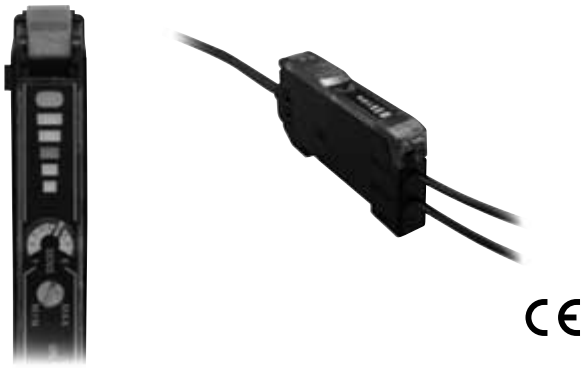
OMRON

# User-Friendly Fiber-Optic Amplifier

# E3X-NA

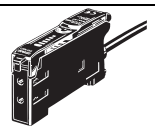
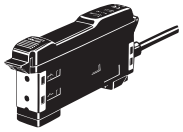
## Solve Your Basic Sensing Challenges Easily with the E3X-NA Series



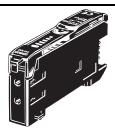
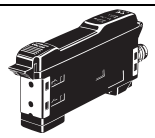
- Streamlined features provide basic sensing immediately after plug-in
- *Wire-saving* amplifiers reduce installation time and minimize space requirements
- Master/slave connector design affords connectivity for up to 16 wire-saving amplifiers
- Use the LED bar display to quickly confirm sensor performance
- Optical communication design prevents mutual interference for up to 5 amplifiers
- Green LED models address *mark-detecting* applications
- High-speed models have a response time of 50 μs
- Select a *water-resistant* model (IP66 rating) using an M8 connector
- Prewired water-resistant models are available

# Ordering Information: Amplifier Units, Connectors, Accessories and Fiber-Optics

## ■ Amplifier Units with Cables

| Type | Part number | | Control output | Appearance |
|---|---|---|---|---|
| | NPN output | PNP output | | |
| Standard | **E3X-NA11** | **E3X-NA41** | ON/OFF |  |
| High-speed | **E3X-NA11F** | **E3X-NA41F** | | |
| Mark-detection | **E3X-NAG11** | **E3X-NAG41** | | |
| Water-resistant | **E3X-NA11V** | **E3X-NA41V** | |  |

## ■ Connector-Ready Amplifiers (Order Connector Separately)

| Item | Part number | | Applicable connector (order separately) | | Control output | Appearance |
|---|---|---|---|---|---|---|
| | NPN output | PNP output | | | | |
| Wire-saving | **E3X-NA6** | **E3X-NA8** | Master | E3X-CN11 | ON/OFF output |  |
| | | | Slave | E3X-CN12 | | |
| Water-resistant (M8 connectors) | **E3X-NA14V** | **E3X-NA44V** | XS3F-M421-40□-A<br>XS3F-M422-40□-A | | |  |

## ■ Amplifier Unit Connectors (Order Separately)

**Note:** Stickers for Connectors are included as accessories.

| Item | Appearance | Cable length | No. of conductors | Part number |
|---|---|---|---|---|
| Master Connector |  | 2 m | 3 | **E3X-CN11** |
| Slave Connector |  | | 1 | **E3X-CN12** |

## ■ Combining Amplifier Units and Connectors (Each Sold Separately)

Refer to the following tables when placing an order. Amplifier Units and Connectors are sold separately.

| Amplifier Units | | |
|---|---|---|
| Type | NPN | PNP |
| Wire-saving models | E3X-NA6 | E3X-NA8 |

+

| Applicable Connectors (Order Separately) | |
|---|---|
| Master Connector | Slave Connector |
| E3X-CN11 (3-wire) | E3X-CN12 (1-wire) |

**Example:** **When Using 5 Amplifier Units**

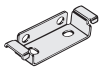
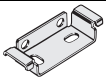
Amplifier Units (5 Units) + 1 Master Connector + 4 Slave Connectors

## ■ Sensor I/O Connectors (Order Separately)

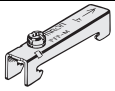
| Size | Cable specifications | Appearance | Cable type | | Part number |
|---|---|---|---|---|---|
| M8 | Standard cable | Straight connector  | 2 m | Four-core cable | **XS3F-M421-402-A** |
| | | | 5 m | | **XS3F-M421-405-A** |
| | | L-shaped connector  | 2 m | | **XS3F-M422-402-A** |
| | | | 5 m | | **XS3F-M422-405-A** |

## ■ Accessories (Order Separately)

### Mounting Brackets

| Appearance | Applicable models | Quantity | Part number |
|---|---|---|---|
|  | E3X-NA□<br>E3X-NA□F<br>E3X-NAG□ | 1 | **E39-L143** |
|  | E3X-NA□V | | **E39-L148** |

### End Plate

| Appearance | Quantity | Part number |
|---|---|---|
|  | 1 | **PFP-M** |

## ■ Fiber-Optic Cables

The E3X-NA amplifiers use Omron's E32-series fiber-optic cables. With a choice of over 80 sensing heads, you are sure to find one that matches your application requirements. Refer to the selection of E32 cables (listed with their respective sensing distances) in the fiber section at the end of this data sheet. Order fiber-optic cables separately.

# Specifications

## ■ Amplifier Units

### Ratings/Characteristics

| Item | | Amplifier Units with Cables | | | | Connector-ready amplifier units | |
|---|---|---|---|---|---|---|---|
| | | Standard models | High-speed detection models | Mark-detecting models | Water-resistant models | Wire-saving models | Water-resistant models (use M8 connectors) |
| Output type | NPN output | E3X-NA11 | E3X-NA11F | E3X-NAG11 | E3X-NA11V | E3X-NA6 | E3X-NA14V |
| | PNP output | E3X-NA41 | E3X-NA41F | E3X-NAG41 | E3X-NA41V | E3X-NA8 | E3X-NA44V |
| Light source (wavelength) | | Red LED (680 nm) | | Green LED (520 nm) | Red LED (680 nm) | | |
| Supply voltage | | 12 to 24 VDC ±10%, ripple (p-p): 10% max. | | | | | |
| Current consumption | | 35 mA max. | 35 mA max. (for 24-VDC power supply) | 35 mA max. | | | |
| Control output | | NPN/PNP (depends on model) open collector; load current: 50 mA max.; residual voltage: 1 V max. | | | | | |
| Operation mode | Switch-selectable | Light-ON/Dark-ON operation | | | | | |
| Response time | | 200 μs max. for operation and reset respectively (See note.) | Operation: 20 μs max. Reset: 30 μs max. | 200 μs max. for operation and reset respectively (See Note.) | | | |
| Sensitivity adjustment | | 8-turn sensitivity adjuster (with indicator) | | | | | |
| Circuit protection | | Reverse polarity, output short-circuit, mutual interference prevention (optically synchronized) | Reverse polarity, output short-circuit | Reverse polarity, output short-circuit, mutual interference prevention (optically synchronized) | | | |
| Timer function | | OFF-delay timer: 40 ms (fixed) | | | | | |
| Ambient illumination (receiver side) | | Incandescent lamp:10,000 lux max. Sunlight:20,000 lux max. | | | | | |
| Ambient temperature | | Operating: Groups of 1 to 3 Amplifiers: –25°C to 55°C (-13°F to 131°F) Groups of 4 to11 Amplifiers: –25°C to 50°C (-13°F to 122°F) Groups of 12 to16 Amplifiers: –25°C to 45°C (-13°F t0 113°F) with no icing or condensation Storage: –30°C to 70°C (-22 °F to 158°F) with no icing or condensation | | | | | |
| Ambient humidity | | Operating and storage: 35% to 85% (with no condensation) | | | | | |
| Insulation resistance | | 20 MΩ min. (at 500 VDC) | | | | | |
| Dielectric strength | | 1,000 VAC at 50/60 Hz for 1 minute | | | | | 500 VAC at 50/ 60 Hz for 1 minute |
| Vibration resistance | | 10 to 55 Hz with a 1.5-mm double amplitude for 2 hrs each in X, Y and Z directions | | | | | |
| Shock resistance | | 500 $m/s^2$, for 3 times each in X, Y and Z directions | | | | | |
| Enclosure rating | | IEC60529 IP50 (with Protective Cover attached) | | | IEC60529 IP66 (with Protective Cover attached) | IEC60529 IP50 (with Protective Cover attached) | IEC60529 IP66 (with Protective Cover attached) |
| Connection method | | Prewired (standard cable length: 2 m) | | | | Connector | M8 connector |
| Weight (packed) | | Approx. 100 g | | | Approx. 110 g | Approx. 55 g | Approx. 65 g |
| Material | Case | Polybutylene terephthalate (PBT) | | | | | |
| | Cover | Polycarbonate | | | Polyethersulfone (PES) | Polycarbonate | Polyethersulfone (PES) |
| Accessories | | Instruction Sheet | | | | | |

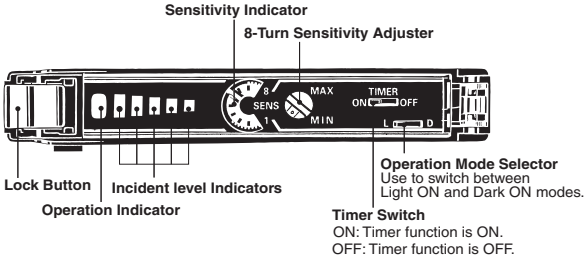
**Note:** When there are 8 or more Amplifier Units mounted side-by-side, the response time will be 350 μs max.

## ■ Amplifier Unit Connectors

| Item | | E3X-CN11 | E3X-CN12 |
|---|---|---|---|
| Rated current | | 2.5 A | |
| Rated voltage | | 50 V | |
| Contact resistance | | 20 mΩ max. (20 mVDC max., 100 mA max.) (The above figure is for connection to the Amplifier Unit and the adjacent Connector. It does not include the conductor resistance of the cable.) | |
| Number of insertions | | 50 times (for connection to the Amplifier Unit and the adjacent Connector) | |
| Material | Housing | Polybutylene terephthalate (PBT) | |
| | Contact | Phosphor bronze/gold-plated nickel | |
| Weight (packed) | | Approx. 55 g | Approx. 25 g |

# Nomenclature

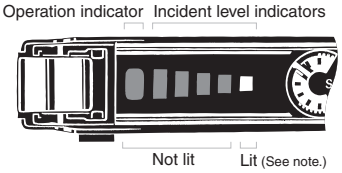
## ■ Amplifier Units




## ■ LED Bar Display

### Indicators

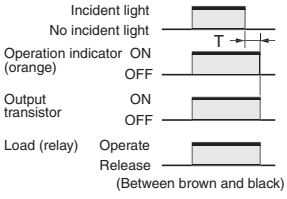
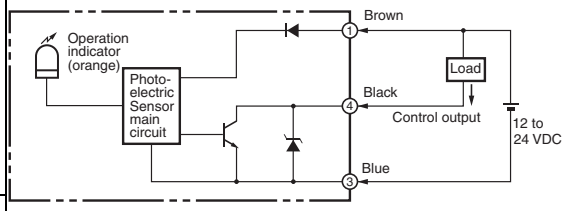
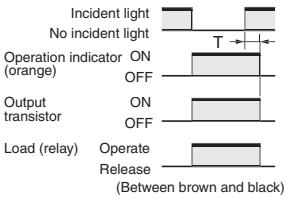
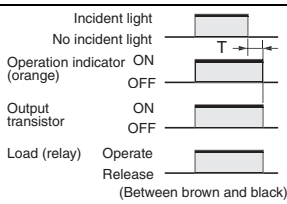
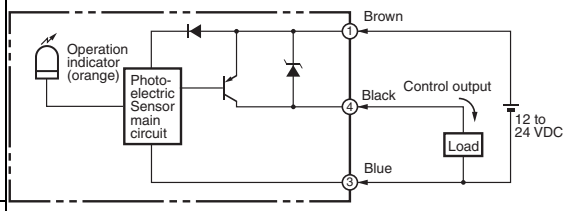
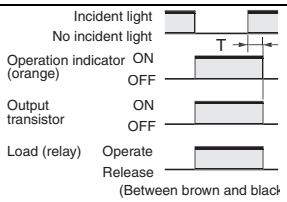
In addition to an operation indicator (orange), the E3X-NA also has incident level indicators (4 green and 1 red). Use these indicators for optical axis adjustments and maintenance.

| Status of indicators (in L/ON mode) | Operation indicator (in L/ON mode) | Incident level |
|---|---|---|
|   | Not lit | Approx. 80% max. of operating level |
|  | Not lit | Approx. 80% to 90% of operating level |
|  | Not lit or lit | Approx. 90% to 110% of operating level |
|  | Lit | Approx. 110% to 120% of operating level |
|  | Lit | Approx. 120% min. of operating level |

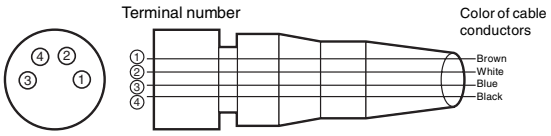
**Note:** The indicator farthest to the right will be lit even if the incident level is 0.

# Operation

## ■ Output Circuits

| Output | Model | Mode selector | Timing chart | State of output transistor | Output circuit |
|---|---|---|---|---|---|
| NPN | E3X-NA11<br>E3X-NA6<br>E3X-NAG11<br>E3X-NA11F<br>E3X-NA11V<br>E3X-NA14V | LIGHT ON (L/ON) |  | Light ON |  |
| | | DARK ON (D/ON) |  | Dark ON | **M8 Connector Pin Arrangement**<br>  <br>**Note:** Pin 2 is not used. |
| PNP | E3X-NA41<br>E3X-NA8<br>E3X-NAG41<br>E3X-NA41F<br>E3X-NA41V<br>E3X-NA44V | LIGHT ON (L/ON) |  | Light ON |  |
| | | DARK ON (D/ON) |  | Dark ON | **M8 Connector Pin Arrangement**<br>  <br>**Note:** Pin 2 is not used. |

## ■ Connectors (Sensor I/O Connectors)




XS3F-M421-402-A, XS3F-M422-402-A
XS3F-M421-405-A, XS3F-M422-405-A

| Classification | Color of cable conductors | Connection pin number | Application |
|---|---|---|---|
| DC | Brown | 1 | Power supply (+V) |
| | White | 2 | --- |
| | Blue | 3 | Power supply (0 V) |
| | Black | 4 | Output |

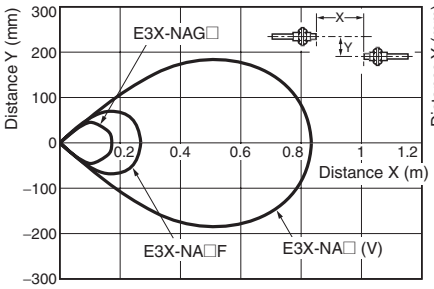
**Note:** Pin 2 is not used.

# Engineering Data (Typical)

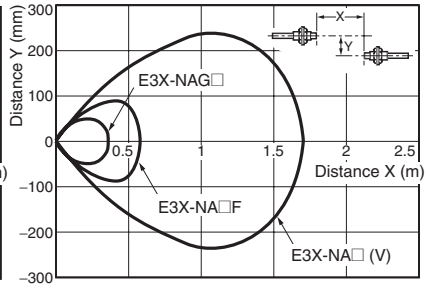
## ■ Parallel Operating Range

At max. sensitivity. (Use for optical axis adjustment at installation.)

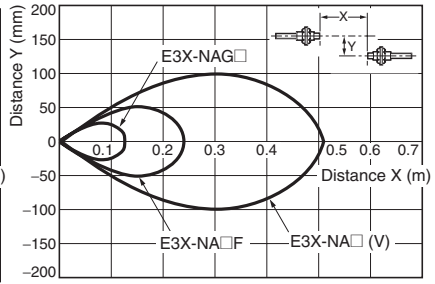
**E32-TC200**



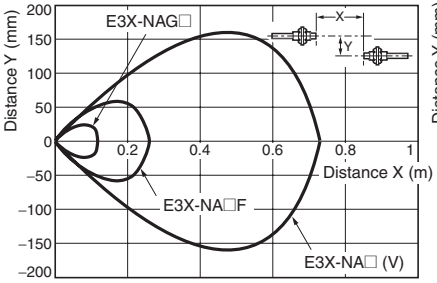

**E32-T11L/T12L**



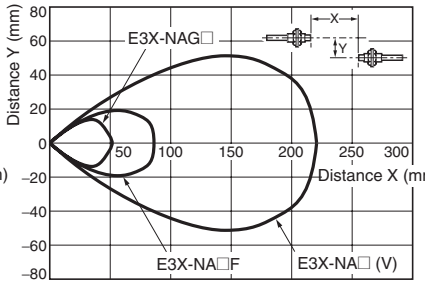

**E32-T11R**



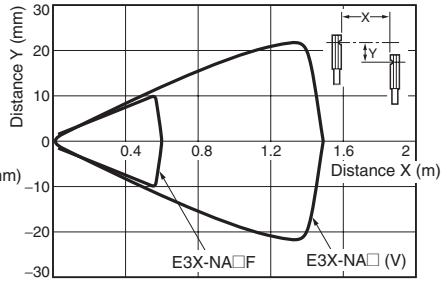

**E32-T11**




**E32-TC200E**



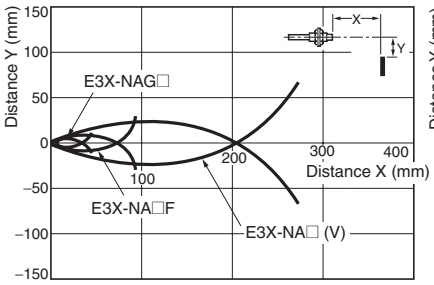

**E32-T24S**



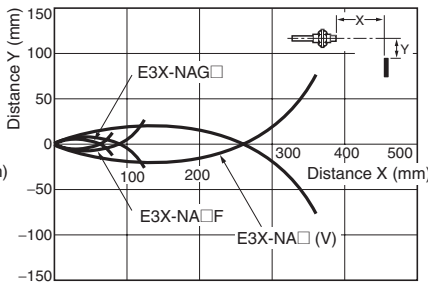

## ■ Operating Range

With standard sensing target at max. sensitivity. (Use for the positioning of the object and Sensor.)

