

## Highly Durable Proximity Sensor for Tough Environments



- Completely stainless-steel housing
- Aluminum chip immunity
- Embedding installation to metal (steel) fittings
- Chemical resistance certified by Ecolab Europe
- Lineup includes pre-wire models and DC 3-wire NPN output models with fluororesin coating.



Be sure to read *Safety Precautions* on page 9.

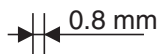
Note: Models with a fluororesin coating also use vinyl chloride for the cable material and require separate protection.

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

## Features

### One-piece completely stainless-steel housing with a face thickness of 0.8 mm

The face thickness is approximately 4 times that of previous models (E2ES) to enable sensing in even more severe conditions than ever.



### Brush Test



After 3 Minutes

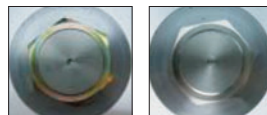


E2FM

E2EQ  
(Spatter-resistant)

The stainless-steel head means almost no wear when cleaned with a metal brush.

### Continuous Impact Test



E2ES

E2FM

The E2ES with a top wall thickness of 0.2 mm was **penetrated** after 10,000 impacts.

The E2FM was not **penetrated** after 250,000 impacts (depth: 0.26 mm).

More than 20 times the durability of the E2ES!

### Chemical and Detergent Proof

The one-piece completely stainless-steel housing of the sensing section withstands the following chemicals better.

- Sodium chloride
- Gasoline
- Dilute sodium hydroxide
- Dilute hydrochloric acid
- Mineral oil
- Barium hydroxide
- Any many others

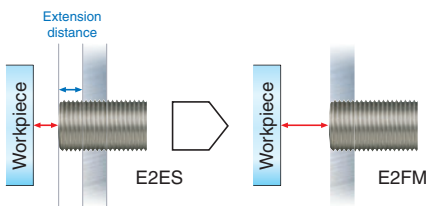
Note: Cannot be used for explosion-proof applications.

## Built-in Chip Immunity

Chip immunity performance has been provided to greatly reduce false signals caused by spatter accumulation and other causes, almost eliminating the needs for cleaning, e.g., with metal brushes.



## Flush Mounting



**Not influenced by surrounding installation environment.**

Note: When mounted in steel.



## Main Performance Comparison to Previous OMRON Products

### Face thickness

|            | E2FM   | E2ES   |
|------------|--------|--------|
| <b>M8</b>  | 0.4 mm | ---    |
| <b>M12</b> | 0.8 mm | ---    |
| <b>M18</b> | 0.8 mm | 0.2 mm |
| <b>M30</b> | 0.8 mm | 0.2 mm |

### Sensing distance

|            | E2FM    | E2ES   |
|------------|---------|--------|
| <b>M8</b>  | 1.5 mm  | ---    |
| <b>M12</b> | 2.0 mm  | ---    |
| <b>M18</b> | 5.0 mm  | 4.0 mm |
| <b>M30</b> | 10.0 mm | 8.0 mm |

### Response frequency

|            | E2FM   | E2ES  |
|------------|--------|-------|
| <b>M8</b>  | 200 Hz | ---   |
| <b>M12</b> | 100 Hz | ---   |
| <b>M18</b> | 100 Hz | 12 Hz |
| <b>M30</b> | 50 Hz  | 8 Hz  |

### Ambient operating temperature

| E2FM        | E2ES      |
|-------------|-----------|
| -25 to 70°C | 0 to 50°C |

## The chemical resistance has been certified by Ecolab Europe

**ECOLAB**

Ecolab GmbH & Co. OHG  
P.O. Box 13 94 96  
D-40551 Düsseldorf  
certifies that for

**OMRON**  
OMRON Manufacturing of Germany GmbH  
Carl-Benz-Strasse 4  
71154 Nuttingen

**material resistance tests**

were performed with cleaning substances P3-Aopax 56, P3-Aopax 66, P3-Aopax 91 and demineralized water as a zero reference factor.

The material resistance of the tested series  
**Inductive Proximity Sensor E2FM**

to the P3 products used in the test can be considered to be positive according to the cleaning procedures mentioned overleaf.

Düsseldorf, 14th February 2006

Ecolab GmbH & Co. OHG  
L.V. *Thomas Tyborski*  
L.V. *Reinhold Lauff*

**ECOLAB**

This certificate is based on:

- documented test procedures (test no.: FAEP3-E Nr. 40-1) according to material resistance
- defined product descriptions
- standardized cleaning procedure

**Test procedure**  
Ecolab test P&E Nr. 40-1

**Dyeing test:**

- Complete immersion in solution/liquid

**Test period:**

- 15 days

**Temperature:**

- room temperature (constant)

**Analysis:**

- Visual judgement like swelling, brittleness, discoloring
- compared to zero-reference factor (demineralized water)
- Photometric documentation

**Product specifications:**

**P3-Aopax 56:**  
Acid foam cleaning substance for food and beverage industry

**P3-Aopax 66:**  
Alkaline foam cleaning detergent with active chlorine for machine cleaning in food and beverage industry

**P3-Aopax 91:**  
Neutral disinfectant agent based on quaternary ammonium compounds (QAV) for the food industry

**Cleaning plan for food and beverage industry\***


- Rinsing with water 48 – 50°C**  
Rinsing with the pressure. Rinsing from top to bottom in the direction of the drains. Cleaning of the drains.
- Foaming from bottom to top**  
alkaline: P3-Aopax 66 2 – 3 % daily  
acid: P3-Aopax 56 2 % on demand  
temperature: cold up to 40°C  
contact time: 15 min. recommended
- Rinsing with water 48 – 50°C**  
Rinsing from top to bottom with the pressure  
**Spray disinfection P3-Aopax 91 1-2 %**, 30-40 minutes

\*not applicable

## Ordering Information

Sensors [Refer to *Dimensions* on page 10.]


