# E3S-C

CSM\_E3S-C\_DS\_E\_6\_1

### Water- and Oil-resistant Photoelectric Sensor with Metal Housing Used for Longrange Sensing

- Excellent resistance against the water and oil. Easy application in locations with oil mist.
- Long-range sensing up to 30 m with Through-beam models.
- Shock resistance rated at 1,000m/s<sup>2</sup>.
- Product lineup includes metal M12 pre-wired connector models.
- NPN/PNP selector switch output.



Be sure to read *Safety Precautions* on page 6.



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### Ordering Information

#### Sensors (Refer to Dimensions on page 8.)

Sensors (Refer to D	<i>imensions</i> on page 8.)					Red light Infrared light
Sensing method	Appearance	Connection method	Ser	sing di	stance	Model
	Horizontal	Pre-wired				E3S-CT11 2M Emitter E3S-CT11-L 2M Receiver E3S-CT11-D 2M
Through-beam		Pre-wired Connector (M12)			<u> </u>	E3S-CT11-M1J 0.3M Emitter E3S-CT11-L-M1J 0.3M Receiver E3S-CT11-D-M1J 0.3M
(Emitter + Receiver) *	Vertical	Pre-wired				E3S-CT61 2M Emitter E3S-CT61-L 2M Receiver E3S-CT61-D 2M
		Pre-wired Connector (M12)				E3S-CT61-M1J 0.3M Emitter E3S-CT61-L-M1J 0.3M Receiver E3S-CT61-D-M1J 0.3M
	Horizontal	Pre-wired				E3S-CR11 2M
Detus veffeetive		Pre-wired Connector (M12)				E3S-CR11-M1J 0.3M
Retro-reflective	Vertical	Pre-wired		3 n	ח 	E3S-CR61 2M
		Pre-wired Connector (M12)				E3S-CR61-M1J 0.3M
		Pre-wired	700	) mm		E3S-CD11 2M
	Horizontal	rie-wiieu		2 m		E3S-CD12 2M
		Pre-wired Connector (M12)	700	) mm		E3S-CD11-M1J 0.3M
Diffuse-reflective		Fie-wired Confilector (W12)		2 m		E3S-CD12-M1J 0.3M
	M. Park	Pre-wired	700	mm		E3S-CD61 2M
	Vertical	Fie-wileu		2 m		E3S-CD62 2M
		Pre-wired Connector (M12)	700	mm		E3S-CD61-M1J 0.3M
		1 10 William Collination (WI12)		2 m		E3S-CD62-M1J 0.3M

<sup>\*</sup> Through-beam Sensors are normally sold in sets that include both the Emitter and Receiver. Orders for individual Emitters and Receivers are accepted.

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#### Accessories (Order Separately)

Slits (A Slit is not provided with Through-beam Sensors. Order a Slit separately if required.) (Refer to Dimensions on page 10.)

Slit width	Sensing distance	Minimum detect- able object (typical)	Model	Quantity	Remarks
0.5 mm × 11 mm	1.8 m	0.5-mm dia.		1 set each for	
1 mm × 11 mm	3.5 m	1-mm dia.	E39-S61	Emitter and Receiver (8 Slits total)	(Snap-in Long Slit) Can be used with the E3S-CT□1(-M1J) Through-beam Sensor. Refer to page 10.
2 mm × 11 mm	7 m	2-mm dia.			
4 mm × 11 mm	15 m	2.6-mm dia.			

#### Reflectors (Reflector required for Retroreflective Sensors)

A Reflector is provided with the E39-R1 Sensor. For other Sensors, order a reflector separately if required. (Refer to Dimensions on E39-L/F39-L/E39-S/E39-R.)

Name	Sensing distance (typical)	Model	Quantity	Remarks
Reflectors	3 m (rated value)	E39-R1	1	Provided with the E3S-CR□1 (-M1J) Retro-reflective Sensor.
Hellectors	4 m	E39-R2	1	
Small Reflectors	1.5 m	E39-R3	1	
Small Reliectors	750 mm	E39-R4	1	
	700 mm (50 mm)*	E39-RS1	1	
Tape Reflectors	1,100 mm (100 mm)*	E39-RS2	1	Enables MSR function.
	1,400 mm (100 mm)*	E39-RS3	1	

Note: 1. When using any reflector other than the provided one, use a sensing distance of approximately 0.7 times the typical value as a guide. 2. Refer to Reflectors on E39-L/F39-L/E39-S/E39-R for details.

