Transparent object sensor
E3S-DB

Outstanding detection performance
for all kinds of transparent objects

- Most reliable detection of all transparent objects such as PET bottles, glass bottles or transparent trays
- SmartTeach for fast set up and optimum threshold setting
- Sensing distance up to 4.5 m
- Narrow beam types with 2 mm spot detecting smallest gaps
- Proven for environments in Food & Beverage industry

Ordering Information

<table>
<thead>
<tr>
<th>Sensor type</th>
<th>Sensitivity adjustment</th>
<th>Connection method</th>
<th>Sensing distance, typ.</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retro-reflective</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>with MSR function</td>
<td></td>
<td>Pre-wired (2 m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Connector (M12, 4 pins)</td>
<td>0 to 4.5 m with E39-R8</td>
<td>E3S-DBN11 2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pigtail Connector¹ (M12, 4 pins)</td>
<td>0 to 4.5 m with E39-R8</td>
<td>E3S-DBP11 2M</td>
</tr>
<tr>
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<td>Pre-wired (2 m)</td>
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<td>E3S-DBN11 2M</td>
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<tr>
<td></td>
<td></td>
<td>Connector (M12, 4 pins)</td>
<td>Narrow beam</td>
<td>E3S-DBN12 2M</td>
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<tr>
<td></td>
<td></td>
<td>Pigtail Connector¹ (M12, 4 pins)</td>
<td>0 to 0.7 m with E39-R21</td>
<td>E3S-DBP12 2M</td>
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<tr>
<td></td>
<td></td>
<td>Pre-wired (2 m)</td>
<td></td>
<td>E3S-DBN12 2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Connector (M12, 4 pins)</td>
<td></td>
<td>E3S-DBN22 2M</td>
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<tr>
<td></td>
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<td>Pigtail Connector¹ (M12, 4 pins)</td>
<td>0 to 0.7 m with E39-R21</td>
<td>E3S-DBP22 2M</td>
</tr>
<tr>
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<td></td>
<td>Pre-wired (2 m)</td>
<td></td>
<td>E3S-DBN12 2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Connector (M12, 4 pins)</td>
<td></td>
<td>E3S-DBN22 2M</td>
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<tr>
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<td>Pigtail Connector¹ (M12, 4 pins)</td>
<td>0 to 0.7 m with E39-R21</td>
<td>E3S-DBP22 2M</td>
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<td></td>
<td></td>
<td>Pre-wired (2 m)</td>
<td></td>
<td>E3S-DBN12 2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Connector (M12, 4 pins)</td>
<td></td>
<td>E3S-DBN22 2M</td>
</tr>
<tr>
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<td>Pigtail Connector¹ (M12, 4 pins)</td>
<td>0 to 0.7 m with E39-R21</td>
<td>E3S-DBP22 2M</td>
</tr>
<tr>
<td></td>
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<td>Pre-wired (2 m)</td>
<td></td>
<td>E3S-DBN11T 2M</td>
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<tr>
<td></td>
<td></td>
<td>Connector (M12, 4 pins)</td>
<td>0 to 4.5 m with E39-R8</td>
<td>E3S-DBP11T 2M</td>
</tr>
<tr>
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<td></td>
<td>Pigtail Connector¹ (M12, 4 pins)</td>
<td>0 to 4.5 m with E39-R8</td>
<td>E3S-DBP21T</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pre-wired (2 m)</td>
<td></td>
<td>E3S-DBN12T 2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Connector (M12, 4 pins)</td>
<td>Narrow beam</td>
<td>E3S-DBN22T</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pigtail Connector¹ (M12, 4 pins)</td>
<td>0 to 0.7 m with E39-R21</td>
<td>E3S-DBP22T</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pre-wired (2 m)</td>
<td></td>
<td>E3S-DBN12T 2M</td>
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<tr>
<td></td>
<td></td>
<td>Connector (M12, 4 pins)</td>
<td></td>
<td>E3S-DBN22T</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pigtail Connector¹ (M12, 4 pins)</td>
<td>0 to 0.7 m with E39-R21</td>
<td>E3S-DBP22T</td>
</tr>
</tbody>
</table>

¹ OMRON SmartClick connector for fast and save connection.
Reflectors [Refer to Dimensions on page 9.]
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, typ.</th>
<th>Appearance</th>
<th>Dimensions [mm]</th>
<th>Remarks</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>E3S-DB_1(T)</td>
<td>0 to 4.5 m</td>
<td>100 × 100</td>
<td>E39-R8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E3S-DB_1(T)</td>
<td>0 to 3.5 m</td>
<td>60 × 40</td>
<td>E39-R1S</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 to 3 m</td>
<td>Special polarizing filter for enhanced PET detection</td>
<td>E39-RP1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E3S-DB_2(T)</td>
<td>0 to 700 mm</td>
<td>35 × 30</td>
<td>E39-R21</td>
<td>For narrow gap detection</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 to 700 mm</td>
<td>60 × 20</td>
<td>E39-R52</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: For more reflectors please check OMRON catalogue or contact your OMRON representative.

