OMRON

| Sensing distance | Supply voltage | Output |
|---|---|---|
| 1.0 mm<br>1.5 mm<br>2.5 mm<br>5.0 mm | 12 to 24 VDC | 100 mA max.,<br>2 outputs |

# High-precision Proximity Sensor

# E2CD

## Ideal for Positioning and Discriminating Objects

- Assures minimal temperature drift.
- Digital setting method allows teaching, thus making it possible to adjust the sensing distance with ease.
- Liquid crystal display assures easy value setting.
- Independent two outputs are ideal for High/Pass/Low discrimination.
- Metals have little effect on the sensing distance.

ISO9001 and 14001 Approved
OMRON Corporation, Ayabe Factory, Sensing Components and Systems

# Ordering Information

| Sensing head | | Sensing distance | Model |
|---|---|---|---|
| 5.4 dia. | Shielded | 0 to 1.0 mm | E2CD-C1C3A |
| 8 dia. | | 0 to 1.5 mm | E2CD-C1R5C3A |
| M12 | | 0 to 2.5 mm | E2CD-X2R5C3A |
| M18 | | 0 to 5.0 mm | E2CD-X5C3A |

**Note:** Each of the above model numbers consists of a set which includes a sensor model number and an amplifier model number. Neither a sensor nor an amplifier is sold separately.

# Specifications

## ■ Ratings/Characteristics

| Item | E2CD-C1C3A | E2CD-C1R5C3A | E2CD-X2R5C3A | E2CD-X5C3A |
|---|---|---|---|---|
| **Power supply voltage (operating voltage)** | 12 to 24 VDC (10 to 30 VDC), ripple (p-p): 10% max. | | | |
| **Current consumption** | 65 mA max. | | | |
| **Sensing object** | Ferrous metal, non-ferrous metal | | | |
| **Standard object** | Iron, 5 x 5 x 1 mm | Iron, 8 x 8 x 1 mm | Iron, 12 x 12 x 1 mm | Iron, 18 x 18 x 1 mm |
| **Sensing distance** | 0 to 1 mm | 0 to 1.5 mm | 0 to 2.5 mm | 0 to 5 mm |
| **Guaranteed accuracy range** | 0.4 to 0.6 mm | 0.6 to 0.9 mm | 1.0 to 1.5 mm | 2.0 to 3.0 mm |
| **Influence of temperature** | 0.8 μm/°C | 1.5 μm/°C | | |
| **Differential travel** | 5 μm max. | 10 μm max. | 12 μm max. | 30 μm max. |
| **Response time** | Sampling time: 8 ms | | | |
| **Control output** | 2 NPN open collector outputs, 100 mA max (residual voltage: 1.0 V max.) | | | |
| **Synchronization input** | ON: 0 to 4 V (5 mA min.)<br>OFF: 7 to 24 V (2 mA max.)<br>Pulse width: 2.5 ms min. | | | |
| **Indicators** | Green: Power; Red: Error; Orange: Zone (HIGH, PASS, and LOW) | | | |

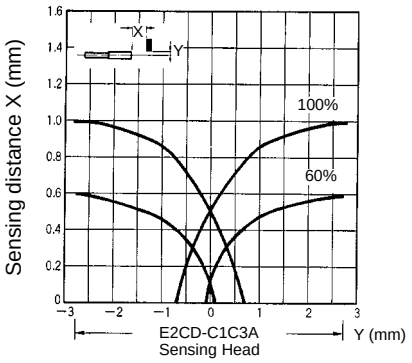
| Item | E2CD-C1C3A | E2CD-C1R5C3A | E2CD-X2R5C3A | E2CD-X5C3A |
|---|---|---|---|---|
| **LCD** | 3 1/2 digits, set value zone display (FINE, ROUGH, and NG)<br>Mode display: A and B<br>Set input display (IN1 and IN2): RUN and MON | | | |
| **Distance setting** | Digital setting method with teaching function | | | |
| **Resolution (typical)** | 0.5 μm | 1 μm | 2 μm | 5 μm |
| **Circuit protection** | Protection for load short circuit, surge voltage, reverse polarity | | | |
| **Diagnostic function** | Output load short-circuit, sensor error, memory error, and CPU error | | | |
| **Ambient temperature** | Sensor: operating: –10°C to 60°C (with no icing)<br>Amplifier: operating: –10°C to 55°C (with no icing) | | | |
| **Ambient humidity** | Operating: 35% to 85% (with no condensation) | | | |
| **Influence of voltage** | ±1% differences within a range of ±15% of rated voltage | | | |
| **Insulation resistance** | 50 MΩ min. (at 500 VDC) between current carry parts and case | | | |
| **Dielectric strength** | Sensor: 1,000 VAC, 50/60 Hz for 1 min between current carry parts and case<br>Amplifier: 1,500 VAC, 50/60 Hz for 1 min between current carry parts and case | | | |
| **Vibration resistance** | Sensor (destruction): 10 to 55 Hz, 3.0-mm double amplitude for 2 hrs each in X, Y, and Z directions<br>Amplifier (destruction): 10 to 150 Hz, 1.5-mm double amplitude for 2 hrs each in X, Y, and Z directions | | | |
| **Shock resistance** | Sensor (destruction): 1,000 $m/s^2$ (100G) 3 times each in X, Y, and Z directions<br>Amplifier (destruction): 300 $m/s^2$ (30G) 3 times each in X, Y, and Z directions | | | |
| **Degree of protection** | Sensor: IEC60529 IP67<br>Amplifier: IEC60529 IP30 | | | |
| **Weight (sensor and amplifier)** | 190 g | 200 g | 220 g | 250 g |

**Note:** 1. The above specifications are guaranteed on condition that the sensing object is located within the guaranteed accuracy range.
2. Be sure to use a right combination of a sensor and amplifier or the operation accuracy of the sensor will not be maintained.

