# KEYENCE

New Standard! All-Purpose Laser Sensor





All-Purpose Laser Sensor







## A NEW DIMENSION TO ALL-PURPOSE LASER SENSORS

The LR-T Series of reflective sensors represents a seamless fusion of innovative technology and robust functionality. The Time of Flight (TOF) detection method and custom integrated circuit allow the LR-T Series sensors to provide consistently stable detection in all applications. Equally as impressive, this innovative technology is stored in a compact and durable metal housing for versatile installation in any environment. Lastly, the LR-T Series offers user-friendly operability to further minimize installation and set up time. All of these features combine to add a new dimension to all-purpose laser sensors.

## **Superior Detection Capabilities**

Innovative Technology and Adaptable Features

Easy to Use Flexible Mounting and Simplified Setup

## **Unmatched Versatility**

Utilize in Any Application

# **Superior Detection Capabilities**

## HS<sup>2</sup> TECHNOLOGY

HS2: HIGH-SPEED & HIGH-SENSITIVITY

"HS<sup>2</sup> Technology" combines the Time of Flight (TOF) detection method with a custom integrated circuit, allowing for consistently stable detection over long distances, regardless of target color, surface finish, or angle.

Detecting distance 0.06 to 5 m 0.2' to 16.4'



### TOF (Time of Flight)

The "TOF" method of detection measures distance by calculating the time it takes for a pulse-emitted beam to leave the sensor, hit the target, and then return to the sensor. This enables stable detection that is unaffected by the surface conditions of the workpiece that is being detected.

### Custom IC (Integrated Circuit)

The newly-developed custom IC provides the LR-T with an ultra high-speed sampling rate of approx. 8 GHz, as well as increased processing capabilities. This allows for stable detection over long distances, even on targets of varying color or angle.

## **ADAPTABLE FEATURES**

The LR-T Series is full of innovative features that enable detection of targets that were previously considered undetectable. These features allow users to tailor the sensor to their specific applications and ensure optimal detection.

## Adjustable beam spot mechanism\*

By adjusting the beam spot size, users are able to guarantee reliable detection of any target, even those with irregular surfaces.

\* For LR-TB5000x only





### **DATUM** function

This function enables the sensor to detect all conditions, except for a set "reference" state. It allows for detection of any target that passes in front of the sensor, even those that prevent laser light from returning to the unit.



### Focused detection capabilities

The influence of surrounding objects\* is greatly reduced by the LR-T's focused detection design when compared to other position based sensors that use triangulation or ultrasonic detection principles.



\*Other position based sensors may be affected by factors such as the distance to and surface finish of the surrounding objects, as well as gap/hole sizes.

## Outstanding interference prevention

#### Mutual interference prevention for up to 4 units

Up to four sensors can operate in close proximity without the potential for mutual interference. This makes it possible to stably detect multiple points on a target without interference.

## Ambient light resistance of up to 100,000 lux

The custom integrated circuit (IC) prevents the sensor from being affected by factory lighting, as well as various other types of light generated in production processes.

# Easy to Use

# **FLEXIBLE MOUNTING**

The design of the LR-T Series makes it possible to detect targets from any mounting position. Whether they are mounted close to a target, far from a target, horizontally, vertically, or diagonally, these sensors will provide reliable and consistent detection. This makes the LR-T Series ideal for installation in new or existing equipment.



## SIMPLIFIED SETUP

The LR-T Series provides an intuitive user-friendly interface,

as well as a highly visible indicator to provide simplified installation and troubleshooting.

### **OLED** display

The OLED display allows for easy operation with precisely displayed characters and intuitive navigation.



#### Precise and rich expression

Characters are displayed precisely and clearly, allowing users to operate and interpret the device quicker and easier.



### Large indicator

With outstanding visibility over long distances, the indicator easily communicates the operational status of the sensor.



FLASHING RED: An error has occurred



FLASHING GREEN: Stability output ON

### Auto tuning

Calibrate your sensor in seconds by simply pressing the SET button while the target you would like to detect is present, and then again when it is absent. The sensor will automatically set the optimum ON/OFF set point for your output.



### All-in-one outputs

All models feature the ability to switch between NPN and PNP outputs. The LR-TB5000 Series models also feature the option for an analog (voltage or current) output.

The state of the sensor is also easily checked at a glance.



# **Unmatched Versatility**

### When a worker is involved in the process

When sensors must be mounted close to a workpiece, operators run the risk of bumping into these sensors and causing misalignment. To avoid accidently hitting these sensors, operators will typical work slower and more carefully, effectively reducing efficiency. The LR-T Series eliminates these concerns and maximizes efficiency by providing stable detection from a position that is completely unobtrusive to an operator.



