

## Capacitive Prox

## E2K-X

Threaded, Cylindrical Sensor  
Detects Metallic and  
Non-metallic Objects

- Permits non-contact detection of metallic and non-metallic objects such as glass, wood, water, oil and plastic
- Allows indirect detection of materials inside non-metallic containers
- Built-in amplifier accepts a wide range of supply voltages and switches up to 200 mA
- LED indicator and fixed sensitivity for simple installation



## Ordering Information

### ■ 3-WIRE DC SENSORS

| Size                       |        | M12            | M18            | M30             |
|----------------------------|--------|----------------|----------------|-----------------|
| Type                       |        | Unshielded     |                |                 |
| Nominal detecting distance |        | 4 mm (0.16 in) | 8 mm (0.32 in) | 15 mm (0.59 in) |
| Part number                | NPN-NO | E2K-X4ME1      | E2K-X8ME1      | E2K-X15ME1      |
|                            | NPN-NC | E2K-X4ME2      | E2K-X8ME2      | E2K-X15ME2      |
|                            | PNP-NO | E2K-X4MF1      | E2K-X8MF1      | E2K-X15MF1      |
|                            | PNP-NC | E2K-X4MF2      | E2K-X8MF2      | E2K-X15MF2      |

### ■ 2-WIRE AC SENSORS

| Size                       |        | M12            | M18            | M30             |
|----------------------------|--------|----------------|----------------|-----------------|
| Type                       |        | Unshielded     |                |                 |
| Nominal detecting distance |        | 4 mm (0.16 in) | 8 mm (0.32 in) | 15 mm (0.59 in) |
| Part number                | SCR-NO | E2K-X4MY1      | E2K-X8MY1      | E2K-X15MY1      |
|                            | SCR-NC | E2K-X4MY2      | E2K-X8MY2      | E2K-X15MY2      |

### ■ ACCESSORIES

| Description                                 |                       | Part number |
|---------------------------------------------|-----------------------|-------------|
| Mounting brackets for standard size sensors | Fits M12 size sensors | Y92E-B12    |
|                                             | Fits M18 size sensors | Y92E-B18    |
|                                             | Fits M30 size sensors | Y92E-B30    |

## REPLACEMENT PARTS

| Description                                         |                                                   | Part number     |
|-----------------------------------------------------|---------------------------------------------------|-----------------|
| Mounting hardware includes one pair of plastic nuts | Fits M12 size sensors (supplied with each sensor) | <b>M12-PHWS</b> |
|                                                     | Fits M18 size sensors (supplied with each sensor) | <b>M18-PHWS</b> |
|                                                     | Fits M30 size sensors (supplied with each sensor) | <b>M30-PHWS</b> |

