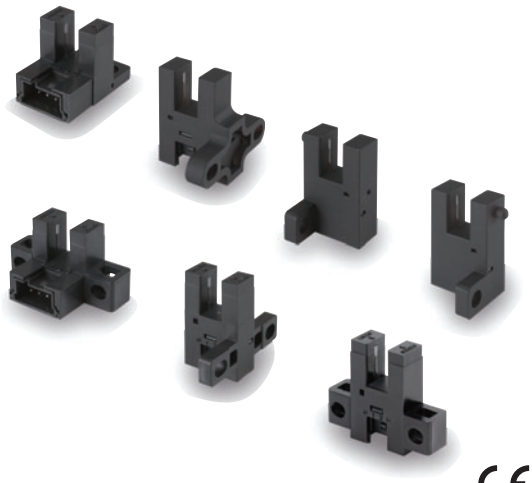
Slot-type Photomicrosensor

EE-SX97

CSM_EE-SX97_DS_E_1_2

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

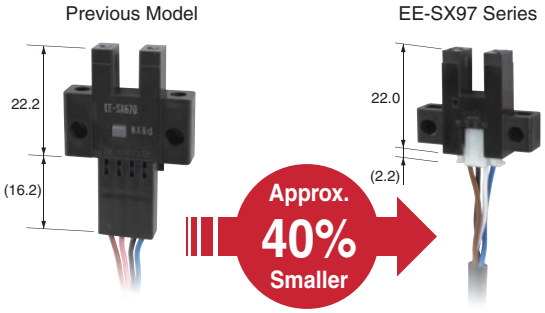
*1. Output overcurrent protection is provided only on output 2 (OUT2) on NPN models.
*2. Recommended connector:
J.S.T. Mfg. Co., Ltd. Contacts: SPHD-001T-P0.5, Housing: PAP-04V-S
Ask the manufacturer of the connector for details.

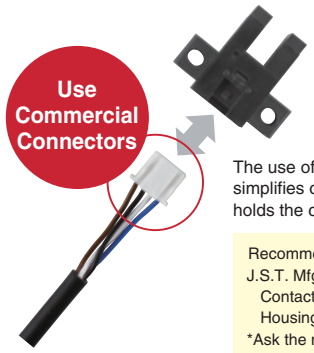
Be sure to read the *Safety Precautions* on page 5.

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.



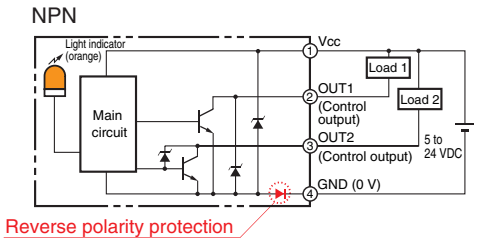


The use of a commercially available connector simplifies connections and the positive lock holds the connector in place.

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.

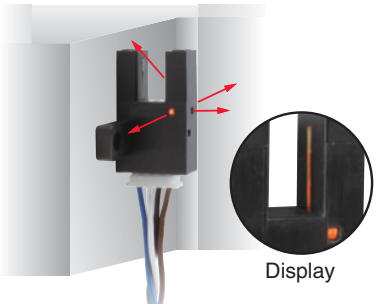
Safer Operation with Built-in Power Supply Reverse Polarity Protection

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 	Through-beam type (with slot)	Connector model (4 poles)		5 mm (slot width)	Dark-ON/ Light-ON (2 outputs)	Incident light	**EE-SX970-C1**	**EE-SX970P-C1**
L-shaped 							**EE-SX971-C1**	**EE-SX971P-C1**
T-shaped, slot center 7 mm 							**EE-SX972-C1**	**EE-SX972P-C1**
Close-mounting 							**EE-SX974-C1**	**EE-SX974P-C1**
T-shaped, slot center 10 mm 							**EE-SX975-C1**	**EE-SX975P-C1**
F-shaped 							**EE-SX976-C1**	**EE-SX976P-C1**
R-shaped 							**EE-SX977-C1**	**EE-SX977P-C1**

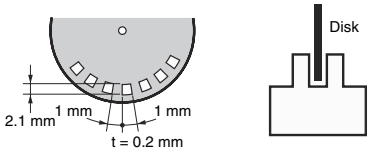
Accessories (Order Separately)

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, slot center 7 mm	Close-mounting	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
	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 wavelength)		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 (Destruction)		10 to 2,000 Hz 0.75-mm single amplitude (15-min periods, 10 cycles) each in X, Y, and Z directions						
Shock resistance (Destruction)		Destruction: 500 m/s² 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						
Material	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.



