OMRON

# Long Range Metal Body Sensor

# E3S-C

## 30 m Range With Advanced Fuzzy Logic

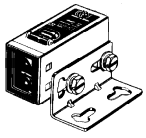
- Mutual interference protection
- NPN/PNP switch selectable output
- M12 plug-in connector
- Meets IP67 and NEMA 4X, 6P
- Vibration resistance of 10 Hz to 2 kHz and a shock resistance of 1,000 m/s$^2$ (approx. 100 G)



ISO 9001 Approved
OMRON Corporation, Ayabe Factory, Sensing Components and Systems

# Ordering Information

## ■ SENSORS

| Mounting | Method of detection | Sensing distance | Part number | |
|---|---|---|---|---|
| | | | Pre-leaded | Connector |
| Horizontal  | Through-beam | 30 m (98.43 ft) | **E3S-CT11** | **E3S-CT16** |
| | Polarized retroreflective | 3 m (9.84 ft) | **E3S-CR11** | **E3S-CR16** |
| | Diffuse reflective | 70 cm (27.56 in) | **E3S-CD11** | **E3S-CD16** |
| | | 2 m (6.56 ft) | **E3S-CD12** | **E3S-CD17** |
| Vertical  | Through-beam | 30 m (98.43 ft) | **E3S-CT61** | **E3S-CT66** |
| | Polarized retroreflective | 3 m (9.84 ft) | **E3S-CR61** | **E3S-CR66** |
| | Diffuse reflective | 70 cm (27.56 in) | **E3S-CD61** | **E3S-CD66** |
| | | 2 m (6.56 ft) | **E3S-CD62** | **E3S-CD67** |

## ■ ACCESSORIES

| Description | Part number |
|---|---|
| Slits for E3S-CT□□sensors (4 pairs: 0.5 mm, 1.0 mm, 2 mm, and 4 mm wide, includes mounting hardware) | **E39-S61** |
| Mounting bracket for E39-R1 reflector | **E39-L7** |

## ■ CONNECTOR CABLES

| Connector type | Cable size | Length | Straight connector | Right angle connector |
|---|---|---|---|---|
| 3-wire DC MicroChange® | 22 AWG | 2 m (6.56 ft) | **Y96E-43SD2** | **Y96E-43RD2** |
| | | 5 m (16.40 ft) | **Y96E-43SD5** | **Y96E-43RD5** |
| | | 10 m (32.8 ft) | **Y96E-43SD10** | **Y96E-43RD10** |

## ■ REPLACEMENT PARTS

| Description | Part number |
|---|---|
| Mounting bracket for E3S-C□1□ (horizontal) | **E39-L102** |
| Mounting bracket for E3S-C□6□ (vertical) | **E39-L103** |
| Reflector (supplied with retroreflective sensors) | **E39-R1** |

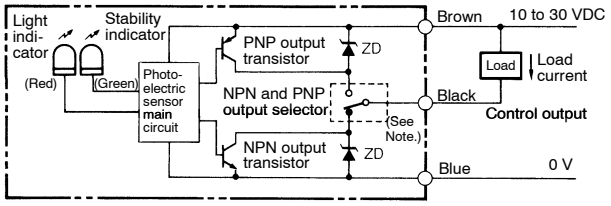
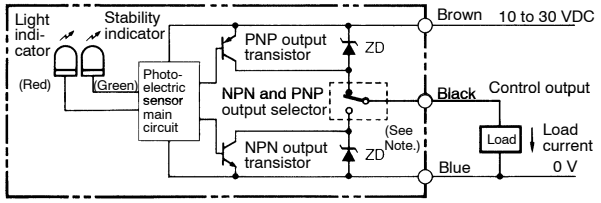
# Specifications

| Part number | | E3S-CT11<br>E3S-CT61<br>E3S-CT16<br>E3S-CT66 | E3S-CR11<br>E3S-CR61<br>E3S-CR16<br>E3S-CR66 | E3S-CD11<br>E3S-CD61<br>E3S-CD16<br>E3S-CD66 | E3S-CD12<br>E3S-CD62<br>E3S-CD17<br>E3S-CD67 |
|---|---|---|---|---|---|
| Method of detection | | Through-beam | Polarized retroreflective | Diffuse reflective | |
| Supply voltage | | 10 to 30 VDC, ±10% | | | |
| Current consumption | | 50 mA max. (emitter and receiver) | 40 mA max. | | |
| Sensing distance | White mat paper | 0 to 30 m<br>(0 to 98.43 ft) | 0 to 3 m<br>(0 to 9.84 ft) | 0 to 70 cm<br>(0 to 27.56 in) | 0 to 2 m<br>(0 to 6.56 ft) |
| | With accessories | 4-mm slit: 15 m<br>2-mm slit: 7 m<br>1-mm slit: 3.5 m<br>0.5-mm slit: 1.8 m | E39-R2: 0 to 4 m<br>E39-R3: 0 to 150 cm<br>E39-R4: 0 to 75 cm<br>E39-RSA: 5 to 35 cm<br>E39-RSB: 5 to 60 cm | ___ | |
| | Minimum object size | 4-mm slit: 2.6-mm dia.<br>2-mm slit: 2-mm dia.<br>1-mm slit: 1-mm dia.<br>0.5-mm slit: 0.5-mm dia. | E39-R1 Reflector: 13-mm dia.<br>E39-R3: 8-mm dia.<br>E39-R4: 4-mm dia. | ___ | |
| Light source | | Pulse modulated infrared LED (880 nm) | Pulse modulated red LED (700 nm) | Pulse modulated infrared LED (880 nm) | |
| Standard object | Type | Opaque materials | Opaque materials | Opaque and transparent materials | |
| | Size | 9 mm (3.54 in) min. | 30 mm (1.18 in) min. | 30 x 30 cm (11.81 x 11.81 in) white mat paper | |
| Operation mode | | Light-ON/Dark-ON operation, switch selectable | | | |
| Variation in sensing distance | | - | | ±10% max. | |
| Hysteresis | | - | | 20% max. of sensing distance | |
| Variation in optical axis and mounting direction | | ±2° max. | | | |
| Sensitivity | | Adjustable, 3/4 turn knob | | Adjustable, 2-1/2 turn knob with clutch and indicator | |
| Mutual interference protection | | Not provided | Provided | | |
| Control output | Type | NPN or PNP (selectable), open collector current output | | | |
| | Max. load | 100 mA max. | | | |
| | Residual voltage | NPN output: 1.2 V max., PNP output: 2.0 V max. | | | |
| Response time | OFF | 1 ms max. | | | 2 ms max. |
| | ON | 1 ms max. | | | 2 ms max. |
| Circuit protection | | Output short-circuit protection, reversed polarity protection | | | |
| Vibration resistance | Destruction | 10 to 2 kHz, 1.5-mm double amplitude, or 300 m/s$^2$ (approx. 30G) 0.5 hrs each in X, Y, and Z axes | | | |
| Shock resistance | Destruction | 1,000 m/s$^2$ (approx. 100G) 3 times each in X, Y, and Z axes | | | |

