Compact Photoelectric Sensor with Built-in Amplifier

E3Z-F

A Visible Spot That Simplifies the Usage of Photoelectric Sensors

- E3Z-F is added to the E3Z Series of Photoelectric Sensors that boasts annual worldwide sales of 1.5 million units.
- Many different sensing distances
  Diffuse-reflective: 100 mm, 300 mm, 500 mm, 1 m
  Through-beam: 20 m
  Retro-reflective: 4 m
- Models with infrared LEDs are also available.



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

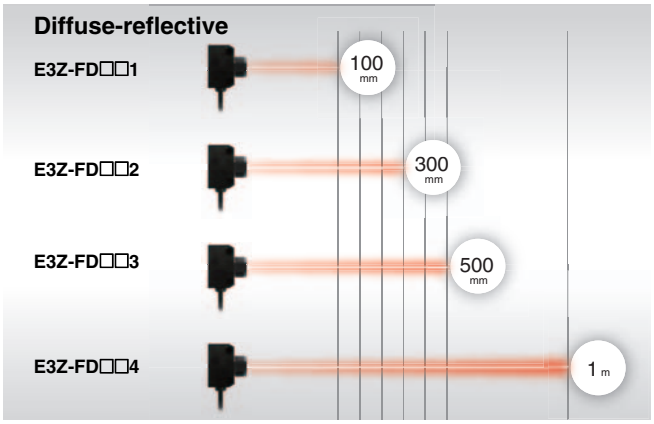
Refer to the *Safety Precautions* on page 9.

Features

Visible spot for easy installation

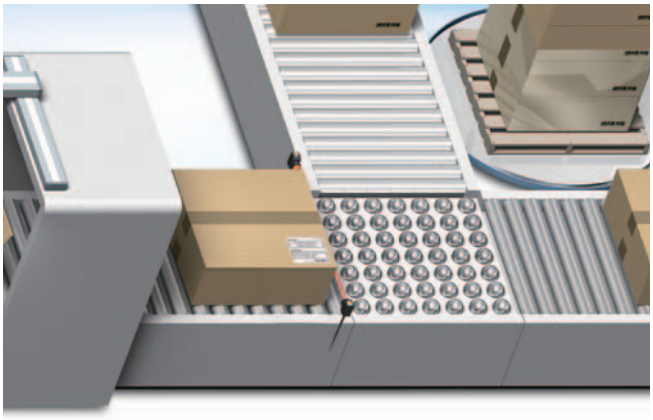


Many different sensing distances are available, so you can select the best model for your application distance.

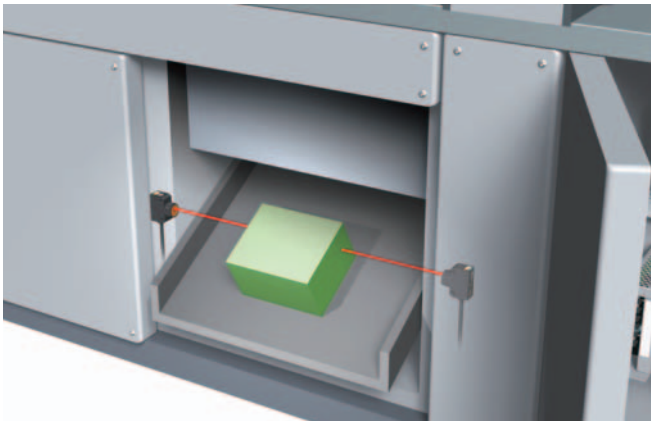


Application

Materials handling: detect passing cardboard boxes



Molding machines: detect falling molded objects

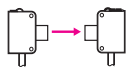
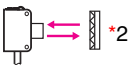


E3Z-F

Ordering Information

Sensors [Refer to *Dimensions on page* 10.]

Red light Infrared light

Sensing method	Appearance	Connecting method	Sensing distance	Model	
				NPN output	PNP output
Through-beam (Emitter + Receiver)		Pre-wired (2 m)	20 m	**E3Z-FTN11 2M *1** Emitter E3Z-FTN11-L 2M Receiver E3Z-FTN11-D 2M	**E3Z-FTP11 2M *1** Emitter E3Z-FTP11-L 2M Receiver E3Z-FTP11-D 2M
		Connector (M12)		**E3Z-FTN21 *1** Emitter E3Z-FTN21-L Receiver E3Z-FTN21-D	**E3Z-FTP21 *1** Emitter E3Z-FTP21-L Receiver E3Z-FTP21-D
		Pre-wired (2 m)	20 m	**E3Z-FTN12 2M *1** Emitter E3Z-FTN12-L 2M Receiver E3Z-FTN12-D 2M	**E3Z-FTP12 2M *1** Emitter E3Z-FTP12-L 2M Receiver E3Z-FTP12-D 2M
		Connector (M12)		**E3Z-FTN22 *1** Emitter E3Z-FTN22-L Receiver E3Z-FTN22-D	**E3Z-FTP22 *1** Emitter E3Z-FTP22-L Receiver E3Z-FTP22-D
Retro-reflective with MSR function	 *2	Pre-wired (2 m)	4 m *3 (100 mm)	**E3Z-FRN11 2M**	**E3Z-FRP11 2M**
		Connector (M12)		**E3Z-FRN21**	**E3Z-FRP21**
Diffuse-reflective		Pre-wired (2 m)	100 mm	**E3Z-FDN11 2M**	**E3Z-FDP11 2M**
		Connector (M12)		**E3Z-FDN21**	**E3Z-FDP21**
		Pre-wired (2 m)	300 mm	**E3Z-FDN12 2M**	**E3Z-FDP12 2M**
		Connector (M12)		**E3Z-FDN22**	**E3Z-FDP22**
		Pre-wired (2 m)	500 mm	**E3Z-FDN13 2M**	**E3Z-FDP13 2M**
		Connector (M12)		**E3Z-FDN23**	**E3Z-FDP23**
		Pre-wired (2 m)	1 m	**E3Z-FDN14 2M**	**E3Z-FDP14 2M**
		Connector (M12)		**E3Z-FDN24**	**E3Z-FDP24**
		Pre-wired (2 m)	100 mm	**E3Z-FDN15 2M**	**E3Z-FDP15 2M**
		Connector (M12)		**E3Z-FDN25**	**E3Z-FDP25**
		Pre-wired (2 m)	300 mm	**E3Z-FDN16 2M**	**E3Z-FDP16 2M**
		Connector (M12)		**E3Z-FDN26**	**E3Z-FDP26**
		Pre-wired (2 m)	500 mm	**E3Z-FDN17 2M**	**E3Z-FDP17 2M**
		Connector (M12)		**E3Z-FDN27**	**E3Z-FDP27**
		Pre-wired (2 m)	1 m	**E3Z-FDN18 2M**	**E3Z-FDP18 2M**
		Connector (M12)		**E3Z-FDN28**	**E3Z-FDP28**

