

# Color Mark Sensors

E3S-DC/E3NX-CA Series

## Color Mark Detection on Any Type of Packaging

Color Mark Photoelectric Sensor  
E3S-DC

IO-Link

Color Fiber Amplifier Unit  
E3NX-CA

EtherCAT

- Able to handle glossy materials
- Able to detect subtle color differences
- Stable even when lots change



Food/  
Beverage/  
Personal Care  
Industries

## Packaging Comes in a Variety of Designs and Materials

Recently, packaging materials and designs have grown much more diverse, such as aluminum vapor deposition material to prevent oxidation, or very colorful packages to attract the attention of consumers.



Highly-reflective glossy packaging, such as aluminum vapor deposition material



Colorful packaging where there is little difference in color between the mark and background



Low-reflection packaging, such as film with fine asperities

### Business Challenge

If we respond to packaging trends, the number of false detection with color mark sensors will increase, reducing productivity...

More and more people working with color mark detection in the field are calling for the following:

"I want stable detection of aluminum vapor deposition material and other glossy packaging."

"I want stable detection of colorful packaging with little color difference."

"I want stable detection of packaging even if the lot changes."



NEW

Color Mark Photoelectric Sensor  
E3S-DC IO-Link

OMRON's New Color Mark Sensors

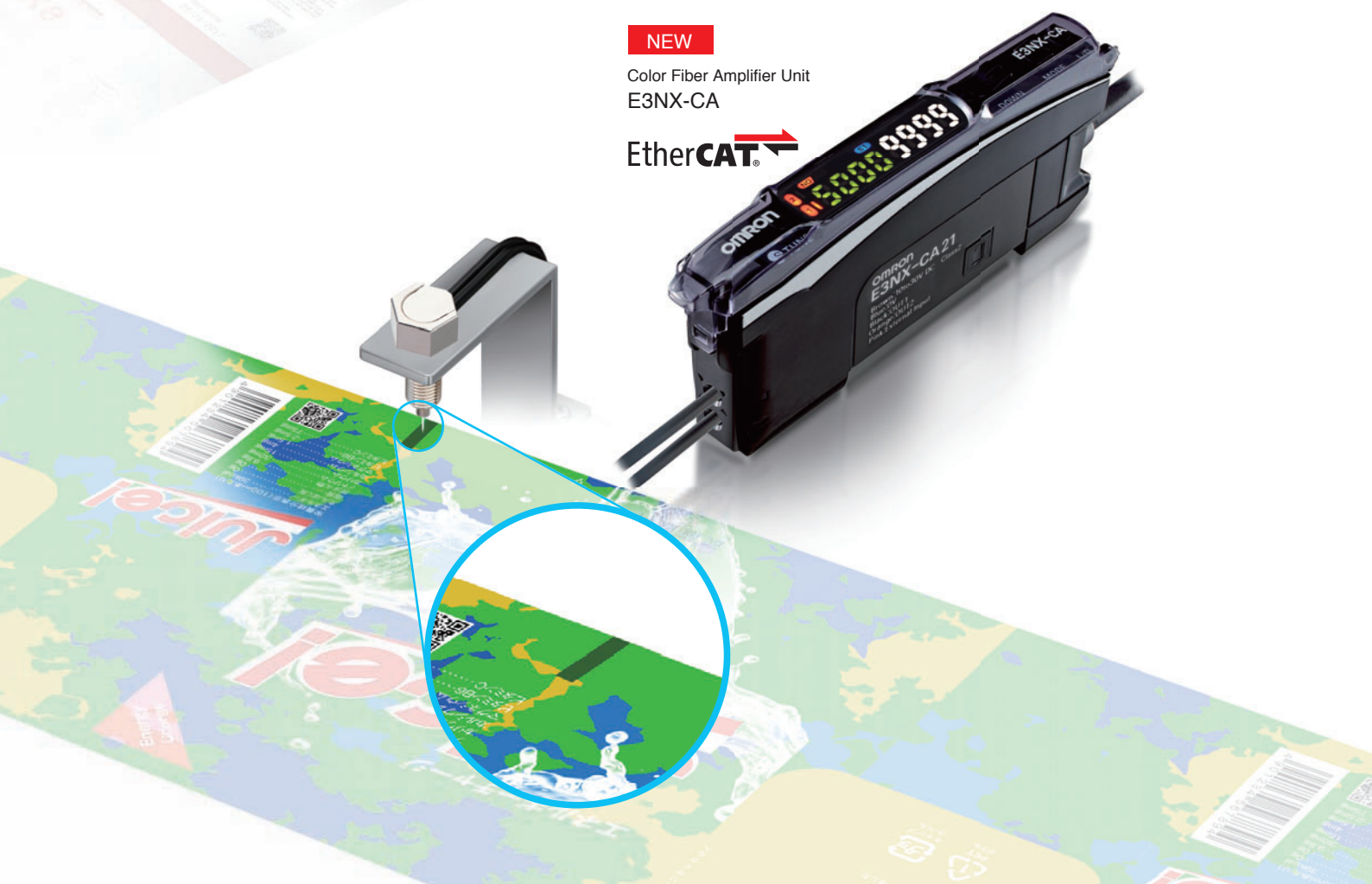
# Offer Stable Detection of Both Glossy and Colorful Packaging.

It therefore does not reduce the operation rates of production facilities.

The Sensors can accurately detect color marks on glossy and colorful packaging, which have been troublesome for conventional systems.

They also help reduce the number of troubleshooting requests made to packaging machine manufacturers—without any decrease in the operation rate due to equipment stoppages caused by false detection.

NEW

Color Fiber Amplifier Unit  
E3NX-CAEtherCAT 

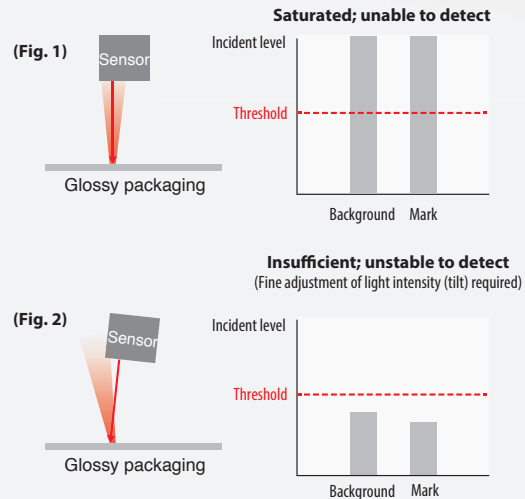
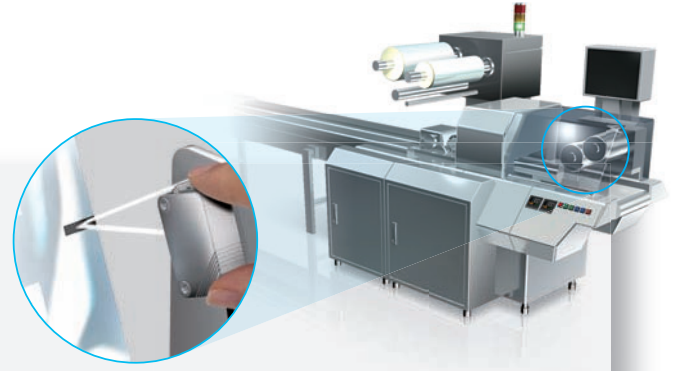


**"I want stable detection of aluminum vapor deposition material and other glossy packaging."**

Existing challenges

The intensity of the light received by the sensor from highly-reflective glossy packaging is too strong, so there is not enough difference in incident levels to perform color mark detection (i.e. saturation, Fig. 1).

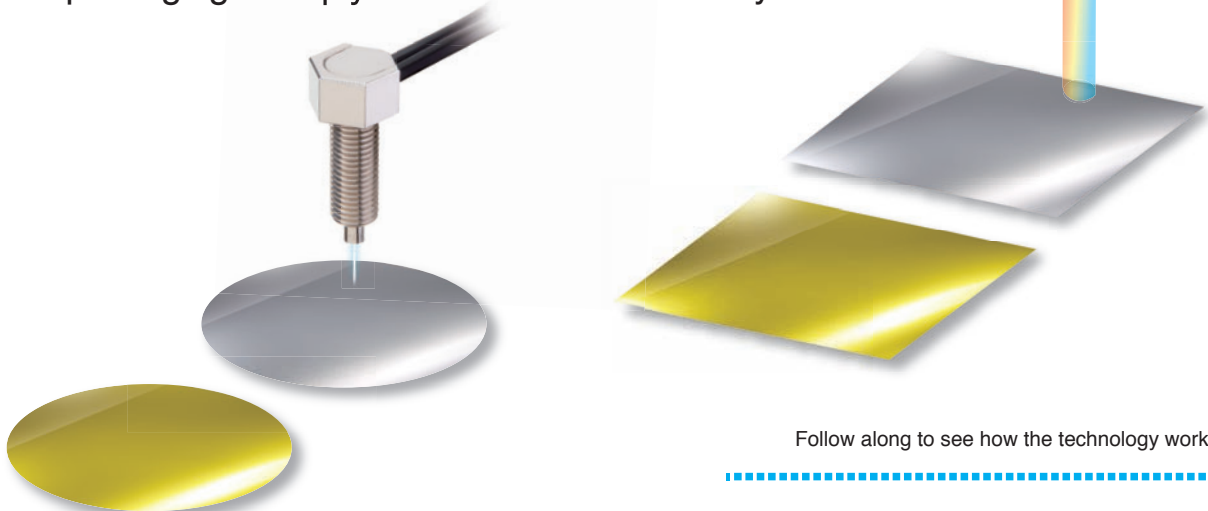
The angle needs to be finely adjusted to avoid saturation and allow the sensor to detect the mark. However, if the sensor is tilted too much, detection will become unstable as the incident level decreases (Fig. 2).



E3S-DC/E3NX-CA

## Light Is Received over a Wide Range: Enough Even for Glossy Packaging

This allows for the stable detection of glossy aluminum vapor deposition packaging—simply install the Sensor directly above



Follow along to see how the technology works.



No Saturation Even with 99% Reflective Optical Mirrors

## High Dynamic Range (Wide Incident Light Range)

### Color Mark Photoelectric Sensor (E3S-DC):

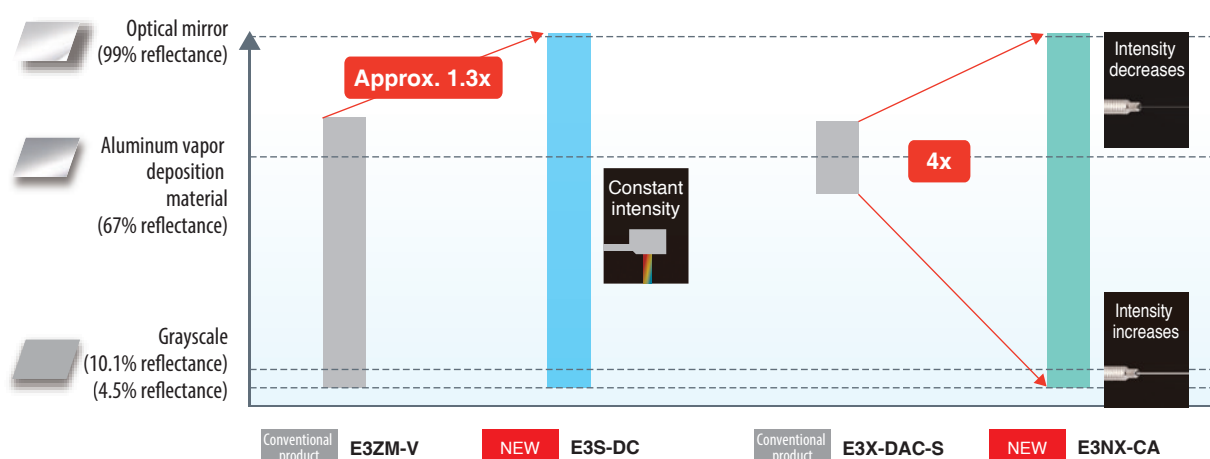
The incident light range in which no saturation occurs—no adjustment required

The included high luminance RGB three-color LED light emitting element drastically improves the light intensity. Meanwhile, Smart Noise Reduction technology in the Fiber Sensor is applied to reduce the amount of noise, resulting in a high dynamic range where the Sensor is not saturated even when detecting a mirror surface—without having to make any light intensity adjustments.

### Color Fiber Amplifier Unit (E3NX-CA):

The optimal light intensity—with just two button presses

The high luminance white LED and Smart Noise Reduction technology work together to increase the light intensity and reduce the amount of noise. These have made it possible to expand the light intensity adjustment range for the emitter and receiver to 1/100x and 1/3x respectively, resulting in a high dynamic range four times that of conventional products. You can automatically adjust the optimal intensity by just pressing a button once with a mark and once without it.



\* Optical mirror and aluminum vapor deposition material measured at the distance with maximum incident level (13 mm); grayscale measured at the distance with minimum incident level (7 mm or 13 mm).

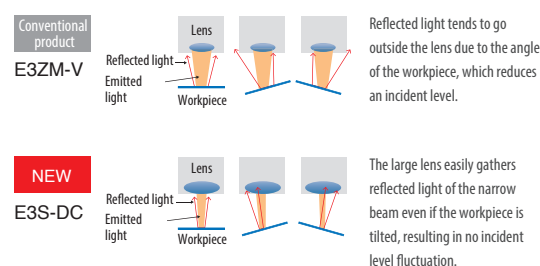
### Further Information



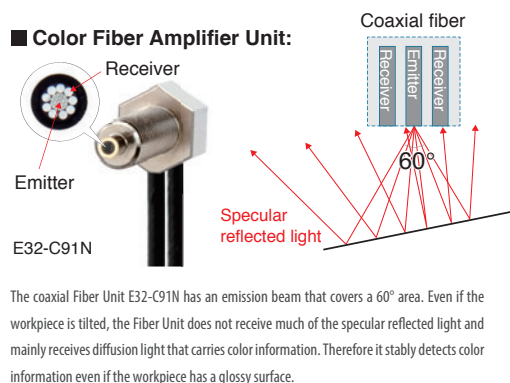
### Stable Detection Even of Tilted Workpieces

Thin and soft wrapping paper tends to be difficult to detect stably due to shifting angles. E3S-DC that has OMRON's original narrow beam and large optical system and E3NX-CA used with the coaxial Fiber Unit make stable detection possible.

#### Color Mark Photoelectric Sensor:



#### Color Fiber Amplifier Unit:



The coaxial Fiber Unit E32-C91N has an emission beam that covers a 60° area. Even if the workpiece is tilted, the Fiber Unit does not receive much of the specular reflected light and mainly receives diffusion light that carries color information. Therefore it stably detects color information even if the workpiece has a glossy surface.

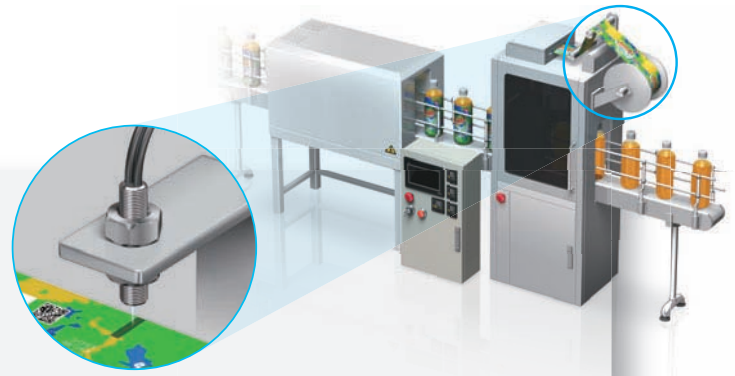


"I want stable detection of colorful packaging with little color difference."

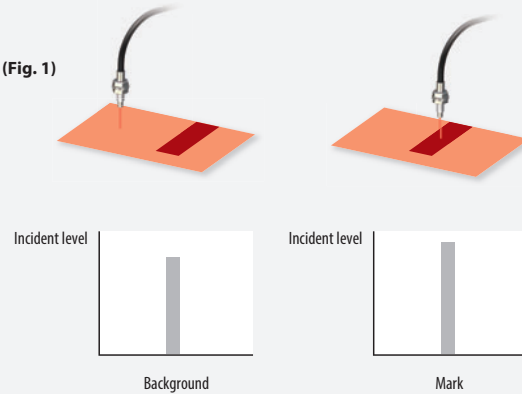
Existing challenges

With designs becoming more colorful, there are times where there is little difference in color between the color mark and the design elements (background). When color differences are subtle, the S/N ratio\*1 required for detection cannot be obtained, and the color mark cannot be detected (Fig. 1).

\*1 The ratio of incident levels at which a workpiece is and is not detected. For example, if this is 1,000 when detecting the workpiece and 100 when not detecting the workpiece, the S/N ratio is 10:1. The higher the S/N ratio is, the more stable the detection becomes.



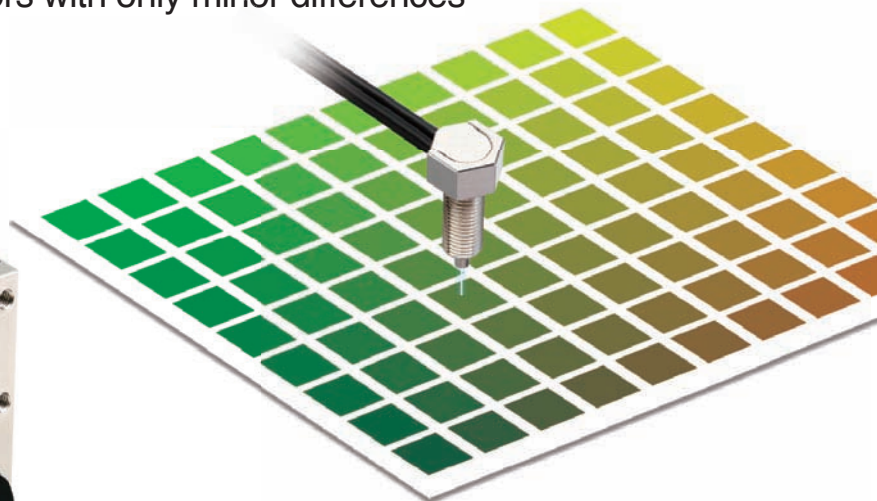
(Fig. 1)



E3S-DC/E3NX-CA

# Provides a High S/N Ratio to Detect Subtle Color Differences

Stable detection even of similar colors with only minor differences



Follow along to see how the technology works.

