

## Transparent Object Detection Sensor

## E3S-R

### Transparent Object Sensor with Built-in DC Amplifier

- Detects clear glass or plastic bottles, and transparent films with simple setup
- Fast, 1 ms maximum response time
- Choose PNP or NPN output models
- Light-ON/Dark-ON operation, wire selectable
- Vertical and horizontal mounting styles
- Ready-to-use: pre-leaded with 2 m (6.56 ft) cable, includes mounting bracket







## Ordering Information

### ■ PLASTIC-HOUSING COMPACT MODELS

Connection	Appearance	Sensing method	Sensing distance	Light source color	Operating modes	Part number		Typical application	
						NPN	PNP	Flat object	Cylindrical object
								Sensing of glass wafers and LCD glass circuit boards	Sensing of plastic bottles and other transparent bottles
Pre-leaded	Horizontal	Retro-reflective	10 to 30 cm	Infrared	Light-ON Dark-ON (selectable)	<b>E3S-R12</b>	<b>E3S-R32</b>	Ideal	Ideal
			0.1 to 1 m	Red		<b>E3S-R11</b>	<b>E3S-R31</b>	Ideal	---
	Vertical		10 to 30 cm	Infrared		<b>E3S-R62</b>	<b>E3S-R82</b>	Ideal	Ideal
			0.1 to 1 m	Red		<b>E3S-R61</b>	<b>E3S-R81</b>	Ideal	---
M12 quick disconnect	Horizontal	Retro-reflective	10 to 30 cm	Infrared	Light-ON Dark-ON (selectable)	<b>E3S-R17</b>	<b>E3S-R37</b>	Ideal	Ideal
			0.1 to 1 m	Red		<b>E3S-R16</b>	<b>E3S-R36</b>	Ideal	---
	Vertical		10 to 30 cm	Infrared		<b>E3S-R67</b>	<b>E3S-R87</b>	Ideal	Ideal
			0.1 to 1 m	Red		<b>E3S-R66</b>	<b>E3S-R86</b>	Ideal	---

Note: Consult your OMRON representative before using the product under conditions not described in the manual. Make sure that the ratings and performance characteristics of the product are correct for the systems, machines, and equipment and provide double safety mechanisms.

## ■ METAL-HOUSING MODELS

Method of detection		Retroreflective			
Sensing distance		30 cm (11.81 in)		1 m (3.28 ft)	
Mounting style		Horizontal 	Vertical 	Horizontal 	Vertical 
Part number	NPN output	E3S-RS30E4-30	E3S-RS30E42-30	E3S-R1E4	E3S-R1E42
	PNP output	E3S-RS30B4-30	E3S-RS30B42-30	E3S-R1B4	E3S-R1B42

## ■ CONNECTOR CORDSETS

Description			Part number	
Connector	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

## ■ ACCESSORIES

Description		Part number
Optional mounting brackets	Side mounting bracket for E3S-RS30 and E3S-R1 metal body sensors	E39-L2
	Side mounting bracket for E3S-R plastic body sensors	E39-L59
	Contact mounting plate for E3S-R connector versions	E39-L60
	For E39-R1 reflector	E39-L7

## ■ REPLACEMENT PARTS

Description	Part number
Reflector supplied with each E3S-R sensor	E39-R1
Horizontal mounting bracket for E3S-R plastic body sensors	E39-L69
Vertical mounting bracket for E3S-R plastic body sensors	E39-L70
Mounting bracket for E3S-RS30 and E3S-R1 metal body sensors	E39-L6
Sensitivity adjuster knob for E3S-RS30 and E3S-R1 metal body sensors	E39-G1
Sensitivity adjuster knob for E39-R plastic body sensors	E39-G2