#### **Mounting Brackets**

Some Mounting Brackets are provided with the Sensor. Order other Mounting Brackets separately if required. (Refer to Dimensions on E39-L/F39-L/E39-S/E39-R.)

Appearance	Model	Quantity	Remarks
	E39-L102	1	Provided with Horizontal Models.
	E39-L103	1	Provided with Vertical Models.
	E39-L85	1	Mounting bracket for changing from E3S-
	E39-L86	1	Mounting bracket for changing from E3S-
	E39-L87	1	

Note: 1. When using a Through-beam Sensor, order one Connector for the Receiver and one for the Emitter.

#### **Sensor I/O Connectors**

(Models with Pre-wired Connectors: A Connector is not provided with the Sensor. Be sure to order a Connector separately.) (Refer to Dimensions on XS2.)

Cable	Appearance	Cable	type	Model
	Straight	2 m	3-wire	XS2F-D421-DC0-A
Ctandard		5 m		XS2F-D421-GC0-A
Standard	L-shape	2 m		XS2F-D422-DC0-A
		5 m		XS2F-D422-GC0-A

Note: 1. When using a Through-beam Sensor, order one Connector for the Receiver and one for the Emitter.

<sup>\*</sup> Values in parentheses indicate the minimum distance required between the Sensor and Reflector.

<sup>2.</sup> Refer to Mounting Brackets on E39-L/F39-L/E39-S/E39-R for details.

<sup>2.</sup> For details on Sensor I/O Connectors and cables such as vibration-proof robot cables, refer to Introduction to Sensor I/O Connectors.

## **Ratings and Specifications**

	Sensing method	Through-beam	Retro-reflective (with M.S.R. function) *1	Diffuse reflective			
	Model	Horizontal E3S-CT11(-M1J)	Horizontal E3S-CR11(-M1J)	Horizontal E3S-CD11(-M1J)	Horizontal E3S-CD12(-M1J)		
Item	Woder	Vertical E3S-CT61(-M1J)	Vertical E3S-CR61(-M1J)	Vertical E3S-CD61(-M1J)	Vertical E3S-CD62(-M1J)		
Sensing o	listance	30 m	3 m (when using E39-R1)	700 mm (300 × 300 mm white paper)	2 m (300 × 300 mm white paper)		
Standard object	sensing	Opaque, 15-mm dia. min.	Opaque, 75-mm dia. min.				
Differenti	al travel	-	-	20% max. of sensing dista	ince		
Direction	al angle	Emitter and Receiver: 3° to15°	3° to 10°				
Light sou (wavelenç		Infrared LED (880 nm)	Red LED (700 nm)	Infrared LED (880 nm)			
Power su	pply voltage	10 to 30 VDC including 10% (	p.p) ripple				
Current c	onsumption	50 mA max. (Emitter 25 mA max. Receiver 25 mA max.)	40 mA max.				
Control o	utput	Load power supply voltage: 3 Load current: 100 mA max. (F Open controller output (NPN/I Light-ON/Dark-ON selectable	Residual voltage: NPN output:	1.2 V max., PNP output: 2.0	V max.)		
Protection	Power supply reverse polarity circuit protection, Output short-circuit protection, Mutual interference prevention  Power supply reverse polarity protection, Output short-circuit protection, Mutual interference prevention				rcuit protection,		
Response	Desponse time Operate or reset: 1 ms max.				Operate or reset 2 ms max		
Sensitivit adjustme		One-turn adjuster		Two-turn endless adjuster	with an indicator		
Ambient i (Receiver	llumination side)	Incandescent lamp: 5,000 lx max. Sunlight: 10,000 lx max.					
Ambient t	emperature	Operating: -25°C to 55°C, Sto	orage: -40°C to 70°C (with no i	icing or condensation)			
Ambient l range	numidity	Operating: 35% to 85%, Stora	ge: 35% to 95% (with no cond	lensation)			
Insulation	resistance	20 MΩ min. (at 500 VDC)					
Dielectric	strength	1,000 VAC, 50/60 Hz for 1 mi	n				
Vibration	resistance	Destruction: 10 to 2,000 Hz, 1	.5-mm double amplitude or 30	0 m/s <sup>2</sup> for 0.5 hours each in	X, Y, and Z directions		
Shock res	sistance	Destruction: 1,000 m/s <sup>2</sup> 3 time	es each in X, Y, and Z direction	ns			
Degree of	protection	IEC 60529: IP67 (in-house sta	andards: oil-resistant), NEMA:	6P (indoors only) *2			
Connection	on method	Pre-wired (standard cable len	gth: 2 m) or Pre-wired M12 Co	nnector (standard cable len	gth: 0.3 m)		
Weight (packed state) (Pre-wired cable) Approx. 230 g (Pre-wired cable)		Approx. 160 g (Pre-wired cable) Approx. 130 g (Pre-wired Connector (M12))	Approx. 150 g (Pre-wired cable) Approx. 110 g M12)) (Pre-wired Connector (M12))				
Case Zinc die-cast  Operation panel cover PES (polyether sulfone)		Zinc die-cast					
Material	terial Lens Methacrylic resin						
	Mounting Bracket	Stainless steel (SUS304)					
Accessor	ies	Mounting Bracket (with screw Sensors)	s), Adjustment screwdriver, Ins	struction manual, and Reflec	ctor (only for Retro-reflective		

