

# Authorised Distributors:-

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## Optical Fiber Glossy Object Sensor

# E3X-NL

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### Employs OMRON's Unique Free Angle Optics Technology for Detecting Minute Differences in Glossiness

- Detects minute differences in glossiness because the Sensor is not affected by colors and patterns.
- Teaching system ensures easy adjustment at the press of a button.
- Fiber Heads available in short-range, small spot and long-range models.
- Uses the pulse-ON system to minimize the influence of external light interference.
- Fuzzy Teaching function enhances detection reliability.



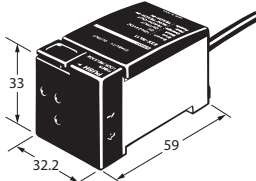
CE

 Be sure to read Safety Precautions on page 247.

## Ordering Information



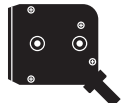

### Sensors

#### Amplifier Units

Connection method	Appearance	Model
Pre-wired		E3X-NL11

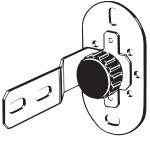
#### Fiber Units

 Red light

Sensing method	Appearance	Sensing distance	Fiber length	Model
Reflective		 10±3 mm	0.5 m	E32-S15-1
			1 m	E32-S15-2
		 20±7 mm	0.5 m	E32-S15L-1
			1 m	E32-S15L-2

## Accessories (Order Separately)

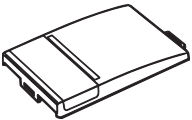
### Mounting Brackets

Appearance	Model	Quantity	Remarks
	E39-L109	1	Can be used with the Fiber Unit E32-S15-□. The Mounting Bracket has a variable angle (0°, 45°) for stable detection of transparent films (double-refractive objects*) on glossy objects such as metal or glass plates.

Note: Refer to *Mounting Brackets* on page 292 for details.

\* Refer to *Technical Guide* on page 246 for details on double-refractive objects.

### Protective Cover

Appearance	Model	Quantity	Remarks
	E39-G9	1	Attached to the Amplifier Unit E3X-NL11. Order a replacement if the Protective Cover is damaged or lost.

## Ratings and Specifications

### Amplifier Units

Item	Model	E3X-NL11
Light source (wavelength)		Red LED (680 nm)
Power supply voltage		12 to 24 VDC ±10%, ripple (p-p): 10% max.
Current consumption		100 mA max.
Control output		Load power supply voltage: 30 VDC max., Load current: 100 mA max. (residual voltage: 1 V max.), Open collector output type (NPN output), Light-ON/Dark-ON selectable
Answer-back output		Load power supply voltage: 30 VDC max., Load current: 100 mA max. (residual voltage: 1 V max.), Open collector output type (NPN output)
Remote teaching input		Purple and blue (0 V) are connected when remote input turns ON: 0 V short-circuit current 1 mA max. Purple and blue (0 V) are disconnected when remote input turns OFF: Open or 9 V min. (max. input voltage 24 V). Note that the input is valid only when remote RUN/TEACH selection input (across pink-blue) is provided.
Protection circuits		Power supply reverse polarity protection, Output short-circuit protection
Response time		Operate or reset: 1 ms max.
Sensitivity adjustment		Teaching system
Timer function *		OFF-delay fixed at 40 ms
Ambient illuminance (Receiver side)		Incandescent lamp: 3,000 lux max., Sunlight 10,000 lux max.
Ambient temperature		Operating: -25°C to 55°C, Storage: -40°C to 70°C (with no icing or condensation)
Ambient humidity		Operating: 35% to 85%, Storage: 35% to 95% (with no condensation)
Insulation resistance		20 MΩ min. at 500 VDC
Dielectric strength		1,000 VAC at 50/60 Hz for 1 minute
Vibration resistance		Destruction: 10 to 55 Hz, 1.5-mm double amplitude or 300 m/s <sup>2</sup> for 2 hrs each in X, Y, and Z directions
Shock resistance		Destruction: 500 m/s <sup>2</sup> for 3 times each in X, Y, and Z directions
Degree of protection		IEC 60529 IP50 (with Protective Cover attached)
Connection method		Pre-wired models (standard length: 2 m)
Weight (packed state)		Approx. 200 g
Material	Case	PBT (polybutylene terephthalate)
	Cover	Polycarbonate
	Mounting Brackets	Stainless steel (SUS304)
Accessories		Mounting Bracket, Instruction manual

\* The OFF-delay timer can be reset by setting the switch.

