Photoelectric sensors in M18 stainless steel housing

# E3FC

## Best durability for wash-down applications

- High grade steel housing (SUS316L)
- Withstands heat shock conditions
- Epoxy resin preventing water ingress if connector is not fixed properly
- Proven with various industrial detergents of Ecolab and Diversey (Details see page 10)
- Bright visible red LED enabling easy alignment

ECOLAB Diversey

## Ordering Information

### Sensors

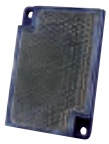
Red light  Infrared light

| Sensor type | Sensing distance | Connection method | Model | |
|---|---|---|---|---|
| | | | NPN output | PNP output |
| Through-beam | 20 m | pre-wired | **E3FC-TN11 2M** *1 | **E3FC-TP11 2M** *1 |
| | | M12 connector | **E3FC-TN21** *1 | **E3FC-TP21** *1 |
| Retro-reflective with MSR function *2 | 0.1 to 4 m with E39-R1S | pre-wired | **E3FC-RN11 2M** | **E3FC-RP11 2M** |
| | | M12 connector | **E3FC-RN21** | **E3FC-RP21** |
| Diffuse-reflective *3 | 300 mm | pre-wired | **E3FC-DN12 2M** | **E3FC-DP12 2M** |
| | | M12 connector | **E3FC-DN22** | **E3FC-DP22** |
| | 1 m | pre-wired | **E3FC-DN13 2M** | **E3FC-DP13 2M** |
| | | M12 connector | **E3FC-DN23** | **E3FC-DP23** |
| | 300 mm | pre-wired | **E3FC-DN15 2M** | **E3FC-DP15 2M** |
| | | M12 connector | **E3FC-DN25** | **E3FC-DP25** |
| | 1 m | pre-wired | **E3FC-DN16 2M** | **E3FC-DP16 2M** |
| | | M12 connector | **E3FC-DN26** | **E3FC-DP26** |
| BGS *3 (background suppression) | 100 mm | pre-wired | **E3FC-LN11 2M** | **E3FC-LP11 2M** |
| | | M12 connector | **E3FC-LN21** | **E3FC-LP21** |
| | 200 mm | pre-wired | **E3FC-LN12 2M** | **E3FC-LP12 2M** |
| | | M12 connector | **E3FC-LN22** | **E3FC-LP22** |

*1. The set type includes the emitter and receiver.
*2. The Reflector is sold separately. Select the Reflector model most suited to the application.
*3. L-On fixed output available for Diffuse reflective and BGS models. Please add "A" in order code (e.g. E3FC-DP11A 2M)

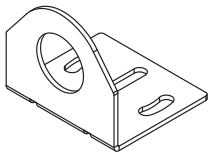
## Reflectors [Refer to *Dimensions on page 11.*]

**Reflectors required for Retro-reflective Sensors: A Reflector is not provided with the Sensor. Be sure to order a Reflector separately.**

| Sensing distance | Appearance | Model | Remarks |
|---|---|---|---|
| 0.1 to 4 m |  | **E39-R1S** | IP67 |
| 0.1 to 4 m |  | **E39-R50** | IP67, IP69K<br>Ecolab tested plastic material |

## Mounting brackets [Refer to *Dimensions on page 11.*]

**A Mounting Bracket is not enclosed with the Sensor. Order a Mounting Bracket separately if required.**

| Sensor | Appearance | Model (Material) | Remarks |
|---|---|---|---|
| all types |  | **E39-L183** (SUS304) | Mounting bracket |
| |  | **E39-EL16** (SUS316L) | M18 Flush mounting nut |

## Sensor I/O connectors

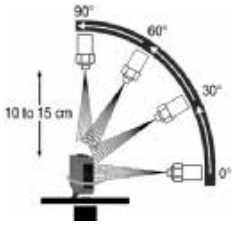
**Models for Connectors: A Connector is not provided with the Sensor. Be sure to order a Connector separately.**

| Sensor | Model | Material | Appearance | Cable type | | Model |
|---|---|---|---|---|---|---|
| M12 connector types | Detergent resistant connector cable | Cable: Detergent resistant PVC<br>Connector: SUS316L | Straight  | 2 m | 4-wire | **Y92E-S12PVC4S2M-L** |
| | | | | 5 m | | **Y92E-S12PVC4S5M-L** |
| | | | Angle  | 2 m | | **Y92E-S12PVC4A2M-L** |
| | | | | 5 m | | **Y92E-S12PVC4A5M-L** |

