


# E3S-CL

## Simply Set the Distance to Reliably Detect Workpieces of Various Colors



- Reliable detection regardless of color or material. Black/white error of only 2% max. (E3S-CL1)
- Long sensing distance of 500 mm (E3S-CL2).
- Eliminates background influence. (Differential travel of only 2% max. with E3S-CL1.)
- Metal body with IP67 protection. Oil resistance (E3S-CL2).



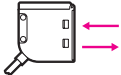
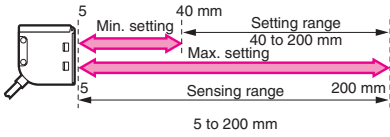
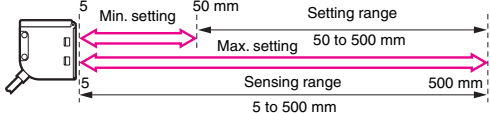
 Be sure to read *Safety Precautions* on page 7.

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

### Ordering Information

**Sensors** (Refer to *Dimensions* on page 8.)

 Red light  Infrared light

Appearance	Sensing/Setting range	Model
	 <p>5 40 mm Setting range Min. setting 40 to 200 mm Max. setting Sensing range 200 mm 5 to 200 mm</p>	<b>E3S-CL1 2M</b>
	 <p>5 50 mm Setting range Min. setting 50 to 500 mm Max. setting Sensing range 500 mm 5 to 500 mm</p>	<b>E3S-CL2 2M</b>

## Ratings and Specifications

Sensing method		Distance-settable	
Item	Model	E3S-CL1	E3S-CL2
Sensing distance		5 to 200 mm (white paper: 200 x 200 mm, setting distance: 200 mm)	5 to 500 mm (white paper: 200 x 200 mm, setting distance: 500 mm)
Setting range		40 to 200 mm (white paper: 200 x 200 mm)	50 to 500 mm (white paper: 200 x 200 mm)
Differential travel		2% max. of setting distance	10% max. of setting distance
Reflectivity characteristics (black/white error) *1		2% max. of setting distance	10% max. of setting distance
Light source (wavelength)		Red LED (700 nm)	Infrared LED (860 nm)
Power supply voltage		10 to 30 VDC; ripple: 10% max.	
Current consumption		35 mA max.	50 mA max.
Control output		Load power supply voltage: 30 VDC max., Load current: 100 mA max. Residual voltage: NPN output: 1.2 V max. PNP output: 2 V max. Open collector output (NPN/PNP depending on model) Light-ON/Dark-ON selectable	
Protection circuits		Power supply reverse polarity protection, Output short-circuit protection, Mutual interference prevention	
Response time		Operate or reset: 1 ms max.	Operate or reset: 2 ms max.
Distance setting		Six-turn endless adjuster with an indicator	
Ambient illumination (Receiver side)		Incandescent lamp: illumination on optical spot: 5,000 lx max. Sunlight: illumination on optical spot: 10,000 lx max.	
Ambient temperature range		Operating/storage: -25 to 55°C (with no icing or condensation)	
Ambient humidity range		Operating/storage: 35% to 85% (with no condensation)	
Insulation resistance		20 MΩ min. at 500 VDC	
Dielectric strength		1,000 VAC, 50/60 Hz for 1 min	
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 <sup>2</sup> 3 times each in X, Y, and Z directions	
Degree of protection		IP67 (IEC 60529), NEMA: 6P (indoors only) *2	IP67 (IEC 60529) (in-house standards: oil-resistant), NEMA: 6P (indoors only) *2
Connection method		Pre-wired (standard length: 2 m)	
Weight (packed state)		Approx. 170 g	
Materials	Case	Zinc die-cast	
	Operation panel	PES (Polyether sulfone)	
	Lens	Methacrylic resin	
	Mounting bracket	Stainless steel (SUS304)	
Accessories		Mounting bracket, 12 M4 hexagonal bolts (with spring and flat washers), Adjustment screwdriver, and Instruction manual	

