OMRON

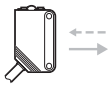
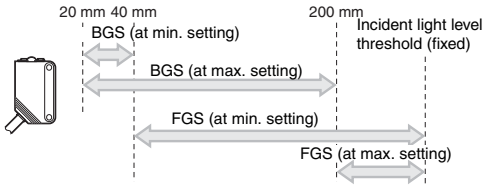
Distance-settable Photoelectric Sensor
E3Z-LS

Selectable Foreground/Background Suppression Photoelectric Sensor

- Stable sensing regardless of target's color or size.
- Adjustable sensing distance.
- Unique Algorithm minimizes external interference from fluorescent lighting.
- Visible light ensures easy alignment.
- Available in pre-wired or connector-ready configuration.

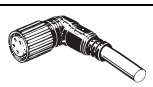
Ordering Information

■ Sensors

Sensing method (selectable)	Appearance	Connection method	Sensing distance (white paper)	Model	
				NPN output	PNP output
BGS/FGS diffuse		Pre-wired (2-m cable)		**E3Z-LS61**	**E3Z-LS81**
		M8 Connector		**E3Z-LS66**	**E3Z-LS86**

■ Accessories (Order Separately)

Sensor I/O Connectors

Cable specification	Appearance	Cable type		Model
Standard M8 cable	Straight 	2 m	4-wire	**XS3F-M421-402-A**
		5 m		**XS3F-M421-405-A**
	L-shaped 	2 m		**XS3F-M422-402-A**
		5 m		**XS3F-M422-405-A**

Mounting Brackets (Same for Entire E3Z Series)

Appearance	Qty	Remarks	Model	Appearance	Qty	Remarks	Model
	1	Mounting Bracket	**E39-L153**		1 set	Sensor Adjusters For easy mounting and adjustment with aluminum frames and rails, such as those on conveyors For horizontal adjustment	**E39-L150**
	1		**E39-L104**				
	1	Horizontal Mounting Bracket	**E39-L43**		1 set		**E39-L151**
	1	Horizontal Protective Cover/ Mounting Bracket	**E39-L142**				
	1	Rear-connecting Mounting Bracket	**E39-L44**				
	1	Protective Cover/ Mounting Bracket	**E39-L98**		1 set	Compact Protective Cover/ Mounting Bracket (for E3Z only)	**E39-L144**

Specifications

■ Ratings/Characteristics

Sensing method		Distance-settable	
Item	NPN output	E3Z-LS61	E3Z-LS66
	PNP output	E3Z-LS81	E3Z-LS86
Sensing distance (see *Operation*)	BGS	White or black paper (100 x 100 mm): 20 mm to 200 mm	
	FGS	White paper (100 x 100 mm): 40 mm to 200 mm Black paper (100 x 100 mm): 40 mm to 160 mm	
Adjustable sensing range (see note)		White paper (100 x 100 mm): 40 to 200 mm Black paper (100 x 100 mm): 40 to 160 mm	
Hysteresis		(Refer to the "Hysteresis vs. Sensing Distance" graph in the *Engineering* section of this data sheet.)	
Reflectivity characteristic (black/white error)		10% of set distance max.	
Light source (wavelength)		Red LED (680 nm)	
Power supply voltage		12 to 24 VDC ±10%, ripple (p-p) 10% max.	
Current consumption		30 mA max.	
Control output		Load power supply voltage 26.4 VDC max., load current 100 mA max. (residual voltage 1 V max.) Open collector output (NPN or PNP depending on model) Light-ON/Dark-ON switch selectable	
BGS/FGS selection (wire selectable)		BGS: Open or connected to GND FGS: Connected to Vcc (See *Operation*)	
Protective circuits		Reverse polarity protection, output short-circuit protection, mutual interference prevention	
Response time		Operation or reset: 1 ms max.	
Distance setting		5-turn adjuster	
Ambient illumination		Incandescent lamp: 3,000 lx max.; Sunlight: 10,000 lx max.	
Ambient temperature		Operating: –25 to 55°C, Storage: –40 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		1,000 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 60529 IP67	
Connection method		Pre-wired (standard length: 2 m/0.5 m)	M8 connector
Indicators		Operation indicator (orange), stability indicator (green)	
Weight (packed state)		Pre-wired Sensors, 2 m: Approx. 65 g	Approx. 20 g
Material	Case	PBT (polybutylene terephthalate)	
	Lens	Denaturated polyallylate	
Accessories		Instruction sheet (Mounting Brackets must be purchased separately.)	

