

Sensing object: White paper
**Sensing Distance vs. Sensing Object Material**

**BGS Models**

- **E3FA-D□4, E3FA-D□5**
  - Sensing object: White paper
  - Graph showing distance vs. length of sensing object (mm)

- **E3FA-D□6**
  - Sensing object: White paper
  - Graph showing distance vs. length of sensing object (mm)

**Dark Excess Gain vs. Sensing Object Characteristics**

**Transparent detected with P-opaques function**

- **E3F□-L□1**
  - Graph showing dark excess gain vs. sensing object characteristics

- **E3F□-L□2**
  - Graph showing dark excess gain vs. sensing object characteristics

**Material**

- White paper
- Black paper
- SUS

**Operating level**

- Sensing distance (mm)
- Relative amount of light received
Object Surface Color vs. Sensing Distance
Diffuse-reflective Models
E3FA-D

Output circuit diagram
PNP Output

<table>
<thead>
<tr>
<th>Model</th>
<th>Operation mode</th>
<th>Timing charts</th>
<th>Operation selector</th>
<th>Output circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>E3FA-D1</td>
<td>Light-ON</td>
<td>Light incident Light interrupted Operation indicator (orange) On Off</td>
<td>Connect the pink wire (Pin(2)) to the brown (Pin(1))</td>
<td></td>
</tr>
<tr>
<td>E3FA-D2</td>
<td>Dark-ON</td>
<td>Light incident Light interrupted Operation indicator (orange) On Off</td>
<td>Connect the pink wire (Pin(2)) to the blue (Pin(3)) or open the pink wire (Pin(2))</td>
<td></td>
</tr>
<tr>
<td>E3FA-D3</td>
<td>Light-ON</td>
<td>Light incident Light interrupted Operation indicator (orange) On Off</td>
<td>Connect the pink wire (Pin(2)) to the brown (Pin(1))</td>
<td></td>
</tr>
<tr>
<td>E3FA-D4</td>
<td>Dark-ON</td>
<td>Light incident Light interrupted Operation indicator (orange) On Off</td>
<td>Connect the pink wire (Pin(2)) to the blue (Pin(3)) or open the pink wire (Pin(2))</td>
<td></td>
</tr>
<tr>
<td>E3FA-D5</td>
<td>Light-ON</td>
<td>Light incident Light interrupted Operation indicator (orange) On Off</td>
<td>Connect the pink wire (Pin(2)) to the brown (Pin(1))</td>
<td></td>
</tr>
<tr>
<td>E3FA-D6</td>
<td>Dark-ON</td>
<td>Light incident Light interrupted Operation indicator (orange) On Off</td>
<td>Connect the pink wire (Pin(2)) to the blue (Pin(3)) or open the pink wire (Pin(2))</td>
<td></td>
</tr>
</tbody>
</table>


Through-beam Emitter

10 to 30 VDC

Background suppression.
### NPN Output

<table>
<thead>
<tr>
<th>Model</th>
<th>Operation mode</th>
<th>Timing charts</th>
<th>Operation selector</th>
<th>Output circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>E3FA-TN</td>
<td>Light-ON</td>
<td>Light incident Operation indicator (orange)</td>
<td>Connect the pink wire (Pin(2)) to the brown (Pin(1)) or open the pink wire (Pin(2))</td>
<td>Through-beam Receivers, Retro-reflective Models, Diffuse-reflective Models, Limited reflective Models. Transparent detected with P-opaquing function.</td>
</tr>
<tr>
<td>E3FA-RN</td>
<td>Dark-ON</td>
<td>Light incident Operation indicator (orange)</td>
<td>Connect the pink wire (Pin(2)) to the blue (Pin(3))</td>
<td></td>
</tr>
<tr>
<td>E3F-DN</td>
<td>Light-ON</td>
<td>Light incident Operation indicator (orange)</td>
<td>Connect the pink wire (Pin(2)) to the brown (Pin(1)) or open the pink wire (Pin(2))</td>
<td></td>
</tr>
<tr>
<td>E3F-VN</td>
<td>Dark-ON</td>
<td>Light incident Operation indicator (orange)</td>
<td>Connect the pink wire (Pin(2)) to the blue (Pin(3))</td>
<td></td>
</tr>
<tr>
<td>E3R-TN</td>
<td>Light-ON</td>
<td>Light incident Operation indicator (orange)</td>
<td>Connect the pink wire (Pin(2)) to the brown (Pin(1)) or open the pink wire (Pin(2))</td>
<td></td>
</tr>
<tr>
<td>E3R-RN</td>
<td>Dark-ON</td>
<td>Light incident Operation indicator (orange)</td>
<td>Connect the pink wire (Pin(2)) to the blue (Pin(3))</td>
<td></td>
</tr>
</tbody>
</table>

#### Connector Pin Arrangement

**M12 Connector Pin Arrangement**

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Wire color</th>
<th>Connector pin No.</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Brown</td>
<td>Power supply (+V)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>White</td>
<td>L/on - D/on selectable</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Blue</td>
<td>Power supply (0 V)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Black</td>
<td>Output</td>
<td></td>
</tr>
</tbody>
</table>

**M12 4-wire Connectors**

- **Through-beam Emitter**
  - Brown: 10 to 30 VDC
  - Blue: 10 to 30 VDC

- **Background suppression**
  - Brown: 10 to 30 VDC
  - Blue: 10 to 30 VDC

---

#### Classification

- **DC**
  - Brown: Power supply (+V)
  - White: L/on - D/on selectable
  - Blue: Power supply (0 V)
  - Black: Output

---

[Diagram of Through-beam Emitter and Background suppression]
**Nomenclature**

**Straight type, Plastic housing**
- with an adjuster:
  - E3FA-T□D
  - E3FA-R□
  - E3FA-V□
  - E3FA-B□
- without an adjuster:
  - E3FA-T□-L *
  - E3FA-L□

**Radial type, Plastic housing**
- with an adjuster:
  - E3RA-T□D
  - E3RA-R□
  - E3RA-D□
- without an adjuster:
  - E3RA-T□-L *

* The Emitter has two Power indicators (Green) instead of the Stability indicator (Green) and the Operation indicator (Orange).

