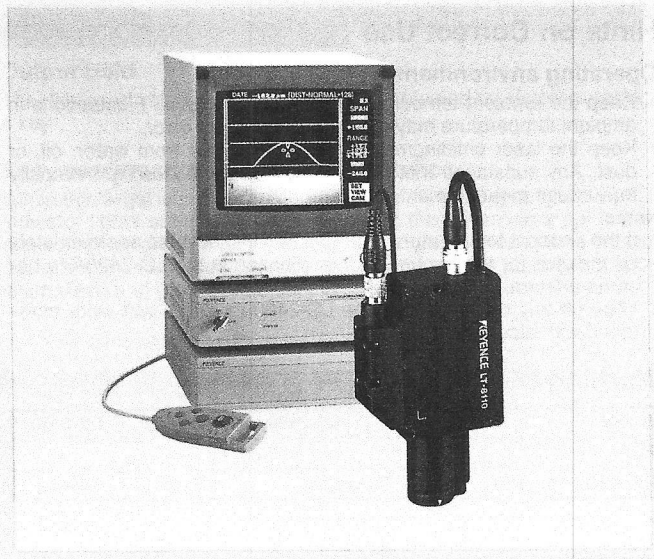


LT SERIES

Laser Confocal Displacement Meters

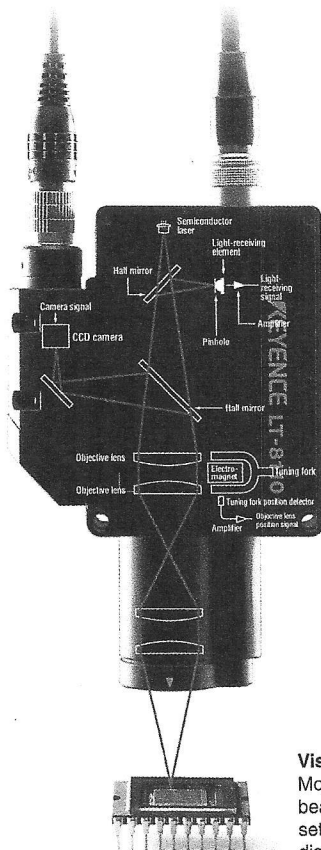
A revolutionary measurement principle based on the focal length of the laser



1

Features

The Active Confocal Principle



Visible beam
Model LT-8110 emits a visible beam 7 μm in diameter. Easy setup is ensured, even at a distance of 28 mm.

Keyence combines the confocal principle with a tuning fork to achieve non-contact, laser measurement.

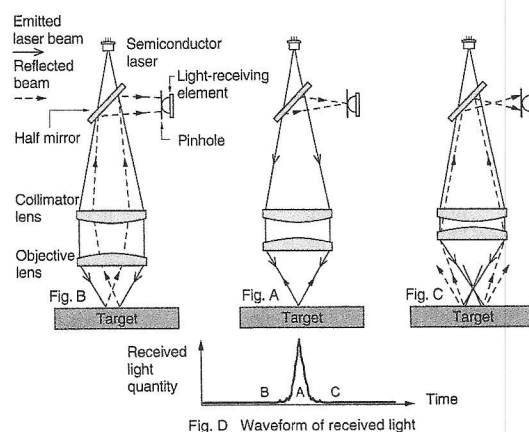
1. The laser beam emitted from the light source is focused on the target surface through an objective lens that vibrates rapidly up and down by means of a tuning fork.
2. The beam is reflected off the target surface and back into the sensor and is redirected by half-mirrors to converge on a pinhole over a light-receiving element.
3. A sensor determines the tuning fork's exact position when the laser beam focuses on the target surface, and the distance to the target surface is calculated. This measuring technique is called the active confocal principle.

