



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

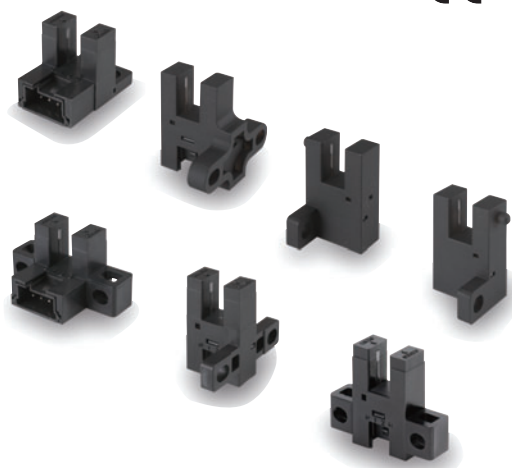
- A built-in connector minimizes the shape and dimensional requirements.
- Two outputs: light-ON and dark-ON.
- Complete lineup including seven different shapes.
- Safer operation with built-in power supply reverse polarity protection.
- Output overcurrent protection with a thermal shutdown circuit (patent 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

\*1. Output overcurrent protection is provided only on output 2 (OUT2) on NPN models.

\*2. Recommended connector:

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 5.

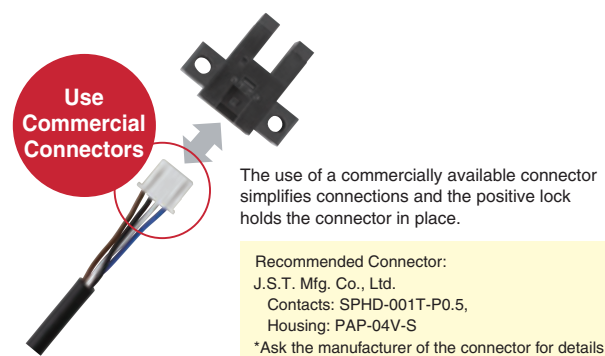
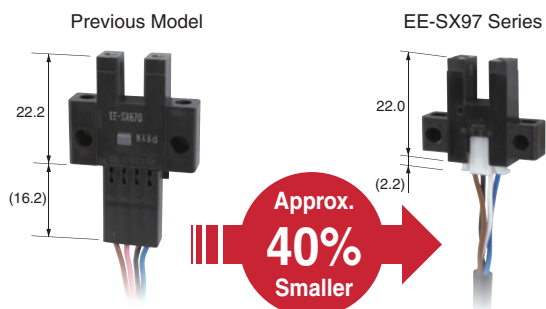


For the most recent information on models that have been certified for safety standards, refer to your OMRON website.

## Features

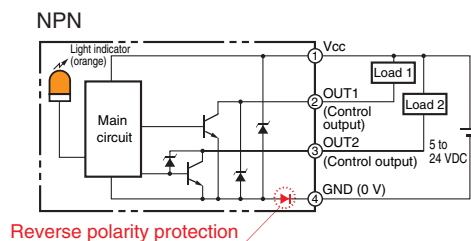
### Built-in Connector for Downsizing and Easier Connection

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



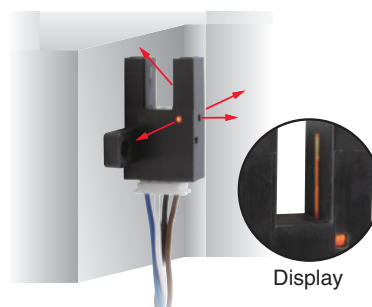
### Safer Operation with Built-in Power Supply Reverse Polarity Protection

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.