Mounting brackets [Refer to Dimensions on page 9.]
A Mounting Bracket is not enclosed with the Sensor. Order a Mounting Bracket separately if required.

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Material</th>
<th>Remarks</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUS304</td>
<td>A Mounting bracket is not provided with the Sensor.</td>
<td>E39-L192</td>
<td></td>
</tr>
<tr>
<td>SUS304</td>
<td>A Mounting bracket is not provided with the Sensor.</td>
<td>E39-L193</td>
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</table>

Sensor I/O connectors

<table>
<thead>
<tr>
<th>Size</th>
<th>Specifications</th>
<th>Appearance</th>
<th>Cable type</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>M12 (4 pins)</td>
<td>Standard PVC</td>
<td>Straight</td>
<td>2 m</td>
<td>XS2F-M12PVC4S2M-EU</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Angled</td>
<td>5 m</td>
<td>XS2F-M12PVC4S5M-EU</td>
</tr>
<tr>
<td></td>
<td>Smartclick PVC</td>
<td>Straight</td>
<td>2 m</td>
<td>XS5F-D421-D80-F</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4-wire</td>
<td>XS2F-M12PVC4A2M-EU</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5 m</td>
<td>XS2F-M12PVC4A5M-EU</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2 m</td>
<td>XS5F-D421-G80-F</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5 m</td>
<td></td>
</tr>
</tbody>
</table>
## Ratings and Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>E3S-DBN_1</th>
<th>E3S-DBN_1T</th>
<th>E3S-DBN_2</th>
<th>E3S-DBN_2T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensing method</td>
<td></td>
<td>Retro-reflective with MSR function</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model NPN output</td>
<td>E3S-DBP_1</td>
<td>E3S-DBP_1T</td>
<td>E3S-DBP_2</td>
<td>E3S-DBP_2T</td>
</tr>
<tr>
<td>Sensing distance, typ.(^1)</td>
<td>0 to 4.5 m (with E39-R8)</td>
<td>0 to 4.5 m (with E39-R8)</td>
<td>0 to 700 mm (with E39-R21)</td>
<td>0 to 700 mm (with E39-R21)</td>
</tr>
<tr>
<td>Sensing distance, recommended(^2)</td>
<td>0 to 3.5 m (with E39-R8)</td>
<td>0 to 3.5 m (with E39-R8)</td>
<td>0 to 500 mm (with E39-R21)</td>
<td>0 to 500 mm (with E39-R21)</td>
</tr>
<tr>
<td>Light source (wavelength)</td>
<td>Red LED (624 nm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply voltage</td>
<td>10 to 30 VDC, including 10% ripple (p-p)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current consumption</td>
<td>720 mW max. (24 VDC, 30 mA)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control output</td>
<td>Load power supply voltage: 30 VDC max., Load current: 100 mA max. (Residual voltage: 2 V max.) NPN/PNP transistor output (depending on model)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating modes</td>
<td>OUT1: L-ON/OUT2: D-ON (antivalent output)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protection circuits</td>
<td>Reversed power supply polarity protection, Output short-circuit protection, Reversed output polarity protection, Missconnection protection, Mutual interference suppression</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Response time</td>
<td>0.5 ms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensitivity adjustment</td>
<td>SmartTeach</td>
<td>11-turn trimmer</td>
<td>SmartTeach</td>
<td>11-turn trimmer</td>
</tr>
<tr>
<td>Auto-Compensation function (AC3)</td>
<td>yes (default = OFF)</td>
<td>–</td>
<td>yes (default = OFF)</td>
<td>–</td>
</tr>
<tr>
<td>Lock function</td>
<td>yes</td>
<td>–</td>
<td>yes</td>
<td>–</td>
</tr>
<tr>
<td>Ambient illumination</td>
<td>Incandescent lamp: 3,000 lx max./Sunlight: 10,000 lx max.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature range</td>
<td>Operating: –25 to 60°C/Storage: –40 to 70°C (with no icing or condensation)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Ambient humidity range</td>
<td>Operating: 35 to 85% RH/Storage: 35 to 95% RH (with no condensation)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Insulation resistance</td>
<td>20 MΩ min. at 500 VDC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dielectric strength</td>
<td>1,000 VAC at 50/60Hz for 1min. Between current-carrying parts and case</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibration resistance</td>
<td>Destruction: 10 to 55 Hz, 1.5 mm double amplitude for 2 hours each in X,Y,Z directions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shock resistance</td>
<td>Destruction: 500 m/s², 3 times each in X,Y,Z directions</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Degree of protection</td>
<td>IEC: IP67, DIN 40050-9: IP69K</td>
<td></td>
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<tr>
<td>Connection method</td>
<td>Pre-wired cable (standard length: 2 m) or M12 4-pin connector or Pigtail (0.3 m/M12 4-pin)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Indicators</td>
<td>Light indicator (orange), Stability indicator (green)</td>
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</tr>
<tr>
<td>Weight (packed state)</td>
<td>Approx. 40 g</td>
<td></td>
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</tr>
<tr>
<td>Materials</td>
<td></td>
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<tr>
<td>Housing</td>
<td>PBT/ABS</td>
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<tr>
<td>Lens &amp; indicators</td>
<td>PMMA (Polymethylmethacrylate)</td>
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<tr>
<td>Buttons</td>
<td>Elastomer</td>
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<tr>
<td>Cable</td>
<td>PVC</td>
<td></td>
<td></td>
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<tr>
<td>Accessories</td>
<td>Instruction manual</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) Maximum sensing distance for typical reflector and sensor

