

# Photoelectric Sensor

E3F2

## Threaded Cylindrical Photoelectric Sensor with Built-in Amplifier for Use as an Optical Proximity Sensor

- M18 DIN-sized cylindrical housing, ABS resin case.
- Compact and space-saving.
- Long sensing distance (30 cm) with sensitivity adjuster for diffuse type. (DC switching type)
- DC Switching types with connectors for easy maintenance.
- Wide operating voltage range (10 to 30 VDC, or 24 to 240 VAC).
- Short-circuit and reverse connection protection. (DC switching type)
- UL and CSA approved (AC switching type)



## Ordering Information

### DC Switching Models

| Operating modes                  | Connection method | Control output                        | Sensing method     | Sensing distance   | Model                    |
|----------------------------------|-------------------|---------------------------------------|--------------------|--------------------|--------------------------|
| Light-ON or Dark-ON (selectable) | Pre-wired         | Transistor output, NPN open collector | Through-beam       | 3 m (4 m typ.)     | E3F2-3C4                 |
|                                  |                   |                                       | Retroreflective    | 2 m (2.5 m typ.)   | E3F2-R2C4                |
|                                  |                   |                                       | Diffuse reflective | 10 cm              | E3F2-R2C4-E (See note)   |
|                                  |                   |                                       |                    | 30 cm (40 cm typ.) | E3F2-DS10C4-N            |
|                                  |                   | Transistor output, PNP open collector | Through-beam       | 3 m (4 m typ.)     | E3F2-3B4                 |
|                                  |                   |                                       | Retroreflective    | 2 m (2.5 m typ.)   | E3F2-R2B4                |
|                                  |                   |                                       | Diffuse reflective | 10 cm              | E3F2-R2B4-E (See note)   |
|                                  |                   |                                       |                    | 30 cm (40 cm typ.) | E3F2-DS10B4-N            |
|                                  | Connector         | Transistor output, NPN open collector | Through-beam       | 3 m (4 m typ.)     | E3F2-3C4-P1              |
|                                  |                   |                                       | Retroreflective    | 2 m (2.5 m typ.)   | E3F2-R2C4-P1             |
|                                  |                   |                                       | Diffuse reflective | 10 cm              | E3F2-R2C4-P1E (See note) |
|                                  |                   |                                       |                    | 30 cm (40 cm typ.) | E3F2-DS10C4-P1           |
|                                  |                   | Transistor output, PNP open collector | Through-beam       | 3 m (4 m typ.)     | E3F2-3B4-P1              |
|                                  |                   |                                       | Retroreflective    | 2 m (2.5 m typ.)   | E3F2-R2B4-P1             |
|                                  |                   |                                       | Diffuse reflective | 10 cm              | E3F2-R2B4-P1E            |
|                                  |                   |                                       |                    | 30 cm (40 cm typ.) | E3F2-DS10B4-P1           |

Note: Without E39-R<sub>1</sub> (Retroreflector)

### AC Switching Models

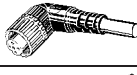
| Operating modes  | Connection method | Control output       | Sensing method     | Sensing distance | Model         |
|------------------|-------------------|----------------------|--------------------|------------------|---------------|
| Light-ON (Fixed) | Pre-wired         | AC solid state (SCR) | Through-beam       | 3 m (4 m typ.)   | E3F2-3Z1      |
|                  |                   |                      | Retroreflective    | 2 m (2.5 m typ.) | E3F2-R2Z1     |
|                  |                   |                      | Diffuse reflective | 10 cm            | E3F2-DS10Z1-N |
| Dark-ON (Fixed)  |                   |                      | Through-beam       | 3 m (4 m typ.)   | E3F2-3Z2      |
|                  |                   |                      | Retroreflective    | 2 m (2.5 m typ.) | E3F2-R2Z2-N   |
|                  |                   |                      | Diffuse reflective | 10 cm            | E3F2-DS10Z2   |

### ■ Accessories (Order Separately)

| Name                       | Model            |
|----------------------------|------------------|
| Retroreflector             | E39-R1, E39-R3   |
| Retroreflector (tape type) | E39-RSA, E39-RSB |
| Lens Cap                   | E39-F31          |
| Mounting Bracket           | Y92E-B18         |

