

Cylindrical Proximity Sensor for Mobile Usage

# E2AU

*Designed and tested to keep your machines moving*



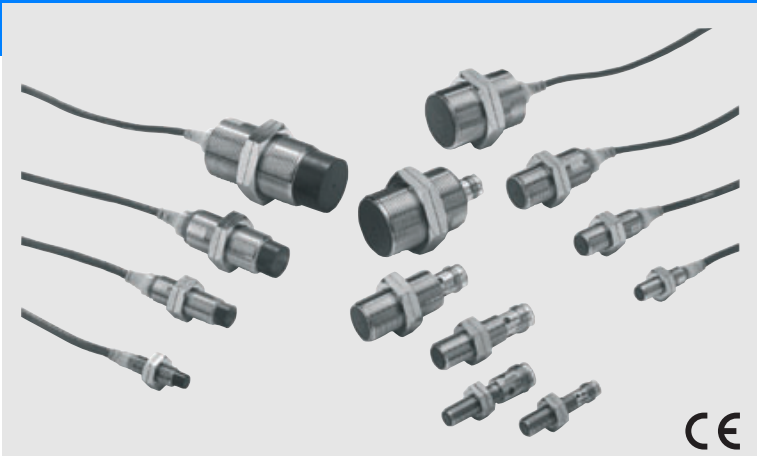
IP69k tested and certified for highest water resistance



e1 type approval (according to automotive directive 95/54/EC)



EMC noise tested up to 100 V/m (ISO 11452-2)



## Ordering Information

DC 3-wire models

| Size |          | Sensing distance | Connection    | Body material | Thread length (overall length) | Output configuration | Operation mode NO     |
|------|----------|------------------|---------------|---------------|--------------------------------|----------------------|-----------------------|
| M12  | Shielded | 4.0 mm           | Pre-wired     | Brass         | 34 (50)                        | PNP                  | E2AU-M12KS04-WP-B1 2M |
|      |          |                  |               |               | 56 (72)                        | PNP                  | E2AU-M12LS04-WP-B1 2M |
|      |          |                  | M12 connector | Brass         | 34 (48)                        | PNP                  | E2AU-M12KS04-M1-B1    |
|      |          |                  |               |               | 56 (70)                        | PNP                  | E2AU-M12LS04-M1-B1    |
| M18  | Shielded | 8.0 mm           | Pre-wired     | Brass         | 39 (59)                        | PNP                  | E2AU-M18KS08-WP-B1 2M |
|      |          |                  |               |               | 61 (81)                        | PNP                  | E2AU-M18LS08-WP-B1 2M |
|      |          |                  | M12 connector | Brass         | 39 (53)                        | PNP                  | E2AU-M18KS08-M1-B1    |
|      |          |                  |               |               | 61 (75)                        | PNP                  | E2AU-M18LS08-M1-B1    |
| M30  | Shielded | 15.0 mm          | Pre-wired     | Brass         | 44 (64)                        | PNP                  | E2AU-M30KS15-WP-B1 2M |
|      |          |                  |               |               | 66 (86)                        | PNP                  | E2AU-M30LS15-WP-B1 2M |
|      |          |                  | M12 connector | Brass         | 44 (58)                        | PNP                  | E2AU-M30KS15-M1-B1    |
|      |          |                  |               |               | 66 (80)                        | PNP                  | E2AU-M30LS15-M1-B1    |

## Model Number Legend

**E2A** □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □

1 2 3 4 5 6 7 8 9 10 11 12

**Example:** E2A-M12LS04-M1-B1

E2A-S08KN04-WP-B1 5M

Standard, M12, long barrel, shielded, Sn=4 mm, M12 connector, PNP-NO

Standard, M8 stainless steel, short barrel, non-shielded, Sn=4 mm, pre-wired PVC cable, PNP-NO, cable length=5 m

### 1. Basic name

E2A

### 2. Sensing technology

Blank: Standard double distance

3: Triple distance

U: Mobile Usage

X: Explosion hazardous environments

### 3. Housing shape and material

M: Cylindrical, metric threaded, brass

S: Cylindrical, metric threaded, stainless steel

### 4. Housing size

08: 8 mm

12: 12 mm

18: 18 mm

30: 30 mm

### 5. Barrel length

K: Standard length

L: Long body

### 6. Shield

S: Shielded

N: Non-shielded

### 7. Sensing distance

Numeral: Sensing distance: e.g. 02=2 mm, 16=16 mm

### 8. Kind of connection

WP: pre-wired, PVC, dia 4mm (standard)