# Specifications

## ■ RATINGS/CHARACTERISTICS

Part number		E3S-R12/-R62/ -R17/-R67	E3S-R11/-R61/ -R16/-R66	E3S-R32/-R82/ -R37/-R87	E3S-R31/-R81/ -R36/-R86	E3S-RS30□4/ -RS30□42	E3S-R1□4/ -R1□42
Method of detection		Retroreflective	Retroreflective with polarized function	Retroreflective	Retroreflective with polarized function	Retroreflective	
Supply voltage		10 to 30 VDC; ripple 10% max.				12 to 24 VDC±10%; ripple: 10% max.	
Current consumption		30 mA max.				40 mA max.	
Sensing distance with E39-R1 reflector		10 to 30 cm (3.94 in to 11.81 in)	0.1 to 1 m (3.94 in to 3.28 ft)	10 to 30 cm (3.94 to 11.81 in)	0.1 to 1 m (3.94 to 3.28 ft)	30 cm (11.81 in)	1 M (3.28 ft)
Light source		Infrared LED (880 nm)	Red LED (700 nm)	Infrared LED (880 nm)	Red LED (700 nm)	Infrared LED (950 nm)	
Detectable object type		0.7-mm-thick LCD glass boards; 10-mm-dia., 1.0-mm-thick, 30-mm-long cylindrical glass objects	0.7-mm-thick LCD glass boards	0.7-mm-thick LCD glass boards; 10-mm- dia., 1.0-mm- thick, 30-mm- long cylindrical glass objects	0.7-mm-thick LCD glass boards	10-mm-dia., 1.0-mm-thick, 30-mm- long cylindrical glass objects	
Operation mode		Light-ON/Dark-ON, wire selectable					
Sensitivity adjustment		Two-turn adjuster with an indicator				One-turn adjuster	
Control output		NPN open collector, 30 VDC, 100 mA max.		PNP open collector, 30 VDC, 100 mA max.		NPN output (with suffix -E): Load (relay, sink logic): 80 mA max. Volt- age (source) logic: 1.5 to 4 mA max. PNP output (with suffix -B): Load (relay , source) logic: 100 mA	
Response time		1 ms max. for both operation and release					
Circuit protection		Load short-circuit protection, reverse polarity protection, mutual interfer- ence prevention				Load short-circuit protection, mutual interference prevention	
Indicators		Light incident indicator (red), excess gain indicator (green)				Light incident indi- cator (red)	Light incident indicator (red), stability indica- tor (green)
Materials	Case	Polybutylene terephthalate				Zinc die-cast	
	Lens	Denatured polyallylate				Polycarbonate	
	Bracket	304 stainless steel				Iron	
Connections		2 m (6.56 ft) cable: E3S-R11/-R12/-R61/-R62/-R31/-R32/-R81/-R82 M12 quick disconnect: E3S-R16/-R17/-R66/-R67/-R36/-R37/-R86/-R87				2 m (6.56 ft) cable	
Weight		110g with cable: E3S-R11/-R12/-R61/-R62/-R31/-R32/-R81/-R82 60 g with connector: E3S-R16/-R17/-R66/-R67/-R36/-R37/-R86/-R87				Approx. 190 g	
Enclosure rating		IP67					
Ambient operating temperature		0°C to 40°C (32°F to 104°F) with no icing				-25°C to 55°C (-13°F to 131°F) with no icing	
Relative humidity		35% to 85% RH					
Ambient illumina- tion	Incandes- cent lamp	5,000 lx max.				Illumination on optical spot: 3,000 lx max.	
	Sunlight	10,000 lx max.				Illumination on optical spot: 10,000 lx max.	
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 for 2 h each in X, Y, and Z axes					
Shock resistance		500 m/s <sup>2</sup> (approx. 50G) for 3 times each in X, Y, and Z axes					

Note: 1. The above sensing distances are possible when the E39-R1 Reflector is used. The E39-R1 Reflector is provided with the E3S-R.  
 2. Even though the excess gain indicator of the E3S-R is dimly lit during sensitivity adjustment of the E3S-R, the E3S-R will provide stable operation if the ambient temperature does not rise or fall by more than 5°C (91°F) while the E3S-R is operating.

## ■ CHARACTERISTIC DATA (REFERENCE VALUES)

### Light Level Change Rates with Various Transparent Objects

The following are the permeation rates of a various transparent objects on condition that a permeation rate of 100 means that there is no object within the sensing distance of the E3S-R. The permeation rate of any type of object sensed by the E3S-R must be as low as possible for the stable sensing of the object. Before using the E3S-R to sense objects, use samples of the objects to check if the E3S-R can sense the samples easily. (See Note 1.)

