Miniature photoelectric sensors in cylindrical M8 and M12 housing

**E3H2**

- M8 or M12 sized cylindrical housings when mounting space is crucial
- Retro-reflective models with two teaching modes for standard and semi-transparent objects
- pre-wired and connector models

**Ordering Information**

**M12 cylindrical housing**

<table>
<thead>
<tr>
<th>Sensor type</th>
<th>Sensing distance</th>
<th>Operation mode</th>
<th>Connection method</th>
<th>Order code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Through-beam</td>
<td>4 m (adjustable)</td>
<td>light on / dark on selectable</td>
<td>- - 2 m</td>
<td>E3H2-T4C4M 2M E3H2-T4B4M 2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>E3H2-T4C4M-M1 E3H2-T4B4M-M1</td>
</tr>
<tr>
<td>Retro-reflective with M.S.R.</td>
<td>2 m (teachable)</td>
<td></td>
<td></td>
<td>E3H2-R2C4M 2M E3H2-R2B4M 2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>E3H2-R2C4M-M1 E3H2-R2B4M-M1</td>
</tr>
<tr>
<td>Diffuse-reflective</td>
<td>300 mm (teachable)</td>
<td>- - 2 m</td>
<td></td>
<td>E3H2-DS30C4M 2M E3H2-DS30B4M 2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>E3H2-DS30C4M-M1 E3H2-DS30B4M-M1</td>
</tr>
<tr>
<td></td>
<td>100 mm (fixed)</td>
<td>- - 2 m</td>
<td></td>
<td>E3H2-DS10C4M 2M E3H2-DS10B4M 2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>E3H2-DS10C4M-M1 E3H2-DS10B4M-M1</td>
</tr>
</tbody>
</table>

*1. Models without teach-button are available. Contact your OMRON representative.
2. Without reflector; order reflector separately

**M8 cylindrical housing**

<table>
<thead>
<tr>
<th>Sensor type</th>
<th>Sensing distance</th>
<th>Operation mode</th>
<th>Connection method</th>
<th>Order code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Through-beam</td>
<td>2 m</td>
<td>dark on</td>
<td>- - 2 m</td>
<td>E3H2-T2C2S 2M E3H2-T2B2S 2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>E3H2-T2C2S-M5 E3H2-T2B2S-M5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>light on</td>
<td>- - 2 m</td>
<td>E3H2-T2C1S 2M E3H2-T2B1S 2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>E3H2-T2C1S-M5 E3H2-T2B1S-M5</td>
</tr>
</tbody>
</table>
## Accessories

### Reflectors

<table>
<thead>
<tr>
<th>Shape</th>
<th>Type</th>
<th>Material</th>
<th>Features</th>
<th>Size in mm</th>
<th>Applicable Sensor</th>
<th>Order code</th>
</tr>
</thead>
<tbody>
<tr>
<td>General purpose reflectors</td>
<td>- ABS base</td>
<td>Acrylic</td>
<td>Surface screw mounting</td>
<td>60x40x7.5</td>
<td>- Retro-reflective photoelectric sensors – non polarizing</td>
<td>E39-R1S</td>
</tr>
<tr>
<td></td>
<td>- Acrylic surface</td>
<td></td>
<td>(diagonal holes)</td>
<td></td>
<td>- Retro-reflective photoelectric sensors – polarizing (MSR)</td>
<td></td>
</tr>
<tr>
<td>Small size</td>
<td>Surface screw mounting</td>
<td></td>
<td></td>
<td>23x13.7x4.9</td>
<td></td>
<td>E39-R4</td>
</tr>
<tr>
<td>Simple mounting</td>
<td>Round shape</td>
<td></td>
<td>with centered mounting hole for simple screw mounting</td>
<td>Diameter: 64</td>
<td></td>
<td>E39-R7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Depth: 7.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General purpose tape reflectors</td>
<td>Acrylic</td>
<td></td>
<td>Self adhesive</td>
<td>40x35x0.6</td>
<td></td>
<td>E39-RS2</td>
</tr>
</tbody>
</table>

