

# Transparent Object Detection Photoelectric Sensor E3S-DB

## Superb Detection of Many Types of Transparent Objects



- Double slits inside Sensor prevent incorrect operation.
- P-opaquin function\* improves detection of PET bottles and transparent films.
- Smart Teaching for optimum settings in as little as 3 seconds.
- Maximum sensing distance of 3.5 m.
- IP69K protection recommended for food and beverage industry. Third-party certification from Ecolab in Europe for detergent resistance.
- Variable connector and cable directions, and 360° indicators for greater usability.



\* This function uses polarization to opaque transparent objects that exhibit double refraction.



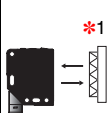

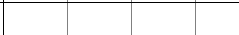
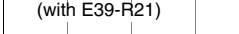

Refer to the **Safety Precautions** on page 7.

For the most recent information on models that have been certified for safety standards, refer to your OMRON website.

## Ordering Information

### Sensors (Refer to *Dimensions* on page 8.)

 Red light



Sensing method	Appearance	Sensitivity adjustment	Connection method	Sensing distance *2	Model	
					NPN output	PNP output
Retro-reflective (with MSR function)		Smart Teaching	Pre-wired (2 m)	 3.5 m	E3S-DBN11 2M	E3S-DBP11 2M
			Connector (M12)		E3S-DBN21	E3S-DBP21
			M12 Smartclick pre-wired connector (0.3 m)		E3S-DBN31 0.3M	E3S-DBP31 0.3M
		Eleven-turn adjuster	Pre-wired (2 m)	 3.5 m	E3S-DBN12 2M	E3S-DBP12 2M
			Connector (M12)		E3S-DBN22	E3S-DBP22
			M12 Smartclick pre-wired connector (0.3 m)		E3S-DBN32 0.3M	E3S-DBP32 0.3M
		Eleven-turn adjuster	Pre-wired (2 m)	 3.5 m	E3S-DBN11T 2M	E3S-DBP11T 2M
			Connector (M12)		E3S-DBN21T	E3S-DBP21T
			M12 Smartclick pre-wired connector (0.3 m)		E3S-DBN31T 0.3M	E3S-DBP31T 0.3M
		Eleven-turn adjuster	Pre-wired (2 m)	 3.5 m	E3S-DBN12T 2M	E3S-DBP12T 2M
			Connector (M12)		E3S-DBN22T	E3S-DBP22T
			M12 Smartclick pre-wired connector (0.3 m)		E3S-DBN32T 0.3M	E3S-DBP32T 0.3M

\*1. A Reflector is not included with the Sensor. Select a Reflector (sold separately) according to the application.

\*2. There is no close-range dead zone between the Sensor and Reflector.

## Accessories (Sold Separately)

**Sensor I/O Connectors (Connector on One End)** (A Connector is required for a Sensor with a connector or pre-wired connector.) Connectors are not provided with the Sensors. Be sure to order a Connector separately.


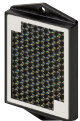




Size	Cable specifications	Appearance	Cable length	Model
*1 M12 (4 pins)	Fire-retardant robot cable	Straight  *2	2 m	XS2F-D421-D80-F
			5 m	XS2F-D421-G80-F
		Straight  *2	2 m	XS5F-D421-D80-F
			5 m	XS5F-D421-G80-F

\*1 Refer to your OMRON website for details on the XS2 and XS5.

\*2 The connectors will not rotate after they are connected.

**Reflectors** (A Reflector is required for each Retro-reflective Sensor.) (Refer to *Dimensions* on page 10.)

Reflectors are not provided with the Sensors. Be sure to order a Reflector separately.

