



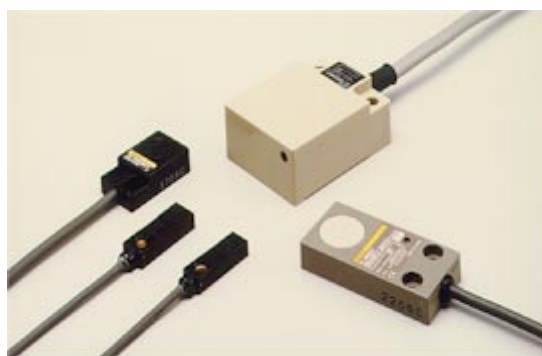
| Sensing distance |                                                                                     |      | Supply voltage | Output                                                                                                          |
|------------------|-------------------------------------------------------------------------------------|------|----------------|-----------------------------------------------------------------------------------------------------------------|
| 20 mm            |    | 5 mm | 12 to 24 VDC   | <br>100/200 mA<br>NPN or PNP |
| 1.5 mm           |    | 3 mm |                |                                                                                                                 |
| 3 mm             |  | 5 mm |                |                                                                                                                 |

# Inductive Proximity Sensor

TL-W/WM

## Space Saving Flat Proximity Switch

- Space-saving, low-profile rigid aluminum die-cast housing (TL-W5E/F).
- All models provided with an operation indicator.
- Mounting possible from either the front or rear of the housing.
- Protected to endure water and oil splashes (conforms to IEC IP67).
- DC 2-wire models (TL-W5MD1/-W5MD2) provide easy wiring.



## Ordering Information

### DC 2-wire

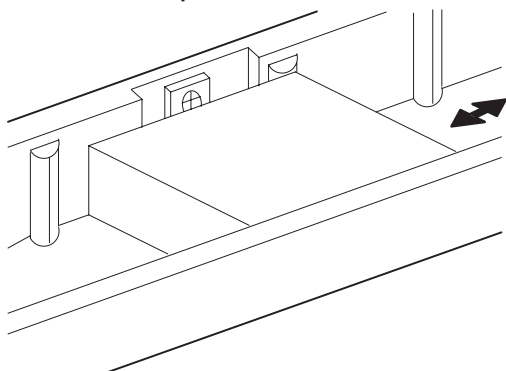
| Sensing head | Sensing distance | Output   |          |     |     |
|--------------|------------------|----------|----------|-----|-----|
|              |                  | NPN      |          | PNP |     |
|              |                  | NO       | NC       | NO  | NC  |
| Non-shielded | 5 mm             | TL-W5MD1 | TL-W5MD2 | --- | --- |

### DC 3-wire

| Sensing head | Sensing distance | Output     |           |            |          |
|--------------|------------------|------------|-----------|------------|----------|
|              |                  | NPN        |           | PNP        |          |
|              |                  | NO         | NC        | NO         | NC       |
| Shielded     | 5 mm             | TL-W5E1    | TL-W5E2   | TL-W5F1    | TL-W5F2  |
| Non-shielded | 1.5 mm           | TL-W1R5MC1 | ---       | TL-W1R5MB1 | ---      |
|              | 3 mm             | TL-W3MC1   | TL-W3MC2  | TL-W3MB1   | TL-W3MB2 |
|              | 5 mm             | TL-W5MC1   | TL-W5MC2  | TL-W5MB1   | ---      |
|              | 20 mm            | TL-W20ME1  | TL-W20ME2 | ---        | ---      |

