KEYENCE

High Precision Measurement General Catalog

Laser Displacement Sensors | 2D/3D Laser Displacement Sensors | Spectral-Interference Laser Displacement Meters | Laser Confocal Displacement Meters | Optical Micrometers | High-speed 2D Optical Micrometer

KEYENCE Measurement Technology Evolution

KEYENCE Corporation has continuously developed measurement technology for over 30 years. Each generation of measurement systems provided additional capabilities and significant improvements in inspection quality.

E³CMOS 2D Laser

Newly developed high sensitivity receiver enables highly stable and accurate 2D measurement.

Confocal System

Revolutionary system enables new measurement capabilities for transparent materials.

Surface Scanning Laser Confocal

Surface scanning provides a new level of stability and flexibility.

CCD Triangulation

CCD based receiver element enables stable measurement on any material.

LED+PSD System

Small sensor head and robust controller.

LASER+PSD System

Semiconductor laser enables small sensor head and high stability on shiny targets.

CCD Optical Micrometer

Innovative CCD based system enables high repeatability and high speed.

1980

History of development

Spectral Interferometry

Original principle provides nanometer level measurement in a small sensor head design.

High-speed 2D/3D Laser Scanner

64000 profiles per second allow precision inspection of even the most difficult parts.

Ultra High Speed Laser Displacement

Completely original design device achieves world's fastest sampling rate (392 kHz).

High-speed Optical Micrometer

Stable measurement thanks to 16000 samples per second, the fastest in its class.
The original optical design makes possible long-term stability and high maintainability, providing the ultimate in on-site usability.

High-speed 2D Optical Micrometer

Inline imaging system measures 2 dimensions in with sub-micron precision.

2015
and Beyond

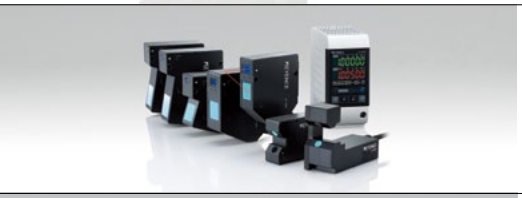
INDEX

Laser Triangulation	LK-G5000 Series	Ultra High-Speed/High-Accuracy Laser Displacement Sensor
	LK-G3000 Series	High-Speed, High-Accuracy CCD Laser Displacement Sensor
	LJ-V7000 Series	High-Speed 2D/3D Laser Scanner
	LJ-G Series	High-Accuracy 2D Laser Displacement Sensor
Spectral Interferometer	SI-F1000 Series	Micro-Head Spectral-Interference Laser Displacement Meter
	SI-F80R Series	Spectral-Interference Wafer Thickness Meter
Confocal Laser	LT-9000 Series	Surface Scanning Laser Confocal Displacement Meter
Optical Micrometer	LS-9000 Series	High-Speed Optical Micrometer
	LS-7000 Series	CCD Optical Micrometer
	TM-3000 Series	High-Speed 2D Optical Micrometer

- Fastest in the world 392 kHz sampling
- Best linearity in its Class 0.02% of F.S.
- Connect up to 12 sensor heads/network capable

▶ P.10

LK-G5000 Series



- Sampling rate of 50 kHz
- Linearity of 0.05% of F.S.
- Repeatability down to 0.01 µm
- Can measure diffuse, specular, transparent or translucent targets
- Wide beam spot models are available

▶ P.18

LK-G3000 Series

- An emphasis on inline measurement
- The world's fastest at 64,000 profiles/sec.
- Blue laser optical system

▶ P.24

LJ-V7000 Series

- Linearity of 0.1% of F.S.
- High-speed sampling
- Simultaneous measurement/judgment of up to 8 features
- Stable measurement for all targets

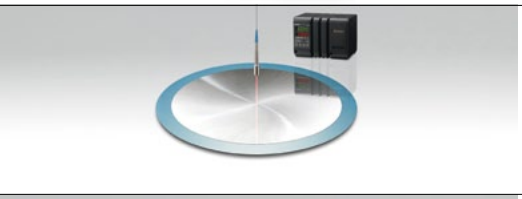
▶ P.32

LJ-G Series

- Resolution of 0.001 µm
- Micro-head size of ø2 mm ø0.000079"
- Spectral interference method

▶ P.38

SI-F1000 Series



- Resolution of 0.001 µm
- Sampling speed of 5 kHz
- Working distance 80 mm 3.15"

▶ P.44

SI-F80R Series

- Precise 2 µm 0.000079" diameter beam spot
- 0.01 µm resolution

▶ P.46

LT-9000 Series

- High-speed 16000 samples/second
- Smallest detectable object 10 µm 0.000394"
- Tilt correction and transmitter/receiver position measurement
- Equipped with a wide variety of measurement functions

▶ P.50

LS-9000 Series

- High repeatability 0.06 µm
- High speed 2400 samples/second
- Maintenance-free design

▶ P.58

LS-7000 Series

- Multi-point 2D measurement
- Tilt correction for inline measurement
- High-speed sampling of 5.5 ms

▶ P.64

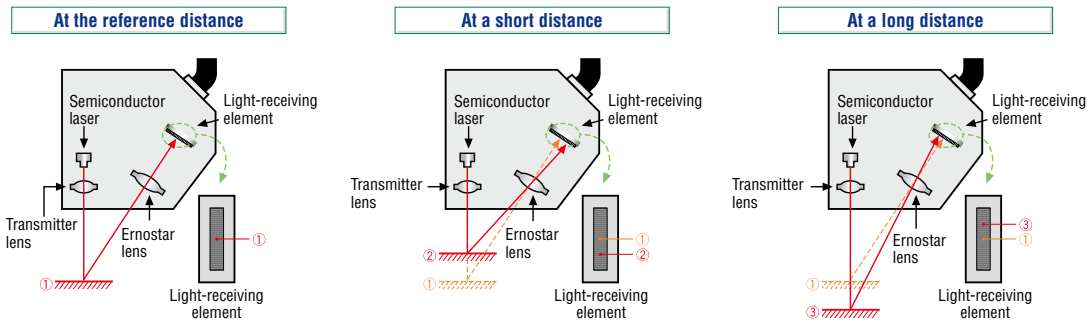
TM-3000 Series

PRINCIPLE

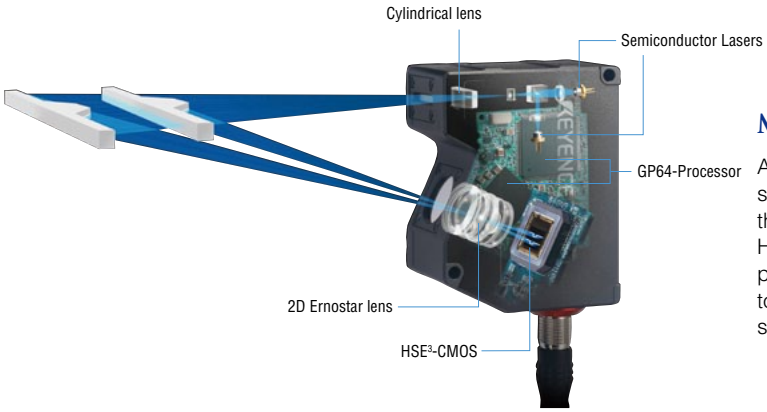
LK-G5000 Series Measurement Principle (Triangulation type)

HIGH-SPEED WIDE RANGE

The semiconductor laser emits the laser beam to the target as shown below. The light reflected off the target is focused by the ernostar lens and forms an image on the light-receiving element. The position of the beam spot on the receiving element varies with the distance to the target. This variation is evaluated and converted into a measurement of target position.



LJ-V7000 Series Measurement Principle



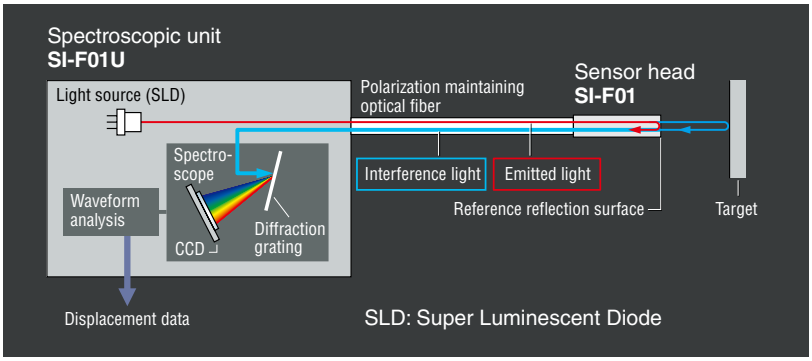
Measurement principle

A laser beam that has been expanded into a band shape is diffusely reflected from the surface of the target. This reflected light is formed on the HSE^3-CMOS and by detecting changes in the position and shape of the reflection, it is possible to measure the position of various points along the surface of the target.

SI Series Measurement Principles (Spectral-Interference type)

micro-head ultra high accuracy

Actual size



SLD

Part of the broad wavelength light emitted from the SLD is reflected by the reference reflector mounted in the sensor head, while the part that passes the reference surface is mirror-reflected on the target and returns into the head.

Optical interference method

The two reflected light beams interfere with each other. The intensity of the light with a specific wavelength is determined according to the distance between the reference surface and the target. The relative maximum interference is reached when the determined distance is an integral multiple of the wavelength.

Spectroscopic analysis

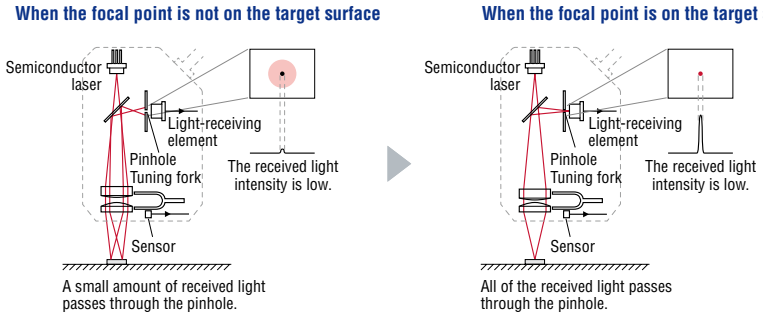
Splitting the returned light into different wavelengths with a diffraction grating produces an optical intensity distribution for a specific wavelength band. The distance to the target is obtained by carrying out waveform analysis on this distribution.

LT-9000 Series Measurement Principle (Confocal type)

CLEAR TARGET THICKNESS | HIGH-ACCURACY

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.



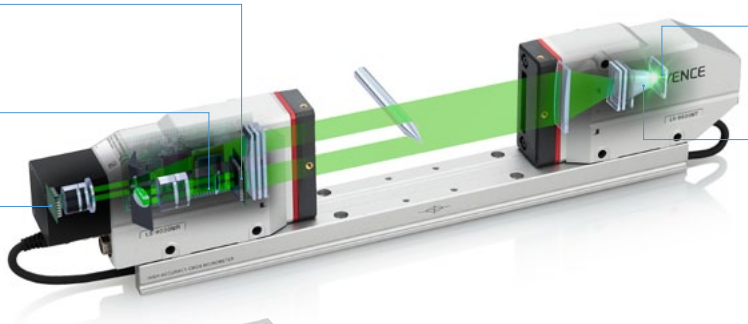
LS-9000 Series Measurement Principle (Thrubeam type)

HIGH-ACCURACY | LONG LIFE

High-speed exposure CMOS
Proprietary designed measurement CMOS features an integrated amplifier to maximize performance and speed.

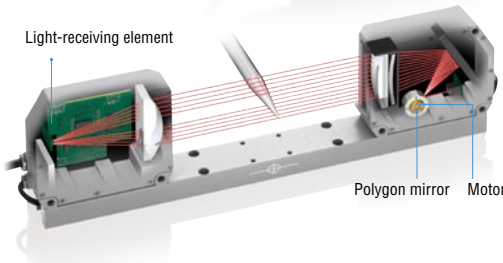
Target Position CMOS
The CMOS measures the position between the transmitter and receiver

Monitor CMOS
The Monitor CMOS tracks workpiece inclination to automatically correct for tilt errors.



High-intensity Green-LED
High-intensity Green LED lasts longer than traditional LED light sources while providing high intensity and evenly-distributed lighting.

High performance condenser
Lens unit efficiently focuses LED light.



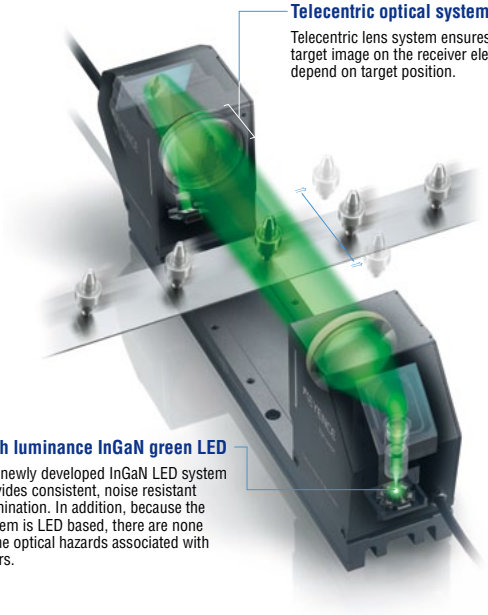
Improvement over the laser-scanning method

The green LED light is distributed as a uniform, parallel beam and is applied to a target. The edges between the bright and dark areas on the CCD detected and used to calculate a measurement value. The conventional scanning method as shown in the figure on the left uses a high speed motor, which limits the sensor's durability and stability. The solid state LS-9000 Series solves this problem and ensures excellent durability.

TM Series Measurement Principles (2D Thrubeam type)

MICRO-HEAD | ULTRA HIGH ACCURACY

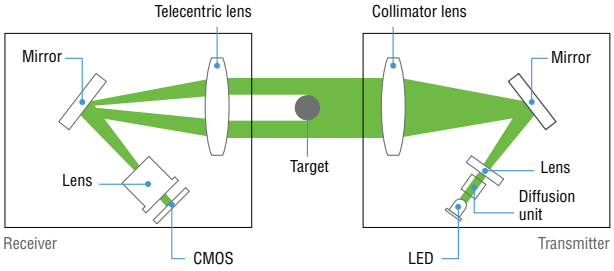
Telecentric optical system
Telecentric lens system ensures that the target image on the receiver element does not depend on target position.



High luminance InGaN green LED
The newly developed InGaN LED system provides consistent, noise resistant illumination. In addition, because the system is LED based, there are none of the optical hazards associated with lasers.

Principle of measurement

A collimated green LED beam is used to generate a shadow on the high precision CMOS receiver. This shadow is then analyzed to produce two dimensional measurements of distances, angle, etc.

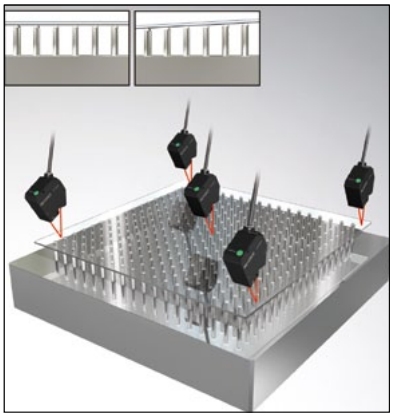


SUCCESSFUL APPLICATIONS

Thickness

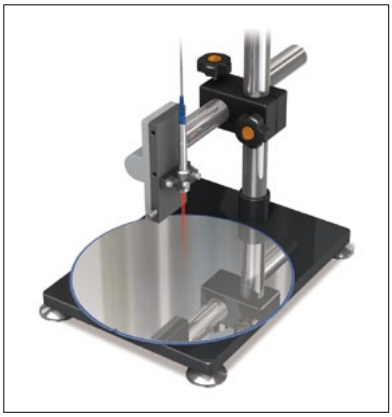
Substrate thickness measurement of solar cells

LK-G5000 Series ➡ P.10



Measurements of glass sheet thickness, curvature, and parallelism

LK-G5000 Series ➡ P.10



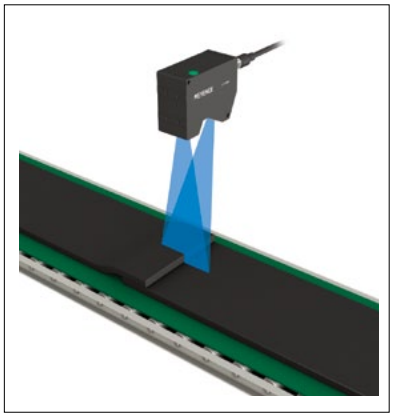
Thickness measurement of a wafer

SI-F80R Series ➡ P.44

Height and Step Height

HDD arm assembly position

LK-G5000 Series ➡ P.10



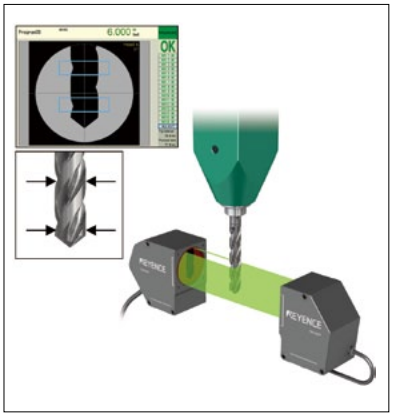
Height and width measurement of rubber overlap

LJ-V7000 Series ➡ P.24

Height control of dispenser

LK-G3000 Series ➡ P.18

Width and Outside Diameter



Drill bit outer diameter measurement

TM-3000 Series ➡ P.64

Roller outer diameter measurement

LS-9000 Series ➡ P.50

Film width measurement

LS-7000 Series ➡ P.58

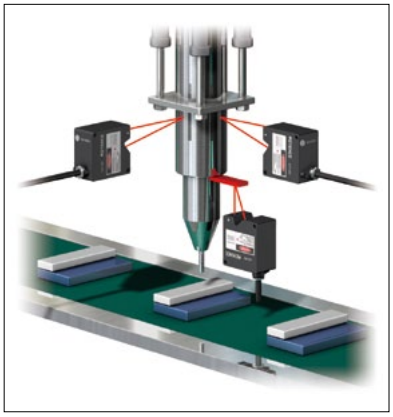
Eccentricity and Vibration

Disk rotor warpage measurement

LK-G5000 Series ➡ P.10

Tire runout measurement

LK-G5000 Series ➡ P.10



Ultrasonic welder monitoring

LK-G5000 Series ➡ P.10

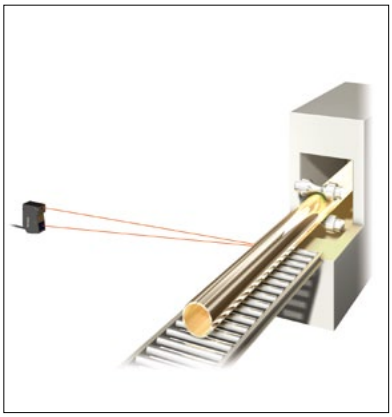
Position Measurement

Precision stage positioning

SI Series ➡ P.38

Feedback control of a welder

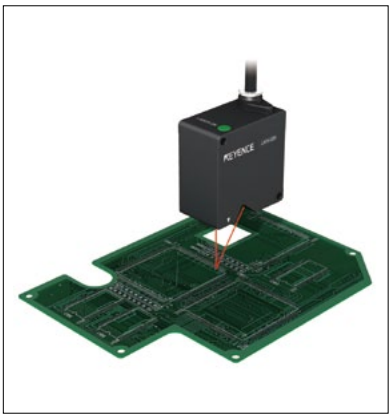
LJ-V7000 Series ➡ P.24



Position tracking of high temperature steel pipe

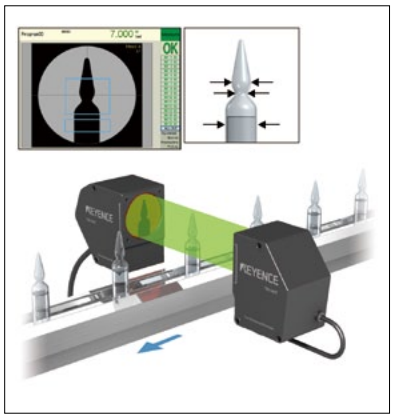
LK-G3000 Series ➡ P.18

Profile and Contour



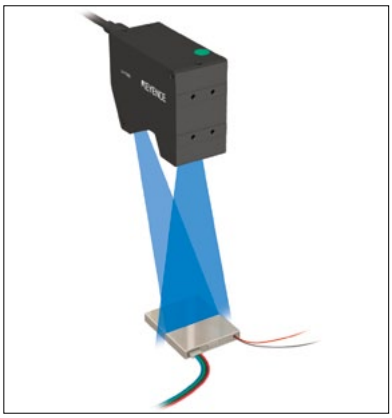
Warpage measurement of a circuit board

LK-G5000 Series ➡ P.10



Ampoule shape inspection

TM-3000 Series ➡ P.64



Thermal expansion of a lithium-ion battery.

LJ-V7000 Series ➡ P.24

Ultra High-Speed/High-Accuracy Laser Displacement Sensor

LK-G5000 Series

CE

Features

- Fastest in the World 392 kHz
- Best linearity in its Class 0.02% of F.S.
- Connect up to 12 sensor heads/network capable

Best specifications in class

Highest Repeatability in its Class

0.005 µm

The need to improve product quality makes high performance critical. The LK-G5000 Series provides the highest repeatability in its class and is highly capable in any application.

Highest Accuracy in its Class

±0.02 %

High-linearity enhances the LK-G5000's capabilities. By taking advantage of new technology, the series provides high performance with the high accuracy that is increasingly required.

Fastest in the World

392 kHz

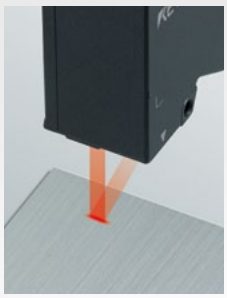
The world's fastest sampling rate not only captures displacement of moving or rotating targets, but also increases stability in all manner of applications.

Selectable variations

Wide spot type (2.5x conventional models)

Stable measurement on coarse targets

Surfaces that may appear flat, once magnified will often contain minute projections and depressions. This microscopic surface roughness can often cause measurement errors with conventional focused spot sensors. By using a sensor head with a wide beam spot, the effect of the uneven surface is averaged and stable measurements of even coarse targets are possible.

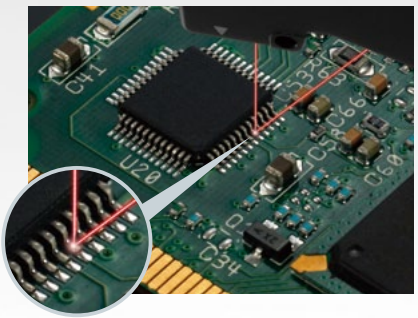


2x wider than conventional model

Focused spot type (ø25 µm ø0.000984")

Optimal for fine or profile measurements

The smallest spot diameter in its class of ø25 µm ø0.000984" (LK-H022) can measure any target, from fine components to profile measurements, with the highest level of accuracy in the industry.

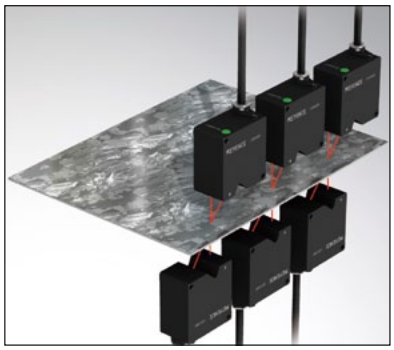


Specular reflection type

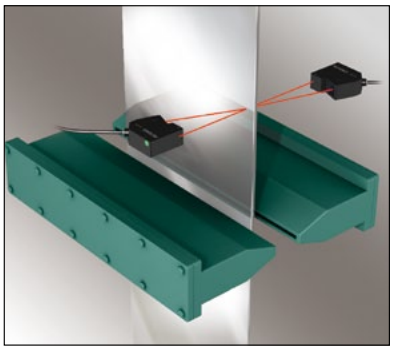
Transparent/mirror surface measurement

The LK-G5000 Series includes a group of heads specifically designed for use on highly reflective targets such as glass or other mirror surfaces. These heads are available with wide or focused beam spots and are ideally suited for high accuracy measurements on such surfaces.

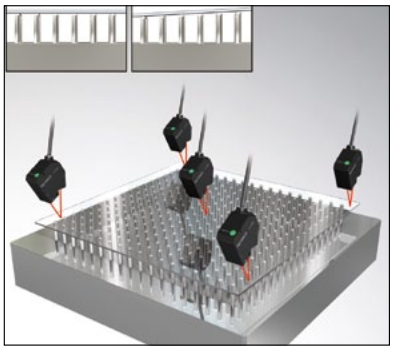
Applications



Active layer measurement of solar modules



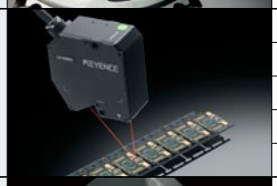
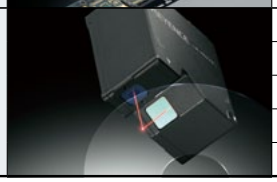
Position control of an air knife



Measurements of glass board thickness, warpage, and parallelism

Lineup

Sensor Head

Measurement type		Reference Distance & Measurement Range	Repeatability	Model
WIDE SPOT TYPE		8±0.5 mm 0.32" ± 0.02"	0.005 µm	**LK-H008W**
		20±3 mm 0.79" ± 0.12"	0.02 µm	**LK-H027**
		50±10 mm 1.97" ± 0.39"	0.025 µm	**LK-H057**
		80±18 mm 3.15" ± 0.71"	0.1 µm 0.000004"	**LK-H087**
		150±40 mm 5.91" ± 1.57"	0.25 µm 0.000010"	**LK-H157**
FOCUSED SPOT TYPE		8±0.5 mm 0.32" ± 0.02"	0.005 µm	**LK-H008**
		20±3 mm 0.79" ± 0.12"	0.02 µm	**LK-H022**
		50±10 mm 1.97" ± 0.39"	0.025 µm	**LK-H052**
		80±18 mm 3.15" ± 0.71"	0.1 µm 0.000004"	**LK-H082**
		150±40 mm 5.91" ± 1.57"	0.25 µm 0.000010"	**LK-H152**
SPECULAR REFLECTION TYPE		8±0.5 mm 0.32" ± 0.02"	0.005 µm	**LK-H008(W)**
		16.1±2.8 mm 0.63" ± 0.11"	0.02 µm	**LK-H027K**
		46.3±5.2 mm 1.82" ± 0.20"	0.025 µm	**LK-H057K**
		76.7 -17.6 mm/+14.5 mm 3.02" -0.69"/+0.57"	0.1 µm 0.000004"	**LK-H087 & LK-F3**
		147.5 -39.5 mm /+24.4 mm 5.81" -1.56"/+0.96"	0.25 µm 0.000010"	**LK-H157 & LK-F2**

Main controller

All-in-one type
LK-G5001(P)V

Separate display type
LK-G5001(P)

Additional head unit
LK-HA100

CC-Link unit
LK-CC100

DeviceNet™ unit
LK-DN100

Display

Touch panel display
LK-HD1001

Compact display
LK-HD500

Configuration Software

LK-Navigator2
LK-H2

Cable

Sensor head-to-controller cable
(0.7, 2, 5, 10, 20, 30 m)
(2.30', 6.56', 16.4', 32.81',65.62', 98.43')
CB-Axx

Extension cable between the head and controller cable (5, 10 m)
(16.4', 32.81')
CB-AxxE

Controller-to-display connection cable
0.33 m 1.08' : **OP-84427**
3 m 9.84': **OP-51655**
10 m 32.81': **OP-51656**

I/O Cable and Connector
OP-51657

Ethernet cable
OP-66843

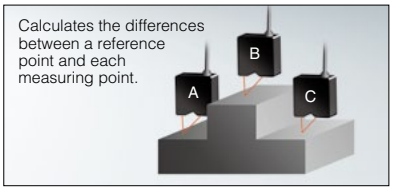
Neutral density filter

For **LK-H08x**
LK-F3
For **LK-H15x**
LK-F2

Convenient calculation functions

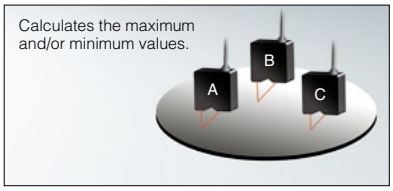
Instantly calculates values based on measurements obtained by more than one head, enabling the user to easily set complicated calculations inside the controller that were conventionally done with PLCs or PCs.