Appearance	Sensing distance* (reference value)	Model	Quantity	Applicable Sensors	Remarks
	3.5 m	E39-R1S	1	E3S-DB□□1(T)	Standard model
	2 m	E39-R1K		E3S-DB□□1(T)	Non-fogging reflective plate
	3 m	E39-RP1		E3S-DB□□1(T)	Special Polarizing Reflector
	0.5 m (rated value)	E39-R21		E3S-DB□□2(T)	Narrow-beam Reflector
	3.5 m (rated value)	E39-R8		E3S-DB□□1(T)	Standard model
	1.5 m	E39-RS10		E3S-DB□□1(T)	Sheets
	0.5 m			E3S-DB□□2(T)	
	2.5 m	E39-RS11		E3S-DB□□1(T)	
	0.5 m			E3S-DB□□2(T)	



**Note: 1.** If you use the Reflector at any distance other than the rated distance, make sure that the stability indicator lights properly when you install the Sensor.

**2.** Refer to *Engineering Data (Reference Value)* on page 4 for details.

\* There is no close-range dead zone between the Sensor and Reflector.

**Mounting Brackets** (Refer to *Dimensions* on page 11.)

A Mounting Bracket is not provided with the Sensor. It must be ordered separately as required.

Type	Appearance	Model	Quantity
Bottom-mounting		E39-L192	1
Side-mounting		E39-L193	

**Note:** For details, refer to the *Mounting Brackets* on E39-L/E39-S/E39-R which can be accessed from your OMRON website.

## Ratings and Specifications

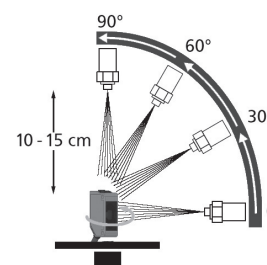
Sensing method		Retro-reflective (with MSR function)			
Model	NPN output	E3S-DBN□1	E3S-DBN□1T	E3S-DBN□2	E3S-DBN□2T
Item	PNP output	E3S-DBP□1	E3S-DBP□1T	E3S-DBP□2	E3S-DBP□2T
Sensing distance		0 to 3.5 m (with E39-R8)			0 to 0.5 m (with E39-R21)
Spot diameter (reference value)*1		6-mm dia. (at sensing distance of 250 mm)			2.5-mm dia. (at sensing distance of 200 mm)
Light source (wavelength)		Red LED (624 nm)			
Power supply voltage		10 to 30 VDC, including 10% ripple (p-p)			
Power consumption		720 mW max. (current consumption: 30 mA max. at power supply voltage of 24 VDC)			
Control output		Load power supply voltage: 30 VDC max., Load current: 100 mA max. (Residual voltage: 2 V max.) Open-collector output (NPN/PNP output depending on model.)			
Indicators		Light indicator (orange) and stability indicator (green)			
Protection circuits		Reversed power supply polarity protection, output short-circuit protection, reversed output polarity protection, and mutual interference prevention			
Response time		Operate or reset: 0.5 ms max.			
Sensitivity adjustment		Smart Teaching	Eleven-turn adjuster	Smart Teaching	Eleven-turn adjuster
Smart Teaching lock function		Provided.	---	Provided.	---
Automatic compensation (AC <sup>3</sup> )		Provided (OFF by default).	---	Provided (OFF by default).	---
Ambient illumination		(Receiver side) Incandescent lamp: 3,000 lx max., Sunlight: 10,000 lx max.			
Ambient temperature range		Operating: -25 to 60°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 at 50/60 Hz for 1 minute			
Vibration resistance		Destruction: 10 to 55 Hz with double amplitude of 1.5 mm for 2 hours each in X, Y, and Z directions			
Shock resistance		Destruction: 500 m/s <sup>2</sup> 3 times each in X, Y, and Z directions			
Degree of protection*2		IEC IP67, DIN 40050-9 IP69K			
Connection method		Pre-wired cable (standard cable length: 2 m) Connector (M12, 4 pins) Pre-wired connector (standard cable length: 0.3 m/M12, 4 pins)			
Weight (packed state/Sensor only)	Pre-wired models	Approx. 80 g/approx. 60 g			
	Models with connector	Approx. 60 g/approx. 40 g			
	Models with pre-wired connector	Approx. 180 g/approx. 160 g			
Materials	Case	Polybutylene terephthalate (PBT)/ABS			
	Lens	Methacrylic resin (PMMA)			
	Indicators	Methacrylic resin (PMMA)			
	Sensitivity adjuster and Threshold adjuster	Polyester elastomer			
	Cable	Polyvinyl chloride (PVC)			
Accessories		Instruction manual			

\*1. Refer to *Emission Spot Diameter vs. Distance in Engineering Data (Reference Value)* on page 4 for details.

