Transparent Object Detection Sensor

E3S-R

CSM_E3S-R_DS_E_4_1

Ideal for Detecting Glass Wafers and Other Transparent Objects

- Detects glass wafers and LCD glass circuit boards.

(Compact models with plastic housing only)

Be sure to read *Safety Precautions* on page 7.

Ordering Information

Sensors

Compact Models with Plastic Housing **(Refer to *Dimensions* on page 8.)**

Red light Infrared light

Sensing method	Appearance	Connection method	Sensing distance	Model		Recommended application *2	
						Flat object	Cylindrical object
				NPN	PNP	Detecting glass wafers and LCD glass circuit boards	Detecting plastic bottles and other transparent containers
Retro-reflective	Horizontal	Pre-wired (2 m)	300 mm *1 [100 mm]	E3S-R12 2M	---	Ideal	Ideal
			1 m *1 [100 mm]	E3S-R11 2M	E3S-R31 2M	Ideal	---
		Standard M12 Connector	300 mm *1 [100 mm]	E3S-R17	---	Ideal	Ideal
			1 m *1 [100 mm]	E3S-R16	E3S-R36	Ideal	---
	Vertical	Pre-wired (2 m)	300 mm *1 [100 mm]	E3S-R62 2M	---	Ideal	Ideal
			1 m *1 [100 mm]	E3S-R61 2M	E3S-R81 2M	Ideal	---
		Standard M12 Connector	300 mm *1 [100 mm]	E3S-R67	---	Ideal	Ideal
			1 m *1 [100 mm]	E3S-R66	E3S-R86	Ideal	---

*1. Values in parentheses indicate the minimum required distance between the Sensor and Reflector.
*2. The E3S-R may not detect some glass wafer materials or plastic bottle shapes. Before using the E3S-R, be sure to test it on samples to make sure it can detect the items reliably.

Models with Metal Housing (Refer to *Dimensions* on page 10.)

Red light

Sensing method	Appearance	Connection method	Sensing distance	Model	Recommended application *	
					Flat object	Cylindrical object
					Detecting glass wafers and LCD glass circuit boards	Detecting plastic bottles and other transparent containers
Retro-reflective	Horizontal	Pre-wired	300 mm	**E3S-RS30E4**	---	Ideal
			1 m	**E3S-R1E4**	---	Applicable
	Vertical		300 mm	**E3S-RS30E42**	---	Ideal
			1 m	**E3S-R1E42**	---	Applicable

* The E3S-R may not detect some glass wafer materials or plastic bottle shapes. Before using the E3S-R, be sure to test it on samples to make sure it can detect the items reliably.

Accessories (Order Separately)

Sensitivity Adjuster/Screwdriver (Refer to *Dimensions* on E39-L/F39-L/E39-S/E39-R.)

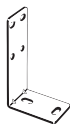
Name	Model	Quantity	Remarks
Sensitivity adjuster	**E39-G1**	1	Provided with the E3S-RS30E4□ and E3S-R1E4□.
Screwdriver for sensitivity adjustment	**E39-G2**	1	Provided with the E3S-R1□, E3S-R3□, E3S-R6□, and E3S-R8□.

Reflector (Refer to *Dimensions* on E39-L/F39-L/E39-S/E39-R.)

Name	Sensing distance	Model	Quantity	Remarks
Reflector	Refer to *Ratings and Specifications*.	**E39-R1**	1	Provided with the E3S-R.

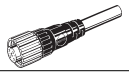
Note: Refer to Reflectors on *E39-L/F39-L/E39-S/E39-R* for details.

Mounting Brackets and Other Products (Refer to *Dimensions* on E39-L/F39-L/E39-S/E39-R.)

Appearance	Model	Quantity	Remarks
	**E39-L69**	1	Provided with the E3S-R1□ and E3S-R3□.
	**E39-L70**	1	Provided with the E3S-R6□ and E3S-R8□.
	**E39-L6**	1	Provided with the E3S-RS30E4□ and E3S-R1E4□.
	**E39-L2**	1	Can be used with the E3S-RS30E4□ and E3S-R1E4□.
	**E39-L97**	1	Horizontal protective cover bracket Can be used for compact models with plastic housing. Refer to E39-L□.
	**E39-L98**	1	Vertical protective cover bracket Can be used for compact models with plastic housing. Refer to E39-L□.
	**E39-L60**	1	Close Mounting Plate Provided with the E3S-R□6 and E3S-R□7.