Standard Step Measurement



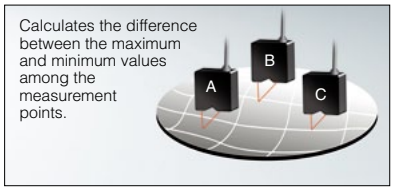
Measured value1=B-A Measured value2=B-C
Measured value3=A-C…

Maximum/Minimum Measurement



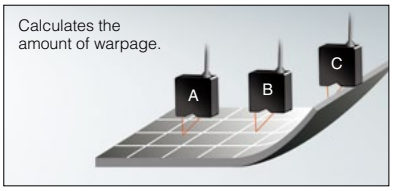
Measured value1=MAX (A,B,C...)
Measured value2=MIN (A,B,C...)

Flatness Measurement



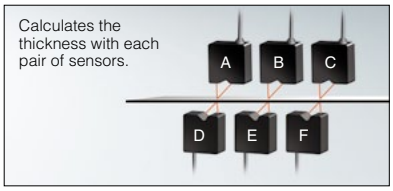
Measured value1=MAX (A,B,C...)–MIN (A,B,C...)...

Warpage Measurement



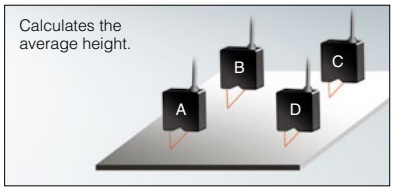
Measured value1=B-(A+C)/2…

Multi-Point Thickness Measurement



Measured value1=X+ (A+D) Measured value2=Y+ (B+E)
Measured value3=Z+ (C+F)...

Average Height Measurement



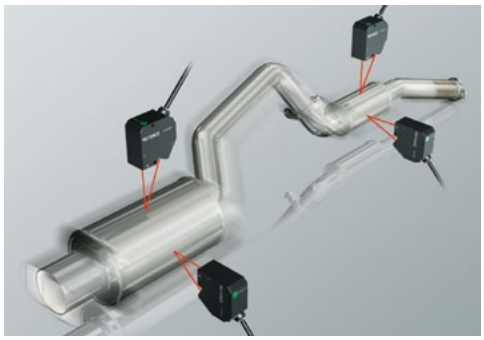
Measured value1=Ave (A,B,C,D,...)

Measurement of Velocity (m/s), Acceleration (m/s²)

The LK-G5000 Series is equipped with a function to directly measure the speed (m/s) and acceleration (m/s²) of targets. Just select the type of measurement: displacement, speed, or acceleration. Using the differential processing circuit inside the controller, it is possible to directly output or evaluate measurements that were previously calculated externally. The LK-G5000 Series is suitable for lightweight, easily deformed, and high-temperature targets which are difficult to measure with contact accelerometers.

Example of measurement of stage movement

Displacement　Speed　Acceleration



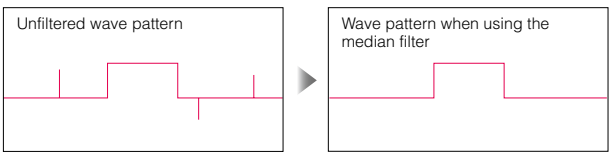
Vibration test of high-temperature-muffler

Data filter functions made easy

4 types of easy to use data processing filters are incorporated directly in the controller. The filters are user selectable for ease of use.

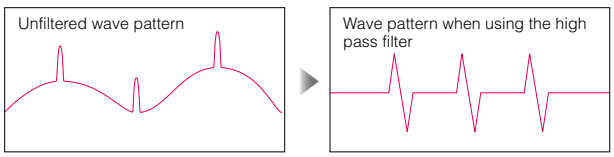
Median filter

Removes any intermittent noise in the output.



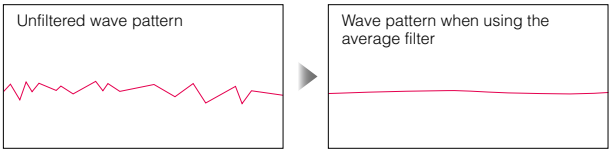
High pass filter

Captures sudden changes and removes low frequency variations.



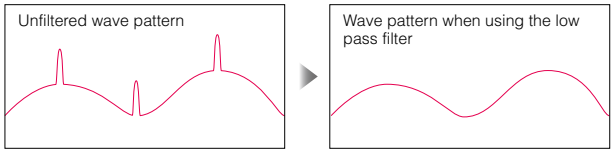
Moving average filter

Averages the measured values to reduce high the overall noise level in the measurement.



Low pass filter

Captures moderate changes while removing high frequency noise.



Specifications

Controller

Main unit/head expansion unit

Model	Single unit type	LK-G5001V	LK-G5001PV	LK-HA100
	Separate type	LK-G5001/LK-HD500	LK-G5001P/LK-HD500	
Designation		Main controller		Head expansion unit
Sensor head compatibility		Compatible		
No. of connectable sensor heads		2		1
Display (LK-HD500)	Minimum display unit	0.001 µm		N/A
	Display range	±999.999 µm to ±9999.99 mm (7 settings selectable)		
	Display cycle	Approx. 10 times/sec.		
Display interface	Display port	Either the display unit (LK-HD500) or dedicated touch panel (LK-HD1001) can be connected		N/A
	LED indicator	LASER ON		POWER ON, STABILITY, BRIGHT, DARK
Terminal block	Analog voltage output	±10 V output, Output impedance: 100 Ω		
	Analog current output	4 to 20 mA, Maximum load resistance: 350 Ω		
	No. of analog outputs	2		1
	TIMING1 input[*1]	Non-voltage input	Voltage input	N/A
	RESET1 input[*1]	Non-voltage input	Voltage input	
	Auto-zero1 input[*1]			
	Laser control input[*2]			
	Laser remote input	Non-voltage input		
	Alarm output	NPN open-collector output	PNP open-collector output	
	Pass/Fail Output			
Expansion connector	TIMING input	Non-voltage input	Voltage input	N/A
	RESET input	Non-voltage input	Voltage input	
	Auto-zero input			
	Program switch input			
	Binary selection input			
	Alarm output	NPN open-collector output	PNP open-collector output	
	Comparator output			
	Binary output			
RS-232C interface		Baud rate: 9600 to 115200 bps Data length: 8 bits Stop bit length: 1 bit Parity: None/even/odd		N/A
USB interface		USB 2.0 Hi-Speed compliant[*3]		
Ethernet interface[*4]		100Base-TX/10Base-T		
Head expansion unit connector		Up to 10 head expansion units can be connected to one main controller		
Expansion unit connector		Either of the CC-Link unit (LK-CC100) or DeviceNet™ unit (LK-DN100) can be connected		N/A
Power supply	Power supply voltage	24 VDC±10%		24 VDC±10% (Supplied from the controller)
	Maximum current consumption	0.6 A or less with 1 head/3.5 A or less with 12 heads		
Environment resistance	Ambient temperature	When one or less head expansion unit is connected: 0 to 50°C 32 to 122°F When two or more head expansion units are connected: 0 to 40°C 32 to 104°F		
	Relative humidity	35 to 85%RH (No condensation)		
Weight		Approx. 600 g		Approx. 300 g

*1 This input is applied to all of the synchronized OUT.
*2 When the laser class 3B sensor head is connected, a key-operated switch must be used for the input to this terminal. The laser is emitted only when the key-operated switch is set to the ON position. (Select a key which can be removed only when it is set to the OFF position.) When the laser class 2/3R sensor head is connected, the laser turns on when this terminal is opened and turns off when it is short-circuited.
*3 When a PC supporting USB 1.1 or USB 2.0 full speed is connected, the data refresh cycle and other operations may slow down.
*4 Use the Ethernet interface only for direct connections with a PC or for local network connections with a PC or LK-G5000 Series units.

- NPN open-collector output rating: 50 mA max. (40 V max.), Residual voltage: 0.5 V max.
- PNP open-collector output rating: 50 mA max. (30 V max.), Residual voltage: 0.5 V max.
- Non-voltage input rating: ON voltage: 1 V max., OFF current: 0.6 mA max.
- Voltage input rating: Maximum input rating: 26.4 V, ON voltage: 10.2 V, OFF current: 0.6 mA
- Part of the input/output circuit of the LK-G5000 Series is internally common. Be careful that no potential difference is generated between the internally common terminals due to the potential difference between the cables/external devices. For details, refer to "Precautions on wiring" in the User's Manual.

LK-H2 (LK-Navigator2) Operating environment

CPU	Pentium III 1 GHz or higher (1.7 GHz or higher recommended)
Supported OS	Windows 10[*1] Windows 7 (SP1 or later)[*2] Windows Vista (SP2 or later)[*3] Windows XP (SP3 or later)[*4]
Memory capacity	256 MB or more (1 GB or more recommended)
Display resolution	1024 x 768 pixels, 24-bit full color or better
Available hard disk space	1 GB or more
Interface	The PC must be equipped with one of these interfaces: • USB: 2.0 Hi-Speed (USB 1.1 compatible full speed)[*5] • LAN: 100BASE-TX, 10BASE-T[*6] • RS-232C (serial port)

*1 Home, Pro, and Enterprise editions are supported.
*2 Home Premium, Professional, and Ultimate editions are supported.
*3 Ultimate, Business, Home Premium, and Home Basic editions are supported.
*4 Professional and Home editions are supported.
*5 Connection through a USB hub is not included in the guarantee.
*6 Connection to LAN and connection via a router is not included in the guarantee.

Sensor heads

Coarse target measurement (wide spot type)

Model			LK-H008W	LK-H025	LK-H027	LK-H055	LK-H057	LK-H085	LK-H087	LK-H155	LK-H157
Mounting mode			Specular reflection	Diffuse reflection	Diffuse reflection	Diffuse reflection	Diffuse reflection	Diffuse reflection	Diffuse reflection	Diffuse reflection	Diffuse reflection
Reference distance			8 mm 0.32"	20 mm 0.79"	20 mm 0.79"	50 mm 1.97"	50 mm 1.97"	80 mm 3.15"	80 mm 3.15"	150 mm 5.91"	150 mm 5.91"
Measurement range*1			±0.5 mm ±0.02"	±3 mm ±0.12"	±3 mm ±0.12"	±10 mm ±0.39"	±10 mm ±0.39"	±18 mm ±0.71"	±18 mm ±0.71"	±40 mm ±1.57"	±40 mm ±1.57"
Light source	Wavelength		Red semiconductor laser								
			655 nm								
	Laser class	IEC 60825-1	Class 1	Class 3R	Class 2	Class 3R	Class 2	Class 3R	Class 2	Class 3R	Class 2
		FDA (CDRH) Part 1040.10	Class II	Class IIIa	Class II	Class IIIa	Class II	Class IIIa	Class II	Class IIIa	Class II
	Output		0.3 mW	4.8 mW	0.95 mW	4.8 mW	0.95 mW	4.8 mW	0.95 mW	4.8 mW	0.95 mW
Spot diameter (at reference distance)			20 µm × 550 µm	25 µm × 1400 µm		50 µm × 2000 µm		70 µm × 2500 µm		120 µm × 4200 µm	
Linearity*2			±0.05% of F.S. (F.S.=1 mm 0.04")	±0.02%of F.S. (F.S.= 6 mm 0.24")		±0.02% of F.S. (F.S.= 20 mm 0.79")		±0.02% of F.S. (F.S.= 36 mm 1.42")		±0.02% of F.S. (F.S.= 80 mm 3.15")	
Repeatability*3			0.005 µm (0.001 µm)	0.02 µm (0.01 µm)		0.025 µm		0.1 µm		0.25 µm	
Sampling cycle			2.55/5/10/20/50/100/200/500/1000 µs (9 steps selectable)								
Temperature fluctuation			0.02% of F.S./°C (F.S.=1 mm 0.04")	0.01% of F.S./°C (F.S.= 6 mm 0.24")		0.01% of F.S./°C (F.S.= 20 mm 0.79")		0.01% of F.S./°C (F.S.= 36 mm 1.42")		0.01% of F.S./°C (F.S.= 80 mm 3.15")	
Environment resistance	Enclosure rating		IP67								
	Ambient light		Incandescent lamp or fluorescent lamp: 10000 lux max.								Incandescent lamp or fluorescent lamp: 5000 lux max.
	Ambient temperature		0 to +50°C 32 to 122°F *4	0 to +50°C 32 to 122°F				0 to +50°C 32 to 122°F*4			
	Relative humidity		35 to 85%RH (No condensation)								
	Vibration resistance		10 to 55 Hz, 1.5 mm 0.06" double amplitude in X, Y, and Z directions, 2 hours respectively								
Material			Aluminum die-cast								
Weight			Approx. 240 g	Approx. 230 g		Approx. 260 g		Approx. 280 g		Approx. 300 g	

*1 Measurement range when the sampling cycle is 20 µs or more. *2 This value is obtained when the KEYENCE standard target (White diffuse workpiece or workpiece with a metal mirror surface only for the LK-H008W) is measured in the normal measurement mode. *3 This value is obtained when the KEYENCE standard target (White diffuse workpiece or workpiece with a metal mirror surface only for the LK-H008W) is measured at the reference distance with the number of averaging measurements set to 16384. The value in parentheses is a typical example of a measurement with the number of averaging measurements set to 65536 and the sampling cycle to 200 µs. *4 When the ambient temperature rises to 40°C 104°F or more, mount this on a metal plate before use.

Fine target measurement (focused spot type)

Model			LK-H008	LK-H020	LK-H022	LK-H050	LK-H052	LK-H080	LK-H082	LK-H150	LK-H152
Mounting mode			Specular reflection	Diffuse reflection	Diffuse reflection	Diffuse reflection	Diffuse reflection	Diffuse reflection	Diffuse reflection	Diffuse reflection	Diffuse reflection
Reference distance			8 mm 0.32"	20 mm 0.79"	20 mm 0.79"	50 mm 1.97"	50 mm 1.97"	80 mm 3.15"	80 mm 3.15"	150 mm 5.91"	150 mm 5.91"
Measurement range*1			±0.5 mm ±0.02"	±3 mm ±0.12"	±3 mm ±0.12"	±10 mm ±0.39"	±10 mm ±0.39"	±18 mm ±0.71"	±18 mm ±0.71"	±40 mm ±1.57"	±40 mm ±1.57"
Light source	Wavelength		Red semiconductor laser								
			655 nm								
	Laser class	IEC 60825-1	Class 1	Class 3R	Class 2	Class 3R	Class 2	Class 3R	Class 2	Class 3R	Class 2
		FDA (CDRH) Part 1040.10	Class II	Class IIIa	Class II	Class IIIa	Class II	Class IIIa	Class II	Class IIIa	Class II
	Output		0.3 mW	4.8 mW	0.95 mW	4.8 mW	0.95 mW	4.8 mW	0.95 mW	4.8 mW	0.95 mW
Spot diameter (at reference distance)			ø20 µm	ø25 µm		ø50 µm		ø70 µm		ø120 µm	
Linearity*2			±0.05% of F.S. (F.S.=1 mm 0.04")	±0.02% of F.S. (F.S.= 6 mm 0.24")		±0.02% of F.S. (F.S.= 20 mm 0.79")		±0.02% of F.S. (F.S.= 36 mm 1.42")		±0.02% of F.S. (F.S.= 80 mm 3.15")	
Repeatability*3			0.005 µm (0.001 µm)	0.02 µm (0.01 µm)		0.025 µm		0.1 µm		0.25 µm	
Sampling cycle			2.55/5/10/20/50/100/200/500/1000 µs (9 steps selectable)								
Temperature fluctuation			0.02% of F.S./°C (F.S.=1 mm 0.04")	0.01% of F.S./°C (F.S.= 6 mm 0.24")		0.01% of F.S./°C (F.S.= 20 mm 0.79")		0.01% of F.S./°C (F.S.= 36 mm 1.42")		0.01% of F.S./°C (F.S.= 80 mm 3.15")	
Environment resistance	Enclosure rating		IP67								
	Ambient light		Incandescent lamp or fluorescent lamp: 10000 lux max.								Incandescent lamp or fluorescent lamp: 5000 lux max.
	Ambient temperature		0 to +50°C 32 to 122°F *4	0 to +50°C 32 to 122°F				0 to +50°C 32 to 122°F*4			
	Relative humidity		35 to 85%RH (No condensation)								
	Vibration resistance		10 to 55 Hz, 1.5 mm 0.06" double amplitude in X, Y, and Z directions, 2 hours respectively								
Material			Aluminum die-cast								
Weight			Approx. 240 g	Approx. 230 g		Approx. 260 g		Approx. 280 g		Approx. 300 g	

*1 Measurement range when the sampling cycle is 20 µs or more. *2 This value is obtained when the KEYENCE standard target (White diffuse workpiece or workpiece with a metal mirror surface only for the LK-H008) is measured in the normal measurement mode. *3 This value is obtained when the KEYENCE standard target (White diffuse workpiece or workpiece with a metal mirror surface only for the LK-H008) is measured at the reference distance with the number of averaging measurements set to 16384. The value in parentheses is a typical example of a measurement with the number of averaging measurements set to 65536 and the sampling cycle to 200 µs. *4 When the ambient temperature rises to 40°C 104°F or more, mount this on a metal plate before use.

Transparent/mirror target measurement (specular reflection type)

Model			LK-H008	LK-H008W	LK-H022K	LK-H027K	LK-H052K	LK-H057K	LK-H082	LK-H087	LK-H152	LK-H157
Mounting mode			Specular reflection	Specular reflection	Specular reflection	Specular reflection	Specular reflection	Specular reflection	Specular reflection*4		Specular reflection*4	
Reference distance			8 mm 0.32"	8 mm 0.32"	16.1 mm 0.63"	16.1 mm 0.63"	46.3 mm 1.82"	46.3 mm 1.82"	76.7 mm 3.02"		147.5 mm 5.81"	
Measurement range*1			±0.5 mm ±0.02"	±0.5 mm ±0.02"	±2.8 mm ±0.11"	±2.8 mm ±0.11"	±5.2 mm ±0.20"	±5.2 mm ±0.20"	–17.6 mm to +14.5 mm -0.69" to +0.57"		–39.5 mm to +24.4 mm -1.56" to +0.96"	
Light source	Wavelength		Red semiconductor laser									
			655 nm									
	Laser class	IEC 60825-1	Class 1		Class 2							
		FDA (CDRH) Part 1040.10	Class II									
	Output		0.3 mW		0.95 mW							
Spot diameter (at reference distance)			ø20µm	20 µm×550 µm	ø25 µm	25 µm×1400 µm	ø50 µm	50 µm×2000 µm	ø70 µm	70 µm × 2500 µm	ø120 µm	120 µm × 4200 µm
Linearity*2			±0.05% of F.S. (F.S.= 1 mm 0.04")		±0.02% of F.S. (F.S.= 6 mm 0.24")		±0.02% of F.S. (F.S.= 20 mm 0.79")		±0.02% of F.S. (F.S.= 36 mm 1.42")		±0.02% of F.S. (F.S.= 80 mm 3.15")	
Repeatability*3			0.005 µm (0.001 µm)		0.02 µm (0.01 µm)		0.025 µm		0.1 µm		0.25 µm	
Sampling cycle			2.55/5/10/20/50/100/200/500/1000 µs (9 steps selectable)									
Temperature fluctuation			0.02% of F.S./°C (F.S.=1 mm 0.04")		0.01% of F.S./°C (F.S.= 6 mm 0.24")		0.01% of F.S. (F.S.= 20 mm 0.79")		0.01% of F.S. (F.S.= 36 mm 1.42")*6		0.01% of F.S. (F.S.= 80 mm 3.15")*6	
Environment resistance	Enclosure rating		IP67									
	Ambient light		Incandescent lamp or fluorescent lamp: 10000 lux max.								Incandescent lamp or fluorescent lamp: 5000 lux max.	
	Ambient temperature		0 to +50°C 32 to 122°F*5		0 to +50°C 32 to 122°F				0 to +50°C 32 to 122°F*5			
	Relative humidity		35 to 85% RH (No condensation)									
	Vibration resistance		10 to 55 Hz, 1.5 mm 0.06" double amplitude in X, Y, and Z directions, 2 hours respectively									
Material			Aluminum die-cast									
Weight			Approx. 240 g		Approx. 230 g		Approx. 260 g		Approx. 280 g		Approx. 300 g	

*1 Measurement range when the sampling cycle is 20 µs or more. *2 This value is obtained when the KEYENCE standard target (White diffuse workpiece or workpiece with a metal mirror surface only for the LK-H008/LK-H008W) is measured in the normal measurement mode. *3 This value is obtained when the KEYENCE standard target (White diffuse workpiece or workpiece with a metal mirror surface only for the LK-H008/LK-H008W) is measured at the reference distance with the number of averaging measurements set to 16384. The value in parentheses is a typical example of a measurement with the number of averaging measurements set to 65536 and the sampling cycle to 200 µs. *4 Use one of the following dark filters when measuring a transparent or mirror surface object: LK-H082/LK-H087: LK-F3, LK-H152/LK-H157: LK-F2 *5 When the ambient temperature rises to 40°C 104°F or more, mount this on a metal plate before use.
*6 Value measured at the event of diffuse reflection installation. Please contact us for the case of regular reflection installation.

LK-CC100 (CC-Link unit)

Model		LK-CC100
Designation		CC-Link communication unit dedicated to LK-G5000 Series
Network connection	Supported CC-Link*1 version	Ver. 1.10 (Extended cyclic setting: Single) Ver. 2.00 (Extended cyclic setting: Double or more)*2
	Master unit	CLPA-certified master unit (CC-Link Ver. 2.00/Ver. 1.10)
	No. of occupied stations	1 to 4
	Communication speed	156 kbps, 625 kbps, 2.5 Mbps, 5 Mbps, 10 Mbps
	Connection cable	Dedicated CC-Link cable supporting Ver. 1.10 (Shielded 3-core twisted-pair cable: OP-79426, OP-79427)
	Maximum total cable extension length	156 kbps: 1200 m 3937', 625 kbps: 900 m 2952.7', 2.5 Mbps: 400 m 1312.3', 5 Mbps: 160 m 524.93', 10 Mbps: 100 m 328.08'
	Station type	Remote device station
Environment resistance	Ambient temperature	When one or less head expansion unit is connected: 0 to 50°C 32 to 122°F. When two or more head expansion units are connected: 0 to 40°C 32 to 104°F.
	Relative humidity	35 to 85 %RH (No condensation)
Rated voltage		24 VDC±10 % (supplied from controller)
Current consumption		200 mA max.
Weight		Approx. 300 g

*1 CC-Link is a registered trademark of Mitsubishi Electric Corporation.
*2 The LK-G5000 Series supports the "extended cyclic transmission" and "station-to-station cable length relaxation" of CC-Link Ver. 2.00.

LK-DN100 (DeviceNet™ unit)

Model		LK-DN100
Designation		DeviceNet™ communication unit dedicated to LK-G5000 Series
Network connection	Communication protocol	DeviceNet™*1 compliant
	Master unit	ODVA-certified master unit
	Transmission speed	500 kbps, 250 kbps, 125 kbps
	Device type	Generic
	Transmission medium	Dedicated 5 cables (2 signal cables, 2 power supply cables, 1 shielding cable)
	Maximum trunk line cable length	Thick cable: 500 m 1640.4' (at transmission speed of 125 kbps)/250 m 820.21' (at 250 kbps)/ 125 m 410.11' (at 500 kbps) Thin cable: 100 m 328.08' (at all transmission speed settings)
	Communication type	I/O communication (Poll) Explicit message communication
	Power supply	11 VDC to 25 VDC
	Current consumption	10 mA max. (when network power supply 24 V is applied)
Environment resistance	Ambient temperature	When one or less head expansion unit is connected: 0 to 50°C 32 to 122°F. When two or more head expansion units are connected: 0 to 40°C 32 to 104°F.
	Relative humidity	35 to 85%RH (No condensation)
Rated voltage		24 VDC ±10% (supplied from controller)
Current consumption		200 mA max.
Weight		Approx. 300 g

*1 DeviceNet™ is a registered trademark of ODVA (Open DeviceNet Vendor Association).

