


## Standard Flat Sensors in Many Different Variations

- Only 6 mm thick yet provides a sensing distance of 3 mm (TL-W3MC1).
- Aluminum die-cast models also available.




 Be sure to read *Safety Precautions* on page 7.



## Ordering Information

Sensors [Refer to *Dimensions* on page 8.]

### DC 2-Wire Models

| Appearance  | Sensing distance |  |  | Model          |                |
|---|------------------|--|--|----------------|----------------|
|   |                  |  |  | Operation mode |                |
|   |                  |  |  | NO             | NC             |
|  | 5 mm             |  |  | TL-W5MD1 2M *1 | TL-W5MD2 2M *1 |

### DC 3-Wire Models

| Appearance  | Sensing distance |  |  | Output configuration | Model               |                 |
|---|------------------|--|--|----------------------|---------------------|-----------------|
|   |                  |  |  |                      | Operation mode      |                 |
|   |                  |  |  |                      | NO                  | NC              |
|  | 1.5 mm           |  |  | DC 3-wire, NPN       | TL-W1R5MC1 2M *1 *2 | ---             |
|   | 3 mm             |  |  |                      | TL-W3MC1 2M *1 *2   | TL-W3MC2 2M     |
|   | 5 mm             |  |  |                      | TL-W5MC1 2M *1 *2   | TL-W5MC2 2M     |
|   | 20 mm            |  |  |                      | TL-W20ME1 2M *1     | TL-W20ME2 2M *1 |
|  | 5 mm             |  |  | DC 3-wire, NPN       | TL-W5E1 2M          | TL-W5E2 2M      |
|   |                  |  |  | DC 3-wire, PNP       | TL-W5F1 2M          | TL-W5F2 2M      |

\*1. Models with a different frequency are also available to prevent mutual interference. The model numbers are TL-W□M□□5 (e.g., TL-W5MD15).

\*2. Models with robotics cables are also available. The model numbers are TL-W□MC1-R (e.g., TL-W1R5MC1-R).

## Ratings and Specifications

### DC 2-Wire Models

| Item   | Model            | TL-W5MD□   |
|--|------------------|--|
| Sensing distance                                 |                  | 5 mm ±10%  |
| Set distance                                     |                  | 0 to 4 mm  |
| Differential travel                              |                  | 10% max. of sensing distance   |
| Detectable object                                |                  | Ferrous metal (The sensing distance decreases with non-ferrous metal. Refer to <i>Engineering Data</i> on page 5.) |
| Standard sensing object                          |                  | Iron, 18 × 18 × 1 mm   |
| Response frequency *1                            |                  | 500 Hz   |
| Power supply voltage (operating voltage range)   |                  | 12 to 24 VDC (10 to 30 VDC), ripple (p-p): 10% max.  |
| Leakage current                                  |                  | 0.8 mA max.  |
| Con-trol output                                  | Load current     | 3 to 100 mA  |
|  | Residual voltage | 3.3 V max. (under load current of 100 mA with cable length of 2 m)   |
| Indicators                                       |                  | D1 Models: Operation indicator (red), Setting indicator (green)<br>D2 Models: Operation indicator (red)            |
| Operation mode (with sensing object approaching) |                  | D1 Models: NO Refer to the timing charts under <i>I/O Circuit Diagrams</i> on page 6 for details.<br>D2 Models: NC |
| Protection circuits                              |                  | Load short-circuit protection, Surge suppressor  |
| Ambient temperature range                        |                  | Operating/Storage: -25 to 70°C (with no icing or condensation) *2  |
| Ambient humidity range                           |                  | Operating/Storage: 35% to 95% (with no condensation)   |
| Temperature influence                            |                  | ±10% max. of sensing distance at 23°C in the temperature range of -25 to 70°C                                      |
| Voltage influence                                |                  | ±2.5% max. of sensing distance at rated voltage in the rated voltage ±15% range                                    |
| Insulation resistance                            |                  | 50 MΩ min. (at 500 VDC) between current-carrying parts and case  |
| Dielectric strength                              |                  | 1,000 VAC for 1 min between current-carrying parts and case  |
| Vibration resistance                             |                  | Destruction: 10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y, and Z directions                       |
| Shock resistance                                 |                  | Destruction: 500 m/s <sup>2</sup> 3 times each in X, Y, and Z directions   |
| Degree of protection                             |                  | IEC 60529 IP67, in-house standards: oil-resistant *2   |
| Connection method                                |                  | Pre-wired Models (Standard cable length: 2 m)  |
| Weight (packed state)                            |                  | Approx. 45 g   |
| Materials  | Case             | Heat-resistant ABS   |
|  | Sensing surface  |  |
| Accessories                                      |                  | Instruction manual   |

