

# Photoelectric Sensor with Built-in Amplifier with New Connector Options

## E3Z

Compact Sensor Offers Long Sensing Distance and Superior Noise-Immunity

- Photo-IC provides long sensing distance: 15 m and 10 m for through-beam, 4 m for retroreflective, and 1 m for diffuse.
- Integrated Photo-IC improves noise immunity to interference from inverters and other inductive loads.
- New injection molding technology assures IP67 rating to withstand water and dust.
- Switch-selectable, Light-ON/Dark-ON operation.
- M8 connector-ready and 2 m, pre-wired models.
- NPN or PNP output models available.



1200 psi  
washdown rated



## Ordering Information

### ■ Sensors

**Stock Note:** Shaded models are normally stocked.

Sensing method	Light source	Appearance	Connection method	Sensing distance	Model	
					NPN output	PNP output
Through-beam	IR/RED		Pre-wired	15 m (IR) 10 m (RED) (See Note 1.)	<b>E3Z-T61(A)</b>	<b>E3Z-T81(A)</b>
			Connector		<b>E3Z-T66(A)</b>	<b>E3Z-T86(A)</b>
			Pigtail 3 pin (M8)		<b>E3Z-T61(A)-M5J</b>	<b>E3Z-T81(A)-M5J</b>
			Pigtail 4 pin (M8)		<b>E3Z-T61(A)-M3J</b>	<b>E3Z-T81(A)-M3J</b>
			Pigtail 4 pin (M12)		<b>E3Z-T61(A)-M1J</b>	<b>E3Z-T81(A)-M1J</b>
Polarized retroreflective	RED	 (See Note 2.)	Pre-wired	100 mm to 4 m 100 mm to 3 m (See Note 3.)	<b>E3Z-R61</b>	<b>E3Z-R81</b>
			Connector		<b>E3Z-R66</b>	<b>E3Z-R86</b>
			Pigtail 3 pin (M8)		<b>E3Z-R61-M5J</b>	<b>E3Z-R81-M5J</b>
			Pigtail 4 pin (M8)		<b>E3Z-R61-M3J</b>	<b>E3Z-R81-M3J</b>
			Pigtail 4 pin (M12)		<b>E3Z-R61-M1J</b>	<b>E3Z-R81-M1J</b>
Diffuse reflective	IR		Pre-wired	5 to 100 mm (wide view)	<b>E3Z-D61</b>	<b>E3Z-D81</b>
			Connector		<b>E3Z-D66</b>	<b>E3Z-D86</b>
			Pigtail 3 pin (M8)		<b>E3Z-D61-M5J</b>	<b>E3Z-D81-M5J</b>
			Pigtail 4 pin (M8)		<b>E3Z-D61-M3J</b>	<b>E3Z-D81-M3J</b>
			Pigtail 4 pin (M12)		<b>E3Z-D61-M1J</b>	<b>E3Z-D81-M1J</b>
			Pre-wired	1 m	<b>E3Z-D62</b>	<b>E3Z-D82</b>
			Connector		<b>E3Z-D67</b>	<b>E3Z-D87</b>
			Pigtail 3 pin (M8)		<b>E3Z-D62-M5J</b>	<b>E3Z-D82-M5J</b>
			Pigtail 4 pin (M8)		<b>E3Z-D62-M3J</b>	<b>E3Z-D82-M3J</b>
			Pigtail 4 pin (M12)		<b>E3Z-D62-M1J</b>	<b>E3Z-D82-M1J</b>

- Note: 1. Model numbers that end with (A) are red LED versions.  
 2. The Reflector is sold separately. Select the Reflector model most suited to the application.  
 3. Sensing distance can be extended to 4 meters when the E39-R1S reflector is used. The sensing distance is 3 meters when the E39-R1 reflector is used.

## ■ Accessories (order separately)

**Stock Note:** Shaded models are normally stocked.

### Slit for Through-beam Models (E3Z-T□□)

Order a slit for each emitter and receiver.

Slit width	Sensing distance (typical)	Minimum sensing object (typical)	Model
0.5 mm dia.	50 mm	0.5 mm dia.	E39-S65A
1 mm dia.	200 mm	1 mm dia.	E39-S65B
2 mm dia.	800 mm	2 mm dia.	E39-S65C
0.5 × 10 mm	1 m	0.7 mm dia.	E39-S65D
1 × 10 mm	2.2 m	1.2 mm dia.	E39-S65E
2 × 10 mm	5 m	2.4 mm dia.	E39-S65F

## ■ Reflectors for Retroreflective Models

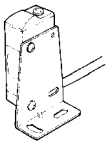
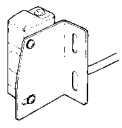
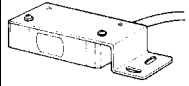
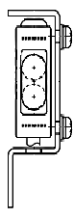
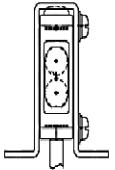
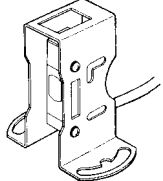
**Stock Note:** Shaded models are normally stocked.

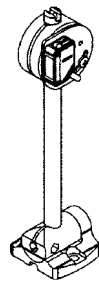
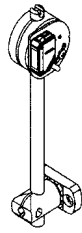
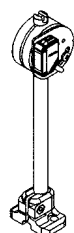
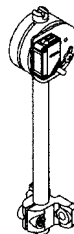
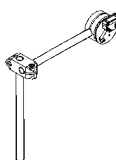
Name	Sensing distance (typical)	Model
Reflector	100 mm to 3 m	E39-R1
	100 mm to 4 m	E39-R1S
	100 mm to 5 m	E39-R2
	100 mm to 2.5 m	E39-R9
	100 mm to 3.5 m	E39-R10
Miniature Reflector	50 mm to 1.5 m	E39-R3
Tape Reflector	150 mm to 700 mm	E39-RS1
	150 mm to 1.1 m	E39-RS2
	150 mm to 1.4 m	E39-RS3

Note: The actual sensing distance may be reduced to approximately 70% of the typical sensing distance when using a Reflector other than the E39-R1 or the E39-R1S.