LK-G5000 Series Touch Panel Display

Model		LK-HD1001
Name		LK-G5000 Series Touch Panel Display
Display panel	Display elements	TFT color LCD
	Display color	32,768 colors
	Pixels (W x H pixels)	640 × 480
	Display area (W x H mm)	170.9 × 128.2 6.73' x 5.04'
	Service life (normal temperature and humidity)	Approx. 50,000 hours
Backlight lamp	Type	White LED
	Service life	Approx. 50,000 hours
Touch switch	Number of switches	40 x 30 per 1 image
	Mode	Matrix resistance membrane mode
	Operating force	0.98N or less
	Service life	More than one million times
Communication function		Available only with the LK-G5000 Series
Structure		Panel built-in type, IP65f equivalent dust-proof, waterjet-proof on only front panel
Operating environment		Limit dust and corrosive gas
Ambient temperature		0 to 50°C 32 to 122°F
Ambient humidity		35 to 85%RH (no condensation) When the ambient temperature is higher than 40°C 104°F, limit the absolute humidity to 85%RH at 40°C 104°F.
Storage temperature		-10 to +60°C 14 to 140°F (no freezing)
Storage humidity		35 to 85%RH (no condensation) When the ambient temperature is higher than 40°C 104°F, limit the absolute humidity to 85%RH at 40°C 104°F.
Vibration resistance		10 to 57 Hz, 0.3 mm 0.01" double amplitude/57 to 500 Hz, 2G, 3 hours in each direction (X, Y, and Z)
Weight		Approx. 1150 g
Rated voltage		24 VDC ±10%
Current consumption		1 A or less

Head-to-controller cable

Model	CB-A07	CB-A2	CB-A5	CB-A10	CB-A20	CB-A30
Cable length	0.7 m 2.30'	2 m 6.56'	5 m 16.40'	10 m 32.81'	20 m 65.62'	30 m 98.43'
Weight	Approx. 100 g	Approx. 200 g	Approx. 400 g	Approx. 750 g	Approx. 1400 g	Approx. 2000 g

Extension cable between the head and controller cable

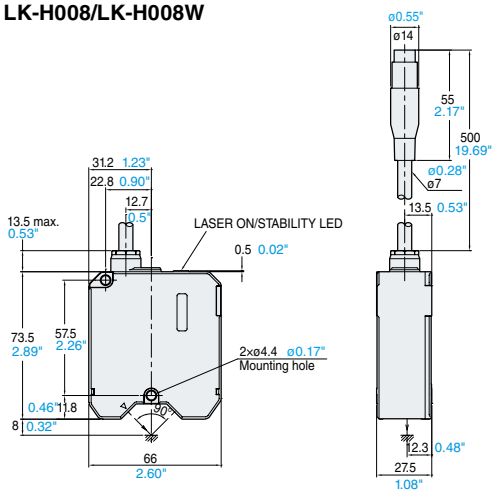
Model	CB-A5E	CB-A10E
Cable length	5 m 16.40'	10 m 32.81'
Weight	Approx. 400 g	Approx. 750 g

Dimensions

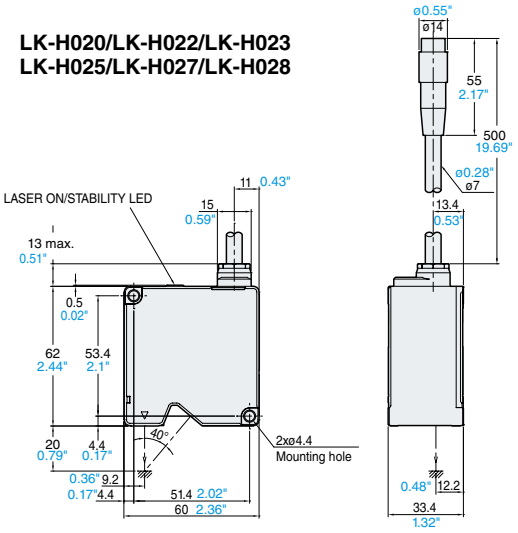
Unit: mm inch

Head

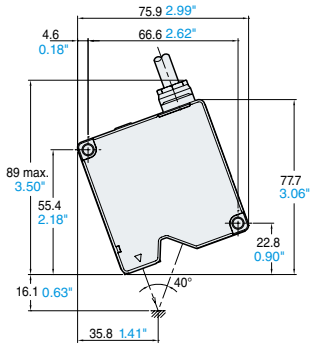
LK-H008/LK-H008W



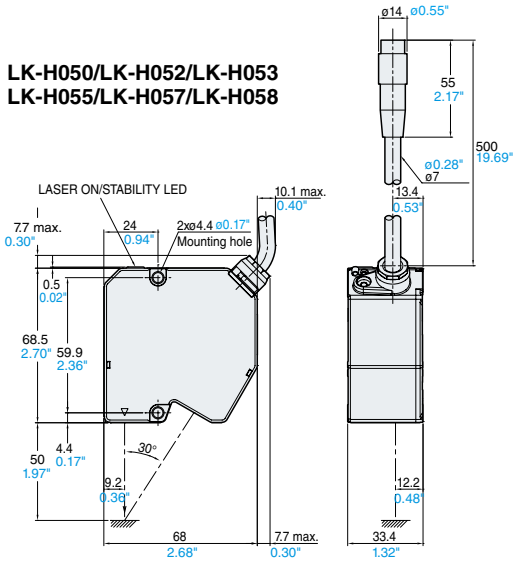
LK-H020/LK-H022/LK-H023
LK-H025/LK-H027/LK-H028



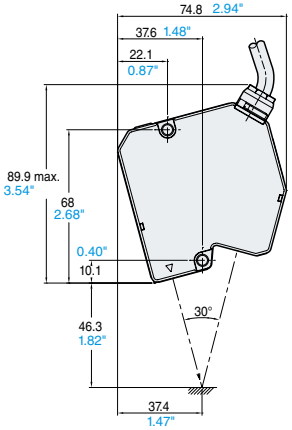
LK-H022K/LK-H027K



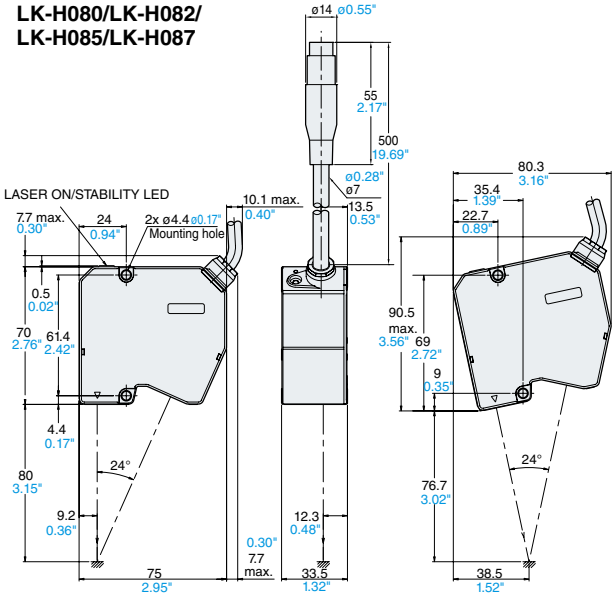
LK-H050/LK-H052/LK-H053
LK-H055/LK-H057/LK-H058



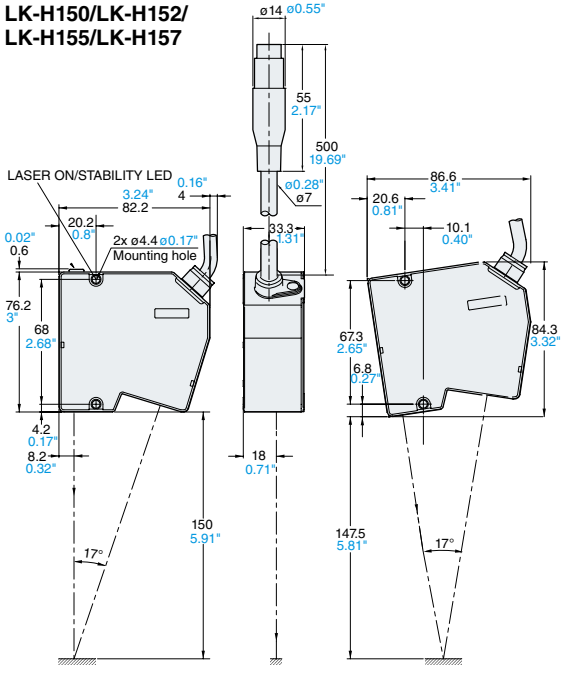
LK-H052K/LK-H057K



LK-H080/LK-H082/
LK-H085/LK-H087



LK-H150/LK-H152/
LK-H155/LK-H157

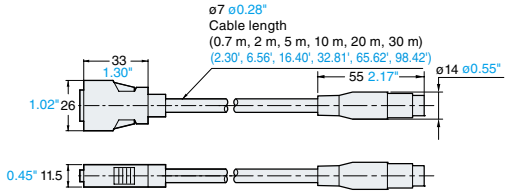


Unit: mm inch

Head-to-controller cable

[Cable between the head and controller]

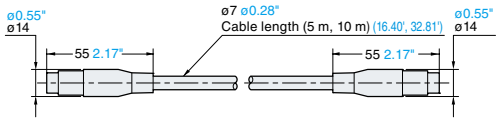
CB-A07/CB-A2/CB-A5/CB-A10/CB-A20/CB-A30



Extension cable

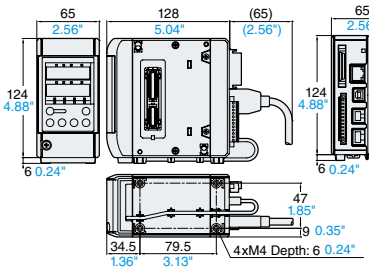
[To extend the distance between head and controller]

CB-A5E/CB-A10E

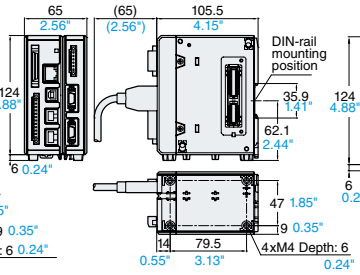


Controller

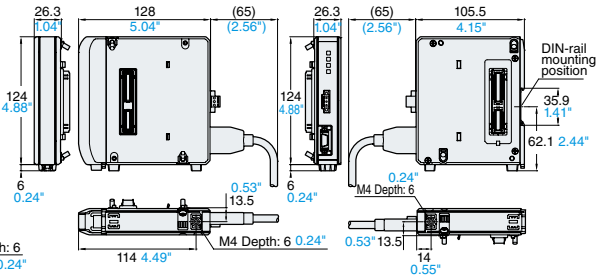
LK-G5001(P)V



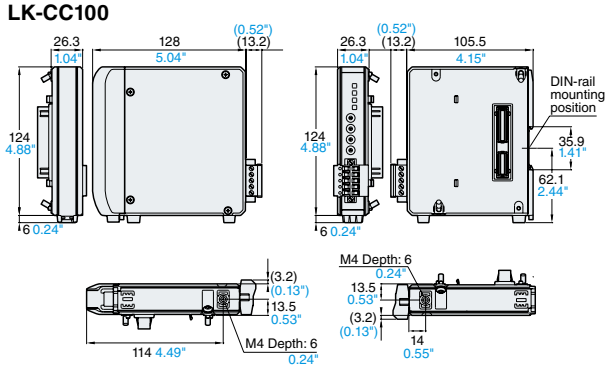
LK-G5001(P)



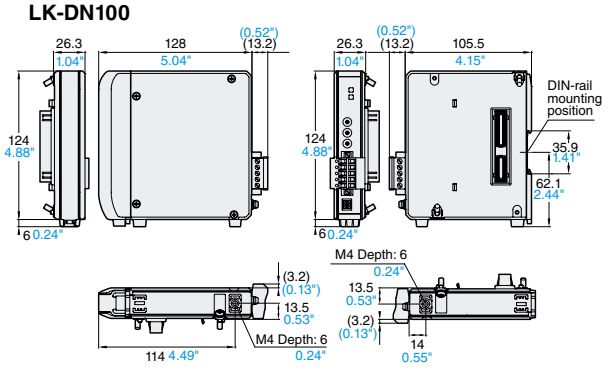
LK-HA100



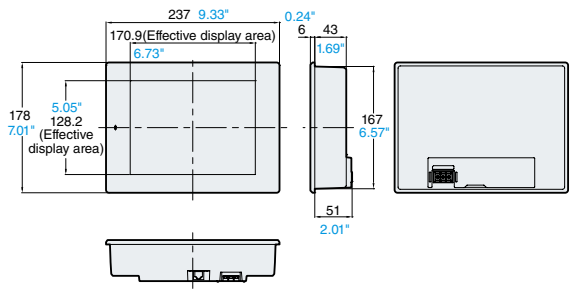
LK-CC100



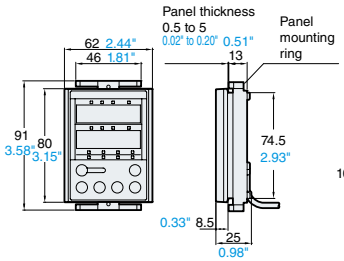
LK-DN100



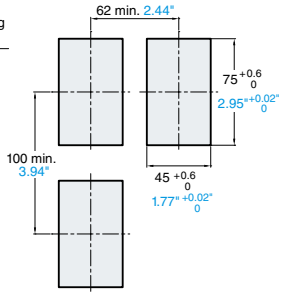
LK-HD1001 Touch Panel Display



LK-HD500



PANEL CUTOUT DIMENSIONS

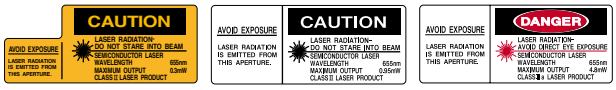


Warning

The LK-G Series conforms to the following FDA and IEC standards:

Model	LK-H008/ LK-H008W	LK-H022/H022K/H027/H027K/H052/H052K/ LK-H057/H057K/H082/H087/H152/H157	LK-H020/H025/H050/H055/ LK-H080/H085/H150/H155
FDA (CDRH) Part 1040.10	Class II Laser Product	Class II Laser Product	Class IIIa Laser Product
IEC60825-1	Class 1 Laser Product	Class 2 Laser Product	Class 3R Laser Product

FDA



High-Speed, High-Accuracy CCD Laser Displacement Sensor

LK-G3000 Series

CE

Features

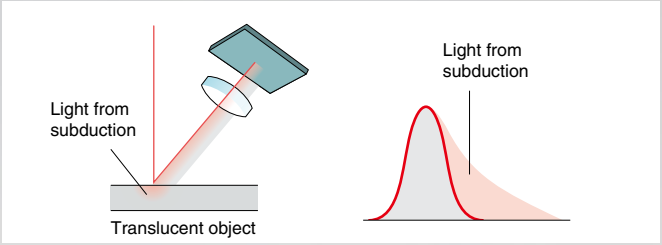
- Sampling rate of 50 kHz
- Linearity of ±0.05% of F.S.
- Repeatability down to 0.01 µm
- Can measure diffuse, specular, transparent, or translucent targets
- Wide beam spot models are available

Algorithms that support various applications

RPD* ALGORITHM

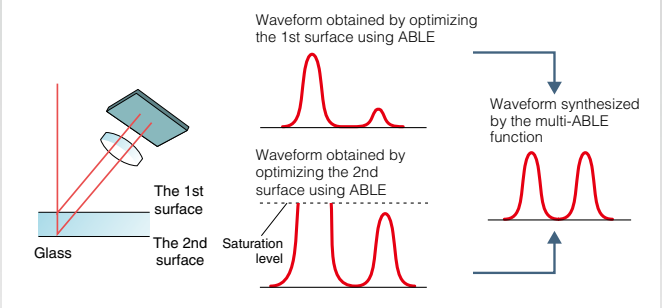
Laser light tends to react differently with translucent targets, generating diffused reflections, which result in gradual broadening of the received light waveform. The RPD algorithm cancels the influence of the broadened waveform and detects the true peak (Real Peak).

* RPD=Real Peak Detect



MULTI-ABLE CONTROL

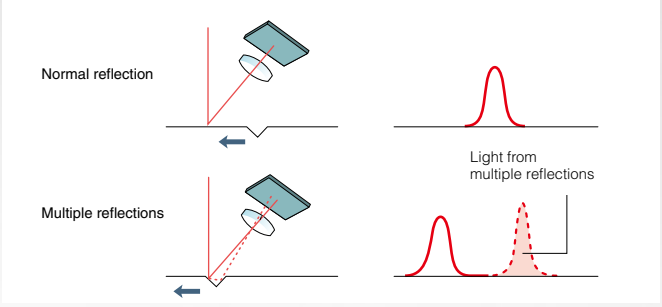
The reflected light at each layer is sensed to optimize the intensity of laser light. Highly accurate thickness measurements are enabled by optimizing the optical setting for each layer.



MRC* ALGORITHM

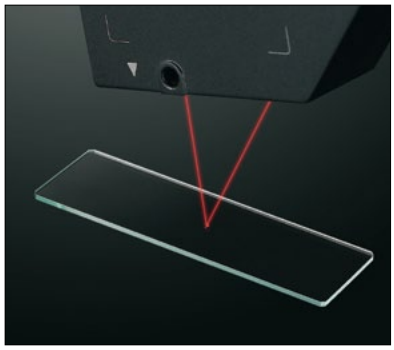
When two or more peaks are generated by multiple reflections, the algorithm compares the waveforms to the most recent received-light waveform and determines the one with the most similarity to the correct waveform.

* MRC=Multiple Reflection Cancel

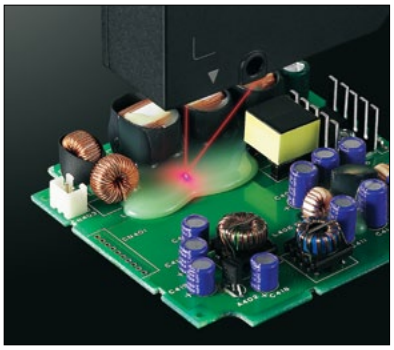


Applications

Detecting the runout of a HDD



Thickness measurement of a glass plate



Height measurement of PCB resin

Lineup

Type		Model	Laser Class	Measuring range	Repeatability	Spot diameter
Transmitter/ receiver separate type	Small spot	**LK-G08**	Class 1 (IEC)	8 mm 0.31" Measuring range 8 ±0.8 mm 0.31" ±0.03"	0.01 µm	ø20 µm ø0.0008"
Compact/ Super Precision	Small spot	**LK-G10**	Class II (FDA) Class 1 (IEC)	10 mm 0.39" Measuring range 10 ±1 mm 0.39" ±0.04"	0.01 µm	ø20 µm ø0.0008"
	Wide beam	**LK-G15**				20 × 500 µm 0.0008" × 0.0197"
High Accuracy	Small spot	**LK-G32**	Class II (FDA) Class 2 (IEC)	25 mm 0.98" 30 mm 1.18" 35 mm 1.38" Measuring range 30 ±5 mm 1.18" ±0.2"	0.05 µm	ø30 µm ø0.0012"
	Wide beam	**LK-G37**				30 × 850 µm 0.0012" × 0.0335"
Multi-purpose	Small spot	**LK-G82**		65 mm 2.56" 80 mm 3.15" 95 mm 3.74" Measuring range 80 ±15 mm 3.15" ±0.59"	0.2 µm 0.000008"	ø70 µm ø0.0028"
	Wide beam	**LK-G87**				70 × 1100 µm 0.0028" × 0.0433"
Long Distance	Small spot	**LK-G152**		110 mm 4.33" 150 mm 5.91" 190 mm 7.48" Measuring range 150 ±40 mm 5.91" ±1.57"	0.5 µm 0.000020"	ø120 µm ø0.0047"
	Wide beam	**LK-G157**				120 × 1700 µm 0.0047" × 0.0669"
High-speed Long Distance	Small spot	**LK-G402**		300 mm 11.81" 400 mm 15.75" 500 mm 19.69" Measuring range 400 ±100 mm 15.75" ±3.94"	2 µm 0.000079"	ø290 µm ø0.0114"
	Wide beam	**LK-G407**				290 × 8300 µm 0.0114" × 0.3268"
Ultra Long Distance	Small spot	**LK-G502**		250 mm 9.84" 500 mm 19.69" 1000 mm 39.37" Measuring range 500 -250/+500 mm 19.69" -9.84"/+19.69"	2 µm 0.000079"	ø300 µm ø0.0118"
	Wide beam	**LK-G507**				300 × 9500 µm 0.0118" × 0.3740"

Specifications

Sensor heads

Model		LK-G08	LK-G10/G15	LK-G32/G37		LK-G82/G87		LK-G152/G157	
Mounting mode		–	–	Diffused reflection	Specular reflection	Diffuse reflection	Specular reflection	Diffuse reflection	Specular reflection
Reference distance		8 mm 0.31"	10 mm 0.39"	30 mm 1.18"	23.5 mm 0.93"	80 mm 3.15"	75.2 mm 2.96"	150 mm 5.91"	147.5 mm 5.81"
Measuring range *1		±0.8 mm ±0.03"	±1 mm ±0.04"	±5 mm ±0.2"	±4.5 mm ±0.18"	±15 mm ±0.59"	±14 mm ±0.55"	±40 mm ±1.57"	±39 mm ±1.54"
Light source		Red semiconductor laser							
	Wavelength	655 nm (visible light)							
	Laser Class	Class II (FDA (CDRH) Part 1040.10), Class 1 (IEC 60825-1)		Class II (FDA (CDRH) Part 1040.10), Class 2 (IEC 60825-1)					
	Output	0.3 mW		0.95 mW					
Spot diameter (at reference distance)		Approx. ø20 µm ø0.0008"	Approx. 20 × 500 µm 0.0008" × 0.0197" (G15), Approx. ø20 µm ø0.0008" (G10)	Approx. 30 × 850 µm 0.0012" × 0.0335" (G37), Approx. ø30 µm ø0.0012" (G32)		Approx. 70 × 1100 µm 0.0028" × 0.0433" (G87), Approx. ø70 µm ø0.0028" (G82)		Approx. 120 × 1700 µm 0.0047" × 0.0669" (G157), Approx. ø120 µm ø0.0047" (G152)	
Linearity *2		±0.05% of F.S. (F.S.= ±0.8 mm ±0.03")	±0.03% of F.S. (F.S.= ±1 mm ±0.04")	±0.05% of F.S. (F.S.= ±5 mm ±0.2")		±0.05% of F.S. (F.S.= ±15 mm ±0.59")		±0.05% of F.S. (F.S.= ±40 mm ±1.57")	
Repeatability *3		0.02 µm (0.01 µm)		0.05 µm *4		0.2 µm *4 0.000008"		0.5 µm *4 0.000020"	
Sampling time		20/50/100/200/500/1000 µs (Selectable from 6 levels)							
LED display		Near the center of the measurement: Green lights, Within the measurement area: Orange lights, Outside the measurement area: Orange flashing							
Temperature characteristics		0.02% of F.S./°C (F.S.= ±0.8 mm ±0.03")	0.01% of F.S./°C (F.S.= ±1 mm ±0.04")	0.01% of F.S./°C (F.S.= ±5 mm ±0.2")		0.01% of F.S./°C (F.S.= ±15 mm ±0.59")		0.01% of F.S./°C (F.S.= ±40 mm ±1.57")	
Enclosure rating		–	IP67 (IEC60529)						
Ambient luminance		Incandescent lamp or fluorescent lamp: 10000 lux max.						Incandescent lamp or fluorescent lamp: 5000 lux max.	
Ambient temperature		+10 to 40°C 50 to 104°F	0 to 50°C 32 to 122°F						
Relative humidity		35 to 85%, No condensation							
Vibration resistance		10 to 55 Hz, double amplitude 1.5 mm 0.06"; two hours in each direction of X, Y, and Z							
Material		Aluminum	Aluminum die-cast						
Weight (including the cable)		Approx. 245 g	Approx. 190 g	Approx. 280 g		Approx. 380 g		Approx. 290 g	

*1 The value is obtained by measuring KEYENCE's standard target (ceramic).
LK-G10/G15: When the sampling rate is 20 µs, the value becomes +0.37 +0.01" (FAR side) to -1 mm -0.04" (NEAR side).
LK-G32/G37: When the sampling rate is 20 µs, the value becomes +1.8 +0.07" (FAR side) to -5 mm -0.20" (NEAR side) for diffuse reflection, and +1.6 +0.06" (FAR side) to -4.5 mm -0.18" (NEAR side) for specular reflection.
LK-G82/G87: When the sampling rate is 20 µs, the value becomes -9 -0.35" (NEAR side) to -15 mm -0.59" (NEAR side) for diffuse reflection, and -8.7 -0.34" (NEAR side) to -14 mm -0.55" (NEAR side) for specular reflection.
LK-G152/G157: When the sampling rate is 20 µs, the value becomes -22 -0.87" (NEAR side) to -40 mm -1.57" (NEAR side) for diffuse reflection, and -22 -0.87" (NEAR side) to -39 mm -1.54" (NEAR side) for specular reflection.
*2 The value is obtained by measuring KEYENCE's standard target (ceramic) with the Standard mode.
*3 The value is obtained by measuring KEYENCE's standard(SUS) with 4096 times of averaging at the reference distance. The value in parenthesis is the typical repeatability obtained by measuring the target with 16384.
*4 Consult your nearest KEYENCE representative for the Class IIIa type with increased repeatability.

Model		LK-G402/G407		LK-G502/G507	
Mounting mode		Diffused reflection	Specular reflection	Diffused reflection	Specular reflection
Reference distance		400 mm 15.75"	398 mm 15.67"	500 mm 19.69"	497.5 mm 19.59"
Measuring range *1		±100 mm ±3.94"	±99 mm ±3.90"	-250 to +500 mm -9.84" to 19.69"	-249 to +498 mm -9.80" to 19.61"
Light source		Red semiconductor laser			
	Wavelength	655 nm (visible light)			
	Laser Class	Class II (FDA (CDRH) Part 1040.10), Class 2 (IEC 60825-1)			
	Output	0.95 mW			
Spot diameter (at reference distance)		Approx. 290 × 8300 µm 0.0114" × 0.3268" (G407) Approx. ø290 µm ø0.0114" (G402)		Approx. 300 × 9500 µm 0.0118" × 0.3740" (G507) Approx. ø300 µm ø0.0118" (G502)	
Linearity *2		±0.05% of F.S.(F.S.= ±100 mm ±3.94")		±0.05% of F.S. (±250 µm ±0.0098") *4*5 -250 to +250 mm -9.84" to +9.84" <High-accuracy range> ±0.02% of F.S. (±100 µm ±0.0039") -250 to -50 mm -9.84" to -1.97" <Long range> ±0.1% of F.S. (±500 µm ±0.0197") -250 to +500 mm -9.84" to +19.69" (F.S. = ±250 mm ±9.84")	
Repeatability *3		2 µm 0.000079"			
Sampling time		20/50/100/200/500/1000 µs (Selectable from 6 levels)			
LED display		Near the center of the measurement: Green lights Within the measurement area: Orange lights Outside the measurement area: Orange flashing			
Temperature characteristics		0.01% of F.S./°C (F.S.= ±100 mm ±3.94")		0.01% of F.S./°C (F.S.= ±250 mm ±9.84")	
Enclosure rating		IP67 (IEC60529)			
Ambient light		Incandescent lamp or fluorescent lamp: 5000 lux max.			
Ambient temperature		0 to 50°C 32 to 122°F			
Relative humidity		35 to 85%, No condensation			
Vibrations resistance		10 to 55 Hz, double amplitude 1.5 mm 0.06"; two hours in each direction of X, Y, and Z			
Material		Aluminum die-cast			
Weight (including the cable)		Approx. 380 g			

*1 The value is obtained by measuring KEYENCE's standard target (ceramic).
<LK-G407/G402>
When the sampling rate is 20 µs, the value becomes -70 mm -2.76" (NEAR side) to -100 mm -3.94" (NEAR side) for diffuse reflection.
When the sampling rate is 20 µs, the value becomes -70 mm -2.76" (NEAR side) to -99 mm -3.90" (NEAR side) for specular reflection.
<LK-G507/G502>
When the sampling rate is 20 µs, the value becomes -230 mm -9.06" (NEAR side) to -250 mm -9.84" (NEAR side) for diffuse reflection.
When the sampling rate is 20 µs, the value becomes -230 mm -9.06" (NEAR side) to -249 mm -9.80" (NEAR side) for specular reflection.
When the sampling rate is 50 µs, the value becomes -125 mm -4.92" (NEAR side) to -250 mm -9.84" (NEAR side) for diffuse reflection.
When the sampling rate is 50 µs, the value becomes -125 mm -4.92" (NEAR side) to -249 mm -9.80" (NEAR side) for specular reflection.
*2 The value is obtained by measuring KEYENCE's standard target (ceramic) with the Standard mode.
*3 The value is obtained by measuring KEYENCE's standard (SUS) with 4096 times of averaging at the reference distance.
*4 All are calculated at F.S. = (±250 mm ±9.84").
*5 "High accuracy range" and "long range" refer to the linearity when those ranges are used.