(This table continues on the next page.)

| Part number | | E3S-CT11<br>E3S-CT61<br>E3S-CT16<br>E3S-CT66 | E3S-CR11<br>E3S-CR61<br>E3S-CR16<br>E3S-CR66 | E3S-CD11<br>E3S-CD61<br>E3S-CD16<br>E3S-CD66 | E3S-CD12<br>E3S-CD62<br>E3S-CD17<br>E3S-CD67 |
|---|---|---|---|---|---|
| Indicators | Emitter | Power ON (red) | Stability indicator (green), Light Incident (red) | | |
| | Receiver | Stability indicator (green), Light Incident (red) | | | |
| Materials | Lens | Acrylic | | | |
| | Case | Zinc die-cast | | | |
| | Operation panel | Sulfonated polyether | | | |
| | Bracket | Stainless steel | | | |
| Mounting | | Either side surface with two threaded holes. Bracket for horizontal (E39-L102) or vertical (E39-L103) sensors and hardware included. | | | |
| Connections | Emitters | 2-conductor cable, 2 m (6.56 ft) length or 4 pin, 12 mm connector | 3-conductor cable, 2 m (6.56 ft) length (for prewired types) | | |
| | Receiver | 3-conductor cable, 2 m (6.56 ft) length or 4 pin, 12 mm connector | | | |
| Weight | Horizontal model | 110 g (3.88 oz.) | | | |
| | Vertical model | 115 g (4.06 oz.) | | | |
| Enclosure ratings | IEC 144 | IP67 | | | |
| | NEMA | 1, 4X, 6P, 12, 13 | | | |
| Ambient temperature | Operating | -25°C to 55°C (-13°F to 131°F) | | | |
| | Storage | -40°C to 70°C (-40°F to 158°F) | | | |

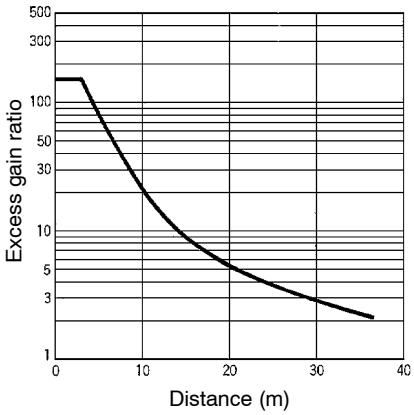
## ■ OUTPUT CIRCUIT DIAGRAMS

| Output configuration | Mode switch | Output transistor | Output circuits |
|---|---|---|---|
| NPN | Light-ON | ON when light is received. |  |
| | Dark-ON | ON when light is not received. | |
| | | | ZD : $V_Z$ = 39 V Note: Set the NPN and PNP output selector to NPN. |
| PNP | Light-ON | ON when light is received. |  |
| | Dark-ON | ON when light is not received. | |
| | | | ZD : $V_Z$ = 39 V Note: Set the NPN and PNP output selector to PNP. |

