OMRON

# Photoelectric Sensors
# E3F2

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

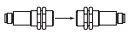
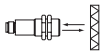
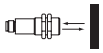
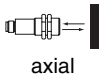
- M18 DIN-sized cylindrical housing
- Housing materials: plastic, nickel plated brass and stainless steel
- Axial and radial types (with integrated 90°-optics)
- Enclosure rating IP67
- DC switching types with connectors for easy maintenance
- Full metal plug-in type
- Sensing distance separate types: 7 m, 10 m
- Retroreflective polarizing types: 2 m, 4 m
- Background suppression type: 10 cm
- Long detection distance (0.3 m, 1 m) with sensitivity adjuster for diffuse type
- Wide-beam characteristics (10 cm) for diffuse type
- 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 types)
- UL listed (DC switching types)

# Ordering Information

## ■ DC-Switching Models

### Housing Material: Plastic

**Note:** Shaded models are normally stocked.

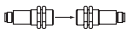
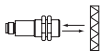
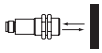
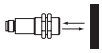
| Sensing method | | | Appearance | Connection method | Sensing distance | Model | |
|---|---|---|---|---|---|---|---|
| | | | | | | PNP output | NPN output |
| Through-beam | Multi purpose | |  axial | pre-wired | 7 m | **E3F2-7B4** | **E3F2-7C4** |
| | | | | M12 connector | | **E3F2-7B4-P1** | **E3F2-7C4-P1** |
| | - precision detection (*1)<br>- test input | | | pre-wired | 10 m | **E3F2-10B4** | **E3F2-10C4** |
| | | | | M12 connector | | **E3F2-10B4-P1** | **E3F2-10C4-P1** |
| Retro-reflective (incl. reflector E39-R1 or E39-R1S) | Non-polarizing (without MSR function) | |  axial | pre-wired | 0.1 - 2 m (*2) | **E3F2-R2B4** | **E3F2-R2C4** |
| | | | | M12 connector | | **E3F2-R2B4-P1** | **E3F2-R2C4-P1** |
| | Polarizing (with MSR function) | Fixed sensitivity | | pre-wired | 0.1 - 4 m (*3) | **E3F2-R4B4F** | **E3F2-R4C4F** |
| | | | | M12 connector | | **E3F2-R4B4F-P1** | **E3F2-R4C4F-P1** |
| | | Adjustable sensitivity | | pre-wired | | **E3F2-R4B4** | **E3F2-R4C4** |
| | | | | M12 connector | | **E3F2-R4B4-P1** | **E3F2-R4C4-P1** |
| | Polarizing (with MSR function) | |  radial | pre-wired | 0.1 - 2 m (*2) | **E3F2-R2RB41** | **E3F2-R2RC41** |
| | | | | M12 connector | | **E3F2-R2RB41-P1** | **E3F2-R2RC41-P1** |
| Diffuse reflective | Fixed sensitivity<br>Wide-beam characteristics | |  axial | pre-wired | 0.1 m | **E3F2-DS10B4-N** | **E3F2-DS10C4-N** |
| | | | | M12 connector | | **E3F2-DS10B4-P1** | **E3F2-DS10C4-P1** |
| | Adjustable sensitivity | | | pre-wired | 0.3 m | **E3F2-DS30B4** | **E3F2-DS30C4** |
| | | | | M12 connector | | **E3F2-DS30B4-P1** | **E3F2-DS30C4-P1** |
| | | | | pre-wired | 1 m | **E3F2-D1B4** | **E3F2-D1C4** |
| | | | | M12 connector | | **E3F2-D1B4-P1** | **E3F2-D1C4-P1** |
| | Adjustable sensitivity | |  radial | pre-wired | 0.3 m | **E3F2-DS30B41** | **E3F2-DS30C41** |
| | | | | M12 connector | | **E3F2-DS30B41-P1** | **E3F2-DS30C41-P1** |
| Background suppression | Fixed sensing distance | |  axial | pre-wired | 10 cm | **E3F2-LS10B4** | **E3F2-LS10C4** |
| | | | | M12 connector | | **E3F2-LS10B4-P1** | **E3F2-LS10C4-P1** |

*1) with slit E39-ES18
*2) with reflector E39-R1
*3) with reflector E39-R1S

**Note:** Standard cable length is 2 m. Models provided with a 5 m long cable are available. When ordering, specify the cable length by adding the length of the cable (e.g. E3F2-R2RB4 2M or E3F2-R2RB4 5M). For other cable length please contact your OMRON sales representative.

