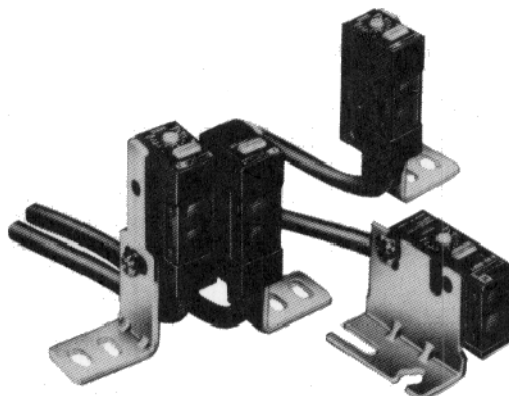


## General Purpose Photoelectric Sensor

## E3S-B

Miniature DC Sensor with Built-in Amplifier Offers Vertical or Horizontal Single-Screw Mounting

- Visible red beam
- High-speed sensing, 0.5 ms response time
- NEMA 4X, 6 and IP67
- Single-screw mounting
- Pre-wired, Light-ON/Dark-ON wire selectable



## Ordering Information

### ■ SENSORS

Through-beam sensors include both emitter and receiver. The polarized retroreflective sensors include E39-R1 reflector. All sensors include mounting hardware.

| Method of detection                                                                            |        | Through-beam  | Polarized retroreflective | Diffuse reflective |
|------------------------------------------------------------------------------------------------|--------|---------------|---------------------------|--------------------|
| Sensing distance                                                                               |        | 2 m (6.56 ft) | 1 m (3.28 ft)             | 20 cm (7.87 in)    |
| Mounting                                                                                       | Output | Part number   |                           |                    |
| Horizontal  | NPN    | E3S-BT11      | E3S-BR11                  | E3S-BD11           |
|                                                                                                | PNP    | E3S-BT31      | E3S-BR31                  | E3S-BD31           |
| Vertical    | NPN    | E3S-BT61      | E3S-BR61                  | E3S-BD61           |
|                                                                                                | PNP    | E3S-BT81      | E3S-BR81                  | E3S-BD81           |

### ■ ACCESSORIES

| Description                                                                                                     |                                | Part number |
|-----------------------------------------------------------------------------------------------------------------|--------------------------------|-------------|
| Slits for E3S-BT□□ sensors (3 pairs of adhesive slits: 2 mm, 1 mm and 0.5 mm wide)                              |                                | E39-S47     |
| Aperture kit for E3S-BT□□ sensors (3 pairs of adhesive apertures: 2 mm, 1 mm and 0.5 mm dia.)                   |                                | E39-S48     |
| Mutual interference filters for E3S-BT□□ sensors (2 pairs: horizontal and vertical, includes mounting hardware) |                                | E39-E8      |
| Small corner cube reflector                                                                                     | 10 to 60 cm (3.94 to 23.62 in) | E39-R3      |
|                                                                                                                 | 7 to 35 cm (2.76 to 13.78 in)  | E39-R4      |
| Adhesive back reflector                                                                                         | 10 to 20 cm (3.94 to 7.87 in)  | E39-RSA     |
|                                                                                                                 | 10 to 30 cm (3.94 to 11.81 in) | E39-RSB     |
| Stainless steel mounting bracket for E39-R1 reflector                                                           |                                | E39-L7      |
| Stainless steel mounting bracket for E39-R3 reflector                                                           |                                | E39-L54     |

### ■ ACCESSORIES

| Description                                                                         | Part number |
|-------------------------------------------------------------------------------------|-------------|
| Corner cube reflector (supplied with E3S-BR□□)                                      | E39-R1      |
| Stainless steel mounting bracket for horizontal sensors (supplied with each sensor) | E39-L71     |
| Stainless steel mounting bracket for vertical sensors (supplied with each sensor)   | E39-L72     |
| Mounting adapter plate                                                              | E39-L61     |