### Sensor I/O connectors

<table>
<thead>
<tr>
<th>Size</th>
<th>Shape</th>
<th>Type</th>
<th>Features</th>
<th>Material</th>
<th>Order code</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Nut</td>
<td>Cable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M8</td>
<td>General purpose</td>
<td>3 pin (LED optionally)</td>
<td>Brass (CuZn)</td>
<td>PVC 2 m</td>
<td>XS3F-M08PVC3S2M</td>
</tr>
<tr>
<td></td>
<td>(screw)</td>
<td></td>
<td></td>
<td>PUR 2 m</td>
<td>XS3F-M08PUR3S2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>XS3F-M08PVC3A2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>XS3F-M08PUR3A2M</td>
</tr>
<tr>
<td>M12</td>
<td>General purpose</td>
<td>3 wire (LED optionally)</td>
<td>Brass (CuZn)</td>
<td>PVC 2 m</td>
<td>XS2F-M12PVC3S2M</td>
</tr>
<tr>
<td></td>
<td>(screw)</td>
<td></td>
<td></td>
<td>PUR 2 m</td>
<td>XS2F-M12PUR3S2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>XS2F-M12PVC3A2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>XS2F-M12PUR3A2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>XS2F-M12PVC4S2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>XS2F-M12PUR4S2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>XS2F-M12PVC4A2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>XS2F-M12PUR4A2M</td>
</tr>
</tbody>
</table>

Note: For the complete list of sensor I/O connectors refer to E26E Accessories datasheet.
## Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Through-beam</th>
<th>Retro-reflective with M.S.R.</th>
<th>Diffuse-reflective</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>E3H2-T4</td>
<td>E3H2-T2</td>
<td>E3H2-R</td>
</tr>
<tr>
<td>Sensing distance</td>
<td>4 m (adjustable)</td>
<td>2 m</td>
<td>2 m (teachable)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(when using E39-R1S)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Differential travel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light source (wave length)</td>
<td>Infrared LED (880 nm)</td>
<td>Red LED (660 nm)</td>
<td>Infrared LED (880 nm)</td>
</tr>
<tr>
<td>Power supply voltage</td>
<td>10 to 30 VDC, 10% ripple</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current consumption</td>
<td></td>
<td></td>
<td>45 mA max</td>
</tr>
<tr>
<td>Control output</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Load current: 100 mA max. (residual voltage 2 V max.);</td>
<td>E3H2-<em>C</em>: NPN</td>
<td>E3H2-<em>B</em>: PNP</td>
</tr>
<tr>
<td></td>
<td>Light-on/dark-on selectable by wire</td>
<td>E3H2-T2_2_: dark on</td>
<td>E3H2-T2_1_: light on</td>
</tr>
<tr>
<td></td>
<td>Light-on/dark-on selectable by wire</td>
<td>Light-on/dark-on selectable by wire</td>
<td></td>
</tr>
<tr>
<td>Protective circuits</td>
<td>Power supply reverse polarity protection, output short circuit protection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Response time</td>
<td>Operation or reset: 2.5 ms max</td>
<td>Operation or reset: 1 ms max.</td>
<td>Operation or reset: 1.1 ms max</td>
</tr>
<tr>
<td>Sensitivity adjustment</td>
<td>Potentiometer adjuster</td>
<td>–</td>
<td>Teach-in</td>
</tr>
<tr>
<td>Ambient illumination</td>
<td>Incandescent lamp: 1500 lx max.; Sunlight: 5000 lx max.</td>
<td>Operating: -25 to +55°C</td>
<td>Operating: -25 to +50°C</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>Operating: -25 to +55°C</td>
<td>Operating: -25 to +50°C</td>
<td>Operating: -25 to +55°C</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>EN 60529: IP67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indicators</td>
<td>Emitter: Power supply indicator: yellow</td>
<td>Output indicator: yellow</td>
<td></td>
</tr>
<tr>
<td>Weight pre-wired connector</td>
<td>approx 110 g</td>
<td>approx 90 g</td>
<td>approx 55 g</td>
</tr>
<tr>
<td></td>
<td>approx 40 g</td>
<td>approx 30 g</td>
<td>approx 20 g</td>
</tr>
<tr>
<td>Material case lens</td>
<td>nickel-plated brass</td>
<td>stainless steel</td>
<td>nickel-plated brass</td>
</tr>
<tr>
<td></td>
<td>plastic</td>
<td>plastic</td>
<td>plastic</td>
</tr>
</tbody>
</table>
Operation