## Ratings and Specifications

| Item | | | Through-beam | Retro-reflective with MSR function |
|---|---|---|---|---|
| Model | Sensing method | | | |
| | NPN output | Pre-wired | E3FC-TN11 2M | E3FC-RN11 2M |
| | | M12 Connector | E3FC-TN21 | E3FC-RN21 |
| | PNP output | Pre-wired | E3FC-TP11 2M | E3FC-RP11 2M |
| | | M12 Connector | E3FC-TP21 | E3FC-RP21 |
| Sensing distance | | | 20 m | 0.1 to 4 m (with E39-R1S) |
| Spot diameter (reference value) | | | — | |
| Standard sensing object | | | Opaque: 7 mm dia.min. | Opaque: 75 mm dia.min. |
| Differential travel | | | — | |
| Directional angle | | | 2° min. | |
| Light source (wavelength) | | | Red LED (624 nm) | Red LED (624 nm) |
| Power supply voltage | | | 10 to 30 VDC (include voltage ripple of 10%(p-p) max.) | |
| Current consumption | | | 40 mA max. (Emitter 25 mA max. Receiver 15 mA max.) | 25 mA max. |
| Control output | | | NPN/PNP (open collector) Load current: 100 mA max. (Residual voltage: 3 V max.), Load power supply voltage: 30 VDC max. | |
| Operation mode | | | Light-ON/Dark-ON selectable by wiring *1. | |
| Indicator | | | Operation indicator (orange) Stability indicator (green) Power indicator (green): only Emitter of Through-beam | |
| Protection circuits | | | Power supply reverse polarity protection, Output short-circuit protection, and Output reverse polarity protection | |
| Response time | | | 0.5 ms | |
| Sensitivity adjustment | | | Fixed | |
| Ambient illumination (Receiver side) | | | Incandescent lamp: 3,000 lx max./ Sunlight: 10,000 lx max. | |
| Ambient temperature range | | | Operating: -25 to 55°C/ Storage: -30 to 70°C (with no icing or condensation) | |
| Ambient humidity range | | | Operating: 35 to 85%/ Storage: 35 to 95% (with no condensation) | |
| Insulation resistance | | | 20 MΩ min. at 500 VDC | |
| Dielectric strength | | | 1,000 VAC at 50/60 Hz for 1 min. between current-carrying parts and case | |
| Vibration resistance | | | Destruction: 10 to 55 Hz, 1.5 mm double amplitude for 2 hours each in X, Y and Z directions | |
| Shock resistance | | | Destruction: 500 m/s$^2$ 3 times each in X, Y and Z directions | |
| Degree of protection | | | IEC: IP67, IP68 *2., DIN 40050-9: IP69K *3. | |
| Weight | Pre-wired cable (2M) | | 152 g | 76 g |
| | Connector | | 44 g | 22 g |
| Material | Case | | SUS 316L (1.4404) | |
| | Lens and Display | | PMMA | |
| | Adjuster | | – | |
| | Nut | | SUS 316L (1.4404) | |
| Accessories | | | Instruction sheet M18 nuts (4 pcs) | Instruction sheet M18 nuts (2 pcs) |

*1. L-On fixed output available for Diffuse reflective and BGS models. Please add "A" in order code (e.g. E3FC-DP11A 2M)
*2. IP68 Degree of Protection Specifications
IP68 is defined by heat shock resistance with 20 test cycles of 30 min. changing between 3° and 60° surface tensioned water.
*3. IP69K Degree of Protection Specifications
IP69K is a protection specification stipulated by DIN 40050 Part 9 of the German standards.
The test item is sprayed with 80°C water from a nozzle of a specified shape at a water pressure of 80 to 100 bar. The amount of water is 14 to 16 liters per minute.
The distance between the test item and the nozzle is 10 to 15 cm. The water is discharged at angles of 0°, 30°, 60°, and 90° from the horizontal plane for 30 seconds at each angle while the test item is rotated horizontally.