## ■ Mounting Brackets

**Stock Note:** Shaded models are normally stocked.

Appearance	Description	Model
	L-bracket, horizontal	<b>E39-L104</b>
	L-bracket, vertical	<b>E39-L44</b>
	Open top, 20° angle adjustability	<b>E39-L43</b>
	Protected top 5° angle adjustability	<b>E39-L144</b>
	Compact vertical protective cover bracket	<b>E39-L142</b>
	Vertical protective cover bracket	<b>E39-L98</b>

Appearance	Description	Model
	Adjustable height and angle bracket for sensors; horizontal mounting rotates every 45 degrees  Mounted to the aluminum frame rails of conveyors, easily adjustable	<b>E39-L93FH</b>
	Adjustable height and angle bracket for sensors; vertical mounting rotates every 45 degrees	<b>E39-L93FV</b>
	Adjustable height and angle bracket for sensors; fixed horizontal base mounting	<b>E39-L93H</b>
	Adjustable height and angle bracket for sensors; fixed vertical base mounting	<b>E39-L93V</b>
	Adjustable height and angle bracket for sensors; free range of X and Y axis posi- tioning; no base included for vertical post	<b>E39-L93XY</b>

Note: If a through-beam model is used, order two Mounting Brackets — one for the emitter and one for the receiver.

■ M8 CONNECTORS

Appearance	Cable type		Model
Straight	2 m (6.56 ft)	Four-wire type	XS3F-M421-402-A
	5 m (16.40 ft)		XS3F-M421-405-A
Right angle	2 m (6.56 ft)		XS3F-M422-402-A
	5 m (16.40 ft)		XS3F-M422-405-A
Straight	2 m (6.56 ft)	Three-wire type	Y96E-M833SD2
	5 m (16.40 ft)		Y96E-M833SD5
Right angle	2 m (6.56 ft)		Y96E-M833RD2
	5 m (16.40 ft)		Y96E-M833RD5

■ M12 CONNECTORS

Appearance	Cable type		Model
Straight	2 m (6.56 ft)	Four-wire type	Y96E-44SD2
	5 m (16.40 ft)		Y96E-44SD5
Right angle	2 m (6.56 ft)		Y96E-44RD2
	5 m (16.40 ft)		Y96E-44RD5

# Specifications

Item	Sensing method		Through-beam	Polarized retroreflective	Diffuse reflective	
		NPN output		E3Z-T61/T66 (A) (Note 3)	E3Z-R61/R66	E3Z-D61/D66
	PNP output		E3Z-T81/T86 (A) (Note 3)	E3Z-R81/R86	E3Z-D81/D86	E3Z-D82/D87
Sensing distance			15 m 10 m (A) (Note 3)	100 mm (4 m Note 1) (when using E39-R1S) 100 mm (3 m Note 2) (when using E39-R1)	White paper (100 × 100 mm): 100 mm	White paper (300 × 300 mm): 1 m
Standard sensing object			Opaque: 12 mm (dia. min.)	Opaque: 75 mm (dia. min.)	---	
Hysteresis			---		20% max. of setting distance	
Directional angle			Both emitter and re- ceiver: 3 to 15°	2 to 10°	---	
Light source (wave length)			Infrared LED (870 nm)	Red LED (660 nm)	Infrared LED (860 nm)	
Power supply voltage			12 to 24 VDC ±10% including 10% (p-p) max. ripple			
Current consumption			Emitter: 15 mA Receiver: 20 mA	30 mA max.		
Control output			100 mA max. at 26.4 VDC, open collector output (residual voltage: 2 V max.) < 10 mA (residual voltage: 1 V max.) L-ON/D-ON, switch selectable			
Circuit protection			Load short-circuit, re- versed power supply protection, and output reverse protection	Reversed power supply connection, output short-circuit, and mutual interference protection, and output reverse protection		
Response time			1 ms max.			
Sensitivity adjustment			One-turn potentiometer			
Ambient illumination (receiver side)	Incandescent lamp		3,000 ℓ max.			
	Sunlight		10,000 ℓ max.			
Ambient temperature	Operating		-25°C to 55°C (-13°F to 131°F)			
	Storage		-40°C to 70°C (-40°F to 158°F) 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, 50/60 Hz for 1 min			
Vibration resistance			10 to 55 Hz, 1.5-mm double amplitude or 300 m/s <sup>2</sup> for 2 hours each in X, Y, and Z axes			
Shock resistance	Destruction		500 m/s <sup>2</sup> 3 times each in X, Y, and Z axes			
Enclosure rating			IP67 (IEC60529) 1200 PSI Washdown (NEMA ICS5, ANNEX F)			
Approvals			CE			
Connection method			2 m cable or M8 connector			
Indicator			Operation indicator (orange) Stability indicator (green) Emitter has power indicator (orange) only			
Weight (packed state)	Pre-wired cable (2 m)		Approx. 120 g (4.2 oz)	Approx. 65 g (2.3 oz)		
	Connector		Approx. 30 g (1.1 oz)	Approx. 20 g (0.7 oz)		
Material			Case: PBT (polybutylene terephthalate); Lens: Denatured polyallylate			
Accessories			Instruction manual (Order Reflector and Mounting Bracket separately.)			

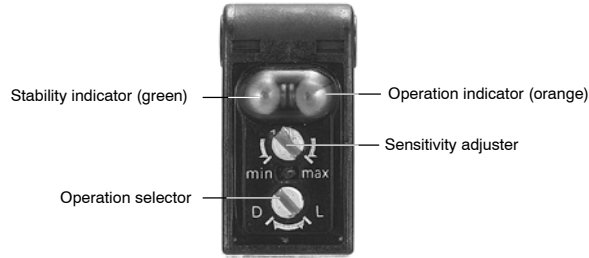
- Note: 1. Sensing distance can be extended up to 4 meters when the E39-R1S reflector is used.  
 2. Sensing distance can be extended up to 3 meters when the E39-R1 reflector is used.  
 3. Sensing distance is 10 meters when using the (A) versions (visible red LED, 660 nm).

