# Compact Photoelectric Sensor with Built-in Amplifier

# E3Z

CSM_E3Z_DS_E_18_8

## The Standard for Photoelectric Sensors with a Secure Track Record of One 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.

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

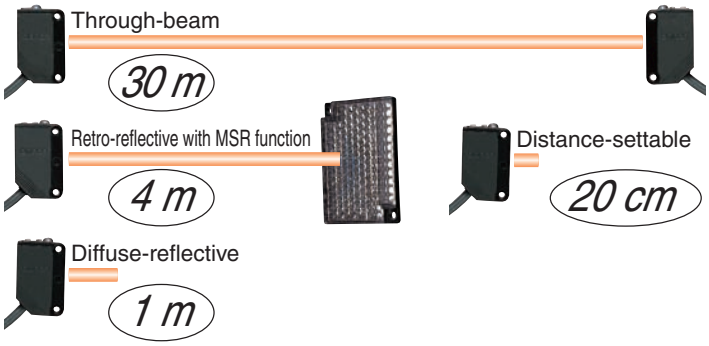
Be sure to read *Safety Precautions* on page 13.

## Features

### Industry's Top-level Sensing Distance with Built-in Amplifier

A separately sold filter is available to prevent mutual interference for Through-beam Models with red lights sources and a sensing distance of 10 m. Reflective Models include functionality to prevent mutual interference (up to 2 sensors).

Long-distance, Through-beam Sensors with a detection distance of 30 m (response time: 2 ms) are also available.

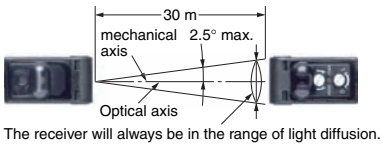



### Low-temperature Operation for Applications in Cold-storage Warehouses

A wider ambient operating range from –40 to 55°C (main models with connectors). We also provide Sensor I/O Connectors with PUR Cables for high resistance to cold environments.

### Improved Matching of Optical Axis and Mechanical Axis for Through-beam Models and Retro-reflective Models

The offset between the optical axis and the mechanical axis is kept within ±2.5°, so the optical axis can be accurately set simply by mounting the Sensor according to the mechanical axis.

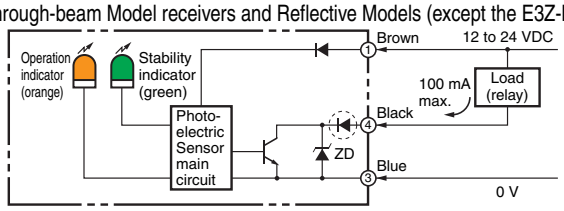



The receiver will always be in the range of light diffusion.

### Sensor Protection against Incorrect Wiring

The Sensor includes output reverse polarity protection.
(A diode to protect against reverse polarity is added to the output line.)

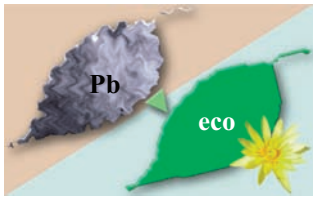
Through-beam Model receivers and Reflective Models (except the E3Z-LS)




Protection for NPN output models

### Complete Compliance with the EU's RoHS Directive

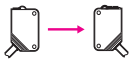
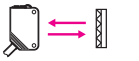
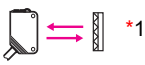
Lead, mercury, cadmium hexachrome, polybrominated biphenyl (PBB), and polybrominated diphenyl ether (PBDE) have all been eliminated. Also, burnable polyethylene packaging has been used.



# Ordering Information

## Sensors [Refer to *Dimensions on page 14.*]

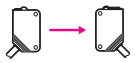
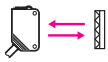
Red light  Infrared light

| Sensing method | Appearance | Connection method | Sensing distance | Model NPN output | Model PNP output |
|---|---|---|---|---|---|
| Through-beam (Emitter + Receiver) *3 |  | Pre-wired (2 m) | 15 m | **E3Z-T61 2M *4 *5**<br>Emitter E3Z-T61-L 2M<br>Receiver E3Z-T61-D 2M | **E3Z-T81 2M *4 *5**<br>Emitter E3Z-T81-L 2M<br>Receiver E3Z-T81-D 2M |
| | | Standard M8 connector | | **E3Z-T66**<br>Emitter E3Z-T66-L<br>Receiver E3Z-T66-D | **E3Z-T86**<br>Emitter E3Z-T86-L<br>Receiver E3Z-T86-D |
| | | Pre-wired (2 m) | 10 m | **E3Z-T61A 2M *4**<br>Emitter E3Z-T61-A-L 2M<br>Receiver E3Z-T61-A-D 2M | **E3Z-T81A 2M *4**<br>Emitter E3Z-T81-A-L 2M<br>Receiver E3Z-T81-A-D 2M |
| | | Standard M8 connector | | **E3Z-T66A**<br>Emitter E3Z-T66-A-L<br>Receiver E3Z-T66-A-D | **E3Z-T86A**<br>Emitter E3Z-T86-A-L<br>Receiver E3Z-T86-A-D |
| | | Pre-wired (2 m) | 30m | **E3Z-T62 2M *4**<br>Emitter E3Z-T62-L 2M<br>Receiver E3Z-T62-D 2M | **E3Z-T82 2M**<br>Emitter E3Z-T82-L 2M<br>Receiver E3Z-T82-D 2M |
| | | Standard M8 connector | | **E3Z-T67**<br>Emitter E3Z-T67-L<br>Receiver E3Z-T67-D | **E3Z-T87**<br>Emitter E3Z-T87-L<br>Receiver E3Z-T87-D |
| Retro-reflective with MSR function |  *1 | Pre-wired (2 m) | 4 m *2 (100 mm) | **E3Z-R61 2M *4 *5** | **E3Z-R81 2M *4 *5** |
| | | Standard M8 connector | | **E3Z-R66** | **E3Z-R86** |
| Diffuse-reflective |  | Pre-wired (2 m) | 5 to 100 mm (wide view) | **E3Z-D61 2M *4** | **E3Z-D81 2M *4 *5** |
| | | Standard M8 connector | | **E3Z-D66** | **E3Z-D86** |
| | | Pre-wired (2 m) | 1 m | **E3Z-D62 2M *4 *5** | **E3Z-D82 2M *4 *5** |
| | | Standard M8 connector | | **E3Z-D67** | **E3Z-D87** |
| | | Pre-wired (2 m) | 90±30 mm (narrow beam) | **E3Z-L61 2M *4 *5** | **E3Z-L81 2M *4 *5** |
| | | Standard M8 connector | | **E3Z-L66** | **E3Z-L86** |
| Distance-settable Refer to **E3Z-LS**. |  | Pre-wired (2 m) | 20 to 40 mm (BGS min setting)<br>20 to 200 mm (BGS max setting) | **E3Z-LS61 2M *4** | **E3Z-LS81 2M *4** |
| | | Standard M8 Connector | 40 min. Incident threshold (FGS min setting)<br>200 min. Incident threshold (FGS max setting) | **E3Z-LS66** | **E3Z-LS86** |
| | | Pre-wired (2 m) | 2 to 20 mm (BGS min setting) | **E3Z-LS63 2M** | **E3Z-LS83 2M *5** |
| | | Standard M8 connector | 2 to 80 mm (BGS max setting) | **E3Z-LS68** | **E3Z-LS88** |
| Slit-type Through-beam Refer to **E3Z-G**. |  1 axis | Pre-wired (2 m) | 25 mm | **E3Z-G61 2M *4 *5** | **E3Z-G81 2M *4 *5** |
| | 2 axes | | | **E3Z-G62 2M *4** | **E3Z-G82 2M *4** |
| | 1 axis | Pre-wired M8 connector | | **E3Z-G61-M3J** | **E3Z-G81-M3J** |
| | 2 axes | | | **E3Z-G62-M3J** | **E3Z-G82-M3J** |
| Limited-reflective for transparent glasses |  | Pre-wired (2 m) | 30±20 mm | **E3Z-L63 2M** | **E3Z-L83 2M** |
| | | Standard M8 connector | | **E3Z-L68** | **E3Z-L88** |
| Retro-reflective without MSR function for clear, plastic bottles |  *1 | Pre-wired (2 m) | *2 500 mm (80 mm) | **E3Z-B61 2M** | **E3Z-B81 2M *4** |
| | | Standard M8 connector | | **E3Z-B66** | **E3Z-B86** |
| | | Pre-wired (2 m) | *2 2 m (500 mm) | **E3Z-B62 2M *4** | **E3Z-B82 2M *4** |
| | | Standard M8 connector | | **E3Z-B67** | **E3Z-B87** |