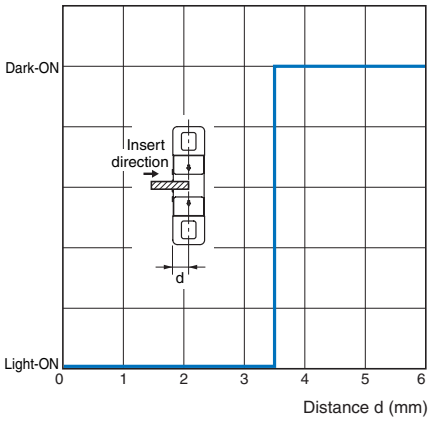
Connector

Item		Connector with Cable	Connector with Robot Cable
Product		Connector with Cable	Connector with Robot Cable
Model		EE-1017	EE-1017-R
Appearance			
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 (Typical)

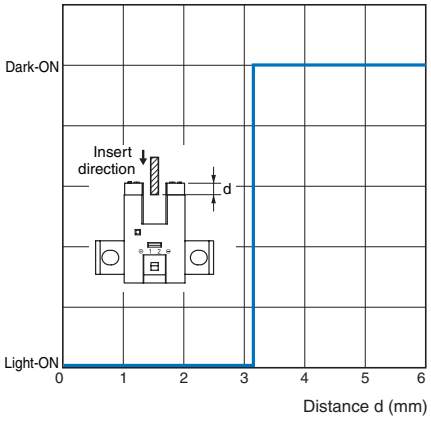
Sensing Position Characteristics

EE-SX970



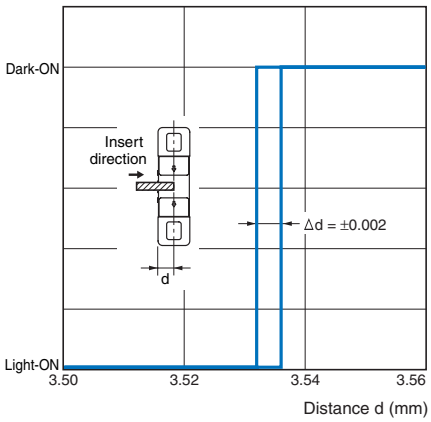
Sensing Position Characteristics

EE-SX970



Repeated Sensing Position Characteristics

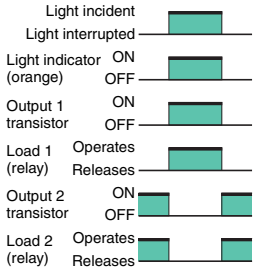
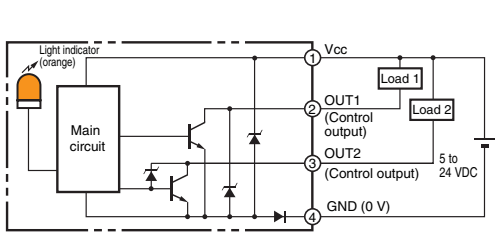
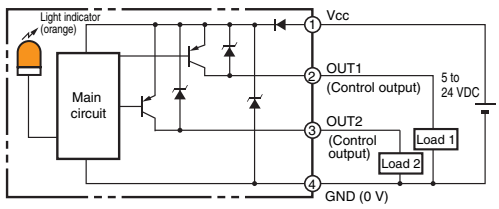
EE-SX970



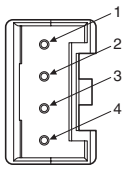
Vcc = 24 V, No. of repetitions: 20, Ta = 25°C
Differential distance = 0.025 mm max.

