KEYENCE

New Standard! All-Purpose Laser Sensor

Multi-Sensor Controller
MU-N Series

All-Purpose
Laser Sensor

LR-T SERIES

Quick Delivery

All-Purpose
Laser Sensor

LR-T
SERIES

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

HS² TECHNOLOGY

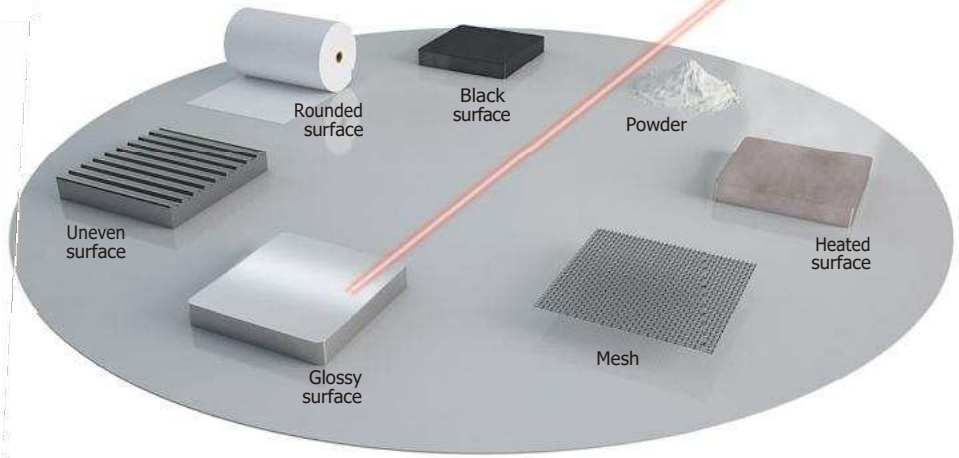
HS²: HIGH-SPEED & HIGH-SENSITIVITY

"HS² 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.

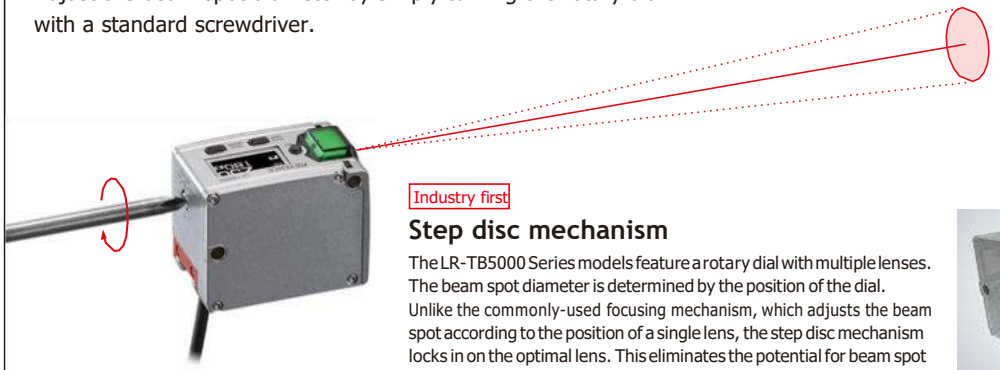
Adjustable beam spot mechanism*

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

Reliable detection of the targets below is possible by increasing the beam spot size.

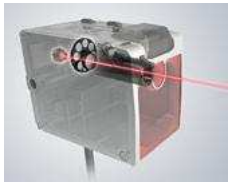
Adjust the beam spot diameter by simply turning the rotary dial with a standard screwdriver.



Industry first

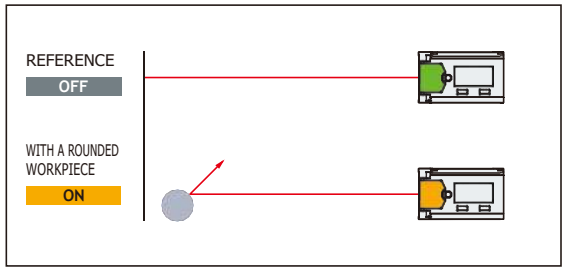
Step disc mechanism

The LR-TB5000 Series models feature a rotary dial with multiple lenses. The beam spot diameter is determined by the position of the dial. Unlike the commonly-used focusing mechanism, which adjusts the beam spot according to the position of a single lens, the step disc mechanism locks in on the optimal lens. This eliminates the potential for beam spot variation caused by the vibration of a position dependant lens.



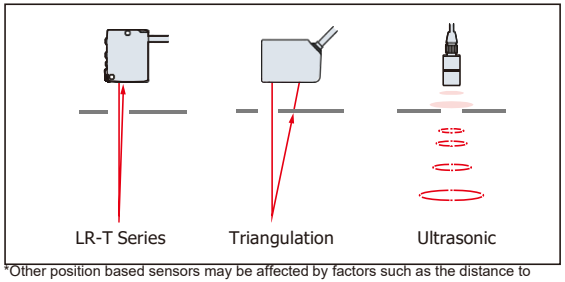
DATUM function

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

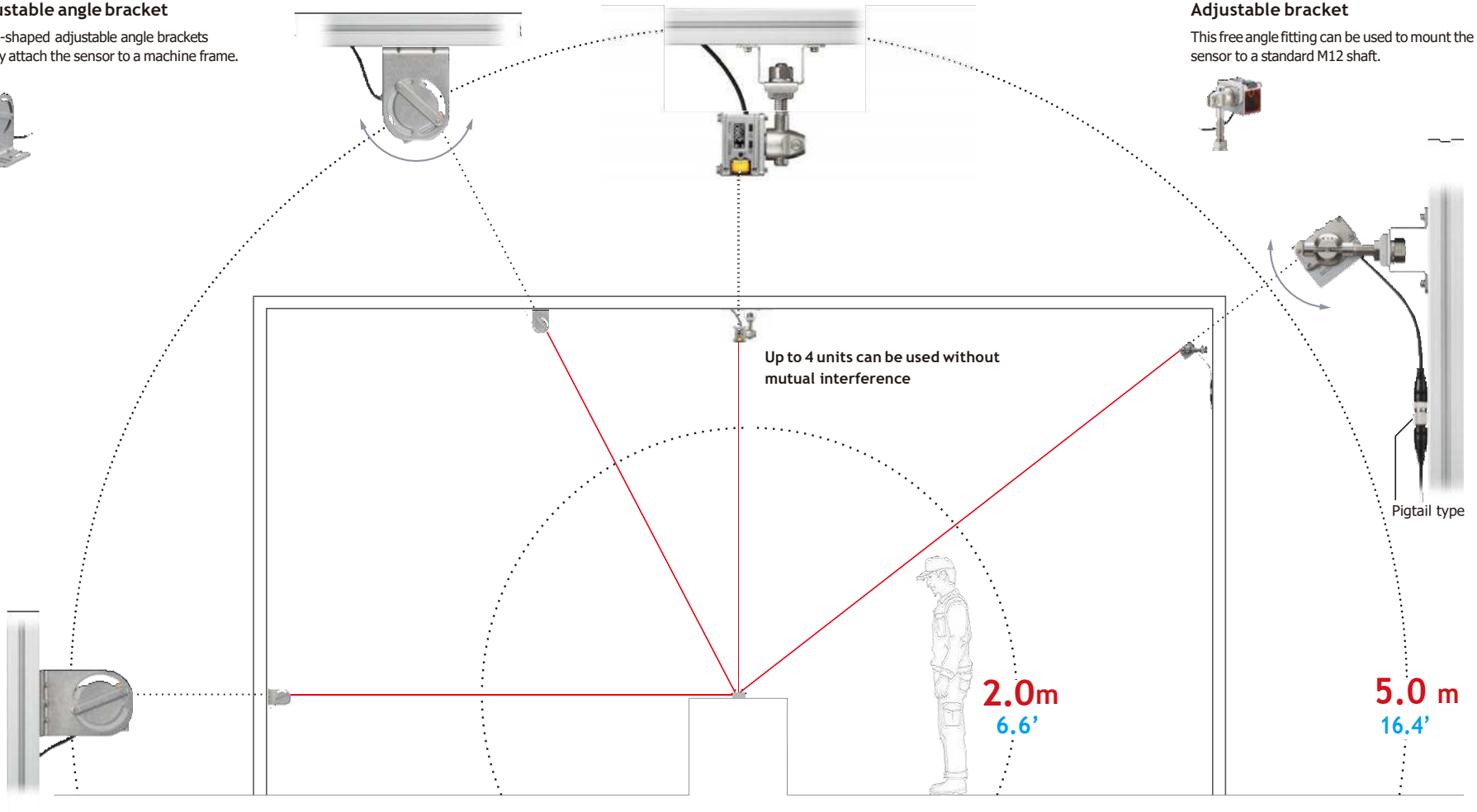
The design of the LR-T Series makes it possible to detect targets from any mounting position.
Whether they are mounted close to a target, far from a target, horizontally, vertically, or diagonally, these sensors will provide reliable and consistent detection. This makes the LR-T Series ideal for installation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

Adjustable angle bracket

The L-shaped adjustable angle brackets quickly attach the sensor to a machine frame.