*1. The Reflector is sold separately. Select the Reflector model most suited to the application.
*2. The sensing distance specified is possible when the E39-R1S is used. Values in parentheses indicate the minimum required distance between the Sensor and Reflector.
*3. Through-beam Sensors are normally sold in sets that include both the Emitter and Receiver.
*4. M12 Standard Pre-wired Connector Models are also availavble.
When ordering, add "-M1J 0.3M" to the end of the model number (e.g., E3Z-T61-M1J 0.3M).
The cable is 0.3 m long. The applicable Sensor I/O Connector is the XS2 Series. For details, refer to the *XS2* information available on the OMRON website.
*5. M12 Pre-wired Smartclick Connector Models are also availavble.
When ordering, add "-M1TJ 0.3M" to the end of the model number (e.g., E3Z-T61-M1TJ 0.3M).
The cable is 0.3 m long. The applicable Sensor I/O Connector is the XS5 Series. For details, refer to the *XS5* information available on the OMRON website.

## Oil-resistive Sensors [Refer to *Dimensions on page 14.*]

Red light  Infrared light

| Sensing method | Appearance | Connection method | Sensing distance | Model NPN output | Model PNP output |
|---|---|---|---|---|---|
| Through-beam (Emitter + Receiver) *3 |  | Pre-wired (2 m) | 15 m | **E3Z-T61K 2M *4**<br>Emitter E3Z-T61K-L 2M<br>Receiver E3Z-T61K-D 2M | **E3Z-T81K 2M *4**<br>Emitter E3Z-T81K-L 2M<br>Receiver E3Z-T81K-D 2M |
| | | Pre-wired M8 connector | | **E3Z-T61K-M3J 0.3M**<br>Emitter E3Z-T61K-L-M3J 2M<br>Receiver E3Z-T61K-D-M3J 2M | **E3Z-T81K-M3J 0.3M**<br>Emitter E3Z-T81K-L-M3J 2M<br>Receiver E3Z-T81K-D-M3J 2M |
| Retro-reflective with MSR function |  *1 | Pre-wired (2 m) | *2<br>3 m (150 mm) | **E3Z-R61K 2M *4** | **E3Z-R81K 2M** |
| | | Pre-wired M8 connector | | **E3Z-R61K-M3J 0.3M** | **E3Z-R81K-M3J 0.3M** |
| Diffuse-reflective |  | Pre-wired (2 m) | 5 to 100 mm (wide view) | **E3Z-D61K 2M *4** | **E3Z-D81K 2M** |
| | | Pre-wired M8 connector | | **E3Z-D61K-M3J 0.3M** | **E3Z-D81K-M3J 0.3M** |
| | | Pre-wired (2 m) | 1 m | **E3Z-D62K 2M *4** | **E3Z-D82K 2M** |
| | | Pre-wired M8 connector | | **E3Z-D62K-M3J 0.3M** | **E3Z-D82K-M3J 0.3M** |

*1. The Reflector is sold separately. Select the Reflector model most suited to the application.
*2. The sensing distance specified is possible when the E39-R1S is used. Values in parentheses indicate the minimum required distance between the Sensor and Reflector.
*3. Through-beam Sensors are normally sold in sets that include both the Emitter and Receiver.
*4. M12 Standard Pre-wired Connector Models are also availavble.
When ordering, add "-M1J 0.3M" to the end of the model number (e.g., E3Z-T61-M1J 0.3M).
The cable is 0.3 m long. The applicable Sensor I/O Connector is the XS2 Series. For details, refer to the *XS2* information available on the OMRON website.

## Accessories (Order Separately)

### Slit (A Slit is not provided with Through-beam Sensors) Order a Slit separately if required. [Refer to *Dimensions* on page 16.]

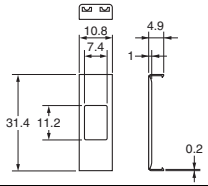
| Slit width | Sensing distance E3Z-T□□ | Sensing distance E3Z-T□□A | Minimum detectable object (Reference value) | Model | Contents |
|---|---|---|---|---|---|
| 0.5-mm dia. | 50 mm | 35 mm | 0.2-mm dia. | **E39-S65A** | One set (contains Slits for both the Emitter and Receiver) |
| 1-mm dia. | 200 mm | 150 mm | 0.4-mm dia. | **E39-S65B** | |
| 2-mm dia. | 800 mm | 550 mm | 0.7-mm dia. | **E39-S65C** | |
| 0.5 × 10 mm | 1 m | 700 mm | 0.2-mm dia. | **E39-S65D** | |
| 1 × 10 mm | 2.2 m | 1.5 m | 0.5-mm dia. | **E39-S65E** | |
| 2 × 10 mm | 5 m | 3.5 m | 0.8-mm dia. | **E39-S65F** | |

### Reflectors (Reflector required for Retroreflective Sensors) A Reflector is not provided with the Sensor. Be sure to order a Reflector separately. [Refer to *Dimensions* on *E39-L/E39-S/E39-R*]

| Name | Sensing distance * E3Z-R Rated value (sensing distance of 15 m) | E3Z-R Reference value (sensing distance of 10 m) | E3Z-R□K Rated value | E3Z-B□1/-B□6 Rated value | E3Z-B□2/-B□7 Rated value | Model | Quantity | Remarks |
|---|---|---|---|---|---|---|---|---|
| Reflector | 3 m (100 mm) | --- | 2 m (100 mm) | --- | --- | **E39-R1** | 1 | • Retro-reflective models are not provided with Reflectors.<br>• The MSR function is enabled. |
| | 4 m (100 mm) | --- | 3 m (150 mm) | 500 mm (80 mm) | 2 m (500 mm) | **E39-R1S** | 1 | |
| | --- | 5 m (100 mm) | --- | --- | --- | **E39-R2** | 1 | |
| | --- | 2.5 m (100 mm) | --- | --- | --- | **E39-R9** | 1 | |
| | --- | 3.5 m(100 mm) | --- | --- | --- | **E39-R10** | 1 | |
| Fog Preventive Coating | --- | 3 m (100 mm) | --- | 500 mm (80 mm) | 2 m (500 mm) | **E39-R1K** | 1 | |
| Small Reflector | --- | 1.5 m (50 mm) | --- | --- | --- | **E39-R3** | 1 | |
| Tape Reflector | --- | 700 mm (150 mm) | --- | --- | --- | **E39-RS1** | 1 | |
| | --- | 1.1 m (150 mm) | --- | --- | --- | **E39-RS2** | 1 | |
| | --- | 1.4 m (150 mm) | --- | --- | --- | **E39-RS3** | 1 | |

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. For details, refer to *Reflectors* on the *E39-L/E39-S/E39-R* information available on the OMRON website.
* Values in parentheses indicates the minimum required distance between the Sensor and Reflector.

### Mutual Interference Protection Filter A Filter is not provided with the Sensor (for the through-beam E3Z-T□□A). Order a Filter separately if required.

| Sensing distance | Appearance/Dimensions | Model | Quantity | Remarks |
|---|---|---|---|---|
| 3 m |  | **E39-E11** | Two sets each for the Emitter and Receiver (total of four pieces) | Can be used with the E3Z-T□□A Through-beam models. The arrow indicates the direction of polarized light. Mutual interference can be prevented by altering the direction of polarized light from or to adjacent Emitters and Receivers. |

Note: The polarization directions of the Filters are offset by 90° to prevent interference. When you install the Emitter and Receiver, install them at the same angle to maintain this offset.

## Mounting Brackets A Mounting Bracket is not enclosed with the Sensor. Order a Mounting Bracket separately if required.