Note: The sensing range of an object that has reflectivity that is similar to a white paper can be adjusted from 40 to 200 mm. The sensing range of an object that has reflectivity that is similar to a black paper can be adjusted from 40 to 160 mm.

Principle of Operation

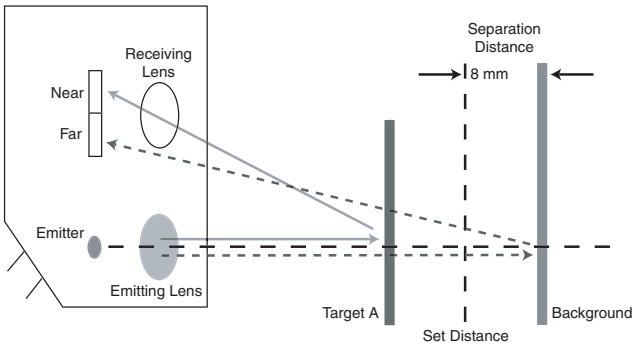
■ Background Suppression

Background Suppression: Objects beyond the set distance will not be detected.

To ensure reliable background suppression, a minimum separation distance between the set distance and the background is recommended. Please refer to the “Hysteresis vs. Sensing Distance” graph in the *Engineering* section of this data sheet to determine the minimum separation distance.

Example: A target that has a reflectivity that is similar to a black paper is set to a maximum set distance of 160 mm. Based on the “Hysteresis vs. Sensing Distance” graph, the hysteresis is 5%. The recommended minimum separation distance in this case is 8.0 mm (5% of 160 mm) between the background and the set distance. This means that the background must be at least 8.0 mm behind the set distance.

Background Suppression Optical Configuration



■ Foreground Suppression

Foreground suppression: Objects in front of the set distance will not be detected.

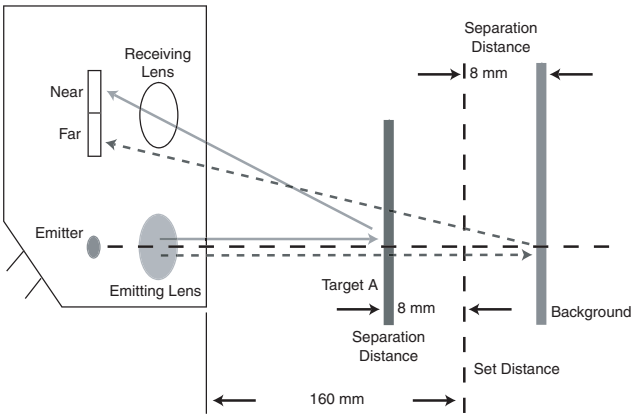
Objects with glossy or irregular surface often reflect the light emitted from the sensor in different directions. This phenomenon often leads to false detection. For such objects, a foreground suppression sensor (FGS) or a polarized retro-reflective sensor is the sensor of choice. For applications that do not have space for a reflector, the FGS is ideal.

FGS sensors accomplish reliable detection by not detecting the object directly. An FGS sensor uses a background, as a retro-reflective sensor would use a reflector, to reliably detect any object that passes between itself and the background. FGS uses the position on which the light reflected from the background strikes its receiver as a point of reference (see the diagram at right.) A change in switching state occurs when the light strikes the receiver at a different position. Any object that passes between the sensor and the background will reflect the light onto the receiver in a position that will be different from the point of reference (reflection from the background).

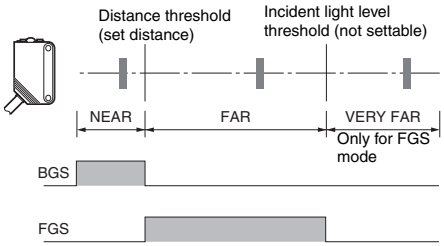
To ensure reliable foreground suppression, a minimum separation distance between the set distance and the background as well as a minimum separation distance from the target to the set distance is recommended. Please refer to the “Hysteresis vs. Sensing Distance” graph in the *Engineering* section of this data sheet to determine the minimum separation distance.