Adjustable bracket

This free angle fitting can be used to mount the sensor to a standard M12 shaft.



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.

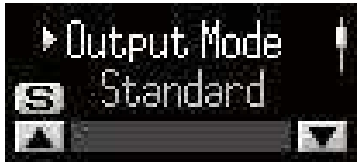
OLED display

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.

OLED Display



Conventional Display

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

The keys are locked

The object is too close

A key is being pressed and held down

Large indicator

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

FLASHING RED:
An error has occurred

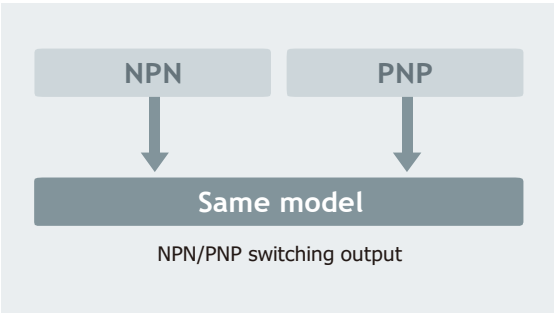
FLASHING GREEN:
Stability output ON

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.

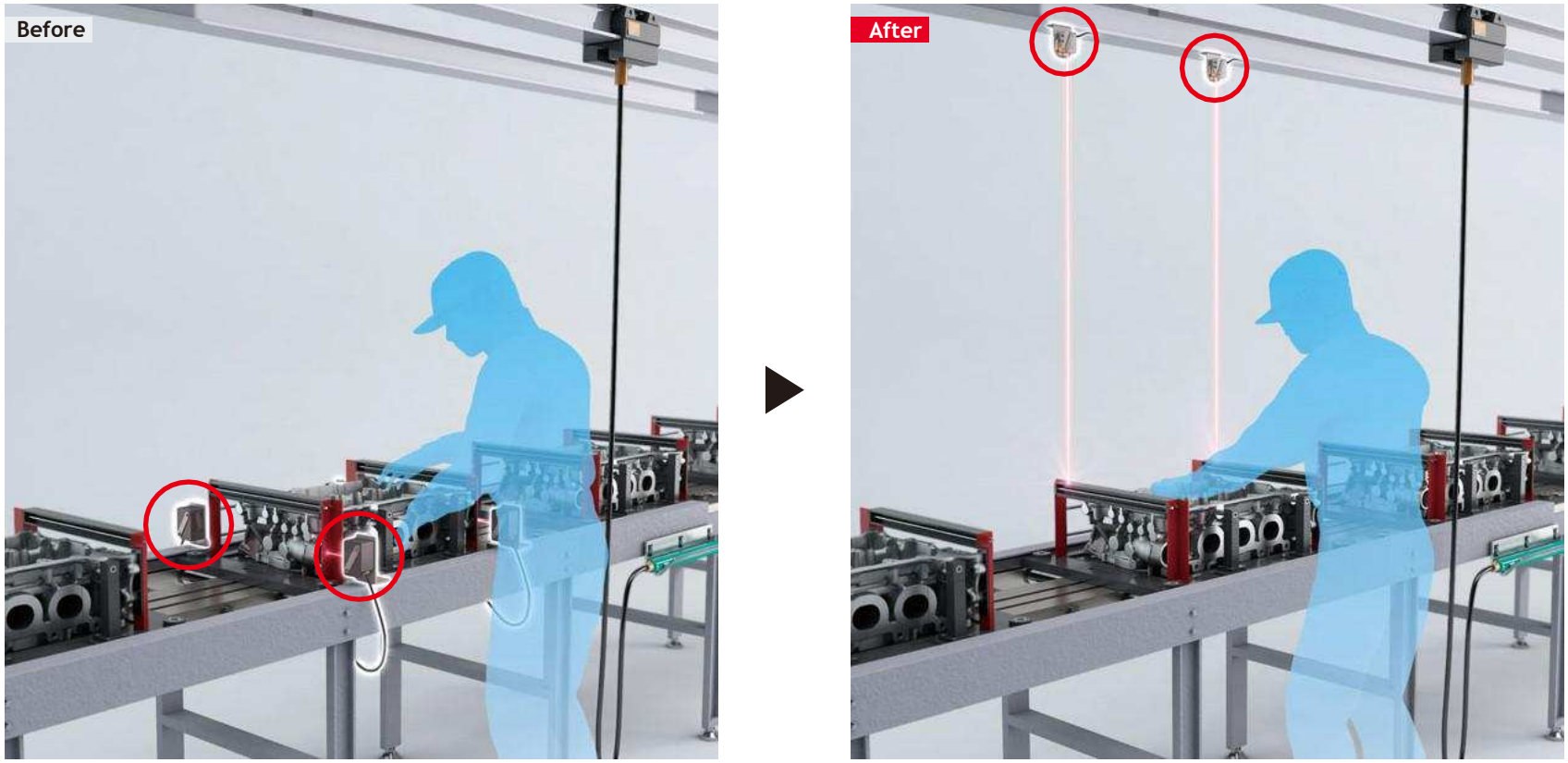


NPN/PNP switching output

Unmatched Versatility

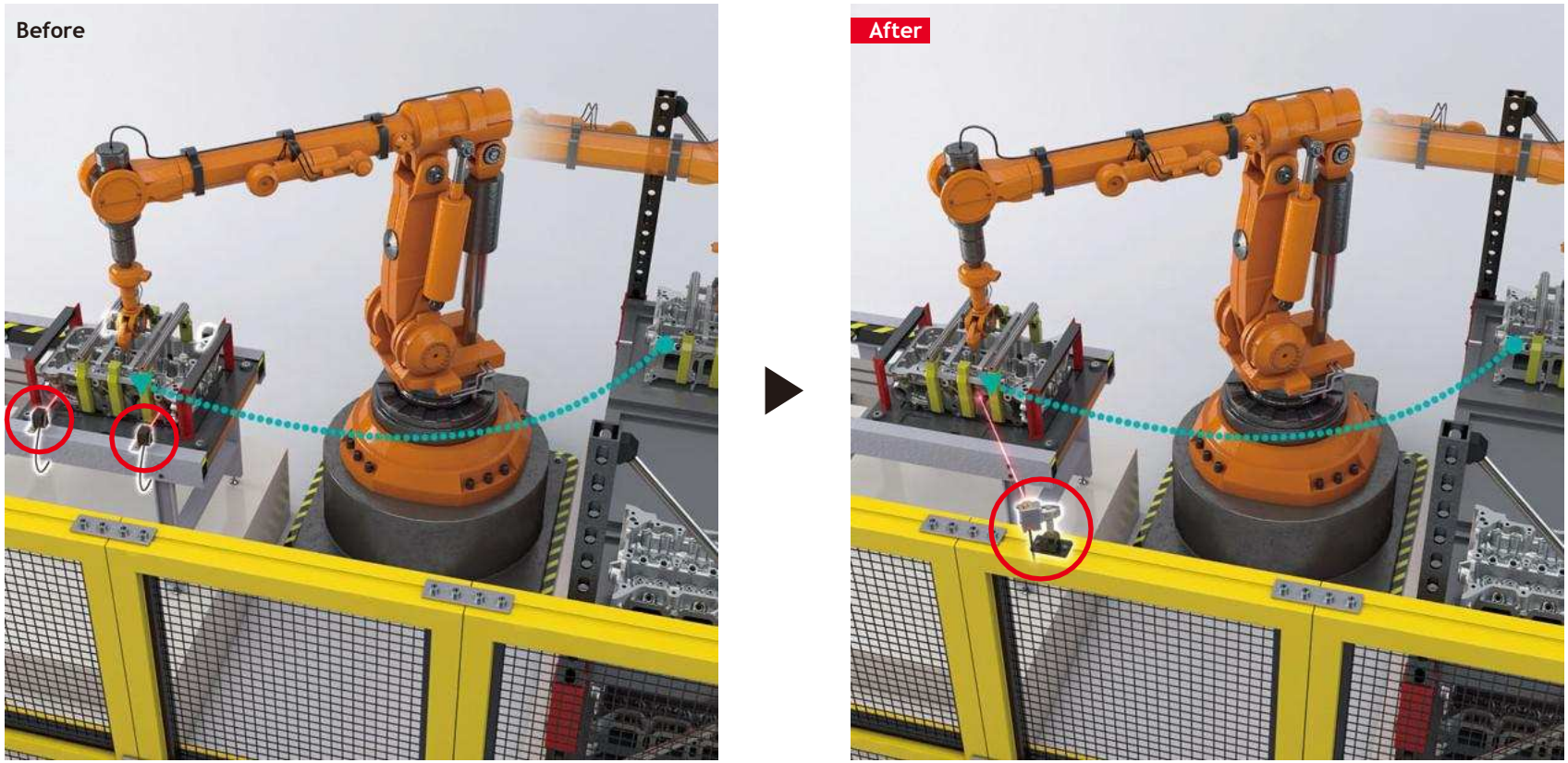
When a worker is involved in the process