*1. Through-beam Sensors are normally sold in sets that include both the Emitter and Receiver. An order for the Emitter or Receiver alone cannot be accepted.
*2. The Reflector is sold separately. Select the Reflector model most suited to the application.
*3. Values in parentheses indicate the minimum required distance between the Sensor and Reflector.

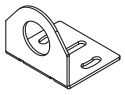
Accessories (Sold Separately)

Reflector **(Required for Retro-reflective Sensors) A Reflector is not provided with the Sensor. It must be ordered separately.**
[Refer to *Dimensions on page* 11.]

Appearance	Sensing distance*		Model	Quantity	Remarks
	Rated value	Reference value			
	4 m (100 mm)	---	**E39-R1S**	1	for E3Z-FR□

* Values in parentheses indicates the minimum required distance between the Sensor and Reflector.

Mounting Brackets **A Mounting Bracket is not provided with the Sensor. It must be ordered separately as required.**
[Refer to *Dimensions on page* 11.]

Applicable Sensors	Mounting method	Appearance	Model	Quantity
All models	M3 screw mounting		**E39-L189**	1
	M18 nut side mounting		**E39-L183**	1

Note: 1. When using Through-beam models, order one bracket for the Receiver and one for the Emitter.

Sensor I/O Connectors (Sockets on One Cable End)
(Required for models for Connectors) A Connector is not provided with the Sensor. It must be ordered separately.

Applicable Sensors	Size	Cable	Appearance	Cable type		Model
Connector (M12)	M12	Standard	Straight 	2 m	4 conductors	**XS2F-M12PVC4S2M**
				5 m		**XS2F-M12PVC4S5M**
			L-shaped 	2 m		**XS2F-M12PVC4A2M**
				5 m		**XS2F-M12PVC4A5M**

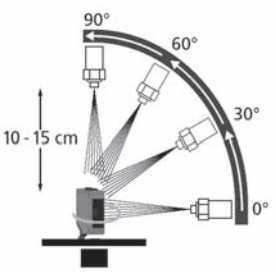
Note: When using Through-beam models, order one sensor I/O connector for the Receiver and one for the Emitter.