### ■ Connector

#### Plugs (Order Separately)

| Cord                    | Appearance             |                                                                                     | Cord length | Model           |
|-------------------------|------------------------|-------------------------------------------------------------------------------------|-------------|-----------------|
| Standard                | Straight (4 conductor) |    | 2 m         | XS2F-D421-D80-A |
|                         |                        |                                                                                     | 5 m         | XS2F-D421-G80-A |
|                         | L-shape (4 conductor)  |    | 2 m         | XS2F-D422-D80-A |
|                         |                        |                                                                                     | 5 m         | XS2F-D422-G80-A |
| Robot (vibration-proof) | Straight (4 conductor) |   | 2 m         | XS2F-D421-D80-R |
|                         |                        |                                                                                     | 5 m         | XS2F-D421-G80-R |
|                         | L-shape (4 conductor)  |  | 2 m         | XS2F-D422-D80-R |
|                         |                        |                                                                                     | 5 m         | XS2F-D422-G80-R |

## Specifications

| Item                   | DC switching type                                                            | AC switching type                    |
|------------------------|------------------------------------------------------------------------------|--------------------------------------|
| Light source           | Pulse modulated Infrared LED                                                 |                                      |
| Indicators             | Light incident indicator (red) (power indicator for light source)            |                                      |
| Sensitivity adjustment | Only for E3F2-DS30□□                                                         | Fixed                                |
| Connection method      | Pre-wired (2 m) or connector                                                 | Pre-wired (2 m)                      |
| Operation mode         | Light-ON or Dark-ON (selectable with wiring)                                 | Light-ON or Dark-ON (separate model) |
| Circuit protection     | Output short-circuit protection, DC power supply reverse polarity protection | None                                 |
| Weight                 | Pre-wired cable models: Approx. 110 g<br>Connector models: Approx. 55 g      |                                      |
| Materials              | Case: ABS resin<br>Lens: Acrylate resin                                      |                                      |

## ■ Ratings/Characteristics

### DC Switching Models

| Item                                | E3F2-3C4-□,<br>E3F2-3B4-□                                                                                                | E3F2-R2C4-□,<br>E3F2-R2B4-□                | E3F2-DS10C4-□,<br>E3F2-DS10B4-□  | E3F2-DS30C4-□,<br>E3F2-DS30B4-□                 |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|----------------------------------|-------------------------------------------------|
|                                     | Through-beam                                                                                                             | Retroreflective                            | Diffuse reflective               |                                                 |
| Power supply voltage                | 10 to 30 VDC (Including 10% ripple)                                                                                      |                                            |                                  |                                                 |
| Current consumption                 | 45 mA max. (Light source and receiver)                                                                                   | 25 mA max.                                 |                                  |                                                 |
| Sensing distance (typ., see note 1) | 3 m (4 m typ.)                                                                                                           | 0.1 to 2 m (2.5 m typ.) (E39-R1 Reflector) | 10 cm (5 x 5 cm white mat paper) | 30 cm (40 cm typ.) (10 x 10 cm white mat paper) |
| Sensing object                      | Opaque object: 11 mm min.                                                                                                | Opaque object: 56 mm min.                  | Transparent, opaque objects      |                                                 |
| Directional angle                   | 3° to 20°                                                                                                                |                                            | ---                              |                                                 |
| Differential travel                 | ---                                                                                                                      |                                            | 20% max.                         |                                                 |
| Response time                       | 2.5 ms max.                                                                                                              |                                            |                                  |                                                 |
| Control output                      | Transistor output (open collector) 100 mA max.; residual voltage: 2 V max. at 100 mA                                     |                                            |                                  |                                                 |
| Power reset time                    | 50 ms max.                                                                                                               |                                            |                                  |                                                 |
| Ambient illumination (see note 2)   | Incandescent lamp: Illumination on optical spot: 3,000 lx max.<br>Sunlight: Illumination on optical spot: 10,000 lx max. |                                            |                                  |                                                 |
| Ambient temperature                 | Operating: -25°C to 55°C (with no icing)<br>Storage: -30°C to 70°C (with no icing)                                       |                                            |                                  |                                                 |
| Ambient humidity                    | Operating: 35% to 85%<br>Storage: 35% to 95%                                                                             |                                            |                                  |                                                 |
| Insulation resistance               | 20 MΩ min. (at 500 VDC) between current carry parts and case                                                             |                                            |                                  |                                                 |
| Dielectric strength                 | 1,000 VAC, 50/60 Hz for 1 min between current carry parts and case                                                       |                                            |                                  |                                                 |
| Vibration resistance                | 10 to 55 Hz, 1.5-mm double amplitude for 2 hrs each in X, Y, and Z directions                                            |                                            |                                  |                                                 |
| Shock resistance                    | 500 m/s <sup>2</sup> (approx. 50G)                                                                                       |                                            |                                  |                                                 |
| Enclosure ratings                   | IEC IP66, NEMA 1, 2, 4 (indoor)                                                                                          |                                            |                                  |                                                 |

**Note:** 1. Actual stable sensing distance. For details, see the Gain vs. Set distance ratios in "Engineering Data."

2. The intensity of illumination on the surface of the receiver with a 20% fluctuation of the optical output per 200 lx. This is not the maximum available operating illumination.