Example: A target that has a reflectivity that is similar to a black paper is set to a maximum set distance of 160 mm. Based on the “Hysteresis vs. Sensing Distance” graph, the hysteresis is 5%. The recommended minimum separation distance in this case is 8.0 mm (5% of 160 mm) between the background and the set distance, and 8.0 mm between the set distance and the background. This means that the background must be at least 8.0 mm behind the set distance, and the set distance must be at least 8.0 mm behind the target.

Foreground Suppression Optical Configuration

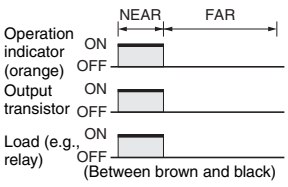
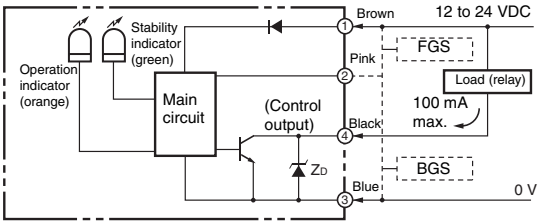
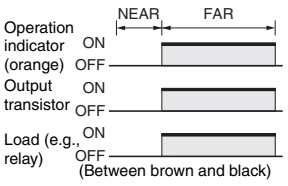
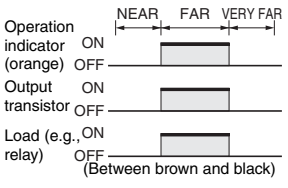
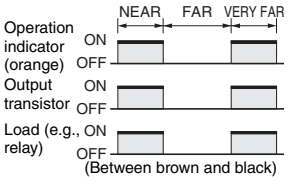


Operation

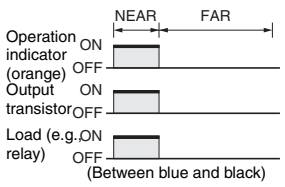
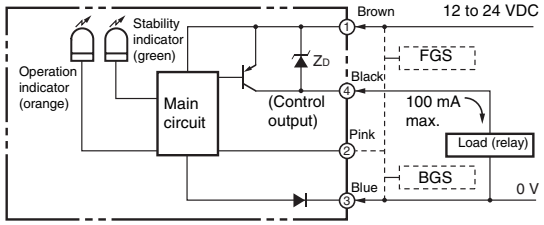
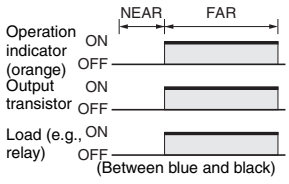
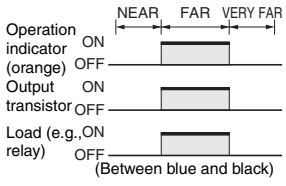
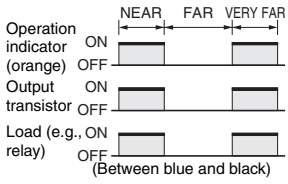


Note: The VERY FAR region is supported only for FGS. The incident light level threshold is fixed and cannot be set.

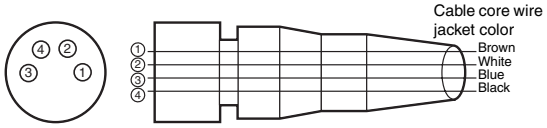
■ NPN Output

Model	Output transistor status	Timing chart	Mode selection switch	BGS/FGS selection method	Output circuit
E3Z-LS61 E3Z-LS66	Light ON		L side (L/ON)	BGS: Either leave the pink wire (2) open or connect it to the blue wire (3).	 Connector Pin Arrangement 
	Dark ON		D side (D/ON)		
	Light ON		L side (L/ON)	FGS: Connect the pink wire (2) to the brown wire (1).	
	Dark ON		D side (D/ON)		

■ PNP Output

Model	Output transistor status	Timing chart	Mode selection switch	BGS/FGS selection method	Output circuit
E3Z-LS81 E3Z-LS86	Light ON		L side (L/ON)	BGS: Either leave the pink wire (2) open or connect it to the blue wire (3).	 Connector Pin Arrangement 
	Dark ON		D side (D/ON)		
	Light ON		L side (L/ON)	FGS: Connect the pink wire (2) to the brown wire (1).	
	Dark ON		D side (D/ON)		

■ Connectors (Sensor I/O Connectors)



