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WHITEPAPER

How do Photomicrosensors Compare to Other Detection Solutions?

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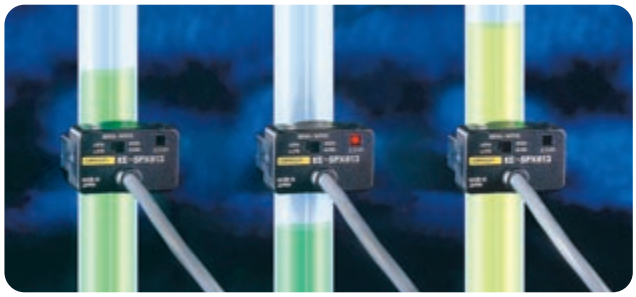
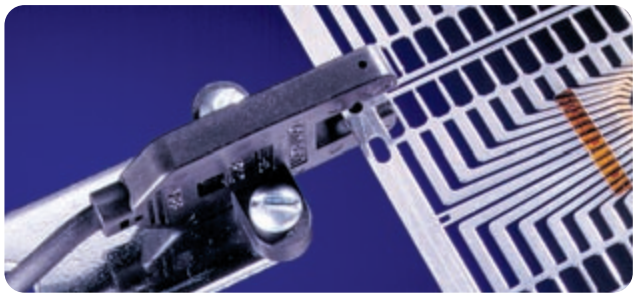
Abstract

Photomicrosensors are small photoelectric sensors that provide reliable position sensing in a space-saving and cost-efficient package for relatively clean manufacturing environments rated IP50 or better. They offer distinct advantages over a range of alternative solutions. This document helps machine builders determine if photomicrosensors might be viable and offers application examples across a wide range of industries.





What are Photomicrosensors?

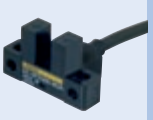
Omron designed a cost-saving line of small photoelectric sensors to fit space-confined areas that operate in relatively clean manufacturing environments. Most photomicrosensors have enclosures rated IP50, so they are ideal for mounting in transit rails for robots and positioning tables, inside automatic assembly equipment and other places with low dust, low humidity and low light interference. All have built-in amplifiers with transistor outputs that operate on DC supply voltage like larger sensors.

Why Choose a Photomicrosensor?

- No contact bounce or contact wear
- Fast response time (switching frequency over 3000 times faster than electromechanical switches)
- Long operating life (measured in thousands of operating hours rather than in electrical or mechanical operations)
- Extremely reliable: Sensor has no mechanical parts to wear out
- Non-contact sensing; no operating force required
- Wide applicability to industrial machinery
- Infrared light modulation (pulsing) minimizes ambient light interference
- Wide variety of mounting styles simplify installation
- Connector versions reduce maintenance downtime
- Variety of detection methods match many applications: slot, diffuse, fiber-optic, through-beam and specialty

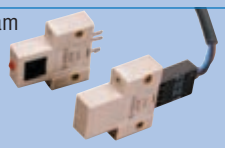
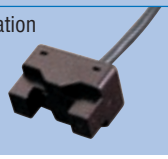
Compare Photomicrosensors to Other Detection Solutions

There are many different ways to solve the same detection problem, for example, end-of-travel for a small transfer table. Depending on the environment, speed of operation, tolerance for physical contact, maintenance and space limitations at the detection site, it is possible to choose from many devices. The table below compares photomicrosensors to other typical sensing solutions.

Sensor type	Appearance	Advantages	Disadvantages
Snap action switch		• Low cost • Simple to use • Rated IP60 to IP67 to match environment • Wide range of actuators	• Contact bounce creates false signals • Mechanical parts wear out • Requires physical contact • Slow speed of operation
Limit switch		• Rugged, rated IP65 or better for dusty, humid environments • Simple to use • Wide range of actuators	• Contact bounce creates false signals • Mechanical parts wear out • Requires physical contact • Slow speed of operation
Small proximity sensor		• Reliable digital output • Easy to install • Rugged, IP60 to IP67 to match environment • Inductive or capacitive sensing	• Short sensing distance • Requires metal to actuate sensor • Sensing face gets magnetized over time
Photomicrosensor		• Fast, reliable digital output • Installs easily • No parts to wear out • Cost-effective • Slot, through-beam, diffuse, fiber-optic	• Slight chance of interference from ambient light • Rated IP50 for clean, dry environments
Small photoelectric sensor		• Fast, reliable digital output • Wide range of capabilities, including fine-tuning controls • Through-beam, diffuse, retroreflective, fiber-optic	• More expensive than a photomicrosensor solution

