Transparent Object Detection Photoelectric Sensor
E3S-DB

Superb Detection of Many Types of Transparent Objects

- Double slits inside Sensor prevent incorrect operation.
- P-opaquing 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)	✻1	Smart Teaching	Pre-wired (2 m)	3.5 m (with E39-R8)	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
			Pre-wired (2 m)	Narrow beam 0.5 m (with E39-R21)	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 (with E39-R8)	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
			Pre-wired (2 m)	Narrow beam 0.5 m (with E39-R21)	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 Smartclick  ✻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

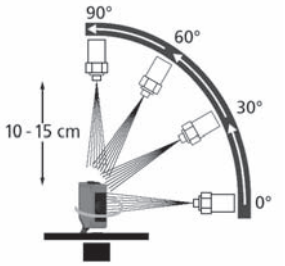
Item \ Model					
Sensing method		**Retro-reflective (with MSR function)**			
	NPN output	**E3S-DBN□1**	**E3S-DBN□1T**	**E3S-DBN□2**	**E3S-DBN□2T**
	PNP output	**E3S-DBP□1**	**E3S-DBP□1T**	**E3S-DBP□2**	**E3S-DBP□2T**
Sensing distance		0 to 3.5 m (with E39-R8)		0 to 0.5 m (with E39-R21)	
Spot diameter (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[3])		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^2 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.

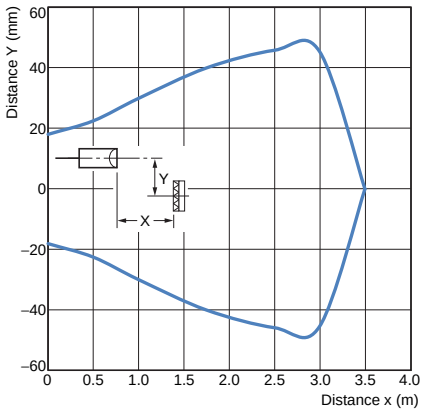
The distance between the test piece and nozzle is 10 to 15 cm, and water is sprayed horizontally for 30 seconds each at 0°, 30°, 60°, and 90° while rotating the test piece on a horizontal plane.



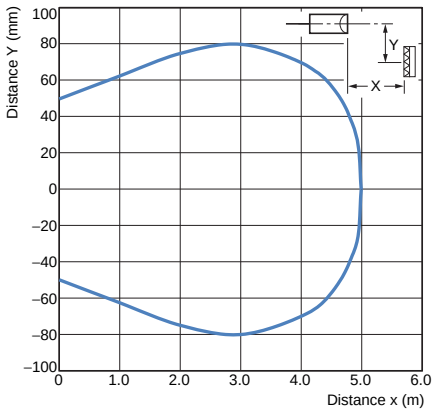
Engineering Data (Reference Value)

Parallel Operating Range

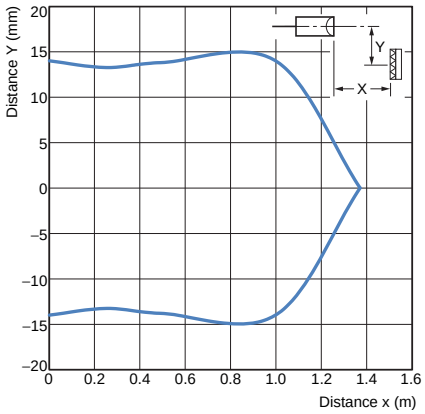
E3S-DB□□1(T) + E39-R1S (Reflector)



E3S-DB□□1(T) + E39-R8 (Reflector)

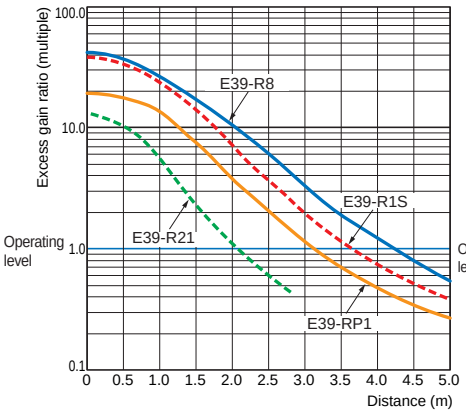


E3S-DB□□2(T) + E39-R21 (Reflector)

