KEYENCE

Surface Scanning
Laser Confocal Displacement Meter
LT-9000 Series

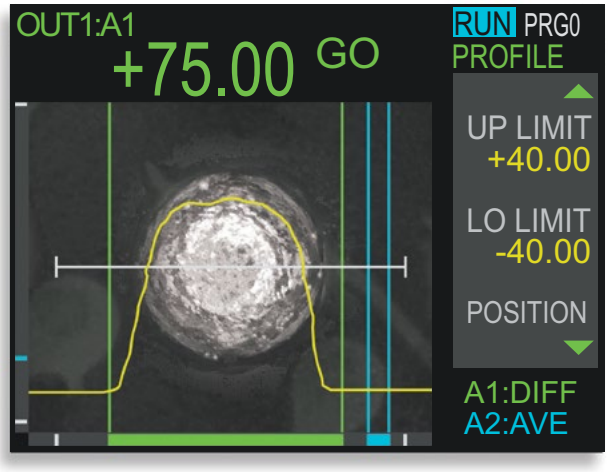
High-Accuracy Surface Scanning Method

High resolution of 0.01 μm

CE

The high-accuracy, surface scanning method allows measurements of all types of targets

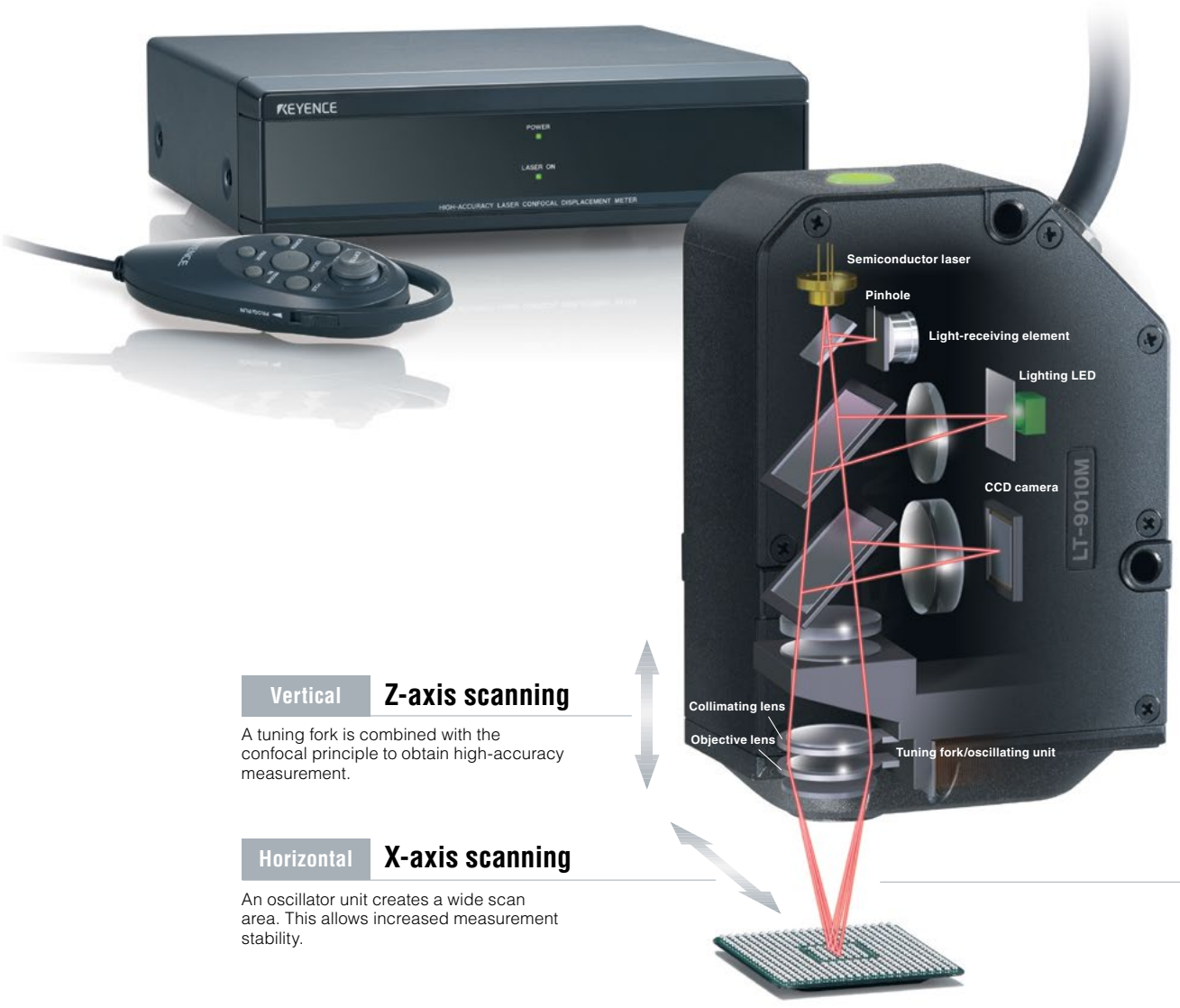
A tuning fork and oscillator unit are combined to create a surface scanning laser. This results in precise displacement and profile measurements that are unaffected by target color or angle.