Controller

Type			All-in-one model	Separate monitor model *1
Model		NPN	**LK-G3001V**	**LK-G3001/LK-GD500**
		PNP	**LK-G3001PV**	**LK-G3001P/LK-GD500**
Display	Head compatibility		All LK-G sensor heads are compatible	
	Number of connectable sensors		Maximum of 2 units	
	Minimum display unit		0.01 µm	
	Display range		±9999.99 mm to ±9999.99 µm (Selectable from six levels)	
	Refresh rate		10 times/sec	
Terminal block	Analog voltage output		±10 V x 2 outputs, output impedance: 100 Ω	
	Analog current output		4 to 20 mA x 2 outputs, maximum load resistance: 350 Ω	
	Timing/Reset/Auto-zero input		For OUT1, non-voltage or voltage input *3	
	Laser remote interlock input		Non-voltage input *3	
	Comparator output		For OUT1, NPN or PNP open-collector output *2	
	Alarm output		For OUT1, NPN or PNP open-collector output *3 (N.C.)	
Expansion connector	Timing/Reset/Auto-zero input		For OUT2, non-voltage or voltage input *3	
	Program switching input		Non-voltage or voltage input *3 x 3 inputs	
	Laser-Off input		For Head A/Head B, non-voltage or voltage input *3	
	Comparator output		For OUT2, NPN or PNP open-collector output *2	
	Alarm output		For OUT2, NPN or PNP open-collector output *2(N.C.)	
	Binary	Binary output	Measured data output (21 bits), OUT1/OUT2 selectable, NPN or PNP open-collector output *2	
		Strobe output	NPN or PNP open-collector output *2	
		Binary selector output	NPN or PNP open-collector output *2	
		Binary selector input	Non-voltage or voltage input *3	
RS-232C interface			Measured data output and control input/output (Maximum baud rate: 115200 bps, selectable)	
USB interface			In conformity with USB Revision 2.0 Full speed (USB1.1 compatible)	
Major functions			2 OUT simultaneous measurement, Operation, Averaging, Filter, Calibration, Measurement, AUTO ZERO, Sampling frequency setting, Mutual interference prevention, Data storage, 8-program memory, ECO mode, ABLE setting, Target setting, ABLE tuning, Selection of measurement surface of transparent target, Statistics processing, Connection of setting support software, Selectable head-mounting, etc.	
Power supply voltage			24 VDC±10%, Ripple: 10% (P to P) or less	
Current consumption			500 mA or less with 1 head/600 mA or less with 2 heads	
Ambient temperature			0 to 50°C 32 to 122°F	
Relative humidity			35 to 85%, No condensation	
Weight			Approx. 480 g (LK-G3001V/G3001PV), Approx. 370 g (LK-G3001/G3001P), Approx. 60 g (LK-GD500)	

*1 LK-G3001(P) can be operated singly. The measured value display and setting modifications can be performed on the display panel (LK-GD500) or via the setting support software (LK-H1W).
*2 The rating of the NPN open-collector: 50 mA max. (40 V max.), residual voltage of 1 V max. The rating of the PNP open collector: 50 mA max. (30 V max.), residual voltage of 1 V max.
*3 (NPN model) The rating of non-voltage input: 1 V or less ON voltage, 0.6 mA or less OFF current. (PNP model) The rating of voltage input: 10.2 V or more ON voltage (26.4 V max.) 0.6 mA or less OFF current.

Hardware environment

Item	Hardware requirements
CPU	Pentium III, 400 MHz or higher
Supported OS	Windows 10*1 Windows 7 (SP1 or later)*2 Windows Vista (SP2 or later)*3 Windows XP (SP3 or later)*4
Memory capacity	64 Mbytes or more
Display	800 x 600 pixels, 256 colors or more
Hard disk space	10 Mbytes or more
Interface	RS-232C (serial port) or USB2.0/1.1*5 must be installed.

*1 Home, Pro, and Enterprise editions are supported.
*2 Home Premium, Professional, and Ultimate editions are supported.
*3 Ultimate, Business, Home Premium, and Home Basic editions are supported.
*4 Professional and Home editions are supported.
*5 Connection through a USB hub is not included in the guarantee.

Sensor head-to-controller cable

Model	LK-GC2	LK-GC5	LK-GC10	LK-GC20	LK-GC30
Cable length	2 m 6.6'	5 m 16.4'	10 m 32.8'	20 m 65.6'	30 m 98.4'
Weight	Approx. 200 g	Approx. 400 g	Approx. 750 g	Approx. 1400 g	Approx. 2000 g

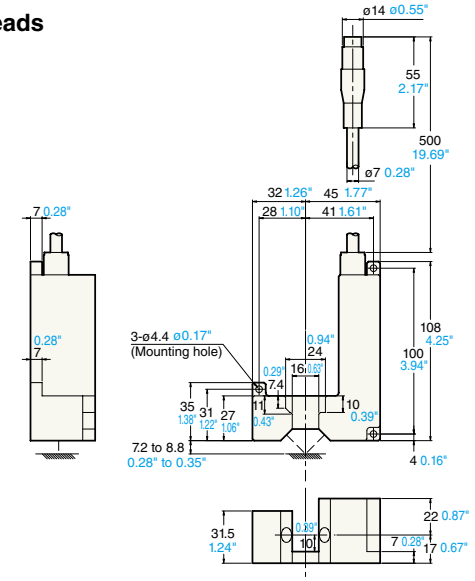
Display panel cable

Model	OP-51654	OP-51655	OP-51656
Cable length	0.3 m 0.98'	3 m 9.8'	10 m 32.8'

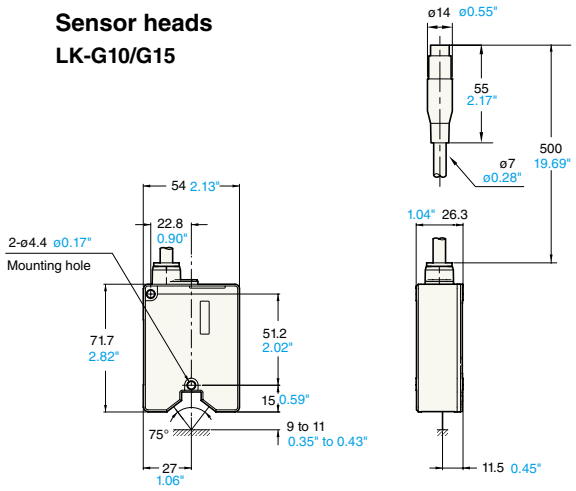
Dimensions

Unit: mm inch

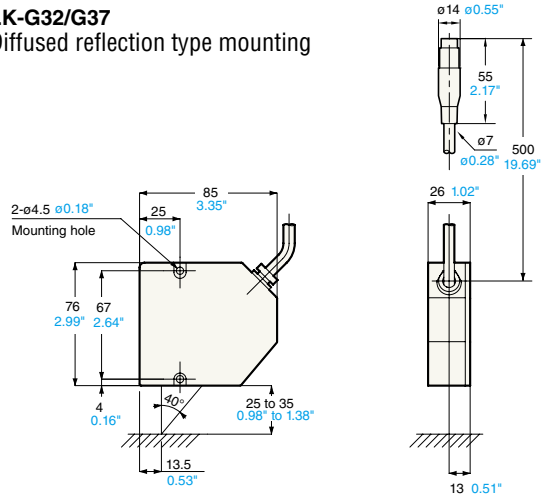
Sensor heads
LK-G08



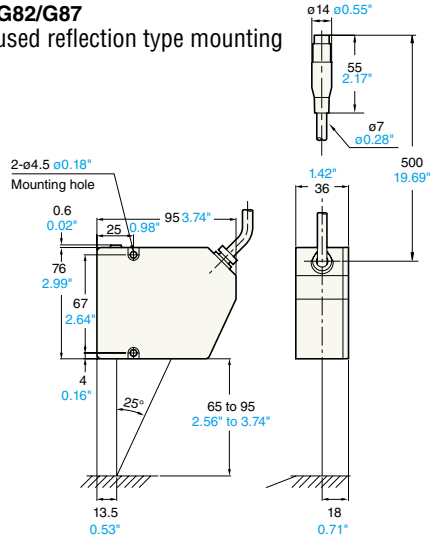
Sensor heads
LK-G10/G15



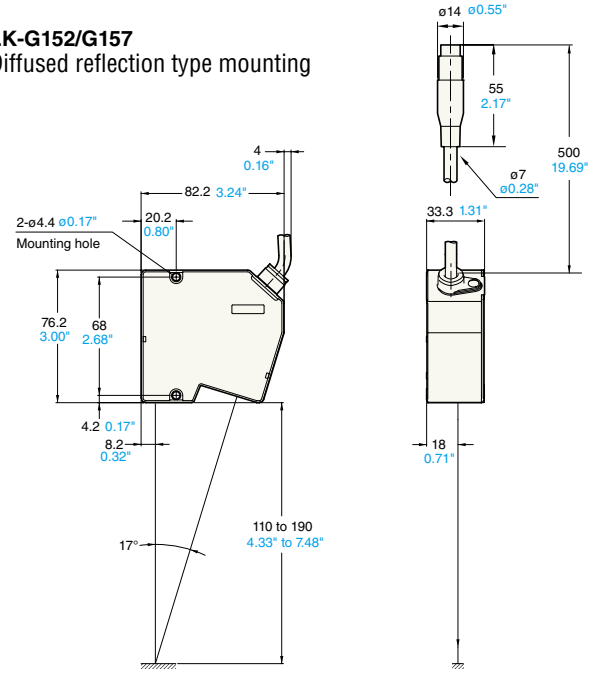
LK-G32/G37
Diffused reflection type mounting



LK-G82/G87
Diffused reflection type mounting

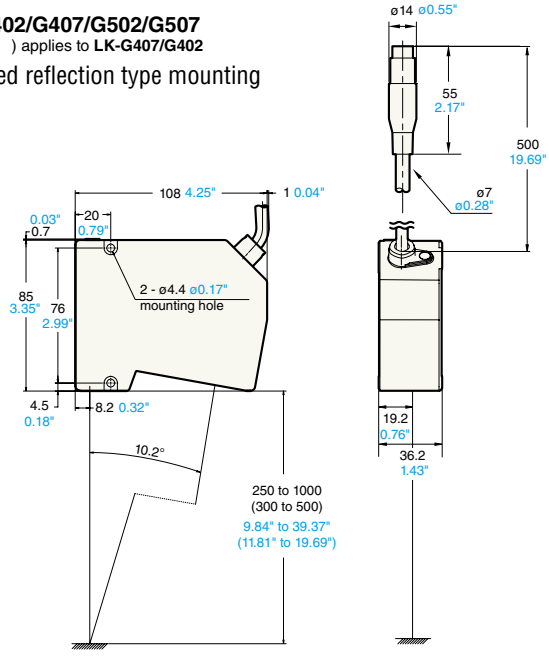


LK-G152/G157
Diffused reflection type mounting



LK-G402/G407/G502/G507
Data in ( ) applies to **LK-G407/G402**

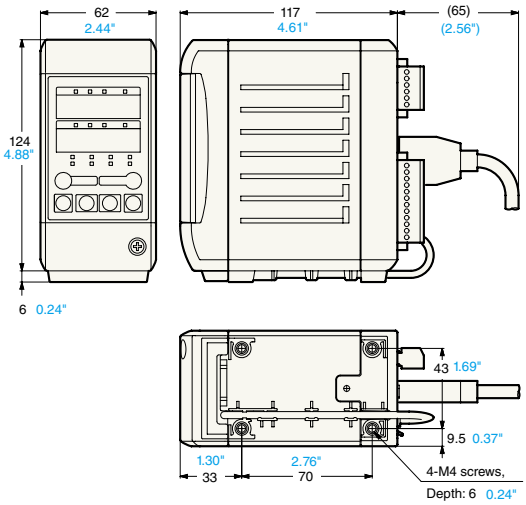
Diffused reflection type mounting



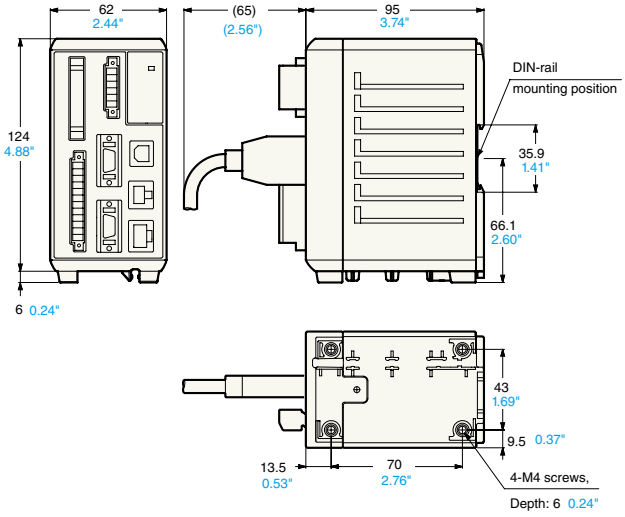
Unit: mm inch

Controllers

LK-G3001V/G3001PV

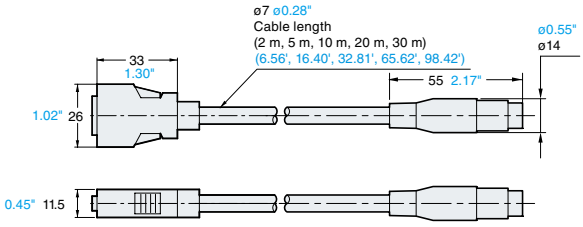


LK-G3001/G3001P



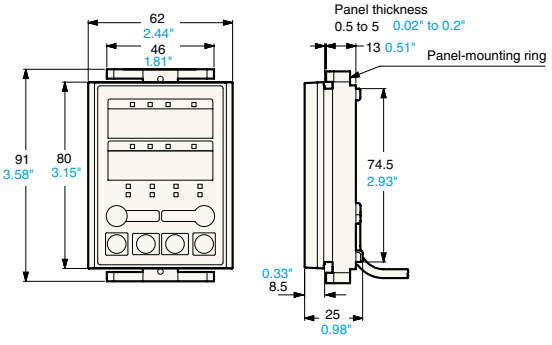
Cable between the head and controller

LK-GC2/GC5/GC10/GC20/GC30

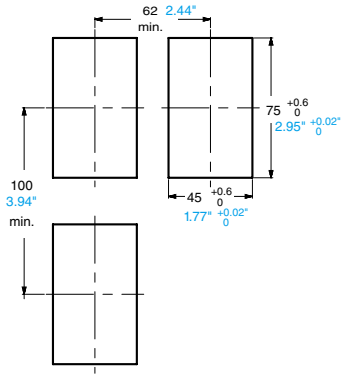


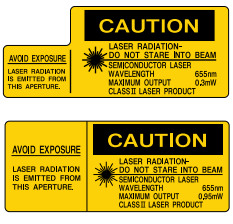
Display panel

LK-GD500



Panel cutout dimensions





High-speed 2D/3D Laser Scanner

LJ-V7000 Series

CE

Features

- An emphasis on inline multi-point measurement
- The world's fastest at 64,000 profiles/sec.
- Blue laser optical system

240 times greater than conventional devices

64,000 profiles/sec. sampling 12,800,000 points/sec. World's fastest

The LJ-V7000 Series was designed to achieve the world's fastest sampling speed. No other laser based 3D measurement system on the market even comes close.
The LJ-V7000 can measure products moving on high-speed lines with high precision and no loss of data.
For example, the LJ-V7000 can measure targets moving at 6.4 m/s with a profile pitch of 0.1 mm 0.0039".

64 times the dynamic range of conventional devices

Overwhelming responsiveness to target properties to optimize output stability Industry best

Normally, detection stability is inversely proportional to speed. However, the LJ-V7000 Series incorporates cutting edge technology that greatly improves both variables. Shapes are accurately measured even where there is a high variation in target reflectivity under the same optical axis.

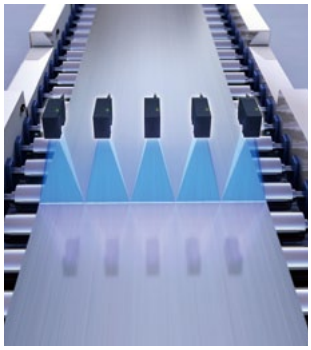
Applications

Bearing seal inspection

Bearings are rotated to inspect seal integrity and perform a variety of other measurements. The LJ-V7000 Series provides the high sampling rates necessary to perform all inspections at full production speeds.

Pre-weld assembly and weld bead inspection

The onboard processing capability of the LJ-V7000 Series systems allows onboard inspection of both pre-weld assembly quality and postweld bead condition. In addition, the robust IP67 structure of the head allows the system to be installed in environments not usually suitable for optical systems.



Rolled steel defect inspection

The advanced processing algorithms of the LJ-V7000 make multi-head setups easy. Obtaining profiles at 64,000 Hz, it is possible to detect even minute defects over a wide area.

Extrusion geometry inspection

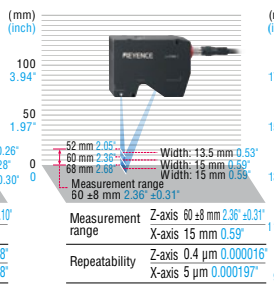
High speed 3D extrusion inspection is made possible by the revolutionary advancement in available sampling rates. Various targets can be measured precisely and at high speed, including rubber, metal, ceramics, concrete, and food products.

Lineup

Ultra high-accuracy — LJ-V7020

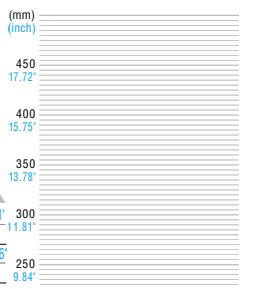
Measurement range	Z-axis	20 ±2.6 mm 0.79" ±0.10"
	X-axis	7 mm 0.28"
Repeatability	Z-axis	0.2 µm 0.000008"
	X-axis	2.5 µm 0.000098"

High-accuracy — LJ-V7060



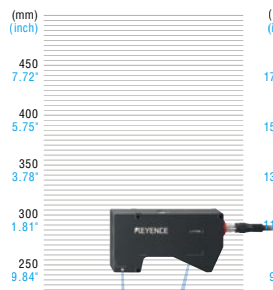
Measurement range	Z-axis	60 ±8 mm 2.36" ±0.31"
	X-axis	15 mm 0.59"
Repeatability	Z-axis	0.4 µm 0.000016"
	X-axis	5 µm 0.000197"

Middle range — LJ-V7080



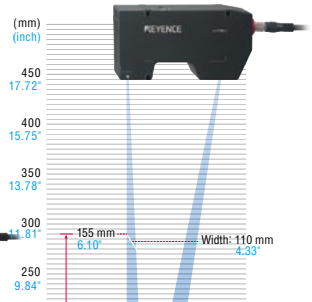
Measurement range	Z-axis	80 ±23 mm 3.15" ±0.91"
	X-axis	32 mm 1.26"
Repeatability	Z-axis	0.5 µm 0.000020"
	X-axis	10 µm 0.000394"

Long range — LJ-V7200



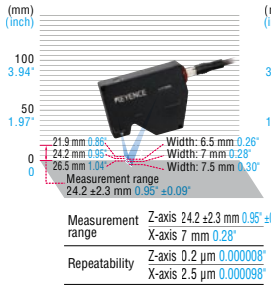
Measurement range	Z-axis	200 ±48 mm 7.87" ±1.89"
	X-axis	62 mm 2.44"
Repeatability	Z-axis	1 µm 0.000039"
	X-axis	20 µm 0.000787"

Ultra-long range — LJ-V7300



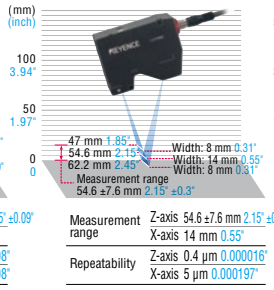
Measurement range	Z-axis	300 ±145 mm 11.81" ±5.71"
	X-axis	180 mm 7.09"
Repeatability	Z-axis	5 µm 0.000197"
	X-axis	60 µm 0.002362"

Ultra high-accuracy specular reflection — LJ-V7020K



Measurement range	Z-axis	24.2 ±2.3 mm 0.95" ±0.09"
	X-axis	7 mm 0.28"
Repeatability	Z-axis	0.2 µm 0.000008"
	X-axis	2.5 µm 0.000098"

High-accuracy specular target — LJ-V7060K



Measurement range	Z-axis	54.6 ±7.6 mm 2.15" ±0.3"
	X-axis	14 mm 0.55"
Repeatability	Z-axis	0.4 µm 0.000016"
	X-axis	5 µm 0.000197"

Controller

Controller
LJ-V7001(P)

Controller variation

NPN output type	**LJ-V7001**
PNP output type	**LJ-V7001P**

Display output unit
LJ-VM100

Settings monitor software
LJ-H3
(Controller accessory)

USB cable
OP-66844

Console
OP-87504

EtherNet/IP™ unit
CB-EP100

PROFINET unit
CB-PN100

Monitor

Touch panel monitor
CA-MP120T

Specialized monitor stand
OP-87262

Cable connector

Sensor head cable
CB-B3 (3 m 9.8')/ CB-B10 (10 m 32.8')

Sensor head extension cable
CB-B5E (5 m 16.4')
CB-B10E (10 m 32.8')
CB-B

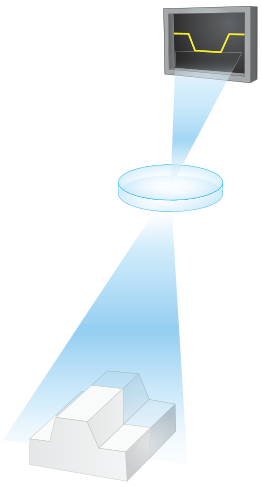
Touch panel monitor cable
OP-87258 (3 m 9.8')
OP-87259 (10 m 32.8')

Display monitor cable
OP-66842 (3 m 9.8')/OP-87055 (10 m 32.8')

RS-232C cable
OP-96368 (2.5 m 8.2')

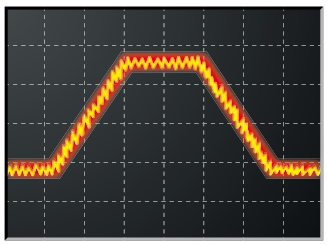
D-sub9 pin connector
OP-26401

Blue laser optical system Provides optimal stability and accuracy on a wide variety of targets. World's first



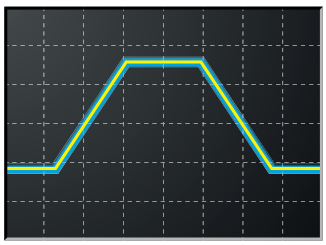
The LJ-V7000 Series is the first 3D laser inspection system in the world to adopt a blue laser. A sharp line beam is formed on the light-receiving element by focusing a short wavelength 405 nm laser to its diffraction limit with a 2D Ernostar lens. This generates a stabilized high-precision profile ensuring optimal accuracy and limiting image blur. Also, the output intensity of the laser source has been optimized to provide a clear return even on targets with a wide range of reflectivities.

Red laser (conventional)



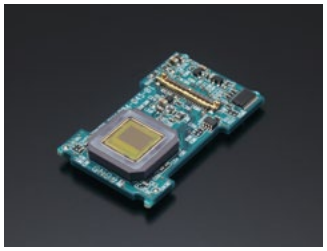
With a conventional red laser, beam focus is severely limited resulting in a diffuse image of the part that contributes to measurement errors.

Blue laser (LJ-V)



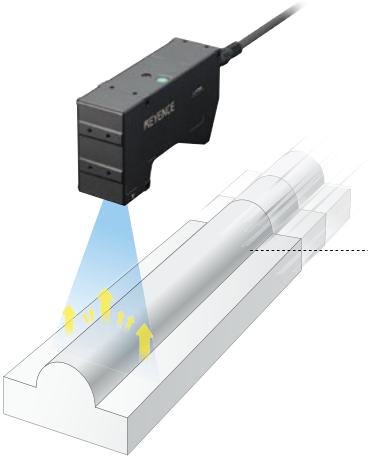
With a blue laser, the target image is tightly focused with minimal blurring or other sources of error.

HSE³*-CMOS Provides enhanced stability on any target, even at high speed World's greatest

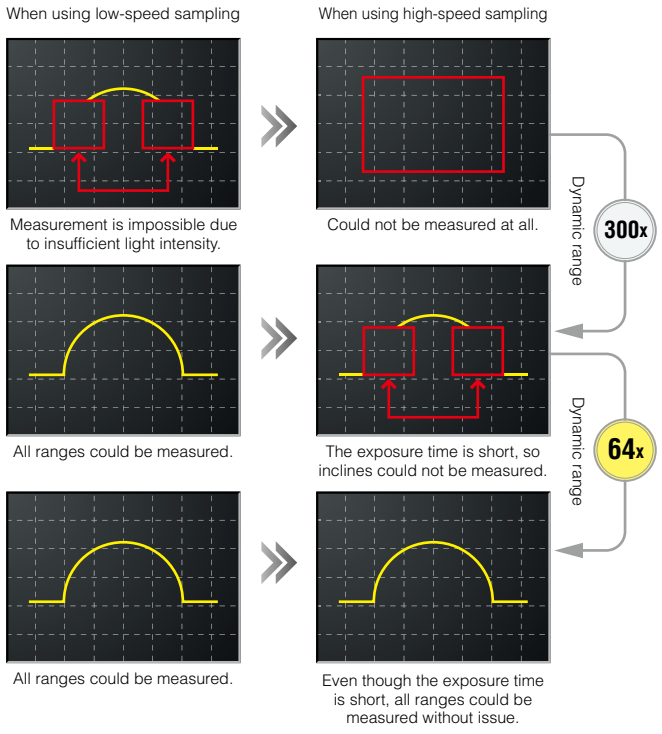


The LJ-V7000 Series is equipped with the HSE³-CMOS. In addition to improved speed, the dynamic range has been further enhanced to be well above that of conventional light receiving elements. Even with an extremely short exposure time of 15.6 µs, the LJ-V7000 can reliably measure a range of surfaces from black (small amount of reflection) surfaces to those with luster (large amount of reflection) simultaneously.

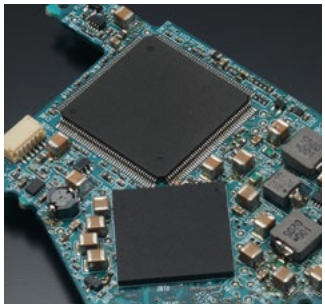
* HS=High Speed E³=Enhanced Eye Emulation



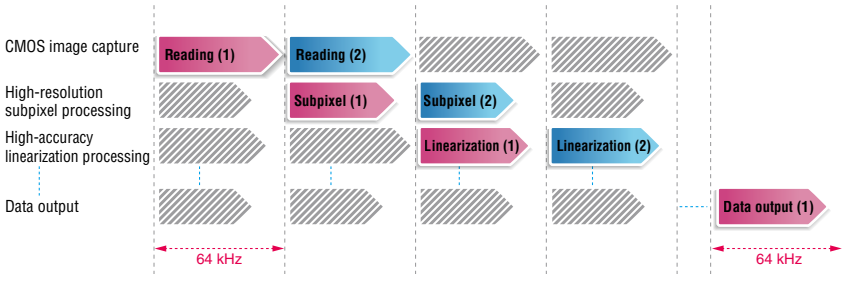
Reflectivity and light intensity in the horizontal axis will change greatly depending on the shape, color, material, or sampling speed (exposure time) of the target.



GP*64-Processor Next generation system designed for high speed data processing



The custom developed GP64 processor, exclusive to the LJ-V7000, is designed to provide high speed parallel data processing. This allows the system to maintain a 64 kHz output frequency while maximizing output stability and accuracy.