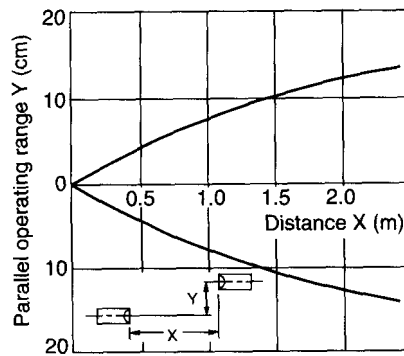
# Specifications

|                                                  |                            |                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                  |                                                  |
|--------------------------------------------------|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| Part number                                      |                            | E3S-BT□□                                                                                                                                                                                                                                                                   | E3S-BT□□                                                                                                                                                                                         | E3S-BD□□                                         |
| Method of detection                              |                            | Through-beam                                                                                                                                                                                                                                                               | Polarized retroreflective                                                                                                                                                                        | Diffuse reflective                               |
| Supply voltage                                   |                            | 10 to 30 VDC, ± 10%                                                                                                                                                                                                                                                        |                                                                                                                                                                                                  |                                                  |
| Current consumption                              |                            | 35 mA max. (emitter and receiver)                                                                                                                                                                                                                                          | 25 mA max.                                                                                                                                                                                       |                                                  |
| Sensing distance                                 | White mat paper            | 0 to 2 m<br>(0 to 6.56 ft)                                                                                                                                                                                                                                                 | 0.1 to 1 m with E39-R1<br>(0.33 to 3.28 ft)                                                                                                                                                      | 0.1 to 20 cm<br>(0.04 to 7.87 in)                |
|                                                  | Black mat paper            |                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                  | 0.2 to 6 cm<br>(0.08 to 2.36 in)                 |
|                                                  | With accessories           | 60 cm (1.97 ft) with E39-E8 filter<br>1 m (3.28 ft) with 2 mm slit<br>50 cm (1.64 ft) with 1 mm slit<br>25 cm (9.84 in) with 0.5 mm slit<br>60 cm (1.97 ft) with 2 mm dia. aperture<br>17 cm (6.69 in) with 1 mm dia. aperture<br>4 cm (1.57 in) with 0.5 mm dia. aperture | 10 to 60 cm with E39-R3<br>(3.94 to 23.62 in)<br>7 to 35 cm with E39-R4<br>(2.76 to 13.78 in)<br>10 to 20 cm with E39-RSA<br>(3.94 to 7.87 in)<br>10 to 30 cm with E39-RSB<br>(3.94 to 11.81 in) | —                                                |
| Light source                                     |                            | Pulse modulated red LED (700 nm)                                                                                                                                                                                                                                           |                                                                                                                                                                                                  |                                                  |
| Standard object                                  | Type                       | Opaque materials                                                                                                                                                                                                                                                           | Opaque materials                                                                                                                                                                                 | Opaque and transparent objects                   |
|                                                  | Size                       | 5.5 mm (0.22 in) dia. minimum                                                                                                                                                                                                                                              | 30 mm (1.18 in) dia. minimum                                                                                                                                                                     | 10 x 10 cm<br>(3.94x 3.94 in)<br>white mat paper |
| Operation mode                                   |                            | Light-ON/Dark-ON operation, wire selectable                                                                                                                                                                                                                                |                                                                                                                                                                                                  |                                                  |
| Variation in sensing distance                    |                            | —                                                                                                                                                                                                                                                                          | —                                                                                                                                                                                                | +30% max., -0% max.                              |
| Hysteresis                                       |                            | —                                                                                                                                                                                                                                                                          | —                                                                                                                                                                                                | 20% max.                                         |
| Variation in optical axis and mounting direction |                            | ± 2° max.                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                  |                                                  |
| Sensitivity                                      |                            | Adjustable, 3/4-turn potentiometer                                                                                                                                                                                                                                         |                                                                                                                                                                                                  |                                                  |
| Mutual interference protection                   |                            | Not provided                                                                                                                                                                                                                                                               | Provided                                                                                                                                                                                         | Provided                                         |
