Thin, Compact, Cylindrical Photoelectric Sensor

# E3HF/E3HS/E3HT/E3HC

CSM_E3HF_E3HS_E3HT_E3HC_DS_E_4_1

- Cylindrical models (E3HT and E3HC) are ideal for embedded installation.
- Square 7.5-mm model (E3HS) has a sensing distance of 1 m.
- Resin-filled models (E3HS and E3HC) offer excellent vibration resistance.
- Ultra-thin 7-mm model (E3HF) requires very little depth for installation, helping to save space.
- E3HTand E3HC comply with EN standards.



Be sure to read *Safety Precautions* on page 6.

## Ordering Information

### Sensors

Infrared light

| Sensing Method | Appearance | Sensing distance | Model | |
|---|---|---|---|---|
| | | | Light- ON | Dark-ON |
| Through-beam * | | 700 mm | **E3HF-1E1**<br>Emitter E3HF-1L<br>Receiver E3HF-1DE1 | **E3HF-1E2**<br>Emitter E3HF-1L<br>Receiver E3HF-1DE2 |
| Diffuse-reflective | | 50 mm | **E3HF-DS5E1** | **E3HF-DS5E2** |
| Through-beam * | | 1 m | **E3HS-1E1**<br>Emitter E3HS-1L<br>Receiver E3HS-1DE1 | **E3HS-1E2**<br>Emitter E3HS-1L<br>Receiver E3HS-1DE2 |
| Diffuse-reflective | | 50 mm | **E3HS-DS5E1** | **E3HS-DS5E2** |
| Through-beam * | | 1 m | **E3HT-1E1**<br>Emitter E3HT-1L<br>Receiver E3HT-1DE1 | **E3HT-1E2**<br>Emitter E3HT-1L<br>Receiver E3HT-1DE2 |
| Diffuse-reflective | | 35 mm | **E3HT-DS3E1** | **E3HT-DS3E2** |
| Through-beam * | | 1 m | **E3HC-1E1**<br>Emitter E3HC-1L<br>Receiver E3HC-1DE1 | **E3HC-1E2**<br>Emitter E3HC-1L<br>Receiver E3HC-1DE2 |
| Diffuse-reflective | | 35 mm | **E3HC-DS3E1** | **E3HC-DS3E2** |

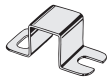
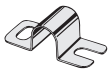
* Through-beam Sensors are normally sold in sets that include both the Emitter and Receiver. Orders for individual Emitters and Receivers are accepted.

## Accessories

### Slits

| Slit width | Sensing distance | Minimum detectable object (typical) | Quantity | Remarks |
|---|---|---|---|---|
| 0.5 mm × 4 mm | 120 mm | 0.5-mm dia. | 1 slit each for the Emitter and Receiver (6 slits total) | Seal-type long slit Provided with the E3HF-1E□ Through-beam Sensor. |
| 1 mm × 4 mm | 200 mm | 1-mm dia. | | |
| 2 mm × 4 mm | 400 mm | 2-mm dia. | | |

### Mounting Brackets

| Appearance | Model | Quantity | Remark |
|---|---|---|---|
|  | **E39-L101** | 1 | Provided with the E3HS |
|  | **E39-L84** | 1 | Provided with the E3HC |

Note: When using through-beam models, order one bracket for the Receiver and one for the Emitter.