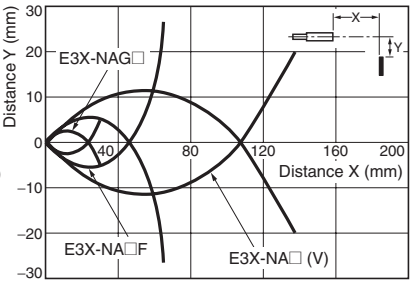
**E32-DC200**



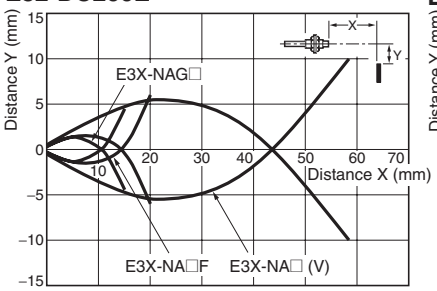

**E32-D11L**



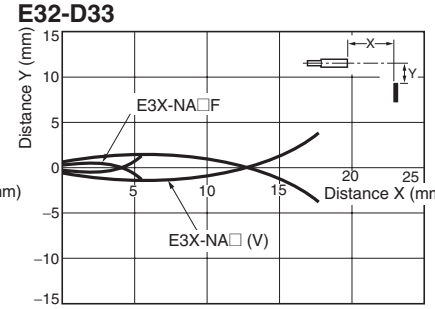

**E32-D11R/D12R**



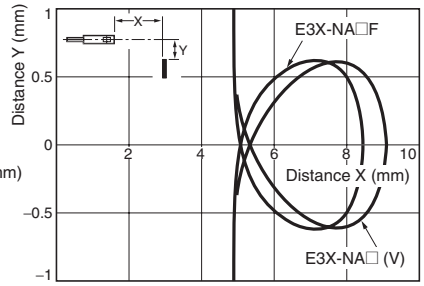

**E32-DC200E**




**E32-D33**

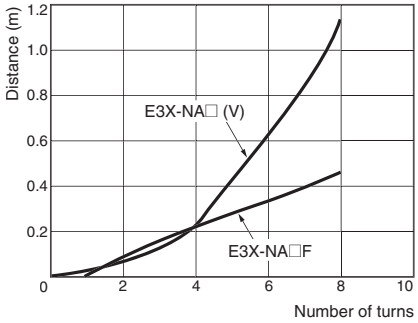



**E32-L25L**

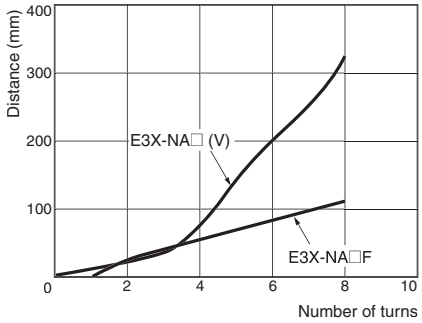


## ■ Number of Turns of Sensitivity Adjuster vs. Sensing Distance

**E32-T11L**

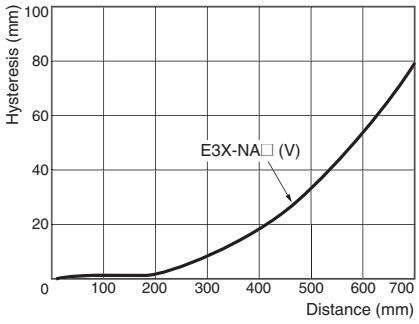



**E32-D11L**

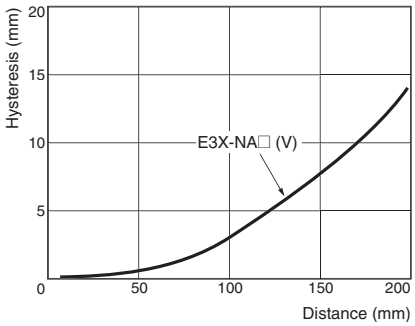



### Sensing Distance vs. Hysteresis

**E32-T11L**




**E32-D11L**



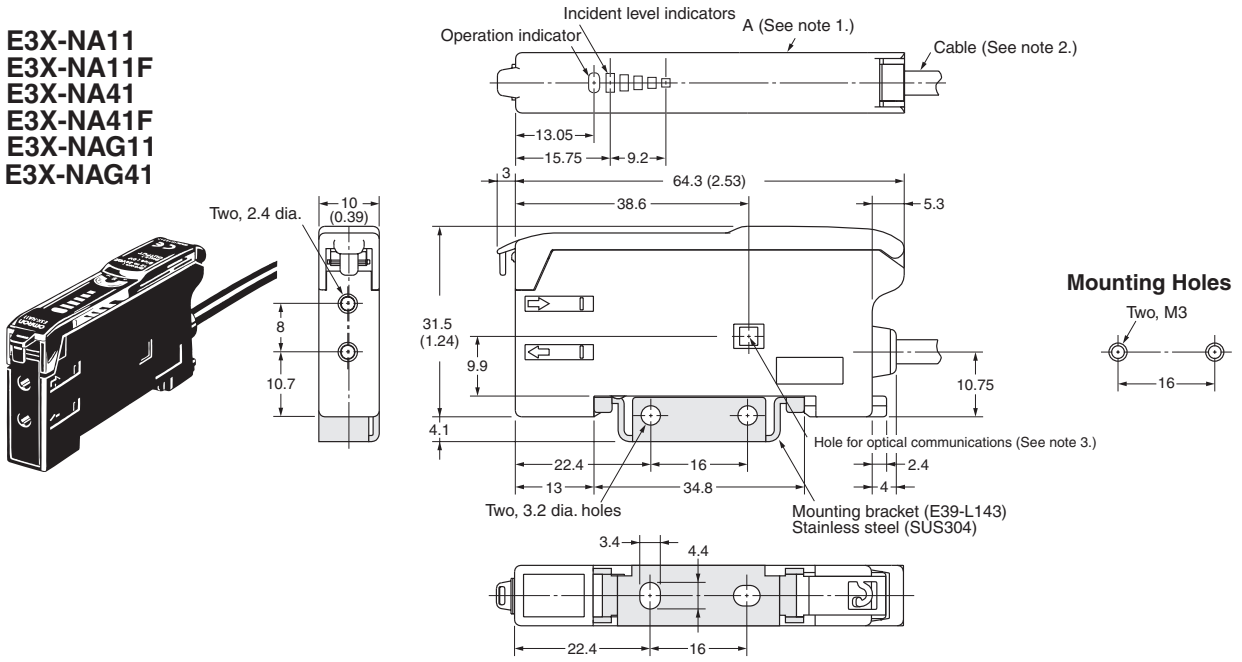
# Dimensions

Unit: mm (inch)

## ■ Amplifier Units

### Amplifier Units with Cables (with Mounting Bracket Attached)

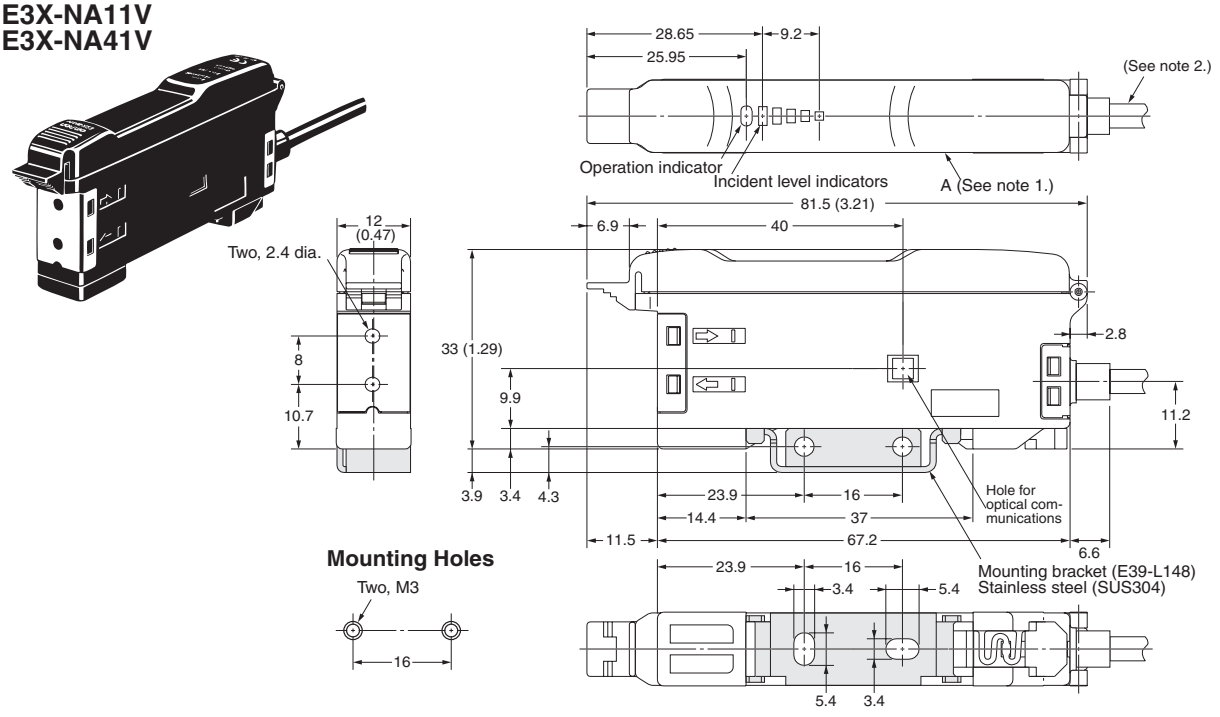
**E3X-NA11**
**E3X-NA11F**
**E3X-NA41**
**E3X-NA41F**
**E3X-NAG11**
**E3X-NAG41**




**Note:** **1.** The mounting bracket can also be used on side A.
**2.** With these models, a 4-dia., 3-conductor, vinyl-insulated round cable (conductor cross-sectional area: 0.45 mm $^2$; insulation diameter: 1.1 mm) is used. Standard length: 2 m.
**3.** The hole for optical communications is for preventing mutual interference. There is no hole for E3X-NA□F models.

### Water-Resistant Amplifier Units with Cables (with Mounting Bracket Attached)

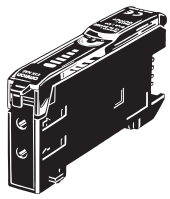
**E3X-NA11V**
**E3X-NA41V**

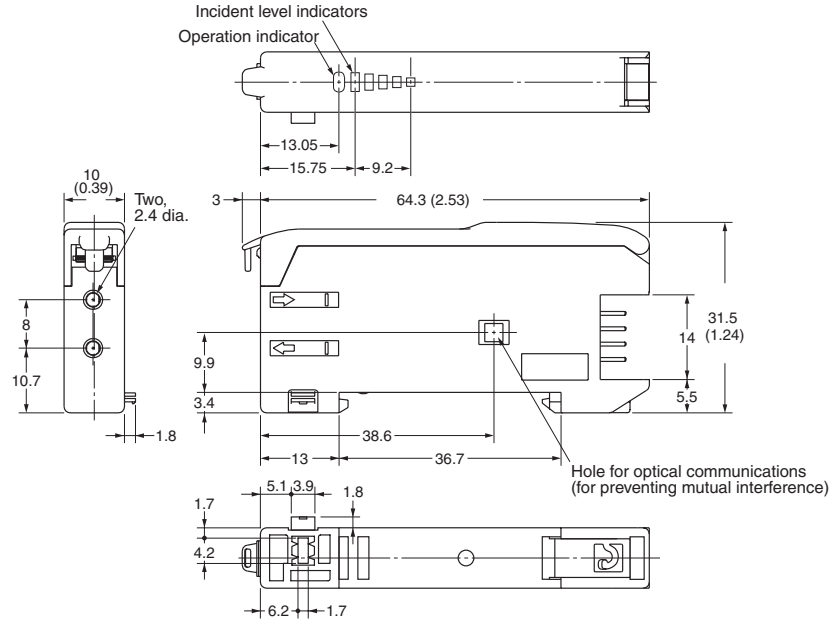



**Note:** **1.** The mounting bracket can also be used on side A.
**2.** With these models, a 4-dia., 3-conductor, vinyl-insulated round cable (conductor cross-sectional area: 0.45 mm $^2$; insulation diameter: 1.1 mm) is used. Standard length: 2 m.