WS: pre-wired, PVC, dia 6mm

WR: pre-wired, PVC, robotic cable, dia 4mm

WA: pre-wired, PUR/PVC (PUR jacket), dia 4mm

WB: pre-wired, PUR/PVC (PUR jacket), dia 6mm

M1: M12 connector (4 pin) \*

M3: M8 connector (4 pin)

M5: M8 connector (3 pin)

M1J pre-wired with M12 cable end connector (4 pin)

M3J pre-wired with M8 cable end connector (4 pin)

M5J pre-wired with M8 cable end connector (3 pin)

### 9. Power source and output

B: DC, 3-wire, PNP open collector

C: DC, 3-wire, NPN open collector

D: DC, 2-wire

E: DC, 3-wire, NPN voltage output

F: DC, 3-wire, PNP voltage output

### 10. Operation mode

1: Normally open (NO)

2: Normally closed (NC)

3: Antivalent (NO+NC)

### 11. Specials (e.g., cable material, oscillating frequency)

### 12. Cable length

Blank: Connector type

Numeral: Cable length

Note: \*In case of DC 2-wire models the M12 connector identifier is 'M1G'

# Specifications

## DC 3-wire Models

| Size                                             |                            | M12                                                                                                                                                                |
|--------------------------------------------------|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Type                                             |                            | Shielded                                                                                                                                                           |
| Item                                             |                            | E2A-M12□S04-□□-B1                                                                                                                                                  |
| Sensing distance                                 |                            | 4 mm ± 10%                                                                                                                                                         |
| Setting distance                                 |                            | 0 to 3.2 mm                                                                                                                                                        |
| Differential travel                              |                            | 10% max. of sensing distance                                                                                                                                       |
| Target                                           |                            | Ferrous metal (The sensing distance decreases with non-ferrous metal.)                                                                                             |
| Standard target (mild steel ST37)                |                            | 12×12×1 mm                                                                                                                                                         |
| Response frequency (See note 1.)                 |                            | 1,000 Hz                                                                                                                                                           |
| Power supply voltage (operating voltage range)   |                            | 12 to 24 VDC. Ripple (p-p): 10% max. (10 to 32 VDC)                                                                                                                |
| Current consumption (DC 3-wire)                  |                            | 10 mA max.                                                                                                                                                         |
| Output type                                      |                            | PNP open collector                                                                                                                                                 |
| Control output                                   | Load current (See note 2.) | 200 mA max. (32 VDC max.)                                                                                                                                          |
|                                                  | Residual voltage           | 2 V max. (under load current of 200 mA with cable length of 2 m)                                                                                                   |
| Indicator                                        |                            | Operation indicator (Yellow LED)                                                                                                                                   |
| Operation mode (with sensing object approaching) |                            | -B1                                                                                                                                                                |
| Protection circuit                               |                            | Output reverse polarity protection, Power source circuit reverse polarity protection, Surge suppressor, Short-circuit protection                                   |
| Ambient air temperature                          |                            | Operating: -40°C to 70°C, Storage: -40°C to 85°C (with no icing or condensation)                                                                                   |
| Temperature influence (See note 2.)              |                            | ±10% max. of sensing distance at 23°C within temperature range of -25°C to 70°C<br>±15% max. of sensing distance at 23°C within temperature range of -40°C to 70°C |
| Ambient humidity                                 |                            | Operating: 35% to 95%, Storage: 35% to 95%                                                                                                                         |
| Voltage influence                                |                            | ±1% max. of sensing distance in rated voltage range ±15%                                                                                                           |
| Insulation resistance                            |                            | 50 MΩ min. (at 500 VDC) between current carry parts and case                                                                                                       |
| Dielectric strength                              |                            | 1,000 VAC at 50/60 Hz for 1 min between current carry parts and case                                                                                               |
| Vibration resistance                             |                            | 10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y and Z directions                                                                                     |
| Shock resistance                                 |                            | 1,000 m/s <sup>2</sup> , 10 times each in X, Y and Z directions                                                                                                    |
| Standard and listings (See note 3.)              |                            | IP67 after IEC 60529<br>IP69k after DIN 40050<br>EMC after EN60947-5-2<br>EMC after 95/54/EC<br>EMC after ISO11452-2                                               |
| Connection method                                |                            | Pre-wired models (dia 4mm PVC cable with length = 2m).<br>M12 connector models                                                                                     |
| Weight (packaged)                                | Pre-wired model            | Approx. 85 g                                                                                                                                                       |
|                                                  | Connector model            | Approx. 35 g                                                                                                                                                       |
| Material                                         | Case                       | Brass-nickel plated                                                                                                                                                |
|                                                  | Sensing surface            | PBT                                                                                                                                                                |
|                                                  | Cable                      | Standard cable is PVC dia 4mm.                                                                                                                                     |
|                                                  | Clamping nut               | Brass-nickel plated                                                                                                                                                |