\*2. IP69K Degree of Protection Specification

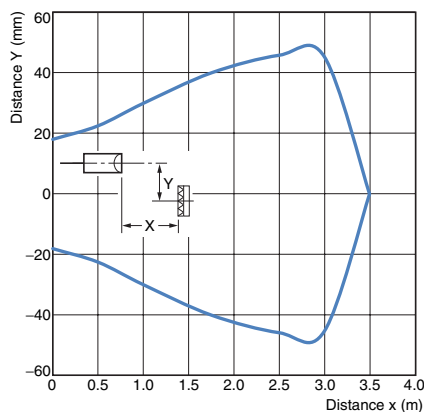
IP69K is a protection standard against high temperature and high-pressure water defined in the German standard DIN 40050, Part 9. The test piece is sprayed with water at 80°C at a water pressure of 80 to 100 BAR using a specified nozzle shape at a rate of 14 to 16 liters/min.

The distance between the test piece and nozzle is 10 to 15 cm, and water is sprayed horizontally for 30 seconds each at 0°, 30°, 60°, and 90° while rotating the test piece on a horizontal plane.

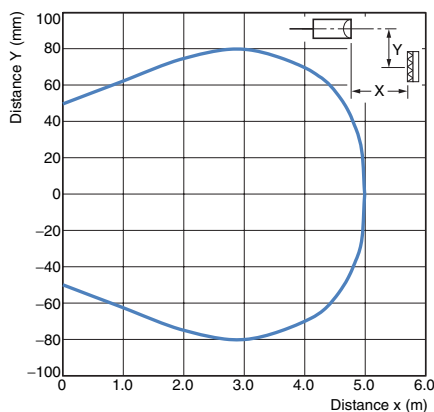


### Parallel Operating Range

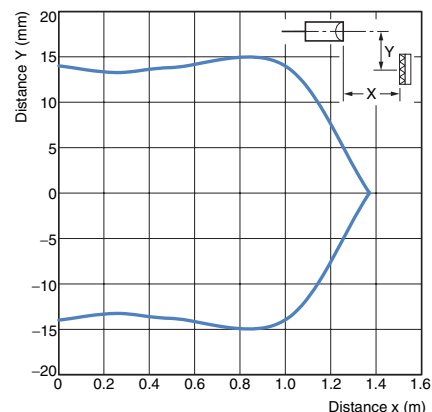
E3S-DB□□1(T) + E39-R1S (Reflector)



E3S-DB□□1(T) + E39-R8 (Reflector)

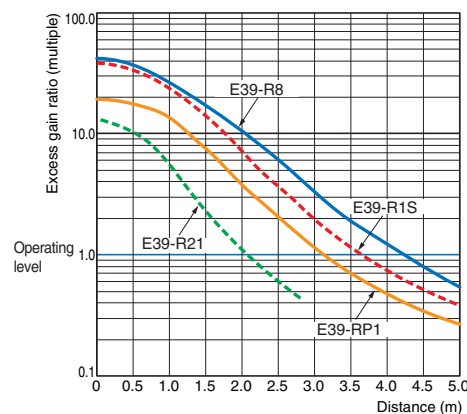


E3S-DB□□2(T) + E39-R21 (Reflector)

