


# 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).



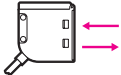
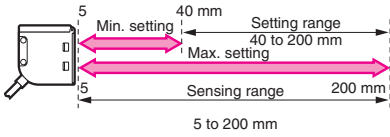
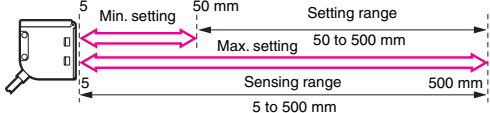
 Be sure to read *Safety Precautions* on page 7.

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<br/>Min. setting 40 to 200 mm<br/>Max. setting<br/>Sensing range 200 mm<br/>5 to 200 mm</p>   | <b>E3S-CL1 2M</b> |
|   |  <p>5 50 mm Setting range<br/>Min. setting 50 to 500 mm<br/>Max. setting<br/>Sensing range 500 mm<br/>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.<br>Residual voltage: NPN output: 1.2 V max.<br>PNP output: 2 V max.<br>Open collector output (NPN/PNP depending on model)<br>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.<br>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   |  |

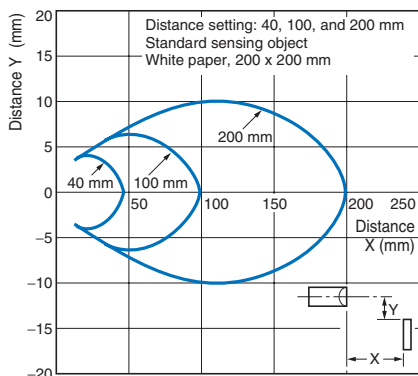
\*1. Sensing distance error for standard white (90% reflective) and black (5% reflective) paper.

\*2. NEMA: National Electrical Manufacturers Association

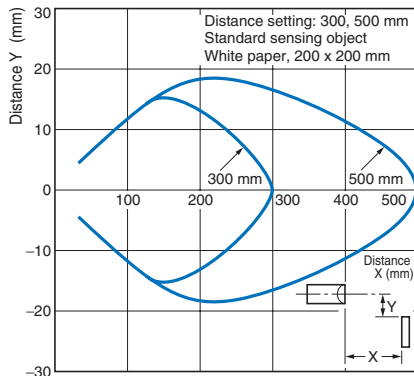
## Engineering Data (Reference value)