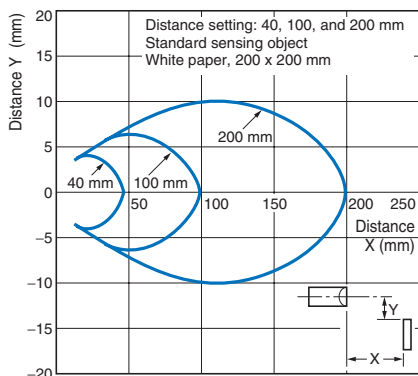
\*1. Sensing distance error for standard white (90% reflective) and black (5% reflective) paper.

\*2. NEMA: National Electrical Manufacturers Association

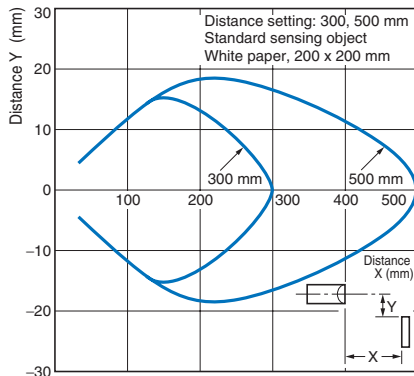
## Engineering Data (Reference value)

### Operating Range

**E3S-CL1**

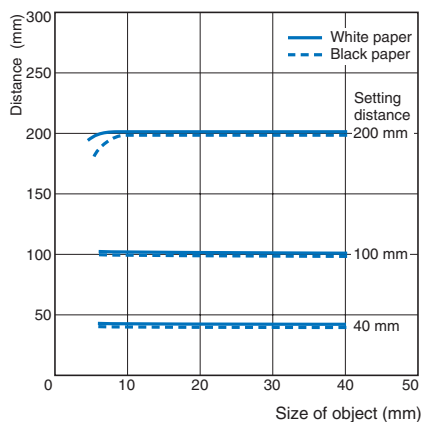


**E3S-CL2**

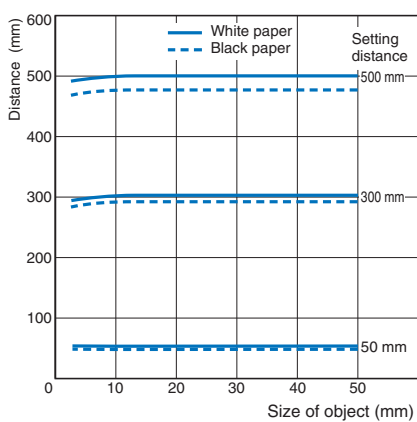


### Sensing Object Size vs. Sensing Distance

**E3S-CL1**

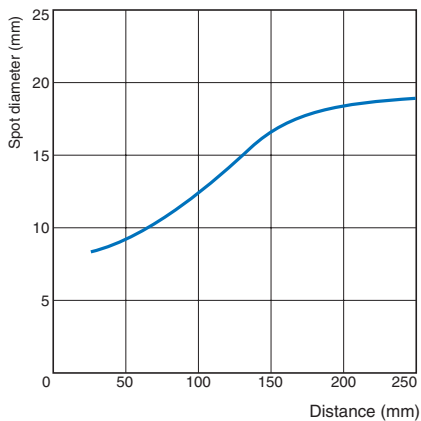


**E3S-CL2**

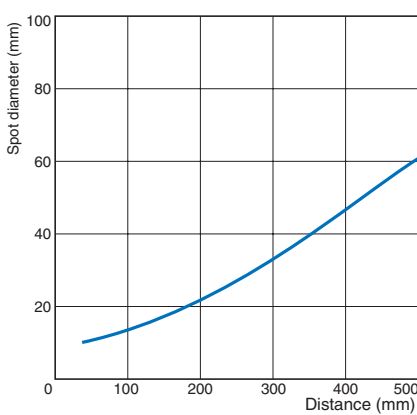