Sensing object		E3S-R12/-R62/-R17/ -R67/-R32/-R82/ -R37/-R87	E3S-R11/-R61/-R16/ -R66/-R31/-R81/ -R36/-R86	E3S-RS30□□	E3S-R1□□
		Center	Center	Center	Center
Cylindrical glass object	10-dia. x 30, t = 1.0	27	---	20	33
	15-dia. x 30, t = 1.25	27	---	20	13
	20-dia. x 30, t = 1.7	22	---	28	13
	30-dia. x 30, t = 1.9	41	---	43	23
	100-dia. x 30, t = 2.5	58	---	55	50
	200-dia. x 30, t = 5.0	55	---	58	58
Glass plate	50 x 50, t = 0.5	82	91.5	78	---
	50 x 50, t = 1	74	82.5	70	75
	50 x 50, t = 2	73	81	70	75
	50 x 50, t = 3	62	69	58	65
	50 x 50, t = 5	53	59	50	55
	50 x 50, t = 10	38	42	35	40
Liquid crystal glass	t = 0.5 (permeability of 98%) (See Note 2.)	86	96	---	---
	t = 0.7 (permeability of 95%) (see note 2)	81	90	---	---
	t = 1.1 (permeability of 91%) (See Note 2.)	75	83	---	---
Operating range		95 max.	95 max.	90 max.	80 max.
Stable operating range		90 max.	90 max.	70 max.	60 max.

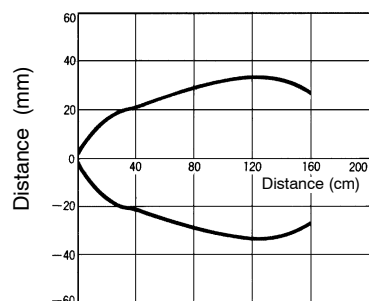
Note: 1. The sensing distance of each model was set to the rated sensing distance.

2. The permeability values were checked with light with a wavelength of 700 μm.

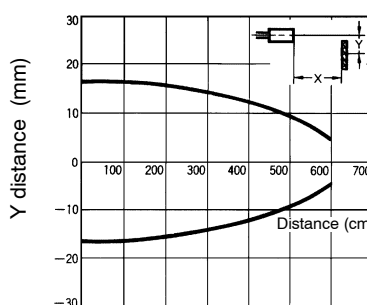
# Engineering Data

## REFLECTOR OPERATION RANGE (TYPICAL)

E3S-R11/-R61/-R16/-R66/-R31/-R81/-R36/-R86

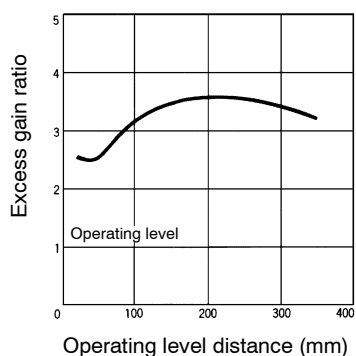


E3S-R12/-R62/-R17/-R67/-R32/-R82/-R37/-R87

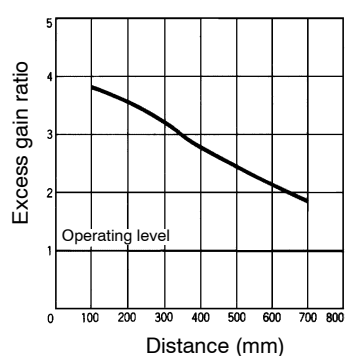


## EXCESS GAIN VS. SET DISTANCE (TYPICAL)

E3S-R11/-R61/-R16/-R66/-R31/-R81/-R36/-R86 with E39-R1



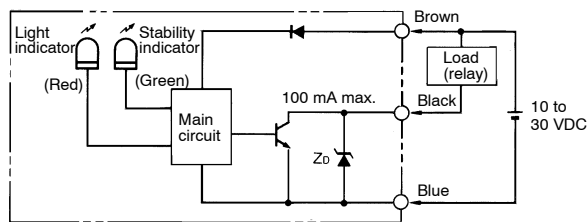
E3S-R12/-R62/-R17/-R67/-R32/-R82/-R37/-R87