### DC 2-Wire, Pre-wired Models

| Size  | Sensing distance |        | Output                  | Operation mode | Model            |
|---|------------------|--------|-------------------------|----------------|------------------|
| Shielded<br> | M8               | 1.5 mm | DC 2-Wire<br>(polarity) | NO             | E2FM-X1R5D1 2M * |
|   | M12              | 2 mm   |                         |                | E2FM-X2D1 2M *   |
|   | M18              | 5 mm   |                         |                | E2FM-X5D1 2M *   |
|   | M30              | 10 mm  |                         |                | E2FM-X10D1 2M *  |


Note: Models with NC operation are also available. Ask your OMRON representative for details.

\* Fluororesin-coated models are also available. The model numbers are E2FM-QX□D1. The cable material, however, is vinyl chloride and requires separate protection.

### DC 2-wire Pre-wired Smartclick Connector Models (M12)


| Size  | Sensing distance |        | Output                           | Operation mode | Model                   |
|---|------------------|--------|----------------------------------|----------------|-------------------------|
| Shielded<br> | M8               | 1.5 mm | Polarity Pin allocations: 1-4    | NO             | E2FM-X1R5D1-M1TGJ 0.3M  |
|   |                  |        | No polarity Pin allocations: 3-4 |                | E2FM-X2D1-M1TGJ 0.3M    |
|   | M12              | 2 mm   | Polarity Pin allocations: 1-4    |                | E2FM-X2D1-M1TGJ-T 0.3M  |
|   |                  |        | No polarity Pin allocations: 3-4 |                | E2FM-X5D1-M1TGJ 0.3M    |
|   | M18              | 5 mm   | Polarity Pin allocations: 1-4    |                | E2FM-X5D1-M1TGJ-T 0.3M  |
|   |                  |        | No polarity Pin allocations: 3-4 |                | E2FM-X10D1-M1TGJ 0.3M   |
|   | M30              | 10 mm  | Polarity Pin allocations: 1-4    |                | E2FM-X10D1-M1TGJ-T 0.3M |
|   |                  |        | No polarity Pin allocations: 3-4 |                |                         |

### DC 3-Wire, Pre-wired Models

| Size   | Sensing distance |        | Model                        |                              |
|--|------------------|--------|------------------------------|------------------------------|
|  |                  |        | Output configuration: NPN NO | Output configuration: PNP NO |
| Shielded<br> | M8               | 1.5 mm | E2FM-X1R5C1 2M               | E2FM-X1R5B1 2M               |
|  | M12              | 2 mm   | E2FM-X2C1 2M                 | E2FM-X2B1 2M                 |
|  | M18              | 5 mm   | E2FM-X5C1 2M                 | E2FM-X5B1 2M                 |
|  | M30              | 10 mm  | E2FM-X10C1 2M                | E2FM-X10B1 2M                |

Note: Models with NC operation are also available. Ask your OMRON representative for details.

### DC 3-Wire, M12 Connector Models




| Size  | Sensing distance |        | Model                        |                              |
|---|------------------|--------|------------------------------|------------------------------|
|   |                  |        | Output configuration: NPN NO | Output configuration: PNP NO |
| Shielded<br> | M8               | 1.5 mm | E2FM-X1R5C1-M1               | E2FM-X1R5B1-M1 *             |
|   | M12              | 2 mm   | E2FM-X2C1-M1                 | E2FM-X2B1-M1 *               |
|   | M18              | 5 mm   | E2FM-X5C1-M1                 | E2FM-X5B1-M1 *               |
|   | M30              | 10 mm  | E2FM-X10C1-M1                | E2FM-X10B1-M1 *              |

\* Fluororesin-coated models are also available. The model numbers are E2FM-QX□B1-M1. The cable material, however, is vinyl chloride and requires separate protection.

## Accessories (Order Separately)

### Sensor I/O Connectors (M12, Sockets on One Cable End)

(Models for Connectors and with Pre-wired Connectors: A Connector is not provided with the Sensor. Be sure to order a Connector separately.)  
**[Refer to XS2, XS5.]**

| Appearance   | Cable length | Sensor I/O Connector model number | Applicable Proximity Sensor model number |
|--|--------------|-----------------------------------|--|
| <br>Straight                                      | 2m           | XS2F-D421-DC0-F                   | E2FM-X□C1-M1<br>E2FM-X□B1-M1             |
|  | 5m           | XS2F-D421-GC0-F                   |  |
| <br>L-shape                                       | 2m           | XS2F-D422-DC0-F                   |  |
|  | 5m           | XS2F-D422-GC0-F                   |  |
| <br>Smartclick<br>Connector Relay<br>Models (M12) | 2m           | XS5F-D421-D80-F                   | E2FM-X□D1-M1TGJ<br>E2FM-X□D1-M1TGJ-T     |
|  | 5m           | XS5F-D421-G80-F                   |  |

Note: Refer to *Introduction to Sensor I/O Connectors* for details.