## Application Examples

Position of Workpiece



## Specifications

### ■ Ratings/Characteristics

#### DC 2-wire

| Item                                              |                 | TL-W5MD                                                                                                                   |
|---------------------------------------------------|-----------------|---------------------------------------------------------------------------------------------------------------------------|
| Sensing distance                                  |                 | 5 mm ±10%                                                                                                                 |
| Supply voltage<br>(operating voltage range)       |                 | 12 to 24 VDC (10 to 30 VDC)                                                                                               |
| Current consumption<br>(leakage current)          |                 | 0.8 mA max.                                                                                                               |
| Sensing object                                    |                 | Magnetic metals (refer to “Engineering Data” for non-magnetic metals)                                                     |
| Setting distance<br>(standard sensing object)     |                 | 0 to 4 mm (iron, 18 x 18 x 1 mm)                                                                                          |
| Differential travel                               |                 | 10% max. of sensing distance                                                                                              |
| Response frequency<br>(see note)                  |                 | 0.5 kHz                                                                                                                   |
| Operating mode (for detecting<br>sensing objects) |                 | D1 models: Load ON<br>D2 models: Load OFF                                                                                 |
| Control output<br>(switching capacity)            |                 | 3 to 100 mA DC                                                                                                            |
| Circuit protection                                |                 | Load short-circuit protection                                                                                             |
| Indicator                                         |                 | D1 models: Operation indicator (red LED), operation set indicator (green LED)<br>D2 models: Operation indicator (red LED) |
| Ambient temperature                               |                 | Operating: –25°C to 70°C (with no icing)                                                                                  |
| Ambient humidity                                  |                 | Operating: 35% to 95%                                                                                                     |
| Temperature influence                             |                 | ±10% max. of sensing distance at 23°C in temperature range of –25°C to 70°C                                               |
| Voltage influence                                 |                 | ±2.5% max. of sensing distance in rated voltage range ±15%                                                                |
| Residual voltage                                  |                 | 3.3 V max. (with 100 mA load current and 2-m cable)                                                                       |
| Insulation resistance                             |                 | 50 MΩ min. (at 500 VDC) between current carry parts and case                                                              |
| Dielectric strength                               |                 | 1,000 VAC for 1 min between current carry parts and case                                                                  |
| Vibration resistance                              |                 | Destruction: 10 to 55 Hz, 1.5-mm double amplitude for 2 hrs each in X, Y, and Z directions                                |
| Shock resistance                                  |                 | Destruction: 500 m/s <sup>2</sup> (approx. 50G) for 3 times each in X, Y, and Z directions                                |
| Enclosure ratings                                 |                 | IEC IP67 (JEM IP67G (water-tight, oil-tight)                                                                              |
| Weight (with 2-m cable)                           |                 | Approx. 45 g                                                                                                              |
| Material                                          | Case            | Heat-resistive ABS resin                                                                                                  |
|                                                   | Sensing surface |                                                                                                                           |

**Note:** The response frequency in the table is a mean value obtained under the following conditions.  
 Location of each standard sensing object: At a distance half as long as the sensing distance of the sensor.  
 Distance between any two adjacent standard sensing objects: Twice as wide as the width of the standard sensing object.