Note: 1. When using through-beam models, order one bracket for the Receiver and one for the Emitter.
2. Refer to Mounting Brackets on *E39-L/F39-L/E39-S/E39-R* for details.

Sensor I/O Connectors (M12) (Refer to *Dimensions* on XS2.)

Cable	Appearance	Cable type		Model
Standard	Straight 	2 m	3-wire	**XS2F-D421-DC0-A**
		5 m		**XS2F-D421-GC0-A**
	L-shape 	2 m		**XS2F-D422-DC0-A**
		5 m		**XS2F-D422-GC0-A**

Note: For details on Sensor I/O Connectors and cables such as vibration-proof robot cables, refer to *Introduction to Sensor I/O Connectors.*

Ratings and Specifications

Item \ Model					
Sensing method		**Retro-reflective**	**Retro-reflective (with MSR function) *1**	**Retro-reflective**	
	NPN	**E3S-R12, R62, R17, R67**	**E3S-R11, R16, R61, R66**	**E3S-RS30E4, RS30E42**	**E3S-R1E4, R1E42**
	PNP	**---**	**E3S-R31, R36, R81, R86**	**---**	**---**
Sensing distance		300 mm [100 mm] *2 (When using E39-R1)	1 m [100 mm] *2 (When using E39-R1)	300 mm (When using E39-R1)	1 m (When using E39-R1)
Standard sensing object		Opaque: 75-mm dia. min. 0.7-mm-thick LCD glass boards; 10-mm-dia., 1.0-mm-thick, 30-mm-long cylindrical glass objects	Opaque: 75-mm dia. min. 0.7-mm-thick LCD glass boards	Opaque: 75-mm dia. min. 10-mm-dia., 1.0-mm-thick, 30-mm-long cylindrical glass objects	
Directional angle		3° to 10°		---	
Light source (wavelength)		Infrared LED (880 nm)	Red LED (700 nm)	Infrared LED (950 nm)	
Power 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.	
Control output		Load power supply voltage: 30 VDC max. Load current: 100 mA max. with a maximum residual voltage of 1 V Open collector output configuration Light-ON/Dark-ON selector switch		Load power supply voltage: 24 VDC max Load current: 80 mA max. with a maximum residual voltage: of 2 V NPN voltage output configuration Light-ON/Dark-ON cable connection selection	
Protection circuits		Power supply reverse polarity protection, Output short-circuit protection, Mutual interference prevention			
Response time		Operate or reset: 1 ms max.			
Sensitivity adjustment		Two-turn endless adjuster		One-turn adjuster	
Ambient illumination (Receiver side)		Incandescent lamp: 5,000 lx max. Sunlight: 10,000 lx max.		Incandescent lamp: 3,000 lx max. Sunlight: 10,000 lx max.	
Ambient temperature range		Operating: 0 to 40°C, Storage: –40 to 70°C (with no icing or condensation)			Operating: –25 to 55°C Storage: –40 to 70°C (with no icing or condensation)
Ambient humidity range		Operating: 35% to 85%, Storage: 35% to 95% (with no condensation)			
Insulation resistance		20 MΩ min. (at 500 VDC)			
Dielectric strength		1,000 VAC, 50/60 Hz for 1 min			
Vibration resistance		Destruction: 10 to 55 Hz, 1.5-mm double amplitude for 2 h 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 60529 IP67			
Connection method		Pre-wired (standard length: 2 m)/Standard connector			
Weight (packed state)		Pre-wired models: Approx. 110 g Standard connector: Approx. 60 g		Pre-wired models: Approx. 190 g	
Materials	**Case**	Polybutylene terephthalate		Zinc die-cast	
	Lens	Modified polyallylate		Polycarbonate	
	Mounting Bracket	Stainless steel (SUS304)		Iron	
Accessories		Mounting Bracket (with screw), Adjustment screwdriver, Instruction manual, Reflector		Mounting Bracket (with screw), Adjustment screwdriver, Sensitivity adjuster, Instruction manual, Reflector	

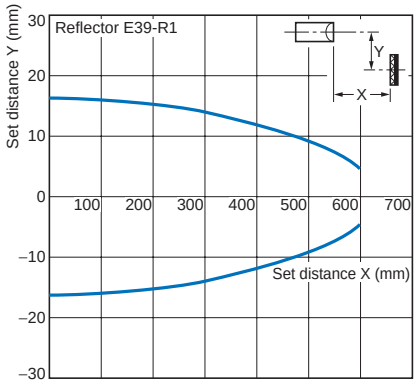
*1. Refer to *MSR function* of *Technical Guide (Technical version)*.
*2. Values in parentheses indicate the minimum required distance between the Sensor and Reflector.