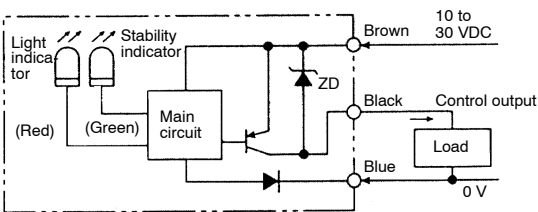
Operation

■ OUTPUT CIRCUITS

E3S-R11/-R12/-R61/-R62/-R16/-R17/-R66/-R67



E3S-R31/-R32/-R81/-R82/-R36/-R37/-R86/-R87



E3S-RS30□4/-RS30□42/-R1□4/-R1□42

Wire color	Polarity of power supply	Output configuration	Output circuit
Brown (See Note 1.)	+	Light-ON	
Blue (See Note 1.)	0 V	Light-ON	
Brown (See Note 1.)	0 V	Dark-ON	
Blue (See Note 1.)	+	Dark-ON	

- Note: 1. Reverse the polarity of the power supply to change the output mode.  
2. The E3S-RS30□ and E3S-RS30□42 do not have a stability indicator.  
3. This load is needed when voltage output to connect a transistor circuit is required.

## ■ TIMING CHARTS

E3S-R11/-R12/-R61/-R62/-R16/-R17/-R66/-R67/-R31/-R32/-R81/-R82/-R36/-R37/-R86/-R87

Output transistor	Timing charts
ON when light is received	<div> <div>Light received</div> <div>Light not received</div> <div> <div>Light indicator (red)</div> <div>ON</div> <div>OFF</div> </div> <div> <div>Output transistor</div> <div>ON</div> <div>OFF</div> </div> <div> <div>Load (relay)</div> <div>Operate</div> <div>Release</div> </div> <div>(Between brown and black)</div> </div>
ON when light is not received	<div> <div>Light received</div> <div>Light not received</div> <div> <div>Light indicator (Orange)</div> <div>ON</div> <div>OFF</div> </div> <div> <div>Output transistor</div> <div>ON</div> <div>OFF</div> </div> <div> <div>Load (relay)</div> <div>Operate</div> <div>Release</div> </div> <div>(Between brown and black)</div> </div>

E3S-RS30□4/-RS30□42/-R1E□/-R1□42

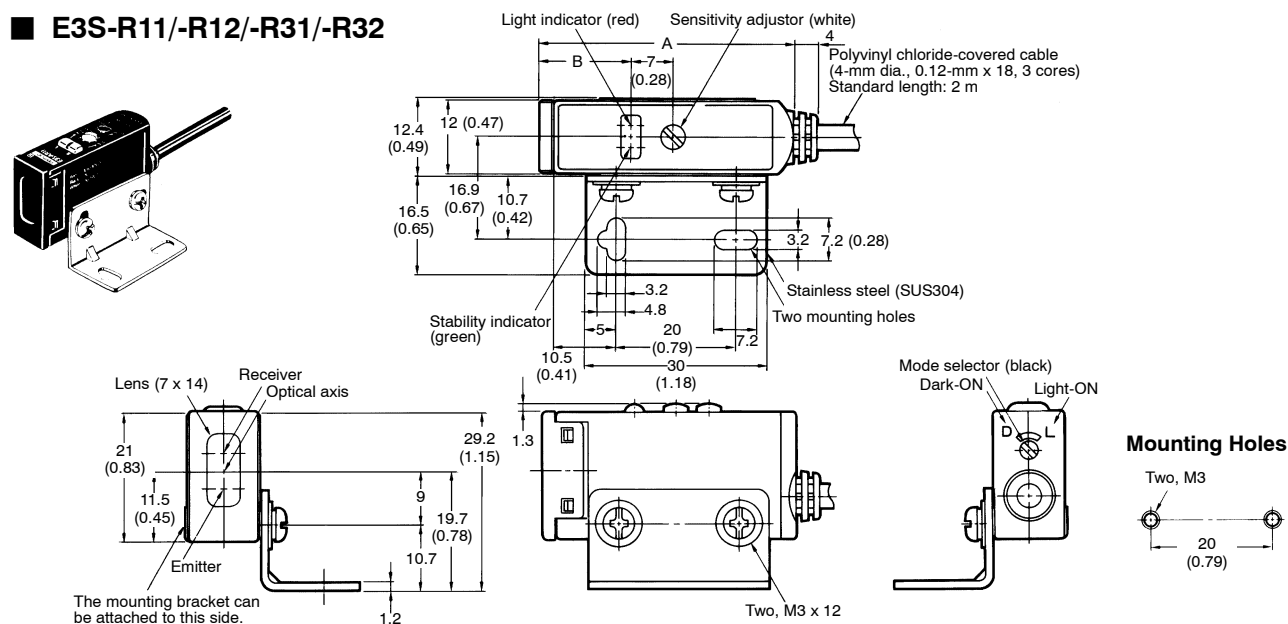
Wire color	Polarity of power supply	Output transistor	Timing charts
Brown (See Note.)	+	ON when light is received.	<div> <div>Light received</div> <div>Light not received</div> <div> <div>Light indicator (red)</div> <div>ON</div> <div>OFF</div> </div> <div> <div>Output transistor</div> <div>ON</div> <div>OFF</div> </div> <div> <div>Load (relay)</div> <div>Operate</div> <div>Release</div> </div> <div>(Between brown and black)</div> </div>
Blue (See Note.)	0 V		<div> <div>Output voltage (logic, etc.)</div> <div>H</div> <div>L</div> <div>(Between blue and black)</div> </div>
Brown (See Note.)	0 V	ON when light is not received.	<div> <div>Light received</div> <div>Light not received</div> <div> <div>Light indicator (red)</div> <div>ON</div> <div>OFF</div> </div> <div> <div>Output transistor</div> <div>ON</div> <div>OFF</div> </div> <div> <div>Load (relay)</div> <div>Operate</div> <div>Release</div> </div> <div>(Between blue and black)</div> </div>
Blue (See Note.)	+		<div> <div>Output voltage (logic, etc.)</div> <div>H</div> <div>L</div> <div>(Between brown and black)</div> </div>