### Easy-to-see Indicator

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



### 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.









### 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.

## Ordering Information

### Sensors

 Infrared light

| Appearance  | Sensing method                | Connecting method         | Sensing distance  |                   | Operating mode                   | Indicator mode | Model       |              |
|---|-------------------------------|---------------------------|---|-------------------|----------------------------------|----------------|-------------|--------------|
|   |                               |                           |   |                   |                                  |                | NPN output  | PNP output   |
| Standard<br>                     | Through-beam type (with slot) | Connector model (4 poles) |  | 5 mm (slot width) | Dark-ON/<br>Light-ON (2 outputs) | Incident light | EE-SX970-C1 | EE-SX970P-C1 |
| L-shaped<br>                     |                               |                           |   |                   |                                  |                | EE-SX971-C1 | EE-SX971P-C1 |
| T-shaped, slot center 7 mm<br>   |                               |                           |   |                   |                                  |                | EE-SX972-C1 | EE-SX972P-C1 |
| Close-mounting<br>               |                               |                           |   |                   |                                  |                | EE-SX974-C1 | EE-SX974P-C1 |
| T-shaped, slot center 10 mm<br> |                               |                           |   |                   |                                  |                | EE-SX975-C1 | EE-SX975P-C1 |
| F-shaped<br>                   |                               |                           |   |                   |                                  |                | EE-SX976-C1 | EE-SX976P-C1 |
| R-shaped<br>                   |                               |                           |   |                   |                                  |                | EE-SX977-C1 | EE-SX977P-C1 |

### Accessories (Order Separately)

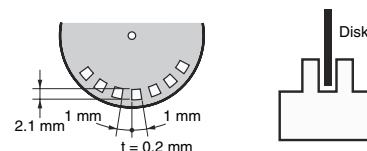
| Type                       | Cable length | Model        |
|----------------------------|--------------|--------------|
| Connector with Cable       | 1 m          | EE-1017 1M   |
|                            | 3 m          | EE-1017 3M   |
| Connector with Robot Cable | 1 m          | EE-1017-R 1M |
|                            | 3 m          | EE-1017-R 3M |

## Ratings and Specifications

| Item                                | Type             | Standard   | L-shaped     | T-shaped,<br>slot center<br>7 mm | Close-mount-<br>ing | T-shaped,<br>slot center<br>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  |
|                                     | PNP              | EE-SX970P-C1   | EE-SX971P-C1 | EE-SX972P-C1                     | EE-SX974P-C1        | EE-SX975P-C1                      | EE-SX976P-C1 | EE-SX977P-C1 |
| Sensing distance                    |                  | 5 mm (slot width)  |              |                                  |                     |                                   |              |              |
| Sensing object                      |                  | Opaque: 2 × 0.8 mm min.  |              |                                  |                     |                                   |              |              |
| Differential distance               |                  | 0.025 mm max. *1   |              |                                  |                     |                                   |              |              |
| Light source (Peak wave-length)     |                  | Infrared LED with a peak wavelength of 940 nm  |              |                                  |                     |                                   |              |              |
| Indicator                           |                  | Light indicator (orange LED)   |              |                                  |                     |                                   |              |              |
| Supply voltage                      |                  | 5 to 24 VDC ±10%, ripple (p-p): 10% max.   |              |                                  |                     |                                   |              |              |
| Current consumption                 |                  | 21 mA max.   |              |                                  |                     |                                   |              |              |
| Control output                      |                  | 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 circuit                  |                  | Power supply reverse polarity protection; output reverse polarity protection; overcurrent protection (only OUT2 on models with NPN output)   |              |                                  |                     |                                   |              |              |
| Response frequency                  |                  | 1 kHz min. (3 kHz average) *2  |              |                                  |                     |                                   |              |              |
| Ambient illumination                |                  | 1,000 lx max. with fluorescent light on the surface of the receiver  |              |                                  |                     |                                   |              |              |
| Ambient temperature range           |                  | Operating: -25 to 55°C Storage: -30 to 80°C (with no icing or condensation)  |              |                                  |                     |                                   |              |              |
| Ambient humidity range              |                  | Operating: 5% to 85% Storage: 5% to 95% (with no icing or condensation)  |              |                                  |                     |                                   |              |              |
| Vibration resistance (De-struction) |                  | 10 to 2,000 Hz 0.75-mm single amplitude (15-min periods, 10 cycles) each in X, Y, and Z directions   |              |                                  |                     |                                   |              |              |
| Shock resistance (De-struction)     |                  | Destruction: 500 m/s <sup>2</sup> for 3 times each in X, Y, and Z directions   |              |                                  |                     |                                   |              |              |
| Degree of protection                |                  | IEC 60529 IP50   |              |                                  |                     |                                   |              |              |
| Connecting method                   |                  | Connector  |              |                                  |                     |                                   |              |              |
| Weight (Packed state)               |                  | Approx. 3 g  |              |                                  |                     |                                   |              |              |
| Mate-<br>rial                       | Case/Cover       | Polybutylene terephthalate (PBT)   |              |                                  |                     |                                   |              |              |
|                                     | Emitter/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