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.



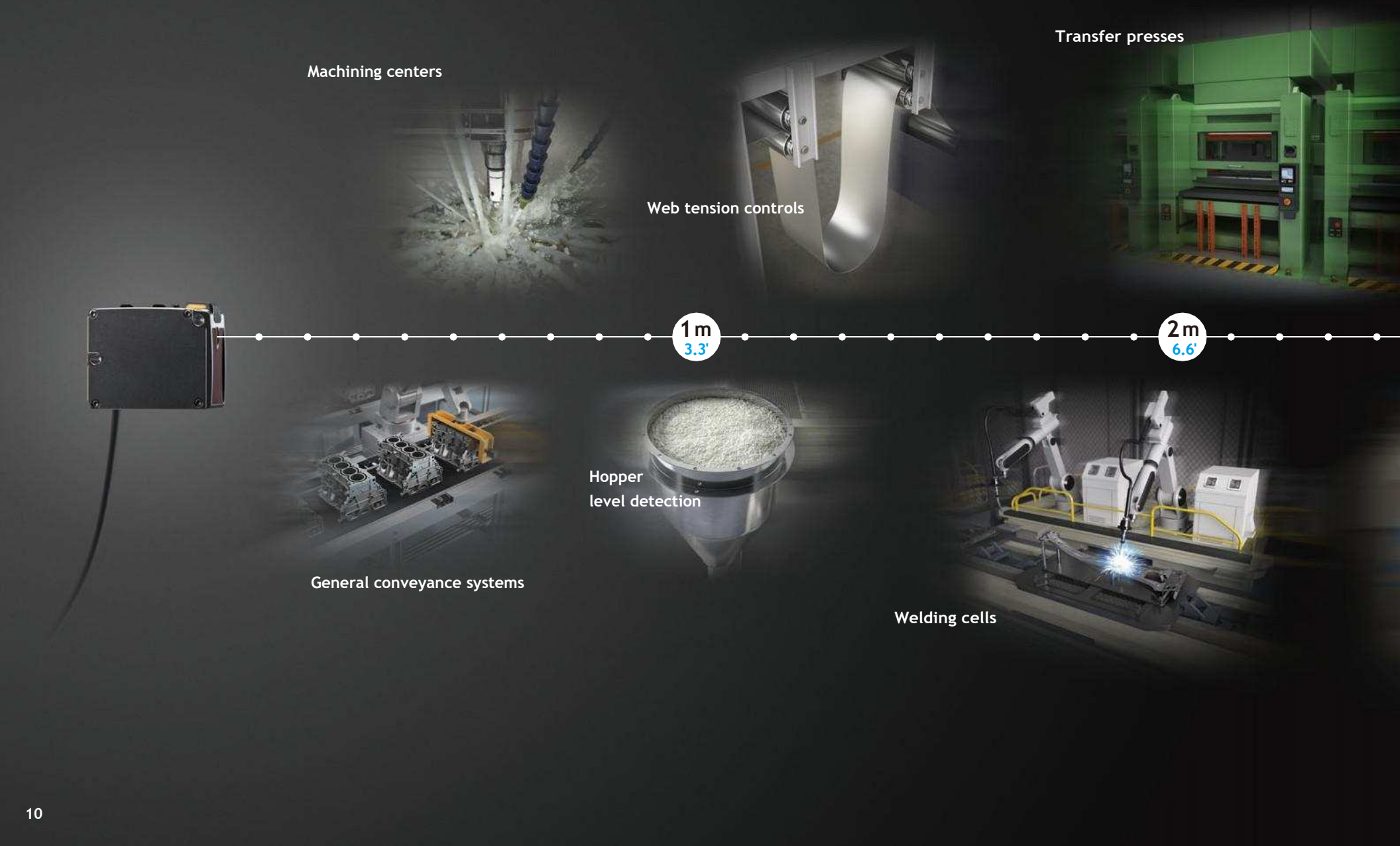
When a robot is involved in the process

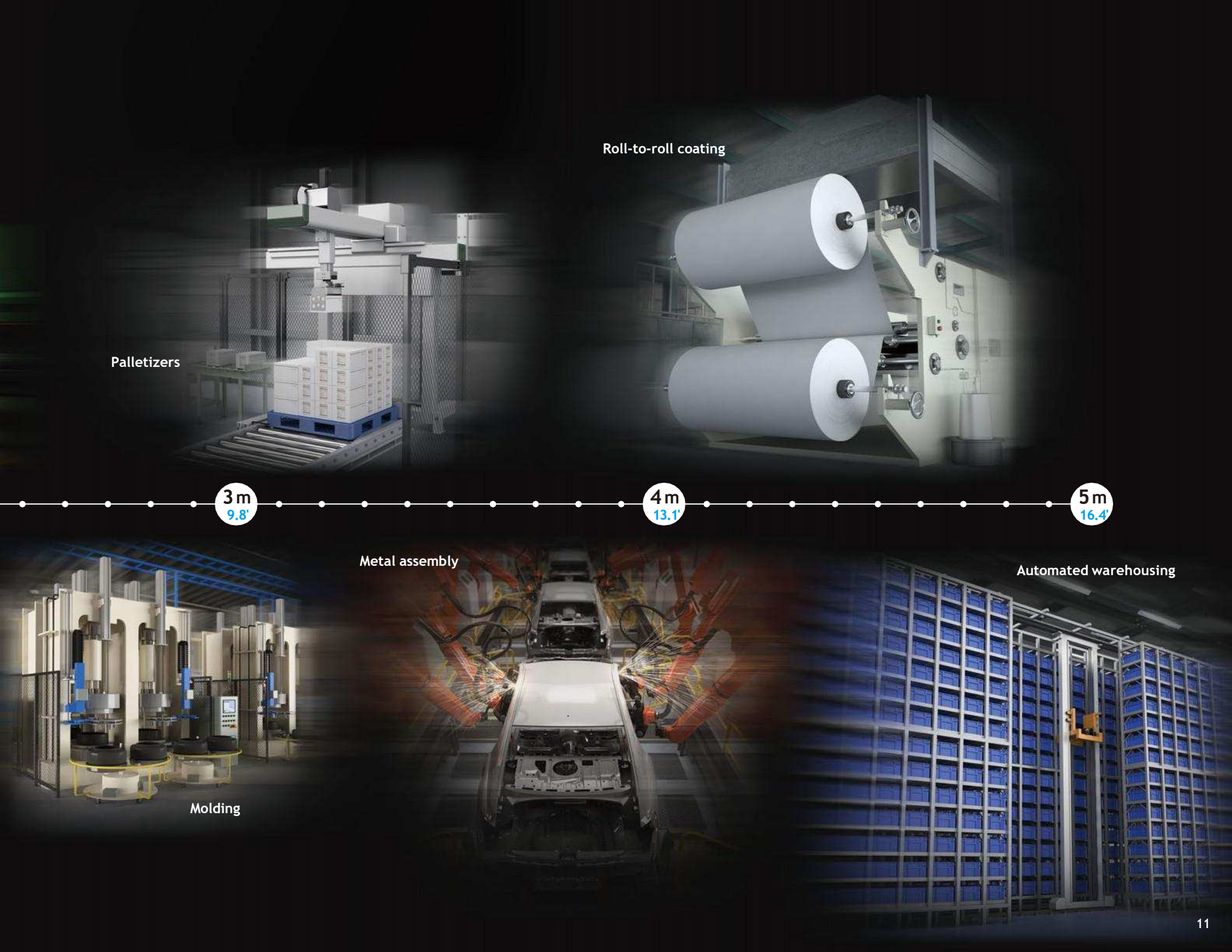
It is generally not preferable to install a sensor near the path of a moving robotic arm; however if a sensor has a short detecting range, it is necessary to place the sensors closer to the path and risk potential damage due to impact. The LR-T Series allows for stable detection from a distance, preventing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