Engineering Data (Typical)

Parallel Operating Range

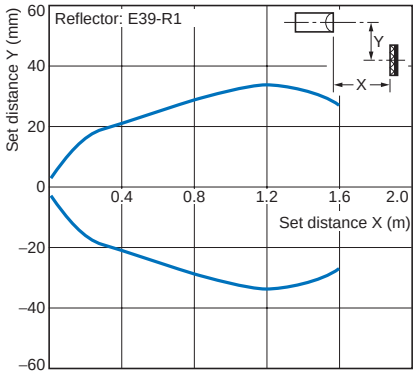
Retro-reflective

E3S-R12, E3S-R62 + E39-R1 (Supplied Reflector)



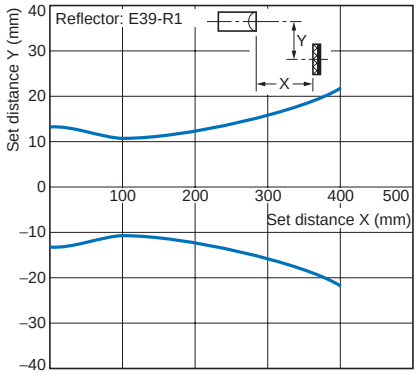
Retro-reflective

E3S-R□1, E3S-R□6 + E39-R1 (Supplied Reflector)



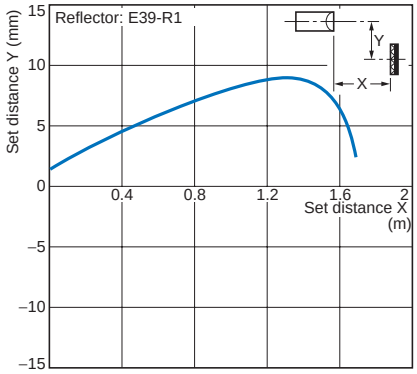
Retro-reflective

E3S-RS30E4□ + E39-R1 (Supplied Reflector)



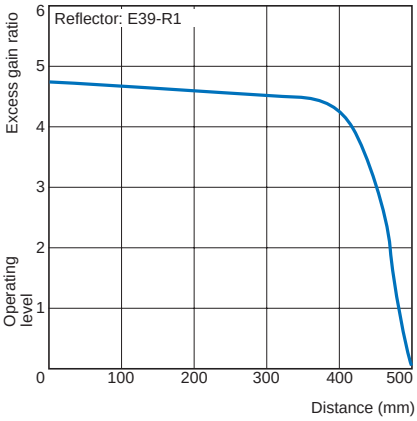
Retro-reflective

E3S-R1E4□ + E39-R1 (Supplied Reflector)

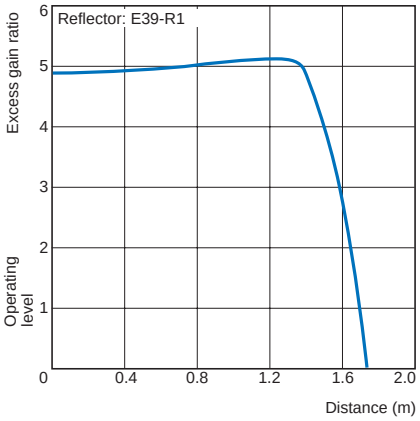


Excess Gain vs. Set Distance

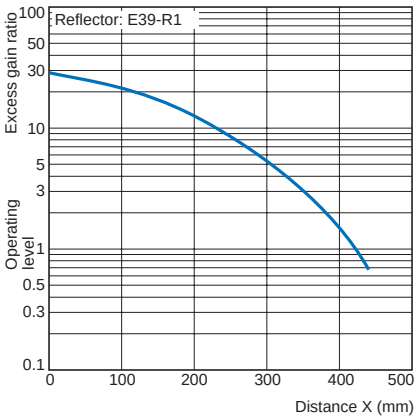
E3S-R12, E3S-R62 + E39-R1 (Supplied Reflector)