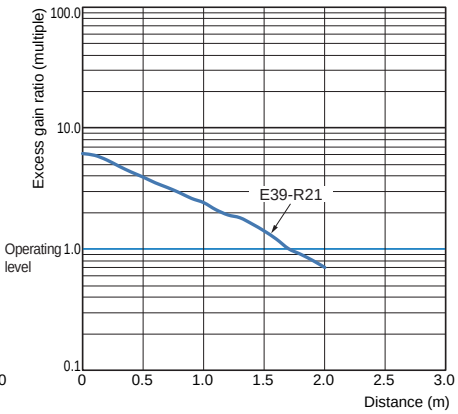


Excess Gain vs. Distance

E3S-DB□□1(T) + Reflector

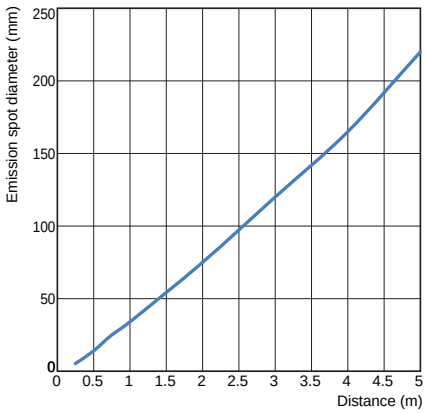


E3S-DB□□2(T) + E39-R21 (Reflector)

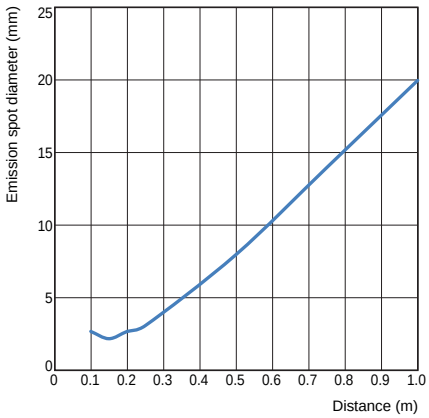


Emission Spot Diameter vs. Distance

E3S-DB□□1(T)



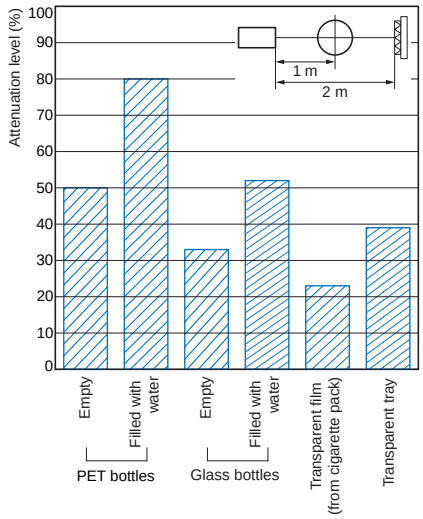
E3S-DB□□2(T)



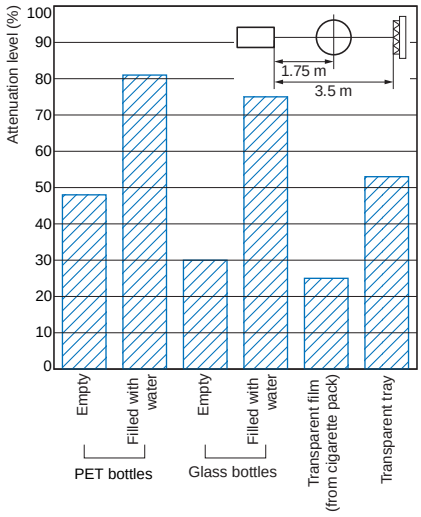
Note: These values were measured at maximum sensitivity.