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

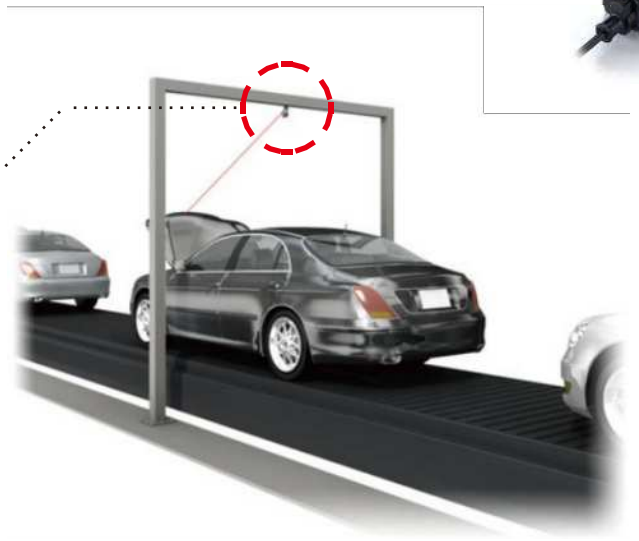
While the LR-T Series is perfect for applications that require the detection of a target at a pre-determined position;
it is also designed to perform detection based on variations in distance for applications such as level sensing or web tension control.
A single LR-T laser sensor makes it possible to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




Palletizers
Roll-to-roll coating
3 m
9.8'
4 m
13.1'
5 m
16.4'
Molding
Metal assembly
Automated warehousing

Multi-Sensor Controller MU-N Series

Increased accessibility with easily attachable controller:



The MU-N Series controller provides a remote display that can be used to quickly calibrate and easily monitor attached sensors. This controller pairs perfectly with the LR-T Series, which can be mounted further from targets and in potentially hard to reach positions, due to its long range detection capabilities.

Network Compatibility

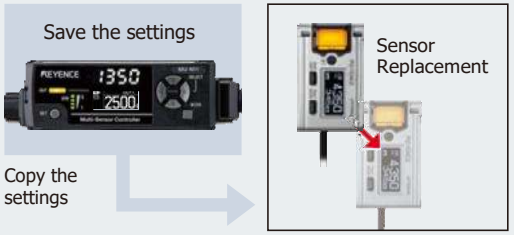
By combining the MU-N Series with the KEYENCE NU Series, users can transmit data over a standard industrial network.

EtherNet/IP™
CC-Link V2
DeviceNet™

Connect up to 4 MU-N Controllers to a single NU Unit.

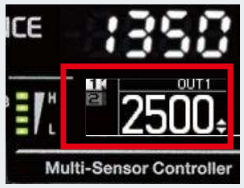
Settings Back-Up Function

The Settings Back-Up Function allows users to save sensor settings on the MU-N and quickly transfer them to new sensors.



Intuitive Displays

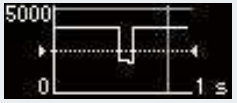
The MU-N features a clear, OLED display that offers innovative graphing functions for simplified sensor monitoring.



7-Segment &OLED Display

Monitor changes in the sensor readings

Monitor the values at the moment when the output turned ON.



Lineup

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

Mounting bracket

Type	Model	Material/Weight
 Adjustable angle bracket (For LR-TB5000 Series) (M4 screw × 2 supplied)	**OP-87773**	SUS304 Approx. 150 g
 Adjustable angle bracket (For LR-TB2000 Series) (M3 screw × 2 supplied)	**OP-87771**	SUS304 Approx. 110 g
 Small bracket (For LR-TB2000 Series) (M3 screw × 2 supplied)	**OP-87770**	SUS304 Approx. 80 g

Mounting bracket

Type	Model	Material/Weight
 Adjustable bracket (For LR-TB5000 Series) (M4 screw × 2 supplied)	**OP-87774**	Zinc nickel plating, etc. Approx. 120 g
 Adjustable bracket (For LR-TB2000 Series) (M3 screw × 2 supplied)	**OP-87772**	Zinc nickel plating, etc. Approx. 110 g
 Locking screw (For adjustable bracket) (85 mm 3.35")	**OP-87775**	Iron nickel plating Approx. 120 g

M12

Protection cover

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

LR-TB5000 + OP-87774 + OP-87775

LR-TB2000 + OP-87772 + OP-87775

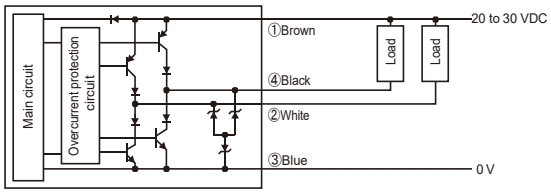
❙ Cable (M12 connector type models, when not using MU-N Controller)

Specifications	Appearance	Model	Material	Sensor side	Terminal side	Length
Standard		**OP-87634**	Cable: PVC (Vinyl chloride) Connector: Zinc nickel plating	M12 4-pin (Straight)	Loose wires	2 m 6.6'
		OP-87635				10 m 32.8'
Oil resistant		**OP-87636**	Cable: PUR (Polyurethane) Connector: Zinc nickel plating			2 m 6.6'
		OP-87637				10 m 32.8'

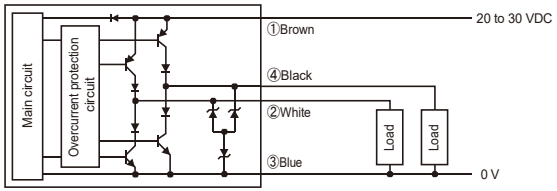
❙ I/O circuit diagram

When I/O wires (④ black, ② white) are set to Out 1 (Output 1)/Out 2 (Output 2)

When NPN is selected

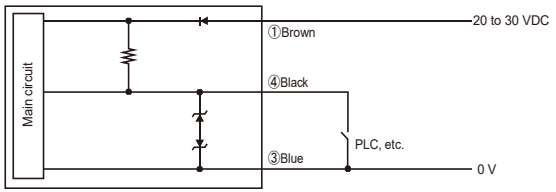


When PNP is selected

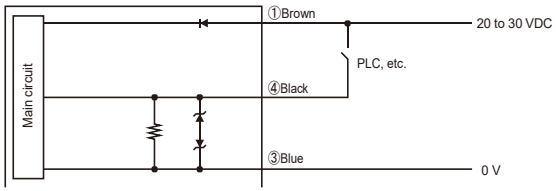


When I/O wire (④ black) is set to Input (external input)

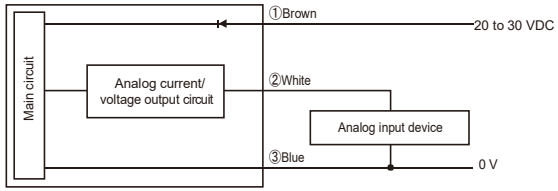
When NPN is selected



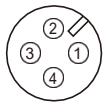
When PNP is selected



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



M12 Connector pin layout



Controller

Type	Control output	External input	Analog output	Model	Weight
 Main unit	2 outputs max.	1 input max.	1 output max.*	**MU-N11**	Approx. 70 g
 Expansion unit			—	**MU-N12**	Approx. 70 g

* Analog output is available when either LR-TB5000(C/CL) or LR-TB2000(C/CL) is connected.