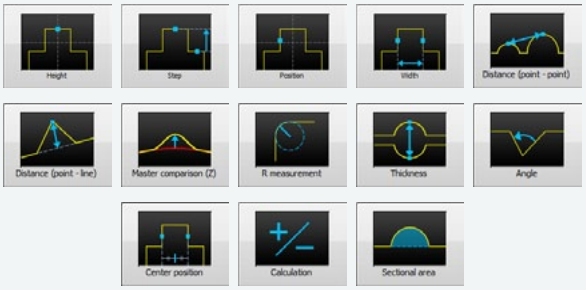


74 discrete measurement modes
16 channels of independent measurement

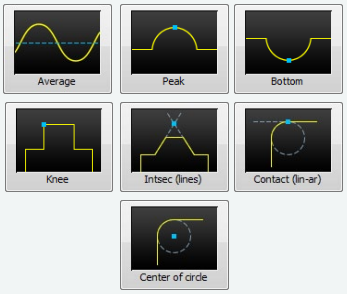
The industry's greatest flexibility

With 13 types of data extraction tools and 7 types of feature definition tools, a single LJ-V7000 can provide a total of 74 distinct measurement definitions. This allows a single system to provide the level of flexibility necessary to adapt to constant changes in production requirements.

Types of measurements



Types of measurement targets for each measurement

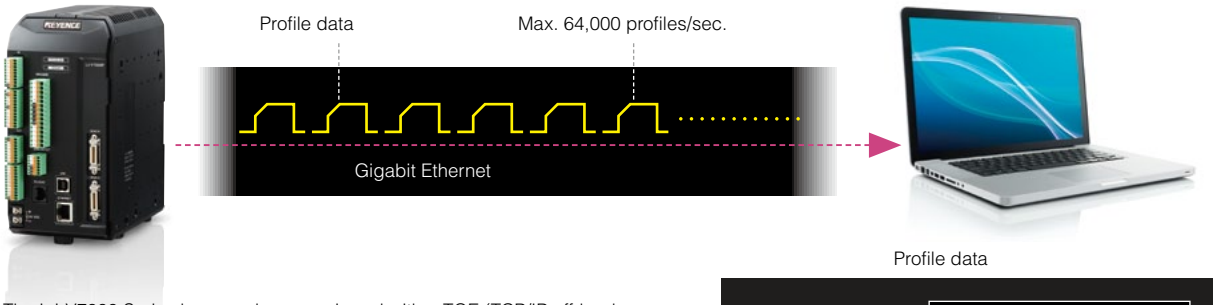


Any 16 dimensions can be measured simultaneously with a measurement mode that has been selected from the 74 types that are available.
The LJ-V7000 can perform onboard profile analysis at a previously impossible rate.

HMI Touch Panel
CA-MP120T

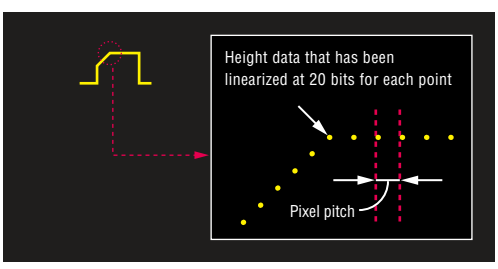
Continuous profile data output at a top speed of 64 kHz

Publicly open communications library



The LJ-V7000 Series has now been equipped with a TOE (TCP/IP off-load engine) specifically for processing high-speed communication. This achieves high throughput that does not affect CPU load. With this it is possible to maintain a 64,000 Hz output frequency.
In addition to advanced on-board processing capabilities, the LJ-V7000 also provides full support for external processing of acquired profile data. In addition to published interface libraries, sample interface code is available in several programming languages.

Profile data



Specifications

Controller

Model		LJ-V7001	LJ-V7001P
No. of connectable sensors		Max. 2 units	
Display	Minimum display unit	0.1 µm 0.000004", 0.00001 mm², 0.01°	
	Maximum display range	±9999.99 mm, ±9999.99 mm²	
Input terminal block	Laser remote interlock input	No-voltage input	
	Encoder input	NPN open-collector output, voltage output (5 V/12 V/24 V), and line-driver output all supported	
	Trigger inputs	Non-voltage input	Voltage input
	Timing 1, 2 input		
	Auto-zero1, 2 input		
	Reset 1, 2 input		
	Start measurement/stop input		
	Start storage/stop input		
	Clear memory input		
	Laser OFF input		
	Program switch input	No-voltage input x 4 inputs	Voltage input x 4 inputs
Output terminal block	Analog voltage output	±10 V x 2 outputs, Output impedance: 100 Ω	
	OUT comparator output	NPN open collector output x 12 outputs (Can freely assign 16 OUTs x 3 stage judgment results)	PNP open collector output x 12 outputs (Can freely assign 16 OUTs x 3 stage judgment results)
	Strobe output	NPN open collector output	PNP open collector output
	Disable trigger output		
	Memory FULL output		
	Ready output		
	Error output	NPN open collector output (N.C.)	PNP open collector output (N.C.)
Ethernet interface		1000BASE-T/100BASE-TX	
USB Interface		USB 2.0 high speed compliant (USB 1.1 Full-SPEED compatible)	
RS-232C interface		Measurement data output and control I/O (Can select a baud rate of up to 115,200 bits/s)	
Rating	Voltage	Includes 24 VDC ±10% ripple (P-P)	
	Maximum current consumption	1.3 A or less when connected to 1 head/ 1.9 A or less when connected to 2 heads	
Environmental resistance	Operating ambient temperature	0 to +50°C 32 to 122°F	
	Operating ambient humidity	20 to 85% RH (No condensation)	
Weight		Approx. 1500 g	

- The rating for NPN open-collector output is up to 50 mA (40 V or less), residual voltage of up to 1 V
- The rating for PNP open-collector output is up to 50 mA (30 V or less), residual voltage of up to 1 V
- The rating for non-voltage input is up to 1 V for ON voltage and up to 0.6 mA for OFF current
- The rating for voltage input is a maximum input voltage of 26.4 V, a minimum ON voltage of 10.8 V, and up to 0.6 mA for OFF current

Display output unit

Model		LJ-VM100
Monitor output		Analog RGB XGA (1024 × 768) Touch panel monitor (CA-MP120T), specialized connector included
Voltage		Supplied from the controller
Power consumption		2.5 W or less
Environmental resistance	Operating ambient temperature	0 to +50°C 32 to 122°F
	Operating ambient humidity	20 to 85% RH (No condensation)
Weight		Approx. 400 g

LJ-H3 (LJ-Navigator 2) operation system environment

Item		Minimum system requirements
PC Interface	Ethernet*1	1000BASE-T/100BASE-TX
	USB*2	USB 2.0 high speed compliant (USB 1.1 Full-SPEED compatible)
Supported OS		Windows 10*3 Windows 7 (SP1 or later)*4 Windows Vista (SP2 or later)*5 Windows XP (SP3 or later)*6
Supported languages		English, Japanese, German, French, Simplified Chinese, Traditional Chinese
CPU		Core i3 2.3 GHz or higher
Memory capacity		2 GB or more
2D cache memory		2 MB or more
Free space on hard disk		10 GB or more
Display resolution		XGA (1024 × 768) or higher
Weight		Approx. 400 g

*1 Connection to LAN and connection via a router is not included in the guarantee.
*2 Connection through a USB hub is not included in the guarantee.
*3 Home, Pro, and Enterprise editions are supported.
*4 Home Premium, Professional, and Ultimate editions are supported.
*5 Ultimate, Business, Home Premium, and Home Basic editions are supported.
*6 Professional and Home editions are supported.

Sensor Head/communication unit

PROFINET unit

Model		CB-PN100
Compatible network		PROFINET IO communication
Ethernet	Compliant standards	IEEE 802.3u*1
	Transmission speed	100 Mbps, full duplex (100BASE-TX)
	Transmission media	STP or Category 5e or higher UTP
	Maximum cable length	100 m 328.1'
PROFINET IO	Supported functions	Data I/O communication
		Record data communication
	Number of connectable PROFINET IO controllers	1
	Update time	2 ms to 2048 ms
	GSDML	Version 2.25
	Conformance class	Conformance Class A compliant
	Conformance test version	Based on Version 2.2.4
	Applicable protocol	LLDP, DCP
Power supply voltage		24 V ±10% (supplied from the controller unit of the laser scanner)
Power consumption		0.12 A max.
Weight		Approx. 470 g

*1 Although this unit conforms to IEEE 802.3u and can establish 100 Mbps full duplex communication using AutoNegotiation function, it does not have AutoCrossOver and AutoPolarity functions that are normally required for the PROFINET IO standard. Select a straight or cross cable according to the Ethernet port of the device to be connected.

EtherNet/IP™ unit

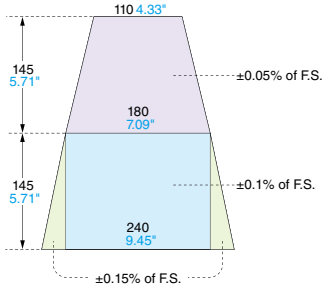
Model		CB-EP100
Compatible network		EtherNet/IP™ and displacement sensor-specific protocols (socket communication)
Ethernet	Compliant standards	IEEE 802.3 (10BASE-T), IEEE 802.3u (100BASE-TX)
	Transmission speed	10 Mbps (10BASE-T), 100 Mbps (100BASE-TX)
	Transmission media	STP or Category 3 or higher UTP (10BASE-T), STP or Category 5 or higher UTP (100BASE-TX)
	Maximum cable length	100 m 328.1' (Distance between the unit and Ethernet switch)
	Maximum number of connectable hubs*1	4 hubs (10BASE-T), 2 hubs (100BASE-TX)
EtherNet/IP™	Supported functions	Cyclic communication (Implicit messaging), Message communication (Explicit messaging), Compatible with UCMM and Class 3
	Number of connections	64
	RPI	0.5 ms to 10000 ms (in 0.5 ms)
	Tolerable communication bandwidth for cyclic communication	6000 pps
	Message communication	UCMM, Class 3
	Conformance test	Compatible with Version A9
Power supply voltage		24 VDC, including ±10% ripple (P-P) (supplied from the controller unit of the laser scanner)
Power consumption		0.12 A max.
Environmental resistance	Operating ambient temperature	0 to +50°C 32 to 122°F
	Operating ambient humidity	20 to 85% RH (No condensation)
Weight		Approx. 470 g

*1 The number of connectable hubs is not limited when using a switching hub.

Sensor head

Model		LJ-V7020K*11	LJ-V7020*11	LJ-V7060K	LJ-V7060	LJ-V7080	LJ-V7200	LJ-V7300
Mounting conditions		Specular reflection	Diffuse reflection	Specular reflection	Diffuse reflection			
Reference distance		24.2 mm 0.95"	20 mm 0.79"	54.6 mm 2.15"	60 mm 2.36"	80 mm 3.15"	200 mm 7.87"	300 mm 11.81"
Measurement range	Z-axis (height)	±2.3 mm ±0.09" (F.S.=4.6 mm 0.18")	±2.6 mm ±0.10" (F.S.=5.2 mm 0.20")	±7.6 mm ±0.30" (F.S.=15.2 mm 0.60")	±8 mm ±0.31" (F.S.=16 mm 0.63")	±23 mm ±0.91" (F.S.=46 mm 1.81")	±48 mm ±1.89" (F.S.=96 mm 3.78")	±145 mm ±5.71" (F.S.=290 mm 11.42")
	X-axis (width) NEAR side	6.5 mm 0.26"	6.5 mm 0.26"	8 mm 0.31"	13.5mm 0.53"	25 mm 0.98"	51mm 2.01"	110 mm 4.33"
	X-axis (width) Reference distance	7 mm 0.28"	7 mm 0.28"	14 mm 0.55"	15 mm 0.59"	32 mm 1.26"	62 mm 2.44"	180 mm 7.09"
	X-axis (width) Far side	7.5 mm 0.30"	7.5 mm 0.30"	8 mm 0.31"	15 mm 0.59"	39 mm 1.54"	73 mm 2.87"	240 mm 9.45"
Light source		Blue semiconductor laser						
	Wavelength	405 nm (visible beam)						
	Laser class IEC60825-1 FDA(CDRH) Part 1040.10*1	Class 2M Laser Product*12		Class 2 Laser Product	Class 2M Laser Product*12	Class 2 Laser Product		
	Output	10 mW		4.8 mW	10 mW	4.8 mW		
Spot size (reference distance)		Approx. 14 mm × 35 µm 0.55" × 0.001378"		Approx. 21 mm × 45 µm 0.83" × 0.001772"		Approx. 48 mm × 48 µm 1.89" × 0.001890"	Approx. 90 mm × 85 µm 3.54" × 0.003346"	Approx. 240 mm × 610 µm 9.45" × 0.024016"
Repeatability*2	Z-axis (height)*3	0.2 µm 0.000008"		0.4 µm 0.000016"		0.5 µm 0.000020"	1 µm 0.000039"	5 µm 0.000197"
	X-axis (width)*4	2.5 µm 0.000098"		5 µm 0.000197"		10 µm 0.000394"	20 µm 0.000787"	60 µm 0.002362"
Linearity	Z-axis (height)*5	±0.1% of F.S.						±0.05 to ±0.15% of F.S.*6
Profile Data interval	X-axis (width)	10 µm 0.000394"		20 µm 0.000787"		50 µm 0.001969"	100 µm 0.003937"	300 µm 0.011811"
Sampling cycle (trigger interval)*7		Top speed: 16 µs (high-speed mode) Top speed: 32 µs (advanced function mode)						
Temperature characteristics		0.01% of F.S./°C						
Environmental resistance	Enclosure rating*8	IP67 (IEC60529)						
	Ambient operating illuminance*9	Incandescent lamp: 10000 lux max.						
	Ambient temperature*10	0 to +45°C 32 to 113°F						
	Operating Ambient humidity	20 to 85% RH (No condensation)						
	Vibration resistance	10 to 57 Hz, 1.5 mm 0.06" double amplitude in X, Y, and Z directions, 3 hours respectively						
	Impact resistance	15G/6 msec						
Material		Aluminum						
Weight		Approx. 410 g		Approx. 450 g		Approx. 400 g	Approx. 550 g	Approx. 1000 g

*1 The laser classification for FDA(CDRH) is implemented based on IEC60825-1 in accordance with the requirements of Laser Notice No. 50.
*2 This value is from a case in which measurement has been performed with a reference distance with 4096 times of averaging.
*3 The measurement targets are KEYENCE standard targets. This value is from a case in which the average height of the default setting area has been measured in height mode. All other settings are default.
*4 The measurement target is a pin gauge. This value is from a case in which the position of the intersection between the rounded surface of the pin gauge and the edge level has been measured in position mode. All other settings are default.
*5 The measurement targets are KEYENCE standard targets. The profile data is from a case in which measurement has been performed with 64 times of smoothing and 8 times of averaging. All other settings are default.
*6 The linearity will differ depending on the measurement area. (See the diagram on the right.)
*7 For high-speed mode, when the measurement area is at its minimum, binning is ON, image capture mode is set to standard, and parallel image capture is ON. All other settings are default. For advanced function mode, when the measurement area is at its minimum, binning is ON and image capture mode is set to standard. All other settings are default.
8 This value is from a case in which the sensor head cable (CB-B) or extension cable (CB-B*E) has been connected.
*9 This is the illuminance for the light-receiving surface of the sensor head during white paper measurement when light has been shined onto the white paper.
*10 The sensor head must be mounted on a metal plate for use.
*11 The double polarization function cannot be used.
*12 Do not look into the beam directly using any optical instruments (such as eye loupes, magnifiers, microscopes, telescopes, or binoculars). Viewing the laser output with an optical instrument may pose an eye hazard.



Cables

Model	CB-B3	CB-B10	CB-B5E	CB-B10E	CB-B20E
Cable type	Head cable		Extension cable		
Cable length	3 m 9.8'	10 m 32.8'	5 m 16.4'	10 m 32.8'	20 m 65.6'
Minimum bend radius	22 mm				
Enclosure rating*1	IP67 (IEC60529)				
Material (outer covering)	PVC				
Weight	Approx. 250 g	Approx. 750 g	Approx. 400 g	Approx. 800 g	Approx. 1500 g

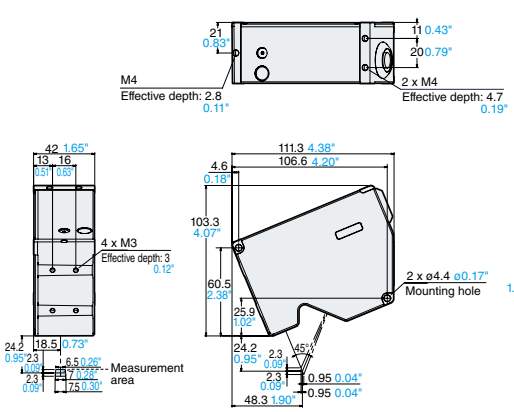
*1 This value is from a case in which the sensor head has been connected. However, the controller side connector is not included.
• Regarding cable extension between the head and controller: Up to 2 cables can be connected with the CB-BxxE, and these cables should be kept to a total length of 30 m 98.4' or less.

Dimensions

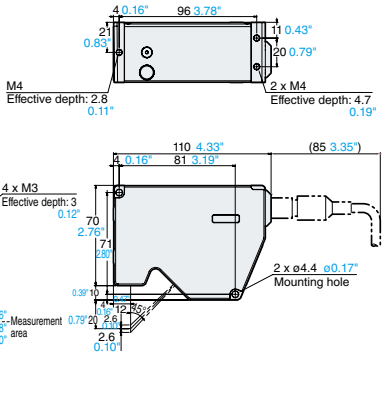
Sensor head

Unit: mm inch

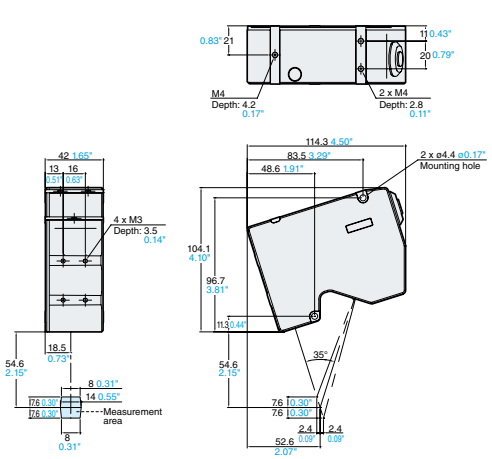
Ultra high-accuracy specular reflection model
LJ-V7020K



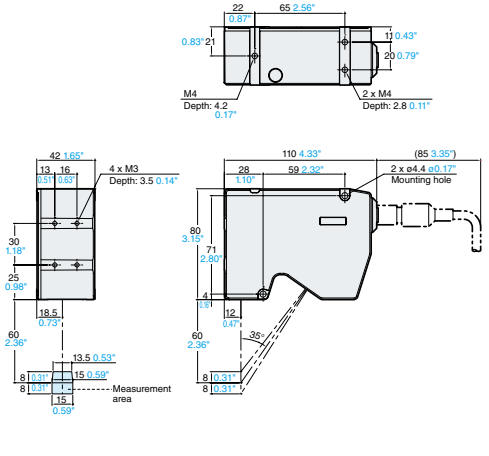
Ultra high-accuracy model
LJ-V7020



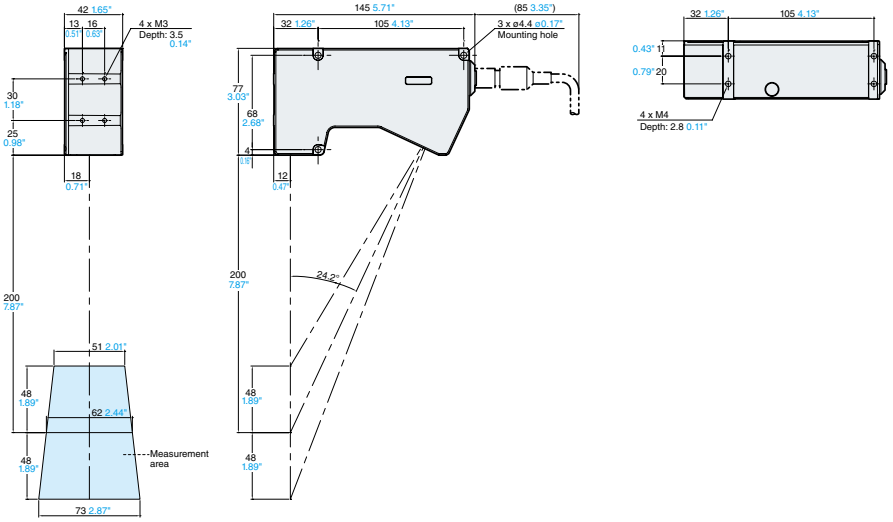
High-accuracy specular target model
LJ-V7060K



High-accuracy model
LJ-V7060

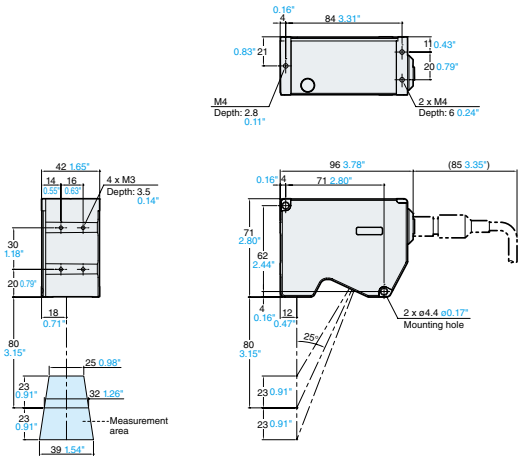


Long range model
LJ-V7200

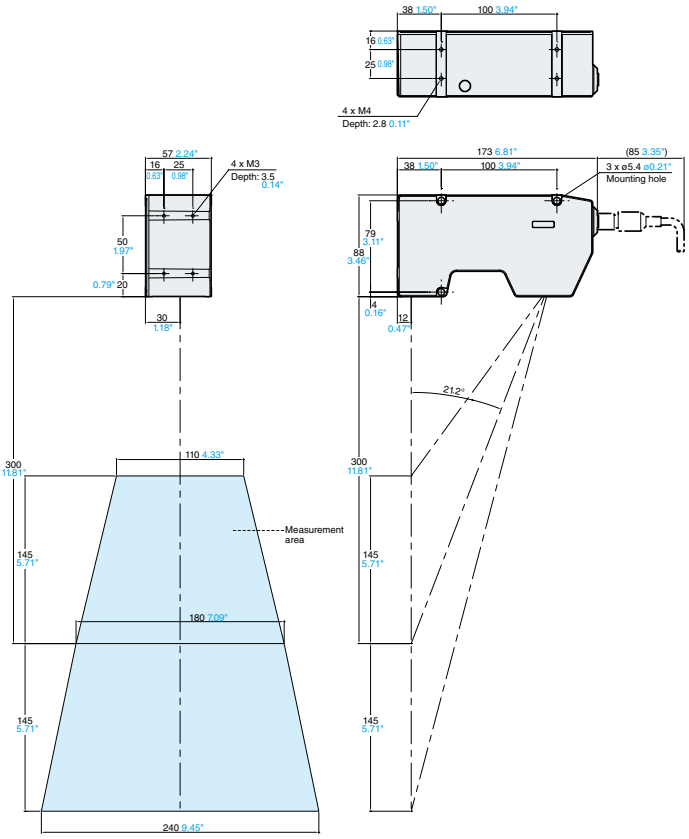


Unit: mm inch

Mid-range model
LJ-V7080

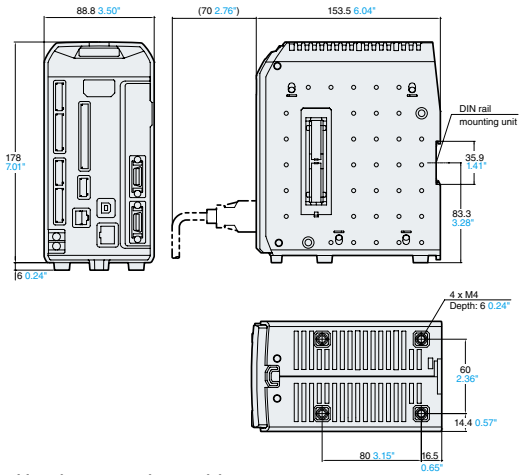


Ultra-long range model
LJ-V7300

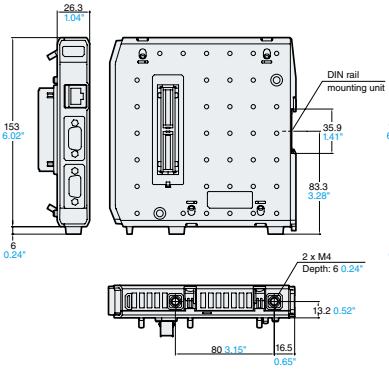


Controller

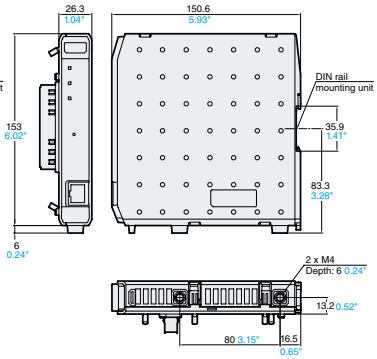
Multi-function controller
LJ-V7001(P)



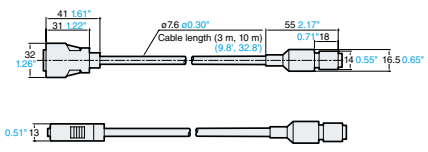
Display output unit
LJ-VM100



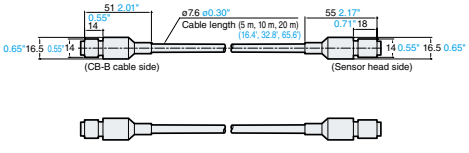
EtherNet/IP™ unit
CB-EP100



Head connection cable
CB-B3/CB-B10



Head connection extension cable
CB-B5E/CB-B10E/CB-B20E



High-Accuracy 2D Laser Displacement Sensor

LJ-G Series

CE

Features

- Linearity of ±0.1% of F.S.
- High-speed sampling
- Simultaneous measurement/judgment of up to 8 features
- Stable measurement for all targets

8-point simultaneous measurement/judgment

Best in its class

The LJ-G Series provides 8-point simultaneous measurement in various measuring modes (height, width, height difference, angle, profile, cross-section area, etc.). Desired measuring points can be specified relative to a profile waveform. Furthermore, the LJ-G Series provides outputs of individual measured values and upper/lower tolerance comparator outputs.

Measurements

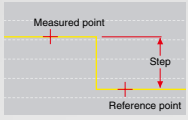
Peak height	Bottom height	Average height	Gap
Width/Position	Section area	Angle/Intersection	Profile comparison

Measurement menus

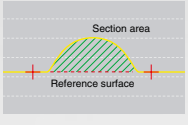
HEIGHT
Measures height in a specified range.

WIDTH/POSITION
Measures width/position with a specified condition.

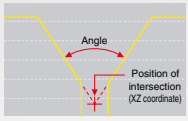
STEP
Determines the height difference between a measured point and the reference point.



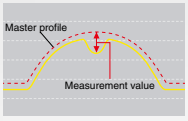
SECTION AREA
Measures the area on the basis of the reference surface.



ANGLE/INTERSECTION
Measures the angle or intersection of detected lines.



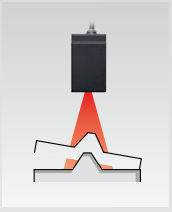
PROFILE COMPARISON
Compares the target profile with the master profile to measure the largest difference.



