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Compact Sensor Offers Long Sensing Distance and Superior Noise-Immunity

- Photo-IC provides long sensing distance: 15 m for through-beam, 4 m for retroreflective, and 1 m for diffuse
- Integrated Photo-IC improves noise immunity to interference from inverters and other inductive loads
- New injection molding technology assures IP67 rating to withstand water and dust
- Switch-selectable, Light-ON/Dark-ON operation
- M8 connector-ready and 2-m, pre-wired models
- NPN or PNP output models available



## Ordering Information

### ■ SENSORS

| Sensing method            | Light source | Appearance | Connection method | Sensing distance                                | Part number    |                |
|---------------------------|--------------|------------|-------------------|---|----------------|----------------|
|                           |              |            |                   |   | NPN output     | PNP output     |
| Through-beam              | IR           |            | Pre-wired         | 15 m  | <b>E3Z-T61</b> | <b>E3Z-T81</b> |
|                           |              |            | Connector         |   | <b>E3Z-T66</b> | <b>E3Z-T86</b> |
| Polarized retroreflective | RED          |            | Pre-wired         | 100 mm to 4 m<br>100 mm to 3 m<br>(See Note 2.) | <b>E3Z-R61</b> | <b>E3Z-R81</b> |
|                           |              |            | Connector         |   | <b>E3Z-R66</b> | <b>E3Z-R86</b> |
| Diffuse reflective        | IR           |            | Pre-wired         | 5 to 100 mm<br>(wide view)                      | <b>E3Z-D61</b> | <b>E3Z-D81</b> |
|                           |              |            | Connector         |   | <b>E3Z-D66</b> | <b>E3Z-D86</b> |
|                           |              |            | Pre-wired         | 1 m   | <b>E3Z-D62</b> | <b>E3Z-D82</b> |
|                           |              |            | Connector         |   | <b>E3Z-D67</b> | <b>E3Z-D87</b> |

**Note: 1.** The Reflector is sold separately. Select the Reflector model most suited to the application.

**2.** Sensing distance can be extended to 4 meters when the E39-R1S reflector is used. The sensing distance is 3 meters when the E39-R1 reflector is used.

## ■ ACCESSORIES (ORDER SEPARATELY)

### Slit for Through-beam Models (E3Z-T□□)

Order a slit for each emitter and receiver.

| Slit width  | Sensing distance (typical) | Minimum sensing object (typical) | Part number     |
|-------------|----------------------------|----------------------------------|-----------------|
| 0.5 mm dia. | 50 mm                      | 0.5 mm dia.                      | <b>E39-S65A</b> |
| 1 mm dia.   | 200 mm                     | 1 mm dia.                        | <b>E39-S65B</b> |
| 2 mm dia.   | 800 mm                     | 2 mm dia.                        | <b>E39-S65C</b> |
| 0.5 × 10 mm | 1 m                        | 0.7 mm dia.                      | <b>E39-S65D</b> |
| 1 × 10 mm   | 2.2 m                      | 1.2 mm dia.                      | <b>E39-S65E</b> |
| 2 × 10 mm   | 5 m                        | 2.4 mm dia.                      | <b>E39-S65F</b> |

### Reflectors for Retroreflective Models

| Name                | Sensing distance (typical) | Part number    |
|---------------------|----------------------------|----------------|
| Reflector           | 100 mm to 3 m              | <b>E39-R1</b>  |
|                     | 100 mm to 4 m              | <b>E39-R1S</b> |
|                     | 100 mm to 5 m              | <b>E39-R2</b>  |
|                     | 100 mm to 2.5 m            | <b>E39-R9</b>  |
|                     | 100 mm to 3.5 m            | <b>E39-R10</b> |
| Miniature Reflector | 50 mm to 1.5 m             | <b>E39-R3</b>  |
| Tape Reflector      | 150 mm to 700 mm           | <b>E39-RS1</b> |
|                     | 150 mm to 1.1 m            | <b>E39-RS2</b> |
|                     | 150 mm to 1.4 m            | <b>E39-RS3</b> |

**Note:** The actual sensing distance may be reduced to approximately 70% of the typical sensing distance when using a Reflector other than the E39-R1 or the E39-R1S.

## ■ MOUNTING BRACKETS

| Appearance  | Description                             | Part number     |
|---|---|-----------------|
|  | L-bracket, horizontal                   | <b>E39-L104</b> |
|  | L-bracket, vertical                     | <b>E39-L44</b>  |
|  | Open top,<br>20° angle adjustability    | <b>E39-L43</b>  |
|  | Protected top<br>5° angle adjustability | <b>E39-L144</b> |

| Appearance   | Description                                  | Part number     |
|--|--|-----------------|
|  | Compact vertical<br>protective cover bracket | <b>E39-L142</b> |
|  | Vertical protective cover<br>bracket         | <b>E39-L98</b>  |
|  |  |                 |

**Note:** If a through-beam model is used, order two Mounting Brackets — one for the emitter and one for the receiver.

## M8 Connectors

| Appearance  | Cable type     | Part number                              |                        |
|-------------|----------------|--|------------------------|
| Straight    | 2 m (6.56 ft)  | Four-wire type<br><b>XS3F-M421-402-A</b> |                        |
|             | 5 m (16.40 ft) |  | <b>XS3F-M421-405-A</b> |
| Right angle | 2 m (6.56 ft)  |  | <b>XS3F-M422-402-A</b> |
|             | 5 m (16.40 ft) |  | <b>XS3F-M422-405-A</b> |