# ■ Housing material: Metal (Nickel plated brass)

**Note:** Shaded models are normally stocked.

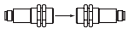
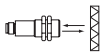
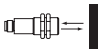
| Sensing method | | | Appearance | Connection method | Sensing distance | Model | |
|---|---|---|---|---|---|---|---|
| | | | | | | PNP output | NPN output |
| Through-beam | Multi purpose | |  axial | pre-wired | 7 m | **E3F2-7B4-M** | **E3F2-7C4-M** |
| | | | | M12 connector | | **E3F2-7B4-M1-M** | **E3F2-7C4-M1-M** |
| | - precision detection<br>- test input | | | pre-wired | 10 m | **E3F2-10B4-M** | **E3F2-10C4-M** |
| | | | | M12 connector | | **E3F2-10B4-M1-M** | **E3F2-10C4-M1-M** |
| Retro-reflective (incl. reflector E39-R1) | Polarizing (with MSR function) | Fixed sensitivity |  axial | pre-wired | 0.1 - 2 m(*1) | **E3F2-R2RB4-M** | **E3F2-R2RC4-M** |
| | | | | M12 connector | | **E3F2-R2RB4-M1-M** | **E3F2-R2RC4-M1-M** |
| | | | | pre-wired | 0.1 - 4 m(*2) | **E3F2-R4B4F-M** | **E3F2-R4C4F-M** |
| | | | | M12 connector | | **E3F2-R4B4F-M1-M** | **E3F2-R4C4F-M1-M** |
| | | Adjustable sensitivity | | pre-wired | | **E3F2-R4B4-M** | **E3F2-R4C4-M** |
| | | | | M12 connector | | **E3F2-R4B4-M1-M** | **E3F2-R4C4-M1-M** |
| | Polarizing (with MSR function) | |  radial | pre-wired | 0.1 - 2 m(*1) | **E3F2-R2RB41-M** | **E3F2-R2RC41-M** |
| Diffuse reflective | Fixed sensing distance Wide-beam characteristics | |  axial | pre-wired | 0.1 m | **E3F2-DS10B4-M** | **E3F2-DS10C4-M** |
| | | | | M12 connector | | **E3F2-DS10B4-M1-M** | **E3F2-DS10C4-M1-M** |
| | Adjustable sensing distance | | | pre-wired | 0.3 m | **E3F2-DS30B4-M** | **E3F2-DS30C4-M** |
| | | | | M12 connector | | **E3F2-DS30B4-M1-M** | **E3F2-DS30C4-M1-M** |
| | | | | pre-wired | 1 m | **E3F2-D1B4-M** | **E3F2-D1C4-M** |
| | | | | M12 connector | | **E3F2-D1B4-M1-M** | **E3F2-D1C4-M1-M** |
| | Adjustable sensing distance | |  radial | pre-wired | 0.3 m | **E3F2-DS30B41-M** | **E3F2-DS30C41-M** |
| | | | | M12 connector | | **E3F2-DS30B41-M1-M** | **E3F2-DS30C41-M1-M** |
| Background suppression | Fixed sensing distance | |  axial | pre-wired | 10 cm | **E3F2-LS10B4-M** | **E3F2-LS10C4-M** |
| | | | | M12 connector | | **E3F2-LS10B4-M1-M** | **E3F2-LS10C4-M1-M** |

*1) with reflector E39-R1
*2) with reflector E39-R1S

**Note:** Standard cable length is 2 m. Models provided with a 5 m long cable are available. When ordering, specify the cable length by adding the length of the cable (e.g. E3F2-R2RB4 2M or E3F2-R2RB4 5M). For other cable length please contact your OMRON sales representative.

# ■ Housing material: Metal (Stainless steel)

**Note:** Shaded models are normally stocked.

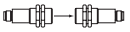
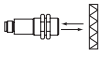
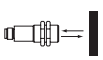
| Sensing method | | Appearance | Connection method | Sensing distance | Model | |
|---|---|---|---|---|---|---|
| | | | | | PNP output | NPN output |
| Through-beam | |  axial | pre-wired | 7 m | **E3F2-7B4-S** | **E3F2-7C4-S** |
| | | | M12 connector | | **E3F2-7B4-M1-S** | **E3F2-7C4-M1-S** |
| Retro-reflective (incl. reflector E39-R1) | Polarizing (with MSR function) |  axial | pre-wired | 0.1 - 2 m (with reflector E39-R1) | **E3F2-R2RB4-S** | **E3F2-R2RC4-S** |
| | | | M12 connector | | **E3F2-R2RB4-M1-S** | **E3F2-R2RC4-M1-S** |
| Diffuse reflective | Fixed sensitivity Wide-beam characteristics |  axial | pre-wired | 0.1 m | **E3F2-DS10B4-S** | **E3F2-DS10C4-S** |
| | | | M12 connector | | **E3F2-DS10B4-M1-S** | **E3F2-DS10C4-M1-S** |
| | Adjustable sensitivity | | pre-wired | 0.3 m | **E3F2-DS30B4-S** | **E3F2-DS30C4-S** |
| | | | M12 connector | | **E3F2-DS30B4-M1-S** | **E3F2-DS30C4-M1-S** |

