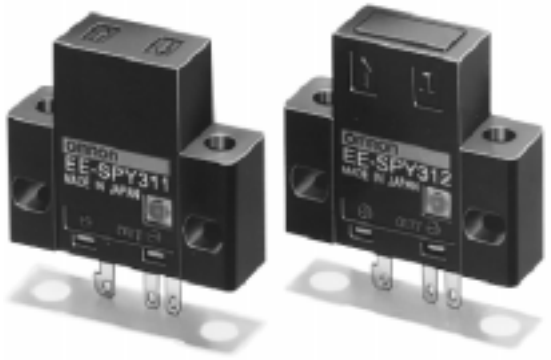
OMRON

# EE-SPY311/411/312/412

## Accurately Detects Objects Placed in Front of Mirror-like Background

- A mirror-like background can be used when the distance between the sensor and the background is 20 mm or more
- Detects an object as small as a 0.05-mm-dia. pure copper wire
- Detects dark-colored objects
- Light modulation effectively reduces external light interference
- Convert to PNP output with EE-2002 conversion connector




## Ordering Information

| Appearance | Sensing method | Sensing distance | Output configuration | Weight | **Part number** |
|---|---|---|---|---|---|
|  | Convergent reflective | 2 to 6 mm (rated sensing distance: 5 mm) | Dark-ON | Approx. 2.6 g | **EE-SPY311** |
| | | | Light-ON | | **EE-SPY411** |
|  | | 5 mm | Dark-ON | | **EE-SPY312** |
| | | | Light-ON | | **EE-SPY412** |

## Specifications

### ■ RATINGS

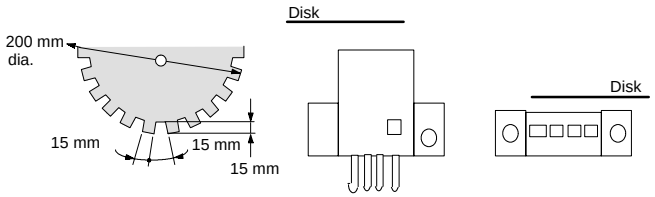
| Item | EE-SPY311 | EE-SPY411 | EE-SPY312 | EE-SPY412 |
|---|---|---|---|---|
| Supply voltage | 5 to 24 VDC ±10%, ripple (p-p): 5% max. | | | |
| Current consumption | Average: 15 mA max.; Peak: 50 mA max. | | | |
| Rated sensing distance | 2 to 6 mm (rated sensing distance: 5 mm, reflection factor: 90%; white paper: 15 x 15 mm) | | | |

(This table continues on the next page.)

Specifications Table – continued from previous page

| Item | | EE-SPY311 | EE-SPY411 | EE-SPY312 | EE-SPY412 |
|---|---|---|---|---|---|
| Differential distance | | 0.2 mm (with a sensing distance of 3 mm, horizontally) | | | |
| Control output | | At 5 to 24 VDC: 80-mA load current ($I_C$) with a residual voltage of 1.0 V max.<br>When driving TTL: 10-mA load current ($I_C$) with a residual voltage of 0.4 V max. | | | |
| Output configuration | Transistor on output stage without detecting object | ON | OFF | ON | OFF |
| | Transistor on output stage with detecting object | OFF | ON | OFF | ON |
| Indicator | Without detecting object | OFF | | | |
| | With detecting object | ON | | | |
| Response frequency* | | 100 Hz | | | |
| Minimum detectable object | | Pure copper wire (0.05 mm dia.) | | | |
| Possible background | | Glass with aluminum deposition located 20 mm minimum from sensor | | | |
| Connecting method | | Applicable connectors: EE-1001, EE-1006 | | | |
| Light source | | GaAs infrared LED (pulse-modulated) with a peak wavelength of 940 nm | | | |
| Receiver | | Si photo-diode with a sensing wavelength of 850 nm max. | | | |
| Connecting method | | EE-1002/1003 Connectors | | | |

*The response frequency was measured by detecting the disks rotating, as illustrated at the top of the next page.



