M18 Plastic and Metal Housing Sensors

- Universal M18 cylindrical plastic or nickel-plated brass housing in straight or 90° angled models
- Rugged IP67, IP69K housing withstands high-pressure and high-temperature wash down
- High power red LED for easy sensor alignment and dependable outputs in dusty environments
- Compact and robust housing for easy integration into machines
- Retro-reflective models are polarized to prevent false reads on mirrored surfaces
- High EMC protection and ambient light immunity for detection stability in environments with excess noise or background light

Unrivaled Detection with Simplicity in Setup and Installation

The short body of the E3FA/E3RA fits in tighter mounting spaces.

Visible red LED light for easy alignment.

Transparent object detection sensors utilize Omron's unique technology for detecting objects with birefringent (double refraction) properties.

Bright LED indicators for status visibility and large sensor adjustors for use with a standard size screwdriver.

Flush mounting option for quick and easy installation.

High power LED to compensate for dirt and misalignment.
### E3FA/E3RA Plastic Housing Sensors

[Refer to Dimensions on page 14.]

<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>20 m</td>
<td>pre-wired</td>
<td>E3FA-TN11 2M</td>
<td>E3FA-TP11 2M</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3FA-TN21</td>
<td>E3FA-TP21</td>
<td></td>
</tr>
<tr>
<td>Retro-reflective *2.</td>
<td>0.1 to 4 m with E39-R1S</td>
<td>pre-wired</td>
<td>E3FA-RN11 2M</td>
<td>E3FA-RP11 2M</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3FA-RN21</td>
<td>E3FA-RP21</td>
<td></td>
</tr>
<tr>
<td>Coaxial Retro-reflective *2.</td>
<td>0 to 500 mm with E39-R1S</td>
<td>pre-wired</td>
<td>E3FA-RN12 2M</td>
<td>E3FA-RP12 2M</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3FA-RN22</td>
<td>E3FA-RP22</td>
<td></td>
</tr>
<tr>
<td>Diffuse-reflective</td>
<td>100 mm</td>
<td>pre-wired</td>
<td>E3FA-DN11 2M</td>
<td>E3FA-DP11 2M</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3FA-DN21</td>
<td>E3FA-DP21</td>
<td></td>
</tr>
<tr>
<td></td>
<td>300 mm</td>
<td>pre-wired</td>
<td>E3FA-DN12 2M</td>
<td>E3FA-DP12 2M</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3FA-DN22</td>
<td>E3FA-DP22</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 m</td>
<td>pre-wired</td>
<td>E3FA-DN13 2M</td>
<td>E3FA-DP13 2M</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3FA-DN23</td>
<td>E3FA-DP23</td>
<td></td>
</tr>
<tr>
<td>BGS (background suppression)</td>
<td>100 mm</td>
<td>pre-wired</td>
<td>E3FA-LN11 2M</td>
<td>E3FA-LP11 2M</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3FA-LN21</td>
<td>E3FA-LP21</td>
<td></td>
</tr>
<tr>
<td></td>
<td>200 mm</td>
<td>pre-wired</td>
<td>E3FA-LN12 2M</td>
<td>E3FA-LP12 2M</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3FA-LN22</td>
<td>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</td>
<td>E3FA-VP11 2M</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3FA-VN21</td>
<td>E3FA-VP21</td>
<td></td>
</tr>
<tr>
<td>Transparent detection with P-opaquing function *2.</td>
<td>100 to 500 mm with E39-RP1</td>
<td>pre-wired</td>
<td>E3FA-BN11 2M</td>
<td>E3FA-BP11 2M</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3FA-BN21</td>
<td>E3FA-BP21</td>
<td></td>
</tr>
<tr>
<td>Transparent detection with P-opaquing function *2.</td>
<td>0.1 to 2 m with E39-RP1</td>
<td>pre-wired</td>
<td>E3FA-BN12 2M</td>
<td>E3FA-BP12 2M</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3FA-BN22</td>
<td>E3FA-BP22</td>
<td></td>
</tr>
<tr>
<td>Through-beam *1.</td>
<td>15 m</td>
<td>pre-wired</td>
<td>E3RA-TN11 2M</td>
<td>E3RA-TP11 2M</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3RA-TN21</td>
<td>E3RA-TP21</td>
<td></td>
</tr>
<tr>
<td>Retro-reflective *2.</td>
<td>0.1 to 3 m with E39-R1S</td>
<td>pre-wired</td>
<td>E3RA-RN11 2M</td>
<td>E3RA-RP11 2M</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3RA-RN21</td>
<td>E3RA-RP21</td>
<td></td>
</tr>
<tr>
<td>Diffuse reflective</td>
<td>100 mm</td>
<td>pre-wired</td>
<td>E3RA-DN11 2M</td>
<td>E3RA-DP11 2M</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3RA-DN21</td>
<td>E3RA-DP21</td>
<td></td>
</tr>
<tr>
<td></td>
<td>300 mm</td>
<td>pre-wired</td>
<td>E3RA-DN12 2M</td>
<td>E3RA-DP12 2M</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3RA-DN22</td>
<td>E3RA-DP22</td>
<td></td>
</tr>
<tr>
<td></td>
<td>700 mm</td>
<td>pre-wired</td>
<td>E3RA-DN13 2M</td>
<td>E3RA-DP13 2M</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3RA-DN23</td>
<td>E3RA-DP23</td>
<td></td>
</tr>
</tbody>
</table>

