ATA BOOK hotomicrosensors

OMRON

Photomicrosensor Data Book



- Photomicrosensor with Cable (Non-modulated)
- Slot-type Photomicrosensor (Non-modulated)
- Slot-type Photomicrosensor with Connector (Modulated)
- Slot-type Photomicrosensor with Cable
- Broad Slot-type Photomicrosensor
- Long-distance Through-beam Photomicrosensor
- Photomicrosensor with Amplifier and Cable
- Slot-type Reflective Photomicrosensor
- Light Convergent Reflective Photomicrosensor
- Reflective Photomicrosensor with Sensitivity Adjuster (Non-modulated)
- Retroreflective Photomicrosensor with Lens
- Pipe-mounting Liquid Level Photomicrosensor with Built-in Amplifier
- Wafer-carrier Mounting Photomicrosensors

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	light	Miniature, slim models	EE-SX77/87	49
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Reflective (with groove)	Modulated light	Models with connectors	EE-SPX301/401/ EE-SPY30/40	87
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Sensing Guide

ough-beam Type (w	 ensing	Optical		Output	Indi-	Ma	Infrar	-
Appearance	stance	modulation	Features	configuration	cator*	NPN output	PNP output	Pa
22.0 NEW 26.0 7.0						EE-SX970-C1	EE-SX970P- C1	
15.5 NEW 14.7			window			EE-SX971-C1	EE-SX971P- C1	
22.0 NEW 23.0 26.0	Built-in			EE-SX972-C1	EE-SX972P- C1			
15.5 NEW 12.8 21.7	mm ot width)	Non- modulated light		Dark-ON/ Light-ON (2 outputs)		EE-SX974-C1	EE-SX974P- C1	3
22.0 NEW 26.0 26.0						EE-SX975-C1	EE-SX975P- C1	
13.4 NEW 22.0 13.2						EE-SX976-C1	EE-SX976P- C1	
13.4 <u>NEW</u> 22.0						EE-SX977-C1	EE-SX977P- C1	

A = = = = = = = = = = = = = = = = = = =		Sensing	Optical	Fastures	Output	Indi-	Мо	del	Dama
Appearance		distance	modulation	Features	configuration	cator*	NPN output	PNP output	Page
							EE-SX910-R	EE-SX910P-R	
12 12 12				Ultracompact pre-wired models	Light-ON Dark-ON (2 outputs)		EE-SX911-R	EE-SX911P-R	
				Emitter/receiver window			EE-SX912-R	EE-SX912P-R	41
13.4				1.2 mm			EE-SX913-R	EE-SX913P-R	
		5 mm (slot width)					EE-SX914-R	EE-SX914P-R	
18					Dark-ON		EE-SX770	EE-SX770P	
31.1					Dark ON	0	EE-SX770A	EE-SX770R	
				Miniature, slim, pre-wired	Light-ON		EE-SX870	EE-SX870P	
4.6				models		0	EE-SX870A	EE-SX870R	
18				Emitter/receiver	Dark-ON		EE-SX771	EE-SX771P	
21				Emitter/receiver window		0	EE-SX771A	EE-SX771R	49
					Light-ON		EE-SX871	EE-SX871P	
				1.45 mm	J • -	0	EE-SX871A	EE-SX871R	-
-12				1	Dark-ON		EE-SX772	EE-SX772P	-
31.1	31.1	-+ += 0.7 mm			0	EE-SX772A	EE-SX772R	-	
			Light-ON		EE-SX872	EE-SX872P	-		
1					, , , , , , , , , , , , , , , , , , ,	0	EE-SX872A	EE-SX872R	

A		Sensing	Optical	Fastures	Output	Indi-	Мо	del	Dama		
Appearance		distance	modulation	Features	configuration	cator*	NPN output	PNP output	Page		
					Dark-ON		EE-SX670	EE-SX670P			
6.95					Light-ON (selectable)	0	EE-SX670A	EE-SX670R			
-25.4 -			Dark-ON	Light-ON					EE-SX470	EE-SX470P	
							EE-SX671	EE-SX671P			
					Light-ON (selectable)	0	EE-SX671A	EE-SX671R			
26.2					Light-ON		EE-SX471	EE-SX471P			
					Dark-ON		EE-SX672	EE-SX672P			
					Light-ON (selectable)	0	EE-SX672A	EE-SX672R	-		
13.4 26			Non- modulated light		Light-ON		EE-SX472	EE-SX472P			
				General- purpose models	Dark-ON Light-ON		EE-SX673	EE-SX673P			
22.2				with connectors	(selectable)	0	EE-SX673A	EE-SX673R			
13.4				Emitter/receiver window	Light-ON		EE-SX473	EE-SX473P			
		5 mm (slot width)			Dark-ON Light-ON		EE-SX674	EE-SX674P	55		
15.5					(selectable)	0	EE-SX674A	EE-SX674R			
21.5				2 mm	Light-ON		EE-SX474	EE-SX474P			
22.2 0415-26 16.7				-+ - 0.8 mm			EE-SX675	EE-SX675P			
13.4 22.2 13.2					Dark-ON Light-ON (selectable)		EE-SX676	EE-SX676P			
13.4							EE-SX677	EE-SX677P			

Appearance		Sensing	Optical	Features	Output	Indi-		odel	Page
Appearance		distance	modulation	reatures	configuration	cator*	NPN output	PNP output	Page
26.2							EE-SX670 -WR	EE-SX670P -WR	
18.7							EE-SX671 -WR	EE-SX671P -WR	
26.2							EE-SX672 -WR	EE-SX672P -WR	-
26.2		5 mm	Non-	General-purpose pre-wired models Emitter/receiver	Dark-ON		EE-SX673 -WR	EE-SX673P -WR	
25.7		(slot width)	modulated light	ulated window	Light-ON (selectable)		EE-SX674 -WR	EE-SX674P -WR	55
13.4							EE-SX675 -WR	EE-SX675P -WR	
13.2 26.2								EE-SX676 -WR	EE-SX676P -WR
26.2							EE-SX677 -WR	EE-SX677P -WR	-
21.2	•				Dark-ON		EE-SPX740		
7.4				Models with connectors	Light-ON		EE-SPX840		
		3.6 mm		Emitter/receiver	Dark-ON		EE-SPX742		
21.2		(slot width)		window	Light-ON		EE-SPX842		
			Modulated	1 mm -+ - 0.5 mm	Dark-ON		EE-SPX743		GE
7			idth)		Light-ON		EE-SPX843		65
21,2				connectors Emitter/receiver	Dark-ON		EE-SPX741		-
27.2		5 mm (slot width)		Light-ON		EE-SPX841			

	with Slot)	Outient							
Appearance	Sensing distance	Optical modulation	Features	Output configuration	Model	Pag			
24			Models with connectors Emitter/receiver window	Dark-ON	EE-SPX301	87			
			1 mm → → 0.5 mm	Light-ON	EE-SPX401	07			
21.2				Dark-ON	EE-SPX302-W2A				
	3.6 mm	Pre-wired models Emitter/receiver windo		Light-ON	EE-SPX402-W2A				
21.2	(slot width)		Pre-wired models Emitter/receiver window	Dark-ON	EE-SPX304-W2A				
77			+⊟+ 0.5 mm ulated	Light-ON	EE-SPX404-W2A				
1.2				Dark-ON	EE-SPX306-W2A	71			
25				Light-ON	EE-SPX406-W2A				
27.2	5 mm					Pre-wired models Emitter/receiver window	Dark-ON	EE-SPX305-W2A	
	(slot width)		2 mm 1 mm 0.8 mm	Light-ON	EE-SPX405-W2A				
26	13 mm		2.2	Dark-ON	EE-SPX303N				
7.4	(slot width)		0.5	Light-ON	EE-SPX403N	/5			

Through-beam Type		₽ <u>∎</u> ₿			Infra	red light
Appearance	Sensing distance	Optical modulation	Features	Output configuration	Model	Page
25.4			 Compact size Bright, easy-to-see, 	Dark-ON	EE-SPW311 (set including emitter and receiver)	- 79
		Modulated light	light (ON-state) indicator	Light-ON	EE-SPW411 (set including emitter and receiver)	_ /5
			Compact, slim profile	Dark-ON	EE-SPW321 EE-SPW321-A	83
))_J 300 mm		Excellent space efficiency	Light-ON	EE-SPW421 EE-SPW421-A	03

Appearance		Sensing listance	Sensing method	Optical modulation	Features	Output configuration	Model	Page
						Dark-ON	EE-SPY301	
			Diffuse-		Resistant to external light	Light-ON	EE-SPY401	
20	5	5 mm	reflective		interference Nodulated	Dark-ON	EE-SPY302	
				Modulated		Light-ON	EE-SPY402	
Horizontal model	model ⁸		light		Dark-ON	EE-SPY311		
8			Conver- gent reflec- tive		Resistant to background interference	Light-ON	EE-SPY411	93
Vertical 22.8 model	2 to	o 5 mm				Dark-ON	EE-SPY312	
8						Light-ON	EE-SPY412	
Horizontal model			Dittuso-	Non- modulated	Equipped with sensitivity	Dark-ON Light-ON	EE-SY671	97
Vertical model	1 tc	o 5 mm ref	reflective	light	adjuster	(selectable)	EE-SY672	97

Retroreflective Type

Sensing distance	Optical modulation	Features

Appearance	Sensing distance	Optical modulation	Features	Output configuration	Model	Page
7.4		Modulated light	Modulated light	Dark-ON	EE-SPZ301-A	103
	200 mm			Light-ON	EE-SPZ401-A	

Infrared light

Liquid Level Photomicrosensors Classified According to Product Model

Classified According to Product Model										
Appearance	Outer diameter of mounting pipe	Optical modulation	Features	Output configuration	Model	Page				
EE-SPX613	6 to 13 mm dia., thickness: 1 mm Transparent pipe	Modulated light	 Easy mounting Equipped with sensitivity selector 	Dark-ON/ Light-ON (selectable)	EE-SPX613	107				

Photomicrosensors to Detect Wafer-carrier Mounting Classified According to Product Model

Appearance	Sensing distance	Sensing method	Features	Output configuration	Model	Page
EE-SPY801/802	0 to 3 mm (wafer carrier)	Reflective (modulated light)	Wafer-carrier mounting detection	Turns ON when wafer carrier is present	EE-SPY80□	111

Pushbutton Type

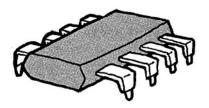
Appearance	Sensing method	Features	Output	Мо	del	Page	
Appearance	Sensing method	reatures	configuration	NPN output	PNP output	rage	
EE-SA701/801	Pushbutton	Long service life (5 million operations) with combination of	ON with no load	EE-SA801A EE-SA801A-R	EE-SA801R EE-SA801R-R	115	
		mechanical and optical sensors	OFF with no load	EE-SA701-R	EE-SA701P-R	ſ	

Application Examples

More Applications Than Ever with High-Accuracy, Low-Cost Sensing

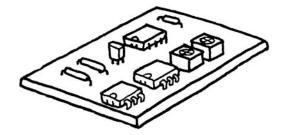
1. Semiconductor Equipment

Accurate position detection in ever phase of semiconductor production like die and wire bonding.



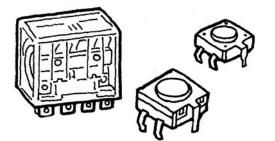
2. Component Mounting

Ultimate efficiency and positioning accuracy in chip mounting, including component edge detection and X-Y table limit detection.



3. Component-Assembly Robots

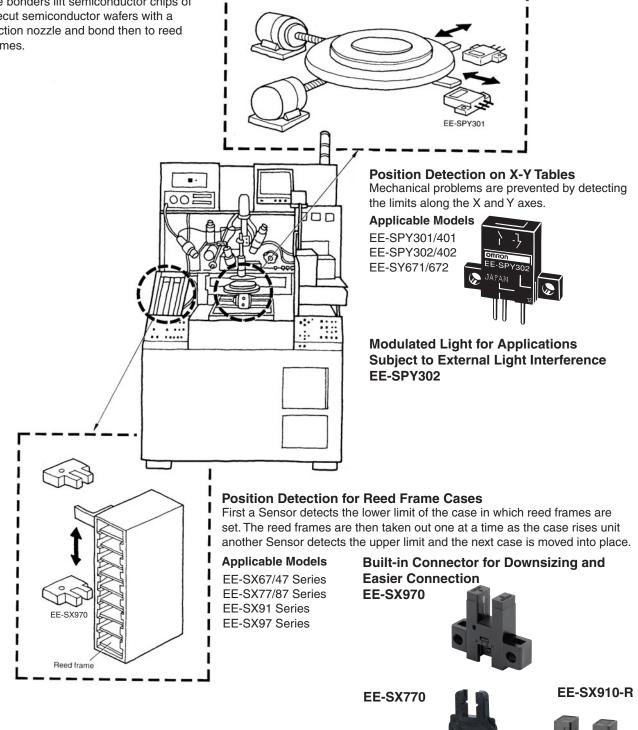
Optimum performance for cam positioner timing detection and upper/lower limit detection in assembly work, where vertical positioning is ultimately important.



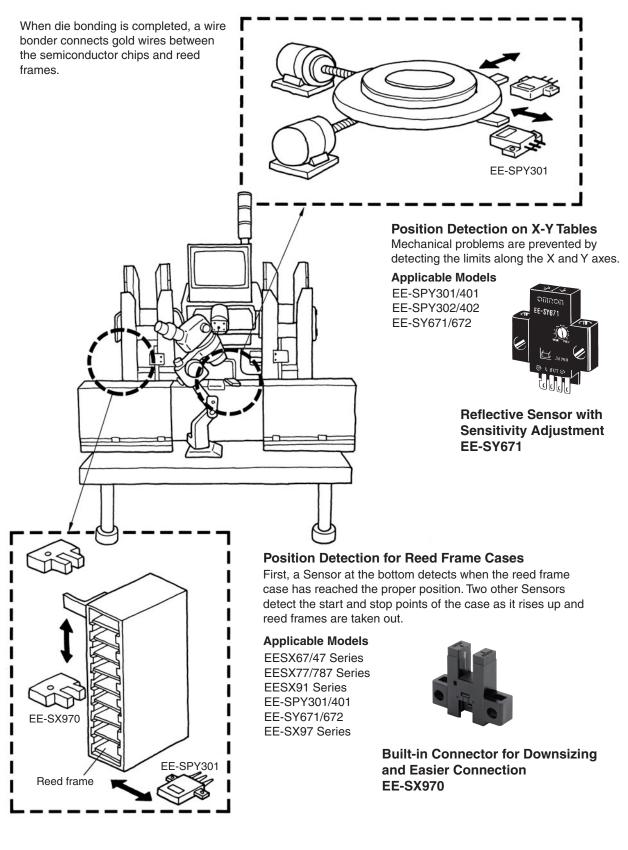
1. Semiconductor Equipment

1-1. Die Bonders

Die bonders lift semiconductor chips of precut semiconductor wafers with a suction nozzle and bond then to reed frames.

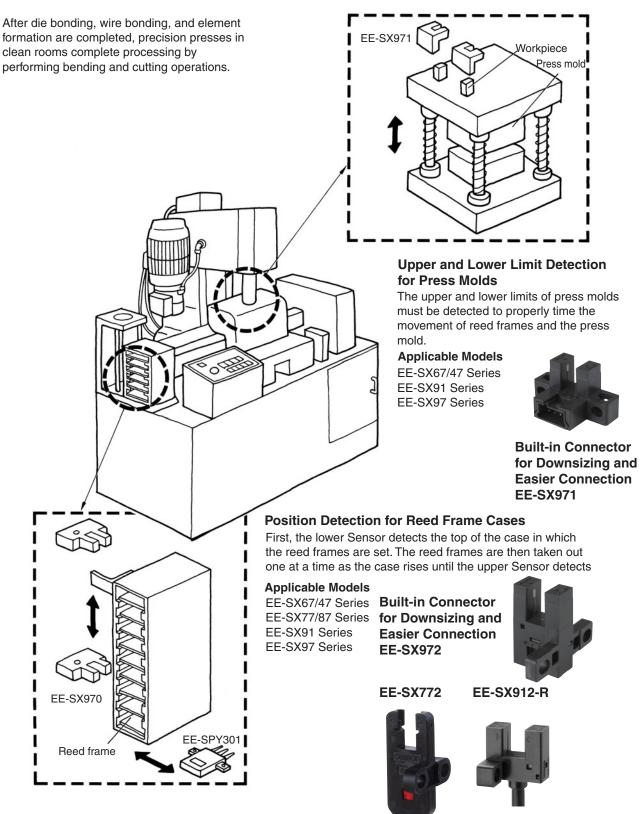


1-2. Wire Bonders

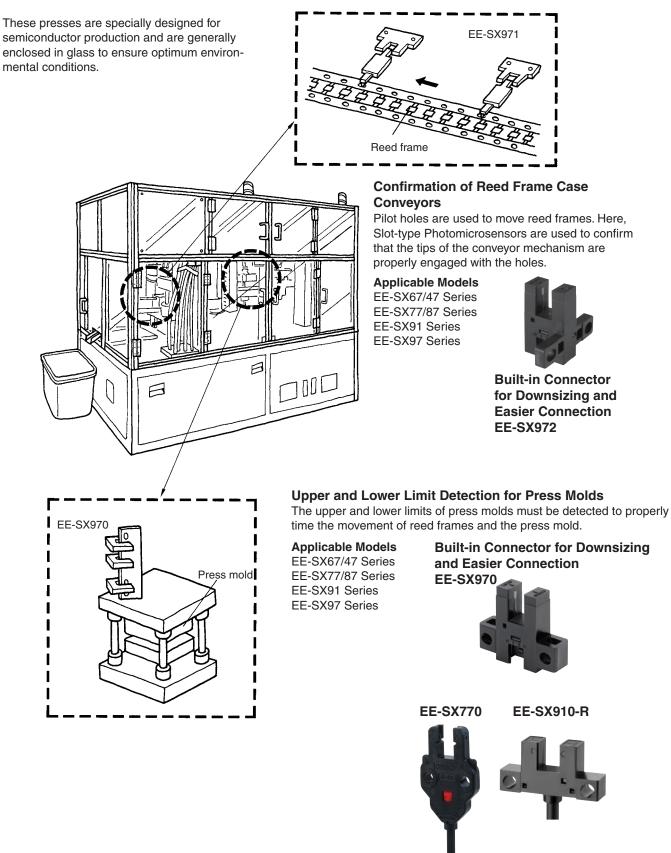


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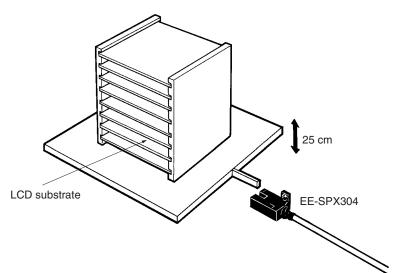
1-3. Precision Presses



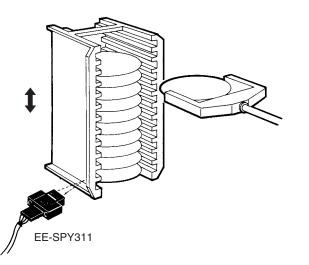
1-4. Precision Presses



1-5. Sensing LCD Casette Vertical Position



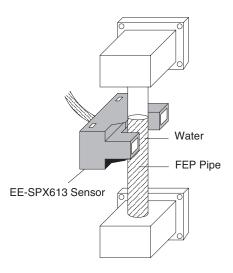
1-6. Checking Wafer Casettes



1-7. Detecting Fluid

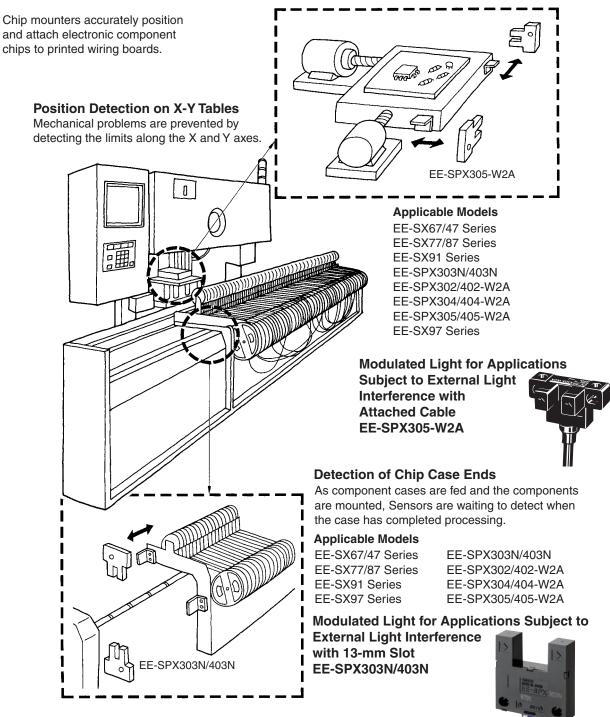
Application

Water contained within a tank is pressurized to create water vapor. Liquid water rises in a FEP tube for water level monitoring. EE-SPX613 Sensors are used to detect the water levels.



2. PCB Component Mounters

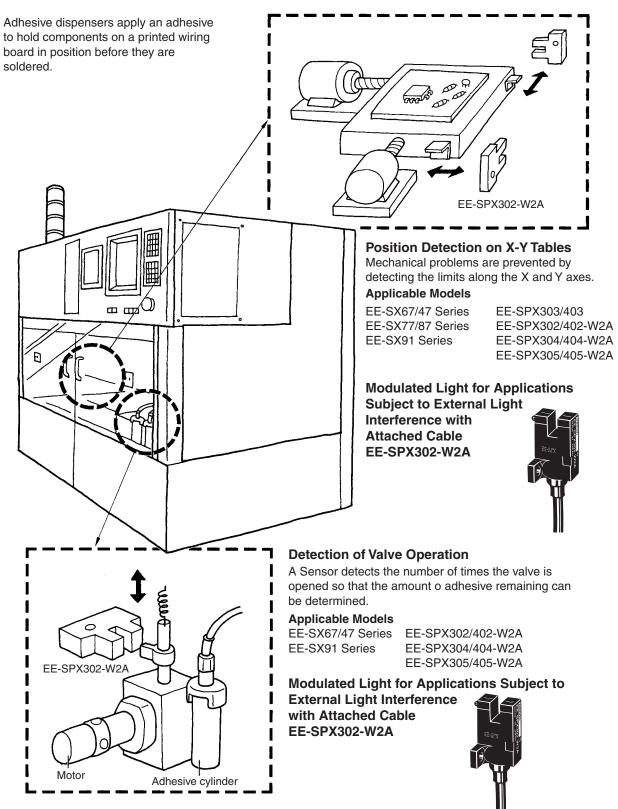
2-1. Chip Mounters



0 11

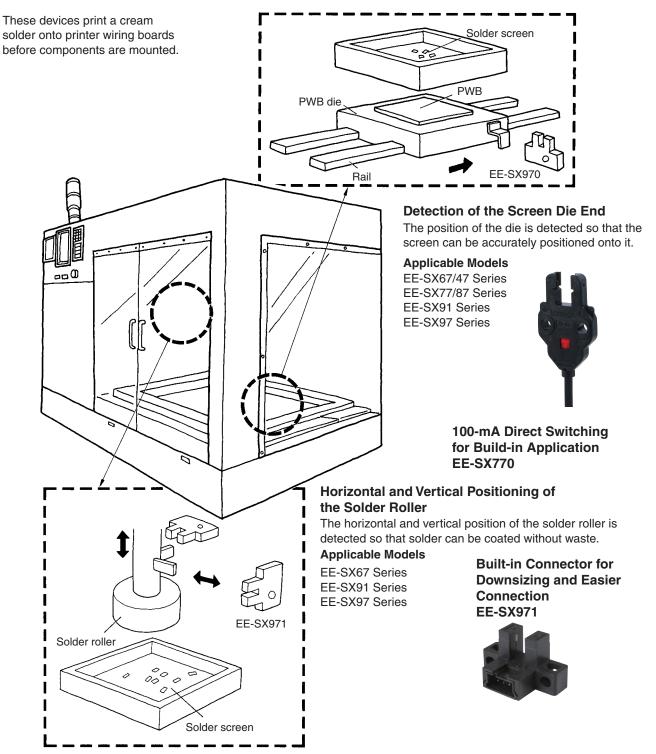
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2-2. Adhesive Dispensers

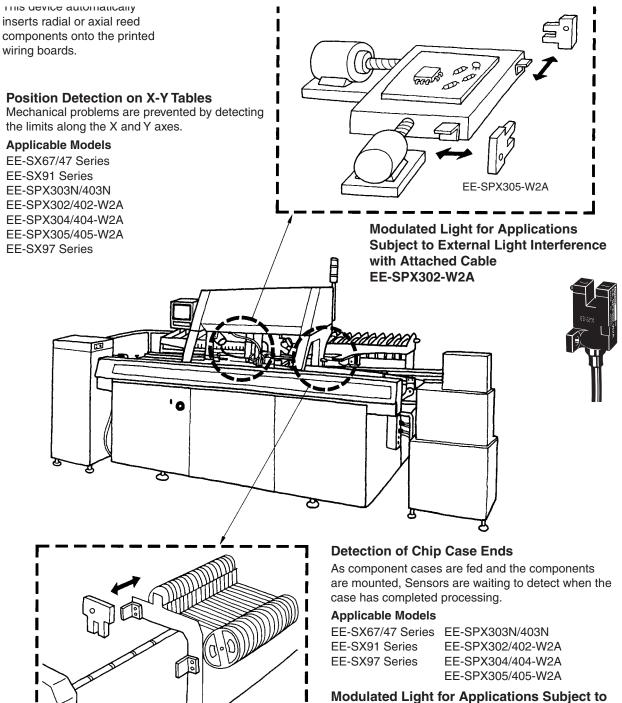


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2-3. Cream Solder Printers



2-4. Reed Component Inserters

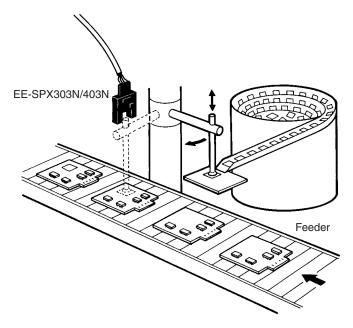


EE-SPX303N/403N

Modulated Light for Applications Subject to External Light Interference with 13-mm Slot EE-SPX303N/403N