# Specifications

## 3-WIRE DC SENSORS

|                                                             |                |                                  |                                                                                                                                                                                                              |                                                                          |                                                                          |
|-------------------------------------------------------------|----------------|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|--------------------------------------------------------------------------|
| Part number                                                 |                |                                  | E2K-X4M□□                                                                                                                                                                                                    | E2K-X8M□□                                                                | E2K-X15M□□                                                               |
| Sensor type                                                 |                |                                  | Capacitive                                                                                                                                                                                                   |                                                                          |                                                                          |
| Body                                                        |                | Size                             | M12                                                                                                                                                                                                          | M18                                                                      | M30                                                                      |
|                                                             |                | Type                             | Unshielded                                                                                                                                                                                                   |                                                                          |                                                                          |
| Supply voltage                                              |                |                                  | 10 to 30 VDC                                                                                                                                                                                                 |                                                                          |                                                                          |
| Current consumption                                         |                |                                  | 8 mA at 12 VDC<br>15 mA at 24 VDC                                                                                                                                                                            |                                                                          |                                                                          |
| Detectable object type                                      |                |                                  | Metallic and non-metallic objects                                                                                                                                                                            |                                                                          |                                                                          |
| Sensitivity                                                 |                |                                  | Fixed                                                                                                                                                                                                        |                                                                          |                                                                          |
| Effective maximum detecting distance (with standard target) |                |                                  | 4 mm (0.16 in)                                                                                                                                                                                               | 8 mm (0.32 in)                                                           | 15 mm (0.59 in)                                                          |
| Standard target size (grounded mild steel, L x W x H)       |                |                                  | 50 x 50 x 1 mm (2.0 x 2.0 x 0.04 in)                                                                                                                                                                         |                                                                          |                                                                          |
| Differential travel                                         |                |                                  | 20% max. of effective maximum detecting distance                                                                                                                                                             |                                                                          |                                                                          |
| Control output                                              | DC solid-state | Type                             | NPN-NO open collector with pull-up (E2K-X□□ME1)<br>NPN-NC open collector with pull-up (E2K-X□□ME2)<br>PNP-NO open collector with pull-down (E2K-X□□MF1)<br>PNP-NC open collector with pull-down (E2K-X□□MF2) |                                                                          |                                                                          |
|                                                             |                | Max. load                        | 200 mA                                                                                                                                                                                                       |                                                                          |                                                                          |
|                                                             |                | Max. on-state voltage drop       | 1 VDC                                                                                                                                                                                                        |                                                                          |                                                                          |
| Response frequency                                          |                |                                  | 100 Hz                                                                                                                                                                                                       |                                                                          |                                                                          |
| Circuit protection                                          |                | Output short-circuit             | Not provided                                                                                                                                                                                                 |                                                                          |                                                                          |
|                                                             |                | DC power supply reverse polarity | Provided                                                                                                                                                                                                     |                                                                          |                                                                          |
|                                                             |                | Weld field immunity              | Not provided                                                                                                                                                                                                 |                                                                          |                                                                          |
|                                                             |                | RFI immunity                     | Not provided                                                                                                                                                                                                 |                                                                          |                                                                          |
| Indicators                                                  |                |                                  | Target Present (red LED)                                                                                                                                                                                     |                                                                          |                                                                          |
| Materials                                                   |                | Housing                          | ABS                                                                                                                                                                                                          |                                                                          |                                                                          |
|                                                             |                | Sensing face                     | ABS                                                                                                                                                                                                          |                                                                          |                                                                          |
|                                                             |                | Cable sheath                     | Polyethylene                                                                                                                                                                                                 |                                                                          |                                                                          |
| Mounting                                                    |                |                                  | Two metal lock washers and M12 nuts included. Bracket Y92E-B12 optional.                                                                                                                                     | Two metal lock washers and M18 nuts included. Bracket Y92E-M18 optional. | Two metal lock washers and M30 nuts included. Bracket Y92E-M30 optional. |
| Connections                                                 |                |                                  | Three-conductor cable, 2 m (6.56 ft) length                                                                                                                                                                  |                                                                          |                                                                          |
| Weight with cable                                           |                |                                  | Approx. 65 g (2.3 oz.)                                                                                                                                                                                       | Approx. 145 g (5.1 oz.)                                                  | Approx. 205 g (7.2 oz.)                                                  |
| Enclosure ratings                                           |                | UL                               | —                                                                                                                                                                                                            |                                                                          |                                                                          |
|                                                             |                | NEMA                             | 1, 4, 12, 13                                                                                                                                                                                                 |                                                                          |                                                                          |
|                                                             |                | IEC 144                          | IP66                                                                                                                                                                                                         |                                                                          |                                                                          |
| Approvals                                                   |                | UL                               | —                                                                                                                                                                                                            |                                                                          |                                                                          |
|                                                             |                | CSA                              | —                                                                                                                                                                                                            |                                                                          |                                                                          |
| Ambient operating temperature                               |                |                                  | –25° to 70°C (–13° to 158°F)                                                                                                                                                                                 |                                                                          | –10° to 55°C (14° to 131°F)                                              |
| Vibration                                                   |                |                                  | 10 to 55 Hz, 1.5 mm (0.06 in) double amplitude                                                                                                                                                               |                                                                          |                                                                          |
| Shock                                                       |                |                                  | Approx. 50 G's                                                                                                                                                                                               |                                                                          |                                                                          |