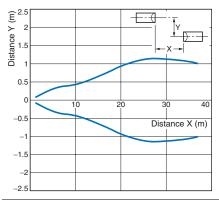
<sup>\*1.</sup> Refer to MSR function of Technical Guide (Technical version).
\*2. NEMA: National Electrical Manufactures Association

### **Engineering Data (Typical)**

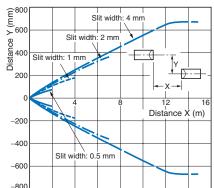
#### **Parallel Operating Range**

Through-beam

E3S-CT□ (-M1J)

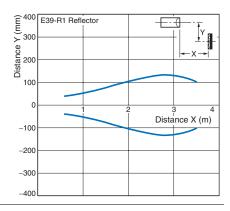


Through-beam E3S-CT□ (-M1J) + E39-S61 Slit (Order Separately)



Retro-reflective

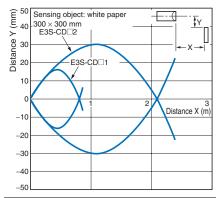
E3S-CR□1 (-M1J) + E39-R1 Reflector (Provided)



#### **Operating Range**

Diffuse-reflective

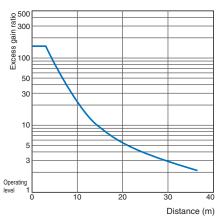
E3S-CD (-M1J)



#### **Excess Gain vs. Set Distance**

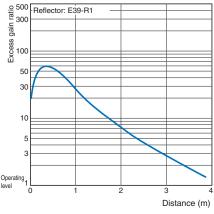
Through-beam

E3S-CT 1 (-M1J)



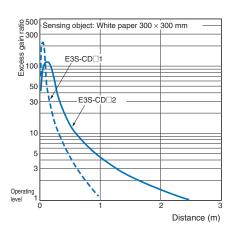
Retro-reflective

E3S-CR□1 (-M1J) + E39-R1 Reflector (Provided)



Diffuse-reflective

E3S-CD (-M1J)