**[Refer to *Dimensions* on *E39-L/E39-S/E39-R*]**

| Appearance | Model (material) | Quantity | Remarks | Appearance | Model (material) | Quantity | Remarks |
|---|---|---|---|---|---|---|---|
|  | **E39-L153 (SUS304)** *1 | 1 | Mounting Brackets |  | **E39-L98 (SUS304)** *2 | 1 | Metal Protective Cover Bracket |
|  | **E39-L104 (SUS304)** *1 | 1 | |  | **E39-L150 (SUS304)** | 1 | (Sensor adjuster) |
|  | **E39-L43 (SUS304)** *2 | 1 | Horizontal Mounting Brackets |  | **E39-L151 (SUS304)** | 1 | Easily mounted to the aluminum frame rails of conveyors and easily adjusted.<br>For left to right adjust-ment |
|  | **E39-L142 (SUS304)** *2 | 1 | Horizontal Protective Cover Bracket | | | | |
|  | **E39-L44 (SUS304)** | 1 | Rear Mounting Bracket |  | **E39-L144 (SUS304)** *2 | 1 | Compact Protective Cover Bracket (For E3Z only) |

Note: 1. When using Through-beam models, order one bracket for the Receiver and one for the Emitter.
2. For details, refer to *Mounting Brackets* on the *E39-L/E39-S/E39-R* information available on the OMRON website.

*1. Cannot be used for Standard Connector models with mounting surface on the bottom. In that case, use Pre-wired Connector models.
*2. Cannot be used for Standard Connector models.

## Sensor I/O Connectors (Sockets on One Cable End)

**(Models for Connectors and Pre-wired Connectors: A Connector is not provided with the Sensor. Be sure to order a Connector separately.)**

**[Refer to *Dimensions* for *XS3*.]**

| Size | Cable | Appearance | Cable type | | Model |
|---|---|---|---|---|---|
| M8 | Standard | Straight *2  | 2 m | 4-wire | **XS3F-M421-402-A** |
| | | | 5 m | | **XS3F-M421-405-A** |
| | | L-shaped *2 *3  | 2 m | | **XS3F-M422-402-A** |
| | | | 5 m | | **XS3F-M422-405-A** |
| | PUR (Polyure-thane) cable *1 | Straight *2  | 2 m | | **XS3F-M421-402-L** |
| | | | 5 m | | **XS3F-M421-405-L** |
| | | L-shaped *2 *3  | 2 m | | **XS3F-M422-402-L** |
| | | | 5 m | | **XS3F-M422-405-L** |
| | Vibration-proof robot cable | Straight *2  | 2 m | | **XS3F-M421-402-R** |
| | | | 5 m | | **XS3F-M421-405-R** |
| | | L-shaped *2 *3  | 2 m | | **XS3F-M422-402-R** |
| | | | 5 m | | **XS3F-M422-405-R** |

Note: 1. When using Through-beam models, order one connector for the Receiver and one for the Emitter.
2. For details, refer to the *XS3* information available on the OMRON website.

*1. The Sensor can be used in low-temperature environments (–25°C to –40°C). Do not use the Sensor in locations that are subject to oil.
*2. The connector will not rotate after connecting.
*3. The cable is fixed at an angle of 180° from the sensor emitter/receiver surface.

## Ratings and Specifications

| Item | Model | Sensing method | Through-beam | | | Retro-reflective with MSR function | Diffuse-reflective | | (Narrow-beam Models) |
|---|---|---|---|---|---|---|---|---|---|
| | NPN output | Pre-wired | E3Z-T61 | E3Z-T62 | E3Z-T61A | E3Z-R61 | E3Z-D61 | E3Z-D62 | E3Z-L61 |
| | | Connector (M8) | E3Z-T66 | E3Z-T67 | E3Z-T66A | E3Z-R66 | E3Z-D66 | E3Z-D67 | E3Z-L66 |
| | PNP output | Pre-wired | E3Z-T81 | E3Z-T82 | E3Z-T81A | E3Z-R81 | E3Z-D81 | E3Z-D82 | E3Z-L81 |
| | | Connector (M8) | E3Z-T86 | E3Z-T87 | E3Z-T86A | E3Z-R86 | E3Z-D86 | E3Z-D87 | E3Z-L86 |
| Sensing distance | | | 15 m | 30 m | 10 m | 4 m (100 mm) *1 (when using E39-R1S) 3 m (100 mm) *1 (when using E39-R1) | 100 mm (white paper: 100 × 100 mm) | 1 m (white paper: 300 × 300 mm) | 90 + 30 mm (white paper, 100 x 100 mm) |
| Spot diameter (reference value) | | | --- | | | | | | (2.5 dia. and sensing distance of 90 mm) |
| Standard sensing object | | | Opaque: 12-mm dia. min. | | | Opaque: 75-mm dia. min. | --- | | |
| Minimum detectable object (reference value) | | | --- | | | | | | 0.1 mm (copper wire) |
| Differential travel | | | --- | | | | 20% max. of setting distance | | Refer to *Engineering data* on page 8. |
| Directional angle | | | Both emitter and receiver: 3 to 15° | | | 2 to 10° | --- | | |
| Light source (wavelength) | | | Infrared LED (870 nm) | | Red LED (660 nm) | Red LED (660 nm) | Infrared LED (870 nm) | | Red LED (650 nm) |
| Current consumption | | | 35 mA max. (Emitter: 15 mA max., Receiver: 20 mA max.) | | | 30 mA max. | | | |
| Protection circuits | | | Reversed power supply polarity protection, Output short-circuit protection, and Reversed output polarity protection | | | Reversed power supply polarity protection, Output short-circuit protection, Mutual interference prevention, and Reversed output polarity protection | | | |
| Response time | | | Operate or reset: 1 ms max. | Operate or reset: 2 ms max. | Operate or reset: 1 ms max. | | | | |
| Degree of protection | | | IEC, IP67 | | | | | | |
| Connection method | | | Pre-wired cable (standard length: 2 m and 0.5 m), Connector (M8) | | | | | | |
| Weight (packedstate) | Pre-wired cable (2 m) | | Approx. 120 g | | | Approx. 65 g | | | |
| | Connector | | Approx. 30 g | | | Approx. 20 g | | | |
| Material | Case | | PBT (polybutylene terephthalate) | | | | | | |
| | Lens | | Modified polyarylate | | | Methacrylic resin | Modified polyarylate | | |

| Item | Model | Sensing method | Retro-reflective for clear, plastic bottles (without MSR function) | | | |
|---|---|---|---|---|---|---|
| | | NPN output | E3Z-B61 | E3Z-B66 | E3Z-B62 | E3Z-B67 |
| | | PNP output | E3Z-B81 | E3Z-B86 | E3Z-B82 | E3Z-B87 |
| Sensing distance | | | 500 mm (80 mm) *1 (using E39-R1S) | | 2 m (500 mm) *1 *2 (using E39-R1S) | |
| Standard sensing object | | | Opaque materials, 75mm dia. min. (Standard detectable object :glass Cylinder 15mm dia. thickness 1.1mm length 50mm, and the transmission factor 92% or less in wave length 660nm) | | | |
| Light source (wavelength) | | | Red LED (660 nm) | | | |
| Current consumption | | | 30 mA max. | | | |
| Protection circuits | | | Reversed power supply polarity protection, Output short-circuit protection, Mutual interference prevention, and Reversed output polarity protection | | | |
| Response time | | | Operate or reset: 1 ms max. | | | |
| Degree of protection | | | IEC, IP67 | | | |
| Connection method | | | Pre-wired cable (standard length: 2 m and 0.5 m) | Connector (M8, 4 pins) | Pre-wired cable (standard length: 2 m and 0.5 m) | Connector (M8, 4 pins) |
| Weight (packed state) | Pre-wired cable (2 m) | | Approx. 65 g | | | |
| | Standard Connector | | Approx. 20 g | | | |
| Material | Case | | PBT (polybutylene terephthalate) | | | |
| | Lens | | Modified polyarylate | | | |

*1. Values in parentheses indicate the minimum required distances between the Sensors and Reflectors.
*2. Plastic bottles must pass with the minimum clearance of 500 mm.