**Note:** Standard cable length is 2 m. Models provided with a 5 m long cable are available. When ordering, specify the cable length by adding the length of the cable (e.g. E3F2-R2RB4-S 2M or E3F2-R2RB4-S 5M). For other cable length please contact your OMRON sales representative.

# ■ AC-Switching Models

## Housing material: Plastic

**Note:** Shaded models are normally stocked.

| Sensing method | | Appearance | Connection method | Sensing distance | Model | |
|---|---|---|---|---|---|---|
| | | | | | Light-ON | Dark-ON |
| Through-beam | |  axial | pre-wired | 3 m | **E3F2-3Z1** | **E3F2-3Z2** |
| Retro-reflective (incl. reflector E39-R1) | Non-polarizing (without MSR function) |  axial | pre-wired | 0.1 - 2 m (with reflector E39-R1) | **E3F2-R2Z1** | **E3F2-R2Z2** |
| Diffuse reflective | Fixed sensing distance Wide-beam characteristics |  axial | pre-wired | 0.1 m | **E3F2-DS10Z1-N** | **E3F2-DS10Z2-N** |

**Note:** Standard cable length is 2 m. Models provided with a 5 m long cable are available. When ordering, specify the cable length by adding the length of the cable (e.g. E3F2-R2Z1 2M or E3F2-R2Z1 5M). For other cable length please contact your OMRON sales representative.

## ■ Accessories (Order Separately)

**Note:** Shaded models are normally stocked.

| Name | Sensing distance (typical) [1.] | Model | Remark |
|---|---|---|---|
| Reflectors | 0.1 - 3.7 m (axial)<br>0.1 - 2.4 m (radial) | **E39-R1** | 60 x 40 mm (included in some models) |
| | 0.1 - 4.3 m (axial) | **E39-R1S** | for E3F2-R4 |
| | 0.1 - 4.2 m (axial)<br>0.1 - 2.7 m (radial) | **E39-R7** | 84 mm |
| | 0.1 - 5.3 m (axial)<br>0.1 - 3.1 m (radial) | **E39-R8** | 100 x 100 mm |
| | 0.1 - 4.3 m (axial) | **E39-R40** | 80 x 80 mm |
| Tape Reflectors | | **E39-RSA** | 35 x 10 mm |
| | | **E39-RSB** | 35 x 40 mm |
| | | **E39-RS3** | 80 x 70 mm |
| Lens Cap | | **E39-F31** | |
| Mounting Bracket | | **Y92E-B18** | screw mount |
| | | **Y92E-G18** | quick access mounting |
| Slit | | **E39-ES18** | for E3F2-10□ - precision detection |

For detailed information about Accessories, refer to the main chapter “Accessories” at the end of the document.

**Note: 1.** Typical sensing distance corresponds to 80% of the max. sensing distance. For details, please refer to “Engineering Data”.

## ■ Sensor I/O Connectors

**Note:** Shaded models are normally stocked.

| Cord | Shape | Cable type | | Model |
|---|---|---|---|---|
| Standard | Straight  | 2 m | Four-wire type | **XS2F-D421-D80-A** |
| | | 5 m | | **XS2F-D421-G80-A** |
| | L-shaped  | 2 m | | **XS2F-D422-D80-A** |
| | | 5 m | | **XS2F-D422-G80-A** |
| Vibration-proof robot cable | Straight  | 2 m | | **XS2F-D421-D80-R** |
| | | 5 m | | **XS2F-D421-G80-R** |
| | L-shaped  | 2 m | | **XS2F-D422-D80-R** |
| | | 5 m | | **XS2F-D422-G80-R** |