BGA profile measurement

Surface Scanning Laser
Confocal Displacement Meter

LT-9000 Series



Vertical **Z-axis scanning**

A tuning fork is combined with the confocal principle to obtain high-accuracy measurement.

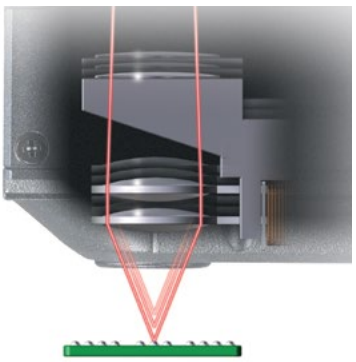
Horizontal **X-axis scanning**

An oscillator unit creates a wide scan area. This allows increased measurement stability.

Excellent resolution of 0.01 µm for high-accuracy applications

Vertical

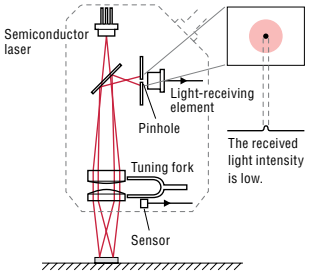
Z-axis scanning



High-accuracy measurement method uses the confocal principle and tuning fork

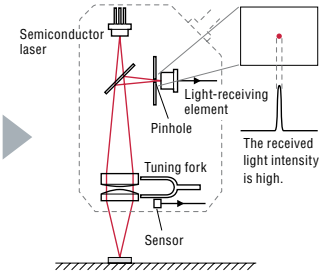
The laser beam is focused on the target surface through an objective lens that vibrates up and down at high speed by means of a tuning fork. The beam reflected off the target surface is converged on a pinhole and then enters the light-receiving element. By measuring the exact position of the objective lens when the light enters the light-receiving element, the target height can be determined. The sensor measures the distance to the target surface accurately without being affected by the material, color, or angle of the target.

When focus is not obtained on the target surface



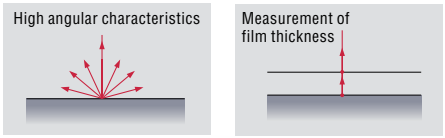
A small amount of reflected light passes through the pinhole.

When focus is obtained on the target surface



All of the reflected light passes through the pinhole.