E3Z-F

Ratings and Specifications

Item		Sensing method	Through-beam	Retro-reflective with MSR function	Diffuse-reflective			
Model	NPN output	Pre-wired	E3Z-FTN11	E3Z-FRN11	E3Z-FDN11	E3Z-FDN12	E3Z-FDN13	E3Z-FDN14
		Connector (M12)	E3Z-FTN21	E3Z-FRN21	E3Z-FDN21	E3Z-FDN22	E3Z-FDN23	E3Z-FDN24
	PNP output	Pre-wired	E3Z-FTP11	E3Z-FRP11	E3Z-FDP11	E3Z-FDP12	E3Z-FDP13	E3Z-FDP14
		Connector (M12)	E3Z-FTP21	E3Z-FRP21	E3Z-FDP21	E3Z-FDP22	E3Z-FDP23	E3Z-FDP24
Sensing distance			20 m	4 m (100 mm) *1 (when using E39-R1S)	100 mm (white paper: 300 × 300 mm)	300 mm (white paper: 300 × 300 mm)	500 mm (white paper: 300 × 300 mm)	1 m (white paper: 300 × 300 mm)
Spot diameter (reference value)			---		40 × 45 mm (at sensing distance of 100 mm)	40 × 50 mm (at sensing distance of 300 mm)	45 × 50 mm (at sensing distance of 500 mm)	120 × 150 mm (at sensing distance of 1 m)
Standard sensing object			Opaque: 7 mm dia. min.	Opaque: 75 mm dia. min.	---			
Differential travel			---		20% max. of sensing distance			
Directional angle			2° min.		---			
Light source (wavelength)			Red LED (624 nm)					
Power supply voltage			10 to 30 VDC (including voltage ripple of 10% (p-p) max.)					
Current consumption			40 mA max. (Emitter: 25 mA max., Receiver: 15 mA max.)	25 mA max.				
Control output			Load power supply voltage: 30 VDC max., Load current: 100 mA max. (Residual voltage: 3 V max.) Open collector output (NPN (negative common)/PNP (positive common) depending on model) Light-ON/Dark-ON cable connection selectable					
Indicators			Operation indicator (orange) Stability indicator (green) Trough-beam Emitter has only power indicator (green).					
Protection circuits			Power supply reverse polarity protection, Output short-circuit protection, and Output reverse polarity protection					
Response time			Operate or reset: 0.5 ms max.					
Sensitivity adjustment			One-turn adjuster					
Ambient illumination (Receiver side)			Incandescent lamp: 3,000 lx max. Sunlight: 10,000 lx max.					
Ambient temperature range			Operating: −25 to 55°C, Storage: −40°C 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 min					
Vibration resistance (destruction)			10 to 55 Hz with a 1.5 mm double amplitude for 2 hours each in X, Y, and Z directions					
Shock resistance (destruction)			500 m/s² for 3 times each in X, Y, and Z directions					
Degree of protection *2			IEC IP67, DIN40050-9 standard IP69K					
Connecting method			Pre-wired (standard length: 2 m), Connector (M12, 4-Pin)					
Weight (packedstate/ Sensor only)	**Pre-wired**		Approx. 120 g/ Approx. 105 g	Approx. 70 g/ Approx. 55 g				
	Connector		Approx. 35 g/ Approx. 20 g	Approx. 25 g/ Approx. 10 g				
Materials	**Case**		ABS					
	Lens		Methacrylic resin (PMMA)					
	Display		Methacrylic resin (PMMA)					
	Sensitivity adjuster		Polyacetal (POM)					
	Cable *3		Vinyl chloride (PVC)					
	Nuts		ABS					
Accessories			Nuts (2 pcs), Instruction manual	Nut (1 pcs), Instruction manual				

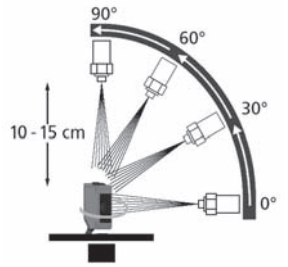
*1. Values in parentheses indicate the minimum required distances between the Sensors and Reflectors.
*2. IP69K Degree of Protection Specifications.
IP69K is a protection specification stipulated by DIN 40050 Part 9 of the German standards.
The test item is sprayed with 80°C water from a nozzle of a specified shape at a water pressure of 80 to 100 bar. The amount of water is 14 to 16 liters per munute.
The distance between the test item and the nozzle is 10 to 15 cm. The water is discharged at angles of 0°, 30°, 60°, and 90° from the horizontal plane for 30 seconds at each angle while the test item is rotated horizontally.
*3. Only for Pre-wired models.



Item \ Model		Sensing method	Through-beam	Diffuse-reflective			
	NPN output	Pre-wired	E3Z-FTN12	E3Z-FDN15	E3Z-FDN16	E3Z-FDN17	E3Z-FDN18
		Connector (M12)	E3Z-FTN22	E3Z-FDN25	E3Z-FDN26	E3Z-FDN27	E3Z-FDN28
	PNP output	Pre-wired	E3Z-FTP12	E3Z-FDP15	E3Z-FDP16	E3Z-FDP17	E3Z-FDP18
		Connector (M12)	E3Z-FTP22	E3Z-FDP25	E3Z-FDP26	E3Z-FDP27	E3Z-FDP28
Sensing distance			20 m	100 mm (white paper: 300 × 300 mm)	300 mm (white paper: 300 × 300 mm)	500 mm (white paper: 300 × 300 mm)	1 m (white paper: 300 × 300 mm)
Spot diameter (reference value)			---				
Standard sensing object			Opaque: 7 mm dia. min.	---			
Differential travel			---	20% max. of sensing distance			
Directional angle			2° min.	---			
Light source (wavelength)			Infrared LED (850 nm)				
Power supply voltage			10 to 30 VDC (including voltage ripple of 10% (p-p) max.)				
Current consumption			40 mA max. (Emitter: 25 mA max., Receiver:15 mA max.)	25mA max.			
Control output			Load power supply voltage: 30 VDC max., Load current: 100 mA max. (Residual voltage: 3 V max.) Open collector output (NPN (negative common)/PNP (positive common) depending on model) Light-ON/Dark-ON cable connection selectable				
Indicators			Operation indicator (orange) Stability indicator (green) Trough-beam Emitter has only power indicator (green).				
Protection circuits			Power supply reverse polarity protection, Output short-circuit protection, and Output reverse polarity protection				
Response time			Operate or reset: 0.5 ms max.				
Sensitivity adjustment			One-turn adjuster				
Ambient illumination (Receiver side)			Incandescent lamp: 3,000 lx max. Sunlight: 10,000 lx max.				
Ambient temperature range			Operating: –25 to 55°C, Storage: –40°C 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 min				
Vibration resistance (destruction)			10 to 55 Hz with a 1.5 mm double amplitude for 2 hours each in X, Y, and Z directions				
Shock resistance (destruction)			500 m/s² for 3 times each in X, Y, and Z directions				
Degree of protection *1			IEC IP67, DIN40050-9 standard IP69K				
Connecting method			Pre-wired (standard length: 2 m), Connector (M12, 4-Pin)				
Weight (packedstate/ Sensor only)	**Pre-wired**		Approx. 120 g/ Approx. 105 g	Approx. 70 g/ Approx. 55 g			
	Connector		Approx. 35 g/ Approx. 20 g	Approx. 25 g/ Approx. 10 g			
Materials	**Case**		ABS				
	Lens		Methacrylic resin (PMMA)				
	Display		Methacrylic resin (PMMA)				
	Sensitivity adjuster		Polyacetal (POM)				
	Cable *2		Vinyl chloride (PVC)				
	Nuts		ABS				
Accessories			Nuts (2 pcs), Instruction manual	Nut (1 pcs), Instruction manual			