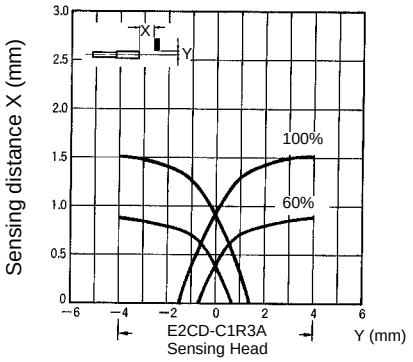
# Engineering Data

**Operating Range (Typical)**

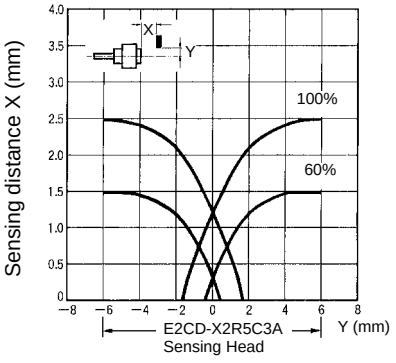
**E2CD-C1C3A**



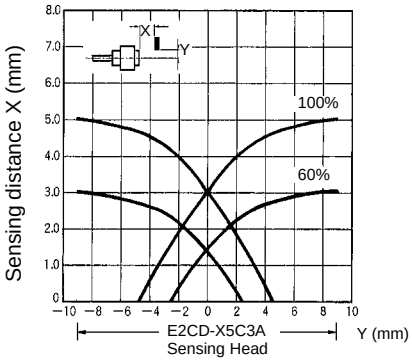

**E2CD-C1R5C3A**




**E2CD-X2R5C3A**

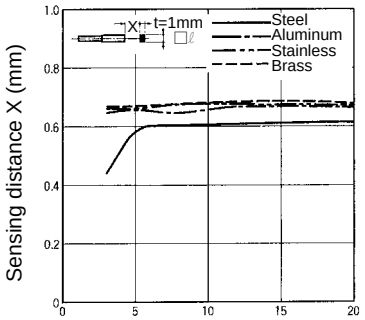



**E2CD-X5C3A**

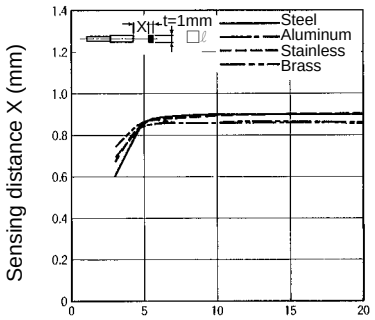


## Sensing Distance vs. Sensing Object (Typical)

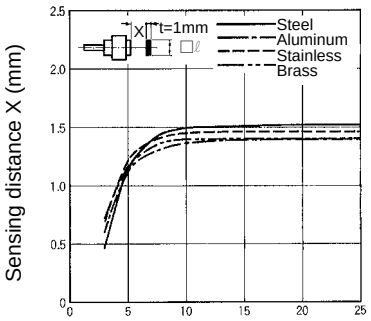
**E2CD-C1C3A**



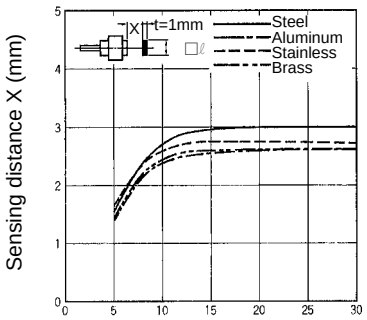

**E2CD-C1R5C3A**




**E2CD-X2R5C3A**



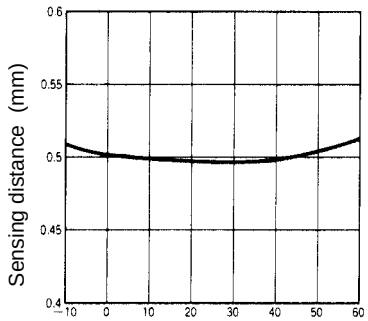

**E2CD-X5C3A**



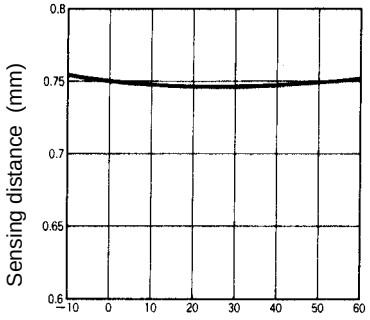

**Note:** The sensing distance is 60% of the rated sensing distance.

## Temperature Characteristics (Typical)

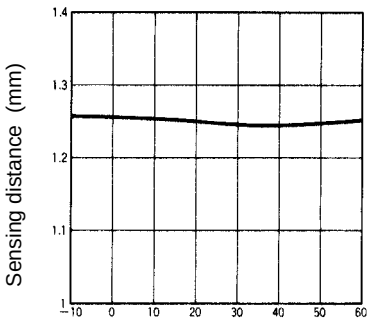
**E2CD-C1C3A**



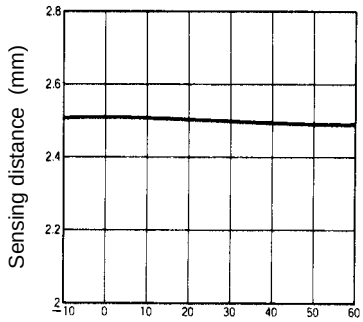

**E2CD-C1R5C3A**



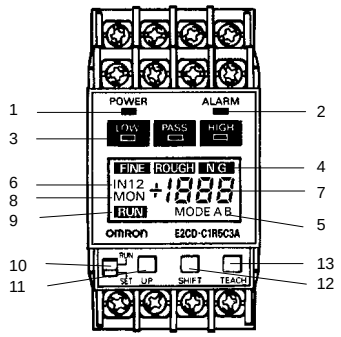

**E2CD-X2R5C3A**




**E2CD-X5C3A**



# Nomenclature




1: POWER indicator
2: ALARM indicator
3: Zone indicators
4: Set value zone indicators
5: MODE indicator
6: Set input indicator
7: Value indicator
8: Monitor
9: RUN indicator
10: Operation mode selector
11: UP Key
12: SHIFT Key
13: TEACH Key

## LED Display

**Power Indicator (Green LED)**

Lit when the power is supplied to the sensor.