Measuring Principle

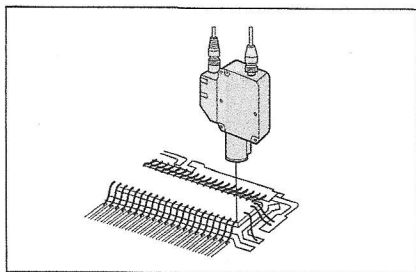
When the lens accurately focuses the laser beam on the target (Fig. A), the reflected beam converges precisely at the pinhole over the light-receiving element. At this lens position, the maximum quantity of light is directed to the light-receiving element. As the lens moves closer to or farther from the target, however, the reflected beam is diffused and does not converge at the pinhole over the light-receiving element (Figs. B and C). As a result, the quantity of light passing through the pinhole to the light-receiving element decreases greatly. Fig. D shows the relationship between the lens position and the quantity of light received.

A detection signal is generated only when the lens is precisely positioned for maximum light reception ("peak light quantity"). The LT then calculates the lens position and outputs a measured value.

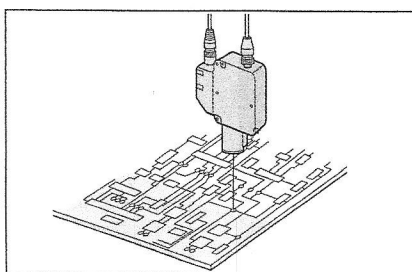
Typical optical path from a specular target
Pinhole diameter: 10 μm



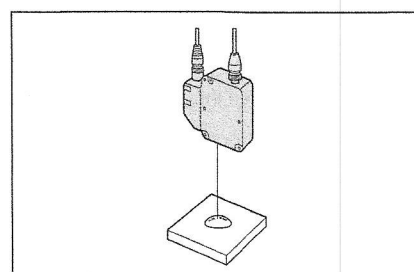
Applications



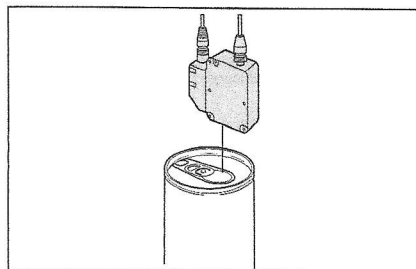
Confirming height of bonding wire



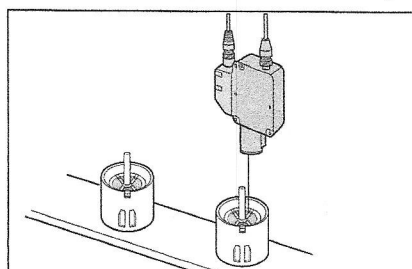
Measuring thickness of PC board coating



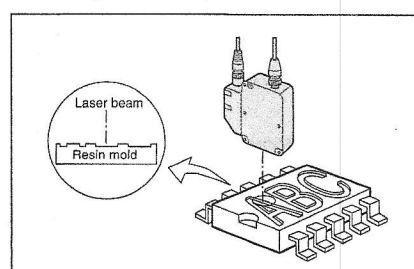
Checking thickness/profile of contact lens