## ■ 2-WIRE AC SENSORS

|                                                             |                      |                                |                                                                               |                                                                          |                                                                          |
|-------------------------------------------------------------|----------------------|--------------------------------|-------------------------------------------------------------------------------|--------------------------------------------------------------------------|--------------------------------------------------------------------------|
| Part number                                                 |                      |                                | E2K-X4MY□                                                                     | E2K-X8MY□                                                                | E2K-X15MY□                                                               |
| Sensor type                                                 |                      |                                | Capacitive                                                                    |                                                                          |                                                                          |
| Body                                                        | Size                 | M12                            |                                                                               | M18                                                                      | M30                                                                      |
|                                                             | Type                 | Unshielded                     |                                                                               |                                                                          |                                                                          |
| Supply voltage                                              |                      |                                | 90 to 250 VAC, 50/60 Hz                                                       |                                                                          |                                                                          |
| Current consumption                                         |                      |                                | 2.2 mA at 200 VAC                                                             |                                                                          |                                                                          |
| Detectable object type                                      |                      |                                | Metallic and non-metallic objects                                             |                                                                          |                                                                          |
| Sensitivity                                                 |                      |                                | Fixed                                                                         |                                                                          |                                                                          |
| Effective maximum detecting distance (with standard target) |                      |                                | 4 mm (0.16 in)                                                                | 8 mm (0.32 in)                                                           | 15 mm (0.59 in)                                                          |
| Standard target size (grounded mild steel, L x W x H)       |                      |                                | 50 x 50 x 1 mm (2.0 x 2.0 x 0.04 in)                                          |                                                                          |                                                                          |
| Differential travel                                         |                      |                                | 20% max. of effective detecting distance                                      |                                                                          |                                                                          |
| Control output                                              | AC solid-state       | Type                           | SCR-NO (E2K-X□□Y1)<br>SCR-NC (E2K-X□□Y2)                                      |                                                                          |                                                                          |
|                                                             |                      | Max. load                      | 200 mA                                                                        |                                                                          |                                                                          |
|                                                             |                      | Max. off-state leakage current | See “Leakage Current Characteristics” graph in Engineering Data section       |                                                                          |                                                                          |
|                                                             |                      | Max. on-state voltage drop     | See “Residual Load Voltage Characteristics” graph in Engineering Data section |                                                                          |                                                                          |
| Response frequency                                          |                      |                                | 10 Hz                                                                         |                                                                          |                                                                          |
| Circuit protection                                          | Output short-circuit | Not provided                   |                                                                               |                                                                          |                                                                          |
|                                                             | Weld field immunity  | Not provided                   |                                                                               |                                                                          |                                                                          |
|                                                             | RFI immunity         | Not provided                   |                                                                               |                                                                          |                                                                          |
| Indicators                                                  |                      |                                | Output Operation (red LED)                                                    |                                                                          |                                                                          |
| Materials                                                   | Housing              | ABS                            |                                                                               |                                                                          |                                                                          |
|                                                             | Sensing face         | ABS                            |                                                                               |                                                                          |                                                                          |
|                                                             | Cable sheath         | Polyethylene                   |                                                                               |                                                                          |                                                                          |
| Mounting                                                    |                      |                                | Two metal lock washers and M12 nuts included. Bracket Y92E-B12 optional.      | Two metal lock washers and M18 nuts included. Bracket Y92E-B18 optional. | Two metal lock washers and M30 nuts included. Bracket Y92E-B30 optional. |
| Connections                                                 |                      |                                | Two-connector cable, 2 m (6.56 ft) length                                     |                                                                          |                                                                          |
| Weight with cable                                           |                      |                                | Approx. 65 g (2.3 oz.)                                                        | Approx. 145 g (5.1 oz.)                                                  | Approx. 205 g (7.2 oz.)                                                  |
| Enclosure ratings                                           | UL                   | —                              |                                                                               |                                                                          |                                                                          |
|                                                             | NEMA                 | 1, 4, 12, 13                   |                                                                               |                                                                          |                                                                          |
|                                                             | IEC 144              | IP66                           |                                                                               |                                                                          |                                                                          |
| Approvals                                                   | UL                   | Recognized, File Number E76675 |                                                                               |                                                                          |                                                                          |
|                                                             | CSA                  | Certified, File Number LR45951 |                                                                               |                                                                          |                                                                          |
| Ambient operating temperature                               |                      |                                | –25° to 70°C (–13° to 158°F)                                                  |                                                                          | –10° to 55°C (14° to 131°F)                                              |
| Vibration                                                   |                      |                                | 10 to 55 Hz, 1.5 mm (0.06 in) double amplitude                                |                                                                          |                                                                          |
| Shock                                                       |                      |                                | Approx. 50 G's                                                                |                                                                          |                                                                          |