### Operating Range

**E3S-CL1**

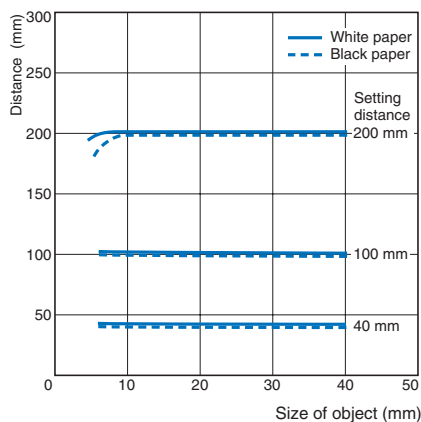


**E3S-CL2**

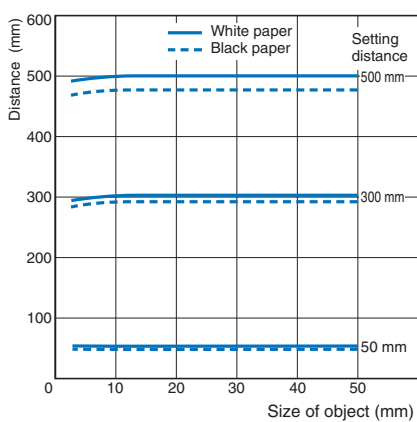


### Sensing Object Size vs. Sensing Distance

**E3S-CL1**

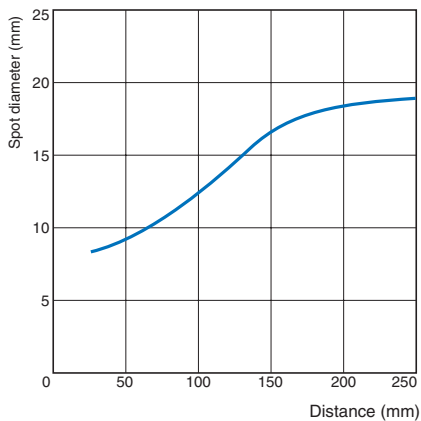


**E3S-CL2**

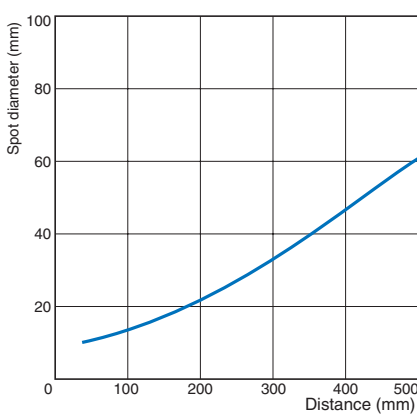


### Spot Diameter vs. Sensing Distance

**E3S-CL1**

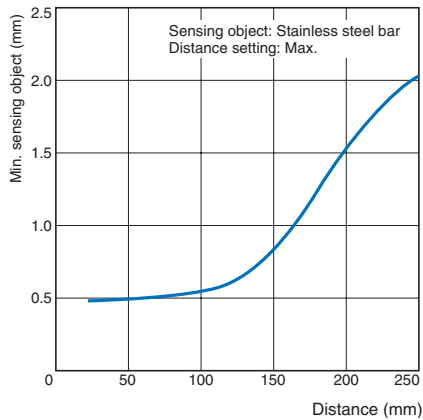


**E3S-CL2**

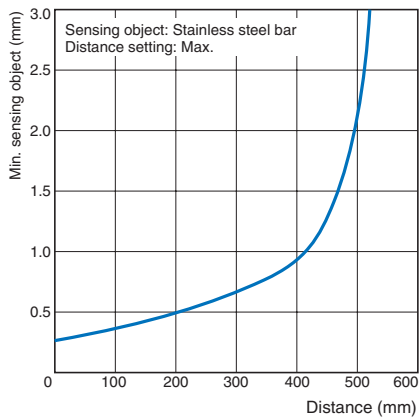


## Sensing Distance vs. Minimum Detectable Object Size

### E3S-CL1

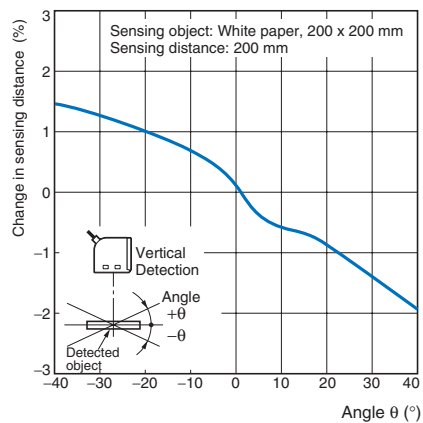


### E3S-CL2

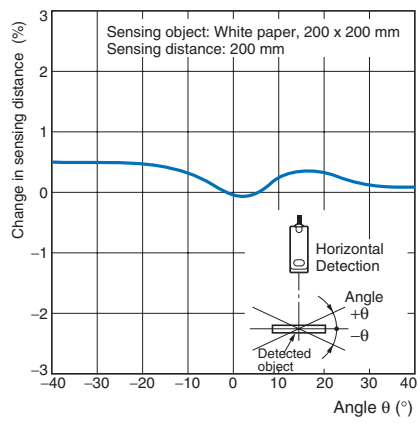


