Flat Inductive Proximity Sensor

TL-W

BERME

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.

For the most recent information on models that have been certified for safety standards, refer to your BERME website.

Ordering Information

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

DC 2-Wire Models

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

DC 3-Wire Models

Appearance	Sensing distance	Output configuration	Model Operation mode NO	Model Operation mode NC
Unshielded	1.5 mm	NPN	TL-W1R5MC1 2M *1 *2	---
		PNP	TL-W1R5MB1 2M	---
	3 mm	NPN	TL-W3MC1 2M *1 *2	TL-W3MC2 2M *1 *2
		PNP	TL-W3MB1 2M *2	TL-W3MB2 2M *2
	5 mm	NPN	TL-W5MC1 2M *1 *2	TL-W5MC2 2M
		PNP	TL-W5MB1 2M	TL-W5MB2 2M
	20 mm	NPN	TL-W20ME1 2M *1	TL-W20ME2 2M *1
Shielded	5 mm	NPN	TL-W5E1 2M	TL-W5E2 2M
		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 are also available with robotics (bend resistant) cables. Add "-R" to the model number. (e.g., TL-W5MC1-R 2M)

Mounting Bracket (Attachment)

Order a Nut Set when required, e.g., if you lose the nuts.

Model	Applicable Sensors	Quantity
Y92E-D2R5	TL-W1R5@	1
Y92E-D3	TL-W3@	

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 *Engineering Data* 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 D2 Models: NC Refer to the timing charts under *I/O Circuit Diagrams* on page 5 for details.
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 MΛ 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/s² 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. 80 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

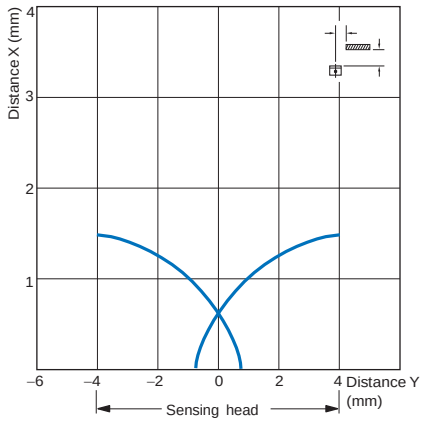
Item \ Model		TL-W1R5MC1 TL-W1R5MB1	TL-W3MC@ TL-W3MB@	TL-W5MC@ TL-W5MB@	TL-W5E1, TL-W5E2 TL-W5F1, TL-W5F2	TL-W20ME1 TL-W20ME2
Sensing distance		1.5 mm ±10%	3 mm ±10%	5 mm ±10%		20 mm ±10%
Set distance		0 to 1.2 mm	0 to 2.4 mm	0 to 4 mm		0 to 16 mm
Differential travel		10% max. of sensing distance				1% to 15% of sensing distance
Detectable object		Ferrous metal (The sensing distance decreases with non-ferrous metal. Refer to *Engineering Data* on page 5.)				
Standard sensing object		Iron, 8 × 8 × 1 mm	Iron, 12 × 12 × 1 mm	Iron, 18 × 18 × 1 mm		Iron, 50 × 50 × 1 mm
Response frequency		1 kHz min.	600 Hz min.	500 Hz min.	300 Hz min.	40 Hz min.
Power 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), ripple (p-p): 10% max.
Current consumption		15 mA max. at 24 VDC (no-load)		10 mA max. at 24 VDC (no-load)	15 mA max. at 24 VDC (no-load)	8 mA at 12 VDC, 15 mA at 24 VDC
Control output	**Load current**	TL-W1R5MC1/-W3MC@: NPN open collector 100 mA max. at 30 VDC max. TL-W1R5MB1/-W3MB@: PNP open collector 100 mA max. at 30 VDC max.		TL-W5MC@: NPN open collector 50 mA max. at 12 VDC (30 VDC max.) 100 mA max. at 24 VDC (30 VDC max.) TL-W5MB@: PNP 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
	Residual voltage	1 V max. (under load current of 100 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)
Indicators		Detection indicator (red)				
Operation mode (with sensing object approaching)		NO	B1/C1 Models: NO B2/C2 Models: NC		E1/F1 Models: NO E2/F2 Models: NC	
		Refer to the timing charts under *I/O Circuit Diagrams* on page 6 for details.				
Protection circuits		Reverse polarity protection, Surge suppressor				
Ambient temperature range		Operating/Storage: –25 to 70°C (with no icing or condensation) *				
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 ±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	
Insulation resistance		50 MΛ min. (at 500 VDC) between current-carrying parts and case				
Dielectric strength		1,000 VAC, 50/60 Hz for 1 minute 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/s² 3 times each in X, Y, and Z directions				Destruction: 500 m/s² 10 times each in X, Y, and Z directions
Degree of protection		IEC 60529 IP67, in-house standards: oil-resistant *				
Connection method		Pre-wired Models (Standard cable length: 2 m)				
Weight (packed state)		Approx. 70 g		Approx. 80 g	Approx. 100 g	Approx. 210 g
Materials	**Case**	Heat-resistant ABS			Aluminum die-cast	Heat-resistant ABS
	Sensing surface	Heat-resistant ABS				
Accessories		Mounting Bracket, Instruction manual		Instruction manual		