*1. Includes the emitter and receiver.

*2. The Reflector is sold separately. Select the Reflector model most suited to the application.
## E3FB/E3RB Metal Housing Sensors

[Refer to Dimensions on page 15.]

<table>
<thead>
<tr>
<th>Sensor type</th>
<th>Sensing distance</th>
<th>Connection method</th>
<th>NPN output</th>
<th>PNP output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Through-beam *1.</td>
<td>20 m</td>
<td>pre-wired</td>
<td>E3FB-TN11 2M</td>
<td>E3FB-TP11 2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3FB-TN21</td>
<td>E3FB-TP21</td>
</tr>
<tr>
<td>Retro-reflective *2.</td>
<td>0.1 to 4 m</td>
<td>pre-wired</td>
<td>E3FB-RN11 2M</td>
<td>E3FB-RP11 2M</td>
</tr>
<tr>
<td></td>
<td>with E39-R1S</td>
<td>M12 connector</td>
<td>E3FB-RN21</td>
<td>E3FB-RP21</td>
</tr>
<tr>
<td>Coaxial Retro-reflective *2.</td>
<td>0 to 500 mm</td>
<td>pre-wired</td>
<td>E3FB-RN12 2M</td>
<td>E3FB-RP12 2M</td>
</tr>
<tr>
<td></td>
<td>with E39-R1S</td>
<td>M12 connector</td>
<td>E3FB-RN22</td>
<td>E3FB-RP22</td>
</tr>
<tr>
<td>Diffuse-reflective</td>
<td>100 mm</td>
<td>pre-wired</td>
<td>E3FB-DN11 2M</td>
<td>E3FB-DP11 2M</td>
</tr>
<tr>
<td></td>
<td>300 mm</td>
<td>pre-wired</td>
<td>E3FB-DN12 2M</td>
<td>E3FB-DP12 2M</td>
</tr>
<tr>
<td></td>
<td>1 m</td>
<td>pre-wired</td>
<td>E3FB-DN13 2M</td>
<td>E3FB-DP13 2M</td>
</tr>
<tr>
<td>BGS (background suppression)</td>
<td>100 mm</td>
<td>pre-wired</td>
<td>E3FB-LN11 2M</td>
<td>E3FB-LP11 2M</td>
</tr>
<tr>
<td></td>
<td>200 mm</td>
<td>pre-wired</td>
<td>E3FB-LN12 2M</td>
<td>E3FB-LP12 2M</td>
</tr>
<tr>
<td>Limited distance reflective</td>
<td>10 to 50 mm</td>
<td>pre-wired</td>
<td>E3FB-VN11 2M</td>
<td>E3FB-VP11 2M</td>
</tr>
<tr>
<td>Transparent detection with P-opaquing function *2.</td>
<td>100 to 500 mm with E39-RP1</td>
<td>pre-wired</td>
<td>E3FB-BN11 2M</td>
<td>E3FB-BP11 2M</td>
</tr>
<tr>
<td></td>
<td>0.1 to 2 m</td>
<td>pre-wired</td>
<td>E3FB-BN12 2M</td>
<td>E3FB-BP12 2M</td>
</tr>
<tr>
<td>Through-beam *1.</td>
<td>15 m</td>
<td>pre-wired</td>
<td>E3RB-TN11 2M</td>
<td>E3RB-TP11 2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12 connector</td>
<td>E3RB-TN21</td>
<td>E3RB-TP21</td>
</tr>
<tr>
<td>Retro-reflective *2.</td>
<td>0.1 to 3 m</td>
<td>pre-wired</td>
<td>E3RB-RN11 2M</td>
<td>E3RB-RP11 2M</td>
</tr>
<tr>
<td></td>
<td>with E39-R1S</td>
<td>M12 connector</td>
<td>E3RB-RN21</td>
<td>E3RB-RP21</td>
</tr>
<tr>
<td>Diffuse reflective</td>
<td>100 mm</td>
<td>pre-wired</td>
<td>E3RB-DN11 2M</td>
<td>E3RB-DP11 2M</td>
</tr>
<tr>
<td></td>
<td>300 mm</td>
<td>pre-wired</td>
<td>E3RB-DN12 2M</td>
<td>E3RB-DP12 2M</td>
</tr>
<tr>
<td></td>
<td>700 mm</td>
<td>pre-wired</td>
<td>E3RB-DN13 2M</td>
<td>E3RB-DP13 2M</td>
</tr>
</tbody>
</table>