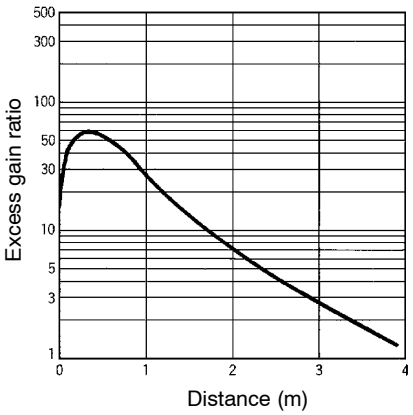
# Engineering Data

## ■ EXCESS GAIN RATIO

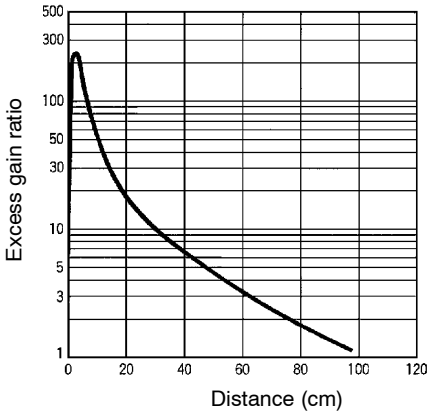
**E3S-CT□6**



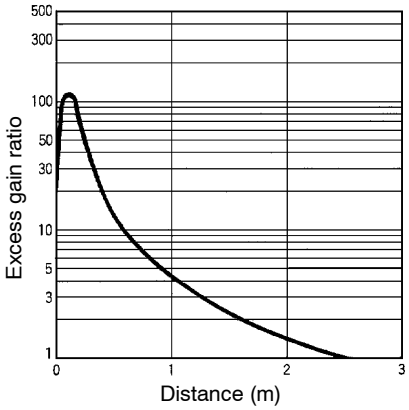

**E3S-CR□6 (E39-R1 Reflector)**




**E3S-CD□6**



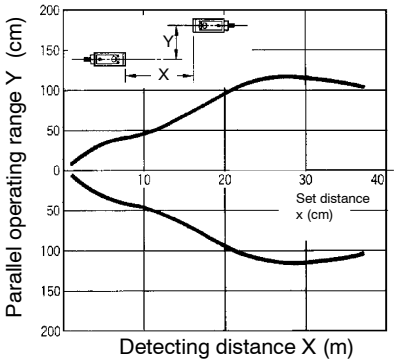

**E3S-CD□2**
**E3S-CD□7**




## ■ OPERATING RANGE

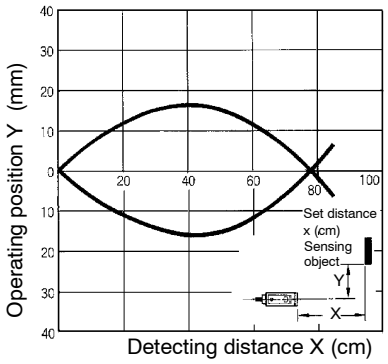
### Parallel Operating Range (Typical)