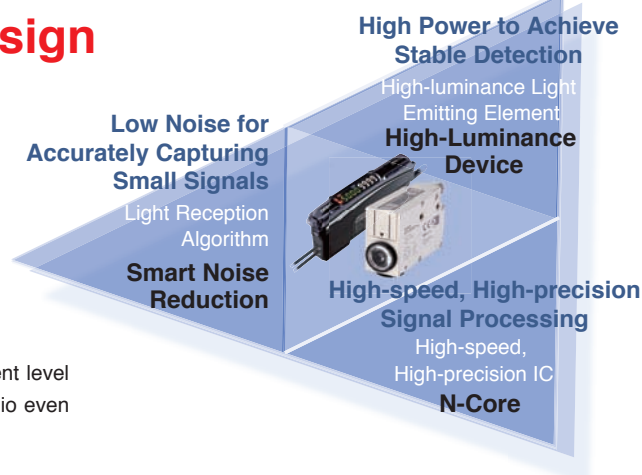


Identifies Even Minor Color Differences

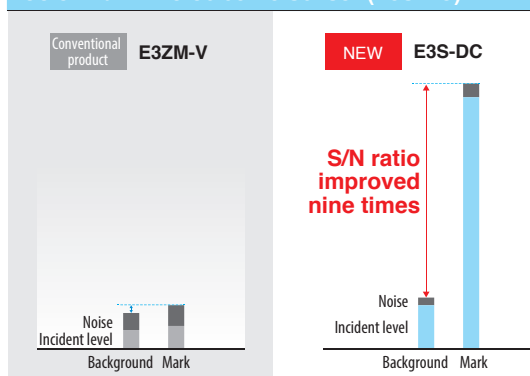
## High S/N Ratio System Design

Three N-Smart Technologies Work Together to Obtain a High S/N Ratio

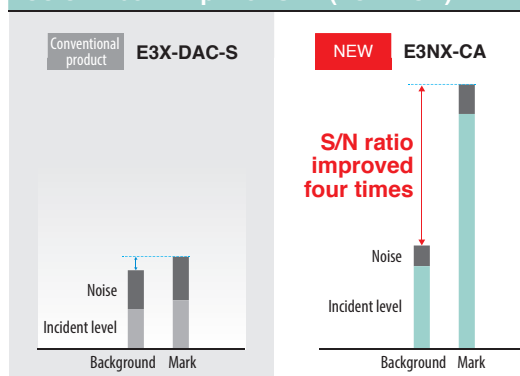
The high luminance white LED of the Fiber Amplifier Unit, and the high luminance RGB three-color LEDs and high efficiency optical system design of the Photoelectric Sensor deliver high power. "Smart Noise Reduction" (a light reception algorithm) and "N-Core" (a high-speed, high-precision IC) work together to dramatically reduce the effect of noise. Increasing the incident level and decreasing noise make it possible to obtain a high S/N ratio even when color differences are subtle.



### Color Mark Photoelectric Sensor (E3S-DC):



### Color Fiber Amplifier Unit (E3NX-CA):



### Further Information

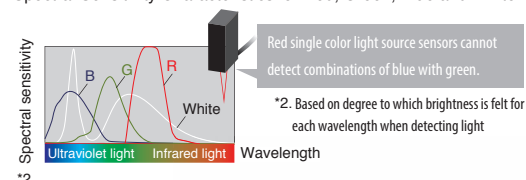


### From Single Wavelengths to Color Sensing

The wavelength ranges for red, green, and blue are narrow, and combinations with other colors cannot be detected with RGB single-color light source sensors (Fig. 2). For the new Color Mark Sensors, the Photoelectric Sensor uses RGB three-color LEDs as the light source, and the Fiber Sensor uses a white LED that has a broad wavelength range. Color sensing makes stable detection possible—even for those color combinations that would be difficult using single wavelengths.

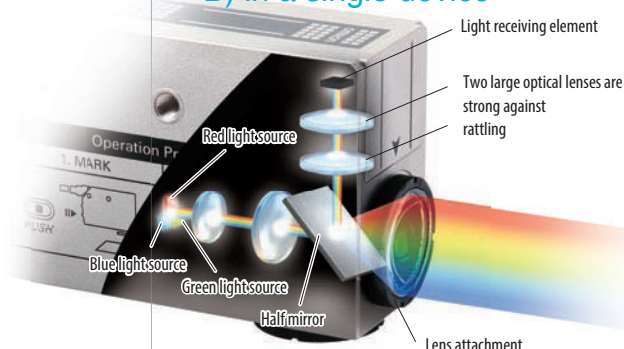
(Fig. 2)

Spectral Sensitivity Characteristics for Red, Green, Blue and White



### Color Mark Photoelectric Sensor (E3S-DC):

#### Three light sources (R, G, and B) in a single device

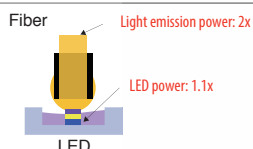


### Color Fiber Amplifier Unit (E3NX-CA):

#### White LED light emitting element & RGB matrix light receiving element

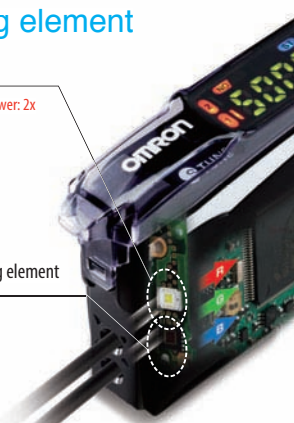
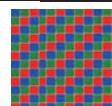
High luminance white LED light emitting element

LEDs with narrow light emitting regions improve the efficiency of optical coupling with fiber.



**Patented** Highly sensitive RGB matrix light receiving element

Detects all RGB wavelengths included in light reflected from the workpiece.

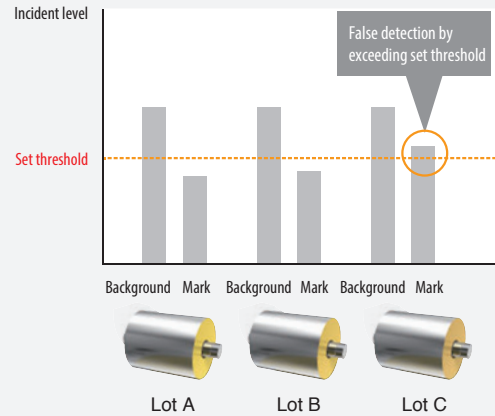
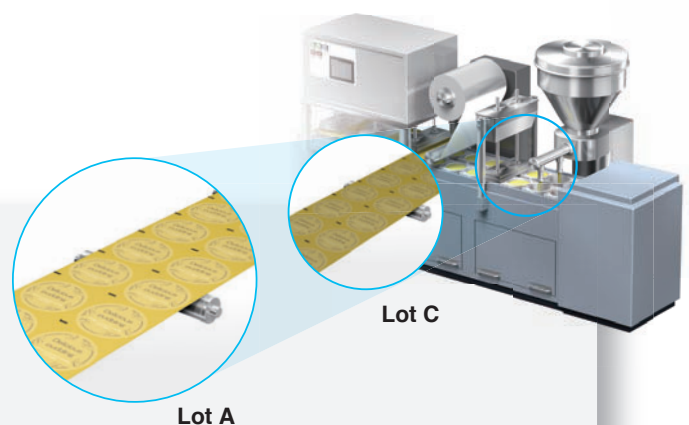




"I want stable detection of packaging even if the lot changes."

Existing challenges

There are cases where colors of packaging materials vary from lot to lot. If the parameters are not changed, this could result in equipment stoppage caused by false detection. In such a case it can be difficult to determine the cause of the problem—resulting in time lost due to troubleshooting and a notable decrease in productivity.



E3S-DC/E3NX-CA

# Visualization of Variation in Colors Printed on Packaging Makes Troubleshooting Easier

Allowing support of packaging printing color variation, and helping to reduce downtime

R: 1780

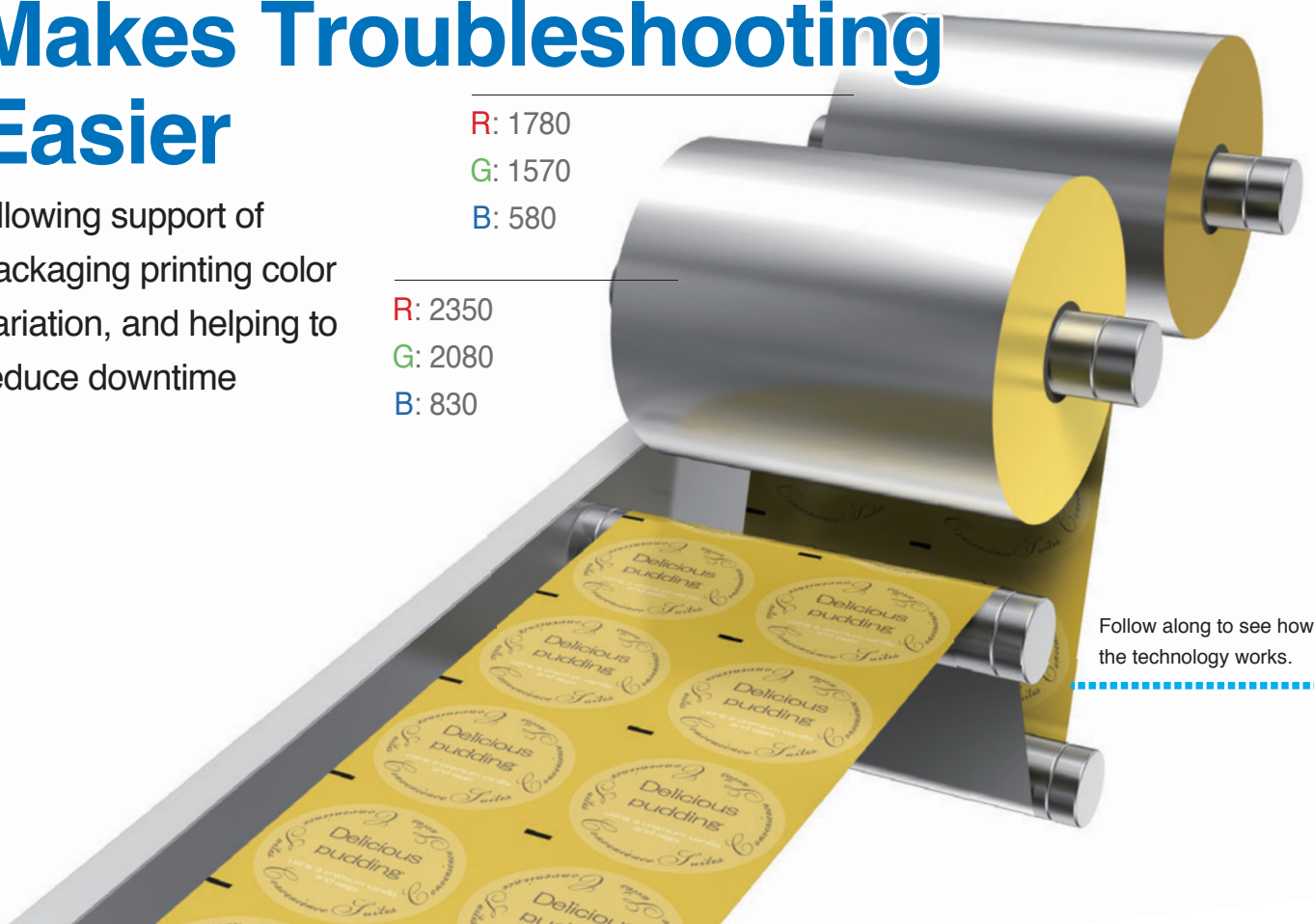
G: 1570

B: 580

R: 2350

G: 2080

B: 830



Follow along to see how the technology works.

## Visualization of Color Variation

## RGB Data Transmission Function

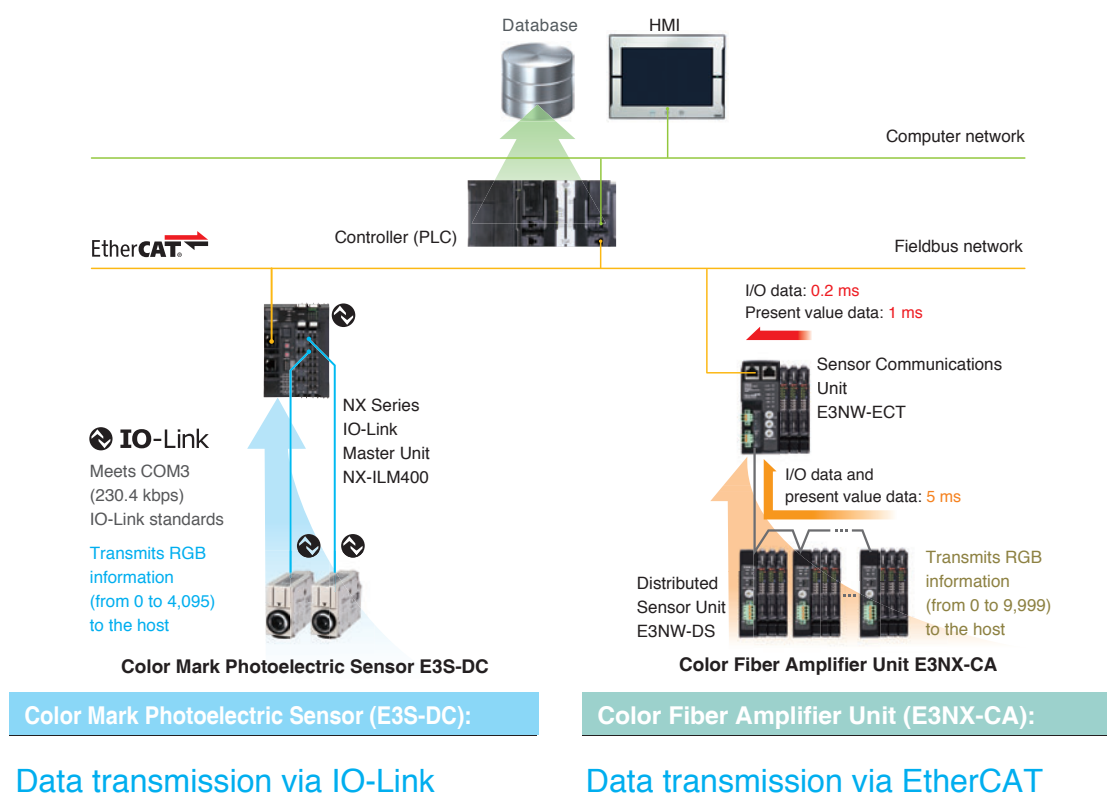
RGB information for color marks and backgrounds for each lot is transmitted to a host and quantified. This information is then managed in a database, making it possible to set optimal thresholds and identify causes quickly if a problem occurs.

### During commissioning

Until now, setting the threshold during commissioning required the knowledge of an expert. Now it is possible to get the optimal setting just by registering the RGB ratio of the packaging.

### During maintenance

When the Sensor makes false detection, values can be checked to determine whether color variation from lot to lot in packaging material has occurred, making it easy to identify what has caused a problem and to then resolve it.



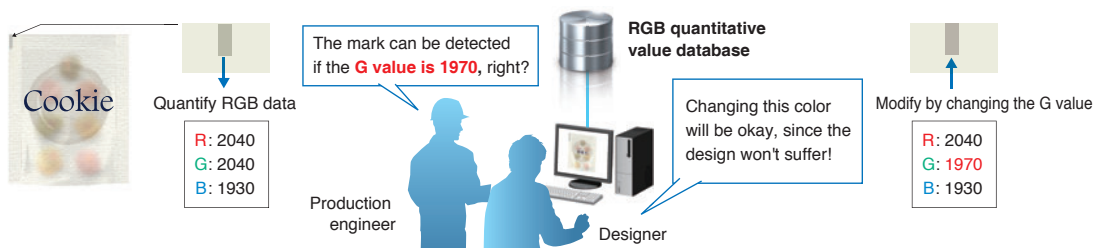
### Further Information



### Test Parameter Support Function \*1

The test parameter support function allows users to determine whether or not detection is possible for designs in the prototyping stage. Package designers and production engineers use quantified RGB digital data to discuss the designs, which allows them to reach a quick decision on which design to use—and helps shorten lead times from design to production line commissioning.

**Examine values that can be detected based on RGB data, then provide feedback on the design.**



\*1 Made possible through using a function that transmits RGB data via IO-Link (for E3S-DS) or EtherCAT (for E3NX-CA) to build a system that covers everything from Sensors to the computer network.

[illegible]

# Color Mark Photoelectric Sensor

## E3S-DC

### Color Mark Detection on Any Type of Packaging.

### Narrow Beam and Large Lens for Stable Detection of Workpieces Tilted at Various Angles.



- Detects subtle color differences.  
High luminance, three-element (RGB) LED light source for greater light intensity. Highly efficient optics technology provides high power and enables stable detection even of subtle color differences.
- Handles glossy workpieces.  
Thorough noise reduction.  
High dynamic range covers everything from black to mirror surfaces.
- IoT compatible.  
Models that support IO-Link also available.  
Sends RGB information to host with high-speed IO-Link communications.  
Optimum threshold set to reduce false detection.

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

Refer to *Safety Precautions* on page 16.