\*1. The response frequency is an average value.

Measurement conditions are as follows: standard sensing object, a distance of twice the standard sensing object, and a set distance of half the sensing distance.

\*2. For environments that require oil resistance, the upper limit of the ambient operating temperature range is 40°C.

DC 3-Wire Models

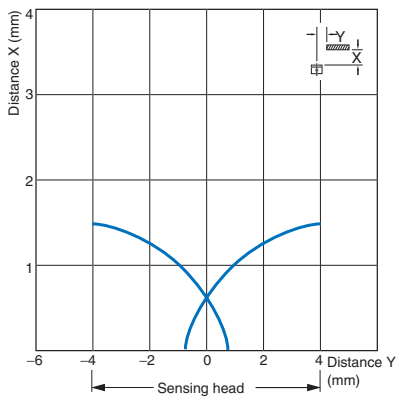
| Model   |                         | TL-W1R5MC1   | TL-W3MC□                          | TL-W5MC□  | TL-W5E1, TL-W5E2<br>TL-W5F1, TL-W5F2  | TL-W20ME1<br>TL-W20ME2  |
|---|-------------------------|--|-----------------------------------|---|---|---|
| <b>Sensing distance</b>                                 |                         | 1.5 mm ±10%  | 3 mm ±10%                         | 5 mm ±10%   |   | 20 mm ±10%  |
| <b>Set distance</b>                                     |                         | 0 to 1.2 mm  | 0 to 2.4 mm                       | 0 to 4 mm   |   | 0 to 16 mm  |
| <b>Differential travel</b>                              |                         | 10% max. of sensing distance   |                                   |   |   | 1% to 15% of sensing distance   |
| <b>Detectable object</b>                                |                         | Ferrous metal (The sensing distance decreases with non-ferrous metal. Refer to <i>Engineering Data</i> on page 5.) |                                   |   |   |   |
| <b>Standard sensing object</b>                          |                         | Iron, 8 × 8 × 1 mm   | Iron, 12 × 12 × 1 mm              | Iron, 18 × 18 × 1 mm  |   | Iron, 50 × 50 × 1 mm  |
| <b>Response frequency</b>                               |                         | 1 kHz min.   | 600 Hz min.                       | 500 Hz min.   | 300 Hz min.   | 40 Hz min.  |
| <b>Power supply voltage (operating voltage range)</b>   |                         | 12 to 24 VDC (10 to 30 VDC), ripple (p-p): 10% max.  |                                   |   | 12 to 24 VDC (10 to 30 VDC), ripple (p-p): 20% max.                             | 12 to 24 VDC (10 to 30 VDC), ripple (p-p): 10% max.                       |
| <b>Current consumption</b>                              |                         | 15 mA max. at 24 VDC (no-load)   |                                   | 10 mA max.  | 15 mA max. at 24 VDC (no-load)  | 8 mA at 12 VDC, 15 mA at 24 VDC   |
| <b>Control output</b>                                   | <b>Load current</b>     | NPN open collector<br>100 mA max. at 30 VDC max.   |                                   | NPN open collector<br>50 mA max. at 12 VDC (30 VDC max.)<br>100 mA max. at 24 VDC (30 VDC max.) | 200 mA  | 100 mA max. at 12 VDC<br>200 mA max. at 24 VDC                            |
|   | <b>Residual voltage</b> | 1 V max. (under load current of 100 mA with cable length of 2 m)   |                                   | 1 V max. (under load current of 50 mA with cable length of 2 m)                                 | 2 V max. (under load current of 200 mA with cable length of 2 m)                | 1 V max. (under load current of 200 mA with cable length of 2 m)          |
| <b>Indicators</b>                                       |                         | Detection indicator (red)  |                                   |   |   |   |
| <b>Operation mode (with sensing object approaching)</b> |                         | NO   | C1 Models: NO<br>C2/B2 Models: NC |   | E1/F1 Models: NO<br>E2/F2 Models: NC  |   |