## Ratings and Specifications

### E3HF/E3HS

| Sensing method | Through-beam | Diffuse-reflective | Through-beam | Diffuse-reflective |
|---|---|---|---|---|
| Item / Model | E3HF-1E□ | E3HF-DS5E□ | E3HS-1E□ | E3HS-DS5E□ |
| **Sensing distance** | 700 mm | 50 mm (White paper 30 × 30 mm) | 1 m | 50 mm (White paper 30 × 30 mm) |
| **Standard sensing object** | Opaque, 3.7-mm dia. min. | --- | Opaque, 5.1-mm dia. min. | --- |
| **Differential travel** | --- | 20% max. of sensing distance | --- | 20% max. of sensing distance |
| **Directional angle** | Emitter/Receiver: 3 to 20° each | --- | Emitter/Receiver: 3 to 25° each | --- |
| **Light source (wavelength)** | Infrared LED (950 nm) | | | |
| **Power supply voltage** | 12 to 24 VDC ±10%, ripple (p-p): 10% max. | | | |
| **Current consumption** | Emitter/Receiver: 20 mA max. | 30 mA max. | Emitter/Receiver: 20 mA max. | 30 mA max. |
| **Control output** | Load power supply voltage: 24 VDC max., Load current: 80 mA (residual voltage: E3HF: 1 V max., E3HS: 1.2 V max.) NPN voltage output type Light-ON/Dark-ON (depends on model) | | | |
| **Protection** | Reverse polarity protection, Output short-circuit protection | Reverse polarity protection, Output short-circuit protection, Mutual interference prevention | Reverse polarity protection, Output short-circuit protection | Reverse polarity protection, Output short-circuit protection, Mutual interference prevention |
| **Response time** | Operate or reset: 5 ms max. each | Operate or reset: 3 ms max. each | Operate or reset: 5 ms max. each | Operate or reset: 3 ms max. each |
| **Sensitivity adjustment** | --- | One-turn adjuster | --- | One-turn adjuster |
| **Ambient illuminance (Receiver side)** | Incandescent lamp: 3,000 lx, Sunlight 10,000 lx | | | |
| **Ambient temperature** | Operating: –25 to 55°C, Storage: –30 to 70°C (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** | 500 VAC at 50/60 Hz for 1 minute | | | |
| **Vibration resistance (destruction)** | 10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y, and Z directions | | | |
| **Shock resistance (destruction)** | 500 $m/s^2$ for 3 times each in X, Y, and Z directions | | | |
| **Degree of protection** | IEC IP64 | | IEC IP65 | |
| **Connection method** | Pre-wired models (standard length: 2 m) | | | |
| **Weight (packed state)** | Approx. 110 g | Approx. 70 g | Approx. 120 g | Approx. 80 g |
| **Material: Case** | ABS | | Stainless steel (SUS304) | |
| **Material: Lens** | Methacrylic resin | | | |
| **Material: Mounting Brackets** | --- | | Stainless steel (SUS304) | |
| **Accessories** | Slit (0.5-mm, 1-mm, 2-mm widths), Instruction sheet | Screwdriver for adjustment, Instruction sheet | Mounting Bracket (with screws), Stoppers, Instruction sheet | Mounting Bracket (with screws), Screwdriver for adjustment, Stoppers, Instruction sheet |