## Ordering Information

### Sensors (Refer to *Dimensions* on page 17.)

Red light, Green light, Blue light

| Sensing method                      | Appearance | Connection method | Sensing distance | Output    | Model                | IO-Link baud rate * |
|-------------------------------------|------------|-------------------|------------------|-----------|----------------------|---------------------|
| Diffuse-reflective (mark detection) |            | M12 connector     | 10±3 mm          | Push-pull | <b>E3S-DCP21-IL2</b> | COM2 (38.4 kbps)    |
|                                     |            |                   |                  |           | <b>E3S-DCP21-IL3</b> | COM3 (230.4 kbps)   |
|                                     |            |                   |                  | NPN       | <b>E3S-DCN21</b>     | Not supported       |

**Note:** Please contact your OMRON sales representative regarding the IO-Link setup file (IODD file).

\* Refer to *Ratings and Specifications* on page 12 for the baud rate.

## Accessories (Sold Separately)

### Sensor I/O Connectors (Required for a Sensor with a connector.)

Connectors are not provided with the Sensors. Be sure to order a Connector separately.

| Size | Type                             | Appearance                               | Cable length | Model                  |
|------|----------------------------------|------------------------------------------|--------------|------------------------|
| M12  | Socket on one cable end          | Straight                                 | 2 m          | <b>XS2F-D421-D80-F</b> |
|      |                                  |                                          | 5 m          | <b>XS2F-D421-G80-F</b> |
|      |                                  | L-shape  *2                              | 2 m          | <b>XS2F-D422-D80-F</b> |
|      |                                  |                                          | 5 m          | <b>XS2F-D422-G80-F</b> |
|      | Socket and plug on cable ends *1 | Smartclick connector Straight/straight   | 2 m          | <b>XS5W-D421-D81-F</b> |
|      |                                  |                                          | 5 m          | <b>XS5W-D421-G81-F</b> |
|      |                                  | Smartclick connector L-shape/L-shape  *2 | 2 m          | <b>XS5W-D422-D81-F</b> |
|      |                                  |                                          | 5 m          | <b>XS5W-D422-G81-F</b> |

**Note:** 1. Refer to *Sensor I/O Connectors/Sensor Controllers* on your OMRON website for details.

The XS2W (Socket and Plug on Cable Ends) and XS5F (Socket on One Cable End) are also available.

2. The connectors will not rotate after they are connected.

\*1. There are also straight type/L-shape type combinations available.

\*2. The cable is fixed at an angle of 180° from the sensor emitter/receiver surface.

## Ratings and Specifications

| Item                              | Sensing method<br>Output<br>Model | Diffuse-reflective (mark detection)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               |                           |
|-----------------------------------|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------|
|                                   |                                   | Push-pull                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |               | NPN                       |
|                                   |                                   | E3S-DCP21-IL2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | E3S-DCP21-IL3 | E3S-DCN21                 |
| Sensing distance                  |                                   | 10 ±3 mm (White paper 10 ×10 mm)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               |                           |
| Spot size (reference value)       |                                   | 1 × 4 mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |               |                           |
| Light source (wavelength)         |                                   | Red LED (635 nm), Green LED (525 nm), Blue LED (465 nm)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |                           |
| Power supply voltage              |                                   | 10 to 30 VDC±10% (Ripple (p-p) 10% max.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |               |                           |
| Power consumption                 |                                   | 960 mW max. (Reference: Power supply voltage 24 V, Current consumption 40 mA max.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               |                           |
| Control output                    |                                   | Load current: 100 mA max. (30 VDC max.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |                           |
| Indications                       |                                   | Operation indicator (orange), RUN indicator (green),<br>7-segment indicator (white), Key lock indicator (white),<br>Timer indicator (white), 1-point teaching mode indicator (white)                                                                                                                                                                                                                                                                                                                                                                                                                                         |               |                           |
| Operation mode                    |                                   | High when mark is detected.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               | ON when mark is detected. |
| Protection circuits               |                                   | Power supply reverse polarity protection, output short-circuit protection and output incorrect connection protection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |               |                           |
| Response time                     |                                   | Operate or reset: 50 μs max. for each (2-point teaching mode)<br>Operate or reset: 150 μs max. for each (1-point teaching mode)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |               |                           |
| Sensitivity adjustment            |                                   | Teaching method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |               |                           |
| Ambient illumination              |                                   | Incandescent lamp: 3,000 lx max.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               |                           |
| Ambient temperature range         |                                   | Operating: -10 to 55°C; Storage: -25 to 70°C (with no icing or condensation)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |                           |
| Ambient humidity range            |                                   | Operation: 35% to 85%, Storage: 35% to 95% (with no condensation)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               |                           |
| Insulation resistance             |                                   | 20 MΩ min. (at 500 VDC)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |                           |
| Dielectric strength               |                                   | 1,000 VAC, 50/60 Hz for 1 min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                           |
| Vibration resistance              |                                   | Destruction: 10 to 55 Hz with double amplitude of 1.5 mm for 2 hours each in X, Y, and Z directions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               |                           |
| Shock resistance                  |                                   | Destruction: 500 m/s <sup>2</sup> 3 times each in X, Y, and Z directions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |               |                           |
| Degree of protection              |                                   | IEC 60529 IP67                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |                           |
| Connection method                 |                                   | M12, 4-pin connector                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |               |                           |
| Weight (packed state/Sensor only) | Model with connector              | Approx. 370 g/approx. 320 g                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |                           |
| Materials                         | Case                              | Diecast zinc (nickel-plated brass)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               |                           |
|                                   | Lens                              | Methacrylic resin (PMMA)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |               |                           |
|                                   | Indicators                        | ABS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               |                           |
|                                   | Buttons                           | Elastomers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |               |                           |
|                                   | Connector                         | Diecast zinc (nickel-plated brass)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               |                           |
| Main IO-Link functions            |                                   | <ul style="list-style-type: none"> <li>• Operation mode switching between NO and NC</li> <li>• Timer function of the control output and timer time selecting function (Select a function from disabled, ON delay, OFF delay, one-shot or ON/OFF delay.) (Select a timer time of 1-5000 ms.)</li> <li>• Selecting function of ON delay timer time for instability (0 (disabled)-1000 ms)</li> <li>• Monitor output function (PD output indicating a relative detection quantity)</li> <li>• Energizing time read-out function (unit: h)</li> <li>• Initialize the settings function "Restore the factory settings"</li> </ul> |               | ---                       |
| Communication specifications      | IO-Link specification             | Version 1.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               | ---                       |
|                                   | Baud rate                         | E3S-DCP21-IL3: COM3 (230.4 kbps), E3S-DCP21-IL2: COM2 (38.4 kbps)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               | ---                       |
|                                   | Data length                       | PD size: 8 bytes, OD size: 1 byte (M-sequence type: TYPE_2_2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               | ---                       |
|                                   | Minimum cycle time                | E3S-DCP21-IL3 (COM3): 1.5 ms, E3S-DCP21-IL2 (COM2): 4.8 ms                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |               | ---                       |
| Accessories                       |                                   | Instruction manual                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               |                           |

\* Standard Sensing Object for the Mark Sensor

| Color        | Munsell code |
|--------------|--------------|
| White        | N9.5         |
| Red          | 4R 4.5/12.0  |
| Yellow-red   | 4YR 6.0/11.5 |
| Yellow       | 5Y 8.5/11.0  |
| Yellow-green | 3GY 6.5/10.0 |
| Green        | 3G 6.5/9.0   |
| Blue-green   | 5BG 4.5/10.0 |
| Blue         | 3PB 5.0/10.0 |
| Blue-purple  | 9PB 5.0/10.0 |
| Purple       | 7P 5.0/10.0  |
| Red-purple   | 6RP 4.5/12.5 |
| (Black)      | (N2.0)       |

## Engineering Data (Reference Value)

### Color vs. Detection Capability

#### E3S-DC

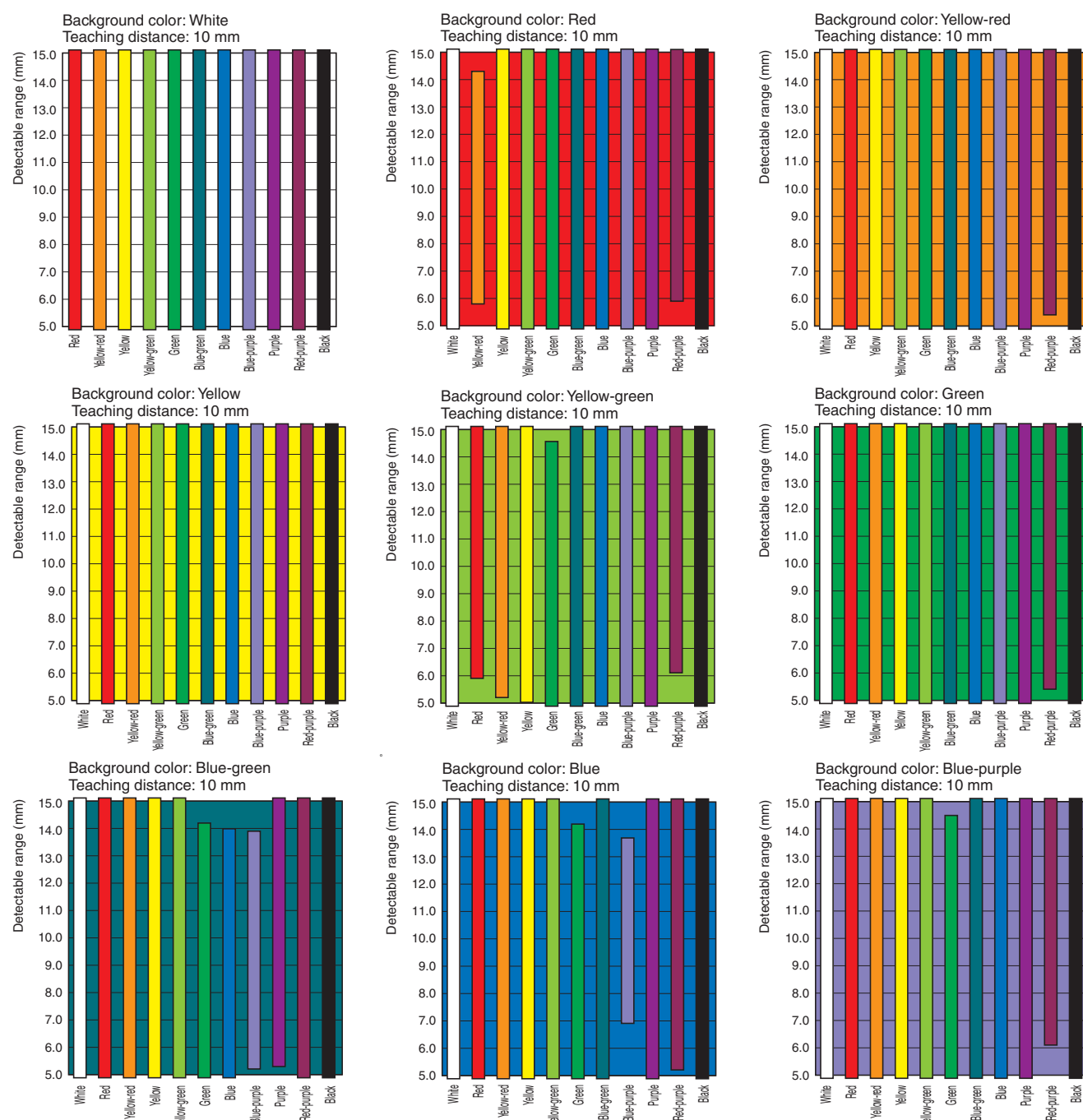
##### Teaching Capabilities

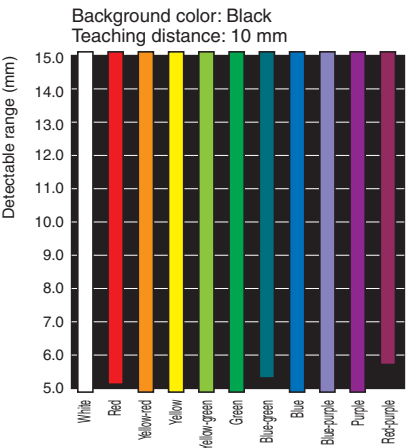
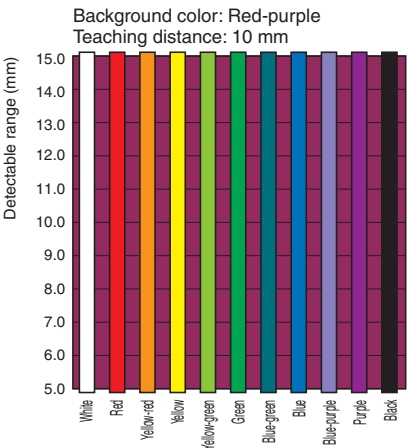
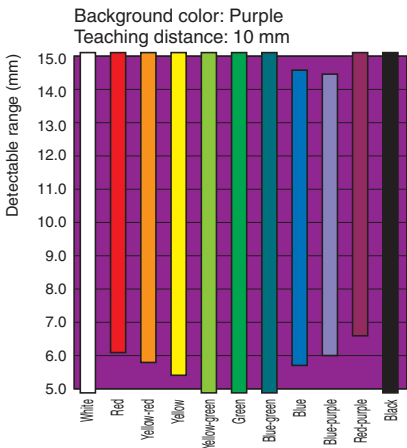
|              | White | Red | Yellow-red | Yellow | Yellow-green | Green | Blue-green | Blue | Blue-purple | Purple | Red-purple | Black |
|--------------|-------|-----|------------|--------|--------------|-------|------------|------|-------------|--------|------------|-------|
| White        | ○     | ○   | ○          | ○      | ○            | ○     | ○          | ○    | ○           | ○      | ○          | ○     |
| Red          | ○     | ○   | ○          | ○      | ○            | ○     | ○          | ○    | ○           | ○      | ○          | ○     |
| Yellow-red   | ○     | ○   | ○          | ○      | ○            | ○     | ○          | ○    | ○           | ○      | ○          | ○     |
| Yellow       | ○     | ○   | ○          | ○      | ○            | ○     | ○          | ○    | ○           | ○      | ○          | ○     |
| Yellow-green | ○     | ○   | ○          | ○      | ○            | ○     | ○          | ○    | ○           | ○      | ○          | ○     |
| Green        | ○     | ○   | ○          | ○      | ○            | ○     | ○          | ○    | ○           | ○      | ○          | ○     |
| Blue-green   | ○     | ○   | ○          | ○      | ○            | ○     | ○          | ○    | ○           | ○      | ○          | ○     |
| Blue         | ○     | ○   | ○          | ○      | ○            | ○     | ○          | ○    | ○           | ○      | ○          | ○     |
| Blue-purple  | ○     | ○   | ○          | ○      | ○            | ○     | ○          | ○    | ○           | ○      | ○          | ○     |
| Purple       | ○     | ○   | ○          | ○      | ○            | ○     | ○          | ○    | ○           | ○      | ○          | ○     |
| Red-purple   | ○     | ○   | ○          | ○      | ○            | ○     | ○          | ○    | ○           | ○      | ○          | ○     |
| Black        | ○     | ○   | ○          | ○      | ○            | ○     | ○          | ○    | ○           | ○      | ○          | ○     |

**Note:** The above chart shows the combinations of colors for which teaching is possible at a sensing distance of 10 mm.