**Safety Precautions**

Refer to **Warranty and Limitations of Liability**.

---

**WARNING**

This product is not designed or rated for directly or indirectly ensuring safety of persons. Do not use it for such a purpose.

---

**CAUTION**

Never use the product with an AC power supply. Do not use the product with voltage in excess of the rated voltage.

Do not use the product with incorrect wiring. Otherwise, explosion, fire, malfunction may result.

---

**Precautions for Safe Use**

Be sure to follow the safety precautions below for added safety.

1. Do not use the sensor under the environment with explosive, flammable or corrosive gas.
2. Do not use the sensor under the oil or chemical environment.
3. Do not use the sensor in the water, rain or outdoors.
4. Do not use the sensor in the environment where humidity is high and condensation may occur.
5. Do not use the sensor under the environment with explosive, flammable or corrosive gas.
6. Do not use the sensor in place that is exposed by direct sunlight.
7. Do not use the sensor in place where the sensor may receive direct vibration or shock.
8. Do not use the thinner, alcohol, or other organic solvents.
9. Never disassemble, repair nor tamper with the sensor.
10. Please process it as industrial waste.

---

**Precautions for Correct Use**

1. Laying Sensor wiring in the same conduit or duct as high-voltage wires or power lines may result in malfunction or damage due to conduit or use shielded cable.
2. Do not pull on the cable with excessive force.
3. If a commercial switching regulator is used, ground the FG (frame ground) terminal.
4. The sensor will be available 100 ms after the power supply is turned ON. Start to use the sensor 100 ms or more after turning ON the power supply. If the load and the sensor are connected to separate power supplies, be sure to turn ON the sensor first.
5. Output pulses may be generated even when the power supply is OFF. Therefore, it is recommended to first turn OFF the power supply for the load or the load line.
6. The sensor must be mounted using the provided nuts. The proper tightening torque range of E3FA/E3RA plastic housing series is between 0.4 and 0.5 N•m. The proper tightening torque of E3FB/E3RB metal housing series is 20 N•m max.
E3FA/E3RA/E3FB/E3RB

Specifications

Sensors (E3FA/E3RA Plastic housing)

**E3FA series**

**Pre-wired Models**
- E3FA-T-□
- E3FA-R-□
- E3FA-D-□
- E3FA-L-□
- E3FA-V-□
- E3FA-B-□

**M12 Connector Models**
- E3FA-T-□
- E3FA-R-□
- E3FA-D-□
- E3FA-L-□
- E3FA-V-□
- E3FA-B-□

**E3RA series**

**Pre-wired Models**
- E3RA-T-□
- E3RA-R-□
- E3RA-D-□
- E3RA-L-□
- E3RA-V-□
- E3RA-B-□

**M12 Connector Models**
- E3RA-T-□
- E3RA-R-□
- E3RA-D-□
- E3RA-L-□
- E3RA-V-□
- E3RA-B-□

Dimensions

Tolerance class IT16 applies to dimensions in this data sheet unless otherwise specified.

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<tr>
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<th>Specification</th>
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<td>3</td>
<td>0V</td>
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Mounting Holes

Vinyl insulated round cable 4 dia. 4 cores (conductor cross sectional area 0.128 mm² (AWG26) insulation outside diameter 0.85 dia.) standard length 2 m
E3FA/E3RA/E3FB/E3RB

**Sensors (E3FB/E3RB Metal housing)**

### E3FB series

#### Pre-wired Models

- **E3FB-T011**
- **E3FB-R011**
- **E3FB-D011**
- **E3FB-L011**
- **E3FB-V011**
- **E3FB-B011**

#### M12 Connector Models

- **E3FB-T021**
- **E3FB-R021**
- **E3FB-D021**
- **E3FB-L021**
- **E3FB-V021**
- **E3FB-B021**

**Terminal No.**

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### E3RB series

#### Pre-wired Models

- **E3RB-T011**
- **E3RB-R011**
- **E3RB-D011**

#### M12 Connector Models

- **E3RB-T021**
- **E3RB-R021**
- **E3RB-D021**

**Terminal No.**

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**Mounting Holes**

- **Front view**
- **Left side view**
- **Right side view**

**Operation indicator (orange)**

**Sensitivity adjuster**

**Stability indicator (green)**

**Vinyl insulated round cable 4 dia. 4 cores**

(conductor cross sectional area:0.128 mm² (AWG26)

Insulation outside diameter:0.85 mm)

Standard length 2 m
E3FA/E3RA/E3FB/E3RB

Attached nut

Material: POM (for E3FA/E3RA)
Nickel-brass (for E3FB/E3RB)

Accessories (Order Separately)

**Reflectors**
**E39-R1S**

**E39-RP1**

Material, reflective surface: acrylic
Rear surface: ABS

**Mounting brackets**
**E39-L183**

**Mounting brackets**
**E39-L182**

Material, reflective surface: acrylic
Rear surface: ABS
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To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.