# Nomenclature

**Through-beam Models**  
E3Z-T6□ Receiver

**Retroreflective Models**  
E3Z-R6□

**Diffuse-reflective Models**  
E3Z-D6□



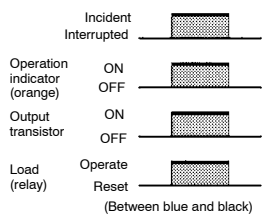
# Operation

## Output Circuits

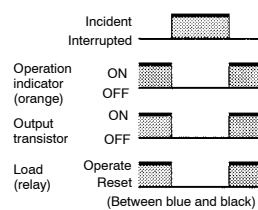
Model	E3Z-T61/-T66/-R61/-R66/-D61/-D66/-D62/-D67	
NPN output	Through-beam receiver Retroreflective model Diffuse reflective model	Through-beam emitter
Model	E3Z-T81/-T86/-R86/-D81/-D86/-D82/-D87	
PNP output	Through-beam receiver Retroreflective model Diffuse reflective model	Through-beam emitter
Connector pin arrangement	<p>Pin 2 is open.</p>	<p>Pins 2, 4 are open.</p>

## Timing Charts

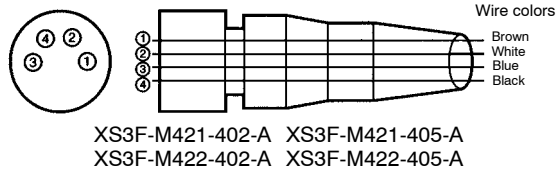
### Light-ON (L-ON) Operation



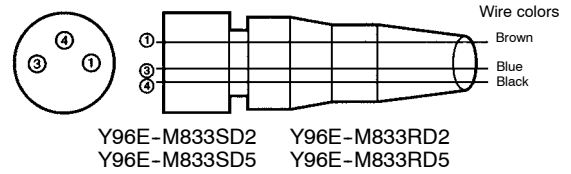
### Dark-ON (D-ON) Operation



■ M8 Connector PIN-OUT (4-Pin)



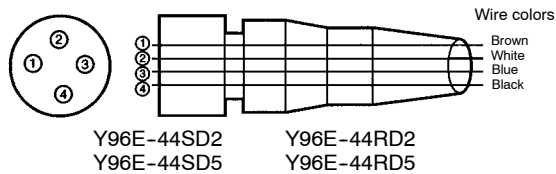
(3-Pin)



Classification	Wire color	Connector pin No.	Description
DC	Brown	1	Power supply (+V)
	White	2	Pin 2 is not used.
	Blue	3	Power supply (0 V)
	Black	4	Output

Note: The through-beam emitter does not use pins 2 and 4.

■ M12 Connector PIN-OUT (4-Pin)



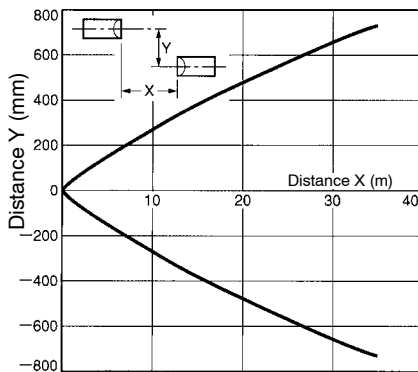
Classification	Wire color	Connector pin No.	Description
DC	Brown	1	Power supply (+V)
	White	2	Pin 2 is not used.
	Blue	3	Power supply (0 V)
	Black	4	Output

Note: The through-beam emitter does not use pins 2 and 4.

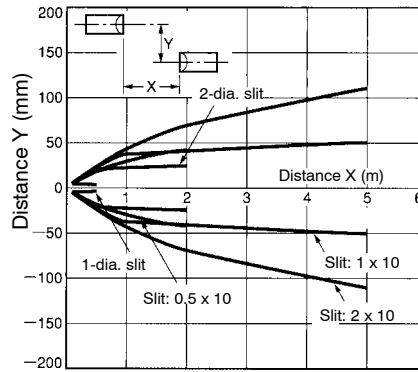
# Engineering Data

## Parallel Operating Range (typical)

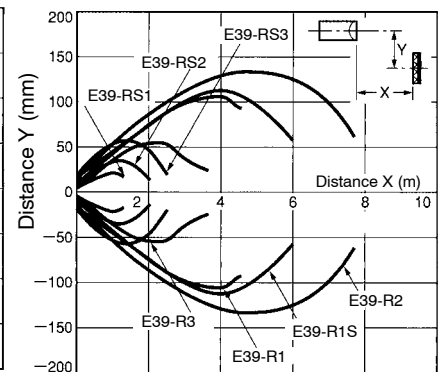
**Through-beam Models**  
E3Z-T□1 (T□6)



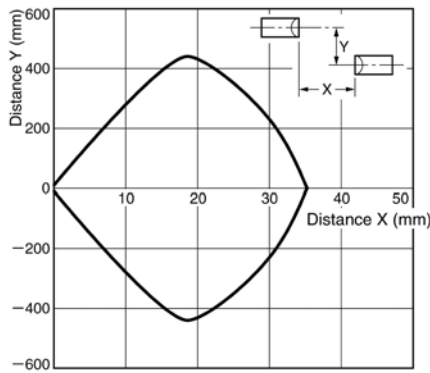
**Through-beam Models**  
E3Z-T□1 (T□6) and Slit



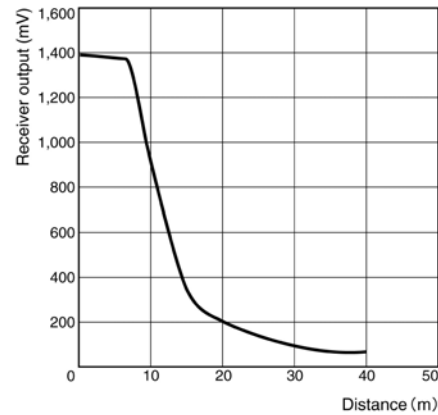
**Retroreflective Models**  
E3Z-R□1 (R□6) and Reflector