Note: Reverse the polarity of the power supply to change the output mode of the E3S-R.

# Dimensions

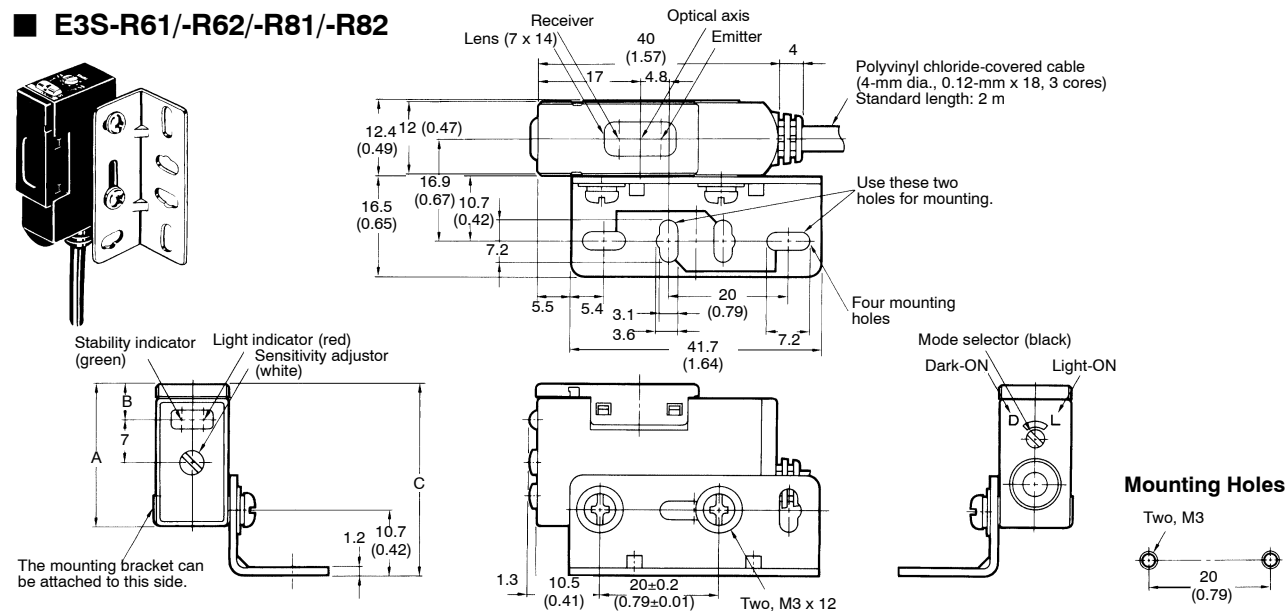
Unit: mm (inch)

## ■ E3S-R11/-R12/-R31/-R32



Type	NPN output	E3S-R11	E3S-R12
	PNP output	E3S-R31	E3S-R32
Size	A	42.3 (1.67)	40 (1.57)
	B	15.2 (0.60)	12.9 (0.51)