| Item | Model | Transparent glass Limited-reflective (for transparent object detection ) | |
|---|---|---|---|
| Sensing method | | | |
| | NPN output | E3Z-L63 | E3Z-L68 |
| | PNP output | E3Z-L83 | E3Z-L88 |
| Sensing distance | | 30±20 mm (transparent glasses 100 × 100 mm) | |
| Spot diameter (reference value) | | 2-mm dia. min. (at sensing distance of 30 mm) | |
| Minimum detectable object (reference value) | | 0.1 mm dia. (copper wire) | |
| Light source (wavelength) | | Red LED (660 nm) | |
| Current consumption | | 30 mA max. | |
| Protection circuits | | Power supply reverse polarity protection, Output short-circuit protection, Mutual interference prevention, Reverse output polarity protection | |
| Response time | | Operate or reset: 1 ms max. | |
| Degree of protection | | IEC, IP67 | |
| Connection method | | Pre-wired (standard length: 2 m) | M8 connector |
| Weight (packed state) | Pre-wired cable (2 m) | Approx. 65 g | |
| | Standard Connector | Approx. 20 g | |
| Material | Case | PBT (polybutylene terephthalate) | |
| | Lens | Modified polyarylate | |

## Oil-resistant

| Item | Model | | Sensing method | Through-beam | Retro-reflective | Diffuse-reflective | |
|---|---|---|---|---|---|---|---|
| | NPN output | | Pre-wired Models | E3Z-T61K | E3Z-R61K | E3Z-D61K | E3Z-D62K |
| | | | M8 Pre-wired connector | E3Z-T61K-M3J | E3Z-R61K-M3J | E3Z-D61K-M3J | E3Z-D62K-M3J |
| | PNP output | | Pre-wired Models | E3Z-T81K | E3Z-R81K | E3Z-D81K | E3Z-D82K |
| | | | M8 Pre-wired connector | E3Z-T81K-M3J | E3Z-R81K-M3J | E3Z-D81K-M3J | E3Z-D82K-M3J |
| **Sensing distance** | | | | 15 m | 3 m (150 mm) * (when using E39-R1S)<br>2 m (100 mm) * (when using E39-R1) | 100 mm (white paper: 100 × 100 mm) | 1 m (white paper: 300 × 300 mm) |
| **Standard sensing object** | | | | Opaque: 12-mm dia. min. | Opaque: 75-mm dia. min. | --- | |
| **Differential travel** | | | | --- | | 20% max. of setting distance | |
| **Directional angle** | | | | Both emitter and receiver: 3 to 15° | 2 to 10° | --- | |
| **Light source (wavelength)** | | | | Infrared LED (870 nm) | Red LED (660 nm) | Infrared LED (860 nm) | |
| **Current consumption** | | | | 35 mA max. (Emitter: 15 mA max., Receiver: 20 mA max.) | 30 mA max. | | |
| **Protection circuits** | | | | Reversed power supply polarity protection, Output short-circuit protection, and Reversed output polarity protection | Reversed power supply polarity protection, Output short-circuit protection, Mutual interference prevention, and Reversed output polarity protection | | |
| **Response time** | | | | Operate or reset: 1 ms max. | | | |
| **Degree of protection** | | | | IP67 (IEC), Oil resistant models: IP67 (IEC) (in-house standards: oilproof), excluding cables and connectors | | | |
| **Connection method** | | | | Pre-wired cable (standard length: 2 m), M8 Pre-wired Connector | | | |
| **Weight (packed state)** | **Pre-wired cable (2 m)** | | | Approx. 120 g | Approx. 65 g | | |
| | **Connector (M8, 4 pins)** | | | Approx. 50 g | Approx. 30 g | | |
| **Material** | **Case** | | | PBT (polybutylene terephthalate) | | | |
| | **Lens** | | | Modified polyarylate | Methacrylic resin | Modified polyarylate | |

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

## Common

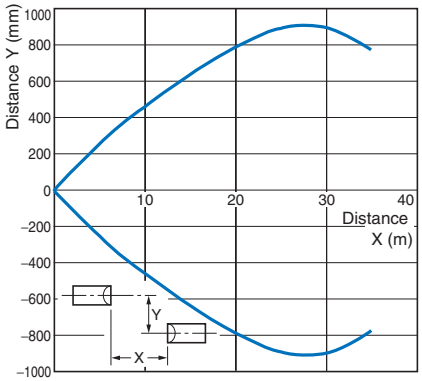
| | |
|---|---|
| **Power supply voltage** | 12 to 24 VDC±10%, ripple (p-p): 10% max. |
| **Control output** | Load power supply voltage: 26.4 VDC max., Load current: 100 mA max.<br>Residual voltage: Load current of less than 10 mA: 1 V max.<br>Load current of 10 to 100 mA: 2 V max.<br>Open collector output (NPN/PNP depending on model)<br>Light-ON/Dark-ON selectable |
| **Sensitivity adjustment** | One-turn adjuster |
| **Ambient illumination (Receiver side)** | Incandescent lamp: 3,000 lx max.<br>Sunlight: 10,000 lx max. |
| **Ambient temperature range** | Operating: –25 to 55°C, Some connector models: –40°C to 55°C * (with no icing or condensation)<br>Storage: –40 to 70°C (with no icing or condensation) |
| **Ambient humidity range** | Operating: 35% to 85%, Storage: 35% to 95% (with no condensation) |
| **Insulation resistance** | 20 MΩ min. at 500 VDC |
| **Dielectric strength** | 1,000 VAC, 50/60 Hz for 1 min |
| **Vibration resistance** | Destruction: 10 to 55 Hz, 1.5 mm double amplitude for 2 hours each in X, Y, and Z directions |
| **Shock resistance** | Destruction: 500 m/s$^2$ 3 times each in X, Y, and Z directions |
| **Indicator** | Operation indicator (orange)<br>Stability indicator (green)<br>Through-beam Emitter has power indicator (orange) only. |
| **Accessories** | Instruction manual (Neither Reflectors nor Mounting Brackets are provided with any of the above models.) |

* The ambient temperature range during operation for connector models depends on the model. For the E3Z-T66/T86/R66/R86, the range is –40°C to 55°C. For the E3Z-D66/D86/D67/D87, the range is –30°C to 55°C. For other connector models, the range is –25°C to –55°C.
The sensing distance for Retro-reflective Models (E3Z-R66/R86) between –40°C to –25°C, however, will be as follows (not the values in the table):
With E39-R1S: 3 m (100 mm), With E39-R1: 2 m (100 mm).
Also, use the XS3F-M42□-4□□-L Sensor I/O Connector (PUR cable) for applications between –25°C to –40°C. (Refer to page 4.)

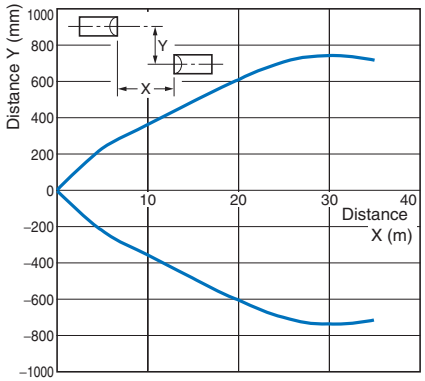
# Engineering Data (Reference Value)

## Parallel Operating Range

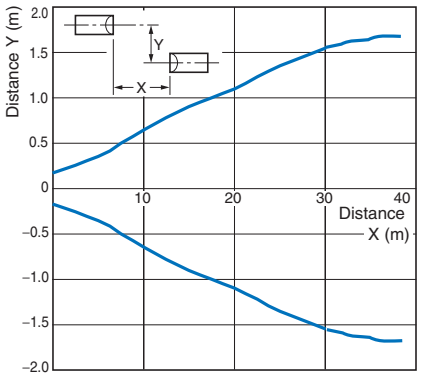
### Through-beam Models
### E3Z-T□1(T□6)