**ALARM Indicator (Red LED)**

Flashes when an error occurs, at which time sensor outputs will be OFF and the LCD will display the following error messages.

| Kind of error | LCD | Resetting method |
|---|---|---|
| Output load short-circuited | E1 (flashes) | Automatically reset when the short-circuited load is reset. |
| Sensor error (wire disconnection, wrong connection, temperature rise) | E2 (flashes) | Automatically reset when the sensor error is corrected. |
| User memory data error | E3 (flashes) | Re-input the data. |
| OS memory data error | E4 (flashes) | Impossible to reset. |
| CPU error | E5 (flashes) | Impossible to reset. |

**Zone Indicators (Orange LED)**

No indicators are lit when the synchronization input is OFF.

LOW is lit when the sensing object is nearer than the point set by set value 1 (output 1 is ON).

PASS is lit when the sensing object is between the points set by set values 1 and 2 (output 1 and output 2 are OFF).

HIGH is lit when the sensing object is farther than the point set by set value 2 (output 2 is ON).

## Selector

**Operation Mode Selector**

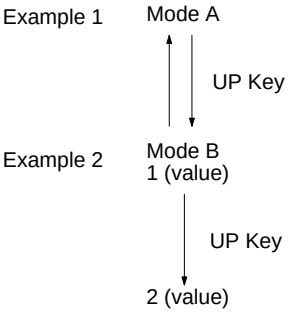
Select one of the following modes with the operation mode selector.

RUN: The sensor operates. No program input is accepted.

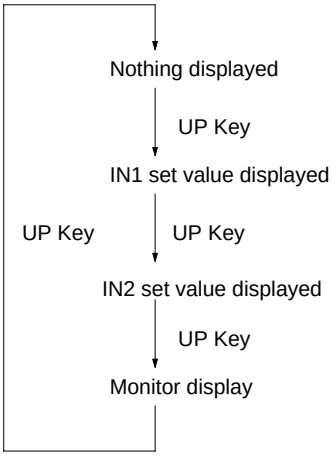
SET: Select this mode for setting value. The set value will be written to the memory when the operation mode is changed to RUN from SET.

**UP Key**

SET Mode: Used to change the mode setting or set value.




RUN Mode: Used to change the contents of the display.




**SHIFT Key**

Used to finalize the mode or value setting or to shift to the next digit.

**TEACH Key**

Used in the teaching mode. With the teaching function, the set value will be input by locating the sensing object at an appropriate position and pressing the TEACH Key. No set value can be input if the sensing object is outside the sensing range.

## LCD

**Set Value Zone Indicators (SET Mode only)**

Displays the location of the set values in the sensing range.

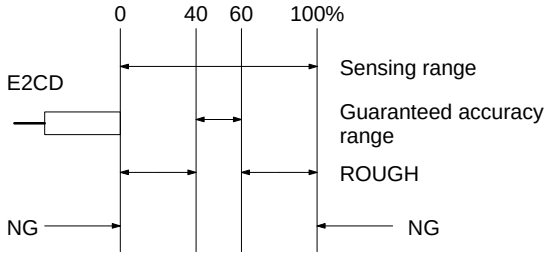
FINE: Displayed when the set values are in the guaranteed accuracy range.

ROUGH: Displayed when the set values are outside the guaranteed accuracy range.

NG: Displayed when the set values are outside the sensing range. However, no program error will result even if NG is displayed.

Example 1: FINE is displayed if set values 1 and 2 are within the guaranteed accuracy range.

Example 2: FINE and NG are displayed if one of the set values is within the guaranteed accuracy range and the other is outside the sensing range.



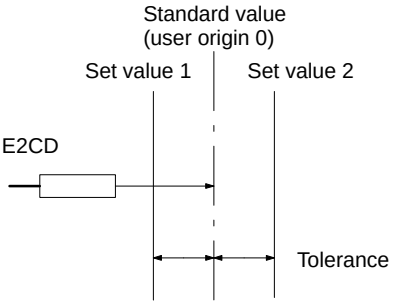

**MODE Indicator**

Displays the status of the present set mode. The set mode display flashes while the E2CD is waiting for an input. It is possible to select one of the following two modes on the E2CD.

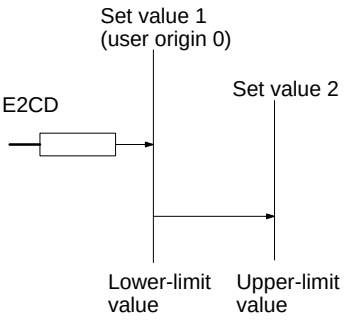
MODE A: Deviation value setting mode. A standard value and its tolerance are input in this mode.

MODE B: Upper- and lower-limit setting mode. An upper-limit value and lower-limit value are input in this mode.

**Mode A**




**Mode B**




**Set Input Indicator**

Displays the status of the present value display. The set input indicator flashes while the E2CD is waiting for an input.

IN1: The standard value is displayed in MODE A and the lower-limit value is displayed in MODE B. The IN1 input value will be the user origin in this case. Thus 0 is displayed after the IN1 value is input.

IN2: The tolerance is displayed in MODE A and the upper-limit value is displayed in MODE B.

**Value Indicator**

The 7-segment display of 3 1/2 digits (±1999) is possible. The set input value (in the SET mode), monitor value (in the RUN mode), and an error message will be displayed. One digit is the same as the set resolution.