### Detectable Ranges

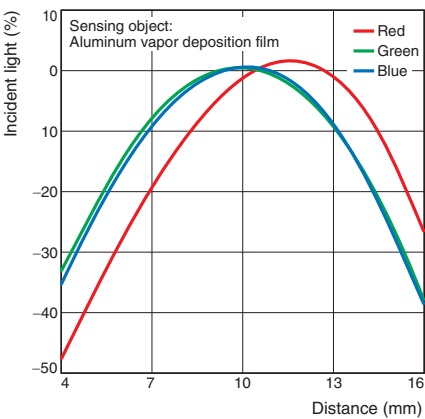
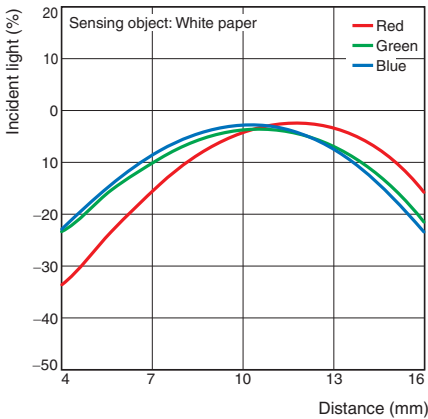
#### E3S-DC





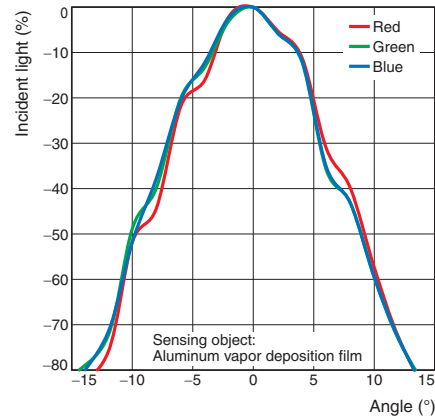
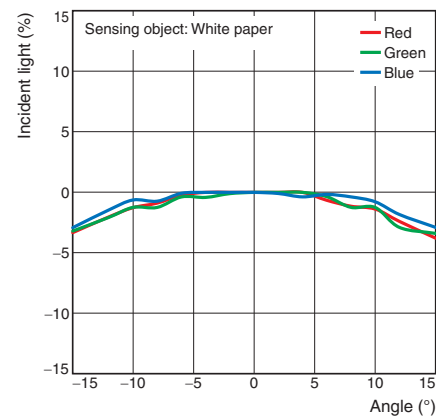
Excess Gain vs. Distance

E3S-DC



Angle vs. Incident Characteristics

E3S-DC



## I/O Circuit Diagrams

### Push-Pull Output

| Model                          | Output mode                                                | NO/NC setting *4 | Timing chart                                                                                                                                                                                                                                                                                              | Output circuit                                                  |
|--------------------------------|------------------------------------------------------------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|
| E3S-DCP21-IL2<br>E3S-DCP21-IL3 | Standard I/O mode<br>(SIO mode)<br>(Pin 2 Output Settings) | NO *5            | Sensing object: Background (Not Lighting), Mark (Lighting)<br>RUN indicator (Green): Lighting<br>Operation indicator (Orange): Not Lighting, Lighting<br>Pin 4 output (NO): LOW, HIGH<br>Pin 2 output (NO): LOW, HIGH<br>Load current (PNP connection): OFF, ON<br>Load current (NPN connection): ON, OFF | Using Pin 2 as an external input *1<br>(enabled by default)<br> |
|                                |                                                            |                  | Sensing object: Background (Not Lighting), Mark (Lighting)<br>RUN indicator (Green): Lighting<br>Operation indicator (Orange): Lighting, Not Lighting<br>Pin 4 output (NC): HIGH, LOW<br>Pin 2 output (NC): HIGH, LOW<br>Load current (PNP connection): ON, OFF<br>Load current (NPN connection): OFF, ON | Using Pin 2 with a control output *1<br>(set for IO-Link)<br>   |
|                                | IO-Link mode<br>(Pin 2 Output Settings)                    | NO *5            | Sensing object: Background (Not Lighting), Mark (Lighting)<br>RUN indicator (Green) (1 sec cycles Flashing): Not Lighting, Lighting<br>Operation indicator (Orange): Not Lighting, Lighting<br>Pin 4 output (NO) (IO-Link communications): HIGH, LOW<br>Pin 2 output (NO): LOW, HIGH                      |                                                                 |
|                                |                                                            |                  | Sensing object: Background (Not Lighting), Mark (Lighting)<br>RUN indicator (Green) (1 sec cycles Flashing): Not Lighting, Lighting<br>Operation indicator (Orange): Lighting, Not Lighting<br>Pin 4 output (NC) (IO-Link communications): HIGH, LOW<br>Pin 2 output (NC): HIGH, LOW                      |                                                                 |
|                                |                                                            | NC               | Sensing object: Background (Not Lighting), Mark (Lighting)<br>RUN indicator (Green) (1 sec cycles Flashing): Not Lighting, Lighting<br>Operation indicator (Orange): Lighting, Not Lighting<br>Pin 4 output (NC) (IO-Link communications): HIGH, LOW<br>Pin 2 output (NC): HIGH, LOW                      |                                                                 |
|                                |                                                            |                  | Sensing object: Background (Not Lighting), Mark (Lighting)<br>RUN indicator (Green) (1 sec cycles Flashing): Not Lighting, Lighting<br>Operation indicator (Orange): Lighting, Not Lighting<br>Pin 4 output (NC) (IO-Link communications): HIGH, LOW<br>Pin 2 output (NC): HIGH, LOW                      |                                                                 |

\*1. Pin 2 input/output can be switched with the IO-Link communication command "Switchpoint Pin 2".

\*2. In case of NPN connection, please connect the load between Pin 1 and Pin 4.

\*3. In case of PNP connection, please connect the load between Pin 3 and Pin 4.

\*4. It can be switched in IO-Link.

\*5. Factory default

**Note:** 1. You can use IO-Link communications to reverse the operation logic, set an output delay, and change between an input and output.

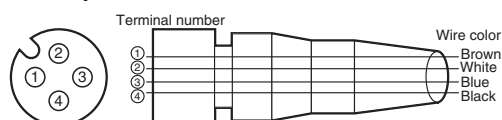
2. Please contact your OMRON sales representative regarding assignment of data.

### NPN Output

| Model     | Timing chart                                                                                                                                                                                                 | Output circuit |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| E3S-DCN21 | Sensing object: Background (Not Lighting), Mark (Lighting)<br>RUN indicator (Green): Lighting<br>Operation indicator (Orange): Not Lighting, Lighting<br>Pin 4 output (NO): OFF, ON<br>Load current: OFF, ON |                |

### Plugs (Sensor I/O Connectors)

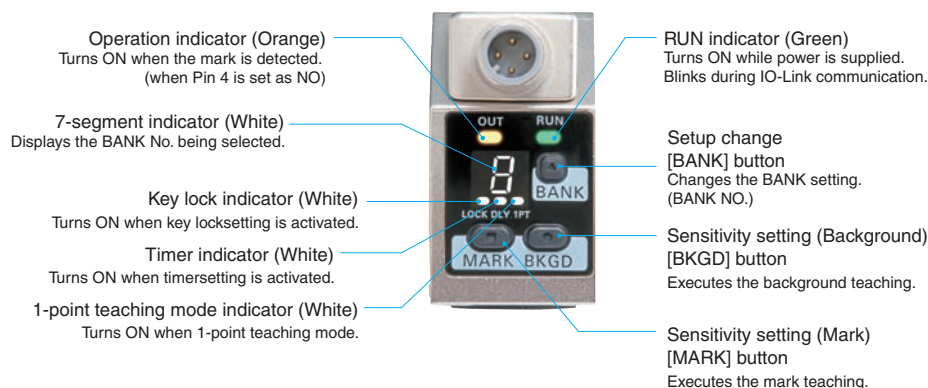
#### M12, 4-pin Connector



| Classification | Wire color | Connector pin No. | Application                    |                    |
|----------------|------------|-------------------|--------------------------------|--------------------|
|                |            |                   | E3S-DCP21-IL2<br>E3S-DCP21-IL3 | E3S-DCN21          |
| DC             | Brown      | ①                 | Power supply (+V)              | Power supply (+V)  |
|                | White      | ②                 | External input *               | External input     |
|                | Blue       | ③                 | Power supply (0 V)             | Power supply (0 V) |
|                | Black      | ④                 | Output C/Q                     | Control output     |

\* It can be set as the control output with IO-Link.

## Nomenclature



## Safety Precautions

Be sure to read the precautions for all models in the website at: <http://www.ia.omron.com/>.

### Warning Indications

|                                    |                                                                                                                                                                                                                                       |
|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                    | <b>Warning level</b><br>Indicates a potentially hazardous situation which, if not avoided, will result in minor or moderate injury, or may result in serious injury or death. Additionally, there may be significant property damage. |
| <b>Precautions for Safe Use</b>    | Supplementary comments on what to do or avoid doing, to use the product safely.                                                                                                                                                       |
| <b>Precautions for Correct Use</b> | Supplementary comments on what to do or avoid doing, to prevent failure to operate, malfunction or undesirable effect on product performance.                                                                                         |

### Meaning of Product Safety Symbols

|  |                                                                                                |
|--|------------------------------------------------------------------------------------------------|
|  | <b>General prohibition</b><br>Indicates the instructions of unspecified prohibited action.     |
|  | <b>Caution, explosion</b><br>Indicates the possibility of explosion under specific conditions. |
|  | <b>Caution, fire</b><br>Indicates the possibility of fire under specific conditions.           |
|  | <b>General caution</b><br>Indicates unspecified general alert.                                 |

### WARNING

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



Never use the product with an AC power supply. Otherwise, explosion may result.



Do not use the product with voltage in excess of the rated voltage. Excess voltage may result in malfunction or fire.



Be sure to tighten the external lens until it reaches the chassis.



### Precautions for Safe Use

The following precautions must be observed to ensure safe operation of the product.

- Do not install the product in the following locations.
  - Locations subject to direct sunlight
  - Locations subject to condensation due to high humidity
  - Locations subject to corrosive gas
  - In the place where vibration or shock is directly transmitted to the product.
- Do not use the product in environments subject to flammable or explosive gases.
- Do not use the product in any atmosphere or environment that exceeds the ratings.
- Do not pull on the cable with excessive strength.
- Do not attempt to disassemble, repair, or modify the product in any way.
- Do not use the product with the main unit damaged.
- Be sure that before making supply the supply voltage is less than the maximum rated supply voltage (30 VDC).
- Do not apply any load exceeding the ratings.
- Do not short the load. Otherwise damage or fire may result.
- Connect the load correctly.
- Do not use the product under a chemical or an oil environment without prior evaluation.
- Though this is type IP67, do not use in the water, rain or outdoors.
- Do not use thinner, alcohol, or other organic solvents. Otherwise, the optical properties and degree of protection may be degraded.
- When disposing of the product, treat it as industrial waste.
- These Sensors are certificated for the UL standard on the assumption of usage in a Class 2 circuit. Use them with Class 2 power supplies in the United States or Canada. Use the OMRON XS2F-D4-series or XS5F-D4-series Cables. Cables that have wires less than AWG24 (0.2 mm<sup>2</sup>) are for connection to terminal blocks and are not for field splicing. External overcurrent protection of 1 A for AWG26, 2 A for AWG24, or 3 A for AWG22 wire must be provided for cable protection.

### Precautions for Correct Use

- Note that the water-resistant function is impaired if installing the Photoelectric Sensor by hitting it with a hammer and so on.
- Be sure to tighten the external lens until it reaches the chassis.
- If the Sensor wiring is placed in the same conduits or ducts as high-voltage or high-power lines, inductive noise may cause malfunction or damage. Wire the cables separately or use a shielded cable.
- To extend a cable in the standard I/O mode, use a cable of 0.3 mm<sup>2</sup> or more and keep the length 100 m or less. Keep the length 20 m or less if using the Sensor in the IO-Link mode.
- Apply a screw tightening torque of 2.0 N·m or less.
- If a commercial switching regulator is used, ground the FG (frame ground) terminal.
- The Sensor will be able to detect objects 100 ms after the power supply is turned ON. Start using the Sensor 100 ms or more after turning ON the power supply. If the load and the Sensor are connected to separate power supplies, be sure to turn ON the Sensor first.
- Do not press the button with anything sharp such as a screwdriver because it might be damaged.
- Output pulses may occur when the power supply is turned OFF. We recommend that you turn OFF the power supply to the load or load line first.

## Dimensions

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

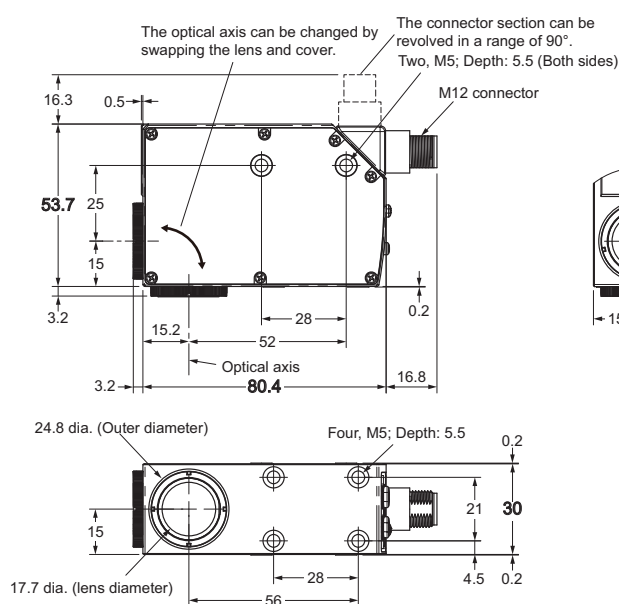
### Sensors

#### Diffuse-reflective Models

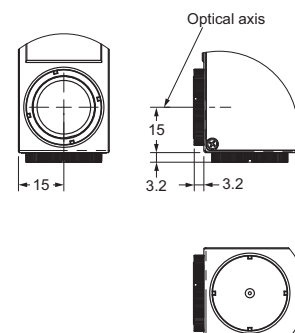
E3S-DCP21-IL2

E3S-DCP21-IL3

E3S-DCN21



#### When Lens or Cover Is Replaced



- Note:** 1. Apply a screw tightening torque of 2.0 N·m or less.  
2. Be sure to tighten the external lens or cover until it reaches the chassis.

[illegible]

# Color Fiber Amplifier Unit

## E3NX-CA

**Smart Fiber Amplifier Units with White LEDs.**  
**High Color Discrimination Capability with the Same**  
**Easy Operation as Previous Fiber Amplifier Units.**  
**Existing General-purpose Fiber Units Can Be**  
**Connected.**



- Detects subtle color differences.  
The new white LED optic system increases the light intensity and the low-noise circuit in the Smart Fiber Amplifier Unit provides a surprising detection capability.
- Handles glossy workpieces.  
Smart Tuning lets you set the optimum sensitivity for detection with one simple operation.
- IoT compatible.  
The detected RGB data can be displayed on the Amplifier Unit, and the Amplifier Unit for communications can transfer this data to the host in realtime.



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

Refer to Safety Precautions on page 30.

## Ordering Information

**Fiber Amplifier Units** (Refer to *Dimensions* on pages 31 and 32.)

| Type                                   | Appearance | Connecting method                        | Inputs/outputs      | Model               |                     |
|----------------------------------------|------------|------------------------------------------|---------------------|---------------------|---------------------|
|                                        |            |                                          |                     | NPN output          | PNP output          |
| Standard models                        |            | Pre-wired (2 m)                          | 1 output            | <b>E3NX-CA11 2M</b> | <b>E3NX-CA41 2M</b> |
|                                        |            | Wire-saving Connector                    | 1 output            | <b>E3NX-CA6</b>     | <b>E3NX-CA8</b>     |
| Advanced models                        |            | Pre-wired (2 m)                          | 2 outputs + 1 input | <b>E3NX-CA21 2M</b> | <b>E3NX-CA51 2M</b> |
| Model for Sensor Communications Unit * |            | Connector for Sensor Communications Unit | ---                 | <b>E3NX-CA0</b>     |                     |

\* A Sensor Communications Unit is required if you want to use the Fiber Amplifier Unit on a network.

**Note:** Refer to your OMRON website for details on models with wire-saving connectors.

**Fiber Units** (Refer to *Dimensions* on page 32.)

| Sensing method              | Appearance | Sensing direction | Size  | Model              |
|-----------------------------|------------|-------------------|-------|--------------------|
| Reflective                  |            | Right-angle       | M6    | <b>E32-C91N 2M</b> |
| Through-beam (Grooved type) |            | Array             | 10 mm | <b>E32-G16 2M</b>  |

**Note:** Refer to *Fiber Units* on your OMRON website or to the *Fiber Sensor Best Selection Catalog* (Cat. No. E418-E1) for details on Fiber Units.

## Accessories (Sold Separately)

**Wire-saving Connectors (Required for models for Wire-saving Connectors.) (Refer to Dimensions on page 33.)**

Connectors are not provided with the Fiber Amplifier Unit and must be ordered separately. \*Protective stickers are provided.

| Type             | Appearance                                                                        | Cable length | No. of conductors | Model    | Applicable Fiber Amplifier Units |
|------------------|-----------------------------------------------------------------------------------|--------------|-------------------|----------|----------------------------------|
| Master Connector |  | 2 m          | 3                 | E3X-CN11 | E3NX-CA6<br>E3NX-CA8             |
| Slave Connector  |  |              | 1                 | E3X-CN12 |                                  |

**Note:** Models are also available with a 5-m cable. The model names have the suffix 5M. Ask your OMRON representative for delivery times.

**Mounting Bracket (Refer to Dimensions on page 33.)**

A Mounting Bracket is not provided with the Fiber Amplifier Unit. It must be ordered separately as required.

| Appearance                                                                        | Model    | Quantity |
|-----------------------------------------------------------------------------------|----------|----------|
|  | E39-L143 | 1        |

**DIN Tracks (Refer to Dimensions on page 34.)**

A DIN Track is not provided with the Fiber Amplifier Unit. It must be ordered separately as required.

| Appearance                                                                         | Type                              | Model     | Quantity |
|------------------------------------------------------------------------------------|-----------------------------------|-----------|----------|
|  | Shallow type, total length: 1 m   | PFP-100N  | 1        |
|                                                                                    | Shallow type, total length: 0.5 m | PFP-50N   |          |
|                                                                                    | Deep type, total length: 1 m      | PFP-100N2 |          |

**Note:** Refer to PFP-□ on your OMRON website for details.

**End Plate (Refer to Dimensions on page 34.)**

Two End Plates are provided with the Sensor Communications Unit.