*1. 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 16.]
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</td>
<td>0.1 to 4 m</td>
<td></td>
<td>E39-R1S</td>
<td>1</td>
<td>for E3FA-R, E3RA-R, E3FB-R, E3RB-R</td>
</tr>
<tr>
<td>E3FB-R</td>
<td>0 to 500 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E3FA-B</td>
<td>100 to 500 mm</td>
<td></td>
<td>E39-RP1</td>
<td>1</td>
<td>for E3FA-B, E3FB-B</td>
</tr>
<tr>
<td>E3FB-B</td>
<td>0.1 to 2 m</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mounting brackets [Refer to Dimensions on page 16.]
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></td>
<td></td>
<td>E39-L183 (SUS304)</td>
<td>1</td>
<td>Mounting bracket</td>
</tr>
<tr>
<td>E3FA-</td>
<td></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
D: Diffuse-reflective
L: Background suppression
V: Limited distance reflective
B: Transparent detection with P-opaquing function

3. Output
P: PNP
N: NPN

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

5. Difference of Sensing distance
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-TN12-D;
Cylindrical, Radial type, Plastic housing/ Through-beam/ NPN/ Connector, M12, 4-pin/ Difference of Sensing distance/ Connector type

E3FB-VP12;
Cylindrical, Straight type, Plastic housing/ Limited distance reflective/ PNP/ Connector, M12, 4-pin/ Difference of Sensing distance/ Connector type
# Specifications