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

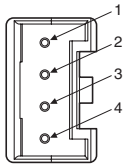
I/O Circuit Diagrams

Output configuration	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 OUT2: Dark-ON		
PNP output	EE-SX970P-C1 EE-SX971P-C1 EE-SX972P-C1 EE-SX974P-C1 EE-SX975P-C1 EE-SX976P-C1 EE-SX977P-C1			

Connector pin arrangement



Connector pin arrangement



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

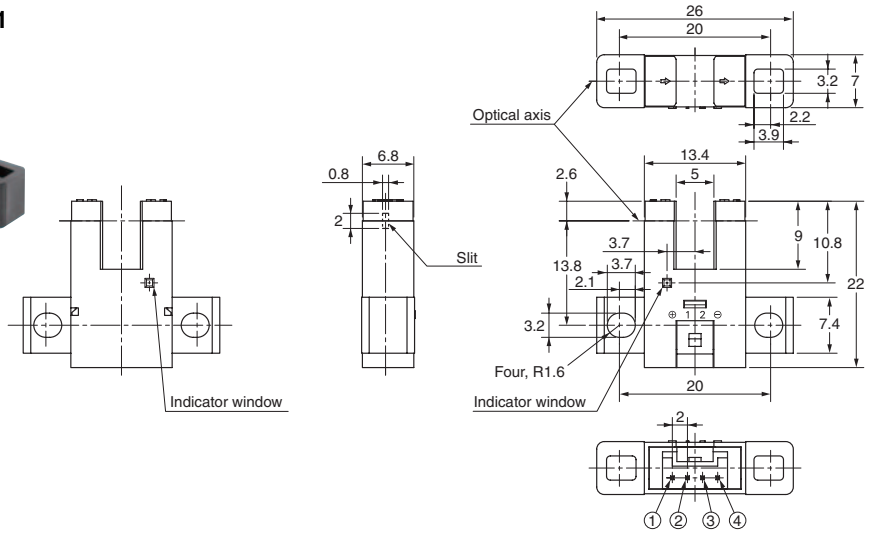
- The power cable connected to the Sensor must not be more than 10 m in length.
- Only output 2 (OUT2) on NPN models is provided with overcurrent protection.
  If an overcurrent occurs, heat generated by the output transistor will activate the thermal shutdown circuit and OUT2 will turn OFF. Check the 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

(Unit: mm)
Tolerance class IT16 applies to dimensions in this datasheet unless otherwise specified.