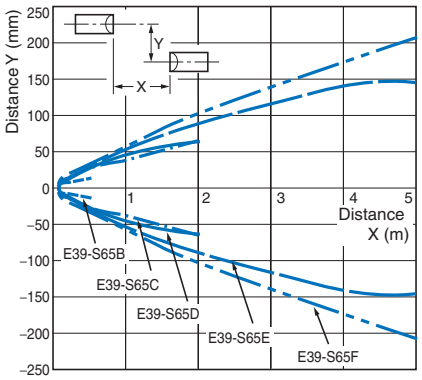

### Through-beam Models
### E3Z-T□A



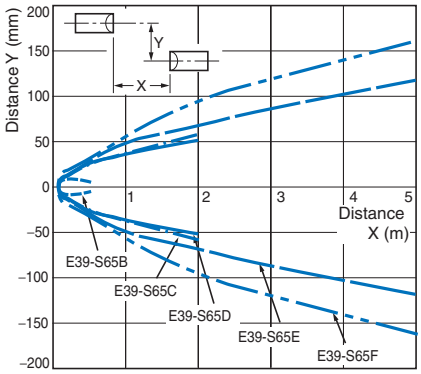

### Through-beam Models
### E3Z-T□2(T□7)



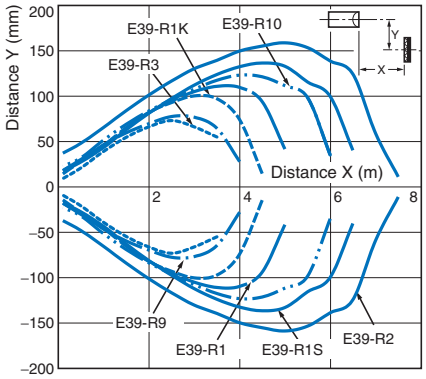

### Through-beam Models
### E3Z-T□1(T□6) and Slit
### (A Slit is mounted to the Emitter and Receiver.)



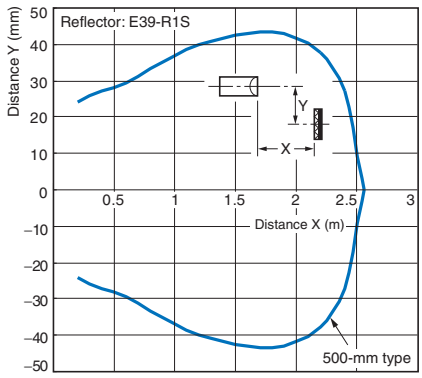

### Through-beam Models
### E3Z-T□A and Slit
### (A Slit is mounted to the Emitter and Receiver.)



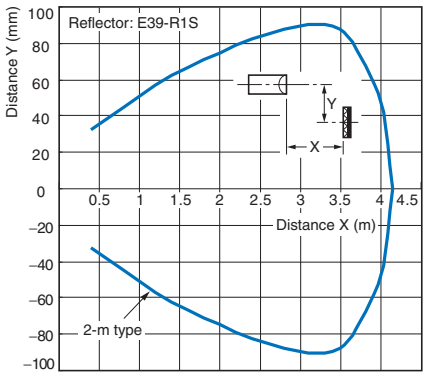

### Retro-reflective Models
### E3Z-R□1(R□6) and Reflector




### E3Z-B□1/B□6 + E39-R1S Reflector (Order Separately)

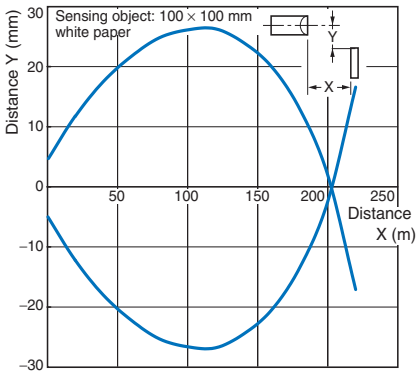



### E3Z-B□2/B□7 + E39-R1S Reflector (Order Separately)

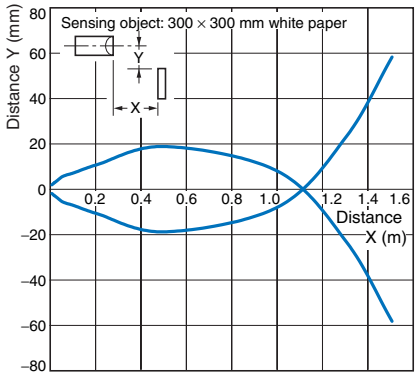


## Operating Range

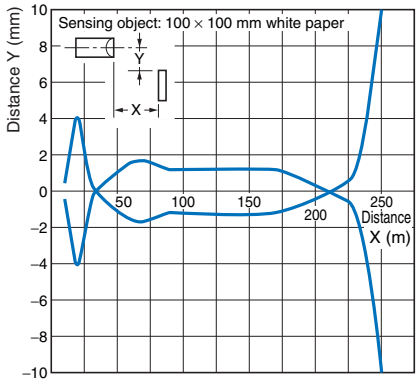
### Diffuse-reflective Models
### E3Z-D□1(D□6)




### Diffuse-reflective Models
### E3Z-D□2(D□7)

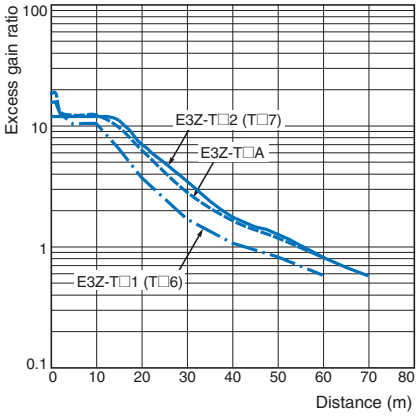



### Narrow-beam Reflective Models
### E3Z-L□1(L□6)

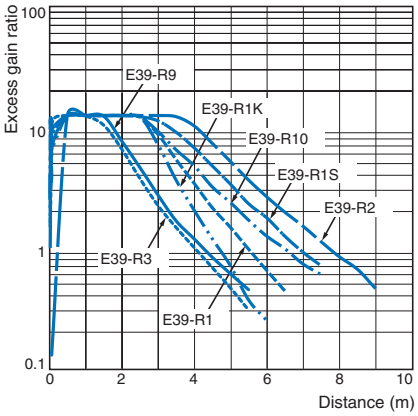



## Excess Gain vs. Set Distance

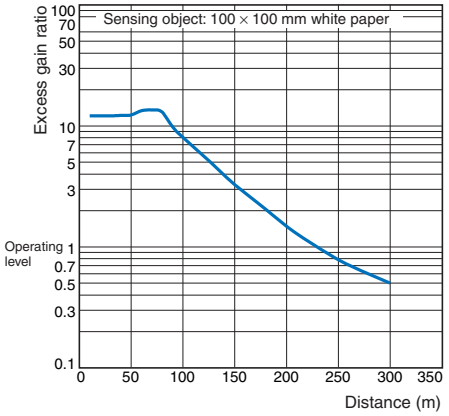
### Through-beam Models
### E3Z-T□1(T□6)/-T□A/-T□2(T□7)