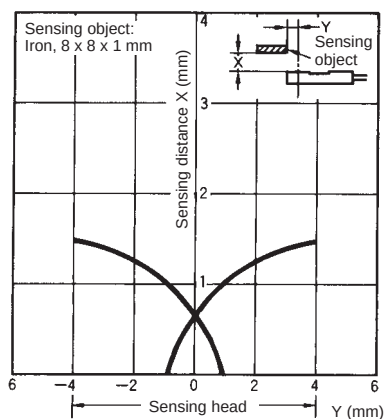
## DC 3-wire

| Item                                           |                 | TL-W1R5M                                                                                                                               | TL-W3M                             | TL-W5M                                                                 | TL-W5                                                                                                                                                                | TL-W20M                                                                                     |
|------------------------------------------------|-----------------|----------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| Sensing distance                               |                 | 1.5 mm ±10%                                                                                                                            | 3 mm ±10%                          | 5 mm ±10%                                                              |                                                                                                                                                                      | 20 mm ±10%                                                                                  |
| Supply voltage (operating voltage range)       |                 | 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)                                                                 |
| Current consumption (leakage current)          |                 | 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                                                             |
| Sensing object                                 |                 | Magnetic metals (Non-magnetic metals can be detected if they are located close to the sensor. Refer to "Engineering Data" for details) |                                    |                                                                        |                                                                                                                                                                      |                                                                                             |
| Setting distance (standard sensing object)     |                 | 0 to 1.2 mm (iron, 8 x 8 x 1 mm)                                                                                                       | 0 to 2.4 mm (iron, 12 x 12 x 1 mm) | 0 to 4 mm (iron, 18 x 18 x 1 mm)                                       |                                                                                                                                                                      | 0 to 16 mm (iron, 50 x 50 x 1 mm)                                                           |
| Differential travel                            |                 | 10% max. of sensing distance                                                                                                           |                                    |                                                                        |                                                                                                                                                                      | 1% to 15% of sensing distance                                                               |
| Response frequency (see note)                  |                 | 1 kHz                                                                                                                                  | 600 Hz min.                        | 500 Hz min.                                                            | 300 Hz min.                                                                                                                                                          | 40 Hz                                                                                       |
| Operating mode (for detecting sensing objects) |                 | Load ON                                                                                                                                |                                    |                                                                        | E1 models: Output signal low, load ON<br>E2 models: Output signal high, load OFF<br>F1 models: Output signal high, load ON<br>F2 models: Output signal low, load OFF |                                                                                             |
| Control output (switching capacity)            |                 | NPN or PNP open collector, 100 mA max.                                                                                                 |                                    | NPN or PNP open collector, 50 mA max. at 12 VDC, 100 mA max. at 24 VDC | 200 mA max.                                                                                                                                                          | 100 mA max. at 12 VDC, 200 mA max. at 24 VDC                                                |
| Circuit protection                             |                 | Reverse connection protection                                                                                                          |                                    |                                                                        |                                                                                                                                                                      | ---                                                                                         |
| Ambient temperature                            |                 | Operating: -25°C to 70°C (with no icing)                                                                                               |                                    |                                                                        |                                                                                                                                                                      |                                                                                             |
| Ambient humidity                               |                 | Operating: 35% to 95%                                                                                                                  |                                    |                                                                        |                                                                                                                                                                      |                                                                                             |
| Temperature influence                          |                 | ±10% max. of sensing distance at 23°C in temperature range of -25°C to 70°C                                                            |                                    |                                                                        |                                                                                                                                                                      |                                                                                             |
| Voltage influence                              |                 | ±2.5% max. of sensing distance in rated voltage range ±10%                                                                             |                                    | ±2.5% max. of sensing distance in rated voltage range ±20%             | ±2.5% max. of sensing distance in rated voltage range ±10%                                                                                                           |                                                                                             |
| Residual voltage                               |                 | 1.0 V max. (with 100 mA load current and 2-m cable)                                                                                    |                                    | 1.0 V max. (with 50 mA load current and 2-m cable)                     | 2.0 V max. (with 200 mA load current and 2-m cable)                                                                                                                  | 1.0 V max. (with 200 mA load current and 2-m cable)                                         |
| Insulation resistance                          |                 | 50 MΩ min. (at 500 VDC) between current carry parts and case                                                                           |                                    |                                                                        |                                                                                                                                                                      |                                                                                             |
| Dielectric strength                            |                 | 1,000 VAC, 50/60 Hz for 1 min between current carry parts and case                                                                     |                                    |                                                                        |                                                                                                                                                                      |                                                                                             |
| Vibration resistance                           |                 | Destruction: 10 to 55 Hz, 1.5-mm double amplitude for 2 hrs each in X, Y, and Z directions                                             |                                    |                                                                        |                                                                                                                                                                      |                                                                                             |
| Shock resistance                               |                 | Destruction: 500 m/s <sup>2</sup> (approx. 50G) for 3 times each in X, Y, and Z directions                                             |                                    |                                                                        |                                                                                                                                                                      | Destruction: 500 m/s <sup>2</sup> (approx. 50G) for 10 times each in X, Y, and Z directions |
| Enclosure ratings                              |                 | IEC IP67 (JEM IP67G (water-tight, oil-tight))                                                                                          |                                    |                                                                        |                                                                                                                                                                      |                                                                                             |
| Weight (with 2-m cable)                        |                 | Approx. 30 g                                                                                                                           |                                    | Approx. 45 g                                                           | Approx. 70 g                                                                                                                                                         | Approx. 180 g                                                                               |
| Material                                       | Case            | ABS resin                                                                                                                              |                                    |                                                                        | ADC (Al die-cast)                                                                                                                                                    | Heat-resistive ABS                                                                          |
|                                                | Sensing surface | ABS resin                                                                                                                              |                                    |                                                                        |                                                                                                                                                                      |                                                                                             |