| Item | | | | | | |
|---|---|---|---|---|---|---|
| Model | Sensing method | | Diffuse-reflective | | | |
| | NPN output | Pre-wired | E3FC-DN12 2M | E3FC-DN13 2M | E3FC-DN15 2M | E3FC-DN16 2M |
| | | M12 Connector | E3FC-DN22 | E3FC-DN23 | E3FC-DN25 | E3FC-DN26 |
| | PNP output | Pre-wired | E3FC-DP12 2M | E3FC-DP13 2M | E3FC-DP15 2M | E3FC-DP16 2M |
| | | M12 Connector | E3FC-DP22 | E3FC-DP23 | E3FC-DP25 | E3FC-DP26 |
| Sensing distance | | | 300 mm (white paper: 300 × 300 mm) | 1 m (white paper: 300 × 300 mm) | 300 mm (white paper: 300 × 300 mm) | 1 m (white paper: 300 × 300 mm) |
| Spot diameter (reference value) | | | 40 × 50 mm Sensing distance of 300 mm | 120 × 150 mm Sensing distance of 1 m | 40 × 50 mm Sensing distance of 300 mm | 120 × 150 mm Sensing distance of 1 m |
| Standard sensing object | | | — | | | |
| Differential travel | | | 20% max. | | | |
| Directional angle | | | — | | | |
| Light source (wavelength) | | | Red LED (624 nm) | | Infrared LED (850 nm) | |
| Power supply voltage | | | 10 to 30 VDC (include voltage ripple of 10%(p-p) max.) | | | |
| Current consumption | | | 25 mA max. | | | |
| Control output | | | NPN/PNP (open collector)<br>Load current: 100 mA max. (Residual voltage: 3 V max.), Load power supply voltage: 30 VDC max. | | | |
| Operation mode | | | Light-ON/Dark-ON selectable by wiring *3. | | | |
| Indicator | | | Operation indicator (orange)<br>Stability indicator (green) | | | |
| Protection circuits | | | Power supply reverse polarity protection, Output short-circuit protection, and Output reverse polarity protection | | | |
| Response time | | | 0.5 ms | | | |
| Sensitivity adjustment | | | One-turn adjuster | | | |
| Ambient illumination | | | Incandescent lamp: 3,000 lx max./ Sunlight: 10,000 lx max. | | | |
| Ambient temperature range | | | Operating: -25 to 55°C/ Storage: -30 to 70°C (with no icing or condensation) | | | |
| Ambient humidity range | | | Operating: 35 to 85%/ Storage: 35 to 95% (with no condensation) | | | |
| Insulation resistance | | | 20 MΩ min. at 500 VDC | | | |
| Dielectric strength | | | 1,000 VAC at 50/60 Hz for 1 min. between current-carrying parts and case | | | |
| Vibration resistance | | | Destruction: 10 to 55 Hz, 1.5 mm double amplitude for 2 hours each in X, Y and Z directions | | | |
| Shock resistance | | | Destruction: 500 m/s$^2$ 3 times each in X, Y and Z directions | | | |
| Degree of protection | | | IEC: IP67, IP68 *2., DIN 40050-9: IP69K *3. | | | |
| Weight | Pre-wired cable (2M) | | 76 g | | | |
| | Connector | | 22 g | | | |
| Material | Case | | SUS 316L (1.4404) | | | |
| | Lens and Display | | PMMA | | | |
| | Adjuster | | POM | | | |
| | Nut | | SUS 316L (1.4404) | | | |
| Accessories | | | Instruction sheet<br>M18 nuts (2 pcs) | | | |

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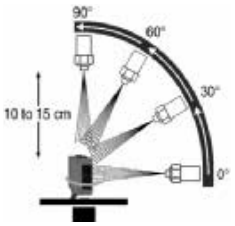
*2. IP68 Degree of Protection Specifications
IP68 is defined by heat shock resistance with 20 test cycles of 30 min. changing between 3° and 60° surface tensioned water.
*3. IP69K Degree of Protection Specifications
IP69K is a protection specification stipulated by DIN 40050 Part 9 of the German standards.
The test item is sprayed with 80°C water from a nozzle of a specified shape at a water pressure of 80 to 100 bar. The amount of water is 14 to 16 liters per minute.
The distance between the test item and the nozzle is 10 to 15 cm. The water is discharged at angles of 0°, 30°, 60°, and 90° from the horizontal plane for 30 seconds at each angle while the test item is rotated horizontally.



| Model / Item | Sensing method | | BGS (Background suppression) | |
|---|---|---|---|---|
| | NPN output | Pre-wired | E3FC-LN11 2M | E3FC-LN12 2M |
| | | M12 Connector | E3FC-LN21 | E3FC-LN22 |
| | PNP output | Pre-wired | E3FC-LP11 2M | E3FC-LP12 2M |
| | | M12 Connector | E3FC-LP21 | E3FC-LP22 |
| Sensing distance | | | 100 mm (white paper: 300 × 300 mm) | 200 mm (white paper: 300 × 300 mm) |
| Spot diameter (reference value) | | | 10 × 10 mm Sensing distance of 100 mm | 10 × 15 mm Sensing distance of 200 mm |
| Standard sensing object | | | — | |
| Differential travel | | | 20% max. | |
| Directional angle | | | — | |
| Light source (wavelength) | | | Red LED (624 nm) | |
| Power supply voltage | | | 10 to 30 VDC (include voltage ripple of 10%(p-p) max.) | |
| Current consumption | | | 25 mA max. | |
| Control output | | | NPN/PNP (open collector) Load current: 100 mA max. (Residual voltage: 3 V max.), Load power supply voltage: 30 VDC max. | |
| Operation mode | | | Light-ON/Dark-ON selectable by wiring *1. | |
| Indicator | | | Operation indicator (orange) Stability indicator (green) | |
| Protection circuits | | | Power supply reverse polarity protection, Output short-circuit protection, and Output reverse polarity protection | |
| Response time | | | 0.5 ms | |
| Sensitivity adjustment | | | Fixed | |
| Ambient illumination | | | Incandescent lamp: 3,000 lx max./ Sunlight: 10,000 lx max. | |
| Ambient temperature range | | | Operating: -25 to 55°C/ Storage: -30 to 70°C (with no icing or condensation) | |
| Ambient humidity range | | | Operating: 35 to 85%/ Storage: 35 to 95% (with no condensation) | |
| Insulation resistance | | | 20 MΩ min. at 500 VDC | |
| Dielectric strength | | | 1,000 VAC at 50/60 Hz for 1 min. between current-carrying parts and case | |
| Vibration resistance | | | Destruction: 10 to 55 Hz, 1.5 mm double amplitude for 2 hours each in X, Y and Z directions | |
| Shock resistance | | | Destruction: 500 m/s$^2$ 3 times each in X, Y and Z directions | |
| Degree of protection | | | IEC: IP67, IP68 *2., DIN 40050-9: IP69K *3. | |
| Weight (packed state/only sensor) | Pre-wired cable (2M) | | 76 g | |
| | Connector | | 22 g | |
| Material | Case | | SUS316L (1.4404) | |
| | Lens and Display | | PMMA | |
| | Adjuster | | – | |
| | Nut | | SUS316L (1.4404) | |
| Accessories | | | Instruction sheet M18 nuts (2 pcs) | |