Power supply cable for MU-N Series

Cable is not included with the controller. Must be purchased separately.

Appearance	Applicable unit	Cable material	Cable end	Controller side	Length	Model	Weight
	Main unit	PVC (Polyvinyl chloride)	4-core loose wires	Connector	2 m 6.6'	**MU-CB4***	Approx. 120 g
	Expansion unit		2-core loose wires			**MU-CB2**	Approx. 100 g
	Main unit		M12 4-pin straight		0.3 m 1.0'	**MU-CC4**	Approx. 30 g

* When the I/O setting is "analog output + external input", please select MU-CB8 (8-core loose wires).

Sensor-to-controller cable (4-pin M12 connector type models)

Appearance	Cable material	Sensor side	Controller side	Length	Model	Weight
	PVC (Polyvinyl chloride)	M12 4-pin straight	Connector	2 m 6.6'	**OP-88025**	Approx. 75 g
				10 m 32.8'	**OP-88026***	Approx. 280 g

* The 10 m 32.8' cable includes one spare connector for the controller side.

Connector set for sensor-to-controller connection

This set is required when the sensor cable end is loose wires or when the sensor-to-controller cable is cut.

Appearance	Type	Applicable model	Model	Weight
	For PVC (Polyvinyl chloride) cable	LR-TB2000/TB5000*	**OP-88029**	Approx. 3 g
	For PUR (Polyurethane) cable	OP-87636 / 87637	**OP-88030**	Approx. 3 g

* OP-87634/87635 cannot be connected to this option. Use OP-88025/88026 when using a connector type sensor head and M12 PVC connector cable.

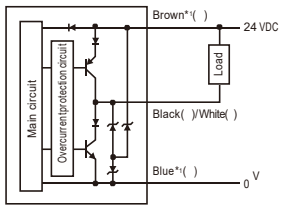
Controller mounting options

Appearance	Type	Description	Model	Weight
	Mounting adapter (for main unit)	Allows the main unit to be mounted without a DIN rail.	**OP-76877**	Approx. 11 g
	End unit (for expansion)	Used to secure the main and expansion units to DIN rail from both ends. End units must be used when an expansion unit is connected. (2 pieces included)	**OP-26751**	Approx. 15 g

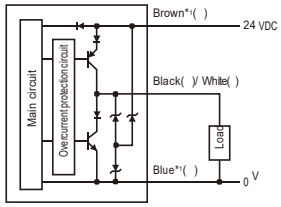
I/O circuit diagrams (When using MU-N series)

Control output circuit

When NPN is selected

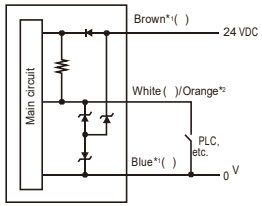


When PNP is selected

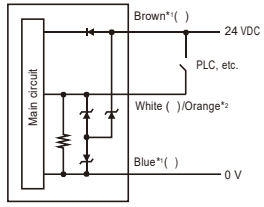


Input circuit

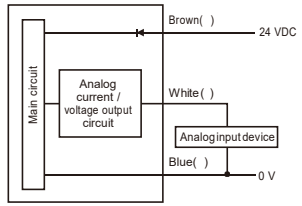
When NPN is selected



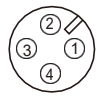
When PNP is selected



Analog output circuit *1



Pin layout when the M12 connector (4-pin) cable is used



*1 MU-N11 only *2 When the I/O setting is "analog output + external input", the power supply cable should be MU-CB8(8-core loose wires). In this case, the white wire corresponds to the "analog output" and the orange wire corresponds to the "external input".

Specifications

Model	Cable	LR-TB5000	—	LR-TB2000	—
	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		Variable (use a spot diameter 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
Light source	Type	Red laser (660 nm)			
	Laser class	Class 2 laser product (IEC60825-1, FDA(CDRH) Part1040.10*3)	Class 1 laser product (IEC60825-1, FDA(CDRH) Part1040.10*3)	Class 2 laser product (IEC60825-1, FDA(CDRH) Part1040.10*3)	Class 1 laser product (IEC60825-1, FDA(CDRH) Part1040.10*3)
Mutual interference prevention function		4 units (when using the interference prevention function)			
Timer		OFF/OFF delay/ON delay/One-shot			
Power voltage		20 to 30 VDC, including 10% ripple (P-P), Class 2 or LPS			
Current consumption		50 mA or less (without load)*4		45 mA or less (without load)*5	
I/O*6*7	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			
	External input	Transmission OFF/Tuning/Reference surface update (when using the DATUM mode) selectable Short-circuit current: 1 mA or less for both NPN and PNP For the applied voltage, see the wiring diagrams in the instruction manual. For the input times, see the time charts in the instruction manual.			
	Analog output	Current output/Voltage output selectable Current output: 4 to 20 mA with a max. load resistance of 500 Ω Voltage output: 0 to 10 V with an external load resistance of 5 kΩ or more		—	
Protection circuit		Protection against reverse power connection, power supply surges, output overcurrent, reverse output connection, and output surge			
Environmental resistance	Enclosure rating	IP65/IP67 (IEC60529)			
	Ambient light	Incandescent lamp/Sunlight: 100000 lux or less			
	Ambient temperature	-20 to +55°C -4 to 131°F (no freezing)			
	Ambient humidity	35 to 85%RH (no condensation)			
	Shock resistance	1000 m/s^2 in X, Y, Z axis directions respectively 6 times			
	Vibration resistance	10 to 55 Hz Double amplitude 1.5 mm 0.06" in the X, Y, Z axis directions respectively, 2 hours			
Material		Case: Zinc die cast (Nickel chrome plating), 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 with connector M12 type: Approx. 160 g		Cable type: Approx. 125 g (Including cable) Cable with connector M12 type: Approx. 85 g	
Accompanying items		Instruction manual, Laser warning and explanation labels (except LR-TB5000CL/TB2000CL)			

*1 The range for displayable distance is from 50 to 5200.
*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.

Specifications

Model		MU-N11	MU-N12
Main unit/expansion unit		Main unit	Expansion unit
Response time		LR-TB5000(C), LR-TB2000(C): 7 ms/15 ms/30 ms/105 ms/1000 ms selectable LR-TB5000CL, LR-TB2000CL: 8 ms/25 ms/55 ms/205 ms/2000 ms selectable	
Timer		OFF/OFF delay/ON delay/One-shot	
Power supply	Power voltage	24 VDC, ripple (P-P) 10% or less, Class 2 or LPS	
	Current consumption	LR-TB5000(C/CL) connected: 120 mA or less*1 LR-TB2000(C/CL) connected: 115 mA or less*1	LR-TB5000(C/CL) connected: 105 mA or less*2 LR-TB2000(C/CL) connected: 100 mA or less*2
I/O*3	Control output	Maximum 2 outputs NPN open collector/PNP open collector selectable Main unit: 24 VDC or less, 50 mA*4 or less, residual voltage: 2 V or less, N.O./N.C. selectable Expansion unit: 24 VDC or less, 20 mA or less, residual voltage: 2 V or less, N.O./N.C. selectable	
	External input	Maximum 1 input Transmission OFF / tuning / reference surface update selectable Short-circuit current: 1 mA or less for NPN/2 mA or less for PNP For the applied voltage, see the wiring diagrams in the User's Manual (LR-T Edition). For the input times, see the time charts in the User's Manual (LR-T Edition).	
	Analog output	Maximum 1 output Current output/voltage output selectable Current output: 4 to 20 mA with a max. load resistance of 450 Ω Voltage output: 0 to 10 V with an external load resistance of 5 kΩ or more	—
Protection circuit		Protection against reverse power connection, power supply surge, output overcurrent, output surge, and reverse output connection	
Unit expansion		Up to 4 units per main unit*5	
Environmental resistance	Ambient temperature	-20 to +50°C -4 to 122ºF (no freezing)	
	Ambient humidity	35 to 85%RH (no condensation)	
	Shock resistance	1000 m/s^2 in X, Y, Z axis directions respectively 6 times	
	Vibration resistance	10 to 55 Hz Double amplitude 1.5 mm 0.06" in the X, Y, Z axis directions respectively, 2 hours	
Material		Case and dust cover: Polycarbonate, Button: Polyacetal, Display panel: Acrylic	
Weight		Approx. 70 g	