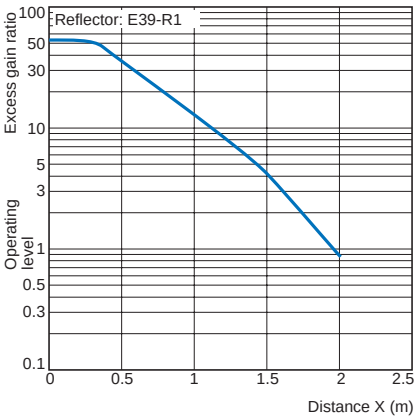
E3S-R□1, E3S-R□6 + E39-R1 (Supplied Reflector)



E3S-RS30E4□ + E39-R1 (Supplied Reflector)



E3S-R1E4□ + E39-R1 (Supplied Reflector)



Light Level Change Rates with Various Transparent Objects (*1)

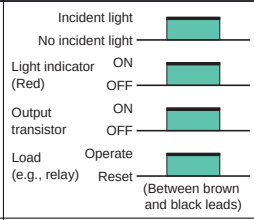
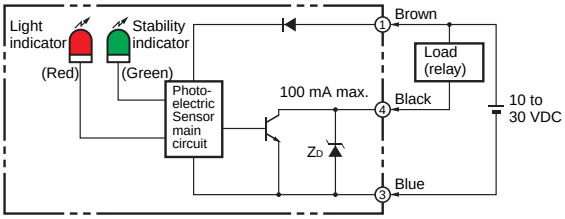
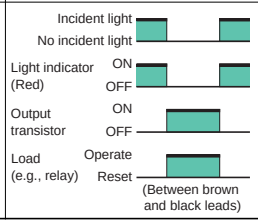
The following are the permeation rates of various transparent objects on condition that a permeation rate of 100 means that there is no object within the sensing distance of the E3S-R. The permeation rate of any type of object sensed by the E3S-R must be as low as possible for reliable detection of the object. Before using the E3S-R, be sure to test it on samples to make sure it can detect the items reliably.

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

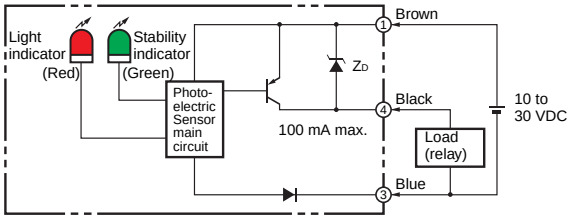
*1. The sensing distance of each model was set to the rated sensing distance.
*2. The permeability values were checked with light at a wavelength of 700 μm.

I/O Circuit Diagrams

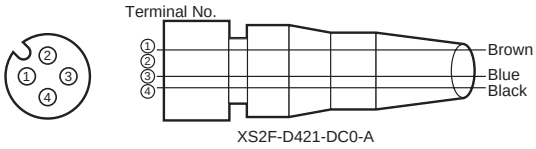
NPN Output

Model	Operation mode	Timing Charts	Operation selector	Output circuit
E3S-R11(12) E3S-R61(62) E3S-R16(17) E3S-R66(67)	Light-ON		L side (LIGHT ON)	 Connector Pin Arrangement  Note: Pin 2 is not used.
	Dark-ON		D side (DARK ON)	

PNP Output

Model	Operation mode	Timing Charts	Operation selector	Output circuit
E3S-R31 E3S-R36 E3S-R81 E3S-R86	Light-ON	Incident light No incident light Light indicator (Red) ON OFF Output transistor ON OFF Load (e.g., relay) Operate Reset (Between blue and black leads)	L side (LIGHT ON)	 Connector Pin Arrangement  Note: Pin 2 is not used.
	Dark-ON	Incident light No incident light Light indicator (Red) ON OFF Output transistor ON OFF Load (e.g., relay) Operate Reset (Between blue and black leads)	D side (DARK ON)	

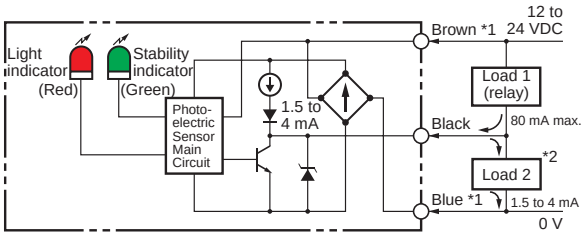
Plug (Sensor I/O Connector)



Classification	Wire color	Connection pin No.	Application
DC	Brown	1	Power supply (+V)
	---	2	---
	Blue	3	Power supply (0 V)
	Black	4	Output

Note: Pin 2 is not used.