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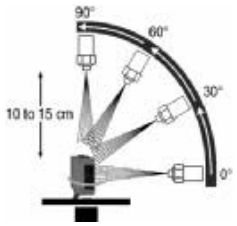
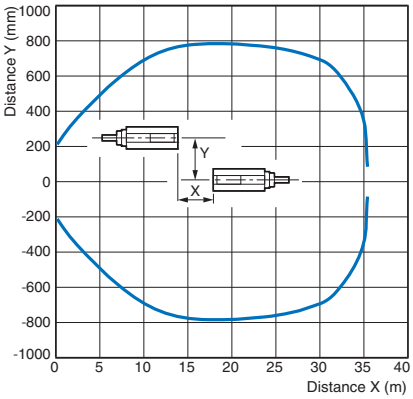
The distance between the test item and the nozzle is 10 to 15 cm. The water is discharged at angles of 0°, 30°, 60°, and 90° from the horizontal plane for 30 seconds at each angle while the test item is rotated horizontally.



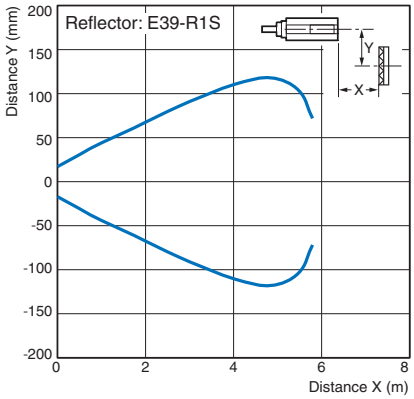
# Engineering Data (Reference Value)

## Parallel Operating Range

### Through-beam Models
### E3FC-T□

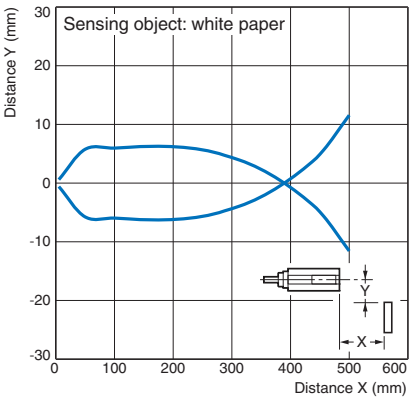



### Retro-reflective Models (with MSR function)
### E3FC-R□

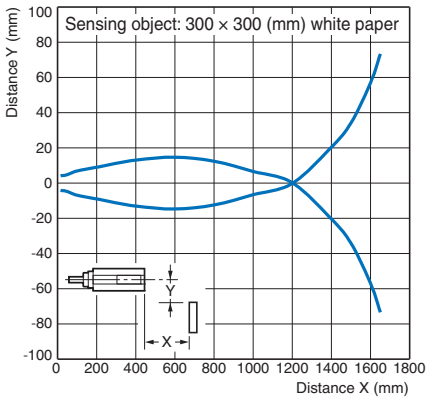



## Operating Range

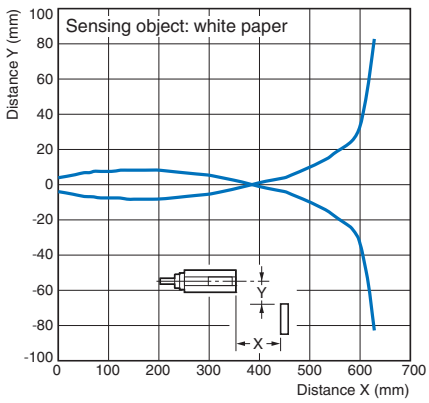
### Diffuse-reflective Models
### E3FC-D□2