### Spot Diameter vs. Sensing Distance

**E3S-CL1**

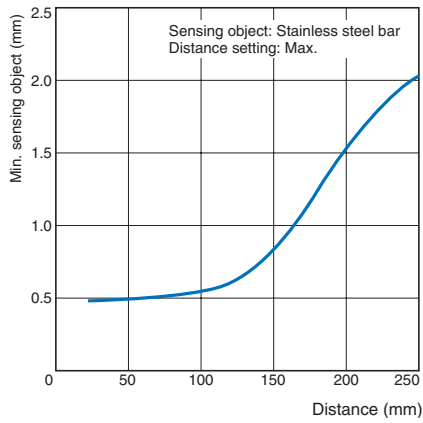


**E3S-CL2**

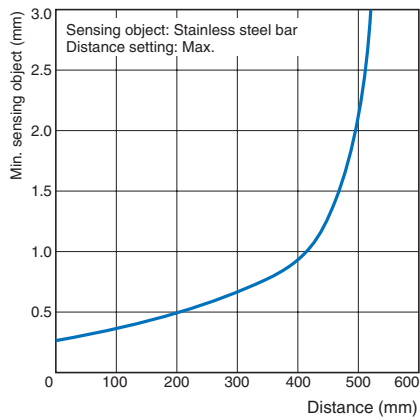


## Sensing Distance vs. Minimum Detectable Object Size

### E3S-CL1

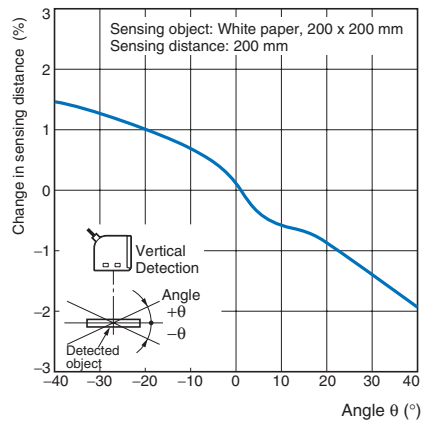


### E3S-CL2

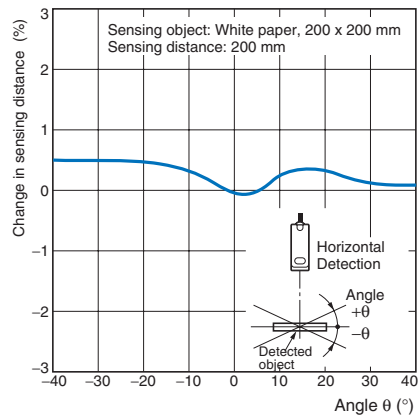


## Sensing Object Angle Characteristics

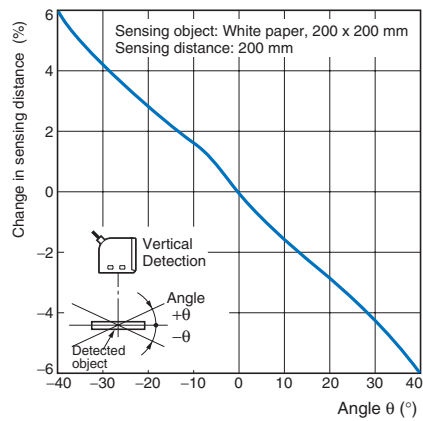
### E3S-CL1 Vertical



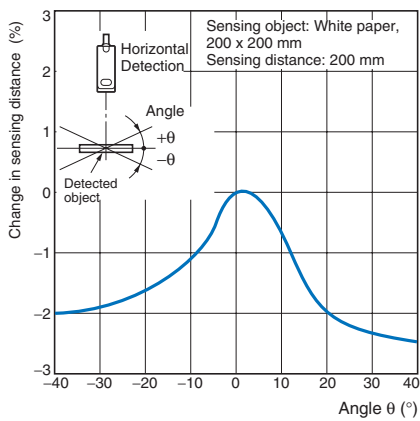
### E3S-CL1 Horizontal



### E3S-CL2 Vertical



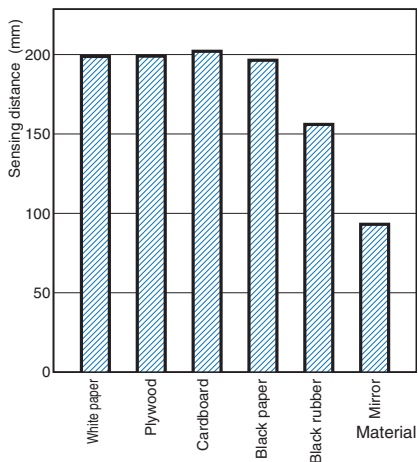
