


## 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.
Control 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) 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. 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

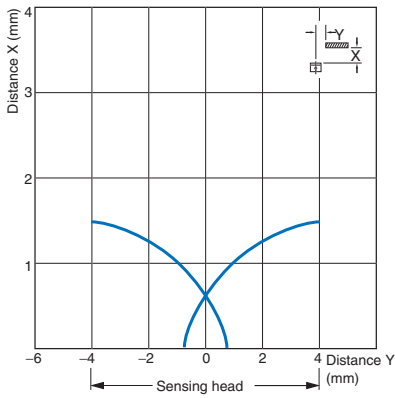
Model		TL-W1R5MC1	TL-W3MC□	TL-W5MC□	TL-W5E1, TL-W5E2 TL-W5F1, TL-W5F2	TL-W20ME1 TL-W20ME2
<b>Sensing distance</b>		1.5 mm ±10%	3 mm ±10%	5 mm ±10%		20 mm ±10%
<b>Set distance</b>		0 to 1.2 mm	0 to 2.4 mm	0 to 4 mm		0 to 16 mm
<b>Differential travel</b>		10% max. of sensing distance				1% to 15% of sensing 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 100 mA max. at 30 VDC max.		NPN open collector 50 mA max. at 12 VDC (30 VDC max.) 100 mA max. at 24 VDC (30 VDC max.)	200 mA	100 mA max. at 12 VDC 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 C2/B2 Models: NC		E1/F1 Models: NO 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.

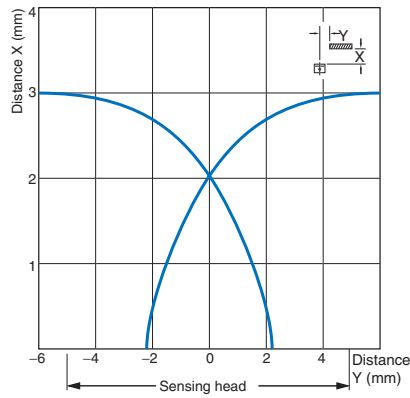
Engineering Data (Typical)