End Plates are not provided with the Fiber Amplifier Unit. They must be ordered separately as required.

| Appearance                                                                          | Model | Quantity |
|-------------------------------------------------------------------------------------|-------|----------|
|  | PFP-M | 1        |

**Note:** Refer to PFP-M on your OMRON website for details.

## Related Products

### Sensor Communications Units

| Type                                    | Appearance                                                                          | Model    |
|-----------------------------------------|-------------------------------------------------------------------------------------|----------|
| Sensor Communications Unit for EtherCAT |  | E3NW-ECT |
| Distributed Sensor Unit                 |  | E3NW-DS  |

**Note:** Refer to your OMRON website for details.

EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

## Ratings and Specifications

| Item                                               |                                | Type                                            | Standard models                                                                                                                                                                                                                                                                                                   |                       | Advanced models | Model for Sensor Communications Unit *1                             |
|----------------------------------------------------|--------------------------------|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------|---------------------------------------------------------------------|
|                                                    |                                | NPN output                                      | E3NX-CA11                                                                                                                                                                                                                                                                                                         | E3NX-CA6              | E3NX-CA21       | E3NX-CA0                                                            |
|                                                    |                                | PNP output                                      | E3NX-CA41                                                                                                                                                                                                                                                                                                         | E3NX-CA8              | E3NX-CA51       |                                                                     |
|                                                    |                                | Connecting method                               | Pre-wired                                                                                                                                                                                                                                                                                                         | Wire-saving Connector | Pre-wired       | Connector for Sensor Communications Unit                            |
| I/O                                                | Outputs                        | 1 output                                        |                                                                                                                                                                                                                                                                                                                   | 2 outputs             |                 | —*3                                                                 |
|                                                    | External input                 | —                                               |                                                                                                                                                                                                                                                                                                                   | 1 input *2            |                 |                                                                     |
| Light source (wavelength)                          |                                |                                                 | White LED (420 to 700 nm)                                                                                                                                                                                                                                                                                         |                       |                 |                                                                     |
| Supply voltage                                     |                                |                                                 | 10 to 30 VDC, including 10% ripple (p-p)                                                                                                                                                                                                                                                                          |                       |                 | Supplied from the connector through the Sensor Communications Unit. |
| Power consumption *4                               |                                |                                                 | At Power Supply Voltage of 24 VDC<br>Normal mode: 960 mW max. (Current consumption: 40 mA max.)<br>Eco function ON: 720 mW max. (Current consumption: 30 mA max.)<br>Eco function LO: 800 mW max. (Current consumption: 33 mA max.)                                                                               |                       |                 |                                                                     |
| Control output                                     |                                |                                                 | Load power supply voltage: 30 VDC max., open-collector output<br>Load current: Groups of 1 to 3 Amplifiers: 100 mA max.,<br>Groups of 4 to 30 Amplifiers: 20 mA max.<br>(Residual voltage: At load current of less than 10 mA: 1 V max.<br>At load current of 10 to 100 mA: 2 V max.)<br>OFF current: 0.1 mA max. |                       |                 | —                                                                   |
| Indications                                        |                                |                                                 | 7-segment displays (Sub digital display: green, Main digital display: white)<br>Display direction: Switchable between normal and reversed.<br>OUT indicator (orange), NO/NC indicator (orange), Smart Tuning indicator (blue), and<br>OUT selection indicator (orange, only on models with 2 outputs)             |                       |                 |                                                                     |
| Protection circuits                                |                                |                                                 | Power supply reverse polarity protection, output short-circuit protection, and output reverse polarity protection                                                                                                                                                                                                 |                       |                 | Power supply reverse polarity protection                            |
| Sensing method                                     |                                |                                                 | Contrast Mode: Light intensity discrimination for RGB (initial state/after 2-point tuning)<br>(R+G+B light intensity discrimination for 1-point tuning)<br>Color Mode: RGB ratio discrimination                                                                                                                   |                       |                 |                                                                     |
| Response time                                      | Super-high-speed Mode (SHS) *5 | Operate or reset: 50 μs (only in Contrast Mode) |                                                                                                                                                                                                                                                                                                                   |                       |                 |                                                                     |
|                                                    | High-speed Mode (HS)           | Operate or reset: 250 μs                        |                                                                                                                                                                                                                                                                                                                   |                       |                 |                                                                     |
|                                                    | Standard Mode (Stnd)           | Operate or reset: 1 ms                          |                                                                                                                                                                                                                                                                                                                   |                       |                 |                                                                     |
|                                                    | Giga-power Mode (GIGA)         | Operate or reset: 16 ms                         |                                                                                                                                                                                                                                                                                                                   |                       |                 |                                                                     |
| Sensitivity adjustment                             |                                |                                                 | Smart Tuning (2-point tuning, full autotuning, or 1-point tuning (1% to 99%)) or manual adjustment                                                                                                                                                                                                                |                       |                 |                                                                     |
| Maximum connectable Units                          |                                |                                                 | 30 Units                                                                                                                                                                                                                                                                                                          |                       |                 | 30 Units (When connected to OMRON NJ-series Unit)                   |
| No. of Units for mutual interference prevention *6 | Super-high-speed Mode (SHS) *5 | —                                               |                                                                                                                                                                                                                                                                                                                   |                       |                 |                                                                     |
|                                                    | High-speed Mode (HS)           | 10 Units                                        |                                                                                                                                                                                                                                                                                                                   |                       |                 |                                                                     |
|                                                    | Standard Mode (Stnd)           | 10 Units                                        |                                                                                                                                                                                                                                                                                                                   |                       |                 |                                                                     |
|                                                    | Giga-power Mode (GIGA)         | 10 Units                                        |                                                                                                                                                                                                                                                                                                                   |                       |                 |                                                                     |

\*1. The E3NW-ECT Sensor Communications Unit can be used, but the E3NW-CRT/CCL, E3X-DRT21-S, and E3X-CRT/ECT Sensor Communications Units cannot be used.

\*2. The following details apply to the input.

|     | Contact input (relay or switch)                                                   | Non-contact input (transistor)                                                                          |
|-----|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| NPN | ON: Shorted to 0 V (Sourcing current: 2 mA max.).<br>OFF: Open or shorted to Vcc. | ON: 1.5 V max. (Sourcing current: 2 mA max.).<br>OFF: Vcc - 1.5 V to Vcc (Leakage current: 0.1 mA max.) |
| PNP | ON: Shorted to Vcc (Sinking current: 3 mA max.).<br>OFF: Open or shorted to 0 V.  | ON: Vcc - 1.5 V to Vcc (sinking current: 3 mA max.).<br>OFF: 1.5 V max. (Leakage current: 0.1 mA max.)  |

\*3. Two sensor outputs are allocated in the programmable logic controller (PLC) I/O table.

PLC operation via Communications Unit enables reading detected values and changing settings.

\*4. Power consumption

At Power Supply Voltage of 10 to 30 VDC

Normal mode: 1,080 mW max. (Current consumption: 36 mA max. at 30 VDC, 74 mA max. at 10 VDC)

Eco function ON: 840 mW max. (Current consumption: 28 mA max. at 30 VDC, 50 mA max. at 10 VDC)

Eco function LO: 930 mW max. (Current consumption: 31 mA max. at 30 VDC, 55 mA max. at 10 VDC)

\*5. The mutual interference prevention function is disabled if the detection mode is set to Super-high-speed Mode.

\*6. The tuning will not change the number of units.

The least unit count among the mutual interference prevention units of E3NX and E3NC.

Check the mutual interference prevention unit count and response speed of each model.

| Item                                 |                       | Type                                                                                                                                                                                                                                                                           | Standard models                                                                                                                   |                                                         | Advanced models                                                                                                                                                                                                                                                  | Model for Sensor Communications Unit *1  |
|--------------------------------------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
|                                      |                       | NPN output                                                                                                                                                                                                                                                                     | E3NX-CA11                                                                                                                         | E3NX-CA6                                                | E3NX-CA21                                                                                                                                                                                                                                                        | E3NX-CA0                                 |
|                                      |                       | PNP output                                                                                                                                                                                                                                                                     | E3NX-CA41                                                                                                                         | E3NX-CA8                                                | E3NX-CA51                                                                                                                                                                                                                                                        |                                          |
|                                      |                       | Connecting method                                                                                                                                                                                                                                                              | Pre-wired                                                                                                                         | Wire-saving Connector                                   | Pre-wired                                                                                                                                                                                                                                                        | Connector for Sensor Communications Unit |
| Functions                            | Operation mode        | Contrast Mode: NO (Light-ON) or NC (Dark-ON)<br>Color Mode: NO (ON for match: ON for same color as registered color) or NC (ON for mismatch: ON for different color from registered color)                                                                                     |                                                                                                                                   |                                                         |                                                                                                                                                                                                                                                                  |                                          |
|                                      | Timer                 | Select from timer disabled, OFF-delay, ON-delay, one-shot, or ON-delay + OFF-delay timer (Counted by 0.1 s in a range of 0.1 to 0.5 ms, by 0.5 ms for 0.5 to 5 ms, and by 1 ms for 5 to 9999 ms. Default: 10 ms, Error: 0.1 ms)                                                |                                                                                                                                   |                                                         |                                                                                                                                                                                                                                                                  |                                          |
|                                      | Zero reset            | Contrast Mode only<br>Negative values can be displayed. (Threshold level is shifted.)                                                                                                                                                                                          |                                                                                                                                   |                                                         |                                                                                                                                                                                                                                                                  |                                          |
|                                      | Resetting settings *7 | Select from initial reset (factory defaults), user reset (saved settings), or bank reset.                                                                                                                                                                                      |                                                                                                                                   |                                                         |                                                                                                                                                                                                                                                                  |                                          |
|                                      | Eco mode              | Select from OFF (digital display lit), Eco ON (digital display not lit), and Eco LO (digital display dimmed).                                                                                                                                                                  |                                                                                                                                   |                                                         |                                                                                                                                                                                                                                                                  |                                          |
|                                      | Bank switching        | Select from banks 1 to 8.                                                                                                                                                                                                                                                      |                                                                                                                                   |                                                         |                                                                                                                                                                                                                                                                  |                                          |
|                                      | Power tuning level    | Set from 100 to 9,999. (The RGB maximum incident level at Smart Tuning is adjusted to the power tuning level.)                                                                                                                                                                 |                                                                                                                                   |                                                         |                                                                                                                                                                                                                                                                  |                                          |
|                                      | Output 2              | —                                                                                                                                                                                                                                                                              | Normal, error output, AND output, or OR output                                                                                    |                                                         | —                                                                                                                                                                                                                                                                |                                          |
|                                      | External input        | —                                                                                                                                                                                                                                                                              | Select from input OFF, tuning, full-auto tuning, emission OFF, bank 1 and 2 switching, bank 1 through 8 switching, or zero reset. |                                                         | —                                                                                                                                                                                                                                                                |                                          |
|                                      | Changing the displays | Threshold level and incident level, channel number and incident level, RGB display and incident level, or bank display and incident level                                                                                                                                      |                                                                                                                                   |                                                         |                                                                                                                                                                                                                                                                  |                                          |
| Ambient illumination (Receiver side) |                       | Incandescent lamp: 20,000 lx max., Sunlight: 30,000 lx max.                                                                                                                                                                                                                    |                                                                                                                                   |                                                         |                                                                                                                                                                                                                                                                  |                                          |
| Ambient temperature range            |                       | Operating:<br>Groups of 1 or 2 Amplifier Units: -25 to 55°C,<br>Groups of 3 to 10 Amplifier Units: -25 to 50°C,<br>Groups of 11 to 16 Amplifier Units: -25 to 45°C,<br>Groups of 17 to 30 Amplifier Units: -25 to 40°C<br>Storage: -30 to 70°C (with no icing or condensation) |                                                                                                                                   |                                                         | Operating:<br>Groups of 1 or 2 Amplifier Units: 0 to 55°C, Groups of 3 to 10 Amplifier Units: 0 to 50°C,<br>Groups of 11 to 16 Amplifier Units: 0 to 45°C, Groups of 17 to 30 Amplifier Units: 0 to 40°C<br>Storage: -30 to 70°C (with no icing or condensation) |                                          |
| Ambient humidity range               |                       | Operating and storage: 35% to 85% (with no condensation) within the surrounding air temperature range shown above                                                                                                                                                              |                                                                                                                                   |                                                         |                                                                                                                                                                                                                                                                  |                                          |
| Installation environment             |                       | Pollution degree 3 (as per IEC 60947-1)                                                                                                                                                                                                                                        |                                                                                                                                   |                                                         |                                                                                                                                                                                                                                                                  |                                          |
| Insulation resistance                |                       | 20 MΩ min. (at 500 VDC)                                                                                                                                                                                                                                                        |                                                                                                                                   |                                                         |                                                                                                                                                                                                                                                                  |                                          |
| Dielectric strength                  |                       | 1,000 VAC at 50/60 Hz for 1 minute                                                                                                                                                                                                                                             |                                                                                                                                   |                                                         |                                                                                                                                                                                                                                                                  |                                          |
| Vibration resistance                 |                       | 10 to 55 Hz with a 1.5-mm double amplitude for 2 hours each in X, Y, and Z directions                                                                                                                                                                                          |                                                                                                                                   |                                                         |                                                                                                                                                                                                                                                                  |                                          |
| Shock resistance (destruction)       |                       | 500 m/s <sup>2</sup> for 3 times each in X, Y, and Z directions                                                                                                                                                                                                                |                                                                                                                                   |                                                         | 150 m/s <sup>2</sup> for 3 times each in X, Y, and Z directions                                                                                                                                                                                                  |                                          |
| Weight (packed state/Sensor only)    |                       | Approx. 115 g/<br>approx. 75 g                                                                                                                                                                                                                                                 | Approx. 60g/<br>approx. 20g                                                                                                       | Approx. 115 g/approx. 75 g<br>Approx. 65 g/approx. 25 g |                                                                                                                                                                                                                                                                  |                                          |
| Materials                            | Case                  | Polycarbonate (PC)                                                                                                                                                                                                                                                             |                                                                                                                                   |                                                         |                                                                                                                                                                                                                                                                  |                                          |
|                                      | Cover                 | Polycarbonate (PC)                                                                                                                                                                                                                                                             |                                                                                                                                   |                                                         |                                                                                                                                                                                                                                                                  |                                          |
|                                      | Cable covering        | Polyvinyl chloride (PVC)                                                                                                                                                                                                                                                       |                                                                                                                                   |                                                         | —                                                                                                                                                                                                                                                                |                                          |
| Accessories                          |                       | Instruction manual                                                                                                                                                                                                                                                             |                                                                                                                                   |                                                         |                                                                                                                                                                                                                                                                  |                                          |

\*7. The bank is not reset by the user reset function or saved by the user save function.

## Sensing Distances

### Specifications

#### Hex-shaped Models

| Type           |      |                | Appearance (mm)                                                                   | Bending radius of cable (mm) | Sensing distance (mm) |    |    |     |                         |    |    |     | Model       |
|----------------|------|----------------|-----------------------------------------------------------------------------------|------------------------------|-----------------------|----|----|-----|-------------------------|----|----|-----|-------------|
| Sensing method | Size | Aperture angle |                                                                                   |                              | White paper           |    |    |     | 12-color discrimination |    |    |     |             |
|                |      |                |                                                                                   |                              | GIGA                  | ST | HS | SHS | GIGA                    | ST | HS | SHS |             |
| Reflective     | M6   | 60°            |  | Flexible, R4                 | 90                    | 45 | 30 | 13  | 18                      | 9  | 6  | 4   | E32-C91N 2M |

#### Through-beam Models (Grooved Type)

| Type  | Sensing width | Appearance (mm)                                                                   | Bending radius of cable (mm) | Sensing distance (mm) |    |    |     |                    |    |    |     | Model      |
|-------|---------------|-----------------------------------------------------------------------------------|------------------------------|-----------------------|----|----|-----|--------------------|----|----|-----|------------|
|       |               |                                                                                   |                              | Opaque object         |    |    |     | Translucent object |    |    |     |            |
|       |               |                                                                                   |                              | GIGA                  | ST | HS | SHS | GIGA               | ST | HS | SHS |            |
| Array | 10 mm         |  | R5                           | 10                    |    |    |     |                    |    |    |     | E32-G16 2M |

### Installation Information

| Model       | Installation        |                   |                                       | Cable               |                        |                  |                 |               |                                  | Weight (packed state) |
|-------------|---------------------|-------------------|---------------------------------------|---------------------|------------------------|------------------|-----------------|---------------|----------------------------------|-----------------------|
|             | Ambient temperature | Tightening torque | Mounting hole                         | Bending radius (mm) | Unbendable length (mm) | Tensile strength | Sheath material | Core material | Emitter/receiver differentiation |                       |
| E32-C91N 2M | −40 to 70°C         | 0.98 N·m          | 6.2 <sup>+0.5</sup> <sub>0</sub> dia. | R4                  | 0                      | 29.4 N           | Polyethylene    | Plastic       | White line on emitter cable      | 36 g                  |
| E32-G16 2M  | −40 to 70°C         | 0.53 N·m          | —                                     | R5                  | 0 *                    | 29.4 N           | Polyethylene    | Plastic       | —                                | 51 g                  |

\* The bending radius of the protective cover (PVC, 25 mm) is 10 mm min.

#### Hex-shaped Models

| Sensing method                                    | Size | Aperture angle | Model                                                                | Sensing distance (mm)                                |          |            |                  |                                                                          |          |            |                     |
|---------------------------------------------------|------|----------------|----------------------------------------------------------------------|------------------------------------------------------|----------|------------|------------------|--------------------------------------------------------------------------|----------|------------|---------------------|
|                                                   |      |                |                                                                      | Reflective: White paper, Through-beam: Opaque object |          |            |                  | Reflective: 12-color discrimination, Through-beam: Translucent object *1 |          |            |                     |
|                                                   |      |                |                                                                      | GIGA                                                 | Standard | High-speed | Super-high-speed | GIGA                                                                     | Standard | High-speed | Super-high-speed *2 |
| Through-beam                                      | M4   | 15°            | E32-LT11N 2M (Built-in Lens)                                         | 980                                                  | 510      | 350        | 140              | 190                                                                      | 100      | 70         | 44                  |
|                                                   |      | 60°            | E32-T11N 2M                                                          | 300                                                  | 150      | 100        | 45               | 60                                                                       | 31       | 21         | 13                  |
| Reflective                                        | M3   | 60°            | E32-C21N 2M                                                          | 54                                                   | 27       | 18         | 7                | 10                                                                       | 5        | 3.6        | 2.6                 |
|                                                   |      |                | E32-D21N 2M                                                          | 90                                                   | 45       | 30         | 13               | 18                                                                       | 9        | 6          | 4                   |
|                                                   | M4   | 15°            | E32-LD11N 2M (Built-in Lens)                                         | 88                                                   | 44       | 29         | 13               | 17                                                                       | 8        | 5          | 4                   |
|                                                   | M6   | 60°            | E32-C31N 2M                                                          | 12                                                   | 6        | 4          | 1.8              | 2.4                                                                      | 1.2      | 0.8        | 0.6                 |
|                                                   | M3   |                | E32-C11N 2M                                                          | 90                                                   | 45       | 30         | 13               | 18                                                                       | 9        | 6          | 4                   |
| Retro-reflective for transparent object detection | M6   | 15°            | E32-LR11NP 2M (Built-in Lens) + E39-RP1 (Reflector, sold separately) | 370                                                  | 180      | 120        | 55               | 75                                                                       | 37       | 25         | 16                  |

\*1. These sensing distances are recommended to make the most of the detection capabilities of the Sensor.