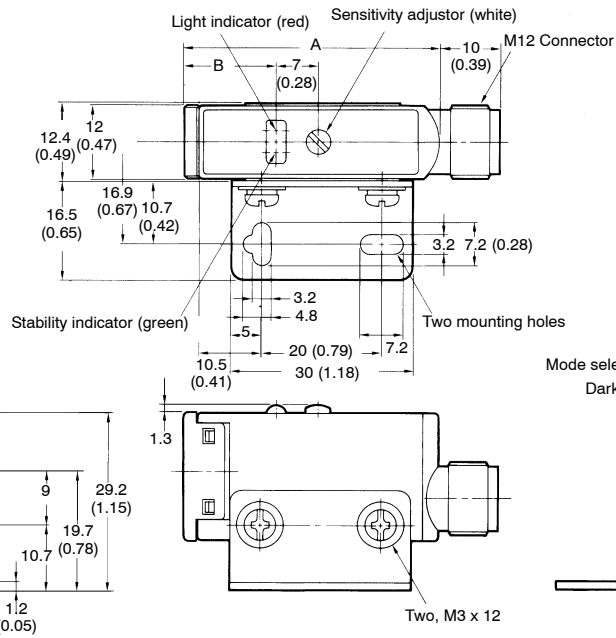
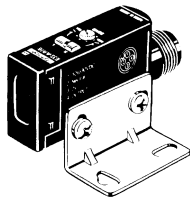
## ■ E3S-R61/-R62/-R81/-R82



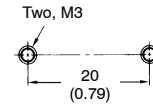
Type	NPN output	E3S-R61	E3S-R62
	PNP output	E3S-R81	E3S-R82
Size	A	23.3 (0.92)	21 (0.83)
	B	5.9 (0.23)	3.6 (0.14)
	C	31.5 (1.24)	29.2 (1.15)



### ■ E3S-R16/-R17/-R36/-R37

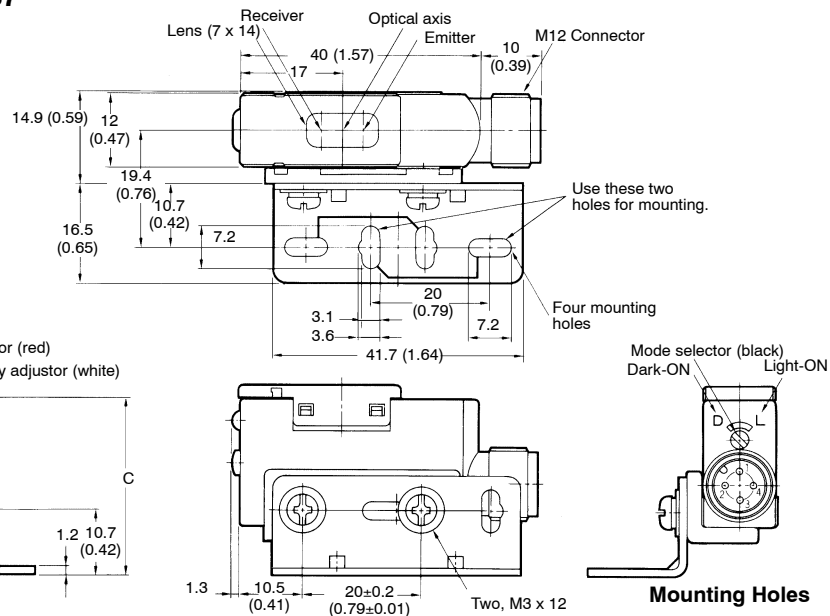
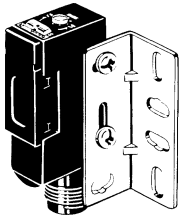


#### Mounting Holes

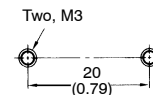


Type	NPN output	E3S-R16	E3S-R17
	PNP output	E3S-R36	E3S-R37
Size	A	42.3 (1.67)	40 (1.57)
	B	15.2 (0.60)	12.9 (0.51)