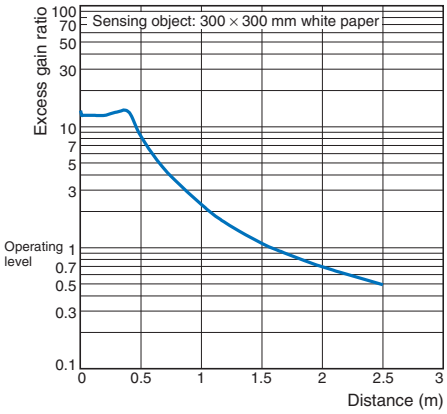

### Retro-reflective Models
### E3Z-R□1(R□6) and Reflector



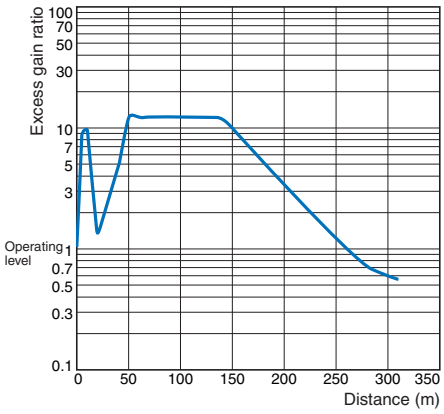

### Diffuse-reflective Models
### E3Z-D□1(D□6)



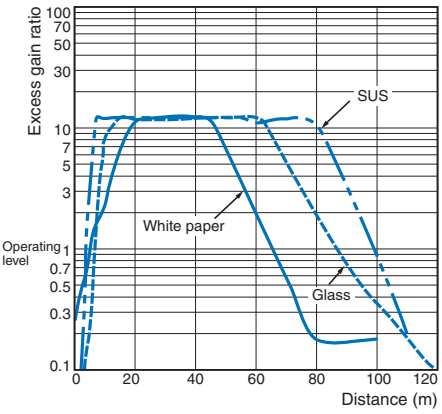

### Diffuse-reflective Models
### E3Z-D□2(D□7)




### Narrow-beam Reflective Models
### E3Z-L□1(L□6)

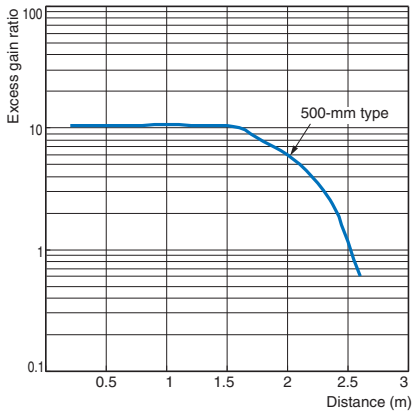



### Limited reflective Models
### E3Z-L□3(L□8)

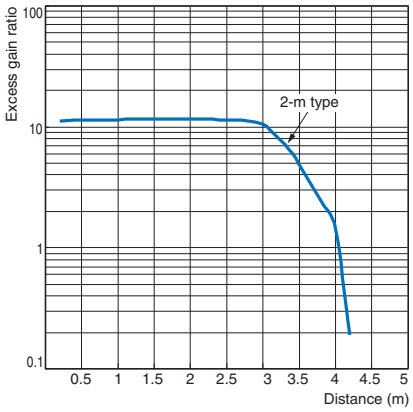


## Excess Gain vs. Set Distance

**E3Z-B□1/B□6 + E39-R1S Reflector (Order Separately)**



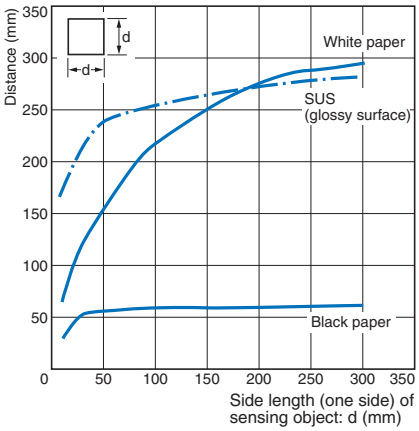

**E3Z-B□2/B□7 + E39-R1S Reflector (Order Separately)**




## Sensing Object Size vs. Sensing Distance

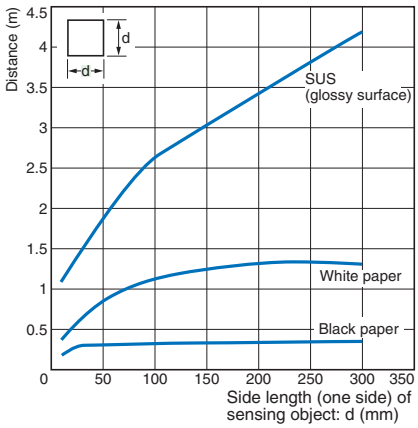
**Diffuse-reflective Models**

**E3Z-D□1(D□6)**



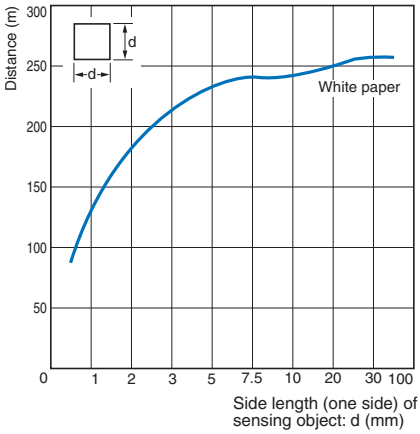

**Diffuse-reflective Models**

**E3Z-D□2(D□7)**




**Narrow-beam Reflective Models**

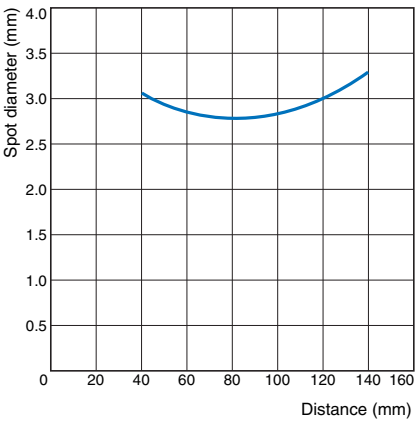
**E3Z-L□1(L□6)**




## Spot Diameter vs. Sensing Distance

**Narrow-beam Reflective Models**

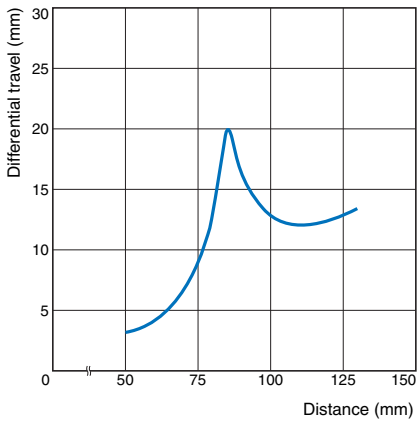
**E3Z-L□1(L□6)**




## Differential Travel vs. Sensing Distance

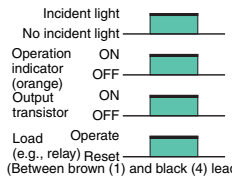
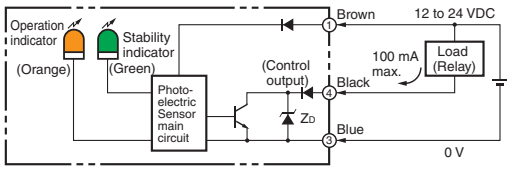
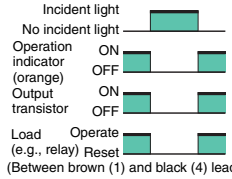
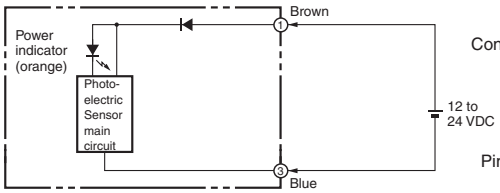
**Narrow-beam Reflective Models**

**E3Z-L□1(L□6)**

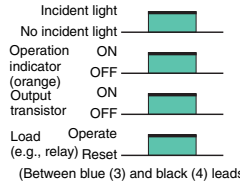
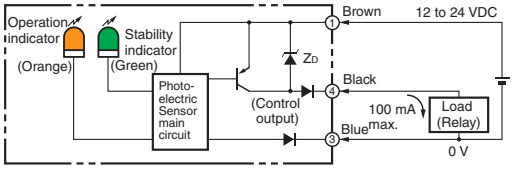
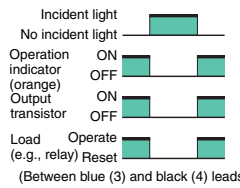
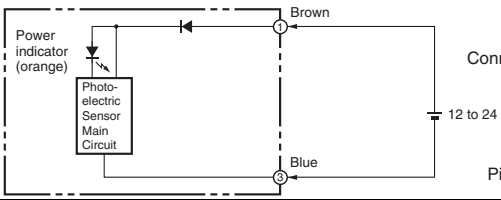


# I/O Circuit Diagrams

## NPN Output

| Model* | Operation mode | Timing charts | Operation selector | Output circuit |
|---|---|---|---|---|
| E3Z-T61(K)<br>E3Z-T66<br>E3Z-T62<br>E3Z-T67<br>E3Z-T61A<br>E3Z-T66A<br>E3Z-R61(K)<br>E3Z-R66<br>E3Z-D61(K)<br>E3Z-D66<br>E3Z-D62(K)<br>E3Z-D67<br>E3Z-L61<br>E3Z-L66<br>E3Z-B61<br>E3Z-B66<br>E3Z-B62<br>E3Z-B67<br>E3Z-L63<br>E3Z-L68 | Light-ON |  | L side (LIGHT ON) | Through-beam Receivers, Retro-reflective Models, Diffuse-reflective Models, Limited reflective Models.<br>  <br>Connector Pin Arrangement<br>  <br>Pin 2 is not used. |
| | Dark-ON |  | D side (DARK ON) | |
| | Through-beam Emitter |  | | Connector Pin Arrangement<br>  <br>Pins 2 and 4 are not used. |