## Sensing Object Angle Characteristics

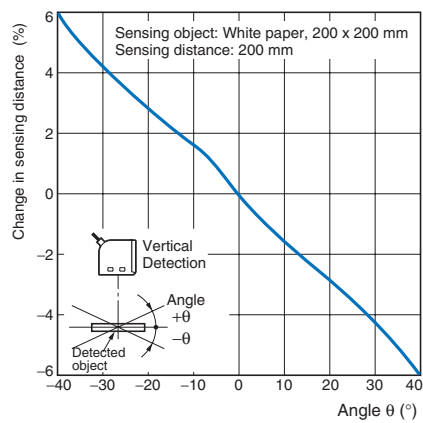
### E3S-CL1 Vertical



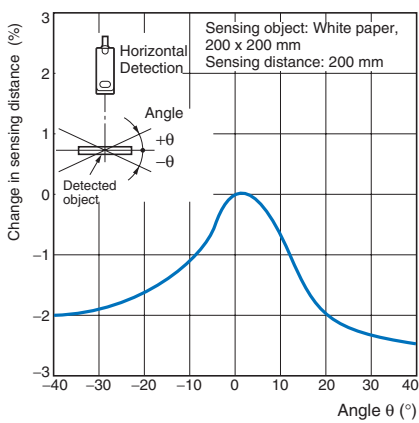
### E3S-CL1 Horizontal



### E3S-CL2 Vertical



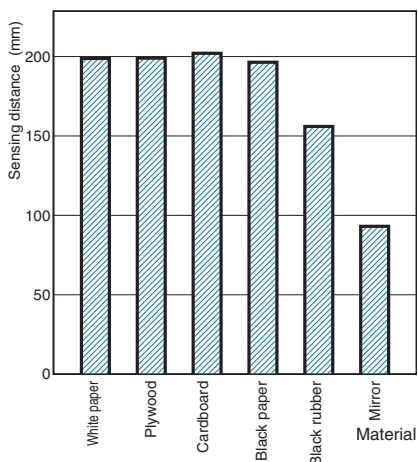
### E3S-CL2 Horizontal



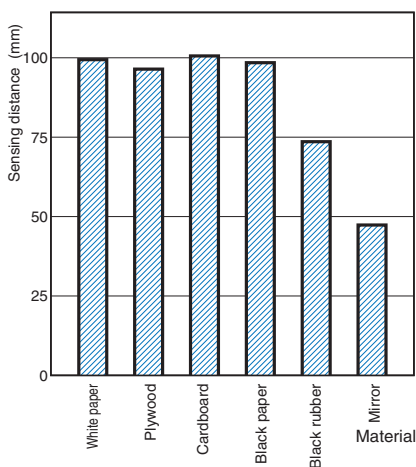
## Sensing Distance vs. Sensing Object Material

### E3S-CL1

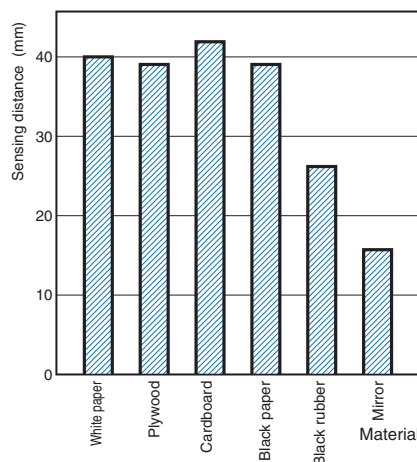
(Setting Distance of 200 mm using White Paper)



(Setting Distance of 100 mm using White Paper)

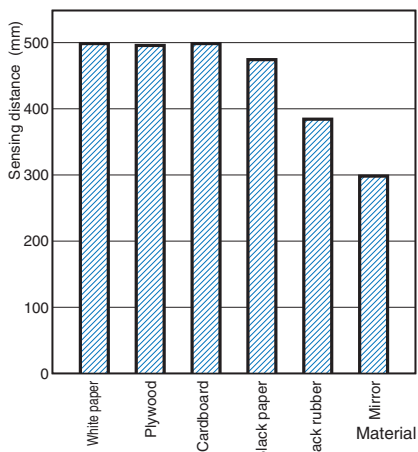


(Setting Distance of 40 mm using White Paper)