**Parallel Operating Range (Typical)**  
E3Z-T□A

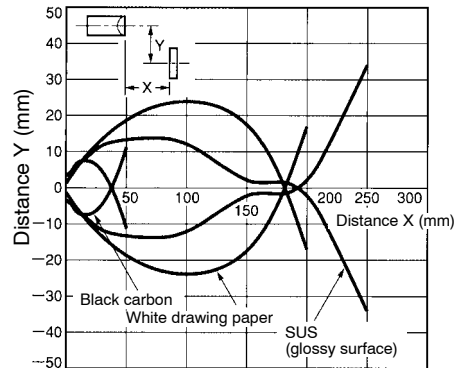


**Receiver Output vs. Distance (Typical)**  
E3Z-T□A

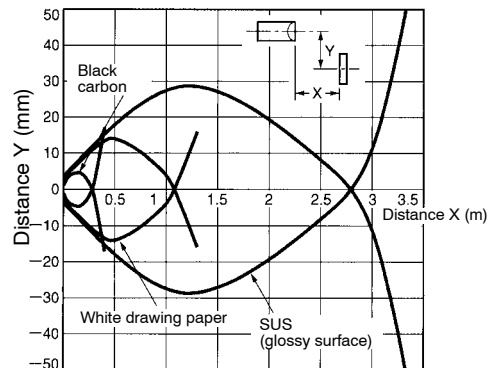


## Operating Range (typical)

**Diffuse Reflective Models**  
E3Z-D□1 (D□6)



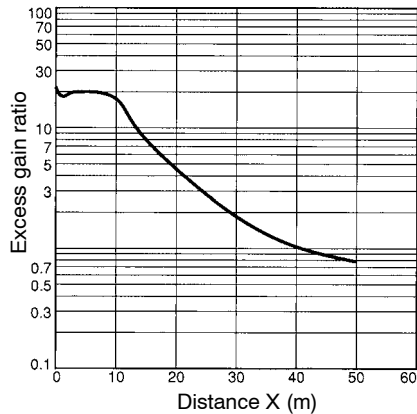
**Diffuse Reflective Models**  
E3Z-D□2 (D□7)



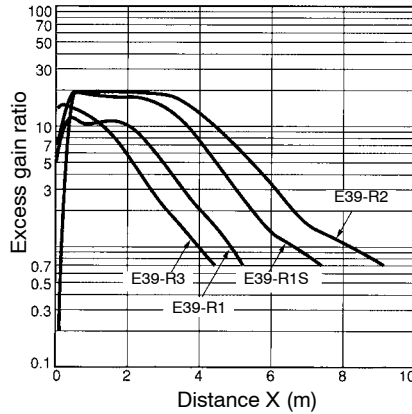


■ Excess Gain Ratio vs. Distance (typical)

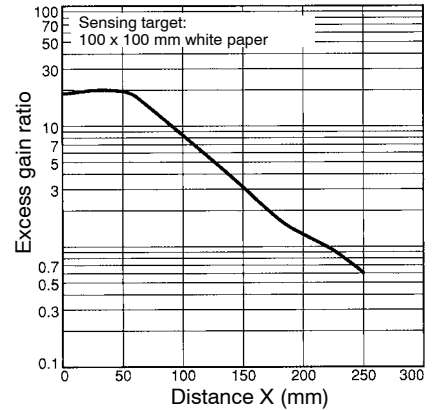
Through-beam Models  
E3Z-T□1 (T□6)



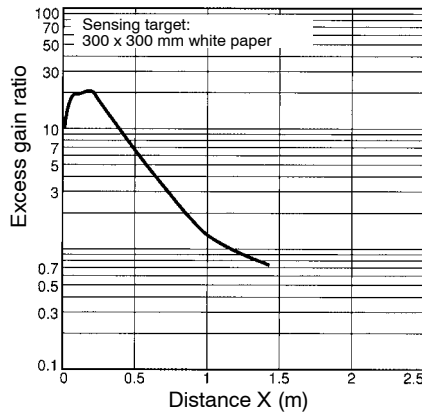
Retroreflective Models  
E3Z-R□1 (R□6) and Reflector



Diffuse Reflective Models  
E3Z-D□1 (D□6)

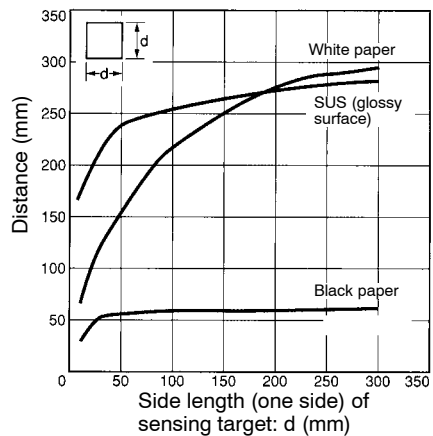


Diffuse Reflective Model  
E3Z-D□2 (D□7)

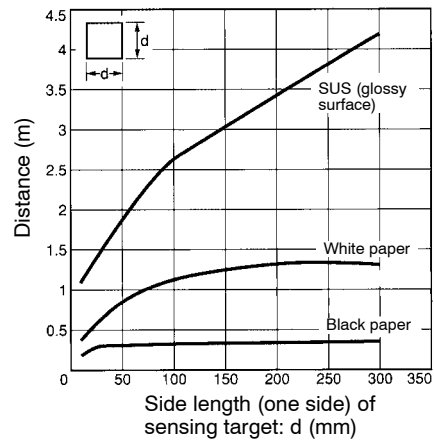


■ Sensing Target Size vs. Sensing Distance (typical)

Diffuse Reflective Models  
E3Z-D□1 (D□6)



Diffuse Reflective Models  
E3Z-D□2 (D□7)

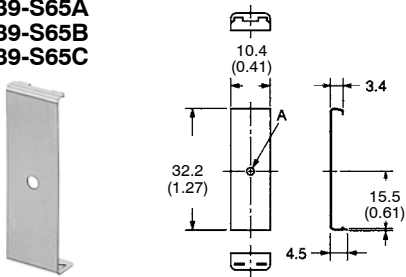




Unit: mm (inch)

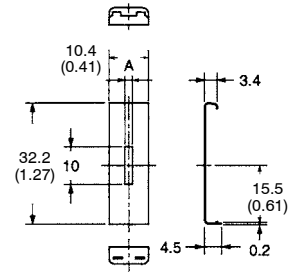
### ■ Slits

**E39-S65A**  
**E39-S65B**  
**E39-S65C**



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

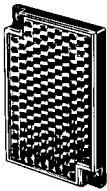
**E39-S65D**  
**E39-S65E**  
**E39-S65F**



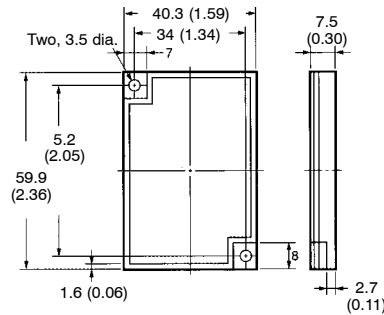
Model	Side A	Material
E39-S65D	0.5	SUS301 stainless steel
E39-S65E	1.0	
E39-S65F	2.0	