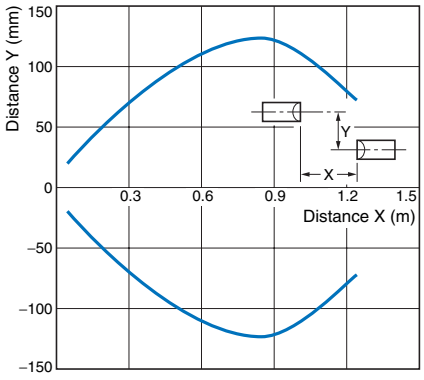
### E3HT/E3HC

| Sensing method / Item / Model | Through-beam<br>E3HT-1E□ | Diffuse-reflective<br>E3HT-DS3E□ | Through-beam<br>E3HC-1E□ | Diffuse-reflective<br>E3HC-DS3E□ |
|---|---|---|---|---|
| **Sensing distance** | 1 m | 35 mm<br>(White paper 30 × 30 mm) | 1 m | 35 mm<br>(White paper 30 × 30 mm) |
| **Standard sensing object** | Opaque, 6.25-mm dia. min. | --- | Opaque, 6.25-mm dia. min. | --- |
| **Differential travel** | --- | 20% max. of sensing distance | --- | 20% max. of sensing distance |
| **Directional angle** | Emitter/Receiver: 10 to 25° each | --- | Emitter/Receiver: 10 to 25° each | --- |
| **Light source (wavelength)** | Infrared LED (950 nm) | Infrared LED (940 nm) | Infrared LED (950 nm) | Infrared LED (940 nm) |
| **Power supply voltage** | 12 to 24 VDC ±10%, ripple (p-p): 10% max. | | | |
| **Current consumption** | Emitter: 25 mA max.<br>Receiver: 15 mA max. | 30 mA max. | Emitter: 25 mA max.<br>Receiver: 15 mA max. | 30 mA max. |
| **Control output** | Load power supply voltage: 24 VDC max., Load current: 80 mA (Residual voltage: 1 V max.)<br>NPN open collector output type<br>Light-ON/Dark-ON (depends on model) | | | |
| **Protection** | Reverse polarity protection, Output short-circuit protection | Reverse polarity protection, Output short-circuit protection, Mutual interference prevention | Reverse polarity protection, Output short-circuit protection | Reverse polarity protection, Output short-circuit protection, Mutual interference prevention |
| **Response time** | Operate or reset: 5 ms max. each | Operate or reset: 3 ms max. each | Operate or reset: 5 ms max. each | Operate or reset: 3 ms max. each |
| **Ambient illuminance (Receiver side)** | Incandescent lamp: 3,000 lx, Sunlight 10,000 lx | | | |
| **Ambient temperature** | Operating: –25 to 55°C, Storage: –30 to 70°C (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** | 500 VAC at 50/60 Hz for 1 minute | | | |
| **Vibration resistance** | Destruction: 10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y, and Z directions | | | |
| **Shock resistance** | Destruction: 500 m/s$^2$ for 3 times each in X, Y, and Z directions | | | |
| **Degree of protection** | IEC IP66 | | | |
| **Connection method** | Pre-wired models (standard length: 2 m) | | | |
| **Weight (packed state)** | Approx. 130 g | Approx. 80 g | Approx. 110 g | Approx. 75 g |
| **Material** Case | Brass | | Stainless steel (SUS304) | |
| **Material** Lens | Methacrylic resin | | | |
| **Material** Mounting Brackets | --- | | Stainless steel (SUS304) | |
| **Accessories** | Instruction sheet | | Mounting bracket (with screws), Instruction sheet | |

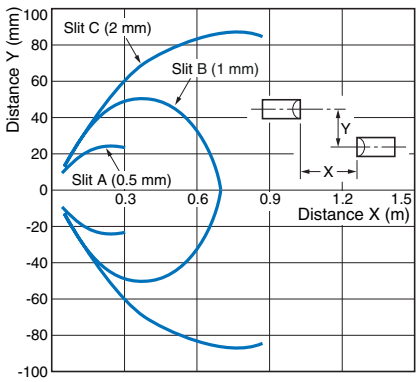
## Engineering Data (Typical)