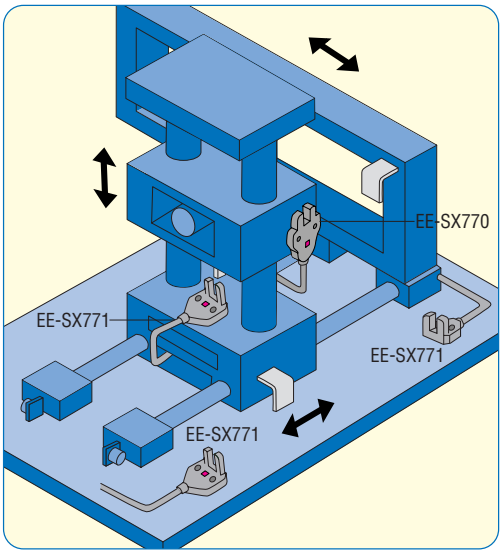
Broad Range of Sensor Types to Match Your Application

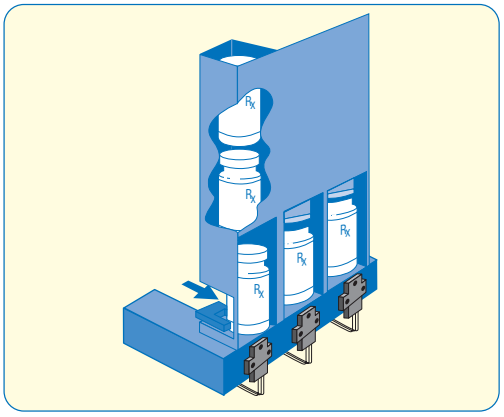
Omron offers hundreds of variations on the basic photomicrosensor. This guide will help you focus on the type, body shape and connection style best suited for your application.

Sensor type	Body shape	Connection	Output	Supply voltage
Slot 	Standard; L-shaped; T-shaped; Space-saving standard; Space-saving L-shaped	Pre-wired with 2 m cable; Connector accepts cordset	NPN; PNP	12-24 VDC; 5-24 VDC
Diffuse 	Side-sensing; Top-sensing	Connector accepts cordset	NPN; PNP conversion cable available	5-24 VDC
Retroreflective 	Top-sensing, use E39-R1 reflector	Connector accepts cordset	NPN; PNP conversion cable available	5-24 VDC
Fiber-optic 	Amp with 1 m cable and sensing head	Pre-wired	NPN; PNP	12-24 VDC
	Amp uses E32-series fiber-optic cables/sensing heads	Connector accepts cordset		
Through-beam 	Amplifier with sensing heads	Pre-wired	NPN; PNP conversion cable available	12-24 VDC
	Standard	Connector accepts cordset	NPN; PNP conversion cable available	
Special application 	Measurement	Connector accepts cordset	Analog or NPN	12-24 VDC
	Inductive Proximity	Connector accepts cordset	NPN; PNP conversion cable available	
	Liquid Level Sensor	Pre-wired with 2 m cable	NPN	

Slot Type for Easy Installation

- Eliminates most problems with alignment and aiming; emitter and receiver are in a fixed “U-shaped” housing
- Optical axis markings simplify setup
- Wide range of mounting styles
- Slot widths in 3.6, 5 and 13 mm pre-wired and connector-ready models; connector models allow fast servicing
- Reliable transistor outputs: NPN (100 mA load) or PNP (80 mA load)
- Pulse modulated light source models resist ambient light interference
- All have indicators; some models are wired to show Light-ON or Dark-ON operation
- 5 to 24 VDC supply voltage