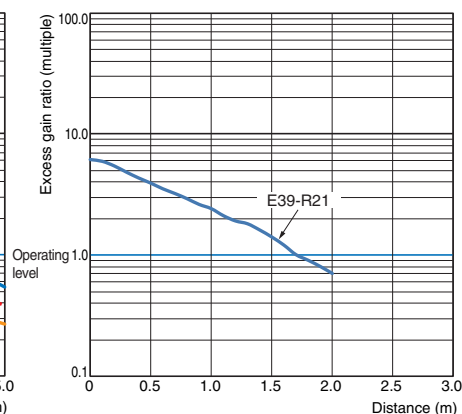


### Excess Gain vs. Distance

E3S-DB□□1(T) + Reflector

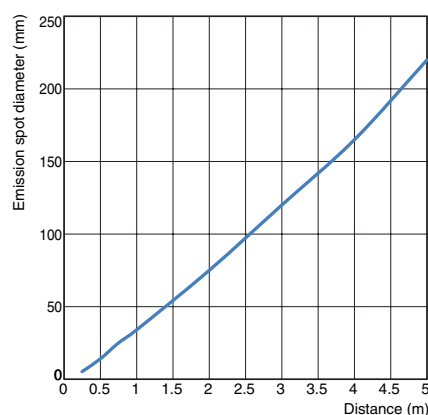


E3S-DB□□2(T) + E39-R21 (Reflector)

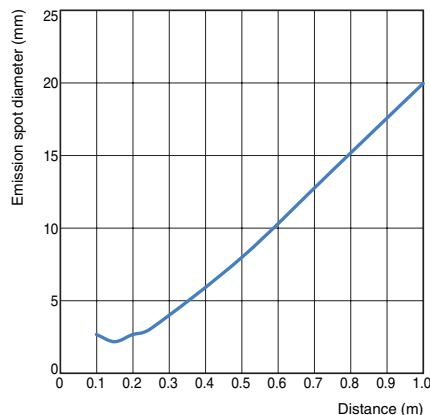


### Emission Spot Diameter vs. Distance

E3S-DB□□1(T)



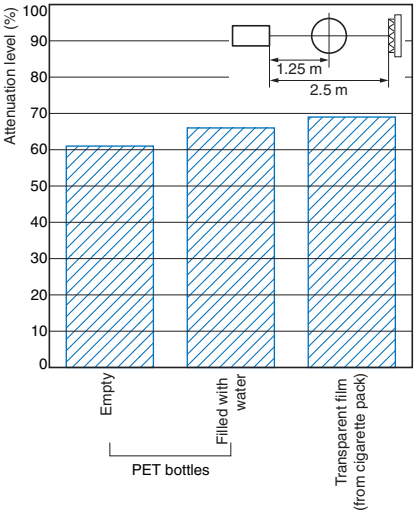
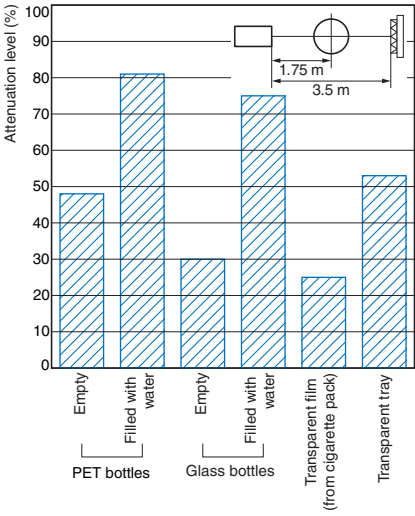
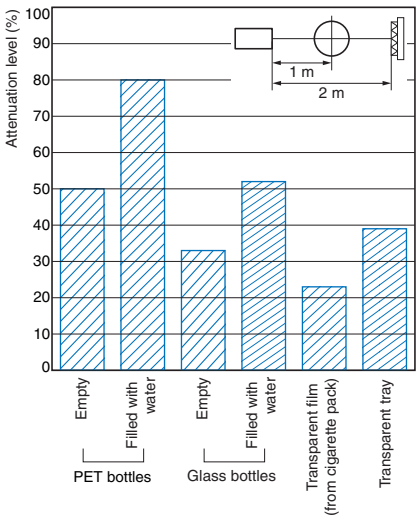
E3S-DB□□2(T)