Confirming scarring depth of pull-tab can



Confirming component height inside an electric motor



Measurement of depth of laser marker printing on resin molds

Specifications

Type		Standard				Long range			
Model	Sensor head	LT-8010				LT-8110			
	Camera unit	LT-V201							
	Controller	LT-8101	LT-8102	LT-8105	LT-8106	LT-8101	LT-8102	LT-8105	LT-8106
Measuring range		±0.3 mm				±1 mm			
Operating distance		5 mm				28 mm			
Light source		Semiconductor laser							
	Wavelength	670 nm							
	Max. power	20 μW							
	Pulse width	Continuous wave							
	Class	Class II							
	FDA	Class 1							
	IEC 825-1 11.1993	Class 1							
Camera light source		Infrared LED (wavelength: 830 nm)							
Spot diameter		Approx. 2 μm				Approx. 7 μm			
Resolution ¹ .	NORMAL Mode	0.3 μm		0.1 μm		0.4 μm		0.2 μm	
	THICK Mode	0.7 μm		0.2 μm		0.8 μm		0.4 μm	
Linearity		±0.5% of F.S.				±0.3% of F.S.			
Sampling frequency		1.4 kHz min.							
Response time		2.2 ms max. (number of averaging measurements: 2)							
Number of averaging measurements		2/16/128 (selectable)							
Terminal block I/O	Analog displacement output	±6 V (10 mV/μm, thickness measurement: 5 mV/μm) Output impedance: 140 Ω				±8 V (4 mV/μm, thickness measurement: 2 mV/μm) Output impedance: 140 Ω			
	LASER REMOTE input	Non-voltage input (contacts/solid state)							
	Print start output	NPN open-collector: 30 mA max. (30 V max.)							
9-pin connector I/O	Upper/lower limit output	NPN open-collector: 30 mA max. (30 V max.)							
	ALARM output								
	Low light quantity output								
	HOLD input	Non-voltage input (contacts/solid state)							
	Auto-zero set input								
	P-P reset input								
Interface	RS-232C	Displacement data output and control input							
Temperature characteristics (ambient temperature: 20 to 30°C)		±0.5% of F.S.				±0.25% of F.S.			
Power supply		LT-8101/LT-8105: 100/120 VAC ±10%, 50/60 Hz LT-8102/LT-8106: 220/240 VAC ±10%, 50/60 Hz							
Power consumption		40 VA max.							
Ambient light		Incandescent/fluorescent lamp: 2,000 lux max.							
Ambient temperature		0 to 35°C							
Relative humidity		35 to 85%							
Weight	Controller	3.3 kg							
	Sensor head	400 g				430 g			
	Camera unit					1.8 kg			

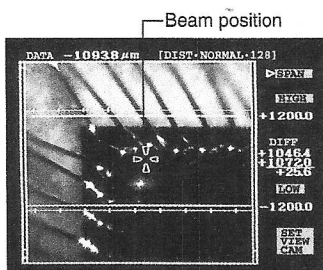
1. When measuring a mirror-surfaced target with the number of averaging measurements is set to 128.

Functions

Microscope function

High-speed autofocus lens ensures clear captured images.

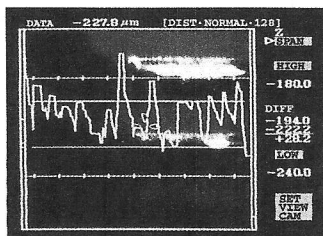
The sensor head incorporates a miniature CCD camera. During measurement, a 9-inch monitor can be used to display the target image at 200x (Model LT-8010) or 90x (Model LT-8110) magnification.



Waveform monitor

Real-time display of measured values.

Much like a storage oscilloscope, the LT displays the measured values on a monitor as a waveform — so you can easily observe measurement data in real time.



Stable measurement regardless of surface conditions

The confocal measurement system detects only peak beam reflection and ignores beam intensity, which is easily affected by surface conditions. As a result, the color, luster, and texture of the target surface have no effect on measurement.

Thickness measurement of transparent materials

A single sensor head mounted at the side of the target can be used to measure thickness. Unlike conventional displacement meters, the LT requires no additional sensor head on the opposite side. By detecting the peak beam reflection from the top and bottom surfaces of the target, it achieves accurate measurement with ease.

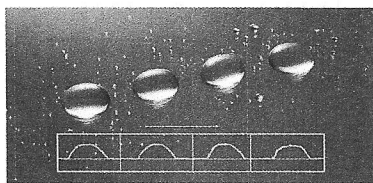
Resolution of 0.1 μm and linearity of ±0.5%*

The LT achieves these specifications with almost any target.

*Resolution of 0.2 μm and linearity of ±0.3% with Model LT-8110

Accurately measures wet surfaces

Unlike conventional sensors, the LT can measure the thickness of wet coatings, eliminating the need to dry the target. As shown in the photo, even dew drops can be measured accurately.



Smallest spot size and longest distance

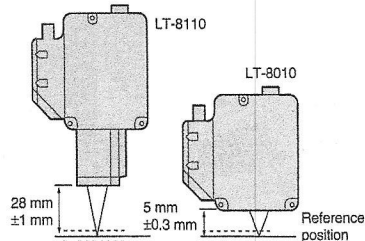
With a 2-μm or 7-μm diameter laser beam spot and a working range of 5 mm or 28 mm (depending on the model), the LT easily spans the distance required between sensor head and target in most applications.