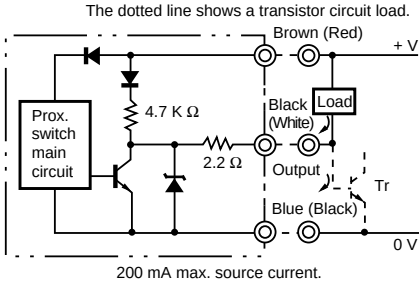
Operation

■ OUTPUT DIAGRAMS AND TIMING CHARTS

DC Switching Types

E2K-X□ME□

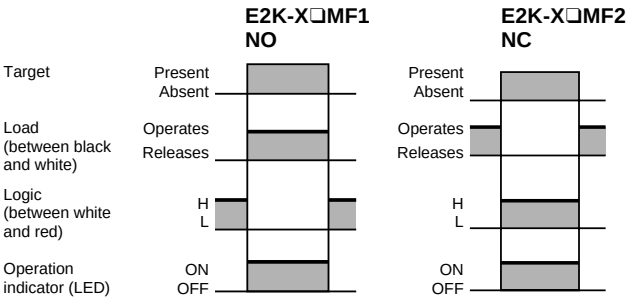
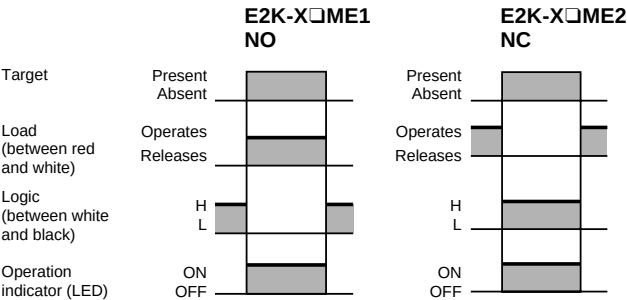
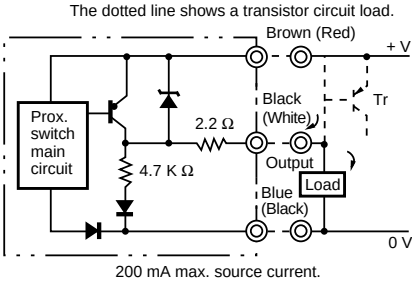
NPN



Note: IEC colors are shown in parentheses.

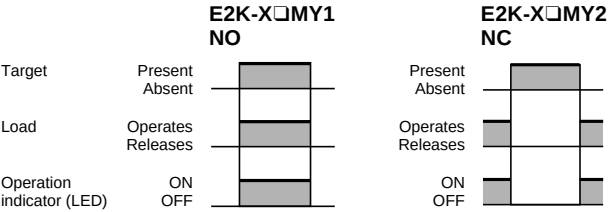
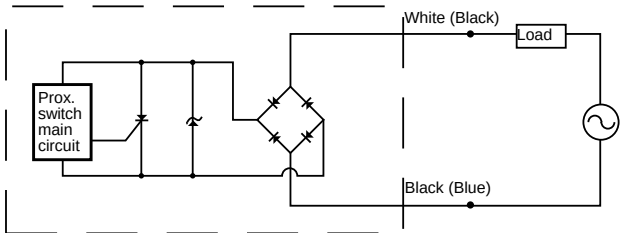
E2K-X□MF□