### E3S-CL2 Horizontal



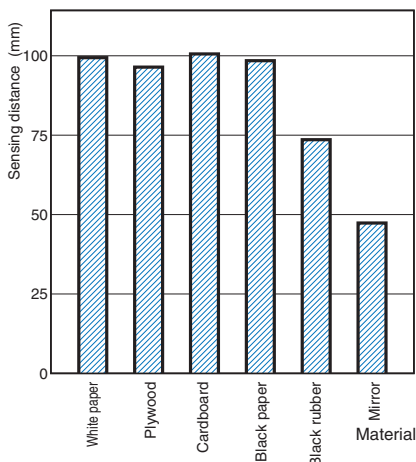
## Sensing Distance vs. Sensing Object Material

### E3S-CL1

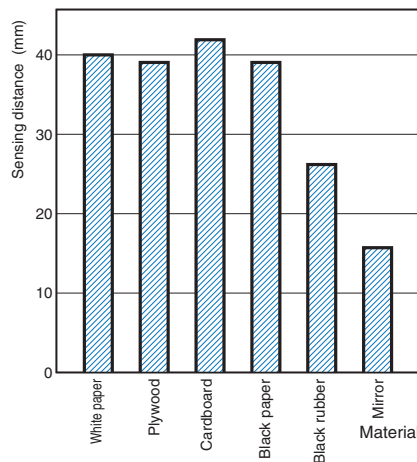
(Setting Distance of 200 mm using White Paper)



(Setting Distance of 100 mm using White Paper)

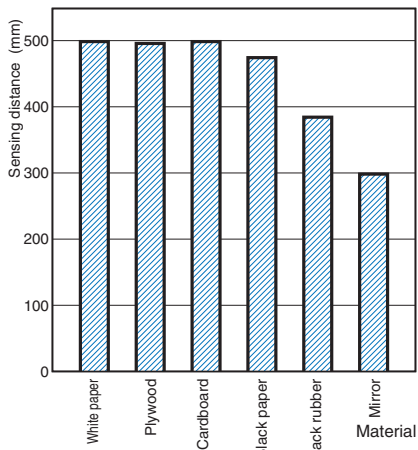


(Setting Distance of 40 mm using White Paper)

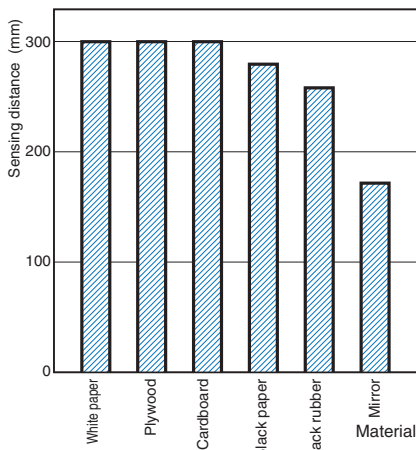


### E3S-CL2

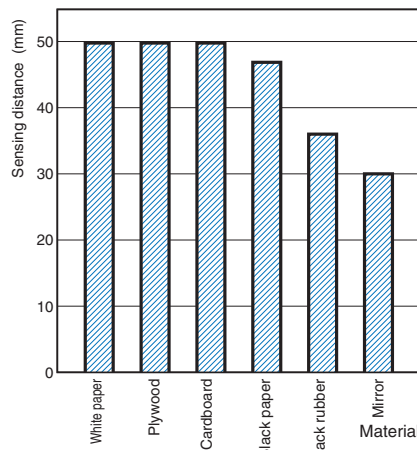
(Setting Distance of 500 mm using White Paper)