# Specifications

## ■ Ratings / Characteristics of DC Switching Models

| Item | E3F2-7□ | E3F2-10□ | E3F2-R2□4-□ | E3F2-R2R□ | E3F2-R4□-□ | E3F2-DS10□ | E3F2-DS30□ | E3F2-D1□4-□ | E3F2-LS10□4-□ |
|---|---|---|---|---|---|---|---|---|---|
| Sensing method | Through-beam | | Retroreflective | | | Diffuse reflective | | | |
| | - multi purpose | - Precision detection [6.] - test input | Non-polarizing | Polarizing | | Wide beam characteristic | Adjustable sensing distance | | Background suppression |
| Power supply voltage | 10 to 30 V DC | 12 to 24 V DC | 10 to 30 V DC | | | | | | |
| Current consumption | 50 mA max. | | 25 mA max. | 30 mA max. | | 25 mA max. | 30 mA max. | | |
| Rated sensing distance [1.] | 7 m | 10 m | 0.1 - 2 m (with reflector E39-R1) | | 0.1 - 4 m (with reflector E39-R1S) | 0.1 m (5 x 5 cm white mat paper) | 0.3 m (10 x 10 cm white mat paper) | 1 m (30 x 30 cm white mat paper) | 0.1 m (10 x 10 cm white mat paper) |
| Typical sensing distance for different reflector types (ref. to accessories) [2.] | – | | E39-R1: 4.0 m<br>E39-R7: 4.5 m<br>E39-R8: 5.3 m | E39-R1:<br>axial 3.7 m<br>radial 2.4 m<br>E39-R7:<br>axial 4.2 m<br>radial 2.7 m<br>E39-R8:<br>axial 5.3 m<br>radial 3.1 m | E39-R1S: 4.3 m<br>E39-R7: 4.8 m<br>E39-R8: 5.6 m<br>E39-R40: 4.3 m<br>E39-RS3: 2 m | – | | | |
| Standard object | Opaque: 11 mm dia. min. | | Opaque: 56 mm dia. min. | | | – | | | |
| Directional angle | 3° to 20° | | | | | – | | | |
| Differential travel (hysteresis) | – | | | | | 20% max. | | | 5% max |
| Black/white error | – | | | | | | | | 3% |
| Response time | Operation and Reset: 2.5 ms max. | | | | 1 ms max | 2.5 ms max. | | 1 ms max. | |
| Control output | Transistor (open collector), load current: 100 mA max. (residual voltage: 2 V max.) | | | | | | | | |
| Power reset time | 50 ms | | | | 100 ms max. | 50 ms | | 100 ms | |
| Ambient illumination | Incandescent lamp: 3000 lx max. / Sunlight: 10000 lx max. | | | | | | | | |
| Ambient temperature | Operating: -25 to 55 °C / Storage: -30 to 70 °C (with no icing or condensation) | | | | | | | | |
| Ambient humidity | Operating: 35% to 85% / Storage: 35% to 95% (without condensation) | | | | | | | | |
| Insulation resistance | 20 MΩ min. at 500 V DC between energized parts and case | | | | | | | | |
| Dielectric strength | 1000 VAC max., 50 / 60 Hz for 1 min between energized parts and case | | | | | | | | |
| Vibration resistance | 10 to 55 Hz, 1.5 mm double amplitude for 2 hrs each direction (X, Y, Z) | | | | | | | | |
| Shock resistance | Destruction: 500 m/s² each direction (X, Y, Z) | | | | | | | | |
| Enclosure ratings | IP67 [3.]; NEMA 1, 2, 4 | | | | | | | | |
| Light source | Infrared LED (880 nm/850 nm) | | | Red LED (660 nm) | | Infrared LED (880 nm) | | | Red LED (660 nm) |
| Indicators | Light incident / power indicator for light source (red) | Output (orange) / light emission (red) | Light incident / power indicator for light source (red) | | Light incident (red) / stability (green) | Light incident / power indicator for light source (red) | | Light incident (red) / stability (green) | Output indicator (orange) / stability (green) |
| Sensitivity adjustment | Fixed | | | | Fixed / Adjustable | Fixed | Adjustable | | Fixed |
| Connection method | 2 m, 5 m pre-wired cable (PVC, dia. 4 mm (18 / 0.12) [4.]) or M12-connector | | | | | | | | |
| Test Input | – | [7.] | – | | | | | | |
| Operation mode | Light-ON or Dark-ON selectable by wiring | | | | | | | | |
| Weight (approx.) | | | | | | | | | |
| Plastic case pre-wired (2 m) | 120 g | | 60 g | | | | | | |
| Plastic case connector | 40 g | | 20 g | | | | | | |
| Metal case pre-wired (2 m) | 180 g | | 90 g | | | | | | |
| Metal case connector | 120 g | | 50 g | | | | | | |
| Circuit protection | Output short-circuit and power supply reverse polarity | | | | | | | | |
| Housing materials | Plastic (case: ABS; lens: PMMA) | | | | | | | | |
| | Nickel brass | Nickel brass | – | Nickel brass | Nickel brass | Nickel brass | Nickel brass | Nickel brass | Nickel brass |
| | Stainless steel [5.] | – | – | Stainless steel [5.] | – | Stainless steel [5.] | Stainless steel [5.] | – | – |