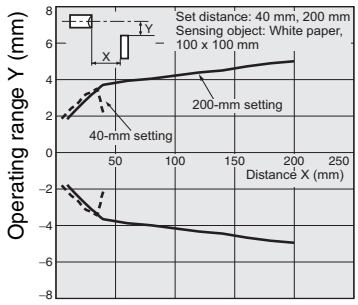
XS3F-M421-402-A
XS3F-M421-405-A
XS3F-M422-402-A
XS3F-M422-405-A

Class	Wire jacket color	Connector pin No.	Application
For DC	Brown	①	Power supply (+V)
	White	②	BGS/FGS selection
	Blue	③	Power supply (0 V)
	Black	④	Output

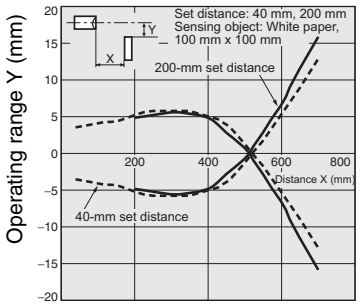
Engineering Data

Operating Range

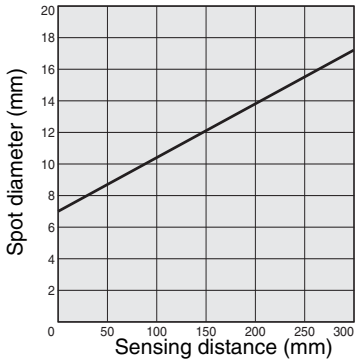
BGS



FGS

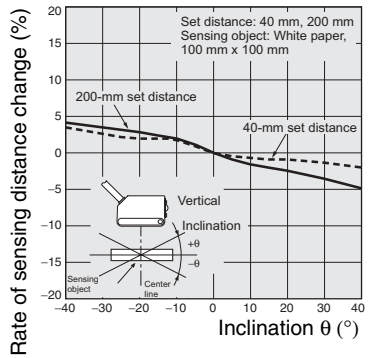


Spot Diameter vs. Sensing Distance

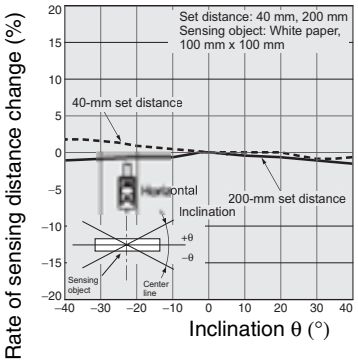


Inclination Characteristics

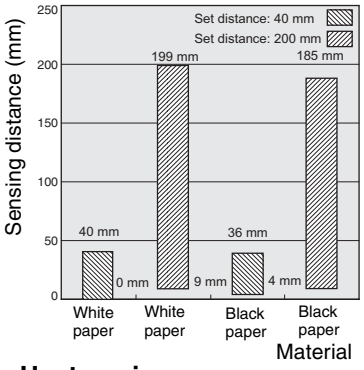
Vertical



Horizontal

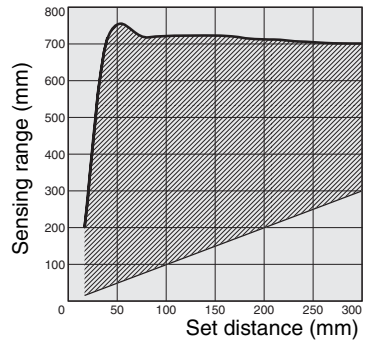


Short-distance Characteristic

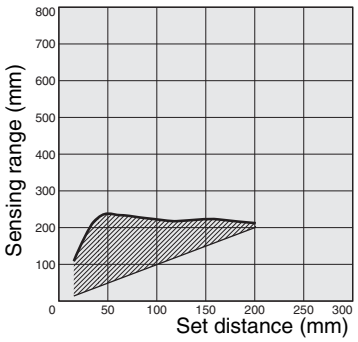


FGS Mode Set Distance vs. Sensing Range

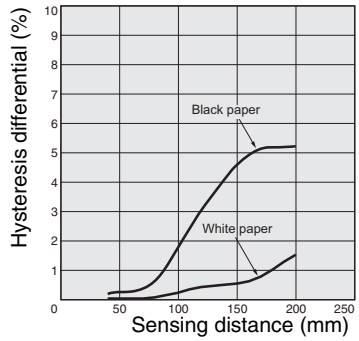
White Paper



Black Paper

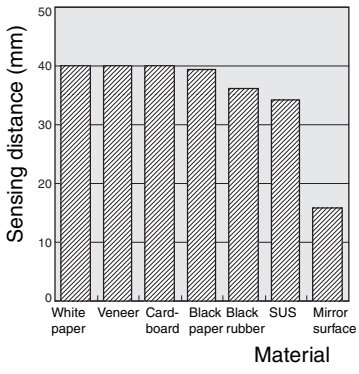


Hysteresis vs. Sensing Distance

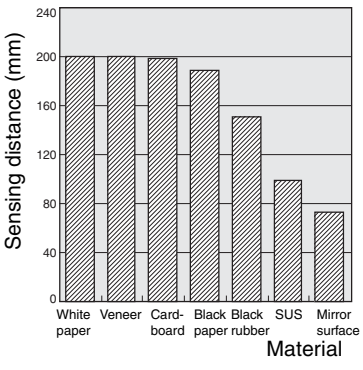


Sensing Distance vs. Material

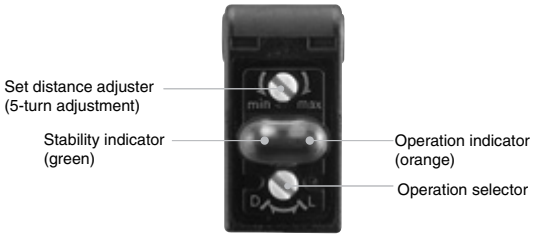