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E3L

E3X-NL

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E3S-R

E3HQ

E3S-LS3□

F3UV

# E3X-NL

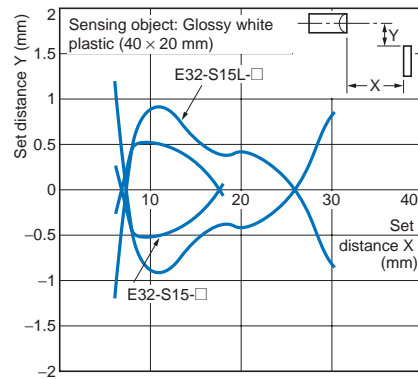
## Fiber Units

Item	Sensing method Features Model	Reflective model			
		Short-range small spot		Long-range	
		E32-S15-1	E32-S15-2	E32-S15L-1	E32-S15L-2
<b>Sensing distance</b>		10±3 mm (white paper, white glossy plastic 40 × 20 mm)		20±7 mm (white paper, white glossy plastic 40 × 20 mm)	
<b>Min. sensing object</b>		0.5-mm		2-mm	
<b>Sensing object angle</b>		Glossiness determination is possible at ±4° inclination from the mounting hole (at sensing distance of 10 mm)		Glossiness determination is possible at ±7° inclination from the mounting hole (at sensing distance of 20 mm)	
<b>Emission/sensing spot diameter</b>		Approx. 2-mm dia./approx. 2-mm dia. (at sensing distance of 10 mm)		Approx. 15-mm dia./approx. 4-mm dia. (at sensing distance of 20 mm)	
<b>Ambient temperature</b>		Operating: -25°C to 55°C, Storage: -40°C to 70°C (with no icing or condensation)			
<b>Ambient humidity</b>		Operating: 35% to 85%, Storage: 35% to 90% (with no condensation)			
<b>Permissible bending radius</b>		4 mm min.			
<b>Degree of protection</b>		IEC 60529 IP50			
<b>Fiber length (cutting not possible)</b>		500 mm	1 m	500 mm	1 m
<b>Weight (packed state)</b>		Approx. 50 g	Approx. 60 g	Approx. 80 g	Approx. 90 g
<b>Material</b>	<b>Sensing Head</b>	Heat-resistant ABS resin			
	<b>Sensor window</b>	Transparent glass		Acrylics	
	<b>Fiber cladding</b>	Urethane			