(Setting Distance of 300 mm using White Paper)

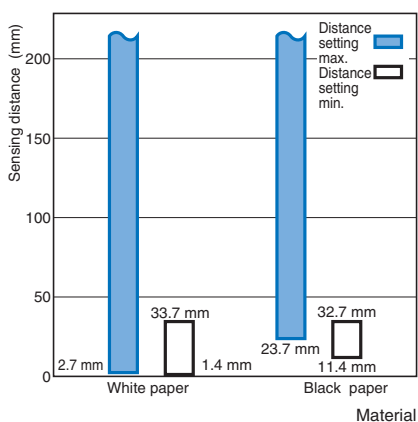


(Setting Distance of 50 mm using White Paper)

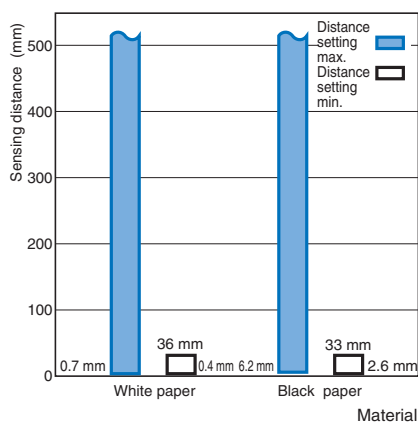


## Close-range Characteristics

### E3S-CL1

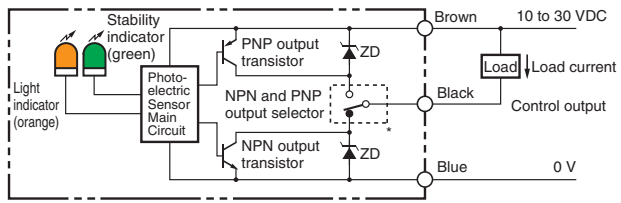


### E3S-CL2

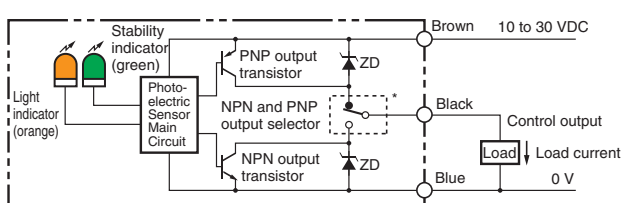


## I/O Circuit Diagrams

### NPN Output

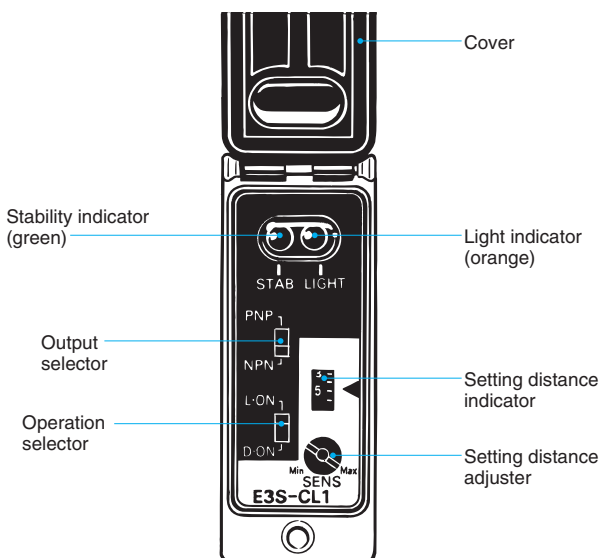
Model	Operation mode	Timing charts	Operation selector	Output circuit
E3S-CL1 E3S-CL2	Light-ON	Incident light: ON (green bar) No incident light: OFF (white bar) Operation indicator (orange): OFF (white bar) Output transistor: ON (green bar) Load (relay): Operate (green bar), Reset (white bar)	L side (LIGHT ON)	 <p>*Set the NPN and PNP output selector to NPN.</p>
	Dark-ON	Incident light: ON (green bar) No incident light: OFF (white bar) Operation indicator (orange): OFF (white bar) Output transistor: ON (green bar), OFF (white bar) Load (relay): Operate (green bar), Reset (white bar)	D side (DARK ON)	