At Set Distance of 40 mm



At Set Distance of 200 mm



Nomenclature

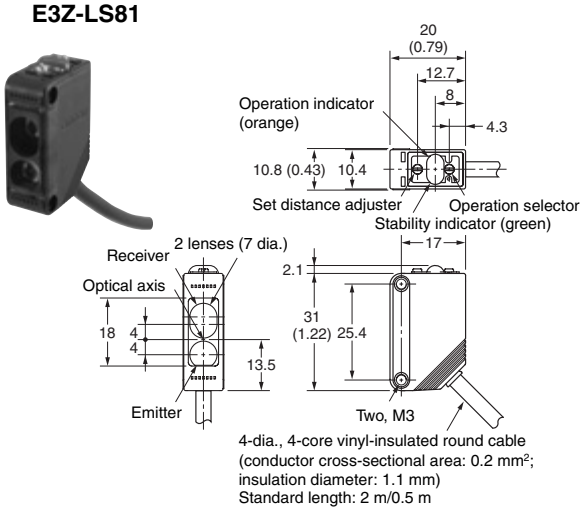


Dimensions

Unit: mm (inch)

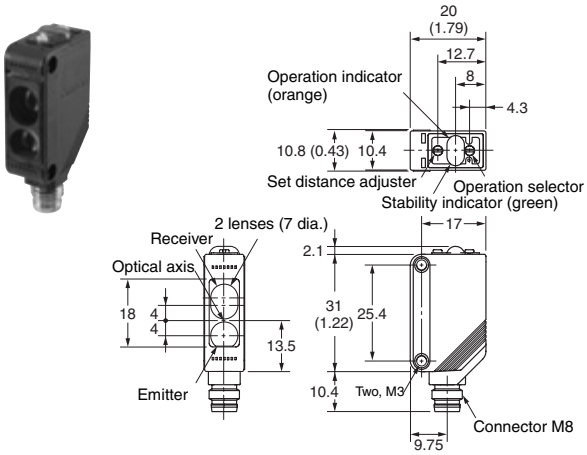
Pre-wired Sensors

E3Z-LS61
E3Z-LS81



Sensors with M8 Connectors

E3Z-LS66
E3Z-LS86



Precautions

⚠ Caution

Do not connect an AC power supply to the Sensor. If AC power (100 VAC or more) is supplied to the Sensor, it may explode or burn.

Be sure to abide by the following precautions for the safe operation of the Sensor.

Wiring

Power Supply Voltage and Output Load Power Supply Voltage

Make sure that the power supply to the Sensor is within the rated voltage range. If a voltage exceeding the rated voltage range is supplied to the Sensor, it may explode or burn.

Load Short-circuiting

Do not short-circuit the load, otherwise the Sensor may be damaged.

Connection without Load

Do not connect the power supply to the Sensor with no load connected, otherwise the internal elements may explode or burn.