## Straight type (E3FA/E3FB)

<table>
<thead>
<tr>
<th>Item</th>
<th>Sensing method</th>
<th>Through-beam</th>
<th>Retro-reflective</th>
<th>Coaxial Retro-reflective</th>
<th>Diffuse-reflective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>NPN/ PNP output</td>
<td>Pre-wired E3F</td>
<td>Pre-wired E3F</td>
<td>Pre-wired E3F</td>
<td>Pre-wired E3F</td>
</tr>
<tr>
<td></td>
<td>M12 Connector</td>
<td>E3FL-TN11 2M</td>
<td>E3FL-RP11 2M</td>
<td>E3FL-TP11 2M</td>
<td>E3FL-TP21</td>
</tr>
<tr>
<td></td>
<td>E3FL-TN21</td>
<td>E3FL-RP21</td>
<td>E3FL-TP21</td>
<td>Pre-wired E3F</td>
<td>Pre-wired E3F</td>
</tr>
<tr>
<td></td>
<td>E3FL-RN21</td>
<td>E3FL-RP12</td>
<td>E3FL-TP12</td>
<td>E3F</td>
<td>E3F</td>
</tr>
<tr>
<td></td>
<td>E3FL-RN22</td>
<td>E3F-DN12 2M</td>
<td>E3F-DN12 2M</td>
<td>E3F-DN12 2M</td>
<td>E3F-DN13 2M</td>
</tr>
<tr>
<td></td>
<td>E3FL-DN21</td>
<td>E3F-DN12 2M</td>
<td>E3F-DN12 2M</td>
<td>E3F-DN12 2M</td>
<td>E3F-DN13 2M</td>
</tr>
<tr>
<td></td>
<td>E3FL-DN22</td>
<td>E3F-DN12 2M</td>
<td>E3F-DN12 2M</td>
<td>E3F-DN12 2M</td>
<td>E3F-DN13 2M</td>
</tr>
<tr>
<td>Sensing distance</td>
<td>0.1 to 4 m (with E39-R1S)</td>
<td>0 to 500 mm (with E39-R1S)</td>
<td>100 mm (white paper: 300 x 300 mm)</td>
<td>300 mm (white paper: 300 x 300 mm)</td>
<td>1 m (white paper: 300 x 300 mm)</td>
</tr>
<tr>
<td>Spot diameter (typical)</td>
<td>40 x 45 mm</td>
<td>Sensing distance of 100 mm</td>
<td>40 x 50 mm</td>
<td>Sensing distance of 300 mm</td>
<td>120 x 150 mm</td>
</tr>
<tr>
<td>Standard sensing object</td>
<td>Opaque: 7 mm dia. min.</td>
<td>Opaque: 75 mm dia. min.</td>
<td>Opaque: 75 mm dia. min.</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Differential travel</td>
<td>2° min.</td>
<td>2° min.</td>
<td>2° min.</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Directional angle</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>20% max.</td>
<td>—</td>
</tr>
<tr>
<td>Light source (wavelength)</td>
<td>Red LED (634 nm)</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Power supply voltage</td>
<td>10 to 30 VDC (include voltage ripple of 10%(p-p) max.)</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Current consumption</td>
<td>40 mA max. (Emitter 25 mA max. Receiver 15 mA max.)</td>
<td>25 mA max.</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Control output</td>
<td>NPN/PNP (open collector)</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Operation mode</td>
<td>Light-ON/Dark-ON selectable by wiring</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Indicator</td>
<td>Operation indicator (orange)</td>
<td>Stability indicator (green)</td>
<td>Power indicator (green): only Emitter of Through-beam</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Protection circuits</td>
<td>Reversed power supply polarity protection, Output short-circuit protection and Reversed output polarity protection</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Response time</td>
<td>0.5 ms</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Sensitivity adjustment</td>
<td>One-turn adjuster</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Ambient illumination (Receiver side)</td>
<td>Incandescent lamp: 3,000 lx max./ Sunlight: 10,000 lx max.</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Ambient temperature range</td>
<td>Operating: -25 to 55°C/ Storage: -30 to 70°C (with no ice or condensation)</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<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>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Insulation resistance</td>
<td>20 MΩ min. at 500 VDC</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Dielectric strength</td>
<td>1,000 VAC at 50/60 Hz for 1 min. between current-carrying parts and case</td>
<td>—</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 and Z directions</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Shock resistance</td>
<td>Destruction: 500 m/s² 3 times each in X, Y and Z directions</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>IEC: IP67, DIN 40050-9: IP69K</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

* 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.

---

Accuracy: ±5% (full scale) over 10 to 30 VDC power supply voltage.
Accuracy including voltage ripple: ±10% (p-p) max.
Noise characteristic: DC-500 kHz.
Ambient illumination (Emitter side) = 1,000 lx max.
### 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.

### Sensing distance

<table>
<thead>
<tr>
<th>Item</th>
<th>Sensing method</th>
<th>BGS (Background suppression)</th>
<th>Limited distance reflective</th>
<th>Transparent detection with P-opaquing function</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPN output Pre-wired</td>
<td>E3FA-LN11 2M</td>
<td>E3FA-LN12 2M</td>
<td>E3FA-VN11 2M</td>
<td>E3FA-BN11 2M</td>
</tr>
<tr>
<td>M12 Connector</td>
<td>E3FA-LN21</td>
<td>E3FA-LN22</td>
<td>E3FA-VN21</td>
<td>E3FA-BN21</td>
</tr>
<tr>
<td>PNP output Pre-wired</td>
<td>E3FA-LP11 2M</td>
<td>E3FA-LP12 2M</td>
<td>E3FA-VP11 2M</td>
<td>E3FA-BP11 2M</td>
</tr>
<tr>
<td>M12 Connector</td>
<td>E3FA-LP21</td>
<td>E3FA-LP22</td>
<td>E3FA-VP21</td>
<td>E3FA-BP21</td>
</tr>
</tbody>
</table>