## Engineering Data (Typical)

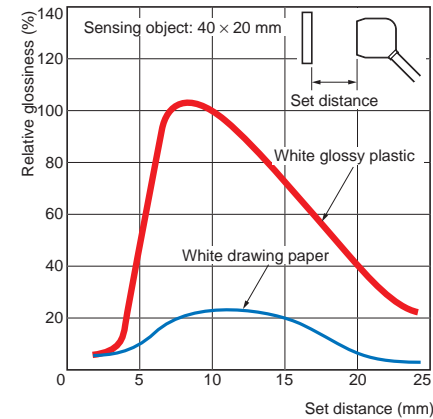
### Operating Range

E3X-NL11 + E32-S15-□/E32-S15L-□

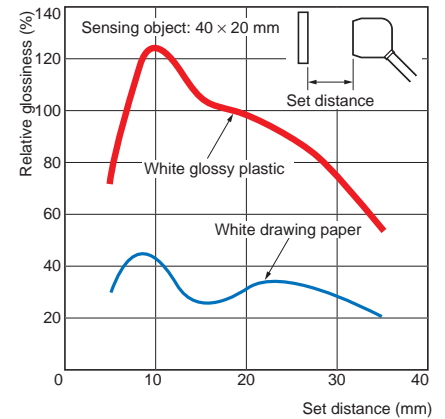


### Glossiness vs. Sensing Distance

E3X-NL11 + E32-S15-□



E3X-NL11 + E32-S15L-□



E3MC

E3C-VS  
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F3C-AL

E3L

E3X-NL

E3S-CR62  
/67

E3S-R

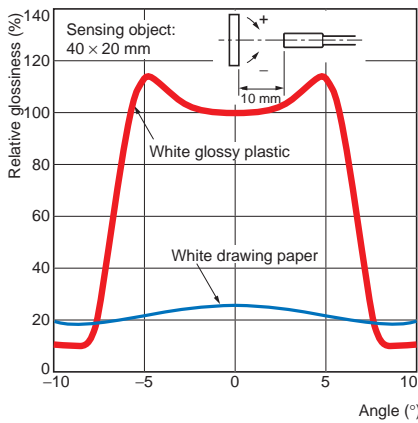
E3HQ

E3S-LS3□

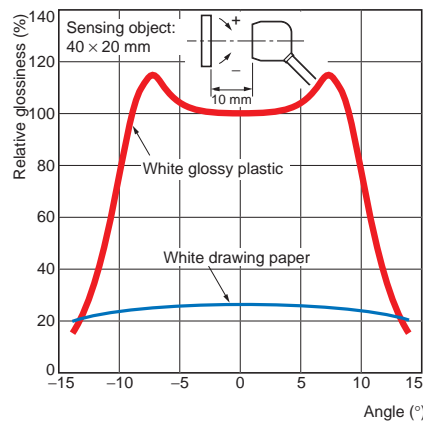
F3UV

## Glossiness vs. Angle

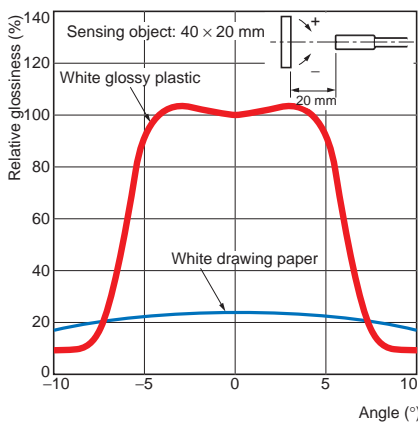
### E3X-NL11 + E32-S15-□ (X direction)



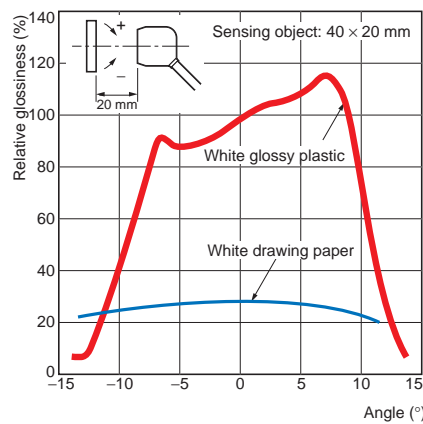
### E3X-NL11 + E32-S15-□ (Y direction)



### E3X-NL11 + E32-S15L-□ (X direction)



### E3X-NL11 + E32-S15L-□ (Y direction)



## I/O Circuit Diagrams

### NPN Output

Model	Operation mode	Timing charts	Mode selector switch	Output circuit
E3X-NL11	Light-ON	<p>Incident light: ON (green bar), OFF (white bar)</p> <p>No incident light: OFF (white bar)</p> <p>Light indicator (orange): ON (green bar), OFF (white bar)</p> <p>Output transistor: ON (green bar), OFF (white bar)</p> <p>Load Operate (e.g., relay): Operate (green bar), Reset (white bar)</p> <p>(Between brown and black leads)</p> <p>T: OFF-delay timer Either 0 or 40 ms (fixed) can be selected.</p>	L-ON (LIGHT ON)	
	Dark-ON	<p>Incident light: ON (green bar), OFF (white bar)</p> <p>No incident light: ON (green bar), OFF (white bar)</p> <p>Light indicator (orange): ON (green bar), OFF (white bar)</p> <p>Output transistor: ON (green bar), OFF (white bar)</p> <p>Load Operate (e.g., relay): Operate (green bar), Reset (white bar)</p> <p>(Between brown and black leads)</p> <p>T: OFF-delay timer Either 0 or 40 ms (fixed) can be selected.</p>	D-ON (DARK ON)	