### Parallel Operating Range

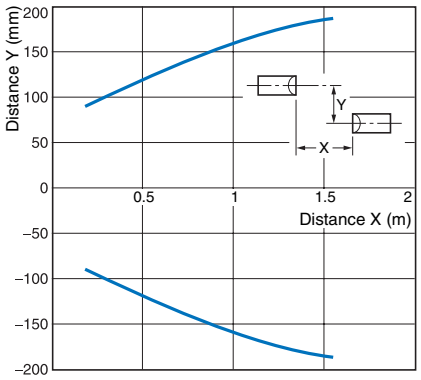
**Through-beam**
**E3HF-1E□**



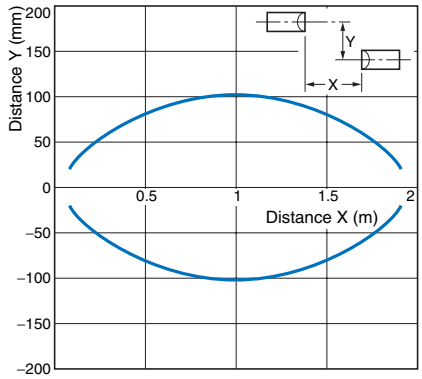

**Through-beam**
**E3HF-1E□**




**Through-beam**
**E3HS-1E□**

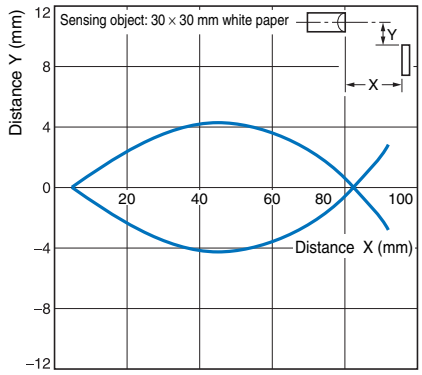


**Through-beam**
**E3HT-1E□, E3HC-1E□**

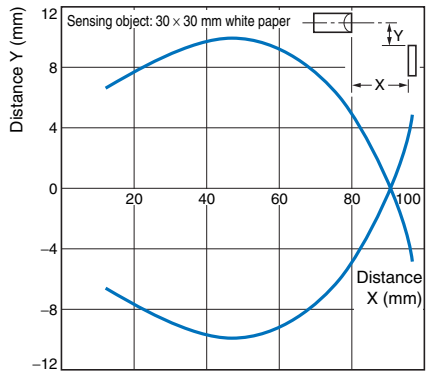



## Operating Range

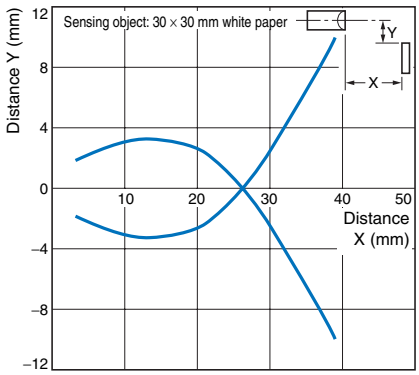
**Diffuse-reflective**
**E3HF-DS5E□**




**Diffuse-reflective**
**E3HS-DS5E□**

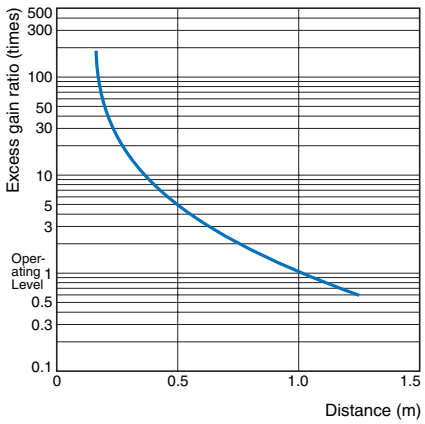



**Diffuse-reflective**
**E3HT-DS3E□, E3HC-DS3E□**

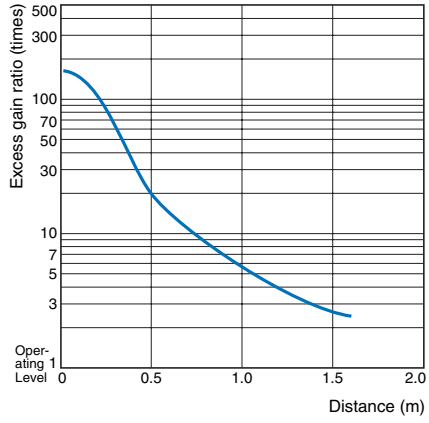



## Excess Gain vs. Set Distance

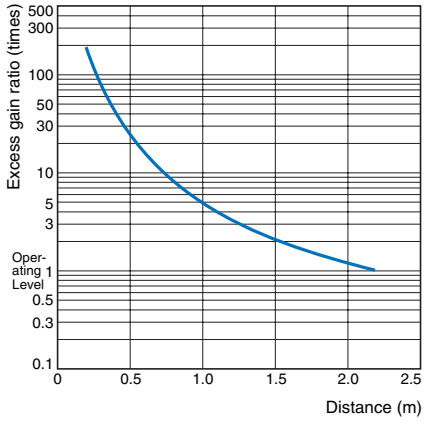
**Through-beam**
**E3HF-1E□**



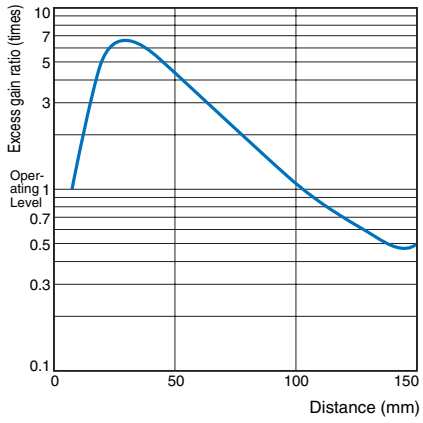

**Through-beam**
**E3HS-1E□**



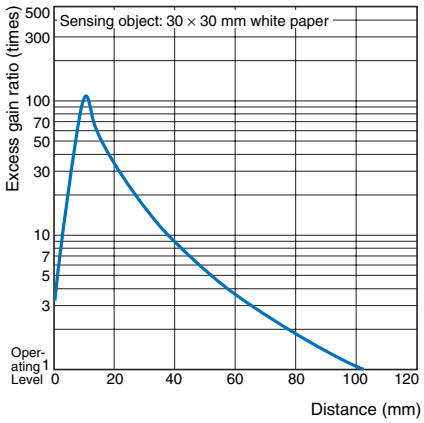

**Through-beam**
**E3HT-1E□, E3HC-1E□**



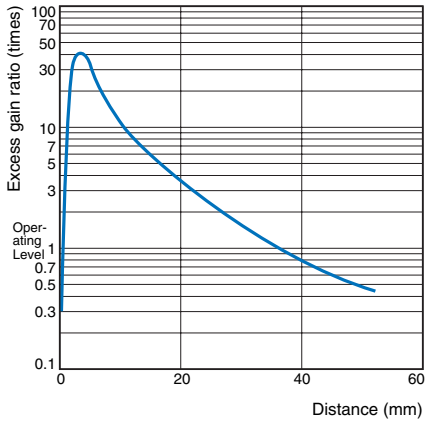
**Diffuse-reflective**
**E3HF-DS5E□**




**Diffuse-reflective**
**E3HS-DS5E□**

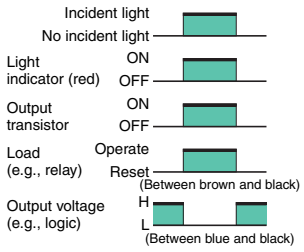
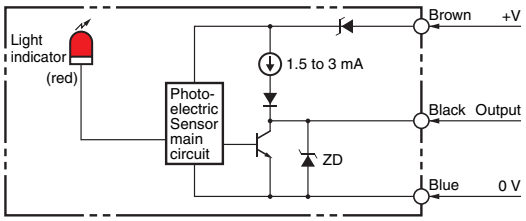
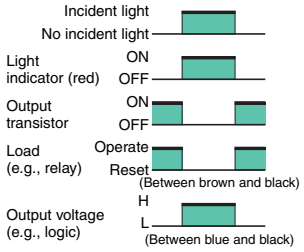



**Diffuse-reflective**
**E3HT-DS3E□, E3HC-DS3E□**

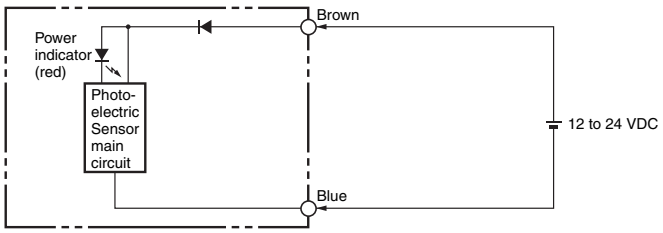



## I/O Circuit Diagrams

### NPN Output

| Model | Operation mode | Timing charts | Output circuit |