Ideal for measuring mirror-surfaced targets

Conventional methods cannot reliably measure mirror-surfaced targets such as metallic objects and compact discs, because no light is reflected at some angles or because the light-receiving element is saturated by excessive specular reflections from the target. The active confocal method, which detects the peak quantity of received light, ensures stable measurement even when the optical axis is inclined up to ±17° (Model LT-8010) or ±7° (Model LT-8110) toward the target.

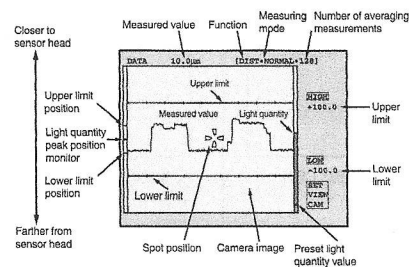
Two types of sensor heads available

Two models with different beam aperture angles offer the ideal characteristics for a variety of applications. The high-accuracy Model LT-8010 excels at tracing the profiles of tilted and curved surfaces, while the long-distance Model LT-8110 provides greater flexibility for mounting of the sensor head.

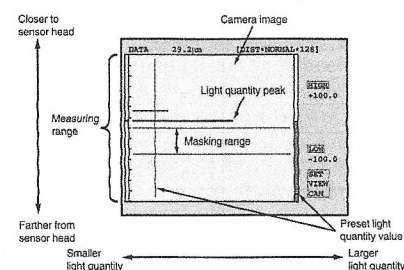


Screen Displays

Scrolling Screen



Light Quantity Distribution Screen

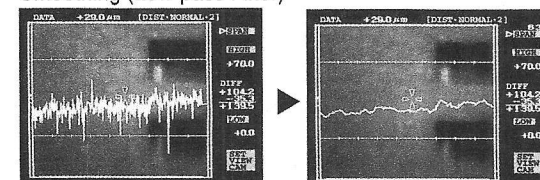


Processing of displayed data as waveforms

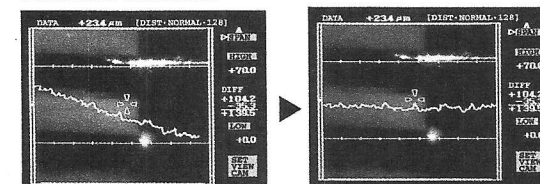
Smoothing and inclination correction

The LT's smoothing feature omits extraneous fluctuations in the measured data. In addition, an inclination correction feature corrects waveform inclinations to clearly reveal height differences.

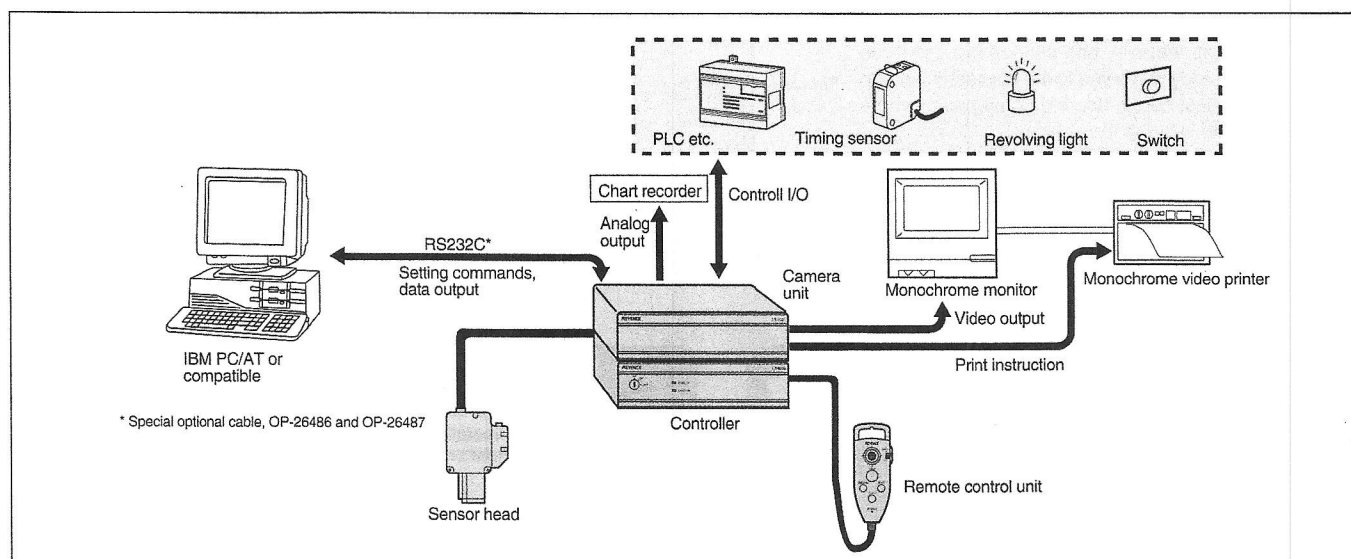
Smoothing (Low-pass Filter)