Sensors

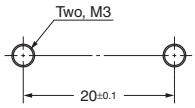
EE-SX970-C1
EE-SX970P-C1



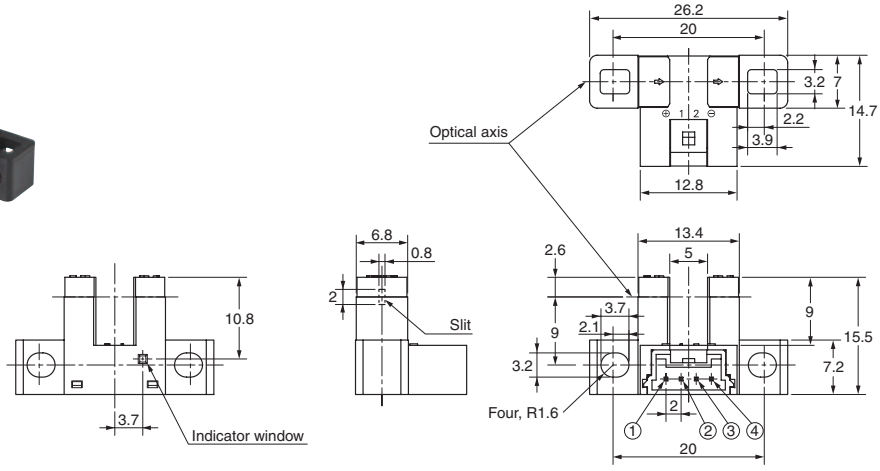
Terminal Arrangement

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

Mounting screw holes



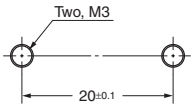
EE-SX971-C1
EE-SX971P-C1



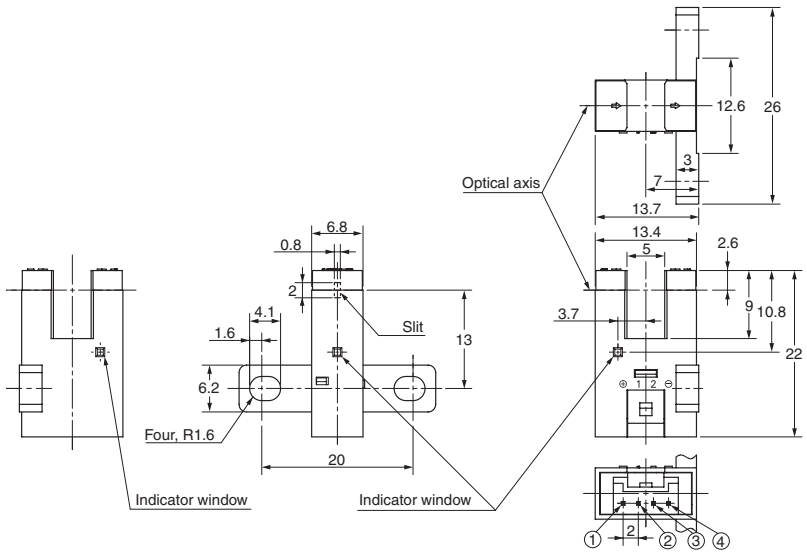
Terminal Arrangement

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

Mounting screw holes



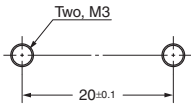
EE-SX972-C1
EE-SX972P-C1



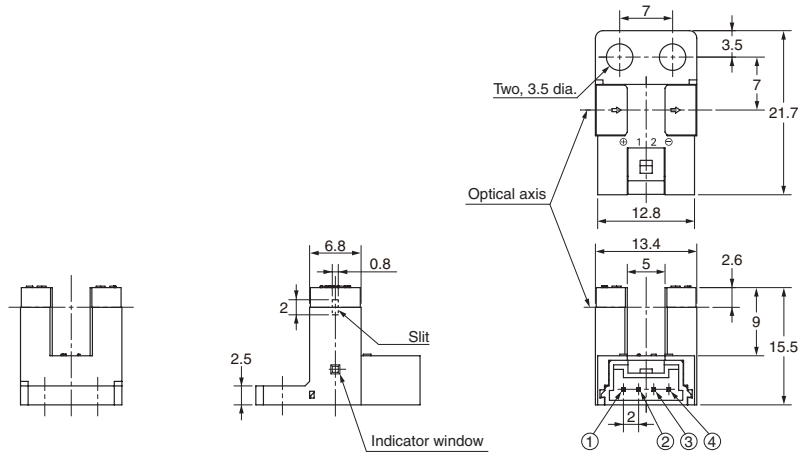
Terminal Arrangement

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

Mounting screw holes



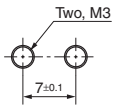
EE-SX974-C1
EE-SX974P-C1



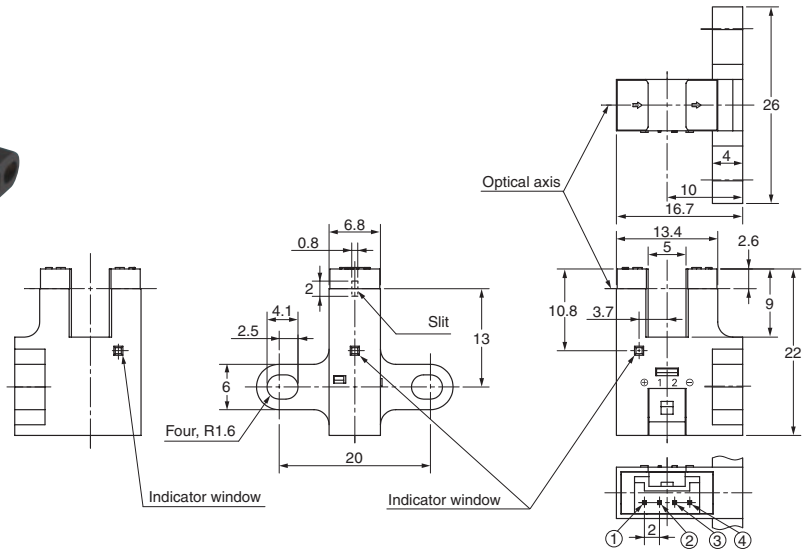