*1. IP69K Degree of Protection Specifications.
IP69K is a protection specification stipulated by DIN 40050 Part 9 of the German standards.
The test item is sprayed with 80°C water from a nozzle of a specified shape at a water pressure of 80 to 100 bar. The amount of water is 14 to 16 liters per munute.
The distance between the test item and the nozzle is 10 to 15 cm. The water is discharged at angles of 0°, 30°, 60°, and 90° from the horizontal plane for 30 seconds at each angle while the test item is rotated horizontally.

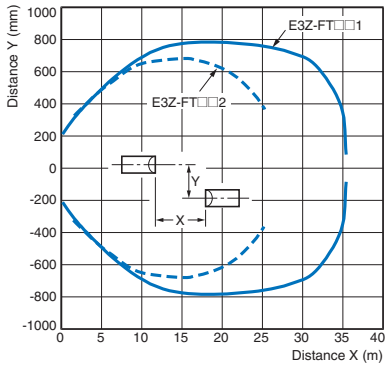
*2. Only for Pre-wired models.



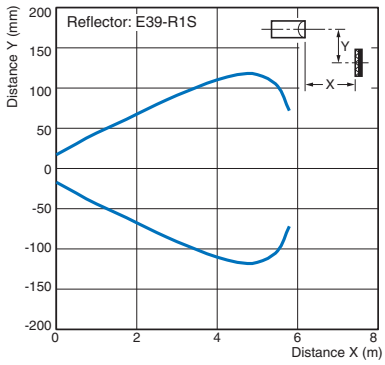
Engineering Data (Reference Value)