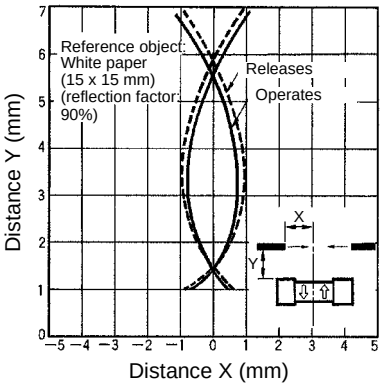

## ■ CHARACTERISTICS

| | | |
|---|---|---|
| Ambient illumination | | Sensing face: 3,000 ℓ x max. (incandescent light, fluorescent light, and sunlight) |
| Enclosure ratings | | IP50 (except the terminal section) |
| Ambient temperature | Operating | -10°C to 55°C (14°F to 131°F) |
| Vibration resistance | | Destruction: 10 to 55 Hz, 1.5-mm double amplitude for 2 hrs each in X, Y, and Z directions |
| Shock resistance | | Destruction: 500 $m/s^2$ (approx. 50G) for 3 times each in X, Y, and Z directions |
| Cable length | | 2 m max. (AWG26 min.) |

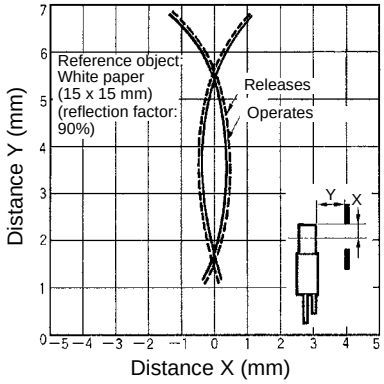
# Engineering Data

## ■ OPERATING RANGE (TYPICAL)

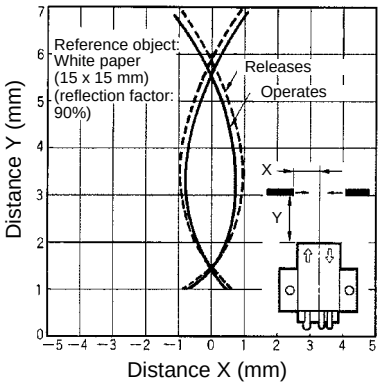
**EE-SPY311/411**



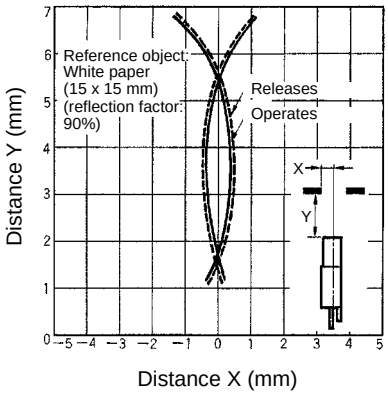

**EE-SPY311/411**



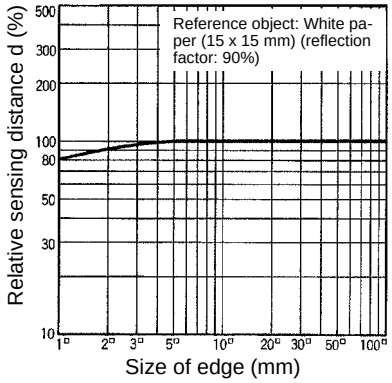

**EE-SPY312/412**



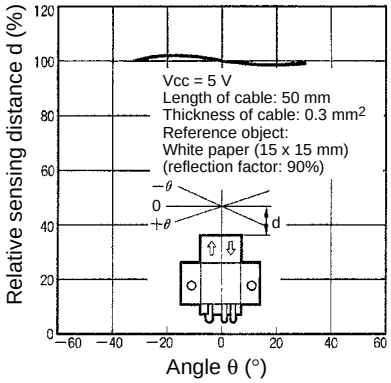

**EE-SPY312/412**



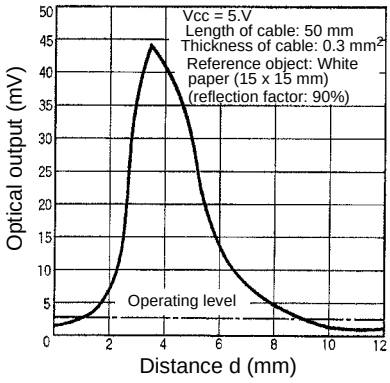
## ■ SENSING DISTANCE VS. OBJECT AREA (TYPICAL)