**Monitor (RUN Mode only)**

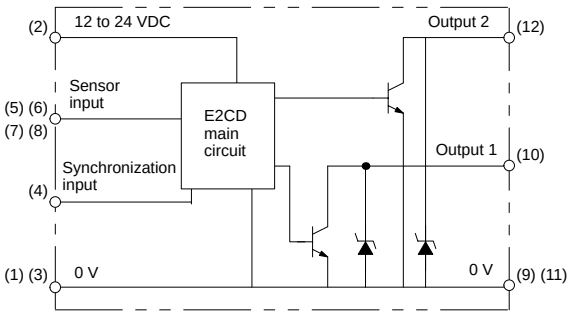
Displays the distance between the user setting point (user origin) and the position of sensing object.

**RUN Indicator**

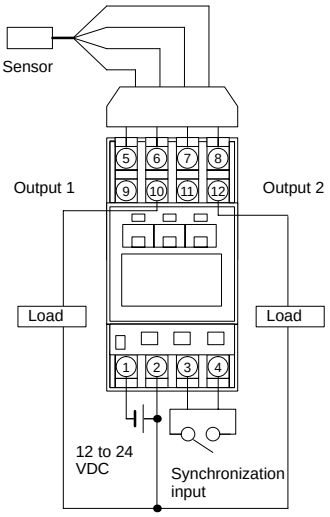
Indicates that the E2CD is set to the RUN mode.

# Operation

## ■ I/O Circuit Diagram

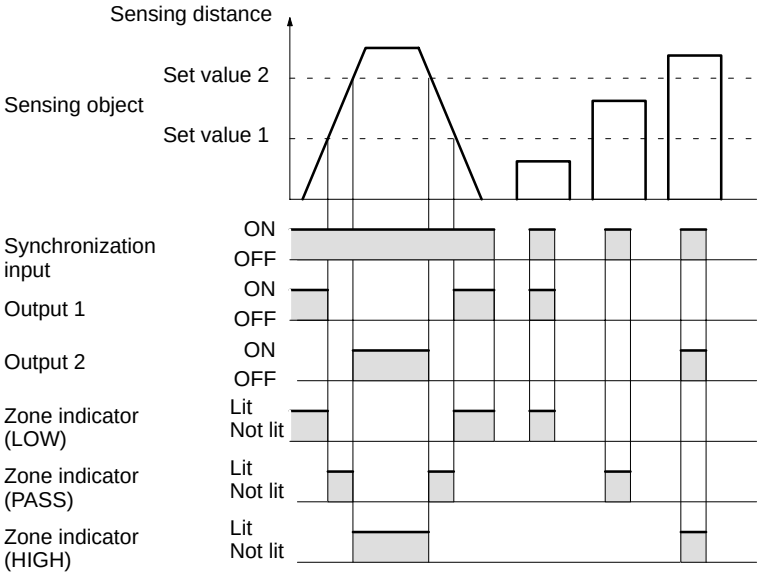


## ■ Connection




| Terminal No. | Terminal type |
|---|---|
| 1 | Power supply 0 V |
| 2 | Power supply +V |
| 3 | Synchronization input 0 V |
| 4 | Synchronization input |
| 5 | Sensor input |
| 6 | Sensor input |
| 7 | Sensor input |
| 8 | Sensor input |
| 9 | Output 0 V |
| 10 | Output 1 |
| 11 | Output 0 V |
| 12 | Output 2 |