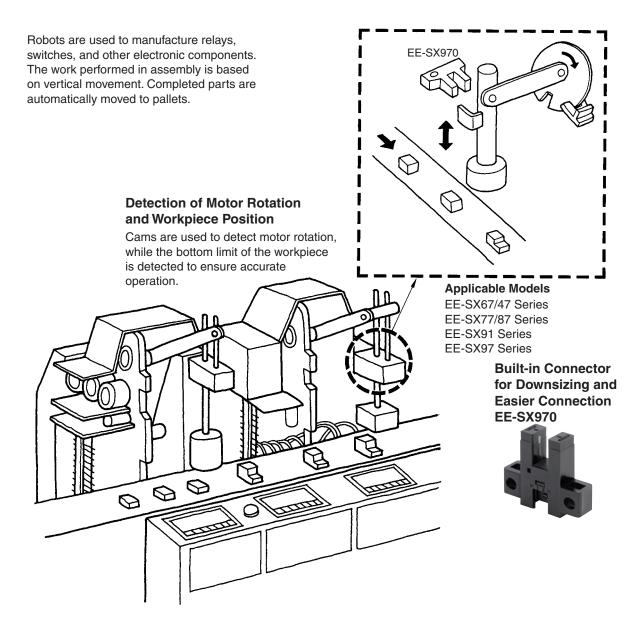


2-5. Sensing an Arm's Starting Point

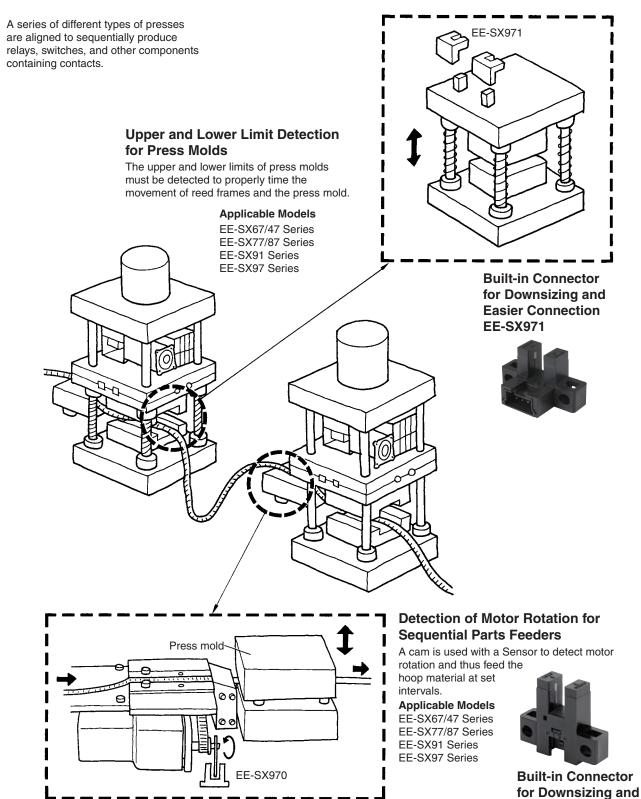


3. Electronic Component Manufacturing Equipment

3-1. Assembly Robots



3-2. Sequential Presses



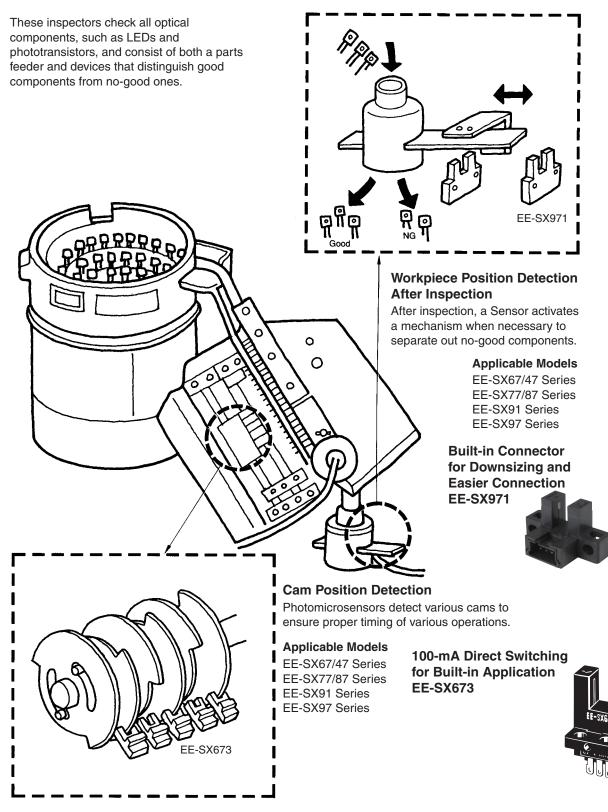
Easier Connection

EE-SX970

OMRON

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3-3. Component Inspectors

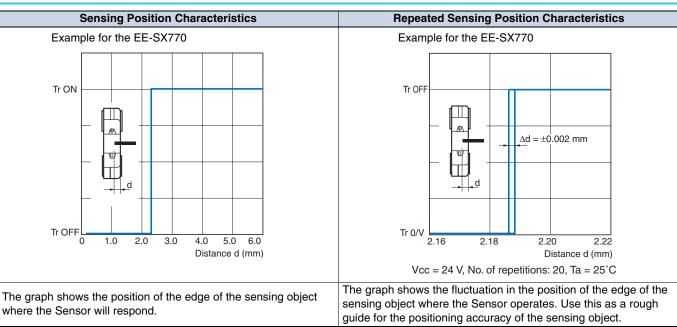


23

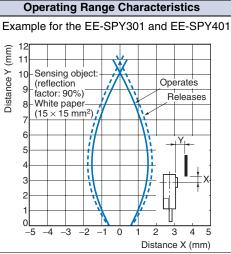
Definition of Terms

	Term	Reference diagram	Explanation
Non-mod	ulated light		Method used to detect light steadily emitted
Light mod	-		by the emitter element. Method used to detect light emitted in pulses by the emitter element.
	Through- beam (with slot)	Slot width	The slot width, i.e., the distance between the opposing faces of the emitter and receiver.
	Through- beam	Emitter	The minimum distance that can be set con- sidering factors such as the variation be- tween products and fluctuations in
Sensing distance	Retro- reflective	Emitter/receiver	temperature. Note: The actual value under standard conditions for each method is longer than the rated sensing distance.
	Diffuse- reflective	Emitter/receiver	The minimum distance that can be set for a standard sensing object (white paper) considering factors such as the variation between products and fluctuations in temperature. Note: The actual value under standard conditions for each method is longer than the rated sensing distance.
Differentia	al distance	Releases Operates Co	The difference in distance between the op- erating point and releasing point.
Response frequency		Example for Slot-type Photomicrosensor	The frequency at which an object satisfying specified conditions (size, transparency rate, reflection factor, sensing distance, and power supply voltage) can be repeatedly de- tected.
Response	e time	$0 \frac{\text{Light input}}{Operating time} \xrightarrow{- t} t$	The delay from the light input turning ON/ OFF until the control output operation or re- lease operation. The following equation generally applies. Operating time (Ton) ≈ Releasing time (Toff)
Ambient i	llumination	White paper White paper Receiver Receiver Receiver	The level of illumination on the sensing sur- face that enables stable operation of the Sensor.

Interpreting Engineering Data



Receiver Output Excess Gain vs. Sensing Distance Characteristics	Parallel Movement Characteristics
Sensing Distance Characteristics Example for the EE-SPW311/411 Image: sensing distance of the sensing distance of 1 m. It can be seen that the receiver output excess gain	Example for the EE-SPW311/411
is increased by a factor of approximately ten at the rated sensing distance.	 sensing limit of the Reflector when the position of the Sensor is constant. Multiple Through-beam Sensors: A range of 1.5 times the amount shown in the graph is required to prevent mutual interference.



• The graph shows the point where sensing starts when a standard sensing object is moved perpendicular to the optical axis. The curved line on the right in the graph shows values for when the sensing object is approaches from the right side.

Note: These values are for standard sensing objects. If the sensing object changes, the operating range and sensing distance will also change.

General Precautions

*Refer to *Precautions* section for individual models for specific precautions for each model.

<u> Warning</u>

These products cannot be used in safety devices for presses or other safety devices used to protect human life. This product is designed for use in applications for sensing workpieces and workers that will not affect levels of safety.

Precautions for Safe Use

Be sure to use the product safely according to the following precautions.

• Wiring

Item		Examples
Power Supply Do not apply any voltage exceed- ing the rated voltage range. Apply- ing any excessive voltage or supplying AC power (100 VAC or higher) to a DC-type sensor may cause the Sensor to explode or burn.	• DC 3-wire NPN output sensor	Sensor Blue
Load Short-circuit Do not short-circuit the load. Doing so may cause the Sensor to explode or burn.	DC 3-wire NPN output sensor	Sensor Blue Blue
Wiring Be sure to wire the Sensor correct- ly and be careful not to connect the polarities incorrectly, otherwise the Sensor may explode or burn.	• DC 3-wire NPN output sensor (Example) Wrong polarity	• DC 3-wire NPN output sensor (Example) Wrong polarity or wrong wiring
Connection with No Load If connected to the power supply without any load, internal elements may explode or burn. Make sure that a proper load is connected to the Sensor.	DC 3-wire NPN output sensor	Blue 0 V
AND Connections Do not use AND connections such	Sensor 1	Sensor 2
as in the example shown in the diagram here. Voltage will be applied to the Vcc terminal without the GND terminal of Sensor 2 being securely grounded, and may cause the Sensor to malfunction. Depending on the model used, inrush current to Sensor 2 when Sensor 1 is turned ON may result in malfunction.	Sensor	Black (Vcc) Black (Vcc) Black (OUT) Blue GRD) GRD GRD GRD GRD GRD GRD GRD GRD

Precautions for Correct Use

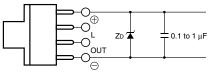
Installation

- The Sensors without light modulation (i.e., EE-SX, EE-SY) are built into the device being used and are, therefore, not equipped to deal with interference from an external light source. When using a Sensor without light modulation in an area exposed to an incandescent light or other external light interference, install so as to minimize the effects of external light sources.
- Mount the Sensors securely on a flat surface.
- Mount the Sensor with two M3 screws, using a spring washer to ensure the screws will not become loose. Use a tightening force of 6 kgf·cm (0.59 N·m) max.
- Note: Be sure to read the precautions for the model being used before tightening the screws.
- Install so that nothing can collide with the sensing section of the Sensor. Damage to the sensing surface will result in inferior performance.
- Before using the Sensor, check to be sure that it has not become loose due to vibration or shock.

Wiring

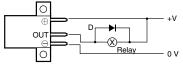
Surge

• If there is surge in the power supply, try connecting a capacitor (with a capacitance of 0.1 to 1 μ F) or a Zener diode (Z_D in the diagram below, with a rated voltage of 30 to 35 V). Use the Sensor only after confirming that the surge has been removed.



ZD: Zener diode

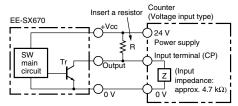
• When driving a small inductive load, such as a relay, wire as shown below. (Be sure to connect a diode to absorb the reverse voltage.)



- Separate the wiring for the Sensor from high-tension lines or power lines. If the wiring is routed in the same conduit or duct as such lines, the Sensor will be damaged or its operation will be affected by inductive interference.
- Make sure that the connectors (either dedicated or commercially available) are securely locked.

Voltage Output

• A Sensor with an open-collector output can be connected to a counter with a voltage input by connecting a resistor between the power source and output. Select a resistor with reference to the following example. The resistance of the resistor is generally 4.7 k Ω and its wattage is 1/2 W for a supply voltage of 24 V and 1/4 W for 12 V. Example:



If resistance R = 4.7 k Ω for the EE-SX670, the input voltage at the high level is as follows:

Input voltage V_H =
$$\frac{Z}{R + Z}$$
 V_{CC} = $\frac{4.7 \text{ k}}{4.7 \text{ k} + 4.7 \text{ k}} \times 24 \text{ V}$
= 12 V

And the input voltage and load current at the low level are as follows:

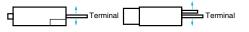
Input voltage $V_L \le 0.4 V$ (Residual voltage for 40-mA load current)

Residual voltage IC =
$$\frac{V_{CC}}{R} = \frac{V_{CC}}{R} = 5.1 \text{ mA} \le 40 \text{ mA}$$

Note: Refer to the ratings of the Sensor for the residual voltage of the load current.

Terminals

• Make sure that the terminals are not subjected to stress (external force). Stress will cause damage to the terminals.



Design Considerations

Influence of Power Supply and Cable Length (EE-SP Models)

When using a Sensor with a model number beginning with EE-SP with light modulation, make sure that the power and cable length are considered in the design. These models are more easily influenced than models with direct light modulation (i.e., Sensors with model numbers beginning with EE-SX or EE-SY).

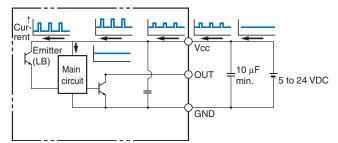
- Sensors with light modulation that are easily affected: EE-SPX301/401, EE-SPY30□/40□, EE-SPZ301□/401□, EE-SPY31□/41□ EE-SPX303/403, EE-SPW311/411, EE-SPX74□/84□, EE-SPX□□-W
- Sensors with light modulation that are not easily affected: EE-SPX613, EE-SPY801/802
 - * All Sensors with model numbers beginning with EE-SX and EE-SY without light modulation are not easily influenced by power or cable length.

Reasons for Interference from Power and Cable Length on Models with Light Modulation

The emitter LED is lit using pulses for models with light modulation. As a result, the large current required to emit light from the LED will produce pulsation in the current consumption. Photoelectric Sensors have built-in capacitors with sufficient capacity. Therefore, these Sensors are not influenced by pulsating current consumption. Incorporating built-in capacitors with sufficient capacity in compact Photomicrosensors, however, is difficult, thereby resulting in pulsating current consumption. Operation may not be able to keep up with the pulsation in the current consumption depending on the cable length and the type of power supply used, and this may result in unstable operation.

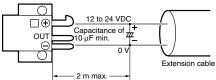
Countermeasures Adding a Capacitor

Attach a capacitor (e.g., film capacitor) of $10 \,\mu\text{F}$ min. to the wires as close as possible to the Sensor. (Use a capacitor with a dielectric strength that is at least twice the Sensor's power supply voltage. Do not use tantalum capacitors. Short-circuit malfunctions may result in the capacitor igniting due to the large current flow.)



Cable Length

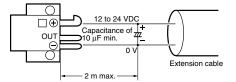
- Design the configuration using a total cable length of 2 m max. for the Sensor.
- To use a cable longer than 2 m, attach a capacitor with a capacitance of approximately 10 μ F to the wires as shown below (the distance between the terminal and the capacitor must be within 2 m). Make sure that the total cable length is no longer than approximately 5 m. To use a cable length longer than 5 m, use a PLC or other means to read the sensor output and then transmit the signals using a PLC with communications functions. Although cables can be extended longer than 5 m, performance will be affected by the noise interference from adjacent cables and other devices and the influence of cable specifications. Voltage drops due to resistance in wiring materials will also influence performance. Therefore, factors, such as the difference in voltage between the end of the cable and the sensor and noise levels, must be given full consideration.



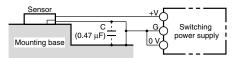
Note: Refer to the precautions for the Sensor being used before extending cables. The length that cables can be extended depends on the Sensor model and cable specifications. EE-SX, EE-SY, and all other Sensors without light modulation are not easily affected by cable length (effective extension from 20 to 50 m is possible).

Using a Switching Power Supply

- Take either of the following countermeasures as required if connecting a Sensor with optical modulation to a switching power supply.
- 1. Attach a capacitor of 10 μ F min to the wires as close as possible to the Sensor. (Use a capacitor with a dielectric strength that is at least twice the Sensor's power supply voltage. Do not use tantalum capacitors. Short-circuit malfunction may result in the capacitor igniting due to the large current flow.)



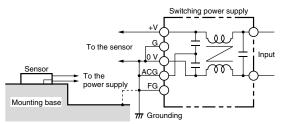
2. Connect to the 0-V line of the power source or connect to the power source via a capacitor of approximately 0.47 μ F to reduce the impedance of the mounting base to prevent inductive noise from entering the mounting base.



 Connect the noise filter terminal (neutral terminal to ACG) of the switching power supply to the case (FG) and 0-V terminal of the power supply.

Note: The line connected as mentioned above should be grounded or connected to the mounting base to ensure stable operation.

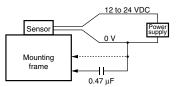
Countermeasures to Handle Inductive Noise



4. Insert a plastic insulator of approximately 10 mm between the Sensor and the mounting base.

Effects of Inductive Noise

• When there is inductive noise in the Sensor mounting frame (metal), the output of the Sensor may be affected. In this case, ensure that there is no electrical potential difference between the Sensor 0-V terminal and the Sensor mounting frame, or put a 0.47- μ F capacitor between the 0-V terminal and the frame.



Output Signal Processing

• Set a processing speed slower than 100 ms to prevent noise interference.

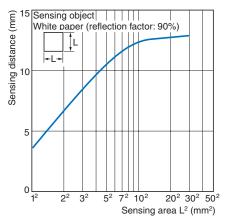
Reflective Photomicrosensors

Sensing Distance

• The maximum sensing distance of each Reflective Photomicrosensor model is based on sensing a sheet of white paper with a reflection factor of 90%. The sensing distance varies with the other conditions of the objects being detected.

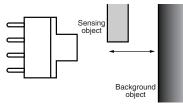
Typical Example

EE-SPY30/40 Series



Background Objects

 The Reflective Photomicrosensor detects objects by sensing the difference in the reflection factor between the object and the background, therefore the background objects should not be glossy.

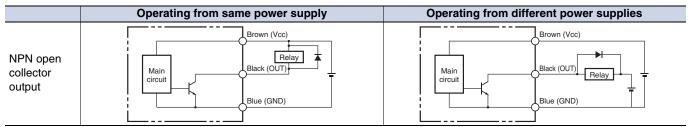


Decrease reflection from the background object, e.g., by providing a sufficient distance to the background or by using a black sponge as the background.

PLC Connections

NPN open collector output	Brown (Vcc) Main circuit Black (OUT) Black (OUT) COM Black (OUT) COM Black (OUT) COM Black (OUT) Black (OUT) COM Black (OUT) Black (OU
NPN voltage output	Brown (Vcc) Main circuit Black (OUT) Black (OUT) 12 to 24 VDC Blue (GND)
PNP open collector output	Brown (Vcc) Main circuit 12 to 24 VDC Blue (GND) N COM

Relay Connections



Counter Connections

	No-voltage Input	Transistor input (voltage input)
NPN open collector output	Brown (Vcc) Main circuit Black (OUT) 5 to 24 VDC Blue (GND) Input common	Brown (Vcc) Black (OUT) S to 24 VDC Blue (GND) * Refer to the information on the specific model for details on calculating external resistance.
NPN voltage output	Brown (Vcc) Hain circuit Black (OUT) 5 to 24 VDC Blue (GND) CP1 (N) (Reset) O CP2 (N) (Reset) O CP1 (N) (Reset)	Brown (Vcc) Main circuit Black (OUT) 5 to 24 VDC - 24 VDC (-) Blue (GND)

Other Precautions

- Do not disconnect the Connector from the Sensor when power is supplied to the Sensor, or Sensor damage could result.
- Avoid installing the Sensor in the following places to prevent malfunction or trouble:
- 1. Places exposed to dust
- 2. Places exposed to corrosive gases
- 3. Places exposed to water, oil, or chemicals
- 4. Outdoor or places exposed to intensive light, such as direct sunlight
- Be sure to use the Sensor under the rated ambient temperature.
- The Sensor may be dissolved by exposure to organic solvents, acids, alkali, or aromatic hydrocarbons, causing deterioration in characteristics. Do not expose the Sensor to such chemicals.

Slot-type Photomicrosensor

EE-SX97

Built-in connector enables downsizing and easier connection. Protective circuit for safe operation.

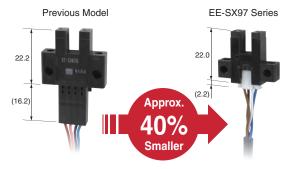
- A built-in connector minimizes the shape and dimensional requirements.
- Two outputs: light-ON and dark-ON.
- Complete lineup including seven different shapes.
- Safer operation with built-in power supply reverse polarity protection.
- Output overcurrent protection with a thermal shutdown circuit (patent pending). *1
- The indicator can be seen from many directions to enable installation in more locations.
- Connector with lock that mates with commercially available connectors. *2
- Output overcurrent protection is provided only on output 2 (OUT2) on NPN models.
 Recommended connector:
 Loss Marco et al. OPUD 2017 Do 5 Linearies: DAD 2017 O
 - J.S.T. Mfg. Co., Ltd. Contacts: SPHD-001T-P0.5, Housing: PAP-04V-S Ask the manufacturer of the connector for details.

Be sure to read the *Safety Precautions* on page 37.



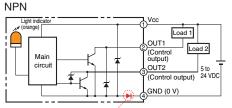
Built-in Connector for Downsizing and Easier Connection

A built-in connector minimizes the shape and dimensional requirements. And wiring costs can be reduced by using commercially available connectors.



Safer Operation with Built-in Power Supply Reverse Polarity Protection

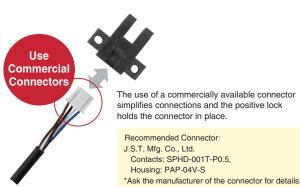
The built-in power supply reverse polarity protection protects against reverse connection of the power supply or outputs for safer operation at the assembly site.



Reverse polarity protection

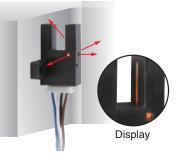
Built-in Thermal Shutdown Circuit

Control output 2 on models with NPN outputs is protected from output overcurrents by a built-in thermal shutdown circuit.



Easy-to-see Indicator

The indicator can be seen from up to four directions to enable installation in more locations.



Two Outputs: Light-ON and Dark-ON

All models provide both a light-ON and dark-ON output so that the output can be switched according to the application simply by changing the wiring.

CE

EE-SX97

Ordering Information

Sensors								Infrared light							
Appearance	Sensing	Connecting	Sensing distance		Operating	Indicator	Model								
	method	method			mode	mode	NPN output	PNP output							
Standard							EE-SX970-C1	EE-SX970P-C1							
L-shaped							EE-SX971-C1	EE-SX971P-C1							
T-shaped, slot center 7 mm			el 5 n (slo	5 mm (slot	5 (s		(slo		5 mm	(slot	(slot			EE-SX972-C1	EE-SX972P-C1
Close-mounting	Through- beam type (with slot)	Connector model (4 poles)						(:				(slot	5 mm L (slot	Dark-ON/ Light-ON (selectable)	Incident light
T-shaped, slot center 10 mm															EE-SX975-C1
F-shaped						EE-SXS	EE-SX976-C1	EE-SX976P-C1							
R-shaped								EE-SX977-C1	EE-SX977P-C1						

Accessories (Order Separately)

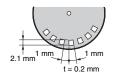
· ·	• •	
Туре	Cable length	Model
Connector with Cable	1 m	EE-1017 1M
Connector with Cable	3 m	EE-1017 3M
Connector with Robot Cable	1 m	EE-1017-R 1M
Connector with hobot Cable	3 m	EE-1017-R 3M

EE-SX97

Ratings and Specifications

	Туре	Standard	L-shaped	T-shaped, slot center 7 mm	Close-mount- ing	T-shaped, slot center 10 mm	F-shaped	R-shaped	
	NPN	EE-SX970-C1	EE-SX971-C1	EE-SX972-C1	EE-SX974-C1	EE-SX975-C1	EE-SX976-C1	EE-SX977-C1	
Item	PNP	EE-SX970P-C1	EE-SX971P-C1	EE-SX972P-C1	EE-SX974P-C1	EE-SX975P-C1	EE-SX976P-C1	EE-SX977P-C1	
Sensing d	distance	5 mm (slot wid	th)						
Sensing o	object	Opaque: 2 × 0	Dpaque: 2×0.8 mm min.						
Differentia	al distance	0.025 mm max	. *1						
Light sour length)	rce (Peak wave-	Infrared LED w	vith a peak wave	elength of 940 n	m				
Indicator		Light indicator	(orange LED)						
Supply vo	oltage	5 to 24 VDC ±	10%, ripple (p-p): 10% max.					
Current co	onsumption	21 mA max.							
Control ou	utput		Load power supply voltage: 5 to 24 VDC, Load current: 50 mA max., Off-state current : 0.5mA max, 50 mA load current with a residual voltage of 1.0 V max., 5 mA load current with a residual voltage of 0.4 V max.						
Protection	n circuit		Power supply reverse polarity protection; output reverse polarity protection; overcurrent protection (only OUT2 on models with NPN output)						
Response	e frequency	1 kHz min. (3 k	(Hz average) *2	2					
Ambient il	llumination	1,000 lx max. v	with fluorescent	light on the sur	ace of the recei	ver			
Ambient to range	emperature	Operating: -25	to 55°C Storag	je: −30 to 80°C	(with no icing or	condensation)			
Ambient h	numidity range	Operating: 5%	to 85% Storage	e: 5% to 95% (w	ith no icing or c	ondensation)			
Vibration struction)	resistance (De-	10 to 2,000 Hz	10 to 2,000 Hz 0.75-mm single amplitude (15-min periods, 10 cycles) each in X, Y, and Z directions						
Shock res struction)	sistance (De-	Destruction: 500 m/s ² for 3 times each in X, Y, and Z directions							
Degree of	f protection	IEC 60529 IP5	IEC 60529 IP50						
Connectin	ng method	Connector							
Weight (P	acked state)	Approx. 3 g							
Mate- Ca	ase/Cover	Polybutylene to	erephthalate (Pl	BT)					
rial Er	mitter/receiver	Polycarbonate	(PC)						

*1. The differential distance is the value when a sensing object is moved in a lateral direction to the slot.
*2. The response frequency was measured by detecting the following rotating disk.