## Ratings and Specifications

### DC 2-Wire (E2FM-X□D□)

| Item  | Size                      | M8  | M12   | M18                     | M30                     | M12  | M18                     | M30                     |  |
|---|---------------------------|---|---|-------------------------|-------------------------|--|-------------------------|-------------------------|--|
|   | Shielded Model            | Shielded  |   |                         |                         |  |                         |                         |  |
|   |                           | E2FM-X1R5D1-□   | E2FM-X2D1-□   | E2FM-X5D1-□             | E2FM-X10D1-□            | E2FM-X2D1-M1T1GJ-T   | E2FM-X5D1-M1T1GJ-T      | E2FM-X10D1-M1T1GJ-T     |  |
| <b>Sensing distance</b>                                 |                           | 1.5 mm±10%  | 2 mm±10%  | 5 mm±10%                | 10 mm±10%               | 2 mm±10%   | 5 mm±10%                | 10 mm±10%               |  |
| <b>Set distance</b>                                     |                           | 0 to 1.05 mm  | 0 to 1.4 mm   | 0 to 3.5 mm             | 0 to 7 mm               | 0 to 1.4 mm  | 0 to 3.5 mm             | 0 to 7 mm               |  |
| <b>Differential travel</b>                              |                           | 15% max. of sensing distance  |   |                         |                         |  |                         |                         |  |
| <b>Sensing object</b>                                   |                           | Ferrous metal (The sensing distance decreases with non-ferrous metal. Refer to <i>Engineering Data</i> on page 7.)                                |   |                         |                         |  |                         |                         |  |
| <b>Standard sensing object</b>                          |                           | Iron,<br>8 × 8 × 1 mm   | Iron,<br>12 × 12 × 1 mm   | Iron,<br>30 × 30 × 1 mm | Iron,<br>54 × 54 × 1 mm | Iron,<br>12 × 12 × 1 mm                                    | Iron,<br>30 × 30 × 1 mm | Iron,<br>54 × 54 × 1 mm |  |
| <b>Response frequency *1</b>                            |                           | 200 Hz  | 100 Hz  | 100 Hz                  | 50 Hz                   | 100 Hz   | 100 Hz                  | 50 Hz                   |  |
| <b>Power supply voltage (operating voltage range)</b>   |                           | 12 to 24 VDC (10 to 30 VDC), ripple (p-p): 10% max.   |   |                         |                         |  |                         |                         |  |
| <b>Leakage current</b>                                  |                           | 0.8 mA max.   |   |                         |                         |  |                         |                         |  |
| <b>Output configuration</b>                             |                           | With polarity   |   |                         |                         | No polarity  |                         |                         |  |
| <b>Control output</b>                                   | <b>Switching capacity</b> | 3 to 100 mA   |   |                         |                         |  |                         |                         |  |
|   | <b>Residual voltage</b>   | 3 V max.<br>(Load current: 100 mA max., Cable length: 2 m)  |   |                         |                         | 5 V max.<br>(Load current: 100 mA max., Cable length: 2 m) |                         |                         |  |
| <b>Indicators</b>                                       |                           | Operation indicator (red LED), Setting/Operation indicator (green LED)  |   |                         |                         |  |                         |                         |  |
| <b>Operation mode (with sensing object approaching)</b> |                           | NO *2   |   |                         |                         |  |                         |                         |  |
| <b>Protection circuits</b>                              |                           | Surge suppressor, Load short-circuit protection   |   |                         |                         |  |                         |                         |  |
| <b>Ambient temperature range</b>                        |                           | Operating/Storage: -25 to 70°C (with no icing or condensation)  |   |                         |                         |  |                         |                         |  |
| <b>Ambient humidity range</b>                           |                           | Operating/Storage: 35% to 95% (with no condensation)  |   |                         |                         |  |                         |                         |  |
| <b>Temperature influence</b>                            |                           | ±20% max. of sensing distance at 23°C in the temperature range of -25 to 70°C.  |   |                         |                         |  |                         |                         |  |
| <b>Voltage influence</b>                                |                           | ±1% max. of sensing distance at rated voltage in the rated voltage ±15% range   |   |                         |                         |  |                         |                         |  |
| <b>Insulation resistance</b>                            |                           | 50 MΩ min. (at 500 VDC) between current-carrying parts and case   |   |                         |                         |  |                         |                         |  |
| <b>Dielectric strength</b>                              |                           | 1,000 VAC, 50/60 Hz for 1 minute between current-carrying parts and case  |   |                         |                         |  |                         |                         |  |
| <b>Vibration resistance</b>                             |                           | Destruction: 10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y, and Z directions  |   |                         |                         |  |                         |                         |  |
| <b>Shock resistance</b>                                 |                           | Destruction:<br>500 m/s <sup>2</sup><br>10 times each<br>in X, Y, and Z<br>directions   | Destruction: 1,000 m/s <sup>2</sup> 10 times each in X, Y, and Z directions |                         |                         |  |                         |                         |  |
| <b>Degree of protection</b>                             |                           | IEC 60529 IP67  |   |                         |                         |  |                         |                         |  |
| <b>Connection method</b>                                |                           | Unmarked: Pre-wired Models (Standard cable length: 2 m)<br>Models ending with -M1GJ-□: Pre-wired Connector Models (Standard cable length: 300 mm) |   |                         |                         |  |                         |                         |  |