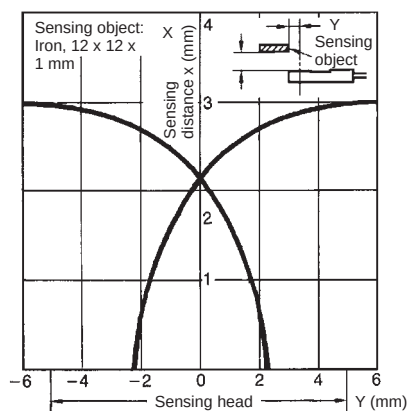
## Engineering Data

## Operating Range (Typical)

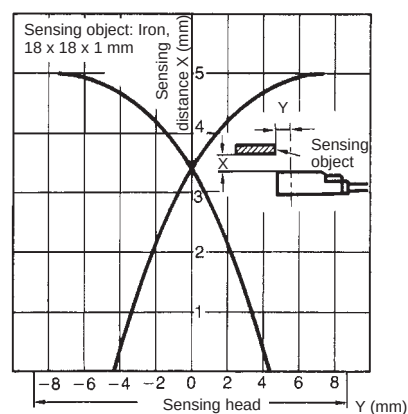
TL-W1R5M



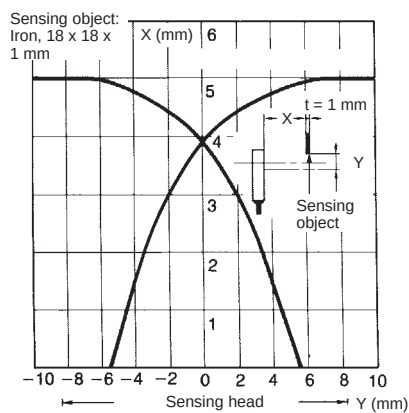
TL-W3M



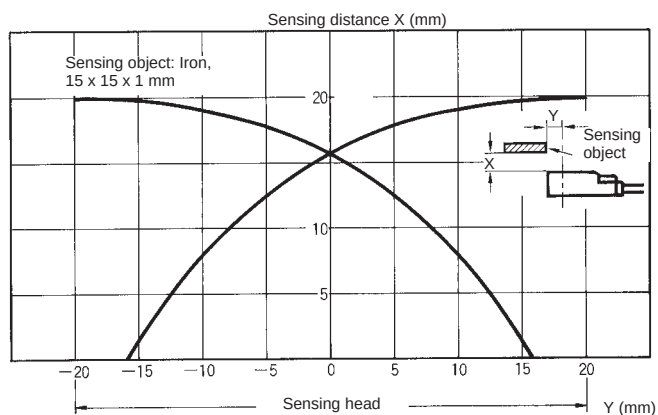
TL-W5M



TL-W5

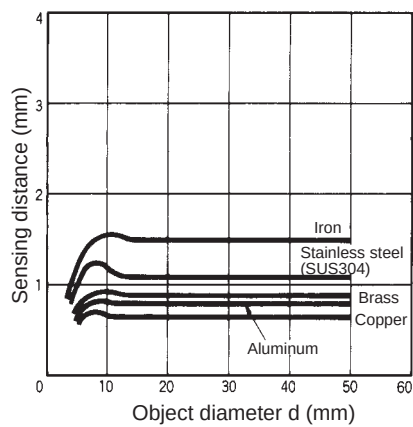


TL-W20M

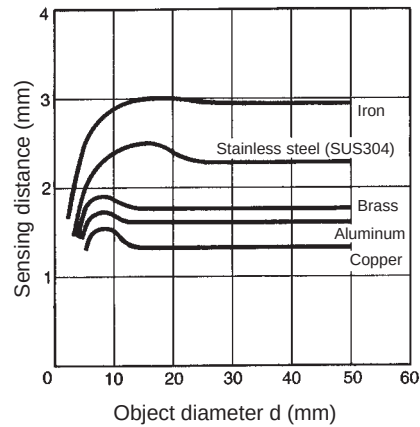


# Sensing Distance vs. Size and Material of Sensing Object (Typical)

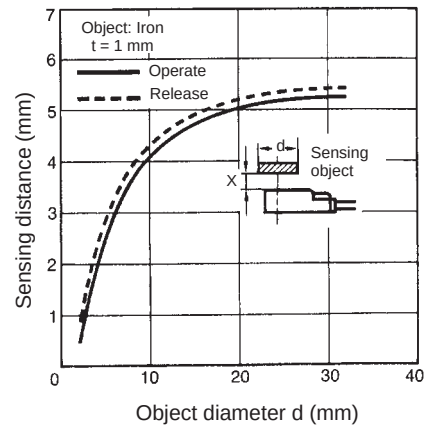
TL-W1R5M



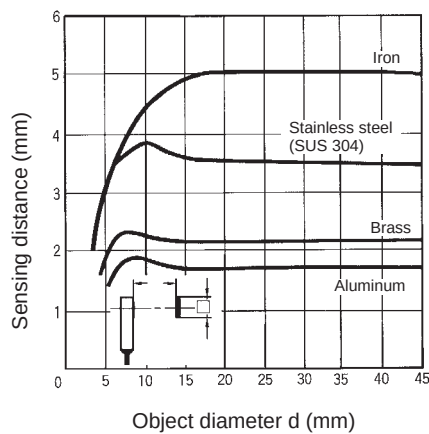
TL-W3M



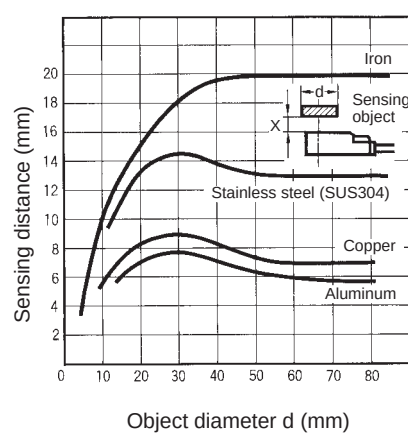
TL-W5M



TL-W5



TL-W20M