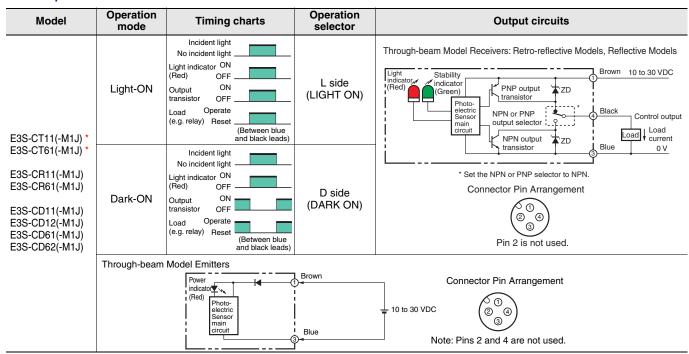


### I/O Circuit Diagrams

#### **NPN Output**

Model	Operation mode	Timing charts	Operation selector	Output circuits
E3S-CT11(-M1J) *	Light-ON	Incident light No incident light Light indicator ON (Red) OFF Output ON transistor OFF Load Operate (e.g. relay) Reset (Between brown and black leads)	L side (LIGHT ON)	Through-beam Model Receivers: Retro-reflective Models, Reflective Models    Control output   Control output
E3S-CT61(-M1J) * E3S-CR11(-M1J) E3S-CR61(-M1J) E3S-CD11(-M1J) E3S-CD12(-M1J) E3S-CD61(-M1J) E3S-CD62(-M1J)	Dark-ON	Incident light No incident light Light indicator ON (Red) OFF Output ON transistor OFF Load Operate (e.g. relay) Reset (Between brown and black leads)	D side (DARK ON)	* Set the NPN or PNP selector to NPN.  Connector Pin Arrangement  (a) (b) (c) (d) (d) (d) (d) (e) (e) (e) (f) (f) (f) (f) (f) (g) (g) (g) (g) (g) (g) (g) (g) (g) (g
	Through-beam	Model Emitters  Power indicator hoto-electric Sensor main circuit	Brown	Connector Pin Arrangement  10 to 30 VDC  One of the property o

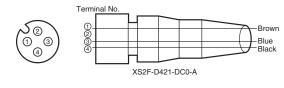
#### **PNP Output**



<sup>\*</sup> Models numbers for Through-beam Sensors (E3S-CT□1(-M1J)) 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: E3S-CT11-L 2M), the model number of the Receiver, by adding "-D" (example: E3S-CT11-D 2M.) Refer to Ordering Information to confirm model numbers for Emitter and Receivers.

#### Plug (Sensor I/O Connector)



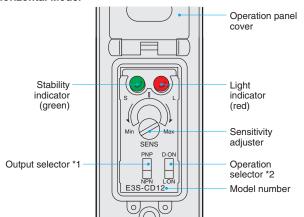
Conductor	Connector pin No.	Application
Brown	1	Power supply (+V)
	2	
Blue	3	Power supply (0 V)
Black	4	Output
	Brown  Blue	Brown   1   2   Blue   3

Note: Pin 2 is not used.

Refer to Introduction to Sensor I/O connectors for details.

#### Nomenclature

#### **Horizontal Model**



### **Vertical Model** Operation panel Light indicator Stability indicator (red) (green) Output selector \*1 Sensitivity adjuster Operation selector \*2

Note: The sensitivity adjuster on Through-beam and Retro-reflective Models is

\*1. Use the output selector to select the type of output transistor, NPN or PNP. \*2. Use the operation selector to select the operation mode.

### **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.

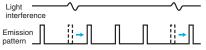
#### Designing

#### **Fuzzy Mutual Interference Prevention Function**

If Reflective Sensors are installed side by side, each Sensor may be influenced by the light emitted from the other Sensors. The fuzzy mutual interference prevention function of the E3S-C enables the E3S-C to monitor any light interference for a certain period before the E3S-C starts emitting light so that the E3S-C can retrieve the intensity and frequency of the light interference as data. Using this data, the E3S-C estimates with fuzzy inference the risk of the malfunctioning of the E3S-C and controls the timing of the E3S-C's light emission.

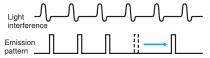
#### When the risk is low:

The E3S-C waits until there is no light interference and emits light.



#### When the risk is high:

The E3S-C emits light between each period of light interference.



#### Wiring

#### Cable

- The E3S-C uses an oil-resistive cable to ensure oil resistivity.
- Do not allow the cable to be bent to a radius of less than 25 mm.

#### Mounting

#### Mounting

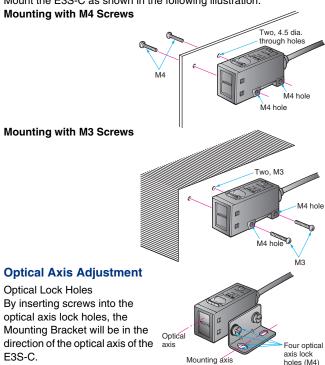
- When mounting the E3S-C, do not hit the E3S-C with a hammer, or the E3S-C will loose watertightness.
- Use M4 screws to mount the E3S-C. The tightening torque of each screw must be 1.18 N·m maximum.

#### **Mounting Bracket**

- When mounting the E3S-C with the mounting bracket so that sensing objects will be in the direction of the mechanical axis, use the optical axis lock holes.
- If it is not possible to mount the E3S-C so that the sensing objects will be in the direction the mechanical axis, move the E3S-C upwards, downwards, to the left, or to the right and secure the E3S-C in the center of the range where the light indicator will be lit, at which time make sure that the stability indicator is lit.

#### **Direct Mounting**

Mount the E3S-C as shown in the following illustration.