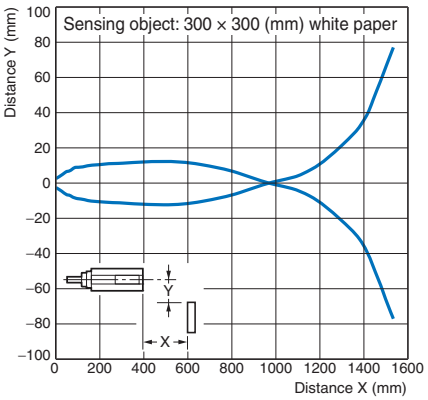

### E3FC-D□3



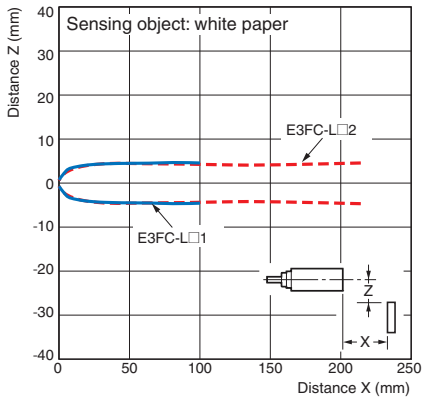

### E3FC-D□5




### E3FC-D□6

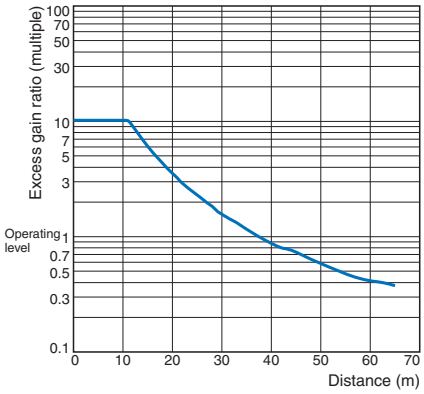



### BGS Models
### E3FC-L□1, E3FC-L□2

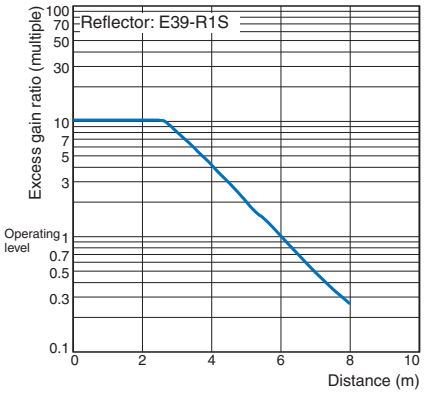


## Excess Gain vs. Distance

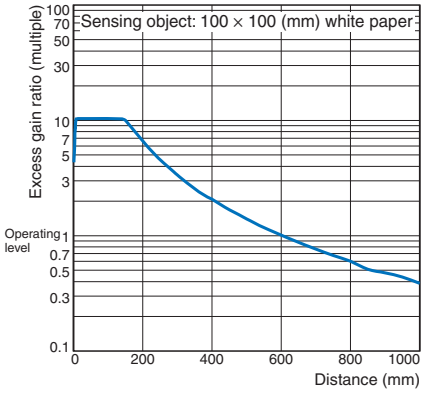
### Through-beam Models
### E3FC-T□



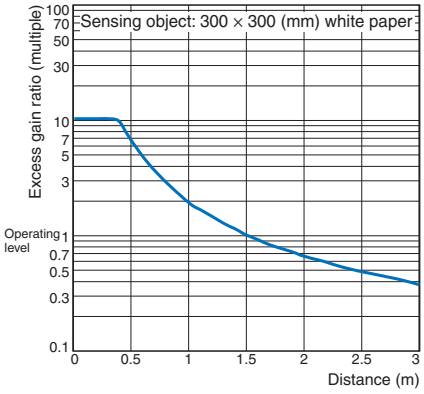

### Retro-reflective Models (with MSR function)
### E3FC-R□



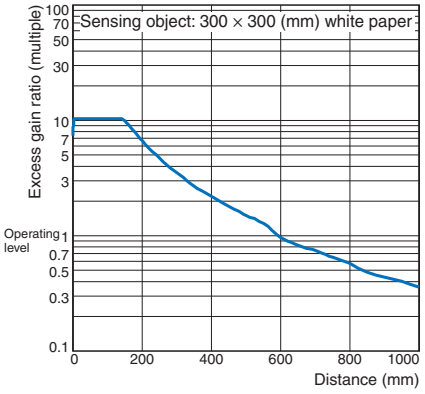

### Diffuse-reflective Models
### E3FC-D□2



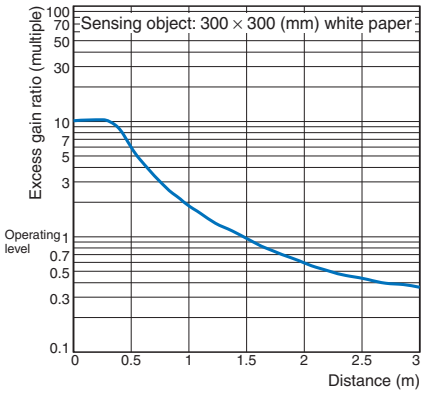

### E3FC-D□3




### E3FC-D□5

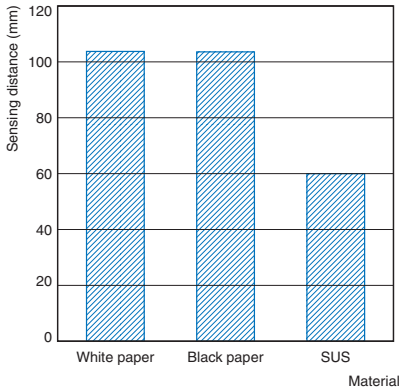



### E3FC-D□6

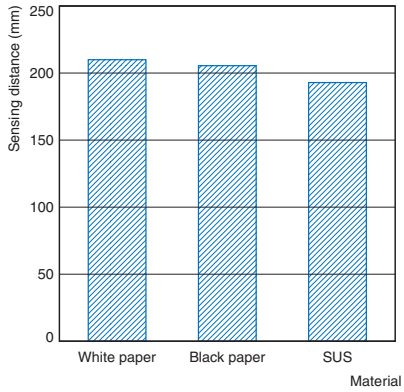



## Sensing Distance vs. Sensing Object Material

### BGS Models
### E3FC-L□1

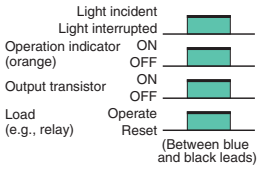
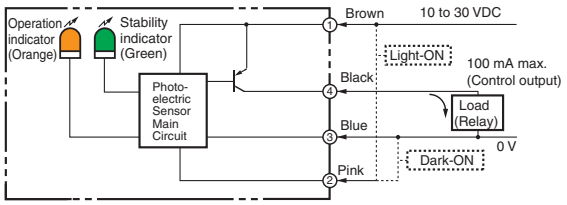
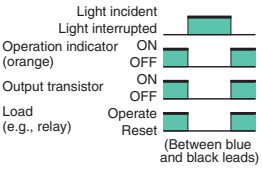
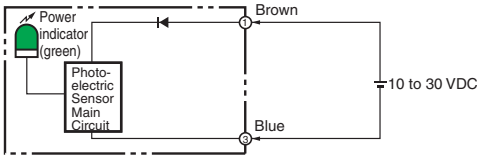



### E3FC-L□2



## Output circuit diagram

### PNP Output

<table>