### When a robot is involved in the process

It is generally not preferable to install a sensor near the path of a moving robotic arm; however if a sensor has a short detecting range, it is necessary to place the sensors closer to the path and risk potential damage due to impact. The LR-T Series allows for stable detection from a distance, preventing potential damage to the sensor and machine.





## WHAT CAN BE DETECTED WITH A MULTI-PURPOSE LASER SENSOR?

While the LR-T Series is perfect for applications that require the detection of a target at a pre-determined position; it is also designed to perform detection based on variations in distance for applications such as level sensing or web tension control. A single LR-T laser sensor makes it possible to detect targets in the range of 0.06 m 0.2' to 5 m 16.4' on any type of machine for any application.





	Туре	Detecting distance	Spot diameter	Input/Output	Model
	Cable (2 m 6.6')		Adjuctable	[Control Output + Control Output], [Control Output + External Input],	LR-TB5000
	M12 connector (Cable sold separately)	60 to 5000 mm 2.36° to 196.85°	Aujustable	[Control Output + Analog Output], or [External Input + Analog Output]	LR-TB5000C/ LR-TB5000CL
	Cable (2 m 6.6')		Fixed	[Control Output + Control Output], or	LR-TB2000
	M12 connector (Cable sold separately)	60 to 2000 mm 2.36* to 78.74*	(Approx. ø4 mm ø0.16°)	[Control Output + External Input]	LR-TB2000C/ LR-TB2000CL

#### Mounting bracket

#### Mounting bracket

<b>.</b> .								
	Туре	Model	Material/Weight	Туре	Model	Material/Weight		
	Adjustable angle bracket (For LR-TB5000 Series) (M4 screw x 2 supplied)	OP-87773	SUS304 Approx. 150 g	Adjustable bracket (For LR-TB5000 Series) (M4 screw x 2 supplied)	OP-87774	Zinc nickel plating, etc. Approx. 120 g		
<b>1</b> 0-	Adjustable angle bracket (For LR-TB2000 Series) (M3 screw x 2 supplied)	OP-87771	SUS304 Approx. 110 g	Adjustable bracket (For LR-TB2000 Series) (M3 screw x 2 supplied)	OP-87772	Zinc nickel plating, etc. Approx. 110 g		
	Small bracket (For LR-TB2000 Series) (M3 screw x 2 supplied)	OP-87770	SUS304 Approx. 80 g	Locking screw (For adjustable bracket) M12	OP-87775	lron nickel plating Approx. 120 g		

#### Protection cover

Ī		Туре	Model	Material/Weight
		Front protection cover (For LR-TB5000 Series)	OP-87778	SUS304, PC, etc. Approx. 6 g
	Mar a	Front protection cover (For LR-TB2000 Series)	OP-87776	SUS304, SUS430, PC, etc. Approx. 50 g

#### LR-TB5000 + OP-87774 + OP-87775



#### Cable (For M12 connector type models)

Specifications	Appearance	Model	Material	Sensor side	Terminal side	Length
Standard		OP-87634	Cable: PVC (Vinyl chloride)			2 m 6.6'
Stanuaru		OP-87635	Connector: Zinc nickel plating	M12 4-pin		10 m 32.8'
0il recistant		OP-87636	Cable: PUR (Polyurethane)	(Straight)	LUUSE WIRES	2 m 6.6'
on realstdit		OP-87637	Connector: Zinc nickel plating			10 m 32.8'

#### I/O circuit diagram

When I/O wires ( black, white) are set to Out 1 (Output 1)/Out 2 (Output 2)

When NPN is selected



#### When PNP is selected



When I/O wire ( black) is set to Input (external input)