Operating Environment

Do not use the Sensor in locations with explosive or flammable gas.

■ Correct Use

Design

Power Reset Time

The Sensor is ready to operate 100 ms after the Sensor is turned ON. If the load and Sensor are connected to independent power supplies respectively, be sure to turn ON the Sensor before supplying power to the load.

Wiring

Avoiding Malfunctions

If using the Photoelectric Sensor with an inverter or servomotor, always ground the FG (frame ground) and G (ground) terminals, otherwise the Sensor may malfunction.

Mounting

Mounting the Sensor

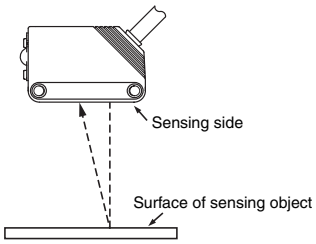
- If Sensors are mounted face-to-face, make sure that the optical axes are not in opposition to each other. Otherwise, mutual interference may result.
- Always install the Sensor carefully so that the aperture angle range of the Sensor will not cause it to be directly exposed to intensive light, such as sunlight, fluorescent light, or incandescent light.
- Do not strike the Photoelectric Sensor with a hammer or any other tool during the installation of the Sensor, or the Sensor will lose its water-resistive properties.
- Use M3 screws to mount the Sensor.
- When mounting the case, make sure that the tightening torque applied to each screw does not exceed 0.54 N·m.

M8 Connector

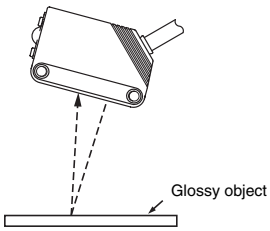
- Always turn OFF the power supply to the Sensor before connecting or disconnecting the metal connector.
- Hold the connector cover to connect or disconnect it.
- Secure the connector cover by hand. Do not use pliers, otherwise the connector may be damaged.
- If the connector is not connected securely, it may be disconnected by vibration or the proper degree of protection of the Sensor may not be maintained.

Mounting Directions

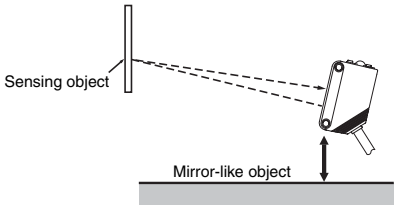
- Make sure that the sensing side of the Sensor is parallel with the surface of the sensing objects. Normally, do not incline the Sensor towards the sensing object.



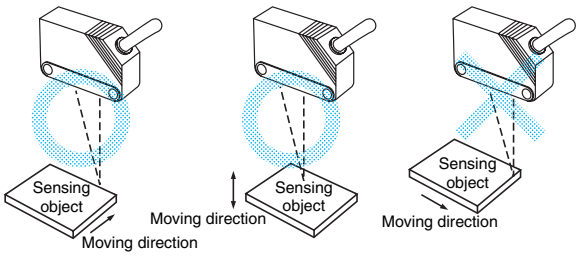
If the sensing object has a glossy surface, however, incline the Sensor by 5° to 10° as shown in the illustration, provided that the Sensor is not influenced by background objects.



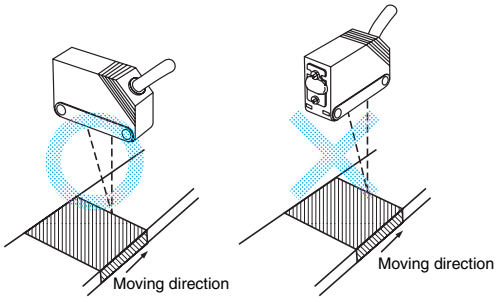
- If there is a mirror-like object below the Sensor, the Sensor may not operate stably. Therefore, incline the Sensor or separate the Sensor from the mirror-like object as shown below.



- Do not install the Sensor in the wrong direction. Refer to the following illustration.