- Note 1.** The response frequency is an average value. Measurement conditions are as follows: standard target, a distance of twice the standard target distance between targets, and a setting distance of half the sensing distance.
- 2.** When using any model at an ambient temperature between -40°C and -25°C and a power voltage between 30 and 32 VDC, use a load current of 100 mA max.,
- 3.** For USA and Canada: Use class 2 circuit only.

## DC 3-wire Models / DC 4-wire

| Size                                             |                            | M18                                                                                                                                                                | M30               |
|--------------------------------------------------|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| Type                                             |                            | Shielded                                                                                                                                                           | Shielded          |
| Item                                             |                            | E2A-M18□S08-□□-B1                                                                                                                                                  | E2A-M30□S15-□□-B1 |
| Sensing distance                                 |                            | 8 mm±10%                                                                                                                                                           | 15 mm±10%         |
| Setting distance                                 |                            | 0 to 6.4 mm                                                                                                                                                        | 0 to 12 mm        |
| Differential travel                              |                            | 10% max. of sensing distance                                                                                                                                       |                   |
| Target                                           |                            | Ferrous metal (The sensing distance decreases with non-ferrous metal.)                                                                                             |                   |
| Standard target (mild steel ST37)                |                            | 24×24×1 mm                                                                                                                                                         | 45×45×1 mm        |
| Response frequency (See note 1.)                 |                            | 500 Hz                                                                                                                                                             | 250 Hz            |
| Power supply voltage (operating voltage range)   |                            | 12 to 24 VDC. Ripple (p-p): 10% max. (10 to 32 VDC)                                                                                                                |                   |
| Current consumption (DC 3-wire)                  |                            | 10 mA max.                                                                                                                                                         |                   |
| Output type                                      |                            | PNP open collector                                                                                                                                                 |                   |
| Control output                                   | Load current (See note 2.) | 200 mA max. (32 VDC max.)                                                                                                                                          |                   |
|                                                  | Residual voltage           | 2 V max. (under load current of 200 mA with cable length of 2 m)                                                                                                   |                   |
| Indicator                                        |                            | Operation indicator (Yellow LED)                                                                                                                                   |                   |
| Operation mode (with sensing object approaching) |                            | -B1                                                                                                                                                                |                   |
| Protection circuit                               |                            | Output reverse polarity protection, Power source circuit reverse polarity protection, Surge suppressor, Short-circuit protection                                   |                   |
| Ambient air temperature                          |                            | Operating: -40°C to 70°C, Storage: -40°C to 85°C (with no icing or condensation)                                                                                   |                   |
| Temperature influence (See note 2.)              |                            | ±10% max. of sensing distance at 23°C within temperature range of -25°C to 70°C<br>±15% max. of sensing distance at 23°C within temperature range of -40°C to 70°C |                   |
| Ambient humidity                                 |                            | Operating: 35% to 95%, Storage: 35% to 95%                                                                                                                         |                   |
| Voltage influence                                |                            | ±1% max. of sensing distance in rated voltage range ±15%                                                                                                           |                   |
| Insulation resistance                            |                            | 50 MΩ min. (at 500 VDC) between current carry parts and case                                                                                                       |                   |
| Dielectric strength                              |                            | 1,000 VAC at 50/60 Hz for 1 min between current carry parts and case                                                                                               |                   |
| Vibration resistance                             |                            | 10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y and Z directions                                                                                     |                   |
| Shock resistance                                 |                            | 1,000 m/s <sup>2</sup> , 10 times each in X, Y and Z directions                                                                                                    |                   |
| Standard and listings (See note 3.)              |                            | IP67 after IEC 60529<br>IP69k after DIN 40050<br>EMC after EN60947-5-2<br>EMC after 95/94/EC<br>EMC after ISO11452-2                                               |                   |
| Connection method                                |                            | Pre-wired models (dia 4mm PVC cable with length = 2m).<br>M12 connector models.                                                                                    |                   |
| Weight (pakka-ged)                               | Pre-wired model            | Approx. 160 g                                                                                                                                                      | Approx. 280 g     |
|                                                  | Connector model            | Approx. 70 g                                                                                                                                                       | Approx. 200 g     |
| Material                                         | Case                       | Brass-nickel plated                                                                                                                                                |                   |
|                                                  | Sensing surface            | PBT                                                                                                                                                                |                   |
|                                                  | Cable                      | Standard cable is PVC dia 4mm.                                                                                                                                     |                   |
|                                                  | Clamping nut               | brass-nickel plated for brass models stainless steel for steel models                                                                                              |                   |

**Note 1.** The response frequency is an average value. Measurement conditions are as follows: standard target, a distance of twice the standard target distance between targets, and a setting distance of half the sensing distance.