**E3S-CT□6**

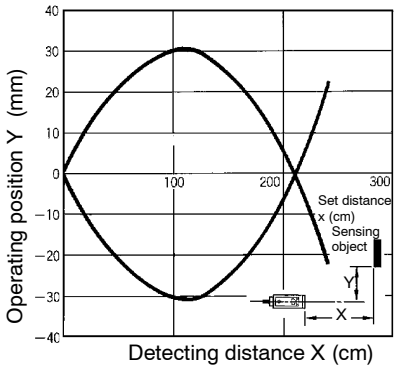



### Operating Range (Typical)

**E3S-CD□6 (Left and Right)**

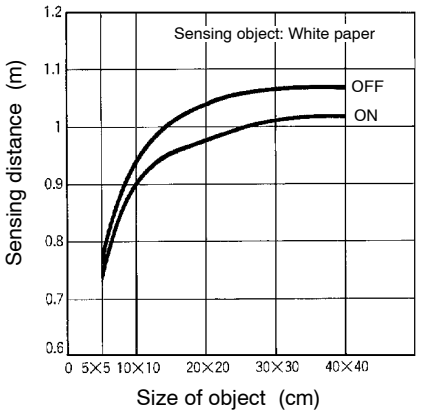



**E3S-CD□7 and E3S-CD□2 (Left and Right)**

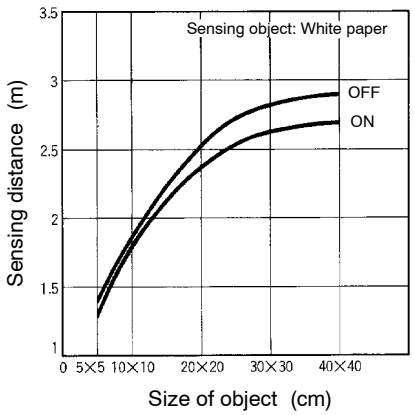


## ■ SENSING DISTANCE VS. OBJECT SIZE (TYPICAL)

**E3S-CD□6**

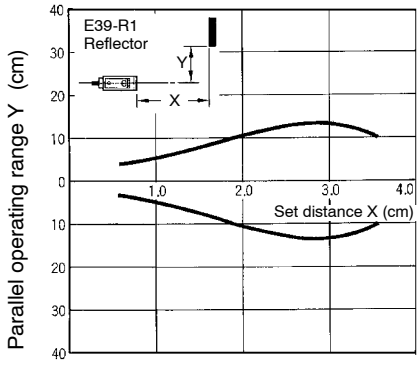



**E3S-CD□7**
**E3S-CD□2**

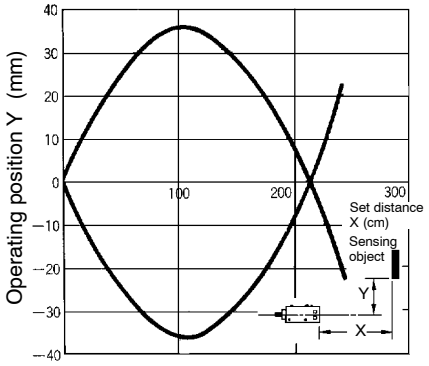



## ■ REFLECTOR PARALLEL MOVEMENT (TYPICAL)

**E3S-CR□6**




**E3S-CD□7 and E3S-CD□2 (Up and Down)**

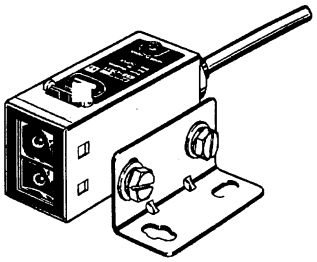


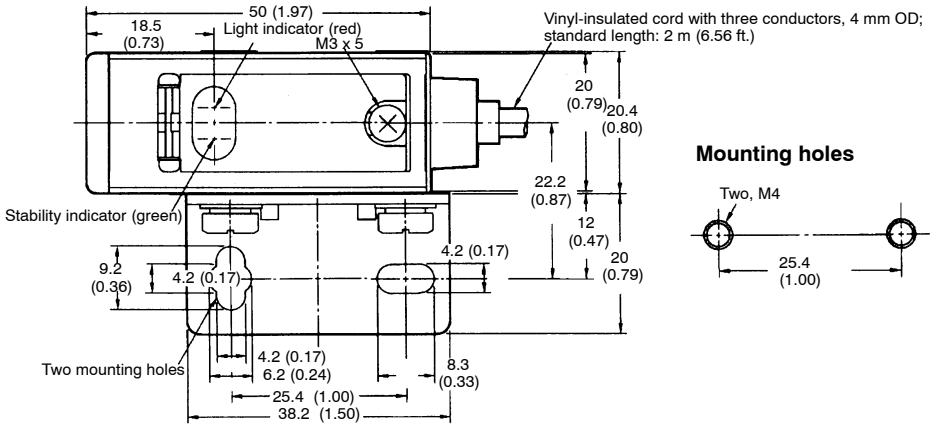
# Dimensions

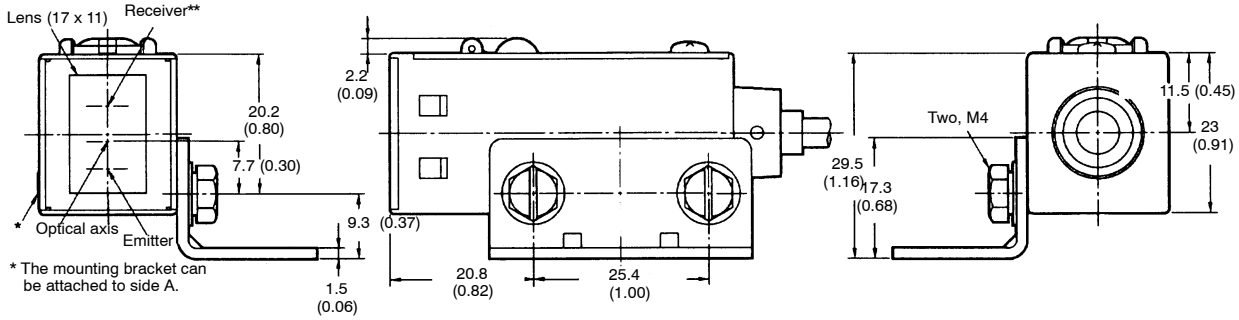
Unit: mm (inch)

## ■ SENSORS

**E3S-CT11, E3S-CR11**
**E3S-CD11, E3S-CD12**



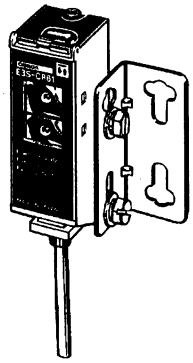


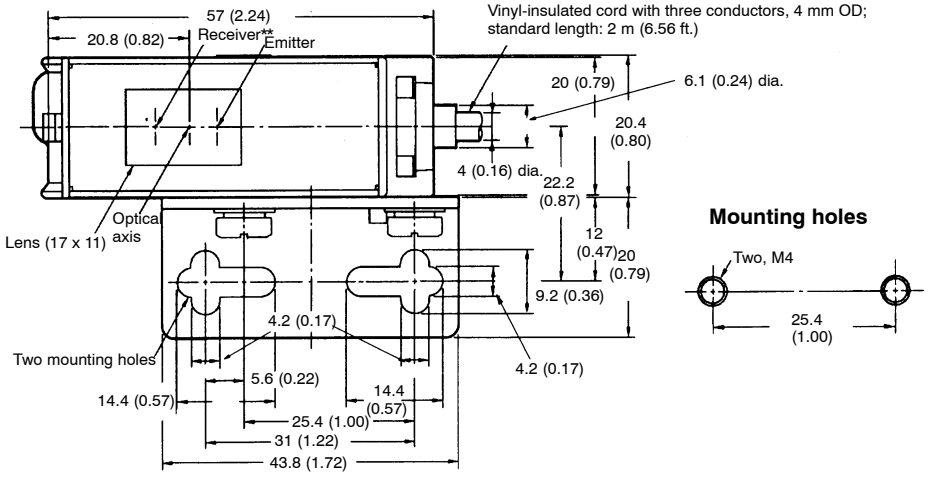



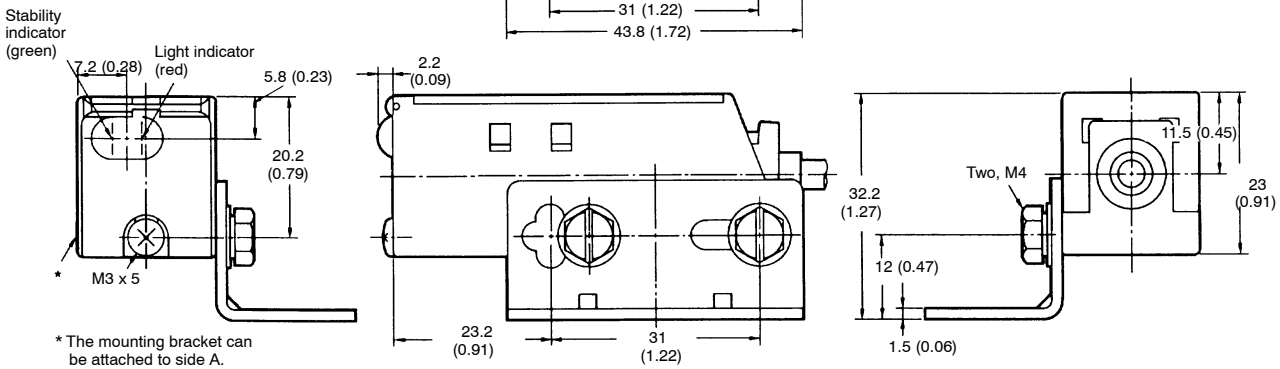

* The mounting bracket can be attached to side A.