| Item                  | Size                       | M8                       | M12           | M18           | M30           | M12                | M18                | M30                 |
|-----------------------|----------------------------|--------------------------|---------------|---------------|---------------|--------------------|--------------------|---------------------|
|                       | Shielded                   | Shielded                 |               |               |               |                    |                    |                     |
|                       | Model                      | E2FM-X1R5D1-□            | E2FM-X2D1-□   | E2FM-X5D1-□   | E2FM-X10D1-□  | E2FM-X2D1-M1T1GJ-T | E2FM-X5D1-M1T1GJ-T | E2FM-X10D1-M1T1GJ-T |
| Weight (packed state) | Pre-wired Models (2 m)     | Approx. 105 g            | Approx. 190 g | Approx. 215 g | Approx. 295 g | ---                | ---                | ---                 |
|                       | Pre-wired Connector Models | Approx. 65 g             | Approx. 85 g  | Approx. 110 g | Approx. 190 g | Approx. 85 g       | Approx. 110 g      | Approx. 190 g       |
| Materials             | Case                       | Stainless steel (SUS303) |               |               |               |                    |                    |                     |
|                       | Sensing surface            | Stainless steel (SUS303) |               |               |               |                    |                    |                     |
|                       | (thickness)                | (0.4 mm)                 | (0.8 mm)      |               |               |                    | (0.8 mm)           |                     |
|                       | Clamping nuts              | Stainless steel (SUS303) |               |               |               |                    |                    |                     |
|                       | Cable                      | PVC (flame retardant)    |               |               |               |                    |                    |                     |
|                       | Toothed washer             | Zinc-plated iron         |               |               |               |                    |                    |                     |
| Accessories           | Instruction manual         |                          |               |               |               |                    |                    |                     |

\*1. The response frequency of the DC switching section is an average value. Measurement conditions are as follows: standard sensing object, a distance of twice the standard sensing object, and a set distance of half the sensing distance.

\*2. NC (normally closed) models are also available. Contact your OMRON representative.

## DC 3-Wire (E2FM-X□C□, E2FM-X□B□)

| Item   | Size                        | M8  | M12   | M18                  | M30                  |
|--|-----------------------------|---|---|----------------------|----------------------|
|  | Shielded Model              | Shielded  |   |                      |                      |
|  |                             | E2FM-X1R5□  | E2FM-X2□  | E2FM-X5□             | E2FM-X10□            |
| Sensing distance                                 |                             | 1.5 mm±10%  | 2 mm±10%  | 5 mm±10%             | 10 mm±10%            |
| Set distance                                     |                             | 0 to 1.05 mm  | 0 to 1.4 mm   | 0 to 3.5 mm          | 0 to 7 mm            |
| Differential travel                              |                             | 15% max. of sensing distance  |   |                      |                      |
| Sensing object                                   |                             | Ferrous metal (The sensing distance decreases with non-ferrous metal. Refer to <i>Engineering Data</i> on page 7.)  |   |                      |                      |
| Standard sensing object                          |                             | Iron, 8 × 8 × 1 mm  | Iron, 12 × 12 × 1 mm  | Iron, 30 × 30 × 1 mm | Iron, 54 × 54 × 1 mm |
| Response frequency *1                            |                             | 200 Hz  | 100 Hz  | 100 Hz               | 50 Hz                |
| Power supply voltage (operating voltage range)   |                             | 12 to 24 VDC (10 to 30 VDC), ripple (p-p): 10% max.   |   |                      |                      |
| Current consumption                              |                             | 10 mA max.  |   |                      |                      |
| Output configuration                             |                             | PNP open collector output   |   |                      |                      |
| Control output                                   | Switching capacity          | 200 mA max.   |   |                      |                      |
|  | Residual voltage            | 2 V max. (Load current: 200 mA, Cable length: 2 m)  |   |                      |                      |
| Indicators                                       |                             | Operation indicator (yellow LED)  |   |                      |                      |
| Operation mode (with sensing object approaching) |                             | C1 Models: NPN open collector, NO (normally open) *2<br>B1 Models: PNP open collector, NO (normally open) *2  |   |                      |                      |
| Protection circuits                              |                             | Reversed power supply polarity protection, Surge suppressor, Load short-circuit protection, and Reversed output polarity protection (except the E2FM-X1R5B1-M1) |   |                      |                      |
| Ambient temperature range                        |                             | Operating/Storage: -25 to 70°C (with no icing or condensation)  |   |                      |                      |
| Ambient humidity range                           |                             | Operating/Storage: 35% to 95% (with no condensation)  |   |                      |                      |
| Temperature influence                            |                             | ±20% max. of sensing distance at 23°C in the temperature range of -25 to 70°C.  |   |                      |                      |
| Voltage influence                                |                             | ±1% max. of sensing distance in the rated voltage ±15% range (using the sensing distance at the rated voltage as standard)                                      |   |                      |                      |
| Insulation resistance                            |                             | 50 MΩ min. (at 500 VDC) between current-carrying parts and case   |   |                      |                      |
| Dielectric strength                              |                             | 1,000 VAC, 50/60 Hz for 1 minute 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 <sup>2</sup><br>10 times each in X, Y, and Z directions  | Destruction: 1,000 m/s <sup>2</sup> 10 times each in X, Y, and Z directions |                      |                      |
| Degree of protection                             |                             | IEC 60529 IP67  |   |                      |                      |
| Connection method                                |                             | Unmarked: Pre-wired Models (Standard cable length: 2 m)<br>Models ending with -M1: Connector Models   |   |                      |                      |
| Weight (packed state)                            | Pre-wired Models (2 m)      | ---   | Approx. 170 g   | Approx. 190 g        | Approx. 275 g        |
|  | Pre-wired Connector Models  | Approx. 45 g  | Approx. 55 g  | Approx. 75 g         | Approx. 160 g        |
| Materials  | Case                        | Stainless steel (SUS303)  |   |                      |                      |
|  | Sensing surface (thickness) | Stainless steel (SUS303)  |   |                      |                      |
|  |                             | (0.4 mm)  | (0.8 mm)  |                      |                      |
|  | Clamping nuts               | Stainless steel (SUS303)  |   |                      |                      |
| Toothed washer                                   | Zinc-plated iron            |   |   |                      |                      |
| Accessories                                      |                             | Instruction manual  |   |                      |                      |