## ■ Operation Chart

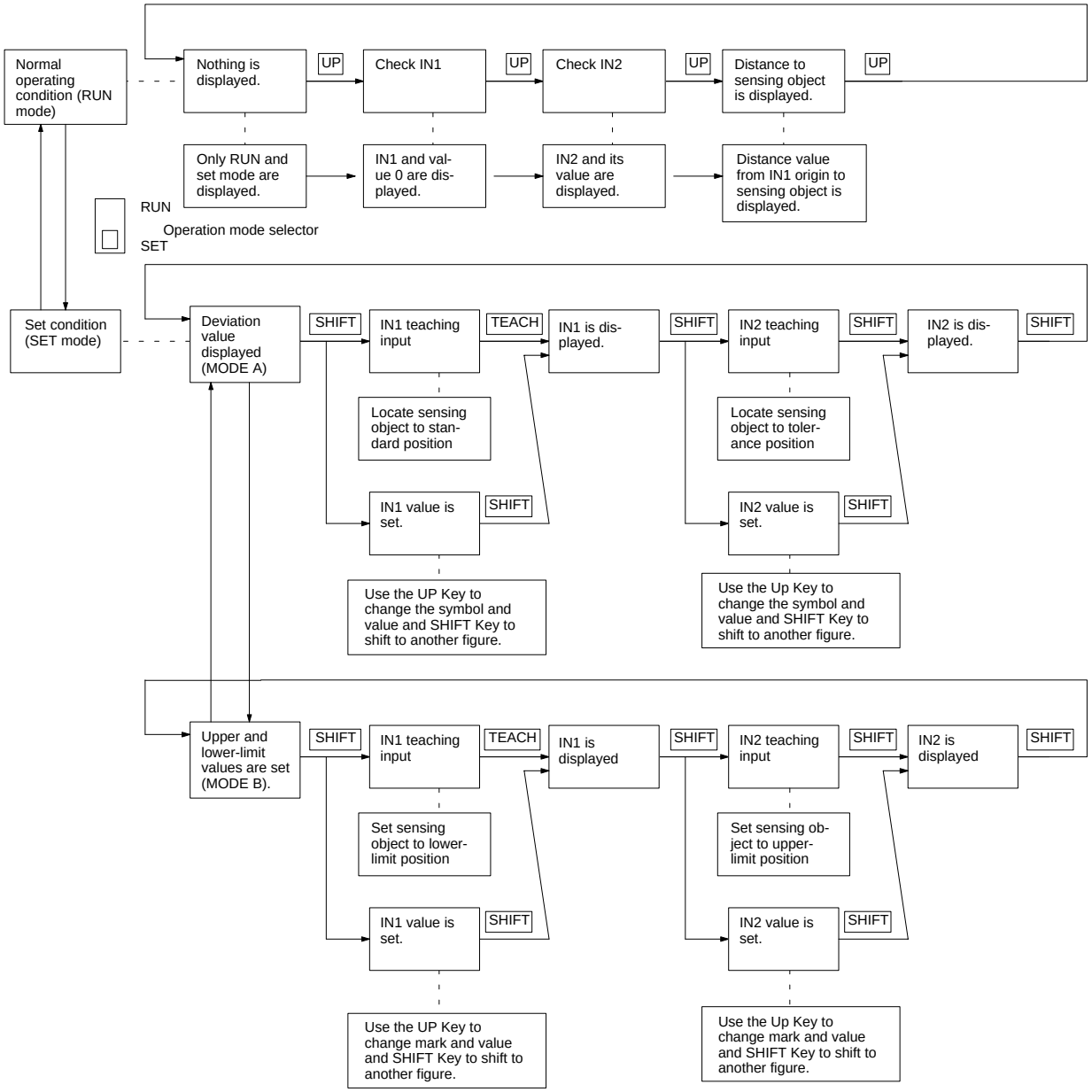


## ■ Operating Procedures

Before operating an E2CD, be sure to connect the sensor head to the E2CD and provide power and an synchronization input to the E2CD. If the sensor head is not connected, an error (E2 error) will result. If the synchronization input is not provided, the zone display LED and output will be prohibited.

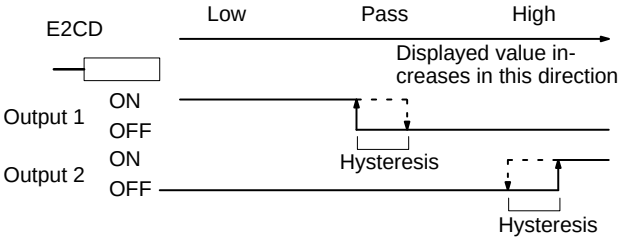
If no synchronization input is used, short-circuit the synchronization terminal and 0-V terminal. These terminals are short-circuited before shipping.

The following flow chart shows the operating procedures of an E2CD.




### Relationship among Value Increment/Decrement Direction, Output, and Hysteresis

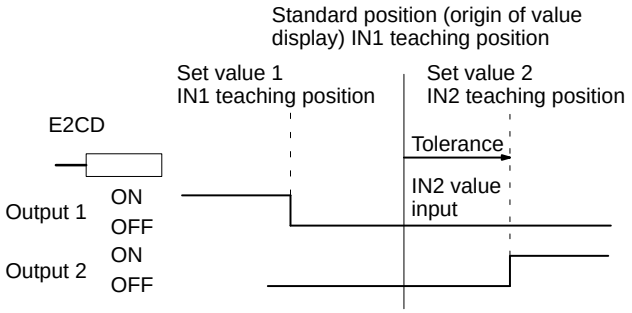
The displayed value increases as shown in the following timing chart. The set value indicates the point where the output is turned ON.



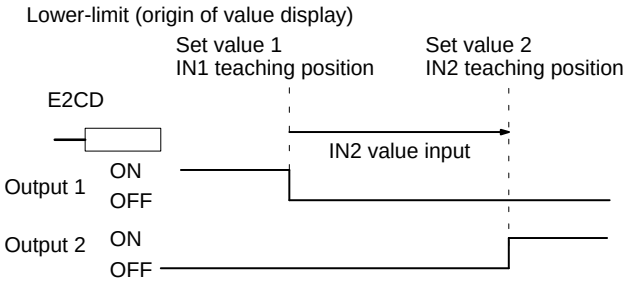

**Note:** Because of the hysteresis, if the difference between set values 1 and 2 are smaller than the hysteresis, a normal output is ON but the zone indicators will not operate normally.

## Relationship among Set Mode and Input Value

**MODE A (Deviation Value Setting)**



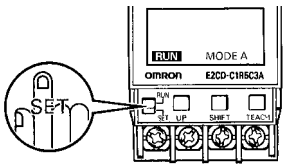
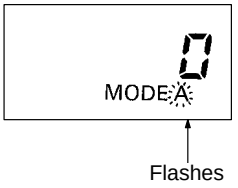
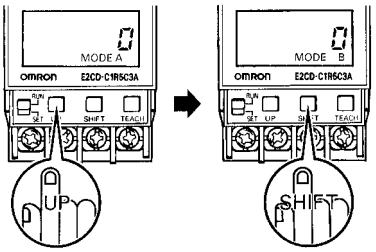
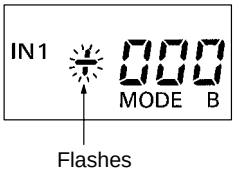
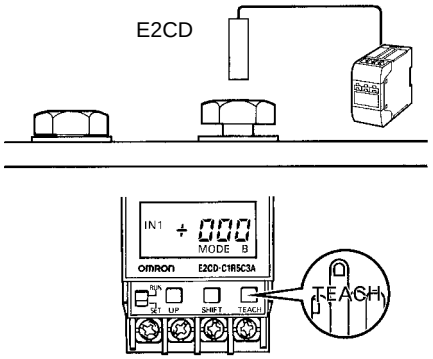
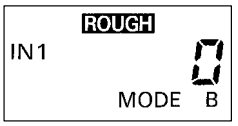