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E3HQ

E3S-LS3□

F3UV

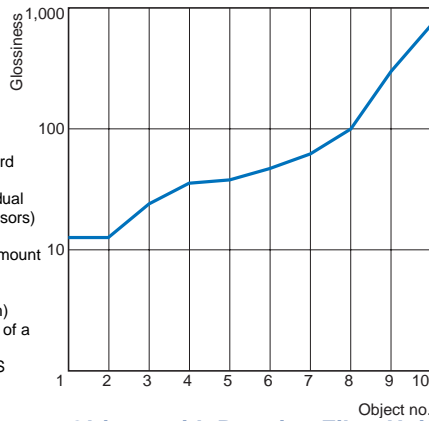
# E3X-NL

## Technical Guide

### Glossiness

When light is applied to the sensing object, the reflected light is generally a mixture of regular reflection components and diffuse reflection components. Glossiness is directly proportional to the light intensity of the regular reflection components. In JIS, the glossiness of a glass plate surface having 1.567 reflectivity is defined 100 as the basis of glossiness.

### Glossiness of Typical Object Sensing by E3X-NL11 + E32-S15

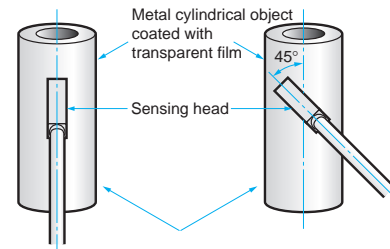


1. White paper
2. Brown corrugated cardboard
3. Paper gummed tape
4. White glossy paper (individual packages for OMRON sensors)
5. Blue mount paper for label
6. Transparent label on blue mount paper
7. Glossy plastic
8. Transparent glass (t=1 mm)
9. Gold printing ink (gold part of a cigarette box)
10. Metal mirror surface (SUS mirror surface)

### Sensing of Transparent Objects with Rotating Fiber Unit Mounting Bracket

There are transparent films and transparent plastic objects that change the direction of polarized light when it passes through the transparent films and transparent plastic objects. When the E3X-NL senses these transparent films and transparent plastic objects on glossy background objects, such as glossy paper or metals, the E3X-NL will not sense these objects smoothly if the angle of the sensor head is improper. The most suitable angle of the sensor head varies with the transparent object. The angle of the sensor head can be, however, 0° or 45° for the smooth sensing of such transparent objects due to the characteristic of polarized light. There is no need for the angle to be midway between 0° and 45°. The E39-L109, which is sold separately, is a mounting bracket that rotates to angles of 0° or 45° and enables the E3X-NL to sense such transparent objects smoothly with its sensing head set at 0° or 45° without changing the sensing position.

### (Example) Metal cylindrical object coated with transparent film

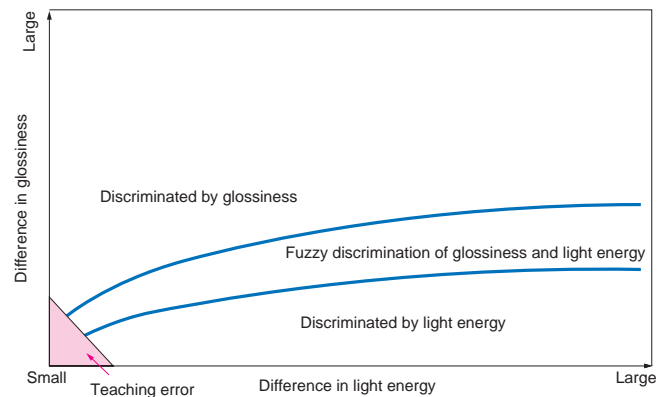


The object can be sensed accurately when the angle of the sensing head is either 0° or 45°.

### Fuzzy Teaching Function

The E3X-NL in two-point teaching operation will perform fuzzy computation using the difference in glossiness and the difference in light energy between the two teaching points to determine the thresholds setting with the E3X-NL. As shown in the following table, if there is only a small difference in glossiness but there is a large difference in light energy between the two teaching points, the thresholds set with the E3X-NL will be determined by the light energy values.