## ■ SENSING ANGLE VS. SENSING DISTANCE (TYPICAL)



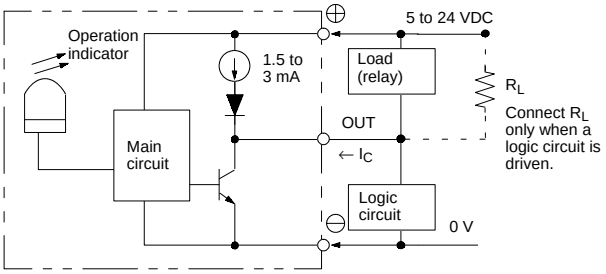

## ■ RECEIVER OUTPUT VS. SENSING DISTANCE (TYPICAL)




# Operation

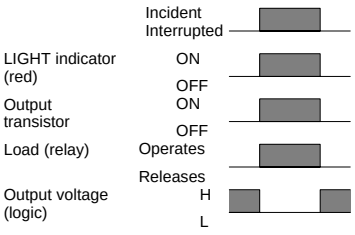
## ■ INTERNAL/EXTERNAL CIRCUIT DIAGRAM

**Light-ON/Dark-ON**

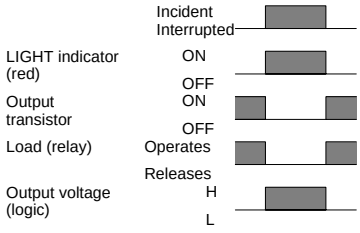


## ■ TIMING CHART

**Light-ON**



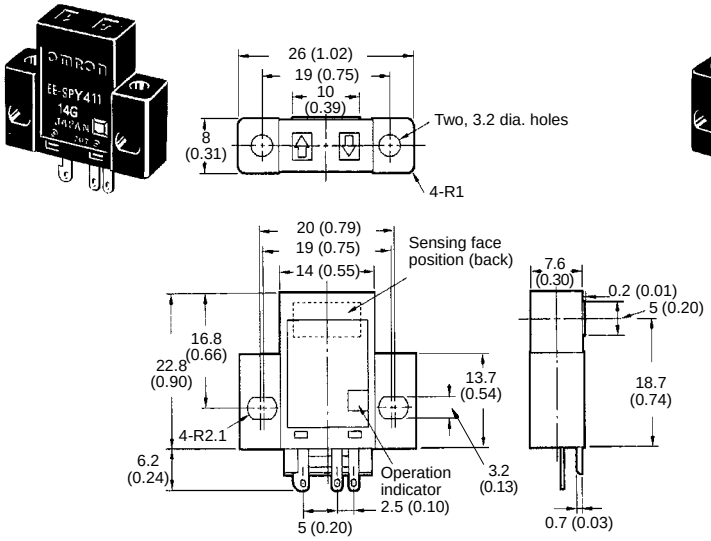

**Dark-ON**



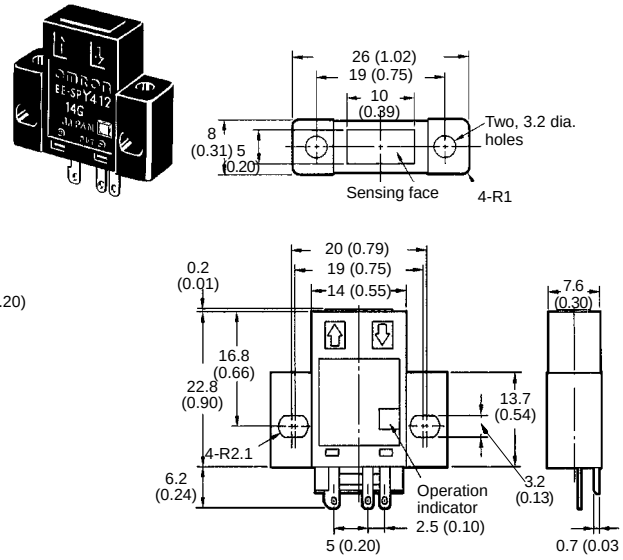

# Dimensions

Unit: mm (inch)