Sensitivity adjustment

**E3H2-T4**
The emitter of the E3H2-T4 allows an adjustment of the emitted amount of light by turning the potentiometer. Turn the potentiometer clockwise for increasing the amount of emitted light and counter-clockwise for decreasing the amount of emitted light.

**E3H2-R2**
a) standard mode
To teach the retro-reflective model E3H2-R, place the sensor with the lens facing the reflector. Press the teach button for 2-5 seconds. For remote teach connect the white wire (Pin 2) for 2-5 seconds to common (-).
The threshold is now set to 50% of the received light level.
b) high sensitivity mode (e.g. for semi-transparent models)
To teach the retro-reflective model E3H2-R in high sensitivity mode, place the sensor with the lens facing the reflector. Press the teach button for >8 seconds. For remote teach connect the white wire (Pin 2) for >8 seconds to common (-).
The threshold is now set just below the received light level. If the teaching was successful the LED should no longer be flashing and a state change occurs when the light is interrupted.

**E3H2-DS30**
a) standard mode
To teach the diffuse-reflective model E3H2-DS30, place the object in front of the sensor at the required sensing distance. Press the teach button for 2-5 seconds. For remote teach connect the white wire (Pin 2) for 2-5 seconds to common (-).
The threshold is now set to 50% of the received light level. When the object is removed, a state change at the sensor should occur. If this is not the case the high sensitivity mode may be required.
b) high sensitivity mode
To teach the diffuse-reflective model E3H2-DS30 in high sensitivity mode, place the object in front of the sensor at the required sensing distance. Press the teach button for >8 seconds. For remote teach connect the white wire (Pin 2) for >8 seconds to common (-).
The threshold is now set just below the received light level. When the object is removed, a state change at the sensor should occur and the LED should no longer be flashing.

For E3H2-T2 and E3H2-DS10 the sensitivity setting is fixed.

Operation mode selection
The light-on / dark-on operation mode can be selected by wire (except for E3H2-T2). The white wire (Pin 2) can be connected to plus (+), common (-) or left open (not connected) for the default setting.

a) E3H2-T4 Receiver
   Default setting (wire left open): DARK-ON
   Connected to plus (+): LIGHT-ON
   Connected to common (-): DARK-ON
b) E3H2-R2
   Default setting (wire left open): DARK-ON
   Connected to plus (+): LIGHT-ON
   Connected to common (-): TEACH*1
c) E3H2-DS30
   Default setting (wire left open): LIGHT-ON
   Connected to plus (+): DARK-ON
   Connected to common (-): TEACH*1
d) E3H2-DS10
   Default setting (wire left open): LIGHT-ON
   Connected to plus (+): DARK-ON
   Connected to common (-): LIGHT-ON

For E3H2-T2 the operation mode is fixed and models with light-on and dark-on operation are available.

*1 In case the remote teach operation is required when the white wire is connected to plus (+), add a 2.2 kΩ resistor between the white wire and (+) to avoid a short circuit.
Engineering data (typical)

Parallel operating range

Through-beam models

- E3H2-T4
- E3H2-T2
- E3H2-R2

Retroreflective models

- E3H2-R2

Excess gain vs. distance

Through-beam models

- E3H2-T4
- E3H2-T2
- E3H2-R2

Diffuse reflective models

- E3H2-DS30
- E3H2-DS10

Gain

- E3H2-DS30
- E3H2-DS10

Excess Gain

- E3H2-DS30
- E3H2-DS10
Diffuse reflective Models

E3H2-DS30

E3H2-DS10

Distance X (cm)

Distance (cm)