| Control output                                   | Type                       | NPN transistor, open collector (E3S-B□11, E3SB□61)<br>PNP transistor, open collector (E3S-B□31, E3SB□81)                                                                                                                                                                   |                                                                                                                                                                                                  |                                                  |
|                                                  | Max. load                  | 100 mA max. at 30 VDC                                                                                                                                                                                                                                                      |                                                                                                                                                                                                  |                                                  |
|                                                  | Max. ON-state voltage drop | 1 VDC max. at 100 mA load current                                                                                                                                                                                                                                          |                                                                                                                                                                                                  |                                                  |
| Response time                                    |                            | 0.5 ms max. for both ON and OFF operation                                                                                                                                                                                                                                  |                                                                                                                                                                                                  |                                                  |
| Circuit protection                               |                            | Load short-circuit protection, reverse polarity protection                                                                                                                                                                                                                 |                                                                                                                                                                                                  |                                                  |
| Indicators                                       |                            | Emitter:<br>Operation (red)<br>Receiver:<br>Operation (red)<br>Stability (green)                                                                                                                                                                                           | Operation (red), Stability (green)                                                                                                                                                               |                                                  |
| Materials                                        | Lens                       | Denatured polyarylate                                                                                                                                                                                                                                                      |                                                                                                                                                                                                  |                                                  |
|                                                  | Case                       | Polybutylene terephthalate (PBT)                                                                                                                                                                                                                                           |                                                                                                                                                                                                  |                                                  |
|                                                  | Bracket                    | Stainless steel                                                                                                                                                                                                                                                            |                                                                                                                                                                                                  |                                                  |
| Mounting                                         |                            | Either side surface with one stud and one threaded hole. Bracket E39-L71 for horizontal or E39-L72 for vertical sensors and hardware included.                                                                                                                             |                                                                                                                                                                                                  |                                                  |
| Connections                                      | Prewired                   | 2 m (6.56 ft) long cable                                                                                                                                                                                                                                                   |                                                                                                                                                                                                  |                                                  |
| Weight                                           | Emitter                    | 56 g (1.96 oz)                                                                                                                                                                                                                                                             | 56 g (1.96 oz)                                                                                                                                                                                   | 65 g (2.28 oz)                                   |
|                                                  | Receive                    | 66 g (2.31 oz)                                                                                                                                                                                                                                                             | —                                                                                                                                                                                                | —                                                |
| Enclosure rating                                 | IEC 144                    | IP67                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                  |                                                  |
|                                                  | NEMA                       | 4X, 6                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                  |                                                  |
| Ambient temperature                              | Operating                  | -25° to 55°C (-13° to 131°F) with no icing                                                                                                                                                                                                                                 |                                                                                                                                                                                                  |                                                  |
|                                                  | Storage                    | -40° to 70°C (-40° to 158°F)                                                                                                                                                                                                                                               |                                                                                                                                                                                                  |                                                  |