Connector

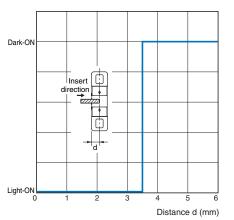
	Product	Connector with Cable	Connector with Robot Cable				
	Model	EE-1017	EE-1017-R				
Item	Appearance						
Contact resistance		25 m Ω max. (at 10 mA DC and 20 mV max.)					
Insertion stre	ength	20 N max.					
Surplus stree	ngth	1.5 N min.					
Cable length		1 m, 3 m					
Ambient temperature range		-10 to +60°C					
Housing		Nylon					
Materials	Contact	Phosphor bronze					

EE-SX97

Engineering Data (Typical)

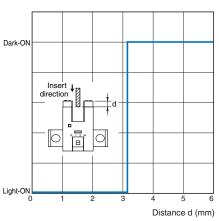
Sensing Position Characteristics

EE-SX970

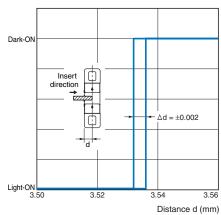


Sensing Position Characteristics

EE-SX970



Repeated Sensing Position Characteristics EE-SX970



Vcc = 24 V, No. of repetitions: 20, Ta = 25°C Differential distance = 0.025 mm max.

Note: Data is provided for dark conditions. Light interference and the translucence of the sensing object can affect operation.

I/O Circuit Diagrams

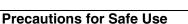
Output configu- ration	Model	Output transistor operation status	Timing charts	Output circuit	
NPN output	EE-SX970-C1 EE-SX971-C1 EE-SX972-C1 EE-SX974-C1 EE-SX975-C1 EE-SX976-C1 EE-SX977-C1	OUT1: Light-ON	Light incident Light interrupted Light indicator ON (orange) OFF Output 1 ON Transistor OFF	Light indicator Upt indicator Main circuit Main circuit GRD (0 V) Control output) Control output) C	
PNP output	EE-SX970P-C1 EE-SX971P-C1 EE-SX972P-C1 EE-SX974P-C1 EE-SX975P-C1 EE-SX976P-C1 EE-SX977P-C1	OUT2: Dark-ON	Load 1 Operates (relay) Releases Output 2 ON	Load 1 Operates (relay) Releases Output 2 ON transistor OFF	Light indicator Main circuit Main circuit Main circuit Main circuit Main circuit Main circuit Main Control output) Control outp

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.



• Operating Environment

These Photomicrosensors have an IP50 (conforms to IEC) enclosure and do not have a water-proof or dust-proof structure. Therefore, do not use them in applications in which the sensor will be subjected to splashes from water, oil, or any other liquid. Liquid entering the Sensor may result in malfunction.

Precautions for Correct Use

Make sure that this product is used within the rated ambient environment conditions.

Installation

• Mount the Sensor with two M3 screws, using plain washers and spring washers to ensure the screws will not become loose. Use a tightening force of 0.54 N·m max.

Wiring

Unused Output Lines

Be sure to isolate output lines that are not going to be used.

Wiring method

Connection is made using a connector. Do not solder to the pins (leads). The pins (leads) are soldered to the internal board of the Sensor. Therefore, direct soldering of the pins (leads) may result in an internal disconnection causing malfunction.

• Others

- The power cable connected to the Sensor must not be more than 10 m in length.
- Only output 2 (OUT2) on NPN models is provided with overcurrent protection.

If an overcurrent occurs, heat generated by the output transistor will activate the thermal shutdown circuit and OUT2 will turn OFF. Check the wiring and load current and cycle the power supply. If there is no overcurrent, normal operation will be resumed. (The thermal shutdown circuit will be activated again if there is an overcurrent.)

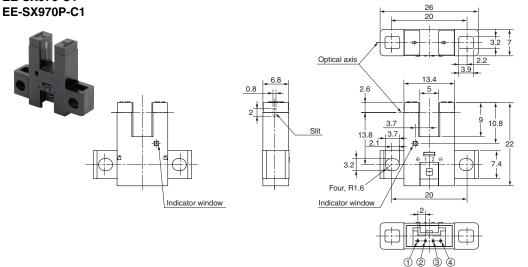
This function does not provide protection against load short circuits. If the electric power of the output transistor increases due to a load short-circuit or near load short-circuit, the Sensor may be damaged.

• An output pulse may occur when the power supply is turned ON depending on the power supply and other conditions. The operation of the Sensor will be stable 100 ms after turning ON the power supply.



Dimensions

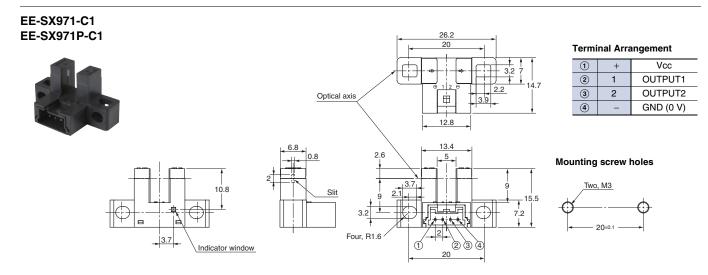


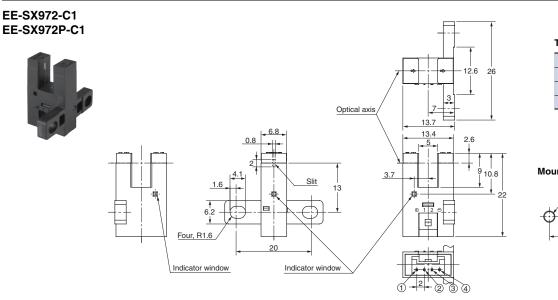


Terminal Arrangement			
1	+	Vcc	
2	1	OUTPUT1	
3	2	OUTPUT2	
4	-	GND (0 V)	

Mounting screw holes







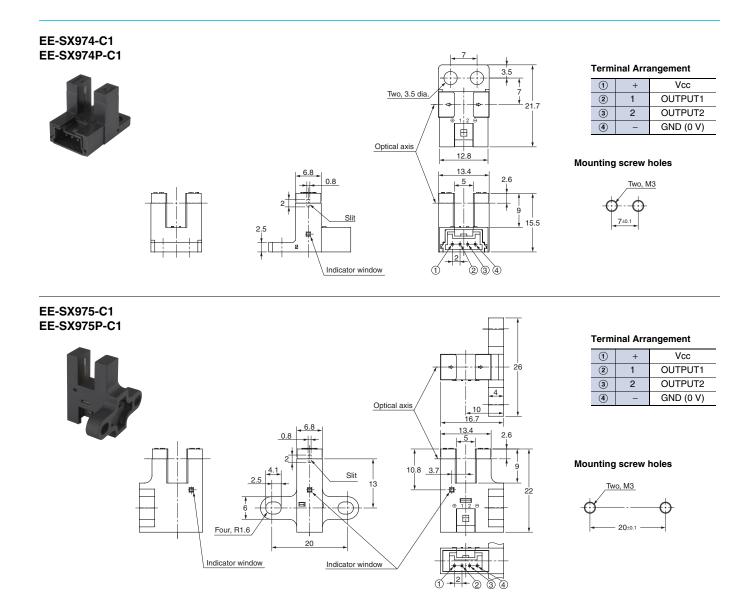
Terminal Arrangement

1	+	Vcc
2	1	OUTPUT1
3	2	OUTPUT2
4	_	GND (0 V)

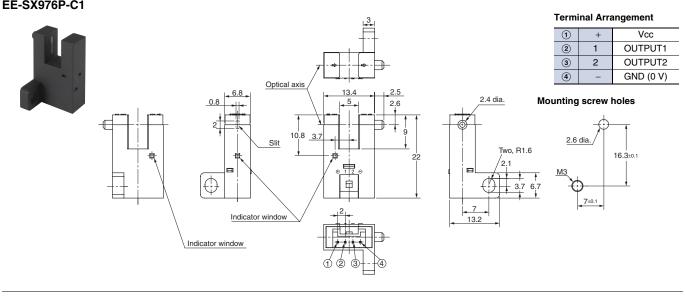
Mounting screw holes



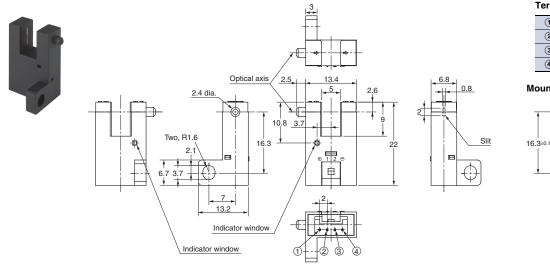
38



EE-SX976-C1 EE-SX976P-C1



EE-SX977-C1 EE-SX977P-C1



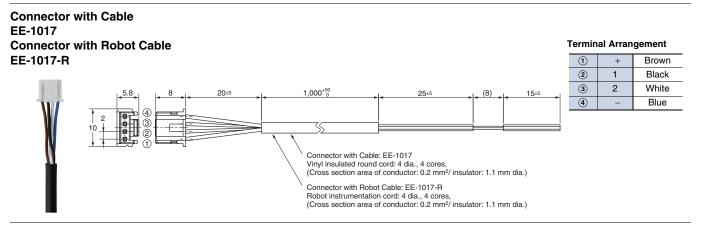
Terminal Arrangement

1	+	Vcc
2	1	OUTPUT1
3	2	OUTPUT2
4	-	GND (0 V)

Mounting screw holes



Accessories (Order Separately) Connector



Compact Pre-wired Photomicrosensor with Built-in Amplifier (Non-modulated)

EE-SX91

Meeting Customer Needs with Compact Sensors that Mount with M3 Screws

- · Both light-ON and dark-ON outputs provided.
- A compact size and choice of five models for a wide range of applications.
- Compact NPN and PNP output models.

Be sure to read Safety Precautions on

- Mount using M3 or M2 screws.
- Indicator is visible in many directions for installation in any location.
- Maximum load current of 100 mA.
- Flexible robot cables are standard on all models.



CE

Features

page 46

A Compact Size and Choice of Five Models for a Wide Range of Applications

Select any of five models to minimize the space required.



Compact NPN and PNP Output Models

Both NPN and PNP output models are available for use according to system requirements.

Maximum Load Current of 100 mA

Output control of up to 100 mA is supported for either NPN or PNP outputs.

Flexible Robot Cables: Standard on All Models

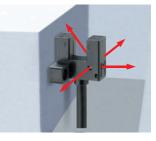
Robot Cables are effective for moving parts, and are provided as standard equipment with all models.

Both Light-ON and Dark-ON Outputs

Both light-ON and dark-ON outputs are provided on all models, allowing outputs to be switched by simply changing the wiring according to the application.

Indicator Visible from Many Directions for Installation in Any Location

The light indicator can be checked from up to four directions.



Mount Using M3 or M2 Screws

The EE-SX91 can be mounted using M3 or M2 screws, so it can easily replace an existing compact sensor mounted with M2 screws.



Ordering Information

List of Models

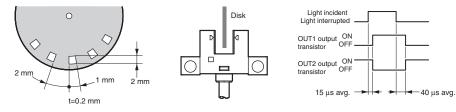
Appearance	Sensing	Sensing	Output	Indicator	Connecting method	Mo	odel		
Appearance	method	distance	configuration	mode	(Cable length)	NPN output	PNP output		
Standard						EE-SX910-R 1M *	EE-SX910P-R 1M		
L-shaped	Through- beam type (with slot)					EE-SX911-R 1M *	EE-SX911P-R 1M		
F-shaped		beam type	beam type	5 mm (slot width	Light-ON Dark-ON (2 outputs)	Lit when light is incident	Pre-wired models (1 m)	EE-SX912-R 1M *	EE-SX912P-R 1M
R-shaped							EE-SX913-R 1M *	EE-SX913P-R 1N	
U-shaped						EE-SX914-R 1M *	EE-SX914P-R 1M		

* Prewired models with a 3-m cable are also available. When ordering, specify the cable length by adding "3M" for the end of the model number (e.g., EE-SX910-R 3M).

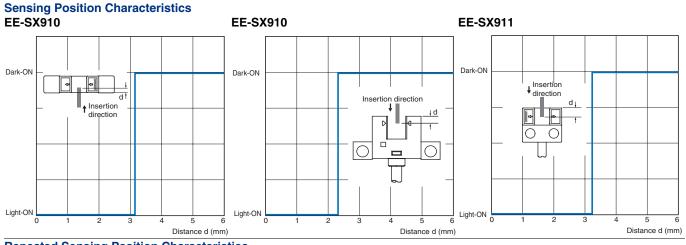
Ratings and Specifications

		Туре	Standard	L-shaped	F-shaped	R-shaped	U-shaped		
	NPN models	Pre-wired models	EE-SX910-R	EE-SX911-R	EE-SX912-R	EE-SX913-R	EE-SX914-R		
ltem	PNP models	Pre-wired models	EE-SX910P-R	EE-SX911P-R	EE-SX912P-R	EE-SX913P-R	EE-SX914P-R		
Sensir	ng distance	•	5 mm (slot width)	l		- W			
Sensir	ng object		Opaque: 1.2×0.8 n	nm min.					
Differe	ential dista	nce	0.025 mm max.						
Light	source		GaAs infrared LED	with a peak waveler	gth of 940 nm				
Indica	tor		Light indicator (red I	LED)					
Supply	y voltage		5 to 24 VDC $\pm 10\%$,	ripple (p-p): 10% m	ax.				
Currer	nt consum	otion	15 mA max.						
Control output			Load power supply voltage: 5 to 24 VDC Load current: 100 mA max. OFF current: 0.5 mA max. 100 mA load current with a residual voltage of 1.0 V max. 5 mA load current with a residual voltage of 0.4 V max.						
Protec	tion circui	ts	Power supply reverse polarity protection; output reverse polarity protection						
Respo	nse freque	ency	3 kHz min. (8 kHz average) Light incident: 15 μ s average; light interrupted: 40 μ s average*						
Ambie	ent illumina	tion	1,000 lx max. with fluorescent light on the surface of the receiver						
Ambie	ent tempera	iture range	Operating: –25 to 55°C Storage: –30 to 80°C (with no icing or condensation)						
Ambie	ent humidit	y range	Operating: 5% to 85% Storage: 5% to 95% (with no icing or condensation)						
Vibration resistance (Destruction)			10 to 2,000 Hz 0.75-mm single amplitude for 2.5 h (15-min periods, 10 cycles) each in X, Y, and Z directions						
Shock resistance (Destruction)			500 m/s ² for 3 times each in X, Y, and Z directions						
Degree of protection			IEC60529 IP50						
Connecting method			Pre-wired Models (standard cable length: 1 m)						
Woigh	•	Pre-wired Models	Approx. 17 g						
Weight (packed state) Models winectors		Models with Con- nectors	Approx. 7 g						
Mate-	Case/cov	er	Polybutylene phthal	ate (PBT)					
rials	Emitter/re	eceiver	Polycarbonate (PC)						

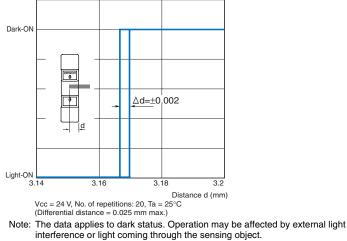
* The response frequency was measured by detecting the following rotating disk. The response times for light incidence and light interruption are shown in the timing chart.



Engineering Data (Typical)



Repeated Sensing Position Characteristics EE-SX910



I/O Circuit Diagrams

Output type	Model	Output transistor operation status	Timing charts	Output circuit
	EE-SX910-R		Light incident Light interrupted	Light OUT1 Load 1
NPN output	EE-SX911-R EE-SX912-R EE-SX913-R EE-SX914-R	OUT1: Light-ON OUT2: Dark-ON	Light indicator ON (red) OFF	Main circuit (Black) OUT2 (White) Uoad 2 OUT2 (White)
			Output 1 ON transistor OFF	5 to 24 VDC → → → → → → → → → → → → → → → → → → →
	EE-SX910P-R	OUTZ. Daik-ON	Load 1 Operates (e.g., relay) Releases	Light indicator
PNP output	EE-SX911P-R EE-SX912P-R EE-SX913P-R EE-SX914P-R		Output 2 ON transistor OFF	Main circuit
			Load 2 Operates (e.g., relay) Releases	(Blue)

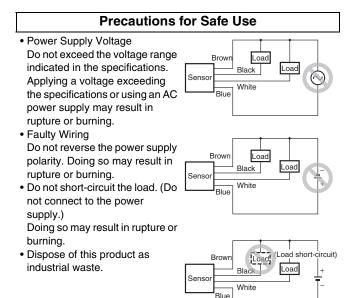
Safety Precautions

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

Installation

- It is assumed that EE-SX91 Sensors will be built into a device. These Sensors use non-modulated light and are not equipped to deal with interference from an external light source. When they are used in locations subject to external light interference, such as near a window or under an incandescent light, install them to minimize the effects of external light interference.
- Mount the Sensors securely on a flat surface.
- Use M3 or M2.0 screws to secure the Photomicrosensor. (The stronger M3 screws are recommended. In addition, use flat washers and spring washers to prevent the screws from loosening.) Refer to the following table for the correct tightening torque.

Screw diameter	Tightening torque
M2.0	0.15 N·m max.
M3	0.54 N·m max.

• If the Sensor is to be used on a moving part, secure the cable connection point so that it is not directly subjected to stress.

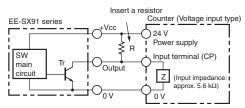
Wiring

Unused Output Lines

Be sure to isolate output lines that are not going to be used.

Connecting to Devices with Voltage Input Specifications

A Sensor with an open-collector output can be connected to a counter with a voltage input by connecting a resistor between the power source and output. Select a resistor with reference to the following example. The resistance of the resistor is generally 4.7 $k\Omega$ and its wattage is 1/2 W for a supply voltage of 24 V and 1/4 W for 12 V.



Example: EE-SX91 Series

Load Resistance of 4.7 k Ω Connected in a Counter

Counter Specifications

Input impedance	5.6 ΚΩ
Voltage judged as high level (input ON)	4.5 to 30 VDC
Voltage judged as low level (input OFF)	0 to 2 VDC

The high and low levels are found using the following formulas. The input device specifications must satisfy both formulas.

High level:

Input voltage V_H = $\frac{Z}{B+Z}$ Vcc = $\frac{5.6 \text{ k}}{4.7 \text{ k+}5.6 \text{ k}} \times 24 \text{ V} = 13 \text{ V}$

Low level:

Load current Ic = $\frac{Vcc}{R} = \frac{24 \text{ V}}{R} = 5.1 \text{ mA} \le 100 \text{ mA}$

Input voltage VL \leq 1.0 V (Residual voltage for 100-mA load current)

Note: Refer to the ratings of the Sensor for the residual voltage of the load current.

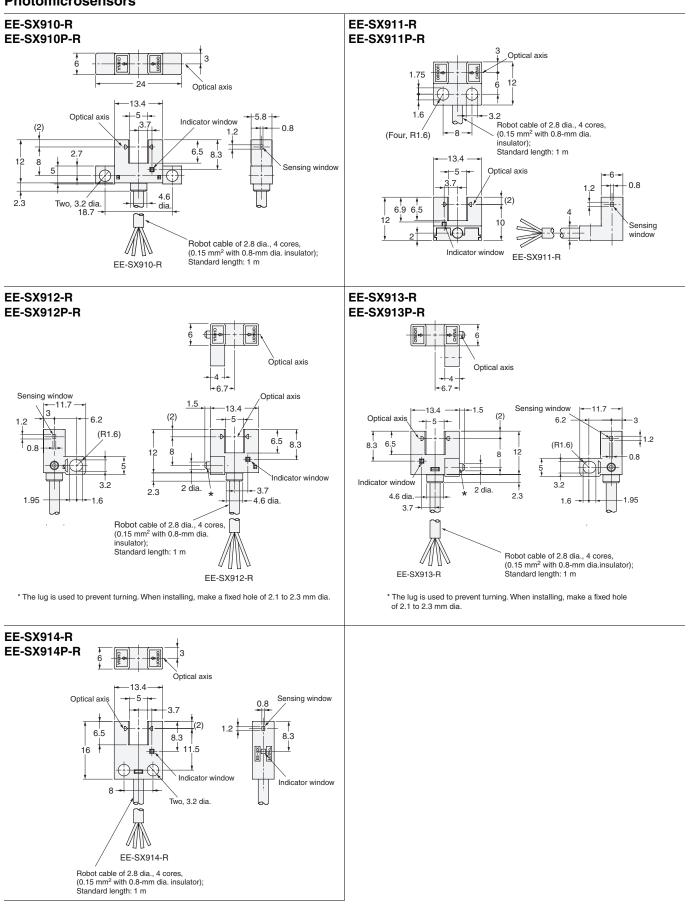
Other Precautions

- Do not disconnect the Connector from the Sensor when power is supplied to the Sensor, or Sensor damage could result.
- Do not install the Sensor in the following places to prevent malfunction or trouble:
 - 1. Places exposed to dust or oil mist

 - 3. Places directly or indirectly exposed to water, oil, or chemicals
- 4. Outdoor or places exposed to intensive light, such as direct sunlight
- Be sure to use the Sensor under the rated ambient temperature.
- The Sensor may be dissolved by exposure to organic solvents, acids, alkali, or aromatic hydrocarbons, aliphatic chloride hydrocarbons causing deterioration in characteristics. Do not expose the Sensor to such chemicals.
- Make sure the total length of the power cable connected to the product is less than 10 m.

Dimensions (Unit: mm)

Photomicrosensors



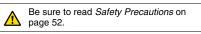
Photomicrosensor with Slim Cable (Non-modulated)

EE-SX77/87

Slim, Compact Photomicrosensor that is still easy to use.

- · Compact, thin profile enables dense mounting.
- Indicator is visible from both sides.
- Wide operating voltage range: 5 to 24 VDC





Ordering Information

Pre-wired Models Infrared light

	Sensing	Cable	Canalna	. dlatawaa	Output	lu dia atau mada	Ма	odel
Appearance	method	length	Sensing	distance configuratio		Indicator mode	NPN output*	PNP output
Standard					Dark-ON	Incident light	EE-SX770 2M	EE-SX770P 2M
<u>R</u>					Dark-ON	No incident light	EE-SX770A 2M	EE-SX770R 2M
					Light ON	Incident light	EE-SX870 2M	EE-SX870P 2M
Ť	Through-beam type (with slot)	2 m		5 mm (slot width)	Light-ON	No incident light	EE-SX870A 2M	EE-SX870R 2M
L-shaped					Dark-ON	Incident light	EE-SX771 2M	EE-SX771P 2M
						No incident light	EE-SX771A 2M	EE-SX771R 2M
					Light-ON	Incident light	EE-SX871 2M	EE-SX871P 2M
I						No incident light	EE-SX871A 2M	EE-SX871R 2M
T-shaped					Incident light	EE-SX772 2M	EE-SX772P 2M	
					Dark-ON	No incident light	EE-SX772A 2M	EE-SX772R 2M
ų.					Incident light	EE-SX872 2M	EE-SX872P 2M	
Ţ					Light-ON	No incident light	EE-SX872A 2M	EE-SX872R 2M

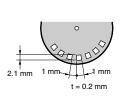
* Models with NPN outputs are available with pre-wired e-CON connectors.

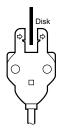
Specify an NPN output by adding "-ECON" and the cable length (0.3 m or 2 m) to the end of the model number. (Example: EE-SX770-ECON 0.3M)

Ratings and Specifications

	Туре	Standard	L-shaped	T-shaped			
	NPN models	EE-SX770/EE-SX870 EE-SX770A/EE-SX870A	EE-SX771/EE-SX871 EE-SX771A/EE-SX871A	EE-SX772/EE-SX872 EE-SX772A/EE-SX872A			
Item	PNP models	EE-SX770P/EE-SX870P EE-SX770R/EE-SX870R	EE-SX771P/EE-SX871P EE-SX771R/EE-SX871R	EE-SX772P/EE-SX872P EE-SX772R/EE-SX872R			
Sensing distance		5 mm (slot width)					
Sensing object		Opaque: 2×0.8 mm min.					
Differential distar	nce	0.025 mm					
Light source		GaAs infrared LED with a peak wave	ength of 940 nm				
Indicator		Light indicator (red) (turns ON when I	ight is interrupted for models with A or	r R suffix)			
Supply voltage		5 to 24 VDC $\pm 10\%,$ ripple (p-p): 10%	max.				
Current consump	otion	35 mA max. (NPN models), 30 mA m	ax. (PNP models)				
Control output		NPN open collector: 5 to 24 VDC, 100 mA max. 100 mA load current with a residual voltage of 0.8 V max. 40 mA load current with a residual voltage of 0.4 V max. OFF current (leakage current): 0.5 mA max. PNP open collector: 5 to 24 VDC, 50 mA max. 50 mA load current with a residual voltage of 1.3 V max. OFF current (leakage current): 0.5 mA max.					
Response freque	ncy *	1 kHz min. (3 kHz average)					
Ambient illuminat	tion	1,000 lx max. with fluorescent light on the surface of the receiver					
Ambient temperat	ture range	Operating: -25 to +55°C Storage: -30 to +80°C (with no icing)					
Ambient humidity	/ range	Operating: 5% to 85% Storage: 5% to 95% (with no condensation)					
Vibration resistar	ice	Destruction: 20 to 2,000 Hz (peak acceleration: 100 m/s ²) 1.5-mm double amplitude for 2 h (4-min periods) each in X, Y, and Z directions					
Shock resistance		Destruction: 500 m/s ² for 3 times each in X, Y, and Z directions					
Degree of protect	ion	IEC60529 IP60					
Connecting meth	od	Pre-wired (standard cable length: 2 m)					
Weight (packaged	d)	Approx. 20 g					
Material		Case: Polybutylene phthalate (PBT)					

* The response frequency was measured by detecting the following rotating disk.