## Specifications

| Item                                    | Sensing method        | Through-beam   | Polarized retroreflective   | Diffuse reflective                       |                                       |
|---|-----------------------|--|---|--|---------------------------------------|
|   |                       | E3Z-T61/T66  | E3Z-R61/R66   | E3Z-D61/D66                              | E3Z-D62/D67                           |
|   |                       | E3Z-T81/T86  | E3Z-R81/R86   | E3Z-D81/D86                              | E3Z-D82/D87                           |
| Sensing distance                        |                       | 15 m   | 100 mm (4 m Note 1)<br>(when using E39-R1S)<br>100 mm (3 m Note 2)<br>(when using E39-R1)     | White paper<br>(100 × 100 mm):<br>100 mm | White paper<br>(300 × 300 mm):<br>1 m |
| Standard sensing object                 |                       | Opaque: 12 mm<br>(dia. min.)   | Opaque: 75 mm<br>(dia. min.)  | ---                                      |                                       |
| Hysteresis                              |                       | ---  |   | 20% max. of setting distance             |                                       |
| Directional angle                       |                       | Both emitter and<br>receiver: 3 to 15°   | 2 to 10°  | ---                                      |                                       |
| Light source (wave length)              |                       | Infrared LED (860 nm)  | Red LED (680 nm)  | Infrared LED (860 nm)                    |                                       |
| Power supply voltage                    |                       | 12 to 24 VDC ±10% including 10% (p-p) max. ripple  |   |  |                                       |
| Current consumption                     |                       | Emitter: 15 mA<br>Receiver: 20 mA  | 30 mA max.  |  |                                       |
| Control output                          |                       | 100 mA max. at 26.4 VDC, open collector output<br>(residual voltage: 1 V max.)<br>L-ON/D-ON, switch selectable |   |  |                                       |
| Circuit protection                      |                       | Load short-circuit and<br>reversed power supply<br>protection  | Reversed power supply connection, output short-circuit, and mutual<br>interference protection |  |                                       |
| Response time                           |                       | 1 ms max.  |   |  |                                       |
| Sensitivity adjustment                  |                       | One-turn potentiometer   |   |  |                                       |
| Ambient illumination<br>(receiver side) | Incandescent lamp     | 3,000 lux max.   |   |  |                                       |
|   | Sunlight              | 10,000 lux max.  |   |  |                                       |
| Ambient temperature                     | Operating             | -25°C to 55°C (-13°F to 131°F)   |   |  |                                       |
|   | Storage               | -40°C to 70°C (-40°F to 158°F) with no icing or condensation   |   |  |                                       |
| Ambient humidity                        | Operating             | 35% to 85%   |   |  |                                       |
|   | Storage               | 35% to 95% with no condensation  |   |  |                                       |
| Insulation resistance                   |                       | 20 MΩ min. at 500 VDC  |   |  |                                       |
| Dielectric strength                     |                       | 1,000 VAC, 50/60 Hz for 1 min  |   |  |                                       |
| Vibration resistance                    |                       | 10 to 55 Hz, 1.5-mm double amplitude or 300 m/s <sup>2</sup> for 2 hours each in X, Y, and Z axes              |   |  |                                       |
| Shock resistance                        | Destruction           | 500 m/s <sup>2</sup> 3 times each in X, Y, and Z axes  |   |  |                                       |
| Enclosure rating                        |                       | IP67 (IEC60529)  |   |  |                                       |
| Approvals                               |                       | CE   |   |  |                                       |
| Connection method                       |                       | 2 m cable or M8 connector  |   |  |                                       |
| Indicator                               |                       | Operation indicator (orange)<br>Stability indicator (green)<br>Emitter has power indicator (orange) only       |   |  |                                       |
| Weight<br>(packed state)                | Pre-wired cable (2 m) | Approx. 120 g (4.2 oz)   | Approx. 65 g (2.3 oz)   |  |                                       |
|   | Connector             | Approx. 30 g (1.1 oz)  | Approx. 20 g (0.7 oz)   |  |                                       |
| Material                                |                       | Case: PBT (polybutylene terephthalate); Lens: Methacrylate resin   |   |  |                                       |
| Accessories                             |                       | Instruction manual (Order Reflector and Mounting Bracket separately.)  |   |  |                                       |

- Note:** 1. Sensing distance can be extended up to 4 meters when the E39-R1S reflector is used.  
2. Sensing distance can be extended up to 3 meters when the E39-R1 reflector is used.

# Nomenclature

**Through-beam Models**  
E3Z-T6□ Receiver

**Retroreflective Models**  
E3Z-R6□

**Diffuse-reflective Models**  
E3Z-D6□



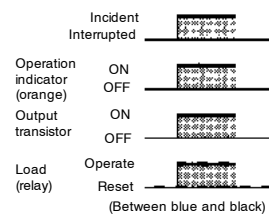
# Operation

## OUTPUT CIRCUITS

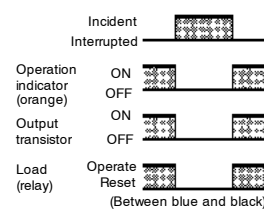
|                           |  |                      |
|---------------------------|--|----------------------|
| Model                     | E3Z-T61/-T66/-R61/-R66/-D61/-D66/-D62/-D67                                 |                      |
| NPN output                | Through-beam receiver<br>Retroreflective model<br>Diffuse reflective model | Through-beam emitter |
|                           |  |                      |
| Model                     | E3Z-T81/-T86/-R86/-D81/-D86/-D82/-D87                                      |                      |
| PNP output                | Through-beam receiver<br>Retroreflective model<br>Diffuse reflective model | Through-beam emitter |
|                           |  |                      |
| Connector pin arrangement |  |                      |