Mounting axis

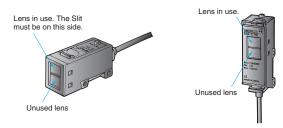
#### Adjusting

#### **Optical Axis of Through-beam Sensor**

The E3S-C Through-beam Models incorporates two lenses, one of which will be used as shown in the following illustration. When using a Slit, the Slit must be on the side where the lens to be used is located.

#### **Horizontal Model**





#### **Water Resistance**

To ensure the water resistance of the E3S-C, tighten the screws of the operation panel cover to a torque of 0.34 N·m to 0.54 N·m.

#### Others

#### Oil and Chemical Resistance

- Although the E3S-C is oil-resistance, refer to the following table before using the E3S-C in places where oil may be sprayed on the E3S-C.
- Tests were carried out with the following oils and it was certified that the E3S-C resists these oils.

Oil	Product name	Kinematic viscosity (mm²/s (cst)) at 40°C	PH
Lubricating oil	Velocite No.3	2.02	
Water insoluble machining oil	Yushiron Oil No. 2 ac	Less than 10	
	Yushiroken EC50T-3		7 to 9.5
Water soluble	Yushiron Lubic HWC68		7 to 9.9
machining oil	Griton 1700D		7 to 9.2
	Yushiroken S50N		7 to 9.8

- Note: 1. The E3S-C maintained a minimum insulation resistance of 100 M $\Omega$  after the E3S-C was dipped in all the above oils at a temperature of 50°C for 240 hours.
  - 2. When using the E3S-C in a place where an oil other than the ones listed above is sprayed on the E3S-C, refer to the above kinematic viscosity and ph values. The location may be suitable for the E3S-C if the kinematic viscosity and pH values of the oil are close to the above kinematic viscosity and pH values, but make sure that the oil does not contain any additive that may have a negative influence on the E3S-C.

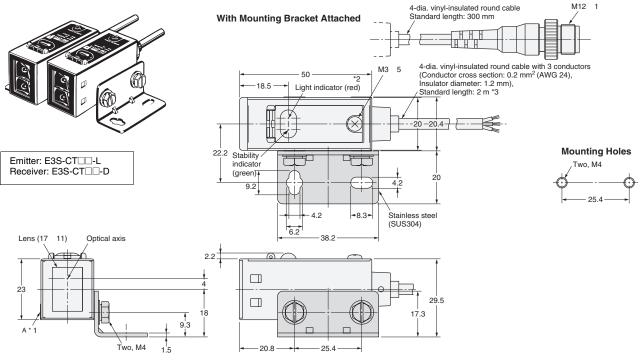
#### **Dimensions**

#### **Sensors**

#### **Through-beam (Horizontal)**

#### E3S-CT11(-M1J)

#### Pre-wired Connector (-M1J)



- \*1. The Mounting Bracket can be attached to side A.

  \*2. The Emitters for Through-beam Sensors only have the power indicator (red),

  \*3. The Emitter cable is 4-dia.vinyl-insulated round cable with 2 conductors (conductor cross section: 0.3 mm², insulator diameter: 1.3 mm) and a standard length of 2 m.

Note: Models numbers for Through-beam Sensors (E3S-CT11(-M1J)) are for sets that include both the Emitter and Receiver.

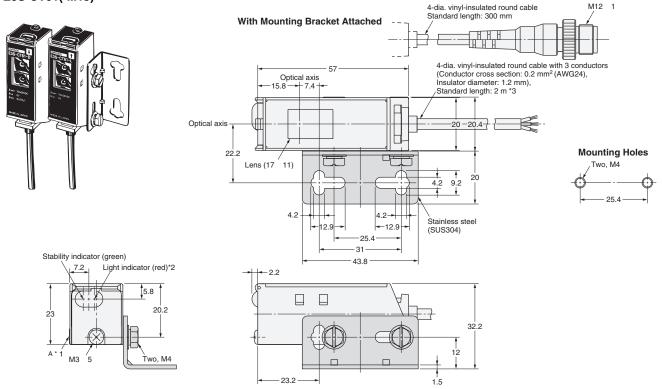
The model number of the Emitter is expressed by adding "-L" to the set model number (example: E3S-CT11-L 2M), the model number of the Receiver, by adding "-D" (example: E3S-CT11-D 2M.) Refer to Ordering Information to confirm model numbers for Emitter and Receivers.