\*2. The Super-high-speed Mode for 12-color discrimination with a Reflective Sensor or for detection of translucent objects with a Through-beam Sensor can be set only in Contrast Mode. The Super-high-speed Mode can not be set in Color Mode.

## Threaded Models

| Sensing method | Size | Aperture angle | Model                        | Sensing distance (mm)                                   |          |            |                  |                                                                             |          |            |                     |  |
|----------------|------|----------------|------------------------------|---------------------------------------------------------|----------|------------|------------------|-----------------------------------------------------------------------------|----------|------------|---------------------|--|
|                |      |                |                              | Reflective: White paper,<br>Through-beam: Opaque object |          |            |                  | Reflective: 12-color discrimination,<br>Through-beam: Translucent object *1 |          |            |                     |  |
|                |      |                |                              | GIGA                                                    | Standard | High-speed | Super-high-speed | GIGA                                                                        | Standard | High-speed | Super-high-speed *2 |  |
| Through-beam   | M4   | 60°            | E32-T11R 2M                  | 300                                                     | 150      | 100        | 45               | 60                                                                          | 31       | 21         | 13                  |  |
|                |      | 15°            | E32-LT11 2M (Built-in Lens)  | 1,150                                                   | 600      | 410        | 170              | 230                                                                         | 120      | 82         | 52                  |  |
|                |      |                | E32-LT11R 2M (Built-in Lens) | 980                                                     | 510      | 350        | 140              | 190                                                                         | 100      | 70         | 44                  |  |
| Reflective     | M6   |                | E32-LD11 2M (Built-in Lens)  | 92                                                      | 46       | 30         | 13               | 18                                                                          | 9        | 6          | 4                   |  |
|                |      |                | E32-LD11R 2M (Built-in Lens) | 88                                                      | 44       | 29         | 13               | 17                                                                          | 8        | 5          | 4                   |  |
|                | M3   | 60°            | E32-C31 2M                   | 37                                                      | 18       | 12         | 5                | 7                                                                           | 3.8      | 2.5        | 1.8                 |  |
|                | M6   |                | E32-D11R 2M                  | 90                                                      | 45       | 30         | 13               | 18                                                                          | 9        | 6          | 4                   |  |
|                |      |                | E32-CC200 2M                 | 150                                                     | 75       | 50         | 22               | 30                                                                          | 15       | 10         | 7                   |  |

## Cylindrical Models

| Sensing method | Sensing direction | Size     | Model        | Sensing distance (mm)                                |          |            |                  |                                                                          |          |            |                     |
|----------------|-------------------|----------|--------------|------------------------------------------------------|----------|------------|------------------|--------------------------------------------------------------------------|----------|------------|---------------------|
|                |                   |          |              | Reflective: White paper, Through-beam: Opaque object |          |            |                  | Reflective: 12-color discrimination, Through-beam: Translucent object *1 |          |            |                     |
|                |                   |          |              | GIGA                                                 | Standard | High-speed | Super-high-speed | GIGA                                                                     | Standard | High-speed | Super-high-speed *2 |
| Through-beam   | Top-view          | 1.5 dia. | E32-T22B 2M  | 110                                                  | 64       | 37         | 16               | 22                                                                       | 12       | 7          | 5                   |
|                | Side-view         | 3 dia.   | E32-T12R 2M  | 300                                                  | 150      | 100        | 45               | 60                                                                       | 31       | 21         | 13                  |
|                |                   |          | E32-T14LR 2M | 190                                                  | 100      | 68         | 29               | 38                                                                       | 20       | 13         | 8                   |
| Reflective     | Top-view          | 1.5 dia. | E32-D22B 2M  | 17                                                   | 8        | 6          | 2.4              | 3                                                                        | 2        | 1.2        | 0.7                 |
|                |                   | 3 dia.   | E32-D221B 2M | 38                                                   | 20       | 13         | 5                | 7                                                                        | 4        | 3          | 1.7                 |
|                |                   |          | E32-D32L 2M  | 85                                                   | 44       | 30         | 12               | 17                                                                       | 8        | 6          | 3.7                 |

## Flat Models

| Sensing method | Sensing direction | Model                        | Sensing distance (mm)                                |          |            |                  |                                                                          |          |            |                     |
|----------------|-------------------|------------------------------|------------------------------------------------------|----------|------------|------------------|--------------------------------------------------------------------------|----------|------------|---------------------|
|                |                   |                              | Reflective: White paper, Through-beam: Opaque object |          |            |                  | Reflective: 12-color discrimination, Through-beam: Translucent object *1 |          |            |                     |
|                |                   |                              | GIGA                                                 | Standard | High-speed | Super-high-speed | GIGA                                                                     | Standard | High-speed | Super-high-speed *2 |
| Through-beam   | Flat-view         | E32-LT35Z 2M (Built-in Lens) | 360                                                  | 190      | 130        | 55               | 73                                                                       | 38       | 26         | 16                  |
|                | Top-view          | E32-T15XR 2M                 | 300                                                  | 150      | 100        | 45               | 60                                                                       | 31       | 21         | 13                  |
|                | Side-view         | E32-T15YR 2M                 | 190                                                  | 100      | 68         | 29               | 38                                                                       | 20       | 13         | 8                   |
|                | Flat-view         | E32-T15ZR 2M                 | 190                                                  | 100      | 68         | 29               | 38                                                                       | 20       | 13         | 8                   |
| Reflective     | Top-view          | E32-D15XR 2M                 | 90                                                   | 45       | 30         | 13               | 18                                                                       | 9        | 6          | 4                   |
|                | Side-view         | E32-D15YR 2M                 | 21                                                   | 10       | 7          | 3.1              | 4.2                                                                      | 2.1      | 1.4        | 1                   |
|                | Flat-view         | E32-D15ZR 2M                 | 21                                                   | 10       | 7          | 3.1              | 4.2                                                                      | 2.1      | 1.4        | 1                   |

## Sleeve Models

| Sensing method | Sensing direction | Model          | Sensing distance (mm)                                |          |            |                  |                                                                          |          |            |                     |
|----------------|-------------------|----------------|------------------------------------------------------|----------|------------|------------------|--------------------------------------------------------------------------|----------|------------|---------------------|
|                |                   |                | Reflective: White paper, Through-beam: Opaque object |          |            |                  | Reflective: 12-color discrimination, Through-beam: Translucent object *1 |          |            |                     |
|                |                   |                | GIGA                                                 | Standard | High-speed | Super-high-speed | GIGA                                                                     | Standard | High-speed | Super-high-speed *2 |
| Through-beam   | Top-view          | E32-TC200BR 2M | 300                                                  | 150      | 100        | 45               | 60                                                                       | 31       | 21         | 13                  |
| Reflective     |                   | E32-DC200BR 2M | 90                                                   | 45       | 30         | 13               | 18                                                                       | 9        | 6          | 4                   |

\*1. These sensing distances are recommended to make the most of the detection capabilities of the Sensor.

\*2. The Super-high-speed Mode for 12-color discrimination with a Reflective Sensor or for detection of translucent objects with a Through-beam Sensor can be set only in Contrast Mode. The Super-high-speed Mode can not be set in Color Mode.

## Small-spot, Reflective Models

| Sensing method | Type                                       | Spot diameter | Center distance (mm) | Model                  | Sensing distance (mm)                                                |                                 |            |                                     |                                                                     |          |            |                                                                     |
|----------------|--------------------------------------------|---------------|----------------------|------------------------|----------------------------------------------------------------------|---------------------------------|------------|-------------------------------------|---------------------------------------------------------------------|----------|------------|---------------------------------------------------------------------|
|                |                                            |               |                      |                        | White paper                                                          |                                 |            |                                     | 12-color discrimination                                             |          |            |                                                                     |
|                |                                            |               |                      |                        | GIGA                                                                 | Standard                        | High-speed | Super-high-speed                    | GIGA                                                                | Standard | High-speed | Super-high-speed *2                                                 |
| Reflective     | Integrated lens, long-distance, small-spot | 6 dia.        | 50                   | E32-L15 2M             | Spot diameter of 6 mm at 50 mm.<br>Sensing distance of 40 to 100 mm. |                                 |            |                                     | Spot diameter of 6 mm at 50 mm.<br>Sensing distance of 40 to 85 mm. |          |            | Spot diameter of 6 mm at 50 mm.<br>Sensing distance of 40 to 60 mm. |
|                | Parallel light                             | 4 dia.        | 0 to 20              | E32-C31 2M + E39-F3C   | Spot diameter of 4 mm at 0 to 20 mm.                                 |                                 |            |                                     | Spot diameter of 4 mm at 1 to 9 mm. *3                              |          | —          |                                                                     |
|                | Small-spot                                 | 0.5 dia.      | 7                    | E32-C31 2M + E39-F3A-5 | Spot diameter of 0.5 mm at 7 mm.                                     |                                 | —          | Spot diameter of 0.5 mm at 7 mm. *3 |                                                                     | —        |            |                                                                     |
|                |                                            |               | 17                   | E32-C31 2M + E39-F3B   | Spot diameter of 0.5 mm at 17 mm.                                    |                                 | —          | —                                   |                                                                     |          |            |                                                                     |
|                |                                            |               | 3 dia.               | 50                     | E32-CC200 2M + E39-F18                                               | Spot diameter of 3 mm at 50 mm. |            | —                                   | Spot diameter of 3 mm at 50 mm. *3                                  |          | —          |                                                                     |

## High-power Beam Models

| Sensing method | Sensing direction | Aperture angle | Model                 | Sensing distance (mm) |          |            |                  |                       |          |            |                     |
|----------------|-------------------|----------------|-----------------------|-----------------------|----------|------------|------------------|-----------------------|----------|------------|---------------------|
|                |                   |                |                       | Opaque object         |          |            |                  | Translucent object *1 |          |            |                     |
|                |                   |                |                       | GIGA                  | Standard | High-speed | Super-high-speed | GIGA                  | Standard | High-speed | Super-high-speed *2 |
| Through-beam   | Top-view          | 10°            | E32-T17L 10M          | 8,570                 | 200      | 130        | 59               | 1,710                 | 40       | 27         | 17                  |
|                | Side-view         | 30°            | E32-T14 2M            | 1,910                 | 990      | 680        | 290              | 380                   | 190      | 130        | 87                  |
|                | Right-angle       | 12°            | E32-T11N 2M + E39-F1  | 1,470                 | 760      | 520        | 220              | 290                   | 150      | 100        | 66                  |
|                | Top-view          | 12°            | E32-T11R 2M + E39-F1  | 1,470                 | 760      | 520        | 220              | 290                   | 150      | 100        | 66                  |
|                | Side-view         | 60°            | E32-T11R 2M + E39-F2  | 180                   | 98       | 67         | 28               | 37                    | 19       | 13         | 8                   |
|                | Top-view          | 12°            | E32-T11 2M + E39-F1   | 2,430                 | 1,260    | 860        | 360              | 480                   | 250      | 170        | 110                 |
|                | Side-view         | 60°            | E32-T11 2M + E39-F2   | 310                   | 160      | 110        | 47               | 62                    | 32       | 22         | 14                  |
|                | Top-view          | 12°            | E32-T61-S 2M + E39-F1 | 1,080                 | 560      | 380        | 160              | 210                   | 110      | 76         | 49                  |
|                | Side-view         | 60°            | E32-T61-S 2M + E39-F2 | 130                   | 72       | 49         | 21               | 27                    | 14       | 9          | 6                   |

## Narrow View Models

| Sensing method | Sensing direction | Aperture angle | Model       | Sensing distance (mm) |          |            |                  |                       |          |            |                     |
|----------------|-------------------|----------------|-------------|-----------------------|----------|------------|------------------|-----------------------|----------|------------|---------------------|
|                |                   |                |             | Opaque object         |          |            |                  | Translucent object *1 |          |            |                     |
|                |                   |                |             | GIGA                  | Standard | High-speed | Super-high-speed | GIGA                  | Standard | High-speed | Super-high-speed *2 |
| Through-beam   | Side-view         | 4°             | E32-T24S 2M | 750                   | 380      | 260        | 110              | 150                   | 77       | 53         | 34                  |
|                |                   |                | E32-T22S 2M | 1,070                 | 550      | 380        | 160              | 210                   | 110      | 76         | 48                  |

## Chemical-resistant, Oil-resistant Models

| Sensing method | Type                            | Sensing direction | Model       | Sensing distance (mm)                                |          |            |                  |                                                                          |          |            |                     |
|----------------|---------------------------------|-------------------|-------------|------------------------------------------------------|----------|------------|------------------|--------------------------------------------------------------------------|----------|------------|---------------------|
|                |                                 |                   |             | Reflective: White paper, Through-beam: Opaque object |          |            |                  | Reflective: 12-color discrimination, Through-beam: Translucent object *1 |          |            |                     |
|                |                                 |                   |             | GIGA                                                 | Standard | High-speed | Super-high-speed | GIGA                                                                     | Standard | High-speed | Super-high-speed *2 |
| Through-beam   | Chemical/oil resistant          | Top-view          | E32-T12F 2M | 1,710                                                | 880      | 600        | 260              | 340                                                                      | 170      | 120        | 78                  |
|                |                                 |                   | E32-T11F 2M | 250                                                  | 130      | 91         | 39               | 51                                                                       | 26       | 18         | 11                  |
|                |                                 | Side-view         | E32-T14F 2M | 210                                                  | 110      | 76         | 32               | 42                                                                       | 22       | 15         | 9                   |
|                | Chemical/oil-resistant at 150°C | Top-view          | E32-T51F 2M | 770                                                  | 400      | 270        | 110              | 150                                                                      | 80       | 54         | 35                  |
| Reflective     | Chemical/oil resistant          | Top-view          | E32-D12F 2M | 49                                                   | 24       | 16         | 7                | 9                                                                        | 5        | 3          | 2.4                 |
|                | Chemical-resistant cable        |                   | E32-D11U 2M | 90                                                   | 45       | 30         | 13               | 18                                                                       | 9        | 6          | 4                   |

\*1. These sensing distances are recommended to make the most of the detection capabilities of the Sensor.

\*2. The Super-high-speed Mode for 12-color discrimination with a Reflective Sensor or for detection of translucent objects with a Through-beam Sensor can be set only in Contrast Mode. The Super-high-speed Mode can not be set in Color Mode.

\*3. The sensing distances are given for Contrast Mode. The sensing distance cannot be set in Color Mode.

## Bending-resistant Models

| Sensing method | Size     | Model        | Sensing distance (mm)                                   |          |            |                  |                                                                             |          |            |                     |
|----------------|----------|--------------|---------------------------------------------------------|----------|------------|------------------|-----------------------------------------------------------------------------|----------|------------|---------------------|
|                |          |              | Reflective: White paper,<br>Through-beam: Opaque object |          |            |                  | Reflective: 12-color discrimination,<br>Through-beam: Translucent object *1 |          |            |                     |
|                |          |              | GIGA                                                    | Standard | High-speed | Super-high-speed | GIGA                                                                        | Standard | High-speed | Super-high-speed *2 |
| Through-beam   | 1.5 dia. | E32-T22B 2M  | 110                                                     | 64       | 37         | 16               | 22                                                                          | 12       | 7          | 5                   |
|                | M3       | E32-T21 2M   | 100                                                     | 57       | 33         | 14               | 20                                                                          | 11       | 6          | 4                   |
|                | M4       | E32-T11 2M   | 380                                                     | 200      | 130        | 58               | 77                                                                          | 40       | 27         | 17                  |
|                | Square   | E32-T25XB 2M | 77                                                      | 43       | 25         | 10               | 15                                                                          | 8        | 5          | 3.3                 |
| Reflective     | 1.5 dia. | E32-D22B 2M  | 17                                                      | 8        | 6          | 2.4              | 3                                                                           | 2        | 1.2        | 0.7                 |
|                | M3       | E32-D21 2M   | 17                                                      | 8        | 6          | 2.4              | 3.4                                                                         | 1.8      | 1.2        | 0.7                 |
|                | 3 dia.   | E32-D221B 2M | 38                                                      | 20       | 13         | 5                | 7                                                                           | 4        | 3          | 1.7                 |
|                | M4       | E32-D21B 2M  | 38                                                      | 20       | 13         | 5                | 7                                                                           | 4        | 2.7        | 1.7                 |
|                | M6       | E32-D11 2M   | 90                                                      | 45       | 30         | 13               | 18                                                                          | 9        | 6          | 4                   |
|                | Square   | E32-D25XB 2M | 27                                                      | 14       | 9          | 3.9              | 5                                                                           | 3        | 2          | 1.2                 |

## Heat-resistant Models

| Sensing method | Heat-resistant temperature | Model         | Sensing distance (mm)                                   |          |            |                  |                                                                             |          |            |                     |
|----------------|----------------------------|---------------|---------------------------------------------------------|----------|------------|------------------|-----------------------------------------------------------------------------|----------|------------|---------------------|
|                |                            |               | Reflective: White paper,<br>Through-beam: Opaque object |          |            |                  | Reflective: 12-color discrimination,<br>Through-beam: Translucent object *1 |          |            |                     |
|                |                            |               | GIGA                                                    | Standard | High-speed | Super-high-speed | GIGA                                                                        | Standard | High-speed | Super-high-speed *2 |
| Through-beam   | 150°                       | E32-T51 2M    | 420                                                     | 220      | 150        | 65               | 85                                                                          | 44       | 30         | 19                  |
|                | 200°                       | E32-T81R-S 2M | 150                                                     | 80       | 54         | 23               | 30                                                                          | 16       | 10         | 7                   |
|                | 350°                       | E32-T61-S 2M  | 250                                                     | 130      | 91         | 39               | 51                                                                          | 26       | 18         | 11                  |
| Reflective     | 150°                       | E32-D51 2M    | 120                                                     | 60       | 40         | 17               | 24                                                                          | 12       | 8          | 5                   |
|                | 200°                       | E32-D81R-S 2M | 42                                                      | 21       | 14         | 6                | 8                                                                           | 4.3      | 2.9        | 1.9                 |
|                | 350°                       | E32-D61-S 2M  | 42                                                      | 21       | 14         | 6                | 8                                                                           | 4        | 2.9        | 1.9                 |
|                | 400°                       | E32-D73-S 2M  | 28                                                      | 14       | 9          | 4                | 5                                                                           | 2.9      | 1.9        | 1.3                 |