### ■ Reflectors

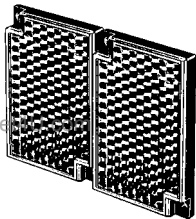
**E39-R1**  
**E39-R1S**



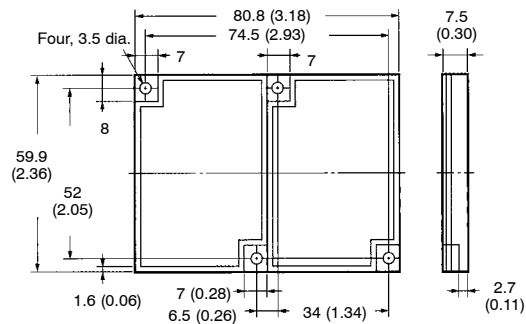
Material  
Surface: Acrylic resin  
Backside: ABS resin



**E39-R2**



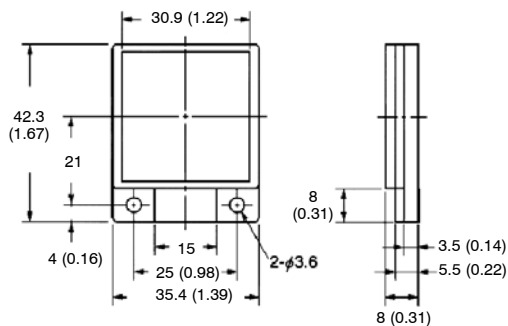
Material  
Surface: Acrylic resin  
Backside: ABS resin



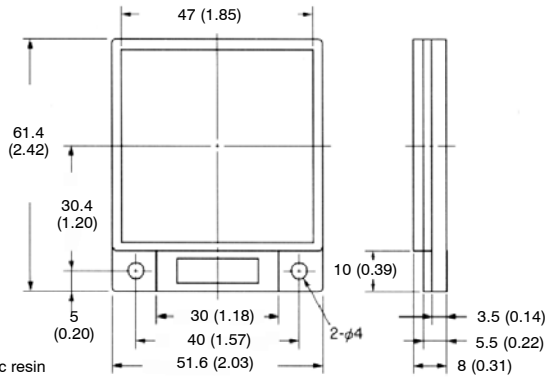
**E39-R9**



Material  
Reflecting surface: Acrylic resin  
Back: ABS resin



**E39-R10**



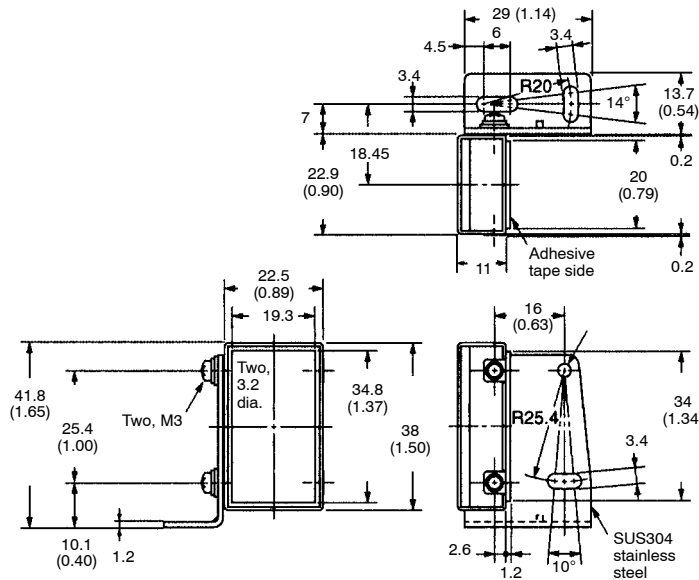
Material  
Reflecting surface: Acrylic resin  
Back: ABS resin

■ **Miniature Reflector**

**E39-R3**



Material  
Surface: Acrylic resin  
Backside: ABS resin



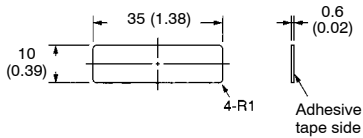
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■ **Tape Reflectors**

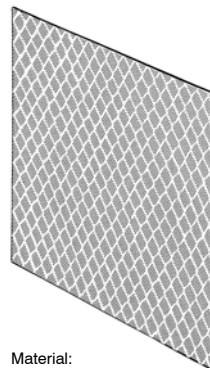
**E39-RS1**



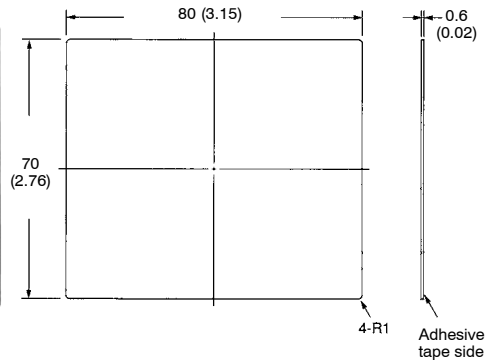
Material:  
Acrylic resin



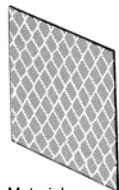
**E39-RS3**



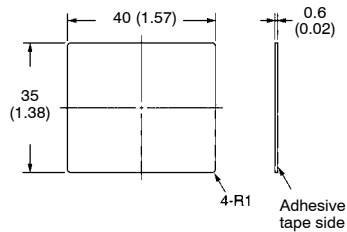
Material:  
Acrylic resin



**E39-RS2**



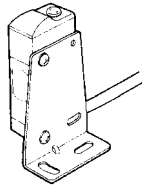
Material:  
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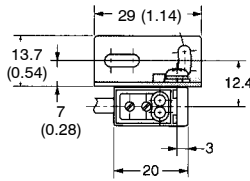
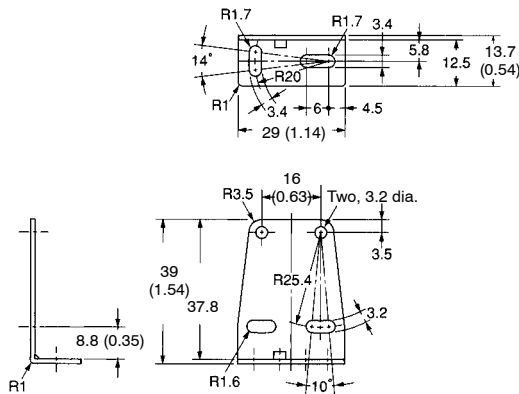
Unit: mm (inch)