Terminal Arrangement

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

Mounting screw holes



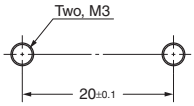
EE-SX975-C1
EE-SX975P-C1



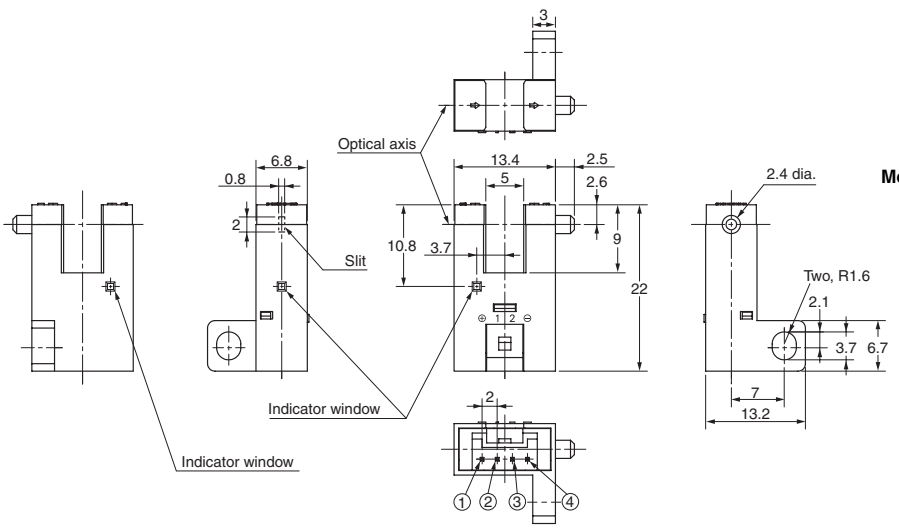
Terminal Arrangement

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

Mounting screw holes



EE-SX976-C1
EE-SX976P-C1

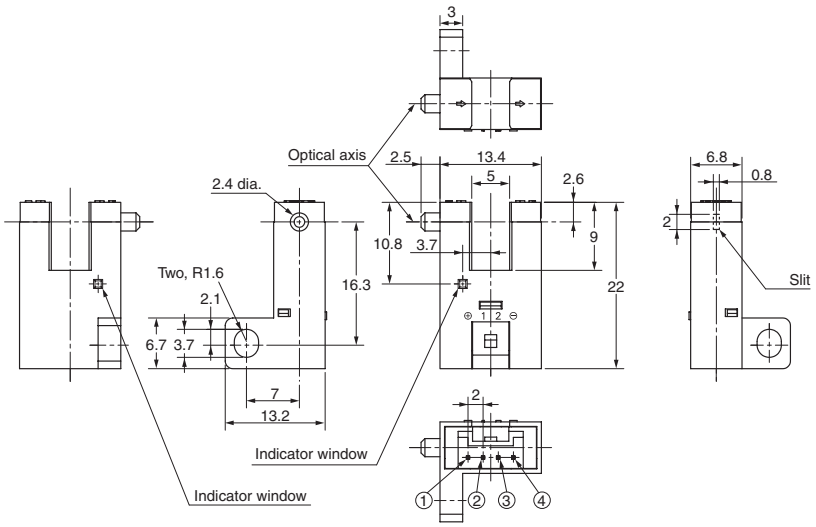


Terminal Arrangement

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

Mounting screw holes

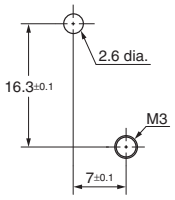
EE-SX977-C1
EE-SX977P-C1



Terminal Arrangement

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

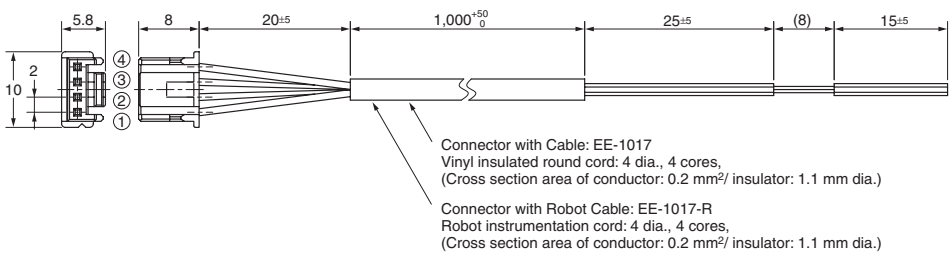
Mounting screw holes



Accessories (Order Separately)

