

# EE-SX91

CSM\_EE-SX91\_DS\_E\_7\_1

## Meeting Customer Needs with Compact Sensors that Mount with M3 Screws

- Both light-ON and dark-ON outputs provided.
- A compact size and choice of five models for a wide range of applications.
- Compact NPN and PNP output models.
- Safer operation with built-in power supply reverse polarity protection.
- Output overcurrent protection with a thermal shutdown circuit (patent pending). \*
- Mount using M3 or M2 screws.
- Indicator is visible in many directions for installation in any location.
- Flexible robot cables are standard on all models.

\* Output overcurrent protection is provided only on output 2 (OUT2) on NPN models.



Be sure to read *Safety Precautions* on page 6.



## Features

### A Compact Size and Choice of Five Models for a Wide Range of Applications

Select any of five models to minimize the space required.

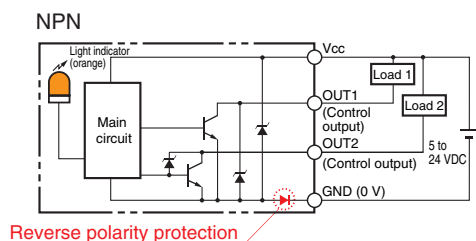


### Compact NPN and PNP Output Models

Both NPN and PNP output models are available for use according to system requirements.

### Safer Operation with Built-in Power Supply Reverse Polarity Protection

The built-in power supply reverse polarity protection protects against reverse connection of the power supply or outputs for safer operation at the assembly site.



### Flexible Robot Cables: Standard on All Models

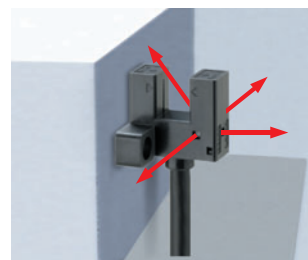
Robot Cables are effective for moving parts, and are provided as standard equipment with all models.

### Both Light-ON and Dark-ON Outputs

Both light-ON and dark-ON outputs are provided on all models, allowing outputs to be switched by simply changing the wiring according to the application.

### Indicator Visible from Many Directions for Installation in Any Location

The light indicator can be checked from up to four directions.



### Mount Using M3 or M2 Screws

The EE-SX91 can be mounted using M3 or M2 screws, so it can easily replace an existing compact sensor mounted with M2 screws.



## Ordering Information

## List of Models

## Models with Robot Cables

 Infrared light

| Appearance                                                                                      | Sensing method                   | Sensing distance                                                                                       |                                    | Output configuration          | Indicator mode            | Connecting method<br>(Cable length) | Model           |                  |
|-------------------------------------------------------------------------------------------------|----------------------------------|--------------------------------------------------------------------------------------------------------|------------------------------------|-------------------------------|---------------------------|-------------------------------------|-----------------|------------------|
|                                                                                                 |                                  |                                                                                                        |                                    |                               |                           |                                     | NPN output      | PNP output       |
| Standard<br>    | Through-beam type<br>(with slot) |  5 mm<br>(slot width) | Light-ON<br>Dark-ON<br>(2 outputs) | Lit when light<br>is incident | Pre-wired models<br>(1 m) |                                     | EE-SX910-R 1M * | EE-SX910P-R 1M * |
| L-shaped<br>   |                                  |                                                                                                        |                                    |                               |                           |                                     | EE-SX911-R 1M * | EE-SX911P-R 1M * |
| F-shaped<br>   |                                  |                                                                                                        |                                    |                               |                           |                                     | EE-SX912-R 1M * | EE-SX912P-R 1M * |
| R-shaped<br>  |                                  |                                                                                                        |                                    |                               |                           |                                     | EE-SX913-R 1M * | EE-SX913P-R 1M * |
| U-shaped<br> |                                  |                                                                                                        |                                    |                               |                           |                                     | EE-SX914-R 1M * | EE-SX914P-R 1M * |

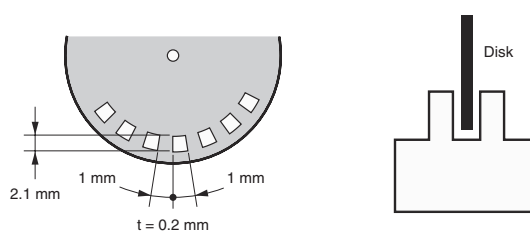
\* Prewired models with a 3-m cable are also available. When ordering, specify the cable length by adding "3M" for the end of the model number (e.g., EE-SX910-R 3M).