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

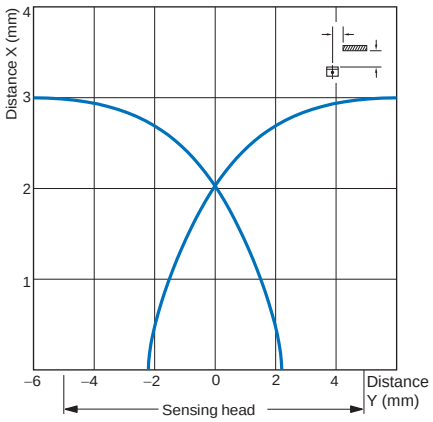
Engineering Data (Reference Value)

Sensing Area

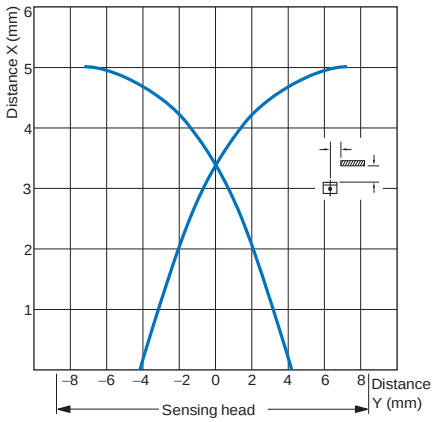
TL-W1R5MB1



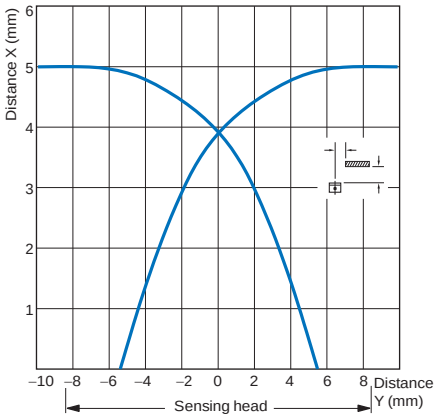
TL-W3MB1



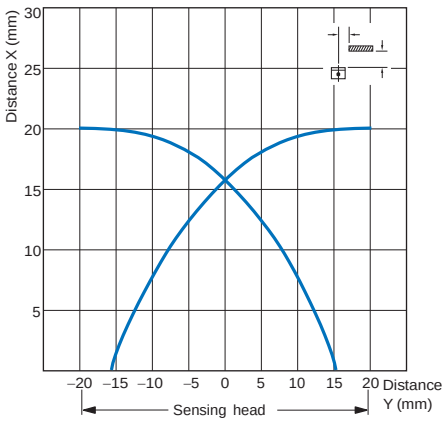
TL-W5MB1/-W5MBD



TL-W5E/-W5F

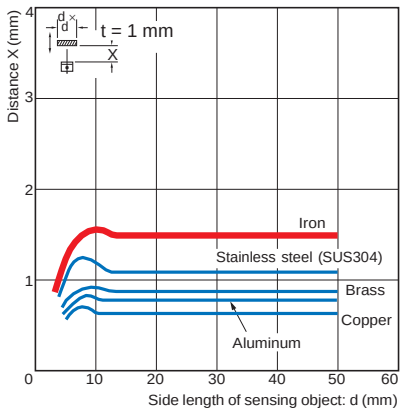


TL-W20B