PNP



AC Switching Types

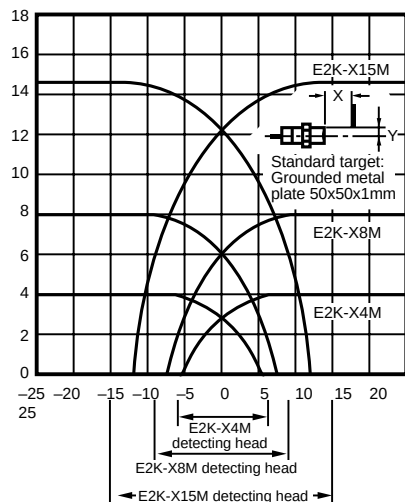
E2K-X□MY□



# Engineering Data

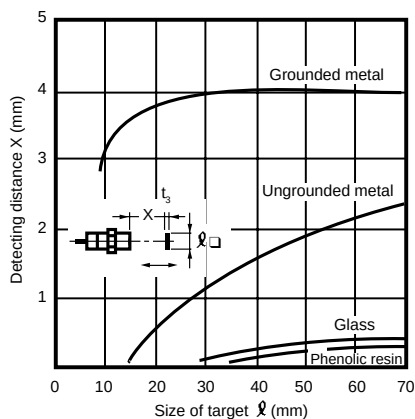
## Operating Range

### E2K-X□□□□

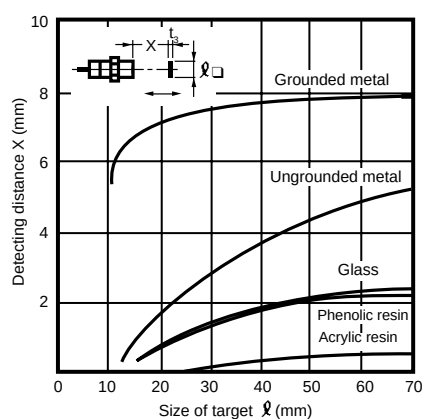


## Detecting Distance vs. Size and Material of Target

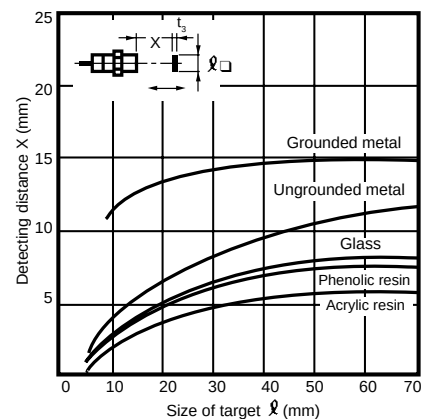
### E2K-X4M□□



### E2K-X8M□□

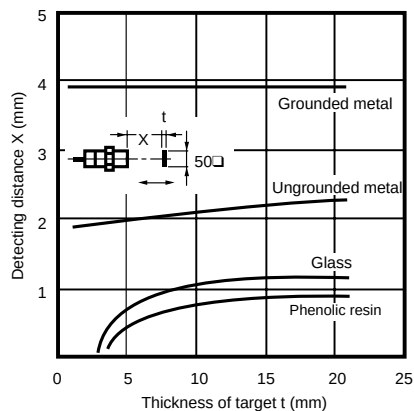


### E2K-X15M□□

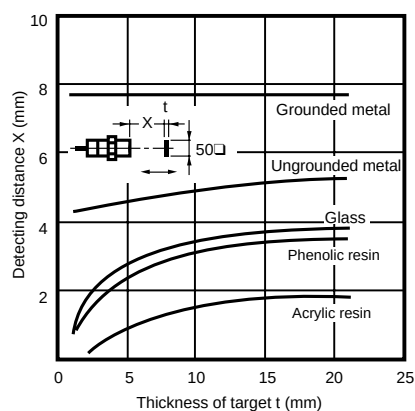


## Detecting Distance vs. Thickness and Material of Target

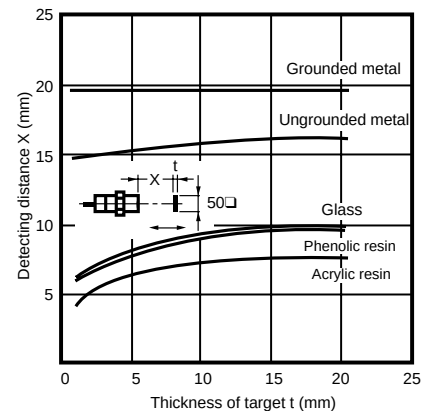
### E2K-X4M□□



### E2K-X8M□□



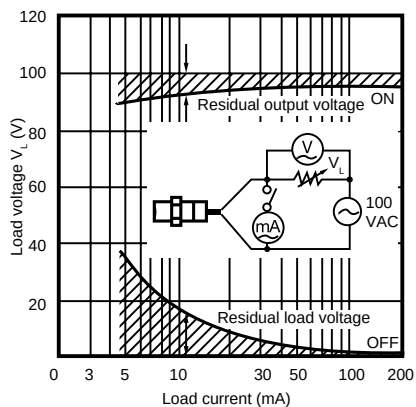
### E2K-X15M□□



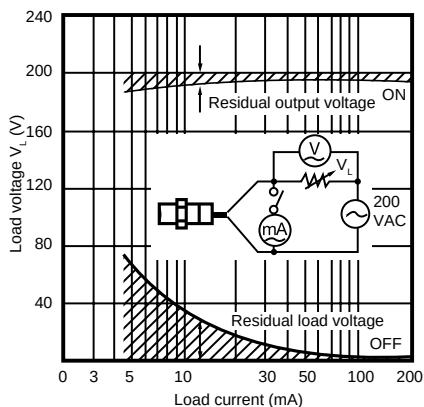
## Residual Load Voltage Characteristics