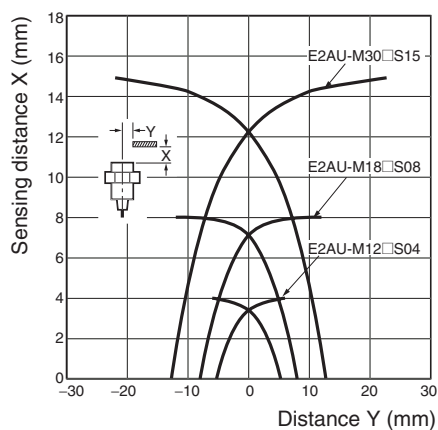
**2.** When using any model at an ambient temperature between -40°C and -25°C and a power voltage between 30 and 32 VDC, use a load current of 100 mA max.

**3.** For USA and Canada: Use class 2 circuit only.

## Engineering Data

### Operating Range (Typical)

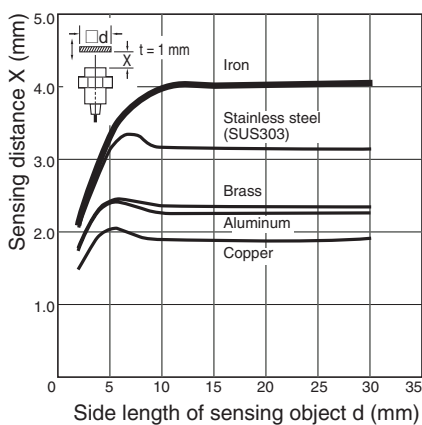
#### Shielded Models



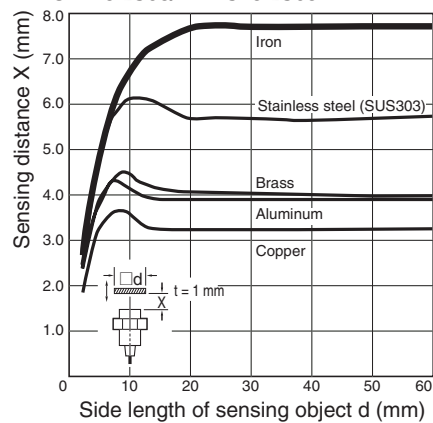
### Influence of Sensing Object Size and Materials

#### Shielded Models

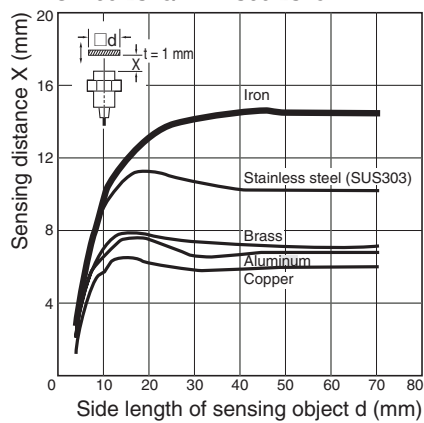
##### E2AU-M12□S04/ E2A-S12□S04



##### E2AU-M18□S08/E2A-S18□S08



##### E2AU-M30□S15/ E2A-S30□S15



# Operation

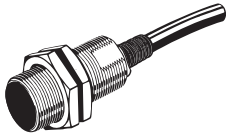
## DC 3-wire models

### PNP Output

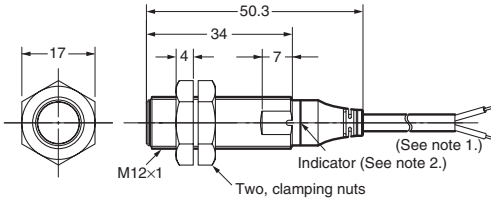
| Operation mode | Model       | Timing chart                                                                                                                                                                                                                   | Output circuit                                                                                                                                                                                                                                                                                                                  |
|----------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NO             | E2AU-□-□-B1 | <p>Non-sensing zone      Sensing zone      Proximity Sensor</p> <p>Sensing object</p> <p>(%)      100      0</p> <p>Rated sensing distance</p> <p>ON      OFF      Yellow indicator</p> <p>ON      OFF      Control output</p> | <p>Brown ①      +V</p> <p>Black ④      Load</p> <p>Blue ③      0 V</p> <p>(See note 1.)</p> <p><b>Note 1:</b> With M8 connector models, there is no output reverse polarity protection diode.</p> <p>M12 Connector<br/>Pin Arrangement<br/>(See note 2.)</p> <p><b>Note 2:</b> Terminal 2 of the M12 connector is not used.</p> |