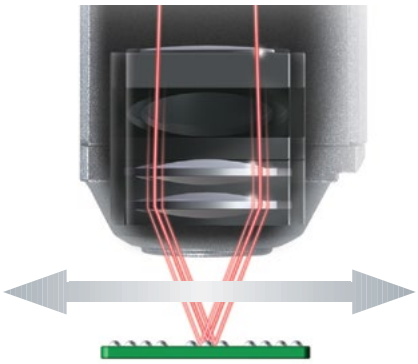
The coaxial optical system improves measurement performance



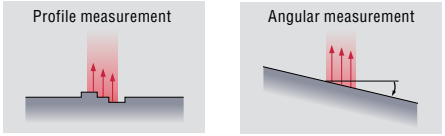
New wide scanning feature increases measurement stability and versatility

Horizontal

X-axis scanning

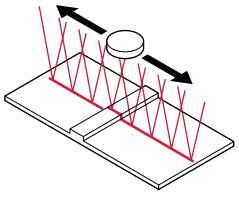


Wide scanning enables various measurements



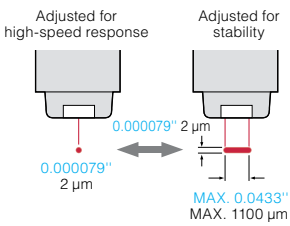
High-accuracy scanning using an oscillator unit

The 0.000079" 2 µm laser beam spot can be scanned horizontally for up to 0.043307" 1100 µm by using the high-accuracy oscillating mechanism. This new scanning method enables measurements of profile, angle, and area.



Adjustable scanning width according to the application

The scanning width of the laser beam can be changed freely according to the application and the surface condition of the target. In addition, highly stable displacement measurements are ensured by calculating the scanning data.



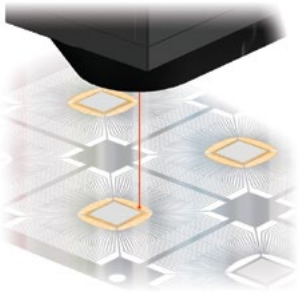
A variety of high accuracy measurements are possible.

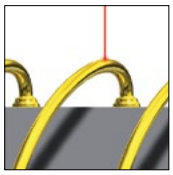
Typical applications for the LT-9000 Series

Microscopic targets

A small spot size enables the measurement of microscopic features.

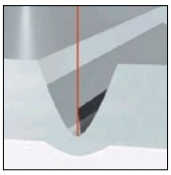
Measuring the height of bonding wire





The height of narrow pitch bonding wire can be measured reliably.

Measuring the score depth of a pull-tab

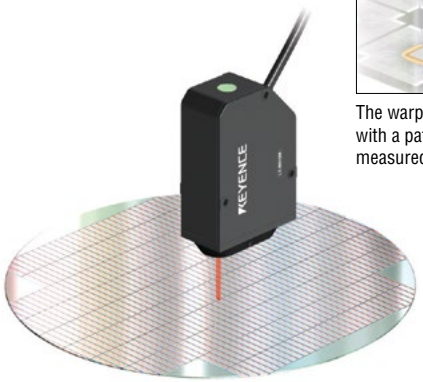


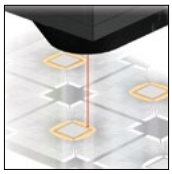
The depth and profile of the groove can be measured stably.

Rough-surfaced targets

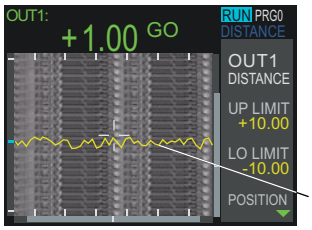
The light intensity integration function and laser scanning method offer high stability.

Measuring warpage of a wafer





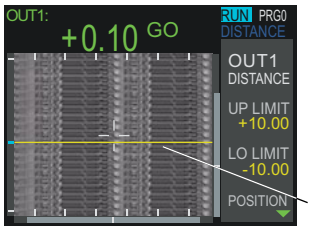
The warpage of a wafer with a pattern can be measured stably.



When the laser scanning method is disabled:

The measurement is affected by the pattern on the surface.

The measurement value is unstable due to the influence of the surface conditions.