■ Mounting Brackets

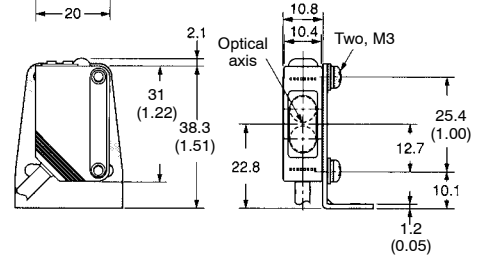
E39-L104



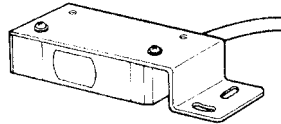
Material:  
SUS304  
stainless steel



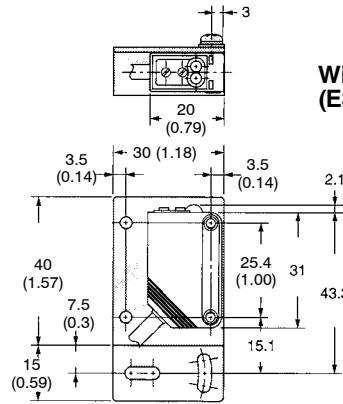
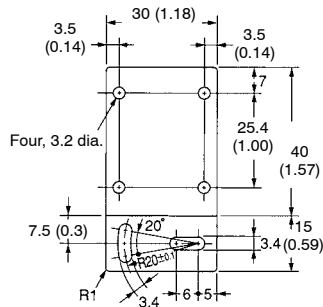
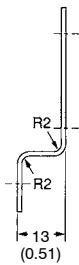
With Mounting Bracket  
(E3Z-D62)



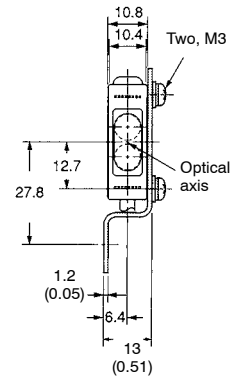
E39-L43



Material:  
SUS304  
stainless steel

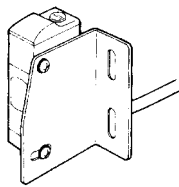


With Mounting Bracket  
(E3Z-D62)

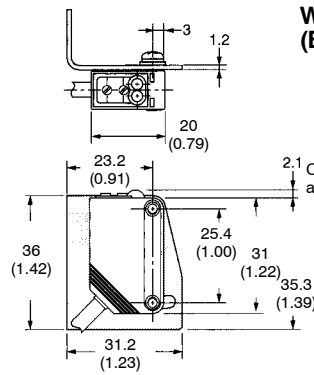
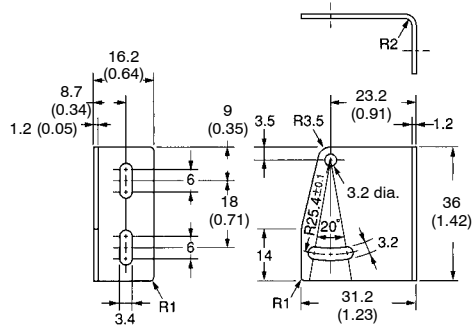


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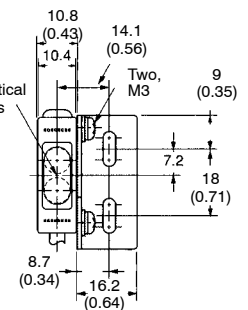
E39-L44



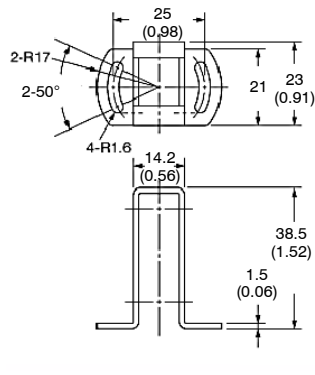
Material:  
SUS304  
stainless steel



With Mounting Bracket  
(E3Z-D62)