- Sensing distance: 100 mm (white paper: 300 x 300 mm)
- Sensing distance: 200 mm (white paper: 300 x 300 mm)
- Sensing distance: 10 to 50 mm (glass: 1 mm thick, 150 x 150 mm)
- Sensing distance: 100 to 500 mm (with E39-RP1)
- Sensing distance: 0.1 to 2 m (with E39-RP1)

### Standard sensing object

- Glass (1.0 mm thick, 150 x 150 mm)
- Glass (1.0 mm thick, 150 x 150 mm)

### Sensing distance of 100 mm

- Sensing distance: 10 x 10 mm
- Sensing distance: 10 x 15 mm
- Sensing distance: 10 x 10 mm
- Sensing distance: 10 x 10 mm
- Sensing distance: 10 x 15 mm
- Sensing distance: 10 x 10 mm
- Sensing distance: 10 x 10 mm
- Sensing distance: 10 x 10 mm
- Sensing distance: 10 x 15 mm
- Sensing distance: 10 x 10 mm
- Sensing distance: 10 x 10 mm
- Sensing distance: 10 x 15 mm
- Sensing distance: 10 x 10 mm
- Sensing distance: 10 x 15 mm
- Sensing distance: 10 x 10 mm
- Sensing distance: 10 x 15 mm

### Material

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

<table>
<thead>
<tr>
<th>Sensing method</th>
<th>Through-beam</th>
<th>Retro-reflective</th>
<th>Diffuse-reflective</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model</strong></td>
<td><strong>NPN</strong></td>
<td><strong>PNP</strong></td>
<td></td>
</tr>
<tr>
<td>Pre-wired</td>
<td>E3RA-TN11 2M</td>
<td>E3RA-RN11 2M</td>
<td>E3RA-DN11 2M</td>
</tr>
<tr>
<td>M12 Connector</td>
<td>E3RA-TN21</td>
<td>E3RA-RN21</td>
<td>E3RA-DN21</td>
</tr>
<tr>
<td><strong>Item</strong></td>
<td>Pre-wired</td>
<td>E3RA-TP11 2M</td>
<td>E3RA-RP11 2M</td>
</tr>
<tr>
<td>M12 Connector</td>
<td>E3RA-TP21</td>
<td>E3RA-RP21</td>
<td>E3RA-DP11 2M</td>
</tr>
</tbody>
</table>

#### Sensing distance
- 15 m
- 0.1 to 3 m (with E39-R1S)
- 100 mm (white paper: 300 x 300 mm)
- 300 mm (white paper: 300 x 300 mm)
- 700 mm (white paper: 300 x 300 mm)

#### Spot diameter (typical)
- 35 x 40 mm
- 40 x 45 mm
- 90 x 120 mm

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

#### Power supply voltage
- 10 to 30 VDC (include voltage ripple of 10%(p-p) 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
- Reversed power supply polarity protection, Output short-circuit protection and Reversed output 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: -30 to 70°C (with no icing or condensation)

#### Ambient humidity range
- Operating: 35 to 85%RH/ Storage: 35 to 95%RH (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): E3RA: Approx. 110 g/ Approx. 50 g, E3RB: Approx. 175 g/ Approx. 65 g, respectively
- Connector: E3RA: Approx. 30 g/ Approx. 10 g, E3RB: Approx. 85 g/ Approx. 20 g, respectively

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

---

*IP69K Degree of Protection Specifications*
Engineering Data (Typical)

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

Retro-reflective Models
E3F-R1, E3R-R1

Encoder: E3F-R2

Transparent detection with P-opaques function
E3F-B1

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

E3R-D1, E3R-D2

Sensing object: white paper

E3F-B2

E3R-B2

Sensing object: 300 × 300 white paper

BGS Models
E3F-L1

E3F-L2

Sensing object: white paper

Limited distance reflective
E3F-V

Sensing object: glass (t=1.0)
Excess Gain vs. Distance

Through-beam Models
E3F, E3R

Retro-reflective Models
E3F, E3R

Diffuse reflective Models
E3F, E3R

Transparent detection with P-opaque function

Sensing Object Size vs. Distance

Diffuse reflective Models
E3F, E3R

Limited distance reflective

Sensing object: 100 × 100 (mm) white paper

Sensing object: 300 × 300 (mm) white paper

Sensing object: Glass (t=1.0)