Attenuation Level vs. Sensing Object Characteristics (Typical Values)

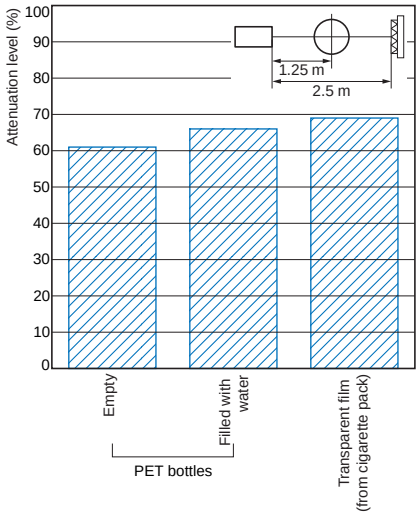
E3S-DB□□1(T) + E39-R1S/E39-R1K (Reflector)



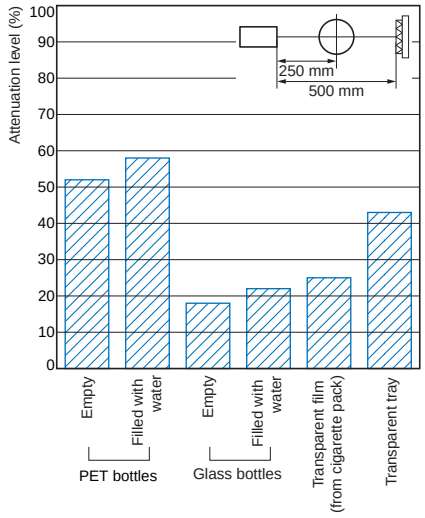
E3S-DB□□1(T) + E39-R8 (Reflector)



E3S-DB□□1(T) + E39-RP1 (Special Polarizing Reflector)



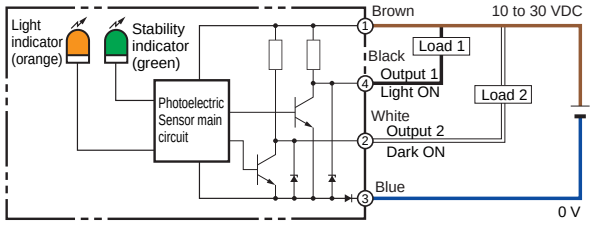
E3S-DB□□2(T) + E39-R21 (Reflector)



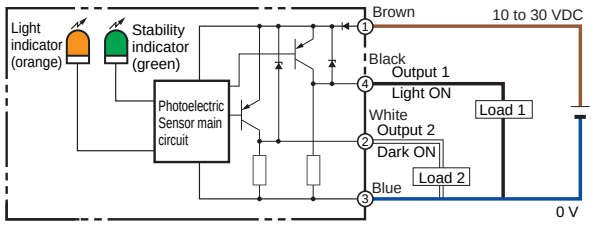
E3S-DB

I/O Circuit Diagrams

NPN Output

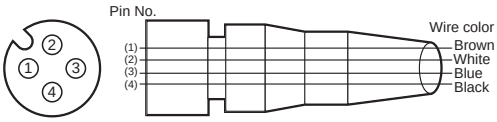
Model	Operation mode	Timing charts	Output circuit
E3S-DBN□ E3S-DBN□T	Light ON	Incident light / No incident light Light indicator (orange): ON / OFF Output 1: ON / OFF Load (e.g., relay): Operate / Reset Between brown (1) and black (4) leads)	  **M12, 4-pin Connector Pin Arrangement**
	Dark ON	Incident 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□T	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)	  **M12, 4-pin Connector Pin Arrangement**
	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)