Taught Difference in glossiness between two teaching points	Taught Difference in light energy between two teaching points	Discriminating method
Large	Large	Discriminated by glossiness.
Large	Small	Discriminated by glossiness.
Small	Large	Discriminated by light energy.
Small	Small	Discriminated by glossiness. A teaching error will result if the difference in glossiness and that in light energy are both less than the sensing levels of the E3X-NL.



### Countermeasures against Teaching Errors Resulted with Transparent Labels on Sheets

The material of the sheets must not be too glossy.

## Nomenclature

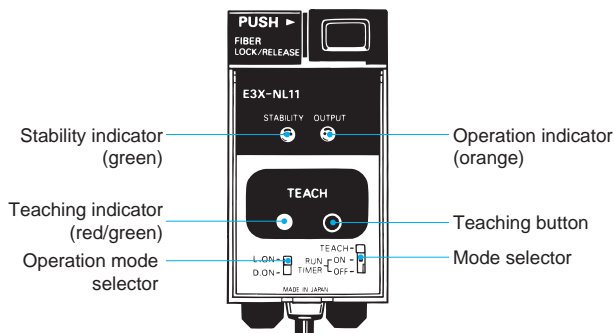


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E3X-NL

E3S-CR62 /67

E3S-R

E3HQ

E3S-LS3□

F3UV

## Safety Precautions

Refer to *Warranty and Limitations of Liability* on page F-2.

**⚠ WARNING**

This product is not designed or rated for ensuring safety of persons. Do not use it for such purpose.



**Precautions for Correct Use**

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

### Fiber Units

#### ● Mounting

#### Tightening

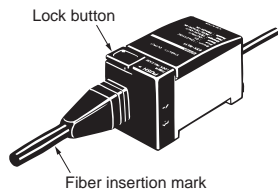
When mounting the Fiber Unit, tighten it to the torque of 0.3 N·m max.

#### Fiber Connection and Disconnection

The E3X-NL amplifier has a push lock. Connect or disconnect the fibers to or from the E3X-NL amplifier using the following procedures:

##### 1. Connection

After inserting the fiber into the Amplifier, push the lock button until it clicks to indicate that the fiber is securely connected.



##### 2. Removal

Be sure to press the lock button again to unlock it. Lift the lock button to release the fiber so that it can be removed. Do not use excessive force to lift the lock button.

(To maintain fiber characteristics, make sure that the lock has been released before attempting to remove the fiber.)



3. The fiber must be locked or released in a temperature range of  $-10^{\circ}$  to  $40^{\circ}$ .

Since face-to-face mounting of the Fiber Units may cause mutual interference, mount them so that the optical axes of the sensors are not opposed.

#### Mounting the Sensor

When two or more sensors are used, face-to-face mounting of the Fiber Units or the regularly reflected light from the sensing object may cause mutual interference. At this time, adjust the Fiber Units to be mounted at the angles where the light of each sensor is not received by the Fiber Unit of the other sensor.

#### ● Adjusting

#### Two-point Teaching and One-point Teaching

Refer to the following information to select the most suitable sensitivity setting method for the application.

Sensitivity setting method	Two-point teaching	One-point teaching
Select depending on application.	Generally use 2-point teaching. The fuzzy teaching function (refer to Technical Guide) is activated to set the optimum algorithms automatically, drawing an operating level just about between the two points taught.	One-point teaching should be performed for the sensing of different background object or a single type of objects on a variety of glossy background objects. The operating level will be set 15% above or below the teaching point, depending on the glossiness of the first sensing object. The fuzzy teaching function is not activated for 1-point teaching.

#### Selection of Teaching Point(s)

If the E3X-NL is used to sense objects that are only slightly different in glossiness from the background object and the sensing objects have color patterns, the difference in glossiness among the inks on the sensing objects may affect E3X-NL operation. Therefore perform two-point teaching with the E3X-NL at a place where the Sensor can sense the objects accurately. If the position of each sensing objects is different, then perform two-point sensing, allowing for the glossiness versus distance characteristics of the E3X-NL.

#### One-point Teaching

If the E3X-NL is used to sense sensing objects different from each other in glossiness on a single background object, perform one-point teaching with the E3X-NL using the background object. If the E3X-NL is used to sense identical sensing objects on a variety of glossy background objects, perform one-point teaching with the E3X-NL using one of the sensing objects.