### ■ E3S-R66/-R67/-R86/-R87



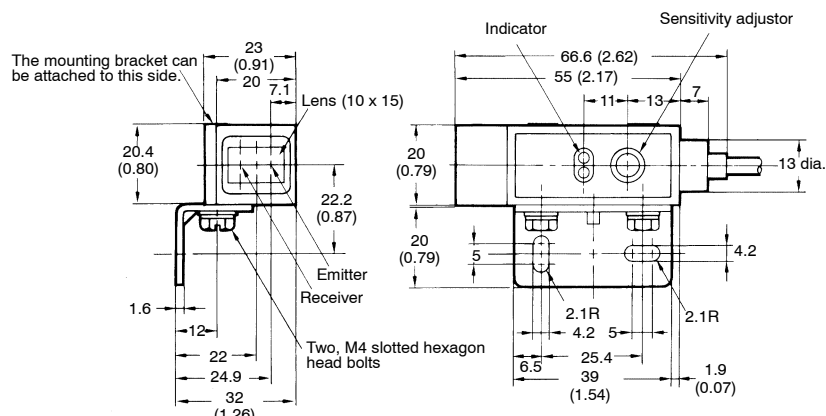
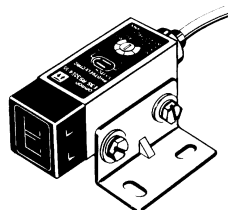
#### Mounting Holes



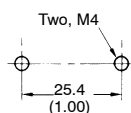
Type	NPN output	E3S-R66	E3S-R67
	PNP output	E3S-R86	E3S-R87
Size	A	23.3 (0.92)	21 (0.83)
	B	5.9 (0.23)	3.6 (0.14)
	C	31.5 (1.24)	29.2 (1.15)

### ■ E3S-RS30□4/-R1□4

Cable: Vinyl-insulated cable (4-mm dia.,  
0.12-mm x 18, 3 cores)  
Standard length: 2 m



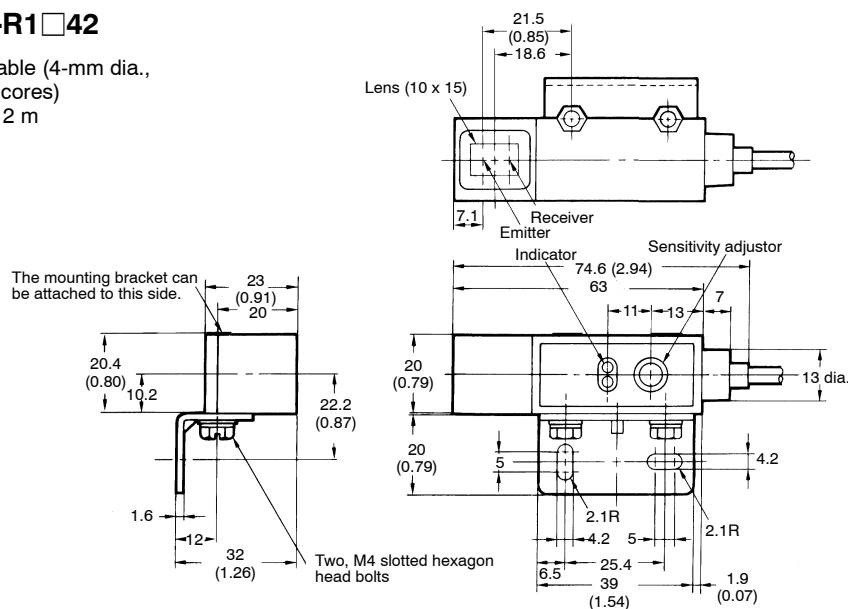
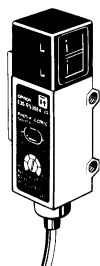
#### Mounting Holes



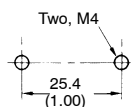
Note: The E3S-RS30□4 does not have a green stability indicator.