**Note: 1.** For stable sensing distance in detail, please refer to “Engineering Data”

**2.** Typical sensing distance corresponds to 80% of the max. sensing distance.

**3.** The enclosure rating IP67 of OMRON internal standards correspond to stricter test requirements than the standard IEC 60529 (refer to chapter “Precautions”)

**4.** For other cable materials (e.g. PUR) please contact your OMRON sales representative.

**5.** Material-specification for stainless steel housing case: 1.4305 (W.-No.), 303 (AISI), 2346 (SS). For other stainless steel materials please contact your OMRON sales representative.

**6.** with slit E39-ES18

**7.** PNP models -B4: $V_{CC}$ to $V_{CC}$ -2.5 V: Emitting OFF (Source current: 3 mA max.) / Open or 0 to 2.5 V: Emitting ON (Leakage current: 0.1 mA max.)
NPN models -C4: 0 to 2.5 V: Emitting OFF (Source current: 3 mA max.) / Open or Vcc to Vcc -2.5 V: Emitting ON (Leakage current: 0.1 mA max.)

# ■ Ratings / Characteristics of AC Switching Models

| Item | E3F2-3Z1<br>E3F2-3Z2 | E3F2-R2Z1<br>E3F2-R2Z2 | E3F2-DS10Z1<br>E3F2-DS10Z2 |
|---|---|---|---|
| Sensing method | Through-beam | Non-polarizing Retroreflective | Diffuse reflective<br>(wide-beam characteristic) |
| Power supply voltage | 24 to 240 VAC ±10%, 50 / 60 Hz | | |
| Current consumption | 10 mA max. | 5 mA max. | |
| Rated sensing distance[1.] | 3 m | 0.1 - 2 m<br>(with reflector E39-R1) | 0.1 m<br>(5 x 5 cm white mat paper) |
| Typical sensing distance for different reflector types [2.] | – | E39-R1: 3,4 m<br>E39-R7: 3,9 m<br>E39-R8: 5,2 m | – |
| Detectable object | Opaque object: 11 mm min. | Opaque object: 56 mm min. | 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 | | |
| Power reset time | 100 ms | | |
| Ambient illumination | Incandescent lamp: 3000 lx max. Sunlight: 10000 lx max. | | |
| Ambient temperature | Operating: -25 to 55 °C / Storage: -30 to 70 °C (with no icing or condensation) | | |
| Ambient humidity | Operating: 35% to 85% / Storage: 35% to 95% (without condensation) | | |
| Insulation resistance | 20 MΩ min. at 500 V DC between energized parts and case | | |
| Dielectric strength | 1500 VAC, 50 / 60 Hz for 1 min between energized parts and case | | |
| Vibration resistance | 10 to 55 Hz, 1.5 mm double amplitude for 2 hrs each direction (X, Y, Z) | | |
| Shock resistance | 500 m/sqr (approx. 50 g) for each direction (X, Y, Z) | | |
| Enclosure rating | IP67 [3.];  NEMA 1, 2, 4 | | |
| Light source | Infrared LED (880 nm) | | |
| Indicators | Light incident/power indicator for light source (red) | | |
| Sensitivity adjustment | Fixed | | |
| Connection method | 2 m, 5 m pre-wired cable (PVC dia. 4 mm (14 / 0.15)) | | |
| Operation mode | Light-ON or Dark-ON (fixed) | | |
| Circuit protection | None | | |
| Weight (approx.) | 110 g (pre-wired 2 m cable) | | |
| Housing materials | Plastic (case: ABS; lens: PMMA) | | |

**Note: 1.** For stable sensing distance in detail, please refer to “Engineering Data”

**2.** Typical sensing distance corresponds to 80% of the max. sensing distance.

**3.** The enclosure rating IP67 of OMRON internal standards correspond to stricter test requirements than the standard IEC 60529 (refer to chapter “Precautions”)