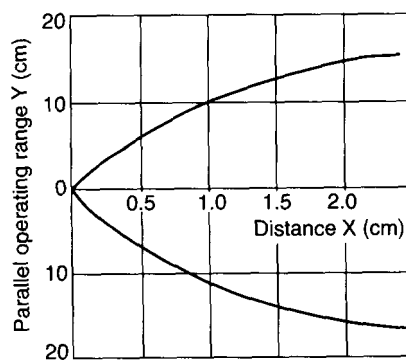


## ■ OPERATING RANGE

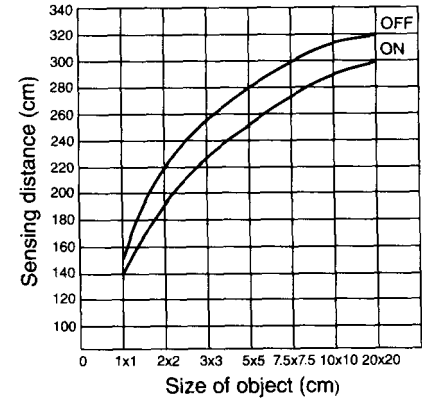
### Parallel Operating Range (Typical)



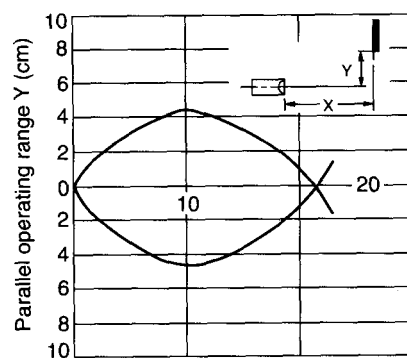
**E3S-BT□1 (Up and down)**



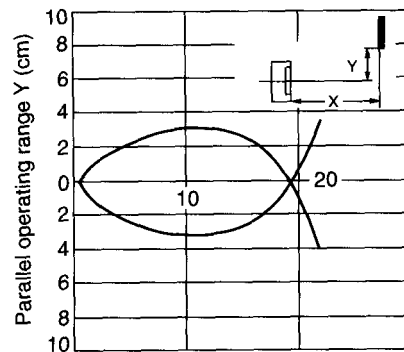
## Sensing Distance vs. Set Distance



**E3S-BD□1 (Left and Right)**



**E3S-BD□1 (Up and down)**

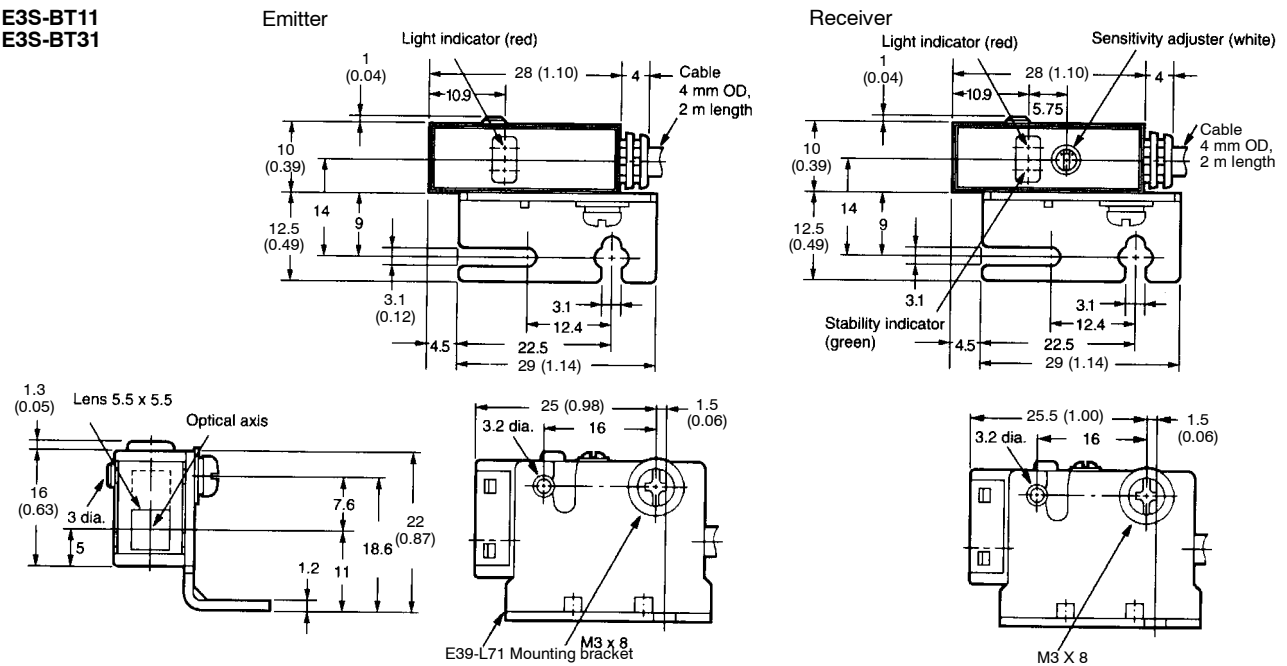


# Dimensions

Unit: mm (inch)