Connector

Connector with Cable
EE-1017
Connector with Robot Cable
EE-1017-R



Terminal Arrangement

①	+	Brown
②	1	Black
③	2	White
④	–	Blue

Terms and Conditions of Sale

1. Offer; Acceptance. These terms and conditions (these "Terms") are deemed part of all quotes, agreements, purchase orders, acknowledgments, price lists, catalogs, manuals, brochures and other documents, whether electronic or in writing, relating to the sale of products or services (collectively, the "Products") by Omron Electronics LLC and its subsidiary companies ("Omron"). Omron objects to any terms or conditions proposed in Buyer's purchase order or other documents which are inconsistent with, or in addition to, these Terms.
2. Prices; Payment Terms. All prices stated are current, subject to change without notice by Omron. Omron reserves the right to increase or decrease prices on any unshipped portions of outstanding orders. Payments for Products are due net 30 days unless otherwise stated in the invoice.
3. Discounts. Cash discounts, if any, will apply only on the net amount of invoices sent to Buyer after deducting transportation charges, taxes and duties, and will be allowed only if (i) the invoice is paid according to Omron's payment terms and (ii) Buyer has no past due amounts.
4. Interest. Omron, at its option, may charge Buyer 1-1/2% interest per month or the maximum legal rate, whichever is less, on any balance not paid within the stated terms.
5. Orders. Omron will accept no order less than $200 net billing.
6. Governmental Approvals. Buyer shall be responsible for, and shall bear all costs involved in, obtaining any government approvals required for the importation or sale of the Products.
7. Taxes. All taxes, duties and other governmental charges (other than general real property and income taxes), including any interest or penalties thereon, imposed directly or indirectly on Omron or required to be collected directly or indirectly by Omron for the manufacture, production, sale, delivery, importation, consumption or use of the Products sold hereunder (including customs duties and sales, excise, use, turnover and license taxes) shall be charged to and remitted by Buyer to Omron.
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9. Cancellation; Etc. Orders are not subject to rescheduling or cancellation unless Buyer indemnifies Omron against all related costs or expenses.
10. Force Majeure. Omron shall not be liable for any delay or failure in delivery resulting from causes beyond its control, including earthquakes, fires, floods, strikes or other labor disputes, shortage of labor or materials, accidents to machinery, acts of sabotage, riots, delay in or lack of transportation or the requirements of any government authority.
11. Shipping; Delivery. Unless otherwise expressly agreed in writing by Omron:
    a. Shipments shall be by a carrier selected by Omron; Omron will not drop ship except in "break down" situations.
    b. Such carrier shall act as the agent of Buyer and delivery to such carrier shall constitute delivery to Buyer;
    c. All sales and shipments of Products shall be FOB shipping point (unless otherwise stated in writing by Omron), at which point title and risk of loss shall pass from Omron to Buyer; provided that Omron shall retain a security interest in the Products until the full purchase price is paid;
    d. Delivery and shipping dates are estimates only; and
    e. Omron will package Products as it deems proper for protection against normal handling and extra charges apply to special conditions.
12. Claims. Any claim by Buyer against Omron for shortage or damage to the Products occurring before delivery to the carrier must be presented in writing to Omron within 30 days of receipt of shipment and include the original transportation bill signed by the carrier noting that the carrier received the Products from Omron in the condition claimed.
13. Warranties. (a) Exclusive Warranty. Omron's exclusive warranty is that the Products will be free from defects in materials and workmanship for a period of twelve months from the date of sale by Omron (or such other period expressed in writing by Omron). Omron disclaims all other warranties, express or implied. (b) Limitations. OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, ABOUT NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OF THE PRODUCTS. BUYER ACKNOWLEDGES THAT IT ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. Omron further disclaims all warranties and responsibility of any type for claims or expenses based on infringement by the Products or otherwise of any intellectual property right. (c) Buyer Remedy. Omron's sole obligation hereunder shall be, at Omron's election, to (i) replace (in the form originally shipped with Buyer responsible for labor charges for removal or replacement thereof) the non-complying Product, (ii) repair the non-complying Product, or (iii) repay or credit Buyer an amount equal to the purchase price of the non-complying Product; provided that in no event shall Omron be responsible for warranty, repair, indemnity or any other claims or expenses regarding the Products unless Omron's analysis confirms that the Products were properly handled, stored, installed and maintained and not subject to contamination, abuse, misuse or inappropriate modification. Return of any Products by Buyer must be approved in writing by Omron before shipment. Omron Companies shall not be liable for the suitability or unsuitability or the results from the use of Products in combination with any electrical or electronic components, circuits, system assemblies or any other materials or substances or environments. Any advice, recommendations or information given orally or in writing, are not to be construed as an amendment or addition to the above warranty. See http://www.omron247.com or contact your Omron representative for published information.
14. Limitation on Liability; Etc. OMRON COMPANIES SHALL NOT BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR PRODUCTION OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED IN CONTRACT, WARRANTY, NEGLIGENCE OR STRICT LIABILITY. Further, in no event shall liability of Omron Companies exceed the individual price of the Product on which liability is asserted.
15. Indemnities. Buyer shall indemnify and hold harmless Omron Companies and their employees from and against all liabilities, losses, claims, costs and expenses (including attorney's fees and expenses) related to any claim, investigation, litigation or proceeding (whether or not Omron is a party) which arises or is alleged to arise from Buyer's acts or omissions under these Terms or in any way with respect to the Products. Without limiting the foregoing, Buyer (at its own expense) shall indemnify and hold harmless Omron and defend or settle any action brought against such Companies to the extent based on a claim that any Product made to Buyer specifications infringed intellectual property rights of another party.
16. Property; Confidentiality. Any intellectual property in the Products is the exclusive property of Omron Companies and Buyer shall not attempt to duplicate it in any way without the written permission of Omron. Notwithstanding any charges to Buyer for engineering or tooling, all engineering and tooling shall remain the exclusive property of Omron. All information and materials supplied by Omron to Buyer relating to the Products are confidential and proprietary, and Buyer shall limit distribution thereof to its trusted employees and strictly prevent disclosure to any third party.
17. Export Controls. Buyer shall comply with all applicable laws, regulations and licenses regarding (i) export of products or information; (iii) sale of products to "forbidden" or other proscribed persons; and (ii) disclosure to non-citizens of regulated technology or information.
18. Miscellaneous. (a) Waiver. No failure or delay by Omron in exercising any right and no course of dealing between Buyer and Omron shall operate as a waiver of rights by Omron. (b) Assignment. Buyer may not assign its rights hereunder without Omron's written consent. (c) Law. These Terms are governed by the law of the jurisdiction of the home office of the Omron company from which Buyer is purchasing the Products (without regard to conflict of law principles). (d) Amendment. These Terms constitute the entire agreement between Buyer and Omron relating to the Products, and no provision may be changed or waived unless in writing signed by the parties. (e) Severability. If any provision hereof is rendered ineffective or invalid, such provision shall not invalidate any other provision. (f) Setoff. Buyer shall have no right to set off any amounts against the amount owing in respect of this invoice. (g) Definitions. As used herein, "including" means "including without limitation"; and "Omron Companies" (or similar words) mean Omron Corporation and any direct or indirect subsidiary or affiliate thereof.