### ■ E3S-RS30□42/-R1□42

Cable: Vinyl-insulated cable (4-mm dia.,  
0.12-mm x 18, 3 cores)  
Standard length: 2 m



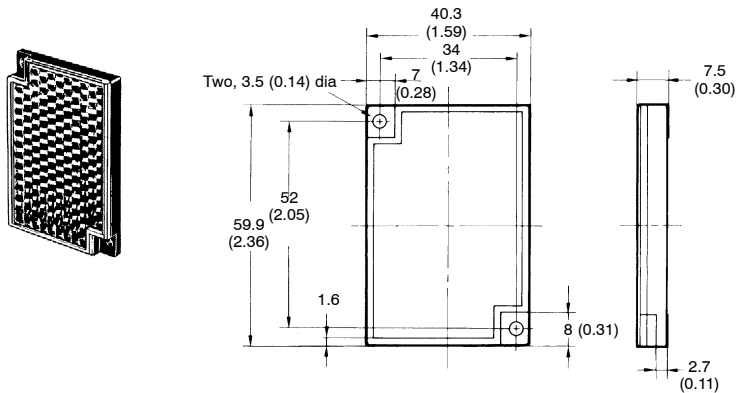
#### Mounting Holes



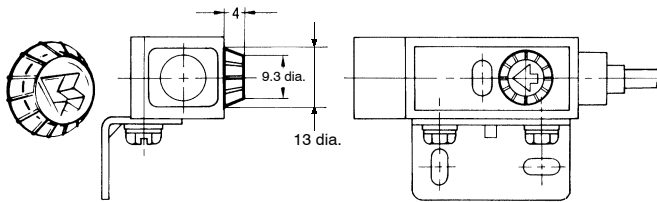
Note: The E3S-RS30□42 does not have a green stability indicator.

## ■ ACCESSORIES

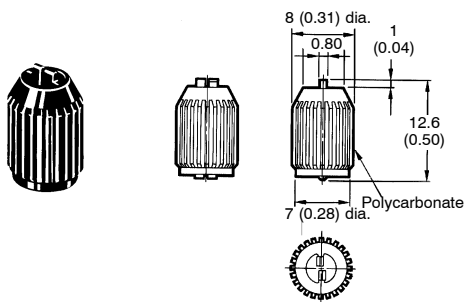
### E39-R1 Retroreflector (Included)



### E39-G1 Sensitivity Adjuster Knob for the E3S-RS30 and E3S-R1□□□/-R1B□□ (Included)

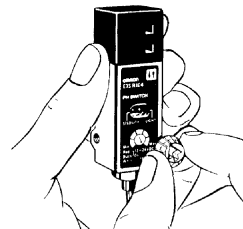


### E39-G2 Sensitivity Adjuster Knob for E3S-R□□

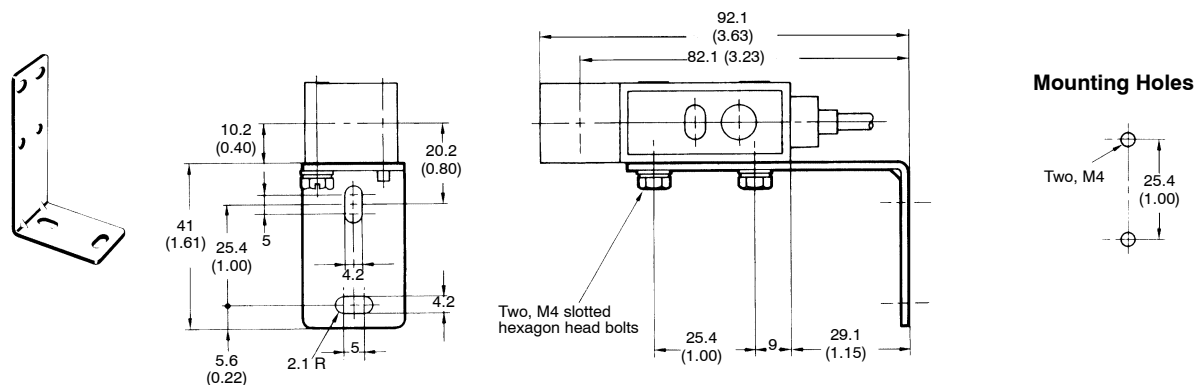


### Installing the Sensitivity Adjuster Knob

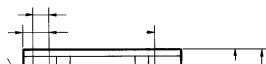
Align the sensitivity adjuster knob with the groove on the sensitivity adjuster. The arrow should point toward the sensing head as shown in the illustration. Press the knob in place. It is impossible to remove the sensitivity adjuster knob from the E3S-R after it has been installed.



**E39-L2 Special Mounting Bracket for the  
E3S-RS30 and E3S-R1 (Order Separately)**



**E39-L69 Mounting Bracket for E3S-R□□  
Horizontal Type (Included)**



**E39-L70 Mounting Bracket for E3S-R□□  
Vertical Type (Included)**

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

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