<tr><th>Model</th><th>Operation mode</th><th>Timing charts</th><th>Operation selector</th><th>Output circuit</th></tr>
<tr><td rowspan="3">E3FC-TP□<br>E3FC-RP□<br>E3FC-DP□</td><td>Light-ON</td><td> 
</td><td>Connect the pink wire (Pin(2)) to the brown (Pin(1))</td><td rowspan="2">Through-beam Receivers, Retro-reflective Models, Diffuse-reflective Models<br> 
</td></tr>
<tr><td>Dark-ON</td><td> 
</td><td>Connect the pink wire (Pin(2)) to the blue (Pin(3)) or open the pink wire (Pin(2))</td></tr>
<tr><td colspan="4">Through-beam Emitter<br> 
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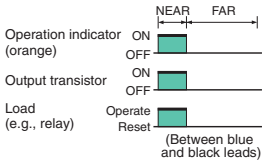
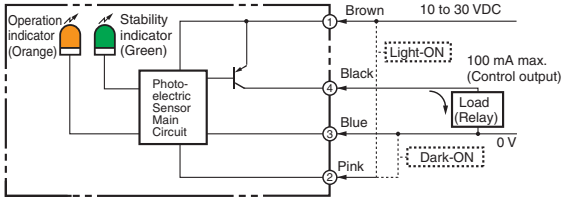
<tr><td rowspan="2">E3FC-LP□</td><td>Light-ON</td><td> 
</td><td>Connect the pink wire (Pin(2)) to the brown (Pin(1))</td><td rowspan="2">Background suppression.<br> 
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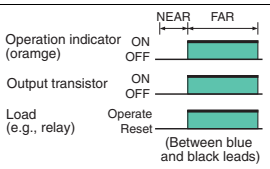
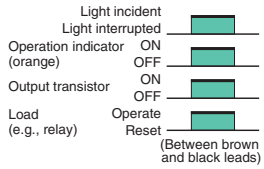
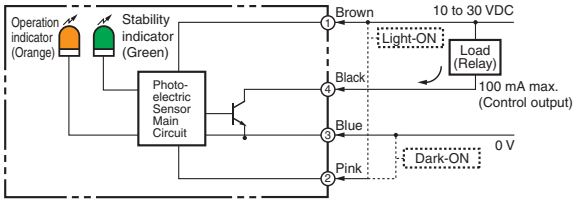
<tr><td>Dark-ON</td><td> 
</td><td>Connect the pink wire (Pin(2)) to the blue (Pin(3)) or open the pink wire (Pin(2))</td></tr>
</table>