Certain Precautions on Specifications and Use

1. Suitability of Use. Omron Companies shall not be responsible for conformity with any standards, codes or regulations which apply to the combination of the Product in the Buyer's application or use of the Product. At Buyer's request, Omron will provide applicable third party certification documents identifying ratings and limitations of use which apply to the Product. This information by itself is not sufficient for a complete determination of the suitability of the Product in combination with the end product, machine, system, or other application or use. Buyer shall be solely responsible for determining appropriateness of the particular Product with respect to Buyer's application, product or system. Buyer shall take application responsibility in all cases but the following is a non-exhaustive list of applications for which particular attention must be given:
   (i) Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this document.
   (ii) Use in consumer products or any use in significant quantities.
   (iii) 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.
   (iv) Systems, machines and equipment that could present a risk to life or property. Please know and observe all prohibitions of use applicable to this Product.
   NEVER USE THE PRODUCT FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY OR IN LARGE QUANTITIES WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON'S PRODUCT IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.
2. Programmable Products. Omron Companies shall not be responsible for the user's programming of a programmable Product, or any consequence thereof.
3. Performance Data. Data presented in Omron Company websites, catalogs and other materials is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of Omron's test conditions, and the user must correlate it to actual application requirements. Actual performance is subject to the Omron's Warranty and Limitations of Liability.
4. Change in Specifications. Product specifications and accessories may be changed at any time based on improvements and other reasons. It is our practice to change part numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the Product may be changed without any notice. When in doubt, special part numbers may be assigned to fix or establish key specifications for your application. Please consult with your Omron's representative at any time to confirm actual specifications of purchased Product.
5. Errors and Omissions. Information presented by Omron Companies has been checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical or proofreading errors or omissions.

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