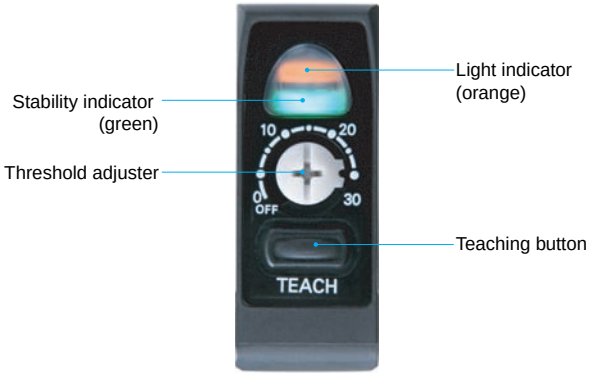
M12, 4-pin Connectors



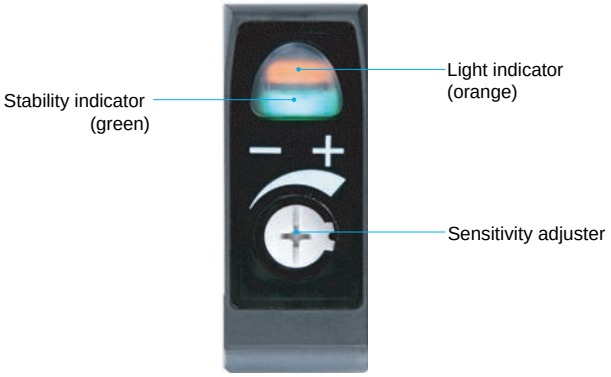
Classification	Wire color	Pin No.	Application
DC	Brown	(1)	Power supply (+V)
	White	(2)	Output 2 (Dark ON)
	Blue	(3)	Power supply (0 V)
	Black	(4)	Output 1 (Light ON)

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.

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 tuned 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.