|---|---|---|---|
| **E3HF-1E1 ***<br>**E3HF-DS5E1**<br>**E3HS-1E1 ***<br>**E3HS-DS5E1**<br>**E3HT-1E1 ***<br>**E3HT-DS3E1**<br>**E3HC-1E1 ***<br>**E3HC-DS3E1** | Light-ON |  | Through-beam Receivers, Reflective Sensors<br> |
| **E3HF-1E2 ***<br>**E3HF-DS5E2**<br>**E3HS-1E2 ***<br>**E3HS-DS5E2**<br>**E3HT-1E2 ***<br>**E3HT-DS3E2**<br>**E3HC-1E2 ***<br>**E3HC-DS3E2** | Dark-ON |  | |

Through-beam Model Emitters




* Models numbers for Through-beam Sensors (E3H□-1E□) are for sets that include both the Emitter and Receiver.
Emitter model numbers are in the form E3H□-1L (e.g., E3HF-1L). Receiver model numbers are in the form E3H□-1DE□ (e.g., E3HF-1DE1). Refer to *Ordering Information* to confirm model numbers for Emitter and Receivers.

## Safety Precautions

**⚠ WARNIGS**

**This product is not designed or rated for ensuring safety of persons. Do not use it for such purpose.**

### Precautions for Correct Use

Do not use the product in atmospheres or environments that exceed product ratings.

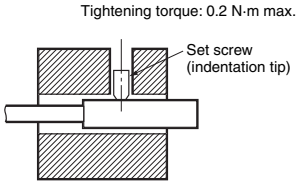
**●Mounting**

**Mounting**

**E3HF**

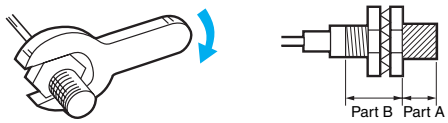
- Use flat washers and spring washers on the M3 screws, and tighten the screws to a torque of 0.29 N·m max.