## NPN Output

<table>
<tr><th>Model</th><th>Operation mode</th><th>Timing charts</th><th>Operation selector</th><th>Output circuit</th></tr>
<tr><td rowspan="3">E3FC-TN□<br>E3FC-RN□<br>E3FC-DN□</td><td>Light-ON</td><td> 
</td><td>Connect the pink wire (Pin(2)) to the brown (Pin(1)) or open the pink wire (Pin(2))</td><td rowspan="2">Through-beam Receivers, Retro-reflective Models, Diffuse-reflective Models<br> 
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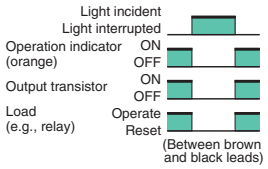
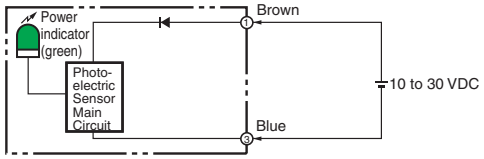
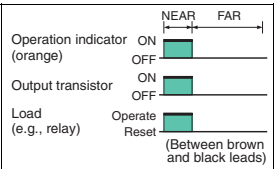
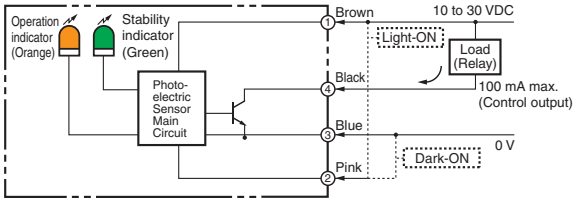
<tr><td>Dark-ON</td><td> 
</td><td>Connect the pink wire (Pin(2)) to the blue (Pin(3))</td></tr>
<tr><td colspan="3">Through-beam Emitter<br> 
</td></tr>
<tr><td rowspan="2">E3FC-LN□</td><td>Light-ON</td><td> 
</td><td>Connect the pink wire (Pin(2)) to the brown (Pin(1)) or open the pink wire (Pin(2))</td><td rowspan="2">Background suppression.<br> 
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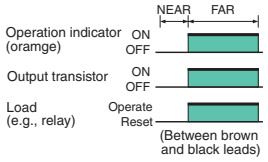
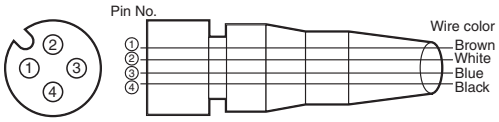
<tr><td>Dark-ON</td><td> 
</td><td>Connect the pink wire (Pin(2)) to the blue (Pin(3))</td></tr>
</table>

## Connector Pin Arrangement

### M12 Connector Pin Arrangement


## Connectors (Sensor I/O connectors)

### M12 4-wire Connectors




| Classification | Wire color | Connector pin No. | Application |
|---|---|---|---|
| DC | Brown | ① | Power supply (+V) |
| | White | ② | L/on · D/on selectable |
| | Blue | ③ | Power supply (0 V) |
| | Black | ④ | Output |

## Safety Precautions

**Refer to *Warranty and Limitations of Liability*.**

**⚠ WARNING**

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

**⚠ CAUTION**

**Never use the product with an AC power supply.**
**Do not use the product with voltage in excess of the rated voltage.**

**Do not use the product with incorrect wiring.**
**Otherwise, explosion, fire, malfunction may result.**

### Precautions for Safe Use

Be sure to follow the safety precautions below for added safety.

1. Do not use the sensor under the environment with explosive, flammable or corrosive gas.
2. Do not use the sensor under the oil or chemical environment exceeding specifications. Performance is assured for typical detergents and disinfectants used in Food & Beverage industry.

Refer to the following table when using these agents:

| Manufacturer | Product name | Concen-tration | Testtime |
|---|---|---|---|
| Diversey | Diverfoam SMS HD | 5% | 720 h |
| | Oxofoam | 5% | 720 h |
| | Acifoam | 5% | 720 h |
| | Divosan Hypochlorit | 1% | 720 h |
| | Divosan Forte | 1% | 720 h |
| Ecolab | P3-topactive® 200 | 5% | 720 h |
| | P3-topax® 56 | 5% | 720 h |
| | P3-topactive® OKTO | 3% | 720 h |
| | P3-topax® 990 | 3% | 720 h |
| | P3-topax® 66 | 3% | 720 h |

3. Do not use the sensor under the environment under the other conditions in excess of rated.
4. Do not use the sensor in place that is exposed by direct sunlight.
5. Do not use the sensor in place where the sensor may receive direct vibration or shock.
6. Do not use the thinner, alcohol, or other organic solvents.
7. Never disassemble, repair nor tamper with the sensor.
8. Please process it as industrial waste.

### Precautions for Correct Use

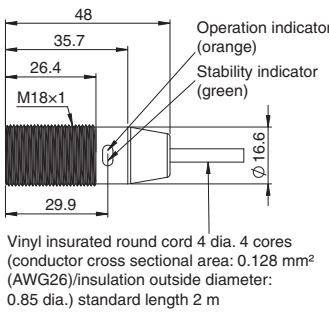
1. Laying Sensor wiring in the same conduit or duct as high-voltage wires or power lines may result in malfunction or damage due to conduit or use shielded cable.
2. Do not pull on the cable with excessive force.
3. If a commercial switching regulator is used, ground the FG (frame ground) terminal.
4. The sensor will be available 100 ms after the power supply is tuned ON. Start to use 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.
5. Output pulses may be generated even when the power supply is OFF. Therefore, it is recommended to first turn OFF the power supply for the load or the load line.
6. The sensor must be mounted using the provided nuts. The proper tightening torque is 20 N°m max..