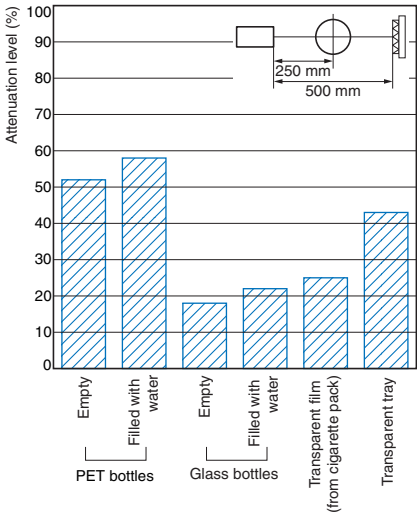
**Note:** These values were measured at maximum sensitivity.

Attenuation Level vs. Sensing Object Characteristics (Typical Values)

E3S-DB□□1(T) + E39-R1S/E39-R1K (Reflector)    E3S-DB□□1(T) + E39-R8 (Reflector)    E3S-DB□□1(T) + E39-RP1 (Special Polarizing Reflector)



E3S-DB□□2(T) + E39-R21 (Reflector)



# E3S-DB

## I/O Circuit Diagrams

### NPN Output

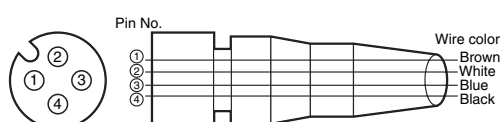
Model	Operation mode	Timing charts	Output circuit
E3S-DBN□ E3S-DBN□IT	Light ON	Incident light No incident light Light indicator (orange) ON OFF Output 1 OFF Load (e.g., relay) Operate Reset Between brown (1) and black (4) leads	
	Dark ON	Incident light No incident light Light indicator (orange) ON OFF Output 2 ON OFF Load (e.g., relay) Operate Reset Between brown (1) and white (2) leads	

### PNP Output

Model	Operation mode	Timing charts	Output circuit
E3S-DBP□ E3S-DBP□IT	Light ON	Incident light No incident light Light indicator (orange) ON OFF Output 1 ON OFF Load (e.g., relay) Operate Reset Between blue (3) and black (4) leads	
	Dark ON	Incident light No incident light Light indicator (orange) ON OFF Output 2 ON OFF Load (e.g., relay) Operate Reset Between white (2) and blue (3) leads	

## Connectors (Sensor I/O Connectors)

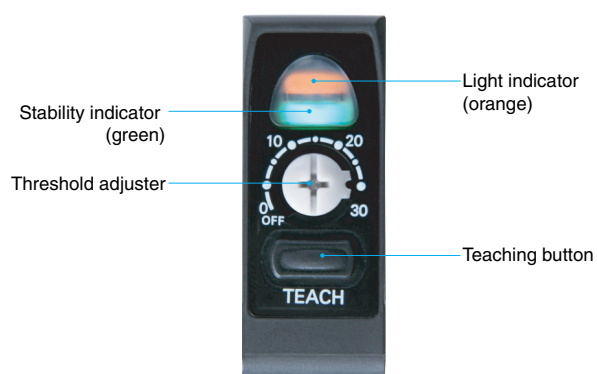
### M12, 4-pin Connectors



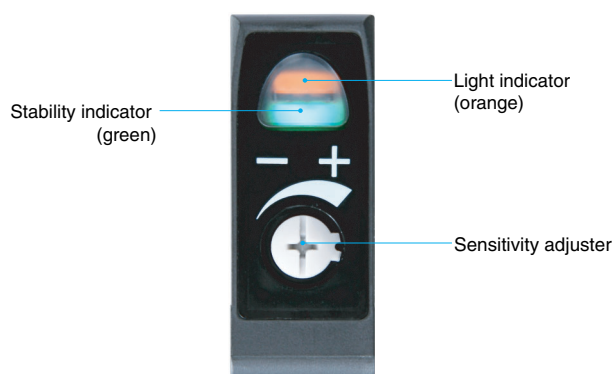
Classification	Wire color	Pin No.	Application
DC	Brown	①	Power supply (+V)
	White	②	Output 2 (Dark ON)
	Blue	③	Power supply (0 V)
	Black	④	Output 1 (Light ON)

## Nomenclature

### Smart Teaching Type



### Eleven-turn Adjuster Type



## Safety Precautions

Be sure to read the precautions for all models in the website at: <http://www.ia.omron.com/>.