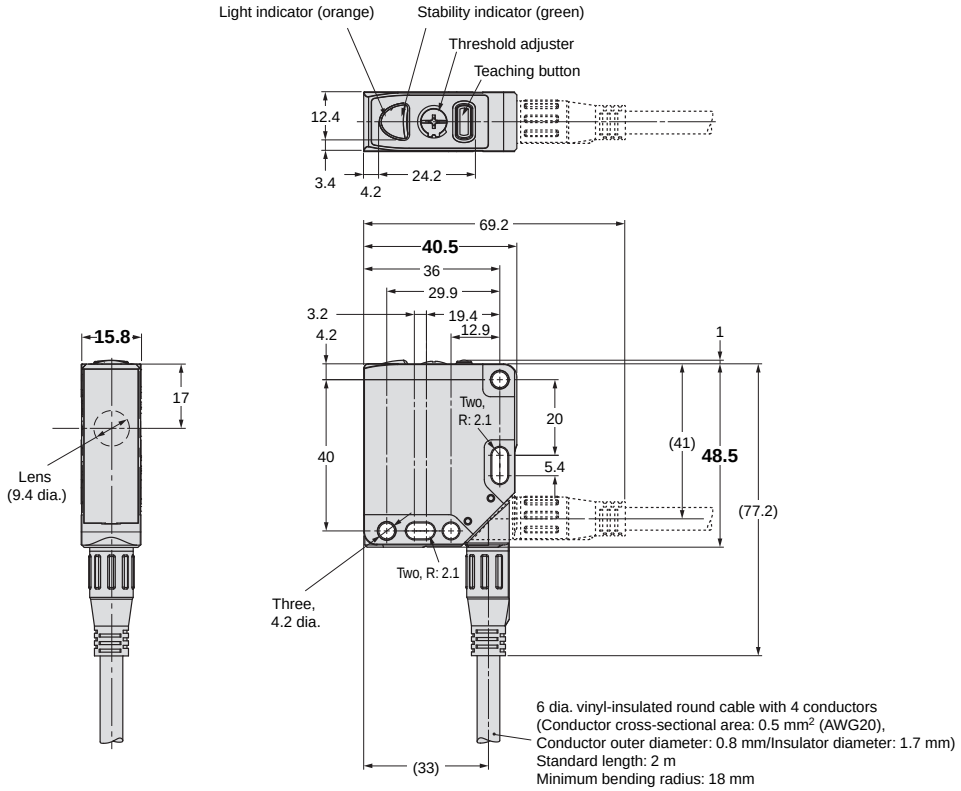
Dimensions

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

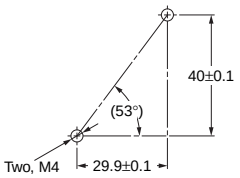
Sensors

Pre-wired Models	Models with Pre-wired Connector
E3S-DBN1□(T)	E3S-DBN3□(T)
E3S-DBP1□(T)	E3S-DBP3□(T)

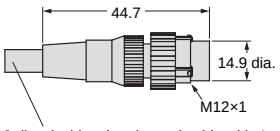
Smart Teaching Type



Mounting Holes



Connector on Models with Pre-wired Connector

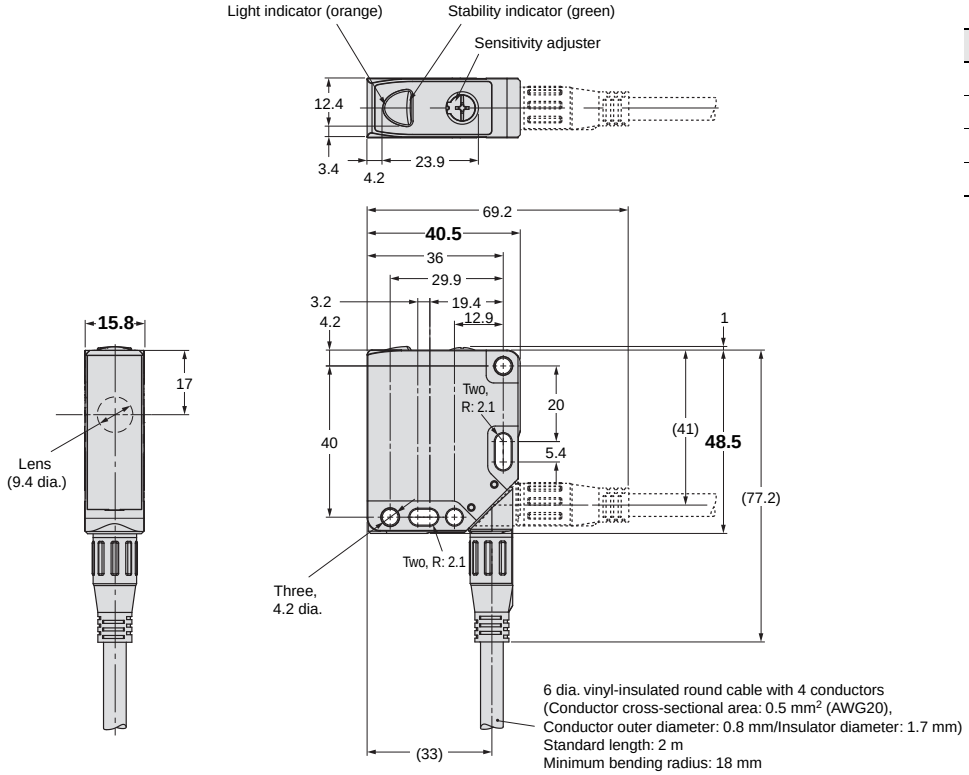


6 dia. vinyl-insulated round cable with 4 conductors (Conductor cross-sectional area: 0.5 mm² (AWG20),
Conductor outer diameter: 0.8 mm/Insulator diameter: 1.7 mm)
Standard length: 0.3 m
Minimum bending radius: 18 mm