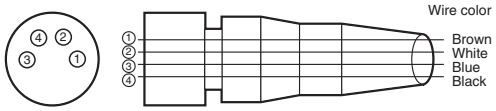
## PNP Output

| Model* | Operation mode | Timing charts | Operation selector | Output circuit |
|---|---|---|---|---|
| E3Z-T81(K)<br>E3Z-T86<br>E3Z-T82<br>E3Z-T87<br>E3Z-T81A<br>E3Z-T86A<br>E3Z-R81(K)<br>E3Z-R86<br>E3Z-D81(K)<br>E3Z-D86<br>E3Z-D82(K)<br>E3Z-D87<br>E3Z-L81<br>E3Z-L86<br>E3Z-B81<br>E3Z-B86<br>E3Z-B82<br>E3Z-B87<br>E3Z-L83<br>E3Z-L88 | Light-ON |  | L side (LIGHT ON) | Through-beam Receivers, Retro-reflective Models, Diffuse-reflective Models, Limited reflective Models.<br>  <br>Connector Pin Arrangement<br>  <br>Pin 2 is not used. |
| | Dark-ON |  | D side (DARK ON) | |
| | Through-beam Emitter |  | | Connector Pin Arrangement<br>  <br>Pins 2 and 4 are not used. |

* Models numbers for Through-beam Sensors (E3Z-T□□) are for sets that include both the Emitter and Receiver. The model number of the Emitter is expressed by adding "-L" to the set model number (example: E3Z-T61-L 2M), the model number of the Receiver, by adding "-D" (example: E3Z-T61-D 2M.) Refer to *Ordering Information* to confirm model numbers for Emitter and Receivers.

## Plugs (Sensor I/O Connectors)

### M8 connector




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

### Pin arrangement

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

Note: Pin 2 is not used.

# Nomenclature

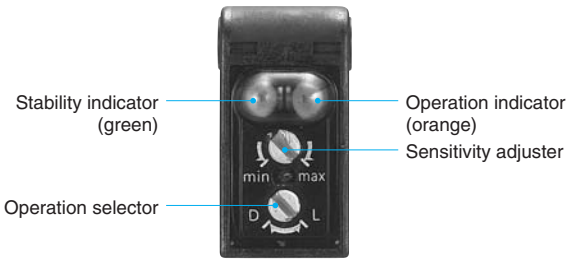
### Through-beam Models
**E3Z-T□□ (Receiver)**
**E3Z-T□□A (Receiver)**

### Retro-reflective Models
**E3Z-R□□**
**E3Z-B□□**

### Diffuse-reflective Models
**E3Z-D□□**

### Narrow-beam Reflective Models
**E3Z-L□□**

### Limited reflective Models
**E3Z-L□□**



# Safety Precautions

**Refer to *Warranty and Limitations of Liability*.**

**⚠ WARNING**

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

## Precautions for Correct Use

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

### ● Wiring

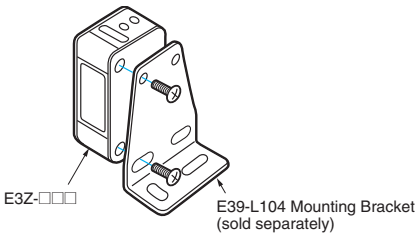
#### M8 Metal Connector

- Be sure to connect or disconnect the metal connector after turning OFF the Sensor.
- Hold the connector cover to connect or disconnect the metal connector.
- Secure the connector cover by hand. Do not use any pliers, otherwise the connector may be damaged.
- The proper tightening torque range is between 0.3 and 0.4 N·m. Be sure to tighten the connector securely, otherwise the specified degree of protection may not be maintained or the connector may be disconnected due to vibration.

### ● Mounting

#### Sensor Mounting

Use M3 screws to mount the sensor and tighten each screw to a maximum torque of 0.53 N·m.




### ● Oil-resistant Models

#### Oil Resistance

- Although the E3Z-□□□K Sensors have oil-resistant specifications, performance may be affected by certain types of oil. Refer to the following table.
- E3Z-□□□K Sensors are tested for resistance to the oils given in the following table. Refer to the information in the table when deciding which type of oil to use.

| Test oil classification | Product name | Kinematic viscosity ($mm^2/s$) at 40°C | pH |
|---|---|---|---|
| Lubricant | Velocity No.3 (manufactured by Exxon Mobil) | 2.02 | --- |
| Water insoluble machining oil | Yushiron Oil No.2 ac (manufactured by Yushiro Chemical Industry Co., Ltd.) | Less than 10 | |
| Water soluble machining oil | Yushiroken EC50T-3 (manufactured by Yushiro Chemical Industry Co., Ltd.) | --- | 7 to 9.5 |
| | Yushiron Lubic HWC68 (manufactured by Yushiro Chemical Industry Co., Ltd.) | | 7 to 9.9 |
| | Gryton 1700D (manufactured by Toho Chemical Industry Co., Ltd.) | | 7 to 9.2 |
| | Yushironken S50N (manufactured by Yushiro Chemical Industry Co., Ltd.) | | 7 to 9.8 |

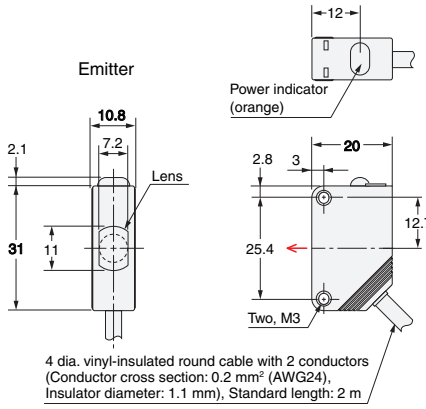
Note: 1. The E3Z maintained a minimum insulation resistance of 100 MΩ after it was dipped in all the above oils for 240 hours.
2. When using the Sensors in environments subject to oils other than those listed above, use the figures for kinematic viscosity and pH from the table as general guidelines. Additives and other substances contained in oils may affect the E3Z. Be sure to consider this before use.

# Dimensions

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

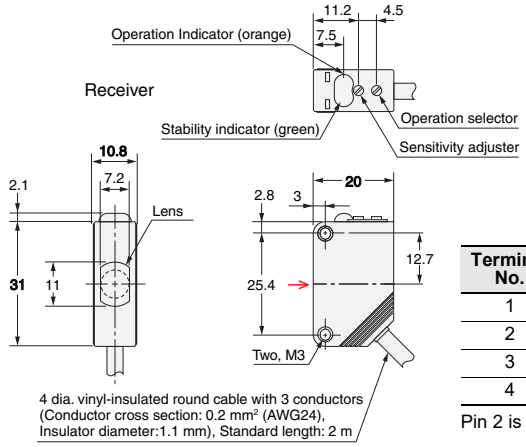
## Sensors

### Through-beam*
**Pre-wired Models**
**E3Z-T61(K)**
**E3Z-T81(K)**
**E3Z-T61A**
**E3Z-T81A**
**E3Z-T62**
**E3Z-T82**




| Terminal No. | Specifications |
|---|---|
| 1 | +V |
| 2 | --- |
| 3 | 0V |
| 4 | --- |

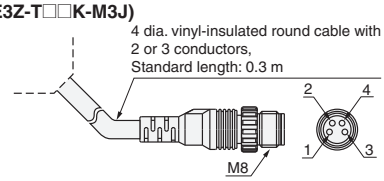
Pins 2 and 4 are not used.




| Terminal No. | Specifications |
|---|---|
| 1 | +V |
| 2 | --- |
| 3 | 0V |
| 4 | Output |

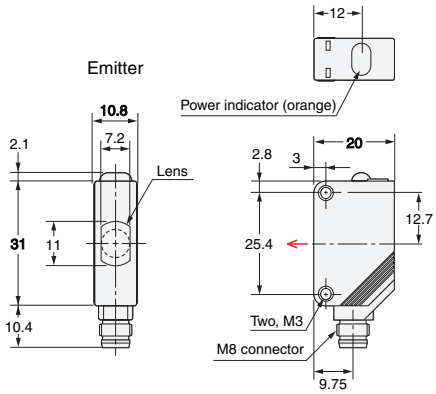
Pin 2 is not used.