### AC switching types

#### 100 VAC



#### 200 VAC



Note: When the current rating of the load is less than 10 mA, false operation may occur. This is normal, and the problem can be cured by installing a bleeder resistor in parallel with the load. Use the formulas given here to calculate the power rating and value of the resistor.

$$R \leq \frac{V_s}{10 - i} \text{ (k}\Omega\text{)} \quad P > \frac{V_s^2}{R} \text{ (mW)}$$

P : Power rating of bleeder resistor

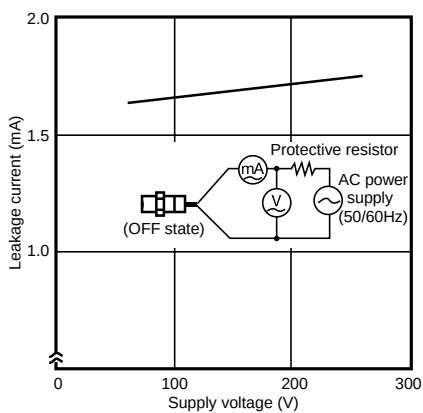
i : Load current (mA)

V<sub>s</sub> : Supply voltage (V)

## Leakage Current Characteristics

### AC switching types

#### E2K-X□MY□

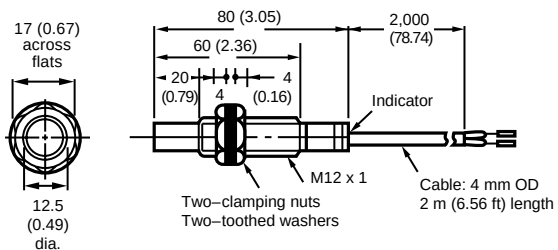


# Dimensions

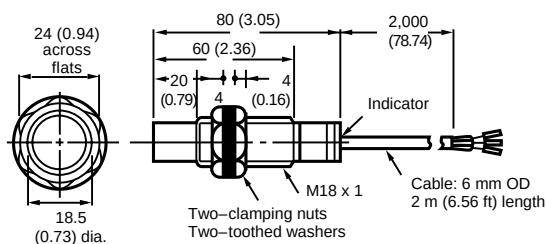
## ■ SENSORS

Unit: mm

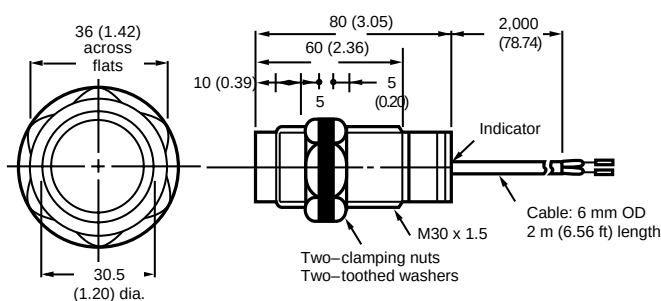
### E2K-X4M□□



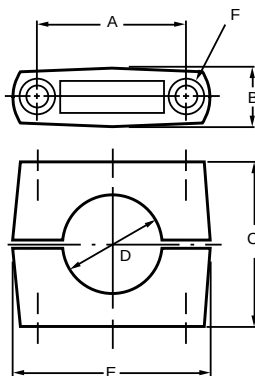
### E2K-X8M□□



### E2K-X15M□□



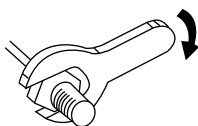
## ■ OPTIONAL MOUNTING BRACKETS



| Part number | Drawing dimensions |           |    |         |         |              | Applicable sensor models |
|-------------|--------------------|-----------|----|---------|---------|--------------|--------------------------|
|             | A                  | B         | C  | D       | E       | F            |                          |
| Y92E-B12    | 24 ± 0.2           | 12.5 max. | 20 | 12 dia. | 37 max. | M4 x 25 bolt | E2K-X4M□□                |
| Y92E-B18    | 32 ± 0.2           | 17 max.   | 30 | 18 dia. | 37 max. | M5 x 32 bolt | E2K-X8M□□                |
| Y92E-B30    | 45 ± 0.2           | 17 max.   | 50 | 30 dia. | 60 max. | M5 x 50 bolt | E2K-X15M□□               |

# Precautions

## ■ TIGHTENING FORCE



Do not exceed the torque listed in the table at right when tightening the mounting nuts.