Refer to *Introduction to Sensor I/O connectors* for details.

Model	Operation mode	Timing Charts	Cable Connection	Output circuit
E3S-RS30E4(42) E3S-R1E4(42)	Light-ON	Incident light No incident light Light indicator (Red) ON OFF Output transistor ON OFF Load 1 (e.g., relay) Operate Reset (Between brown and black leads) Load 2 H L (Between blue and black leads)	Brown cable: +V Blue cable: 0 V	
	Dark-ON	Incident light No incident light Light indicator (Red) ON OFF Output transistor ON OFF Load 1 (e.g., relay) Operate Reset (Between blue and black leads) Load 2 H L (Between brown and black leads)	Brown cable: 0 V Blue cable: +V	

*1. Reverse the polarity of the power supply to change the output mode of the E3S-R.
*2. Voltage output (When connecting a transistor circuit, etc.)

Safety Precautions

Refer to *Warranty and Limitations of Liability*.

⚠ WARNING

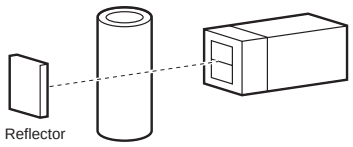
This product is not designed or rated for ensuring safety of persons either directly or indirectly. Do not use it for such purposes.

Precautions for Correct Use

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

● Adjusting

- When the E3S-R senses a cylindrical object, the amount of light received varies with the direction of the cylindrical object. To prevent this, locate the E3S-R as shown in the following illustration.



- When the E3S-R senses an uneven plastic container or glass bottle, the amount of light received varies with the direction and sensing part of the plastic container or glass bottle. To prevent this, turn a sample of the plastic container or glass bottle to the best sensing position of the E3S-R to find and decide the optimum direction and sensing part, and then make the sensitivity adjustment.
- In principle, sensing objects must pass through the center between the E3S-R and the reflector. Sensing objects must not be too close to the Reflector, otherwise sensing errors may result.
- Unless otherwise indicated, the E39-R1 Reflector is required for transparent object detection. The Receiver may not receive any light and detection capability may decline with other Reflectors.

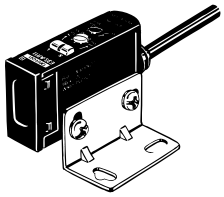
Dimensions

(Unit: mm)
Tolerance class IT16 applies to dimensions in this datasheet unless otherwise specified.

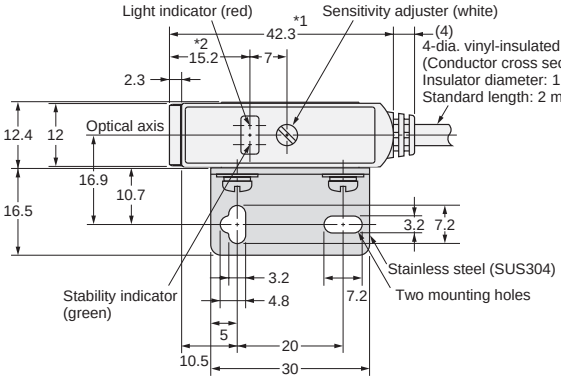
Sensors

Compact Horizontal Models with Plastic Housing

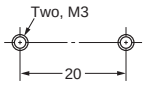
Pre-wired Models
E3S-R11, E3S-R12
E3S-R31