Parallel Operating Range

Through-beam
E3Z-FT□□1/-FT□□2

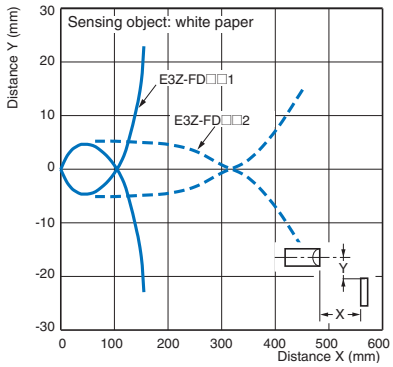


Retro-reflective
E3Z-FR□

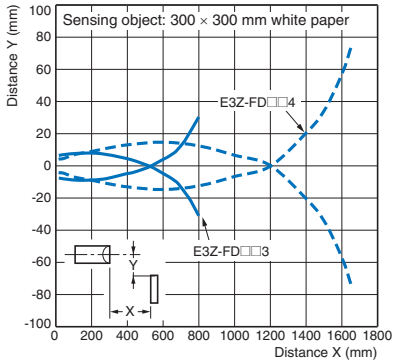


Operating Range

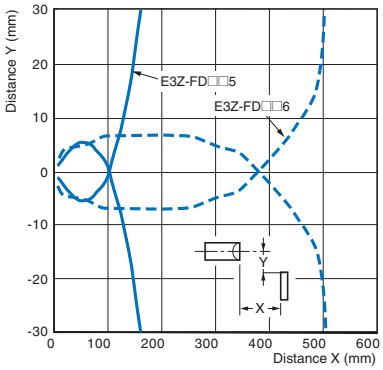
Diffuse-reflective
E3Z-FD□□1/-FD□□2



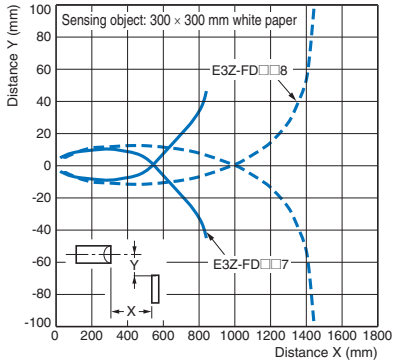
Diffuse-reflective
E3Z-FD□□3/-FD□□4



Diffuse-reflective
E3Z-FD□□5/-FD□□6

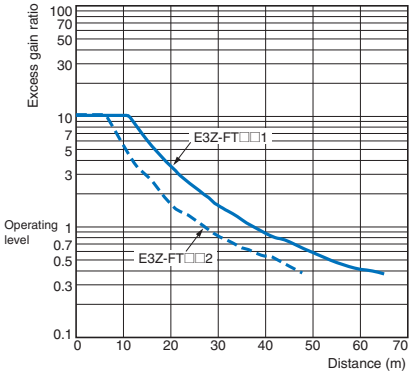


Diffuse-reflective
E3Z-FD□□7/-FD□□8

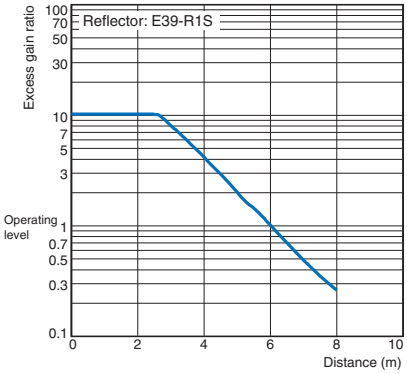


Excess Gain vs. Distance

Through-beam
E3Z-FT□□1/-FT□□2

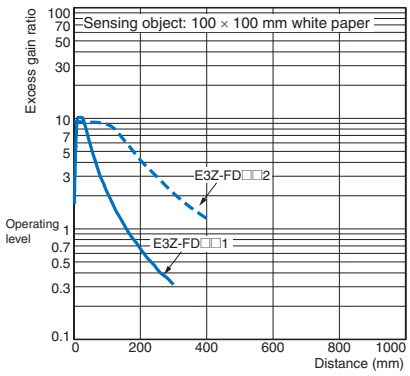


Retro-reflective
E3Z-FR□□

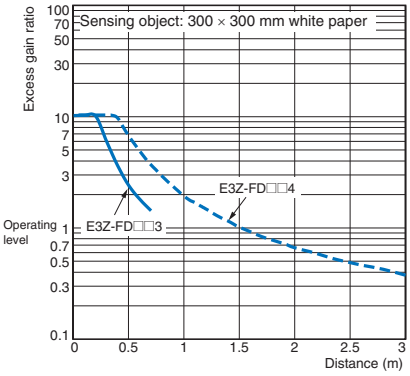


Excess Gain vs. Distance

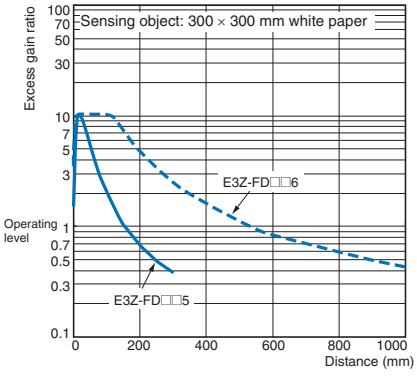
Diffuse-reflective
E3Z-FD□□1/-FD□□2



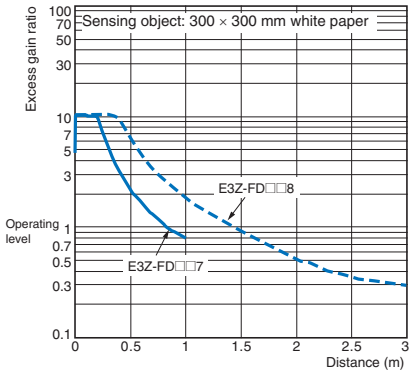
Diffuse-reflective
E3Z-FD□□3/-FD□□4



Diffuse-reflective
E3Z-FD□□5/-FD□□6

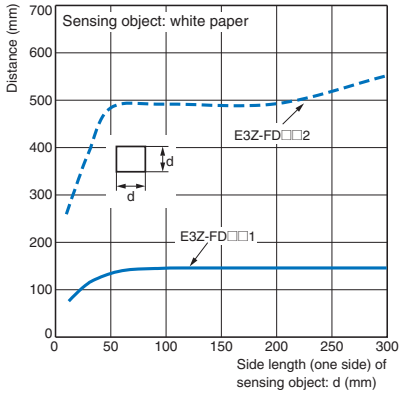


Diffuse-reflective
E3Z-FD□□7/-FD□□8

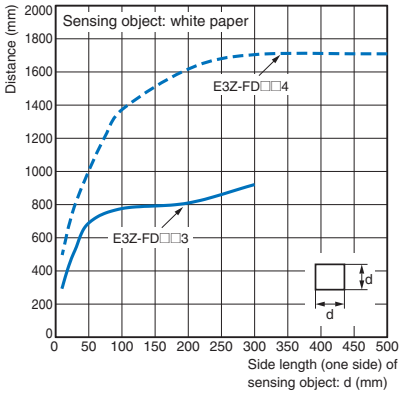


Sensing Object Size vs. Distance

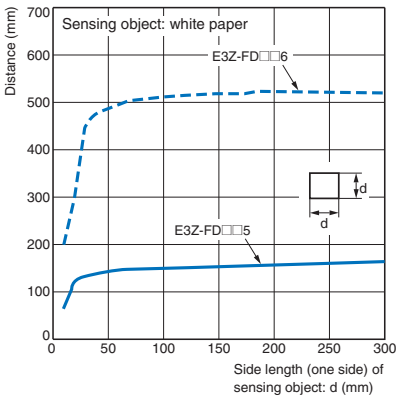
Diffuse-reflective
E3Z-FD□□1/-FD□□2



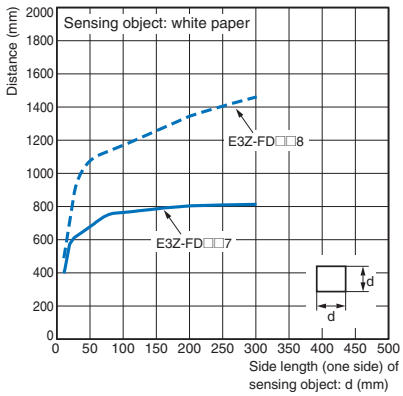
Diffuse-reflective
E3Z-FD□□3/-FD□□4



Diffuse-reflective
E3Z-FD□□5/-FD□□6



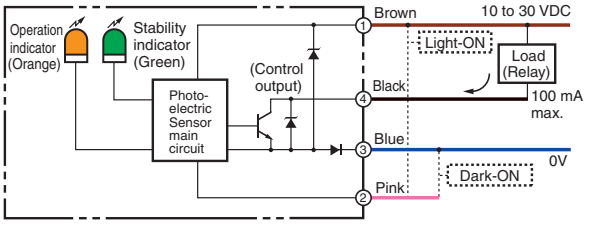
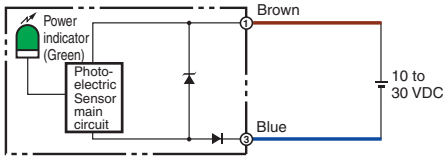
Diffuse-reflective
E3Z-FD□□7/-FD□□8



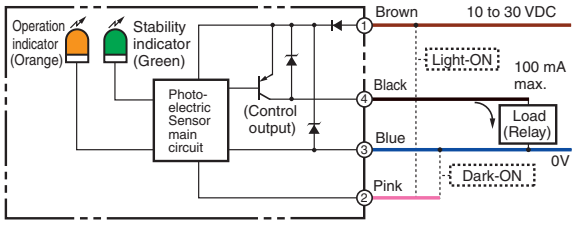
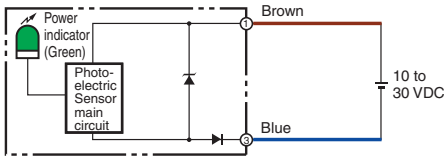
E3Z-F

I/O Circuit Diagrams

NPN Output

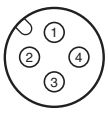
Model	Operation mode	Timing charts	Operation selector	Output circuit
E3Z-FTN□□ E3Z-FRN□□ E3Z-FDN□□	Light-ON	Incident light No incident light Operation indicator (orange) ON OFF Output transistor ON OFF Load (e.g., relay) Operate Reset (Between brown (1) and black (4) leads)	Connect pink lead (2) to brown lead (1) or leave open.	Through-beam Receivers, Retro-reflective, Diffuse-reflective. 
	Dark-ON	Incident light No incident light Operation indicator (orange) ON OFF Output transistor ON OFF Load (e.g., relay) Operate Reset (Between brown (1) and black (4) leads)	Connect pink lead (2) to blue lead (3).	
	Through-beam Emitter			

PNP Output

Model	Operation mode	Timing charts	Operation selector	Output circuit
E3Z-FTP□□ E3Z-FRP□□ E3Z-FDP□□	Light-ON	Incident light No incident light Operation indicator (orange) ON OFF Output transistor ON OFF Load (e.g., relay) Operate Reset (Between blue (3) and black (4) leads)	Connect pink lead (2) to brown lead (1).	Through-beam Receivers, Retro-reflective, Diffuse-reflective. 