Connector Pin Arrangement

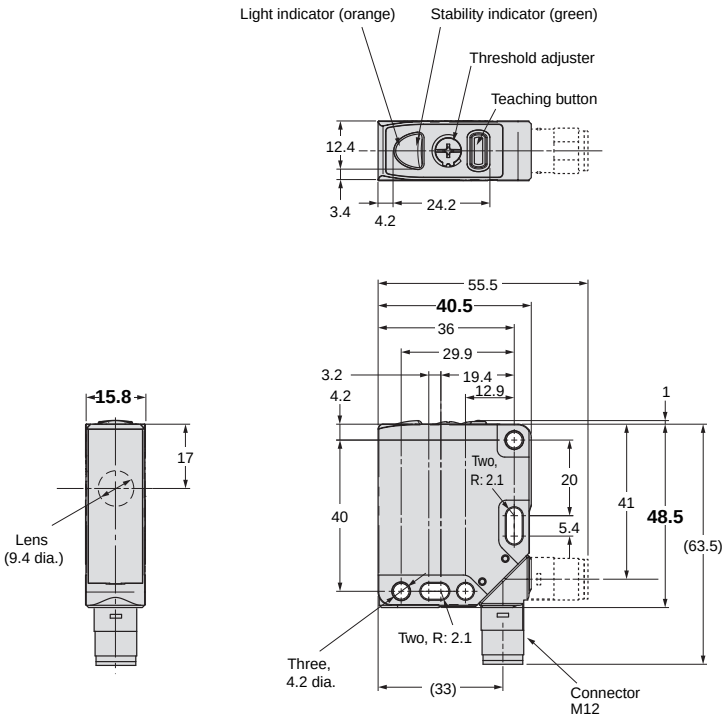
Pin No.	Application
(1)	Power supply (+V)
(2)	Output 2 (Dark ON)
(3)	Power supply (0 V)
(4)	Output 1 (Light ON)

Eleven-turn Adjuster Type

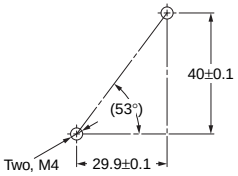


Models with M12 Connector
E3S-DBN2□(T)
E3S-DBP2□(T)

Smart Teaching Type



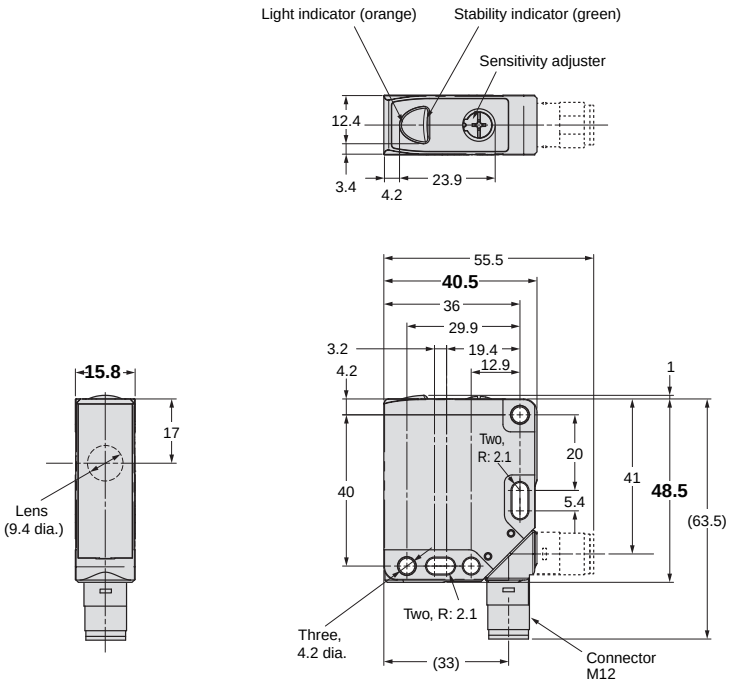
Mounting Holes



Connector Pin Arrangement

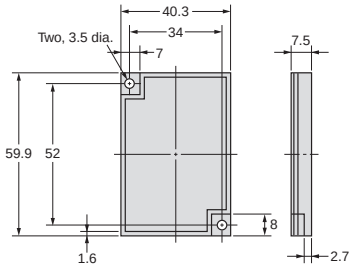
Pin No.	Application
(1)	Power supply (+V)
(2)	Output 2 (Dark ON)
(3)	Power supply (0 V)
(4)	Output 1 (Light ON)