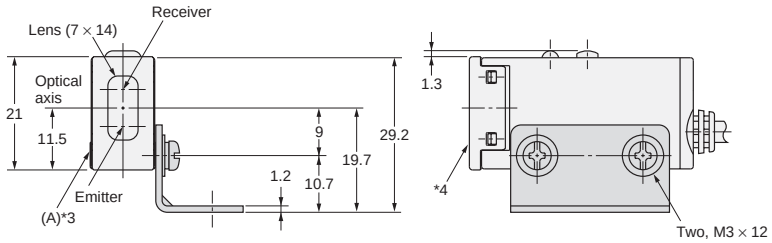


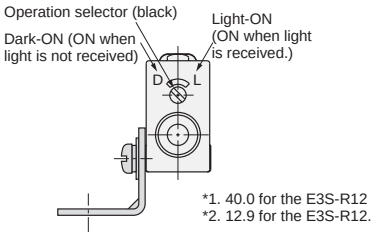
With Mounting Bracket Attached



Mounting Holes



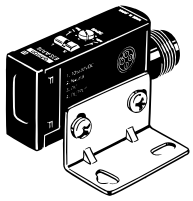




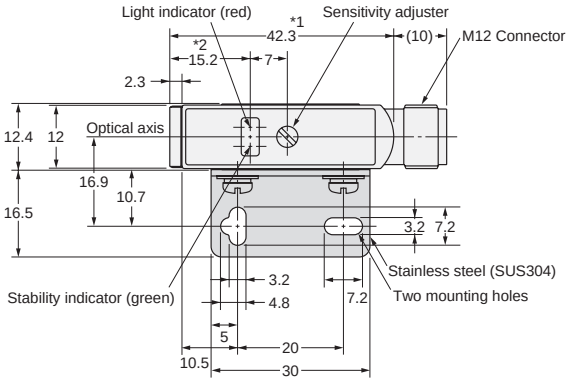
*1. 40.0 for the E3S-R12
*2. 12.9 for the E3S-R12.

*3. The mounting bracket can be attached to this side.
*4. Not available on the E3S-R12.

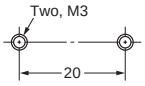
Standard Connector Models
E3S-R16, E3S-R17
E3S-R36

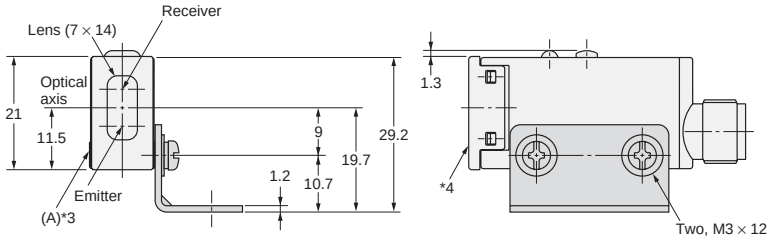


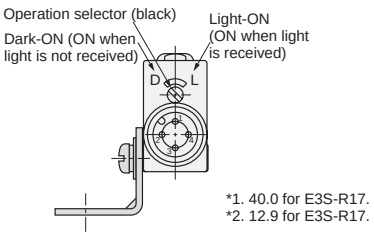
With Mounting Bracket Attached



Mounting Holes





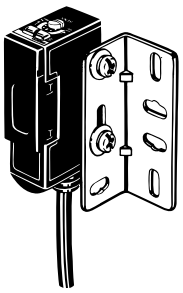


*1. 40.0 for E3S-R17.
*2. 12.9 for E3S-R17.

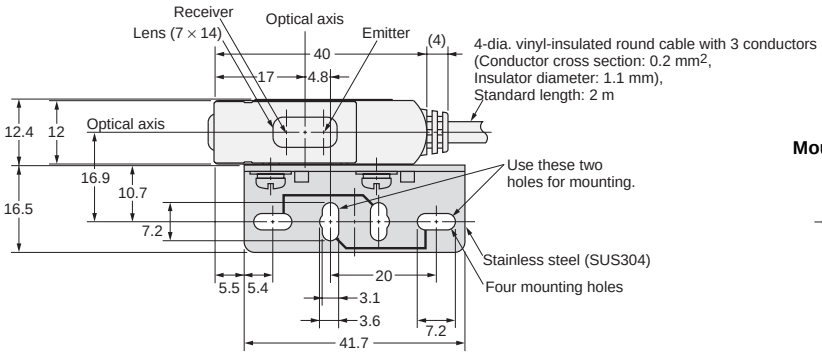
*3. The mounting bracket can be attached to this side.
*4. Not available on the E3S-R17.