**MODE B (Upper and lower-limits Setting)**

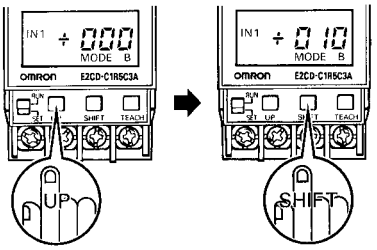
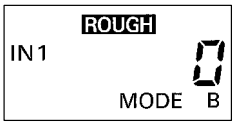
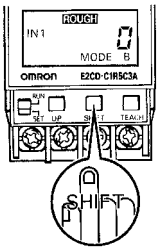
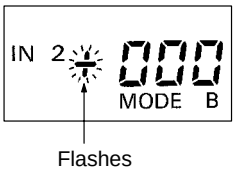
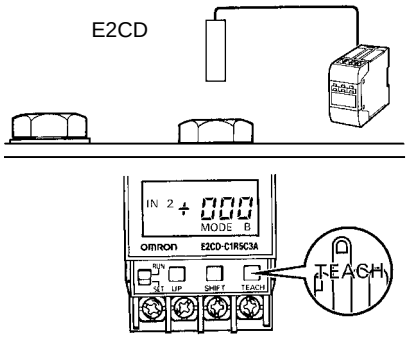
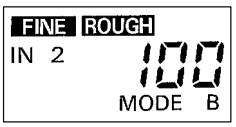
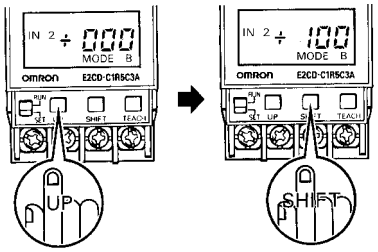
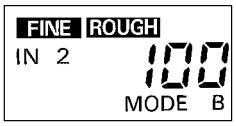


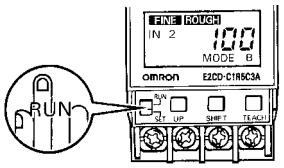
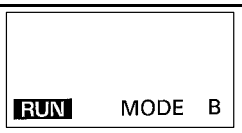

**Note:** When using the teaching function, the sensing object must be within the sensing range or no teaching input will be accepted by the E2CD.

## Application Example 1: In MODE B (Upper and lower-limits Setting Mode)

In this example, the tightness of each bolt with or without a washer is checked. Prepare a sample of a bolt tightened loose and another sample of a bolt without a washer both on the threshold of being sensed.

| Procedure | Operation | LCD | Meaning |
|---|---|---|---|
| **1** | Set the operation mode selector to SET.<br>  |  | The E2CD is ready for the mode input. |
| **2** | Select MODE B. If MODE A has been displayed, use the UP Key to change MODE A to MODE B. Then press the SHIFT Key.<br>  |  | MODE B has been input and the E2CD is ready for the IN1 value input. |
| **3**<br>Teaching input | Locate the loose sample bolt as shown in the following illustration and press the TEACH Key.<br>  |  | Press the TEACH Key to input the IN1 value. Do not set any symbol or value, otherwise the teaching input function cannot be used and the user must restart the operation. When the IN1 value is input, 0 will be displayed. |

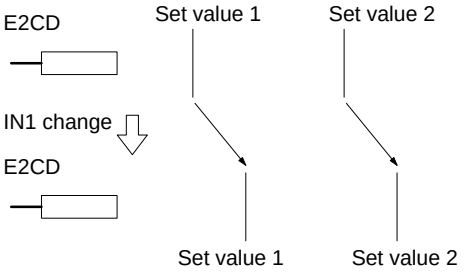
| Procedure | Operation | LCD | Meaning |
|---|---|---|---|
| **3**<br>Value input | Use the Up Key to set the symbol or value for each digit. Press the SHIFT Key to shift to the next digit. After all digits are set, press the SHIFT Key to input the IN1 value.<br>  |  | Use the UP Key to set the value or symbol for each digit. The symbol changes from + to +1, –1, –, and + in this order each time the UP Key is pressed. The value for each digit increases by increments of one each time the UP Key is pressed. When the IN1 value is input, 0 will be displayed. Use the value input function to fine-tune the E2CD. |
| **4** | Press the Shift Key.<br>  |  | The E2CD is ready for the IN2 input. |
| **5**<br>Teaching input | Locate the sample bolt without a washer as shown in the following illustration and press the TEACH Key.<br>  |  | The IN2 value will be input when the TEACH Key is pressed, at which time the IN2 value based on IN1 as the origin will be displayed. |
| Value input | Use the UP Key to change the IN2 value. Press the SHIFT Key to shift to the next digit. After the IN2 value is decided, press the SHIFT Key to input it.<br>  |  | Input the IN2 value for fine-tuning. |

| Procedure | Operation | LCD | Meaning |
|---|---|---|---|
| 6 | Set the operation mode selector to RUN.   |   | The set value is written to the non-volatile memory and the E2CD operates. In this mode, the set value cannot be changed. To change the set value, press the SHIFT Key before setting the operation mode selector to RUN. Then the E2CD will be ready for the mode input (refer to step 1). |

**Note:** 1. When the IN1 value that has been set is changed in MODE B, set value 2 will shift according to the difference between the old and new IN1 values.
Set value 2 = Set value 1 + The difference between set value 1 and set value 2
New set value 2 = New set value 1 + The difference between the previous set value 1 and previous set value 2