Sensing Area

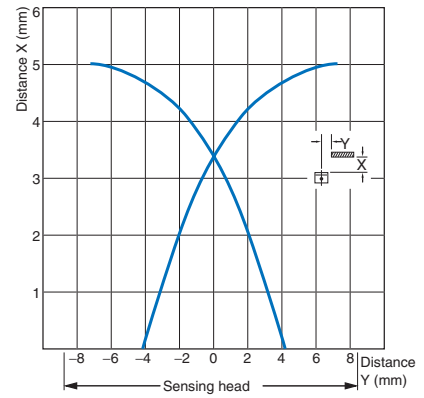
TL-W1R5MC1



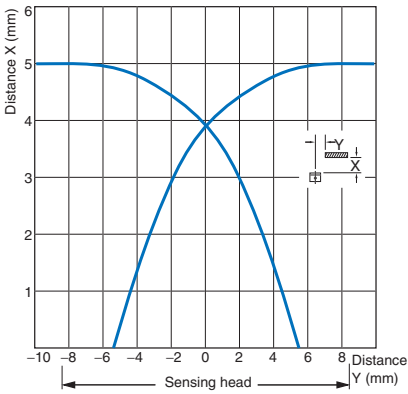
TL-W3MC1



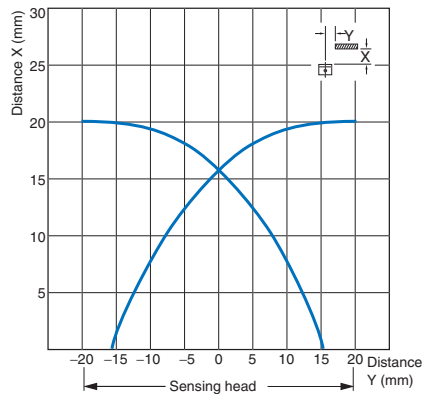
TL-W5MC1/-W5MD



TL-W5E/-W5F

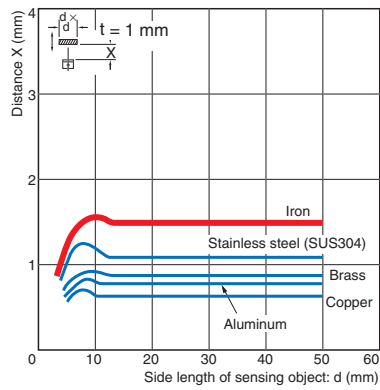


TL-W20

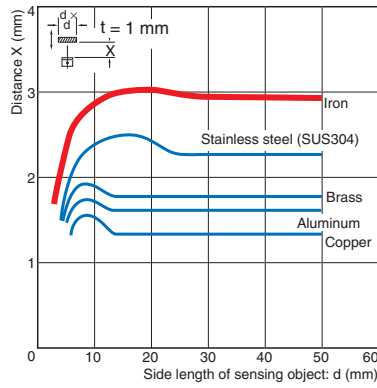


Influence of Sensing Object Size and Material

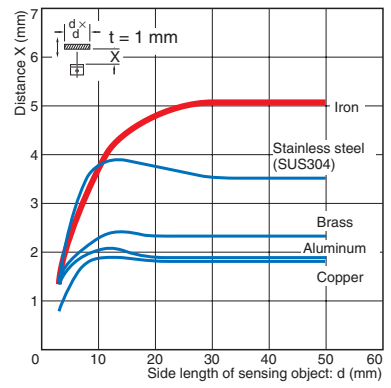
TL-W1R5MC1



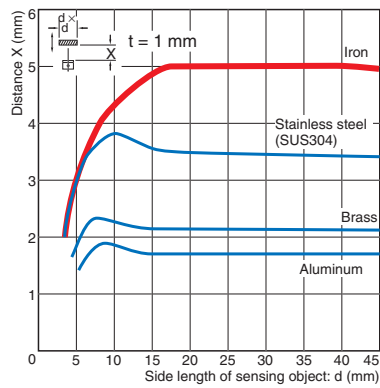
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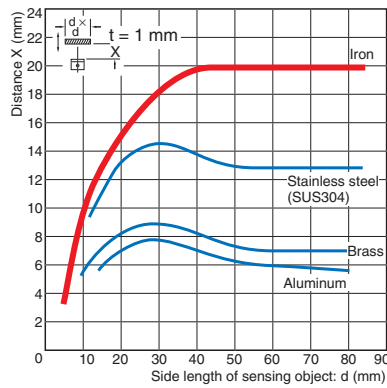
TL-W5MC1



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</p> <p>Sensing object (%)</p> <p>Rated sensing distance</p> <p>100 80 (TYP) 0</p> <p>Proximity Sensor</p> <p>ON OFF</p> <p>Setting indicator (green)</p> <p>ON OFF</p> <p>Operation indicator (red)</p> <p>ON OFF</p> <p>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</p> <p>Sensing object (%)</p> <p>Rated sensing distance</p> <p>100 0</p> <p>Proximity Sensor</p> <p>ON OFF</p> <p>Operation indicator (red)</p> <p>ON OFF</p> <p>Control output</p>	<p>Note: The load can be connected to either the +V or 0 V side.</p>

## DC 3-Wire Models

Operation mode	Model	Timing chart	Output circuit
NO	TL-W1R5MC1 TL-W3MC1 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 TL-W5MC2	<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>
NO	TL-W5E1 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. *2. When a transistor is connected.</p>
NC	TL-W5E2 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>	<p>*1. Load current: 200 mA max. *2. When a transistor is connected.</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. *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>	<p>*1. Load current: 200 mA max. *2. When a transistor is connected.</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

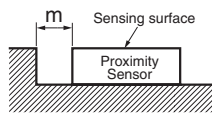
Do not use this product under ambient conditions that exceed the ratings.