# Dimensions

**Note:** All units are in millimeters unless otherwise indicated.  
**Pre-wired Models (Shielded)**

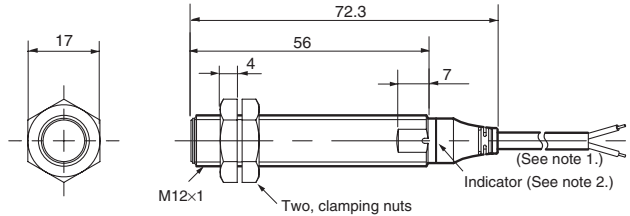


**E2AU-M12KS04-WP-□□**



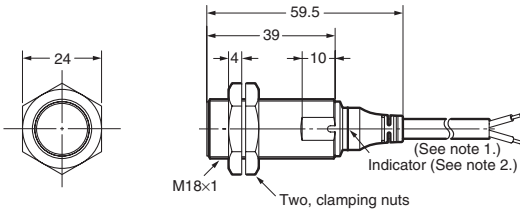
**Note 1.** 4-dia. vinyl-insulated round cable with 3 conductors (conductor cross section: 0.3 mm<sup>2</sup>; insulator diameter: 1.3 mm); standard length: 2 m  
**2.** Operation indicator (yellow)

**E2A-M12LS04-WP-□□**



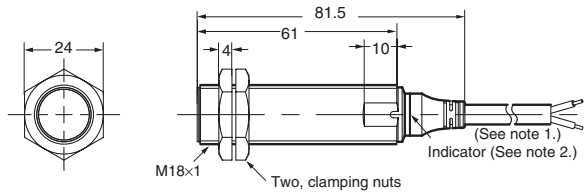
**Note 1.** 4-dia. vinyl-insulated round cable with 3 conductors (conductor cross section: 0.3 mm<sup>2</sup>; insulator diameter: 1.3 mm); standard length: 2 m  
**2.** Operation indicator (yellow)

**E2AU-M18KS08-WP-□□**



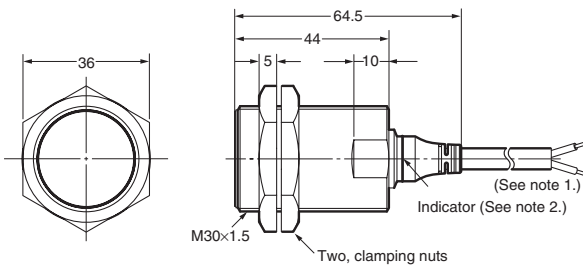
**Note 1.** 4-dia. vinyl-insulated round cable with 3 conductors (conductor cross section: 0.3 mm<sup>2</sup>; insulator diameter: 1.3 mm); standard length: 2 m  
**2.** Operation indicator (yellow)

**E2AU-M18LS08-WP-□□**



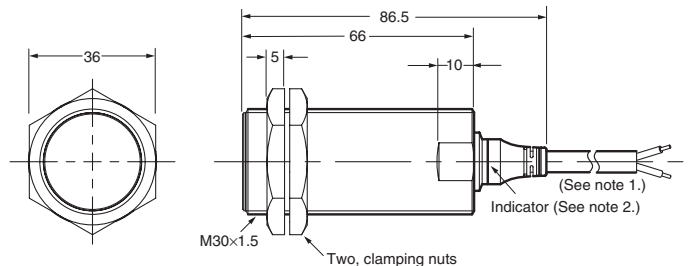
**Note 1.** 4-dia. vinyl-insulated round cable with 3 conductors (conductor cross section: 0.3 mm<sup>2</sup>; insulator diameter: 1.3 mm); standard length: 2 m  
**2.** Operation indicator (yellow)