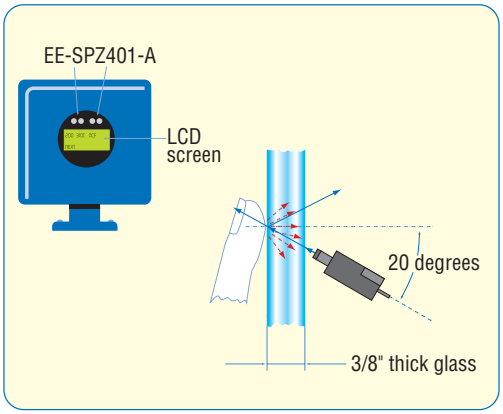


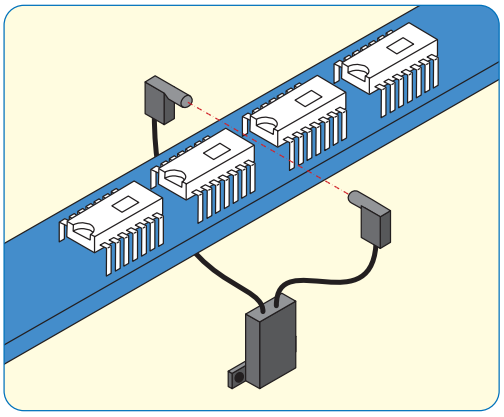
Diffuse Sensors

- 5 mm and 19 mm sensing distance, top- or side-sensing models
- Background suppression models offer adjustable sensing distance: 1 to 5 mm or 2 to 6 mm
- All have indicators; some models are wired to show Light-ON or Dark-ON operation
- Connector-ready models allow fast servicing
- Reliable transistor outputs: NPN (100 mA load) or PNP (80 mA load)
- 5 to 24 VDC supply voltage

Retroreflective Offers Longer Sensing Distance

- Long 200 mm sensing distance using optional E39-R1 reflector
- Light modulation reduces external light interference
- Connector-ready models allow fast servicing
- NPN 80 mA transistor output; PNP conversion connector available
- Light-ON and Dark-ON models



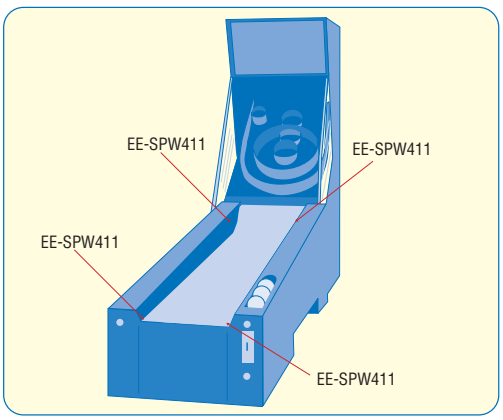


Fiber-optic Sensing Heads Fit Ultra Tight Spaces

- Models that use Omron's E32-series fiber-optic cables offer 20 mm through-beam sensing distance; 150 mm through-beam with lenses on the sensing heads using E32-TC50 fiber-optic cable; 1 to 6 mm diffuse sensing distance using E32-DC50 fiber-optic cable
- Models with built-in fiber-optic cables offer 20 mm through-beam sensing distance without lenses, 30 mm with lenses; 1 to 3 mm diffuse sensing distance
- Connector-ready for easy servicing
- All have indicators; some models are wired to show Light-ON or Dark-ON operation
- Reliable transistor outputs: NPN (100 mA load) or PNP (80 mA load)
- 5 to 24 VDC supply voltage

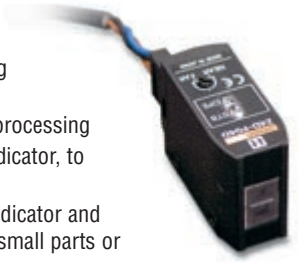
Through-beam for Long-distance Sensing

- Connector-ready model provides 1 meter sensing distance in ultra-compact size
- Pre-wired cable-amp models provide 30 cm sensing distance
- 5 to 24 VDC supply voltage
- NPN output (100 mA)
- Light -ON and Dark-ON models