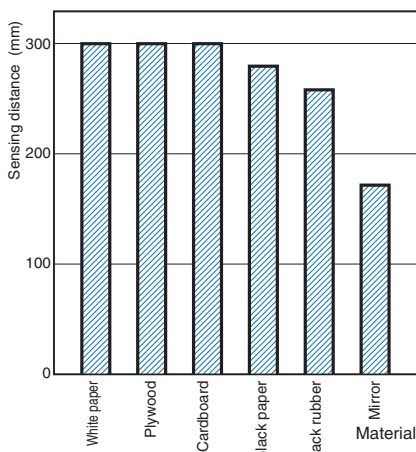


### E3S-CL2

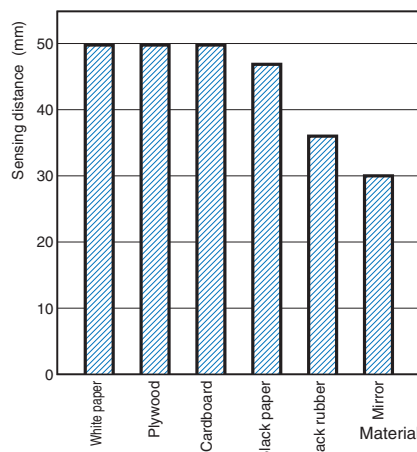
(Setting Distance of 500 mm using White Paper)



(Setting Distance of 300 mm using White Paper)

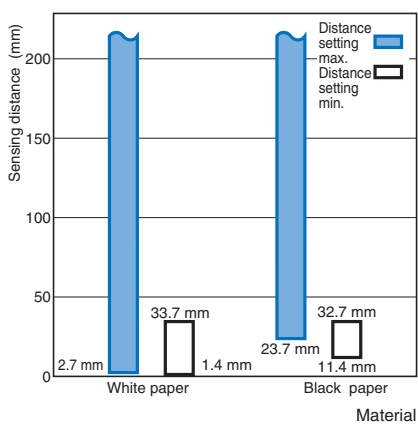


(Setting Distance of 50 mm using White Paper)

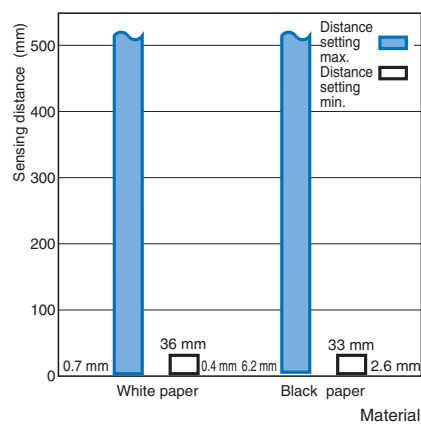


## Close-range Characteristics

### E3S-CL1



### E3S-CL2



## I/O Circuit Diagrams

### NPN Output

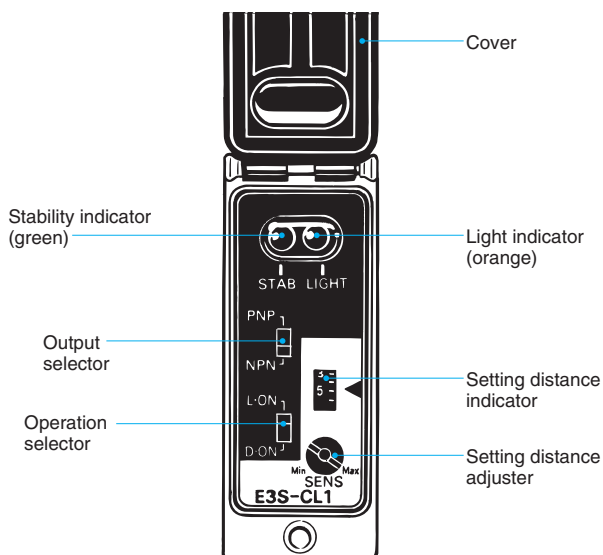
| Model              | Operation mode | Timing charts   | Operation selector | Output circuit                                      |
|--------------------|----------------|---|--------------------|---|
| E3S-CL1<br>E3S-CL2 | Light-ON       | Incident light: ON<br>No incident light: OFF<br>Operation indicator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

### PNP Output

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

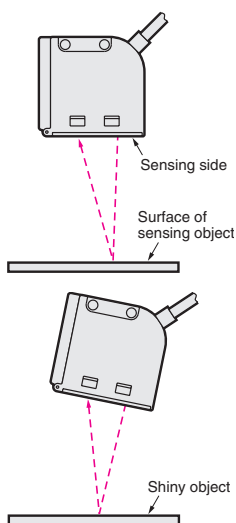
The E3S-CL2 uses an oil-resistive cord to ensure oil resistivity.