	Dark-ON	Incident light No incident light Operation indicator (orange) ON OFF Output transistor ON OFF Load (e.g., relay) Operate Reset (Between blue (3) and black (4) leads)	Connect pink lead (2) to blue lead (3) or leave open.	
	Through-beam Emitter			

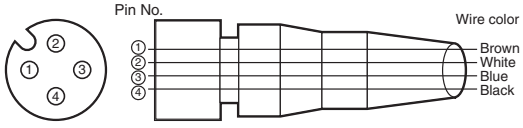
Connector Pin Arrangement

M12 Connector Pin Arrangement



Plugs (Sensor I/O Connectors)

M12, 4-pin Connectors



Pin arrangement

Classification	Wire color	Connector pin No.	Application
DC	Brown	1	Power supply (+V)
	White	2	L/on ·D/on selectable
	Blue	3	Power supply (0 V)
	Black	4	Output

Safety Precautions

To ensure safe operation, be sure to read and follow the Instruction Manual provided with the sensor.

■ Meanings of Alert symbols

⚠ WARNING	Indicates a potentially hazardous situation which, if not avoided, will result in minor or moderate injury, or may result in serious injury or death. Additionally there may be significant property damage.
⚠ CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or in property damage.
Precautions for Safe Use	Supplementary comments on what to do or avoid doing, to use the product safety.
Precautions for Correct Use	Supplementary comments on what to do or avoid doing, to prevent a failure to operate, or undesirable effect on product performance.

⚠ WARNING

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



⚠ CAUTION

Explosion, fire, or product malfunction may occur.
Never use the product with an AC power supply.
Do not use the product with voltage in excess of the rated voltage.
Do not use the product with incorrect wiring.





Precautions for Safe Use

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

1. Do not use the product in atmospheres or environments that exceed product ratings.
2. Do not use the product in an environment where it may be exposed to inflammable or explosive gas.
3. Do not use the product in an environment where it may be exposed to oil or chemicals.
4. Do not use the product in water, in rain, or outdoors.
5. Do not use the product in locations subject to condensation due to high humidity.
6. Do not use the product in any other environment that exceeds the ratings.
7. Do not use the product in a location subject to direct sunlight.
8. Do not use the product in a location subject to direct vibration or shock.
9. Do not use organic solvents (such as thinners or alcohol).
10. Do not attempt to disassemble, repair, or modify the product.
11. Dispose of the product as industrial waste.
12. The E3Z-F devices shall be used with Class2 power supply in the United States.
    The ampere rating of the current protection shall be 1A for 26AWG, 2A for 24AWG, 3A for 22AWG, 5A for 20AWG.