## Ratings and Specifications

| Item                               | Type             |                  | Standard                                                                                                                                                                                                              | L-shaped    | F-shaped    | R-shaped    | U-shaped    |
|------------------------------------|------------------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|-------------|-------------|
|                                    | NPN models       | Pre-wired models | EE-SX910-R                                                                                                                                                                                                            | EE-SX911-R  | EE-SX912-R  | EE-SX913-R  | EE-SX914-R  |
|                                    | PNP models       | Pre-wired models | EE-SX910P-R                                                                                                                                                                                                           | EE-SX911P-R | EE-SX912P-R | EE-SX913P-R | EE-SX914P-R |
| Sensing distance                   |                  |                  | 5 mm (slot width)                                                                                                                                                                                                     |             |             |             |             |
| Sensing object                     |                  |                  | Opaque: 1.2 × 0.8 mm min.                                                                                                                                                                                             |             |             |             |             |
| Differential distance              |                  |                  | 0.025 mm max. *1                                                                                                                                                                                                      |             |             |             |             |
| Light source                       |                  |                  | GaAs infrared LED with a peak wavelength of 940 nm                                                                                                                                                                    |             |             |             |             |
| Indicator                          |                  |                  | Light indicator (orange LED)                                                                                                                                                                                          |             |             |             |             |
| Supply voltage                     |                  |                  | 5 to 24 VDC ±10%, ripple (p-p): 10% max.                                                                                                                                                                              |             |             |             |             |
| Current consumption                |                  |                  | 21 mA max.                                                                                                                                                                                                            |             |             |             |             |
| Control output                     |                  |                  | Load power supply voltage: 5 to 24 VDC<br>Load current: 50 mA max.<br>OFF current: 0.5 mA max.<br>50 mA load current with a residual voltage of 1.0 V max.<br>5 mA load current with a residual voltage of 0.4 V max. |             |             |             |             |
| Protection circuits                |                  |                  | Power supply reverse polarity protection; output reverse polarity protection (only OUT2 on models with NPN output)                                                                                                    |             |             |             |             |
| Response frequency                 |                  |                  | 1 kHz min. (3 kHz average) *2                                                                                                                                                                                         |             |             |             |             |
| Ambient illumination               |                  |                  | 1,000 lx max. with fluorescent light on the surface of the receiver                                                                                                                                                   |             |             |             |             |
| Ambient temperature range          |                  |                  | Operating: -25 to 55°C<br>Storage: -30 to 80°C (with no icing or condensation)                                                                                                                                        |             |             |             |             |
| Ambient humidity range             |                  |                  | Operating: 5% to 85%<br>Storage: 5% to 95% (with no icing or condensation)                                                                                                                                            |             |             |             |             |
| Vibration resistance (Destruction) |                  |                  | 10 to 2,000 Hz (peak acceleration: 150m/s <sup>2</sup> )<br>0.75-mm single amplitude for 2.5 h (15-min periods, 10 cycles) each in X, Y, and Z directions                                                             |             |             |             |             |
| Shock resistance (Destruction)     |                  |                  | 500 m/s <sup>2</sup> for 3 times each in X, Y, and Z directions                                                                                                                                                       |             |             |             |             |
| Degree of protection               |                  |                  | IEC60529 IP50                                                                                                                                                                                                         |             |             |             |             |
| Connecting method                  |                  |                  | Pre-wired Models (standard cable length: 1 m)                                                                                                                                                                         |             |             |             |             |
| Weight (packed state)              | Pre-wired Models |                  | Approx. 17 g                                                                                                                                                                                                          |             |             |             |             |
|                                    |                  |                  |                                                                                                                                                                                                                       |             |             |             |             |
| Materials                          | Case/cover       |                  | Polybutylene phthalate (PBT)                                                                                                                                                                                          |             |             |             |             |
|                                    | Emitter/receiver |                  | Polycarbonate (PC)                                                                                                                                                                                                    |             |             |             |             |

\*1. The differential distance is the value when a sensing object is moved in a lateral direction to the slot.