## TIMING CHARTS

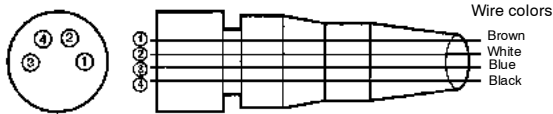
### Light-ON (L-ON) Operation



### Dark-ON (D-ON) Operation



CONNECTOR PIN-OUT



XS3F-M421-402-A XS3F-M421-405-A  
 XS3F-M422-402-A XS3F-M422-405-A

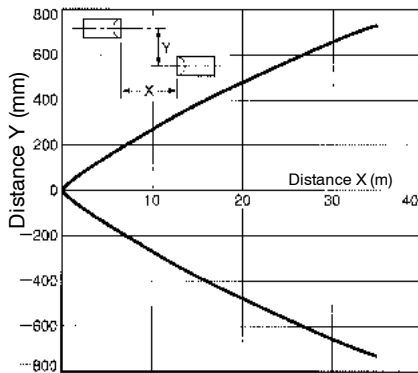
| Classification | Wire color | Connector pin No. | Use                |
|----------------|------------|-------------------|--------------------|
| DC             | Brown      | A                 | Power supply (+V)  |
|                | White      | B                 | Pin 2 is not used. |
|                | Blue       | C                 | Power supply (0 V) |
|                | Black      | D                 | Output             |

Note: The through-beam emitter does not use pins 2 and 4.

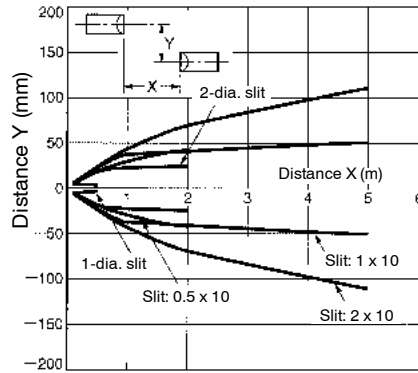
Engineering Data

PARALLEL OPERATING RANGE (TYPICAL)

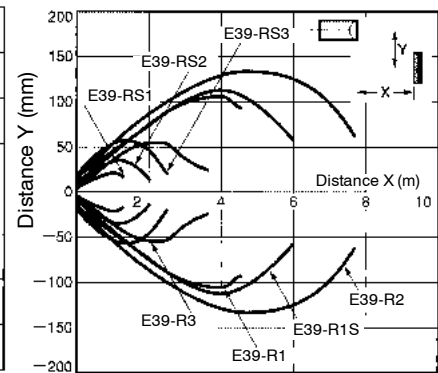
Through-beam Models  
 E3Z-T□1 (T□6)



Through-beam Models  
 E3Z-T□1 (T□6) and Slit

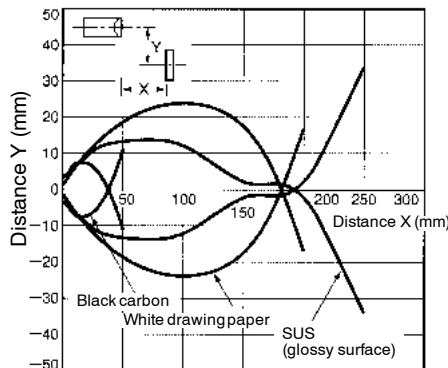


Retroreflective Models  
 E3Z-R□1 (R□6) and Reflector

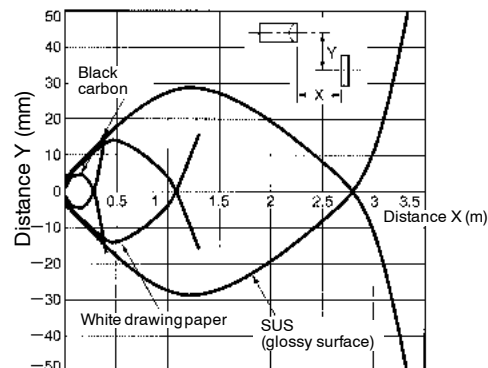


OPERATING RANGE (TYPICAL)

Diffuse Reflective Models  
 E3Z-D□1 (D□6)

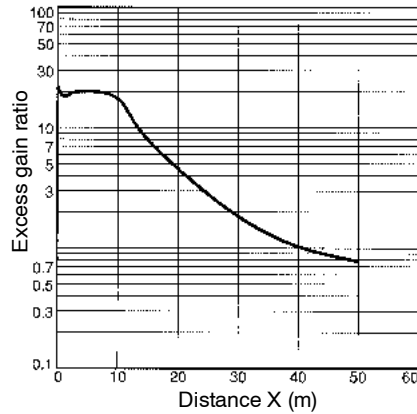


Diffuse Reflective Models  
 E3Z-D□2 (D□7)

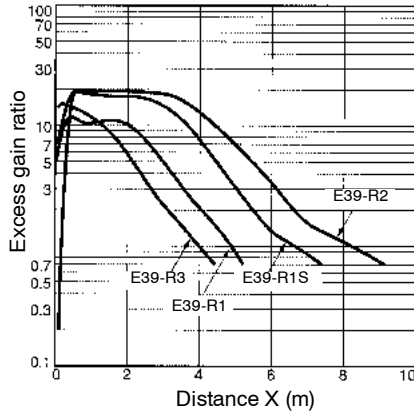


■ EXCESS GAIN RATIO VS. DISTANCE (TYPICAL)