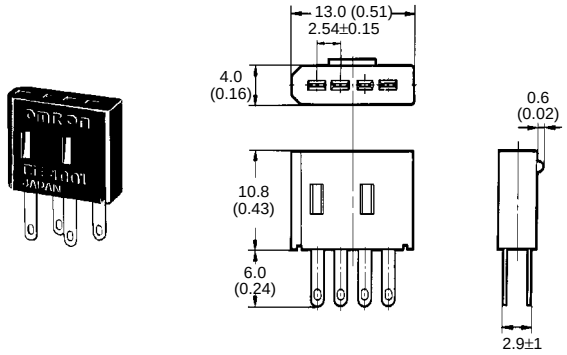
## ■ EE-SPY311, EE-SPY411



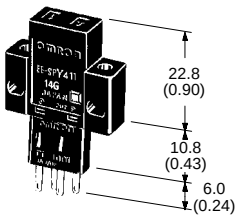

## ■ EE-SPY312, EE-SPY412



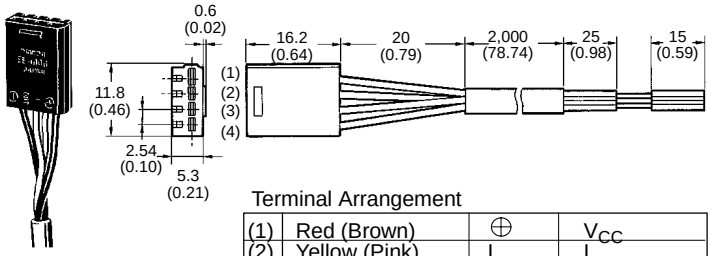

## ■ EE-1001 CONNECTOR




## ■ EE-SPY□+ EE-1001, EE-SPY41□+ EE-1001



## ■ EE-1006 CONNECTOR

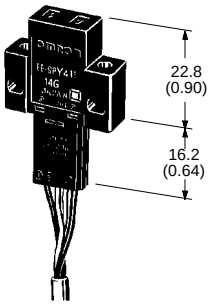



Terminal Arrangement

| | | | |
|---|---|---|---|
| (1) | Red (Brown) | ⊕ | $V_{CC}$ |
| (2) | Yellow (Pink) | L | L |
| (3) | White (Black) | OUT | OUTPUT |
| (4) | Black (Blue) | ⊖ | GND (0 V) |

IEC colors are shown in parentheses.

## ■ EE-SPY31□+ EE-1006, EE-SPY41□+ EE-1006

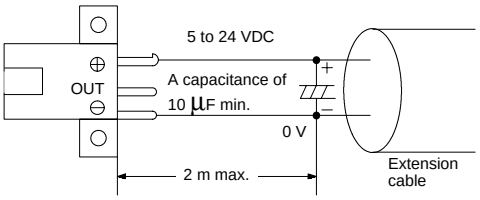



# Precautions

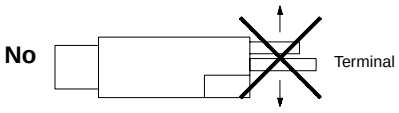
Refer to the Technical Information Section for general precautions.

## ■ WIRING

A cable with a thickness of AWG26 min. and a length of 2 m max. must be connected to the output terminals. To use a cable 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:



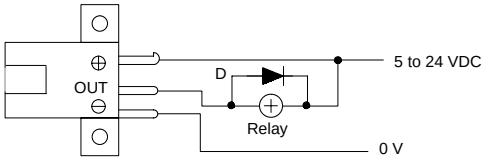

Do not apply excessive force to the terminals (refer to the graphics below). Excess force will damage the terminals.




Do not disconnect the EE-1001 or EE-1006 Connector from the photomicrosensor when power is supplied to the photomicrosensor, or sensor damage could result. If the metal mounting base is subjected to inductive electrical noise, the photomicrosensor can be activated accidentally. If noise is a problem, take the following precautions:

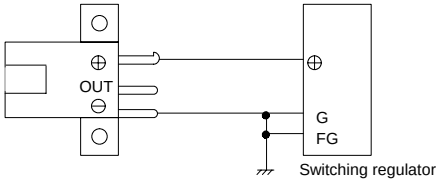
1. Connect the negative terminal to the mounting base to ensure that there will be no difference in electric potential between the photomicrosensor and mounting base.
2. Connect the negative terminal to the mounting base with a 0.47-μF capacitor.
3. Insert a plastic insulating plate with a thickness of approximately 10 mm between the photomicrosensor and mounting base.

Wire as shown by the following illustration to connect a small inductive load (a relay for example) to the photomicrosensor. A diode must be connected parallel to the relay to absorb the reverse voltage.




## ■ POWER SUPPLY

When using a standard switching regulator, ground the FG and G terminal so that the photomicrosensor will be in a stable operating condition.



**NOTE: DIMENSIONS SHOWN ARE IN MILLIMETERS. To convert millimeters to inches divide by 25.4.**

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