Compact Vertical Models with Plastic Housing

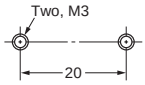
Pre-wired Models
E3S-R61, E3S-R62
E3S-R81

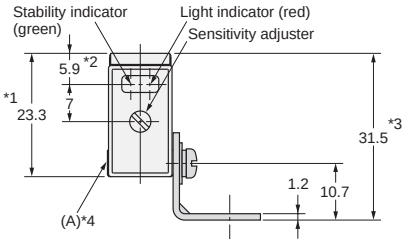


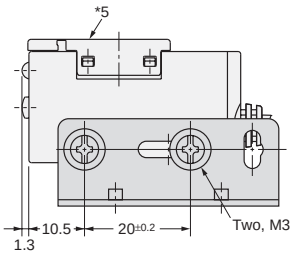
With Mounting Bracket Attached

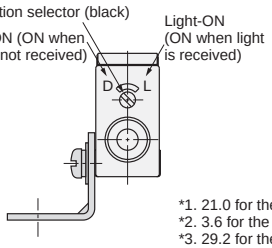


Mounting Holes





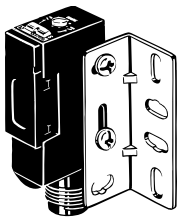




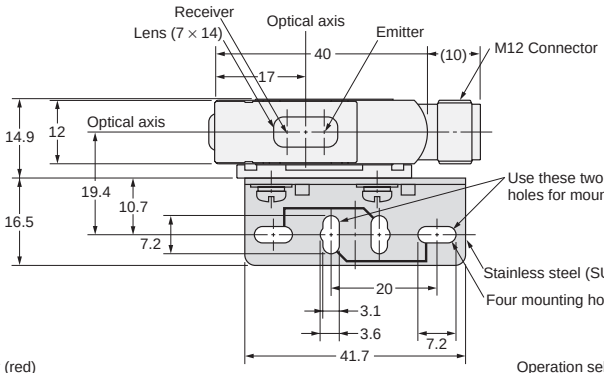
*1. 21.0 for the E3S-R62.
*2. 3.6 for the E3S-R62.
*3. 29.2 for the E3S-R62.

*4. The mounting bracket can be attached to this side.
*5. Not available on the E3S-R62.

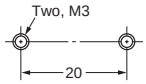
Standard Connector Models
E3S-R66, E3S-R67
E3S-R86

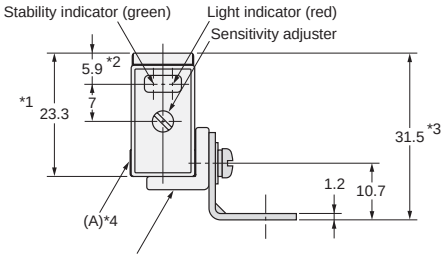


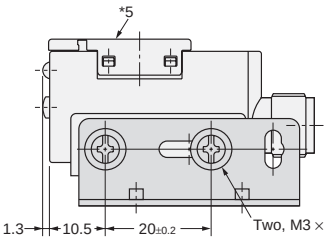
With Mounting Bracket Attached

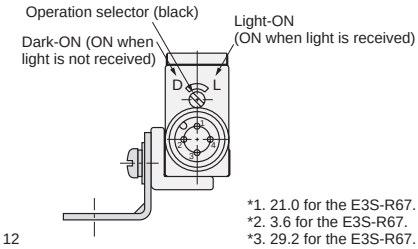


Mounting Holes









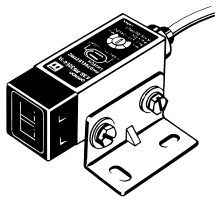
*1. 21.0 for the E3S-R67.
*2. 3.6 for the E3S-R67.
*3. 29.2 for the E3S-R67.

E39-L60 Close Mounting Plate (provided)
(Attach the mounting plate or the plug cannot be connected.)