*1 LR-TB5000(C/CL) connected: 220 mA or less (2 outputs, including load), LR-TB2000(C/CL) connected: 215 mA or less (2 outputs, including load)
*2 LR-TB5000(C/CL) connected: 145 mA or less (2 outputs, including load), LR-TB2000(C/CL) connected: 140 mA or less (2 outputs, including load)
*3 The I/O settings can be selected from the following combinations.
Main unit: Control output × 2, control output + external input, control output + analog output, analog output + external input
Expansion unit: Control output × 2, control output + external input
*4 20 mA or less when using the expansion unit.
*5 Up to 5 N-bus devices, including the main unit (or network unit), can be linked together.

▮ Repetition Accuracy (Typical)

LR-TB5000 / TB5000C (Class 2 laser)

Unit: mm inch

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

LR-TB2000 / TB2000C (Class 2 laser)

Unit: mm inch

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

LR-TB5000CL (Class 1 laser)

Unit: mm inch

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

LR-TB2000CL (Class 1 laser)

Unit: mm inch

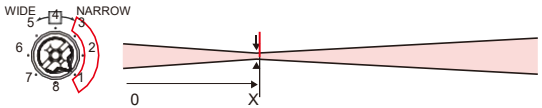
Detecting distance [mm inch]	White Paper (Reflectivity: 90%) Response Time [ms]					Gray Paper (Reflectivity: 18%) Response Time [ms]				
	2	20	50	200	2000	2	20	50	200	2000
60 2.36"	±39 ±1.54"	±13 ±0.51"	±9 ±0.35"	±5 ±0.20"	±3 ±0.12"	±104 ±4.09"	±33 ±1.30"	±25 ±0.98	±14 ±0.55"	±8 ±0.31"
200 7.87"	±8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

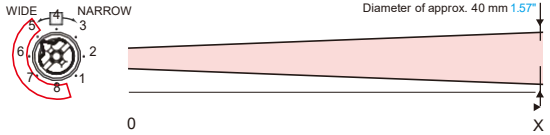


Unit: mm inch

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

Parallel Light Setting

Wide Spot Setting



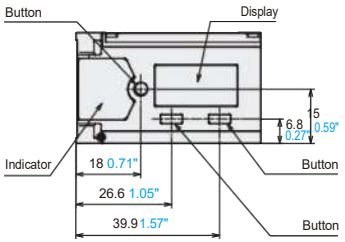
Unit: mm inch

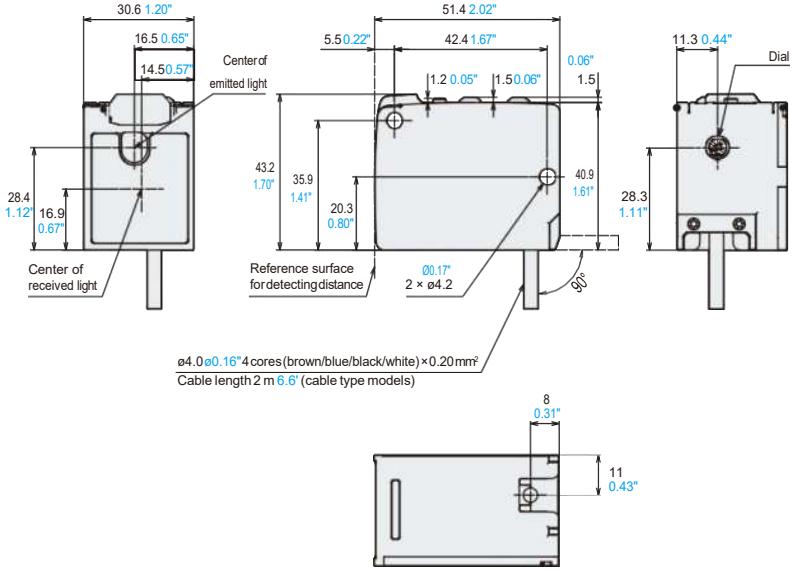
WIDE	5	6	7	8
X (Approx.)	5000 196.85"	3000 118.11"	1500 59.06"	750 29.53"

▮ Dimensions

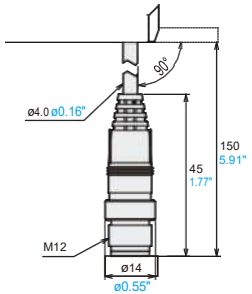
Unit: mm inch

LR-TB5000 / TB5000C/ TB5000CL

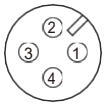




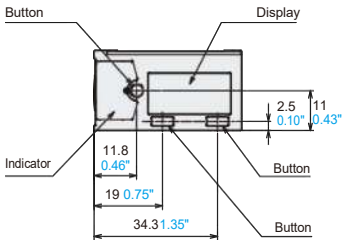
M12 connector type models:
LR-TB5000C/TB5000CL