## ■ SENSORS

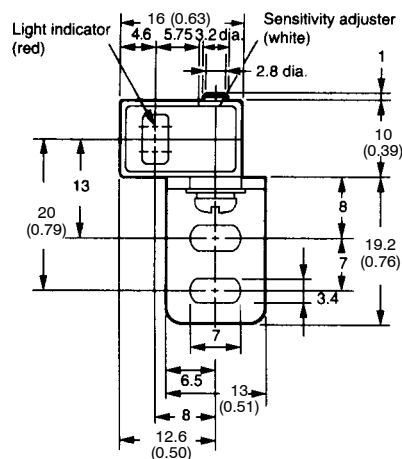
E3S-BT11  
E3S-BT31



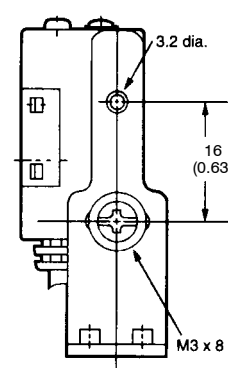
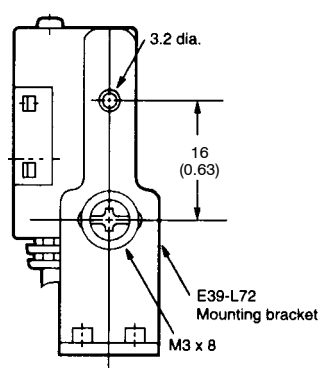
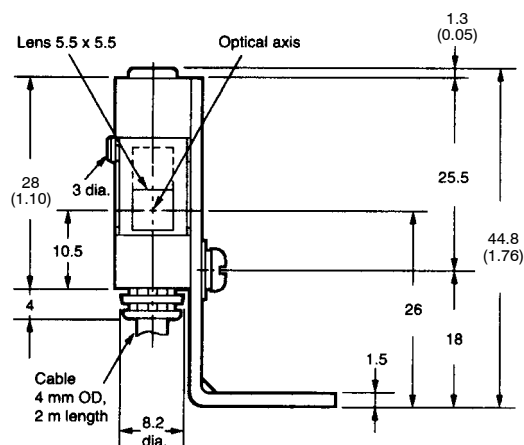
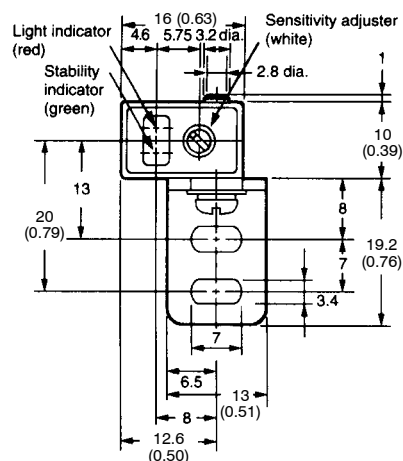
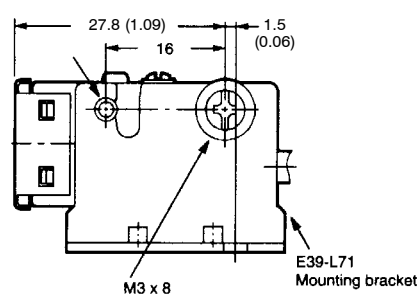
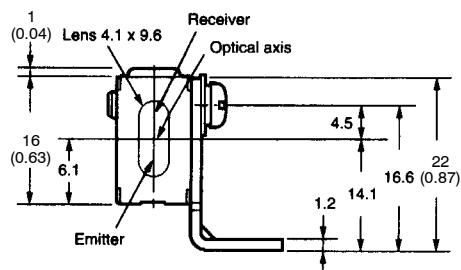
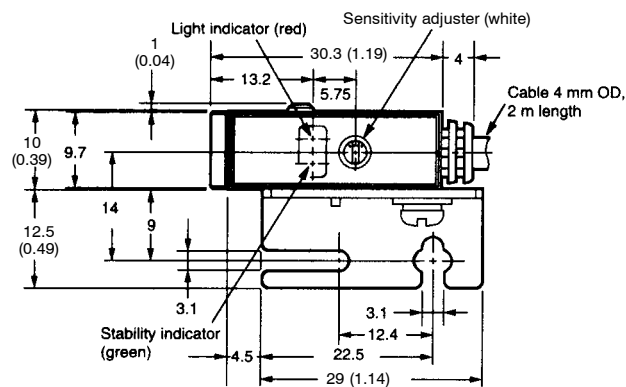
Unit: mm (inch)