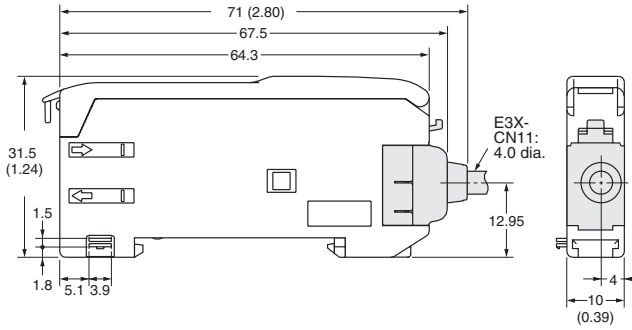
## Wire-Saving Amplifiers

**E3X-NA6**
**E3X-NA8**

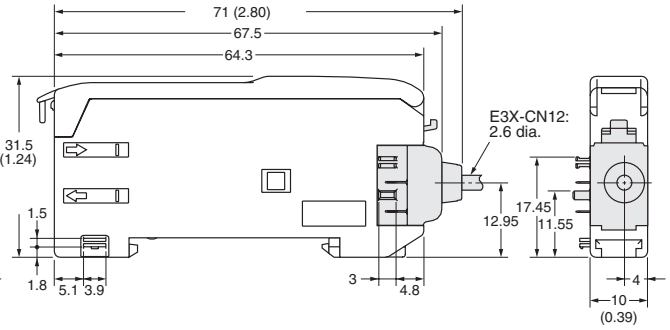





### Dimensions with Master Connector Connected

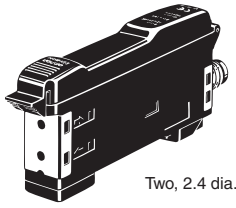


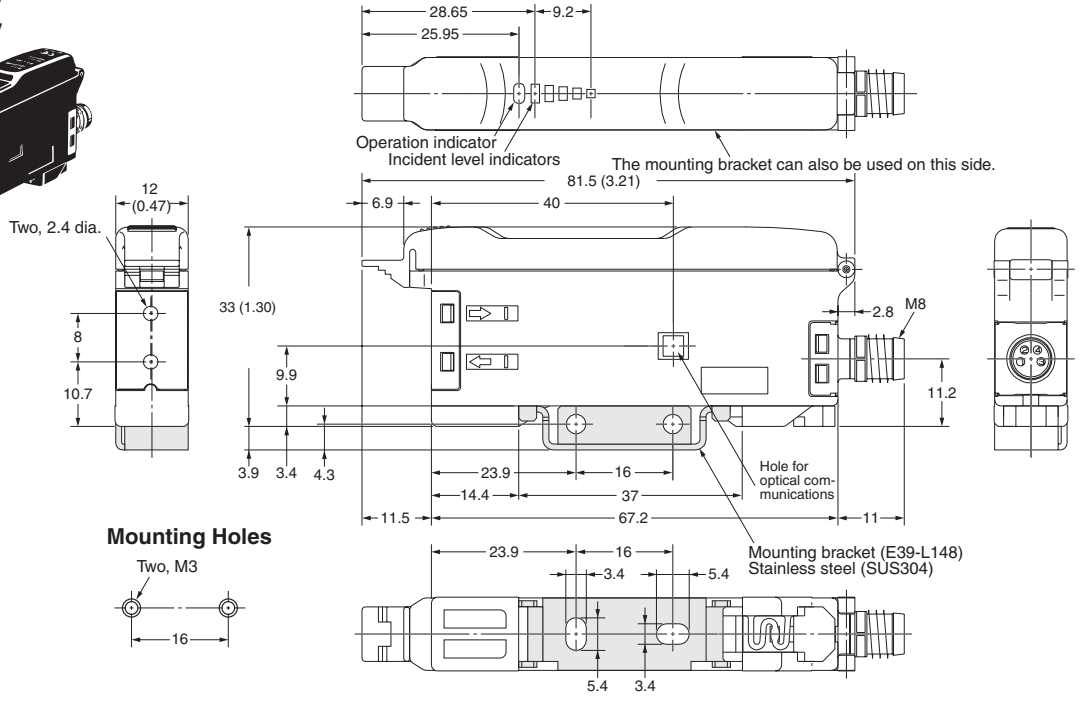

### Dimensions with Slave Connector Connected




## M8 Connector-Ready, Water-Resistant Amplifier Units

**E3X-NA14V**
**E3X-NA44V**

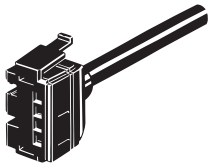


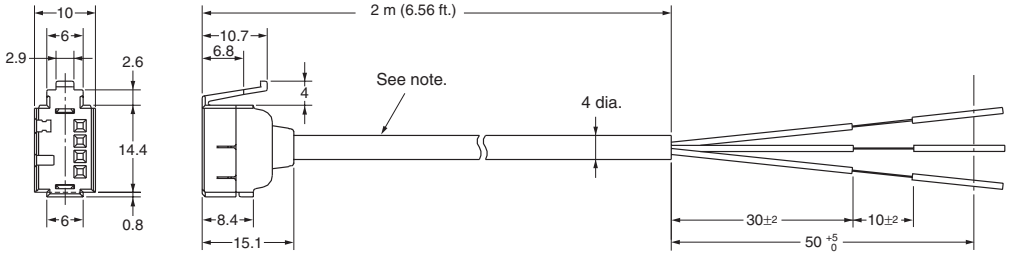



### Mounting Holes

## ■ Amplifier Unit Connectors (Order Separately)

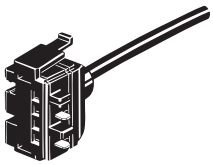
### Master Connectors
### E3X-CN11

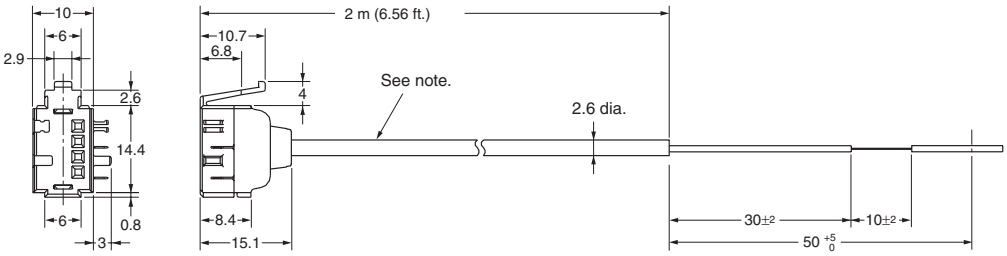





**Note:** A 4-dia., 3-conductor, vinyl-insulated round cable (conductor cross-sectional area: 0.2 mm$^2$; insulation diameter: 1.1 mm) is used.

### Slave Connectors
### E3X-CN12

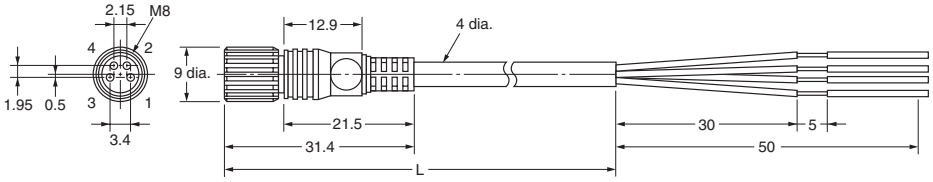




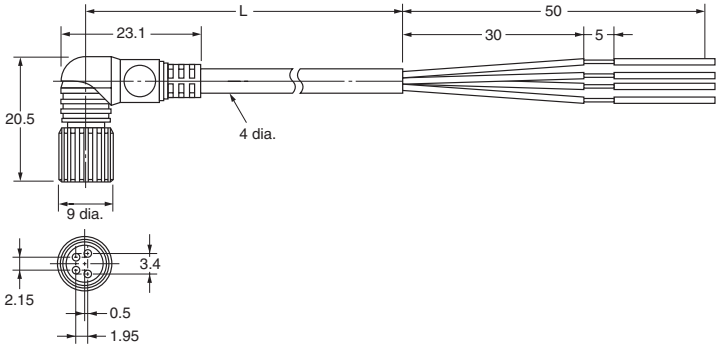

**Note:** A 2.6-dia., single-conductor, vinyl-insulated round cable (conductor cross-sectional area: 0.2 mm$^2$; insulation diameter: 1.1 mm) is used.

## ■ Sensor I/O Connectors (Order Separately)

### Straight Connector (at One End of Cable)
### XS3F-M421-402-A (L=2 m)
### XS3F-M421-405-A (L=5 m)



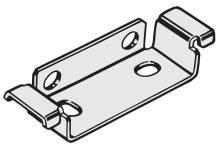

### L-shaped Connector (at One End of Cable)
### XS3F-M422-402-A (L=2 m)
### XS3F-M422-405-A (L=5 m)



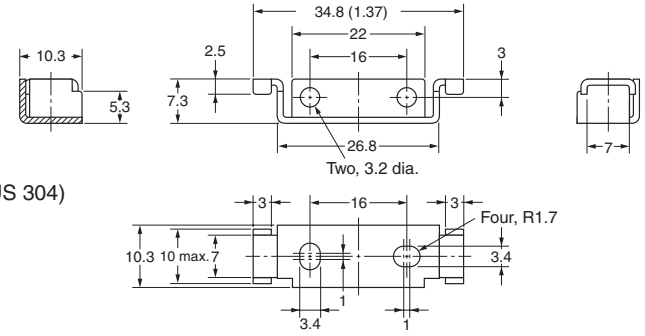
## ■ Accessories (Order Separately)

### Mounting Bracket for E3X-NA□, E3X-NA□F, and E3X-NAG□ Models

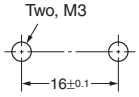
**E39-L143**



Material: Stainless steel (SUS 304)

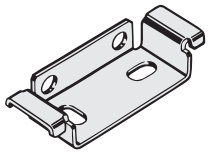



**Mounting Holes**

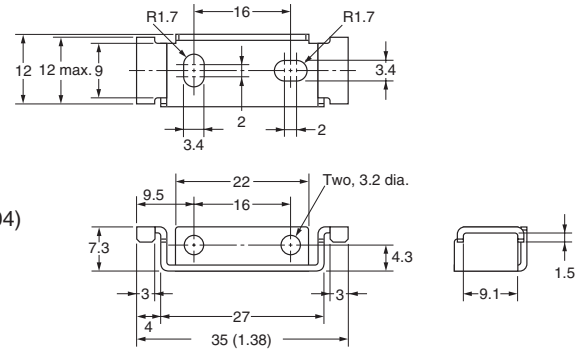



### Mounting Bracket for E3X-NA□V Models

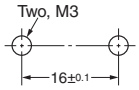
**E39-L148**



Material: Stainless steel (SUS 304)

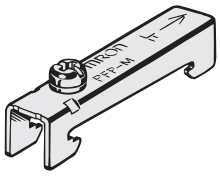


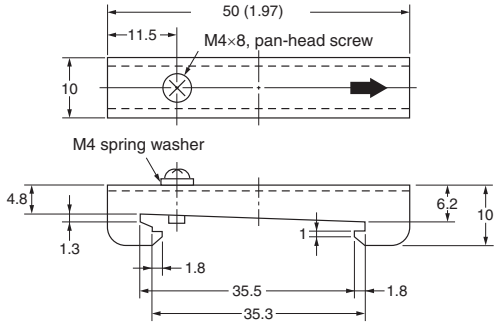

**Mounting Holes**




### End Plate

**PFP-M**



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# Precautions

## ■ Wiring Precautions

Read the following before using the Amplifier Unit and Sensor to ensure safety.

### Power Supply Voltage

Do not impose any voltage exceeding the rated voltage on the E3X-NA. Do not impose AC power (100 VAC) on models that operate with DC. In both cases, the E3X-NA may burst or burn.

### Load Short-circuits

Do not short-circuit the load connected to the E3X-NA, or the E3X-NA may burst or burn.

### Polarity

When supplying power to the E3X-NA, make sure that the polarity of the power is correct, or the E3X-NA may burst or burn.

### No-load Operation

A load must be connected to the E3X-NA during operation, or internal elements may burst or burn. Always wire through a load.

### Operating Environment

- Do not use the Amplifier Unit or Sensor in places with flammable or explosive gas.
- Do not use the Amplifier Unit or Sensor underwater.
- Do not disassemble, repair, or modify the Amplifier Unit or Sensor.

## ■ Power

**Turning Power ON**

The Sensor is ready to operate within 100 ms after the power supply is turned ON. If the Sensor and load are connected to power supplies separately, be sure to turn ON the power supply to the Sensor first.

**Turning Power OFF**

Pulses may be output when the power is turned OFF. Always turn OFF the power to the load or the load line first.

**Power Supply Type**

Do not connect the E3Z-NA to a full-wave or half-wave rectified power supply.

**Communications Hole**

The hole on the side of the Amplifier Unit is a communications hole for preventing mutual interference when Amplifier Units are mounted side-by-side. The E3X-MC11 Mobile Console (sold separately) cannot be used.
If an excessive amount of light is received via the Sensor, the mutual interference prevention function may not work. In this case, make the appropriate adjustments using the sensitivity adjuster.
The mutual interference prevention function will not operate when the E3X-NA is used side-by-side with E3X-DA-N models.

## ■ Wiring the Amplifier Unit

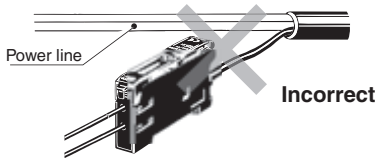
**Cable**

The cable can be extended, provided that the extension wire applied is at least 0.3 $mm^2$ thick and the total distance no more than 100 m.

Do not pull the cable with a force exceeding 30N.

**Separation from Power or High-tension Lines**

Do not wire power lines or high-tension lines alongside the lines of the Amplifier Unit in the same conduit, otherwise the Amplifier Unit may be damaged or malfunction due to induction. Be sure to wire the lines of the Amplifier Unit as far as possible from power lines or high-tension lines or laid in an exclusive, shielded conduit.




**Power Supply**

If a standard switching regulator is used as a power supply, the frame ground (FG) terminal and the ground (G) terminal must be grounded, or faulty operation may result from the switching noise of the power supply.

**M8 Metal Connectors (Water-Resistant Models)**

Turn OFF the power before inserting or removing the connector.

Hold the connector cover when inserting or removing the connector.

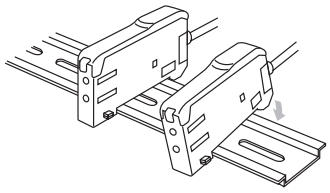
Tighten the fixing screws by hand. Using tools such as pliers may cause damage.

The applicable tightening torque range is 0.3 to 0.4 N·m. If tightening is insufficient, the enclosure rating may not be maintained, and vibrations may cause the connector to come loose.

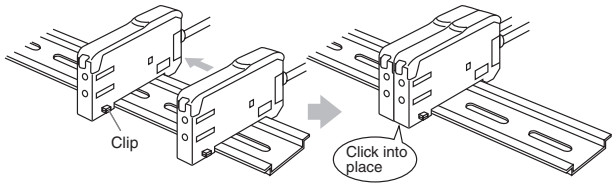
## ■ Mounting the Amplifier Unit

### Joining Amplifier Units

1. Mount the Amplifier Units one at a time onto the DIN rail.



2. Line up the clips and slide the Amplifier Units together. Then press the Amplifier Units together until they click into place.




### Separating Amplifier Units

Slide Amplifier Units away from each other, and remove from the DIN rail one at a time. (Do not attempt to remove Amplifier Units from the DIN rail without separating them first.)

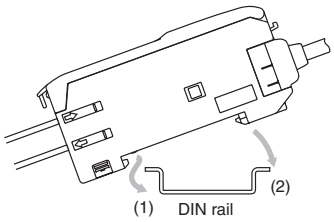
**Note:** **1.** The specifications for ambient temperature will vary according to the number of Amplifier Units used together. For details, refer to *Ratings/Characteristics* in the *Specifications* section of this data sheet.

**2.** Always turn OFF the power supply before joining or separating Amplifier Units.

### Mounting

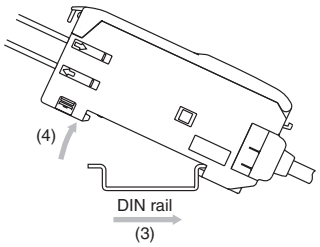
1. Mount the front part on the mounting bracket E39-L143 or E39-L148 (order separately) or onto a DIN rail.
2. Press the back part onto the mounting bracket or the DIN rail.

**Note:** Do not mount the back of the Amplifier Unit onto the mounting bracket or the DIN rail first, or the mounting strength of the Amplifier Unit may be reduced. Always mount the front of the Amplifier Unit first.

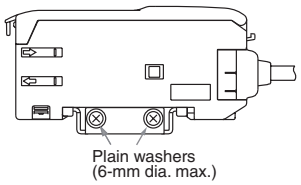



### Removal

Pull the lock tab of the Amplifier Unit with a flat blade screwdriver in direction (3) and lift the fiber insertion part in direction (4) as shown below.




When side-mounting using a mounting bracket, secure the mounting bracket to the Amplifier Unit and then mount using M3 screws. Use plain washers of diameter 6mm or less when mounting.




### Operating Environment

#### Ambient Conditions

Dust or dirt accumulation on the optical communications hole may prevent normal communications. Be sure to remove any dust or dirt before using the Unit.

### Ratings and Specifications

The ratings and performance specifications for items such as the minimum sensing target and characteristics are based on products taken at random from certain production lots. Use this data as reference only.

### Protective Cover

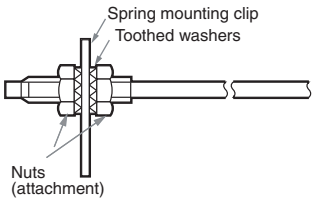
Be sure to mount the Protective Cover before use.

## ■ Mounting the Fiber Unit

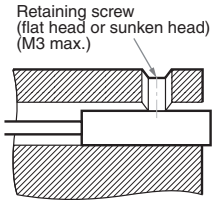
### Tightening Force

The tightening force applied to the Fiber Unit should be as shown below.

**Screw-Mounting Model**

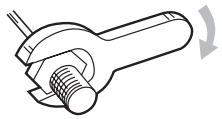



**Cylindrical Model**




| Fiber Units | Clamping torque |
|---|---|
| M3/M4 screw | 0.78 N·m max. |
| M6 screw/ 6-mm dia. cylinder | 0.98 N·m max. |
| 1.5-mm dia. cylinder | 0.2 N·m max. |
| 2-mm dia./3-mm dia. cylinder | 0.29 N·m max. |
| E32-T12F 5-mm dia. Teflon model | 0.78 N·m max. |
| E32-D12F 6-mm dia. Teflon model | |
| E32-T16 | 0.49 N·m max. |
| E32-R21 | 0.59 N·m max. |
| E32-M21 | Up to 5 mm to the tip: 0.49 N·m max.<br>More than 5 mm from the tip: 0.78 N·m max. |
| E32-L25A | 0.78 N·m max. |
| E32-T16P<br>E32-T16PR<br>E32-T24S<br>E32-L24L<br>E32-L25L<br>E32-T16J<br>E32-T16JR | 0.29 N·m max. |
| E32-T16W<br>E32-T16WR | 0.3 N·m max. |

Use a proper-sized wrench.

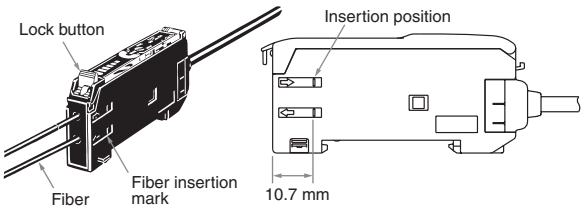


### Fiber Connection and Disconnection

The E3X-NA Amplifier Unit has a lock button. Connect or disconnect the fibers to or from the E3X-NA Amplifier Unit using the following procedures:

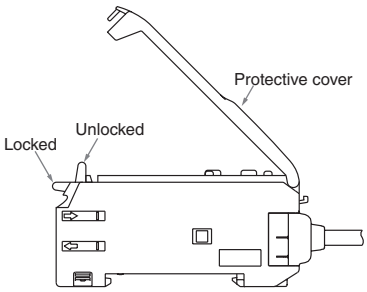
1. Connection

   Open the protective cover, insert the fibers according to the fiber insertion marks on the side of the Amplifier Unit, and lower the lock button.




2. Disconnection

   Remove the protective cover and raise the lock button to pull out the fiber.




**Note:** To maintain the fiber properties, confirm that the lock is released before removing the fiber.

3. Precautions for Fiber Connection/Disconnection

   Be sure to lock or unlock the lock button within an ambient temperature range between −10°C and 40°C.

### Cutting Fiber

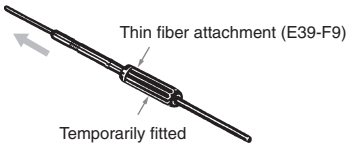
Insert a fiber into the Fiber Cutter and determine the length of the fiber to be cut.

Press down the Fiber Cutter in a single stroke to cut the fiber.

The cutting holes cannot be used twice. If the same hole is used twice, the cutting face of the fiber will be rough and the sensing distance will be reduced. Always use an unused hole.