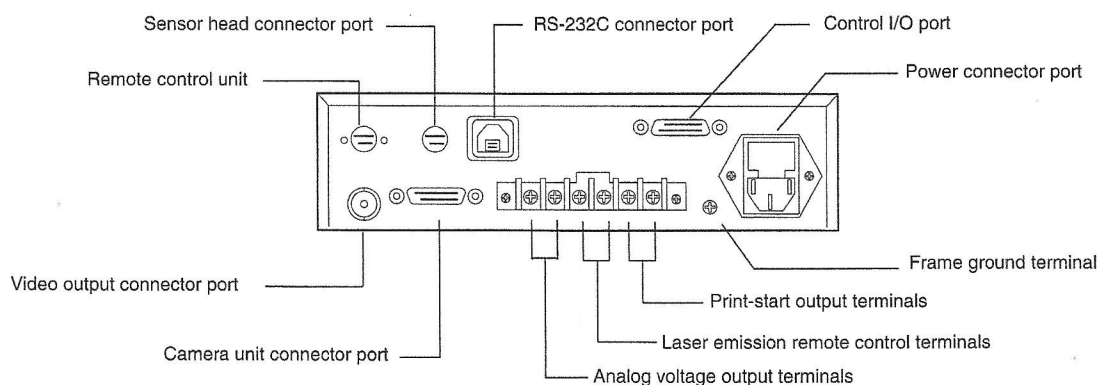
Inclination correction



System Configuration



Rear Panel of the Controller

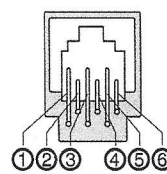


RS-232C Communication Parameters

Same as a modem which conforms to EIA RS-232C.

Duplex	Full
Synchronization	Start-stop
Data format	ASCII
Data length	8 bits
Stop bit length	1 bit
Parity check	None
Baud rate	9,600 bps

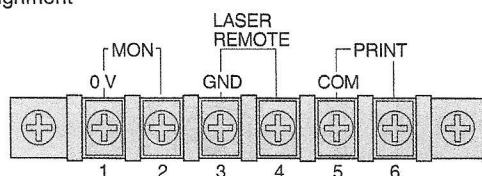
RS-232C Pin Assignment



Pin No.	Signal	Description	I/O
1	—	Unused	—
2	—	Unused	—
3	SD (TXD)	Inputs data from external device	Input
4	SG (GND)	Signal ground	—
5	RD (RXD)	Outputs data to external device.	Output
6	—	Unused	—

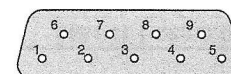
Control I/O (terminal)

Pin Assignment



Pin No.	I/O	Signal	Description
1	—	0 V	Ground for analog voltage
2	Output	Analog voltage output	Outputs analog voltage proportional to measured value.
3	—	GND	Ground for LASER REMOTE
4	Input	LASER REMOTE input	Emits laser when short-circuited with GND. Stops laser when opened.
5	—	COM	COMMON for print start
6	Output	Print start output	Outputs print start signal to video printer.