● **Design**

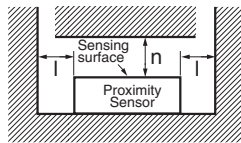
#### Influence of Surrounding Metal

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**

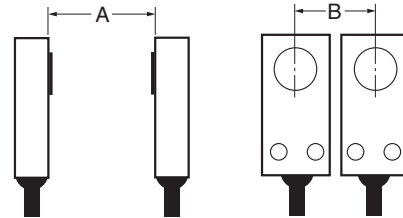


#### Influence of Surrounding Metal (Unit: mm)

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

#### 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.

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

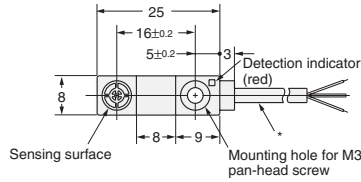
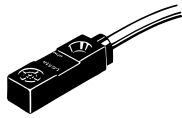
The companies and model number of e-CON connections that can be used with Sensor cables are listed in the following table. Confirm applicability when purchasing e-CON connectors for connection to Pre-wired Sensors.

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

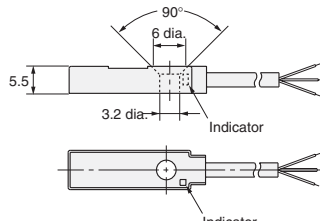
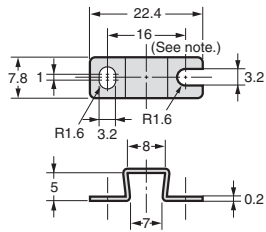
## Dimensions

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

### TL-W1R5MC1



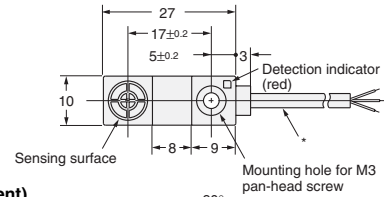
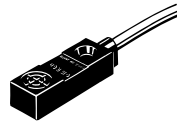
#### Mounting Bracket (Attachment)



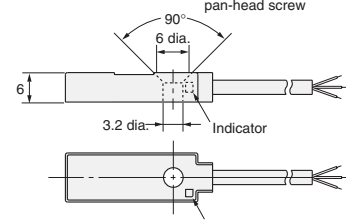
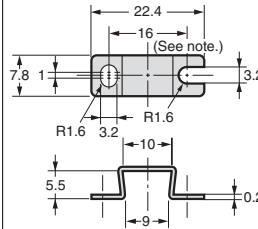
\* 2.9-dia. vinyl-insulated round cable with 3 conductors (Conductor cross section: 0.14 mm<sup>2</sup>, Insulator diameter: 0.9 mm), Standard length: 2 m

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

### TL-W3MC□



#### Mounting Bracket (Attachment)

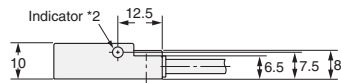
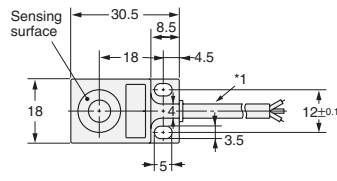
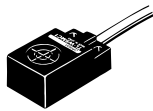


\* 2.9-dia. vinyl-insulated round cable with 3 conductors (Conductor cross section: 0.14 mm<sup>2</sup>, Insulator diameter: 0.9 mm), Standard length: 2 m

Note: Mounting hole dimension: 17 ± 0.20.  
Material: Stainless steel (SUS304)

### TL-W5MC□

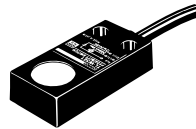
### TL-W5MD□



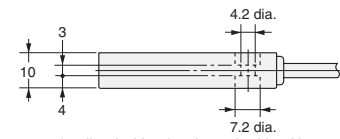
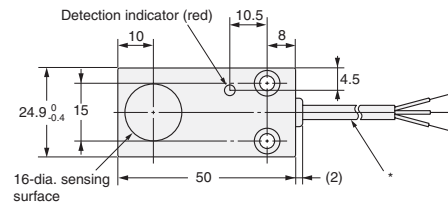
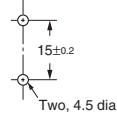
- \*1. TL-W5MC1  
4-dia. vinyl-insulated round cable with 3 conductors (Conductor cross section: 0.2 mm<sup>2</sup>, Insulator diameter: 1.2 mm), Standard length: 2 m  
TL-W5MD□  
4-dia. vinyl-insulated round cable with 2 conductors (Conductor cross section: 0.3 mm<sup>2</sup>, Insulation diameter: 1.3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