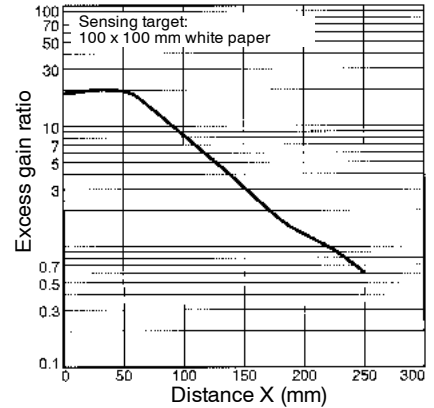
**Through-beam Models**  
E3Z-T□1 (T□6)



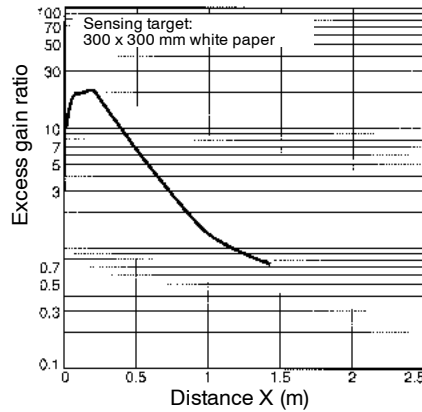
**Retroreflective Models**  
E3Z-R□1 (R□6) and Reflector



**Diffuse Reflective Models**  
E3Z-D□1 (D□6)

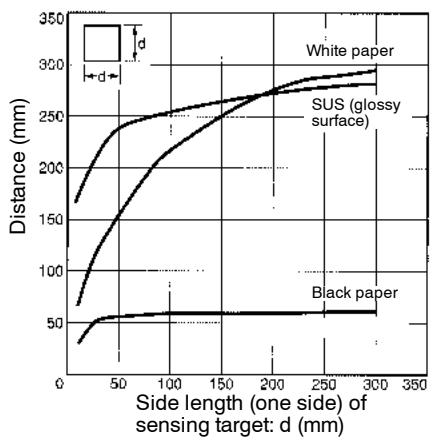


**Diffuse Reflective Model**  
E3Z-D□2 (D□7)



**Sensing Target Size vs. Sensing Distance (Typical)**

**Diffuse Reflective Models**  
E3Z-D□1 (D□6)



**Diffuse Reflective Models**  
E3Z-D□2 (D□7)



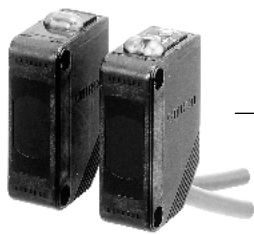
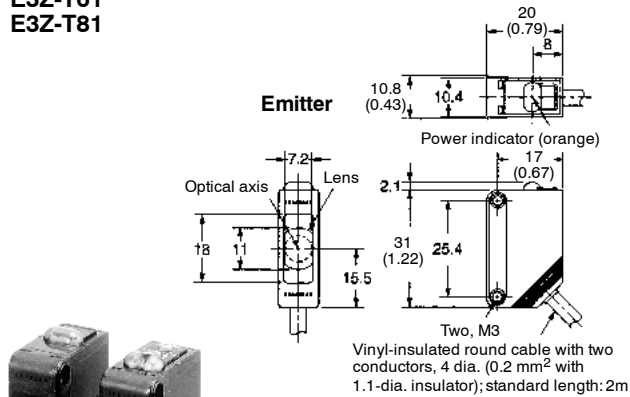
# Dimensions

Unit: mm (inch)

## SENSORS

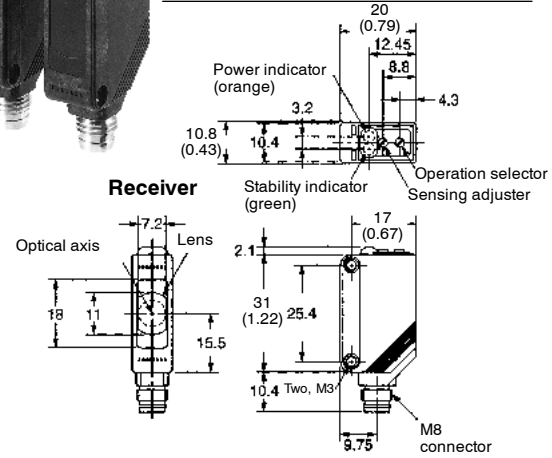
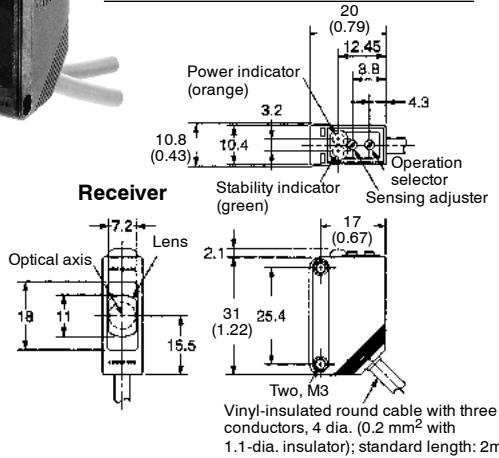
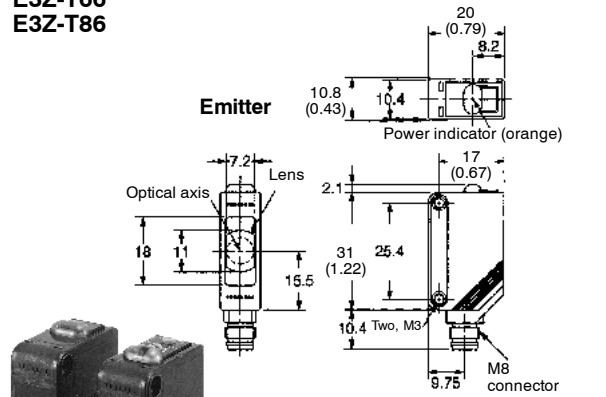
### Through-beam (Pre-wired Models)