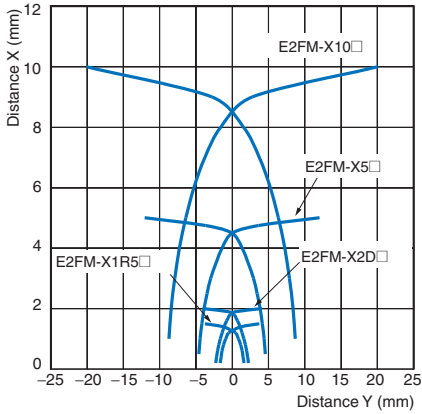
\*1. The response frequency of the DC switching section is an average value. Measurement conditions are as follows: standard sensing object, a distance of twice the standard sensing object, and a set distance of half the sensing distance.

\*2. NC (normally closed) models are also available. Contact your OMRON representative.

Engineering Data (Reference Value)

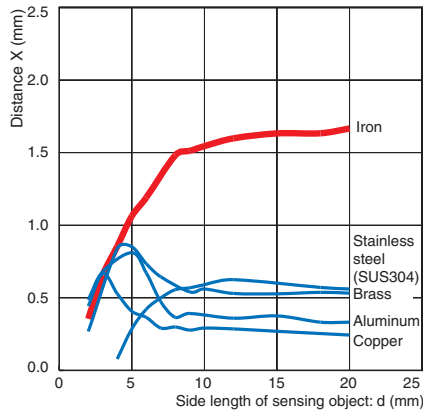
Sensing Area

E2FM-X□

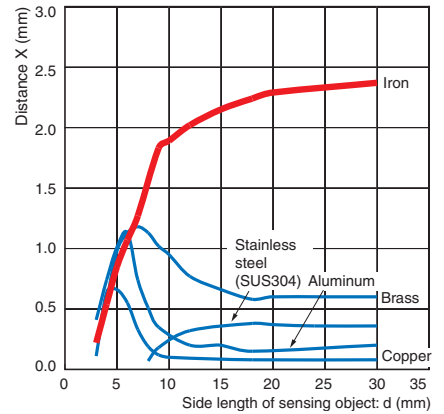


Influence of Sensing Object Size and Material

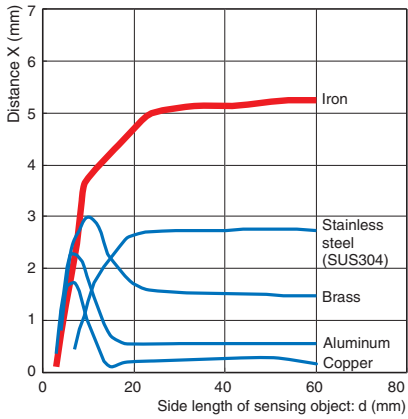
E2FM-X1R5□



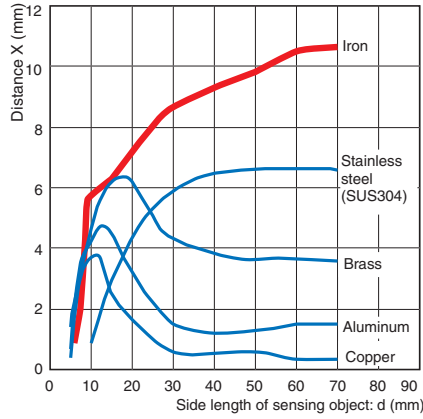
E2FM-X2□



E2FM-X5□

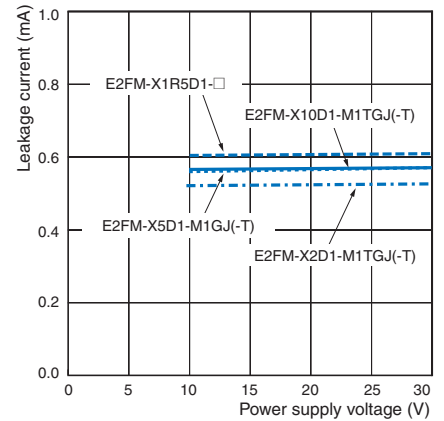


E2FM-X10□



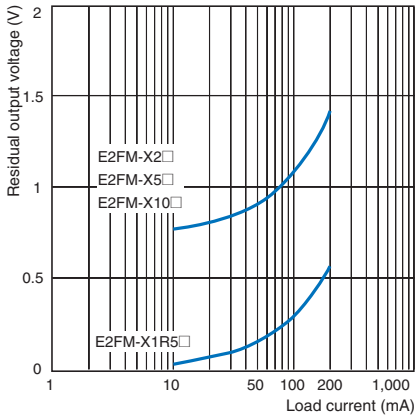
Leakage Current

E2FM-X□D1-M1TGJ (-T)

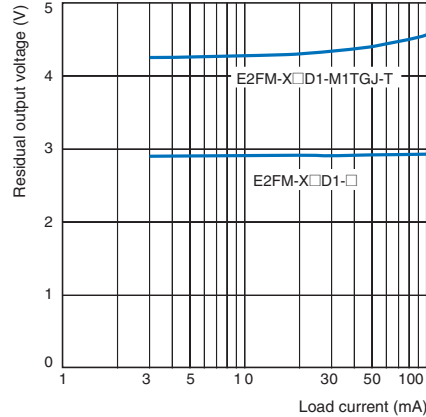


Residual Output Voltage

E2FM-X□C□/B□



E2FM-X□D1-M1TGJ (-T)