| <b>Protection circuits</b>                              |                         | Reverse polarity protection, Surge suppressor  |                                   |   |   |   |
| <b>Ambient temperature range</b>                        |                         | Operating/Storage: -25 to 70°C (with no icing or condensation) *   |                                   |   |   |   |
| <b>Ambient humidity range</b>                           |                         | Operating/Storage: 35% to 95% (with no condensation)   |                                   |   |   |   |
| <b>Temperature influence</b>                            |                         | ±10% max. of sensing distance at 23°C in the temperature range of -25 to 70°C                                      |                                   |   |   |   |
| <b>Voltage influence</b>                                |                         | ±2.5% max. of sensing distance at rated voltage in the rated voltage ±10% range                                    |                                   | ±2.5% max. of sensing distance at rated voltage in the rated voltage ±20% range                 | ±2.5% max. of sensing distance at rated voltage in the rated voltage ±10% range |   |
| <b>Insulation resistance</b>                            |                         | 50 MΩ min. (at 500 VDC) between current-carrying parts and case  |                                   |   |   |   |
| <b>Dielectric strength</b>                              |                         | 1,000 VAC, 50/60 Hz for 1 minute between current-carrying parts and case   |                                   |   |   |   |
| <b>Vibration resistance</b>                             |                         | Destruction: 10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y, and Z directions                       |                                   |   |   |   |
| <b>Shock resistance</b>                                 |                         | Destruction: 500 m/s <sup>2</sup> 3 times each in X, Y, and Z directions   |                                   |   |   | Destruction: 500 m/s <sup>2</sup> 10 times each in X, Y, and Z directions |
| <b>Degree of protection</b>                             |                         | IEC 60529 IP67, in-house standards: oil-resistant *  |                                   |   |   |   |
| <b>Connection method</b>                                |                         | Pre-wired Models (Standard cable length: 2 m)  |                                   |   |   |   |
| <b>Weight (packed state)</b>                            |                         | Approx. 30 g   |                                   | Approx. 45 g  | Approx. 70 g  | Approx. 180 g   |
| <b>Materials</b>  | <b>Case</b>             | Heat-resistant ABS   |                                   |   | Aluminum die-cast   | Heat-resistant ABS  |
|   | <b>Sensing surface</b>  | Heat-resistant ABS   |                                   |   |   |   |
| <b>Accessories</b>                                      |                         | Mounting Bracket, Instruction manual   |                                   | Instruction manual  |   |   |

\* For environments that require oil resistance, the upper limit of the ambient operating temperature range is 40°C.

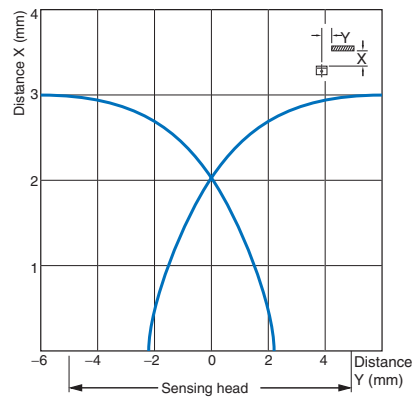
Engineering Data (Typical)