E3Z-T61  
E3Z-T81



### Through-beam (Connector Models)

E3Z-T66  
E3Z-T86

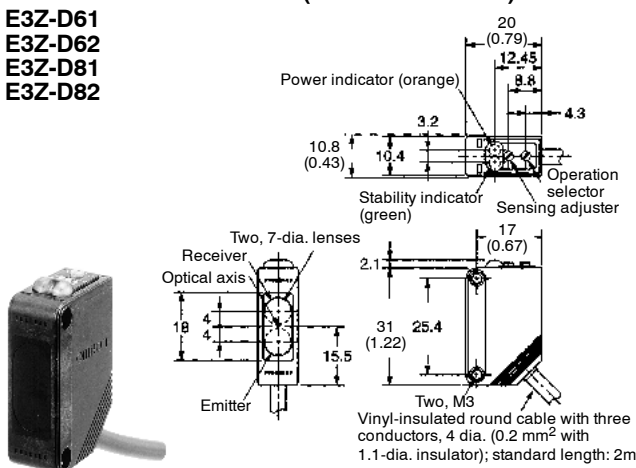


### Retroreflective Models (Pre-wired Models)

E3Z-R61  
E3Z-R81

### Diffuse Reflective Models (Pre-wired Models)

E3Z-D61  
E3Z-D62  
E3Z-D81  
E3Z-D82

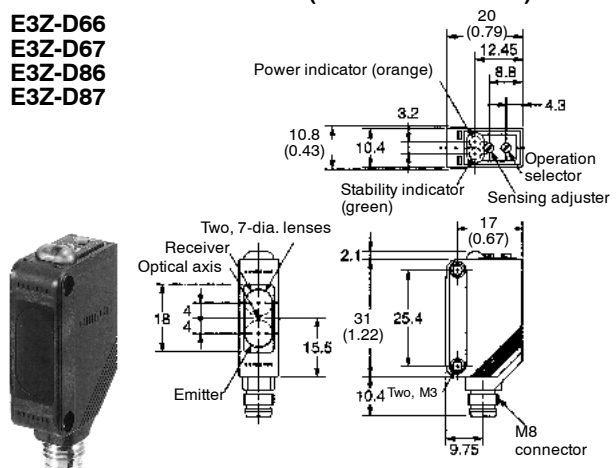


### Retroreflective Models (Connector Models)

E3Z-R66  
E3Z-R86

### Diffuse Reflective Models (Connector Models)

E3Z-D66  
E3Z-D67  
E3Z-D86  
E3Z-D87

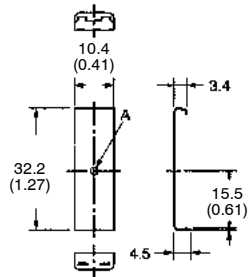




Unit: mm (inch)

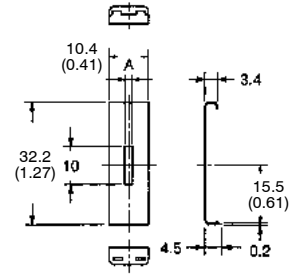
■ SLITS

**E39-S65A**  
**E39-S65B**  
**E39-S65C**



| Model    | Side A   | Material               |
|----------|----------|------------------------|
| E39-S65A | 0.5 dia. | SUS301 stainless steel |
| E39-S65B | 1.0 dia. |                        |
| E39-S65C | 2.0 dia. |                        |

**E39-S65D**  
**E39-S65E**  
**E39-S65F**



| Model    | Side A | Material               |
|----------|--------|------------------------|
| E39-S65D | 0.5    | SUS301 stainless steel |
| E39-S65E | 1.0    |                        |
| E39-S65F | 2.0    |                        |

■ REFLECTORS

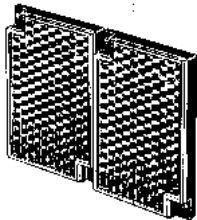
**E39-R1**  
**E39-R1S**



Material  
Surface: Acrylic resin  
Backside: ABS resin



**E39-R2**



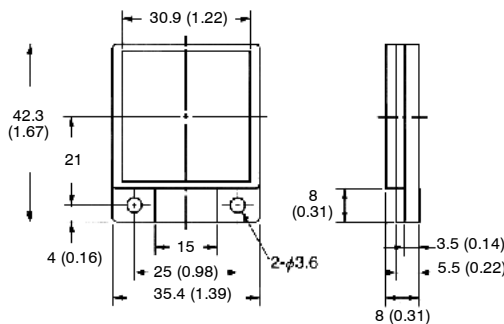
Material  
Surface: Acrylic resin  
Backside: ABS resin