Gain

Excess Gain

White paper 90%

Gray paper 18%

White paper 90%

Gray paper 18%
Output Circuit Diagram

PNP Output

<table>
<thead>
<tr>
<th>Model</th>
<th>Operation Mode</th>
<th>Timing Charts</th>
<th>Mode Selector Switch</th>
<th>Output Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>E3H2-T4B</td>
<td>Light ON</td>
<td>Light Incident</td>
<td>For through-beam and retro-reflective: connect the white wire (Pin 2) to the brown wire (Pin 1). For diffuse-reflective: open (do not connect) the white wire (Pin 2).</td>
<td></td>
</tr>
<tr>
<td>E3H2-R2B</td>
<td>Dark ON</td>
<td>Light Incident</td>
<td>For through-beam and retro-reflective: open (do not connect) the white wire (Pin 2). For diffuse-reflective: connect the white wire (Pin 2) to the brown wire (Pin 1).</td>
<td></td>
</tr>
<tr>
<td>E3H2-D</td>
<td>Light ON</td>
<td>Light Incident</td>
<td>Light Interrupted Operation indicator ON</td>
<td>Through-beam receiver, retro-reflective, diffuse-reflective</td>
</tr>
<tr>
<td></td>
<td>Dark ON</td>
<td>Light Incident</td>
<td>Light Interrupted Operation indicator OFF</td>
<td>Through-beam receiver, retro-reflective, diffuse-reflective</td>
</tr>
</tbody>
</table>

Light Incident
Light interrupted
Operation indicator ON
OFF
Output transistor ON
OFF
Load (e.g. relay) Operate
Reset

Through-beam emitter

10 to 30 VDC
Brown
Blue

Connector Pin Arrangement

E3H2-T2B
Light ON
Light Incident
Light interrupted
Operation indicator ON
OFF
Output transistor ON
OFF
Load (e.g. relay) Operate
Reset

n.a. fixed for E3H2-T2B1

Through-beam receiver

10 to 30 VDC
Brown
Black

Connector Pin Arrangement

E3H2-D
Light ON
Light Incident
Light interrupted
Operation indicator ON
OFF
Output transistor ON
OFF
Load (e.g. relay) Operate
Reset

Through-beam emitter

10 to 30 VDC
Brown
Blue

Connector Pin Arrangement
### NPN Output

<table>
<thead>
<tr>
<th>Model</th>
<th>Operation mode</th>
<th>Timing charts</th>
<th>Mode selector switch</th>
<th>Output circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>E3H2-T4C</td>
<td>Light ON</td>
<td>Light Incident light interrupted</td>
<td>For through-beam and retro-reflective: connect the white wire (Pin 2) to the brown wire (Pin 1). For diffuse-reflective: open (do not connect) the white wire (Pin 2).</td>
<td><a href="#">Diagram</a></td>
</tr>
<tr>
<td>E3H2-R2C</td>
<td>Dark ON</td>
<td>Light Incident light interrupted</td>
<td>For through-beam and retro-reflective: connect the white wire (Pin 2) to the brown wire (Pin 1). For diffuse-reflective: open (do not connect) the white wire (Pin 2).</td>
<td><a href="#">Diagram</a></td>
</tr>
<tr>
<td>E3H2-D</td>
<td>Light ON</td>
<td>Light Incident light interrupted</td>
<td>For through-beam and retro-reflective: connect the white wire (Pin 2) to the brown wire (Pin 1). For diffuse-reflective: open (do not connect) the white wire (Pin 2).</td>
<td><a href="#">Diagram</a></td>
</tr>
</tbody>
</table>

**Mode Selection / Teach**

- **Light ON**: Connect the white wire to the brown wire.
- **Dark ON**: Do not connect the white wire.

**Connector Pin Arrangement**

- **Light Incident**: Connect the white wire (Pin 2) to the brown wire (Pin 1).
- **Light Interrupted**: Open the white wire (Pin 2).
- **Operate**: Connect the white wire (Pin 2) to the brown wire (Pin 1).
- **Reset**: Do not connect the white wire (Pin 2).