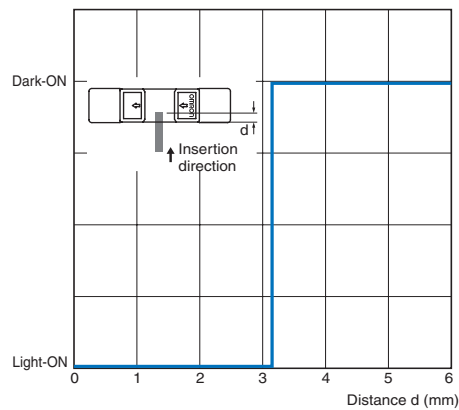
\*2. The response frequency was measured by detecting the following rotating disk.



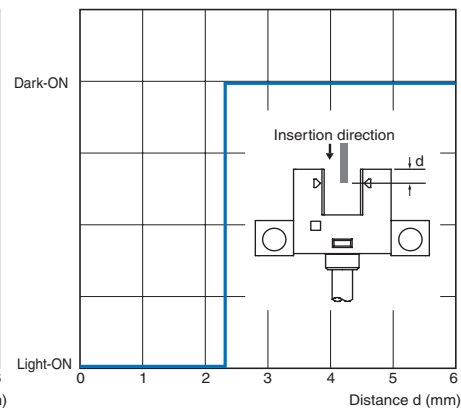
## Engineering Data (Typical)

### Sensing Position Characteristics

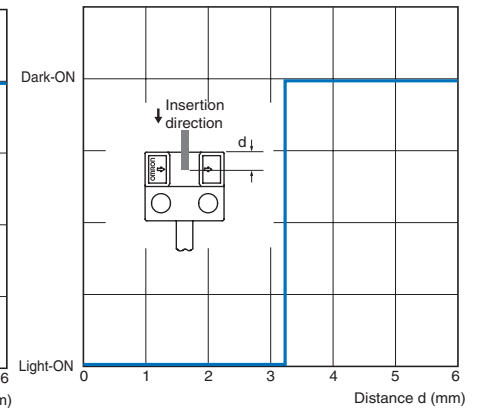
#### EE-SX910



#### EE-SX910

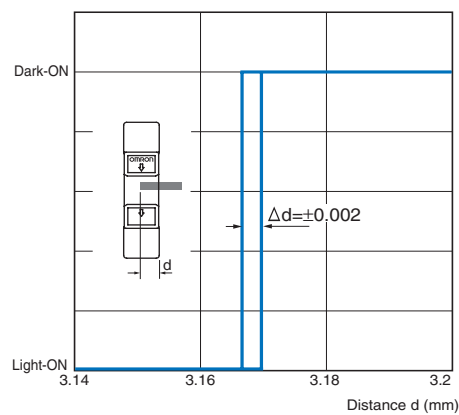


#### EE-SX911



### Repeated Sensing Position Characteristics

#### EE-SX910



$V_{CC} = 24 \text{ V}$ , No. of repetitions: 20,  $T_a = 25^\circ\text{C}$   
(Differential distance = 0.025 mm max.)

Note: The data applies to dark status. Operation may be affected by external light interference or light coming through the sensing object.