## Area Detection Models

| Sensing method | Type  | Sensing width | Model        | Sensing distance (mm)                                   |          |            |                  |                                                                             |          |            |                     |
|----------------|-------|---------------|--------------|---------------------------------------------------------|----------|------------|------------------|-----------------------------------------------------------------------------|----------|------------|---------------------|
|                |       |               |              | Reflective: White paper,<br>Through-beam: Opaque object |          |            |                  | Reflective: 12-color discrimination,<br>Through-beam: Translucent object *1 |          |            |                     |
|                |       |               |              | GIGA                                                    | Standard | High-speed | Super-high-speed | GIGA                                                                        | Standard | High-speed | Super-high-speed *2 |
| Through-beam   | Area  | 11 mm         | E32-T16PR 2M | 480                                                     | 250      | 170        | 73               | 96                                                                          | 50       | 34         | 21                  |
|                |       |               | E32-T16JR 2M | 410                                                     | 210      | 140        | 63               | 83                                                                          | 43       | 29         | 19                  |
|                |       | 30 mm         | E32-T16WR 2M | 730                                                     | 210      | 140        | 63               | 140                                                                         | 43       | 29         | 19                  |
| Reflective     | Array | 11 mm         | E32-D36P1 2M | 75                                                      | 37       | 25         | 11               | 15                                                                          | 7        | 5          | 3.3                 |

## Vacuum-resistant Models

| Sensing method | Type        | Heat-resistant temperature | Model               | Sensing distance (mm) |          |            |                  |                       |          |            |                     |
|----------------|-------------|----------------------------|---------------------|-----------------------|----------|------------|------------------|-----------------------|----------|------------|---------------------|
|                |             |                            |                     | Opaque object         |          |            |                  | Translucent object *1 |          |            |                     |
|                |             |                            |                     | GIGA                  | Standard | High-speed | Super-high-speed | GIGA                  | Standard | High-speed | Super-high-speed *2 |
| Through-beam   | Vacuum side | 120°                       | E32-T51V 1M         | 110                   | 57       | 39         | 16               | 22                    | 11       | 7          | 5                   |
|                |             |                            | E32-T51V 1M+E39-F1V | 170                   | 90       | 61         | 26               | 34                    | 18       | 12         | 7                   |
|                |             | 200°                       | E32-T84SV 1M        | 270                   | 140      | 97         | 41               | 54                    | 28       | 19         | 12                  |

\*1. These sensing distances are recommended to make the most of the detection capabilities of the Sensor.

\*2. The Super-high-speed Mode for 12-color discrimination with a Reflective Sensor or for detection of translucent objects with a Through-beam Sensor can be set only in Contrast Mode. The Super-high-speed Mode can not be set in Color Mode.

Engineering Data (Reference Value)

Color vs. Detection Capability

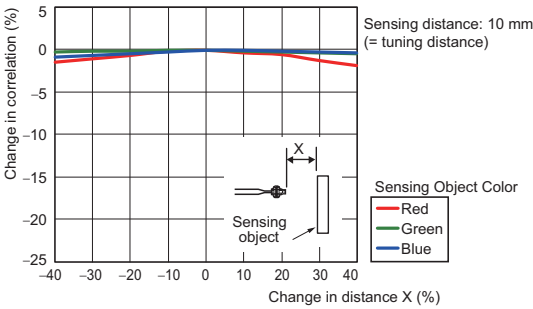
E3NX-CA□□ + E32-CC200

|              | White | Red | Yellow/red | Yellow | Yellow/green | Green | Blue/green | Blue | Blue/purple | Purple | Red/purple | Black* |
|--------------|-------|-----|------------|--------|--------------|-------|------------|------|-------------|--------|------------|--------|
| White        |       | ○   | ○          | ○      | ○            | ○     | ○          | ○    | ○           | ○      | ○          | (○)    |
| Red          | ○     |     | ○          | ○      | ○            | ○     | ○          | ○    | ○           | ○      | ○          | ○      |
| Yellow/red   | ○     | ○   |            | ○      | ○            | ○     | ○          | ○    | ○           | ○      | ○          | ○      |
| Yellow       | ○     | ○   | ○          |        | ○            | ○     | ○          | ○    | ○           | ○      | ○          | ○      |
| Yellow/green | ○     | ○   | ○          | ○      |              | ○     | ○          | ○    | ○           | ○      | ○          | ○      |
| Green        | ○     | ○   | ○          | ○      | ○            |       | ○          | ○    | ○           | ○      | ○          | ○      |
| Blue/green   | ○     | ○   | ○          | ○      | ○            | ○     |            | ○    | ○           | ○      | ○          | ○      |
| Blue         | ○     | ○   | ○          | ○      | ○            | ○     | ○          |      | ○           | ○      | ○          | ○      |
| Blue/purple  | ○     | ○   | ○          | ○      | ○            | ○     | ○          | ○    |             | ○      | ○          | ○      |
| Purple       | ○     | ○   | ○          | ○      | ○            | ○     | ○          | ○    | ○           |        | ○          | ○      |
| Red/purple   | ○     | ○   | ○          | ○      | ○            | ○     | ○          | ○    | ○           | ○      |            | ○      |
| Black*       | (○)   | ○   | ○          | ○      | ○            | ○     | ○          | ○    | ○           | ○      | ○          |        |

High-speed Mode  
Sensing distance: 10 mm (i.e., tuning distance)  
○: Detection possible, ×: Detection not possible.  
\* Use Contrast Mode to distinguish between white and black.

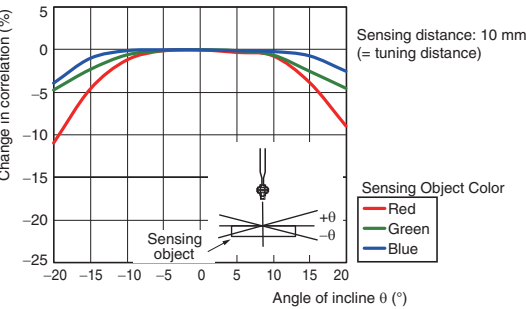
Correlation vs. Distance

E3NX-CA + E32-CC200



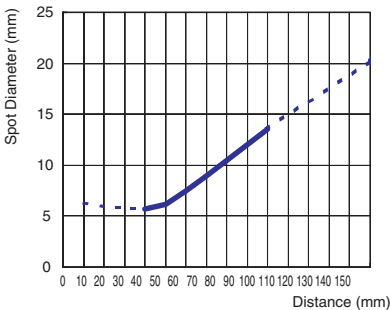
Correlation vs. Angle

E3NX-CA + E32-CC200



Spot Diameter vs. Sensing Distance

E3NX-CA + E32-L15



# E3NX-CA

## I/O Circuit Diagrams

### NPN Output

| Model                              | Operation mode   | Timing chart                                                                                                                                                                       | NO/NC indicator | Output circuit |
|------------------------------------|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------------|
| E3NX-CA11<br>E3NX-CA21<br>E3NX-CA6 | NO<br>(Light-ON) | Incident light:<br>No incident light:<br>Operation indicator (orange): ON<br>OFF<br>Output transistor: ON<br>OFF<br>Load (e.g., relay): Operate<br>Reset (Between brown and black) |                 |                |
|                                    | NC<br>(Dark-ON)  | Incident light:<br>No incident light:<br>Operation indicator (orange): ON<br>OFF<br>Output transistor: ON<br>OFF<br>Load (e.g., relay): Operate<br>Reset (Between brown and black) |                 |                |

\* The CA11 and CA6 have only control output 1. These models do not have control output 2 or an external input, so they do not have the OUT2 indicator.

### PNP Output

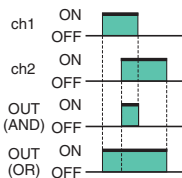
| Model                              | Operation mode   | Timing chart                                                                                                                                                                      | NO/NC indicator | Output circuit |
|------------------------------------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------------|
| E3NX-CA41<br>E3NX-CA51<br>E3NX-CA8 | NO<br>(Light-ON) | Incident light:<br>No incident light:<br>Operation indicator (orange): ON<br>OFF<br>Output transistor: ON<br>OFF<br>Load (e.g., relay): Operate<br>Reset (Between blue and black) |                 |                |
|                                    | NC<br>(Dark-ON)  | Incident light:<br>No incident light:<br>Operation indicator (orange): ON<br>OFF<br>Output transistor: ON<br>OFF<br>Load (e.g., relay): Operate<br>Reset (Between blue and black) |                 |                |

\* The CA41 and CA8 have only control output 1. These models do not have control output 2 or an external input, so they do not have the OUT2 indicator.

**Note: 1.** Timing Charts for Timer Function Settings (T: Set Time)

| ON-delay Timer                                                                                  | OFF-delay Timer                                                                                 | One-shot Timer                                                                                  | ON/OFF-delay Timer                                                                              |
|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| Delays the output ON after detection.                                                           | Holds the output ON for detection by PLC when the detection time is too short.                  | Keeps the output ON for a specified time regardless of the workpiece size variations.           | Sets both OFF-delay Timer and ON-delay Timer.                                                   |
| Incident light:<br>No incident light:<br>L-ON: ON<br>OFF<br>L-ON: OFF<br>OFF<br>D-ON: ON<br>OFF | Incident light:<br>No incident light:<br>L-ON: ON<br>OFF<br>L-ON: OFF<br>OFF<br>D-ON: ON<br>OFF | Incident light:<br>No incident light:<br>L-ON: ON<br>OFF<br>L-ON: OFF<br>OFF<br>D-ON: ON<br>OFF | Incident light:<br>No incident light:<br>L-ON: ON<br>OFF<br>L-ON: OFF<br>OFF<br>D-ON: ON<br>OFF |

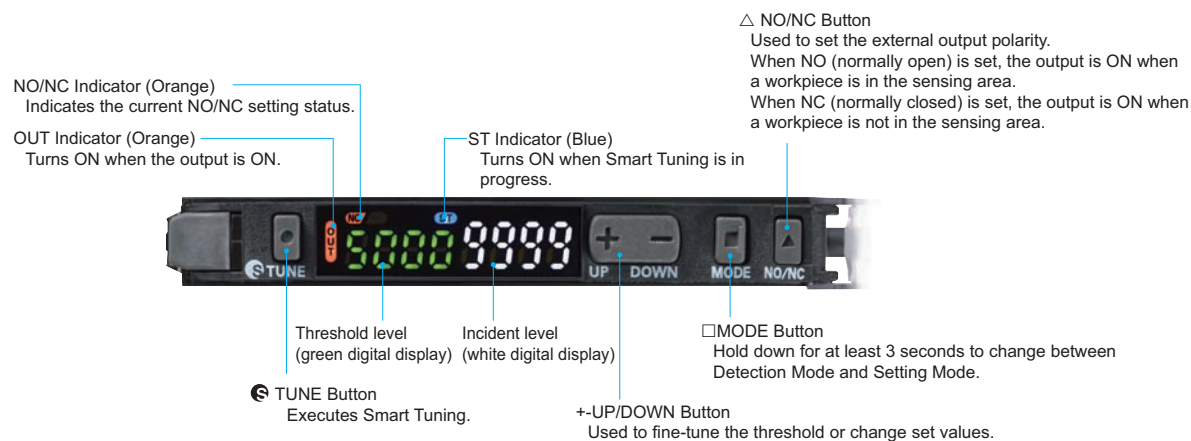
### 2. Timing Chart for Control Output (AND or OR) (T: Set Time)



## Nomenclature

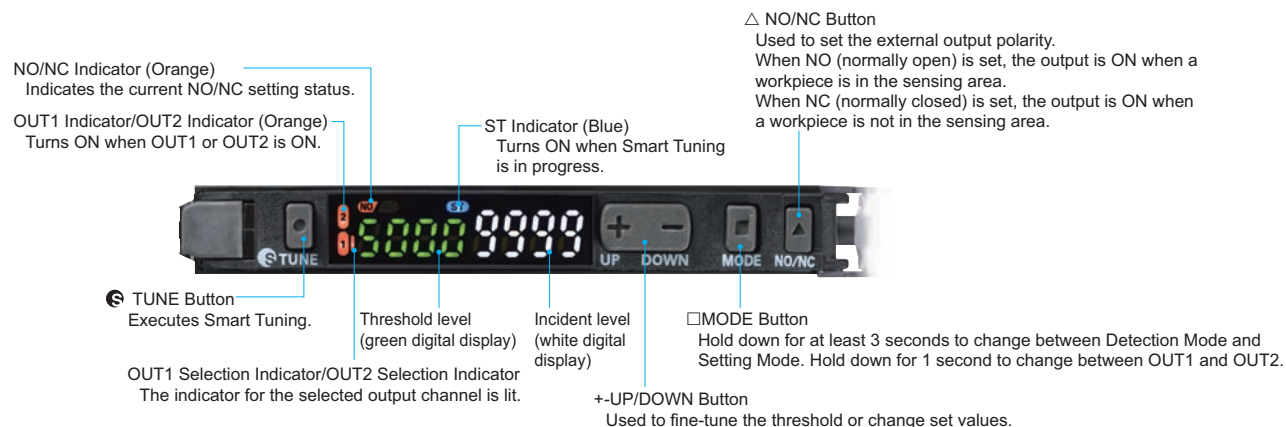
### Standard Models

E3NX-CA11/CA41/CA6/CA8



### Advanced Models and Model for Sensor Communications Unit

E3NX-CA21/CA51/CA0



## Safety Precautions

Be sure to read the precautions for all models in the website at: <http://www.ia.omron.com/>.

### Warning Indications

|                                                                                   |                                                                                                                                                                                                                                       |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>Warning level</b><br>Indicates a potentially hazardous situation which, if not avoided, will result in minor or moderate injury, or may result in serious injury or death. Additionally, there may be significant property damage. |
| <b>Precautions for Safe Use</b>                                                   | Supplementary comments on what to do or avoid doing, to use the product safely.                                                                                                                                                       |
| <b>Precautions for Correct Use</b>                                                | Supplementary comments on what to do or avoid doing, to prevent failure to operate, malfunction or undesirable effect on product performance.                                                                                         |

### Meaning of Product Safety Symbols

|                                                                                   |                                                                                                |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
|  | <b>General prohibition</b><br>Indicates the instructions of unspecified prohibited action.     |
|  | <b>Caution, explosion</b><br>Indicates the possibility of explosion under specific conditions. |
|  | <b>Caution, fire</b><br>Indicates the possibility of fire under specific conditions.           |

### WARNING

This product is not designed or rated for ensuring safety of persons either directly or indirectly. Do not use it for such purposes.



Do not use the product with voltage in excess of the rated voltage. Excess voltage may result in malfunction or fire.



Never use the product with an AC power supply. Otherwise, explosion may result.



### Precautions for Safe Use

The following precautions must be observed to ensure safe operation of the product. Doing so may cause damage or fire.

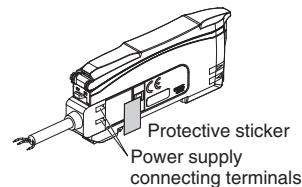
- Do not install the product in the following locations.
  - Locations subject to direct sunlight
  - Locations subject to condensation due to high humidity
  - Locations subject to corrosive gas
  - Locations subject to vibration or mechanical shocks exceeding the rated values
  - Locations subject to exposure to water, oil, chemicals
  - Locations subject to steam
  - Locations subject to strong magnetic field or electric field
- Do not use the product in environments subject to flammable or explosive gases.
- Do not use the product in any atmosphere or environment that exceeds the ratings.
- To secure the safety of operation and maintenance, do not install the product close to high-voltage devices and power devices.
- High-Voltage lines and power lines must be wired separately from this product. Wiring them together or placing them in the same duct may cause induction, resulting in malfunction or damage.
- Do not apply any load exceeding the ratings. Otherwise damage or fire may result.
- Do not short the load. Otherwise damage or fire may result.
- Connect the load correctly.
- Do not miswire such as the polarity of the power supply.

- To use this device as connecting with each other, be sure to connect with the same power supply and turn ON the power simultaneously. Using a separate power supply will influence the functions when connecting the devices to use them.
- Do not use the product if the case is damaged.
- Burn injury may occur. The product surface temperature rises depending on application conditions, such as the ambient temperature and the power supply voltage. Attention must be paid during operation or cleaning.
- When setting the sensor, be sure to check safety such as by stopping the equipment.
- Be sure to turn off the power supply before connecting or disconnecting wires.
- Do not attempt to disassemble, repair, or modify the product in any way.
- When disposing of the product, treat it as industrial waste.
- Do not use the Sensor in water, rain, or outdoors.
- UL Standard Certification  
Only the Sensors with the Enhanced UL Certification Mark are certified by UL. They are intended to be supplied by a "Class 2 circuit". When used in United States and Canada, please use the same Class 2 source for input and output. The overcurrent protection current rating is 2 A max. They were evaluated as Open type and shall be installed within a enclosure.

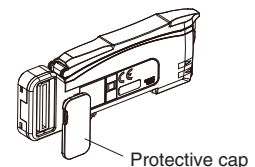
### Precautions for Correct Use

- Be sure to mount the unit to the DIN track until it clicks.
- When using the Amplifier Units with Wire-saving Connectors, attach the protective stickers (provided with E3X-CN-series Connectors) on the unused power pins to prevent electrical shock and short circuiting. When using Amplifier Units with Connectors for Communications Units, attach the protective caps (provided with E3NW-series Sensor Communications Units).