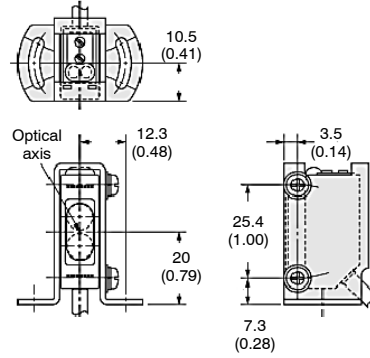


**E39-L144**

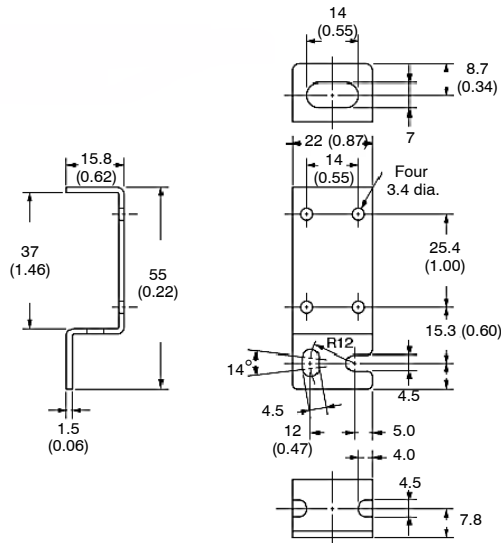


Material:  
SUS304 stainless steel

**With Sensor  
(Example: E3Z-L61)**

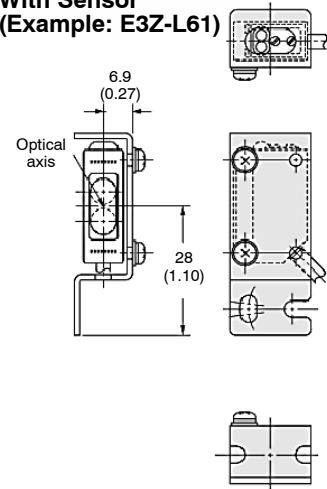


**E39-L142**



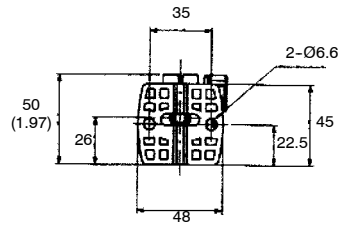
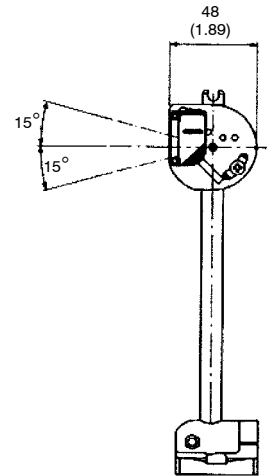
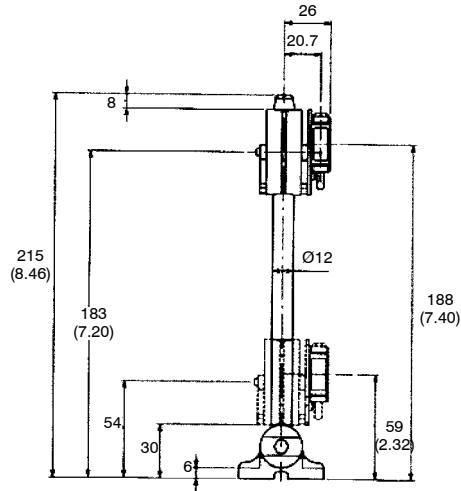
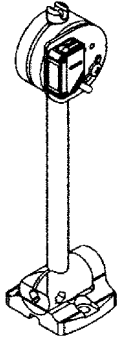
Material:  
SUS304 stainless steel

**With Sensor  
(Example: E3Z-L61)**

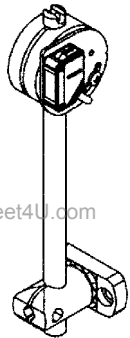


Unit: mm (inch)

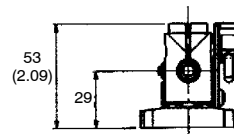
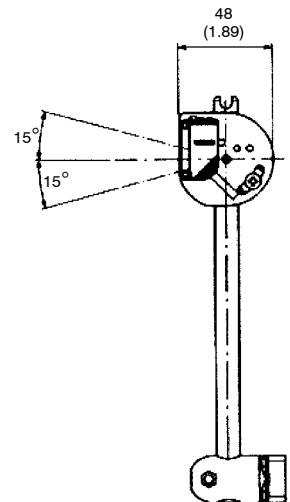
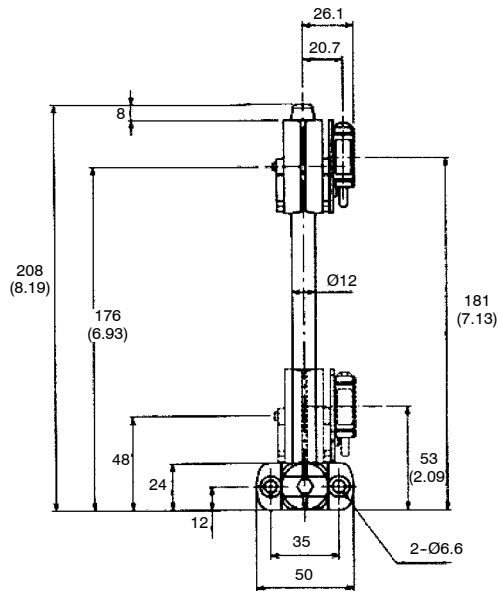
**E39-L93FH**



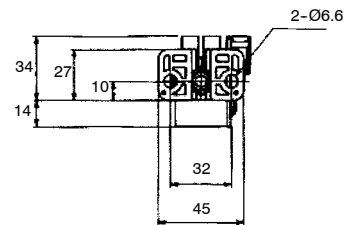
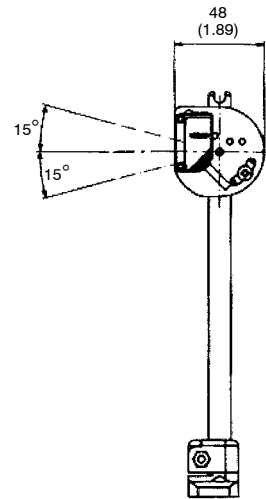
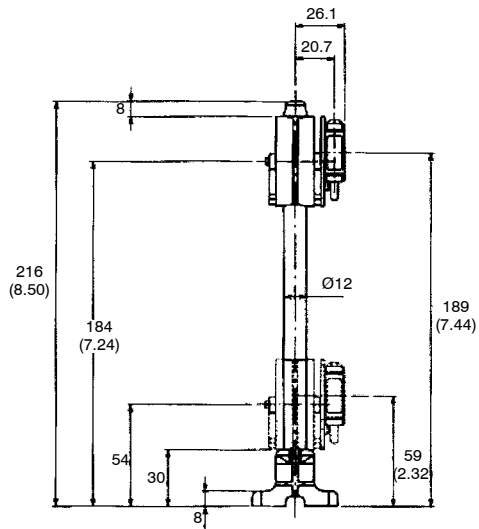
**E39-L93FV**



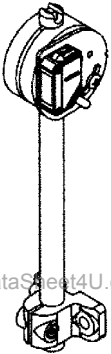
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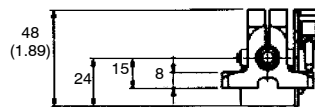
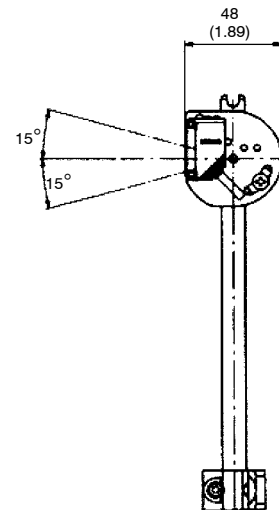
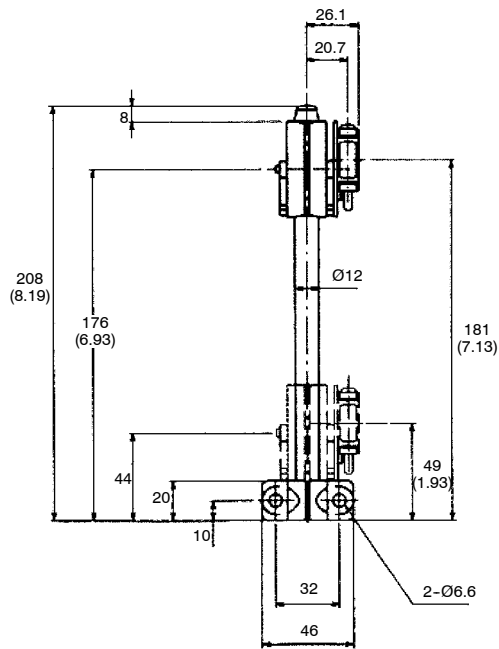
E39-L93H