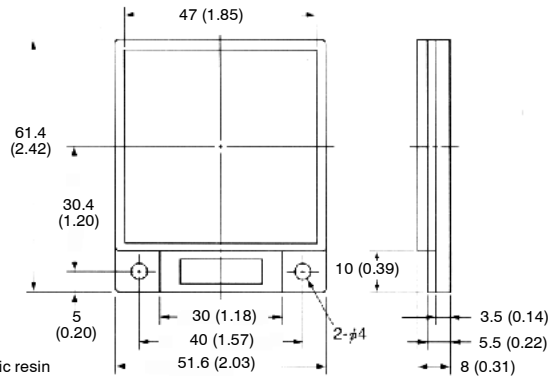
**E39-R9**



Material  
Reflecting surface: Acrylic resin  
Back: ABS resin



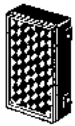
**E39-R10**



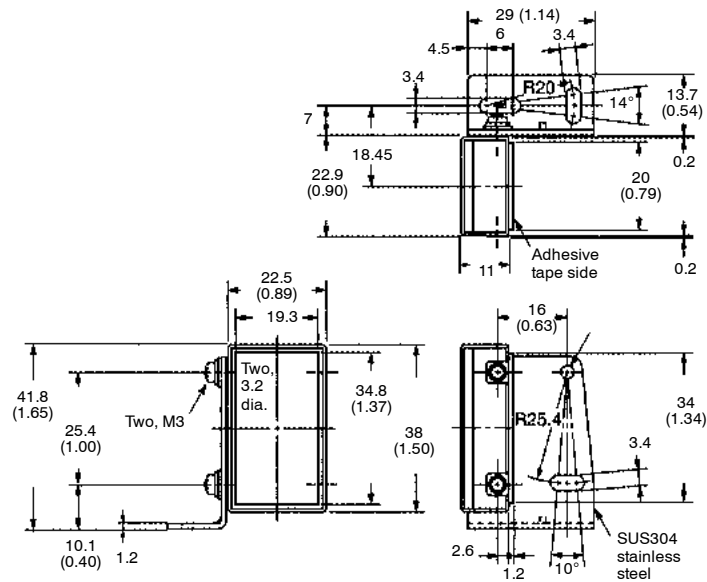
Material  
Reflecting surface: Acrylic resin  
Back: ABS resin

**MINIATURE REFLECTOR**

**E39-R3**



Material  
Surface: Acrylic resin  
Backside: ABS resin

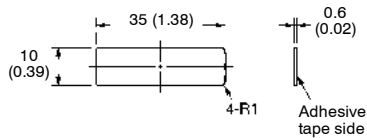


**TAPE REFLECTORS**

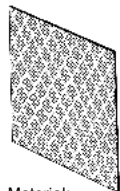
**E39-RS1**



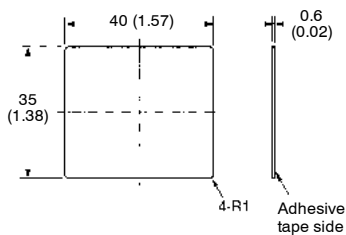
Material:  
Acrylic resin



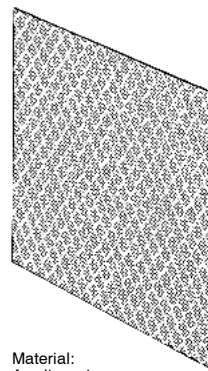
**E39-RS2**



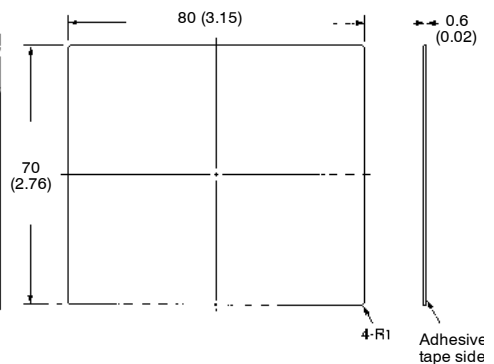
Material:  
Acrylic resin



**E39-RS3**



Material:  
Acrylic resin



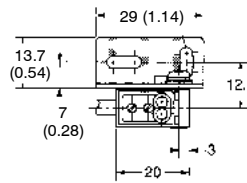
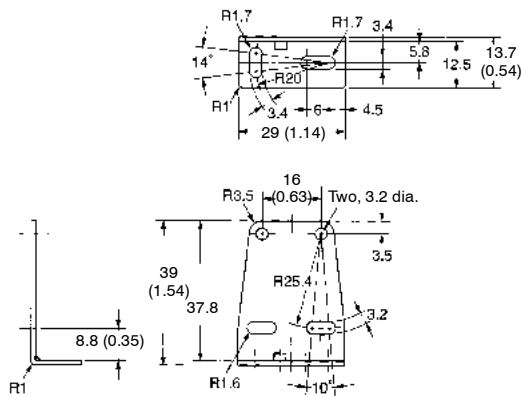
Unit: mm (inch)