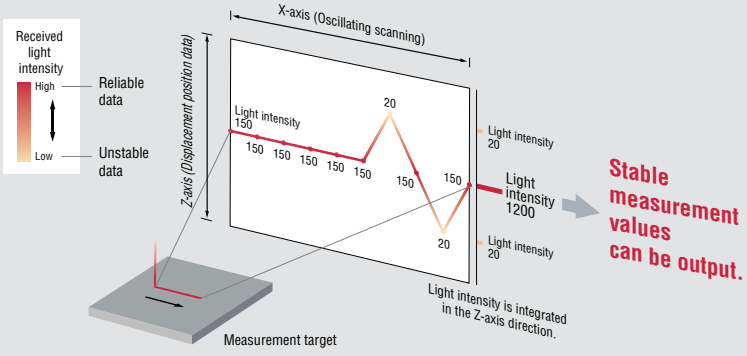
When the laser scanning method is enabled:

Accurate measurement is obtained by eliminating the influence of the pattern.

The measurement value is stable, enabling the measurement of the warpage profile.

The light intensity integration function —— Provides high stability

1. The 0.000079" 2 µm beam spot is shifted in the X-axis direction with the movement of the oscillator unit.
2. The data of each spot in the X-axis direction is divided into two categories: the displacement position data (Z-axis) and the light intensity data.
3. Data is obtained from the rough surface of the target, in which stable data with high received light intensity and unstable data with low received light intensity are mixed. The light intensity integration function further enhances the difference of the light intensity by integrating the light intensity of the Z-axis direction, and it outputs stable displacement position data unaffected by the unstable data with low received light intensity.



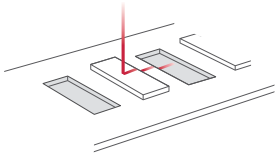
Surface Scanning Laser Confocal Displacement Meter

LT-9000 Series

Multiple measurement modes for a wide range of applications

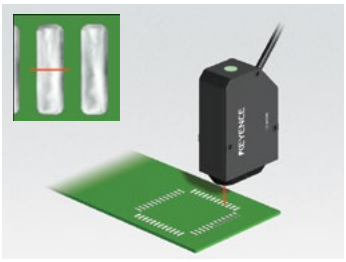
Profile measurement

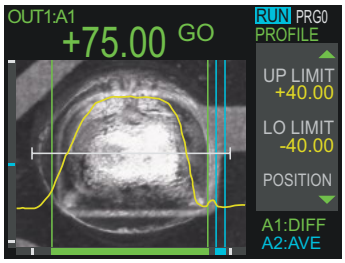
The surface profile can be traced accurately using the oscillating unit.



The surface profile can be traced using the double-scanning method. The height difference between the two points can be measured.

Measuring the profile of solder paste on a PWB

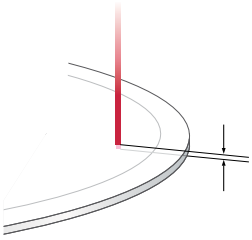




The profile of lead-free solder can be measured for detecting abnormalities such as cracks, bridges, and insufficient soldering.

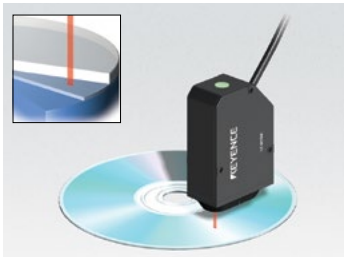
Transparent object thickness measurement

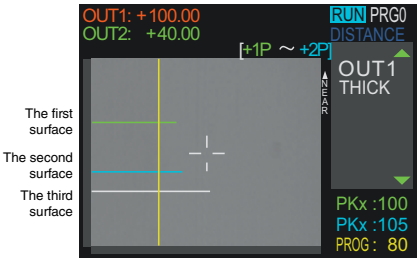
The surface condition, film thickness, and thickness of transparent objects can be measured stably by utilizing the confocal principle.



The surface condition, film thickness, and thickness of transparent objects can be measured. In addition, the **slant correction function** enables more reliable measurements.