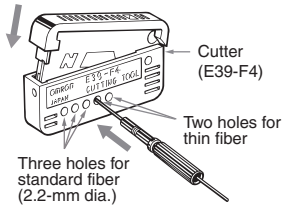
Cut a thin fiber as follows:

1. An attachment is temporarily fitted to a thin fiber before shipment.

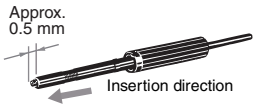



2. Secure the attachment after adjusting the position of it in the direction indicated by the arrow.

3. Insert the fiber to be cut into the E39-F4.




4. Finished state (proper cutting state)

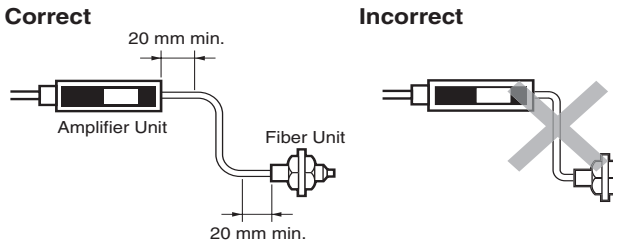



**Note:** Insert the fiber in the direction indicated by the arrow.

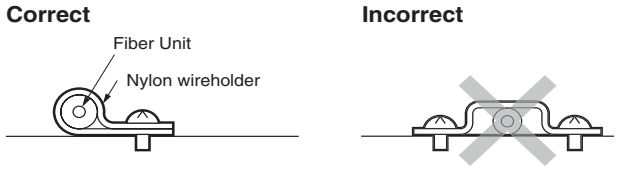
### Connection

Do not pull or press the Fiber Units. The Fiber Units have a withstand force of 9.8 N or 29.4 N maximum (pay utmost attention because the fibers are thin).

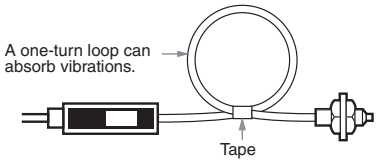
Do not bend the edge of the Fiber Units (excluding the E32-T□R and E32-D□R).




Do not apply excess force on the Fiber Units.




The Fiber Head could be broken by excessive vibration.Use the following method to prevent fiber head breakage:

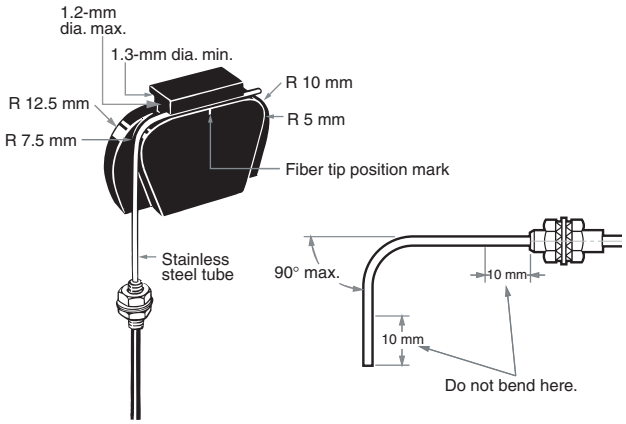



### Bending Radius

#### E39-F11 Sleeve Bender

The bending radius of the stainless steel tube should be as large as possible. The smaller the bending radius becomes, the shorter the sensing distance will be.

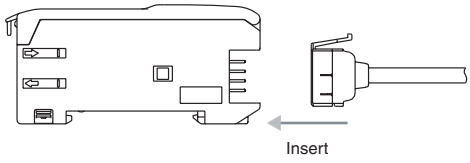
Insert the tip of the stainless steel tube to the Sleeve Bender and bend the stainless steel tube slowly along the curve of the Sleeve Bender (refer to the figure).



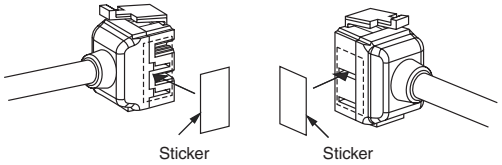

## ■ Mounting Amplifier Units with Connectors

### Mounting Connectors

1. Insert the Master or Slave Connector into the Amplifier Unit until it clicks into place.



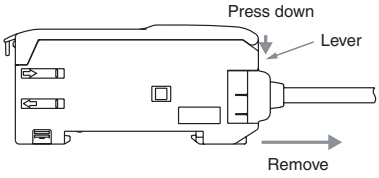

2. Join Amplifier Units together as required after all the Master and Slave Connectors have been inserted.
3. Attach the stickers (provided as accessories) to the sides of Master and Slave Connectors that are not connected to other Connectors.




**Note:** Attach the stickers to the sides with grooves.

### Removing Connectors

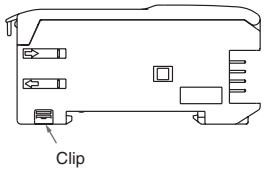
1. Slide the slave Amplifier Unit for which the Connector is to be removed away from the rest of the group.
2. After the Amplifier Unit has been separated, press down on the lever on the Connector and remove it. (Do not attempt to remove Connectors without separating them from other Amplifier Units first.)



## ■ Mounting End Plate (PFP-M)

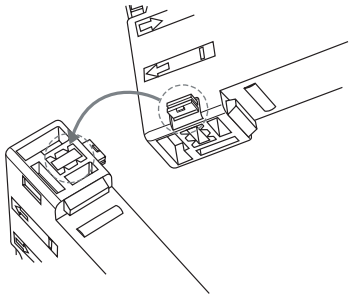
Depending on how it is mounted, an Amplifier Unit may move during operation. In this case, use an End Plate.

Before mounting an End Plate, remove the clip from the master Amplifier Unit using a nipper or similar tool.

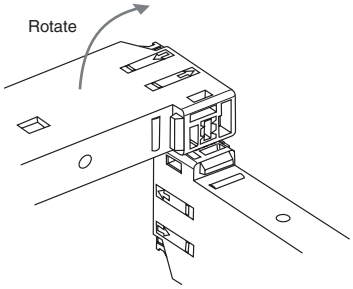



The clip can also be removed using the following mechanism, which is incorporated in the construction of the section underneath the clip.

1. Insert the clip that is to be removed into the slit underneath the clip on another Amplifier Unit.



2. Remove the clip by rotating the Amplifier Unit.




### Pull Strengths for Connectors (Including Cables)

E3X-CN11: 30 N max.
E3X-CN12: 12 N max.

## ■ Reflector

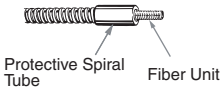
### Use of E39-R3 Reflector

Use detergent, etc., to remove any dust or oil from the surfaces where tape is applied. Adhesive tape will not be attached properly if oil or dust remains on the surface.

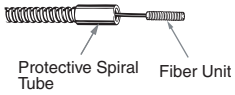
The E39-R3 cannot be used in places where it is exposed to oil or chemicals.

### E39-F32□ Protective Spiral Tubes

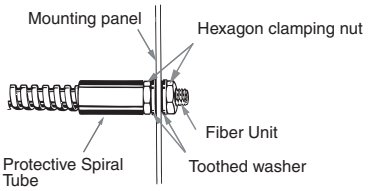
Insert a fiber to the Protective Spiral Tube from the head connector side (screwed) of the tube.



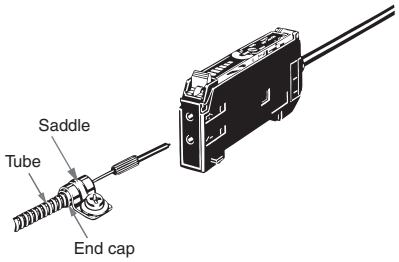

Push the fiber into the Protective Spiral Tube. The tube should be straight so that the fiber is not twisted when inserted. Then turn the end cap of the spiral tube.




Secure the Protective Spiral Tube on a suitable place with the attached nut.

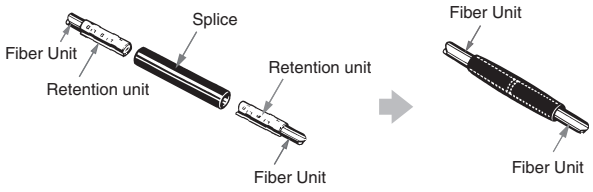



Use the attached saddle to secure the end cap of the Protective Spiral Tube. To secure the Protective Spiral Tube at a position other than the end cap, apply tape to the tube so that the portion becomes thicker in diameter.




## ■ E39-F10 Fiber Connector

Mount the Fiber Connector as shown in the following illustrations.




The Fiber Units should be as close as possible when they are connected.

Sensing distance will be reduced by approximately 25% when fibers are connected.

Only 2.2-mm-dia. fibers can be connected.

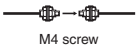
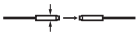
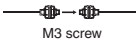
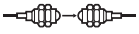
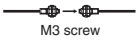
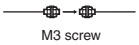
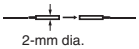
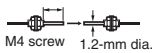
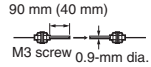
# Sensing Distance with Fiber Optic Cables

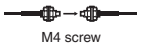
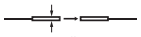
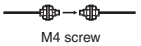
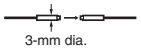
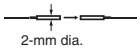
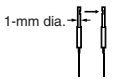
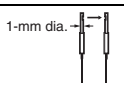
## ■ Through-beam Fiber Units

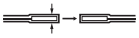
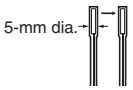
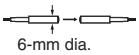
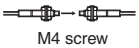
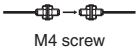
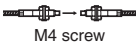
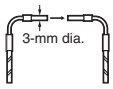
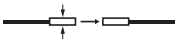
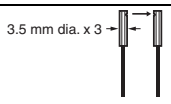
Refer to the end of the following table for notes and precautions.

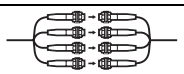
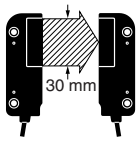
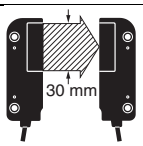
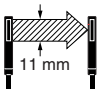
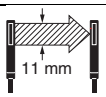
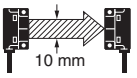
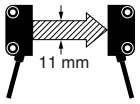
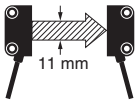
(Free-cut) Indicates models that allow free cutting. Models without this mark do not allow free cutting.

■ : Red light □ : Green light

| Application | Features | Appearance | Applicable Amplifier Unit | Sensing distance (mm) (Values in parentheses: when using the E39-F1 Lens Unit) | Standard object (see notes) (min. sensing target: opaque) | **Part number** | Permissible bending radius |
|---|---|---|---|---|---|---|---|
| Long distance | M4 (Free-cut) |  M4 screw | E3X-NA□ (V) | ■ 700 (2,000) | 1.4-mm dia. (0.03-mm dia.) | **E32-T11L** | 25 mm |
| | | | E3X-NAG□ | □ 130 (370) | | | |
| | | | E3X-NA□F | ■ 210 (600) | 1.4-mm dia. (0.5-mm dia.) | | |
| | 3-mm dia. (Free-cut) |  3-mm dia. | E3X-NA□ (V) | ■ 700 | 1.4-mm dia. (0.03-mm dia.) | **E32-T12L** | |
| | | | E3X-NAG□ | □ 130 | | | |
| | | | E3X-NA□F | ■ 210 | 1.4-mm dia. (0.5-mm dia.) | | |
| | M3 (Free-cut) |  M3 screw | E3X-NA□ (V) | ■ 200 | 0.9-mm dia. (0.03-mm dia.) | **E32-T21L** | 10 mm |
| | | | E3X-NAG□ | □ 40 | | | |
| | | | E3X-NA□F | ■ 60 | 0.9-mm dia. (0.2-mm dia.) | | |
| | 2-mm dia.; small diameter (Free-cut) |  2-mm dia. | E3X-NA□ (V) | ■ 200 | 0.9-mm dia. (0.03-mm dia.) | **E32-T22L** | |
| | | | E3X-NAG□ | □ 40 | | | |
| | | | E3X-NA□F | ■ 60 | 0.9-mm dia. (0.2-mm dia.) | | |
| | M14; with lens; ideal for explo-sion-proof applications (Free-cut) |  M14 screw | E3X-NA□ (V) | ■ 14,000 | 10-mm dia. (0.1-mm dia.) | **E32-T17L** | 25 mm |
| | | | E3X-NA□F | ■ 4,200 | 10-mm dia. (1.5-mm dia.) | | |
| General-purpose | M4 (Free-cut) |  M4 screw | E3X-NA□ (V) | ■ 400 (3,000) | 1.0-mm dia. (0.03-mm dia.) | **E32-TC200** | 25 mm |
| | | | E3X-NAG□ | □ 75 (550) | | | |
| | | | E3X-NA□F | ■ 120 (900) | 1.0-mm dia. (0.2-mm dia.) | | |
| | M3; possible to mount the reflective side-view conversion attachment E39-F5 (Free-cut) |  M3 screw | E3X-NA□ (V) | ■ 360 | 1.0-mm dia. (0.03-mm dia.) | **E32-TC200A** | 25 mm |
| | | | E3X-NAG□ | □ 65 | | | |
| | | | E3X-NA□F | ■ 100 | 1.0-mm dia. (0.2-mm dia.) | | |
| | M3; for detecting minute sensing targets (Free-cut) |  M3 screw | E3X-NA□ (V) | ■ 100 | 0.5-mm dia. (0.03-mm dia.) | **E32-TC200E** | 10 mm |
| | | | E3X-NAG□ | □ 20 | | | |
| | | | E3X-NA□F | ■ 30 | 0.5-mm dia. (0.1-mm dia.) | | |
| Thin fiber | 2-mm dia.; for detecting minute sensing targets (Free-cut) |  2-mm dia. | E3X-NA□ (V) | ■ 100 | 0.5-mm dia. (0.03-mm dia.) | **E32-T22** | 10 mm |
| | | | E3X-NAG□ | □ 20 | | | |
| | | | E3X-NA□F | ■ 30 | 0.5-mm dia. (0.1-mm dia.) | | |
| | 1.2-mm dia.; with sleeve (Free-cut) |  90 mm (40 mm) M4 screw 1.2-mm dia. ( ): E32-TC200B4 | E3X-NA□ (V) | ■ 400 | 1.0-mm dia. (0.03-mm dia.) | **E32-TC200B E32-TC200B4** | 25 mm |
| | | | E3X-NAG□ | □ 75 | | | |
| | | | E3X-NA□F | ■ 120 | 1.0-mm dia. (0.2-mm dia.) | | |
| | 0.9-mm dia.; with sleeve (Free-cut) |  90 mm (40 mm) M3 screw 0.9-mm dia. ( ): E32-TC200F4 | E3X-NA□ (V) | ■ 100 | 0.5-mm dia. (0.03-mm dia.) | **E32-TC200F E32-TC200F4** | 10 mm |
| | | | E3X-NAG□ | □ 20 | | | |
| | | | E3X-NA□F | ■ 30 | 0.5-mm dia. (0.1-mm dia.) | | |

| Application | Features | Appearance | Applicable Amplifier Unit | Sensing distance (mm) (Values in parentheses: when using the E39-F1 Lens Unit) | Standard object (see notes) (min. sensing target: opaque) | **Part number** | Permissible bending radius |
|---|---|---|---|---|---|---|---|
| Flexible (R4) | Ideal for mounting on moving sections (R4) (Free-cut) |  M4 screw | E3X-NA□ (V) | 360 | 1.0-mm dia. (0.03-mm dia.) | **E32-T11** | 4 mm |
| | | | E3X-NAG□ | 65 | | | |
| | | | E3X-NA□F | 100 | 1.0-mm dia. (0.2-mm dia.) | | |
| | |  M3 screw | E3X-NA□ (V) | 100 | 0.5-mm dia. (0.03-mm dia.) | **E32-T21** | |
| | | | E3X-NAG□ | 18 | | | |
| | | | E3X-NA□F | 30 | 0.5-mm dia. (0.1-mm dia.) | | |
| | |  1.5-mm dia. | E3X-NA□ (V) | 100 | 0.5-mm dia. (0.03-mm dia.) | **E32-T22B** | |
| | | | E3X-NAG□ | 18 | | | |
| | | | E3X-NA□F | 30 | 0.5-mm dia. (0.1-mm dia.) | | |
| | M4 (Free-cut) |  M4 screw | E3X-NA□ (V) | 280 (2,100) | 1.0-mm dia. (0.03-mm dia.) | **E32-T11R** | 1 mm |
| | | | E3X-NAG□ | 50 (375) | | | |
| | | | E3X-NA□F | 80 (600) | 1.0-mm dia. (0.2-mm dia.) | | |
| | 3-mm dia. (Free-cut) |  3-mm dia. | E3X-NA□ (V) | 280 (2,100) | 1.0-mm dia. (0.03-mm dia.) | **E32-T12R** | |
| | | | E3X-NAG□ | 50 (375) | | | |
| | | | E3X-NA□F | 80 (600) | 1.0-mm dia. (0.2-mm dia.) | | |
| | M3; small diameter (Free-cut) |  M3 screw | E3X-NA□ (V) | 60 | 0.5-mm dia. (0.03-mm dia.) | **E32-T21R** | 1 mm |
| | | | E3X-NAG□ | 12 | | | |
| | | | E3X-NA□F | 18 | 1.0-mm dia. (0.1-mm dia.) | | |
| | 2-mm dia.; small diameter (Free-cut) |  2-mm dia. | E3X-NA□ (V) | 60 | 0.5-mm dia. (0.03-mm dia.) | **E32-T22R** | 1 mm |
| | | | E3X-NA□F | 18 | 0.5-mm dia. (0.1-mm dia.) | | |
| Side-view | Long distance; space-saving (Free-cut) |  3-mm dia. | E3X-NA□ (V) | 240 | 1.0-mm dia. (0.03-mm dia.) | **E32-T14L** | 25 mm |
| | | | E3X-NAG□ | 45 | | | |
| | | | E3X-NA□F | 70 | 1.0-mm dia. (0.2-mm dia.) | | |
| | Space-saving (Free-cut) |  3-mm dia. | E3X-NA□ (V) | 110 | 1.0-mm dia. (0.03-mm dia.) | **E32-T14LR** | 1 mm |
| | | | E3X-NA□F | 33 | 1.0-mm dia. (0.2-mm dia.) | | |
| | Suitable for detecting minute sensing targets (Free-cut) |  1-mm dia. | E3X-NA□ (V) | 90 | 0.5-mm dia. (0.03-mm dia.) | **E32-T24** | 10 mm |
| | | | E3X-NAG□ | 12 | | | |
| | | | E3X-NA□F | 27 | 0.5-mm dia. (0.3-mm dia.) | | |
| | Suitable for detecting minute sensing targets (Free-cut) |  1-mm dia. | E3X-NA□ (V) | 30 | 0.5-mm dia. (0.03-mm dia.) | **E32-T24R** | 1 mm |
| | | | E3X-NA□F | 9 | 0.5-mm dia. (0.3-mm dia.) | | |
| | Screw-mounting type (Free-cut) |  | E3X-NA□ (V) | 1,800 | 4.0-mm dia. (0.03-mm dia.) | **E32-T14** | 25 mm |
| | | | E3X-NAG□ | 330 | | | |
| | | | E3X-NA□F | 540 | 4.0-mm dia. (0.2-mm dia.) | | |