\(^2\) Operating sensing distance recommended for factory environments
Attenuation level vs. Sensing Object Characteristics (typical values)

**E3S-DB**

**1(T)**

With standard reflector, e.g. E39-R1S or E39-R8

- PET bottle - Empty
- PET bottle - Filled with water
- GLASS bottle - Empty
- GLASS bottle - Filled with water
- Transparent film (from Tobacco case)
- Transparent tray

**E3S-DB**

**2(T)**

- With reflector E39-R21

- PET bottle - Empty
- PET bottle - Filled with water
- GLASS bottle - Empty
- GLASS bottle - Filled with water
- Transparent film (from Tobacco case)
- Transparent tray

**E3S-DB**

**1(T)**

With p-opaquing reflector E39-RP1

- PET bottle - Empty
- PET bottle - Filled with water
- Transparent film (from Tobacco case)

**E3S-DB**

**2(T)**

- With reflector E39-R21

- PET bottle - Empty
- PET bottle - Filled with water
- GLASS bottle - Empty
- GLASS bottle - Filled with water
- Transparent film (from Tobacco case)
- Transparent tray

Atten. level

- 3.5 m
- 1.75 m
- 2.5 m
- 250 mm
- 500 mm

- 100%
- 90%
- 80%
- 70%
- 60%
- 50%
- 40%
- 30%
- 20%
- 10%
- 0%
## E3S-DB

### Output circuit diagram

#### NPN Output

<table>
<thead>
<tr>
<th>Model</th>
<th>Timing charts</th>
<th>Output circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>E3S-DBN</td>
<td>Output 1 (pin 4)</td>
<td><img src="image" alt="NPN Output Circuit" /></td>
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</table>

#### PNP Output

<table>
<thead>
<tr>
<th>Model</th>
<th>Timing charts</th>
<th>Output circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>E3S-DBP</td>
<td>Output 1 (pin 4)</td>
<td><img src="image" alt="PNP Output Circuit" /></td>
</tr>
</tbody>
</table>

### Connector Pin Arrangement

#### M12 Connector Pin Arrangement

- **Classification**: Wire color
- **Connector pin No.**: Pin No.
- **Application**: Wire color

<table>
<thead>
<tr>
<th>Classification</th>
<th>Wire color</th>
<th>Connector pin No.</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC</td>
<td>Brown</td>
<td>➀</td>
<td>Power supply (+V)</td>
</tr>
<tr>
<td></td>
<td>White</td>
<td>➁</td>
<td>Output2 (Dark ON)</td>
</tr>
<tr>
<td></td>
<td>Blue</td>
<td>➂</td>
<td>Power supply (0 V)</td>
</tr>
<tr>
<td></td>
<td>Black</td>
<td>➃</td>
<td>Output1 (Light ON)</td>
</tr>
</tbody>
</table>

### Connectors (Sensor I/O connectors)

#### M12 4-wire Connectors

- **Pin No.**
- **Wire color**: Brown, White, Blue, Black
- **Application**: Power supply, Output2, Power supply, Output1
Operation

Adjusting Trimmer type (11-turn)

1. Install the sensor and reflector and adjust the optical axis (without object). Light indicator (Orange) should be ON.
   - Orange LED: ON  Green LED: ON

2. Turn the sensitivity adjuster to minus until orange indicator LED turns OFF.
   - Orange LED: OFF  Green LED: ON

3. Turn the sensitivity adjuster to plus and stop at the position where the orange output LED changes state from OFF to ON and green stability LED is on.
   - Orange LED: ON  Green LED: ON

4. Confirm correct operation by testing stable detection with object

Note: For opaque object set the sensitivity adjuster to maximum.