Measuring the thickness of an optical disc



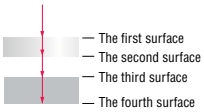


The first surface
The second surface
The third surface

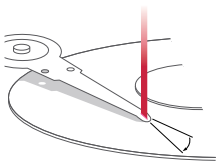
The intermediate layer of an optical disc can be measured.

Multi-surface measurement function

The peak value of light intensity of up to four points can be detected with one measurement unit. The selected measurement surface can be measured with high accuracy.

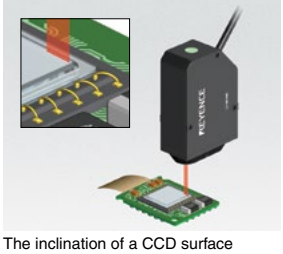


Angle measurement



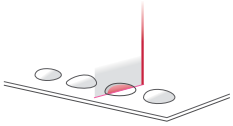
An angle can be measured in increments of 0.01 degrees based on the measurement values of two or more points obtained by scanning the laser beam spot.

Measuring the parallelism of a CCD and cover glass



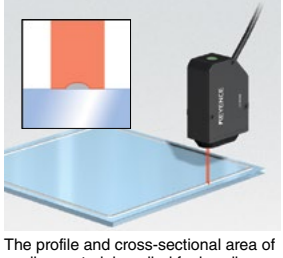
The inclination of a CCD surface against the rear surface of the glass can be measured accurately using the newly developed relative angle measurement.

Measurement of a cross-sectional area



The cross-sectional area can be determined based on the cross sectional profile obtained by scanning the laser beam spot.

Measuring the cross-sectional area of liquid sealing material



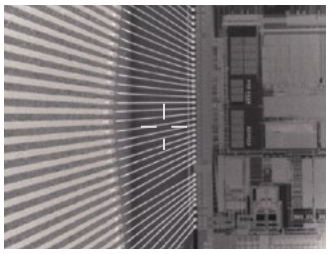
The profile and cross-sectional area of sealing material applied for bonding glass substrates.

Quick and easy setup functions

Microscope function ——— Employing a high-speed auto-focus lens for clear images

An ultra-compact CCD camera is incorporated in the sensor head. The target image can be enlarged approximately 85 times* on the monitor screen. The special optical design provides sharp images, allowing easy positioning of microscopic targets.

* When using special monitor CA-MN81



IC chip

Image of phoenix on a 10-yen coin

Monitor for measured value and waveform display ——— For real-time display of measured values and waveform

Observations of displacement and profile data can be performed with ease.

Soldered area of leads

Engraved mark

Simplified setup menu ——— Simple operation using special remote console

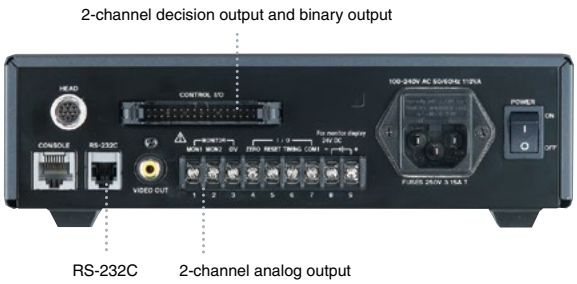
The special remote console and user-friendly setup menu greatly simplify the setup process. Measurement can begin just minutes after unpacking the box.

Multiple I/O options come standard ——— For enhanced operational flexibility

All of the necessary interfaces including 2 channels of analog outputs, RS-232C output, 2 channels of decision outputs, and binary outputs are incorporated as standard into the compact housing.
(Only half the size of conventional models.)

Analog output | **RS-232C output**

Binary output | **Limits output**



System configuration

Controller
LT-9501

Remote control console
(Included with the **LT-9501**)

6.56' 2 m extension cable
LT-C2

32.81' 10 m extension cable
LT-C10

Measuring unit
LT-9010M

Measuring unit
LT-9030M

I/O cable 9.84' 3 m
OP-42341

Measuring unit mounting stand
OP-51543

* The X-Y stage is not included.