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F3C-AL

E3L

E3X-NL

E3S-CR62 /67

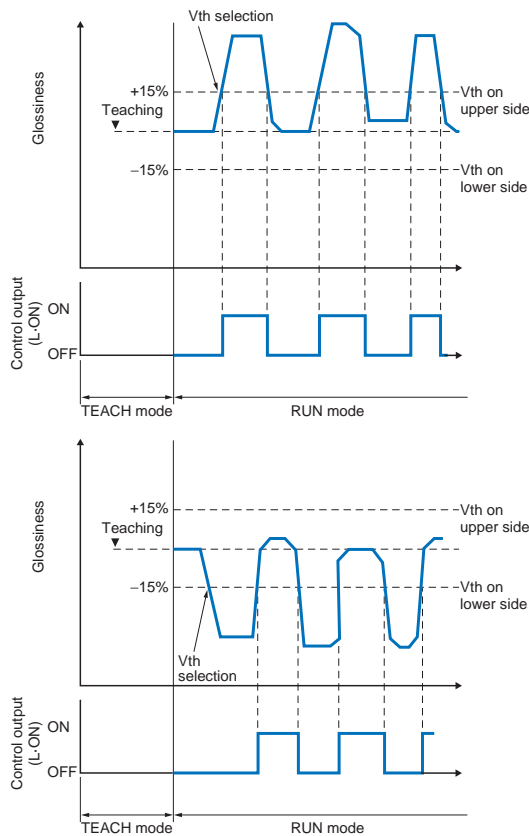
E3S-R

E3HQ

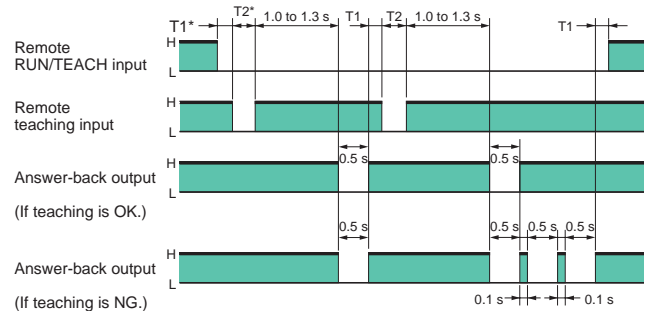
E3S-LS3□

F3UV

## Operating Level Setting and Control Output for One-point Teaching

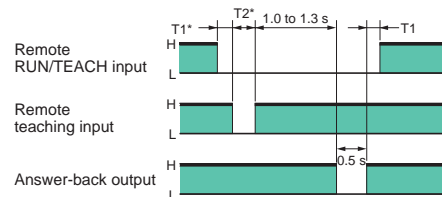


## (Remote 2-point teaching)



\* Note: T1 must be 20 ms minimum and T2 must be 500 ms minimum at the time of remote teaching.

## (Remote 1-point teaching)



### ● Others

#### EEPROM Write Error

If a write error occurs (buzzer beeps, red and green teaching indicators flash at the same time, operation and stability indicators flash) due to power-off, static electricity, or other noise in the teaching mode (until initial operating level compensation is completed in teaching mode without an object), perform teaching again with the unit button.

Note: Unlike teaching errors, the red and green teaching indicators flash at the same time and the stability indicator flashes if a memory error occur.

## Remote teaching function

The mode selector switch and the teaching button are basically the same. In remote teaching, the remote RUN/TEACH input signal is used in place of the mode selector for teaching, and the remote teaching input signal is used instead of pressing the teaching button.

Procedure	Operation
1	Set the mode selector to <b>RUN</b> .
2	<p>The following signals must be given as remote RUN/TEACH input and remote teaching input conditions.</p> <ol style="list-style-type: none"> <li>If there is a teaching error after performing remote two-point teaching with the E3X-NL, try performing remote two-point teaching again. If the remote RUN/TEACH input is set from L to H after the teaching error, the thresholds set with the E3X-NL will not be refreshed.</li> <li>When remote teaching is not performed, cut the pink and purple wires at the root of the cable or connect them to the + side (+V) of the power supply, and cut the orange wire at the root of the cable or connect it to GND (0 V).</li> <li>About 1 s after remote teaching is over, the Sensor is made ready to detect an object.</li> </ol>