| Application | Features | Appearance | Applicable Amplifier Unit | Sensing distance (mm) (Values in parentheses: when using the E39-F1 Lens Unit) | Standard object (see notes) (min. sensing target: opaque) | **Part number** | Permissible bending radius |
|---|---|---|---|---|---|---|---|
| Chemical-resistant | Teflon-covered *1; withstands chemicals and harsh environments (operating ambient temperature: −30°C to 70°C) (Free-cut) |  5-mm dia. | E3X-NA□ (V) | | 4.0-mm dia. (0.2-mm dia.) | **E32-T12F** | 40 mm |
| | | | E3X-NAG□ | 300 | | | |
| | | | E3X-NA□F | 480 | 4.0-mm dia. (0.7-mm dia.) | | |
| | Teflon-covered *1; side-view; withstands chemicals and harsh environments (operating ambient temperature: −30°C to 70°C) (Free-cut) |  5-mm dia. | E3X-NA□ (V) | 200 | 3.0-mm dia. (0.2-mm dia.) | **E32-T14F** | |
| | | | E3X-NAG□ | 37 | | | |
| | | | E3X-NA□F | 60 | 3.0-mm dia. (0.7-mm dia.) | | |
| | Teflon *1; withstands chemicals and harsh environments (operating ambient temperature: −40°C to 200°C) |  6-mm dia. | E3X-NA□ (V) | 350 | 1.0-mm dia. (0.2-mm dia.) | **E32-T81F** | 10 mm |
| | | | E3X-NA□F | 100 | 1.0-mm dia. (0.5-mm dia.) | | |
| Heat-resistant | Resists 200°C; flexible (R10); fiber sheath material: Teflon *1 (operating ambient temperature: −40°C to 200°C) |  M4 screw | E3X-NA□ (V) | 180 | 1.0-mm dia. (0.2-mm dia.) | **E32-T81R** | 10 mm |
| | | | E3X-NA□F | 50 | 1.0-mm dia. (0.5-mm dia.) | | |
| | Resists 150°C *2; fiber sheath material: fluororesin (operating ambient temperature: −40°C to 150°C) (Free-cut) |  M4 screw | E3X-NA□ (V) | 400 | 1.5-mm dia. (0.03-mm dia.) | **E32-T51** | 35 mm |
| | | | E3X-NA□F | 120 | 1.5-mm dia. (1.0-mm dia.) | | |
| | Resists 300°C *3, with spiral tube; high mechanical strength; fiber sheath material: stainless steel (operating ambient temperature: −40°C to 300°C) |  M4 screw | E3X-NA□ (V) | 300 (3,000) | 1.0-mm dia. (0.03-mm dia.) | **E32-T61** | 25 mm |
| | | | E3X-NA□F | 90 | 1.0-mm dia. (0.5-mm dia.) | | |
| | Side-view; resists 150°C *2; suitable for detecting minute sensing targets; fiber sheath material: fluororesin (operating ambient temperature: −40°C to 150°C) (Free-cut) |  2-mm dia. | E3X-NA□ (V) | 130 | 1.0-mm dia. (0.03-mm dia.) | **E32-T54** | 35 mm |
| | | | E3X-NA□F | 35 | 1.0-mm dia. (0.3-mm dia.) | | |
| | Resists 200°C *3; L-shaped; fiber sheath material: stainless steel |  3-mm dia. | E3X-NA□ (V) | 700 | 1.7-mm dia. (0.03-mm dia.) | **E32-T84S** | 25 mm |
| | | | E3X-NA□F | 210 | 1.7-mm dia. (0.4-mm dia.) | | |
| Slot sensor | Suitable for film sheet detection; no optical axis adjustment required; easy to mount (Free-cut) |  | E3X-NA□ (V) | 10 | 4.0-mm dia. (0.1-mm dia.) | **E32-G14** | 25 mm |
| | | | E3X-NAG□ | 10 | | | |
| | | | E3X-NA□F | 10 | 4.0-mm dia. (1.0-mm dia.) | | |
| Narrow vision field | Suitable for detecting wafers (Free-cut) |  3-mm dia. | E3X-NA□ (V) | 1,000 | 1.7-mm dia. (0.5-mm dia.) | **E32-T22S** | 10 mm |
| | | | E3X-NA□F | 300 | | | |
| | Side-view; suitable for detecting wafers (Free-cut) |  3.5 mm dia. x 3 | E3X-NA□ (V) | 700 | 2.0-mm dia. (0.03-mm dia.) | **E32-T24S** | |
| | | | E3X-NA□F | 210 | 2.0-mm dia. (0.5-mm dia.) | | |

| Application | Features | Appearance | Applicable Amplifier Unit | Sensing distance (mm) (Values in parentheses: when using the E39-F1 Lens Unit) | Standard object (see notes) (min. sensing target: opaque) | Part number | Permissible bending radius |
|---|---|---|---|---|---|---|---|
| Area sensing | Multi-point detection (4-head) |  M3 screw | E3X-NA□ (V) | 300 | 2.0-mm dia. (0.03-mm dia.) | **E32-M21** | 25 mm |
| | | | E3X-NA□F | 90 | 2.0-mm dia. (0.3-mm dia.) | | |
| | Detects in a 30-mm area (Free-cut) |  30 mm | E3X-NA□ (V) | 920 | (0.5-mm dia.) *4 | **E32-T16W** | 10 mm |
| | | | E3X-NAG□ | 170 | | | |
| | | | E3X-NA□F | 270 | (4.0-mm dia.) *4 | | |
| | Detects in a 30-mm area; flexible (Free-cut) |  30 mm | E3X-NA□ (V) | 690 | (0.5-mm dia.) *4 | **E32-T16WR** | 1 mm |
| | | | E3X-NA□F | 200 | (4.0-mm dia.) *4 | | |
| | Side-view; suitable for applications with limited spatial depth (Free-cut) |  11 mm | E3X-NA□ (V) | 520 | (0.3-mm dia.) *4 | **E32-T16J** | 10 mm |
| | | | E3X-NAG□ | 95 | | | |
| | | | E3X-NA□F | 150 | (2.0-mm dia.) *4 | | |
| | Side-view; suitable for applications with limited spatial depth; flexible (Free-cut) |  11 mm | E3X-NA□ (V) | 390 | (0.3-mm dia.) *4 | **E32-T16JR** | 1 mm |
| | | | E3X-NA□F | 110 | (2.0-mm dia.) *4 | | |
| | Suitable for detecting over a 10-mm area; long distance (Free-cut) |  10 mm | E3X-NA□ (V) | 1,500 | (0.9-mm dia.) *4 | **E32-T16** | 25 mm |
| | | | E3X-NAG□ | 275 | | | |
| | | | E3X-NA□F | 450 | (1.5-mm dia.) *4 | | |
| | Stable for detecting minute sensing targets in a wide area; enclosure rating: IEC 60529 IP50 (Free-cut) |  11 mm | E3X-NA□ (V) | 600 | (0.3-mm dia.) *4 | **E32-T16P** | 10 mm |
| | | | E3X-NAG□ | 110 | | | |
| | | | E3X-NA□F | 180 | (2.0-mm dia.) *4 | | |
| | Stable for detecting minute objects in a wide area; flexible; enclosure rating: IEC60529 IP50 (Free-cut) |  11 mm | E3X-NA□ (V) | 450 | (0.3-mm dia.) *4 | **E32-T16PR** | 1 mm |
| | | | E3X-NA□F | 130 | (2.0-mm dia.) *4 | | |

*1 Teflon is a registered trademark of the Dupont Company and the Mitsui Dupont Chemical Company for their fluoride resin.

*2 For continuous operation, use the products within a temperature range of −40°C to 130°C.

*3 Indicates the heat-resistant temperature at the fiber tip.

*4 These figures are for a sensing distance of 100 mm. (Diameters of sensing targets are ones at a stationary state.)

**Note:** **1.** The size of standard sensing target is the same as the fiber core diameter (lens diameter for models with lens).

**2.** The values of the minimum sensing target for E3X-NA□ (V) and E3X-NAG□ through-beam models indicate those obtained where the sensing distance and sensitivity are set to optimum values.

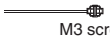
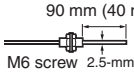
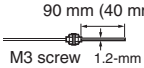
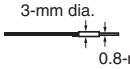
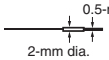
**3.** The value of the minimum sensing target for E3X-NA□F through-beam models indicates that obtained at the rated sensing distance with the sensitivity set to the optimum value.

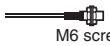
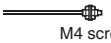
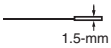
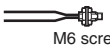
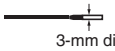
## ■ Fiber Units with Reflective Sensors

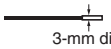
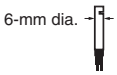
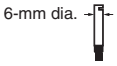
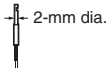
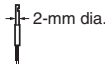
Refer to the end of the following table for notes and precautions.

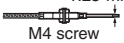
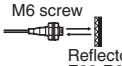
(Free-cut) Indicates models that allow free cutting. Models without this mark do not allow free cutting.

■ : Red light □ : Green light

| Application | Features | Appearance | Applicable Amplifier Unit | Sensing distance (mm) *1 | Standard object (see note) (min. sensing target: Gold wire) | Part number | Permissible bending radius |
|---|---|---|---|---|---|---|---|
| Long distance | M6 (Free-cut) |  M6 screw | E3X-NA□ (V) | ■ 200 | 250×250 (0.01-mm dia.) | **E32-D11L** | 25 mm |
| | | | E3X-NAG□ | □ 35 | 50×50 (0.1-mm dia.) | | |
| | | | E3X-NA□F | ■ 65 | 100×100 (0.015-mm dia.) | | |
| | 3-mm dia.; small diameter (Free-cut) |  3-mm dia. | E3X-NA□ (V) | ■ 120 | 150×150 (0.01-mm dia.) | **E32-D12** | |
| | | | E3X-NAG□ | □ 20 | 25×25 (0.1-mm dia.) | | |
| | | | E3X-NA□F | ■ 40 | 50×50 (0.015-mm dia.) | | |
| | M4 (Free-cut) |  M4 screw | E3X-NA□ (V) | ■ 50 | 100×100 (0.01-mm dia.) | **E32-D21L** | 10 mm |
| | | | E3X-NAG□ | □ 10 | 25×25 (0.1-mm dia.) | | |
| | | | E3X-NA□F | ■ 17 | 25×25 (0.015-mm dia.) | | |
| | 3-mm dia.; small diameter (Free-cut) |  3-mm dia. | E3X-NA□ (V) | ■ 50 | 100×100 (0.01-mm dia.) | **E32-D22L** | |
| | | | E3X-NAG□ | □ 10 | 25×25 (0.1-mm dia.) | | |
| | | | E3X-NA□F | ■ 17 | 25×25 (0.015-mm dia.) | | |
| General-purpose | M6 (Free-cut) |  M6 screw | E3X-NA□ (V) | ■ 150 | 200×200 (0.01-mm dia.) | **E32-DC200** | 25 mm |
| | | | E3X-NAG□ | □ 25 | 50×50 (0.1-mm dia.) | | |
| | | | E3X-NA□F | ■ 50 | 75×75 (0.015-mm dia.) | | |
| | M3; small diameter (Free-cut) |  M3 screw | E3X-NA□ (V) | ■ 36 | 50×50 (0.01-mm dia.) | **E32-DC200E** | 10 mm |
| | | | E3X-NAG□ | ■ 6 | 25×25 (0.1-mm dia.) | | |
| | | | E3X-NA□F | ■ 12 | 25×25 (0.02-mm dia.) | | |
| Thin fiber | 2.5-mm dia.; with sleeve (Free-cut) |  90 mm (40 mm) M6 screw 2.5-mm dia. ( ): E32-DC200B4 | E3X-NA□ (V) | ■ 150 | 200×200 (0.01-mm dia.) | **E32-DC200B E32-DC200B4** | 25 mm |
| | | | E3X-NAG□ | □ 25 | 50×50 (0.1-mm dia.) | | |
| | | | E3X-NA□F | ■ 50 | 75×75 (0.015-mm dia.) | | |
| | 1.2-mm dia.; with sleeve (Free-cut) |  90 mm (40 mm) M3 screw 1.2-mm dia. ( ): E32-DC200F4 | E3X-NA□ (V) | ■ 36 | 50×50 (0.01-mm dia.) | **E32-DC200F E32-DC200F4** | 10 mm |
| | | | E3X-NAG□ | ■ 6 | 25×25 (0.1-mm dia.) | | |
| | | | E3X-NA□F | ■ 12 | 25×25 (0.02-mm dia.) | | |
| | 0.8-mm dia.; for detecting minute sensing targets (Free-cut) |  3-mm dia. 0.8-mm dia. | E3X-NA□ (V) | □ 10 | 25×25 (0.01-mm dia.) | **E32-D33** | 4 mm |
| | | | E3X-NA□F | ■ 3.3 | 25×25 (0.03-mm dia.) | | |
| | 0.5-mm dia.; for detecting minute sensing targets |  0.5-mm dia. 2-mm dia. | E3X-NA□ | ■ 1.5 | 25×25 (0.01-mm dia.) | **E32-D331** | 4 mm |
| | | | E3X-NA□F | ■ 0.5 | 25×25 (0.05-mm dia.) | | |

| Application | Features | Appearance | Applicable Amplifier Unit | Sensing distance (mm) *1 | Standard object (see note) (min. sensing target: Gold wire) | Part number | Permissible bending radius |
|---|---|---|---|---|---|---|---|
| Flexible | Ideal for mounting on moving sections (Free-cut) |  M6 screw | E3X-NA□ (V) | 90 | 150×150 (0.01-mm dia.) | **E32-D11** | 4 mm |
| | | | E3X-NAG□ | 15 | 25×25 (0.1-mm dia.) | | |
| | | | E3X-NA□F | 30 | 50×50 (0.015-mm dia.) | | |
| | (Free-cut) |  M3 screw | E3X-NA□ (V) | 15 | 25×25 (0.01-mm dia.) | **E32-D21** | |
| | | | E3X-NA□F | 5 | 25×25 (0.02-mm dia.) | | |
| | (Free-cut) |  M4 screw | E3X-NA□ (V) | 15 | 25×25 (0.01-mm dia.) | **E32-D21B** | |
| | | | E3X-NAG□ | 2.4 | 25×25 (0.1-mm dia.) | | |
| | | | E3X-NA□F | 5 | 25×25 (0.02-mm dia.) | | |
| | |  1.5-mm dia. | E3X-NA□ (V) | 7 | 25×25 (0.01-mm dia.) | **E32-D22B** | |
| | | | E3X-NA□F | 2.3 | 25×25 (0.02-mm dia.) | | |
| | M6 (Free-cut) |  M6 screw | E3X-NA□ (V) | 90 | 150×150 (0.01-mm dia.) | **E32-D11R** | 1 mm |
| | | | E3X-NAG□ | 15 | 25×25 (0.1-mm dia.) | | |
| | | | E3X-NA□F | 30 | 50×50 (0.02-mm dia.) | | |
| | 3-mm dia. (Free-cut) |  3-mm dia. | E3X-NA□ (V) | 90 | 150×150 (0.01-mm dia.) | **E32-D12R** | |
| | | | E3X-NAG□ | 15 | 25×25 (0.1-mm dia.) | | |
| | | | E3X-NA□F | 30 | 50×50 (0.02-mm dia.) | | |
| | M3; small diameter (Free-cut) |  M3 screw | E3X-NA□ (V) | 15 | 25×25 (0.01-mm dia.) | **E32-D21R** | |
| | | | E3X-NA□F | 5 | 25×25 (0.03-mm dia.) | | |
| | 3-mm dia.; small diameter (Free-cut) |  3-mm dia. | E3X-NA□ (V) | 15 | 25×25 (0.01-mm dia.) | **E32-D22R** | |
| | | | E3X-NA□F | 5 | 25×25 (0.03-mm dia.) | | |