#### When NPN is selected



#### When PNP is selected



#### When I/O wire (2 white) is set to Analog (analog output)



M12 Connector pin layout



Specifications

### CE 🕲 SO-Link

Model	Cable	LR-TB5000	-	LR-TB2000	-						
Mouel	Cable with connector M12	LR-TB5000C	LR-TB5000CL	LR-TB2000C	LR-TB2000CL						
Detectable distance		60 to 5000 mm	2.36" to 196.85"*1	60 to 2000 mm 2	.36" to 78.74"*2						
Spot diameter		Var (use a spot diameter o	riable of 40 mm 1.57" or less)	Approx. 4 mm 0.16"							
Response time		1 ms/10 ms/25 ms/100 ms/1000 ms selectable	2 ms/20 ms/50 ms/200 ms/2000 ms selectable	1 ms/10 ms/25 ms/100 ms/1000 ms selectable	2 ms/20 ms/50 ms/200 ms/2000 ms selectable						
	Туре		Red laser	(660 nm)							
Light source	Laser class	Class 2 laser product (IEC60825-1,FDA(CDRH) Part1040.10 <sup>*3</sup> )	Class 1 laser product (IEC60825-1,FDA(CDRH) Part1040.10 <sup>*3</sup> )	Class 1 laser product (IEC60825-1,FDA(CDRH) Part1040.10 <sup>-3</sup> )							
Mutual interference prevention	on function		4 units (when using the interference prevention function)								
Timer			OFF/OFF delay/O	N delay/One-shot							
Power voltage			20 to 30 VDC, including 10%	6 ripple (P-P), Class 2 or LPS							
Current consumption		50 mA or less	(without load) <sup>^4</sup>	45 mA or less (v	without load) <sup>*5</sup>						
	Control output	NPN open collector/PNP open collector selectable 30 VDC or less, 50 mA or less, residual voltage: 2 V or less, N.O./N.C. selectable									
I/O <sup>*6*7</sup>	External input		Transmission OFF/Tuning/Reference surface up Short-circuit current: 1 mA o For the applied voltage, see the wirin For the input times, see the time	odate (when using the DATUM mode) selectable r less for both NPN and PNP g diagrams in the instruction manual. charts in the instruction manual.							
	Analog output	Current output/Volt Current output: 4 to 20 mA with Voltage output: 0 to 10 V with an ex	age output selectable 1 a max. load resistance of 500 $\Omega$ ternal load resistance of 5 $k\Omega$ or more	-							
Protection circuit		Protection against reverse power connection, power supply surges, output overcurrent, reverse output connection, and output surge									
	Enclosure rating		IP65/IP67	(IEC60529)							
	Ambient light	Incandescent lamp/Sunlight: 100000 lux or less									
Environmental resistance	Ambient temperature		-20 to +55°C -4 to	131°F (no freezing)							
	Ambient humidity		35 to 85%KH (n	io condensation)							
	Shock resistance		10 to 55 Hz Double amplitude 1.5 mm 0.06" in	the X_X_Z axis directions respectively 2 hours							
	Vibration resistance		10 to 55 Hz Double amplitude 1.5 mm 0.06" in Case: Zinc die cast (N	the X, Y, Z axis directions respectively, 2 hours lickel chrome plating),							
Material		Indicator cover and buttons: PES, Lens cover and display: PMMA (scratch-resistant coating specifications), Cable bushing: PBT, Cable: PVC, M12 connector (only for the cable with connector M12 type): TPE, PBT, Nickel-plated brass									
Weight		Cable type: Approx. 200 g (Including cable) Cable type: Approx. 125 g (Including cable)   Cable with connector M12 type: Approx. 160 g Cable with connector M12 type: Approx. 85 g									
Accompanying items			Instructio Laser warning and explanation label	n manual, is (except LR-TB5000CL/TB2000CL)							

 $^{*1}$  The range for displayable distance is from 50 to 5200.

 $^{\ast}2~$  The range for displayable distance is from 50 to 2200.

\*3 The laser classification for FDA (CDRH) is implemented based on IEC60825-1 in accordance with the requirements of Laser Notice No.50.

\*4 150 mA or less (with load)

\*5 145 mA or less (with load)

\*6 You can select the I/O from the following combinations.

• Control output × 2, control output + external input

• Control output + analog output (LR-TB5000/TB5000C/TB5000CL only)

• External input + analog output (LR-TB5000/TB5000C/TB5000CL only)

(For details on the setting method, see the instruction manual.)

\*7 IO-Link specification v.1.1/COM2 (38.4 kbps) is supported. You can download a setup file from the KEYENCE website (http://www.keyence.com).

If you are using the product in an environment in which you cannot download files over the Internet, contact your nearest KEYENCE office.