** For E3S-CT11, optical viewing for the emitter and the receiver are from the top portion of the sensor.

**E3S-CT61, E3S-CR61**
**E3S-CD61, E3S-CD62**



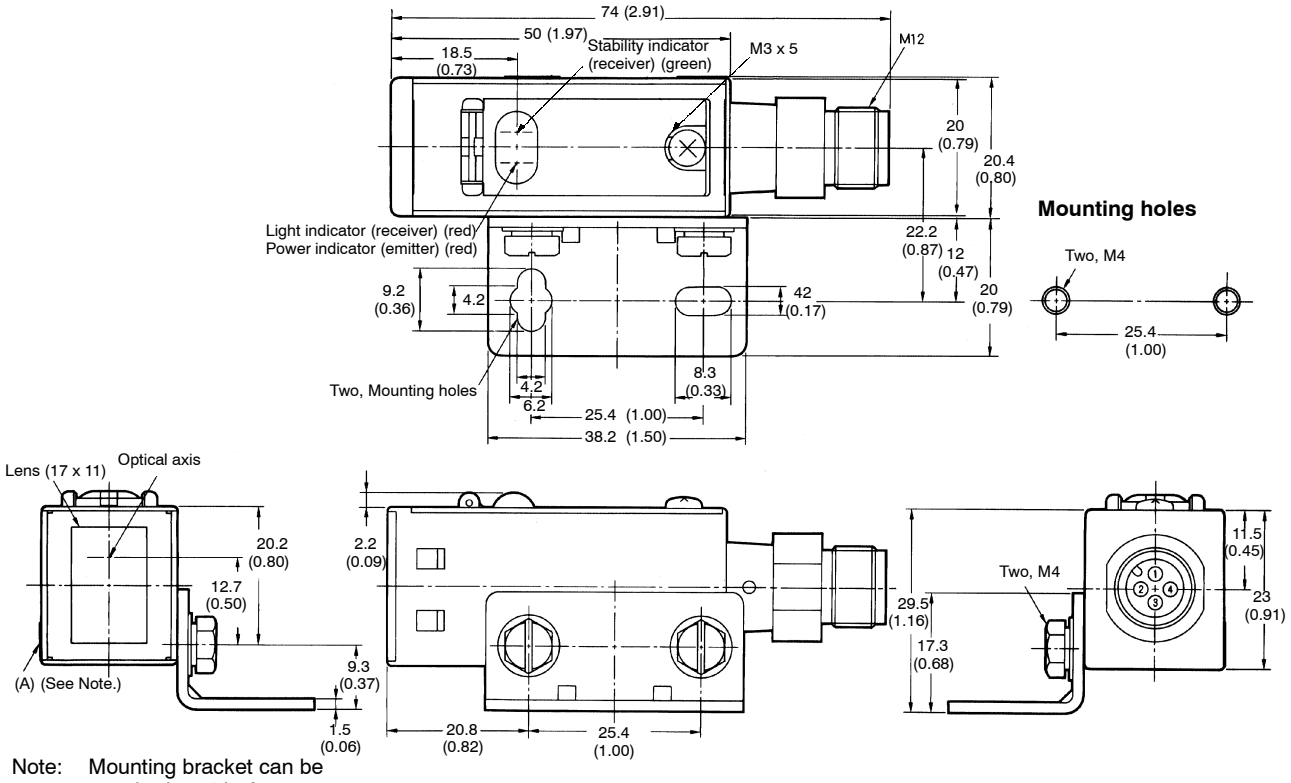



* The mounting bracket can be attached to side A.

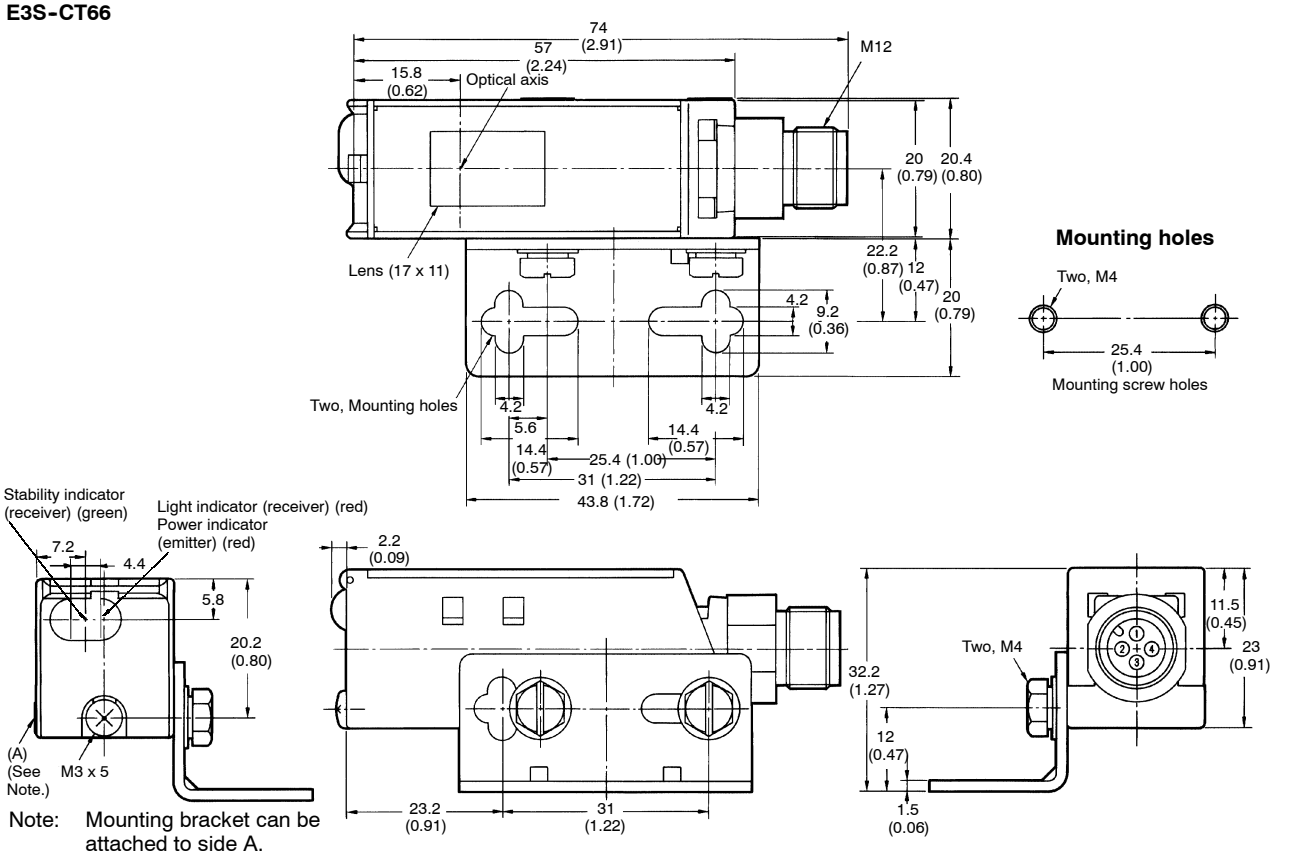
** For E3S-CT61, optical viewing for the emitter and the receiver are from the top portion of the sensor.