■ MOUNTING BRACKETS

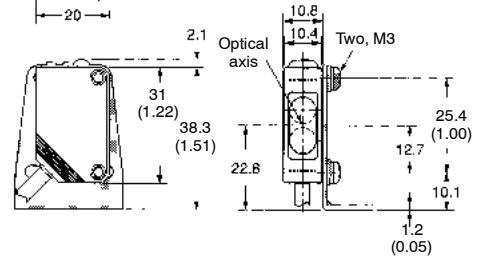
E39-L104



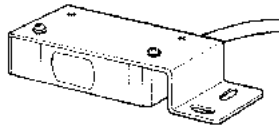
Material:  
SUS304  
stainless steel



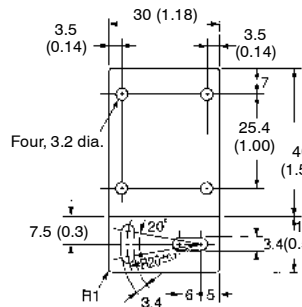
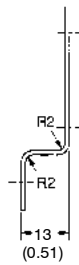
With Mounting Bracket  
(E3Z-D62)



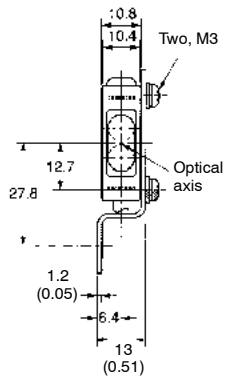
E39-L43



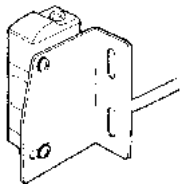
Material:  
SUS304  
stainless steel



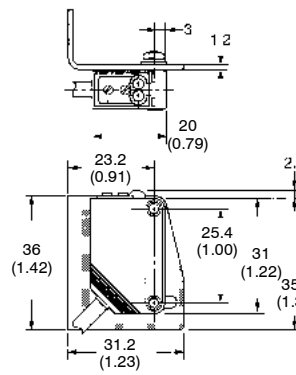
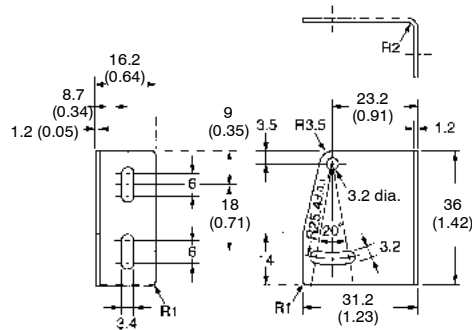
With Mounting Bracket  
(E3Z-D62)



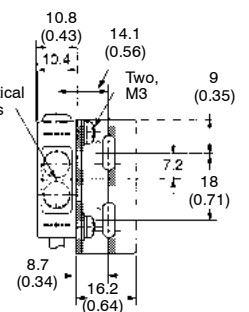
E39-L44



Material:  
SUS304  
stainless steel

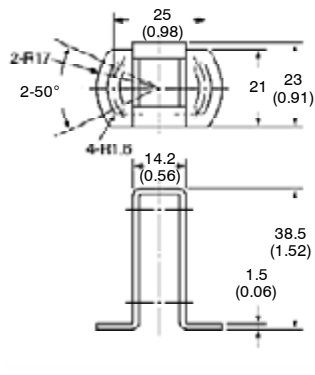


With Mounting Bracket  
(E3Z-D62)

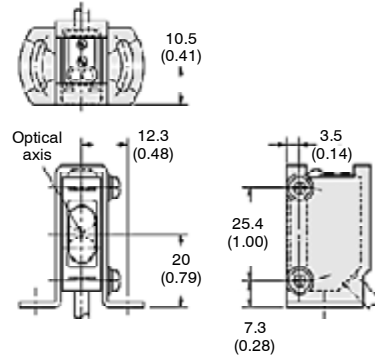


E39-L144

Material:  
SUS304 stainless steel

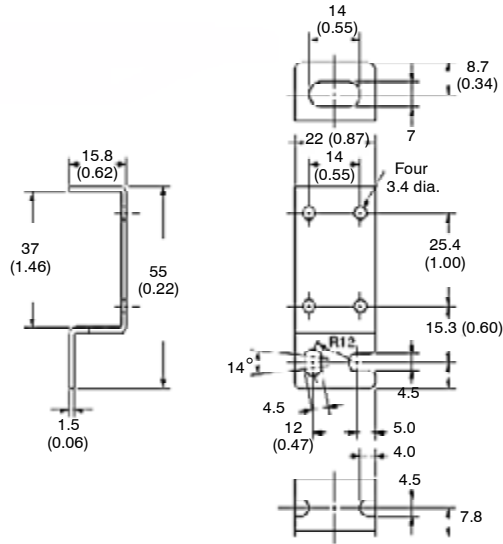


With Sensor  
(Example: E3Z-L61)

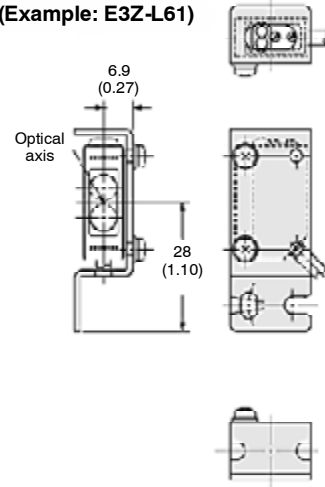


E39-L142

Material:  
SUS304 stainless steel



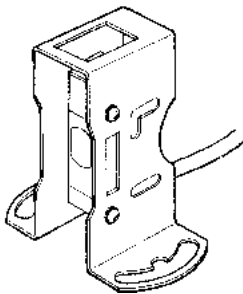
With Sensor  
(Example: E3Z-L61)