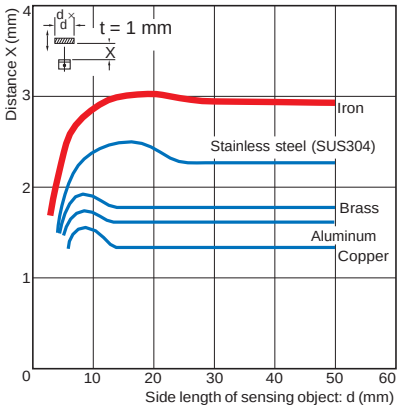


Influence of Sensing Object Size and Material

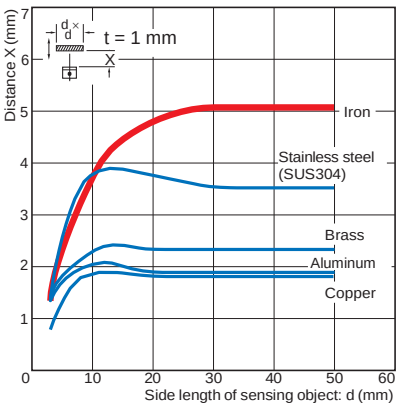
TL-W1R5M@1



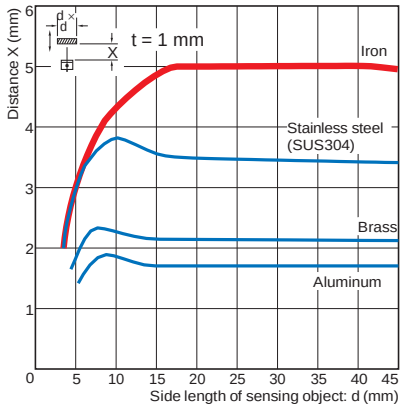
TL-W3M@1



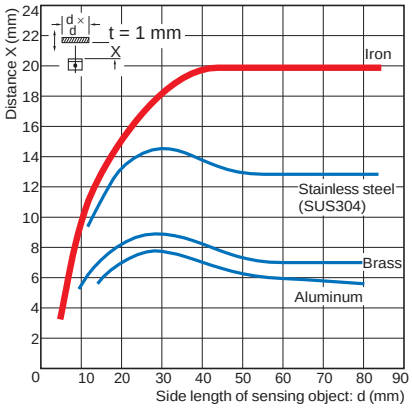
TL-W5M@1



TL-W5E@/-W5F@/-W5MD@

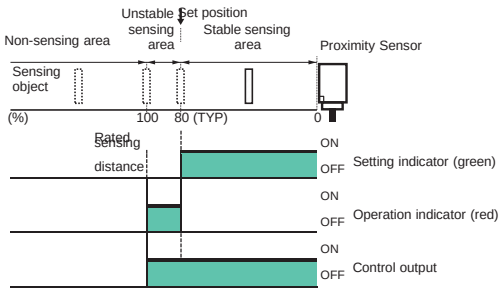
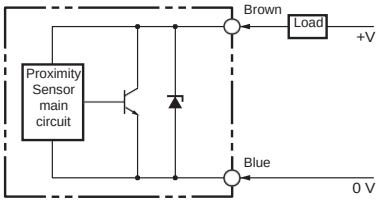
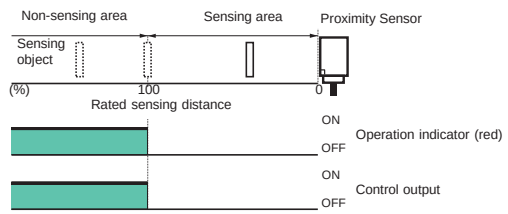