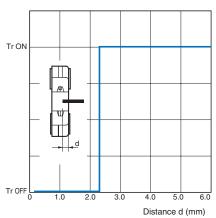


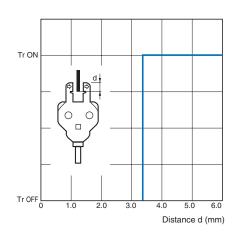


Engineering Data (Typical)

Sensing Position Characteristics

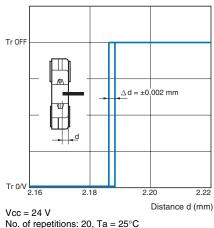
EE-SX770





Sensing Position Characteristics

Repeated Sensing Position Characteristics



Note: The data applies to dark status. Operation may be affected by external light interference or light coming through the sensing object.

I/O Circuit Diagrams

NPN Output Output Model **Timing charts Output circuit** configuration Incident Interrupted Light indicator (red) ON EE-SX770 OFF EE-SX771 Dark-ON Output transistor ON Light indicator (red) EE-SX772 Brown (Vcc) OFF Load (e.g., relay) Operates Load Releases Main Black (OUT) 5 to 24 VDC circui Ŧ (control output) 100 mA max. Incident Interrupted EE-SX870 Light indicator (red) ON Blue (GND) OFF Light-ON EE-SX871 Output transistor ON EE-SX872 OFF Load (e.g., relay) Operates Releases Incident Interrupted Light indicator (red) ON EE-SX770A OFF EE-SX771A Dark-ON ON EE-SX772A Output transistor // Light indicator (red) Brown (Vcc) OFF Load (e.g., relay) Operates Load Releases Black (OUT) Main 5 to 24 VDC Incident circuit (control output) 100 mA max. 4 Interrupted Light indicator (red) ON EE-SX870A OFF Blue (GND) EE-SX871A Light-ON Output transistor ON EE-SX872A OFF Load (e.g., relay) Operates Releases

PNP Output

Model	Output configuration	Timing chart	Output circuit
EE-SX770P EE-SX771P EE-SX772P	Dark-ON	Incident Interrupted Light indicator (red) ON OFF Output transistor ON OFF Load (e.g., relay) Operates Releases	Light indicator (red) Main Black (OUT) Black (OUT)
EE-SX870P EE-SX871P EE-SX872P	Light-ON	Incident Interrupted Light indicator (red) ON OFF Output transistor ON OFF Load (e.g., relay) Operates Releases	Circuit Load Blue (GND)
EE-SX770R EE-SX771R EE-SX772R	Dark-ON	Incident Interrupted Light indicator (red) ON OFF Output transistor OFF Load (e.g., relay) Operates Releases	Light indicator (red) Main Black (OUT) 5 to 24 VDC
EE-SX870R EE-SX871R EE-SX872R	Light-ON	Incident Interrupted Light indicator (red) ON OFF Output transistor ON OFF Load (e.g., relay) Operates Releases	Circuit Load Blue (GND)

Applicable Connectors

2 m or 5 m.

15.8 Vinyl-insulated round cable of 4 dia., 4 cores, (0.2 mm² with 1.1-mm dia. insulator)

E39-ECON M

Note: The
symbol is used to indicate the cable length. The cable length is

0 Vinyl-insulated round cable of 4 dia., 4 cores, (0.2 mm² with 1.1-mm dia. insulator)

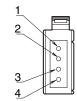
E39-ECONW M

Note: The
symbol is used to indicate the cable length. The cable length is 0.5 to 2 m in increments of 0.1 m.

Shield color	Pin No.	Use
Brown	(1)	Power supply (+V)
White	(2)	
Blue	(3)	Power supply (0 V)
Black	(4)	Output

Note: Pin 2 is not used.

Pre-wired e-CON Connector Pin Arrangement



Note: Pin 2 is not used.

Safety Precautions

OMRON

Refer to Warranty and Limitations of Liability.

🔥 WARNING

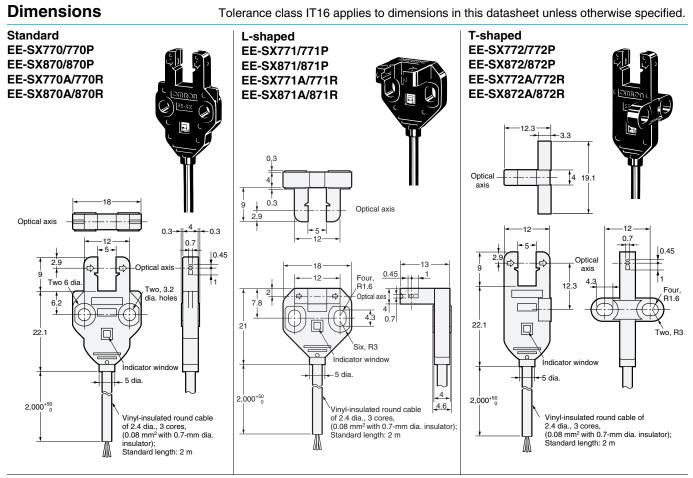
This product is not designed or rated for ensuring safety of persons either directly or indirectly. Do not use it for such purposes.



Precautions for Correct Use

Make sure that this product is used within the rated ambient environment conditions.

(Unit: mm)



МЕМО

Slot-type Photomicrosensor (Non-modulated) +

E-SX47/67

Global Standard Slot-type photomicrosensors with 50- to 100-mA direct switching capacity.

- Series includes models that enable switching between dark-ON and light-ON operation.
- Response frequency as high as 1 kHz.
- Easy operation monitoring with bright light indicator.
- Wide operating voltage range: 5 to 24 VDC
- · Models in which the light indicator turns ON for dark-ON operation are also available.
- A wide range of variations in eight different shapes.
- Flexible robot cable is provided as a standard feature. *2

Be sure to read Safety Precautions on Δ page 59.

*1. Pre-wired Models are available only in the EE-SX67 Series. *2. Only for Pre-wired Models.

Ordering Information

Connoctor

Appearance	Sensing	Connect-	Sensing dis	tance	Output	Indicator mode	Мо	del												
Appearance	method	ing method	Sensing us	stance	configuration	indicator mode	NPN output	PNP output												
Standard					Dark-ON/Light-ON	Incident light	EE-SX670	EE-SX670P												
Trans.					(selectable) *3	No incident light	EE-SX670A	EE-SX670R												
0000					Light-ON	Incident light	EE-SX470	EE-SX470P												
L-shaped					Dark-ON/Light-ON	Incident light	EE-SX671	EE-SX671P												
					(selectable) *3	No incident light	EE-SX671A	EE-SX671R												
1111					Light-ON	Incident light	EE-SX471	EE-SX471P												
T-shaped,					Dark-ON/Light-ON	Incident light	EE-SX672	EE-SX672P												
slot center 7 mm					(selectable) *3	(selectable) *3	No incident light	EE-SX672A	EE-SX672R											
6.08								Light-ON	Incident light	EE-SX472	EE-SX472P									
Close-		eam Connector rpe (4 poles)		Dark-ON/Light-ON	Incident light	EE-SX673	EE-SX673P													
mounting	Through-				(selectable) *3	No incident light	EE-SX673A	EE-SX673R												
CIER	beam type		.	5 mm (slot width)	Light-ON	Incident light	EE-SX473	EE-SX473P												
Close-	(with slot)			() p = - = - ,	()	((/	((((1, p = 1 = 2)	(((. pe.ce)	(1 poioo)	(5)		Dark-ON/Light-ON	Incident light	EE-SX674
mounting					(selectable) *3	No incident light	EE-SX674A	EE-SX674R												
2000					Light-ON	Incident light	EE-SX474	EE-SX474P												
T-shaped, slot center 10 mm	•										•			Dark-ON/Light-ON (selectable) *3	Incident light	EE-SX675	EE-SX675P			
F-shaped											Dark-ON/Light-ON (selectable) *3	Incident light	EE-SX676	EE-SX676P						
R-shaped						Dark-ON/Light-ON (selectable) *3	Incident light	EE-SX677	EE-SX677P											

*3. Dark-ON when the L terminal of the connector is opened, and light-ON when the L terminal and positive (+) terminal are connected. Do not connect the L terminal to 0 V when using dark-ON operation. When using light-ON, it is useful to select the connector EE-1001-1. The L terminal and positive (+) terminal of this connector are connected in advance.





Appearance	Sensing	Sensing distance	Output configura-	Indicator	Connecting method	-	Model	
Appearance	method	Certoing distance	tion	mode		NPN output	PNP output	
tandard						EE-SX670-WR 1M	EE-SX670P-WR 1M	
-shaped	-					EE-SX671-WR 1M	EE-SX671P-WF 1M	
-shaped, lot center mm				EE-SX672-WR 1M	EE-SX672P-WF 1M			
lose- hounting	Through- beam	5 mm	Dark-ON/ Light-ON (selectable) *	Incident light	Pre-wired Models (1m)	EE-SX673-WR 1M	EE-SX673P-WF 1M	
hounting	type (with slot)	(slot width				EE-SX674-WR 1M	EE-SX674P-WF 1M	
-shaped, lot center 0 mm						EE-SX675-WR 1M	EE-SX675P-WF 1M	
-shaped					EE-SX676-WR 1M	EE-SX676P-WF 1M		
-shaped						EE-SX677-WR 1M	EE-SX677P-WF 1M	

* Dark-ON operation can be used when the L terminal is left unconnected or Light-ON operation can be used when the L terminal and positive (+) terminal are connected to each other. Do not connect the L terminal to 0 V when using dark-ON operation.

Accessories (Order Separately) Connector Models

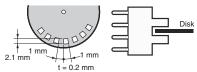
	Туре	Cable length	Model	Remarks	
Connector			EE-1001		
			EE-1001-1	L terminal and positive (+) terminal are already short-circuited.	
			EE-1009		
	Connector with Cable		1 m	EE-1006	
		1	EE-1010		
		2 m	EE-1006		
		2 111	EE-1010		
	Connector with Robot	1 m	EE-1010-R		
	Cable		EE-1010-R		
Connector I	Hold-down Clip		EE-1006A	For EE-1006 only.	

* Refer to Accessories for details.

Ratings and Specifications

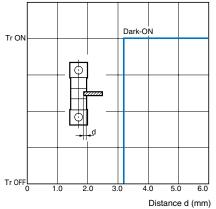
		Туре	Standard	L-shaped	T-shaped, slot center 7 mm	Close-m	nounting	T-shaped, slot center 10 mm	F-shaped	R-shaped
	NPN models	Connector models	EE-SX670 EE-SX670A EE-SX470	EE-SX671 EE-SX671A EE-SX471	EE-SX672 EE-SX672A EE-SX472	EE-SX673 EE-SX673A EE-SX473	EE-SX674 EE-SX674A EE-SX474	EE-SX675	EE-SX676	EE-SX677
	models	Pre-wired models	EE-SX670- WR	EE-SX671- WR	EE-SX672- WR	EE-SX673- WR	EE-SX674- WR	EE-SX675- WR	EE-SX676- WR	EE-SX677- WR
	PNP models	Connector models	EE-SX670P EE-SX670R EE-SX470P	EE-SX671P EE-SX671R EE-SX471P	EE-SX672P EE-SX672R EE-SX472P	EE-SX673P EE-SX673R EE-SX473P	EE-SX674P EE-SX674R EE-SX474P	EE-SX675P	EE-SX676P	EE-SX677P
Item		Pre-wired models	WR	EE-SX671P- WR	EE-SX672P- WR	EE-SX673P- WR	EE-SX674P- WR	EE-SX675P- WR	EE-SX676P- WR	EE-SX677P- WR
-	ng distan	ce	5 mm (slot widt	,						
	ng object		Opaque: 2×0.8	3 mm min.						
	ential dist	ance	0.025 mm							
	source			I	wavelength of 94			`		
Indica			0	7.	U	upted for models	with A or R suffi	x)		
	y voltage			0%, ripple (p-p):		adala)				
Curre	nt consun	nption		ector: 5 to 24 VD	nA max. (PNP m	odels)				
Contro	ol output			100 mA loa 40 mA load OFF curren ctor: 5 to 24 VD0 50 mA load	d current with a r current with a re t (leakage currer C, 50 mA max.	sidual voltage of	0.4 V max.			
Respo	onse frequ	lency *2	1 kHz min. (3 kl		(0	,				
Ambie	ent illumin	nation	1,000 lx max. w	ith fluorescent lig	ght on the surface	e of the receiver.				
Ambie	ent tempe	rature range	Operating: -25	to +55°C, Storag	e: -30 to +80°C	(with no icing or	condensation)			
Ambie	ent humid	ity range	Operating: 5% t	to 85%, Storage:	5% to 95% (with	no icing or cond	ensation)			
Vibrat	ion resist	ance			ak acceleration: 1 n (4-min periods)	00 m/s ²) each in X, Y, and	d Z directions			
Shock	<pre>c resistand</pre>	ce	Destruction: 50	0 m/s ² for 3 times	s each in X, Y, ar	nd Z directions				
Degre	e of prote	ction	IEC60529 IP50							
Conne	ecting me	thod	Connector Models (direct soldering possible), Pre-wired Models (Standard cable length: 1 m), Models with Connectors (Standard cable length: 0.1 m)							
Wei- Connector models Approx. 3.1 g Approx. 3 g Approx. 2.4 g Approx. 2.3 g Approx. 3 g						11 0	Approx. 2.7 g	Approx. 2.2 g	Approx. 2.2 g	
ght	Pre-wire	d models	11 0	11 0	Approx. 17.8 g	Approx. 16.8 g	Approx. 17.1 g	Approx. 18.3 g	Approx. 16.9 g	Approx. 16.9 g
Ma-	Case		Polybutylene ph	nthalate (PBT)						
teri-	Cover		Polycarbonate							
al	Emitter/r	eceiver	. injeanosnato							

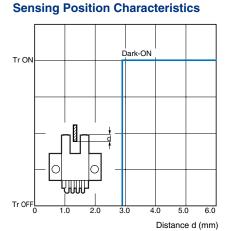
*1. The indicator is a GaP red LED (peak wavelength: 690 nm).
*2. The response frequency was measured by detecting the rotating disk shown at the right.



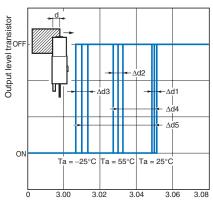
Engineering Data (Typical)

Sensing Position Characteristics





Repeated Sensing Position Characteristics



Distance d (mm) ns: 20 $\Delta d1 = 0.002 \text{ mm}$

Vcc =12 V, No. of repetitions: 20, $\Delta d1 = 0.002$ mm, $\Delta d2 = 0.004$ mm, $\Delta d3 = 0.005$ mm, $\Delta d4 = 0.02$ mm, $\Delta d5 = 0.04$ mm

Note: The data applies to dark status. Operation may be affected by external light interference or light coming through the sensing object.

I/O Circuit Diagrams

NPN Output									
Model	Output configuration	Timing charts	Terminal connections	Output circuit					
EE-SX67□ EE-SX67⊡-WR	Light-ON	Incident Interrupted Light indicator ON (red) OFF Output ON transistor OFF Load Operates (e.g., relay) Releases	Short-circuited between ① terminal and positive ⊕ terminal						
	Dark-ON	Incident Interrupted Light indicator ON (red) OFF Output ON transistor OFF Load Operates (e.g., relay) Releases	Open between ① terminal and positive ⊕ terminal *1	Light indicator (red) Main circuit Coutrol output) Coutrol output) C					
EE-SX670A EE-SX671A EE-SX672A EE-SX673A EE-SX674A	Light-ON	Incident Interrupted Light indicator ON (red) OFF Output ON transistor OFF Load Operates (e.g., relay) Releases	Short-circuited between ① terminal and positive ⊕ terminal	*The terminal arrangement depends on the model. Check the dimensional diagrams.					
	Dark-ON	Incident Interrupted Light indicator ON (red) OFF Output ON transistor OFF Load Operates (e.g., relay) Releases	Open between ① terminal and positive ⊕ terminal *1						
EE-SX470 EE-SX471 EE-SX472 EE-SX473 EE-SX474	Light-ON	Incident Interrupted Light indicator ON (red) OFF Output ON transistor OFF Load Operates (relay) Releases		Light indicator (red) Main circuit Cir					

*1. Do not connect the L terminal to 0 V when using dark-ON operation.

Model	Output configuration	Timing charts	Terminal connections	Output circuit
EE-SX67□P	Light-ON	Incident Interrupted Light indicator ON (red) OFF Output ON transistor OFF Load Operates (relay) Releases	Short-circuited between © terminal and positive ⊕ terminal	
EE-SX67⊡P-WR	Dark-ON	Light indicator ON (red) OFF Output ON transistor OFF Load Operates (relay) Releases	 ① terminal and positive ⊕ terminal Open between ① terminal and positive ⊕ terminal *1 Short-circuited between ① terminal and positive ⊕ terminal Open between ① terminal and positive ⊕ terminal Open between ① terminal and positive ⊕ terminal 	
EE-SX670R EE-SX671R	Light-ON	Incident Interrupted Light indicator ON (red) OFF Output ON transistor OFF Load Operates (e.g., relay) Releases	between () terminal and	*The terminal arrangement depends on the model.
EE-SX672R EE-SX673R EE-SX674R	Dark-ON	Load Operates (e.g., relay) Destree Incident Interrupted Light indicator ON OPER Open between (red) OFF		
EE-SX470P EE-SX471P EE-SX472P EE-SX473P EE-SX474P	Light-ON	Incident Interrupted Light indicator ON (red) OFF Output ON transistor OFF Load Operates (relay) Releases		Light indicator (red) Main circuit CLoad CLoad CLoad

*1. Do not connect the L terminal to 0 V when using dark-ON operation.

Safety Precautions

Refer to Warranty and Limitations of Liability.

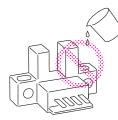
This product is not designed or rated for ensuring safety of persons either directly or indirectly. Do not use it for such purposes.



Precautions for Safe Use

Operating Environment

These Photomicrosensors have an IP50 (conforms to IEC) enclosure and do not have a water-proof or dust-proof structure. Therefore, do not use them in applications in which the sensor will be subjected to splashes from water, oil, or any other liquid. Liquid entering the Sensor may result in malfunction.



Precautions for Correct Use

Make sure that this product is used within the rated ambient environment conditions.

Installation

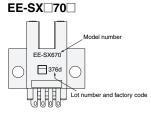
• When direct soldering to the terminals, use the following guidelines. Soldering Conditions

Item	Temper- ature	Permissible time	Remarks					
Soldering iron	350°C max.	3 s max.	The portion between the base of the terminals and the position 1.5 mm from the terminal base must not be soldered.					

 The terminal base uses a polycarbonate resin, which could be deformed by excessive soldering heat, resulting in damage to the product's functionality.

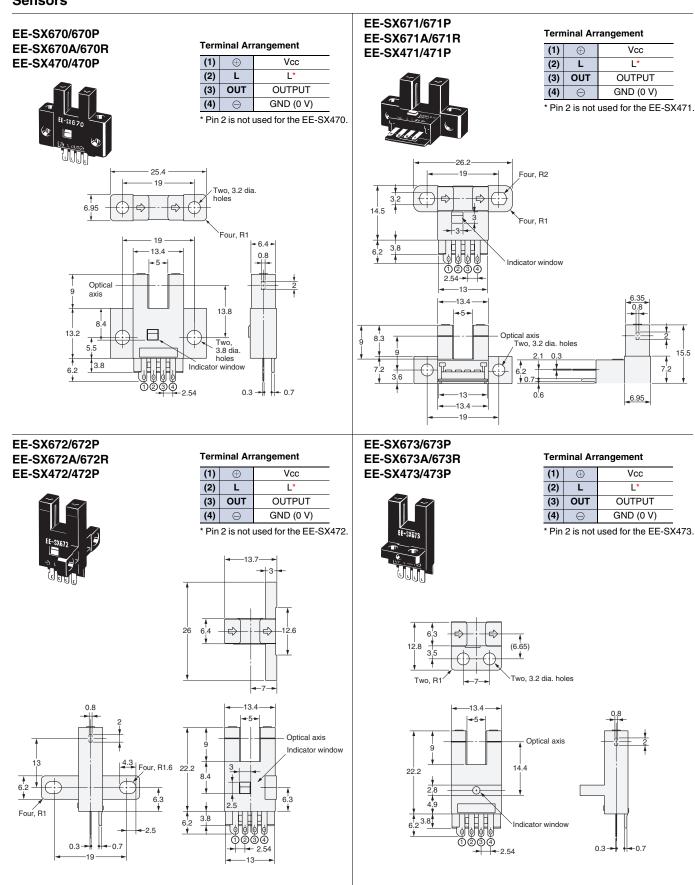
Lot Number and Model Number Legend

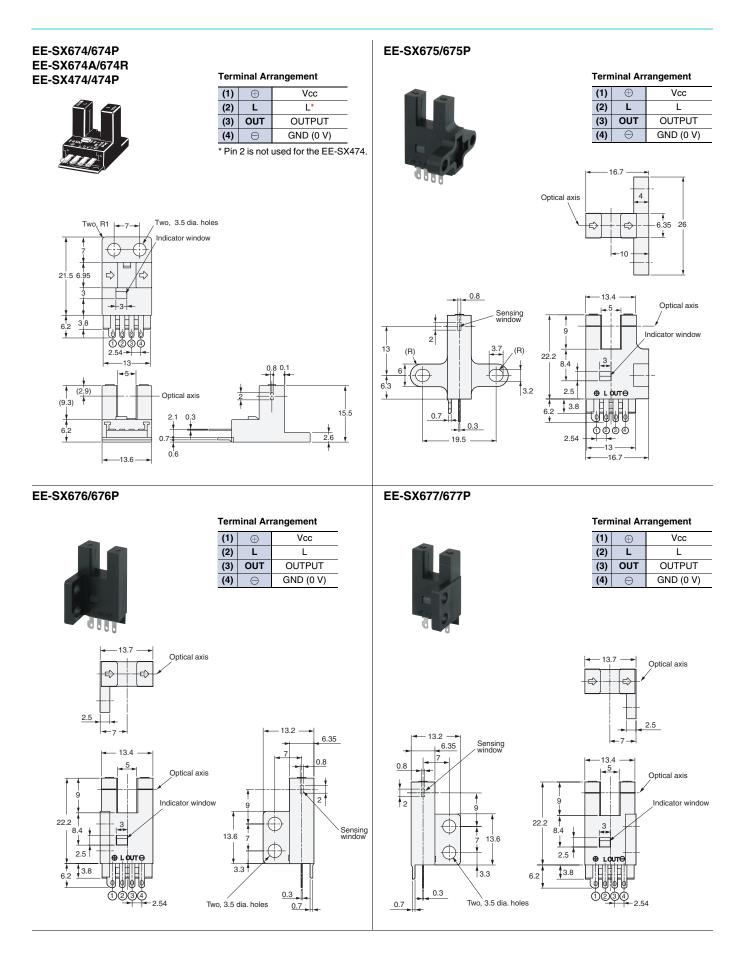
In the following diagrams, 376d indicates the lot number and factory where the product was manufactured. Do not include this code with the model number when ordering.

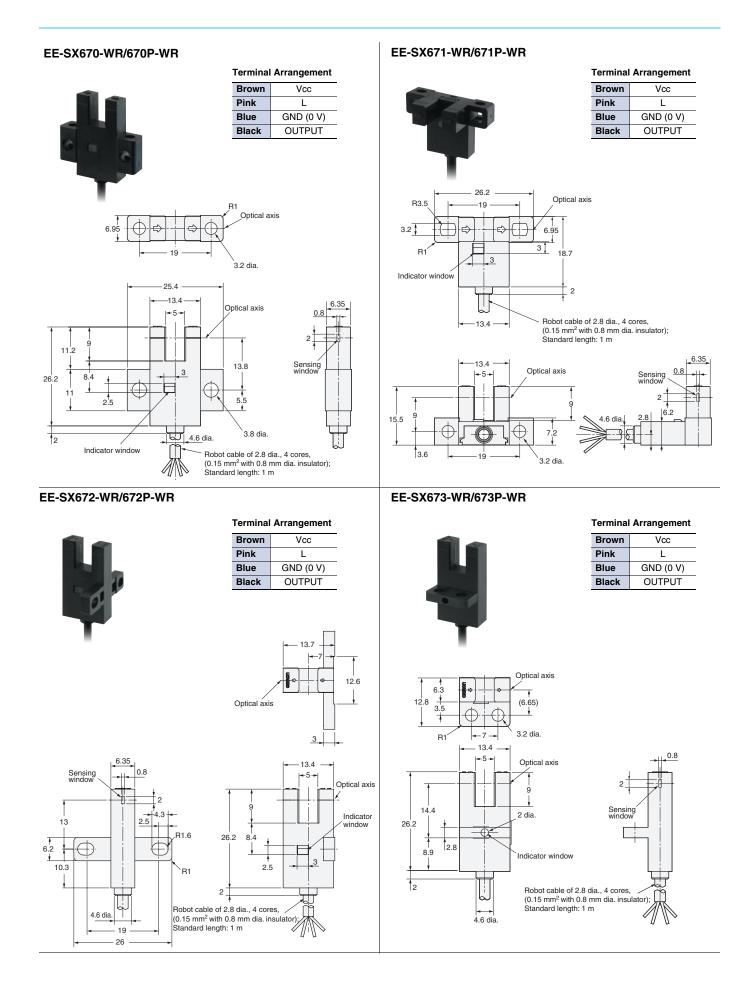


Dimensions

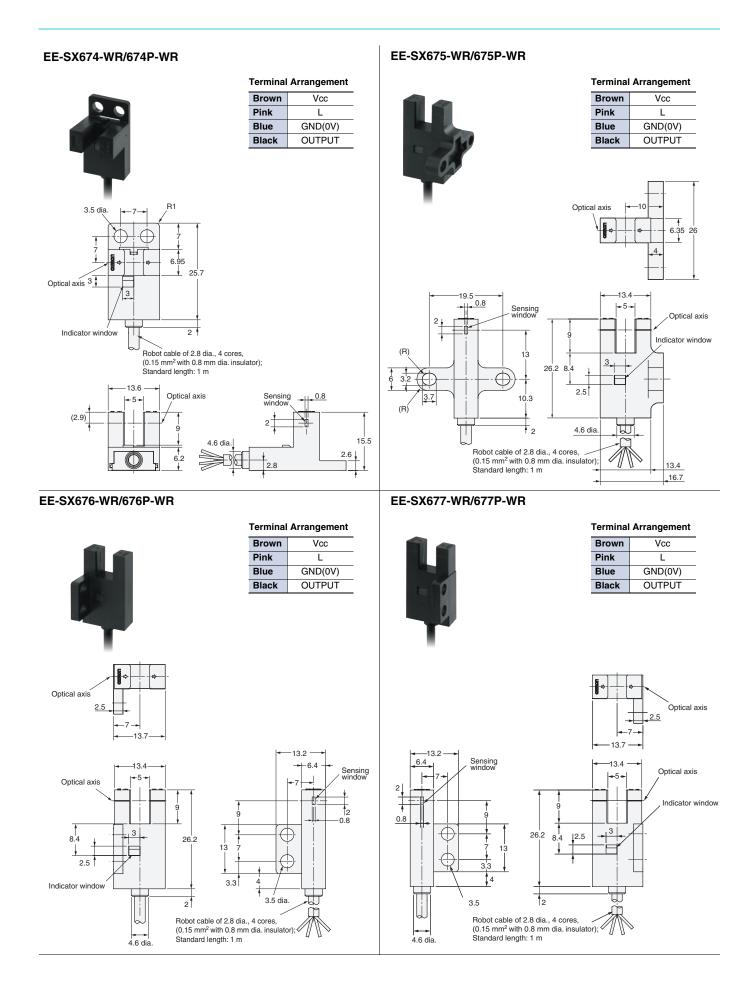
Sensors







OMRON



МЕМО

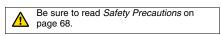
Slot-type Photomicrosensor with Connector (Modulated)

EE-SPX74/84

Photomicrosensor with light modulation for reduced external light interference and a connector for easy maintenance.