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

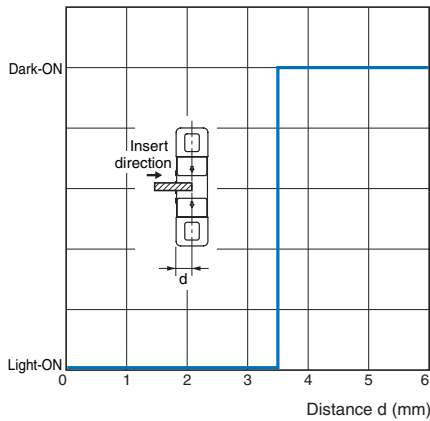
Engineering Data (Reference Value)

Sensing Position Characteristics

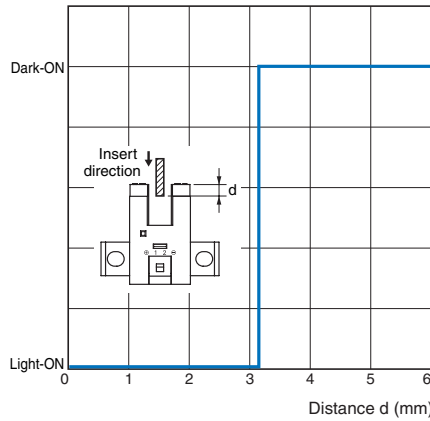
Sensing Position Characteristics

Repeated Sensing Position Characteristics

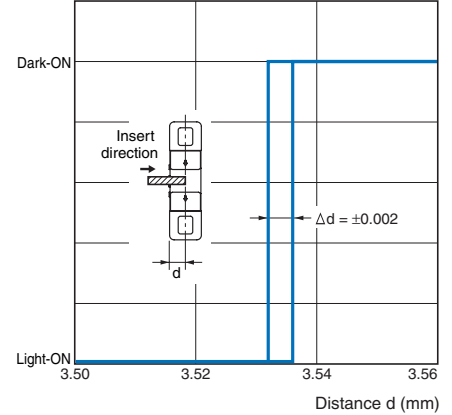
EE-SX970



EE-SX970



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 configuration | Model  | Output transistor operation status    | Timing charts   | Output circuit                   |
|----------------------|--|---------------------------------------|---|----------------------------------|
| NPN output           | EE-SX970-C1<br>EE-SX971-C1<br>EE-SX972-C1<br>EE-SX974-C1<br>EE-SX975-C1<br>EE-SX976-C1<br>EE-SX977-C1        | OUT1:<br>Light-ON<br>OUT2:<br>Dark-ON | Light incident:<br>Light interrupted:<br>Light indicator (orange) ON:  OFF:<br>Output 1 transistor ON:  OFF:<br>Load 1 (relay) Operates:  Releases: | <p>Connector pin arrangement</p> |
|                      | EE-SX970P-C1<br>EE-SX971P-C1<br>EE-SX972P-C1<br>EE-SX974P-C1<br>EE-SX975P-C1<br>EE-SX976P-C1<br>EE-SX977P-C1 |                                       | Output 2 transistor ON:  OFF:<br>Load 2 (relay) Operates:  Releases:  | <p>Connector pin arrangement</p> |

## 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 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

- 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.)