TL-W20@

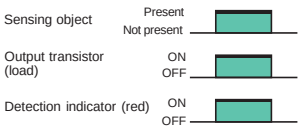
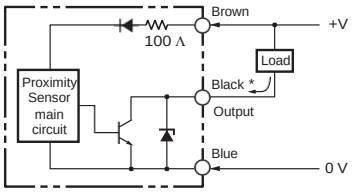
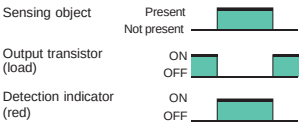
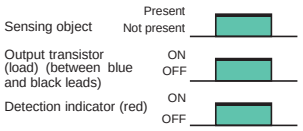
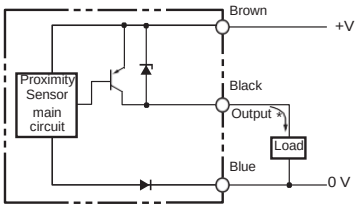
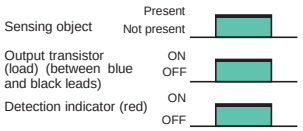
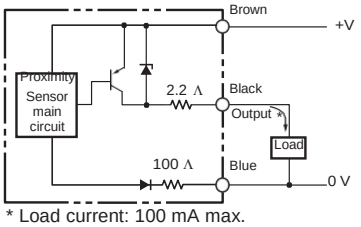
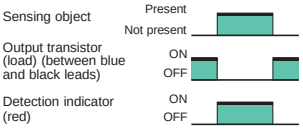
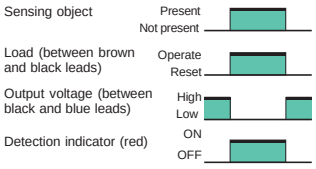
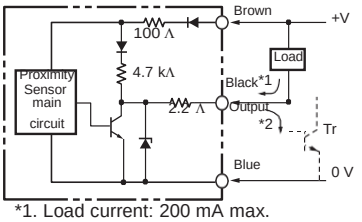
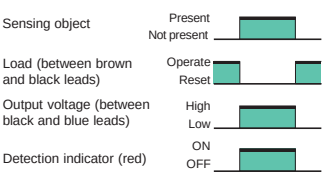
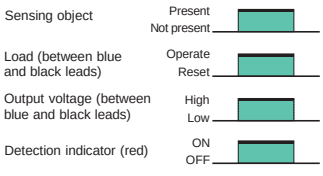
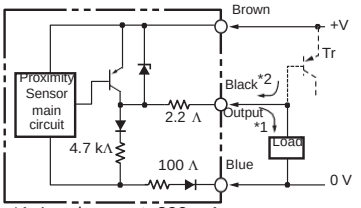
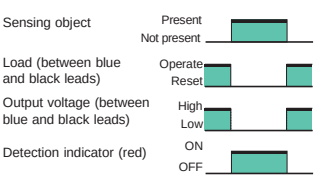


I/O Circuit Diagrams

DC 2-Wire Models

Model	Operation mode	Timing chart	Output circuit
TL-W5MD1	NO		
TL-W5MD2	NC		Note: The load can be connected to either the +V or 0 V side.

DC 3-Wire Models

Model	Operation mode	Output configuration	Timing chart	Output circuit
TL-W1R5MC1 TL-W3MC1 TL-W5MC1	NO	NPN		 * Load current: 100 mA max.
TL-W3MC2 TL-W5MC2	NC	NPN		
TL-W1R5MB1	NO	PNP		 * Load current: 100 mA max.
TL-W3MB1 TL-W5MB1	NO	PNP		 * Load current: 100 mA max.
TL-W3MB2 TL-W5MB2	NC	PNP		
TL-W5E1 TL-W20ME1	NO	NPN		 *1. Load current: 200 mA max. *2. When a transistor is connected.
TL-W5E2 TL-W20ME2	NC	NPN		
TL-W5F1	NO	PNP		 *1. Load current: 200 mA max. *2. When a transistor is connected.
TL-W5F2	NC	PNP		

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

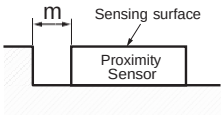
Do not use this product under ambient conditions that exceed the ratings.