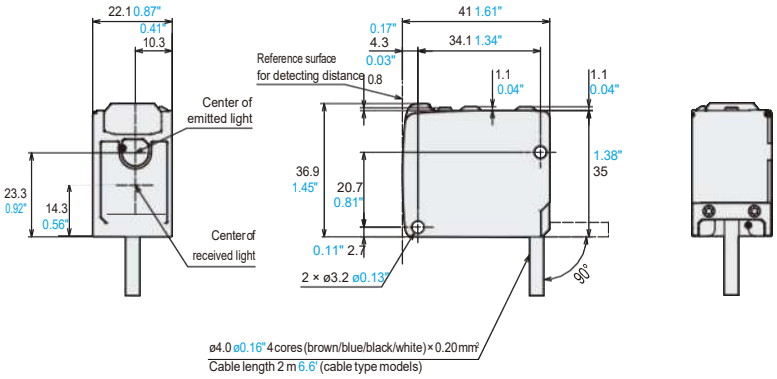


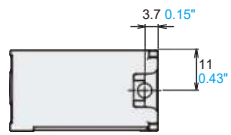
Pin layout



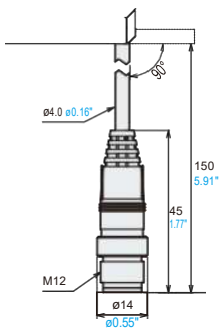
LR-TB2000 / TB2000C/ TB2000CL



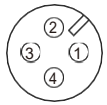




M12 connector type models:
LR-TB2000C/ TB2000CL

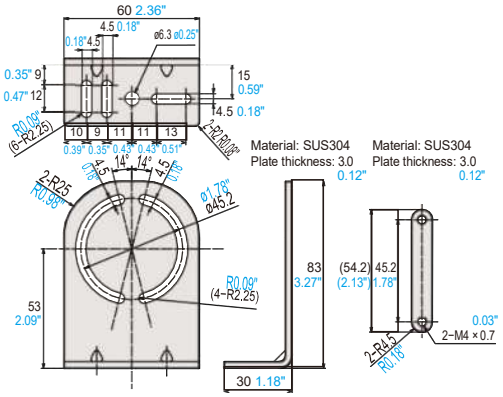


Pin layout

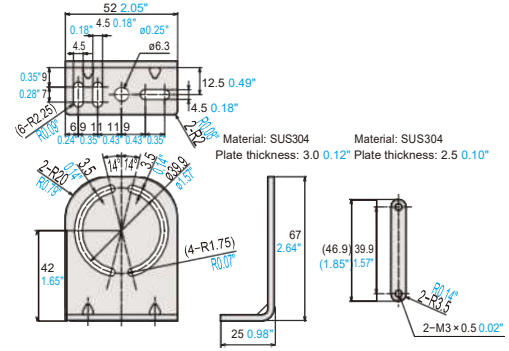


▮ Dimensions

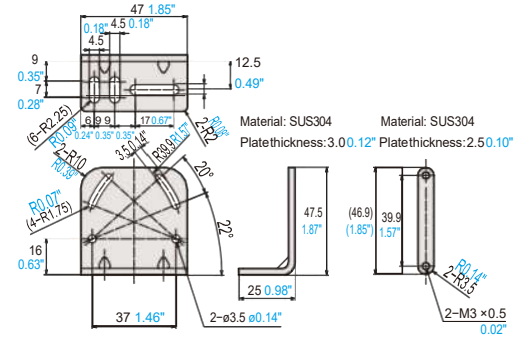
OP-87773



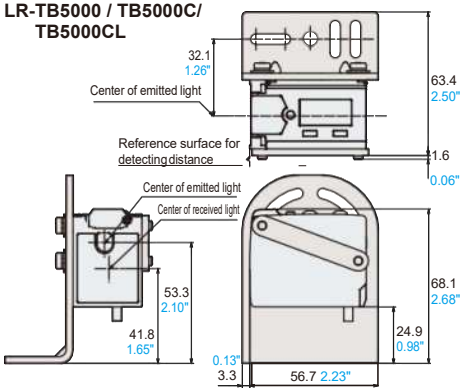
OP-87771



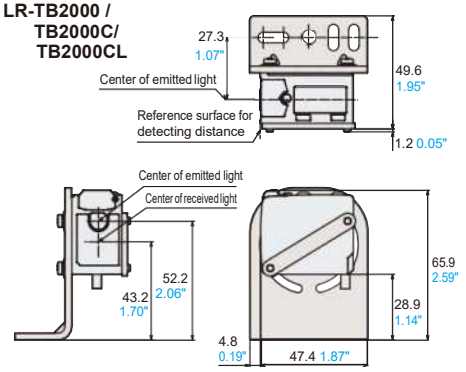
OP-87770



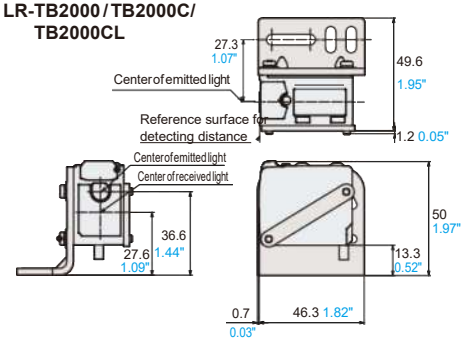
OP-87773 + LR-TB5000 / TB5000C/ TB5000CL



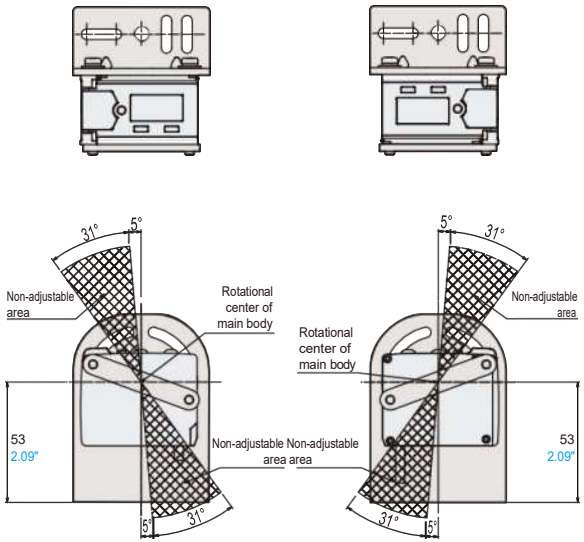
OP-87771 + LR-TB2000 / TB2000C/ TB2000CL



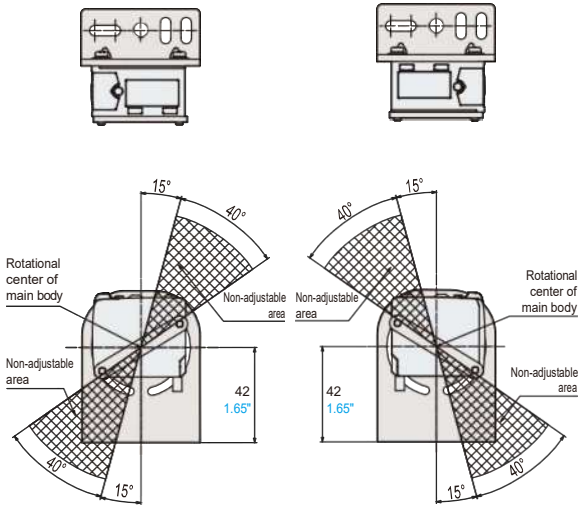
OP-87770 + LR-TB2000 / TB2000C/ TB2000CL



Non-adjustable area when OP-87773 is used

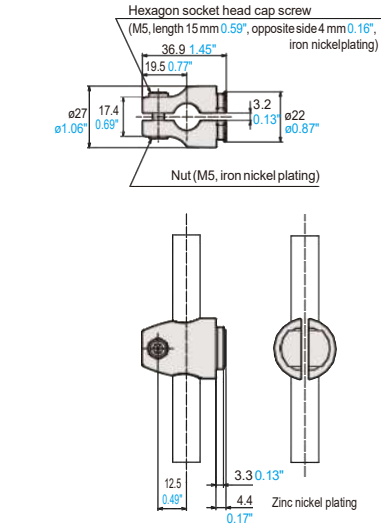


Non-adjustable area when OP-87771 is used

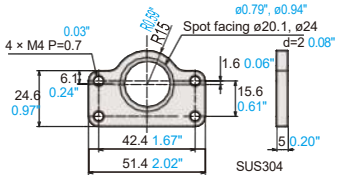


Unit: mm inch

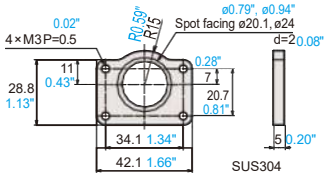
OP-87774/87772



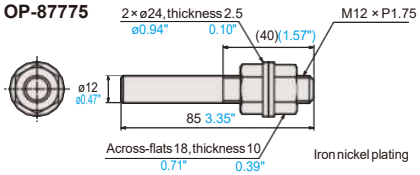
OP-87774



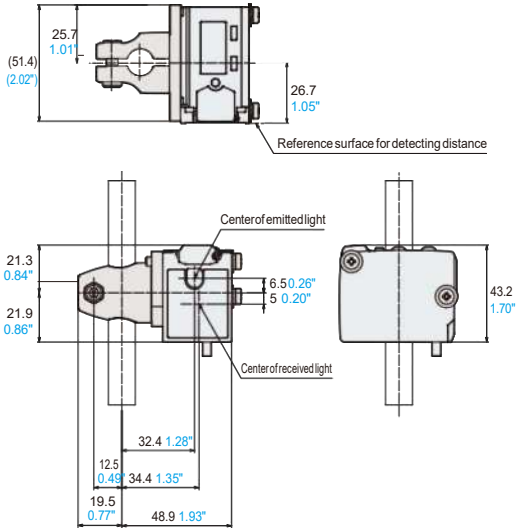
OP-87772



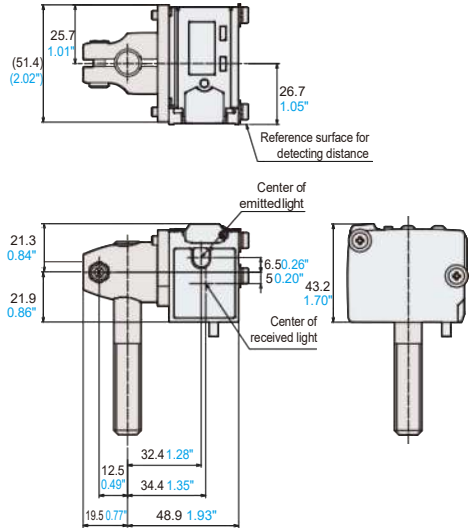
OP-87775



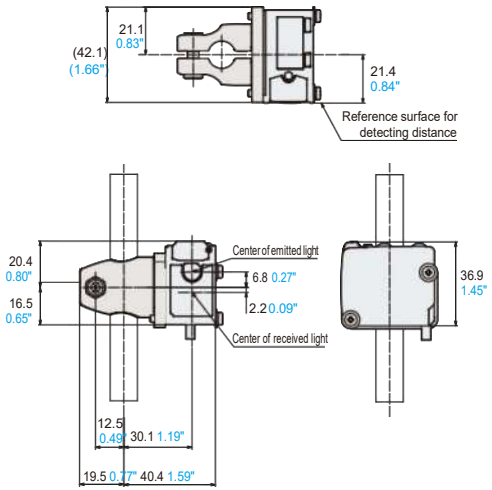
OP-87774 + LR-TB5000 / TB5000C/ TB5000CL