**E2AU-M30KS15-WP-□□**



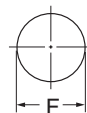
**Note 1.** 4-dia. vinyl-insulated round cable with 3 conductors (conductor cross section: 0.3 mm<sup>2</sup>; insulator diameter: 1.3 mm); standard length: 2 m  
**2.** Operation indicator (yellow)

**E2AU-M30LS15-WP-□□**



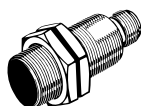
**Note 1.** 4-dia. vinyl-insulated round cable with 3 conductors (conductor cross section: 0.3 mm<sup>2</sup>; insulator diameter: 1.3 mm); standard length: 2 m  
**2.** Operation indicator (yellow)

## Mounting Hole Cutout Dimensions

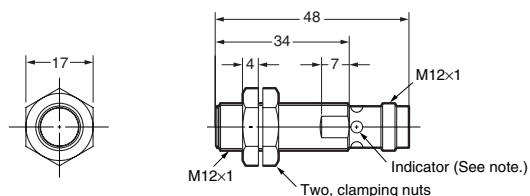


| External diameter of Proximity Sensor | Dimension F (mm)                       |
|---------------------------------------|----------------------------------------|
| <b>M12</b>                            | 12.5 dia. <sup>+0.5</sup> <sub>0</sub> |
| <b>M18</b>                            | 18.5 dia. <sup>+0.5</sup> <sub>0</sub> |
| <b>M30</b>                            | 30.5 dia. <sup>+0.5</sup> <sub>0</sub> |

# M12 Connector Models (Shielded)

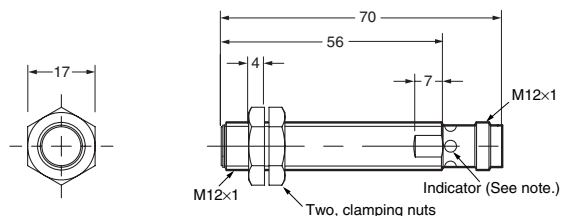


E2AU-M12KS04-M1-□□



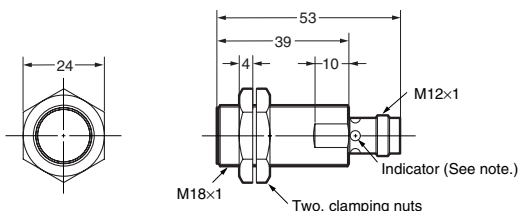
**Note 1:** Operation indicator (yellow LED, 4×90°)

E2AU-M12LS04-M1-□□



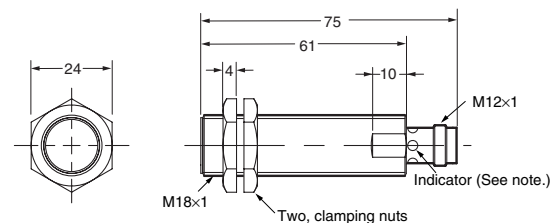
**Note:** Operation indicator (yellow LED, 4×90°)

E2AU-M18KS08-M1-□□



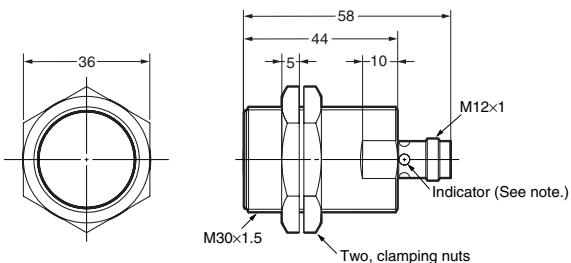
**Note:** Operation indicator (yellow LED, 4×90°)

E2AU-M18LS08-M1-□□



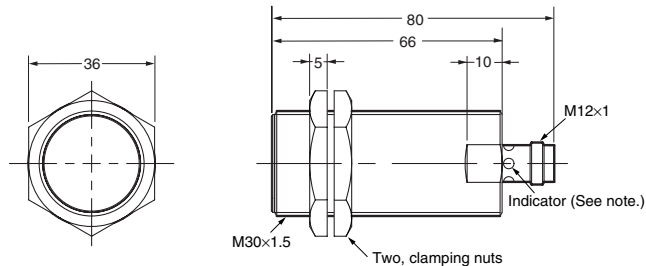
**Note:** Operation indicator (yellow LED, 4×90°)

E2AU-M30KS15-M1-□□



**Note:** Operation indicator (yellow LED, 4×90°)

E2AU-M30LS15-M1-□□



**Note:** Operation indicator (yellow LED, 4×90°)

# Precautions

## Safety Precautions

### Power Supply

Do not impose an excessive voltage on the E2AU, otherwise it may be damaged. Do not impose AC current (100 to 240 VAC) on any DC model, otherwise it may be damaged.