I/O Circuit Diagrams

| Output type | Model                                                                   | Output transistor operation status | Timing charts                          | Output circuit |
|-------------|-------------------------------------------------------------------------|------------------------------------|----------------------------------------|----------------|
| NPN output  | EE-SX910-R<br>EE-SX911-R<br>EE-SX912-R<br>EE-SX913-R<br>EE-SX914-R      | OUT1: Light-ON<br>OUT2: Dark-ON    | Light incident<br>Light interrupted    |                |
|             |                                                                         |                                    | Light indicator ON (orange) OFF        |                |
|             |                                                                         |                                    | Output 1 transistor ON OFF             |                |
| PNP output  | EE-SX910P-R<br>EE-SX911P-R<br>EE-SX912P-R<br>EE-SX913P-R<br>EE-SX914P-R | OUT1: Light-ON<br>OUT2: Dark-ON    | Load 1 Operates (e.g., relay) Releases |                |
|             |                                                                         |                                    | Output 2 transistor ON OFF             |                |
|             |                                                                         |                                    | Load 2 Operates (e.g., relay) Releases |                |

## Safety Precautions

Refer to *Warranty and Limitations of Liability*.

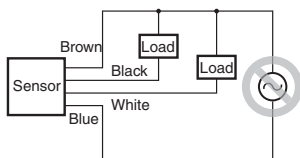
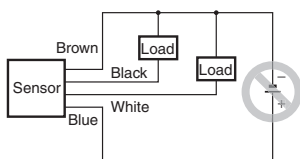
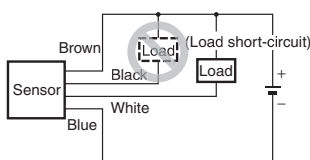
### ⚠ WARNING

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



### Precautions for Safe Use

- **Power Supply Voltage**  
Do not exceed the voltage range indicated in the specifications. Applying a voltage exceeding the specifications or using an AC power supply may result in rupture or burning.
- **Faulty Wiring**  
Do not reverse the power supply polarity. Doing so may result in rupture or burning.
- **Do not short-circuit the load.** (Do not connect to the power supply.)  
Doing so may result in rupture or burning.
- **Dispose of this product as industrial waste.**



### Precautions for Correct Use

#### ● Installation

- It is assumed that EE-SX91 Sensors will be built into a device. These Sensors use non-modulated light and are not equipped to deal with interference from an external light source. When they are used in locations subject to external light interference, such as near a window or under an incandescent light, install them to minimize the effects of external light interference.
- Mount the Sensors securely on a flat surface.
- Use M3 or M2.0 screws to secure the Photomicrosensor. (The stronger M3 screws are recommended. In addition, use flat washers and spring washers to prevent the screws from loosening.) Refer to the following table for the correct tightening torque.

| Screw diameter | Tightening torque |
|----------------|-------------------|
| M2.0           | 0.15 N·m max.     |
| M3             | 0.54 N·m max.     |

- If the Sensor is to be used on a moving part, secure the cable connection point so that it is not directly subjected to stress.

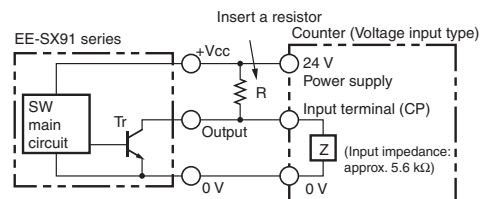
#### ● Wiring

##### Unused Output Lines

Be sure to isolate output lines that are not going to be used.

##### Connecting to Devices with Voltage Input Specifications

A Sensor with an open-collector output can be connected to a counter with a voltage input by connecting a resistor between the power source and output. Select a resistor with reference to the following example. The resistance of the resistor is generally 4.7 kΩ and its wattage is 1/2 W for a supply voltage of 24 V and 1/4 W for 12 V.



Example: EE-SX91 Series

Load Resistance of 4.7 kΩ Connected in a Counter

#### Counter Specifications

|                                         |               |
|-----------------------------------------|---------------|
| Input impedance                         | 5.6 KΩ        |
| Voltage judged as high level (input ON) | 4.5 to 30 VDC |
| Voltage judged as low level (input OFF) | 0 to 2 VDC    |

The high and low levels are found using the following formulas. The input device specifications must satisfy both formulas.