Amplifier Unit with Wire-saving Connector



Amplifier Unit with Connector for Communications Unit



- Use an extension cable with a maximum length of 30 m. Be sure to use a cable of at least 0.3 mm<sup>2</sup> for extension. The power voltage must be 24 to 30 V when connecting Amplifier Units with extension cable and wire-saving connector.
- Do not apply the forces on the cable exceeding the following limits:  
Pull: 40 N; torque: 0.1 N·m; pressure: 20 N; bending: 29.4 N
- Use the E32-□□ Fiber Unit.
- Do not apply excessive force such as tension, compression or torsion to the Fiber Amplifier Unit with the Fiber Unit fixed to the Fiber Amplifier Unit.
- Always keep the protective cover in place when using the product. Not doing so may cause malfunction.
- It may take time until the incident level and measurement value become stable immediately after the power is turned on depending on use environment.
- The product is ready to operate 200 ms after the power supply is turned ON.
- The Mobile Console E3X-MC11, E3X-MC11-SV2 and E3X-MC11-S cannot be connected.
- The mutual interference prevention function does not work when in combination with E3C/E2C/E3X.
- Excessive incident light cannot be sufficiently handled by the mutual interference prevention function and may cause malfunction. To prevent this, set a higher threshold level.
- The Communication Unit E3X-DRT21-S, E3X-CRT, E3X-ECT and E3NW cannot be connected.
- If you notice an abnormal condition such as a strange odor, extreme heating of the unit, or smoke, immediately stop using the product, turn off the power, and consult your dealer.
- Do not use thinner, benzene, acetone, and lamp oil for cleaning.

## Dimensions

### Fiber Amplifier Units

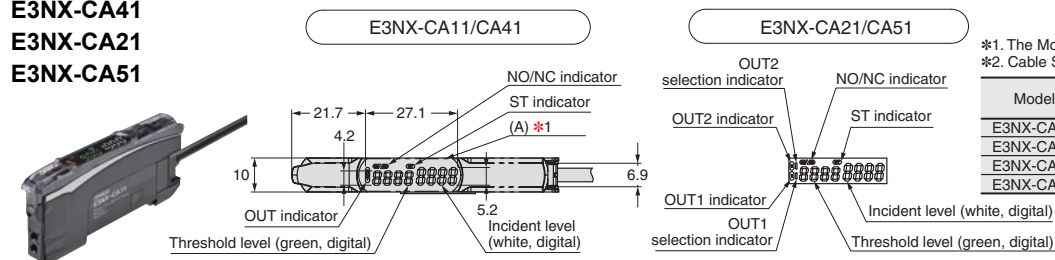
#### Pre-wired Amplifier Units

E3NX-CA11

E3NX-CA41

E3NX-CA21

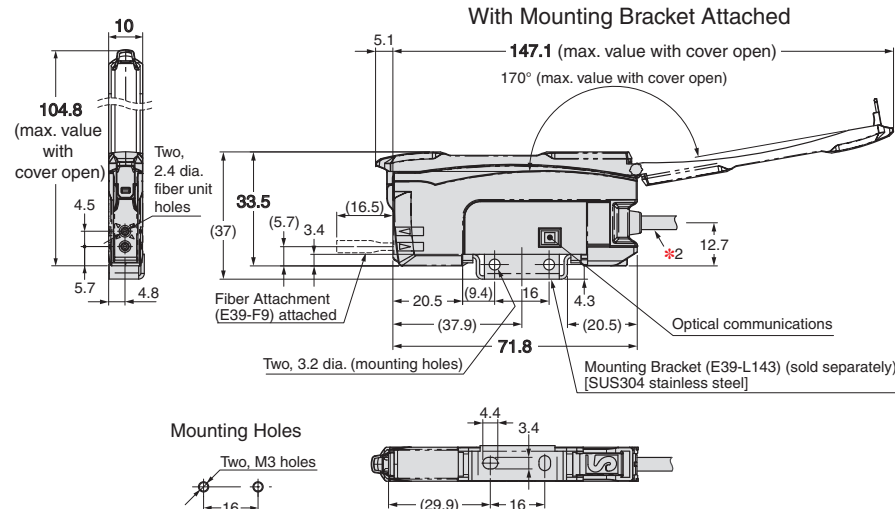
E3NX-CA51



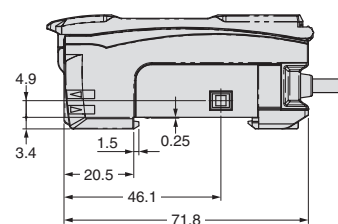
\*1. The Mounting Bracket can also be used on side A.

\*2. Cable Specifications

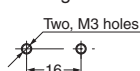
| Model     | Outer diameter | No. of conductors | Others                                                                 |
|-----------|----------------|-------------------|------------------------------------------------------------------------|
| E3NX-CA11 | 4.0 dia.       | 3                 | Conductor cross-section: 0.2 mm <sup>2</sup><br>Insulator dia.: 0.9 mm |
| E3NX-CA41 |                | 3                 |                                                                        |
| E3NX-CA21 |                | 5                 |                                                                        |
| E3NX-CA51 |                |                   |                                                                        |



#### Standalone Product Diagram



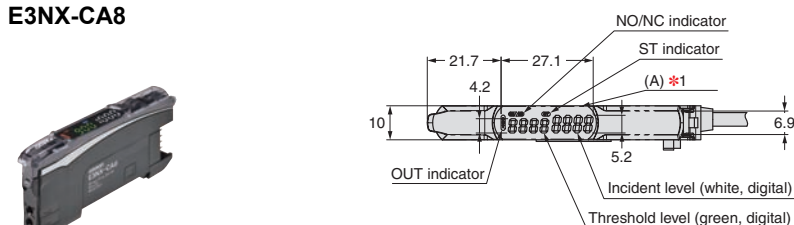
#### Mounting Holes



#### Amplifier Units with Wire-saving Connectors

E3NX-CA6

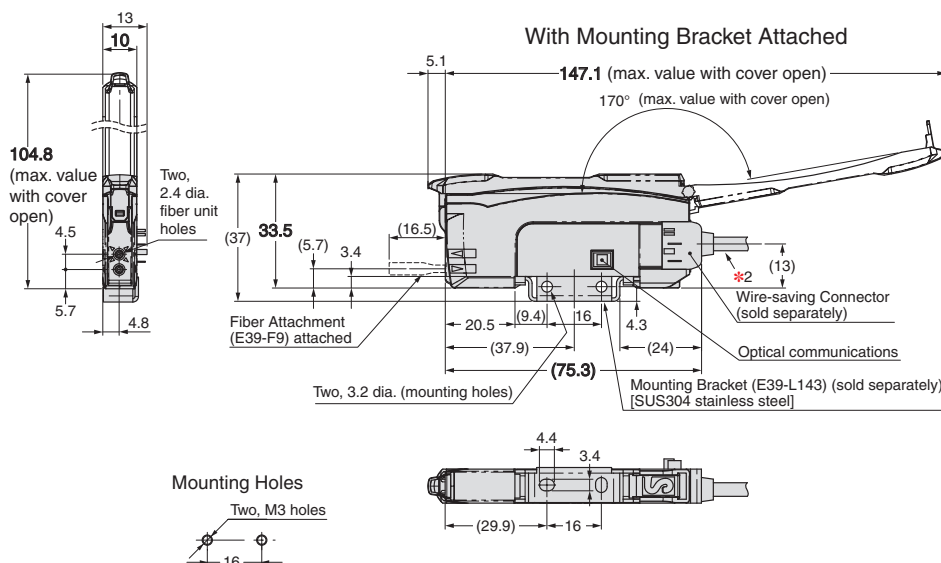
E3NX-CA8



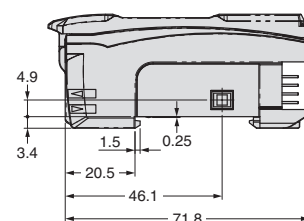
\*1. The Mounting Bracket can also be used on side A.

\*2. Cable Specifications

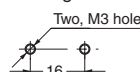
| Model    | Outer diameter | No. of conductors |
|----------|----------------|-------------------|
| E3X-CN12 | 2.6 dia.       | 1                 |
| E3X-CN22 | 4.0 dia.       | 2                 |
| E3X-CN11 |                | 3                 |



#### Standalone Product Diagram

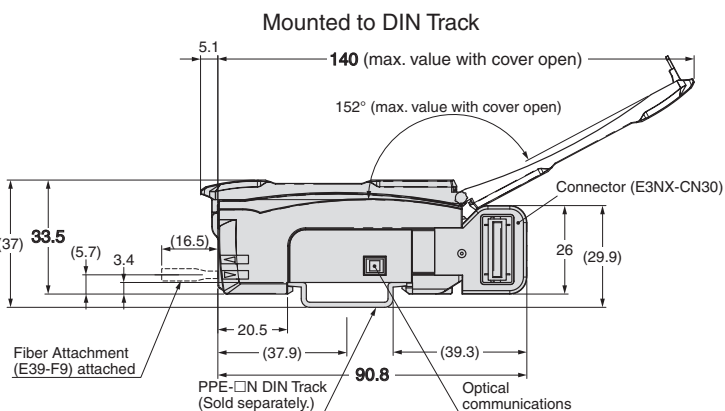
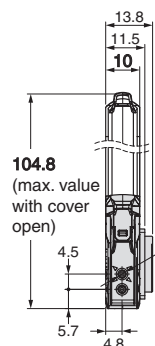
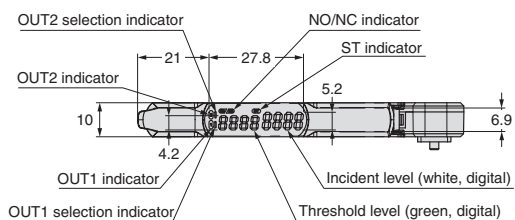


#### Mounting Holes

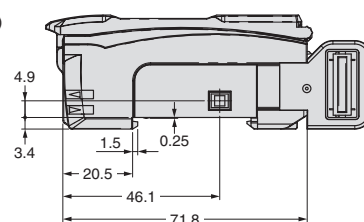


# E3NX-CA

## Amplifier Unit with Connector for Sensor Communications Unit E3NX-CA0

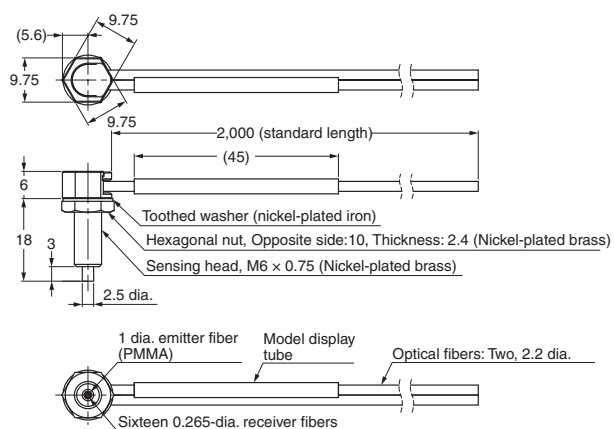


Standalone Product Diagram

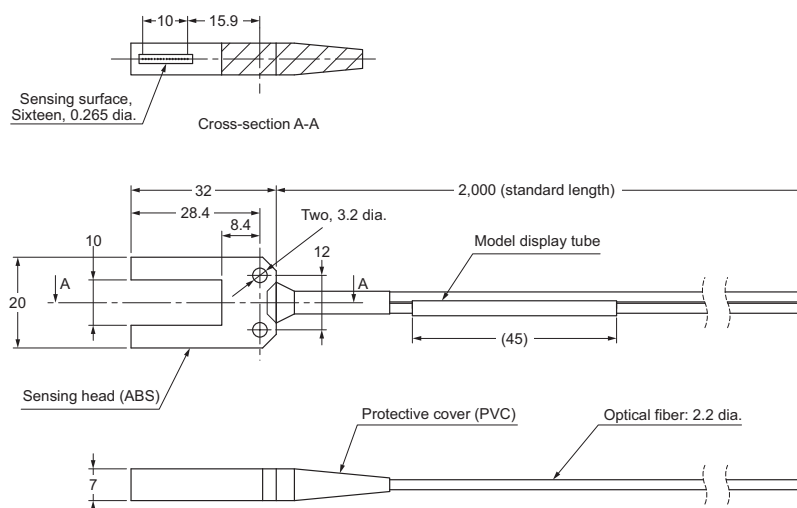


## Fiber Units

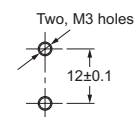
### Reflective Models E32-C91N



### Through-beam Models (Grooved Type) E32-G16



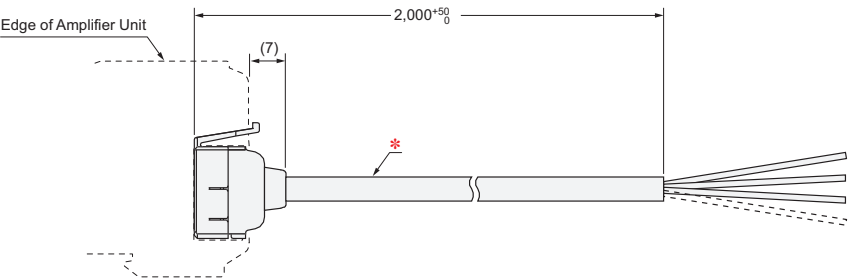
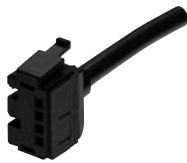
Mounting Holes



Accessories (Sold Separately)

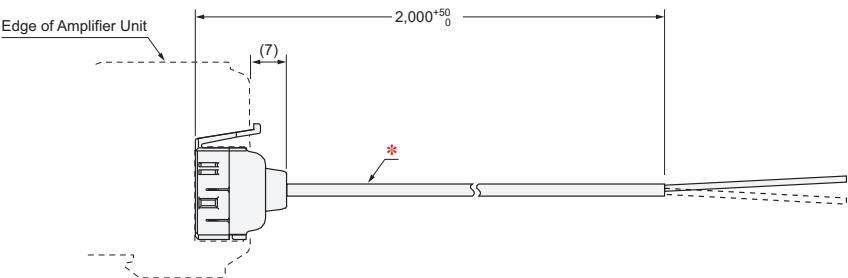
Wire-saving Connectors

Master Connector  
E3X-CN11



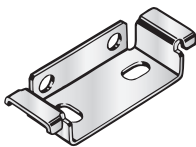
\* 4-dia. cable with 3 conductors, Standard cable length: 2 m (Conductor cross-section: 0.2 mm<sup>2</sup> (AWG24), Insulator diameter: 1.1 mm)

Slave Connector  
E3X-CN12

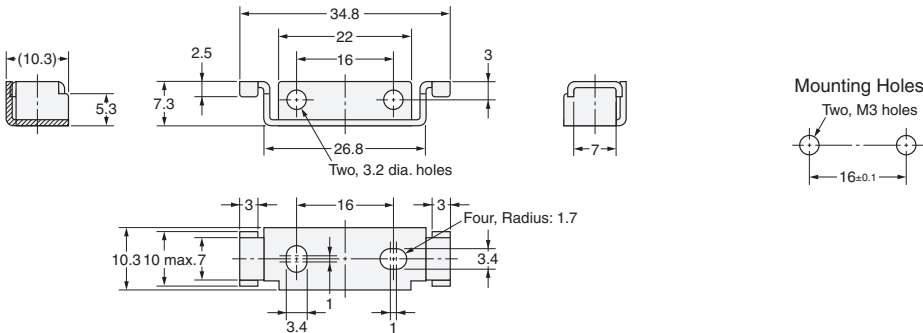


\* 2.6-dia. cable with 1 conductor, Standard cable length: 2 m (Conductor cross-section: 0.2 mm<sup>2</sup> (AWG24), Insulator diameter: 1.1 mm)

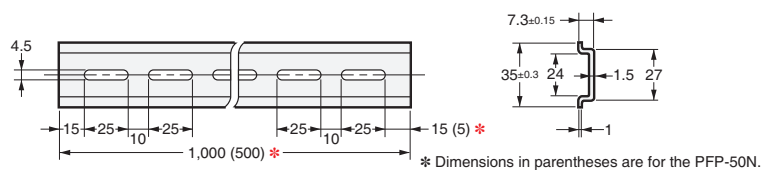
Mounting Bracket  
E39-L143



Material: Stainless steel (SUS304)



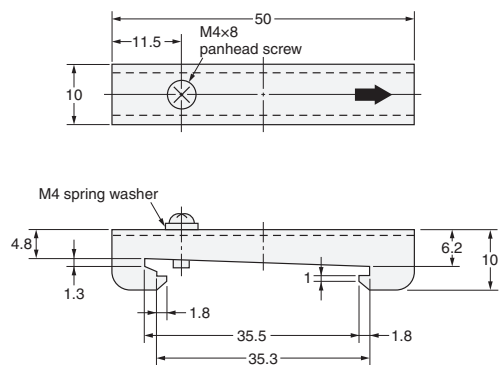
**PFP-50N**



Material: Aluminum

Material: Aluminum

**PFP-M**



Materials: Iron, zinc plating

# Terms and Conditions Agreement

## **Read and understand this catalog.**

Please read and understand this catalog before purchasing the products. Please consult your OMRON representative if you have any questions or comments.

## **Warranties.**

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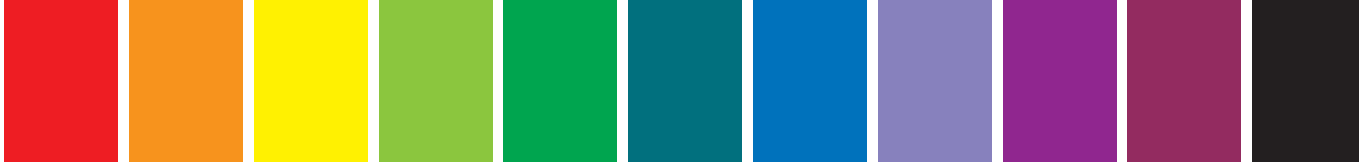
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