## AC Switching Models

| Item                                | E3F2-3Z1,<br>E3F2-3Z2                                                                                                    | E3F2-R2Z1,<br>E3F2-R2Z2                    | E3F2-DS10Z1-N,<br>E3F2-DS10Z2-N  |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|----------------------------------|
|                                     | Through-beam                                                                                                             | Retroreflective                            | Diffuse reflective               |
| Power supply voltage                | 24 to 240 VAC $\pm$ 10%, 50/60 Hz                                                                                        |                                            |                                  |
| Current consumption                 | 10 mA max. (Light source and receiver)                                                                                   | 5 mA max.                                  |                                  |
| Sensing distance (typ., see note 1) | 3 m (4 m typ.)                                                                                                           | 0.1 to 2 m (2.5 m typ.) (E39-R1 Reflector) | 10 cm (5 x 5 cm white mat paper) |
| Sensing object                      | Opaque object: 11 mm min.                                                                                                | Opaque object: 56 mm min.                  | Transparent, opaque objects      |
| Directional angle                   | 3° to 20°                                                                                                                |                                            | ---                              |
| Differential travel                 | ---                                                                                                                      |                                            | 20% max.                         |
| Response time                       | 30 ms max.                                                                                                               |                                            |                                  |
| Control output                      | AC solid state (SCR) 200 mA max.; residual voltage: 5 V max. at 200 mA (see note 3)                                      |                                            |                                  |
| Power reset time                    | 100 ms max.                                                                                                              |                                            |                                  |
| Ambient illumination (see note 2)   | Incandescent lamp: Illumination on optical spot: 3,000 lx max.<br>Sunlight: Illumination on optical spot: 10,000 lx max. |                                            |                                  |
| Ambient temperature                 | Operating: -25°C to 55 °C (with no icing)<br>Storage: -30°C to 70 °C (with no icing)                                     |                                            |                                  |
| Ambient humidity                    | Operating: 35% to 85%<br>Storage: 35% to 95%                                                                             |                                            |                                  |
| Insulation resistance               | 20 M $\Omega$ min. (at 500 VDC) between current carry parts and case                                                     |                                            |                                  |
| Dielectric strength                 | 1,500 VAC, 50/60 Hz for 1 min between current carry parts and case                                                       |                                            |                                  |
| Vibration resistance                | 10 to 55 Hz, 1.5-mm double amplitude for 2 hrs each in X, Y, and Z directions                                            |                                            |                                  |
| Shock resistance                    | 500 m/s <sup>2</sup> (approx. 50G)                                                                                       |                                            |                                  |
| Enclosure ratings                   | IEC IP66, NEMA 1, 2, 4 (indoor)                                                                                          |                                            |                                  |

Note: 1. Actual stable sensing distance. For details, see the Gain vs. Set distance ratios in "Engineering Data."

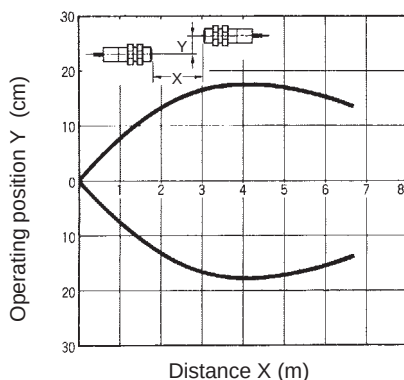
2. The intensity of illumination on the surface of the receiver with a 20% fluctuation of the optical output per 200 lx. This is not the maximum available operating illumination.

3. When you use the Photoelectric Sensor at the temperature over 45°C, the load current must be within derated value. Please refer to "Precautions."