### Load Short-circuit

Do not short-circuit the load, or the E2AU may be damaged.

The E2AU's short-circuit protection function will be valid if the polarity of the supply voltage imposed is correct and within the rated voltage range.

## Correct Use

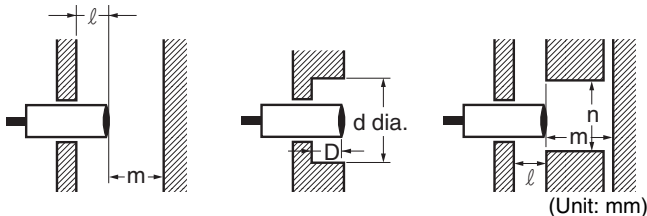
### Designing

#### Power Reset Time

The Proximity Sensor is ready to operate within 100 ms after power is supplied. If power supplies are connected to the Proximity Sensor and load respectively, be sure to supply power to the Proximity Sensor before supplying power to the load.

#### Effects of Surrounding Metal

When mounting the E2AU within a metal panel, ensure that the clearances given in the following table are maintained.



| Type         | Dimension | M12 | M18                | M30                |             |
|--------------|-----------|-----|--------------------|--------------------|-------------|
|              |           |     |                    | Short barrel       | Long barrel |
| Shielded     | l         | 0   | 0<br>(See note 1.) | 0<br>(See note 2.) |             |
|              | m         | 12  | 24                 | 45                 |             |
|              | d         | --- | 27                 | 45                 |             |
|              | D         | 0   | 1.5                | 4                  |             |
|              | n         | 18  | 27                 | 45                 |             |
| Non-shielded | l         | 15  | 22                 | 30                 | 40          |
|              | m         | 20  | 48                 | 70                 | 90          |
|              | d         | 40  | 70                 | 90                 | 120         |
|              | D         | 15  | 22                 | 30                 | 40          |
|              | n         | 40  | 70                 | 90                 | 120         |

- Note 1.** In the case of using the supplied nuts.  
If true flash mounting is necessary, apply a free zone of 1.5 mm.
- 2.** In the case of using the supplied nuts.  
If true flush mounting is necessary, apply a free zone of 4 mm.

## Wiring

Be sure to wire the E2AU and load correctly, otherwise it may be damaged.

### Connection with No Load

Be sure to insert loads when wiring. Make sure to connect a proper load to the E2AU in operation, otherwise it may damage internal elements.

**Do not expose the product to flammable or explosive gases.**

**Do not disassemble, repair, or modify the product.**

## Power OFF

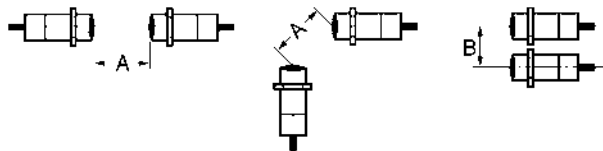
The Proximity Sensor may output a pulse signal when it is turned OFF. Therefore, it is recommended that the load be turned OFF before turning OFF the Proximity Sensor.

## Power Supply Transformer

When using a DC power supply, make sure that the DC power supply has an insulated transformer. Do not use a DC power supply with an auto-transformer.

## 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.



| Type         | Dimension | M12 | M18 | M30          |             |
|--------------|-----------|-----|-----|--------------|-------------|
|              |           |     |     | Short barrel | Long barrel |
| Shielded     | A         | 30  | 60  | 110          |             |
|              | B         | 20  | 35  | 70           |             |
| Non-shielded | A         | 120 | 200 | 300          | 300         |
|              | B         | 100 | 120 | 200          | 300         |

## Wiring

### High-tension Lines

Wiring through Metal Conduit:

If there is a power or high-tension line near the cable of the Proximity Sensor, wire the cable through an independent metal conduit to prevent against Proximity Sensor damage or malfunctioning.

### Cable Extension

Standard cable length is less than 200 m.

The tractive force is 50 N.

## Mounting

The Proximity Sensor must not be subjected to excessive shock with a hammer when it is installed, otherwise the Proximity Sensor may be damaged or lose its water-resistivity.

Do not tighten the nut with excessive force. A washer must be used with the nut.



| Type | Torque |
|------|--------|
| M12  | 30 Nm  |
| M18  | 70 Nm  |
| M30  | 180 Nm |

## Maintenance and Inspection

Periodically perform the following checks to ensure stable operation of the Proximity Sensor over a long period of time.