• Built-in connectors

- · Select from four easy-to-use shapes for efficient space utilization.
- · Connectors with locks for safety against vibration.
- Convenient mounting method using M3 screws.
- Wide operating voltage range: 5 to 24 VDC



Ordering Information

Sensors

Sensors Infrared light								
Appearance	Sensing method	Sensing distance		Output type	Output configuration	Model		
	Through-beam type (with slot)				Dark-ON	EE-SPX740		
					Light-ON	EE-SPX840		
11		3.	6 mm (slot width)	NPN output	Dark-ON	EE-SPX742		
8					Light-ON	EE-SPX842		
Lf		type (with slot)				Dark-ON	EE-SPX743	
1					Light-ON	EE-SPX843		
					Dark-ON	EE-SPX741		
States and States			5 mm (slot width)		Light-ON	EE-SPX841		

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Accessories (Order Separately) **Connector with Cable**

Туре	Cable length	Model
Connector	1 m	EE-1013

* Refer to Accessories for details.

CE

EE-SPX74/84

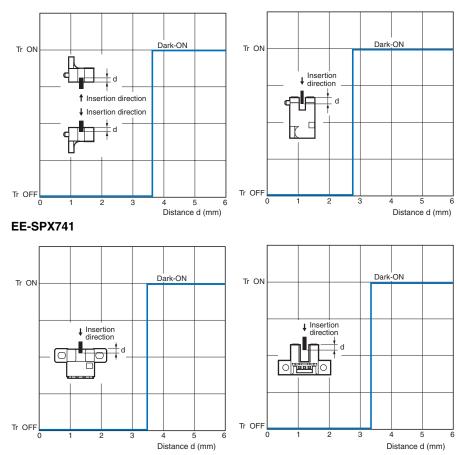
Ratings and Specifications

Item	Models	EE-SPX740, EE-SPX840 EE-SPX742, EE-SPX842 EE-SPX743, EE-SPX843	EE-SPX741 EE-SPX841			
Sensing dis	Sensing distance 3.6 mm (slot width) 5 mm (slot width)			 *1. The indicator is a GaAlAs red LED (peak wavelength: 660 nm). 		
Sensing ob	ject	Opaque: 1 \times 0.5mm min.	Opaque: 2×0.8 mm min.	*2. The response frequency detecting the following re-	was measured by	
Differential	distance	0.05 mm max.			olaling disk.	
Light sourc	e	GaAs infrared LED (pulse lighting) with a	peak wavelength of 940 nm			
Indicator *1		Light indicator (red)			Disk	
Supply volt	age	5 to 24 VDC ±10%, ripple (p-p): 5% max.		2 mm 2 mm 4 2 mm		
Current cor	nsumption	Average: 15 mA max.; Peak: 50 mA max				
Control out	put	NPN voltage output: Load power supply voltage: 5 to 24 VD Load current: 50 mA max. OFF current: 0.5 mA max. 50 mA load current with a residual voltag 10 mA load current with a residual voltag	Disk	EE-SPX741/841		
Response f	requency *2	500 Hz min.				
Ambient illu	umination	3,000 lx max. with incandescent light or s receiver				
Ambient ter range	nperature	Operating: -10 to +55°C Storage: -25 to +65°C				
Ambient hu	midity range	Operating: 5% to 85% Storage: 5% to 95%		EE-SPX742/842 EE-SPX743/843	EE-SPX740/840	
Vibration resistance Destruction: 10 to 55 Hz, 1.5-mm double amplitude for Y, and Z directions		amplitude for 2 h each in X,	-			
Shock resis	Shock resistance Destruction: 500 m/s² for 3 times each in X, Y, and Z directions			-		
Degree of p	Degree of protection IEC IP50			-		
Connecting	method	Special connector	-			
Weight Approx. 2.4 g		Approx. 2.4 g		-		
Material	Case Holder	Polycarbonate	-			
	noidei	1				

Engineering Data (Typical)

Sensing Position Characteristics

EE-SPX740/742/743



EE-SPX74/84

I/O Circuit Diagrams

NPN Output

Model	Output configuration	Timing charts	Output circuit
EE-SPX740 EE-SPX741 EE-SPX742 EE-SPX743	Dark-ON	Incident Interrupted Light indicator ON (red) OFF Output ON transistor OFF Load 1 Operates (relay) Releases H Output 2 L	Light indicator (red) Main Main Load 1 - 5 to 24 VDC
EE-SPX840 EE-SPX841 EE-SPX842 EE-SPX843	Light-ON	Incident Interrupted Light indicator ON (red) OFF Output ON transistor OFF Load 1 Operates (relay) Releases Load 2 H	* Voltage output (when the sensor is connected to a transistor circuit)

Safety Precautions

Refer to Warranty and Limitations of Liability.

<u> WARNING</u>

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

Make sure that this product is used within the rated ambient environment conditions.

Design

Cable Extension

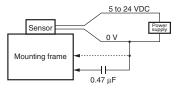
- When extending the cable, use an extension cable with conductors having a total cross-section area of 0.15 mm². The total cable length must be 4 m maximum.
- To use a cable length longer than 4 m, attach a capacitor with a capacitance of approximately 10 μF to the wires as shown below. The distance between the terminal and the capacitor must be within 4 m. (Use a capacitor with a dielectric strength that is at least twice the Sensor's power supply voltage.)



• Make sure the total length of the power cable connected to the product is less than 10 m even if a capacitor is inserted.

Effects of Inductive Noise

When there is inductive noise in the Sensor mounting frame (metal), the output of the Sensor may be affected. In this case, ensure that there is no electrical potential difference between the Sensor 0-V terminal and the Sensor mounting frame, or attach a 0.47 μF capacitor between the 0-V terminal and the frame.

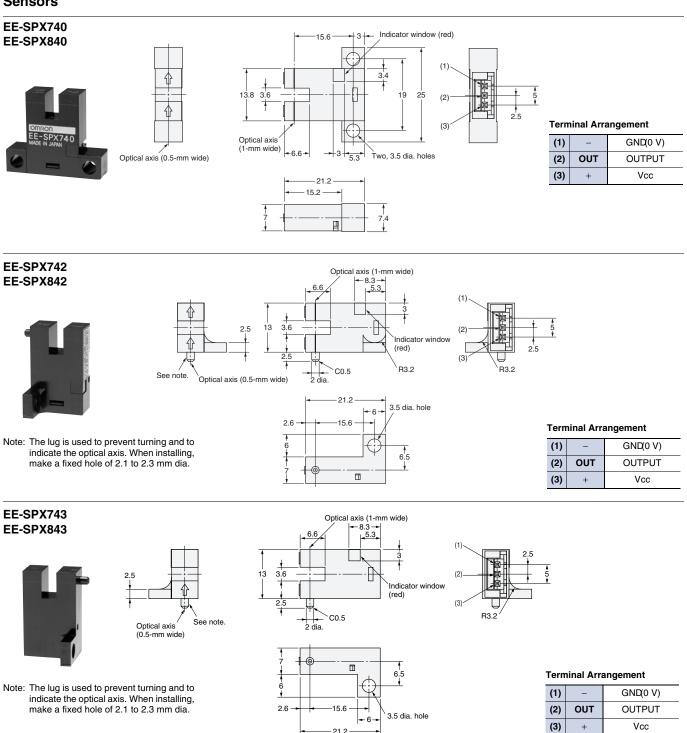


EE-SPX74/84

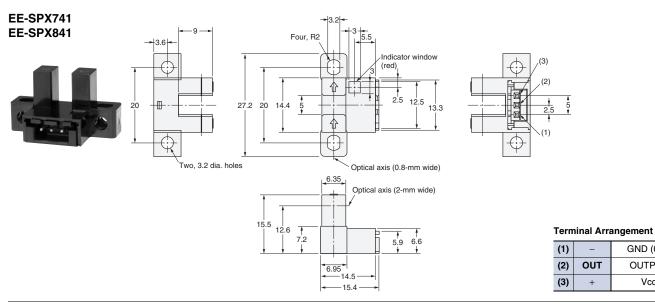
(Unit: mm)

Dimensions

Sensors

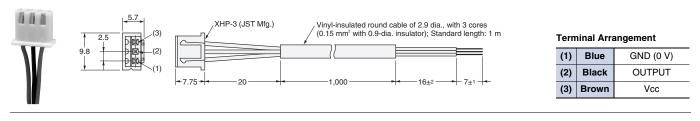


21.2



Accessories (Connector with Cable)





GND (0 V)

OUTPUT

Vcc

Cat. No. E833-E1-03 In the interest of product improvement, specifications are subject to change without notice.

70

Slot-type Photomicrosensor with Cable

EE-SPX-W

Photomicrosensor with built-in amplifier and attached cable reduces external light interference.

- Light modulation effectively reduces external light interference.
- Wide operation voltage range: 5 to 24 VDC
- Easy operation monitoring with bright light indicator.



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Be sure to read *Safety Precautions* on page 73.

Ordering Information

						Infrared light
Appearance	Sensing method	Sensing distance (slot width)	Output type	Output configuration	Cable length	Model
Ĩ				Dark-ON		EE-SPX302-W2A 1M
		3.6 mm		Light-ON		EE-SPX402-W2A 1M
	Through-beam type		3.6 mm NPN output 3.6 mm	Dark-ON	- 1 m -	EE-SPX304-W2A 1M
		3.6 mm		Light-ON		EE-SPX404-W2A 1M
				Dark-ON		EE-SPX306-W2A 1M
		3.6 mm		Light-ON		EE-SPX406-W2A 1M
			_	Dark-ON		EE-SPX305-W2A 1M*
		5 mm		Light-ON		EE-SPX405-W2A 1M*

* These models (EE-SPX305/405-W2A only) are not conformed to CE standards.

EE-SPX-W

Ratings and Specifications

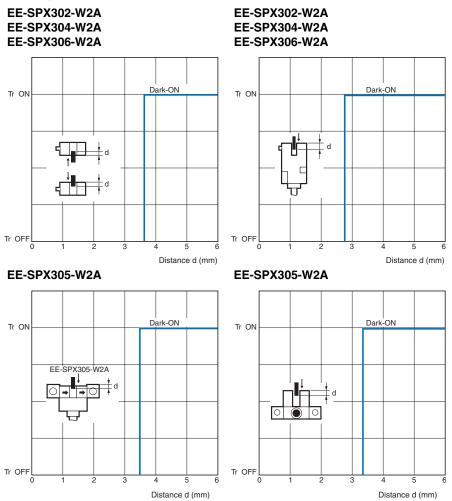
Item	Models	EE-SPX302-W2A, EE-SPX402-W2A EE-SPX304-W2A, EE-SPX404-W2A EE-SPX306-W2A, EE-SPX406-W2A	EE-SPX305-W2A EE-SPX405-W2A			
	tanco	3.6 mm (slot width)	5 mm (slot width)	*1. The indicator is a GaP red LED		
•		Opaque: 1×0.5 mm min.	(peak wavelength: 700 nm).			
Differential	•			detecting the following rotating disk.		
Light sourc		GaAs infrared LED (pulse lighting) with a peak wavelength of 940 nm		•		
Indicator *1	<u> </u>	Light indicator (red)				
Supply volt	age	5 to 24 VDC ±10%, ripple (p-p): 5% max	2 mm 2 mm 2 mm 2 mm			
Current cor	-	Average: 15 mA max.; Peak: 50 mA max				
Control out	put	NPN voltage output: Load power supply voltage: 5 to 24 VD Load current: 80 mA max. OFF current: 0.5 mA max. 80 mA load current with a residual voltag 10 mA load current with a residual voltag	EE-SPX305			
Response f	requency *2	500 Hz min.				
Ambient illu	umination	3,000 lx max. with incandescent light or sunlight on the surface of the receiver				
Ambient temperature range Operating: -10 to +55°C Storage: -25 to +65°C						
Ambient hu	midity range	Operating: 5% to 85% Storage: 5% to 95%	EE-SPX302-W2A EE-SPX306			
Vibration re	sistance	Destruction: 10 to 55 Hz, 1.5-mm double Y, and Z directions				
Shock resis	stance	Destruction: 500 m/s ² for 3 times each in	-			
Degree of p	Degree of protection IEC IP50		-			
Connecting method		Pre-wired (standard cable length: 1 m)				
Weight		18.5 g		-		
Material	Case	Polycarbonate		-		
Material	Holder					

I/O Circuit Diagrams

NPN Output

Model	Output configuration	Timing charts	Output circuit
EE-SPX402-W2A EE-SPX404-W2A EE-SPX405-W2A EE-SPX406-W2A	Light-ON	Incident Interrupted Light indicator ON (red) OFF Output ON transistor OFF Load 1 Operates (relay) Releases Load 2 H	Light indicator (red) Brown Load 1 Main Black Black Black Black
EE-SPX302-W2A EE-SPX304-W2A EE-SPX305-W2A EE-SPX306-W2A	Dark-ON	Incident Interrupted Light indicator ON (red) OFF Output ON transistor OFF Load 1 Operates (relay) Releases Load 2 H	* Voltage output (when the sensor is connected to a transistor circuit)

Sensing Position Characteristics



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.

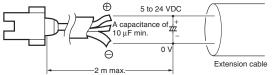


Precautions for Correct Use

Make sure that this product is used within the rated ambient environment conditions.

• Wiring

- When extending the cable, use an extension cable with conductors having a total cross-section area of 0.3 mm². The total cable length must be 2 m maximum.
- To use a cable length longer than 2 m, attach a capacitor with a capacitance of approximately 10 μ F to the wires as shown below. The distance between the terminal and the capacitor must be within 2 m. (Use a capacitor with a dielectric strength that is at least twice the Sensor's power supply voltage.)

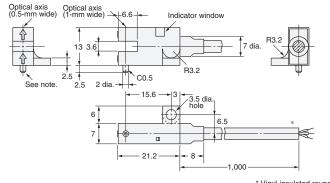


• Make sure the total length of the power cable connected to the product is less than 10 m even if a capacitor is inserted.

EE-SPX-W

Dimensions

EE-SPX302-W2A EE-SPX402-W2A

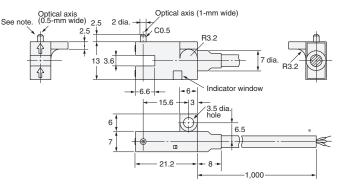


* Vinyl-insulated round cable of 3.5 dia., 3 cores, (0.14 mm² with 1.0-dia. insulator); Standard length: 1 m (Unit: mm)

Note: The lug is used to prevent turning and to indicate the optical axis. When installing, make a fixed hole of 2.1 to 2.3 mm dia.

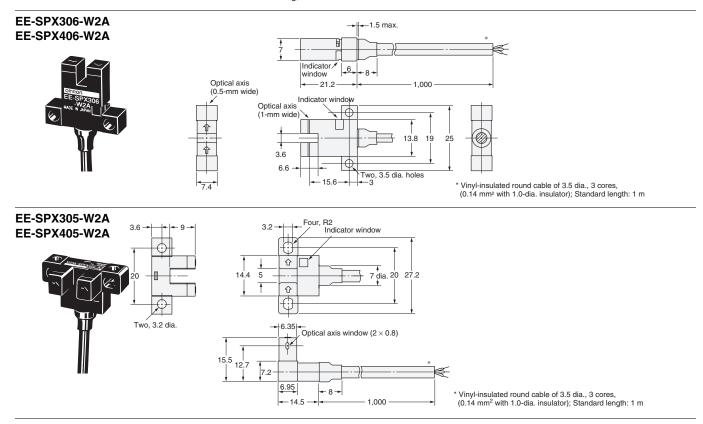
EE-SPX304-W2A EE-SPX404-W2A





* Vinyl-insulated round cable of 3.5 dia., 3 cores, (0.14 mm² with 1.0-dia. insulator); Standard length: 1 m

Note: The lug is used to prevent turning and to indicate the optical axis. When installing, make a fixed hole of 2.1 to 2.3 mm dia.



Tolerance class IT16 applies to dimensions in this datasheet unless otherwise specified.

Broad Slot-type Photomicrosensor

EE-SPX303N/403N

A Wide Slot Width of 13 mm and Superior Resistance to Light Interference and Noise.

- Noise resistance equivalent to photomicrosensors with built-in amplifiers.
- Resistance to common noise at least 30 times that of previous models.
- Resistance to inverter noise at least 10 times that of previous models.
- Reverse polarity protection built in.



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Infrared light

Be sure to read *Safety Precautions* on page 77.

Ordering Information

Sensors

Appearance	Sensing method	Sensing distance (slot width)	Output type	Output configuration	Model		
	Through-beam type (with slot)		NPN output	Dark-ON	EE-SPX303N		
1 0							
Elementa Contractioner and Contraction		(slot width)		Light-ON	EE-SPX403N		

Accessories (Order Separately)

	Туре	Cable length	Model
Connector			EE-1001
			EE-1009
		1 m	EE-1006
	Connector with	1 111	EE-1010
	Cable	2 m	EE-1006
		2 111	EE-1010
	Connector with	1 m	EE-1010-R
	Robot Cable	2 m	EE-1010-R
NPN/PNP Co	nversion Connector	0.46 m (total length)	EE-2002

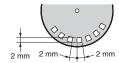


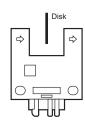
EE-SPX303N/403N

Ratings and Specifications

Item Models	EE-SPX303N, EE-SPX403N			
Sensing distance	13 mm (slot width)			
Sensing object	Opaque: 2.2×0.5 mm min.			
Differential distance	0.05 mm max.			
Light source	Infrared LED (pulse lighting) with a peak wavelength of 940 nm			
Indicator	Light indicator (red)			
Supply voltage	12 to 24 VDC ±10%, ripple (p-p): 5% max.			
Current consumption	15 mA max.			
Control output	 NPN voltage output: Load power supply voltage: 12 to 24 VDC Load current: 80 mA max. OFF current: 0.5 mA max. 80 mA load current with a residual voltage of 2.0 V max. 10 mA load current with a residual voltage of 1.0 V max. 			
Protection circuits	Power supply reverse polarity protection, Output reverse polarity protection			
Response frequency *	100 Hz min.			
Ambient illumination	3,000 lx max. with incandescent light or sunlight on the surface of the receiver.			
Ambient temperature range	Operating: -10 to +55°C Storage: -25 to +65°C			
Ambient humidity range	Operating: 5% to 85% Storage: 5% to 95%			
Vibration resistance	Destruction: 10 to 55 Hz, 1.5-mm double amplitude for 2 h each in X, Y, and Z directions			
Shock resistance	Destruction: 500 m/s ² for 3 times each in X, Y, and Z directions			
Degree of protection	IEC IP50			
Connecting method	Special connector (soldering not possible)			
Weight	Approx. 4 g			
Material	Polycarbonate			

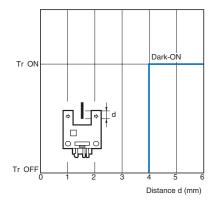
* The response frequency was measured by detecting the following rotating disk.

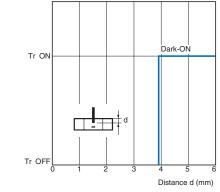




Engineering Data (Typical)

Sensing Position Characteristics EE-SPX303N





I/O Circuit Diagrams

NPN Output

Model	Output configuration	Timing charts	Output circuit
EE-SPX403N	Light-ON	Incident Interrupted Light indicator ON (red) OFF Output ON transistor OFF Load 1 Operates (relay) Releases	Light indicator (red) Main Main
EE-SPX303N	Dark-ON	Incident Interrupted Light indicator ON (red) OFF Output ON transistor OFF Load 1 Operates (relay) Releases Load 2 H	* Voltage output (when the sensor is connected to a transistor circuit)

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.

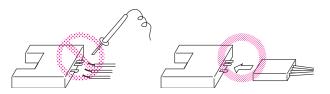


Precautions for Correct Use

Make sure that this product is used within the rated ambient environment conditions.

Wiring

• Connection is made using a connector. Do not solder to the pins (leads). The pins (leads) are soldered to the internal board of the Sensor. Therefore, direct soldering of the pins (leads) may result in an internal disconnection causing malfunction.



- When extending the cable, use an extension cable with conductors having a total cross-section area of 0.3 mm². The total cable length must be 2 m maximum.
- To use a cable length longer than 2 m, attach a capacitor with a capacitance of approximately 10 μF to the wires as shown below. The distance between the terminal and the capacitor must be within 2 m. (Use a capacitor with a dielectric strength that is at least twice the Sensor's power supply voltage.)



• Make sure the total length of the power cable connected to the product is less than 10 m even if a capacitor is inserted.

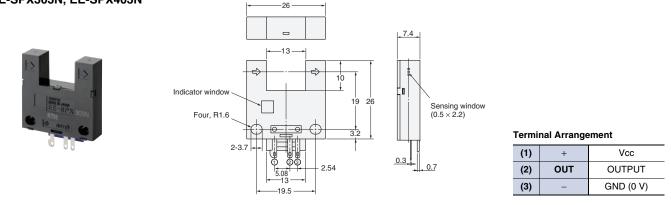
EE-SPX303N/403N

Dimensions

Tolerance class IT16 applies to dimensions in this datasheet unless otherwise specified.

Sensors





Accessories (Order Separately)

Long-distance Through-beam Photomicrosensor

EE-SPW311/411

Through-beam Photomicrosensor with a sensing distance as long as 1 m.

- Easy operation monitoring with bright light indicator.
- Wide operating voltage range: 5 to 24 VDC
- Light modulation effectively reduces external light interference.
- Easy-to-wire connector assures ease of maintenance.





Ordering Information

Senso	rs						Infrared light
A	ppearance	Sensing method	Sensing	distance	Output type	Output configuration	Model
		Through-beam			NPN	Dark-ON	EE-SPW311
		type		_/ 1m	output	Light-ON	EE-SPW411

* Both an EE-1006L Connector with Cable for the Emitter and an EE-1006D Connector with Cable for the Receiver are included with the Photomicrosensor. Refer to *Accessories* when using non-standard connectors, including Robot Cables and PNP Adapters.

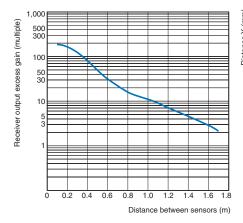
EE-SPW311/411

Ratings and Specifications

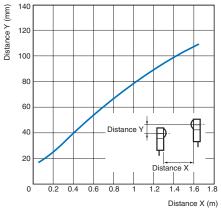
Item	Models	EE-SPW311, EE-SPW411	
J		1 m	
Sensing object		Opaque: 5 mm dia. min.	-
Directional angle		5 to 20°	-
Light source		GaAs infrared LED (pulse lighting) with a peak wavelength of 940 nm	-
Indicator *1		Light indicator (red)	-
Supply volta	age	5 (-5%) to 24 (+10%) VDC, ripple (p-p): 5% max.	-
Current con	sumption	Emitter: 20 mA max., Receiver: 20 mA max.	-
Control output		NPN open collector: Load power supply voltage: 5 to 24 VDC Load current: 100 mA max. OFF current: 0.5 mA max. 100 mA load current with a residual voltage of 0.8 V max. 10 mA load current with a residual voltage of 0.4 V max.	-
Response fr	requency *2	100 Hz min.	-
Ambient illu	mination	3,000 lx max. with incandescent light on the surface of the receiver	*1. The indicator is a GaP red LED
Ambient ten range	nperature	Operating: -10 to +55°C Storage: -25 to +65°C	 (peak wavelength: 700 nm). *2. The response frequency was measured by detecting the following rotating disk.
Ambient hu	midity range	Operating: 5% to 85% Storage: 5% to 95%	ू द <i>ट्र</i>
Vibration rea	sistance	Destruction: 200 to 2,000 Hz (peak acceleration: 100 m/s ²) 1.5-mm double amplitude for 2 h (4-min periods) each in X, Y, and Z directions	5 mm
Shock resist	tance	Destruction: 500 m/s ² for 3 times each in X, Y, and Z directions	5 mm - 5 mm
Degree of protection		IEC IP60	- 1m
Connecting method		Special connector (soldering not possible)	
Weight (packaged)		Approx. 8.8 g	
Material		Polybutylene phthalate (PBT)	· · · · · · · · · · · · · · · · · · ·
Materia	Lens	Polycarbonate	╴└┉╴┙╵└┉┤
Accessories	;	EE-1006L/D Connectors with Cables, Instruction Manual	· ····································

Engineering Data (Typical)

Receiver Output Excess Gain Vs. Sensing Distance Characteristics



Parallel Movement Characteristics



I/O Circuit Diagrams

NPN Output

Model	Output configuration	Timing charts	Output circuit		
EE-SPW411	Light-ON	Incident Interrupted Light indicator ON (red) OFF Output ON transistor OFF Load 1 Operates (relay) Releases	Light indicator		
EE-SPW311	Dark-ON	Incident Interrupted Light indicator ON (red) OFF Output ON transistor OFF Load 1 Operates (relay) Releases			

Safety Precautions

Refer to Warranty and Limitations of Liability.