LCD color monitor
CA-MN81

Stand
OP-42278

RS-232 cable
OP-96368

RS-232C conversion adapter

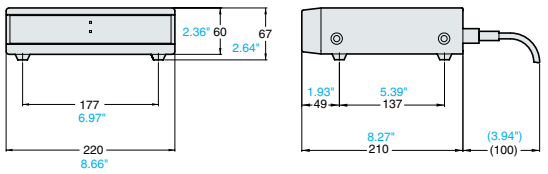
For 25-pin **OP-96369**

For 9-pin **OP-26401**

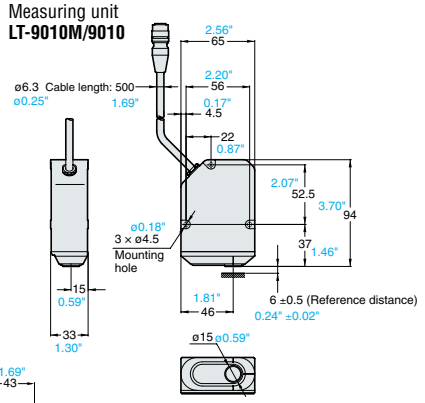
Dimensions

Unit: mm inch

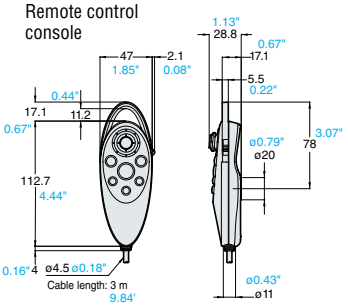
Controller
LT-9501/9001, LT-9501SO(5652)/9001SO(5653)



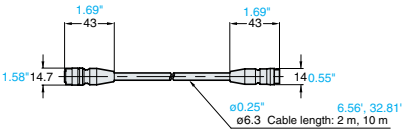
Measuring unit
LT-9010M/9010



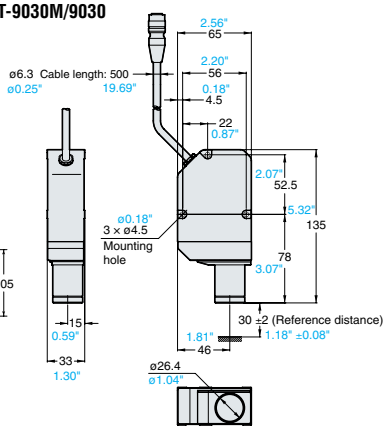
Remote control console



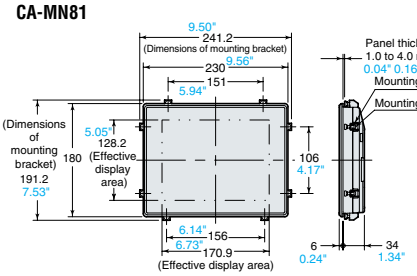
Cable between the measuring unit and the controller
LT-C2/LT-C10



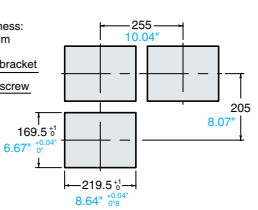
LT-9030M/9030



LCD monitor
CA-MN81



Panel cutout



New features of the LT-9000 Series

Interchangeable sensor head and controller

A CPU is built into the sensor head so that the sensor head and controller become interchangeable. The calibration data and other information of the sensor head is digitally transferred to the controller. Complicated adjustments are no longer required upon replacement.

Calibration function

The measured values can be calibrated by using a reference target. Since logical calibration can be performed using numerical values, optimal adjustment can be made according to the details of the actual target measurements.