**M8 Pre-wired Connector (E3Z-T□□K-M3J)**



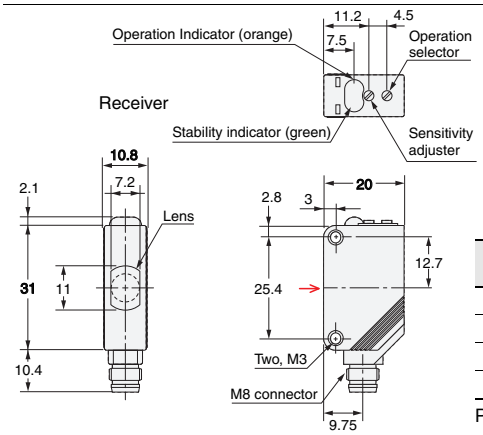

* The Emitter cable has two conductors and the Receiver cable has three conductors.

### Through-beam*
**Connector Models**
**E3Z-T66**
**E3Z-T86**
**E3Z-T66A**
**E3Z-T86A**
**E3Z-T67**
**E3Z-T87**




| Terminal No. | Specifications |
|---|---|
| 1 | +V |
| 2 | --- |
| 3 | 0V |
| 4 | --- |

Pins 2 and 4 are not used.




| Terminal No. | Specifications |
|---|---|
| 1 | +V |
| 2 | --- |
| 3 | 0V |
| 4 | Output |

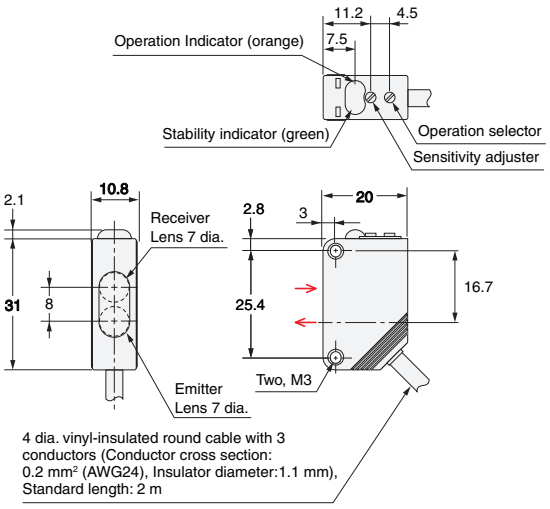
Pin 2 is not used.

* Models numbers for Through-beam Sensors (E3Z-T□□) are for sets that include both the Emitter and Receiver.
The model number of the Emitter is expressed by adding "-L" to the set model number (example: E3Z-T61-L 2M), the model number of the Receiver, by adding "-D" (example: E3Z-T61-D 2M.) Refer to *Ordering Information* to confirm model numbers for Emitter and Receivers.

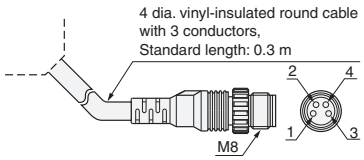
## Retro-reflective Models

### Pre-wired Models

**E3Z-R61(K)** **E3Z-B61**
**E3Z-R81(K)** **E3Z-B81**
**E3Z-D61(K)** **E3Z-B62**
**E3Z-D81(K)** **E3Z-B82**
**E3Z-D62(K)** **E3Z-L63**
**E3Z-D82(K)** **E3Z-L83**
**E3Z-L61**
**E3Z-L81**




**M8 Pre-wired Connector (E3Z-T□□K-M3J)**

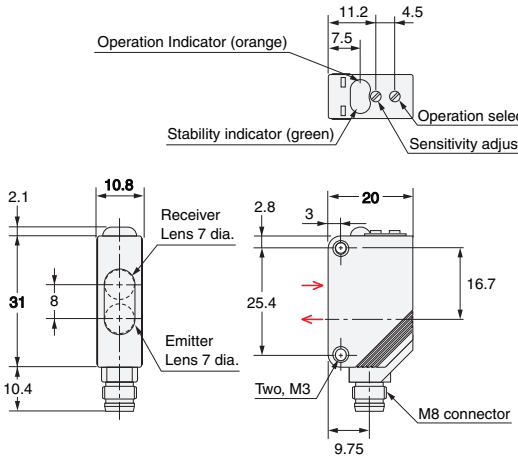



| Terminal No. | Specifications |
|---|---|
| 1 | +V |
| 2 | --- |
| 3 | 0V |
| 4 | Output |

## Retro-reflective Models

### Connector Models

**E3Z-R66** **E3Z-B66**
**E3Z-R86** **E3Z-B86**
**E3Z-D66** **E3Z-B67**
**E3Z-D86** **E3Z-B87**
**E3Z-D67** **E3Z-L68**
**E3Z-D87** **E3Z-L88**
**E3Z-L66**
**E3Z-L86**

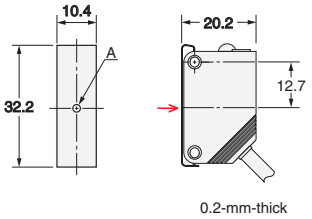



| Terminal No. | Specifications |
|---|---|
| 1 | +V |
| 2 | --- |
| 3 | 0V |
| 4 | Output |

Note: The lens for the E3Z-D□1/D□6/L□□/B□□ is red. The lens for the E3Z-D□2/D□7 is black.

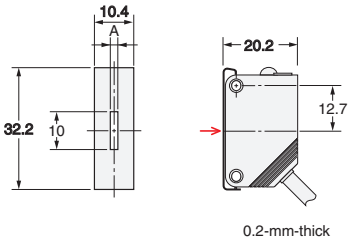
## Accessories (Order Separately)

### Slits
**E39-S65A**
**E39-S65B**
**E39-S65C**




| Model | Size A | Material |
|---|---|---|
| **E39-S65A** | 0.5 dia. | SUS301 stainless steel |
| **E39-S65B** | 1.0 dia. | |
| **E39-S65C** | 2.0 dia. | |

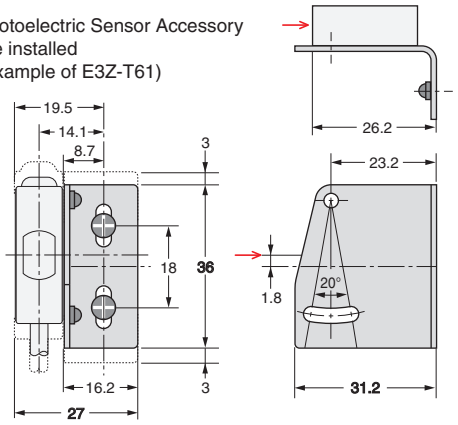
### Slits
**E39-S65D**
**E39-S65E**
**E39-S65F**




| Model | Size A | Material |
|---|---|---|
| **E39-S65D** | 0.5 | SUS301 stainless steel |
| **E39-S65E** | 1.0 | |
| **E39-S65F** | 2.0 | |

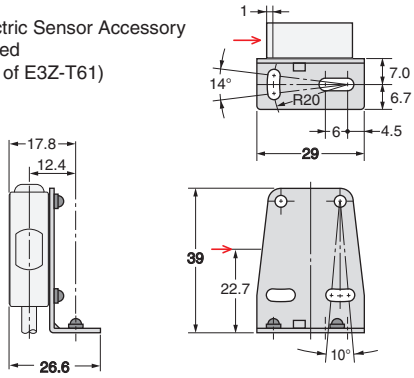
### Slits
**E39-L44**

Photoelectric Sensor Accessory are installed
(Example of E3Z-T61)




### Slits
**E39-L104**

Photoelectric Sensor Accessory are installed
(Example of E3Z-T61)




### Mounting Brackets

Refer to *E39-R* for details.

### Sensor I/O Connectors

Refer to *XS3□* for details.

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