### WARNING

**Do not use the product with voltage in excess of the rated voltage.**

**Excess voltage may result in malfunction or fire.**



**Never use the product with an AC power supply.**

**Otherwise, explosion may result.**



**The maximum power supply voltage is 30 VDC.**

**Before turning the power ON, make sure that the power supply voltage does not exceed the maximum voltage.**



**Do not use the product under a chemical or an oil environment without prior evaluation.**



### Precautions for Safe Use

Be sure to follow the safety precautions below for added safety.

1. Do not use the product in an environment where explosive or flammable gas is present.
2. The degree of protection is IP69K, but do not use the product in water, rain, or outdoors.
3. Do not use the product in atmospheres or environments that exceed product ratings.
4. Do not use the product in locations subject to direct sunlight.
5. Do not use the product in locations subject to direct vibration or shock.
6. Do not use thinner, alcohol, or other organic solvents. Otherwise, the optical properties and degree of protection may be degraded.
7. Do not attempt to disassemble, repair, or modify the product in any way.
8. When disposing of the product, treat it as industrial waste.
9. Do not use highly concentrated cleaning agents. Otherwise, malfunction may result. Also, do not use high-pressure water with a level of pressure that exceeds the stipulated level. Otherwise, the degree of protection may be reduced.
10. Perform sensitivity adjustment with the torque of 0.06 N·m or less.
11. Do not pull on the cable with excessive strength.
12. Do not exert excessive force on the connector section.
13. This product cannot be used as a detection system to protect human bodies.
14. These Sensors are certificated for the UL standard on the assumption of usage in a Class 2 circuit. Use them with Class 2 power supplies in the United States or Canada. Use the OMRON XS2F-D4-series or XS5F-D4-series Cables. Cables that have wires less than AWG24 (0.2 mm<sup>2</sup>) are for connection to terminal blocks and are not for field splicing. External overcurrent protection of 1 A for AWG26, 2 A for AWG24, or 3 A for AWG22 wire must be provided for cable protection.

### Precautions for Correct Use

1. If the Sensor wiring is placed in the same conduits or ducts as high-voltage or high-power lines, inductive noise may cause malfunction or damage. Wire the cables separately or use a shielded cable.
2. If a commercial switching regulator is used, ground the FG (frame ground) terminal.
3. The Sensor will be able to detect objects 100 ms after the power supply is turned ON. Start using the Sensor 100 ms or more after turning ON the power supply. If the load and the Sensor are connected to separate power supplies, be sure to turn ON the Sensor first.
4. Output pulses may occur when the power supply is turned OFF. We recommend that you turn OFF the power supply to the load or load line first.
5. Use M4 screws to mount the sensor and tighten each screw to a maximum torque of 1.2 N·m.

## Dimensions

**Tolerance class IT16 applies to dimensions in this data sheet unless otherwise specified.**

**E3S-DBP1□(T)**

**E3S-DBP3** ☐ (T)

Pin No.	Application
①	Power supply (+V)
②	Output 2 (Dark ON)
③	Power supply (0 V)
④	Output 1 (Light ON)