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

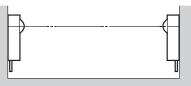
Make sure that this product is used within the rated ambient environment conditions.

- Wiring
- Connection is made using a connector. Do not solder to the pins (leads).
- When extending the cable, use an extension cable with conductors having a total cross-section area of 0.3 mm². The total cable length must be less than 10 m.

• Axis Adjustment

(1)Tentatively mount the emitter and receiver so that the center of each lens is in a single line.

Side view





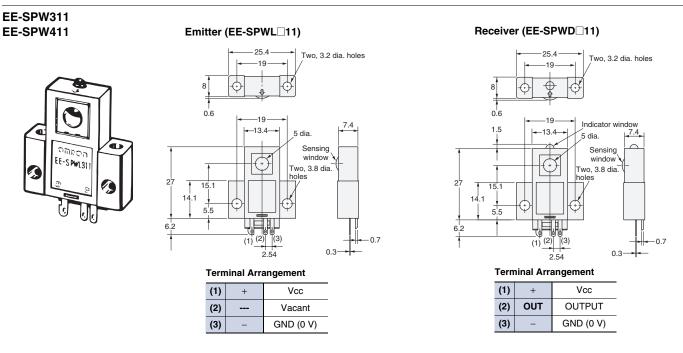
- (2)Turn ON the emitter and receiver after making sure that they have been wired correctly. When power is turned ON, the light indicator on the receiver will light. Make sure that the light indicator is OFF when an object intercepts the optical axis and that the light indicator lights again when the object is removed.
- (3)Fix the position of the receiver (or emitter) securely, move the emitter (or receiver) horizontally and vertically to check the range in which the operation indicator is lit. Then locate the emitter (or receiver) in the center of the range and fix the position securely.



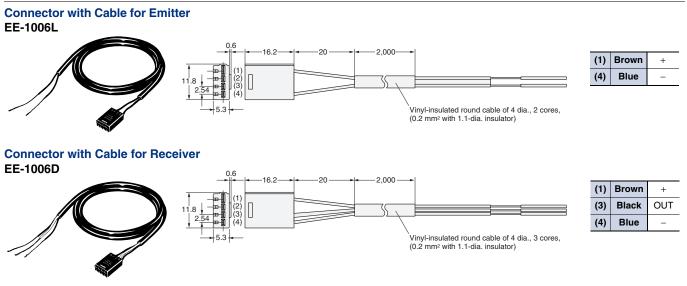
EE-SPW311/411

Dimensions

Sensors



Accessories (Included)



Note: These cables can also be ordered separately.

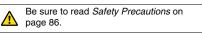
Pre-wired Photomicrosensor with Amplifier and Cable

EE-SPW321/421

Compact, Thin-profile Photomicrosensor with special amplifier.

- \bullet Slim amplifier (50 \times 7.5 \times 12 mm) can be handled like a cable.
- Provided with two operation indicators, enabling monitoring from the housing and sensor head.
- Simple wiring with a 3-conductor cable.
- Wide operating voltage range: 12 to 24 VDC





Ordering Information

Sensing method	Sensing	distance	Output type	Output configuration	Cable length	Cable length from emitter to amplifier	Model
				Dark-ON		0.5 m	EE-SPW321
Through-beam type	300 mm		NPN output	Daik-ON	2 m	1 m	EE-SPW321-A
		mm				0.5 m	EE-SPW421
		Light-ON	Light-ON		1 m	EE-SPW421-A	

EE-SPW321/421

Ratings and Specifications

Item	Models	EE-SPW321, EE-SPW421	EE-SPW321-A, EE-SPW421-A		
Sensing distance		300 mm *1			
Sensing object		Opaque: 2 mm dia. min. *2			
Directional angle		10° to 40°			
Light source		GaAs infrared LED (pulse lighting) with a peak w	vavelength of 940 nm		
Indicator		Light indicator (Red LEDs, one each on Sensor a	and Amplifier)		
Supply voltage		12 to 24 VDC ±10%, ripple (p-p): 5% max.			
Current consumption		Average: 30 mA max.			
Control output		NPN open collector, Load power supply voltage: 12 to 24 VDC, Load current: 100 mA max., OFF current: 0.5 mA max. Residual voltage: 1 V max (at a 100-mA load current)			
Response time		1 ms max. for both detection and reset			
Ambient illumination		3,000 lx max. (incandescent light); 10,000 lx max. (sunlight) on the receiver			
Ambient temperature	range	-20 to +55°C			
Ambient humidity rang	je	5% to 85%			
Vibration resistance		Destruction: 10 to 55 Hz, 1.5-mm double amplitude for 2 h each in X, Y, and Z directions			
Shock resistance		500 m/s ²			
Degree of protection		IEC IP64			
Connecting method		Pre-wired (standard cable length: 2 m)			
Cable length from emi amplifier	tter (receiver) to	0.5 m	1 m		
Weight (Packaged)		76 g			
Material Case Lens		ABS resin			
		Acrylate resin			
Accessories		Slits: 0.5×3 mm, 1×3 mm, 3×0.5 mm, 3×1 mm (one each) Sems screws with spring washers and flat washers: Six M2.6 \times 12 Instruction Manual			

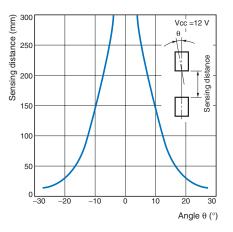
*1. Refer to *Receiver Output Vs. Sensing Distance Characteristics* on the next page.
*2. Detection of objects up to 0.5 mm wide is possible by using slit installation.

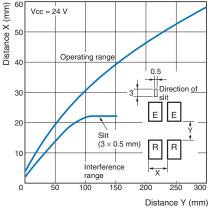
Engineering Data (Typical)

Receiver Output vs. Distance Characteristics

EE-SPW321/421

Sensing Angle Characteristics EE-SPW321/421





Mutual Interference

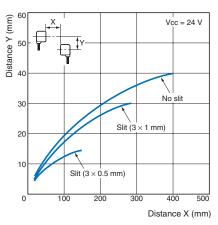
EE-SPW321/421

Sensing Distance vs. Input Voltage EE-SPW321/421

800 700 700 700 600 700 90 700 600 700 400 700 400 700 100 100 100 12 14 16 18 20 22 24 Voltage (V)

Parallel Movement Characteristics

EE-SPW321/421



I/O Circuit Diagrams

NPN Output
Model

Model	Output configuration	Timing charts	Output circuit		
EE-SPW421(-A)	Light-ON	Incident Interrupted Light indicator ON (red) OFF Output ON transistor OFF	Light indicator (red) Main Main Harris Load Black Harris Load Harris Load H		
EE-SPW321(-A)	Dark-ON	Incident Interrupted Light indicator ON (red) OFF Output ON transistor OFF			

Infrared light

Sensing Distance with slit installed

Slit typeSensing distanceSensing objectNone300 mmOpaque: 2 mm dia. min.1 × 3 mm or 3 × 1 mm200 mmOpaque: Greater than the slit0.5 × 3 mm or 3 × 0.5 mm100 mmOpaque: Greater than the slit

EE-SPW321/421

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.

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Precautions for Correct Use

Make sure that this product is used within the rated ambient environment conditions.

Wiring

Connections

The length of the standard cable is 10 m max. (including the cable attachment, AWG24 min.). When extending the Sensor wires, use a wire greater than AWG 22 in diameter and a cable shorter than 100 m. If the cable length exceeds 10 m, the supply voltage applied at the Sensor terminal will decrease as the impedance of the extended cable increases and the low level output voltage at the cable end will increase. Therefore, take voltage fluctuation into account when extending the Sensor cable.

Mounting

Tighten the mounting screws to a torque of 0.54 N·m max.

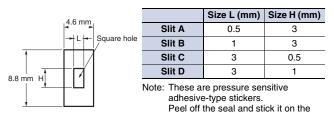
Adjustment

Aperture Stickers

Two kinds of reticles are attached, the 0.5-mm and the 1.0-mm width types (total of 4 stickers with slit widths A to D as shown in the following diagram).

Use these when the sensing object is 2 mm or smaller or when mutual interference must be reduced.

For each slit of the same type, attach a sticker to the sensing surface of the emitter and receiver.

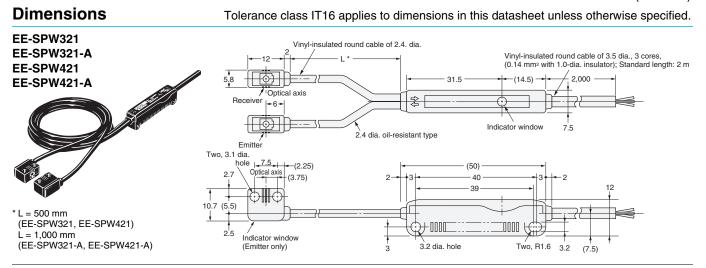


lens

Optical Axis Adjustment

- (1)Set the Sensor so that the center of the lens in the emitter and receiver form one line.
- (2)Having checked that the Sensor is correctly wired, turn ON the power. The operation indicator on the amplifier of the emitter will light. Check to make sure the light goes ON and OFF when an opaque object is moved in and out between the emitter and receiver.
- (3)Move the emitter (or receiver) up and down, left and right and secure the emitter (or receiver) in the center of the range of the operation indicator. Secure the receiver (or emitter) in the same way after adjustment is complete.

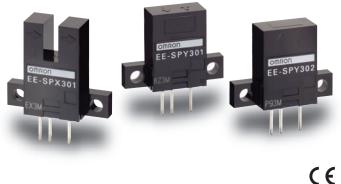
(Unit: mm)

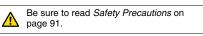


Slot-type Reflective Photomicrosensor EE-SPX301/401 EE-SPY30/40

Photomicrosensor with light modulation is not influenced by external light.

- Voltage-output models with wide operating voltage range (5 to 24 VDC).
- Fitted with an easy-to-adjust optical axis mark.
- Easy adjustment and optical axis monitoring with a light indicator.





Ordering Information

Sensors	Infra	red light			
Appearance	Sensing method	Sensing distance	Output type	Output configuration	Model
	Through-beam type			Dark-ON	EE-SPX301
	(with slot)	3.6 mm (slot width)		Light-ON	EE-SPX401
Horizontal type				Dark-ON	EE-SPY301
	Reflective type	5 mm	NPN output	Light-ON	EE-SPY401
Vertical type				Dark-ON	EE-SPY302
	Reflective type	5 mm		Light-ON	EE-SPY402

Accessories (Order Separately)

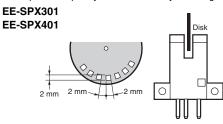
Туре		Cable length	Model	Remarks
Connector			EE-1002	
Connector	Connector with Cable	1 m	EE-1003	
NPN/PNP Conversion Connector		0.46 m (total length)	EE-2001	
Connector Hold-down Clip			EE-1003A	For EE-1003 only.

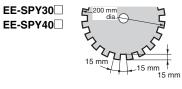
EE-SPX301/401 EE-SPY30/40

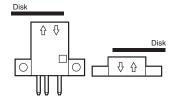
Ratings and Specifications

Sensing method	Through-beam type (with slot)	Reflective type			
Item Models	EE-SPX301, EE-SPX401	EE-SPY301, EE-SPY401 EE-SPY302, EE-SPY402			
Sensing distance	3.6 mm (slot width)	5 mm (Reflection factor: 90%; white paper 15×15 mm) *1			
Sensing object	Opaque: 1×0.5 mm min.				
Differential distance	0.05 mm max.	0.2 mm max. (with a sensing distance of 3 mm, horizontally)			
Light source GaAs infrared LED with a peak wavelength of 940 nm					
Indicator *2 Light indicator (red)					
Supply voltage	Iy voltage 5 to 24 VDC ±10%, ripple (p-p): 5% max.				
Current consumption	Average: 15 mA max., Peak: 50 mA max.				
Control output Control output NPN voltage output: Load power supply voltage: 5 to 24 VDC Load current: 80 mA max. OFF current: 0.5 mA max. 80 mA load current with a residual voltage of 1.0 V max. 10 mA load current with a residual voltage of 0.4 V max.					
Response frequency *3	500 Hz min.	100 Hz min.			
Ambient illumination	3,000 Ix max. with incandescent light or sunlight on th	he surface of the receiver			
Ambient temperature range	Operating: -10 to +55°C Storage: -25 to +65°C (with no icing)				
Ambient humidity range	Operating: 5% to 85% Storage: 5% to 95% (with no condensation)				
Vibration resistance	Destruction: 10 to 55 Hz, 1.5-mm double amplitude for	or 2 h each in X, Y, and Z directions			
Shock resistance	Destruction: 500 m/s ² for 3 times each in X, Y, and Z	directions			
Degree of protection	IEC IP50				
Connecting method	Special connector (soldering not possible)				
Weight	Approx. 2.6 g				
Material Case Polycarbonate					

*1. Operation may not be possible near the Sensor.
*2. The indicator is a GaP red LED (peak wavelength: 700 nm).
*3. The response frequency was measured by detecting the following rotating disk.

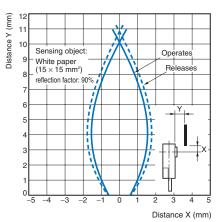




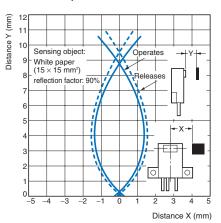


Operating Range Characteristics

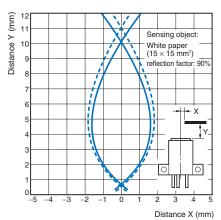
EE-SPY301, EE-SPY401

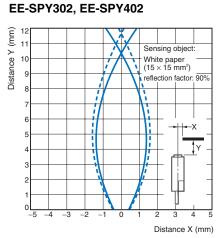


EE-SPY301, EE-SPY401



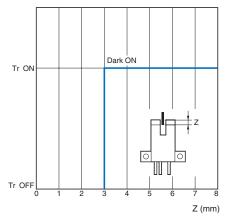
EE-SPY302, EE-SPY402



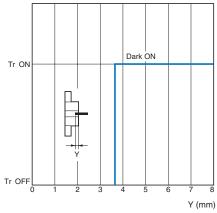


Sensing Position Characteristics

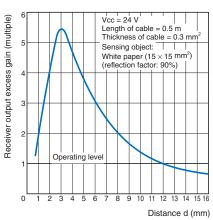
EE-SPX301 (Z Direction)



EE-SPX301 (Y Direction)

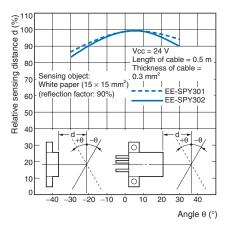


Receiver Output Excess Gain vs. Sensing Distance Characteristics EE-SPY



Sensing Angle vs. Sensing Distance Characteristics

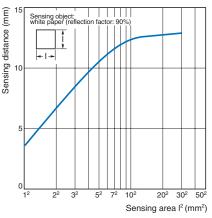
EE-SPY



Sensing Distance vs. Object Area

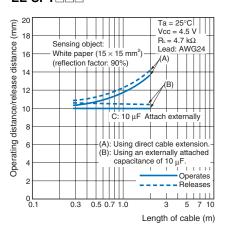
Characteristics

EE-SPY



Dependency on Cable Length for

Operation Distance/Release Distance



EE-SPX301/401 EE-SPY30/40

I/O Circuit Diagrams

NPN Output

Model	Output configuration	Timing charts	Output circuit
EE-SPX401 EE-SPY401 EE-SPY402	Light-ON	Incident Interrupted Light indicator ON (red) OFF Output ON transistor OFF Load 1 Operates (relay) Releases	Light indicator (red)
EE-SPX301 EE-SPY301 EE-SPY302	Dark-ON	Incident Interrupted Light indicator ON (red) OFF Output ON transistor OFF Load 1 Operates (relay) Releases	* Voltage output (when the sensor is connected to a transistor circuit)

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

Make sure that this product is used within the rated ambient environment conditions.

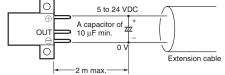
Mounting

The sensing distance for the EE-SPY Reflective-type Photomicrosensor with built-in amplifier varies from 8 to 20 mm depending on the product (90% reflective white paper). Do not place glossy objects in the background of the sensing object.

Wiring

- Connection is made using a connector. Do not solder to the pins (leads).
- When extending the cable, use an extension cable with conductors having a total cross-section area of 0.3 mm². The total cable length must be 2 m maximum.
- To use a cable length longer than 2 m, attach a capacitor with a capacitance of approximately 10 μF to the wires as shown below. The distance between the terminal and the capacitor must be within 2 m.

(Use a capacitor with a dielectric strength that is at least twice the Sensor's power supply voltage.)



[•] Make sure the total length of the power cable connected to the product is less than 10 m even if a capacitor is inserted.

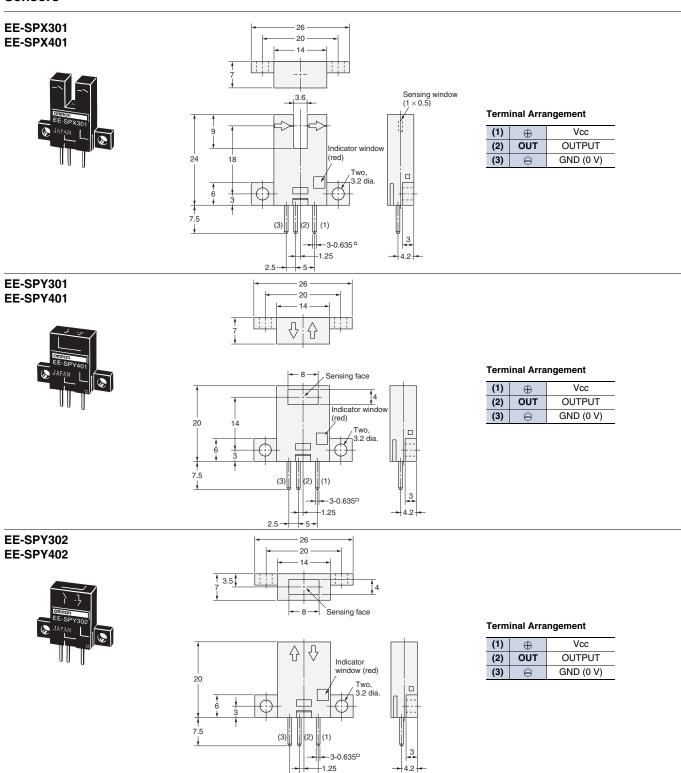
EE-SPX301/401 EE-SPY30/40

(Unit: mm)

Dimensions

Tolerance class IT16 applies to dimensions in this datasheet unless otherwise specified.

Sensors



- 5-

2.5

Accessories (Order Separately)

Light Convergent Reflective Photomicrosensor

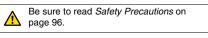
EE-SPY31/41

Accurately detects objects placed in front of shiny Background.

- A shiny background can be used as long as the distance between the sensor and the background is 20 mm or more.
- Detects minute objects such as a 0.05-mm-dia. pure copper wire.
- Small dispersion in sensing distance.
- Light modulation effectively reduces external light interference.
- Wide operating voltage range: 5 to 24 VDC



CE



Ordering Information

Sensors

Infrared light

Appearance	Sensing method	Sensing distance		Output type	Output configuration	Model
Horizontal type					Dark-ON	EE-SPY311
sypc Lec	Convergent reflective type				Light-ON	EE-SPY411
Vertical type		2 to 5	2 to 5 mm	NPN output	Dark-ON	EE-SPY312
lype e					Light-ON	EE-SPY412

Accessories (Order Separately)

	Туре	Cable length	Model
Connector			EE-1001
			EE-1009
		1 m	EE-1006
Connector with Cable		1 111	EE-1010
		2 m	EE-1006
			EE-1010
	Connector with Robot	1 m	EE-1010-R
Cable		2 m	EE-1010-R
NPN/PNP (Conversion Connector	0.46 m (total length)	EE-2002

EE-SPY31/41

Ratings and Specifications

Item	Models	EE-SPY311, EE-SPY411, EE-SPY312, EE-SPY412	
Sensing dista	ance	2 to 5 mm (Reflection factor: 90%; white paper 15×15 mm)	
Minimum sensing object		Pure copper wire (0.05 mm dia.)	
Distance to background *1		20 mm max. (glass with aluminum deposition)	*1.
Differential distance		0.2 mm (with a sensing distance of 3 mm, horizontally)	Sensing object
Light source		GaAs infrared LED with a peak wavelength of 940 nm	Background object
Indicator *2		Light indicator (red)	(glass with aluminum deposition)
Supply voltage	ge	5 to 24 VDC ±10%, ripple (p-p): 5% max.	20 mm
Current cons	umption	Average: 15 mA max., Peak: 50 mA max.	Distance to background
Control output		 NPN voltage output: Load power supply voltage: 5 to 24 VDC Load current: 80 mA max. OFF current: 0.5 mA max. 80 mA load current with a residual voltage of 1.0 V max. 10 mA load current with a residual voltage of 0.4 V max. 	 *2. The indicator is a GaP red LED (peak wavelength: 700 nm). *3. The response frequency was measured by detecting the following rotating disk.
Response frequency *3		100 Hz min.	The start
Ambient illumination		3,000 lx max. with incandescent light or sunlight on the surface of the receiver	15 mm 15 mm 15 mm
Ambient temperature range		Operating: -10 to +55°C Storage: -25 to +65°C	Disk Disk
Ambient humidity range		Operating: 5% to 85% Storage: 5% to 95%	
Vibration resistance		Destruction: 10 to 50 Hz, 1.5-mm double amplitude for 2 h each in X, Y, and Z directions	EE-SPY311/411
Shock resistance		Destruction: 500m/s ² for 3 times each in X, Y, and Z directions	EE-SPY312/412
Degree of protection		IEC IP50	EE-5PY312/412
Connecting method		Special connector (soldering not possible)	
Weight		Approx. 2.6 g	
Material	Case	Polycarbonate	
material	Holder	Polybutylene phthalate (PBT)	_

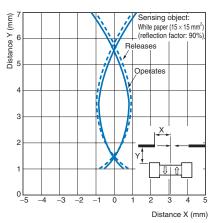
I/O Circuit Diagrams

NPN Output

Model	Output configuration	Timing charts	Output circuit
EE-SPY411 EE-SPY412	Light-ON	Incident Interrupted Light indicator ON (red) OFF Output ON transistor OFF Load 1 Operates (relay) Releases	Light indicator (red) Main circuit Light indicator 0UT Load 1 0UT - Ic - Ic
EE-SPY311 EE-SPY312	Dark-ON	Incident Interrupted Light indicator ON (red) OFF Output ON transistor OFF Load 1 Operates (relay) Releases	* Voltage output (when the sensor is connected to a transistor circuit)

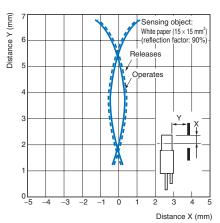
Operating Range Characteristics

EE-SPY311/411

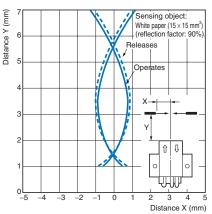


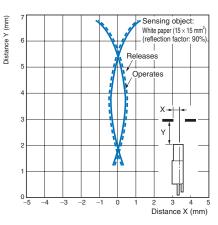
EE-SPY311/411

EE-SPY312/412



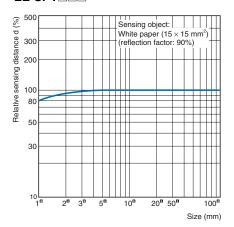
EE-SPY312/412





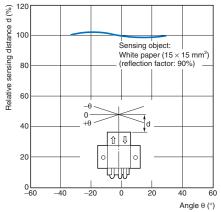
Sensing Distance vs. Object Area Characteristics

EE-SPY



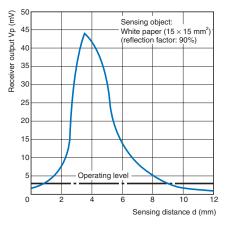
Sensing Angle vs. Sensing Distance Characteristics

EE-SPY312/412



Receiver Output vs. Sensing Distance Characteristics

EE-SPY



EE-SPY31/41

Safety Precautions

Refer to Warranty and Limitations of Liability.

📐 WARNING

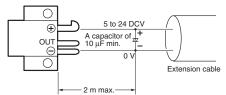
This product is not designed or rated for ensuring safety of persons either directly or indirectly. Do not use it for such purposes.

Precautions for Correct Use

Make sure that this product is used within the rated ambient environment conditions.

Wiring

- Connection is made using a connector. Do not solder to the pins (leads).
- When extending the cable, use an extension cable with conductors having a total cross-section area of 0.3 mm². The total cable length must be 2 m maximum.
- To use a cable length longer than 2 m, attach a capacitor with a capacitance of approximately 10 μF to the wires as shown below. The distance between the terminal and the capacitor must be within 2 m. (Use a capacitor with a dielectric strength that is at least twice the Sensor's power supply voltage.)