Sensing Area

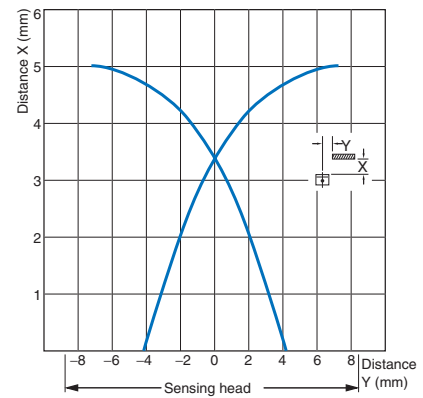
TL-W1R5MC1



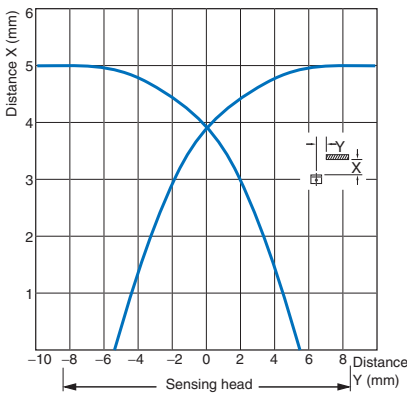
TL-W3MC1



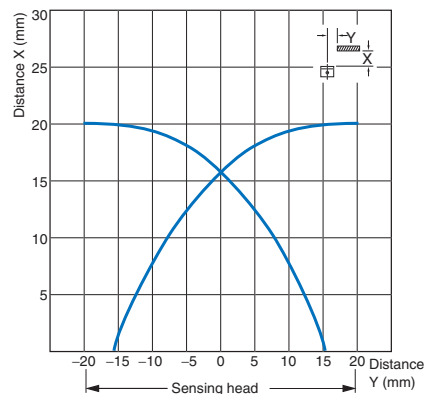
TL-W5MC1/-W5MD



TL-W5E/-W5F

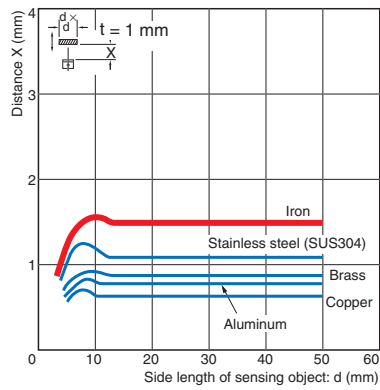


TL-W20

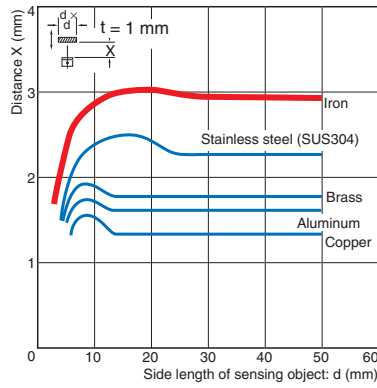


Influence of Sensing Object Size and Material

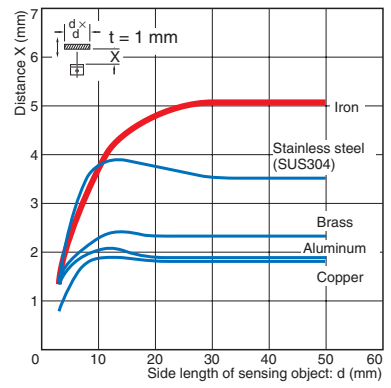
TL-W1R5MC1



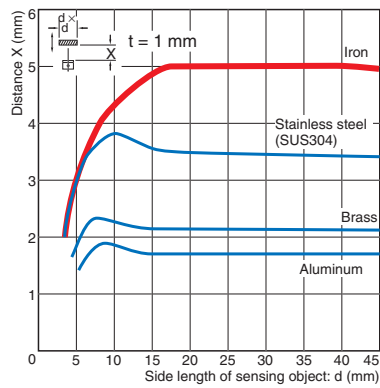
TL-W3MC1



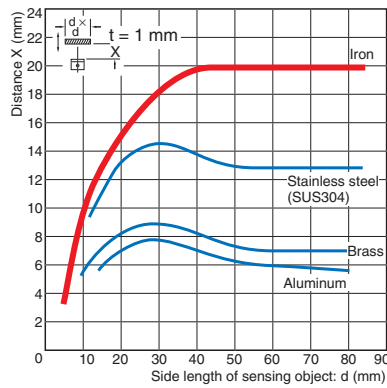
TL-W5MC1



TL-W5E□/-W5F□/-W5MD□



TL-W20□



# I/O Circuit Diagrams

## DC 2-Wire Models

| Operation mode | Model    | Timing chart  | Output circuit   |
|----------------|----------|---|--|
| NO             | TL-W5MD1 | <p>Unstable sensing area   Stable sensing area   Proximity Sensor</p> <p>Sensing object (%)   100   80 (TYP)   0</p> <p>Rated sensing distance</p> <p>ON OFF Setting indicator (green)</p> <p>ON OFF Operation indicator (red)</p> <p>ON OFF Control output</p> | <p>Note: The load can be connected to either the +V or 0 V side.</p> |
| NC             | TL-W5MD2 | <p>Non-sensing area   Sensing area   Proximity Sensor</p> <p>Sensing object (%)   100   0</p> <p>Rated sensing distance</p> <p>ON OFF Operation indicator (red)</p> <p>ON OFF Control output</p>  |  |

## DC 3-Wire Models

| Operation mode | Model                              | Timing chart  | Output circuit   |
|----------------|------------------------------------|---|--|
| NO             | TL-W1R5MC1<br>TL-W3MC1<br>TL-W5MC1 | <p>Sensing object Present Not present</p> <p>Output transistor (load) ON OFF</p> <p>Detection indicator (red) ON OFF</p>  | <p>* bad current: 100 mA max</p>   |