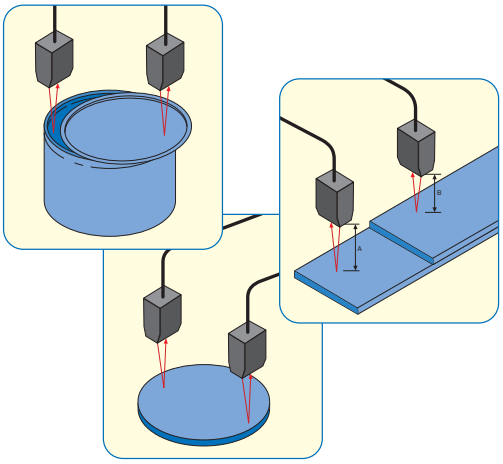


Special Application Sensors

Measurement Sensor



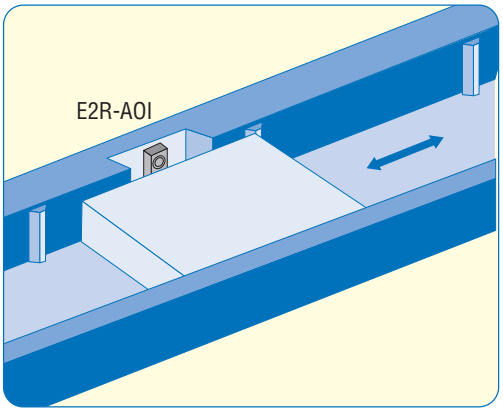
- Measurement sensor provides 4±1.25 mm sensing distance with a resolution to 5 mm
- A self-contained microprocessor handles signal processing
- Analog output models offers power and alarm indicator, to detect double feed or vibration
- On/Off output models offers stability/operation indicator and distance adjuster, to detect presence/absence of small parts or solder points



Z4D-F can detect small changes in thickness or measure vibration in parts traveling on a conveyor. Analog output model Z4D-F04A provides 160 mV per 100 mm change over an inspection range of 2.75 to 5.25 mm. This is ideal for part tolerance measurements in metal fabrication, cap detection in clean/dry applications, and IC pin or circuit board hole inspection.

Inductive Proximity Sensor

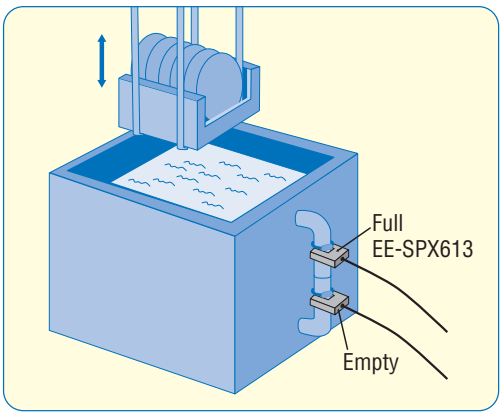
- Unshielded inductive proximity sensor detects metal objects at 5 mm
- Non-contact sensing without regard to target's color or surface texture
- Fast response time of 0.2 ms (5 kHz)
- High output current of 100 mA, NPN-NO
- Connector cordset E22-01 assures easy installation and maintenance
- Compact size allows mounting on conveyor rails or between rollers



Liquid Level Detector

- Sensor straps onto 6 to 13 mm OD clear tubing with tie wraps
- Sensitivity switch adjusts gain when tubing gets tinted or cloudy with age
- Indicator shows when liquid is present
- Ideal for sight-glass applications
- Pre-wired with 2 m cable

Easy-to-install EE-SPX613 liquid level detector uses refraction to detect presence/absence of aqueous liquid in tubing and piping. Use this sensor for sight-glass applications or as a process start/stop signal in water purification equipment such as deionizers, desalinators and ultraviolet bacteriacidal processing. Other sight-glass applications include liquid level in temperature-controlled baths and fill/stop signals for tank level management.



Two liquid level detectors are used on the rinse water bath's sight glass to show when water level has fully emptied and been refilled.

Material Handling Systems

APPLICATION:

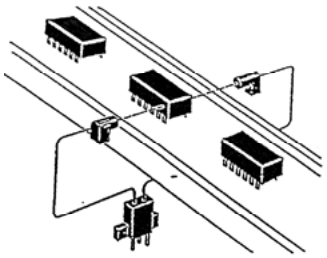
The illustrations on this page show five sensor applications related to material handling.

The EE-SPW321-A/421-A work at a sensing distance of 30 cm and are used to detect and count objects such as pill bottles with labels or opaque bottles.

The EE-SPZ301-W01 with fiber optic cables attached performs similar counting functions.

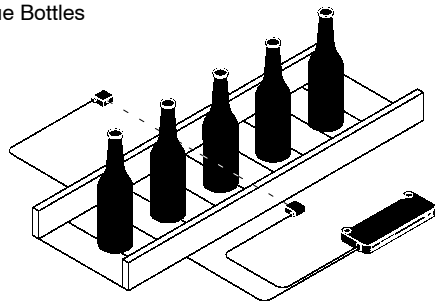
The EE-SPW311 works at a greater sensing distance (1 m) for larger objects such as boxes. In the example shown, it detects the presence of boxes in a conveyor line and sends a signal to activate the next conveyor.