#### ● Mounting

##### Mounting

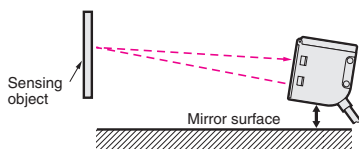
##### Mounting Direction

- 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.

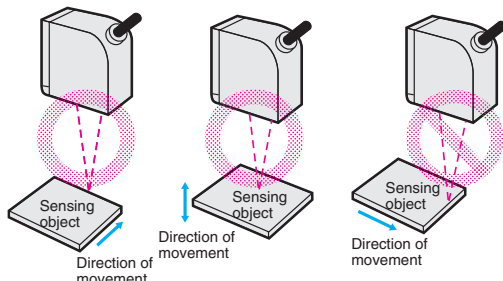


If detecting a shiny object, however, mount the Sensor so that the sensing face is at an angle of between 5° and 10° of the surface of the object being detected as shown below, and check to be sure that there is no interference from the background.

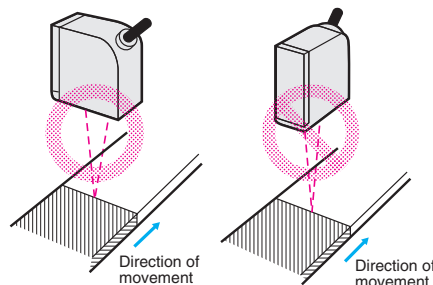
- If stable operation is not possible near a mirror surface, mount the Sensor at an angle as shown below, and separate the Sensor as far as possible from the mirror surface.



- 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 Lubic HWC68  | ---  | 7 to 9.9 |
|                               | Gryton 1700D          |  | 7 to 9.2 |
|                               | Yushiroken S50N       |  | 7 to 9.8 |

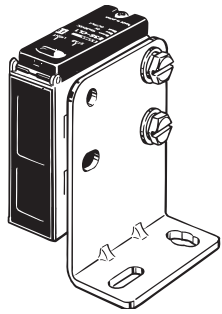
Note: 1. The E3S-CL2 maintained a minimum insulation resistance of 100 MΩ after it was dipped in all the above oils at a temperature of 50°C for 240 hours.

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.

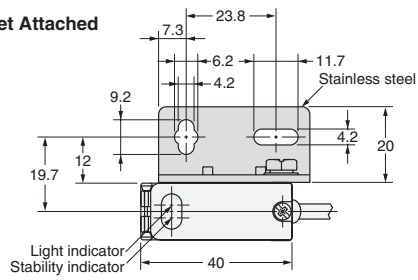
## Dimensions

E3S-CL1

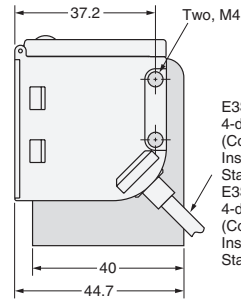
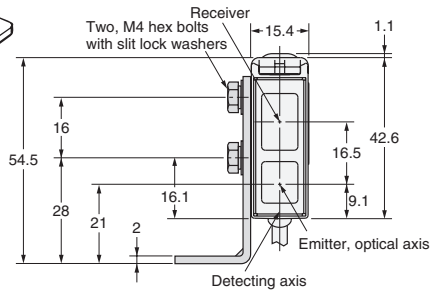
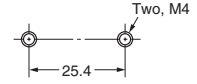
E3S-CL2



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.



## 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

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, REGARDING NON-INFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. OMRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

### LIMITATIONS OF LIABILITY

OMRON SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY.

In no event shall the responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.

IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR, OR OTHER CLAIMS 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 OR REPAIR.

## Application Considerations

### SUITABILITY FOR USE

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the products.

At the customer's request, OMRON will provide applicable third party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use.

The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

- Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this catalog.
- 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.

### PROGRAMMABLE PRODUCTS

OMRON shall not be responsible for the user's programming of a programmable product, or any consequence thereof.

## Disclaimers

### 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 model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the products may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

### DIMENSIONS AND WEIGHTS

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

### PERFORMANCE DATA

Performance data given in this catalog 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 users must correlate it to actual application requirements. Actual performance is subject to the OMRON Warranty and Limitations of Liability.

### ERRORS AND OMISSIONS

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2012.8

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Industrial Automation Company

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