**E3S-CT16**



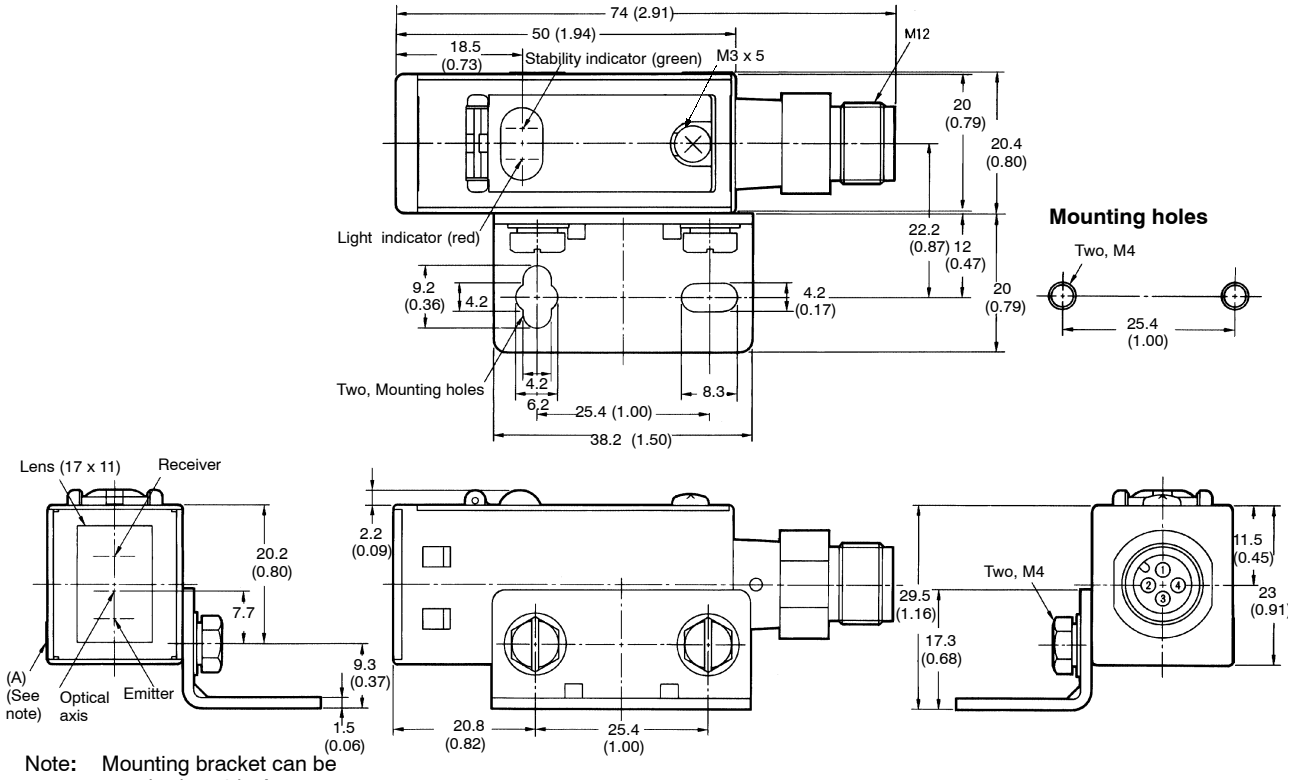

Note: Mounting bracket can be attached to side A.