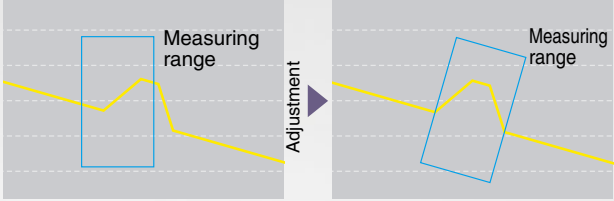
Useful Adjustment Functions

POSITION ADJUSTMENT FUNCTION

After the adjustment, the LJ-G Series can provide stable measurements though the targets are not neatly arranged or positioned.



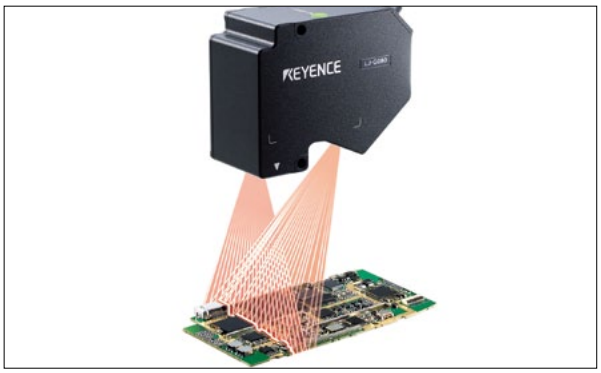
Displacement of target



Since the workpiece is not in the measuring range, a precise measurement cannot be carried out.

The measuring range moves according to the displacement of the workpiece for precise measurement.

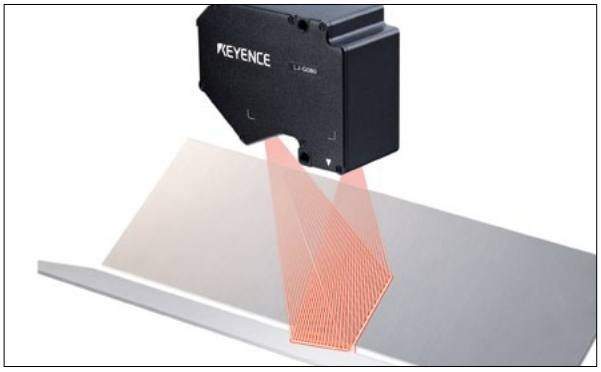
Applications



Confirmation of PCB mounting height

Confirmation of door/hood mounting accuracy

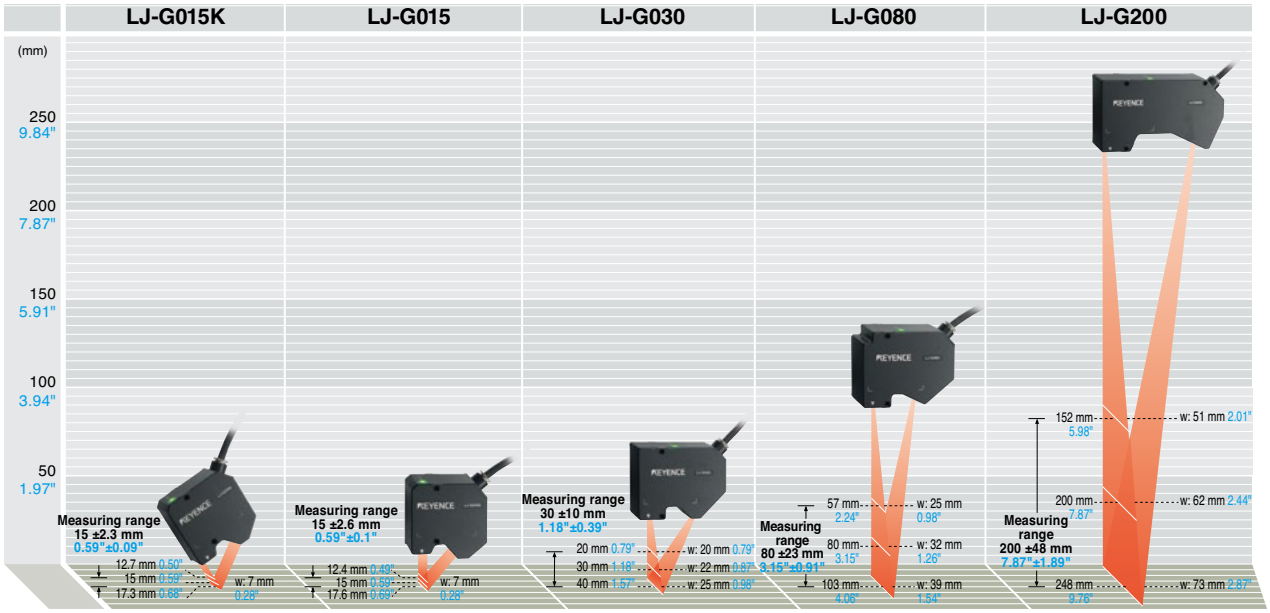
Confirmation of sealant coating profile



Pre-weld position feedback

Lineup

Sensor head



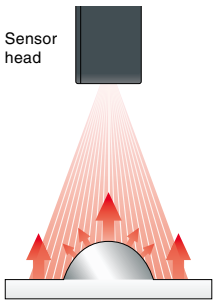
	LJ-G015K		LJ-G015		LJ-G030		LJ-G080		LJ-G200	
Z-axis (Height)	15 ±2.3 mm	0.59"±0.09"	15 ±2.6 mm	0.59"±0.1"	30 ±10 mm	1.18"±0.39"	80 ±23 mm	3.15"±0.91"	200 ±48 mm	7.87"±1.89"
X-axis (Width)	7 mm	0.28"	7 mm	0.28"	22 mm	0.87"	32 mm	1.26"	62 mm	2.44"
Z-axis repeatability	0.2 µm	0.000008"	0.2 µm	0.000008"	1 µm	0.000039"	1 µm	0.000039"	2 µm	0.000079"
X-axis repeatability	2.5 µm	0.000098"	2.5 µm	0.000098"	5 µm	0.000197"	10 µm	0.000394"	20 µm	0.000787"

E³-CMOS providing ultra-wide dynamic range First in the world

The E³-CMOS provides ultra-wide dynamic range which is approximately 300 times wider than conventional modes. The LJ-G Series enables target profile measurement and the measurement of different target materials, such as black rubber (low reflected light intensity) and reflective metal (high reflected light intensity).

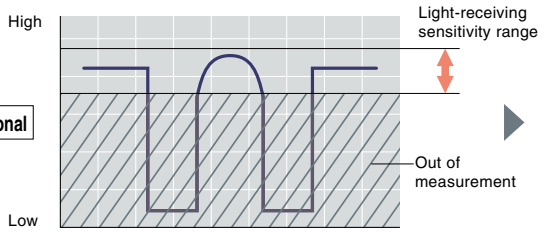
* E³-CMOS sensor: Enhanced Eye Emulation CMOS image sensor

Laser light reflection

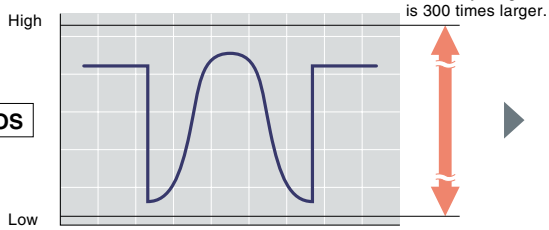


The reflected light intensity changes according to the shape, color, and material of the target.

Light intensity

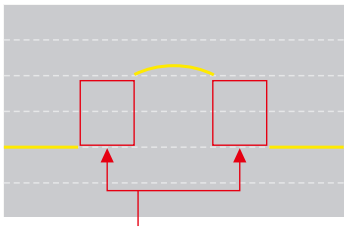


Traditional light receiving elements do not have enough sensitivity to cover the entire range.



The dynamic range is 300 times larger than the conventional model and covers the entire range.

Profile measurement



The edges of the profile are not measured because the light intensity is far less on the angled surfaces than the flat surfaces.

The entire profile is measured.

ASAP (Automatic Sensitivity Adjustment by Pixel)

This function adjusts the sensitivity and laser power of the E³-CMOS to obtain suitable waveform data for each measurement position that has a different reflectance. The obtained data is merged as a single measurement profile.

Dynamic range 6000x

Target with an extremely different reflectance at each position

Sensitivity: Small

Sensitivity: Medium

Sensitivity: Largest

Measurement profile

High capacity memory for saving data Best in its class

High capacity memory is built into the controller. A memory card slot is included to store the production records of mass-produced products.

Handling many product types

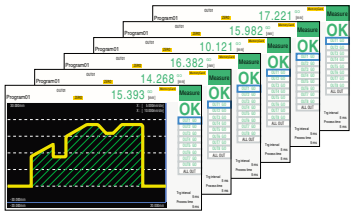
The built-in memory can store up to 16 programs. When the memory card is used, up to 160 programs can be stored to handle various product types.

	Program setting	Profile saving	Data storage
Internal memory	16	1024 x 2	65536 x 8
CF(1GB)	160	1024 x 300	65536 x 3200

Handles 160 types

Profile saving

For analyzing NG records or production history.



1024 profiles

Specifications

Model			LJ-G015K	LJ-G015	LJ-G030	LJ-G080	LJ-G200
Type			Specular reflective	Diffuse reflective			
Reference distance			15 mm 0.59"		30 mm 1.18"	80 mm 3.15"	200 mm 7.87"
Measuring range	Z-axis (Height)		±2.3 mm ±0.09"	±2.6 mm ±0.1"	±10 mm ±0.39"	±23 mm ±0.91"	±48 mm ±1.89"
	X-axis (Width)	Near	6.5 mm 0.26"		20 mm 0.79"	25 mm 0.98"	51 mm 2.01"
		Reference distance	7.0 mm 0.28"		22 mm 0.87"	32 mm 1.26"	62 mm 2.44"
		Far	7.5 mm 0.30"		25 mm 0.98"	39 mm 1.54"	73 mm 2.87"
Light source			Red semiconductor laser				
		Wavelength	655 nm (Visible light)				
		Laser Class	Class II Laser Product (FDA (CDRH) PART1040.10), Class 2 Laser Product (IEC 60825-1)				
		Output	0.95 mW				
Spot diameter (at reference distance)			Approx. 32 µm × 12 mm 0.001260" × 0.47"		Approx. 40 µm × 25 mm 0.001575" × 0.98"	Approx. 80 µm × 46 mm 0.003150" × 1.81"	Approx. 180 µm × 70 mm 0.007087" × 2.76"
Repeatability*1	Z-axis (Height) *2		0.2 µm 0.000008"		1 µm 0.000039"	1 µm 0.000039"	2 µm 0.000079"
	X-axis (Width) *3		2.5 µm 0.000098"		5 µm 0.000197"	10 µm 0.000394"	20 µm 0.000787"
Linearity Z-axis (Height) *2			±0.1% of F.S.				
Sampling frequency (Trigger interval) *4			3.8 ms				
Temperature characteristics			0.02% of F.S./°C				
Environmental resistance		Enclosure rating	IP67 (IEC60529)				
		Ambient light *5	Incandescent lamp or fluorescent lamp: 5000 lux max.				
		Ambient temperature	0 to 50°C 32 to 122°F				
		Relative humidity	35 to 85%, No condensation				
		Vibration	10 to 55 Hz, double amplitude 1.5 mm 0.06", two hours in each direction of X, Y, and Z				
Material			Aluminum				
Weight			Approx. 260 g		Approx. 290 g	Approx. 350 g	Approx. 480 g

*1 The value obtained after 64 times averaging at the reference distance.
*2 The target is KEYENCE standard object. (White diffusing material). The value is the average of the widths in the Height mode.
*3 The target is ø10 mm ø0.39" pin gauge. The value is the edge in the Position mode after 16 times of the Smoothing.
*4 With initial setting, minimum measuring range, and single smoothing processing
*5 The illumination on the receiver of the sensor head when targeting an illuminated white paper.

Controller

Model		LJ-G5001	LJ-G5001P
Sensor head compatibility		Compatible	
Number of connectable sensors		2 units max.	
Display	Minimum display unit	0.1 µm [*1], 0.001 mm², 0.01° (Inch mode: 0.000004", 0.00001 inch)	
	Maximum display range	±99999.9 mm, ±999999 mm², ±99999.9°	
Input terminal block	Laser remote interlock input	Non-voltage input	
	Trigger input	For sensor head A, non-voltage input	For sensor head A, voltage input
	Timing 1 input	Non-voltage input	Voltage input
	Auto-zero 1 input		
	Reset input		
Output terminal block	Analog voltage output	±10 V x 2 outputs, output impedance: 100 Ω	
	Total judgment output	NPN open-collector output	PNP open-collector output
	Error output	NPN open-collector output (N.C.)	PNP open-collector output (N.C.)
	Process output	NPN open-collector output	PNP open-collector output
	Trigger input enable output	For sensor head A, NPN open-collector output	For sensor head A, PNP open-collector output
	Adjusted error output		
Expansion connector	Timing 2 input	Non-voltage input	Voltage input
	Auto-zero 2 input		
	Trigger input	For sensor head B, non-voltage input	For sensor head B, voltage input
	Program switching input	Non-voltage input, 4 inputs	Voltage input, 4 inputs
	Memory card save input	Non-voltage input	Voltage input
	Laser-Off input	For sensor head A/B, non-voltage input	For sensor head A/B, voltage input
	Judgment/Binary output [*2]	3-level judgment output: OUT1 to OUT8, total judgment output Binary output: OUT1 to OUT8 measured data output (21 bits) NPN open-collector output	3-level judgment output: OUT1 to OUT8, total judgment output Binary output: OUT1 to OUT8 measured data output (21 bits) PNP open-collector output
	Strobe output	NPN open-collector output	PNP open-collector output
	Trigger input enable output	For sensor head B, NPN open-collector output	For sensor head B, PNP open-collector output
	Adjusted error output		
Analog RGB monitor output		SVGA (800 x 600 pixels)	
RS-232C interface		Measured data output and control input/output (Maximum baud rate: 115200 bps, selectable)	
USB interface		In conformity with USB Revision 2.0 HI-SPEED (USB 1.1 Full-SPEED compatible)	
Ethernet interface		100BASE-TX/10BASE-T	
Memory card		Compatible with NR-M32 (32 MB), GR-M256 (256MB), and NR-M1G (1GB). (with FAT32)	
Major functions		Sensor heads calculation, Profile adjustment, Filter, Smoothing, Averaging, Position adjustment, OUT name change, Measurement mode selection (Height, position, gap, width, center position, section area, intersection, angle, profile comparison, profile tracking), Scaling, Average, Measurement, Measured value alarm, Tolerance setting, Auto-zero, Storage (data/profile), Memory card saving, Program memory, Trigger mode change, Mutual interference prevention, Measuring range change, Calibration, Laser light adjustment, Sampling time setting, Mask, Profile alarm setting, Inclination adjustment, Height adjustment, Display language switch, Setting support software connection, Trigger pitch/Measuring time display, etc.	
Ratings	Power supply voltage	24 VDC ±10%, Ripple: 10% (P to P) or less	
	Current consumption	800 mA or less with 1 sensor head/1 A or less with two sensor heads	
Environmental resistance	Ambient temperature	0 to 50°C 32 to 122°F	
	Relative humidity	35 to 85%, No condensation	
Weight		Approx. 1050 g	

*1 When LJ-G015 or LJ-G015K is connected only. When other sensor heads are connected, the minimum display unit is 1 µm.
*2 Time-sharing output of judgment results or binary measured data.
The rating of the NPN open-collector output: 50 mA max. (30 V max.), residual voltage of 1 V max. The rating of the PNP open-collector output: 50 mA max. (30 V max.), residual voltage of 1 V max.
The rating of the non-voltage input: 1 V or less ON voltage, 0.6 mA or less OFF current (Trigger input terminal: 1 V or less ON voltage, 1.0 mA or less OFF current)
The rating of the voltage input: 26.4 V maximum rating, 10.8 V or less ON voltage, 0.6 mA or less OFF current (Trigger input terminal: 26.4 V maximum rating, 10.8 V or less ON voltage, 1.0 mA or less OFF current)

Hardware environment for the LJ-H1W (LJ-Navigator)

Model	LJ-H1W
CPU	Pentium III, 400 MHz or higher
Supported OS	Windows 10[*1] Windows 7 (SP1 or later)[*2] Windows Vista (SP2 or later)[*3] Windows XP (SP3 or later)[*4]
Memory capacity	128 MB or more
Display	XGA (1024 x 768 pixels) or greater, 256 colors or greater
Hard disk space	30 MB or more
Interface	Includes one of the following: USB 2.0/1.1[*5], Ethernet[*6], RS-232C (Serial port)

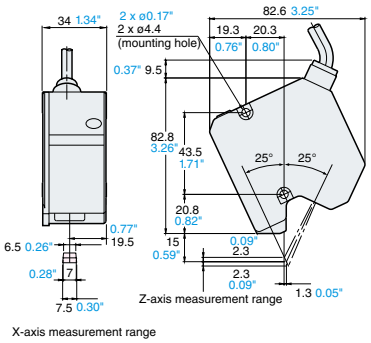
*1 Home, Pro, and Enterprise editions are supported.
*2 Home Premium, Professional, and Ultimate editions are supported.
*3 Ultimate, Business, Home Premium, and Home Basic editions are supported.
*4 Professional and Home editions are supported.
*5 Connection through a USB hub is not included in the guarantee.
*6 Connection to LAN and connection via a router is not included in the guarantee.

Dimensions

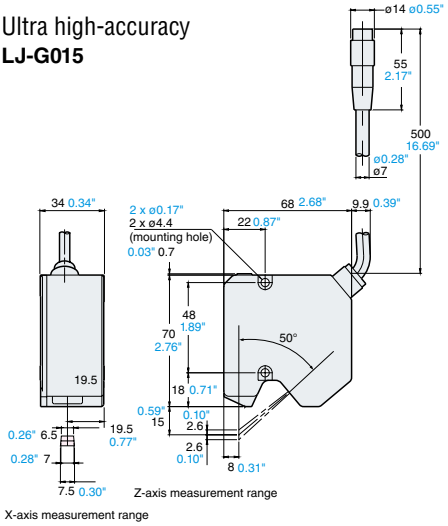
Unit: mm inch

Sensor head

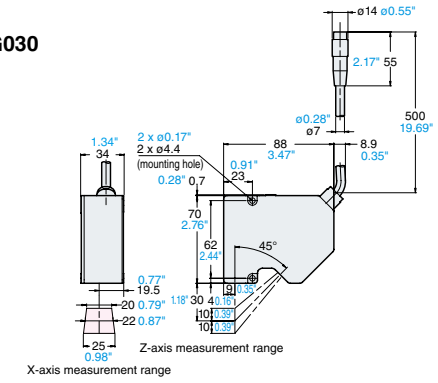
Ultra high-accuracy specular reflection
LJ-G015K



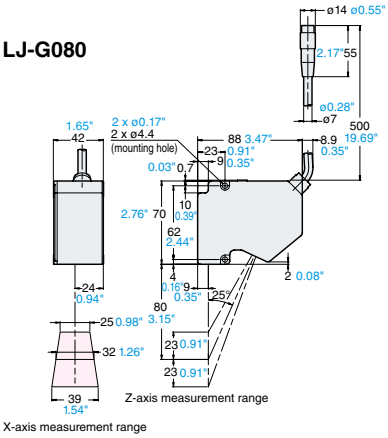
Ultra high-accuracy
LJ-G015



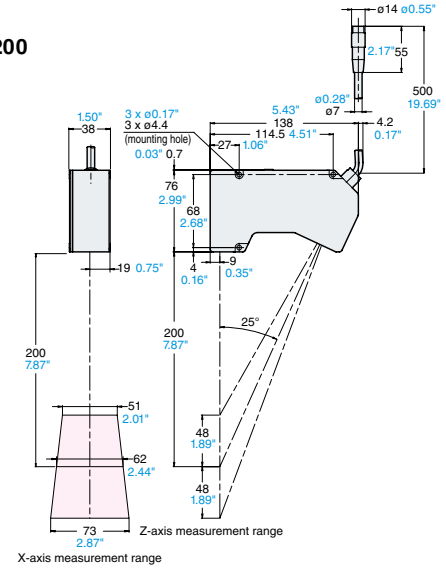
LJ-G030



LJ-G080

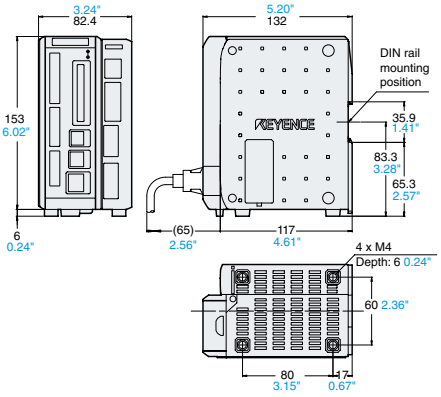


LJ-G200

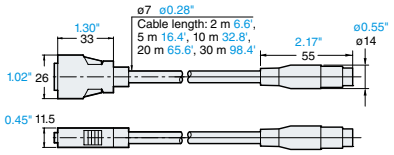


Controller

LJ-G5001(P)



Cable between the sensor head and the controller
LJ-GC2/GC5/GC10/GC20/GC30



Cable between the sensor head and the controller

Model	LJ-GC2	LJ-GC5	LJ-GC10	LJ-GC20	LJ-GC30
Cable length	2 m 6.6'	5 m 16.4'	10 m 32.8'	20 m 65.6'	30 m 98.4'
Weight	Approx. 200 g	Approx. 400 g	Approx. 750 g	Approx. 1400 g	Approx. 2000 g

Micro-Head Spectral-Interference Laser Displacement Meter

SI-F1000 Series

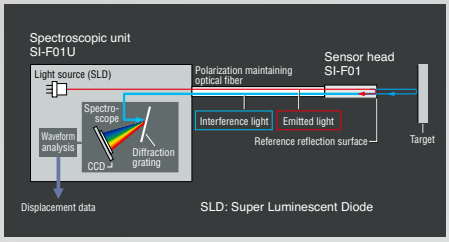
CE

Features

- Resolution of 1 nm
- Micro-head size of ø2 mm ø0.08"
- Spectral interference method

Spectral interface method First in the Industry

Development of a new principle can meet incompatible needs for small size with high accuracy that was previously impossible.



SLD

Part of the broad wavelength light emitted from the SLD is reflected by the head's reference surface, while the part that passes the reference surface is mirror-reflected on the target and returns into the head.

Interference light

The two reflected light beams interfere with each other. The intensity of the interference light with a specific wavelength is determined according to the distance between the reference surface and the target. The relative maximum interference is reached when the determined distance is an integral multiple of the wavelength.

Spectroscopic analysis

Splitting the interference light into different wavelengths with the spectroscope produces an optical intensity distribution for a specific wavelength. The distance to the target is obtained by carrying out waveform analysis on the distribution.

No heat generation and no noise

Advantages of the optical fiber head structure

The measurement head consists of only optical fibers and lenses, with no electronic parts.

Small size, light weight, and heat resistant
These features greatly reduce the constraints on selecting an installation area. A micro-head of this type can be used with a wider range of measurement applications because it can be installed in places where conventional units cannot.

No heat generation
An exothermic body is one of the error-causing factors in high-accuracy measurement. The optical fiber head structure produces no heat generation in the head section.

Not influenced by electromagnetic noise
The measurement head contains no electrical circuits. Because of this, it is not influenced by electromagnetic noise, which is difficult to isolate and remove.

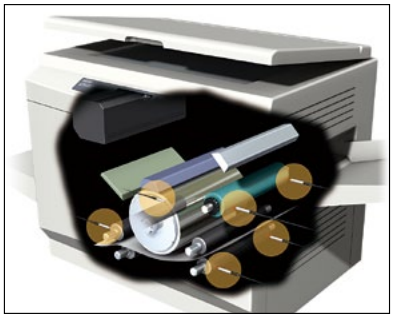
Resolution of 1 nm (0.001 µm) Highest in its class

High resolution of 1 nm (0.001 µm) has been realized by the development of new principles and the application of sophisticated controllers. This resolution can fully respond to a variety of needs for high accuracy.

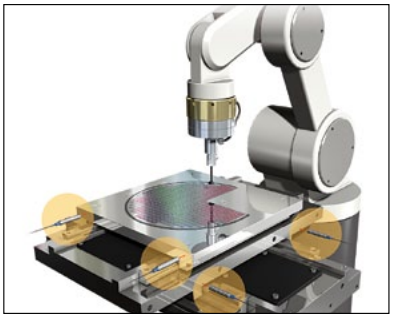
Head size of ø2 mm ø0.08" World's smallest

The simple fiberoptic structure for the measurement head has allowed KEYENCE to develop the world's smallest sensor head without any heat generation problems associated with compact electronics.
In addition as the sensor head has no electronic components, it is immune to electromagnetic noise.

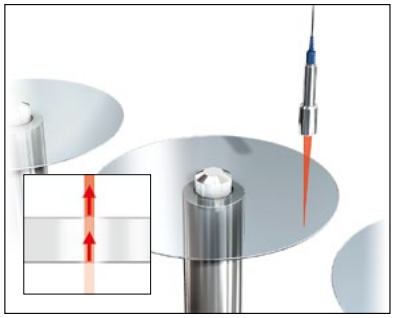
Applications



Measuring the behavior of critical components inside an assembled device



Positioning of high precision stages



Measuring the thickness of glass discs

Lineup

Type	Model		Major technical data	
Micro-Head Type Best suited for measurements requiring ultra high-accuracy, compact spaces, or high temperatures.	**SI-F01**		Measurement range	0.05 to 1.1 mm 0.002" to 0.04"
			Resolution	0.001 µm
			Linearity	±0.2 µm ±0.000008"
			Head size	ø2 mm ø0.08"
Long Distance Type Long-distance measurement with high accuracy.	**SI-F10**		Measurement range	11.3 to 12.35 mm 0.04" to 0.49"
			Resolution	0.01 µm
			Linearity	±0.3 µm ±0.000012"
			Head size	ø8 mm ø0.32"
Thickness (Gap) Measurement Type High accuracy achieved by targeting thickness measurement.	**SI-F80**		Setting distance	80 to 81.1 mm 3.15" to 3.19"
			Measurable thickness	0.05 to 1.1 mm 0.002" to 0.04"
			Resolution	0.001 µm
			Linearity	±0.2 µm ±0.000008"
			Head size	ø12 mm ø0.47"

Sensor head

Micro-head type
SI-F01

Long distance type
SI-F10

Thickness measurement type
SI-F80

Spectrum unit
SI-F01U/
SI-F10U/
SI-F80U

(One spectroscopic unit is needed for each sensor head.)