## Engineering Data

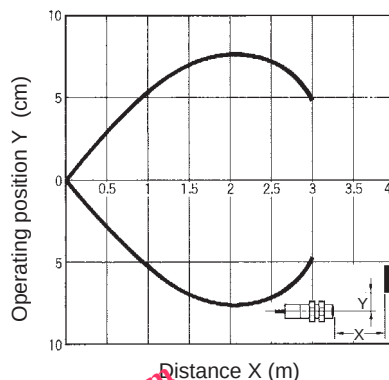
## Operating Range (Typical)

E3F2-3□□-□□ (Through-beam)



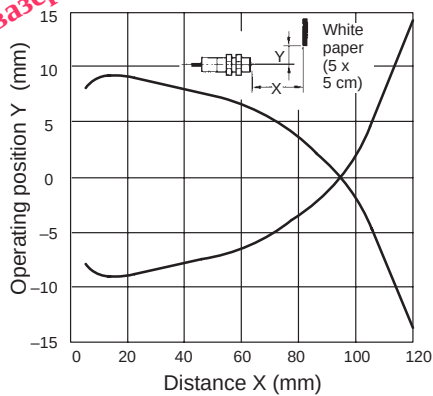
## Operating Range (Typical)

E3F2-R2□□-□□ (Retroreflective)