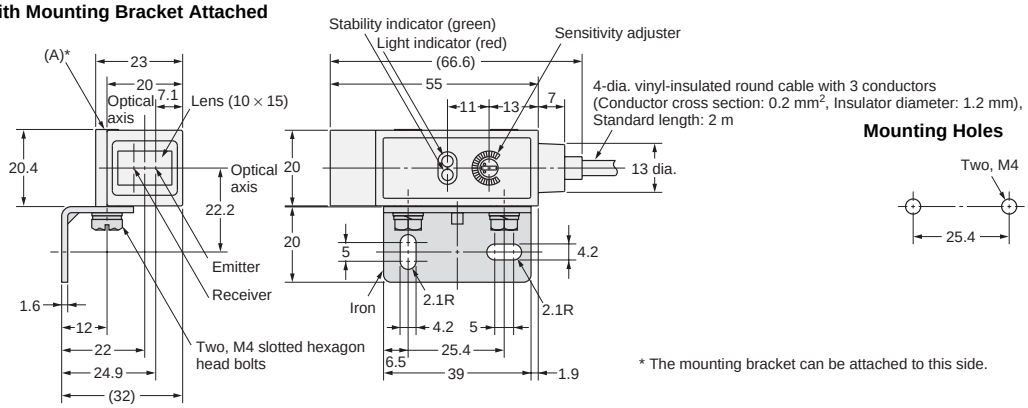
*4. The mounting bracket can be attached to this side.
*5. Not available on the E3S-R67.

Horizontal Models with Metal Housing

E3S-RS30E4
E3S-R1E4



With Mounting Bracket Attached

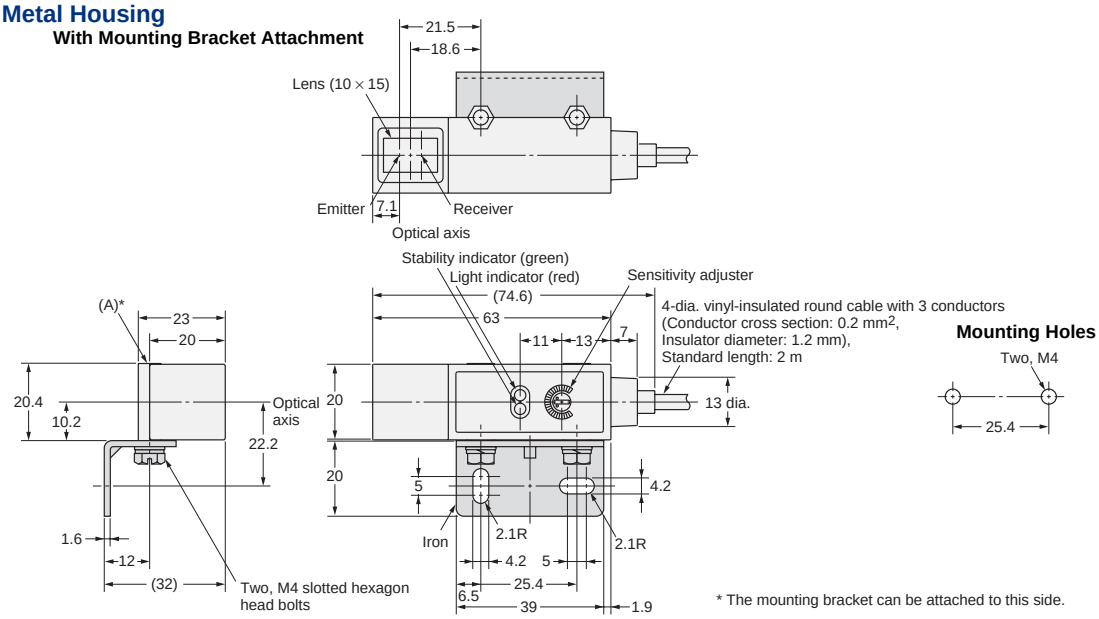


* The mounting bracket can be attached to this side.

Vertical Models with Metal Housing

E3S-RS30E42
E3S-R1E42

With Mounting Bracket Attachment



* The mounting bracket can be attached to this side.

Accessories (Order Separately)

Sensitivity Adjuster

Refer to *E39-L/F39-L/E39-S/E39-R* for details.

Reflectors

Refer to *E39-L/F39-L/E39-S/E39-R* for details.

Mounting Brackets

Refer to *E39-L/F39-L/E39-S/E39-R* for details.

Close Mounting Plates

Refer to *E39-L/F39-L/E39-S/E39-R* for details.

Sensor I/O Connectors

Refer to *Introduction to Sensor I/O Connectors* for details.