# I/O Circuit Diagrams

## DC 2-Wire Models

| Operation mode | Model             | Timing chart | Output circuit  |
|----------------|-------------------|--------------|---|
| NO             | E2FM-X□D1-□       |              | <p>Connector Pin Arrangement</p> <p>Note: Pins 2 and 3 are not used.</p> <p>Note: The load can be connected to either the +V or 0 V side.</p>   |
|                | E2FM-X□D1-M1TGJ-T |              | <p>Connector Pin Arrangement</p> <p>Note: Pins 1 and 2 are not used.</p> <p>Note1. The load can be connected to either the +V or 0 V side.<br/>                 Note 2. The E2FM-X□□1-M1TGJ-T has no polarity. There is no need to be concerned about the polarity of pins 3 and 4.</p> |

## DC 3-Wire Models

| Operation mode | Output configuration     | Model   | Timing chart  | Output circuit  |
|----------------|--------------------------|---|---|---|
| NO             | NPN open-collector model | E2FM-X1R5C□<br>E2FM-X2C□<br>E2FM-X5C□<br>E2FM-X10C□ |   | <p>Connector Pin Arrangement</p> <p>Note: For Connector Models, the connection between pins 1, 4 and 3 uses an NO contact, and the connection between pins 1, 2 and 3 uses an NC contact.</p> <p>* There is no reversed output polarity protection diode.</p> |
|                |                          | PNP open-collector model                            | E2FM-X1R5B□<br>E2FM-X2B□<br>E2FM-X5B□<br>E2FM-X10B□ |   |



## Safety Precautions

### ⚠ WARNING

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



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



### Precautions for Safe Use

The following precautions must be observed to ensure safe operation.

- Do not use the Sensor in an environment where inflammable or explosive gas is present.
- Do not attempt to disassemble, repair, or modify any Sensors.
- Power Supply Voltage  
Do not use a voltage that exceeds the rated operating voltage range. Applying a voltage that is higher than the operating voltage range may result in explosion or fire.
- Incorrect Wiring  
Be sure that the power supply polarity and other wiring is correct. Incorrect wiring may cause explosion or fire.
- Connection without a Load  
If the power supply is connected directly without a load, the internal elements may explode or burn. Be sure to insert a load when connecting the power supply.

### Precautions for Correct Use

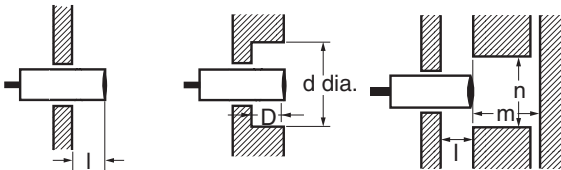
Do not use the Sensor under ambient conditions that exceed the ratings.

- Do not use the Sensor in the following locations.
  - Outdoor locations directly subject to sunlight, rain, snow, or water droplets
  - Locations subject to atmospheres with chemical vapors, in particular solvents and acids
  - Locations subject to corrosive gas
- The Sensor may malfunction if used near ultrasonic cleaning equipment, high-frequency equipment, transceivers, cellular phones, inverters, or other devices that generate a high-frequency electric field. Refer to the *Technical Guide Photoelectric Sensors* for typical measures.
- Laying the Sensor wiring in the same conduit or duct as high-voltage wires or power lines may result in incorrect operation and damage due to induction. Wire the Sensor using a separate conduit or independent conduit.
- Cleaning  
Never use thinner or other solvents. Otherwise, the Sensor surface may be dissolved.

### ● Design

#### Influence of Surrounding Metal

When the Proximity Sensor is embedded in metal, make sure that the clearances given in the following table are maintained. The values depend on the type of nuts used for mounting. Be sure to use the supplied nuts (SUS303).



(Unit: mm)

| Model      | Item Embedding material | l  | d   | D  | m   | n   |
|------------|-------------------------|----|-----|----|-----|-----|
| E2FM-X1R5□ | Iron                    | 0  | 8   | 0  | 4.5 | 30  |
|            | Aluminum                | 10 | 50  | 10 | 4.5 | 50  |
| E2FM-X2□   | Iron                    | 0  | 12  | 0  | 8   | 40  |
|            | Aluminum                | 16 | 70  | 16 | 8   | 70  |
| E2FM-X5□   | Iron                    | 0  | 18  | 0  | 20  | 60  |
|            | Aluminum                | 16 | 80  | 16 | 20  | 80  |
| E2FM-X10□  | Iron                    | 0  | 30  | 0  | 40  | 100 |
|            | Aluminum                | 24 | 120 | 24 | 40  | 120 |

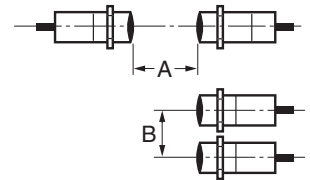
Note: The influence from other non-magnetic surrounding metals is nearly the same as that from aluminum.

#### Mutual Interference

When installing two or more Sensors face-to-face or side-by-side, ensure that the minimum distances given in the following table are maintained.