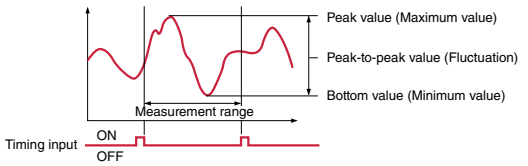
Up to 65.6' 20 m cable extension

Wiring can be extended up to 65.6' 20 m by adopting the digital method for communications between the controller and sensor head. This greatly enhances the installation flexibility.

Various measurement modes

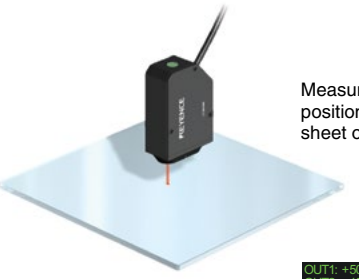
The LT-9000 Series features 9 types of measurement hold modes, including Peak hold, Bottom hold, and Peak-to-peak hold mode. The mode can be set up as desired according to the application without using an analog controller or PLC.

Measuring the warpage of a PWB

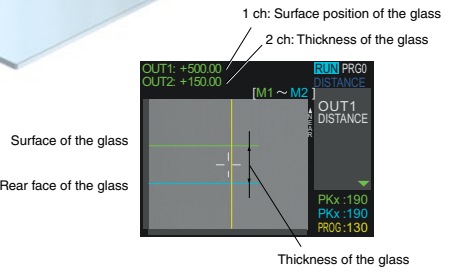


2-channel simultaneous measurement

The measurement of two different points can be performed simultaneously. The surface position and thickness of glass can be measured and displayed at the same time.



Measuring the surface position and thickness of a sheet of glass

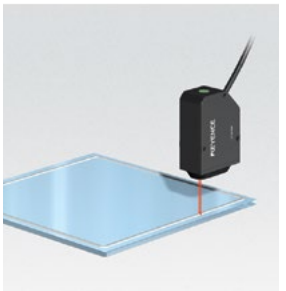


Applications by industry

Automotive industry

Measuring the surface profile of a brake disc

LCD industry



Measuring the cross-sectional area of liquid sealing material on LCD glass

Print industry

Measuring the cell depth of a print roll

Medical industry

Measuring the thickness of a contact lens

Specifications

Controller

Model	Controller		LT-9501/LT-9001	LT-9501SO(5652)/LT-9001SO(5653)
	Measuring unit		LT-9010M/LT-9010	LT-9030M/LT-9030
Measuring unit compatibility			Measuring units are interchangeable without factory recalibration.	
Display	Minimum display unit		0.01 µm, 1 µm², 0.01°	0.01 µm
	Display range		±9999.99 µm, ±999999 µm², ±9999.99°	±9999.99 µm
	Microscope function		Available (LT-9501 only)	Available (LT-9501SO(5652) only)
	Display cycle [1.]		10 times/sec.	
Terminal block	Analog output		±10 V × 2 outputs, output impedance: 100 Ω	
	Timing input/Reset input/Auto-zero input		Non-voltage input	
	Monitor dedicated power supply [2.]		24 VDC, 1 A	
Control I/O	Limits mode [3.]	3-step limits output	For OUT1 and OUT2, and NPN open collector output	
	Binary mode [3.]	Binary output	Measured data output (21 bits), OUT1/OUT2/PROFILE selectable NPN open collector output	
		Strobe output	NPN open collector output	
		Binary selection output	NPN open collector output	
		Binary selection input	Non-voltage input	
	Stability output		NPN open collector output	
	Laser remote input		Non-voltage input	
	Program change input		Non-voltage input × 3 inputs	
RS-232C interface			Measured data output and control I/O (Selectable up to baud rate 115200 bps)	
Video output			NTSC compliant (PIN connector)	
Main function	Distance mode [4.]		Distance measurement, Transparent object thickness measurement, Angle measurement, Relative angle measurement, Surface selection, Dark-out, Mask, Trend graph display, and Scan width/interval change	Distance measurement, Transparent object thickness measurement, Surface selection, Dark-out, Mask, Trend graph display, and Scan width/interval change
	Profile mode [4.]		Area selection (Average, Maximum, Minimum, Maximum-to-minimum, Area) Area calculation, Scan width/interval change, Dark-out, Smoothing, Averaging, and Profile data output	–
	Common		Light intensity accumulation, Microscope (LT-9501, LT-9501SO(5652) only), Tolerance judgment, 8-program registration, Calibration, Averaging, Hold modes, Auto-zero, and interface language selection	
Rating	Power supply voltage		100 to 240 VAC±10% 50/60 Hz	
	Current consumption		110 VA or lower	
	Overvoltage category		II	
	Pollution degree		2	
Ambient temperature			0 to 35°C 32 to 95°F, No condensation	
Relative humidity			35 to 85%, No condensation	
Weight			Approx. 2.4 kg	