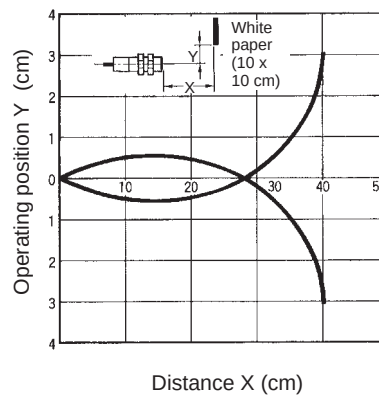


## Operating Range (Typical)

E3F2-DS10□□-N  
E3F2-DS10□□-P1

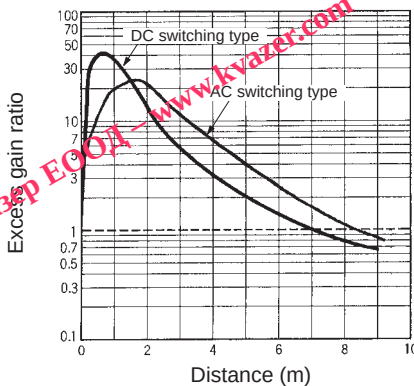


E3F2-DS30□□-□□

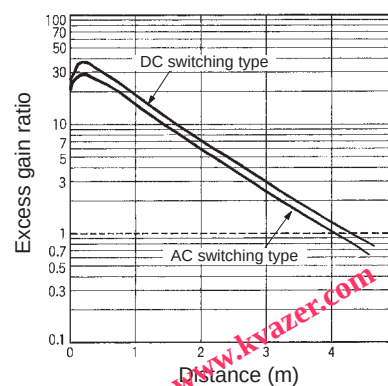


## Excess Gain vs. Set Distance (Typical)

E3F2-3□□-□□

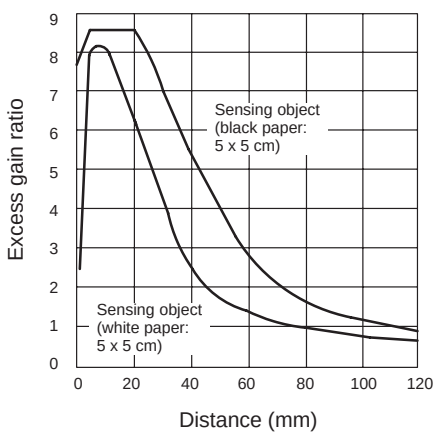


E3F2-R2□□-□□

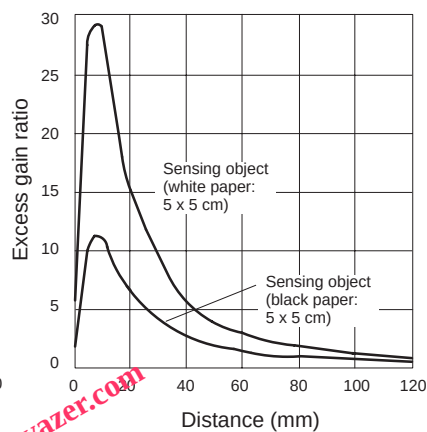


## Excess Gain vs. Set Distance

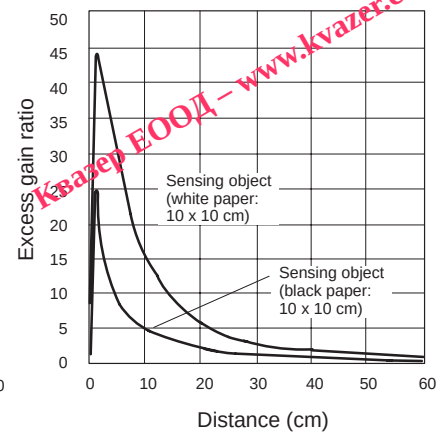
E3F2-DS10Z□□-N



E3F2-DS10□□-N  
E3F2-DS10□□-P1



E3F2-DS30□□-4  
E3F2-DS30□□-P1



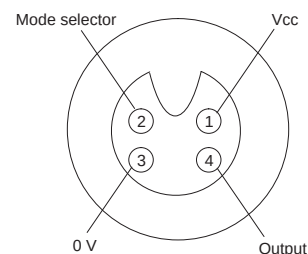
# Operation

## ■ Output Circuits

| Configuration       | Model                                                           | Connection method                                       | Output transistor                       | Output circuit |
|---------------------|-----------------------------------------------------------------|---------------------------------------------------------|-----------------------------------------|----------------|
| NPN pre-wired cable | E3F2-3C4<br>E3F2-R2C4<br>E3F2-DS10C4-N<br>E3F2-DS30C4           | Connect the pink and brown cords or open the pink cord. | ON when light is incident. (Light-ON)   |                |
|                     |                                                                 | Connect the pink and blue cords.                        | ON when light is interrupted. (Dark-ON) |                |
| PNP pre-wired cable | E3F2-3B4<br>E3F2-R2B4<br>E3F2-DS10B4-N<br>E3F2-DS30B4           | Connect the pink and brown cords or open the pink cord. | ON when light is incident. (Light-ON)   |                |
|                     |                                                                 | Connect the pink and blue cords.                        | ON when light is interrupted. (Dark-ON) |                |
| NPN connector       | E3F2-3C4-P1<br>E3F2-R2C4-P1<br>E3F2-DS10C4-P1<br>E3F2-DS30C4-P1 | Connect the pink and brown cords or open the pink cord. | ON when light is incident. (Light-ON)   |                |
|                     |                                                                 | Connect the pink and blue cords.                        | ON when light is interrupted. (Dark-ON) |                |