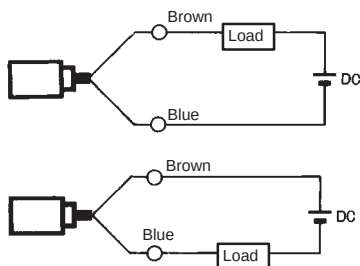
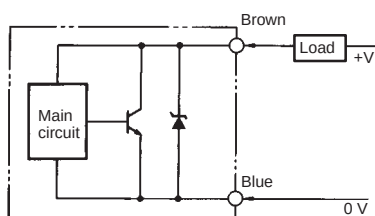


# Operation

## ■ Output Circuits

### DC 2-wire

TL-W5MD□



**Note:** The load can be connected as shown in the above diagram.

### DC 3-wire

TL-W1R5MC1

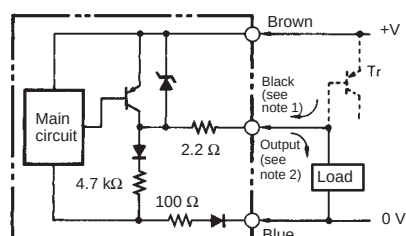
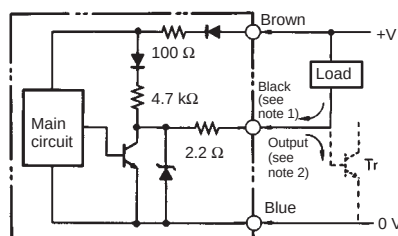
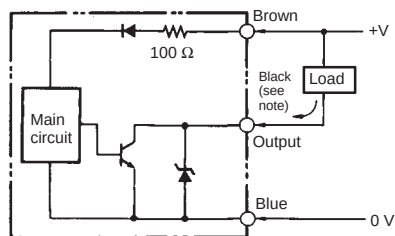
TL-W3MC□

TL-W5MC□

TL-W5E□

TL-W20ME□

TL-W5F□



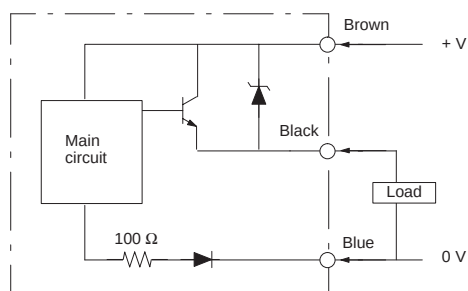
**Note:** Maximum load current: 100 mA

**Note:** 1. Maximum load current: 200 mA  
2. Current flows in this direction if the circuit incorporates the transistor.