1. Varies depending on the setting
2. Dedicated power supply for the monitor specified by KEYENCE.
3. Select either the Limits mode or the Binary mode.
4. Select either the Distance mode or the Profile mode. (Distance mode is only available with the LT-9501SO(5652) and LT-9001SO (5653).)

The rating of the NPN open-collector output is 30 mA (30 V or lower) maximum, and residual voltage is 0.5 V.
The rating of the Non-voltage input is ON voltage 1 V or lower, and OFF current 0.6 mA or lower.

Cable between the sensor head and controller (Extension cable)

Model	LT-C2	LT-C10
Cable length	6.56' 2 m	32.81' 10 m
Weight	Approx. 200 g	Approx. 700 g

* Up to 3 cables can be connected with a total maximum length of 65.6' 20 m.

Measuring Unit

Type		High-accuracy		Long-range	
Model		LT-9010M	LT-9010	LT-9030M	LT-9030
Measurement range		±0.01" ±0.3 mm		±0.04" ±1.0 mm	
Reference distance		0.20" 6 mm		1.18" 30 mm	
Light source		Visible red semiconductor laser			
	Wavelength	655 nm			
	Output	170 µW (IEC)/3.0 µW (FDA)			
	Laser Class	Class IIa (FDA CDRH 21CFR Part 1040.10), Class 1 (IEC60825-1)			
	Spot diameter	Approx. ø0.000079" ø2 µm		Approx. ø0.000276" ø7 µm	
Scan width/interval		0 to 0.0433" 0 to 1100 µm (6 steps)/ 0.000039 to 0.000394" 1 to 10 µm (4 steps)		0 to 0.0220" 0 to 560 µm (6 steps)/ 0.000039 to 0.000315" 1 to 8 µm (4 steps)	
Resolution [1.]		0.01 µm		0.000004" 0.1 µm	
Linearity [1.]		±0.5% of F.S.		±0.3% of F.S.	
Sampling cycle		640 µs to 356 ms (14 steps) [2.]		640 µs to 187 ms (14 steps) [3.]	
Temperature characteristics (20 to 30°C 68 to 86°F)		±0.5% of F.S.		±0.25% of F.S.	
Microscope function		Available	Unavailable	Available	Unavailable
	Field of view	0.05" × 0.04" 1.3 mm × 1.05 mm	–	0.10" × 0.08" 2.5 mm × 2.0 mm	–
	Illumination light source	Infrared LED (wavelength: 870 nm)	–	Infrared LED (wavelength: 870 nm)	–
Ambient light		Incandescent lamp/fluorescent lamp: 10000 lux max.			
Ambient temperature		0 to 35°C 32 to 95°F, No condensation			
Relative humidity		35 to 85%, No condensation			
Weight		Approx. 400 g		Approx. 500 g	

1. The value when the measurement target is an mirrored surface object that is measured in displacement mode, scan width/interval 0.004724" 120 µm/0.000079" 2 µm, and 8-times average
2. The value when the FINE mode is set to OFF.
3. Sampling cycle differs according to the manufacturing variation of individual measuring units.

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SAFETY INFORMATION
Please read the instruction manual carefully in order to safely operate any KEYENCE product.

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