**Note:** Terminals No. for Connector type.

### Light-ON Mode

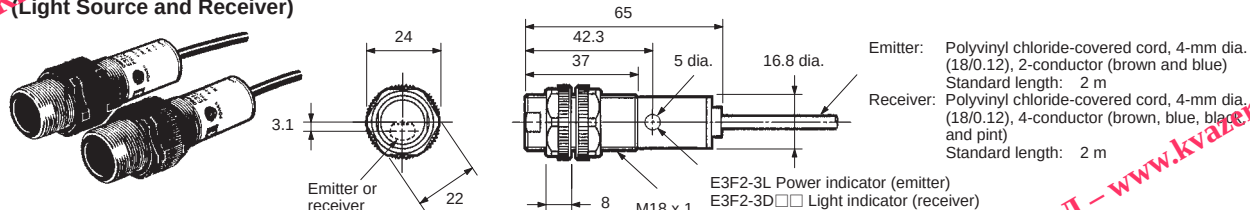




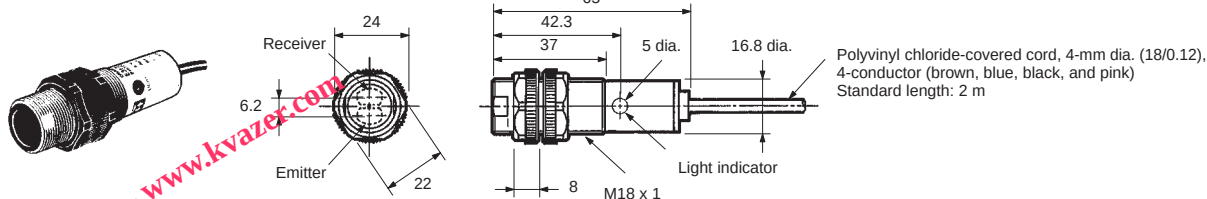
# Dimensions

**Note:** All units are in millimeters unless otherwise indicated.

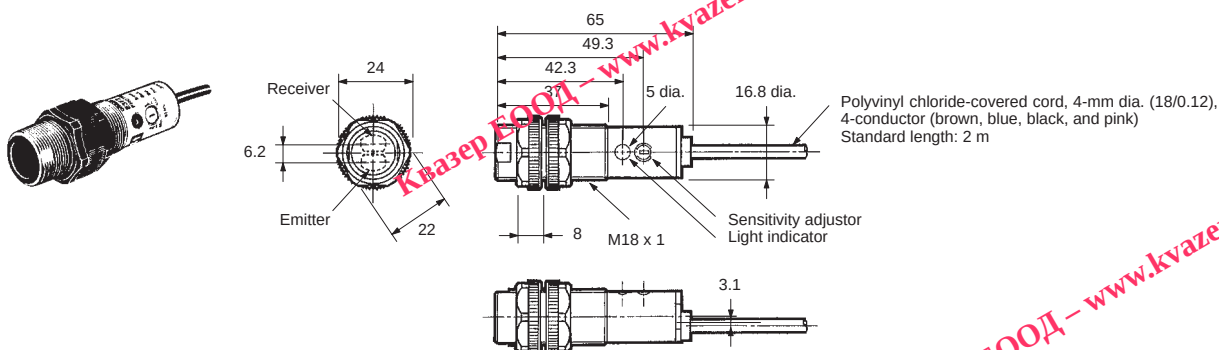
## E3F2-3C4, E3F2-3B4 (Light Source and Receiver)



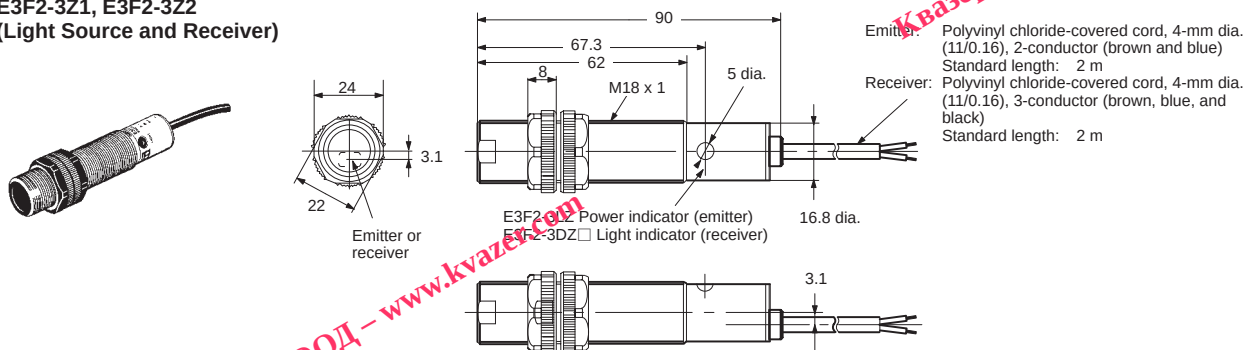
## E3F2-R2C4, E3F2-R2B4 E3F2-DS10C4-N, E3F2-DS10B4-N