| Application | Features | Appearance | Applicable Amplifier Unit | Sensing distance (mm) *1 | Standard object (see note) (min. sensing target: Gold wire) | Part number | Permissible bending radius |
|---|---|---|---|---|---|---|---|
| Coaxial | M6 coaxial; high-precision positioning (Free-cut) |  M6 screw | E3X-NA□ (V) | 150 | 200×200 (0.01-mm dia.) | **E32-CC200** | 25 mm |
| | | | E3X-NAG□ | 25 | 50×50 (0.1-mm dia.) | | |
| | | | E3X-NA□F | 50 | 75×75 (0.015-mm dia.) | | |
| | 3-mm dia. coaxial; small diameter; high-precision positioning (Free-cut) |  3-mm dia. | E3X-NA□ (V) | 80 | 100×100 (0.01-mm dia.) | **E32-D32L** | |
| | | | E3X-NAG□ | 12 | 25×25 (0.1-mm dia.) | | |
| | | | E3X-NA□F | 25 | 50×50 (0.02-mm dia.) | | |
| | M3 coaxial; high-precision positioning; possible to mount small-spot lens (E39-F3A-5/F3B/F3C) (Free-cut) |  M3 screw | E3X-NA□ (V) | 40 | 50×50 (0.01-mm dia.) | **E32-C31** | |
| | | | E3X-NAG□ | 6 | 25×25 (0.1-mm dia.) | | |
| | | | E3X-NA□F | 13 | 25×25 (0.02-mm dia.) | | |
| | M3 coaxial; high-precision positioning; possible to mount small-spot lens (E39-F3A-5/F3B/F3C) |  M3 screw | E3X-NA□ (V) | 15 | 25×25 (0.01-mm dia.) | **E32-C41** | |
| | | | E3X-NA□F | 5 | 25×25 (0.02-mm dia.) | | |
| | 2-mm dia. coaxial; high-precision positioning; possible to mount small-spot (0.1 to 0.6 dia.) lens (E39-F3A) |  2-mm dia. | E3X-NA□ (V) | 15 | 25×25 (0.01-mm dia.) | **E32-C42** | |
| | | | E3X-NA□F | 5 | 25×25 (0.02-mm dia.) | | |
| | 2-mm dia. coaxial; high-precision positioning; possible to mount small-spot (0.5 to 1 dia.) lens (E39-F3A) (Free-cut) |  2-mm dia. | E3X-NA□ (V) | 40 | 50×50 (0.01-mm dia.) | **E32-D32** | |
| | | | E3X-NAG□ | 6 | 25×25 (0.1-mm dia.) | | |
| | | | E3X-NA□F | 13 | 25×25 (0.02-mm dia.) | | |
| Side-view | 6-mm dia.; long distance (Free-cut) |  6-mm dia. | E3X-NA□ (V) | 40 | 50×50 (0.03-mm dia.) | **E32-D14L** | 25 mm |
| | | | E3X-NAG□ | 10 | 25×25 (0.3-mm dia.) | | |
| | | | E3X-NA□F | 13 | 25×25 (0.03-mm dia.) | | |
| | 6-mm dia.; flexible (Free-cut) |  6-mm dia. | E3X-NA□ (V) | 16 | 25×25 (0.03-mm dia.) | **E32-D14LR** | 1 mm |
| | | | E3X-NA□F | 5 | | | |
| | 2-mm dia.; small diameter; flexible, space-saving (Free-cut) |  2-mm dia. | E3X-NA□ (V) | 15 | 25×25 (0.03-mm dia.) | **E32-D24** | 10 mm |
| | | | E3X-NAG□ | 2.4 | 25×25 (0.3-mm dia.) | | |
| | | | E3X-NA□F | 5 | 25×25 (0.03-mm dia.) | | |
| | 2-mm dia.; small diameter space-saving; flexible (Free-cut) |  2-mm dia. | E3X-NA□ (V) | 7 | 25×25 (0.03-mm dia.) | **E32-D24R** | 1 mm |
| | | | E3X-NA□F | 2.3 | | | |
| Chemical-resistant | Teflon-covered *3; withstands chemicals and harsh environments (operating ambient temperature: −30°C to 70°C) (Free-cut) |  6-mm dia. | E3X-NA□ (V) | 50 | 100×100 (0.03-mm dia.) | **E32-D12F** | 40 mm |
| | | | E3X-NAG□ | 8 | 25×25 (0.3-mm dia.) | | |
| | | | E3X-NA□F | 16 | 25×25 (0.03-mm dia.) | | |

| Application | Features | Appearance | Applicable Amplifier Unit | Sensing distance (mm) *1 | Standard object (see note) (min. sensing target: Gold wire) | Part number | Permissible bending radius |
|---|---|---|---|---|---|---|---|
| Heat-resistant | Resists 150°C *2; fiber sheath material: fluororesin (operating ambient temperature: −40°C to 150°C) (Free-cut) |  M6 screw | E3X-NA□ (V) | 120 | 150×150 (0.03-mm dia.) | **E32-D51** | 35 mm |
| | | | E3X-NA□F | 40 | 50×50 (0.03-mm dia.) | | |
| | Resists 300°C *4; fiber sheath material: stainless steel (operating ambient temperature: −40°C to 300°C) |  M6 screw | E3X-NA□ (V) | 45 | 100×100 (0.03-mm dia.) | **E32-D61** | 25 mm |
| | | | E3X-NA□F | 15 | 25×25 (0.03-mm dia.) | | |
| | Resists 400°C *4; fiber sheath material: stainless steel (operating ambient temperature: −40°C to 400°C) | 1.25-mm dia.  M4 screw | E3X-NA□ (V) | 30 | 50×50 (0.03-mm dia.) | **E32-D73** | |
| | | | E3X-NA□F | 10 | 25×25 (0.03-mm dia.) | | |
| Area sensing | Side-view; detection over wide areas (Free-cut) |  | E3X-NA□ (V) | 75 | 100×100 (0.03-mm dia.) | **E32-D36P1** | 25 mm |
| | | | E3X-NA□F | 25 | 50×50 (0.03-mm dia.) | | |
| Retroreflective | Transparent object detection; polarized (Free-cut) | M6 screw  Reflector E39-R3 | E3X-NA□ (V) | 10 to 250 | 35-mm dia. (0.3-mm dia.) | **E32-R21 +E39-R3 (Attachment)** | 10 mm |
| | | | E3X-NA□F | 10 to 250 | 35-mm dia. (0.5-mm dia.) | | |
| | Transparent object detection, polarized (operating ambient temperature: −25°C to 55°C); enclosure rating: IEC 60529 IP66 (Free-cut) |  Reflector E39-R1 | E3X-NA□ (V) | 150 to 1,500 | 35-mm dia. (0.6-mm dia.) | **E32-R16 +E39-R1 (Attachment)** | 25 mm |
| | | | E3X-NA□F | 150 to 1,000 | 35-mm dia. (4.0-mm dia.) | | |
| Limited reflective | Suitable for positioning crystal glass (Free-cut) |  | E3X-NA□ (V) | 4 to12 | --- | **E32-L56E1 E32-L56E2** | 35 mm |
| | | | E3X-NA□F | 4 to12 | | | |
| | Detects wafers and small differences in height; (operating ambient temperature: −40°C to 105°C); enclosure rating: IEC 60529 IP50 (Free-cut) |  | E3X-NA□ (V) | 4±2 | 25×25 (0.015-mm dia.) | **E32-L24L** | 10 mm |
| | | | E3X-NA□F | 4±2 | 25×25 (0.03-mm dia.) | | |
| | |  | E3X-NA□ (V) | 7.2±1.8 | 25×25 (0.015-mm dia.) | **E32-L25L** | |
| | | | E3X-NA□F | 7.2±1.8 | 25×25 (0.03-mm dia.) | | |
| | Detects wafers and small differences in height; enclosure rating: IEC 60529 IP50 (Free-cut) |  | E3X-NA□ (V) | 3.3 | 25×25 (0.015-mm dia.) | **E32-L25** | 25 mm |
| | | | E3X-NA□F | 3.3 | 25×25 (0.03-mm dia.) | | |
| | |  | E3X-NA□ (V) | 3.3 | 25×25 (0.015-mm dia.) | **E32-L25A** | |
| | | | E3X-NA□F | 3.3 | 25×25 (0.03-mm dia.) | | |
| Fluid-level detection | Fluid contact type: unbendable section L 150 mm, 350 mm (two types) |  L | E3X-NA□ (V) | --- | --- | **E32-D82F1 E32-D82F2** | 40 mm |
| | | | E3X-NA□F | | --- | | |
| | Tube-mounting type (Free-cut) |  | E3X-NA□ (V) | --- | --- | **E32-L25T** | 10 mm |
| | | | E3X-NA□F | | --- | | |

*1 Sensing distance indicates values for white paper.

*2 For continuous operation, use the products within a temperature range of −40°C to 130°C.

*3 Teflon is a registered trademark of the Dupont Company and the Mitsui Dupont Chemical Company for their fluoride resin.

*4 Indicates the heat-resistant temperature at the fiber tip.

**Note:** The values of the minimum sensing target indicate those obtained at a distance where the smallest object can be sensed with the Reflective Fiber Unit.

**ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.**
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

OMRON

**OMRON ELECTRONICS LLC**
One East Commerce Drive
Schaumburg, IL 60173
**1-800-55-OMRON**

**OMRON ON-LINE**
Global - http://www.omron.com
USA - http://www.omron.com/oei
Canada - http://www.omron.com/oci

**OMRON CANADA, INC.**
885 Milner Avenue
Scarborough, Ontario M1B 5V8
**416-286-6465**

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OMRON

# High-Precision Fiber-optic Amplifier

# E3X-NH

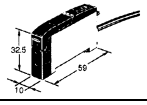
## The E3X-NH Employs a 16-Bit Processor as *An Industry First*

- An Automatic Sensitivity Adjustment feature allows stable detection of objects in frequently changing environments
- Three teach modes for optimal sensing
- 8-point scaled sensitivity meter is ideal for high precision sensing and through-beam applications at long distances (and clearly displays a target's reflectivity level)
- A manual fine tuning sensitivity feature allows 13 threshold adjustments using an easy-to-read digital scale
- Ideal for detecting small objects or fine wires
- NPN/PNP types available

ISO 9001 Approved
OMRON Corporation, Ayabe Factory, Sensing Components and Systems

## Ordering Information

### ■ AMPLIFIER UNITS

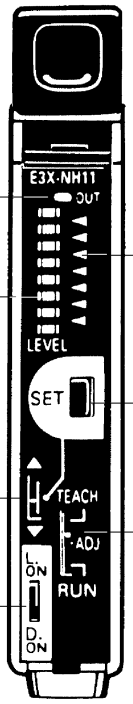
| Description | | General-purpose models | | Timer-function models | |
|---|---|---|---|---|---|
| Output | | NPN | PNP | NPN | PNP |
| **Part number** | | **E3X-NH11** | **E3X-NH41** | **E3X-NH21** | **E3X-NH51** |
| Appearance | |  | | | |
| Light source (Wave length) | | Red LED (680 nm) | | | |
| Power supply voltage | | 12 to 24 VDC ±10%, ripple (p-p) 10% max. | | | |
| Current consumption | | 75 mA max. | | | |
| Output | Control output | NPN open collector, load current: 50 mA max., residual voltage: 1 V max. | PNP open collector, load current: 50 mA max., residual voltage: 1 V max. | NPN open collector, load current: 50 mA max., residual voltage: 1 V max. | PNP open collector, load current: 50 mA max., residual voltage: 1 V max. |
| | Alarm output | | | | |
| Response time | | 1 ms max. for turn-on and turn-off, respectively | | | |
| Sensitivity setting | | Teaching method | | | |
| Fine sensitivity adjustment | | Automatic or manual fine threshold adjustment (13 levels) | | | |

# Specifications

| Description | | General-purpose models | | Timer-function models | |
|---|---|---|---|---|---|
| Part number | | E3X-NH11 | E3X-NH41 | E3X-NH21 | E3X-NH51 |
| Light source | | Red (680 nm) | | | |
| Supply voltage | | 12–24 VDC +10% ripple (p-p) 10 % max. | | | |
| Output | | NPN | PNP | NPN | PNP |
| Timing | | —— | | 40 ms off delay | |
| Indicator | | Operation indicator (orange LED), 8-level incident level indicator (green LED), 13-level threshold indicator (red LED) | | | |
| Circuit protection | | Output short-circuit protection, reverse polarity on supply | | | |
| Operation mode | | Light ON and Dark ON, switch-selectable | | | |
| Ambient light immunity | Incandescent lamp | 3,000 ℓx max. | | | |
| | Sunlight | 10,000 ℓx max. | | | |
| Ambient temperature | Operating | –25°C to 55°C (–13°F to 131°F) with no icing | | | |
| | Storage | –40°C to 70°C (–40°F to 158°F) with no icing | | | |
| Ambient humidity | Operating | 35% to 85% (with no condensation) | | | |
| Dielectric strength | | 1,000 VAC at 50/60 Hz for 1 minute | | | |
| Vibration resistance | | 10 to 55 Hz, 1.5-mm double amplitude or 300 $m/s^2$ (approx. 30G) for 2 hrs each in X, Y, and Z directions | | | |
| Insulation resistance | | 20 MΩ min. (at 500 VDC) | | | |
| Shock resistance | | 500 $m/s^2$ (approx. 50G) for 3 times each in X, Y, and Z axis | | | |
| Enclosure rating | | IEC IP50 | | | |
| Connection method | | 2m cable | | | |
| Material | Case | PBT | | | |
| | Cover | Polycarbonate | | | |
| Weight (with 2 m cable) | | Approx. 100 g | | | |
| Accessory | | Mounting brackets (included) | | | |

# Nomenclature

## ■ E3X-NH11




**Operation Indicator** (orange)
Lit when output is ON.

**Incident Level Indicators**
(green, 8 levels)
Lit depending on the incident light amount.

**UP/DOWN Selector**
Select UP for increasing the threshold value.
Select DOWN for decreasing the threshold value.

**Operation Mode Selector**
Switchable between light-ON and dark-ON modes.

**Threshold Indicators**
(red, 13 levels)
Indicates threshold level.

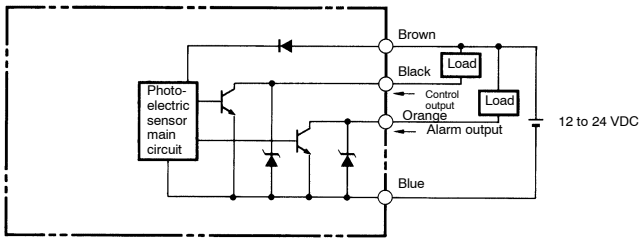
**SET Button**
For teaching or for fine threshold adjustment

**Mode Selector**
Switchable among TEACH, ADJ, and RUN modes.

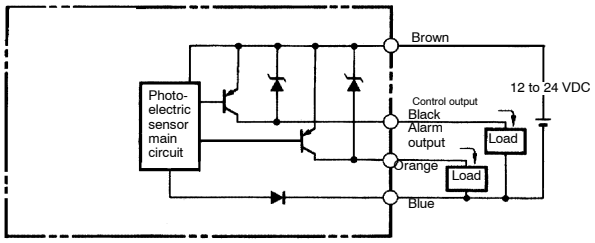
# Operation

## ■ OUTPUT CIRCUITS

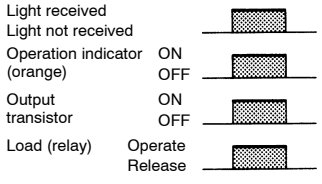
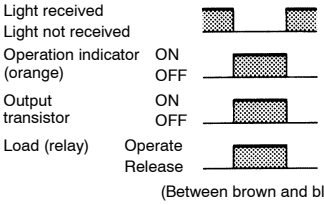
### E3X-NH11 (NPN output)




### PNP circuits




## ■ OPERATION MODE

| Light-ON | Dark-ON |
|---|---|
|  |  |
| Light received / Light not received | Light received / Light not received |
| Operation indicator (orange): ON / OFF | Operation indicator (orange): ON / OFF |
| Output transistor: ON / OFF | Output transistor: ON / OFF |
| Load (relay): Operate / Release | Load (relay): Operate / Release |
| (Between brown and black) | (Between brown and black) |

## ■ SENSITIVITY SETTING AND ADJUSTMENT

Refer to the following to select the most suitable sensitivity setting method. We recommend that two-point teaching and manual-tuning be tried first.

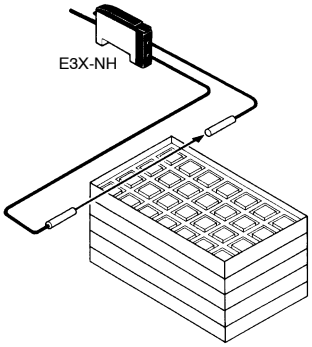
**Sensitivity Setting**

### Using the Sensor at the Maximum Sensitivity

**Application Examples**

Detection of a passing object with through-beam fibers.