| NC             | TL-W3MC2<br>TL-W5MC2               | <p>Sensing object Present Not present</p> <p>Output transistor (load) ON OFF</p> <p>Detection indicator (red) ON OFF</p>  |  |
| NO             | TL-W5E1<br>TL-W20ME1               | <p>Sensing object Present Not present</p> <p>Load (between brown and black leads) Operate Reset</p> <p>Output voltage (between black and blue leads) High Low</p> <p>Detection indicator (red) ON OFF</p> | <p>*1. Load current: 200 mA max.<br/>*2. When a transistor is connected.</p> |
| NC             | TL-W5E2<br>TL-W20ME2               | <p>Sensing object Present Not present</p> <p>Load (between brown and black leads) Operate Reset</p> <p>Output voltage (between black and blue leads) High Low</p> <p>Detection indicator (red) ON OFF</p> |  |
| NO             | TL-W5F1                            | <p>Sensing object Present Not present</p> <p>Load (between blue and black leads) Operate Reset</p> <p>Output voltage (between blue and black leads) High Low</p> <p>Detection indicator (red) ON OFF</p>  | <p>*1. Load current: 200 mA max.<br/>*2. When a transistor is connected.</p> |
| NC             | TL-W5F2                            | <p>Sensing object Present Not present</p> <p>Load (between blue and black leads) Operate Reset</p> <p>Output voltage (between blue and black leads) High Low</p> <p>Detection indicator (red) ON OFF</p>  |  |

## 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 Correct Use

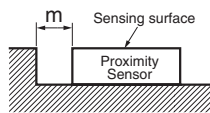
Do not use this product under ambient conditions that exceed the ratings.

● **Design**

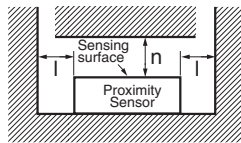
**Influence of Surrounding Metal**

When mounting the Sensor 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.