Optional unit

Head mounting jig (For SI-F01)
OP-84480

Controller

Single unit type
SI-F1001V

Separate type
SI-F1001

Expansion controller
SI-FA100

Back surface

Spectrum unit spacer
OP-84474

(Supplied together with the spectroscopic unit)

Display

Display panel
SI-FD500

Cable

Controller-to-sensor head unit connecting cable
CB-A07/CB-A2/CB-A5/
CB-A10/CB-A20/CB-A30

Controller-to-spectrum unit extension cable
CB-A5E/CB-A10E
Display-to-controller cord
0.33 m 1.08' : **OP-84428**
3 m 9.84': **OP-51655**
10 m 32.81': **OP-51656**

Software

Dedicated PC software "SI-Navigator"
SI-H1

Specifications

Sensor head

Type			Micro-head type	Long distance type	Thickness measurement type
Model	Sensor head		**SI-F01**	**SI-F10**	**SI-F80**
	Spectrum unit		**SI-F01U**	**SI-F10U**	**SI-F80U**
Measurement range			0.05 to 1.1 mm 0.002" to 0.04" *1	11.3 to 12.35 mm 0.04" to 0.49" *1	0.05 to 1.1 mm 0.002" to 0.04" *2 (Possible detection distance : 80 to 81.1 mm 3.15" to 3.19")
Light source			Infrared SLD Central wavelength 820 nm Output 0.6 mW, Class 1 Laser product (IEC60825-1, FDA (CDRH) Part 1040.10 *8)		
Beam spot diameter*3			ø20 µm ø0.000787"	ø40 µm ø0.001575"	ø20 µm ø0.000787"
Linearity			±0.2 µm ±0.000008" *4	±0.3 µm ±0.000012" *4	±0.2 µm ±0.000008" *5
Resolution			0.001 µm *6	0.01 µm *6	0.001 µm *7
Sampling cycle			200 µs		
Light source for guide			Red semiconductor laser Wavelength 650 nm Output 0.1 mW, Class 1 Laser product (IEC60825-1, FDA (CDRH) Part 1040.10 *8)		
LED display			Target near center of measurement range: green lights. Target within measurement range: orange lights. Target outside measurement range: Flashes orange.		
Temperature fluctuation	Spectrum unit		0.01% of F.S./°C		
Environment resistance	Enclosure rating	Sensor head	IP67	IP64	IP64
	Ambient light		Incandescent lamp or fluorescent lamp: 10000 lux max.		
	Ambient temperature	Sensor head	0 to +85°C 32 to 185°F	0 to +40°C 32 to 104°F	0 to +50°C 32 to 122°F
		Spectrum unit	0 to +35°C 32 to 95°F		
	Relative humidity	Sensor head	35 to 85%RH (No condensation)		
		Spectrum unit	35 to 80%RH (No condensation)		
	Vibration	Sensor head	10 to 55 Hz, 1.5 mm 0.06" double amplitude in X, Y, and Z directions, 2 hours respectively		
		Spectrum unit	10 to 55 Hz, 0.5 mm 0.02" double amplitude in X, Y, and Z directions, 2 hours respectively		
Material	Sensor head		SUS		
	Spectrum unit		Polycarbonate		
Weight	Sensor head (including cable)		Approx. 24 g	Approx. 38 g	Approx. 39 g
	Spectrum unit		Approx. 1 kg		

*1 Indicates distance from the front of the sensor head. For long distance type sensor heads there is an individual difference of up to ±0.2 mm ±0.01".
*2 The thickness measurement type sensor head displays the measurement range for the distance between plates of glass. Ensure that the measurement target is within the possible detection distance range.
*3 Indicates the minimum beam spot diameter within the measurement range.
*4 This value is obtained when the measurement target is a glass plate with the number of averaging measurements set to 256.
*5 This value is obtained by measuring the gap between two glass plates with the number of averaging measurements set to 256.
*6 This value is obtained by measuring a glass plate surface located at the center of the measurement range with the number of averaging measurements set to 4,096.
*7 This value is obtained by measuring a 0.3 mm 0.01" thick glass target within the possible detection distance with the number of averaging measurements set to 4,096.
*8 The laser classification for FDA (CDRH) is implemented based on IEC60825-1 in accordance with the requirements of Laser Notice No. 50.

Controller

Type			Main Controller	Expansion controller*1
Model	Single unit type		**SI-F1001V**	**SI-FA100**
	Separate type*2		**SI-F1001/SI-FD500**	
No. of connectable spectrum units			2	1
Display	Minimum display unit		0.001 µm	N/A
	Display range		±999.999 µm to ±9999.99 mm, (7 settings selectable)	
	Display cycle		10 times/sec.	
Terminal block	Laser remote interlock input		Non-voltage input	N/A
	TIMING1 input			
	RESET1 input			
	Auto-zero1 input			
	Laser control input			
	Analog voltage output		±10 V x 2 outputs, Output impedance: 100 Ω	±10 V x 1 output, Output impedance: 100 Ω
	Analog current output		4 to 20 mA x 2 outputs, Maximum load resistance: 350 Ω	4 to 20 mA x 1 output, Maximum load resistance: 350 Ω
	Alarm output		NPN open-collector output (N.C.)	N/A
	General comparator output		NPN open-collector output	
Expansion connector	TIMING input		Non-voltage input 2	N/A
	RESET input		Non-voltage input	
	Auto-zero input			
	Program switch input		Non-voltage input x 3 inputs	
	Alarm output		NPN open-collector output (N.C.)	
	Comparator/ binary output	Binary output	Measured value data output (21 bits) OUT selectable NPN open-collector output	
		Strobe output	NPN open-collector output	
		Binary selection output	NPN open-collector output	
		Binary selection input	Non-voltage input	
RS-232C interface			Measured data output and control input/output (Baud rate selectable to 115,200 bps max.)	N/A
USB interface			USB 2.0 high speed compliant (USB 1.1 Full-SPEED compatible)	
Ethernet interface			100Base-TX/10Base-T	
Major functions			12 Out simultaneous measurement calculation, average, filter, scaling measurement, measured value alarm, tolerance setting, auto-zero, data storage, light monitor, 8-program memory, interferometer mode, mask, connection of setting support software, etc.	
Power supply	Power supply voltage		24 VDC±10% Ripple 10% (P-P) max.	Supplied from the main controller
	Maximum current consumption		One head connected: 0.6 A or less. Six heads connected: 1.5 A or less.	
Environment resistance	Ambient temperature*3		0 to +50°C 32 to 122°F	
	Relative humidity		35 to 85%RH (No condensation)	
	Vibration*4		10 to 55 Hz, 0.5 mm 0.02" double amplitude in X, Y, and Z directions, 2 hours respectively	
Weight			Approx. 600 g	Approx. 300 g

*1 Up to four expansion controllers can be connected to the main controller.
*2 The SI-F1001 can be used independently. The measured value display and setting change can be done with the display panel (SI-FD500) and setup support software (SI-H1).
*3 When two or more expansion controllers are connected, the ambient temperature is 0 to 40°C 32 to 104°F.
*4 When two or more expansion controllers are connected, the vibration resistance is "10 to 55 Hz, 0.3 mm 0.01" double amplitude in X, Y, and Z directions, 2 hours respectively".
• NPN open-collector output rating: 50 mA max. (40 V max.), Residual voltage: 0.5 V max.
• Non-voltage input rating: ON voltage: 1 V max., OFF current: 0.6 mA max.
• Part of the input/output circuit of the SI Series is internally common. Be careful that no potential difference is generated between the internally common terminals due to the potential difference between the cables/external devices. For details, refer to "Precautions on wiring".

Operating environment required to use SI-H1 (SI-Navigator)

Item	Minimum system requirements
CPU	Pentium III, 1 GHz or higher (1.7 GHz or higher is recommended)
OS	Windows 10*1 Windows 7 (SP1 or later)*2 Windows Vista (SP2 or later)*3 Windows XP (SP3 or later)*4
Memory capacity	256 MB or higher (1 GB or more is recommended)
Display resolution	1024 x 768 pixels, 24-bit full color or higher
Free hard disk space	1 GB or larger
Interface	One of the following interfaces is required. - USB: Revision 2.0, high-speed (full speed in USB1.1 compatible mode)*5 - LAN: 100BASE-TX or 10BASE-T*6 - RS-232C (serial port)

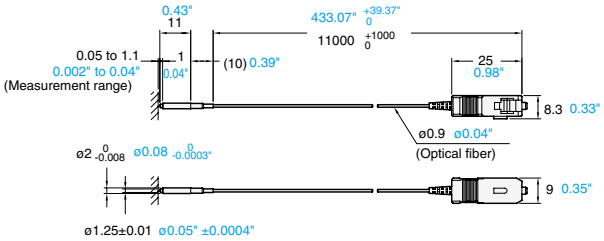
The other system requirements must meet those recommended for your OS.
*1 Home, Pro, and Enterprise editions are supported.
*2 Home Premium, Professional, and Ultimate editions are supported.
*3 Ultimate, Business, Home Premium, and Home Basic editions are supported.
*4 Professional and Home editions are supported.
*5 Connection through a USB hub is not included in the guarantee.
*6 Connection to LAN and connection via a router is not included in the guarantee.

Dimensions

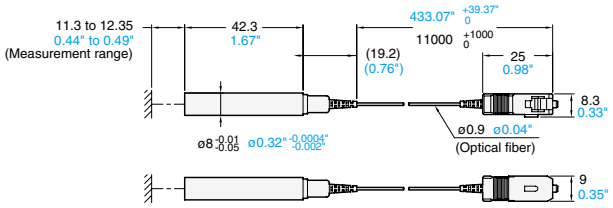
Sensor head

Unit: mm inch

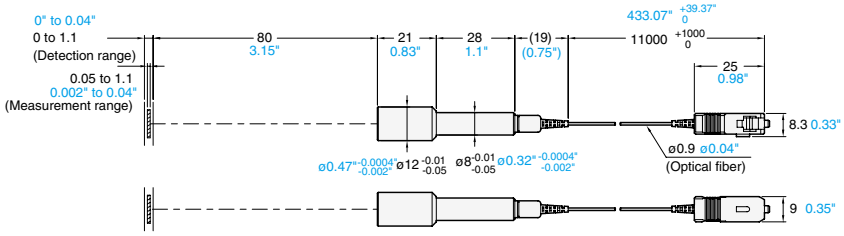
Micro-head type
SI-F01



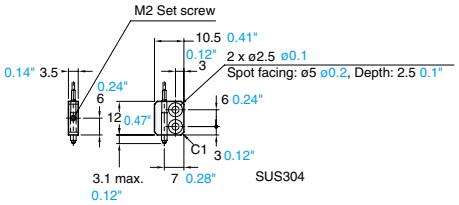
Long distance type
SI-F10



Thickness measurement type
SI-F80

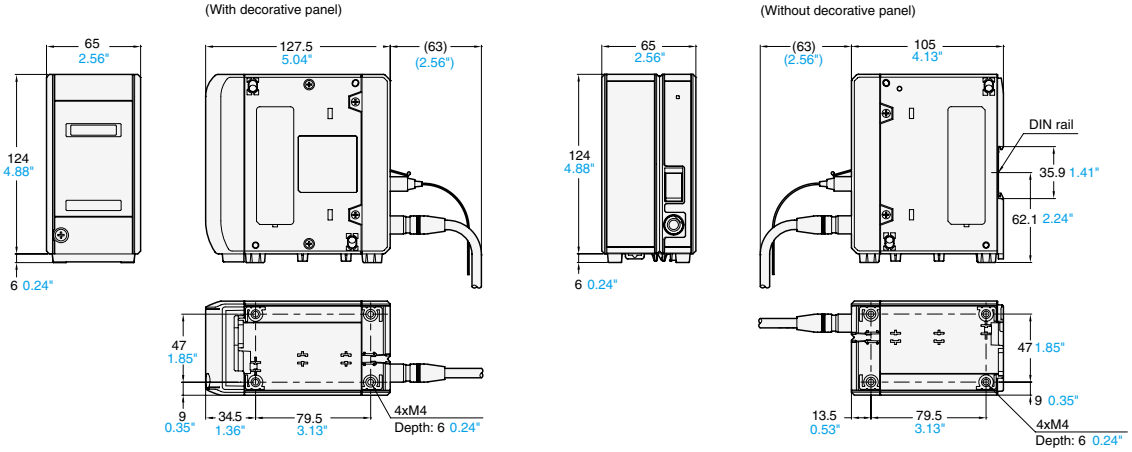


Head mounting jig (For SI-F01)
OP-84480



Spectrum unit

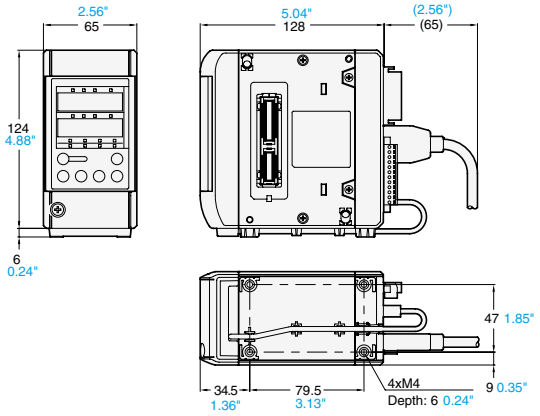
SI-F01U/SI-F10U/SI-F80U



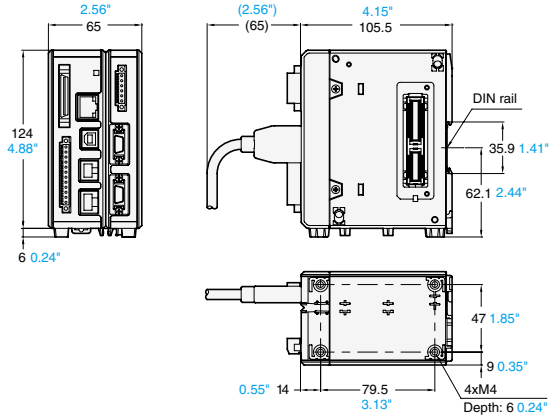
Controller

Unit: mm inch

Single unit type
SI-F1001V

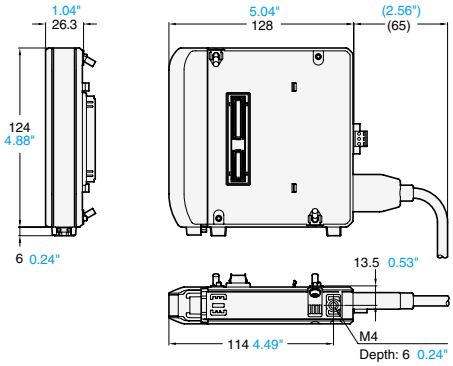


Separate type
SI-F1001

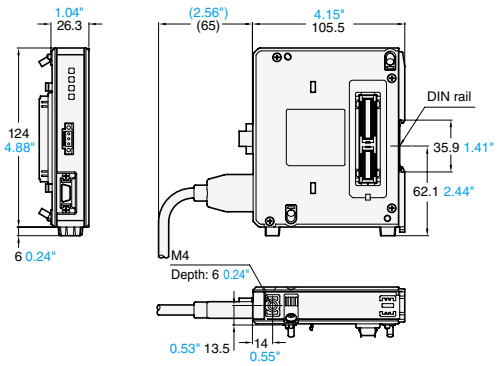


Expansion controller
SI-FA100

(With decorative panel)

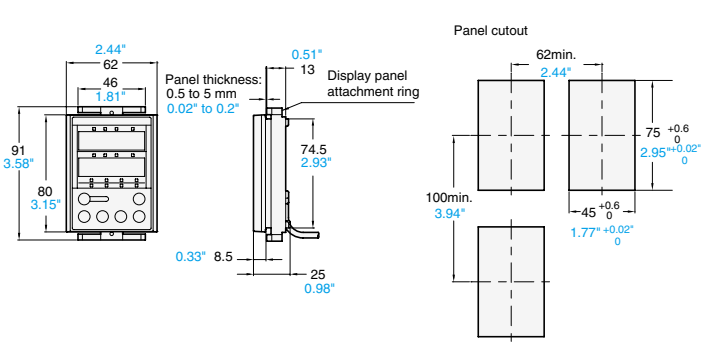


(Without decorative panel)



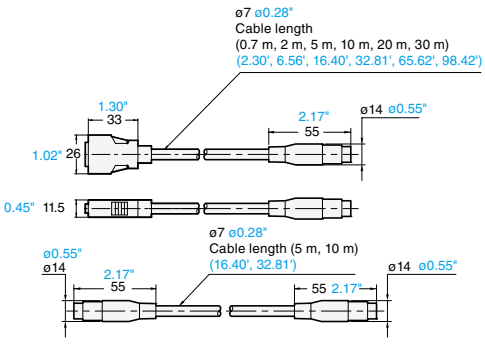
Display

Display panel
SI-FD500



Additional accessories

Controller-to-spectroscopic unit connection cable
CB-A07/CB-A2/CB-A5/CB-A10/
CB-A20/CB-A30



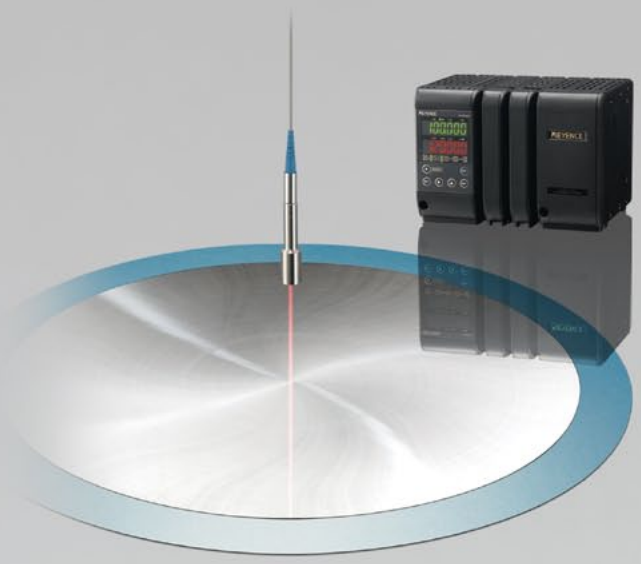
Spectral-Interference Wafer Thickness Meter

SI-F80R Series

CE

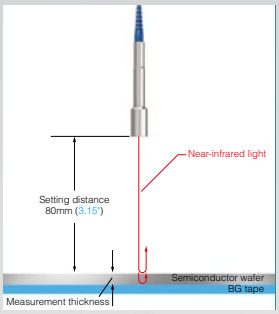
Features

- Resolution of 1 nm
- Sampling speed of 5 kHz
- Working distance 80 mm 3.15"



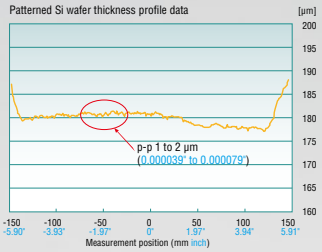
Accurately measure wafer thickness

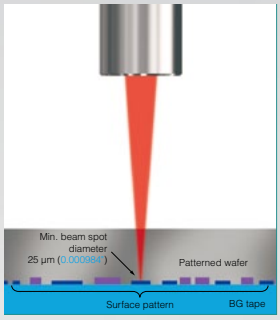
The SI-F80R Series employs a near-infrared SLD that can penetrate through Si, GaAs, SiC, InP, a-Si, and other semiconductors. It can accurately measure wafer thickness, even when covered with BG (backgrind) tape.



Not influenced by wafer patterns

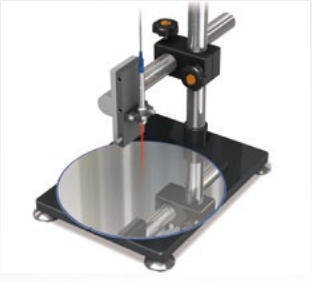
Variations from wafer surface patterns and measurement alarms can be held to a minimum by decreasing the spot beam diameter and surface aberrations inside the beam spot.





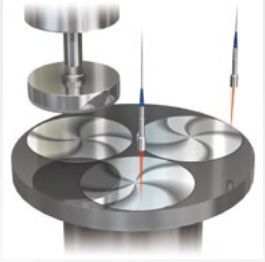
Simple, accurate measurements in-process

- The sensor can easily make measurements just by being positioned 80 mm 3.15" from wafers.
- Non-contact, so wafers are not damaged.
- The sensor can directly measure just wafer thickness, so measurements are not influenced by BG tape thickness.



Constant monitoring in process

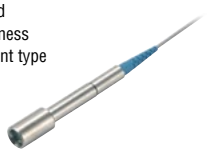
- With a small head that can be installed 80 mm 3.15" from the wafer, wafer thickness can be constantly monitored inside equipment while polishing.



Lineup

Components

Sensor head
Wafer thickness measurement type
SI-F80R



Spectrum unit
SI-F80RU

External device

IR sensor card

Specifications

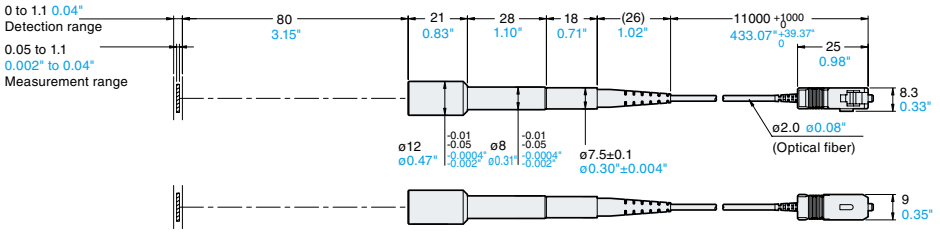
Type			Wafer thickness measurement type
Model	Sensor head		**SI-F80R**
	Spectrum unit		**SI-F80RU**
Measurement range *1			10 to 310 µm 0.0004" to 0.0122" (when n=3.5)
Possible detection distance			80 to 81.1 mm 3.15" to 3.19"
Light source			Infrared SLD Output 0.6 mW, Class 1 Laser Product (IEC60825-1, FDA (CDRH) Part 1040.10 *5)
Beam spot diameter *2			ø25 µm ø0.000984"
Linearity *3			±0.1 µm ±0.000004" (when n=3.5)
Resolution *4			1 nm
Sampling cycle			200 µs
LED display			Target near center of measurement range: green lights. Target within measurement range: orange lights. Target outside measurement range: flashes orange.
Temperature fluctuation	Spectrum unit		0.01% of F.S./°C
Environment resistance	Enclosure rating	Sensor head	IP64
	Ambient light		Incandescent lamp or fluorescent lamp: 10000 lux max.
	Ambient temperature	Sensor head	0 to +50°C 32 to 122°F
		Spectrum unit	0 to +35°C 32 to 95°F
	Relative humidity	Sensor head	35 to 85% RH (No condensation)
		Spectrum unit	35 to 85% RH (No condensation)
	Vibration	Sensor head	10 to 55 Hz, 1.5 mm 0.06" double amplitude in X, Y, and Z directions, 2 hours respectively
		Spectrum unit	10 to 55 Hz, 0.5 mm 0.02" double amplitude in X, Y, and Z directions, 2 hours respectively
Material	Sensor head		SUS
	Spectrum unit		Polycarbonate
Weight	Sensor head (including cable)		Approx. 70 g
	Spectrum unit		Approx. 1.2 kg

The sensor head and spectrum unit are calibrated as a pair. They are not interchangeable.
*1 Indicates the thickness measurement range when the refractive index is 3.5. (The thickness measurement range is 35 to 1100 µm 0.001378" to 0.0433" when the refractive index is 1.)
*2 Indicates the minimum beam spot diameter within the measurement range.
*3 This value is obtained by measuring the gap between two glass plates with the number of averaging measurements set to 256, converted to a refractive index of 3.5.
*4 This value is obtained by measuring a 0.3 mm 0.01" thick glass target within the possible detection distance with the number of averaging measurements set to 4096.
*5 The laser classification for FDA (CDRH) is implemented based on IEC60825-1 in accordance with the requirements of Laser Notice No. 50.

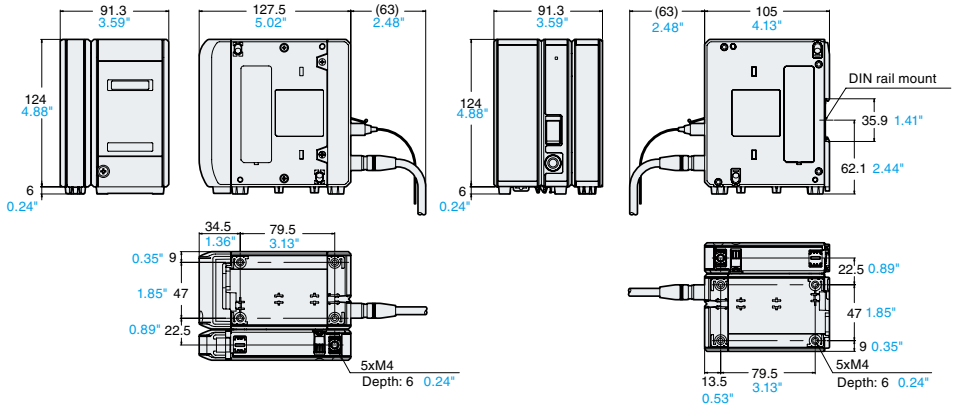
Dimensions

Unit: mm inch

SI-F80R



SI-F80RU



Surface Scanning Laser Confocal Displacement Meter

LT-9000 Series

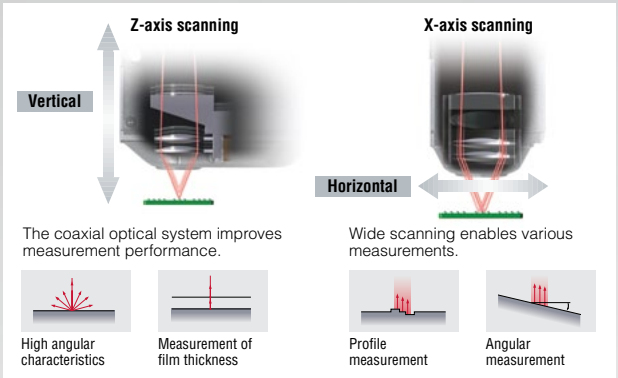
CE

Features

- Precise 2 µm 0.000079" diameter beam spot
- 0.01 µm resolution
- X and Z axis scanning

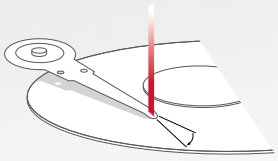
The surface scanning method allows measurements of all types of targets

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



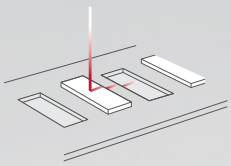
Angle measurement

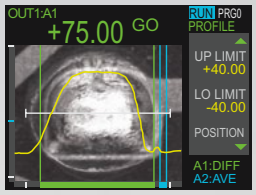
An angle can be measured in increments of 0.01 degrees based on the measurement values of two or more points obtained by scanning the laser beam spot.



Profile measurement

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

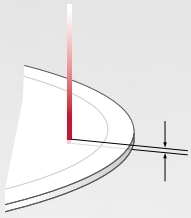




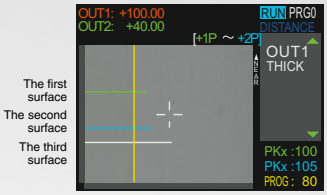
The surface profile can be traced using the double-scanning method. The height difference between the two points can be measured.

Transparent object thickness measurement

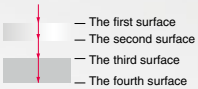
The surface condition and thickness of transparent objects can be measured stably by utilizing the confocal principle.



The thickness of transparent disks can be measured. In addition, the slant correction function enables more reliable measurements.