TL-W1R5MB1

TL-W3MB□

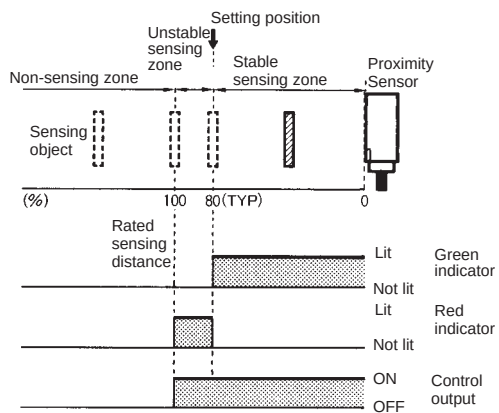
TL-W5MB1



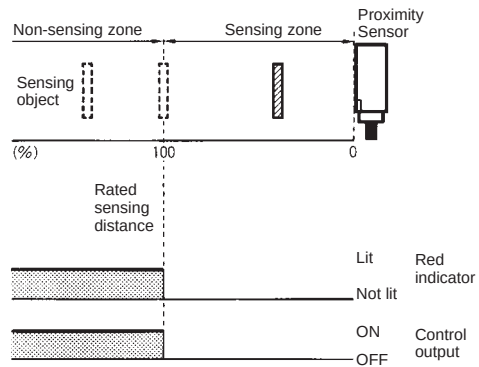
## ■ Timing Chart

### DC 2-wire

#### NO Model

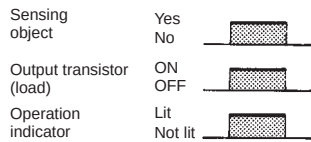


#### NC Model

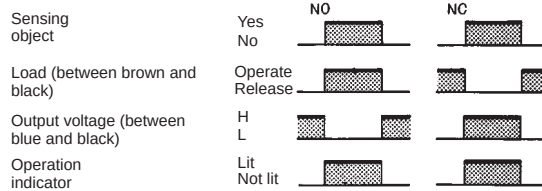


### DC 3-wire

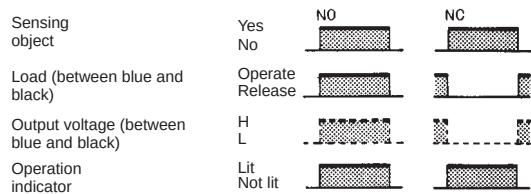
TL-W1R5M□1  
TL-W3M□  
TL-W5M□



TL-W5□  
TL-W20ME□



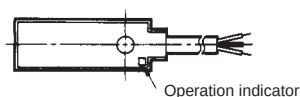
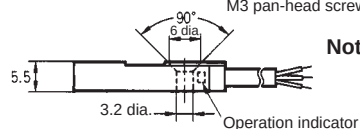
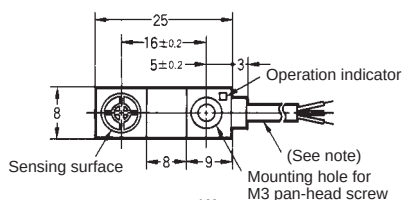
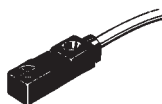
TL-W5F□



# Dimensions

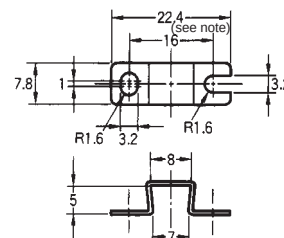
**Note:** All units are in millimeters unless otherwise indicated.