Control I/O (9-pin connector)



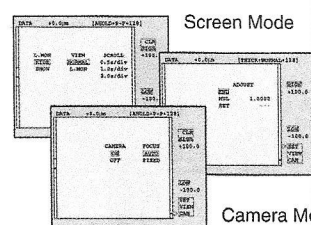
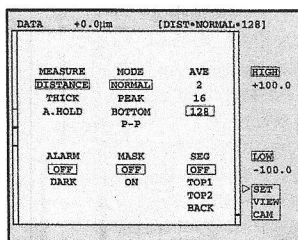
Pin No.	I/O	Signal	Description
1	Output	Low light quantity output	Outputs ON signal when light quantity is lower than lower limit of dark-cut level.
2	Output	HIGH output	Outputs ON signal when measured value is higher than HIGH setting.
3	—	COM (for output)	COMMON for output
4	Input	Auto-zero input	Sets auto-zero when short-circuited with GND.
5	—	GND (for input)	GND for input
6	Output	Alarm output	Outputs OFF signal when measurement is impossible due to abnormal head condition.
7	Output	LOW output	Outputs ON signal when measured value is lower than LOW setting.
8	Input	HOLD input	Sets HOLD when short-circuited with GND. Cancels HOLD when opened.
9	Input	RESET input	Resets settings of PEAK, BOTTOM, and P-P mode when short-circuited with GND.

Operations

Easy setup with simple menus

A simple menu structure — one main menu and three submenus — quickly leads you to the appropriate setup screen. For easiest setup, use the convenient remote control unit while viewing the screen.

Function
Setup



Thickness
Adjustment

Camera Mode

Using the Remote Control Unit

Cursor (PUSH ENTER) pad

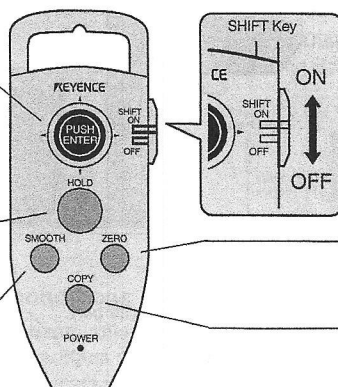
Pressing the upper, lower, right, or left area (▲, ▼, ►, or ◄) of this pad moves the cursor, ▷ mark, light quantity setting bar, or range-specifying bar. Pressing the center of the pad selects the desired item and determines its position.

HOLD button

Pressing this button with the NORMAL (scroll) screen displayed retains the current data and screen display.

SMOOTH (LPF) button

Pressing this button activates the smoothing feature.



SHIFT key

The slide-lock SHIFT key can be set for one-hand operation, which allows you to select various settings with only a few keys.

ZERO button

Pressing this button resets the desired displacement value to zero.

COPY button

Pressing this button prints the current screen data to the video printer.



Hints on Correct Use

Ensuring high accuracy

- Maintain a stable ambient temperature. Fluctuations in ambient temperature may cause measurement errors.
- Keep the laser-emitting/-receiving surfaces free from water, oil, and dust. Any substance adhering to these surfaces will refract or decrease light and may cause measurement errors.
- Clean the LT with a soft cloth moistened with isopropyl alcohol.

Controller/sensor head compatibility

The controller and sensor head are calibrated as a pair; therefore, use the controller only with a sensor head of the same serial number. Combining units of different serial numbers may result in poor performance.

Noise interference

- Isolate all connecting cables from high-tension lines and power lines to avoid malfunctions due to noise interference.
- Be sure to earth-ground the frame grounding terminal. For best performance, provide insulation between the mounting surface and sensor head.

Warning

The LT series conforms to FDA and IEC standards as follows:

Model		LT-8010	LT-8110
Class	FDA	Class II	
	IEC 825-1 11.1993	Class 1	

FDA Class II