### PNP Output

Model	Operation mode	Timing charts	Operation selector	Output circuit
E3S-CL1 E3S-CL2	Light-ON	Incident light: ON (green bar) No incident light: OFF (white bar) Operation indicator (orange): OFF (white bar) Output transistor: ON (green bar) Load (relay): Operate (green bar), Reset (white bar)	L side (LIGHT ON)	 <p>*Set the NPN and PNP output selector to PNP.</p>
	Dark-ON	Incident light: ON (green bar) No incident light: OFF (white bar) Operation indicator (orange): OFF (white bar) Output transistor: ON (green bar), OFF (white bar) Load (relay): Operate (green bar), Reset (white bar)	D side (DARK ON)	

## Nomenclature

### Operation Panel



### Output Selector

1. Set the selector to NPN for NPN output.
2. Set the selector to PNP for PNP output.

### Operation Selector

1. Set the selector to L-ON for ON light-ON operation.
2. Set the selector to D-ON for ON dark-ON operation.

### Setting Distance Adjuster

1. The sensing distance will increase when the adjuster is turned clockwise (toward Max.) and will decrease when the knob is turned counterclockwise.
2. The adjustment can be turned up to 6 times clockwise or counterclockwise to set the sensing distance. The number of turns will be displayed by the indicator.

## 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

Do not use the product in atmospheres or environments that exceed product ratings.

#### ● Designing

##### Cable

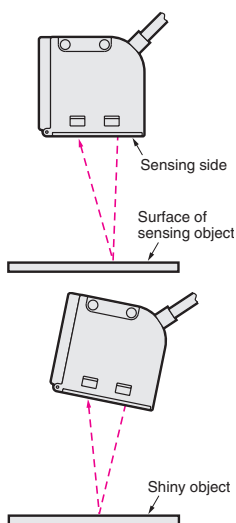
The E3S-CL2 uses an oil-resistive cord to ensure oil resistivity.

#### ● Mounting

##### Mounting

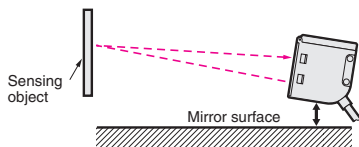
##### Mounting Direction

- Mount the Sensor so that the sensing face runs parallel to the surface of the object being detected as shown below, and not at an angle.

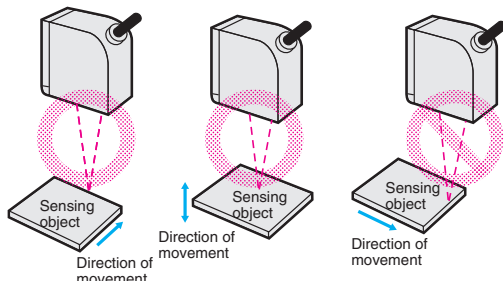


If detecting a shiny object, however, mount the Sensor so that the sensing face is at an angle of between 5° and 10° of the surface of the object being detected as shown below, and check to be sure that there is no interference from the background.

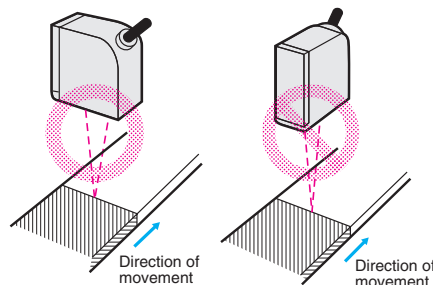
- If stable operation is not possible near a mirror surface, mount the Sensor at an angle as shown below, and separate the Sensor as far as possible from the mirror surface.