2. The IN1 value must be the lower-limit value in MODE B.

3. The contents of the set value zone indicators (FINE, ROUGH, NG) vary with the set status.

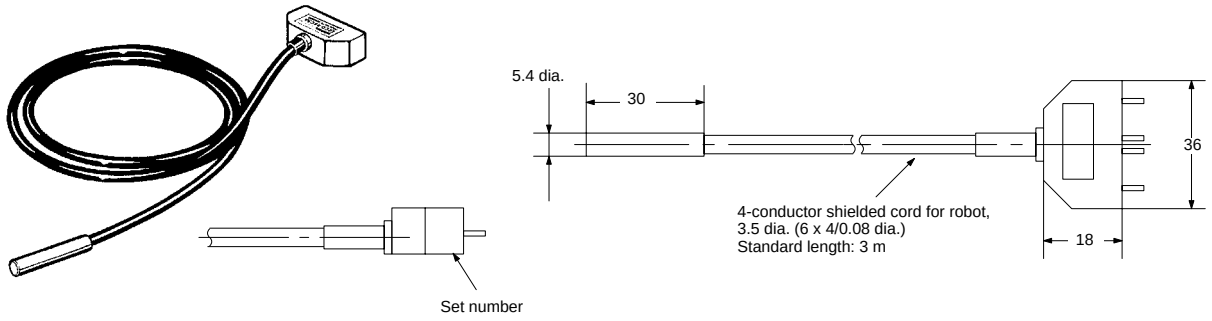



# Dimensions

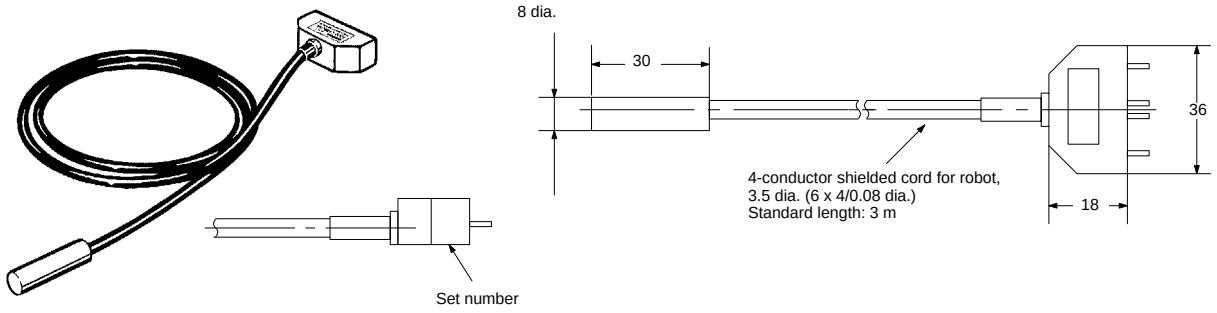
**Note:** All units are in millimeters unless otherwise indicated.