**Metal on a Single Side  
(Not Exceeding the Height  
of the Sensor Surface)**



**Metals on Both Sides and  
in Front of the Sensor**



**Influence of Surrounding Metal (Unit: mm)**

| Model         | Distance | l  | m  | n   |
|---------------|----------|----|----|-----|
| TL-W1R5MC1    |          | 2  | 0  | 8   |
| TL-W3MC□      |          | 3  |    | 12  |
| TL-W5MD□      |          | 5  |    | 20  |
| TL-W5MC1      |          |    |    |     |
| TL-W20ME□     |          | 25 | 16 | 100 |
| TL-W5E□/-W5F□ |          | 0  | 0  | 20  |

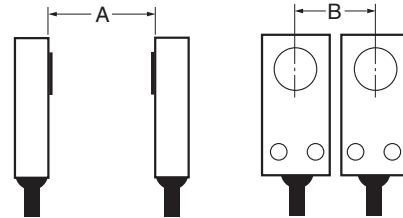
**Applicable e-CON Connector Models and Manufacturers**

The companies and model number of e-CON connections that can be used with Sensor cables are listed in the following table. Confirm applicability when purchasing e-CON connectors for connection to Pre-wired Sensors.

| Model         | Tyco Electronics AMP K.K. |
|---------------|---------------------------|
| TL-W1R5□/-W3□ | 1-1473562-4 (red)         |

**Mutual Interference**

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



**Mutual Interference (Unit: mm)**

| Model         | Distance | A         | B         |
|---------------|----------|-----------|-----------|
| TL-W1R5MC1    |          | 75 (50)   | 25 (8)    |
| TL-W3MC□      |          | 90 (60)   | 30 (10)   |
| TL-W5MD□      |          | 120 (80)  | 60 (30)   |
| TL-W5MC1□     |          |           |           |
| TL-W20ME□     |          | 200 (100) | 200 (100) |
| TL-W5E□/-W5F□ |          | 50        | 35        |

Note: Values in parentheses apply to Sensors operating at different frequencies.

● **Mounting**

- Use M3 flat-head screws to mount the TL-W1R5MC1 and TL-W3MC1.
- Do not exceed the torque in the following table when tightening the resin cover screws.

| Model      | Torque   |
|------------|----------|
| TL-W1R5MC1 | 0.98 N·m |
| TL-W3MC□   |          |
| TL-W5MD□   |          |
| TL-W20M□   | 1.5 N·m  |

● **Adjustment**

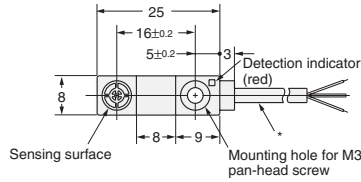
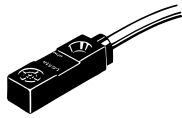
**Turning ON the Power**

An error pulse will occur (approximately 1 ms) if adjustments are made when turning ON the power or making AND connections.

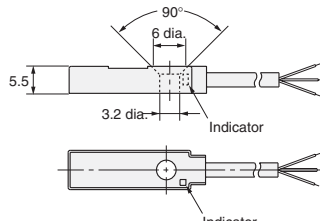
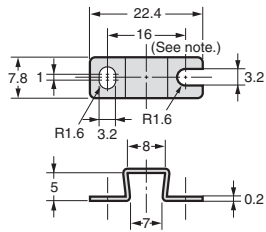
## Dimensions

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

### TL-W1R5MC1



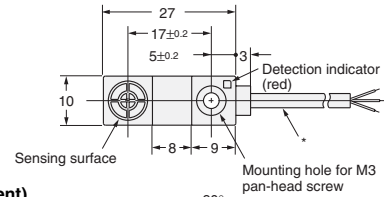
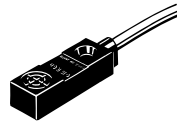
#### Mounting Bracket (Attachment)