**E3S-BT61****E3S-BT81**

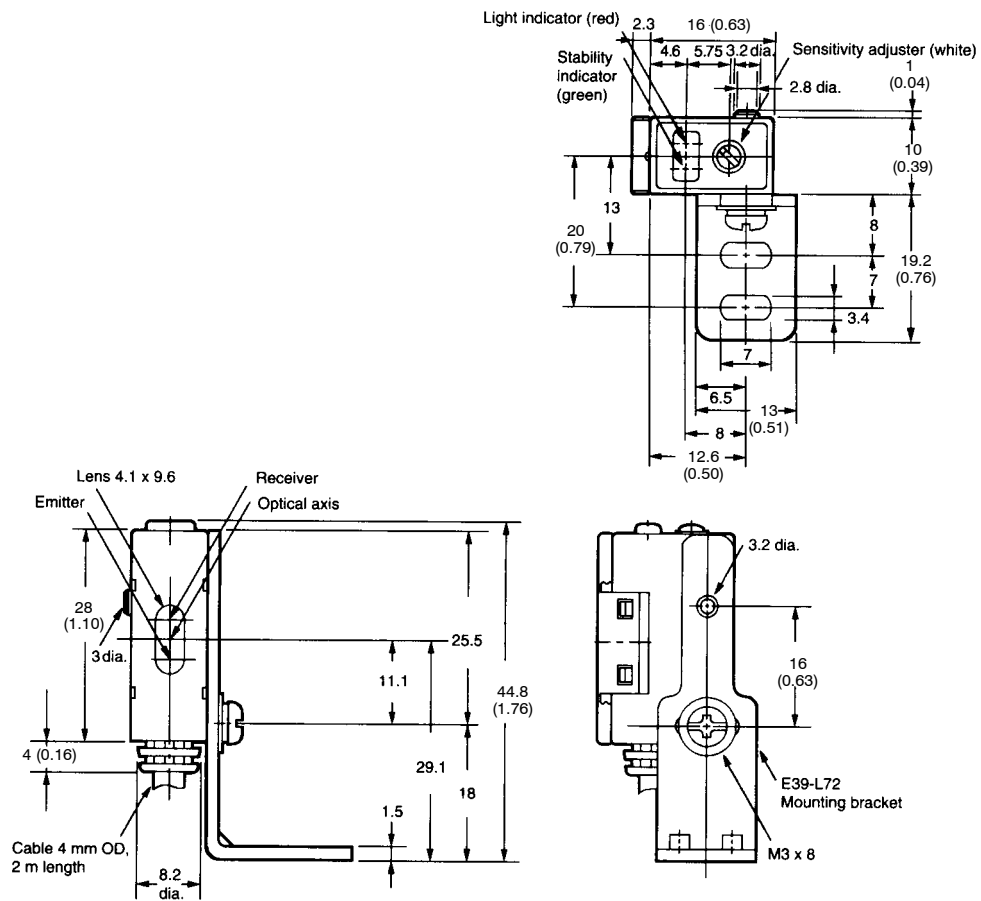
Emitter



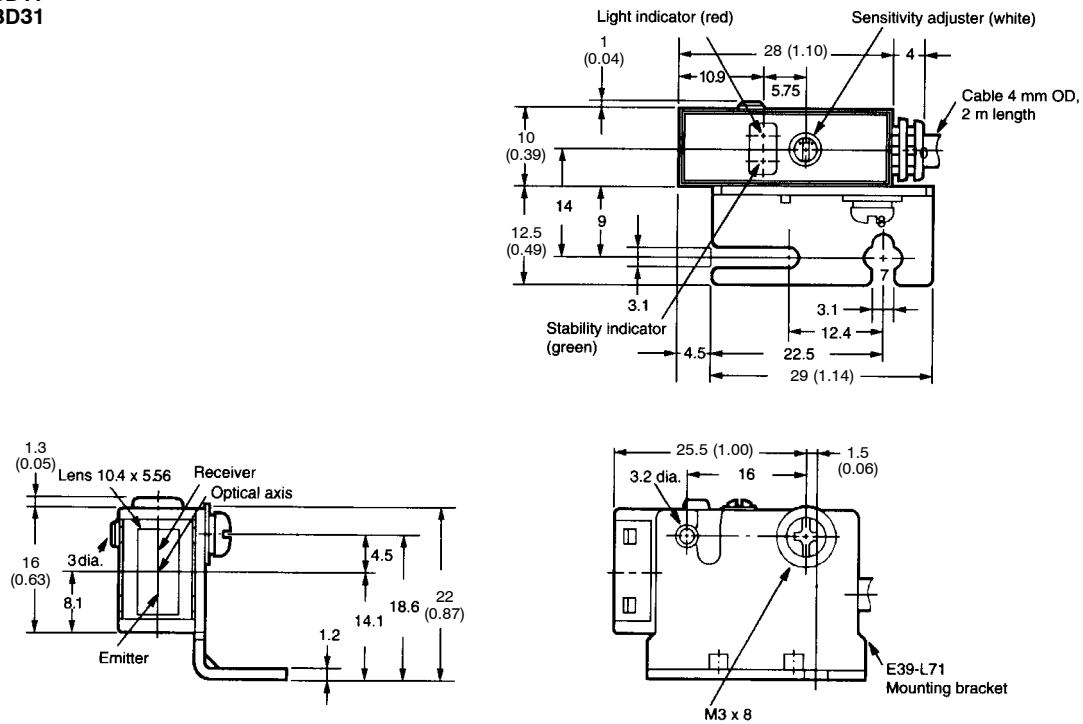
Receiver