● Design

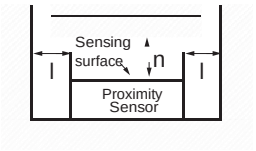
Influence of Surrounding Metal

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

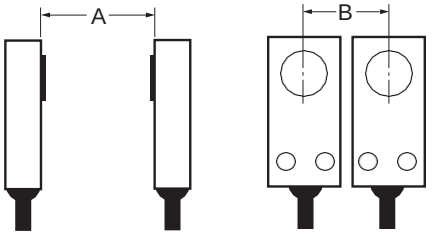


Influence of Surrounding Metal (Unit: mm)

Model / Distance	l	m	n
TL-W1R5M@1	2	0	8
TL-W3MC@/-W3MB@	3		12
TL-W5MD@	5		20
TL-W5MC@/-W5MB@			
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-W1R5MB1	75	25
TL-W3MC@/-W3MB@	90 (60)	30 (10) *
TL-W5MD@	120 (80)	60 (30)
TL-W5MC@/-W5MB@		
TL-W20ME@	200 (100)	200 (100)
TL-W5E@/-W5F@	50	35

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

* Mutual interference will not occur for close-proximity mounting if models with different frequencies are used together.

● Mounting

- Use M3 flat-head screws to mount the TL-W1R5M@1 and TL-W3M@.
- Do not exceed the torque in the following table when tightening the resin cover screws.

Model	Torque
TL-W1R5M@1	0.98 N·m
TL-W3MC@/-W3MB@	
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

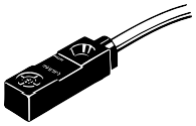
The companies and model number of e-CON connections that can be used with Sensor cables are listed in the following table. Confirm applicability when purchasing e-CON connectors for connection to Pre-wired Sensors.

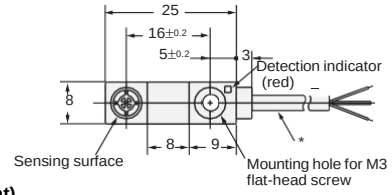
Model	Applicable e-CON Connector	Manufacturer
TL-W1R5@/-W3@	XN2A-1470 Cable Plug Connector	BERME

Dimensions

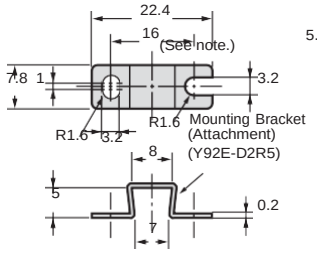
(Unit: mm)
Tolerance class IT16 applies to dimensions in this data sheet unless otherwise specified.

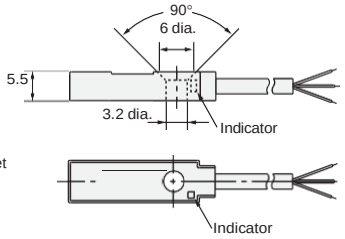
TL-W1R5MB1
TL-W1R5MC1





Mounting Bracket (Attachment)

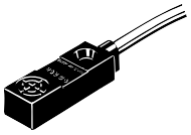


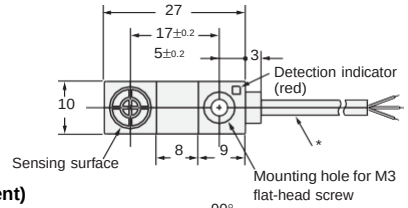


* 2.9-dia. vinyl-insulated round cable with 3 conductors (Conductor cross section: 0.14 mm^2, Insulator diameter: 0.9 mm), Standard length: 2 m

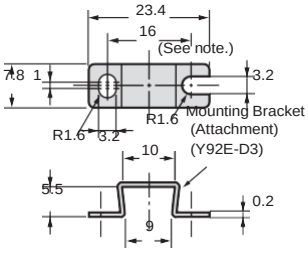
Note: Mounting hole dimension: 17 ±0.2.
Material: Stainless steel (SUS304)