**Through-beam receiver**

- **Operation indicator (yellow)**: Brown
- **Load (Relay)**: Black
- **Black**: Blue

**Through-beam emitter**

- **Operation indicator (yellow)**: Brown
- **Load (Relay)**: Black
- **Black**: Blue

**Main Circuit**

- **Power supply**: 10 to 30 VDC
- **Load**: 100 mA max.
Dimensions

Note: All units are in millimeters unless otherwise stated.

Pre-wired models

E3H2-T4
Emitter

Connector models

E3H2-T4
Receiver

E3H2-T2
Emitter/Receiver

E3H2-R2

E3H2-D
Safety precautions

**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**
Do not use the product with a voltage in excess of the rated voltage. Excess voltage may result in malfunction or fire.

Never use the product with an AC power supply. Otherwise, explosion may result.

When cleaning the product, do not apply a high-pressure spray of water to one part of the product. Otherwise, parts may become damaged and the degree of protection may be degraded.

High-temperature environments may result in burn injury.

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**Precautions for Safe Use**

The following precautions must be observed to ensure safe operation of the Sensor.

**Operating Environment**
Do not use the Sensor in an environment where explosive or flammable gas is present.

**Connecting Connectors**
Be sure to hold the connector cover when inserting or removing the connector. Be sure to tighten the connector lock by hand; do not use pliers or other tools. If the tightening is insufficient, the degree of protection will not be maintained and the Sensor may become loose due to vibration. The appropriate tightening torque is 0.4 to 0.5 N·m for M12 connectors and 0.3 Nm for M8 connectors.

**Load**
Do not use a load that exceeds the rated load.

**Environment with Cleaners and Disinfectants**
Do not use the Sensor in environments subject to cleaners and disinfectants. They may reduce the degree of protection.

**Modifications**
Do not attempt to disassemble, repair, or modify the Sensor.

**Outdoor Use**
Do not use the Sensor in locations subject to direct sunlight.

**Cleaning**
Do not use thinner, alcohol, or other organic solvents. Otherwise, the optical properties and degree of protection may be degraded.

**Surface Temperature**
Burn injury may occur. The Sensor surface temperature rises depending on application conditions, such as the surrounding temperature and the power supply voltage. Use caution when operating or washing the Sensor.

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**Precautions for Correct Use**

Do not use the Sensor in any atmosphere or environment that exceeds the ratings.

**Do not install the Sensor in the following locations.**
1. Locations subject to direct sunlight
2. Locations subject to condensation due to high humidity
3. Locations subject to corrosive gas
4. Locations where the Sensor may receive direct vibration or shock

**Connecting and Mounting**
1. The maximum power supply voltage is 30 VDC. Before turning the power ON, make sure that the power supply voltage does not exceed the maximum voltage.
2. Laying Sensor wiring in the same conduit or duct as high-voltage wires or power lines may result in malfunction or damage due to induction. As a general rule, wire the Sensor in a separate conduit or use shielded cable.
3. Use an extension cable with a minimum thickness of 1 mm² and less than 100 m long.
4. Do not pull on the cable with excessive force.
5. Pounding the Photoelectric Sensor with a hammer or other tool during mounting will impair water resistance.
6. Mount the Sensor either using the bracket (sold separately) or on a flat surface.
7. Be sure to turn OFF the power supply before inserting or removing the connector.

**Cleaning**
Never use thinner or other solvents. Otherwise, the Sensor surface may be dissolved.

**Power Supply**
If a commercial switching regulator is used, ground the FG (frame ground) terminal.

**Power Supply Reset Time**
The Sensor will be able to detect objects 150 ms after the power supply is tuned ON. Start using the Sensor 150 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.

**Turning OFF the Power Supply**
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.

**Load Short-circuit Protection**
This Sensor is equipped with load short-circuit protection, but be sure to not short circuit the load. Be sure to not use an output current flow that exceeds the rated current.

**Water Resistance**
Do not use the Sensor in water, rainfall, or outdoors.
WARRANTY

OMRON'S exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

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