Length d of sensing object (mm)
Sensing Distance vs. Sensing Object Material

BGS Models

Dark Excess Gain vs. Sensing Object Characteristics
Transparent detection with P-opaquist function
## 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>E3F-TP, E3F-RP, E3F-DP, E3F-VP, E3F-BP, E3F-TP, E3F-RP, E3F-DP</td>
<td>Light-ON</td>
<td>Light incident</td>
<td>Connect the pink wire (Pin(2)) to the brown (Pin(1))</td>
<td>Through-beam Receivers, Retro-reflective Models, Diffuse-reflective Models, Limited reflective Models. Transparent detection with P-opaquing function.</td>
</tr>
<tr>
<td></td>
<td>Dark-ON</td>
<td>Light incident</td>
<td>Light interrupted Operation indicator (orange) ON OFF</td>
<td>Brown 10 to 30 VDC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Operation indicator</td>
<td>Dark-ON Operation indicator (orange) OFF</td>
<td>100 mA max. (Control output)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Output transistor</td>
<td>ON OFF</td>
<td>0 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Load (e.g., relay)</td>
<td>ON OFF</td>
<td>Operate Reset</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Between blue and black leads)</td>
<td>(Between blue and black leads)</td>
<td></td>
</tr>
</tbody>
</table>

### Through-beam Emitter

<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>E3F-LP</td>
<td>Light-ON</td>
<td>Light incident</td>
<td>Connect the pink wire (Pin(2)) to the brown (Pin(1))</td>
<td>Through-beam Emitter Power indicator (green)</td>
</tr>
<tr>
<td></td>
<td>Dark-ON</td>
<td>Light incident</td>
<td>Light interrupted Operation indicator (orange) ON OFF</td>
<td>Brown 10 to 30 VDC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Operation indicator</td>
<td>Dark-ON Operation indicator (orange) OFF</td>
<td>100 mA max. (Control output)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Output transistor</td>
<td>ON OFF</td>
<td>0 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Load (e.g., relay)</td>
<td>ON OFF</td>
<td>Operate Reset</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Between blue and black leads)</td>
<td>(Between blue and black leads)</td>
<td></td>
</tr>
</tbody>
</table>

### Background suppression.

<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>E3F-LP</td>
<td>Light-ON</td>
<td>Light incident</td>
<td>Connect the pink wire (Pin(2)) to the brown (Pin(1))</td>
<td>Background suppression.</td>
</tr>
<tr>
<td></td>
<td>Dark-ON</td>
<td>Light incident</td>
<td>Light interrupted Operation indicator (orange) ON OFF</td>
<td>Brown 10 to 30 VDC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Operation indicator</td>
<td>Dark-ON Operation indicator (orange) OFF</td>
<td>100 mA max. (Control output)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Output transistor</td>
<td>ON OFF</td>
<td>0 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Load (e.g., relay)</td>
<td>ON OFF</td>
<td>Operate Reset</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Between blue and black leads)</td>
<td>(Between blue and black leads)</td>
<td></td>
</tr>
</tbody>
</table>
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></td>
<td>Light-ON</td>
<td></td>
<td>Connect the pink wire (Pin(2)) to the brown (Pin(1)) or open the pink wire (Pin(2))</td>
<td>Connect the pink wire (Pin(2)) to the brown (Pin(1)) or open the pink wire (Pin(2))</td>
</tr>
<tr>
<td></td>
<td>Dark-ON</td>
<td></td>
<td>Connect the pink wire (Pin(2)) to the blue (Pin(3))</td>
<td>Connect the pink wire (Pin(2)) to the blue (Pin(3))</td>
</tr>
</tbody>
</table>


**Connector Pin Arrangement**

M12 Connector Pin Arrangement

**Connectors (Sensor I/O connectors)**

M12 4-wire Connectors

<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>①</td>
<td>Power supply (+V)</td>
</tr>
<tr>
<td></td>
<td>White</td>
<td>②</td>
<td>L/on · D/on selectable</td>
</tr>
<tr>
<td></td>
<td>Blue</td>
<td>③</td>
<td>Power supply (0 V)</td>
</tr>
<tr>
<td></td>
<td>Black</td>
<td>④</td>
<td>Output</td>
</tr>
</tbody>
</table>
Nomenclature