**Checking IC Tray Arrangements**



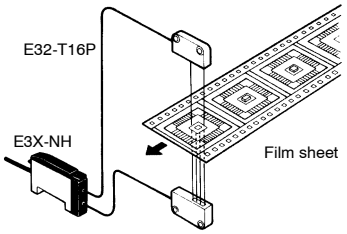

**Maximum Sensitivity Setting**

### Sensing Slight Differences

**Application Examples**

Detection of slight differences in reflection.
Detection of translucent objects.
Detection of object surface irregularities.
Color discrimination.

**Detecting IC Chips on Film Sheet**



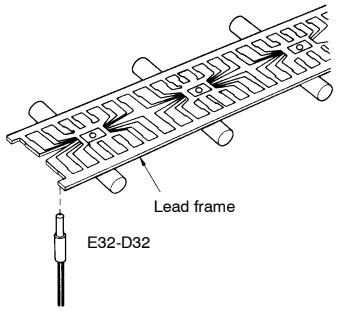

**Two-point Teach Mode**

### Sensitivity Setting Without Objects

**Application Examples**

Detection of minute passing objects.
Detection of lead wires.
High-precision positioning.

**Detecting Lead Frame Position**




**One-point Teach Mode**

Fine-tuning, if required.

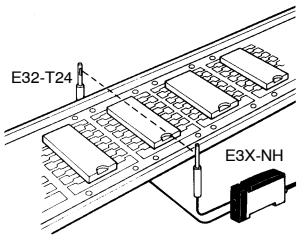
**Sensitivity Adjustment (Fine-tuning)**

### Fine-tuning on Production Lines

**Reason**

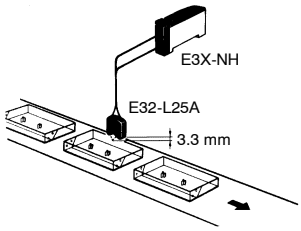
Marginal sensitivity adjustment is required considering the differences in targets.
For high-precision positioning of electronic parts.

**Detecting Lead Frame Rises**




**Detecting Cassette Tape Cases**

Ensuring reliable detection without being influenced by the difference in color or mark.



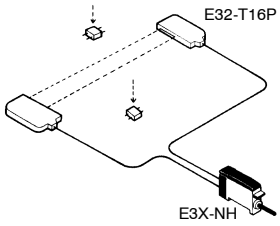

**Manual-tuning (Fine Sensitivity Adjustment)**

### Ideal Operation Under Frequently Changing Environments

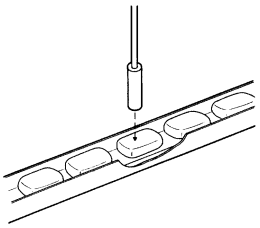
**Reason**

Dust sticking to the fiber tip.
Targets are slightly different from each other in color or surface quality.

**Detecting Passing Chip Parts**




**Counting Number Of Pills**



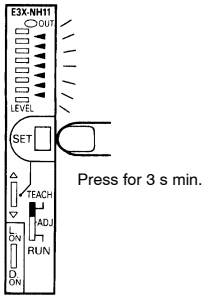
**Auto-tuning (Automatic Sensitivity Compensation)**

## ■ SENSITIVITY SETTING (TEACHING)

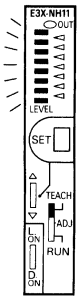
The sensitivity of the E3X-NH is factory-set to maximum. When resetting the sensitivity of the E3X-NH to maximum after with/without-object teaching or positioning/no-object teaching, follow the steps described below.

### Maximum Sensitivity Setting

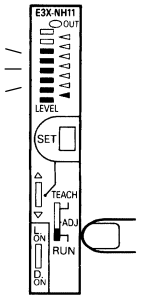
1. Set the mode selector to TEACH.
   Hold the SET button down for three seconds. Be sure that all the threshold indicators (red) are lit. The built-in buzzer will beep once when the threshold indicator is lit.




2. The sensitivity will be set when the built-in buzzer beeps continuously and all the incident level indicators (green) are lit.

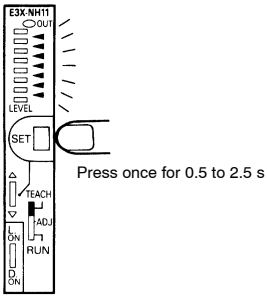



3. Set the mode selector to RUN. Be sure that only the bottom threshold indicator is lit.

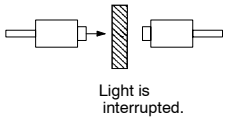



### Two-point Teach Mode

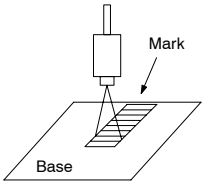
1. Set the mode selector to TEACH.
   Place the target object in the sensing area and press the SET button once. Be sure that all the threshold indicators (red) are lit. The built-in buzzer will beep once when the threshold indicator is lit.



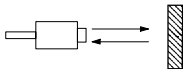

**Through-beam Model**



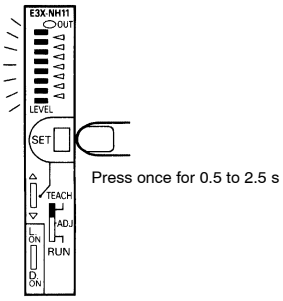

**Diffuse Model**




**Diffuse Model**

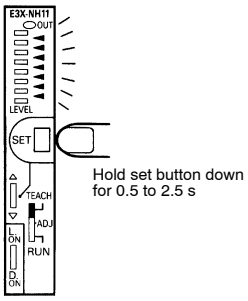


2. Remove the object and press the SET button.
   If teaching is OK:
   All the incident level indicators (green) will be lit. The built-in buzzer will beep once.

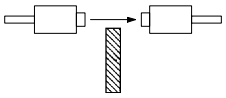


If teaching is not stable:

The threshold indicator (red) will flash. The built-in buzzer will beep 3 times.
Change the position of the object and the sensing distance that has been set and repeat the process.

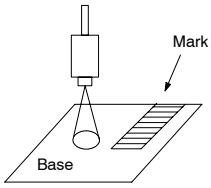



**Through-beam Model**

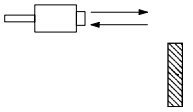


Light is received.

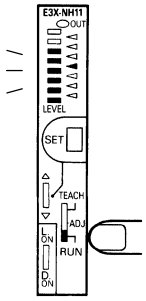
**Diffuse Model**




**Diffuse Model**

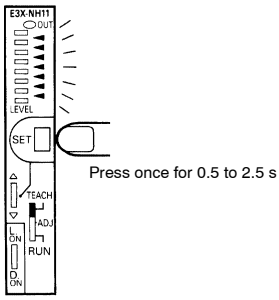


3. Set the mode selector to RUN. Be sure that the middle threshold indicator is lit. The threshold will be set to a 50% value.

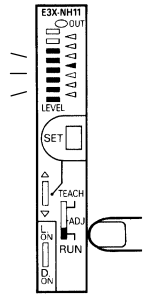



**One-point Teach Mode**

1. Set the mode selector to TEACH.
   Press the SET button once without a target object in the sensing area. Be sure that all the threshold indicators (red) are lit. The built-in buzzer will beep once when the threshold indicators are lit.




2. Set the mode selector to RUN. The threshold is set automatically.



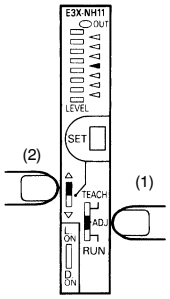

3. The Sensor will automatically compensate for environmental changes.

## ■ SENSITIVITY ADJUSTMENT (TUNING)

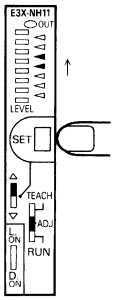
### Manual-tuning
### (Fine Sensitivity Adjustment)

Note: The auto-tuning function will be disabled if manual-tuning is utilized.

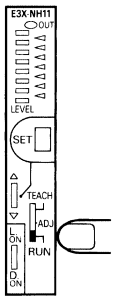
1. After setting the sensitivity of the E3X-NH, select the adjustment direction with the UP/DOWN selector in the ADJ mode.




2. Press the SET button in ADJ mode. Be sure that the threshold-level changes whenever the SET button is pressed. If two threshold indicators are lit, the threshold will automatically be set to a middle value equal to the target's sensed value.

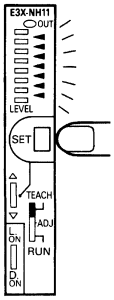



3. Set the mode selector to RUN.

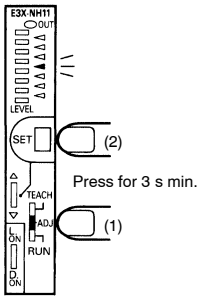



### Auto-tuning
### (Automatic Sensitivity Compensation)

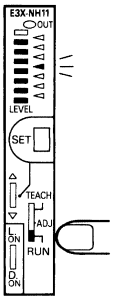
1. Set the mode selector to TEACH.
   Press the SET button once without a target object in the sensing area. Be sure that all the threshold indicators (red) are lit. The built-in buzzer will beep once when the threshold indicators are lit.




2. Set the mode selector to ADJ and press the SET button for three seconds minimum. Be sure that the threshold indicator (red) flashes. The built-in buzzer will beep continuously when cycle is complete.




3. Set the mode selector to RUN. The threshold indicator (red) will continue to flash while the the auto-tuning function is enabled.



## ■ SENSITIVITY SETTING—THRESHOLD SETTING AND INDICATORS

| Threshold indicators | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Level | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |

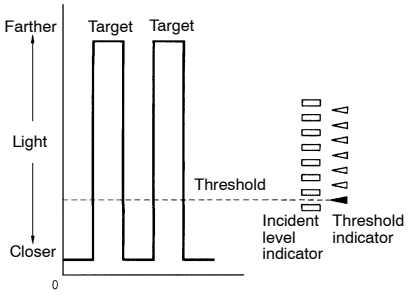
### Maximum Sensitivity Setting

- Use Through-beam Fibers for detection of opaque objects.
- Use the Diffuse Fibers for detection of objects with fixed background.

The threshold should be set to a level slightly higher than the Zero point when detecting objects that completely interrupt light.

**Diffuse Sensor**

The number of incident level indicators that are lit will depend on the location of the object. The bottom indicator of the threshold indicators will always be lit.

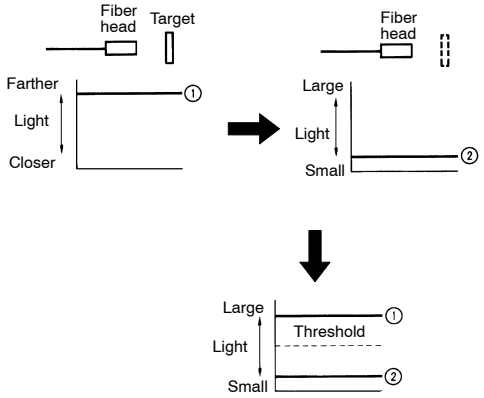



### 2-Point Teach Mode

- Ideal for the detection of object surface irregularities or minute objects.
- Ideal for the detection of objects against a background that reflects light irregularly.

**Diffuse Sensor**

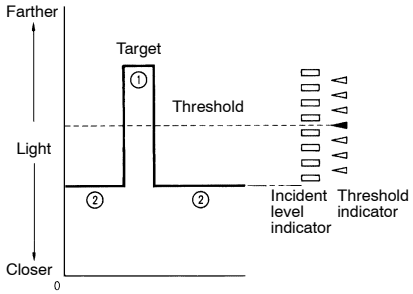
1. Press the SET button *with* the target in the sensing area. Then press the SET button *without* target in the sensing area, as illustrated at the right.




2. Set the threshold to the middle value between the values obtained with and without the target.

**RUN/ADJ Mode**

The number of the incident level indicators lit depends on the position of the target. When using the manual-tuning function, it is possible to adjust the threshold in six levels. The default threshold is set to 7.



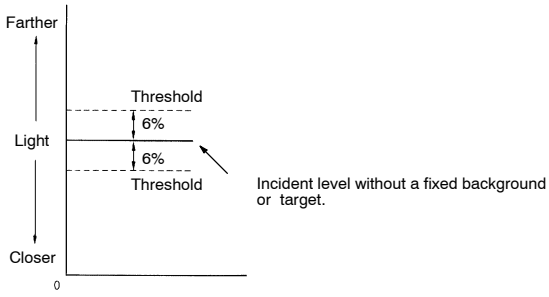
### One-point Teach Mode

- Ideal if it is impossible to perform teaching with the target fixed in the sensing area.
- Ideal for high-precision positioning.
- Ideal for detection of bright or dark objects.

**Diffuse (Light-ON) Fiber Unit**

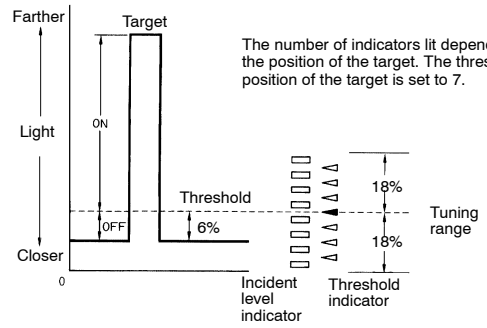
1. Press the SET button without the target in the sensing area.

   Set the threshold to the value that is ±6% of the incident level.




Note: If the target is not present at the time of teaching, the threshold cannot be set to the position corresponding to -6% of the incident level. The sensitivity will then be set to maximum automatically when in RUN mode.

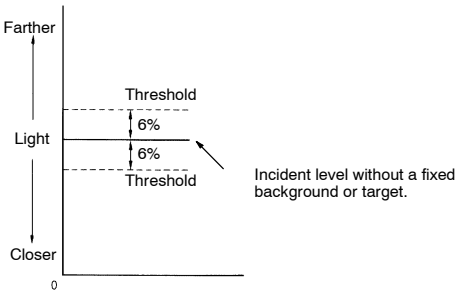
2. Detecting the first object in RUN/ADJ mode.



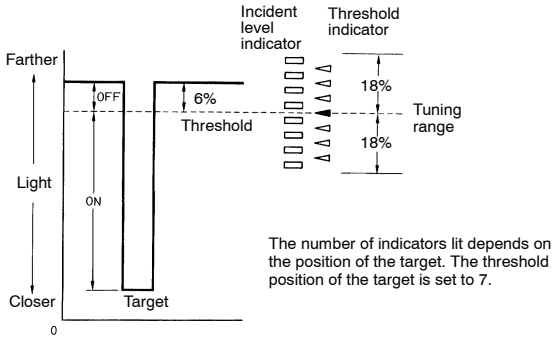

**Through-beam (Dark-ON) Fiber Unit**

1. Press the SET button without target in the sensing area.

   Set the threshold to the value that is ±6% of the incident level.



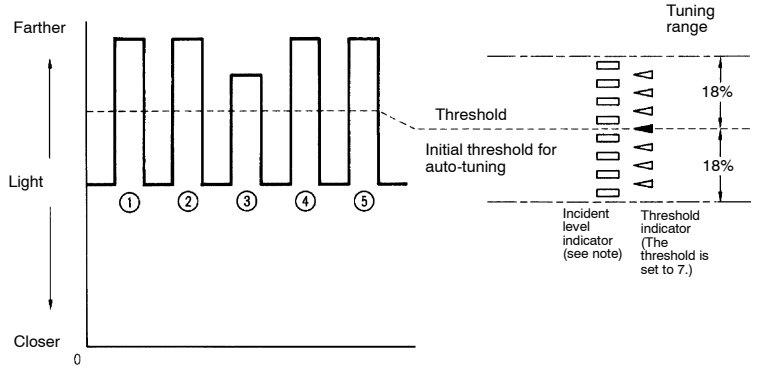

2. Detecting the first object in RUN/ADJ mode.



## ■ THRESHOLD LEVEL AND INDICATOR LEVELS

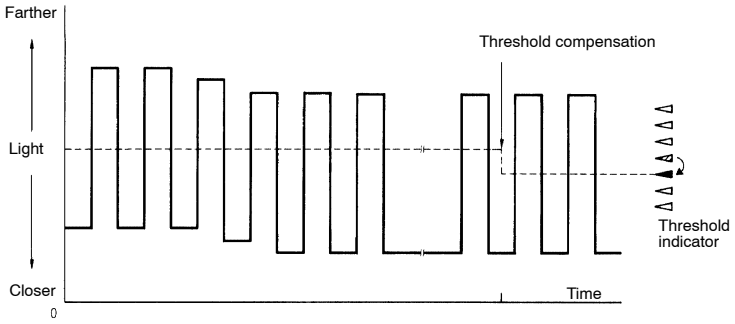
### Setting the Initial Threshold

- To set the initial threshold, perform One-point teaching by pressing the SET button for a minimum of 3 seconds.
- As a result of target movement during operation, the middle value between the highest and lowest point on the incident scale will be obtained. The E3X-NH will perform an auto-tuning function within a range of ±18% of this value.




Note: The number of Incident-level indicators lit depends on the presence of the target.