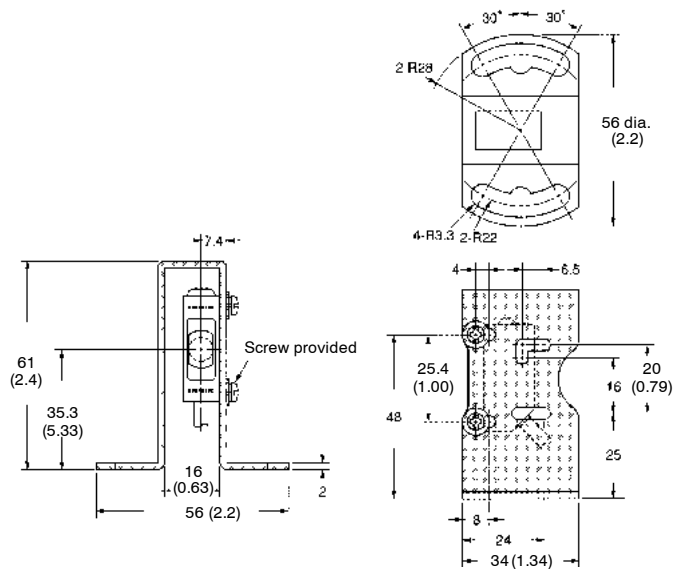
Unit: mm (inch)

E39-L93

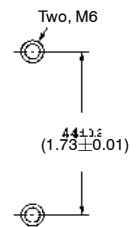
E39-L98



Material:  
SUS304 stainless steel



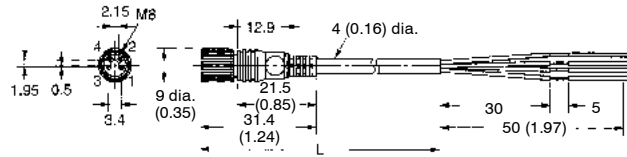
Mounting Holes



## ■ M8 CONNECTOR CORDSETS

### Straight

XS3F-M421-402-A (L=2 m)  
XS3F-M421-405-A (L=5 m)



### Right Angle

XS3F-M422-402-A (L=2 m)  
XS3F-M422-405-A (L=5 m)



## Precautions

To ensure safe sensor operation, please follow the following precautions:

### ■ WIRING

#### Power Supply Voltage

Make sure that the power supply to the Sensor is within the rated voltage range.

#### Load Short-circuiting

Do not short-circuit the load, or the Sensor may be damaged.

#### Polarity

Correct polarity wiring is required to prevent damage to the sensor.

#### Connection Without Load

Do not connect power supply to the Sensor with no load connected, or the internal elements may explode or burn.

### ■ OPERATING ENVIRONMENT

Do not use the Sensor in locations with explosive or flammable gas.

### ■ SETTINGS

#### Power Reset Time

The Sensor is ready to operate 100 ms after the Sensor is turned ON. If the load and Sensor are connected to independent power supplies respectively, be sure to turn ON the Sensor before turning the load ON.

### ■ CONNECTIONS

#### M8 Metal Connector

- Turn off power before disconnecting the sensor.
- Remove the connector cover before connecting or disconnecting the metal connector.
- Secure the connector cover by hand. Do not use any pliers, or the connector may be damaged.
- The proper tightening torque range is between 0.3 and 0.4 N • m. Be sure to tighten the connector securely in order to maintain the the specified degree of protection and to keep the connector from loosening due to vibration.

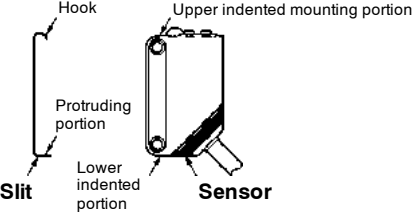
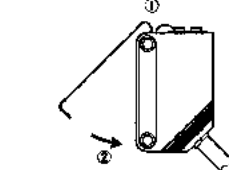
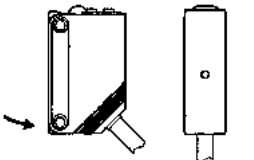
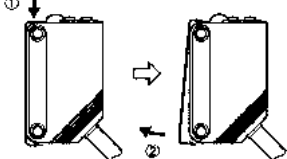
### ■ MOUNTING

Use M3 screws to mount the sensor and tighten each screw to a maximum torque of 0.53 N • m.



## ■ ADJUSTMENT

### Slits for Through-beam Models (E39-S65A/B/C/D/E/F) Sold Separately

|   |   |
|---|---|
|  <p>Hook<br/>Upper indented mounting portion<br/>Protruding portion<br/>Lower indented portion<br/><b>Slit</b>      <b>Sensor</b></p>  |   |
| <p><b>Mounting Method</b></p> <ol style="list-style-type: none"> <li>Hook the upper protruding portion of the Slit to the upper indented mounting portion of the Sensor and adjust the position of the Slit so that the Slit will be in parallel to the lens side of the Sensor.</li> <li>Press the lower protruding portion of the Slit onto the indented mounting portion of the Sensor until the Slit snaps in.</li> </ol> |                                   |
| <p><b>Mounting Condition</b></p>  | <p>Side View      Front View</p>  |
| <p><b>Removal Method</b></p> <ol style="list-style-type: none"> <li>Press the upper portion of the Slit.</li> <li>Disconnect the lower protruding portion of the Slit from the Sensor and remove the Slit.</li> </ol>   |                                  |

**NOTE: DIMENSIONS SHOWN ARE IN MILLIMETERS. To convert millimeters to inches divide by 25.4.**

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**416-286-6465**

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