**E3HC**




**E3HT**

- Do not tighten to a torque that exceeds the following values.




Note: The allowable torque depends on the distance from the tip of the head. Refer to the following table for the tightening torque for parts A and B. (Part A is the range between the tip of the head and the value given in the table. Part B includes the nut on the head, as shown in the figure above. If the edge of the nut enters the area of part A even slightly, apply the torque for part A.)

| Torque / Model | Part A | | Part B |
|---|---|---|---|
| | Dimension (mm) | Torque | Torque |
| E3HT-□□□ | 12 | 2 N·m | 2.9 N·m |

**●Adjusting**

**Slit Adjustment**

**E3HF**

- Slits with widths of 0.5, 1.0, and 2.0 mm are provided. Use these slits for adjustment when the diameter of the sensing object is 3.7 mm or less, and when it is necessary to correct for mutual interference.

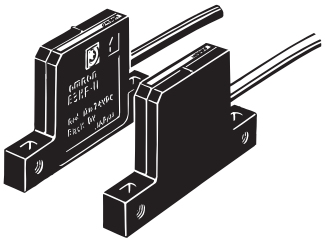
## Dimensions

(Unit: mm)

Unless otherwise specified, the tolerance class IT16 is used for dimensions in this data sheet.

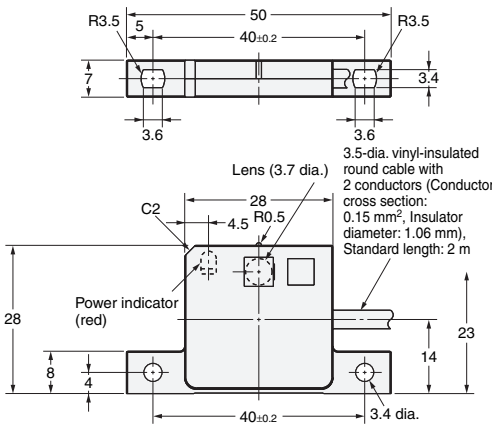
### Sensors

**E3HF-1E□**

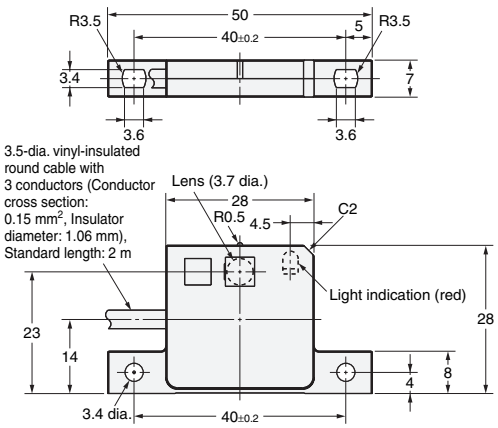


Emitter: E3HF-1L
Receiver: E3HF-1DE□

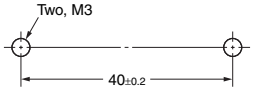
**Emitter**




**Receiver**

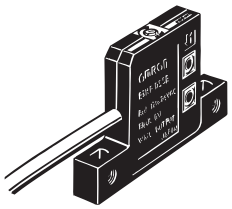


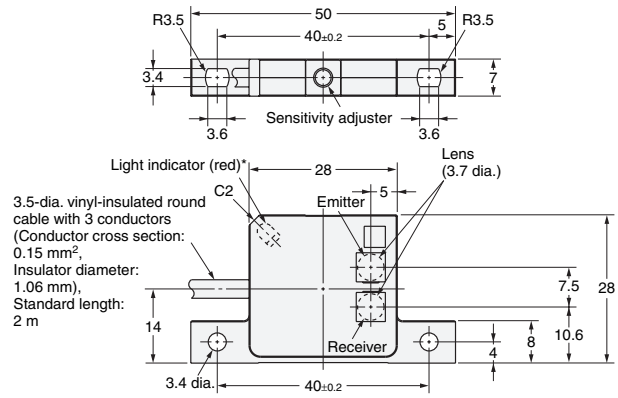

**Mounting Holes**



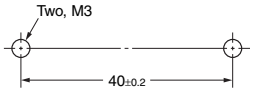

Note: Models numbers for Through-beam Sensors (E3HF-1E□) are for sets that include both the Emitter and Receiver. The Emitter model number is E3HF-1L. Receiver model numbers are in the form E3HF-1DE□ (e.g., E3HF-1DE1). Refer to *Ordering Information* to confirm model numbers for Emitter and Receivers.