#### Repetition Accuracy (Typical)

#### LR-TB5000/TB5000C (Class 2 laser)

Unit: mm inch

LR-TB2000/TB2000C (Class 2 laser)

Unit: mm inch

	White Paper (Reflectivity: 90%)						Gray Paper (Reflectivity: 18%)				
	Response Time [ms]						Response Time [ms]				
		1	10	25	100	1000	1	10	25	100	1000
	60	±25	±7	±6	±3	±3	±52	±19	±14	±6	±4
	2.36	±0.98"	±0.28"	±0.24	±0.12"	±0.12"	±2.05	±0.75"	±0.55"	±0.24"	±0.16"
	200	±8	±4	±3	±3	±3	±15	±5	±4	±3	±3
	7.87	±0.31"	±0.16"	±0.12"	±0.12"	±0.12"	±0.59"	±0.20"	±0.16"	±0.12"	±0.12"
Detecting	1000	±7	±3	±3	±3	±3	±11	±4	±3	±3	±3
dictoring	39.37	±0.28"	±0.12"	±0.12"	±0.12"	±0.12"	±0.43"	±0.16"	±0.12"	±0.12"	±0.12"
	2000	±11	±4	±3	±3	±3	±32	±10	±7	±5	±3
[mm incn]	78.74	±0.43"	±0.16"	±0.12"	±0.12"	±0.12"	±1.26"	±0.39"	±0.28"	±0.20"	±0.12"
	3000	±18	±6	±4	±3	±3	±59	±16	±12	±6	±3
	118.11"	±0.71"	±0.24"	±0.16"	±0.12"	±0.12"	±2.32"	±0.63	±0.47"	±0.24"	±0.12"
	5000	±42	±12	±9	±5	±3	±154	±40	±29	±14	±6
	196.85	±1.65"	±0.47"	±0.35	±0.20"	±0.12"	±6.06"	±1.57"	±1.14"	±0.55"	±0.24"

			White Pap	er (Reflect	ivity: 90%)		Gray Paper (Reflectivity: 18%)				
			Resp	onse Time	[ms]		Response Time [ms]				
		1	10	25	100	1000	1	10	25	100	1000
	60	±36	±12	±7	±4	±3	±100	±32	±21	±12	±5
	2.36"	±1.42"	±0.47*	±0.28"	±0.16"	±0.12"	±3.94"	±1.26	±0.83	±0.47	±0.20"
	200	±8	±3	±3	±3	±3	±10	±4	±3	±3	±3
	7.87"	±0.31"	±0.12"	±0.12"	±0.12"	±0.12"	±0.39"	±0.16"	±0.12"	±0.12"	±0.12"
Detecting	500	±7	±3	±3	±3	±3	±9	±3	±3	±3	±3
distance	19.69"	±0.28"	±0.12"	±0.12"	±0.12"	±0.12"	±0.35"	±0.12"	±0.12"	±0.12"	±0.12"
	1000	±9	±4	±3	±3	±3	±26	±7	±6	±3	±3
(mm incn)	39.37"	±0.35"	±0.16"	±0.12"	±0.12"	±0.12"	±1.02"	±0.28"	±0.24"	±0.12"	±0.12"
	1500	±13	±6	±3	±3	±3	±43	±12	±10	±4	±3
	59.06"	±0.51"	±0.24"	±0.12"	±0.12"	±0.12"	±1.69"	±0.47*	±0.39"	±0.16"	±0.12"
	2000	±25	±7	±6	±3	±3	±69	±21	±13	±6	±4
	78.74"	±0.98"	±0.28"	±0.24"	±0.12"	±0.12"	±2.72"	±0.83"	±0.51"	±0.24"	±0.16"

#### LR-TB5000CL (Class 1 laser)

#### Unit: mm inch

			White Pap	er (Reflect	ivity: 90%)	Gray Paper (Reflectivity: 18%)					
		Response Time [ms]						Response Time [ms]			
		2	20	50	200	2000	2	20	50	200	2000
	60	±27	±9	±6	±5	±3	±55	±20	±14	±8	±4
	2.36"	±1.06"	±0.35"	±0.24	±0.20"	±0.12"	±2.17"	±0.79"	±0.55"	±0.31"	±0.16"
	200	±9	±6	±6	±3	±3	±15	±5	±6	±3	±3
	7.87"	±0.35"	±0.24"	±0.24	±0.12"	±0.12"	±0.59"	±0.20"	±0.24"	±0.12"	±0.12"
Detecting	1000	±9	±6	±6	±3	±3	±12	±6	±4	±3	±3
dictores	39.37"	±0.35"	±0.24"	±0.24	±0.12"	±0.12"	±0.47"	±0.24"	±0.16"	±0.12"	±0.12"
	2000	±12	±7	±6	±3	±3	±33	±11	±8	±5	±3
[mm incn]	78.74"	±0.47"	±0.28"	±0.24	±0.12"	±0.12"	±1.30"	±0.43"	±0.31"	±0.20"	±0.12"
	3000	±19	±8	±6	±4	±3	±60	±18	±12	±7	±4
	118.11"	±0.75	±0.31"	±0.24	±0.16"	±0.12"	±2.36"	±0.71"	±0.47"	±0.28"	±0.16"
	5000	±42	±14	±10	±5	±5	±159	±42	±31	±15	±8
	196.85"	±1.65"	±0.55"	±0.39"	±0.20"	±0.20"	±6.26"	±1.65"	±1.22"	±0.59"	±0.31"