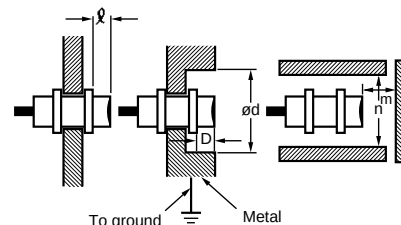
| Part number | Maximum torque |        |
|-------------|----------------|--------|
|             | kg-cm          | in-lbs |
| E2K-X4M□□   | 8              | 7      |
| E2K-X8M□□   | 20             | 17     |
| E2K-X15M□□  | 20             | 17     |

## ■ EFFECTS OF SURROUNDING METAL

When mounting the proximity sensor in or near a metallic panel, be sure to provide a minimum distance as shown in the tables below. This prevents the sensor from being affected by metallic objects other than the target.

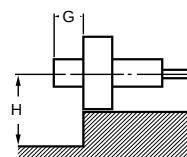
### When Mounting Directly to Metal Panel or Object

| Drawing dimension | Sensor model    |                 |                 |
|-------------------|-----------------|-----------------|-----------------|
|                   | E2K-X4M□□       | E2K-X8M□□       | E2K-X15M□□      |
| ℓ                 | 20 mm (0.79 in) | 20 mm (0.79 in) | 10 mm (0.39 in) |
| d (dia.)          | 50 mm (1.97 in) | 50 mm (1.97 in) | 50 mm (1.97 in) |
| D                 | 20 mm (0.79 in) | 20 mm (0.79 in) | 10 mm (0.39 in) |
| m                 | 8 mm (0.32 in)  | 12 mm (0.47 in) | 25 mm (0.98 in) |
| n                 | 60 mm (2.36 in) | 60 mm (2.36 in) | 60 mm (2.36 in) |



### When Using Optional Mounting Brackets

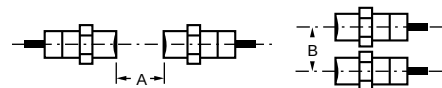
| Drawing dimension | Sensor model    |                 |                 |
|-------------------|-----------------|-----------------|-----------------|
|                   | E2K-X4M□□       | E2K-X8M□□       | E2K-X15M□□      |
| G                 | 20 mm (0.79 in) | 20 mm (0.79 in) | 10 mm (0.39 in) |
| H                 | 30 mm (1.18 in) | 30 mm (1.18 in) | 30 mm (1.18 in) |



## ■ MUTUAL INTERFERENCE

To prevent mutual interference between two sensors, be sure to space the two sensors at a distance greater than that shown in the table below.

| Drawing dimension | Sensor model    |                  |                   |
|-------------------|-----------------|------------------|-------------------|
|                   | E2K-X4M□□       | E2K-X8M□□        | E2K-X15M□□        |
| A                 | 80 mm (3.15 in) | 150 mm (5.91 in) | 300 mm (11.81 in) |
| B                 | 70 mm (2.76 in) | 110 mm (4.33 in) | 200 mm (7.87 in)  |



## ■ REQUIRED WARM-UP TIME BEFORE OPERATION

### DC Switching Sensors

In applying any of the E2K-X□ME series proximity sensors as a voltage output type, note that an unwanted output may be produced momentarily (50 ms max.) when power is applied with a target moving toward the E2K-X□ME1(F1) or with a target moving away from the E2K-X□ME2(F2). After the power application, a minimum of 50 ms is required before the sensor circuit can operate. Move the target toward or away from the proximity sensor after this time period.

### AC Switching Sensors

After applying power to a proximity sensor, a minimum of 100 ms is required before the sensor circuit reaches its steady state. The load is in the OFF state during this period. Do not move the target toward or away from the proximity sensor until the sensor circuit enters the steady state. The operation indicator (LED) will illuminate momentarily when the power is turned ON or OFF, but the output stage circuit is in a normal operating state.

## ■ USING METAL CONDUIT

If a high voltage or power line runs near the proximity sensor cable, be sure to wire the sensor cable through a metal conduit to protect the sensor from malfunctioning or damage.

## ■ SURGE PROTECTION

The proximity sensor is provided with a surge suppressor circuit. However, if any large surge generation source (i.e. motor, welding machine, etc.) exists in the vicinity of the proximity sensor, insert a surge suppressor (such as a varistor) into the surge generating source.





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11/01

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