Precautions for Correct Use

1. Laying Sensor wiring in the same conduit or duct as high-voltage wires or power lines may result in malfunction or damage due to conduit or use shielded cable.
   Separate the Sensor wiring or use a shielded cable.
2. Do not pull on the cable with excessive force.
3. If a commercial switching regulator is used, ground the FG (frame ground) terminal.
4. The sensor will be available 100 ms after the power supply is tuned ON. Start to use 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.
5. Output pulses may be generated even when the power supply is OFF. Therefore, it is recommended to first turn OFF the power supply for the load or the load line.
6. Do not tighten nuts or screws with excessive force. To secure the Sensor with nuts, use the nuts that are included with the Sensor, and tighten the nuts to a torque of 0.3 to 0.4 N·m (2.0 N·m max.). To secure the Sensor with M3 screws, tighten the screws to a torque of 0.6 N·m max..

E3Z-F

Dimensions

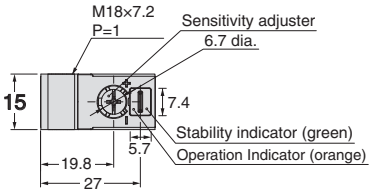
(Unit: mm)
Tolerance class IT16 applies to dimensions in this data sheet unless otherwise specified.

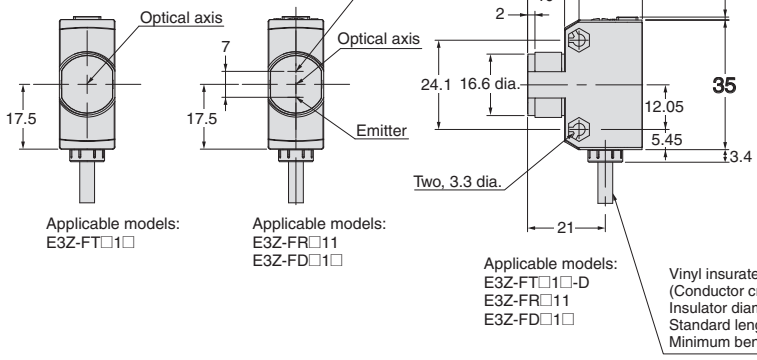
Sensors

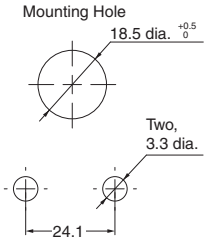
Pre-wired

E3Z-FT□1□
E3Z-FR□11
E3Z-FD□1□





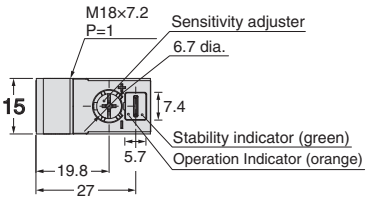


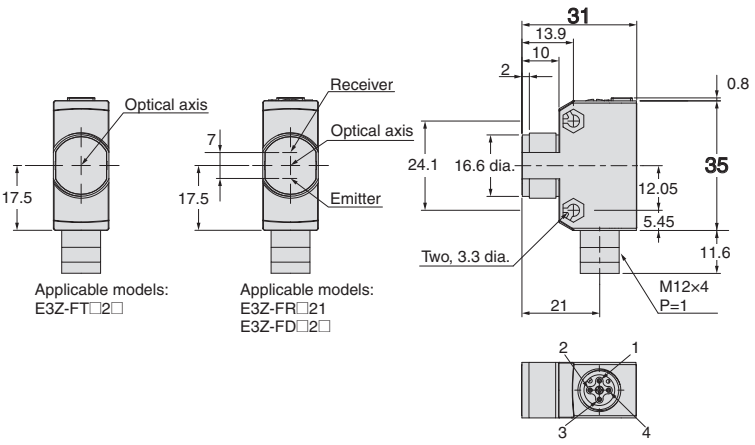


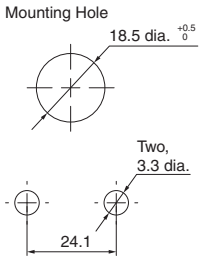
Connector (M12)