#### LR-TB2000CL (Class 1 laser)

Unit: mm inch

			White Pap	er (Reflect	ivity: 90%)	Gray Paper (Reflectivity: 18%)					
			Resp	onse Time	[ms]		Response Time [ms]				
		2	20	50	200	2000	2	20	50	200	2000
	60	±39	±13	±9	±5	±3	±104	±33	±25	±14	±8
	2.36"	±1.54"	±0.51"	±0.35"	±0.20"	±0.12"	±4.09"	±1.30"	±0.98	±0.55"	±0.31"
	200	±8	±5	±3	±3	±3	±11	±6	±3	±3	±3
Detecting	7.87"	±0.31"	±0.20"	±0.12"	±0.12"	±0.12"	±0.43"	±0.24"	±0.12"	±0.12"	±0.12"
	500	±7	±3	±3	±3	±3	±10	±3	±3	±3	±3
distance	19.69"	±0.28"	±0.12"	±0.12"	±0.12"	±0.12"	±0.39"	±0.12"	±0.12"	±0.12"	±0.12"
Installe	1000	±10	±5	±3	±3	±3	±26	±9	±6	±3	±3
(mm inch)	39.37"	±0.39"	±0.20"	±0.12"	±0.12"	±0.12"	±1.02"	±0.35"	±0.24"	±0.12"	±0.12"
	1500	±14	±6	±5	±5	±3	±44	±13	±11	±5	±3
	59.06"	±0.55"	±0.24"	±0.20"	±0.20"	±0.12"	±1.73"	±0.51"	±0.43"	±0.20"	±0.12"
	2000	±26	±8	±7	±5	±3	±71	±22	±15	±9	±5
	78.74"	±1.02"	±0.31"	±0.28"	±0.20"	±0.12"	±2.80"	±0.87*	±0.59"	±0.35	±0.20"

#### Adjusting the Spot Diameter (LR-TB5000/TB5000C/TB5000CL)



Use the dial on the back of the sensor to adjust the spot diameter. The correlations between the spot size and the position of each dial are as follows.

- When detecting objects that have holes in them, stable detection can be achieved by using a larger spot diameter.
- Set the spot diameter so that it is 40 mm 1.57" or less at the desired detecting distance.

#### Narrow Spot Setting



			Unit: mm inch
NARROW	1	2	3
X (Approx.)	500 19.69"	1000 39.37"	2000 78.74"

Parallel Light Setting



#### Wide Spot Setting



Unit: mm inch

Dimensions

LR-TB5000/ TB5000C/TB5000CL













M12 connector type models: LR-TB2000C/TB2000CL



M12 connector type models: LR-TB5000C/TB5000CL















■ Non-adjustable area when OP-87773 is used







■ Non-adjustable area when OP-87771 is used







#### Dimensions

#### OP-87774/87772





51.4 2.02"

SUS304

OP-87772





#### OP-87774 + LR-TB5000/TB5000C/TB5000CL





OP-87774 + OP-87775 + LR-TB5000/TB5000C/TB5000CL





#### OP-87772 + LR-TB2000/TB2000C/TB2000CL



OP-87772 + OP-87775 + LR-TB2000/TB2000C/TB2000CL





Unit: mm inch

#### OP-87778 + LR-TB5000/TB5000C/TB5000CL



38.2

1.3 0.05"

.50





43.2 1.70"

27.7



OP-87636/87637

(4.2) (0.17")

1.35 0.05



27.3

5.3 0.21

r

OP-87776 + OP-87770 +

LR-TB2000/TB2000C/TB2000CL

M12 connector cable

OP-87634/87635

28.4

Center of

received light





OP-87636: Approx. 75 g OP-87637: Approx. 330 g OP-87636: 2000 78.74" / OP-87637: 10000 393.7" 44 1.73° M12 ۲ ø14.8 ø4.7 ø0.19" (4 x 0.34 mm²)

> CAD DATA DOWNLOAD www.keyence.com/CADG





**SERIES** 





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