## E3F2-DS30C4, E3F2-DS30B4

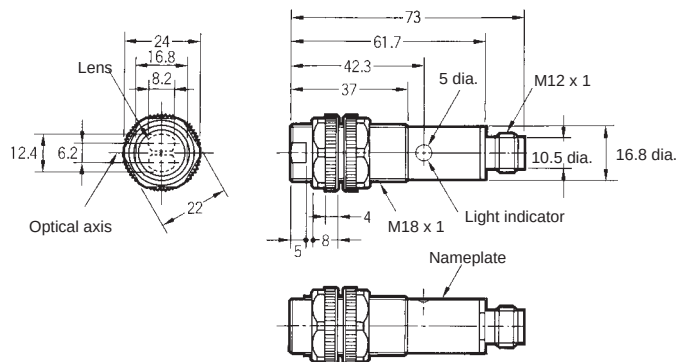


## E3F2-3Z1, E3F2-3Z2 (Light Source and Receiver)

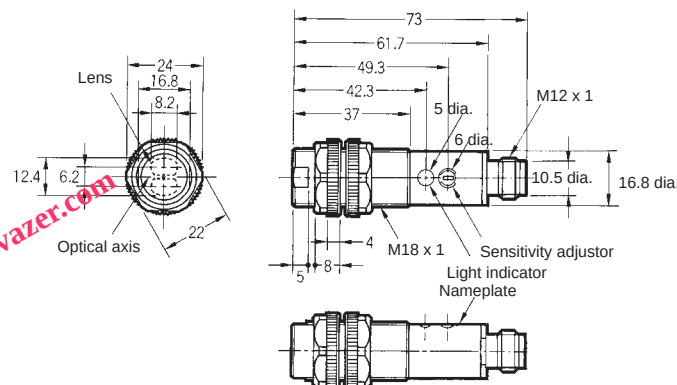




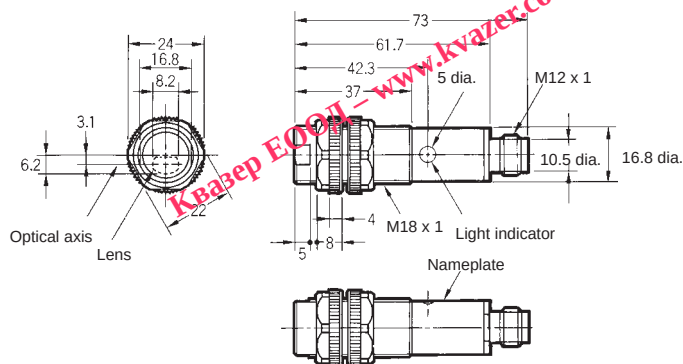
E3F2-R2□4-P1  
E3F2-DS10□4-P1



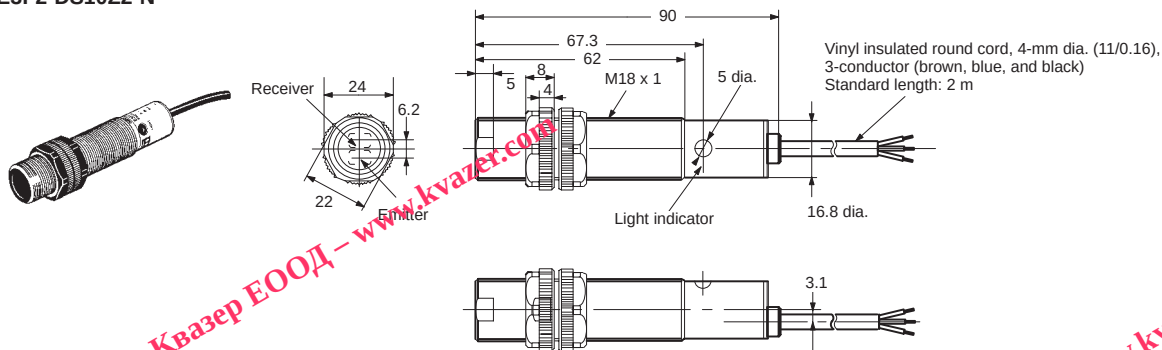
E3F2-DS30□4-P1



E3F2-3□4-P1

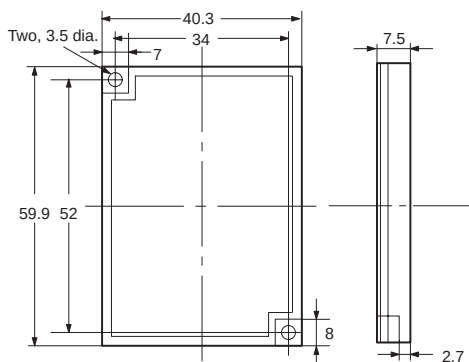
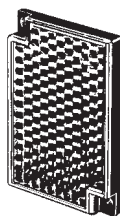


E3F2-R2Z1, E3F2-R2Z2  
E3F2-DS10Z1-N,  
E3F2-DS10Z2-N

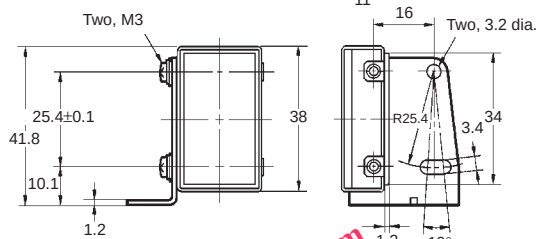
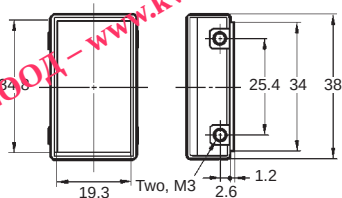
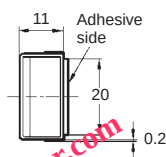