1. Check for mounting position, dislocation, looseness, or distortion of the Proximity Sensor and sensing objects.
2. Check for loose wiring and connections, improper contacts, and line breakage.
3. Check for attachment or accumulation of metal powder or dust.
4. Check for abnormal temperature conditions and other environmental conditions.
5. Check for proper lighting of indicators (for models with a set indicator.)

Never disassemble or repair the Sensor.

## Environment

### Water Resistivity

The Proximity Sensors are tested intensively on water resistance, but in order to ensure maximum performance and life expectancy avoid immersion in water and provide protection from rain or snow.

### Operating Environment

Ensure storage and operation of the Proximity Sensor within the given specifications.

### Inrush Current

A load that has a large inrush current (e.g., a lamp or motor) will damage the Proximity Sensor, in which case connect the load to the Proximity Sensor through a relay.

## <SUITABILITY FOR USE>

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of the products in the customer's application or use of the products.

Take all necessary steps to determine the suitability of the product for the systems, machines, and equipment with which it will be used.

## <CHANGE IN SPECIFICATIONS>

Product specifications and accessories may be changed at any time based on improvements and other reasons. Consult with your OMRON representative at any time to confirm actual specifications of purchased product.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

In the interest of product improvement, specifications are subject to change without notice.

# Terms and Conditions of Sale

1. **Offer; Acceptance.** These terms and conditions (these "Terms") are deemed part of all quotes, agreements, purchase orders, acknowledgments, price lists, catalogs, manuals, brochures and other documents, whether electronic or in writing, relating to the sale of products or services (collectively, the "Products") by Omron Electronics LLC and its subsidiary companies ("Omron"). Omron objects to any terms or conditions proposed in Buyer's purchase order or other documents which are inconsistent with, or in addition to, these Terms.
2. **Prices; Payment Terms.** All prices stated are current, subject to change without notice by Omron. Omron reserves the right to increase or decrease prices on any unshipped portions of outstanding orders. Payments for Products are due net 30 days unless otherwise stated in the invoice.
3. **Discounts.** Cash discounts, if any, will apply only on the net amount of invoices sent to Buyer after deducting transportation charges, taxes and duties, and will be allowed only if (i) the invoice is paid according to Omron's payment terms and (ii) Buyer has no past due amounts.
4. **Interest.** Omron, at its option, may charge Buyer 1-1/2% interest per month or the maximum legal rate, whichever is less, on any balance not paid within the stated terms.
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  - b. Such carrier shall act as the agent of Buyer and delivery to such carrier shall constitute delivery to Buyer;
  - c. All sales and shipments of Products shall be FOB shipping point (unless otherwise stated in writing by Omron), at which point title and risk of loss shall pass from Omron to Buyer; provided that Omron shall retain a security interest in the Products until the full purchase price is paid;
  - d. Delivery and shipping dates are estimates only; and
  - e. Omron will package Products as it deems proper for protection against normal handling and extra charges apply to special conditions.
12. **Claims.** Any claim by Buyer against Omron for shortage or damage to the Products occurring before delivery to the carrier must be presented in writing to Omron within 30 days of receipt of shipment and include the original transportation bill signed by the carrier noting that the carrier received the Products from Omron in the condition claimed.
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18. **Miscellaneous.** (a) **Waiver.** No failure or delay by Omron in exercising any right and no course of dealing between Buyer and Omron shall operate as a waiver of rights by Omron. (b) **Assignment.** Buyer may not assign its rights hereunder without Omron's written consent. (c) **Law.** These Terms are governed by the law of the jurisdiction of the home office of the Omron company from which Buyer is purchasing the Products (without regard to conflict of law principles). (d) **Amendment.** These Terms constitute the entire agreement between Buyer and Omron relating to the Products, and no provision may be changed or waived unless in writing signed by the parties. (e) **Severability.** If any provision hereof is rendered ineffective or invalid, such provision shall not invalidate any other provision. (f) **Setoff.** Buyer shall have no right to set off any amounts against the amount owing in respect of this invoice. (g) **Definitions.** As used herein, "including" means "including without limitation"; and "Omron Companies" (or similar words) mean Omron Corporation and any direct or indirect subsidiary or affiliate thereof.

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  - (ii) Use in consumer products or any use in significant quantities.
  - (iii) Energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
  - (iv) Systems, machines and equipment that could present a risk to life or property. Please know and observe all prohibitions of use applicable to this Product.
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