## Sensor

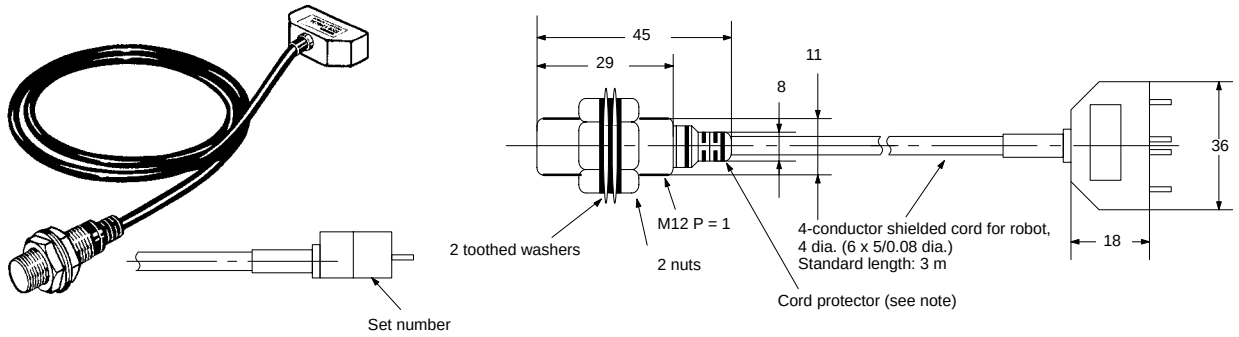
**E2CD-C1C3A**



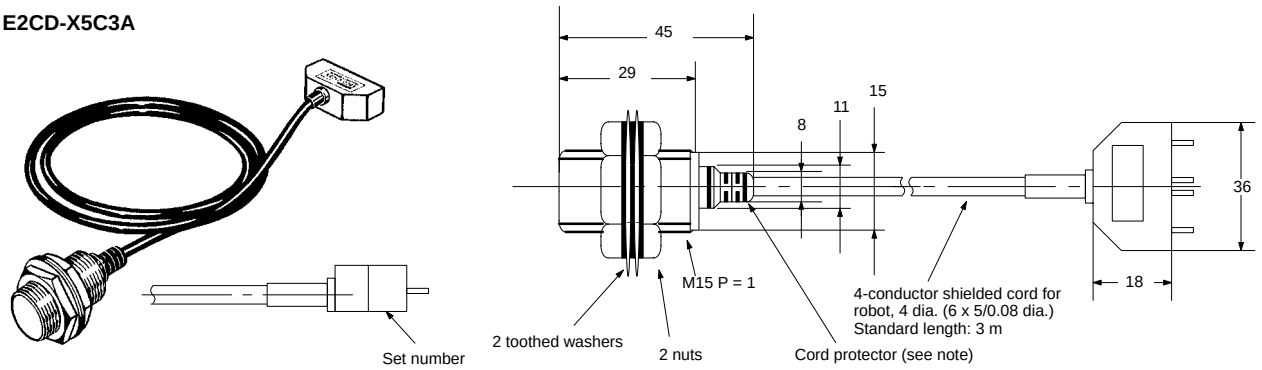

**E2CD-C1R5C3A**



**E2CD-X2R5C3A**




**E2CD-X5C3A**

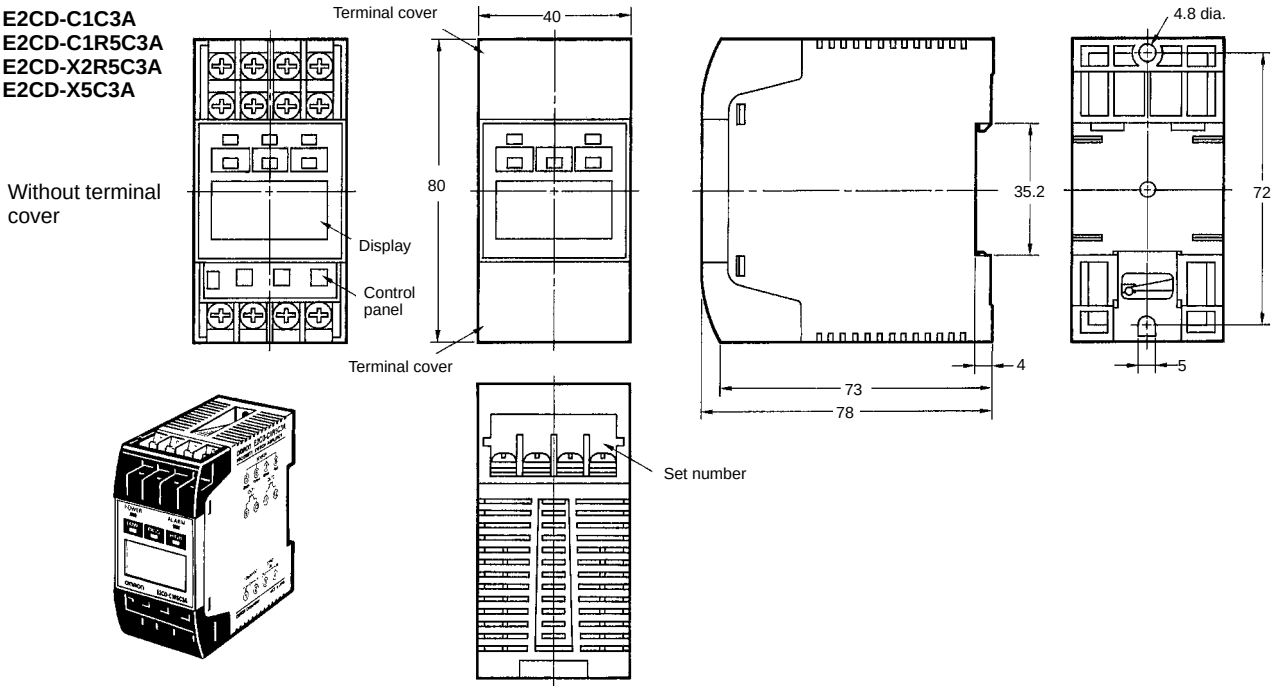



**Note:** The cord protector protects the cord from being bent or damaged. There is some space between the cord protector and the sensor. This space will not, however, affect the watertightness of the sensor.

## Amplifier

**E2CD-C1C3A**
**E2CD-C1R5C3A**
**E2CD-X2R5C3A**
**E2CD-X5C3A**

Without terminal cover



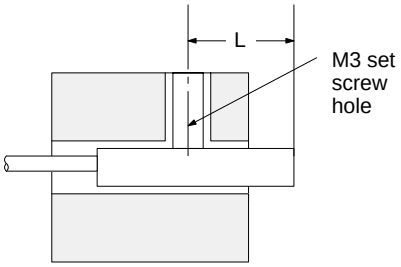

**Note:** 1. Use the right combination of an E2CD sensor and amplifier, both of which have the same identification number. The identification number is printed on the back of the cord adapter of the sensor and on one of the sides of the amplifier.

2. Do not cut off or extend the sensor cord, otherwise the characteristics of the sensor cord will change and the specifications of the E2CD will no longer be guaranteed.

# Precautions

## Installation

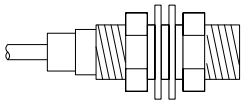
**E2CD-C□ (Column Type without Screw Threads)**




When using a set screw, the tightening torque of the set screw must be 2 kgf • cm (0.2 N • m) maximum. Refer to the following table for the L ranges of the respective models.

| Model | L |
|---|---|
| **E2CD-C1C3A** | 10 to 23 mm |
| **E2CD-C1R5C3A** | 12 to 30 mm |

**E2CD-X□ (Column Type with Screw Threads)**



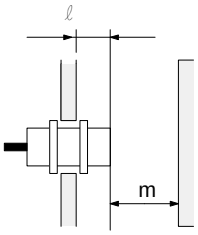
Refer to the following table for the tightening torque ranges of the nuts of the respective models. Be sure to tighten each nut coupled with a toothed washer.

| Model | L |
|---|---|
| **E2CD-X2R5C3A** | 10 N • m (100 kgf • cm) |
| **E2CD-X5C3A** | 20 N • m (200 kgf • cm) |

**Note:** Apply the above tightening torque to each nut coupled with a washer.

## Effects of Surrounding Metal

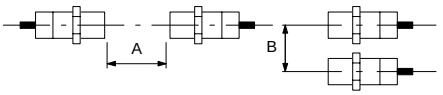
When mounting the E2CD within a metal panel, ensure that the clearances given in the following table are maintained. Failure to maintain these distances may cause deterioration in the performance of the sensor.




| Model | ℓ | m |
|---|---|---|
| **E2CD-C1C3A** | 0 mm | 3 mm |
| **E2CD-C1R5C3A** | 0 mm | 4.5 mm |
| **E2CD-X2R5C3A** | 0 mm | 6 mm |
| **E2CD-X5C3A** | 0 mm | 15 mm |

## Mutual Interference

When installing two or more E2CD face to face or side by side, ensure that the minimum distances given in the following table are maintained.




| Model | A | B |
|---|---|---|
| **E2CD-C1C3A** | 20 mm | 15 mm |
| **E2CD-C1R5C3A** | 20 mm | 15 mm |
| **E2CD-X2R5C3A** | 30 mm | 20 mm |
| **E2CD-X5C3A** | 30 mm | 30 mm |

## Compatibility

Use the right combination of an E2CD sensor and amplifier, both of which have the same identification number. The identification number is printed on the back of the cord adapter of the sensor and on one of the sides of the amplifier.

## Cutting OFF or Extension of Sensor Cord

Do not cut off or extend the sensor cord, otherwise the characteristics of the sensor cord will change and the specifications of the E2CD will no longer be guaranteed.
The E2CD is adjusted with high accuracy. The sensor must not be exposed to sudden temperature changes. Be careful enough not to impose physical forces on the sensor head.

## Turning Power ON

When the E2CD is turned on, the E2CD automatically checks the internal circuitry, which will take 8 seconds. This means that the E2CD operates normally only after the automatic check of the internal circuitry is finished.

**ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.**
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. D052-E1-1B **In the interest of product improvement, specifications are subject to change without notice.**

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