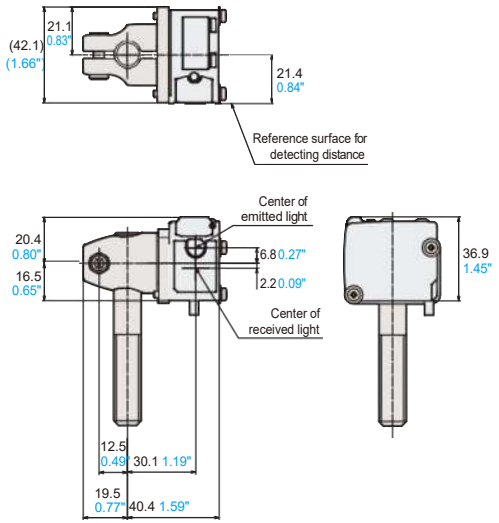
OP-87774 + OP-87775 + LR-TB5000/TB5000C/TB5000CL



OP-87772 + LR-TB2000 / TB2000C/ TB2000CL

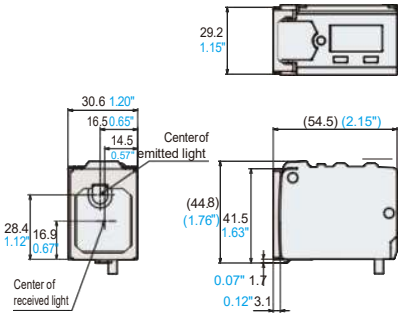


OP-87772 + OP-87775 + LR-TB2000 / TB2000C/ TB2000CL



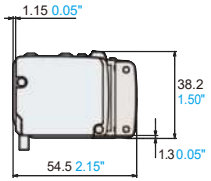
Dimensions

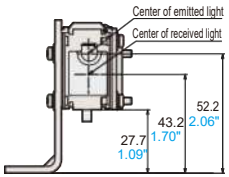
OP-87778 +
LR-TB5000 / TB5000C/ TB5000CL

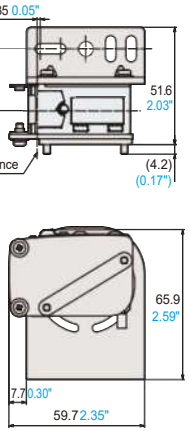


OP-87776 + OP-87771 +
LR-TB2000 / TB2000C/ TB2000CL

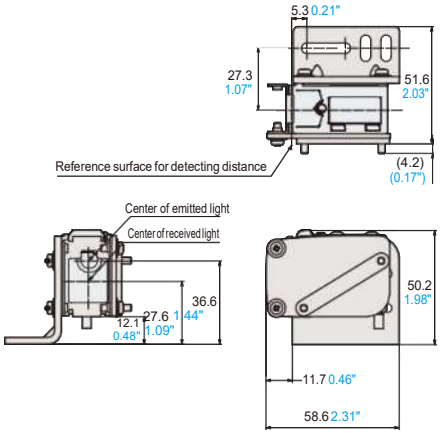
When only OP-87776 is used







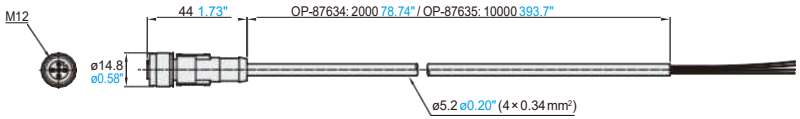
OP-87776 + OP-87770 +
LR-TB2000 / TB2000C/ TB2000CL



M12 connector cable

OP-87634/87635

OP-87634: Approx. 75 g
OP-87635: Approx. 430 g

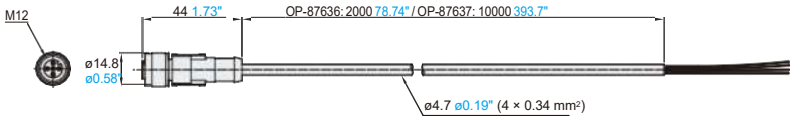


Pin layout

No.	Color
①	Brown
②	White
③	Blue
④	Black

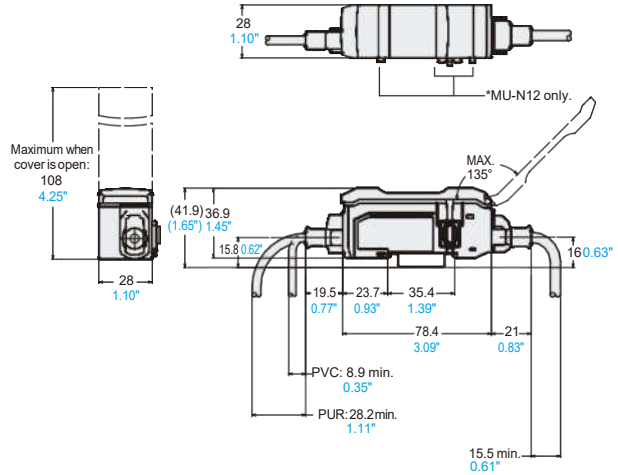
OP-87636/87637

OP-87636: Approx. 75 g
OP-87637: Approx. 330 g

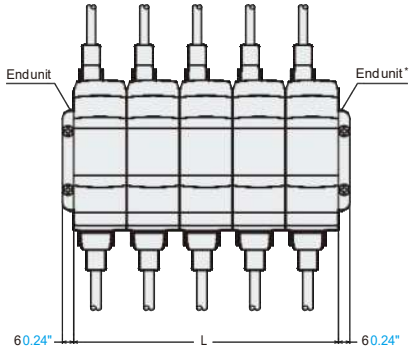


Unit: mm inch

MU-N11 (Main unit)/ MU-N12 (Expansion unit)



When expansion units are connected

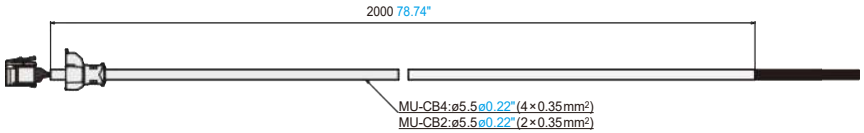


* End units must be used when an expansion unit is connected. (OP-26751)

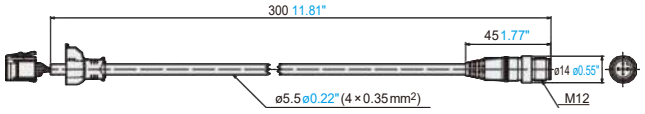
No. of expansion units	L
1	28 1.10"
2	56 2.20"
3	84 3.31"
4	112 4.41"
5	140 5.51"

Power supply cable for MU-N

MU-CB4/CB2



MU-CC4

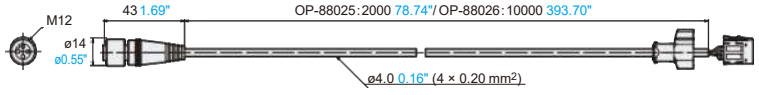


M12 Connector pin layout

No.	Color
	Brown
	White
	Blue
	Black

Sensor-to-controller cable (4-pin M12 connector type)

OP-88025/88026



X
M12 Connector pin layout

X	Y	Color
		Brown
		White
		Blue
		Black

Y
Connector pin layout

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