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#### Through-beam (Vertical)

#### E3S-CT61(-M1J)

### Pre-wired Connector (-M1J)

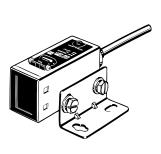


- \*1. The Mounting Bracket can be attached to side A.
  \*2. The Emitters for Through-beam Sensors only have the power indicator (red).
- \*3. The Emitter cable is 4-dia.vinyl-insulated round cable with 2 conductors (conductor cross section: 0.3 mm², insulator diameter: 1.3 mm) and a standard length of 2 m.

#### Retro-/Diffuse-reflective (Horizontal)

E3S-CR11(-M1J) E3S-CD11(-M1J)

E3S-CD12(-M1J)



Lens (17 11)

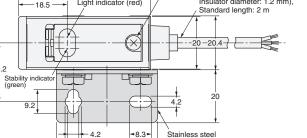
Optical axis

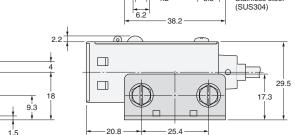
With Mounting Bracket Attached

M12 1 4-dia. vinyl-insulated round cable Standard length: 300 mm 4-dia. vinyl-insulated round cable with 3 conductors (Conductor cross section: 0.2 mm² (AWG24), Insulator diameter: 1.2 mm), Standard length: 2 m МЗ Light indicator (red)

Pre-wired Connector (-M1J)

**Mounting Holes** 





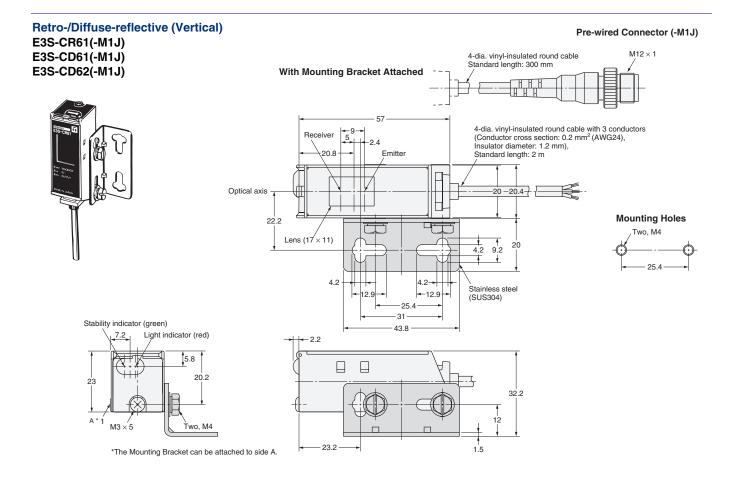
\*The Mounting Bracket can be attached to side A.

Two, M4

Receive

Note: Models numbers for Through-beam Sensors (E3S-CT61(-M1J)) 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: E3S-CT61-L 2M), the model number of the Receiver, by adding "-D" (example: E3S-CT61-D 2M.) Refer to Ordering Information to confirm model numbers for Emitter and Receivers.

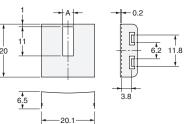


#### **Accessories (Order Separately)**

### Snap-in Long Slit (For Through-beam Models)

E39-S61





Dimension A (mm)	Material	Quantity	
0.5			
1	Stainless	1 set each for Emitter/Receiver	
2	steel	(8 Slits total)	
4		(======================================	

#### **Reflectors**

Refer to E39-L/F39-L/E39-S/E39-R for details.

#### **Mounting Brackets**

Refer to E39-L/F39-L/E39-S/E39-R for details.

#### Read and Understand This Catalog

Please read and understand this catalog before purchasing the products. Please consult your OMRON representative if you have any questions or comments.

#### Warranty and Limitations of Liability

#### WARRANTY

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, REGARDING NON-INFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. OMRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

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OMRON SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY

In no event shall the responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.

IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR, OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED, AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE, OR INAPPROPRIATE MODIFICATION OR REPAIR.

#### **Application Considerations**

#### **SUITABILITY FOR USE**

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the products.

At the customer's request, OMRON will provide applicable third party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use.

The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

- Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this catalog.
- Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
- Systems, machines, and equipment that could present a risk to life or property.

Please know and observe all prohibitions of use applicable to the products.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCTS ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

#### PROGRAMMABLE PRODUCTS

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