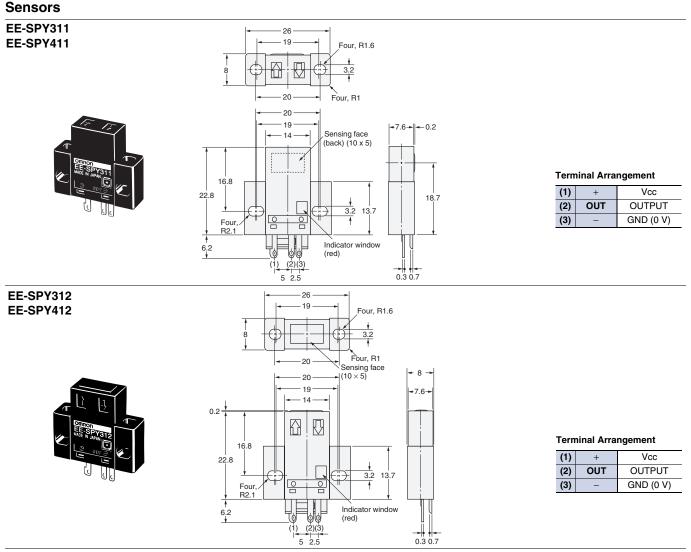


• Make sure the total length of the power cable connected to the product is less than 10 m even if a capacitor is inserted.

(Unit: mm)

Dimensions

Tolerance class IT16 applies to dimensions in this datasheet unless otherwise specified.



Accessories (Order Separately)

Reflective Photomicrosensor with Sensitivity Adjuster (Non-modulated)

EE-SY671/672

Photomicrosensor with sensitivity adjuster.

- Easy adjustment with a built-in sensitivity adjuster.
- Easy optical axis monitoring with a bright light indicator.
- Compact design incorporating a built-in amplifier and special IC enables direct switching capacity of up to 100 mA.
- Wide operating voltage range: 5 to 24 VDC
- Connection possible with a range of ICs, relays, and Programmable Controllers (PLCs).



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Ordering Information

Sensor	rs						Infrared light
	Appearance	Sensing method	Sensing dista	ance	Output type	Output configuration	Model
Horizo 1	ontal training the second seco	_ Reflective type	1 to	o 5 mm	NPN output	Dark-ON or Light-ON	EE-SY671
Vertical 1	type					(Selectable) *	EE-SY672

* The Dark-ON/Light-ON (selectable) models are normally used as dark-ON models. To use them as light-ON models, short-circuit the L terminal and positive (+) terminal.

An EE-1001-1 Connector with the terminals already short-circuited is also available.

Accessories (Order Separately)

	Туре	Cable length	Model	Remarks
Connector			EE-1001	
			EE-1001-1	L terminal and positive (+) terminal are already short-circuited.
			EE-1009	
		1 m	EE-1006	
	Connector with Cable		EE-1010	
	Connector with Cable	0	EE-1006	
		2 m	EE-1010	
-	Connector with Robot Cable	1 m	EE-1010-R	
	Connector with Robot Cable	2 m	EE-1010-R	

EE-SY671/672

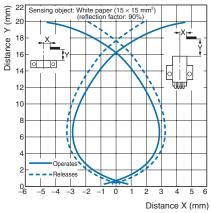
Ratings and Specifications

Item					
Sensing distance		1 to 5 mm (Reflection factor: 90%; white paper 15×15 mm)	-		
Sensing object		Transparent or opaque: 15×15 mm min.	-		
Differential distance		0.5 max. (with a sensing distance of 3 mm, horizontally)	-		
		GaAs infrared LED with a peak wavelength of 940 nm	-		
Indicator *1		Light indicator (red)	-		
Supply volt	age	5 to 24 VDC ±10%, ripple (p-p): 10% max.	-		
Current cor	nsumption	40 mA max.	-		
Control output		 NPN open collector: Load power supply voltage: 5 to 24 VDC Load current: 100 mA max. OFF current: 0.5 mA max. 100 mA load current with a residual voltage of 0.8 V max. 40 mA load current with a residual voltage of 0.4 V max. 	-		
Response f	requency *2	50 Hz min. (Average: 500 Hz)	*1. The indicator is a GaP red LED		
Ambient illumination *3		1,500 lx max. with fluorescent light on the surface of the receiver	 (peak wavelength: 690 nm). *2. The response frequency was measured by 		
Ambient temperature range		Operating: -25 to +55°C Storage: -30 to +80°C	detecting the following rotating disk.		
Ambient humidity range		Operating: 5% to 85% Storage: 5% to 95%	dia.		
Vibration resistance		Destruction: 20 to 2,000 Hz (peak acceleration: 100 m/s ²) 1.5-mm double amplitude for 2 h (4-min periods) each in X, Y, and Z directions	15 mm 15 mm 15 mm		
Shock resis	stance	Destruction: 500m/s ² for 3 times each in X, Y, and Z directions	Disk		
Degree of protection		IEC IP50	-		
Connecting method		Special connector (direct soldering possible)	Disk		
Weight		Approx. 3.5 g (including screwdriver for adjustment)			
Case Polybutylene phthalate (PBT)		Polybutylene phthalate (PBT)			
Material Emitter/ Polycarbonate		EE-SY672			
Accessorie	s	Screwdriver for adjustment	surface of the receiver.		

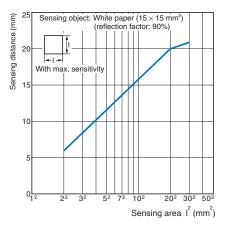
Operating Range Characteristics

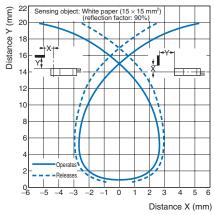
(Max. Sensitivity)

EE-SY67



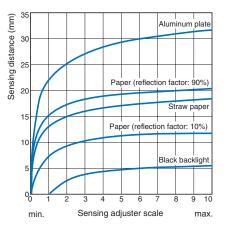
Sensing Distance vs. Object Area Characteristics





EE-SY67

Sensing Distance vs. Sensitivity Volume



I/O Circuit Diagrams

NPN Output

Model	Output configuration	Timing charts	Terminal connections	Output circuit
EE-SY671	Light-ON	Incident Interrupted Light indicator ON (red) OFF Output ON transistor OFF Load 1 Operates (relay) Releases	Short-circuited between © terminal and positive ⊕ terminal	Light indicator
EE-SY672	E-SY672 Dark-ON Dark-ON Dark	Main circuit B B Circuit Circu		

EE-SY671/672

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.

\bigcirc

Precautions for Correct Use

Make sure that this product is used within the rated ambient environment conditions.

• Wiring

Soldering

• When direct soldering to the terminal, use the following guidelines. Soldering Conditions

Item	Temperature	Permissible time	Remarks
Soldering iron	350°C max.	3 s max.	The portion between the base of the terminals and the position 1.5 mm from the terminal base must not be soldered.

• The terminal base uses a polycarbonate resin, which could be deformed by excessive soldering heat, resulting in damage to the product's functionality.

Cable Extension

• When extending the cable, use an extension cable with conductors having a total cross-section area of 0.3 mm². The total cable length must be less than 10 m.

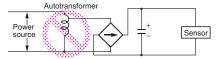
Installation

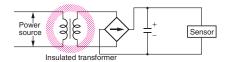
The photomicrosensor is built into the device being used and so is not equipped to deal with interference from an external light source. When using the sensor in an area exposed to an incandescent lamp, install so as to minimize the effects of external light sources.

Sensitivity Adjustment

Use the special screwdriver (sold together) for sensitivity adjustment.

- When an excessive force is applied to sensitivity adjuster, it may be damaged.
- The shaft of the sensitivity adjuster is charged. Connect a DC power supply incorporating an insulated transformer to the photomicrosensor. Do not connect a DC power supply incorporating an autotransformer or the user may receive an electric shock when adjusting the sensitivity.





Sensitivity Adjustment with Background Object

		Point A	Point B	Setting	Check
Sens- ing condi- tions	Ad- juster indi- cator	Background object		Background object Black paper with small reflection factor	
	stment edure	1. Set the sensitivity of the photomicrosensor to minimum, place the sensing object in the sensing position, turn the sensitivity adjuster clockwise slowly until the light indicator is lit (point A).	2. Remove the sensing object, at which time the light indicator will be OFF. Further turn the sensitivity adjuster clockwise slowly until the light indicator is lit again (point B). The operation indicator will not light again if the background object does not reflect light, in which case refer to 'Sensitivity Adjustment with No Background Object''.	 Set the sensitivity adjuster at the center (point C) between point A and B. Points A and B will be very close if the sensor is influenced by excessive light reflected by the background object, in which case take the following preventive measures. Separate the sensor and the background object by a distance of 20 mm min. Cover the surface of the background object with a material with a small reflection factor, such as black sponge. 	4. After setting the sensitivity adjuster to point C, check if the light indicator is lit on placing the sensing object at the sensing position and not lit on removing the sensing object.

Sensitivity Adjustment with No Background Object

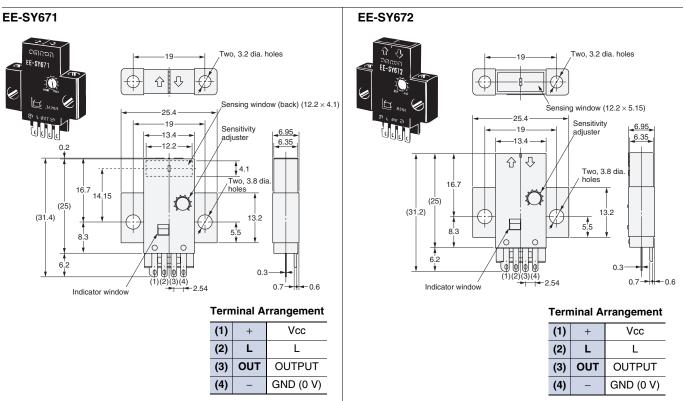
		Point A	Point B	Check
Sens- ing condi- tions	Ad- juster indi- cator			
Adjustment Procedure		1. Set the sensitivity of the photomicrosensor to minimum, place the sensing object at the sensing position, turn the sensitivity adjuster clockwise slowly until the light indicator is lit (point A).	2. Set the sensitivity adjuster at the center (point C) between points A and B (the point where the sensitivity is maximum).	 After setting the sensitivity adjuster to point C, check if the light indicator is not lit on removing the sensing object.

EE-SY671/672

Dimensions

Tolerance class IT16 applies to dimensions in this datasheet unless otherwise specified.

Sensors



Accessories (Order Separately)

Retroreflective Photomicrosensor with Lens

EE-SPZ-A

Photomicrosensor with light modulation for reduced external light interference.

- Easy adjustment and optical axis monitoring with a light indicator.
- Wide operating voltage range: 5 to 24 VDC
- Supports connection with Programmable Controllers (PLCs).
- Easy-to-wire connectors assure easy maintenance.



Be sure to read *Safety Precautions* on page 105.

Ordering Information

Sensors

Infrared light

Appearance	Sensing method	Sensing di	stance	Output type	Output configuration	Model
	Retroreflective type		200 mm	NPN output	Dark-ON	EE-SPZ301-A
					Light-ON	EE-SPZ401-A

Accessories (Order Separately)

	Туре	Cable length	Model	Remarks
Connector			EE-1002	
	Connector with Cable	1 m	EE-1003	
NPN/PNP Conversion Connector 0.46 m (total length)			EE-2001	
Connector Hold-o	lown Clip	+	EE-1003A	For EE-1003 only.
Reflector			E39-R1	

* Refer to Accessories for details.

* Refer to the E39-L/F39-L/E39-S/E39-R Datasheet for information on Reflectors.

EE-SPZ-A

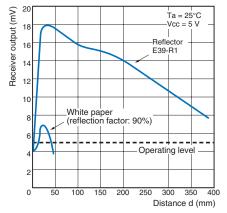
Ratings and Specifications

Item	Models	EE-SPZ301-A, EE-SPZ401-A			
Sensing dist	tance *1	200 mm (using E39-R1 reflector)			
Light source		GaAs infrared LED (pulse lighting) with a peak wavelength of 940 nm			
Indicator *2		Light indicator (red)			
Supply voltage		5 to 24 VDC ±10%, ripple (p-p): 5% max.			
Current cons	sumption	Average: 15 mA max., Peak: 50 mA max.			
Control output		NPN voltage output Load power supply voltage: 5 to 24 VDC Load current: 80 mA max. OFF current: 0.5 mA max. 80 mA load current with a residual voltage of 1.0 V max. 10 mA load current with a residual voltage of 0.4 V max.			
Response fr	equency *3	100 Hz min.			
Ambient illu	mination	3,000 lx max. with incandescent light or sunlight on the surface of the receiver	*1. Operation may not be possible near the sensor. *2. The indicator is a GaP red LED (peak wavelength: 700 nm).		
Ambient tem	perature range	Operating: -10 to +55°C Storage: -25 to +65°C	*3. The response frequency was measured by detecting the following rotating disk.		
Ambient hur	midity range	Operating: 5% to 85% Storage: 5% to 95%	Reflector		
Vibration res	sistance	Destruction: 10 to 55 Hz, 1.5-mm double amplitude for 2 h each in X, Y, and Z directions			
Shock resistance		Destruction: 500 m/s ² for 3 times each in X, Y, and Z directions	60 mm f 40 mm		
Degree of protection		IEC IP50			
Connecting method		Special connector (soldering not possible)			
Weight (pacl	kaged)	Approx. 3 g			
Material	Case	Polycarbonate	000		
material	Lens				

Engineering Data (Typical)

Receiver Output Excess Gain vs. Sensing Distance Characteristics

EE-SPZ301-A + E39-R1 Reflector EE-SPZ401-A



EE-SPZ-A

I/O Circuits

NPN Output

Model	Output configuration	Timing charts	Output circuit
EE-SPZ401-A	Light-ON	Incident Interrupted Light indicator ON (red) OFF Output ON transistor OFF Load 1 Operates (relay) Releases Load 2 H	Light indicator
EE-SPZ301-A	Dark-ON	Incident Interrupted Light indicator ON (red) OFF Output ON transistor OFF Load 1 Operates (relay) Releases	* Voltage output (when the sensor is connected to a transistor circuit)

Safety Precautions

Refer to Warranty and Limitations of Liability.

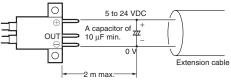
This product is not designed or rated for ensuring safety of persons either directly or indirectly. Do not use it for such purposes.

Precautions for Correct Use

Make sure that this product is used within the rated ambient environment conditions.

Wiring

- Connection is made using a connector. Do not solder to the pins (leads).
- When extending the cable, use an extension cable with conductors having a total cross-section area of 0.3 mm². The total cable length must be 2 m maximum.
- To use a cable length longer than 2 m, attach a capacitor with a capacitance of approximately 10 μ F to the wires as shown below. The distance between the terminal and the capacitor must be within 2 m. (Use a capacitor with a dielectric strength that is at least twice the Sensor's power supply voltage.)

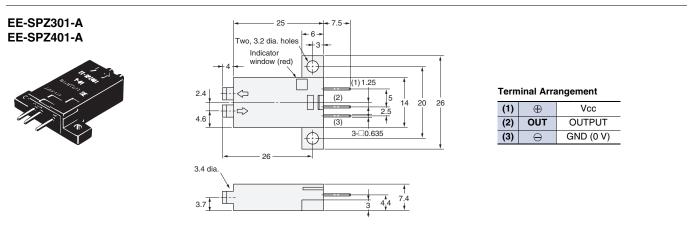


• Make sure the total length of the power cable connected to the product is less than 10 m even if a capacitor is inserted.

EE-SPZ-A

Dimensions

Sensors



* Refer to Accessories for details.
 * Refer to the E39-L/F39-L/E39-S/E39-R Datasheet for information on Reflectors.

Pipe-mounting Liquid Level Photomicrosensor with Built-in Amplifier

EE-SPX613

Liquid Level Photomicrosensor with operation mode and sensitivity selectors for easy application.

- Operation mode selector allows modes to be switched easily.
- Sensitivity selector is suitable for any 6- to 13-mm-diameter transparent or semi-transparent pipe with a wall thickness of 1 mm.
- Uses a clean (with no powder parting agent) cable.
- Operating voltage range: 12 to 24 VDC





Ordering Information

Appearance	Sensing method	Output type	Output configuration	Cable length	Model
	Through-beam type	NPN output	Dark-ON or Light-ON (selectable)	1 m	EE-SPX613 1M

EE-SPX613

Ratings and Specifications

Item Mode	IS EE-SPX613					
Applicable pipe	Any 6- to 13-mm-diameter pipe with a wall thickness of 1 mm that is made of FEP or any other material as transparent as FEP.					
Sensing object	Liquids in pipes (High-viscosity liquids or liquids with floating materials may not be detected.)					
Light source	GaAs infrared LED with a peak wavelength of 940 nm					
Indicator	Light indicator GaP (Red LED: Peak wavelength of 700 nm)					
Supply voltage	12 to 24 VDC ±10%, ripple (p-p): 5% max.					
Current consumption	Average: 30 mA max., Peak: 80 mA max.					
Control output	 NPN open collector: Load power supply voltage: 5 to 24 VDC Load current: 100 mA max. OFF current: 0.5 mA max. 100 mA load current with a residual voltage of 0.8 V max. 40 mA load current with a residual voltage of 0.4 V max. 					
Ambient illumination	3,000 lx max. with incandescent light or sunlight on the surface of the receiver					
Ambient temperature range	Operating: -10 to +55°C Storage: -25 to +65°C (with no icing or condensation)					
Ambient humidity range	Operating: 5% to 85% Storage: 5% to 95% (with no condensation)					
Vibration resistance	Destruction: 10 to 500 Hz, 1.0-mm single amplitude or 150 m/s ² in X, Y, and Z directions 3 times and for 11 min each					
Shock resistance	Destruction: 500 m/s ² for 3 times each in X, Y, and Z directions					
Degree of protection	IEC 60529 IP50					
Connecting method	Pre-wired (Standard length: 1 m)					
Weight (packed state	Approx. 55 g					
Material Case Cover	Polycarbonate					
Accessories	Support belt (2), slip protection tube (2), Instruction Manual					

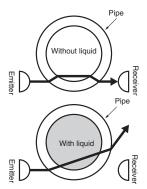
I/O Circuit Diagrams

NPN Output

Model	Output configuration	Timing charts	Operation mode selector	Output circuit
EE-SPX613	Dark-ON	Incident (with no liquid) Interrupted (with liquid) Light indicator ON (red) OFF Output ON transistor OFF Load Operates (relay) Releases	D·ON (DARK ON)	Light indicator (red) Main OUT Load OUT
	Light-ON	Incident (with no liquid) Interrupted (with liquid) Light indicator ON (red) OFF Output ON transistor OFF Load Operates (relay) Releases	L·ON (LIGHT ON)	(Black) (Black) (Black) (Black) (Blue)

Operation

The EE-SPX613 detects the level of liquid by detecting the difference in refractive index between the air and liquid.



- If there is no liquid in the pipe, the emitted beam will reach the receiver after it is refracted by the pipe. (Light incident.)
- If there is liquid in the pipe, the emitted beam will pass through the liquid and not reach the receiver. (Light interrupted.)

Sensitivity selector (available only with EE-SPX613)

If the diameter of the pipe is close to 6 mm, some of the emitted beam may reach the receiver because the angle of refraction is small, thus making the stable operation of the EE-SPX613 difficult. In such cases, set the sensitivity selector to Low and check that

EE-SPX613 operation is stable. If there are floating materials on the surface on the liquid, some of the emitted beam may reach the receiver after it is reflected by the floating materials, thus making the stable operation of the

EE-SPX613 difficult. In such cases, set the sensitivity selector to Low to stabilize operation.

For normal use, set the sensitivity selector to High to account for reduced sensitivity caused by deterioration of the emitter due to age and stains on the pipe.

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

Make sure that this product is used within the rated ambient environment conditions.

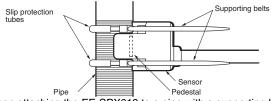
Nomenclature

EE-SPX613

Operation selector Sensitivity selector Light indicator (red) Light Light indicator Cable

Mounting

- The EE-SPX613 may not operate correctly if it is attached to an unsuitable pipe (e.g., opaque pipe).
- Always use the supporting belts and slip protection tubes that are provided with the EE-SPX613 when attaching the EE-SPX613 to a pipe, as shown in the following illustration, and make sure that the pipe is in the center of the sensor slot and not separated from the pedestal. When tightening the supporting belts, make sure that the pipe will not be deformed.



 When attaching the EE-SPX613 to a pipe with a supporting belt, make sure that the pipe will not be deformed.

Wiring

- Do not impose any excessive force on the cable. Do not pull the cable with any tractive force exceeding 30 N.
- When extending the cable, use an extension cable with conductors

having a total cross-section area of 0.15 $\rm mm^2.$ The total cable length must be 5 m maximum.

Adjustment

 The EE-SPX613 requires 10 ms to be in stable operation after power is supplied.

If separate power supplies are used for the EE-SPX613 and load, be sure to supply power to the EE-SPX613 before supplying power to the load.

- Make sure that smoke, air bubbles, or water droplets are not able to form either inside or outside the pipe. Otherwise, a malfunction may occur.
- Do not impose any force exceeding 5 N on the operation mode selector or sensitivity selector.

Others

Operating Environment

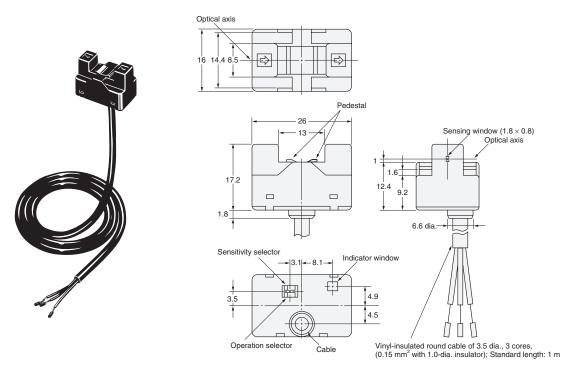
- Do not use the EE-SPX613 outdoors.
- Do not use the EE-SPX613 in places where water, oil, or chemical may be sprayed onto the EE-SPX613.

The exterior coverings of the EE-SPX613 are made of polycarbonate. Keep the coverings away from any alkaline, aromatic hydrocarbon, or aliphatic chloride hydrocarbon solvents, all of which will damage the coverings.

• Do not use the EE-SPX613 in places where the EE-SPX613 is subject to direct sunlight, corrosive gas or salt air.

Dimensions

EE-SPX613

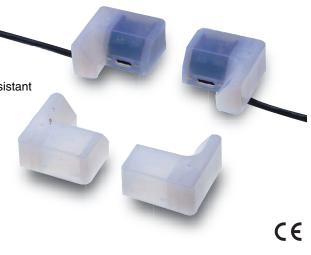


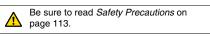
Wafer-carrier Mounting Photomicrosensors

EE-SPY801/802

Photomicrosensors for detecting wafer-carrier mounting.

- The mounting position is set with a pedestal.
- The contact surface with the wafer carrier uses a special chemical-resistant fluororesin.
- The unique optical system enables stable detection of almost all wa
- Light modulation effectively reduces external light interference.
- Utilizes talc-free clean cables.





Ordering Information

Sensors					Infrared light
Appearance	Sensing method	Sensing distance	Output configuration	Cable length	Model
	Deficiency		Turns ON when wafer carrier is	0.77	EE-SPY801 2M
	 Reflective type 	0 to 3 mm	present.	2 m	EE-SPY802 2M

Accessories (Order Separately)

Item	Model
Pedestal	EE9-C01
reuesiai	EE9-C02

Note: There are no sensor functions provided.

EE-SPY801/802

Ratings and Specifications

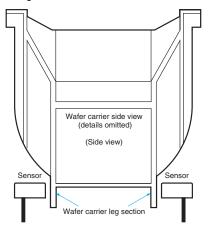
Item	Models	EE- SPY801/802				
Sensing dista (Standard sen		0 to 5 mm (White paper: 15×15 mm ² , reflection factor: 90%) 0 to 3 mm (Black paper: 15×15 mm ² , reflection factor: 10%)				
Sensing object		Transparent or opaque wafer carriers				
Operation ind	icator	Lit orange when object is detected.				
Light source		GaAs infrared LED with a peak wavelength of 940 nm				
Supply voltag	e	12 to 24 VDC ±10%, ripple (p-p): 5% max.				
Current consu	umption	30 mA max.				
Control output		NPN open collector: Load power supply voltage: 5 to 24 VDC Load current: 100 mA max. OFF current: 0.5 mA max. 100 mA load current with a residual voltage of 0.8 V max. 40 mA load current with a residual voltage of 0.4 V max.				
Response tim	e	5 ms max.				
Ambient illum	ination	3,000 lx max. with incandescent light or sunlight on the surface of the receiver				
Ambient temp	erature range	Operating: -10 to +55°C Storage: -25 to +65°C (with no icing)				
Ambient humi	dity range	Operating: 5% to 85% Storage: 5% to 95% (with no condensation)				
Vibration resis	stance	Destruction: 1 to 500 Hz, 1.0-mm single amplitude or 150 m/s ² each in X, Y, and Z directions 3 times and for 11 min. each				
Shock resista	nce	Destruction: 500 m/s ² for 3 times each in X, Y, and Z directions				
Degree of pro	tection	IEC IP30				
Connecting m	ethod	Pre-wired (Standard length: 2 m)				
Weight (packa	iged)	Sensor: Approx. 43 g; Accessory (Pedestal): Approx. 9 g				
Material	Case	Ethylene tetrafluoro ethylene (ETFE)				
wateria	Base plate	Polybutylene phthalate (PBT)				
Accessories		Instruction Manual				

I/O Circuit Diagrams

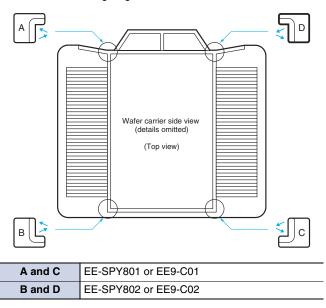
Model	Output configuration	Timing charts	Output circuit
EE-SPY801 EE-SPY802	Turns ON when wafer carrier is present.	With wafer carrier Without wafer carrier Operation indicator ON (orange) OFF Output ON transistor OFF Load Operates (etc., relay) Releases	Operation indicator (orange) + (Brown) OUT Load Main circuit (Black) - (Blue)

Standard Usage

This sensor is designed to detect wafer-carrier mountings. The bottom of the wafer carrier has a ribbed construction for the leg section, as shown in the following diagram. The EE-SPY801/802 detects the wafer-carrier mounting using a reflective optical sensor that detects the leg section of the wafer-carrier.