**E3S-BR11****E3S-BR31**

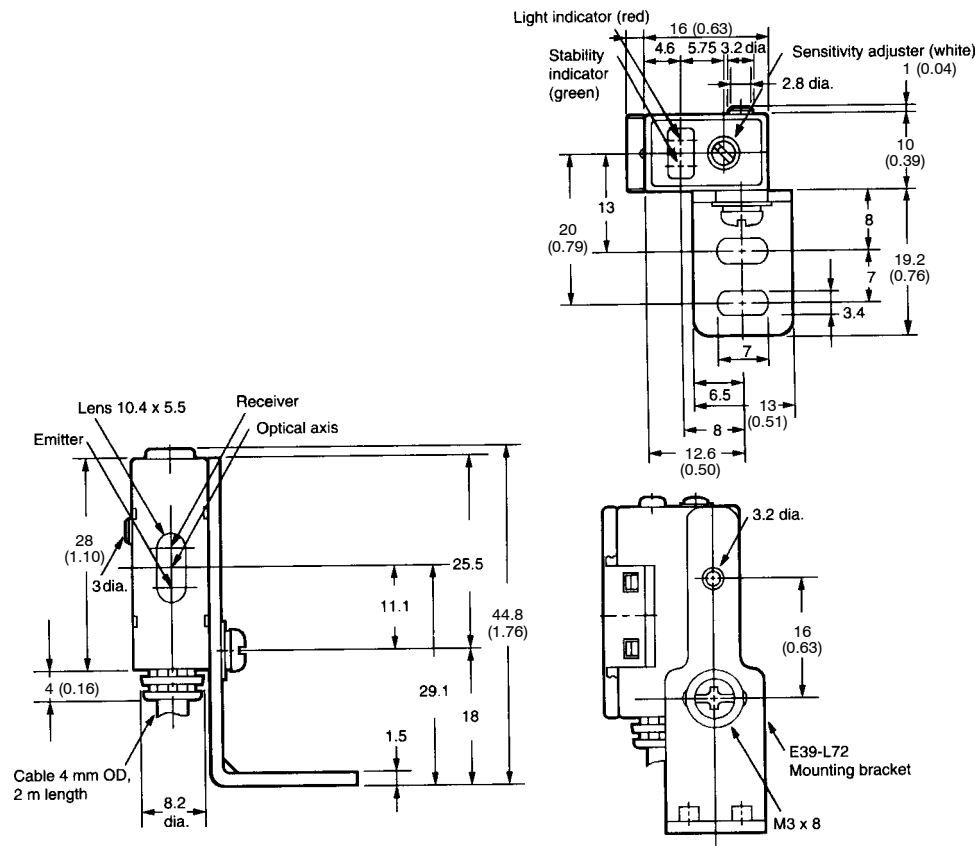
E3S-BR61  
E3S-BR81



E3S-BD11  
E3S-BD31

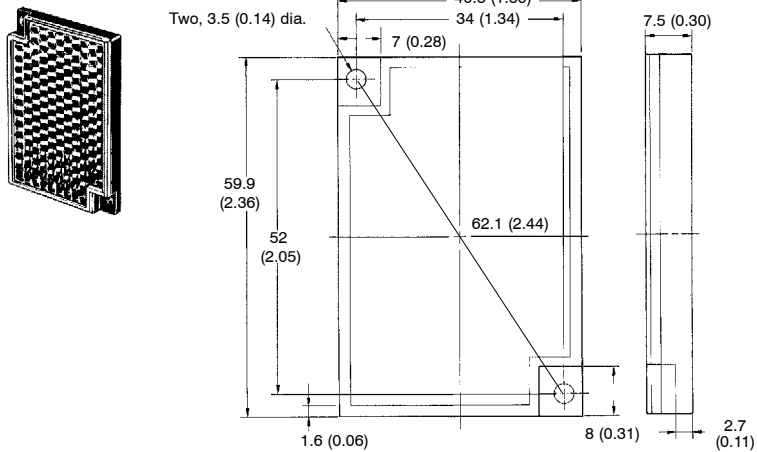


Unit: mm (inch)