## E3HF-DS5E□



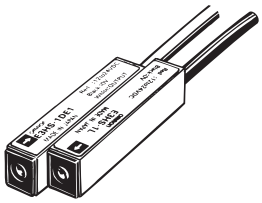



**Mounting Holes**

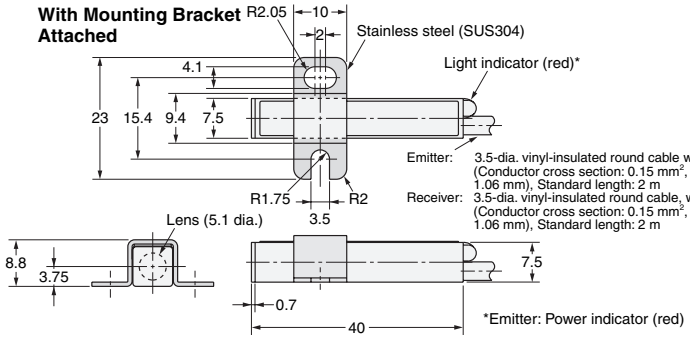



* The indicator is not visible from the lens surface.

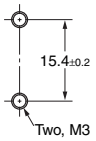
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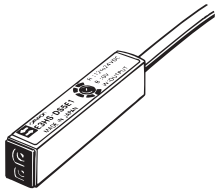
**With Mounting Bracket Attached**



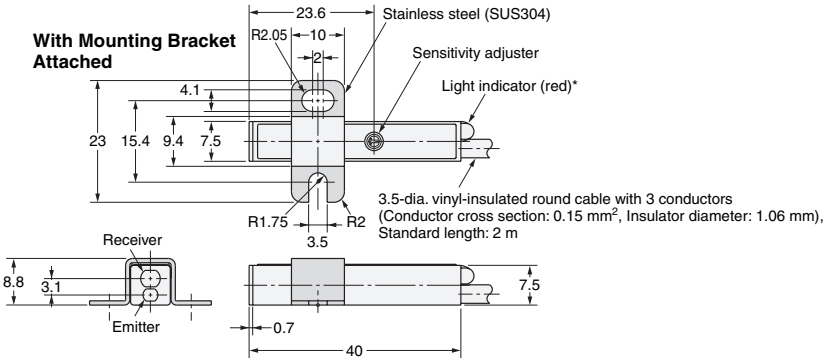

**Mounting Holes**



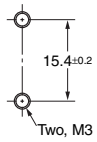

## E3HS-DS5E□



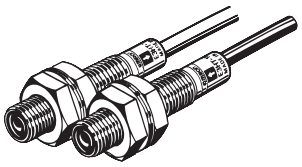
**With Mounting Bracket Attached**

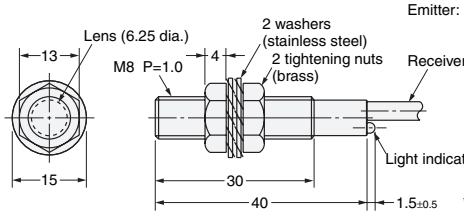



**Mounting Holes**




## E3HT-1E□





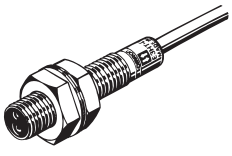

Emitter: 3.5-dia. vinyl-insulated round cable with 2 conductors (Conductor cross section: 0.15 mm², Insulator diameter: 1.06 mm), Standard length: 2 m

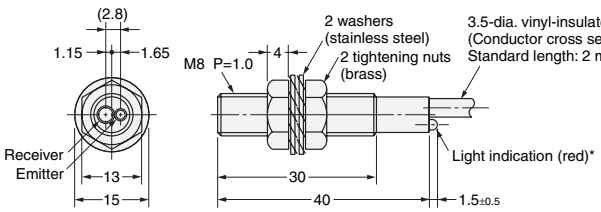
Receiver: 3.5-dia. vinyl-insulated round cable with 3 conductors (Conductor cross section: 0.15 mm², Insulator diameter: 1.06 mm), Standard length: 2 m

Light indicator (red)*

* Emitter has a power indicator (red).