Install a Sensor (or Pedestal) at each of the four corners indicated by a circle in the following diagram.



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

Make sure that this product is used within the rated ambient environment conditions.

Wiring

When extending the cable, use an extension cable with conductors having a total cross-section area of 0.15 mm^2 (AWG26 equivalent). The total cable length must be 5 m maximum.

To use a cable length longer than 5 m, attach a capacitor with a capacitance of approximately 10 μF to the wires as shown below. The distance between the terminal and the capacitor must be within 5 m.

Mounting

Mount the Photomicrosensors securely on a flat surface, and tighten the mounting screws using a tightening force of 0.30 N·m max. (Using a spring washer is recommended to prevent the screws from becoming loose.)

Adjustment

The EE-SPY801/802 requires 10 ms to be in stable operation after power is supplied.

If separate power supplies are used for the EE-SPY801/802 and load, be sure to supply power to the EE-SPY801/802 before supplying power to the load.

• Operating Environment

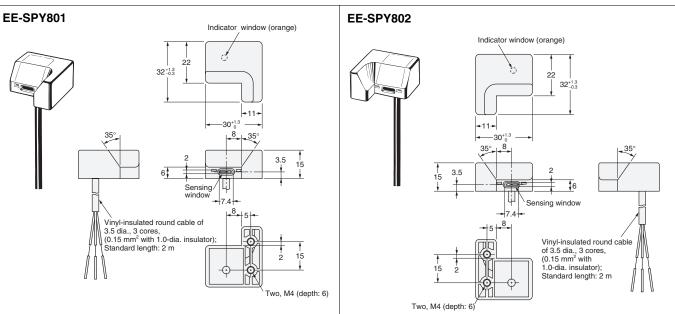
Do not use the EE-SPY801/802 in locations subject to salty air or corrosive gases, such as hydrogen chloride gas.

EE-SPY801/802

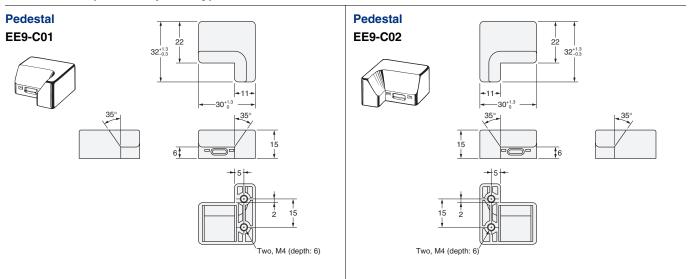
Dimensions

Tolerance class IT16 applies to dimensions in this datasheet unless otherwise specified.

Sensors



Accessories (Order Separately)

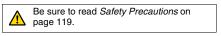


Pushbutton-type Photomicrosensor

EE-SA701/801

Using a pushbutton enables accurately detecting difficult-to-detect objects.

- Conforms to standards for semiconductor FOUP cassettes to enable accurately detecting FOUP cassettes without being affected by the material, color, or reflectance of the bottoms of the cassettes.
- Thin design enables mounting in a wider range of applications, e.g., on transfer arms.
- · Increased visibility with 4-direction indicator.
- Optical detection of actuator operation provides a long life (mechanical life: 5 million operations min.).
- Models available with PNP or NPN output.
- Models are available with very flexible robot cable.



Ordering Information

List of Models

Appearance	Sensing distance	g distance Sensing Operation mode	Cable length	Model		
Appearance	Sensing distance	method		Cable length	NPN output	PNP output
			ON with no load	1 m	EE-SA801A 1M	EE-SA801R 1M
6.9	(See note 2.) 0 to 3.5 mm (pressed position) (See note 1.)	Pushbutton	ON WITHO IDad	1 m	EE-SA801A-R 1M	EE-SA801R-R 1M
			OFF with no load	(robot cable)	EE-SA701-R 1M	EE-SA701P-R 1M

Note: 1. Distance from the top surface of the housing to the top of the actuator.

2. Output reverses between 3.5 and 4.5 mm.

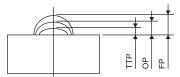


EE-SA701/801

Ratings and Specifications

Model		NPN output	EE-SA801A	EE-SA801A-R	EE-SA701-R			
Item	woder	PNP output	EE-SA801R	EE-SA801R-R	EE-SA701P-R			
Indicator		Lights red when actuator is pre	ssed.	Lit red while there is no load on actuator				
Operation	Free position	• •	5.0±0.4 mm					
Specifica-	Operating po		3.5 to 4.5 mm (See note 2.)					
tions (See		osition (TTP)	0 mm max.					
Operating loa	d (See note 3.)	3 N max. (typical: 0.5 N)					
Supply voltage	Je		12 to 24 VDC±10%, ripple (p-p): 10% max.				
Current const	umption		35 mA max.					
Control output			residual voltage OFF current: 0. PNP Models: PNP open colle	ctor, 5 to 24 VDC, 50 mA max.; of 0.4 V max. at 50-mA load cu	urrent			
External diag	nosis input	Input	NPN Models Emission OFF: Shorted to 0 V or 0.5 V max. (source current: 30 mA max.) Emission ON: Open (leakage current: 0.4 mA max.) PNP Models Emission OFF: Shorted to +DC or +DC-0.5 V max. (sink current: 30 mA max.) Emission ON: Open (leakage current: 0.4 mA max.)					
		Response time	1 ms max.	ns max.				
Protection cir	cuits		Reversed power supply polarity protection					
Ambient temp	perature range	,	Operating: -25 to +55°C Storage: -30 to +60°C (with no icing or condensation)					
Ambient hum	idity range		Operating: 5% to 85% Storage: 5% to 95% (with no condensation)					
Mechanical d	urability		5,000,000 operations min. (One operation is from the free position to operating position and back to the free position.)					
Vibration resi	stance		Destruction: 10 to 500 Hz, 1.0-mm single amplitude or 150 m/s ² 3 times each in X, Y, and Z directions for 11 min. each					
Shock resista	ince		Destruction: 500 m/s ² for 3 time	es each in X, Y, and Z directions	S			
Degree of protection		IEC IP40						
Connecting method			Pre-wired (standard cable length: 1 m) Pre-wired (robot cable length: 1 m)					
Weight			Approx. 16.1 g					
Material	Case		Polycarbonate					
wateria	Actuator		Polyacetal					
Accessories			Instruction Manual					

Note: 1. Free position (FP): The position of the top of the actuator when no force is being applied to the actuator. Operating position (OP): The position of the top of the actuator when the actuator is pressed and the output transistor changes from OFF to ON for the EE-SA701-R/-SA701P-R and from ON to OFF for all other models. Total travel position (TTP): The position of the top of the actuator when the actuator is pressed as far as it can be pressed.



2. This does not indicate that the output will be ON from 3.5 to 4.5 mm, but rather that the output will change from ON to OFF at some point between 3.5 and

4.5 mm.3. The force required to press the actuator from the FP to the OP.

EE-SA701/801

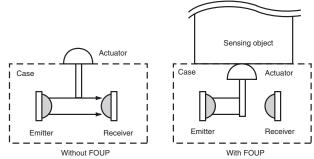
I/O Circuit Diagrams

Model	Operating Mode	Timing chart	Output circuit
EE-SA801A EE-SA801A-R	ON with no load	Sensing Present object Absent Push indicator ON (red) OFF Output transistor OFF Load Operates (e.g., relay) Releases	Push indicator (red)
EE-SA701-R	OFF with no load	Sensing object Absent Push indicator ON (red) OFF Output transistor ON Load Operates (e.g., relay) Releases	Zo White (External diagnosis input)
EE-SA801R EE-SA801R-R	ON with no load	Sensing Present object Absent Push indicator ON (red) OFF Output transistor OFF Load Operates (e.g., relay) Releases	Push indicator (red)
EE-SA701P-R	OFF with no load	Sensing Present object Absent Push indicator ON (red) OFF Output transistor ON OFF Load Operates (e.g., relay) Releases	Main circuit 50 mA max. Black (Control output) Black (relay) Blue

EE-SA701/801

Operating Principles

This is a pushbutton-type sensor. An emitter (GaAs infrared LED) and receiver (Si photo IC) are positioned across from each other inside the sensor and light is received when there is no sensing object. When the sensing object presses the actuator, the light path between the emitter and receiver is broken so that the receiver no longer receives light.

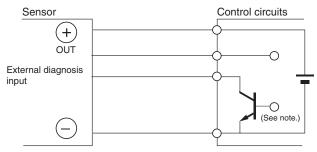


This Sensor provides an external diagnosis function and stability checking function.

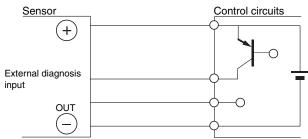
(1) External Diagnosis Function

The light emission from the LED can be stopped by using the following circuit configuration. This enables checking the operation of the receiver by turning the LED ON and OFF when there is no load.

EE-SA801A/-SA-801A-R/-SA701-R



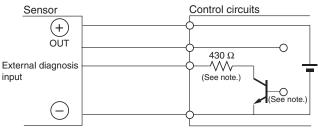
EE-SA801R/-SA-801R-R/-SA701P-R



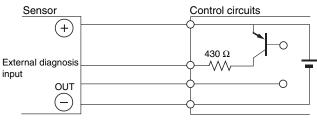
(2) Stability Checking Function

The light intensity emitted by the LED can be reduced by 20% by using the following circuit configuration. By doing so, the light reception operation at 80% light intensity with no sensing object (same as 100%, i.e., the output transistor should turn ON) can be tested in advance to check for malfunctions caused by deterioration of LED light intensity.

EE-SA801A/-SA-801A-R/-SA701-R



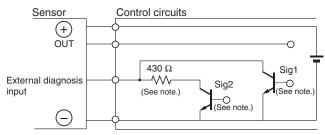
EE-SA801R/-SA-801R-R/-SA701P-R



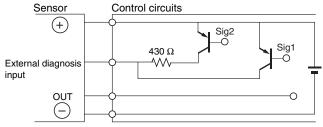
(3) Using Both Functions Simultaneously

Use the following circuit configuration when both the external diagnosis function (Sig1) and the stability checking function (Sig2) are required.

EE-SA801A/-SA-801A-R/-SA701-R



EE-SA801R/-SA-801R-R/-SA701P-R



Note: Use a transistor that is capable of switching 50 mA at 10 V. The resistor must have a power rating of 1/8 W min.

Safety Precautions

Refer to Warranty and Limitations of Liability.

<u> WARNING</u>

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

Make sure that the Photomicrosensor is used within the rated ambient environment conditions.

Mounting

Mount the Photomicrosensor securely on a flat surface using M3 pan head screws, and tighten the mounting screws using a tightening force of 0.59 N·m max.

Adjustment

The EE-SA801 requires 10 ms to be in stable operation after power is supplied. If separate power supplies are used for the EE-SA801 and load, be sure to supply power to the EE-SA801 before supplying power to the load.

Operating Environment

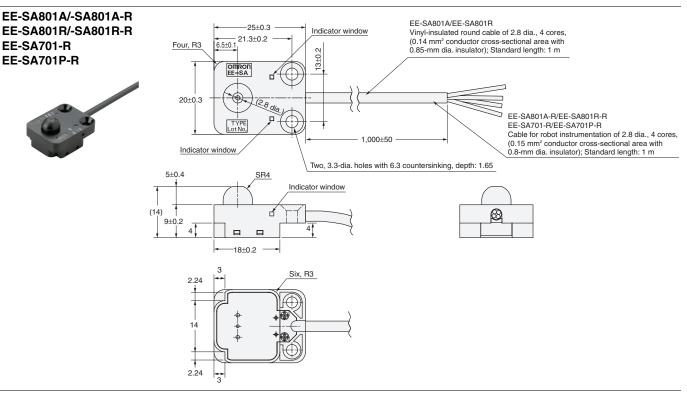
- The EE-SA801 is not watertight. Do not use the EE-SA801 outdoors.
- Do not use the EE-SA801 in places where water, oil, or chemical may be sprayed onto the EE-SA801. The exterior coverings of the EE-SA801 are made of polycarbonate. Keep the coverings away from any alkaline, aromatic hydrocarbon, or aliphatic chloride hydrocarbon solvents, all of which will damage the coverings.

(Unit: mm)

Tolerance class IT16 applies to dimensions in this datasheet unless otherwise specified.

Sensor

Dimensions



Ordering Information

Connectors and Connector Hold-down Clips

Applicable Sensor models

EE-SX67	-	R), EE-SX4	· · · · · · · · · · · · · · · · · · ·	•	X303N/403N, EE-SPW311/411
	Туре		Cable length	Model	Remarks
				EE-1001	
Connecto	r			EE-1001-1	L terminal and positive (+) terminal are already short-circuited.
				EE-1009 *1	
			1 m	EE-1006	4 conductors
				EE-1010 *1	
Co	onnecto	r with		EE-1006	4 conductors
Ca	able		2 m	EE-1006D	3 conductors
			2	EE-1006L	2 conductors
				EE-1010 *1	
Co	onnecto	r with	1 m	EE-1010-R *1	
Ro	obot Cab	ole	2 m	EE-1010-R *1	
NPN/PNP Connector		sion	0.46 m (total length)	EE-2002	
Connecto	r Hold-d	own Clip		EE-1006A	For EE-1006, EE-SX670, 470, EE-SY671, and 672 only.
		Case (hou	ising)	EE-1006H	100 per carton
		Dispersio	n Pins	EE-1006C	500 per carton
Connector Parts *2 Special C		rimping Tool	EE-1006T	Appearance Switching knob Crimping section Hatchet Handle	

*1. EE-1009- or EE-1010-series Connectors have a builtin locking mechanism to prevent cable disconnection when only the cable is pulled. To remove the 1. ELe forde of ELe forde and solver a buildin tocking internation of prevent cable disconnection when only the cable solver a buildin tocking mechanism of prevent cable disconnector from the Sensor, grip the top and bottom of the Connector firmly and push into the Sensor once before pulling out. The locking mechanism prevents the Connector from being removed by pulling on the cable only and enables removal only when the Connector (housing) is pulled.
 *2. The case (housing) and dispersion pins (for hand-crimping) for EE-1006 Connectors can be ordered separately. Use the EE-1006T Special Crimping Tool to prepare the Connector.

Applicable Sensor models	
EE-SX97 -C1, EE-SX97 P-C	1

Item	Cable length	Model	Remarks			
Connector with Cable	1 m	EE-1017 1M				
Connector with Cable	3 m	EE-1017 3M				
Connector with Robot Cable	1 m	EE-1017-R 1M				
Connector with Hobot Cable	3 m	EE-1017-R 3M				

Senso

C

Applicable Sensor models EE-SX91 - C1J-R (Pre-wir	ed Connector)		
Item	Cable length	Model	Remarks
Connector with Cable	2 m	EE-1016-R	The robot cable is standard for all models.
Applicable Sensor models EE-SX67	ed Connector)		
Item	Cable length	Model	Remarks
Item Connector with Cable	Cable length 2 m	Model EE-1016-R-1	Remarks The robot cable is standard for all models.
Connector with Cable Applicable Sensor models	<u> </u>		
	<u> </u>	EE-1016-R-1	

	Applicable Sensor models EE-SPX301/401, EE-SPY30□/40□, EE-SPZ301□/401□					
	Item	Cable length		Model	Remarks	
Conne	ctor		EE-1002			
	Connector with Cable	1 m	EE-1003			
NPN/PNP Conversion0.46 mConnector(total length)		EE-2001				
Conne	ctor Hold-down Clip	•	EE-1003A		For EE-1003 only.	

	Product Model	Connector *1 EE-1009	Connector with Cable *1	Connector with Robot Cable *1	Connector	(short-circuit- ed between	Connector with	
	Model	EE-1009				positive (+) and L terminals) *2	Cable	
			EE-1009 EE-1010 EE-1010			EE-1001 EE-1001-1		
App Item	pearance					S5-1001-1	2 1 2 2 3 3 5 3 5 3 5 3 5 3 5 3 5 5 5 5 5 5	
Contact resistance		20 m Ω max. (at 2	0 mV max., 100 m	nA max.)	15 mΩ max. (at 100 VDC max.) 10 mΩ max. (100 VDC max.)			
Insertion/removal durability		50 times min.						
Insertion strength		No. of poles \times 6 N max.			50 N max.			
Surplus strength (housing holding strength)		No. of poles \times 0.4 N max.			-	20 N max.		
Standard cable length		2 m			2 m			
Lock strength		No. of poles \times 29 N min.						
Ambient humidity		-10 to +60°C			-10 to +75°C	-10 to 60°C		
Material	using	Polybutylene phthalate (PBT)						
Cor	ntact	Phosphor bronze (solder plating)						
Applicable Photomicrosen	nsors	EE-SX67□ (A,P,F EE-SPW311/411	R) (Connector Mod	els only), EE-SX47	′□, EE-SY67□, EE	-SPY31□/41□, EE	-SPX303N/403N,	

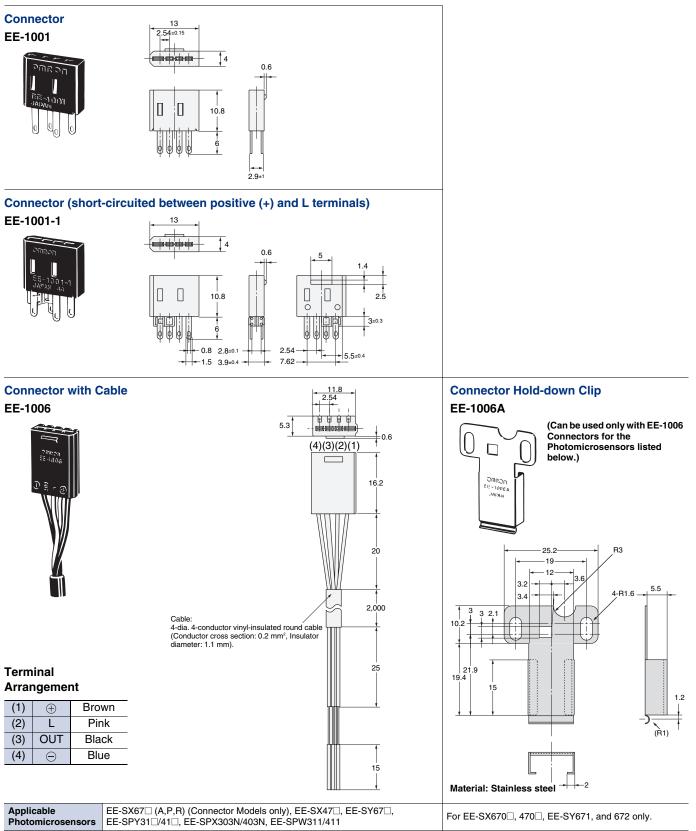


	Product	Connector	Connector with Cable	Connector with Cable	Connector with Cable	Connector with Robot Cable	Connector wit	th Robot Cable		
	Model	EE-1002	EE-1003	EE-1013	EE-1017	EE-1017-R	EE-1016-R	EE-1016-R-1		
Appearance			Uninon El 1007		Y		V			
Contact resistance		10 m Ω max. (at 10 mADC and 1 ADC)	20 m Ω max. (at minute current of 1 kHz and 500 VDC)		25 m Ω max. (at 10 mA DC and 20 mV max.)					
Insertion strength		20 N max.	23.5 N max.	40 N max.	20 N max.					
Surplus strength (housing holding strength)		15 N min. (initial) 10 N min. (ten times)	3.5 N min.	10 N min.	1.5 N min.		15 N min.			
Cable length			1 m		1 m, 3 m		2 m			
Ambient humidity		-10 to +75°C	−10 to +60°C	10 to +60°C -10 to +55°C		-10 to +60°C		–25 to +85°C		
Material	Housing	Nylon								
waterial	Contact	Phosphor bronze (solder plating)								
Applicable Photomicrosensors		,,,,,		EE-SPX74□/ 84□	EE-SX97□C1, EE	-SX97□P-C1	EE-SX91□-C1J-R (Pre-wired Connector)	EE-SX67□-C1J-R (Pre-wired Connector)		

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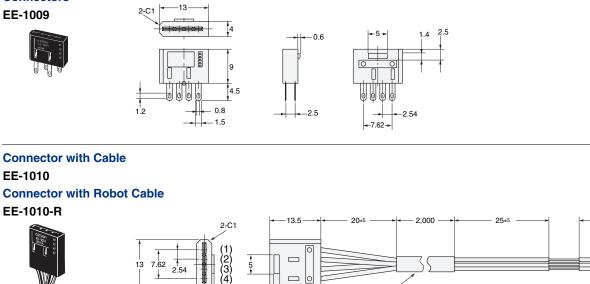
(Unit: mm)

Dimensions Tolerance class IT16 applies to dimensions in this datasheet unless otherwise specified. Photomicrosensor Connectors and Connector Hold-down Clips



Photomicrosensor Connectors

Connectors



- 1.4 - 2.5 EE-1010 cable EE-1010-R cable: 4-dia. 4-conductor vinyl-insulated round cable (Conductor cross section: 0.2 mm², Insulator diameter: 1.1 mm).

Terminal Arrangement

(1)	\oplus	Brown
(2)	L	Pink
(3)	OUT	Black
(4)	Θ	Blue

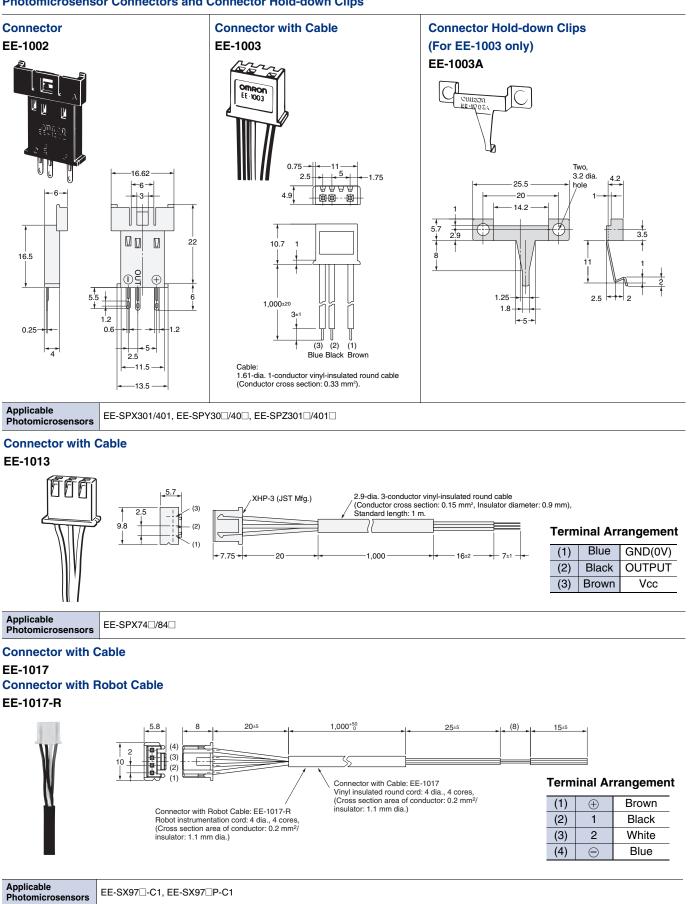
15±5

Applicable Photomicrosensors

EE-SX67 (A,P,R) (Connector Models only), EE-SX47, EE-SY67, EE-SPY31/41 EE-SPX303N/403N, EE-SPW311/411

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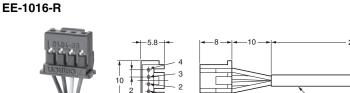
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Photomicrosensor Connectors and Connector Hold-down Clips

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Connector with Robot Cable

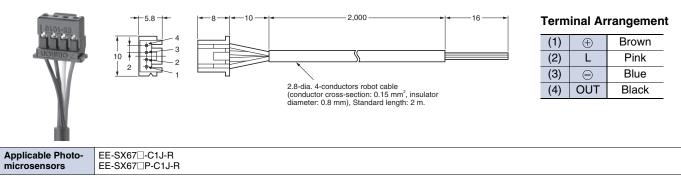


5.8 → 10 → 2,000 → 16 → 7 → 3 2 2 2.8-dia. 4-conductors robot cable (Conductor cross section: 0.15 mm², Insulation diameter: 0.8 mm), Standard length: 2 m. Terminal Arrangement (1) ⊕ Brown (2) OUT2 White (3) ⊖ Blue (4) OUT1 Black

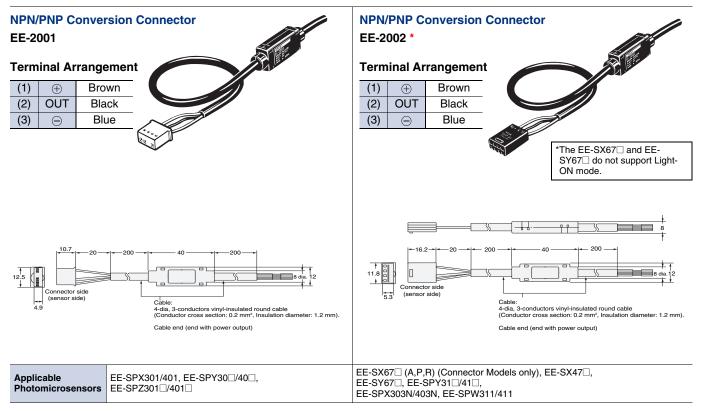
Applicable Photomicrosensors EE-SX91□-C1J-R (Models with Junction Connectors)

Connector with Cable (Connection with Robot Cable)

EE-1016-R-1



NPN to PNP Transistor Output Conversion Connectors



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