## Dimensions

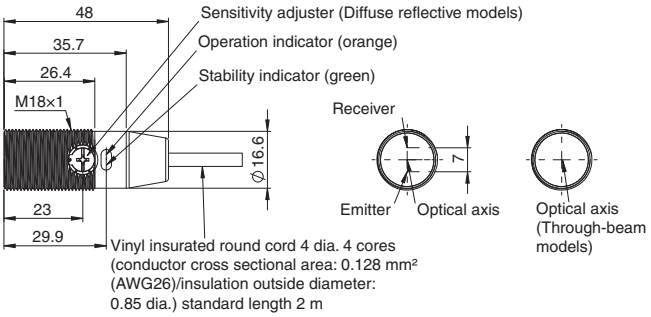
(Unit: mm)
Tolerance class IT16 applies to dimensions in this data sheet unless otherwise specified.

### Sensors

**Pre-wired Models**
**E3FC-T□1□**
**E3FC-R□1□**
**E3FC-D□1□**
**E3FC-L□1□**

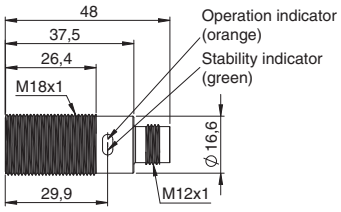


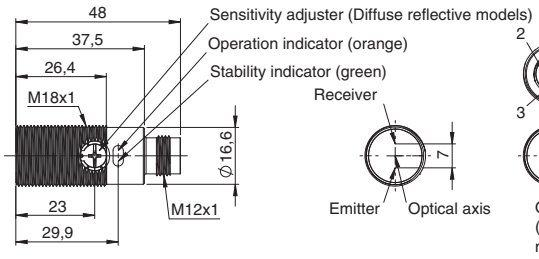

Vinyl insurated round cord 4 dia. 4 cores (conductor cross sectional area: 0.128 mm² (AWG26)/insulation outside diameter: 0.85 dia.) standard length 2 m




Vinyl insurated round cord 4 dia. 4 cores (conductor cross sectional area: 0.128 mm² (AWG26)/insulation outside diameter: 0.85 dia.) standard length 2 m

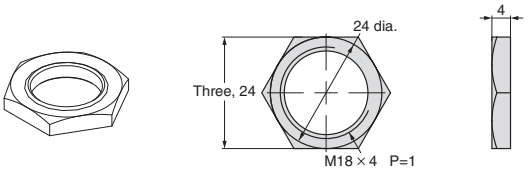
**M12 Connector Models**
**E3FC-T□2□**
**E3FC-R□2□**
**E3FC-D□2□**
**E3FC-L□2□**




| Terminal No. | Specification |
|---|---|
| 1 | +V |
| 2 | L/on · D/on selectable |
| 3 | 0V |
| 4 | Output |

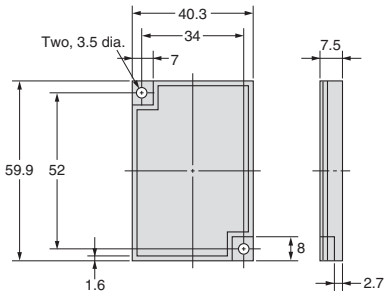
## Attached nut



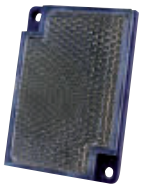

## Accessories (Order Separately)

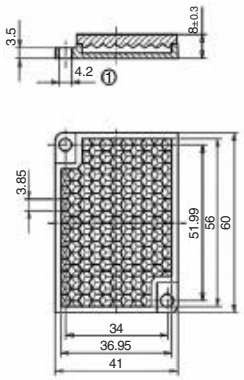
### Reflectors

**E39-R1S**



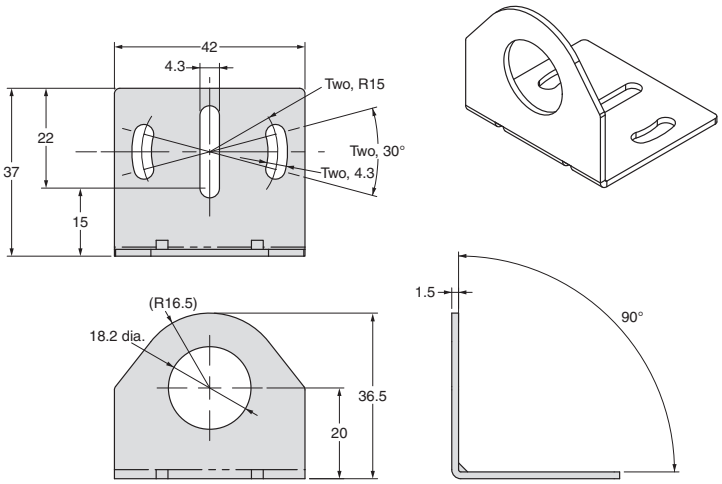

**E39-R50**






### Mounting brackets

**E39-L183**




### Flush mounting nut

**E39-EL16**