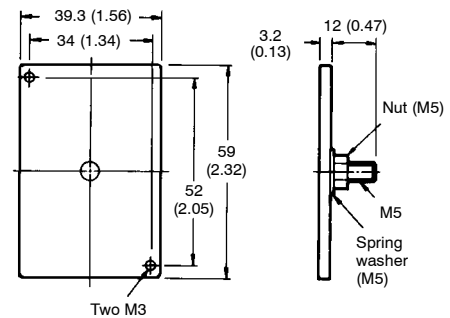
**E3S-BD61****E3S-BD81**

## CORNER CUBE REFLECTORS

**E39-R1 Reflector**  
(Included with E3S-AR□)



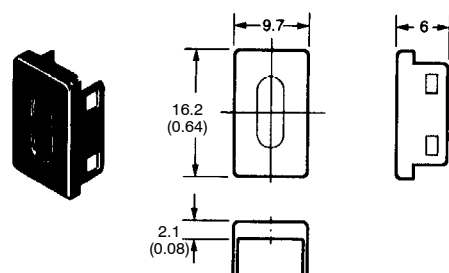
**E39-L7 R1 Reflector Adapter**  
for E39-R1 Reflector  
(Order Separately)





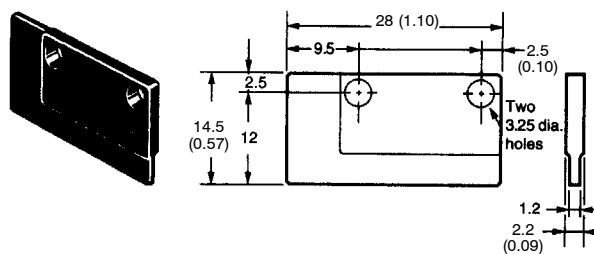
## ■ MUTUAL INTERFERENCE FILTER

E39-E8



## ■ MOUNTING ADAPTER PLATE

E39-L61



## Operation

### ■ SENSITIVITY ADJUSTMENT

Unlike conventional photoelectric sensors, the variation in the sensitivity of E3S photoelectric sensors is minimal. This means the sensitivity can be adjusted on only a single photoelectric sensor, and then the adjusters on the other photoelectric sensors can be set to the same scale position. There is no need to adjust the sensitivity of each photoelectric sensor individually.

| Steps                | Step 1                                                                                                                                                                                                                                                                                                       | Step 2                                                                                                                                                                                                                                                                 | Step 3                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Function             | Determine Position A                                                                                                                                                                                                                                                                                         | Determine Position B                                                                                                                                                                                                                                                   | Adjust to optimum setting                                                                                                                                                                                                                                                                                                                                                                  |
| Sensing condition    |                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                            |
| Sensitivity adjuster |                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                            |
| Indicators           | OFF  STABILITY (green)    ON  LIGHT (red)                                                                                                                                                                                                                                                                    | OFF  STABILITY (green)    OFF  LIGHT (red)                                                                                                                                                                                                                             | ON  STABILITY (green)    OFF  LIGHT (red)                                                                                                                                                                                                                                                                                                                                                  |
|                      | Place target at the desired sensing distance. Set sensitivity adjuster to the minimum scale position and gradually increase sensitivity by turning the sensitivity adjuster clockwise until the Light Incident indicator (red LED) turns ON. Position A designates the point at which the LED has turned ON. | Remove the target. Starting from the maximum scale position, gradually decrease sensitivity by turning the sensitivity adjuster counterclockwise until the Light Incident indicator (red LED) is OFF. Position B designates the point at which the LED has turned OFF. | Set the sensitivity indicator to the position between Positions A and B (in some cases, Positions A and B are opposite of the above example). The photoelectric sensor will then work normally if the stability indicator (green) is lit with and without the target. If it is not lit, stable operation cannot be expected, in which case a different detection method should be applied. |

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

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