(Unit: mm)

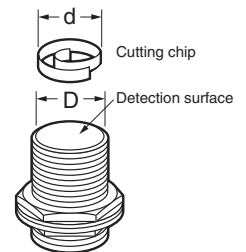
| Model      | Item | A   | B   |
|------------|------|-----|-----|
| E2FM-X1R5□ |      | 35  | 30  |
| E2FM-X2□   |      | 40  | 35  |
| E2FM-X5□   |      | 65  | 60  |
| E2FM-X10□  |      | 110 | 100 |



#### Chips from Cutting Aluminum

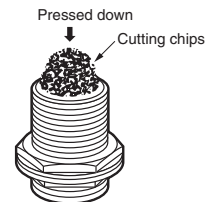
Normally, chips from cutting aluminum or cast iron will not cause a detection signal to be output even if it adheres to or accumulates on the detection surface. In the following cases, however, a detection signal may be output. Remove the cutting chips in these cases.

- If  $d \geq \frac{2}{3} D$  at the center of the detection surface where  $d$  is the cutting chip size and  $D$  is the detection surface size



| Model      | Dimension (mm) | D  |
|------------|----------------|----|
| E2FM-X1R5□ |                | 6  |
| E2FM-X2□   |                | 10 |
| E2FM-X5□   |                | 16 |
| E2FM-X10□  |                | 28 |

- If the cutting chips are pressed down



### ● Mounting

Do not tighten the nut with excessive force. A washer must be used with the nut. Do not use tightening force that exceeds the values in the following table.

| Model      | Torque  |
|------------|---------|
| E2FM-X1R5□ | 9 N·m   |
| E2FM-X2□   | 30 N·m  |
| E2FM-X5□   | 70 N·m  |
| E2FM-X10□  | 180 N·m |



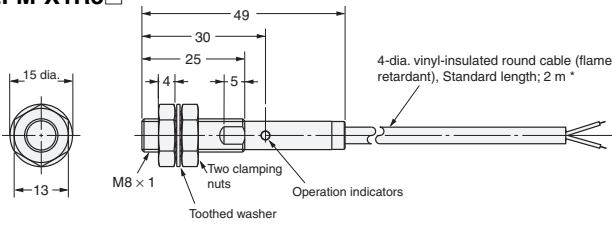
Dimensions

Tolerance class IT16 applies to dimensions in this data sheet unless otherwise specified.

Sensors

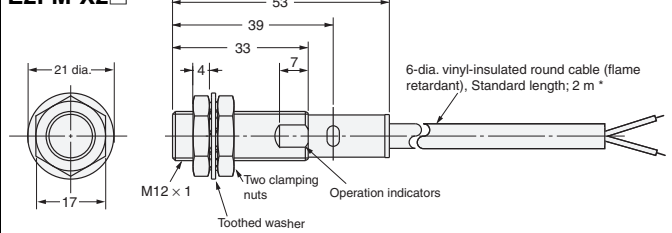
Pre-wired Models

E2FM-X1R5



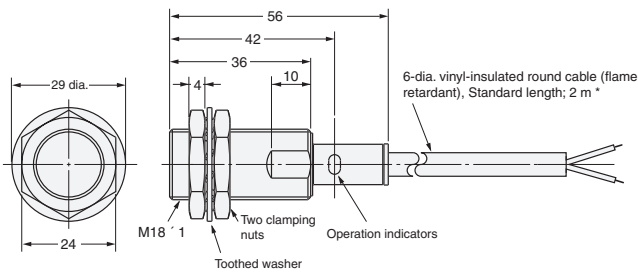
\* 4-dia. vinyl-insulated round cable with 2 conductors  
(Conductor cross section: 0.2 mm<sup>2</sup>, Insulator diameter: 1.4 mm)  
4-dia. vinyl-insulated round cable with 3 conductors  
(Conductor cross section: 0.2 mm<sup>2</sup>, Insulator diameter: 1.2 mm)

E2FM-X2



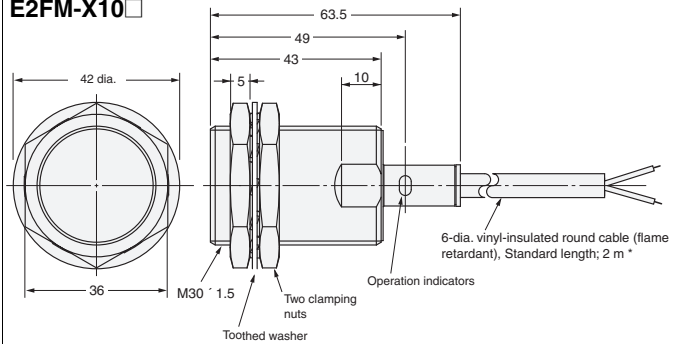
\* 6-dia. vinyl-insulated round cable with 2 conductors  
(Conductor cross section: 0.5 mm<sup>2</sup>, Insulator diameter: 1.75 mm)  
6-dia. vinyl-insulated round cable with 3 conductors  
(Conductor cross section: 0.5 mm<sup>2</sup>, Insulator diameter: 1.75 mm)

E2FM-X5



\* 6-dia. vinyl-insulated round cable with 2 conductors  
(Conductor cross section: 0.5 mm<sup>2</sup>, Insulator diameter: 1.75 mm)  
6-dia. vinyl-insulated round cable with 3 conductors  
(Conductor cross section: 0.5 mm<sup>2</sup>, Insulator diameter: 1.75 mm)

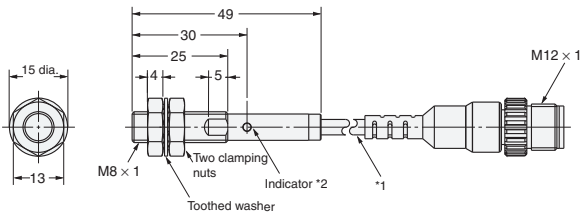
E2FM-X10



\* 6-dia. vinyl-insulated round cable with 2 conductors  
(Conductor cross section: 0.5 mm<sup>2</sup>, Insulator diameter: 1.75 mm)  
6-dia. vinyl-insulated round cable with 3 conductors  
(Conductor cross section: 0.5 mm<sup>2</sup>, Insulator diameter: 1.75 mm)