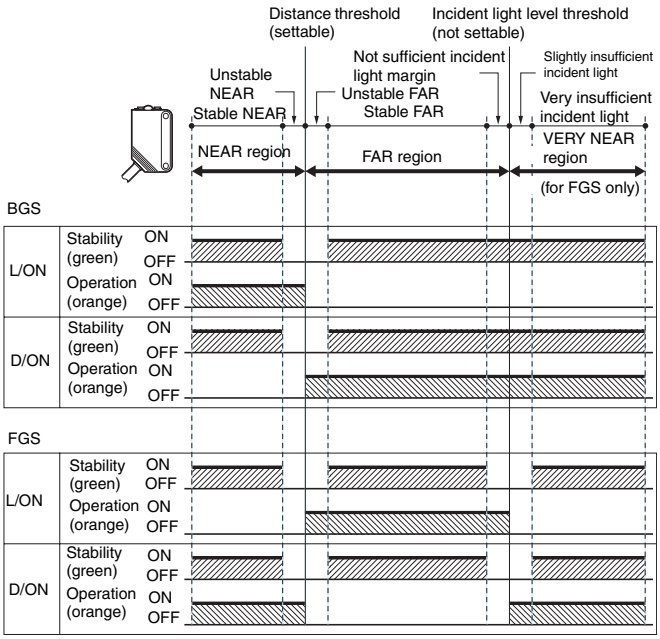


Install the Sensor as shown in the following illustration if each sensing object greatly differs in color or material.



Adjustments

Indicator Operation



Note: 1. If the stability indicator is lit, the detection/no detection status is stable within the rated ambient operating temperature (−25 to 55°C).

2. The VERY FAR region is supported only for FGS. The incident light threshold is fixed and cannot be set. The distance to the incident light threshold depends on the color and gloss of the sensing object's surface.

Inspection and Maintenance

Cleaning

Never use paint thinners or other organic solvents to clean the surface of the product.

E3Z Series

■ Complete E3Z Series

Item \ Sensing method	Distance-settable (NEW)	Diffuse reflective		Narrow-beam diffuse reflective	Retroflective	Retroflective for PET bottles		Through-beam		Grooved type
Appearance					 					
Model	E3Z-LS	E3Z-D		E3Z-L	E3Z-R	E3Z-B		E3Z-T		E3Z-G
Sensing distance	20 mm to set distance (BGS mode) Set distance to 200 mm min. (FGS mode)	5 to 100 mm (wide vision)	1 m	90 ±30 mm	4 m (100 mm) (See note 1.)	500 mm (80 mm) (See note 1.)	2 m (500 mm) (See note 1.)	15 m	10 m	25 mm
Light source (wavelength)	Red LED (680 nm)	Infrared LED (860 nm)		Red LED (670 nm)	Red LED (680 nm)			Infrared LED (860 nm)	Red LED (700 nm)	Infrared LED (940 nm)
Power supply voltage	12 to 24 VDC ±10%, ripple (p-p) 10% max.									
Current consumption	30 mA max.							Emitter: 15 mA Receiver: 20 mA		25 mA max.
Control outputs	Load power supply voltage 26.4 VDC max., load current 100 mA max. (residual voltage 1 V max.) Open collector output (NPN or PNP depending on model) Light-ON/Dark-ON switch selectable									
Protective circuits	Reverse polarity protection, output short-circuit protection, mutual interference prevention (Mutual interference prevention is not provided on E3Z-T.)									
Response time	Operation or reset: 1 ms max.									
Sensitivity adjustment	5-turn endless adjuster	Single-turn adjuster								---
Ambient temperature	Operating: –25 to 55°C, Storage: –40 to 70°C (with no icing or condensation)									
Ambient humidity	Operating: 35% to 85%, Storage: 35% to 95% (with no condensation)									
Protective structure	IEC 60529 IP67									IEC 60529 IP64
Connection method	Pre-wired (standard length: 2 m/0.5 m) or M8 connector	Pre-wired (standard length: 2 m/0.5 m), M8 connector, or M12 connector relay (0.3 m)		Pre-wired (standard length: 2 m/0.5 m) or M8 connector	Pre-wired (standard length: 2 m/0.5 m), M8 connector, or M12 connector relay (0.3 m)	Pre-wired (standard length: 2 m/0.5 m) or M8 connector		Pre-wired (standard length: 2 m/0.5 m), M8 connector, or M12 connector relay (0.3 m, infrared type only)		Pre-wired (standard length: 2 m/0.5 m) or M8 connector relay (0.3 m)

Note: 1. The sensing distance is for when an E39-R1S Reflector is used. The minimum distance between the Reflector and Sensor is given in parentheses.

2. For details, refer to the *Sensing Products* catalog (CEDSAX).

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS. To convert millimeters into inches, divide by 25.4

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