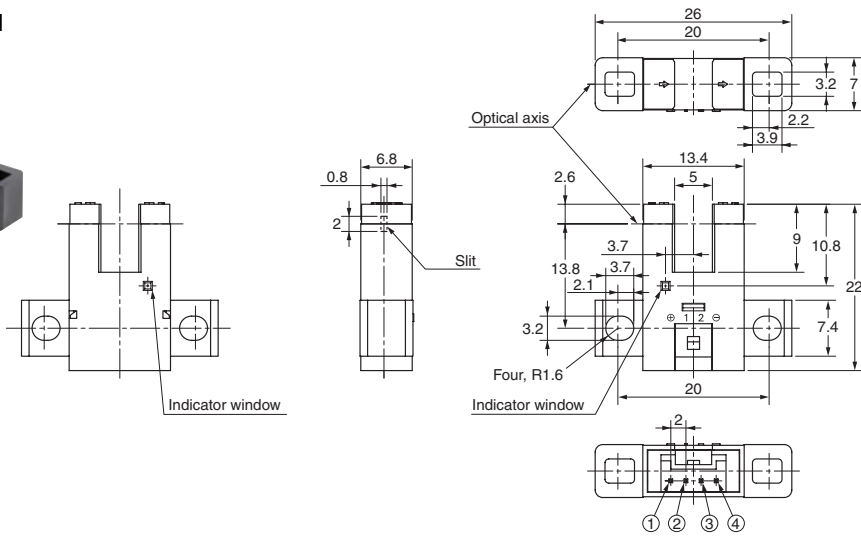
This function does not provide protection against load short circuits. If the electric power of the output transistor increases due to a load short-circuit or near load short-circuit, the Sensor may be damaged.