**E3S-CT66**



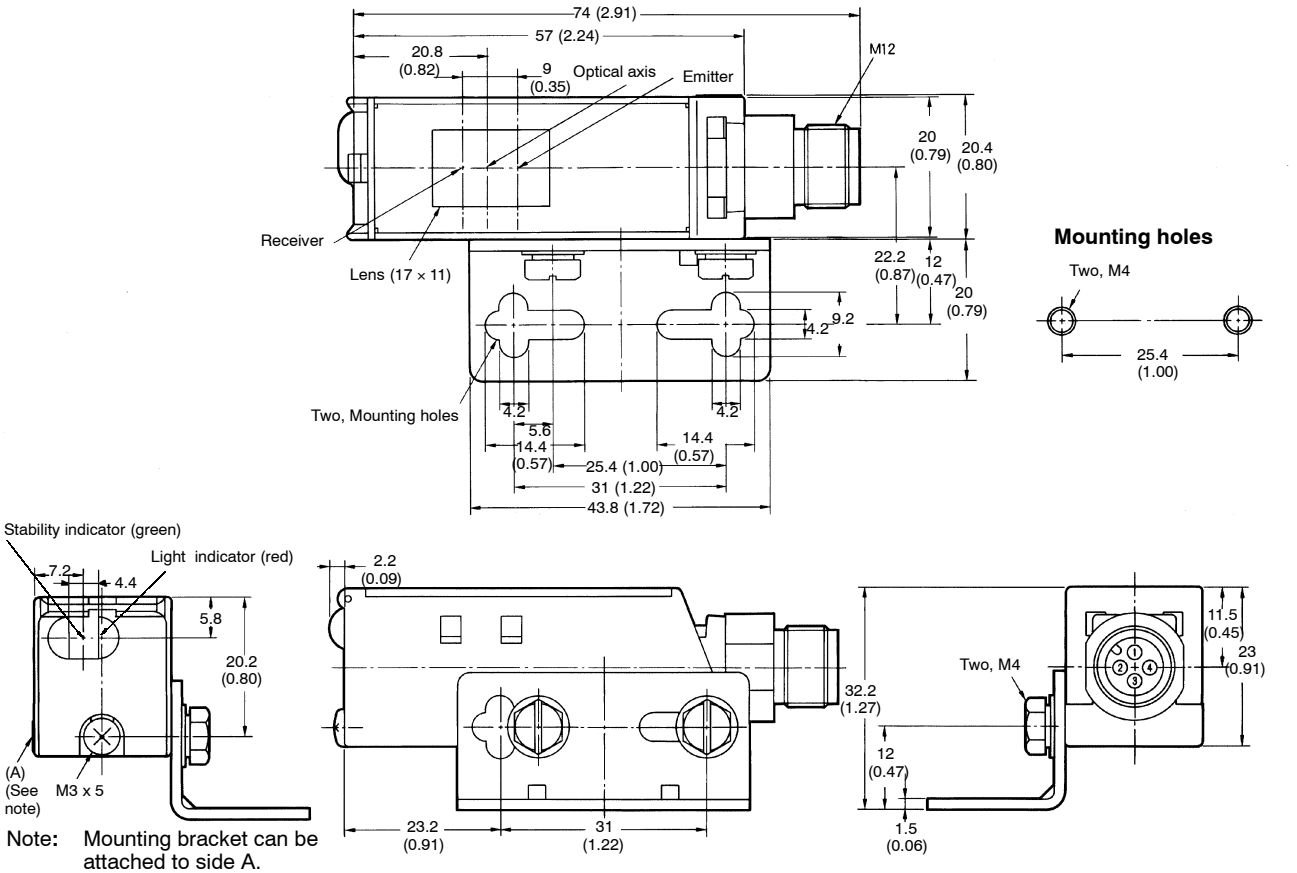

Note: Mounting bracket can be attached to side A.

**E3S-CR16/-CD16/-CD17**




Note: Mounting bracket can be attached to side A.

**E3S-CR66/-CD66/-CD67**

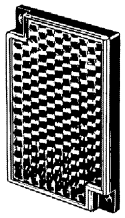


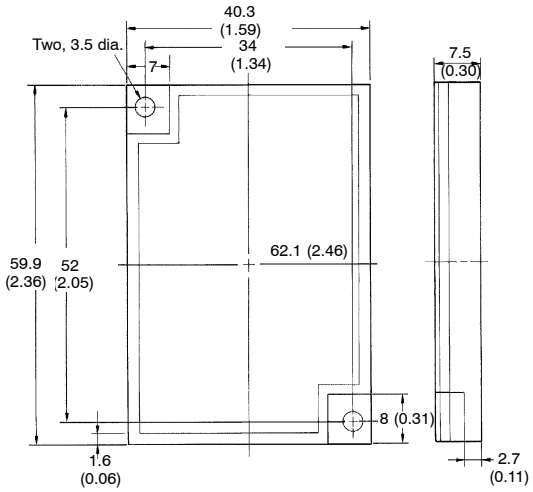

Note: Mounting bracket can be attached to side A.

## ■ CORNER CUBE REFLECTORS

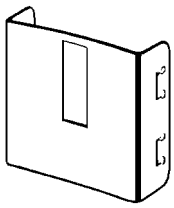
**E39-R1 Retroreflector**

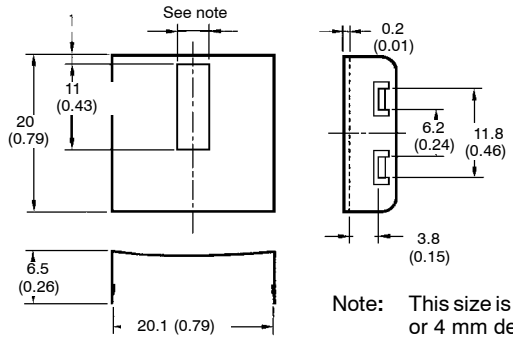
(Included with E3S-CR11/CR61)






**E39-S61 Slit Kit for E3S-C**






Note: This size is 0.5 mm, 1 mm, 2 mm, or 4 mm depending on the type.

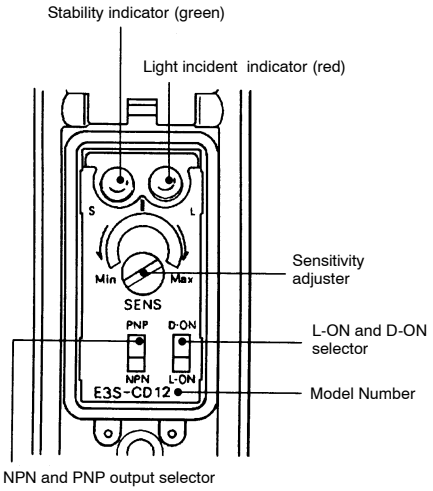
# Nomenclature

## ■ OPERATION PANEL

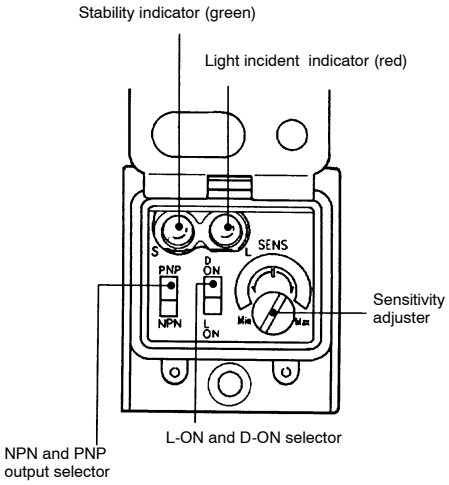
Use the NPN and PNP output selector on the operation panel to select the type of output transistor.