High level:

$$\text{Input voltage } V_H = \frac{Z}{R+Z} \times V_{CC} = \frac{5.6 \text{ k}}{4.7 \text{ k} + 5.6 \text{ k}} \times 24 \text{ V} = 13 \text{ V}$$

Low level:

$$\text{Load current } I_c = \frac{V_{CC}}{R} = \frac{24 \text{ V}}{4.7 \text{ k}} = 5.1 \text{ mA} \leq 50 \text{ mA}$$

Input voltage  $V_L \leq 1.0 \text{ V}$  (Residual voltage for 50-mA load current)

Note: Refer to the ratings of the Sensor for the residual voltage of the load current.

**● Other Precautions**

- Do not disconnect wire the cables from the Sensor when power is supplied to the Sensor, or Sensor damage could result.
- Do not install the Sensor in the following places to prevent malfunction or trouble:
  1. Places exposed to dust or oil mist
  2. Places exposed to corrosive gas
  3. Places directly or indirectly exposed to water, oil, or chemicals
  4. Outdoor or places exposed to intensive light, such as direct sunlight
- Be sure to use the Sensor under the rated ambient temperature.
- The Sensor may be dissolved by exposure to organic solvents, acids, alkali, or aromatic hydrocarbons, aliphatic chloride hydrocarbons causing deterioration in characteristics. Do not expose the Sensor to such chemicals.
- Make sure the total length of the power cable connected to the product is less than 10 m.
- Only output 2 (OUT2) on NPN models is provided with overcurrent protection.

If an overcurrent occurs, heat generated by the output transistor will activate the thermal shutdown circuit and OUT2 will turn OFF.

Check the wiring and load current and cycle the power supply. If there is no overcurrent, normal operation will be resumed. (The thermal shutdown circuit will be activated again if there is an overcurrent.)

This function does not provide protection against load short circuits. If the electric power of the output transistor increases due to a load short-circuit or near load short-circuit, the Sensor may be damaged.

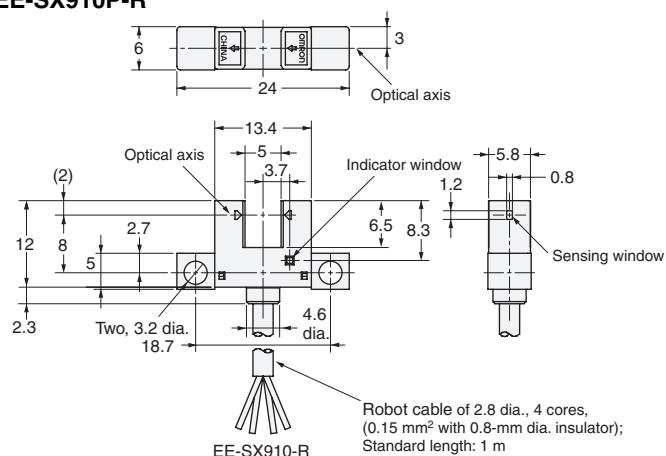
- An output pulse may occur when the power supply is turned ON depending on the power supply and other conditions. The operation of the Sensor will be stable 100 ms after turning ON the power supply.

## Dimensions (Unit: mm)

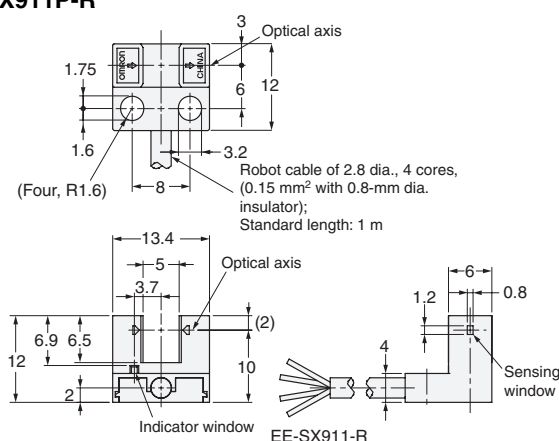
Tolerance class IT16 applies to dimensions in this datasheet unless otherwise specified.