## E3HT-DS3E□



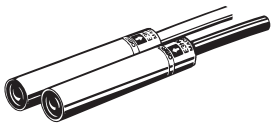



3.5-dia. vinyl-insulated round cable with 3 conductors (Conductor cross section: 0.15 mm², Insulator diameter: 1.06 mm), Standard length: 2 m

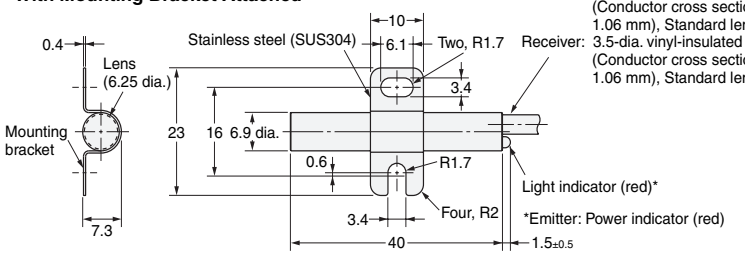
Note: Models numbers for Through-beam Sensors (E3H□-1E□) are for sets that include both the Emitter and Receiver.
Emitter model numbers are in the form E3H□-1L (e.g., E3HS-1L). Receiver model numbers are in the form E3H□-1DE□ (e.g., E3HS-1DE1). Refer to *Ordering Information* to confirm model numbers for Emitter and Receivers.

*

### E3HC-1E□

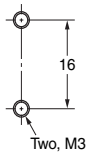


**With Mounting Bracket Attached**

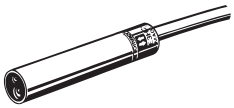



Emitter: 3.5-dia. vinyl-insulated round cable with 2 conductors (Conductor cross section: 0.15 mm², Insulator diameter: 1.06 mm), Standard length: 2 m
Receiver: 3.5-dia. vinyl-insulated round cable with 3 conductors (Conductor cross section: 0.15 mm², Insulator diameter: 1.06 mm), Standard length: 2 m

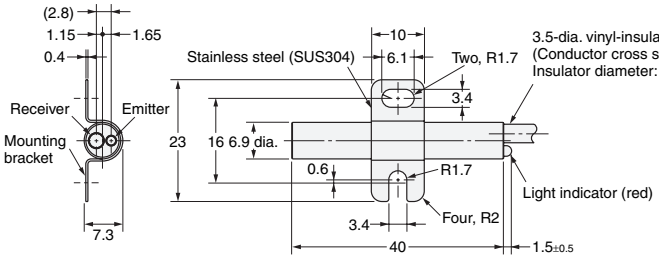
**Mounting Holes**




### E3HC-DS3E□

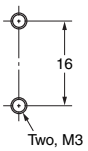


**With Mounting Bracket Attached**




3.5-dia. vinyl-insulated round cable with 3 conductors (Conductor cross section: 0.15 mm², Insulator diameter: 1.06 mm), Standard length: 2 m

**Mounting Holes**

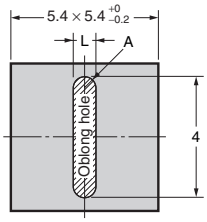



Note: Models numbers for Through-beam Sensors (E3HC-1E□) are for sets that include both the Emitter and Receiver.
The Emitter model number is E3HC-1L. Receiver model numbers are in the form E3HC-1DE□ (e.g., E3HC-1DE1). Refer to *Ordering Information* to confirm model numbers for Emitter and Receivers.

## Accessories (Order Separately)

### Seal-type Long Slit
**(For E3HF-1E□)**






| Name | L (mm) | A (mm) |
|---|---|---|
| Slit (A) | 0.5 | 0.25 |
| Slit (B) | 1 | 0.5 |
| Slit (C) | 2 | 1 |

Note: Slits are adhesive and pressure-sensitive.
Peel off the seal, and attach the slit to the lens surface.

Material: Polyester film
*Provided with the Through-beam E3HF-1E□

### Mounting Brackets

**In the interest of product improvement, specifications are subject to change without notice.**

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2010.9

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