Use the Light-ON and Dark-ON selector on the operation panel to select the operation mode of the E3S-C.

**Horizontal Model**




**Vertical Model**



# Operation

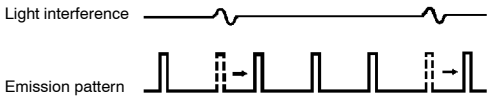
## ■ FUZZY LOGIC MUTUAL INTERFERENCE PREVENTION FUNCTION

**(FOR E3S-CR□□ AND E3S-CD□□ ONLY)**

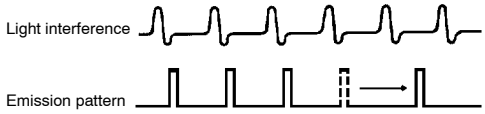
If photoelectric sensors are installed side by side, each Sensor may be influenced (or malfunction) by the light emitted from the other sensors. This is known as mutual interference.

The fuzzy logic mutual interference prevention function of the E3S-C enables the E3S-C to monitor light interference over a certain period of time. Before the E3S-C starts emitting light, the E3S-C retrieves the intensity and frequency of surrounding light interference as data. Using this data, the E3S-C calculates, with fuzzy inference, the risk of the E3S-C malfunctioning and controls the timing of the E3S-C's light emission.

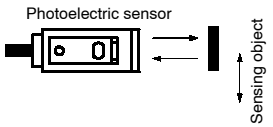
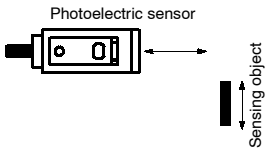
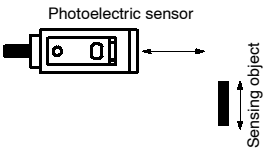
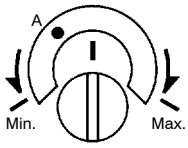
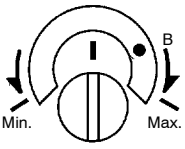
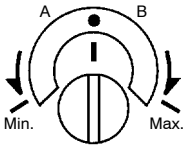
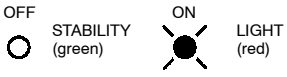
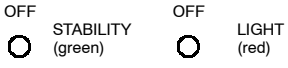
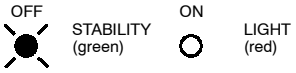
When the risk is low, the E3S-C waits until there is no light interference and emits light.




When the risk is high, the E3S-C emits light between each light interference moment.




## ■ SENSITIVITY ADJUSTMENT (REFLECTIVE SENSORS)

| Steps | Step 1 | Step 2 | Step 3 |
|---|---|---|---|
| Function | Determine position A | Determine position B | Adjust to optimum setting |
| Sensing condition |   |   |   |
| Sensitivity adjustor |   |   |   |
| Indicators |   |   |   |
| Procedure | 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) turns 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 guaranteed,in which case a different detection method should be applied. |

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

# Precautions

## ■ CONNECTION

If the input/output lines of the photoelectric sensor are placed in the same conduit or duct as power lines or high-voltage lines, the photoelectric sensor could be induced to malfunction, or be damaged, by the electrical noise. Either separate the wiring, or use shielded lines as input/output lines to the photoelectric sensor.

The cord connected to the E3S-C can be extended up to 100 m provided that the diameter of each wire of the cord is 0.3 $mm^2$ minimum.

## ■ POWER SUPPLY

If the standard switching regulator is used as a power supply, the frame ground (FG) terminal and the ground (G) terminal, on the power supply, must be grounded. If this is not done the E3S-C may malfunction, due to the switching noise of the power supply.

If an inverter motor or servomotor is used with the E3S-C, the frame ground (FG) terminal and the ground (G) terminal, on the motor, must be grounded, otherwise the E3S-C may malfunction.

## ■ WATER RESISTANCE

To ensure the water resistance of the E3S-C, tighten the screws of the operation panel cover to a torque of 3.5 to 5.5 kgf • cm (0.34 N • m to 0.54 N • m).

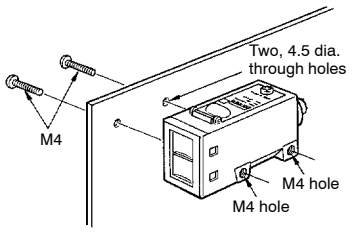
# Installation

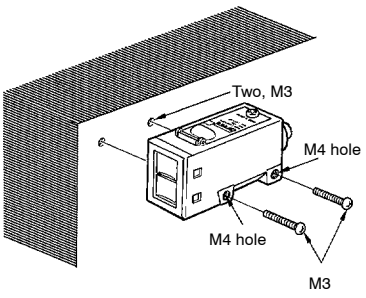
## ■ MOUNTING

Use M4 screws to mount the E3S-C. The tightening torque of each screw must be 12 kgf • m (1.18 N • m) maximum.

## ■ DIRECT MOUNTING

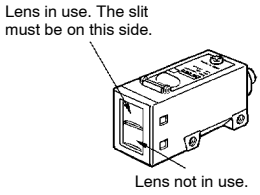
Mount the E3S-C as shown in the following illustrations.




## ■ OPTICAL AXIS OF THROUGH-BEAM SENSOR

The E3S-C through-beam models incorporate two lenses, one of which will be used as shown in the following illustration. When using a slit, the slit must be on the side where the lens is located.



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

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