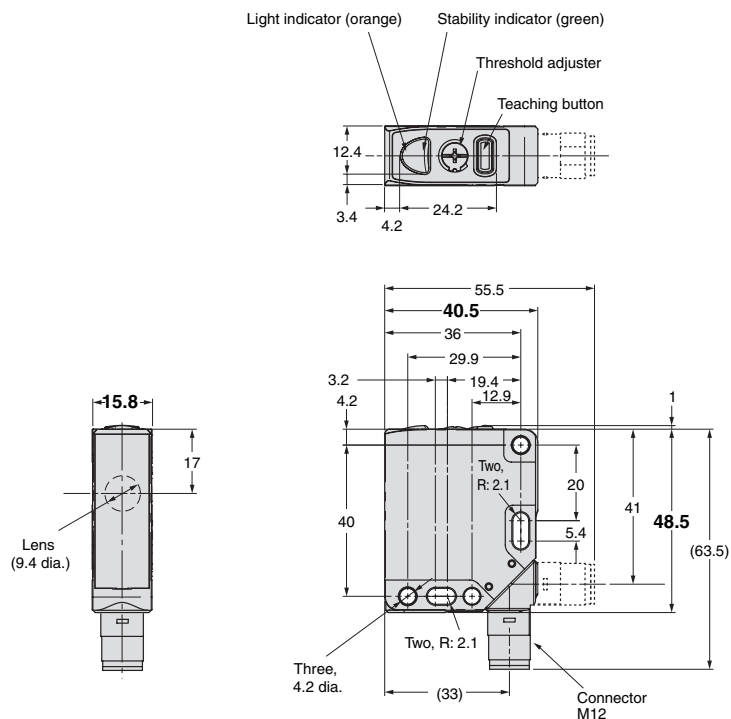


## Models with M12 Connector

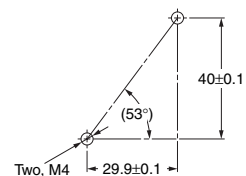
E3S-DBN2□(T)

E3S-DBP2□(T)

### Smart Teaching Type



#### Mounting Holes

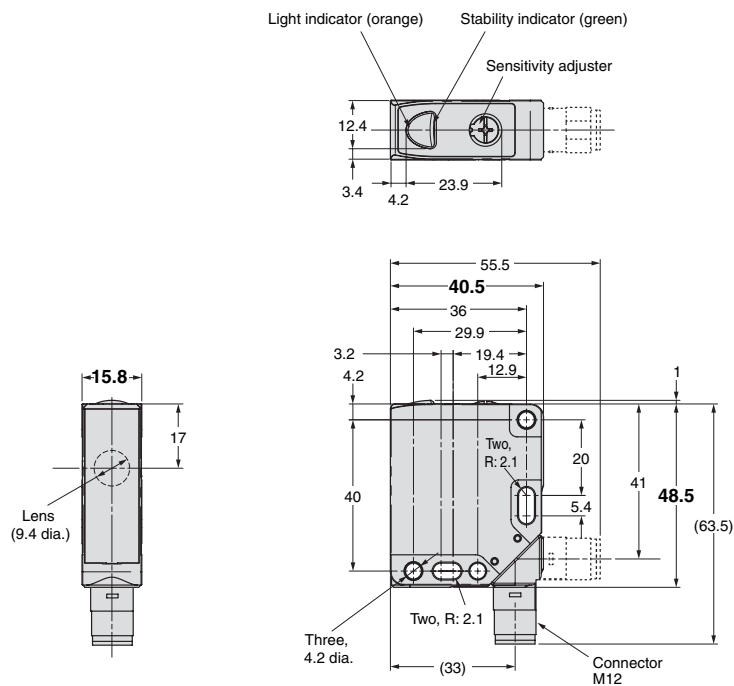


#### Connector Pin Arrangement



Pin No.	Application
①	Power supply (+V)
②	Output 2 (Dark ON)
③	Power supply (0 V)
④	Output 1 (Light ON)

### Eleven-turn Adjuster Type



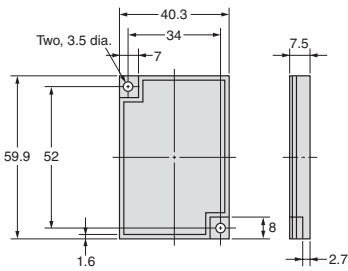
Accessories (Sold Separately)

Reflector

E39-R1S/E39-R1K\*



Materials: Reflective surface: Acrylic, Rear surface: ABS  
\* E39-R1K only  
Coating on reflective surface