- 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

### Sensors

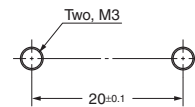
EE-SX970-C1  
EE-SX970P-C1



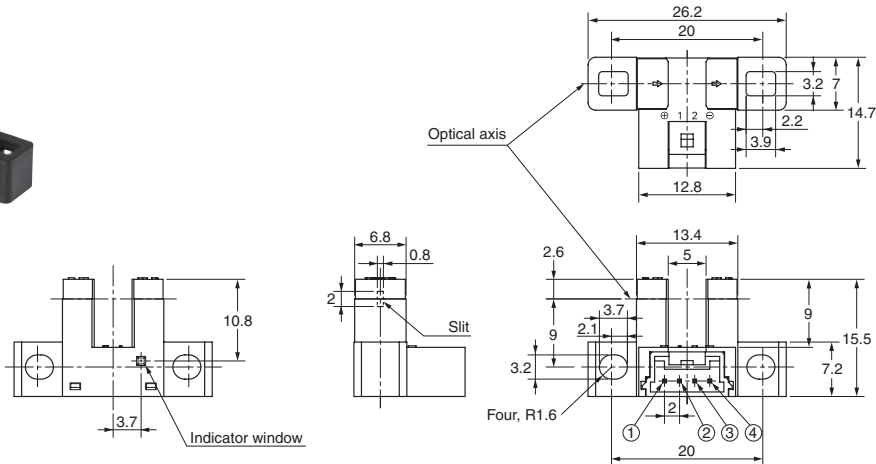
#### Terminal Arrangement

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

#### Mounting screw holes



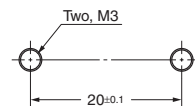
EE-SX971-C1  
EE-SX971P-C1



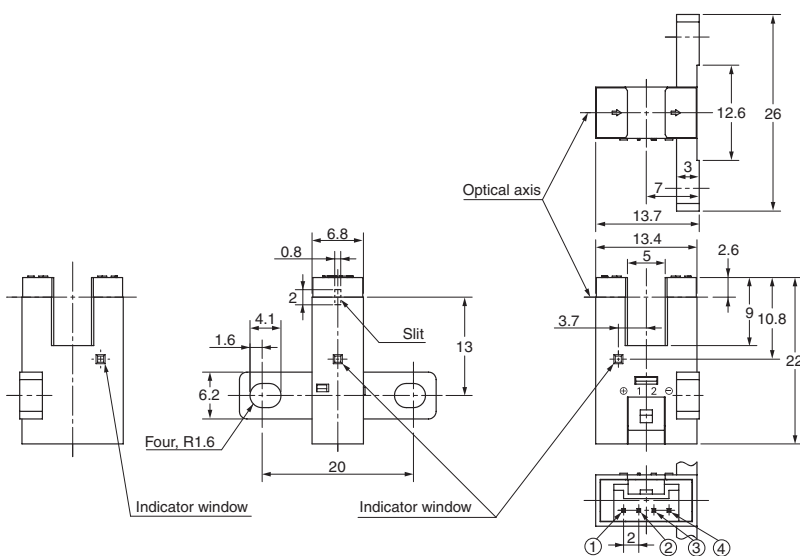
#### Terminal Arrangement

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

#### Mounting screw holes



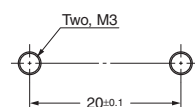
EE-SX972-C1  
EE-SX972P-C1



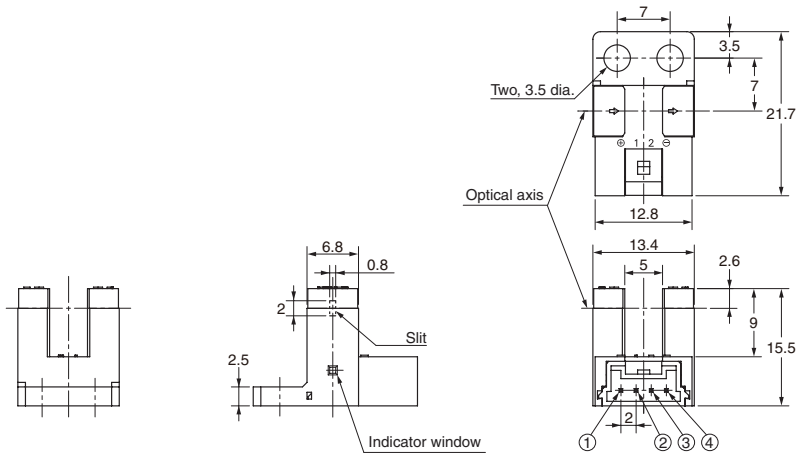
#### Terminal Arrangement

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

#### Mounting screw holes



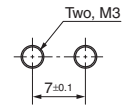
## EE-SX974-C1 EE-SX974P-C1



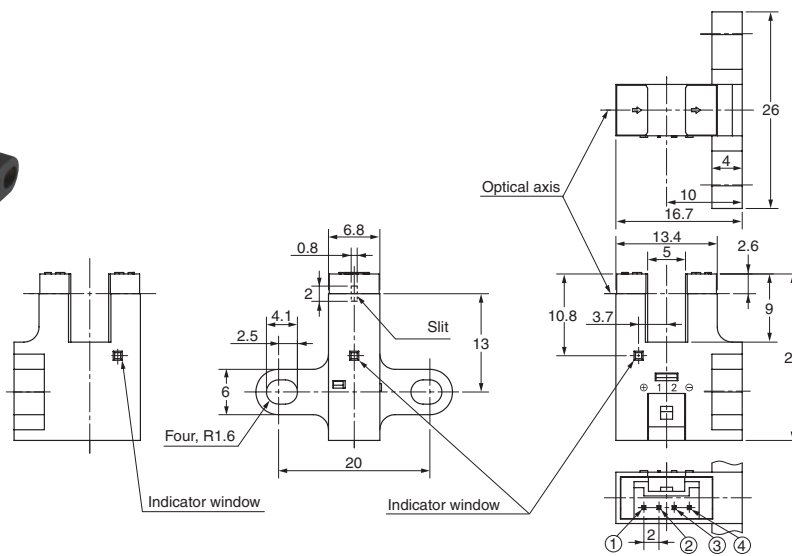
### Terminal Arrangement

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

### Mounting screw holes



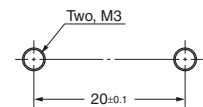
## EE-SX975-C1 EE-SX975P-C1



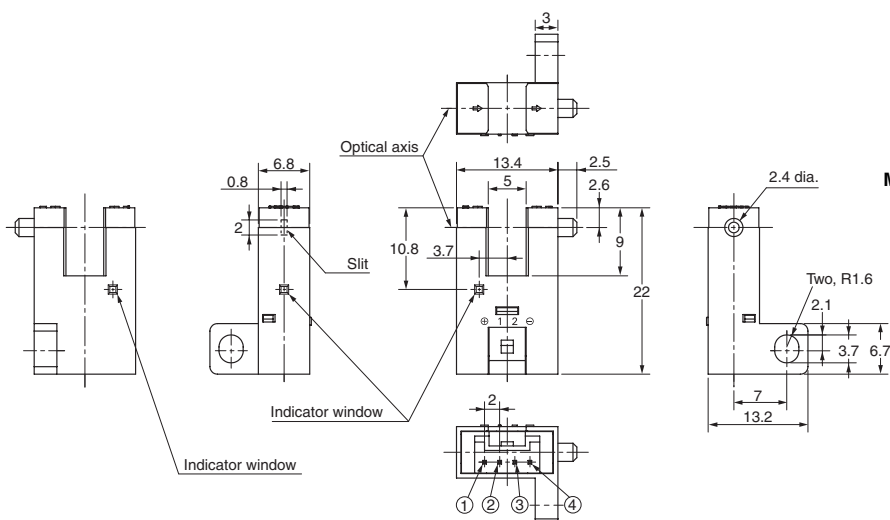
### Terminal Arrangement

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

### Mounting screw holes



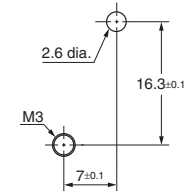
## EE-SX976-C1 EE-SX976P-C1



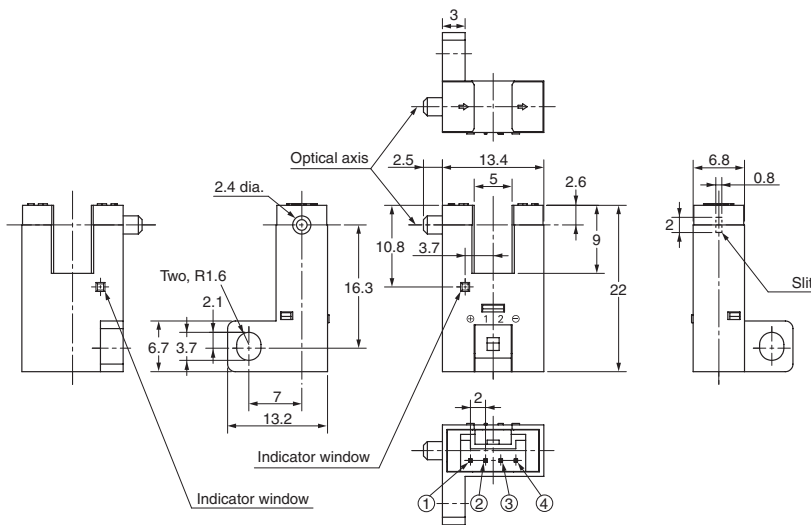
### Terminal Arrangement

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

### Mounting screw holes



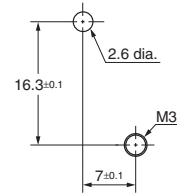