E39-L93V



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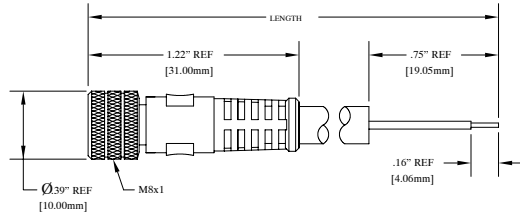
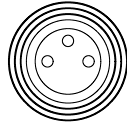




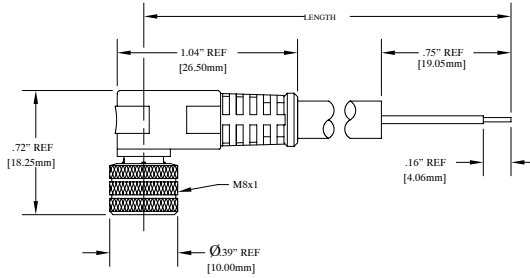
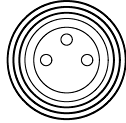


■ M8 Connector Cordsets (3-Pin)

**Straight**  
Y96E-M833SD2  
Y96E-M833SD5

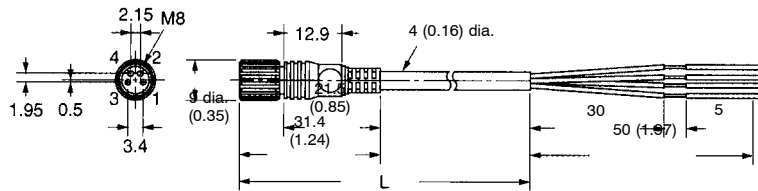


**Right Angle**  
Y96E-M833RD2  
Y96E-M833RD5

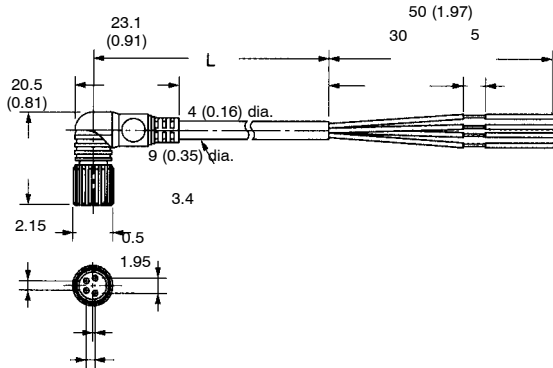


■ M8 Connector Cordsets (4-Pin)

**Straight**  
XS3F-M421-402-A (L=2 m)  
XS3F-M421-405-A (L=5 m)



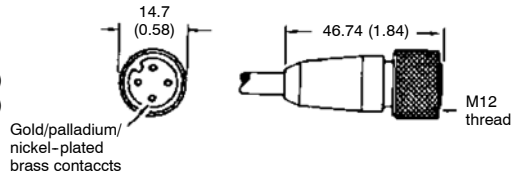
**Right Angle**  
XS3F-M422-402-A (L=2 m)  
XS3F-M422-405-A (L=5 m)



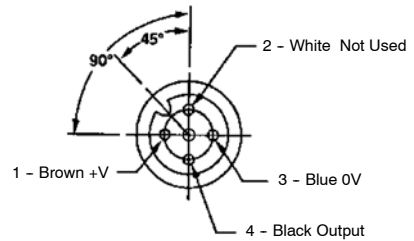
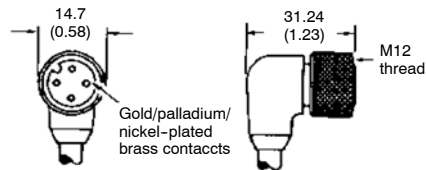
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■ M12 Connector Cordsets (4-Pin)

**Straight**  
Y96E-44SD2 (L=2 m)  
Y96E-44SD5 (L=2 m)



**Right Angle**  
Y96E-44RD2 (L=2 m)  
Y96E-44RD5 (L=2 m)



# Precautions

To ensure safe sensor operation, please follow the following precautions:

## ■ Wiring

### Power Supply Voltage

Make sure that the power supply to the Sensor is within the rated voltage range.

### Load Short-circuiting

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

### Polarity

Correct polarity wiring is required to prevent damage to the sensor.

### Connection Without Load

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

## ■ Operating Environment

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

## ■ Settings

### 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 turning the load ON.

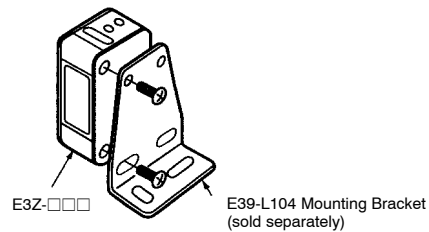
## ■ Connections

### M8 Metal Connector

- Turn off power before disconnecting the sensor.
- Remove the connector cover before connecting or disconnecting the metal connector.
- Secure the connector cover by hand. Do not use any pliers, or 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 in order to maintain the the specified degree of protection and to keep the connector from loosening due to vibration.

## ■ Mounting

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



## ■ Adjustment

### Slits for Through-beam Models (E39-S65A/B/C/D/E/F) Sold Separately

<p>Hook Upper indented mounting portion Protruding portion Lower indented portion Slit Sensor</p>	
<p><b>Mounting Method</b></p> <ol style="list-style-type: none"> <li>1. Hook the upper protruding portion of the Slit to the upper indented mounting portion of the Sensor and adjust the position of the Slit so that the Slit will be in parallel to the lens side of the Sensor.</li> <li>2. Press the lower protruding portion of the Slit onto the indented mounting portion of the Sensor until the Slit snaps in.</li> </ol>	
<p><b>Mounting Condition</b></p>	<p>Side View      Front View</p>
<p><b>Removal Method</b></p> <ol style="list-style-type: none"> <li>1. Press the upper portion of the Slit.</li> <li>2. Disconnect the lower protruding portion of the Slit from the Sensor and remove the Slit.</li> </ol>	

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  - c. All sales and shipments of Goods shall be FOB shipping point (unless otherwise stated in writing by Seller), at which point title to and all risk of loss of the Goods shall pass from Seller to Buyer, provided that Seller shall retain a security interest in the Goods until the full purchase price is paid by Buyer;
  - d. Delivery and shipping dates are estimates only.
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