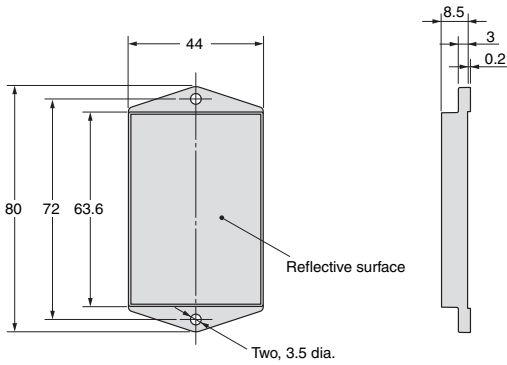


Special Polarizing Reflector

E39-RP1



Materials: Reflective surface: Acrylic, Rear surface: ABS

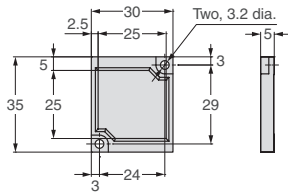


Reflector

E39-R21

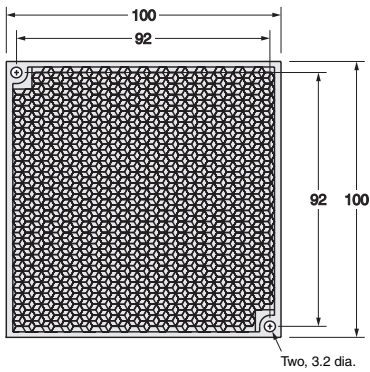
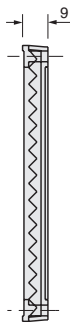
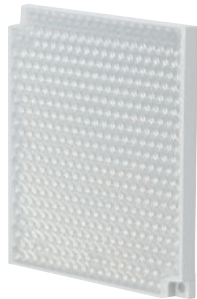


Materials: Reflective surface: Methacrylic resin (PMMA),  
Rear surface: Polybutylene terephthalate (PBT)



Reflector

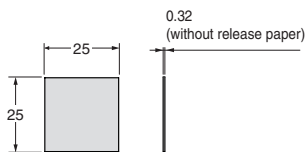
E39-R8



Materials: Reflective surface: Acrylic, Rear surface: ABS

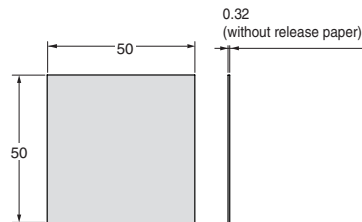
Reflector

E39-RS10



Materials: Reflective surface: Methacrylic resin (PMMA)

E39-RS11



Materials: Reflective surface: Methacrylic resin (PMMA)



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# Terms and Conditions Agreement

## Read and understand this catalog.

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- (a) Exclusive Warranty. Omron's exclusive warranty is that the Products will be free from defects in materials and workmanship for a period of twelve months from the date of sale by Omron (or such other period expressed in writing by Omron). Omron disclaims all other warranties, express or implied.
- (b) Limitations. OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, ABOUT NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OF THE PRODUCTS. BUYER ACKNOWLEDGES THAT IT ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE.

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Further, in no event shall liability of Omron Companies exceed the individual price of the Product on which liability is asserted.

## Suitability of Use.

Omron Companies shall not be responsible for conformity with any standards, codes or regulations which apply to the combination of the Product in the Buyer's application or use of the Product. At Buyer's request, Omron will provide applicable third party certification documents identifying ratings and limitations of use which apply to the Product. This information by itself is not sufficient for a complete determination of the suitability of the Product in combination with the end product, machine, system, or other application or use. Buyer shall be solely responsible for determining appropriateness of the particular Product with respect to Buyer's application, product or system. Buyer shall take application responsibility in all cases.

NEVER USE THE PRODUCT FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY OR IN LARGE QUANTITIES WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCT(S) IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

## Programmable Products.

Omron Companies shall not be responsible for the user's programming of a programmable Product, or any consequence thereof.

## Performance Data.

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