E3Z-FT□2□
E3Z-FR□21
E3Z-FD□2□



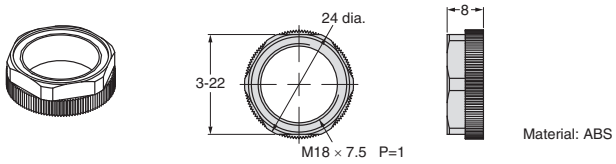






Terminal No.	Specifications
1	+V
2	L/on • D/on selectable
3	0V
4	Output

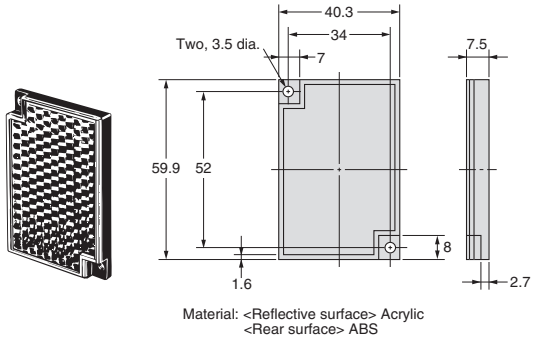
Tightening Nuts



Material: ABS

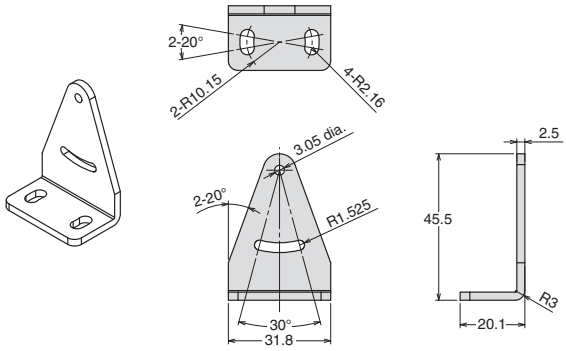
Accessories (Sold Separately)

Reflector
E39-R1S

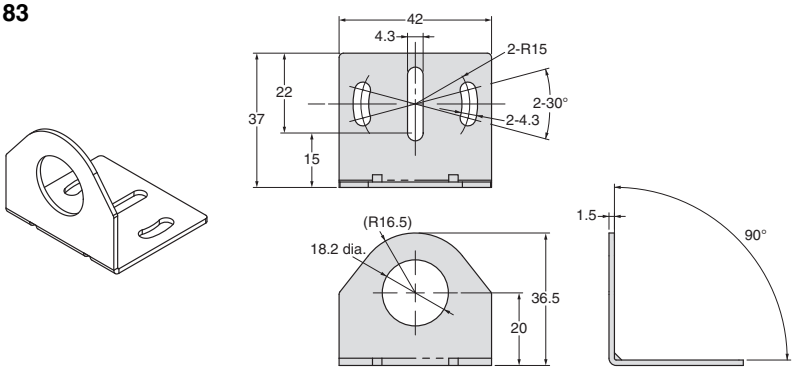


Material: <Reflective surface> Acrylic
<Rear surface> ABS

Mounting Brackets
E39-L189



Mounting Brackets
E39-L183



Compact Photoelectric Sensor with Built-in Amplifier

E3Z

The Standard for Photoelectric Sensors with a Secure Track Record of 1.5 Million Sold Yearly.



- Long sensing distance of 30 m for Through-beam Models, 4 m for Retro-reflective Models, and 1 m for Diffuse-reflective Models.
- Mechanical axis and optical axis offset of less than ±2.5° simplifies optical axis adjustment.
- High stability with unique algorithm that prevents interference of external light.

Compact Laser Photoelectric Sensor with Built-in Amplifier

E3Z-LT/LR/LL

Compact and Reliable Laser Photoelectric Sensor

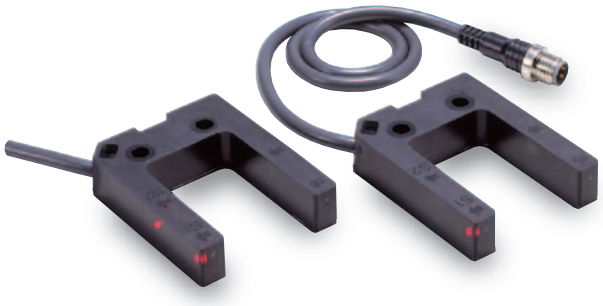


- Safety and reliability with laser class 1 (JIS and IEC).
- Product lineup includes models with distance setting without influence of color.
- Maximum ambient operating temperature of 55°C and waterproof construction (IP67) in E3Z class.

Grooved-type Photoelectric Sensor with Built-in Amplifier

E3Z-G

Photoelectric Sensor with Grooved Design and Easy Settings



- Grooved-type Sensor with groove width of 25 mm.
- Models are available with one or two light axes.
- Models are available with M8 pre-wired connectors.

Compact Photoelectric Sensor with Stainless Steel Housing

E3ZM

Stainless Steel Housing Ideal for Food Industry (SUS316L)

- Strong resistance against detergents, disinfectants, and jet liquid flow.
- Product lineup includes BGS reflective models and through-beam models with built-in slits.
- Certified by Ecolab Europe.



Color Mark Detection Compact Photoelectric Sensor

E3ZM-V

Industry's Smallest Color Mark Sensor

- Excellent space savings.
  (Reduced by 90% compared with previous OMRON models.)
- Improved color-difference discrimination with white LED and RGB signal processing.
- Equipped with two types of teaching:
  (2-point teaching and automatic teaching.)



Transparent Object (PET Bottle) Detection Compact Photoelectric Sensor

E3ZM-B

Excellent PET Bottle Detection

- New detection method that is independent of bottle shape, position, and contents.
- Automatic compensation against effects of contamination and temperature (except E3ZM-B□T).
- Product lineup includes models with adjuster (E3ZM-B□T).
- Detects transparent objects made by PET, resin, or glass.



Oil-resistant, Robust, Compact Photoelectric Sensor

E3ZM-C

Photoelectric Sensor for the Automotive and Machine Tool Industries

- Oil-resistant, rugged body made of stainless steel.
- Spot visibility improved to as far as 1 m away.
  Product lineup includes through-beam models with orange spot.
- Product lineup includes M12 Smartclick pre-wired connector models.



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