### Threshold Compensation



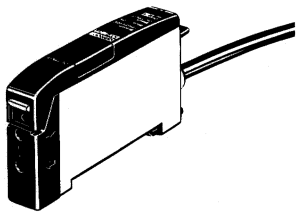

- The sensor will perform an Automatic Threshold Compensation within the preset band.
- After the threshold has been compensated, the Threshold Indicator will flash, indicating the adjusted value.
- Threshold compensation occurs at 1, 3, 6, 10, 15, 22, and 30 minutes after ***turning on*** the E3X-NH. After the initial 30 minute time-frame, Threshold Compensation is continually repeated, every 30-minutes.
- Alarm output will occur if the threshold compensation range is not within the tuning range. Perform sensitivity setting again if the alarm signal turns ON.

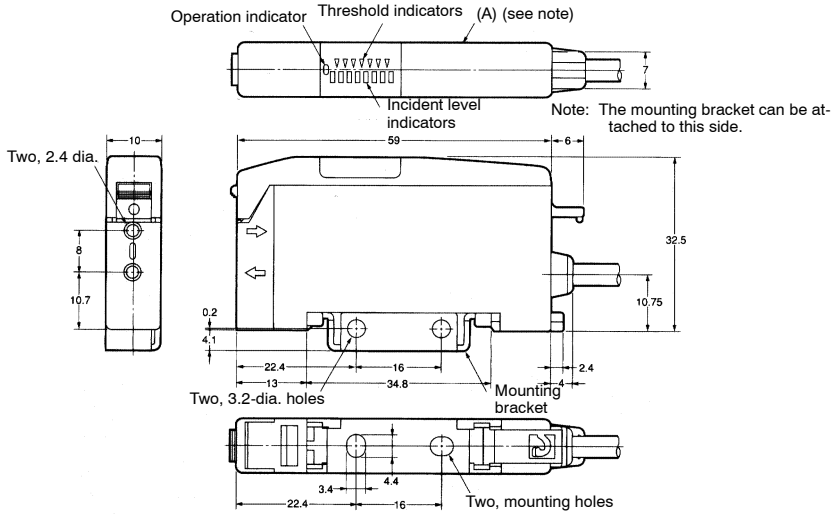
# Dimensions

Unit: mm (inch)

## ■ AMPLIFIER

**E3X-NH□1**






Cable: Polyvinyl chloride-covered cord
4-mm dia. (18/0.12 dia), 4 stranded conductors
Standard length: 2 m

Weight: Approx. 100 g

# Installation

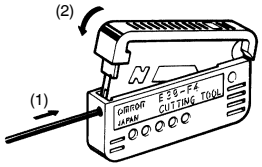
## ■ CUTTING FIBER

Insert a fiber into the Fiber Cutter and determine the length of the fiber to be cut.

Press down the Fiber Cutter in a single stroke to cut the fiber.

An insertion mark can be placed on the fiber to serve as a reference when inserting the fiber into the Amplifier. Use the following procedure.

Confirm through the Cutter hole that the fiber is inserted beyond the insertion mark hole so that the insertion mark is properly indicated, and then press firmly down on the Cutter.



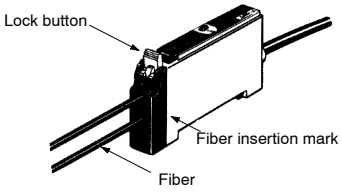

Insert the fiber into the Amplifier up to the insertion mark. Proper fiber performance will not be achieved unless the fiber is inserted all the way to the insertion mark. (This method is applicable to standard, 2.2-mm-diameter fibers only.)

## ■ FIBER CONNECTION OR DISCONNECTION PROCEDURES

The E3X-NH Amplifier has a lock button. Follow these steps to connect or disconnect the fibers to (or from) the E3X-NH Amplifier:

Note: The fiber must be locked or released in a temperature range of -10°C to 40°C (14°F to 104°F).

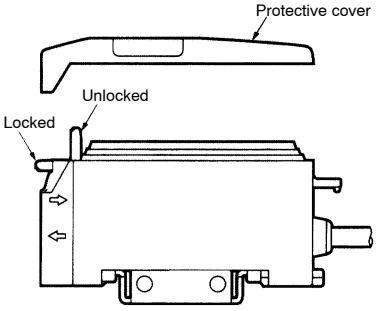
### Connection




1. After cutting the fibers (using the E39-F4 Fiber Cutter), place an insertion mark on the fiber so that it can be correctly inserted into the Amplifier.
2. Insert the fiber into the Amplifier up to this insertion mark.
3. Press the lock button to lock the fiber in that position.

### Disconnection

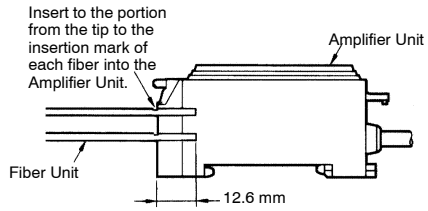
1. Before pulling out the fiber, you MUST first press the lock button to release (unlock) the fiber, or you may damage the fiber.
2. Then, pull the fiber from the amplifier.



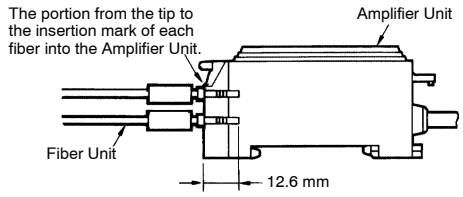

### Procedure for Inserting the Fiber

If the portion from the tip to the insertion mark of the fiber is not inserted into the Amplifier Unit, the sensing distance will be reduced.

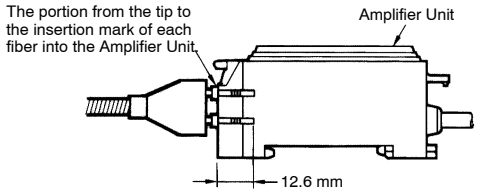
**2.2-mm-dia. Fiber**




**Thin Fiber with the E39-F9 Attachment**




**Fiber with Fixed Length**

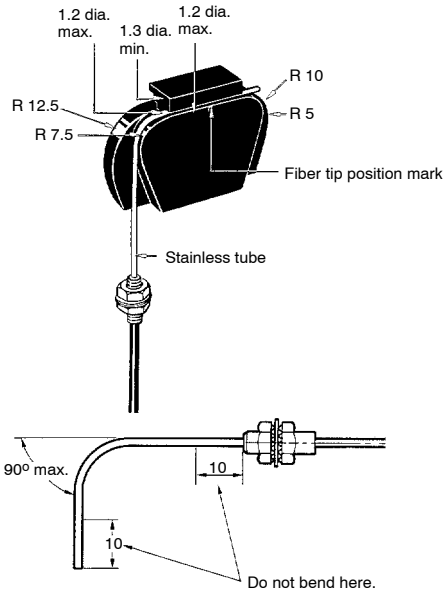



## ■ BENDING RADIUS

### E39-F11 Sleeve Bender

The bending radius of the stainless tube should be as large as possible. The smaller the bending radius becomes, the shorter the sensing distance will be.

Insert the tip of the stainless tube to the Sleeve Bender and bend the stainless tube slowly along the curve of the Sleeve Bender (refer to the figure).




## ■ REFLECTOR

### Observe the Following Precautions when Using the Reflector (E39-R3)

Use detergent, etc., to remove any dust or oil from the surfaces where tape is applied. Adhesive tape will not be attached properly if oil or dust remains on the surface.

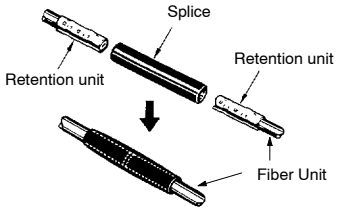
The E39-R3 cannot be used in places where it is exposed to oil or chemicals.

## ■ ATTACHMENT UNITS

### Applications

#### E39-F10 Fiber Connector

Use the following procedure (refer to the figure) to connect fibers via the Fiber Connector.



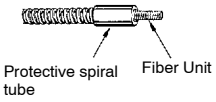

Each Fiber Unit should be as close as possible before they are connected.

Sensing distance will be reduced by approximately 25% when fibers are connected.

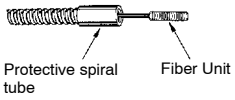
Only fibers with a 2.2-mm dia. can be connected. (Refer to page NO TAG for applicable Fiber Units.)

#### Protective Spiral Tube

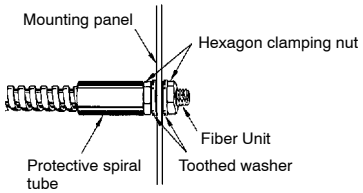
Insert a fiber to the Protective Spiral Tube from the head connector side (threaded) of the tube.



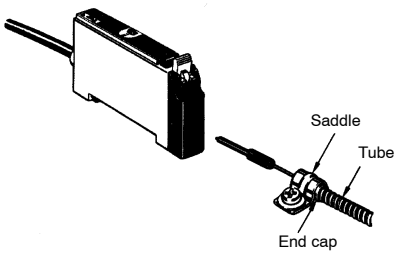

Push the fiber into the Protective Spiral Tube. The tube should be straight so that the fiber is not twisted when inserted. Then turn the end cap of the spiral tube.




Secure the Protective Spiral Tube on a suitable place with the attached nut.




Use the attached saddle to secure the end cap of the Protective Spiral Tube. To secure the Protective Spiral Tube at a position other than the end cap, apply tape to the tube so that the portion becomes thicker in diameter.

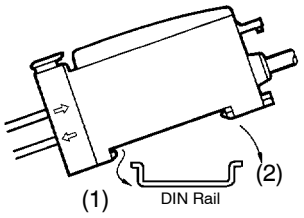



## ■ AMPLIFIER UNITS

### Mounting

1. Mount the *front part* (see #1) to the mounting bracket (attachment) or on a DIN rail.
2. Press the *back part* (see #2) onto the mounting bracket or onto the DIN rail.

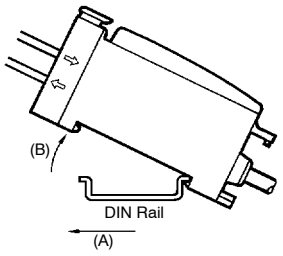
Note: *DO NOT* mount the back part on the mounting bracket or the DIN rail first and then mount the front part on the mounting bracket on the DIN rail. This could decrease the mounting strength of the Amplifier Unit.



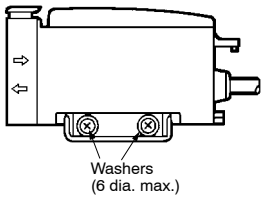

### Removal

You can remove the Amplifier in one easy step:

1. Press the Amplifier Unit in direction (A) and lift the fiber insertion part in direction (B) as shown here

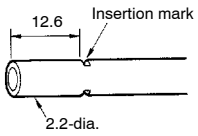


### When Side-Mounting




When side-mounting:
Attach the mounting bracket on the Amplifier first, and secure the amplifier with M3 screws and washers. The diameter of the washers should be a maximum of 6 mm.

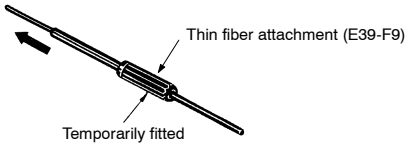
Insert the fiber into the Amplifier up to the insertion mark. Proper fiber performance will not be achieved unless the fiber is inserted all the way to the insertion mark. (This method is applicable to standard, 2.2-mm-diameter fibers only.)




The cutting holes cannot be used twice. If the same hole is used twice, the cutting face of the fiber will be rough and the sensing distance will be reduced. Always use an unused hole.

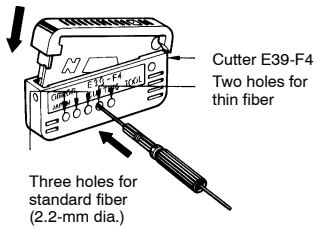
Use either one of the two holes on the right (refer to the following figure) to cut a thin fiber as follows:

1. An attachment is temporarily fitted to a thin fiber before shipment.




2. Secure the attachment after adjusting the position of it in the direction indicated by the arrow.

3. Insert the fiber into the E39-F4 to cut.




4. Finished state (proper cutting state)

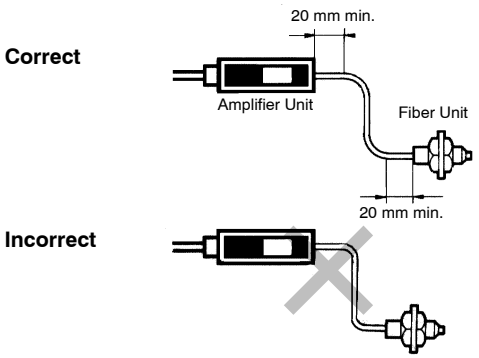

Note: Insert the fiber in the direction indicated by the arrow.

### Connection

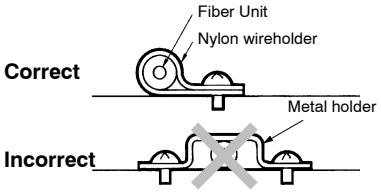
Do not pull or press the Fiber Units. The Fiber Units have a withstand force of 9.8 N (1 kgf) or 29.4 N (3 kgf) (pay utmost attention because the fibers are thin).

Do not bend the Fiber Units beyond the permissible bending radius.

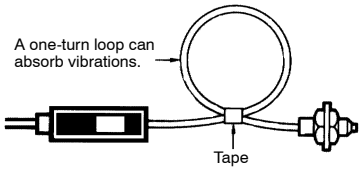
Do not bend the edge of the Fiber Units (excluding the E32-T□R and E32-D□R).




Do not apply excess force on the Fiber Units.




The Fiber Head could be break by excessive vibration. To prevent this, the following is effective:




### Turning the Power ON

When the power is turned ON, the operation indicator will be ON momentarily. Note that this will not have an effect on performance since no control output will be generated.

When the power is turned ON, the operation indicator will be ON momentarily. Note that this will not have an effect on performance since no control output will be generated.

Perform two-point teaching if two to three Fiber Units are closely mounted together, at which time supply power only to the Unit in teaching operation in turn or block the emitters of the Fiber Units not in teaching operation.

# Precautions

**⚠ WARNING**

The E3X-NH is not a safety component for ensuring the safety of people as defined in EC Directive 91/368/EEC, or as covered by separate European standards or by any other regulations or standards.

## ■ AVOID DAMAGE TO THE E3X-NH SENSOR

- Do not impose any voltage exceeding the rated voltage on the E3X-NH.
- Do not impose 100 VAC or more on models that operate with DC.
- When supplying power to the E3X-NH, make sure that the polarity of the power is correct.
- Do not short-circuit the load connected to the E3X-NH.
- The load must be connected to the E3X-NH in operation.

## ■ REFLECTOR

**Precautions for Using the E39-R3 Reflector**

Use detergent, etc., to remove any dust or oil from the surfaces where tape is applied. Adhesive tape will not be attached properly if oil or dust remains on the surface.

The E39-R3 cannot be used in places where it is exposed to oil or chemicals.

## ■ MUTUAL INTERFERENCE PROTECTION

Perform two-point teaching if two to three Fiber Units are closely mounted together. The mutual interference feature will guard against false triggering.

## ■ EEPROM WRITING ERROR

Write errors may result at the time of teaching due to power failure or static noise. If any of these occur, re-teach the amplifier.

## ■ SENSING A MINUTE OBJECT

This data sheet shows typical examples for detecting minute objects. These typical examples are for reference use only, because these example operations were tested on Units sampled at random from a lot and the values described are average values. Do not assume that all Units ensure such operations.

## ■ WHEN THE POWER IS OFF

The moment power is turned off, the E3X-NH may output a pulse signal which could affect the operation of the devices connected to it. This will occur more often if power is supplied to the E3X-NH from an external power supply, thus affecting the connected timer or counter. We recommend using a separate power supply to avoid a false signal.

For extending the cable, use wire with 0.3 $mm^2$ min. The total length of the cable should be a maximum of 100 m.

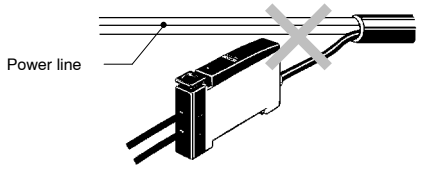
## ■ POWER SUPPLY

If a standard switching regulator is used as a power supply, the frame ground (FG) terminal and the ground (G) terminal must be grounded, or the Amplifier can malfunction due to the switching noise of the power supply.

The supplied voltage must be within the rated voltage range. Unregulated full- or half-wave rectifiers must not be used as power supplies.

## ■ WIRING

Never wire the Amplifier within the same conduit with power lines. Doing so will cause induction between the lines, possibly resulting in faulty operation or damage. Always wire the Amplifier in a separate, dedicated conduit.




**NOTE: DIMENSIONS SHOWN ARE IN MILLIMETERS. To convert millimeters to inches divide by 25.4.**

OMRON®
**OMRON ELECTRONICS LLC**
One East Commerce Drive
Schaumburg, IL 60173
**1-800-55-OMRON**

**OMRON ON-LINE**
Global - http://www.omron.com
USA - http://www.omron.com/oei
Canada - http://www.omron.com/oci

**OMRON CANADA, INC.**
885 Milner Avenue
Scarborough, Ontario M1B 5V8
**416-286-6465**

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