Counting



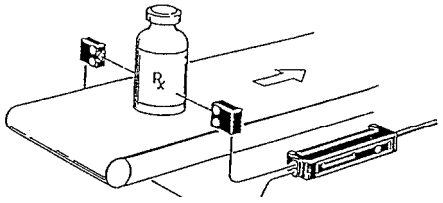
Sensor: EE-SPZ301-W01
Feature: Fiber Optic Cables

Sensing Opaque Bottles

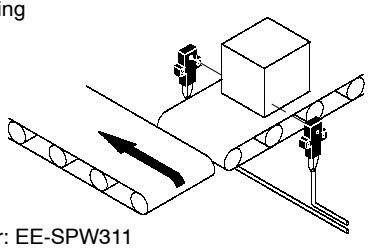


Sensor: EE-SPW421-A
Feature: 30 cm distance

Counting

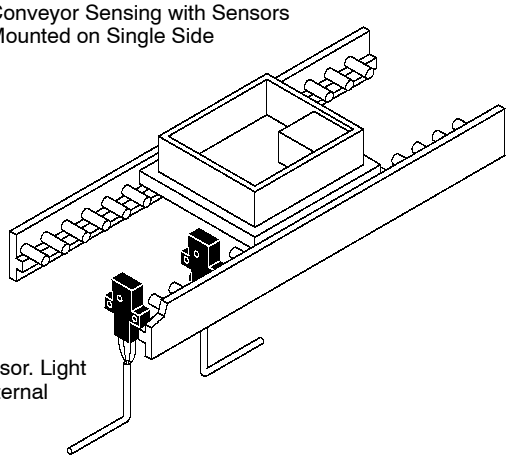


Conveyor Sensing



Sensor: EE-SPW311
Feature: 1 m distance

Conveyor Sensing with Sensors Mounted on Single Side



Sensor: EE-SPY312
Feature: Reflective sensor. Light modulation reduces external interference

Medical Applications

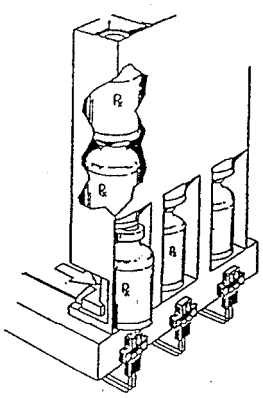
APPLICATION:

The photomicrosensors are used to detect the presence of test tubes in computerized analyzers and the position of test tubes in a motorized turntable. In another application, a bank of sensors is used to detect the presence of pill bottles in dispenser slots.

FUNCTION:

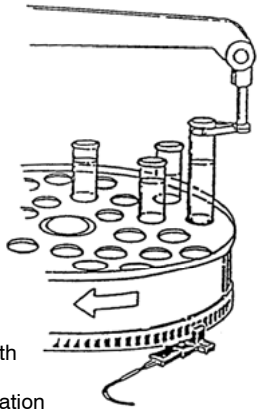
In all three examples, the specified sensors are used in conjunction with EE-1006 connectors. See the illustrations for the sensor part numbers.

Presence Detection in Dispenser



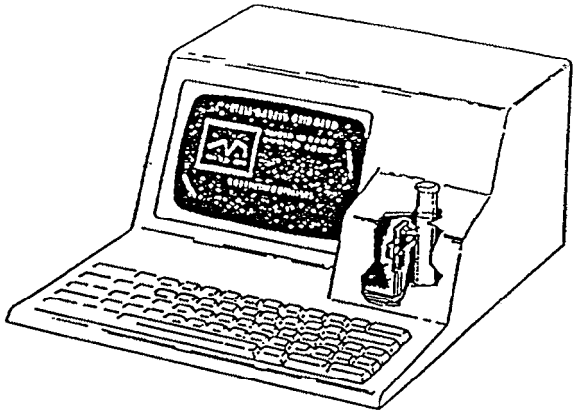
Sensors: EE-SPY312 with
EE-1006 connector
Feature: Convergent Lens
with Operation Indication

Position Sensing



Sensors: EE-SPX672 with
EE-1006 connector
Feature: Operation Indication

Presence Detection in Analyzer



Sensor: EE-SPY411 with EE-1006 connector
Feature: convergent lens

Semiconductor Applications

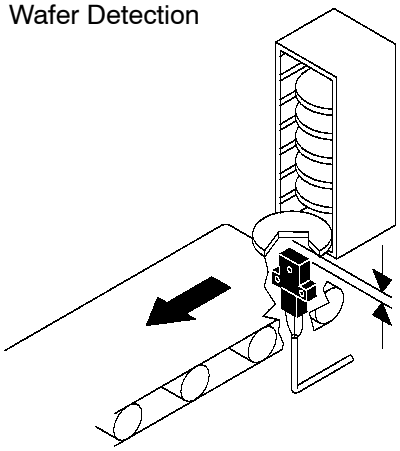
APPLICATION:

As shown in the illustration, sensors are used to detect the presence of semiconductor wafers as they are dispensed onto a conveyor and processed. They are also used to check the alignment of lead frames in transport carriers or processing magazines.