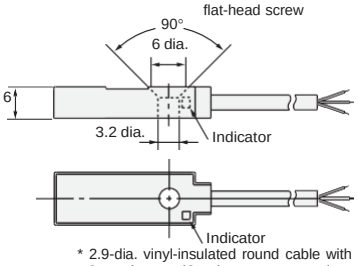
TL-W3MB@
TL-W3MC@





Mounting Bracket (Attachment)

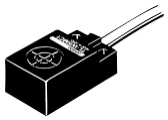


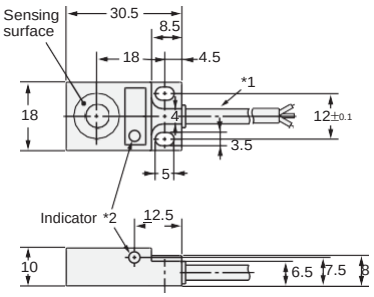


* 2.9-dia. vinyl-insulated round cable with 3 conductors (Conductor cross section: 0.14 mm^2, Insulator diameter: 0.9 mm), Standard length: 2 m

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

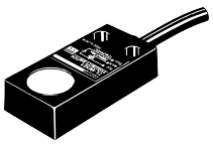
TL-W5MB@
TL-W5MC@
TL-W5MD@



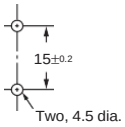


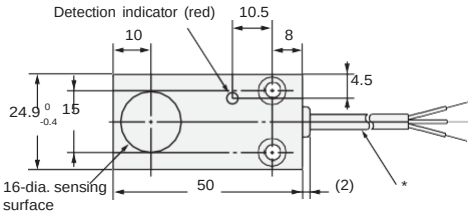
*1. TL-W5MB@/TL-W5MC@
4-dia. vinyl-insulated round cable with 3 conductors (Conductor cross section: 0.2 mm^2, Insulator diameter: 1.2 mm), Standard length: 2 m
TL-W5MD@
4-dia. vinyl-insulated round cable with 2 conductors (Conductor cross section: 0.3 mm^2, Insulation diameter: 1.3 mm), Standard length: 2 m
*2. B/C Models: Detection indicator (red)
D Models: Operation indicator (red), Setting indicator (green)

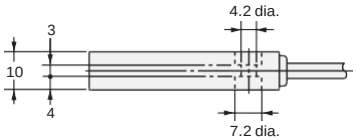
TL-W5E@
TL-W5F@



Mounting Hole Dimensions

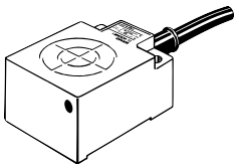


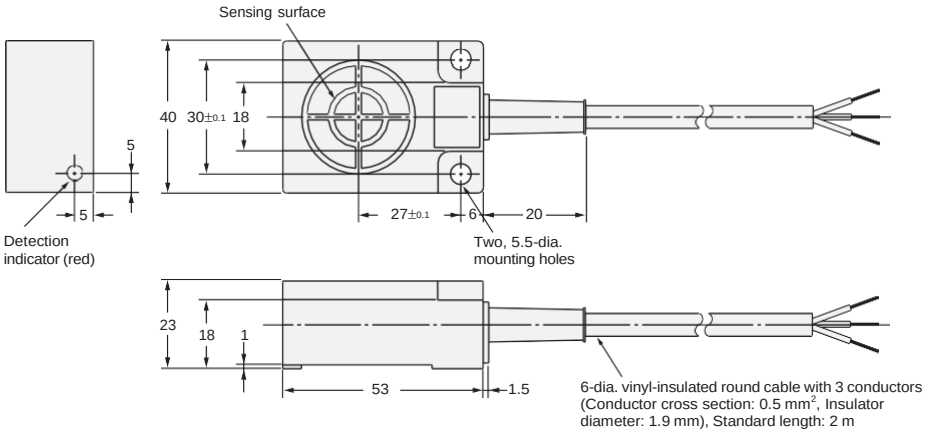




* 4-dia. vinyl-insulated round cable with 3 conductors (Conductor cross section: 0.2 mm^2, Insulator diameter: 1.2 mm), Standard length: 2 m

TL-W20ME@





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