Adjusting SmartTeach type

1. Install the Sensor and Reflector and adjust the optical axis. (without object)

2. Set the trimmer threshold to the desired level. Typical values are:
   - Opaque and semi-transparent objects: 30%
   - Transparent trays, glass and PET bottles: 20 to 25%
   - Transparent film: 10 to 15%

3. Press Teach button between 1 to 5 sec. until orange LED flashes with low speed
   - Orange LED: Flash (low speed)  Green LED: OFF

Orange LED and Green LED flash one time. Teaching is completed.

- Orange LED: Flash one time  Green LED: Flash one time

4. Confirm correct operation by testing stable detection with object

Activation/Deactivation of Lock function (SmartTeach only)

1. Press Teach button between 5 to 10 sec. until orange LED flashes with medium speed.*
   - Orange LED: Flash (medium speed)
     *If Lock function is already active, orange LED stays OFF for the first 5 sec pushing.

If Lock function is OFF, Then Green LED is OFF.
   - Green LED: OFF

If Lock function is ON, Then Green LED is ON.
   - Green LED: ON

2. Release Teach button during Orange LED is flashing.

Orange LED and Green LED flash one time. Lock function Activation/Deactivation is completed.

- Orange LED: Flash one time  Green LED: Flash one time

Lock function activated  Lock function deactivated

Activation/Deactivation of AC3 Auto compensation function (SmartTeach only)

1. Press Teach button > 10 sec. until orange LED flashes with high speed.
   - Orange LED: Flash (high speed)

If AC3 is OFF, Then Green LED is OFF.
   - AC3 is OFF  Green LED: OFF

If AC3 is already ON, Then Green LED is ON.
   - AC3 is already ON  Green LED: ON

2. Release Teach button during Orange LED is flashing.

Orange LED and Green LED flash one time. Then AC3 Activation/Deactivation is completed.

- Orange LED: Flash one time  Green LED: Flash one time

Lock function activated  Lock function deactivated

Note:
* Default value of AC3 is OFF
  * If Lock function is activated, please deactivate Lock function first
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 under the environment under the other conditions in excess of rated.
5. Do not use the sensor in place that is exposed by direct sunlight.
6. Do not use the sensor in place where the sensor may receive direct vibration or shock.
7. Do not use the thinner, alcohol, or other organic solvents.
8. Never disassemble, repair nor tamper with the sensor.
9. Please process it as industrial waste.
10. Do not use the high concentration cleaning agent because it might cause the trouble. Avoid the jet of high-pressure water over

---

**Precautions for Correct Use**

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

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. If a commercial switching regulator is used, ground the FG (frame ground) terminal.
3. The sensor will be available 100 ms after the power supply is tuned 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.
4. 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.
Tolerance class IT16 applies to dimensions in this data sheet unless otherwise specified.

E3S-DB

### Sensors

**E3S-DB**

<table>
<thead>
<tr>
<th>PIN No.</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+V</td>
</tr>
<tr>
<td>2</td>
<td>OUT2(D-ON)</td>
</tr>
<tr>
<td>3</td>
<td>30V</td>
</tr>
<tr>
<td>4</td>
<td>OUT1(L-ON)</td>
</tr>
</tbody>
</table>

**NOTE**

1. REFER BELOW FOR PIN'S CONFIGURATION.

**MOUNTING SCREW HOLES**

**OPTICAL AXIS**

**MATERIAL** PMMA

**STABILITY INDICATOR (GREEN)**

**LIGHT INDICATOR (ORANGE)**

**SENSITIVITY ADJ.**

**TUNING BUTTON**

**CONNECTOR** M12

**OPTICAL AXIS**

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**LIGHT INDICATOR (ORANGE)**

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**OPTICAL AX
Accessories (Order Separately)

**Reflector**

**E39-R8**

**Mounting bracket**

**E39-L192**

**E39-R21**

**E39-R52**

**E39-L193**

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

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