FUNCTION:

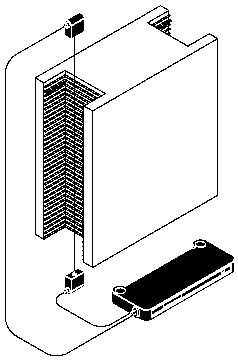
Diffuse sensors, set to detect dark objects, monitor wafer handling processes and can even detect shiny versus etched sides in applications where a wafer may flip over. EE-SPY312/412 sensors accept EE-1006 connectors for easy maintenance. EE-SPW321 through-beam (transmissive) sensing heads and slim cable amplifier fit space-confined detection systems.

Wafer Detection



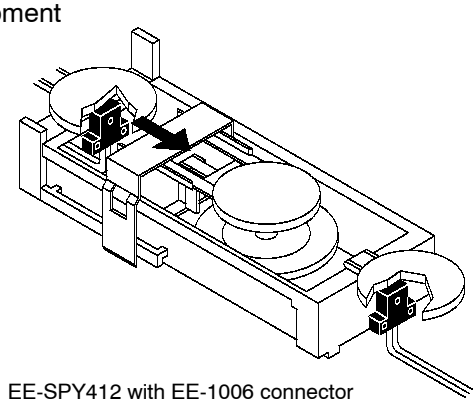
Sensor: EE-SPY312 with EE-1006 connector
Feature: detects dark objects

Lead Frame Detection



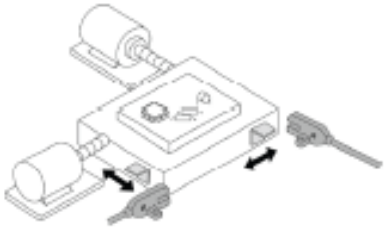
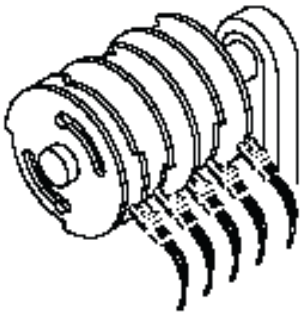
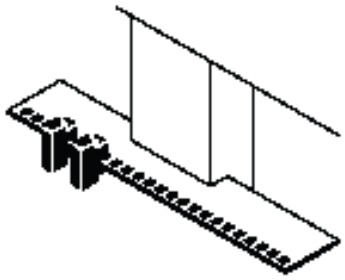
Sensor: EE-SPW321
Feature: slim amplifier (7.5 mm)

Semiconductor Manufacturing Equipment



Sensor: EE-SPY412 with EE-1006 connector
Feature: detects dark objects

Typical Applications

X-Y table or robot positioning – home position and end-of-travel	Cam-timer switching—no contact bounce or wear	End/beginning of perforated or embossed tape or film
		
Use EE-SX770 or EE-SX870 pre-wired models for easy monitoring, indicator visible on two sides. Plug-in EE-SX670 and EE-SX470 allow servicing without rewiring.	Use EE-SX670 or EE-SX470. For single-side mounting, use EE-SX673 or EE-SX473. For narrow spaces, choose EE-SX914 U-shaped models.	Use two EE-SX670 or EE-SX470 to signal position and change of direction. For tight spaces, choose EE-SX910.

- **Pick and Place Machines**
- **Robotic Applications**
- **Pharmaceutical**
- **Semiconductor Back End**
- **Electronics Manufacturing/Packaging**
- **Clean Room Environment Applications**

Specifications

Type	EE-SX47/67	EE-SX77/87	EE-SX91
Sensing distance	5 mm (slot width)		
Sensing object	Opaque: 1.2 x 0.8 mm min.		
Differential distance	0.025 mm max.		
Light source	Infrared LED		
Supply voltage	5-24 VDC		
Current consumption	35 mA max. (NPN models), 30 mA max. (PNP models)		15 mA max.
Operating ambient	-25° to 55°C		
Enclosure rating	IP50	IP60	IP50
Housing material	Polybutylene terephthalate (PBT)		

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