Eleven-turn Adjuster Type



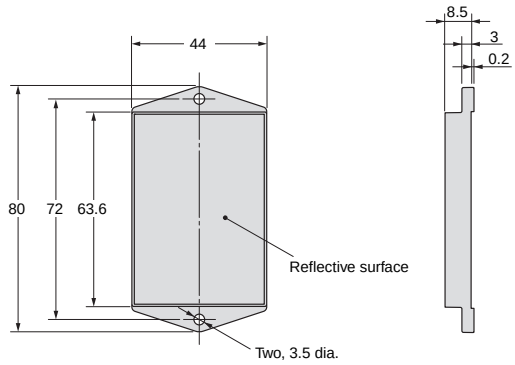
Accessories (Sold Separately)

Reflector
E39-R1S/E39-R1K*



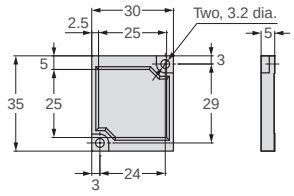
Materials: Reflective surface: Acrylic, Rear surface: ABS
*E39-R1K only
Coating on reflective surface

Special Polarizing Reflector
E39-RP1



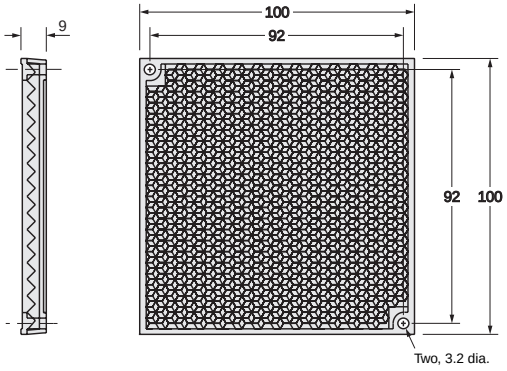
Materials: Reflective surface: Acrylic, Rear surface: ABS

Reflector
E39-R21



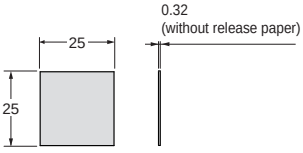
Materials: Reflective surface: Methacrylic resin (PMMA),
Rear surface: Polybutylene terephthalate (PBT)

Reflector
E39-R8



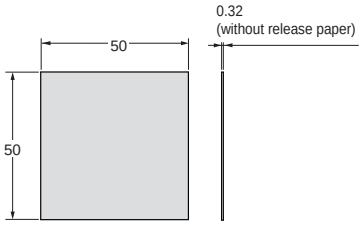
Materials: Reflective surface: Acrylic, Rear surface: ABS

Reflector
E39-RS10



Materials: Reflective surface: Methacrylic resin (PMMA)

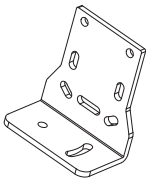
E39-RS11



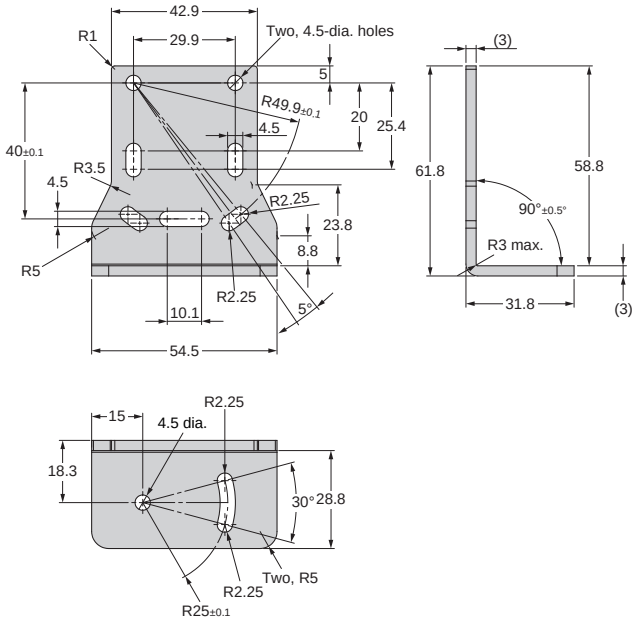
Materials: Reflective surface: Methacrylic resin (PMMA)