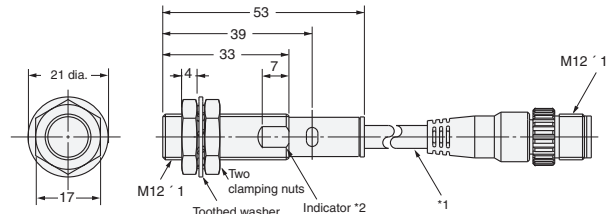
Pre-wired Connector Models

E2FM-X1R5D-M1TGJ



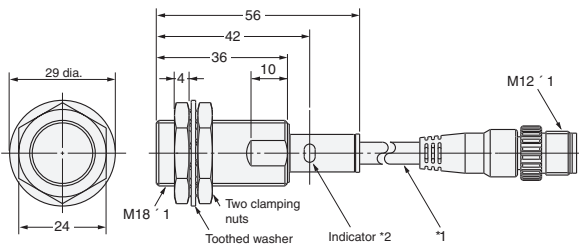
\*1. 4-dia. vinyl-insulated round cable (flame retardant), Standard length; 300 mm  
\*2. Operation indicator (red/green)  
Setting indicator (green)

E2FM-X2D-M1TGJ



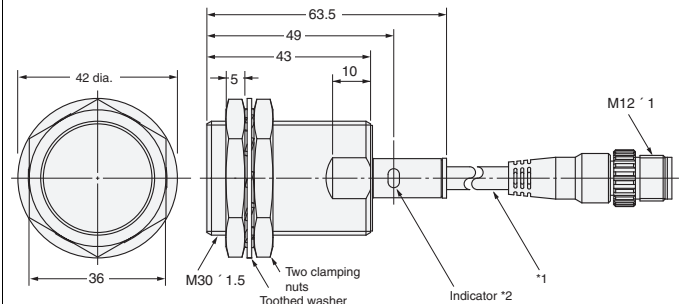
\*1. 6-dia. vinyl-insulated round cable (flame retardant), Standard length; 300 mm  
\*2. Operation indicator (red/green)  
Setting indicator (green)

E2FM-X5D-M1TGJ



\*1. 6-dia. vinyl-insulated round cable (flame retardant), Standard length; 300 mm  
\*2. Operation indicator (red/green)  
Setting indicator (green)

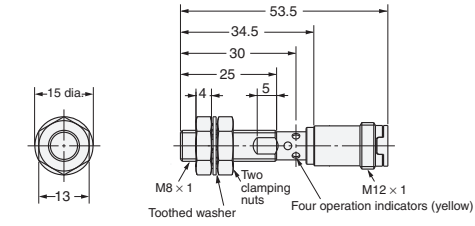
E2FM-X10D-M1TGJ



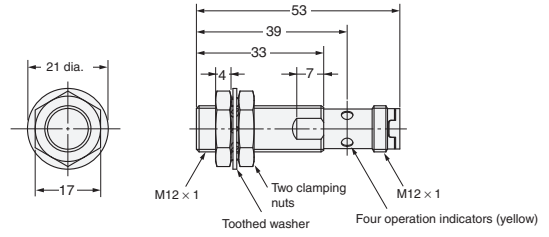
\*1. 6-dia. vinyl-insulated round cable (flame retardant), Standard length; 300 mm  
\*2. Operation indicator (red/green)  
Setting indicator (green)

M12 Connector Models

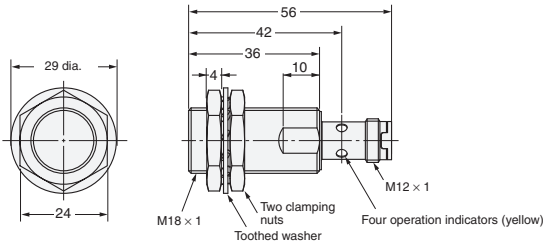
E2FM-X1R5□□-M1



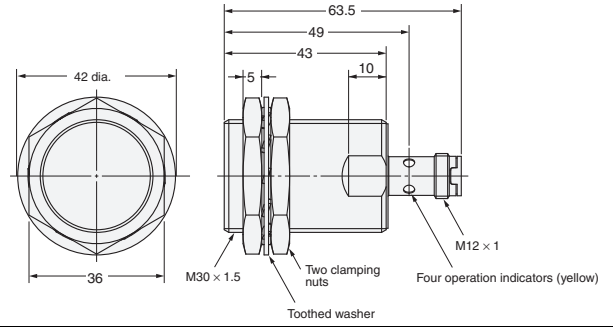
E2FM-X2□□-M1



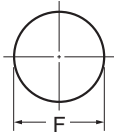
E2FM-X5□□-M1



E2FM-X10□□-M1



Mounting Hole Dimensions



| Dimension | M8                                    | M12                                    | M18                                    | M30                                    |
|-----------|---------------------------------------|--|--|--|
| F (mm)    | 8.5 <sup>+0.5</sup> <sub>0</sub> dia. | 12.5 <sup>+0.5</sup> <sub>0</sub> dia. | 18.5 <sup>+0.5</sup> <sub>0</sub> dia. | 30.5 <sup>+0.5</sup> <sub>0</sub> dia. |

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