## Accessories

## E39-R1 Retroreflector

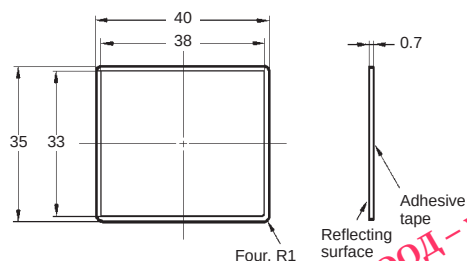
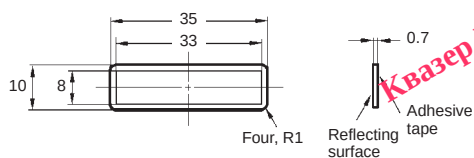


## E39-R3 Retroreflector

Mounting Bracket for E39-R3  
(Sold Together)

## E39-RSA Retroreflector

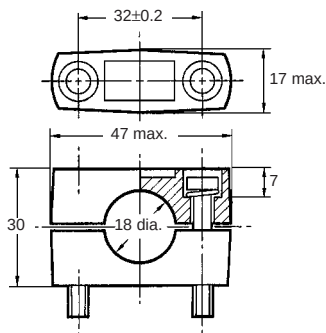
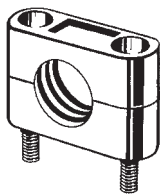
## E39-RSB Retroreflector



**Note:** When connected to the E3F2-R2, the sensing distance for each Retroreflector will differ as seen below.

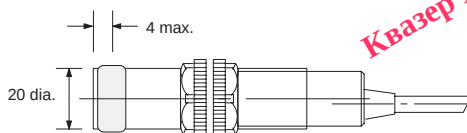
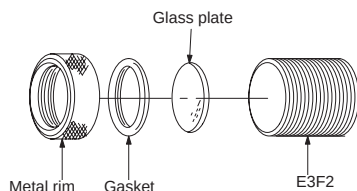
| Retroreflector   | E39-R3      | E39-RSA     | E39-RSB     |
|------------------|-------------|-------------|-------------|
| Sensing distance | 5 to 100 cm | 20 to 50 cm | 20 to 80 cm |

## Y92E-B18 Mounting Bracket



**Note:** Hexagonal bolt: M5 x 32  
Material: plastic

## E39-F31 Lens Cap

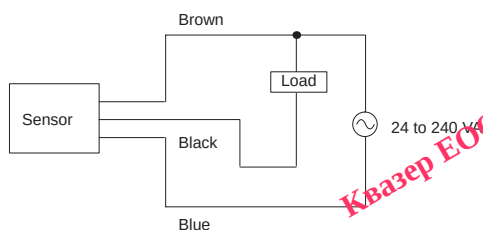


## Precautions

If the input/output lines of the Photoelectric Sensor are placed in the same conduit or duct as power lines or high-voltage lines, the Photoelectric Sensor could be induced to malfunction, or even be damaged, by electrical noise. Separate the wiring, or use shielded lines as input/output lines to the Photoelectric Sensor.

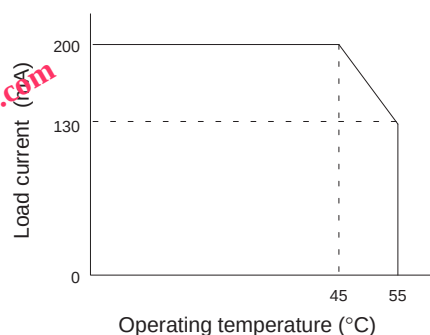
Do not subject the Photoelectric Sensor to excessive shock when mounting, in keeping with IP66 standards.

Do not connect the black wire to the brown wire without a load. Direct connection of these wires may damage the Photoelectric Sensor (AC switching type).



When you use the Photoelectric Sensor in the vicinity of an inverter motor, be sure to connect the protective earth ground wire of the motor to earth. Failure to ground the motor may result in malfunction of the Sensor.

When you use the Photoelectric Sensor at temperatures over 45°C, the load current must be within the derated value shown in the figure below.



### WARNING

The E3F2 Photoelectric Sensor is not a safety component for ensuring the safety of people which is defined in EC Directive (91/368/EEC) and covered by separate European standards or by any other regulations or standards.

### Mounting

Do not exceed a torque of 20 kgf • cm (2.0 N • m) when tightening mounting nuts.



### ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. E224-E1-5

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

## OMRON Corporation

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