## TL-W1R5M□1



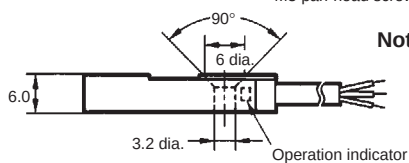
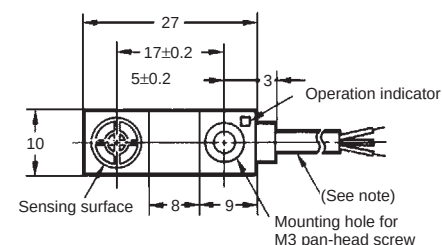
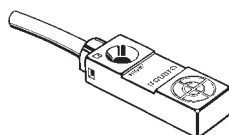
**Note:** Round vinyl-insulated cable (2.9 dia., 0.12 dia. x 12, 3 cores)  
Standard length: 2 m (oil-tight)

### Mounting Bracket (Attachment)



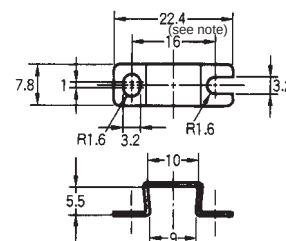
**Note:** Mounting dimensions:  
17±0.2

## TL-W3M□□



**Note:** Round vinyl-insulated cable (2.9 dia., 0.12 dia. x 12, 3 cores)  
Standard length: 2 m (oil-tight)

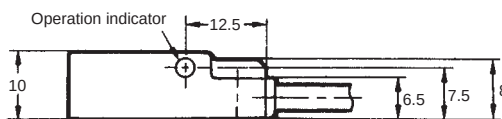
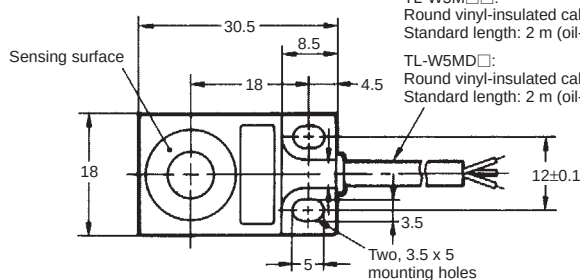
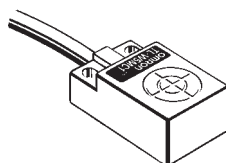
### Mounting Bracket (Attachment)



**Note:** Mounting dimensions:  
17±0.2

## TL-W5M□□

## TL-W5MD□



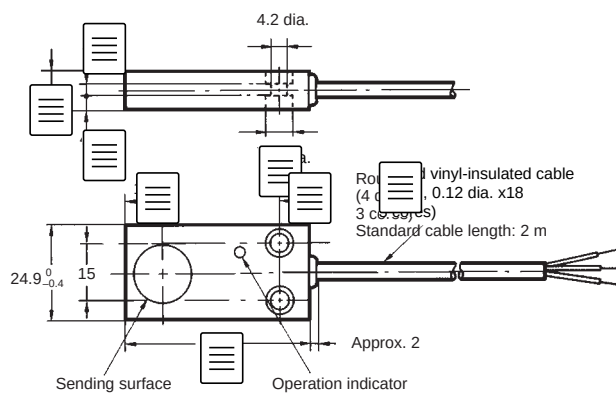
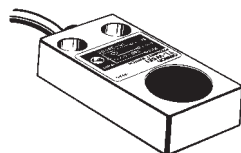
**TL-W5M□□:**  
Round vinyl-insulated cable (4 dia., 0.12 dia. x 18, 3 cores)  
Standard length: 2 m (oil-tight)