Mounting Brackets

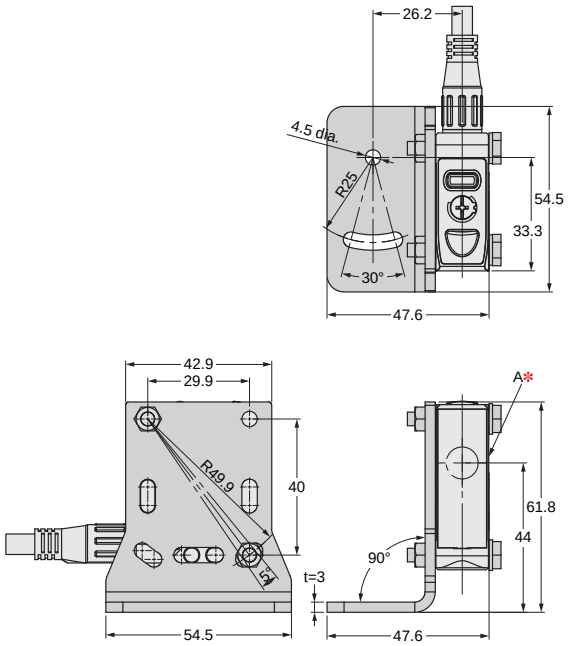
E39-L192



Material: SUS304

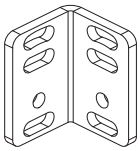


With Sensor Mounted

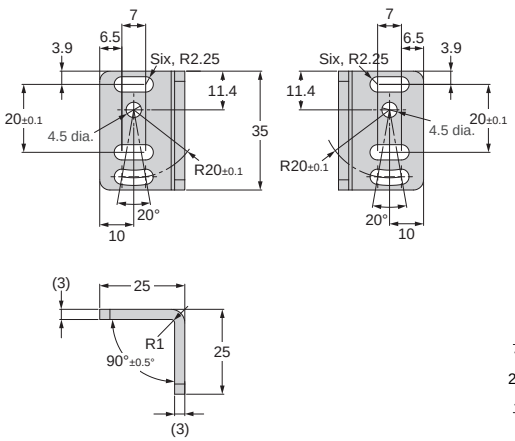


✻The Mounting Bracket can be attached to side A.

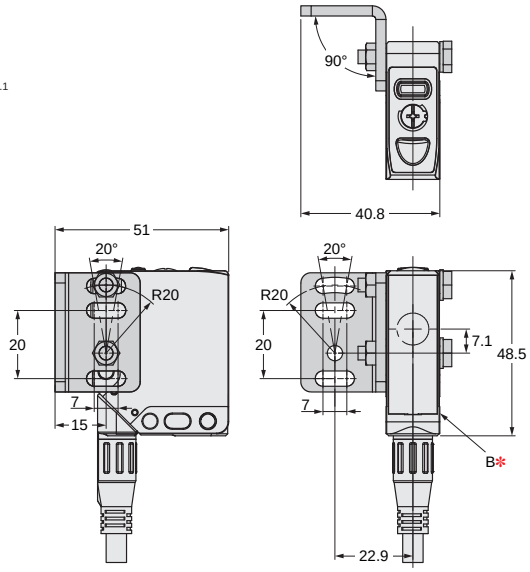
E39-L193



Material: SUS304



With Sensor Mounted



✻The Mounting Bracket can be attached to side B.

MEMO

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