E3MC

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E3HQ

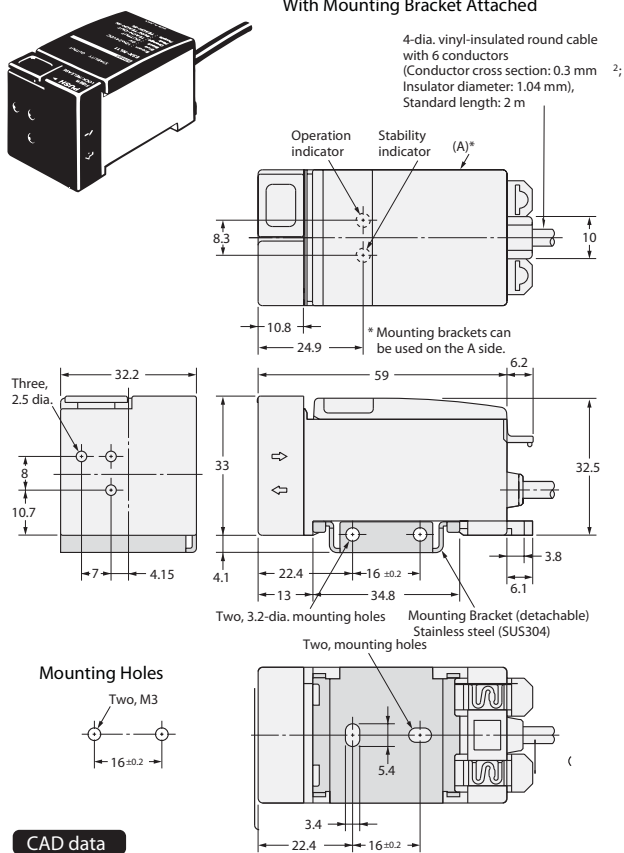
E3S-LS3□

F3UV

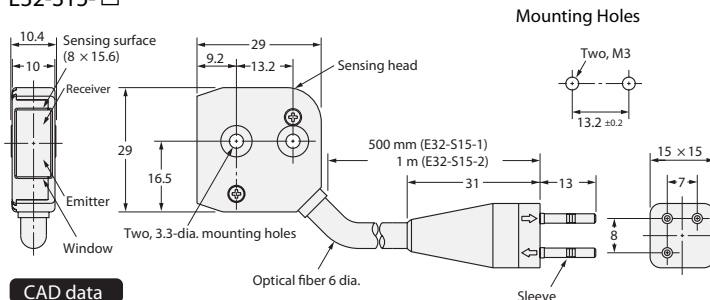
## Dimensions

### Sensors

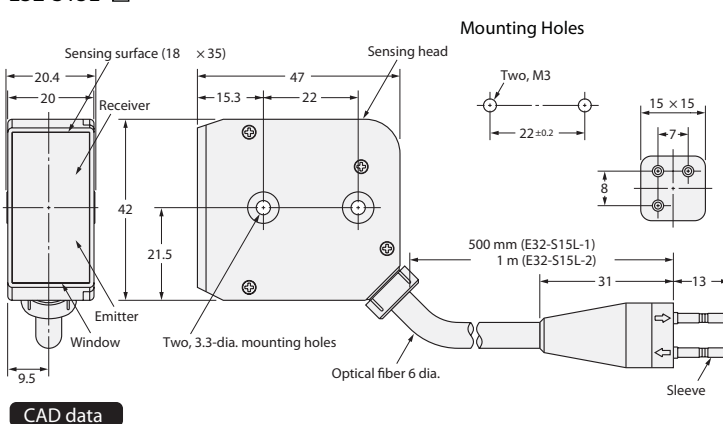
#### Amplifier Units E3X-NL11



#### Fiber Units Short-range, Small Spot Model E32-S15-□



#### Fiber Units Long-range Model E32-S15L-□



### Accessories (Order Separately)

#### Mounting Brackets

Refer to page 292 for details.

#### Protective Covers

Refer to page 308 for details.

Cat. No. E819-E1-01

In the interest of product improvement, specifications are subject to change without notice.



### Authorised Distributors:-

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