**EE-SX977-C1**  
**EE-SX977P-C1**



**Terminal Arrangement**

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

**Mounting screw holes**



**Accessories (Order Separately)**

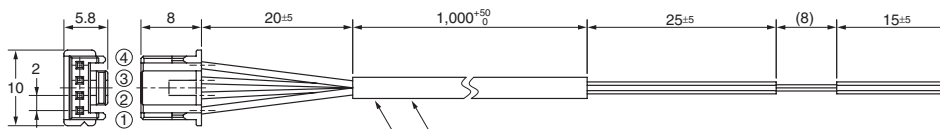
**Connector**

**Connector with Cable**

**EE-1017**

**Connector with Robot Cable**

**EE-1017-R**



Connector with Cable: EE-1017  
Vinyl insulated round cord: 4 dia., 4 cores,  
(Cross section area of conductor: 0.2 mm<sup>2</sup>/ insulator: 1.1 mm dia.)

Connector with Robot Cable: EE-1017-R  
Robot instrumentation cord: 4 dia., 4 cores,  
(Cross section area of conductor: 0.2 mm<sup>2</sup>/ insulator: 1.1 mm dia.)

**Terminal Arrangement**

|   |   |       |
|---|---|-------|
| ① | + | Brown |
| ② | 1 | Black |
| ③ | 2 | White |
| ④ | - | Blue  |



## Read and Understand This Catalog

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

## Warranty and Limitations of Liability

### WARRANTY

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- Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
- Systems, machines, and equipment that could present a risk to life or property.

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

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

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## Disclaimers

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Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

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2012.8

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