Straight type, Plastic housing
with an adjuster:
E3FA-T-D
E3FA-R
E3FA-D
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

Straight type, Metal housing
with an adjuster:
E3FB-T-D
E3FB-R
E3FB-D
E3FB-V
E3FB-B
without an adjuster:
E3FB-T-L *
E3FB-L

Radial type, Metal housing
with an adjuster:
E3RB-T-D
E3RB-R
E3RB-D

* 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 in an environment with explosive, flammable or corrosive gas.
2. Do not use the sensor in an 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 in an environment with conditions in excess of rated specifications.
6. Do not use the sensor in place that is exposed to direct sunlight.
7. Do not use the sensor in place where the sensor may receive direct vibration or shock in excess of specifications.
8. Do not use thinner, alcohol, or other organic solvents on the sensor.
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.
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

Dimensions

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

Sensors (E3FA/E3RA Plastic housing)

**E3FA series**

Pre-wired Models
- E3FA-T\(_{11}\)
- E3FA-R\(_{11}\)
- E3FA-D\(_{11}\)
- E3FA-L\(_{11}\)
- E3FA-V\(_{11}\)
- E3FA-B\(_{11}\)

**E3FA series**

M12 Connector Models
- E3FA-T\(_{21}\)
- E3FA-R\(_{21}\)
- E3FA-D\(_{21}\)
- E3FA-L\(_{21}\)
- E3FA-V\(_{21}\)
- E3FA-B\(_{21}\)

**E3RA series**

Pre-wired Models
- E3RA-T\(_{11}\)
- E3RA-R\(_{11}\)
- E3RA-D\(_{11}\)

**E3RA series**

M12 Connector Models
- E3RA-T\(_{21}\)
- E3RA-R\(_{21}\)
- E3RA-D\(_{21}\)

---

**Terminal No.** | **Specification**
---|---
1 | +V
2 | L/on · D/on selectable
3 | 0V
4 | Output

---

Sensors (E3FA/E3RA Plastic housing)

**E3FA series**

Pre-wired Models
- E3FA-T\(_{11}\)
- E3FA-R\(_{11}\)
- E3FA-D\(_{11}\)
- E3FA-L\(_{11}\)
- E3FA-V\(_{11}\)
- E3FA-B\(_{11}\)

**E3FA series**

M12 Connector Models
- E3FA-T\(_{21}\)
- E3FA-R\(_{21}\)
- E3FA-D\(_{21}\)

---

**Terminal No.** | **Specification**
---|---
1 | +V
2 | L/on · D/on selectable
3 | 0V
4 | Output

---

**E3RA series**

Pre-wired Models
- E3RA-T\(_{11}\)
- E3RA-R\(_{11}\)
- E3RA-D\(_{11}\)

**E3RA series**

M12 Connector Models
- E3RA-T\(_{21}\)
- E3RA-R\(_{21}\)
- E3RA-D\(_{21}\)

---

**Terminal No.** | **Specification**
---|---
1 | +V
2 | L/on · D/on selectable
3 | 0V
4 | Output

---

**E3RA series**

Pre-wired Models
- E3RA-T\(_{11}\)
- E3RA-R\(_{11}\)
- E3RA-D\(_{11}\)

**E3RA series**

M12 Connector Models
- E3RA-T\(_{21}\)
- E3RA-R\(_{21}\)
- E3RA-D\(_{21}\)
Sensors (E3FB/E3RB Metal housing)

### E3FB series

#### Pre-wired Models
- E3FB-T□11
- E3FB-R□11
- E3FB-D□11
- E3FB-L□11
- E3FB-V□11
- E3FB-B□11

![E3FB series diagram](image)

#### M12 Connector Models
- E3FB-T□21
- E3FB-R□21
- E3FB-D□21
- E3FB-L□21
- E3FB-V□21
- E3FB-B□21

![E3FB series diagram](image)

### E3RB series

#### Pre-wired Models
- E3RB-T□11
- E3RB-R□11
- E3RB-D□11

![E3RB series diagram](image)

#### M12 Connector Models
- E3RB-T□21
- E3RB-R□21
- E3RB-D□21

![E3RB series diagram](image)
Attached nut

For E3FA/E3RA

For E3FB/E3RB

Accessories (Order Separately)

Reflectors
E39-R1S

E39-RP1

Mounting brackets
E39-L183

E39-L182