### Photomicrosensors

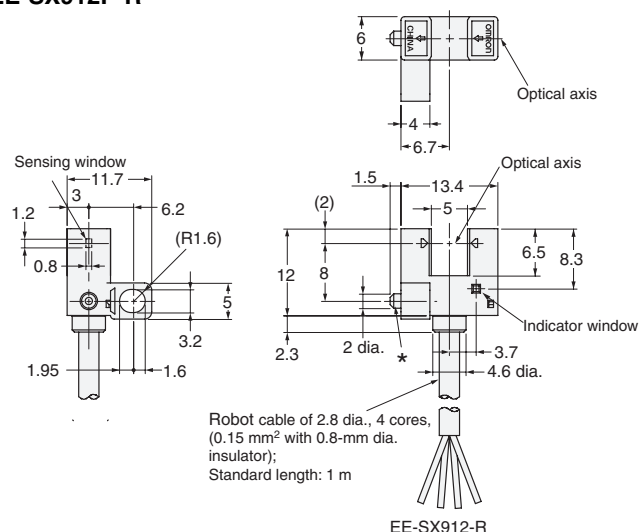
#### EE-SX910-R EE-SX910P-R



#### EE-SX911-R EE-SX911P-R

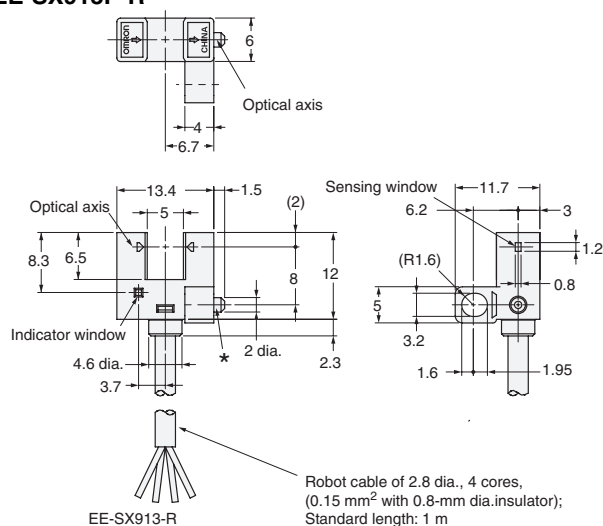


#### EE-SX912-R EE-SX912P-R



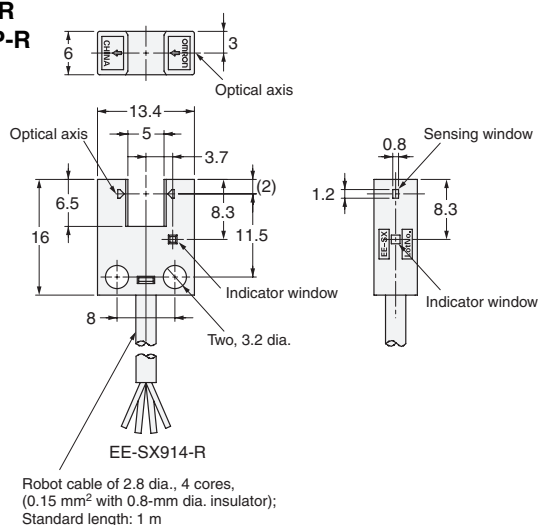
\* The lug is used to prevent turning. When installing, make a fixed hole of 2.1 to 2.3 mm dia.

#### EE-SX913-R EE-SX913P-R



\* The lug is used to prevent turning. When installing, make a fixed hole of 2.1 to 2.3 mm dia.

#### EE-SX914-R EE-SX914P-R



## Read and Understand This Catalog

Please read and understand this catalog before purchasing the products. Please consult your OMRON representative if you have any questions or comments.

## Warranty and Limitations of Liability

### WARRANTY

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

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The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

- Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this catalog.
- Nuclear 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.
- Systems, machines, and equipment that could present a risk to life or property.

Please know and observe all prohibitions of use applicable to the products.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCTS ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

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## Disclaimers

### CHANGE IN SPECIFICATIONS

Product specifications and accessories may be changed at any time based on improvements and other reasons.

It is our practice to change model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the products may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

### DIMENSIONS AND WEIGHTS

Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

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2011.7

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