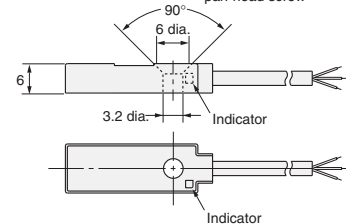
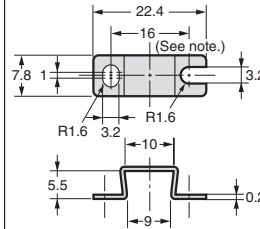
\* 2.9-dia. vinyl-insulated round cable with 3 conductors (Conductor cross section: 0.14 mm<sup>2</sup>, Insulator diameter: 0.9 mm), Standard length: 2 m

Note: Mounting hole dimension: 17 ± 0.2.  
Material: Stainless steel (SUS304)

### TL-W3MC□



#### Mounting Bracket (Attachment)

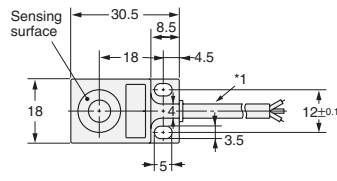
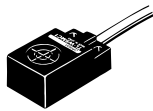


\* 2.9-dia. vinyl-insulated round cable with 3 conductors (Conductor cross section: 0.14 mm<sup>2</sup>, Insulator diameter: 0.9 mm), Standard length: 2 m

Note: Mounting hole dimension: 17 ± 0.2.  
Material: Stainless steel (SUS304)

### TL-W5MC□

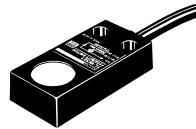
### TL-W5MD□



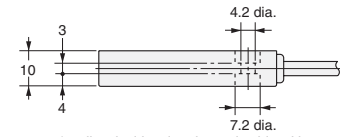
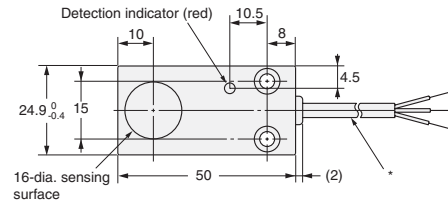
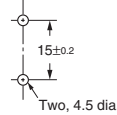
- \*1. TL-W5MC1  
4-dia. vinyl-insulated round cable with 3 conductors (Conductor cross section: 0.2 mm<sup>2</sup>, Insulator diameter: 1.2 mm), Standard length: 2 m
- TL-W5MD□  
4-dia. vinyl-insulated round cable with 2 conductors (Conductor cross section: 0.3 mm<sup>2</sup>, Insulation diameter: 1.3 mm), Standard length: 2 m
- \*2. C Models: Detection indicator (red)  
D Models: Operation indicator (red), Setting indicator (green)

### TL-W5E□

### TL-W5F□

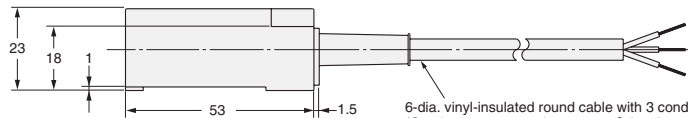
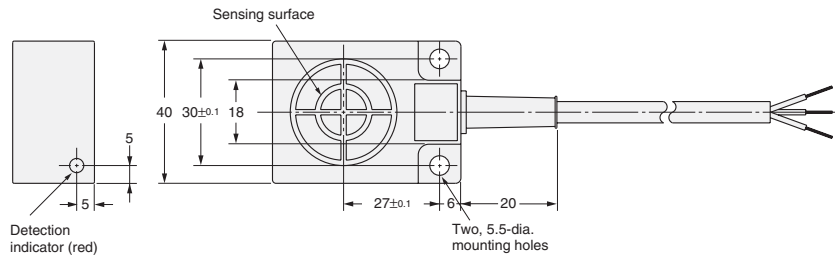
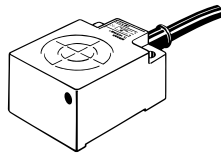


#### Mounting Hole Dimensions



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

### TL-W20ME□



6-dia. vinyl-insulated round cable with 3 conductors (Conductor cross section: 0.5 mm<sup>2</sup>, Insulator diameter: 1.9 mm), Standard length: 2 m