**TL-W5MD□:**  
Round vinyl-insulated cable (4 dia., 0.12 dia. x 27, 2 cores)  
Standard length: 2 m (oil-tight)

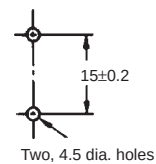


TL-W5E□

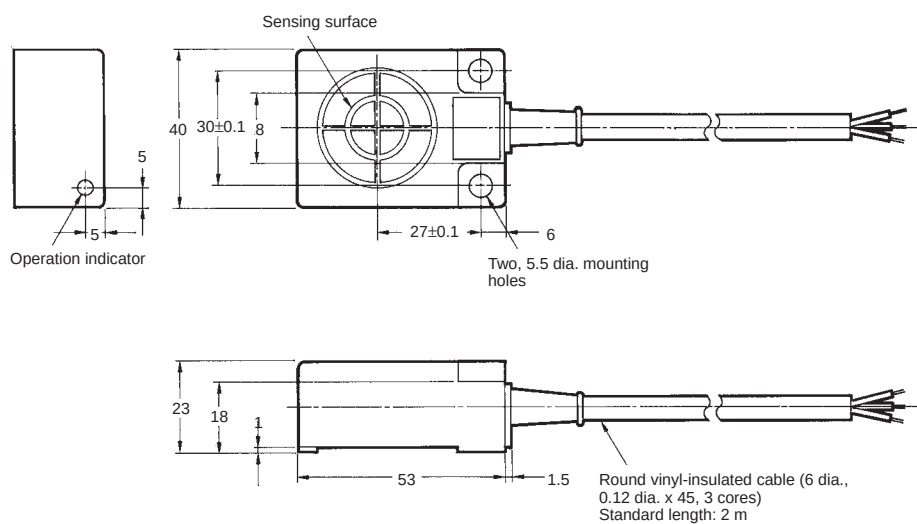
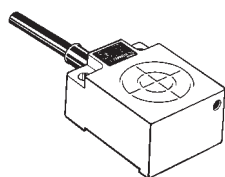
TL-W5F□



## Mounting Holes



TL-W20ME□



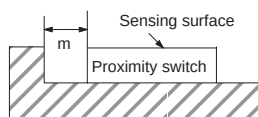
## Precautions

### Effects of Surrounding Metals

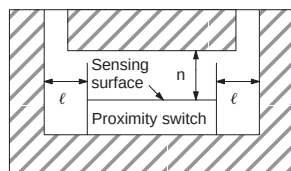
Provide a minimum distance as shown in the table below between the TL-W and the surrounding metals to prevent the TL-W from being induced by the metals and malfunctioning or being affected by the heat radiated by the metals.

| Model      | $\ell$ | m     | n      |
|------------|--------|-------|--------|
| TL-W1R5M□1 | 2 mm   | 0 mm  | 8 mm   |
| TL-W3M     | 3 mm   | 0 mm  | 12 mm  |
| TL-W5MD    | 5 mm   | 0 mm  | 20 mm  |
| TL-W5MC/MB | 5 mm   | 0 mm  | 20 mm  |
| TL-W20ME   | 25 mm  | 16 mm | 100 mm |
| TL-W5E/F   | 0 mm   | 0 mm  | 20 mm  |

**Metal on a Single Side**  
(not exceeding the height of the sensor head)



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

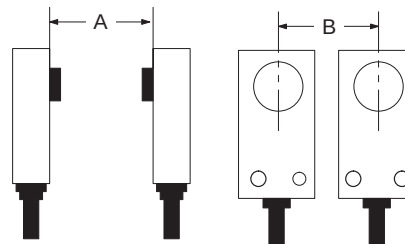


### Mutual Interference

Be sure to space the two sensors at a distance greater than that shown in the table to prevent mutual interference.

| Model      | A            | B            |
|------------|--------------|--------------|
| TL-W1R5M□1 | 75 (50) mm   | 25 (8) mm    |
| TL-W3M     | 90 (60) mm   | 30 (10) mm   |
| TL-W5MD    | 120 (80) mm  | 60 (30) mm   |
| TL-W5MC/MB | 120 (80) mm  | 60 (30) mm   |
| TL-W20ME   | 200 (100) mm | 200 (100) mm |
| TL-W5E/F   | 50 mm        | 35 mm        |

**Note:** The above values in parentheses are applicable when using two sensors with different frequencies.



### Mounting

Use M3 flat-head screws to mount the TL-W1R5M□1 and TL-W3M□1.

The resin cover should be tightened to 10 kgf • cm (0.98 N • m) maximum.

**ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.**

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

Cat. No. E221-E1-2 In the interest of product improvement, specifications are subject to change without notice.

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