- Mount the Sensor so that it is not aligned with the direction of movement of the sensing object, as shown below.



- Also, mount the Sensor so that it is not aligned with extreme changes in color or materials, as shown below.



- Mount the Sensor so that sunlight, fluorescent light, incandescent light, or other strong sources of light do not enter the directional angle of the Sensor.

#### Precautions

- When mounting the Sensor, do not hit the Sensor with a hammer, or the Sensor will lose its watertightness.
- Use M4 screws to mount the Sensor.
- The tightening torque of each screw must be 1.2 N·m maximum.

#### ● Others

##### Oil and Chemical Resistivity (E3S-CL2)

The E3S-CL2 was tested for resistance to the oils given in the following table. Refer to the information in the table when deciding which type of oil to use. However, performance may be affected by certain types of oil.

Test oil classification	Product name	Kinematic viscosity (mm <sup>2</sup> /s (cst)) at 40°C	pH
Lubricating oil	Velocity No.3	2.02	
Water insoluble machining oil	Yushiron Oil No. 2 ac	Less than 10	---
	Yushiroken EC50T-3		7 to 9.5
Water soluble machining oil	Yushiron Lubric HWC68	---	7 to 9.9
	Gryton 1700D		7 to 9.2
	Yushiroken S50N		7 to 9.8

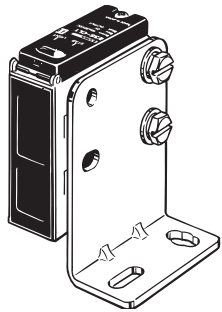
Note: 1. The E3S-CL2 maintained a minimum insulation resistance of 100 MΩ after it was dipped in all the above oils at a temperature of 50°C for 240 hours.

2. When using the E3S-CL2 in environments subject to oils other than those listed above, use the figures for kinematic viscosity and pH values from the table as general guidelines. Additives and other substances contained in oils may affect the E3S-CL2. Be sure to consider this before use.

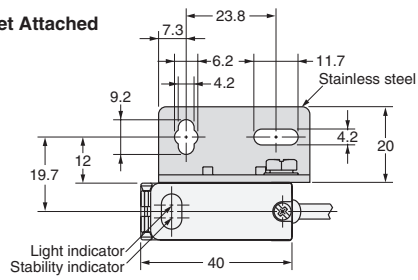
## Dimensions

E3S-CL1

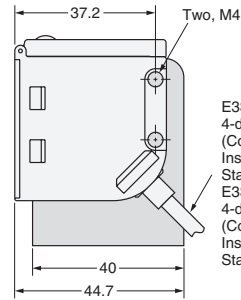
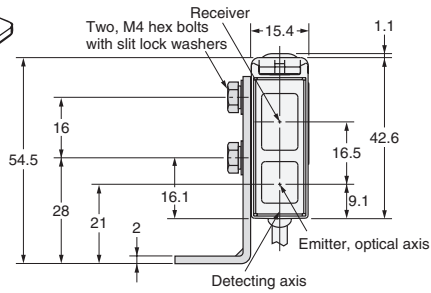
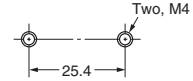
E3S-CL2



With Mounting Bracket Attached



Mounting Holes



E3S-CL1:  
4-dia. vinyl-insulated round cable with 3 conductors  
(Conductor cross section: 0.2 mm<sup>2</sup> (AWG24),  
Insulator diameter: 1.1 mm),  
Standard length: 2 m  
E3S-CL2:  
4-dia. vinyl-insulated round cable with 3 conductors  
(Conductor cross section area: 0.2 mm<sup>2</sup> (AWG24),  
Insulator diameter: 1.2 mm),  
Standard length: 2 m

Note: The output selector, operation selector, and distance setting adjuster are located inside the cover.



# 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.
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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.
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  - 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.
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17. **Export Controls.** Buyer shall comply with all applicable laws, regulations and licenses regarding (i) export of products or information; (ii) sale of products to "forbidden" or other proscribed persons; and (iii) 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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