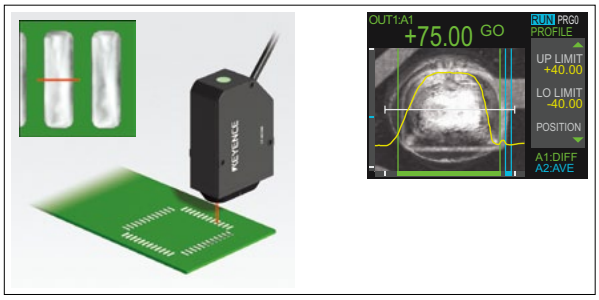


Multi-surface measurement function



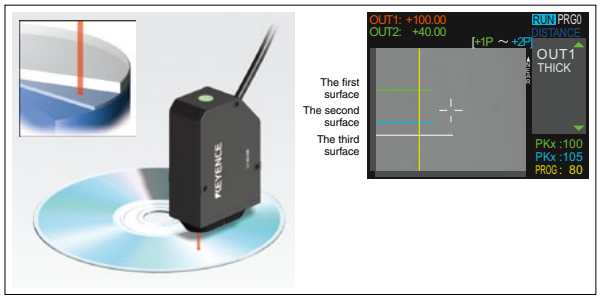
The peak value of light intensity of up to four target surfaces can be detected with one measurement unit. The selected measurement surface can be measured with high accuracy.

Applications



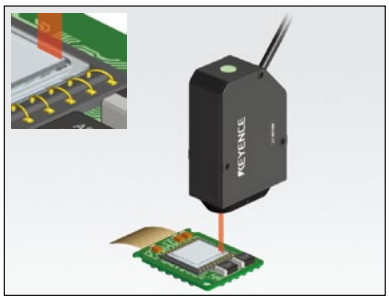
Measuring the profile of solder paste on a PWB

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



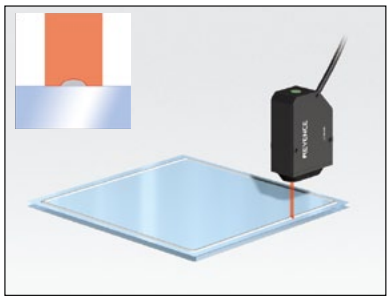
Measuring the thickness of an optical disc

The intermediate layer of an optical disc can be measured.



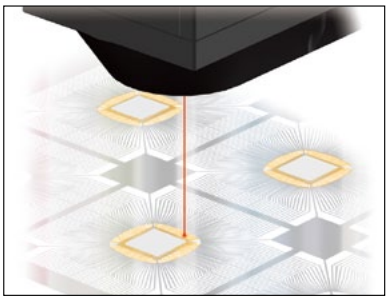
Measuring the parallelism of a CCD and cover glass

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



Measuring the cross-sectional area of liquid sealing material

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



Measuring the height of bond wire

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

Lineup (Measuring unit)

Type	High-accuracy	Long-range
Model	**LT-9010M/LT-9010**	**LT-9030M/LT-9030**
Measurement range	±0.3 mm ±0.01"	±1 mm ±0.04"
Reference distance	6 mm 0.24"	30 mm 1.18"
Appearance		
Scan width	0 to 1100 µm 0 to 0.0433" (6 steps)	0 to 560 µm 0 to 0.0220" (6 steps)
Interval	1 to 10 µm 0.000039" a 0.000394" (4 steps)	1 to 8 µm 0.000039" a 0.000315" (4 steps)
Resolution	0.01 µm	0.1 µm 0.000004"
Linearity	±0.5% of F.S.	±0.3% of F.S.

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*5, 1 µm², 0.01°	0.01 µm*5
	Display range		±9999.99 µm, ±999999 µm², 9999.99°	±9999.99 µm
	Microscope function		LT-9501/LT-9010M only	LT-9501SO(5652)/LT-9030M only
	Display cycle*1		10 times/sec.	
Terminal block	Analog output		±10 V x 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 x 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 (Controller)			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)/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.
*5 Display changes every ±0.3 µm 0.000012".

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	670 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. 0.000079" ø2 µm		Approx. 0.000276" ø7 µm	
Scan width/interval		0 to 0.043307" 0 to 1100 µm (6 steps)/ 0.000039" a 0.000394" 1 to 10 µm (4 steps)		0 to 0.022047" 0 to 560 µm (6 steps)/ 0.000039" a 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 3.		640 µs to 356 ms (14 steps)		640 µs to 187 ms (14 steps)	
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" x 0.04" 1.3 mm x 1.05 mm	–	0.10" x 0.08" 2.5 mm x 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	

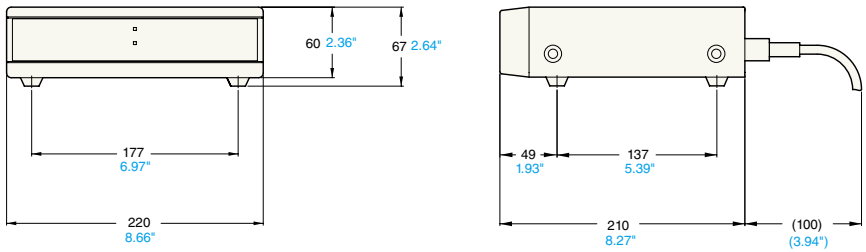
1. The value when the measurement target is an mirrored surface object that is measured in displacement mode, scan width/interval 0.004724" (120 µm)/0.000079" (2 µm), and 8-times average
2. The value when the FINE mode is set to OFF.
3. Sampling cycle differs according to the manufacturing variation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

Dimensions

Controllers

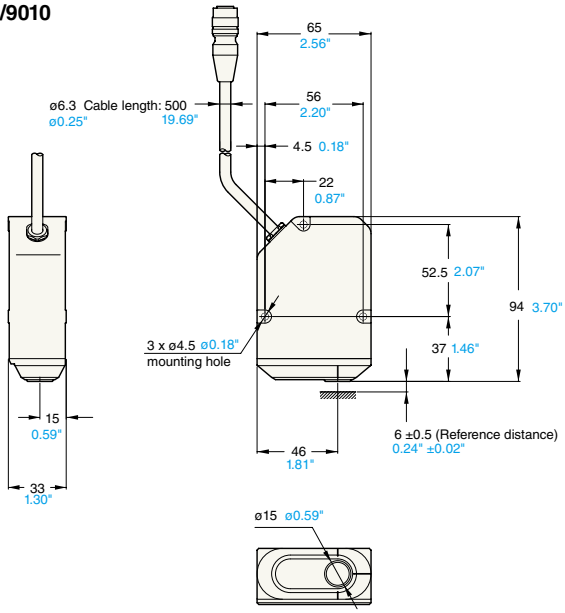
Unit: mm inch

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

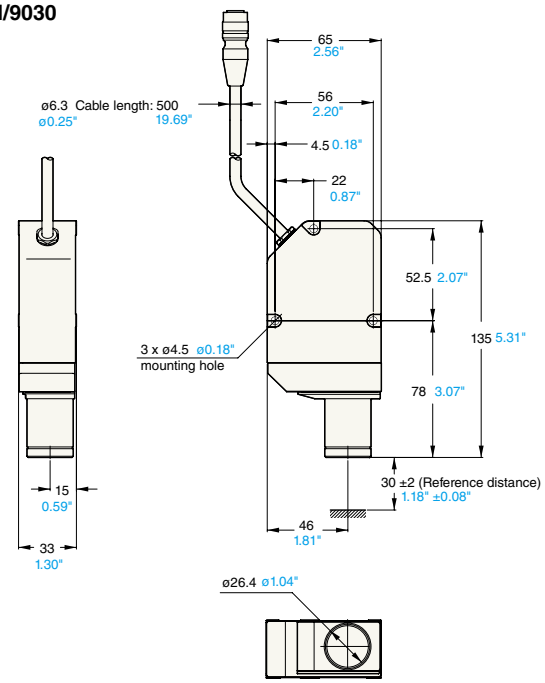


Measuring units

LT-9010M/9010



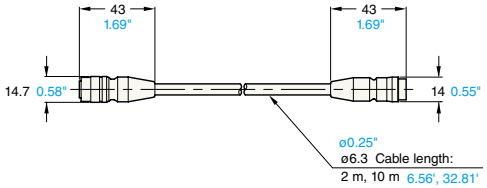
LT-9030M/9030



Sensor head cable

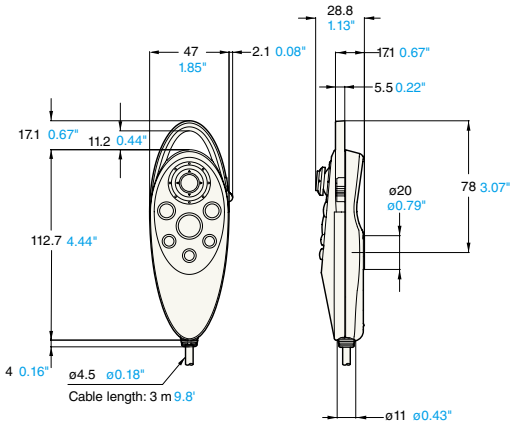
Cable between the measuring unit and the controller

LT-C2/LT-C10



Remote control console

(Standard **OP-51542**)



Class IIa Laser Product
Avoid Long-Term Viewing of Direct Laser Radiation

High-Speed Optical Micrometer

LS-9000 Series

CE

High-accuracy optical micrometer that flexibly supports runout and inclination with the ultimate performance required for on-site measurement.

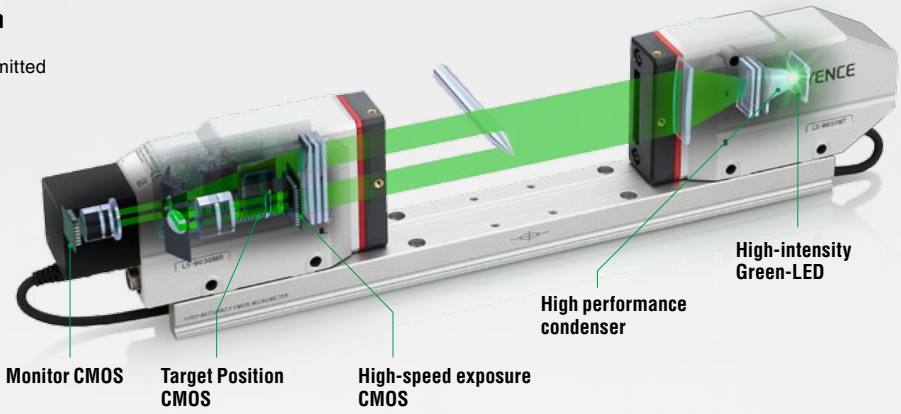
Features

- High-speed 16000 samples/second
- The smallest detectable object 10 µm 0.000394"
- Equipped with the tilt correction and transmitter/receiver position measurement, etc.

Principle

3-CMOS×Green-LED system

[Principle] Green-LED light is emitted as a uniform collimated beam. The CMOS detects the position of the edge between light and dark edges of the received light and calculates measured values.



Three separate CMOS sensors provide advanced inspection capabilities

High-speed CMOS

16000 Hz sampling

By integrating the peripheral circuits of the measurement CMOS into one chip, the S/N ratio has been dramatically improved and high-speed sampling achieved. For example, targets that move at 1000 m 3280.8'/min. can be measured at a pitch of around 1 mm 0.04". Even parts that vibrate at high speeds can be measured stably.

Monitor CMOS

Alignment adjustment*1

Recognizes the misalignment of a workpiece from the image taken by the monitor CMOS. Inclination error is removed automatically and does not affect the measurement result. The captured image can also be checked with computer software so even novices will have no problem taking measurements.

*1 Functions of the LS-9006M and LS-9030M heads only.

Target positioning CMOS

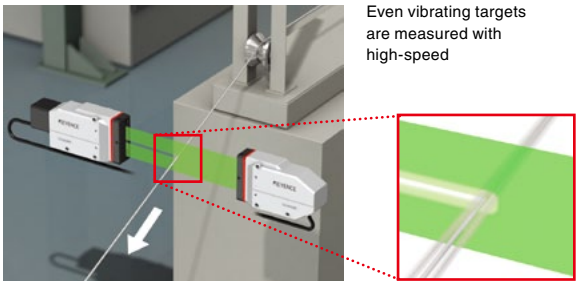
Transmitter/receiver direction and position measurement*2

With the additional data obtained from the target positioning CMOS, the LS-9000 can determine the position of the target in both the X and Y axes.

*2 Functions of the LS-9006 (M) and LS-9030 (M) heads only.

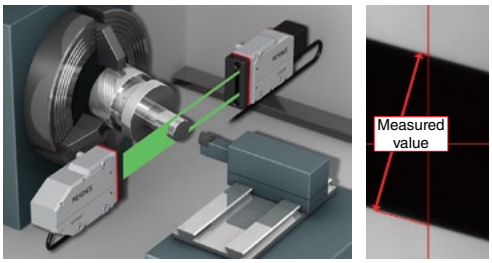
Applications

Measuring the outer diameter wire moving at high speed

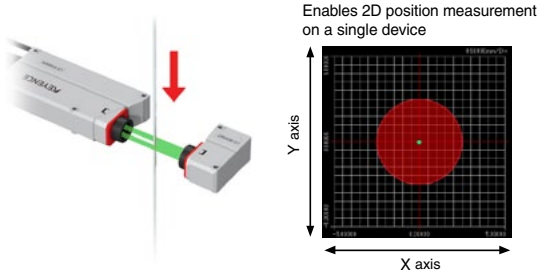


Measuring the outer diameter of a shaft

Misaligned workpieces are adjusted and measured



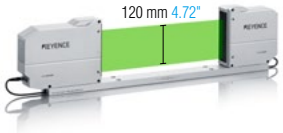
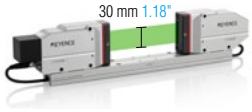
Measuring the position and outer diameter of an optic fiber



Outer diameter measurement in harsh environments

Lineup

Measuring unit

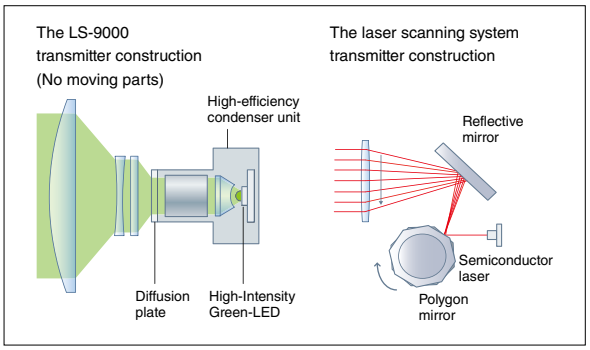
Type	Large-diameter model		Standard model		Small-diameter model	
Subtype	With monitor camera		With monitor camera	Without monitor camera	With monitor camera	Without monitor camera
Model	**LS-9120M**		**LS-9030M**	**LS-9030**	**LS-9006M**	**LS-9006**
Appearance						
Measurement range	0.8 to 120 mm 0.03" to 4.72"		0.08 to 30 mm 0.003" to 1.18"		0.01 to 6 mm 0.0004" to 0.24"	
Measurement accuracy	±8 µm ±0.000315"		±2 µm ±0.000079"		±0.5 µm ±0.000020"	
Repeatability	±0.3 µm ±0.000012"		±0.1 µm ±0.000004"		±0.03 µm	
Monitor function	Provided	Not provided	Provided	Not provided	Provided	Not provided

Type	2-axis standard model	2-axis small-diameter model
Subtype	Without monitor camera	Without monitor camera
Model	**LS-9030D**	**LS-9006D**
Appearance		
Measurement range	0.3 to 30 mm 0.01" to 1.18"	0.04 to 6 mm 0.002" to 0.24"
Measurement accuracy	±2 µm ±0.000079"	±0.5 µm ±0.000020"
Repeatability	±0.1µm ±0.000004"	±0.03 µm

Structure

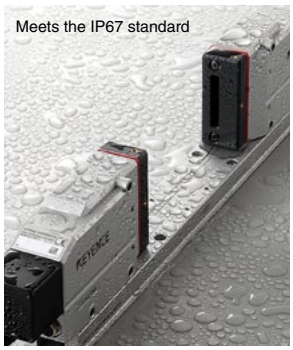
Our proprietary wear-free construction

As a high intensity Green LED is used to generate the measurement beam, laser degradation typical with traditional systems is completely avoided. In addition, as the entire beam is generated with no moving parts, there is no motor or mirror system to wear out or replace.



Best in class environmental resistance design*

The system enclosure maintains an IP67 rated protection for all internal components. In addition, the LS-9000 Series heads come standard with a built in air purge mechanism to further enhance the system's resistance to environmental influence.



* The air purge unit is sold as an optional accessory only for the LS-9120M head.

Functions

Ultra-thin outer diameter and ultra-thin gap measurement*

Specialized ultra-fine diameter/gap tool now allows measurement of gaps and diameters previously undetectable.

Measuring the outer diameter of an ultra-thin wire

Smallest detectable object

	Standard mode	Ultra-thin mode
6 mm 0.24" type	40 µm 0.0016"	10 µm 0.0004"
30 mm 1.18" type	300 µm 0.0118"	80 µm 0.0031"

* Functions of the LS-9006 (M) and LS-9030 (M) heads only.

16-channel simultaneous measurement

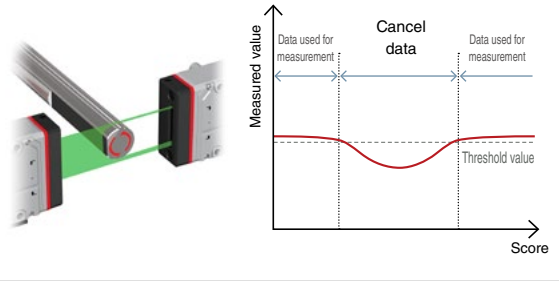
With up to 16 simultaneous outputs, it is possible to measure any combination of diameters, position, gaps, etc. to meet your needs.

Measuring the outer diameter and runout of a photocopier roller

Irregular surface cancellation

Irregular surface cancellation allows for proper outer diameter inspection of parts with complex profiles such as key slots or D-cuts.

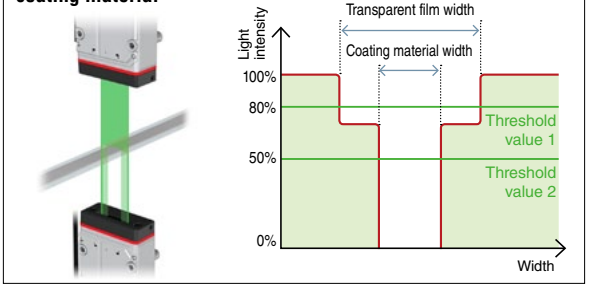
Measuring the outer diameter of a motor shaft



Transparent object/two-level edge detection threshold value setting

Using two-level threshold settings, it is possible to simultaneously measure two targets of differing transparency.

Taking dimensional measurements of transparent film and coating material



Specifications

Measuring unit

Head (Standard model/small-diameter model)

Model		LS-9006M (with monitor camera)	LS-9006 (without monitor camera)	LS-9030M (with monitor camera)	LS-9030 (without monitor camera)
Measurement range		0.04 mm (0.01 mm) to 6 mm 0.002"(0.0004") to 0.24"		0.3 mm (0.08 mm) to 30 mm 0.01"(0.003") to 1.18"	
Smallest detectable object		0.04 mm (0.01 mm) 0.002"(0.0004")		0.3 mm (0.08 mm) 0.01"(0.003")	
Transmitter/receiver distance		60 ±5 mm 2.36" ±0.20"		160 ±40 mm 6.3" ±1.57"	
Repeatability		±0.03 µm*1		±0.1 µm ±0.000004"*2	
Measurement accuracy		±0.5 µm ±0.000020"*3		±2 µm ±0.000079"*4	
Sampling cycle*7		16000 samples/sec.			
Transmitter/receiver direction and position detection	Detection area	4 x 5 mm 0.16" x 0.20"		20 x 24 mm 0.79" x 0.94"	
	Smallest detectable object	0.04 mm 0.002"		0.3 mm 0.01"	
	Repeatability	±0.02 mm ±0.0008"*5		±0.2 mm ±0.008"*6	
	Sampling cycle	4000 samples/sec.			
Light source		InGaN green LED			
Monitor camera		Provided	Not provided	Provided	Not provided
Environmental resistance	Ambient temperature	0 to +50°C 32 to 122°F			
	Relative humidity	20 to 85% RH (no condensation)			
	Ambient light	Incandescent lamp/fluorescent lamp 3000 lux or lower			
	Vibration resistance	10 to 55 Hz, double amplitude 1.5 mm 0.06", 2 hours in each direction (X,Y, and Z)			
	Shock resistance	15G/6 ms			
Enclosure rating		IP67 (including connector)			
Material		Aluminum			
Weight		Transmitter: Approx. 130 g Receiver: Approx. 300 g Base: Approx. 180 g	Transmitter: Approx. 130 g Receiver: Approx. 280 g Base: Approx. 180 g	Transmitter: Approx. 440 g Receiver: Approx. 500 g Base: Approx. 430 g	Transmitter: Approx. 440 g Receiver: Approx. 440 g Base: Approx. 430 g

The values in brackets are measured in ultra-thin mode. For details on the accuracy of ultra-thin mode, contact the nearest KEYENCE office.
*1 A ±2σ margin of error when measuring a ø1.0 mm ø0.04" rod in the center of the measurement area using outer diameter mode with the average measurement number set as 2048 times.
*2 A ±2σ margin of error when measuring a ø10 mm ø0.39" rod in the center of the measurement area using outer diameter mode with the average measurement number set as 2048 times.
*3 Margin of error when a moving ø1.0 mm ø0.04" rod is measured in the 2 mm × 4 mm 0.08" × 0.16" measurement area using outer diameter mode.
*4 Margin of error when a moving ø10 mm ø0.39" rod is measured in the 10 mm × 20 mm 0.39" × 0.79" measurement area using outer diameter mode.
*5 A ±2σ margin of error when measuring the position of a ø1.0 mm ø0.04" rod in the center of the measurement area with the average measurement number set as 512 times.
*6 A ±2σ margin of error when measuring the position of a ø10 mm ø0.39" rod in the center of the measurement area with the average measurement number set as 512 times.
*7 The sampling cycle is changed by the number of OUT set, and by the use of the mutual interference prevention function.

Head (2-axis standard model/2-axis small-diameter model)

Model		LS-9006D	LS-9030D
Measurement range		ø0.04 mm to ø6 mm ø0.002" to ø0.24"	ø0.3 mm to ø30 mm ø0.01" to ø1.18"
Smallest detectable object		0.04 mm 0.002"	0.3 mm 0.01"
Repeatability		±0.03 µm*1	±0.1 µm ±0.000004"*2
Measurement accuracy		±0.5 µm ±0.000020"*3	±2 µm ±0.000079"*4
Sampling cycle*5		16000 samples/sec.	
Light source		InGaN green LED	
Monitor camera		Not provided	
Environmental resistance	Ambient temperature	0 to +50°C 32 to 122°F	
	Relative humidity	20 to 85% RH (no condensation)	
	Ambient light	Incandescent lamp/fluorescent lamp 3000 lux or lower	
	Vibration resistance	10 to 55 Hz, double amplitude 1.5 mm 0.06", 2 hours in each direction (X,Y, and Z)	
	Shock resistance	15G/6 ms	
Measuring head enclosure rating		IP67 (including connector)	
Material		Aluminum	
Weight		Approx. 4.8 kg	Approx. 9 kg

*1 A ±2σ margin of error when measuring a ø1.0 mm ø0.04" rod in the center of the measurement area using outer diameter mode with the average measurement number set as 2048 times.
*2 A ±2σ margin of error when measuring a ø10 mm ø0.39" rod in the center of the measurement area using outer diameter mode with the average measurement number set as 2048 times.
*3 Margin of error when a moving ø1.0 mm ø0.04" rod is measured in the 2 mm × 2 mm 0.08" × 0.08" measurement area.
*4 Margin of error when a moving ø10 mm ø0.39" rod is measured in the 10 mm × 10 mm 0.39" × 0.39" measurement area.
*5 The sampling cycle is changed by the number of OUT set, and by the use of the mutual interference prevention function.

Head (Large-diameter model)

Model		LS-9120M
Measurement range		0.8 mm to 120 mm 0.03" to 4.72"
Smallest detectable object		0.8 mm 0.03"
Transmitter/receiver distance		400 ±100 mm 15.75" ±3.94"
Repeatability		±0.3 µm ±0.000012"*1
Measurement accuracy		±8 µm ±0.000315"*2
Sampling cycle		16000 samples/sec.
Light source		InGaN green LED
Monitor camera		Provided
Environmental resistance	Ambient temperature	0 to +50°C 32 to 122°F
	Relative humidity	20 to 85% RH (no condensation)
	Ambient light	Incandescent lamp/fluorescent lamp 3000 lux or lower
	Vibration resistance	10 to 55 Hz, double amplitude 1.5 mm 0.06", 2 hours in each direction (X,Y, and Z)
	Shock resistance	15G/6 ms
Enclosure rating		IP67 (including connector)
Material		Aluminum
Weight		Transmitter: Approx. 1800 g, Receiver: Approx. 2800 g, Base: Approx. 1600 g

*1 A ±2σ margin of error when measuring a ø40 mm ø1.57" rod in the center of the measurement area using outer diameter mode with the average measurement number set as 2048 times.
*2 Margin of error when a moving ø40 mm ø1.57" rod is measured in the 40 mm × 120 mm 1.57" × 4.72" measurement area using outer diameter mode.

Specifications

Controller

Model		LS-9501	LS-9501P
No. of connectable sensor heads		2	
Head compatibility		Yes	
Display	Minimum display unit	0.01 µm	
	Display range	±99999.99 µm to ±9999.9 mm	
	LED display	POWER ON indicator, ERROR indicator	
Input terminal block	Encoder input	NPN/PNP open-collector output, voltage output (5 V/12 V/24 V), line-driver output	
	Synchronous 1, 2 input	Non-voltage input	Voltage input
	Auto-zero 1, 2 input		
	Reset 1, 2 input		
	Storage trigger input		
	Storage enable input		
	Storage data clear input		
	Statistics 1, 2 input		
	Statistics clear 1, 2 input		
	Program selection input	Non-voltage input x 4 inputs	Voltage input x 4 inputs
Output terminal	Analog voltage output	±10 V x 2 outputs, output impedance 100 Ω	
	Analog current output	4 to 20 mA x 2 outputs, compatible load max. 350 Ω	
	Universal output	NPN open-collector output x 10 outputs Measured value and tolerance judgment output, status output allocatable	PNP open-collector output x 10 outputs Measured value and tolerance judgment output, status output allocatable
	Status 1, 2 output	NPN open-collector output	PNP open-collector output
	Total judgment output		
	Memory FULL output		
	Strobe 1, 2 output		
	Error output	NPN open-collector output (N.C.)	PNP open-collector output (N.C.)
Ethernet interface		1000BASE-T/100BASE-TX	
USB interface		USB 2.0 HI-SPEED supported (USB 1.1 Full-SPEED compatible)	
RS-232C interface		Measured value output, control I/O, setting change, baud rate can be selected up to 115200 bps	
Display and settings panel interface		LS-D1000 Max. four heads connectable	
Rating	Power supply voltage	24 VDC ±10%, including ripple (P-P)	
	Current consumption*1	When LS-HA100 not used: 1.0 A max. when 1 head connected; 1.4 A max. when 2 heads connected When LS-HA100 in use: 2.0 A max. when 3 heads connected; 2.3 A max. when 4 heads connected	
Environmental resistance	Ambient temperature	When LS-HA100 not used: 0 to +50°C 32 to 122°F When LS-HA100 in use: 0 to +45°C 32 to 113°F	
	Relative humidity	20 to 85% RH (no condensation)	
Weight		Approx. 1500 g	

- NPN open-collector output rating: 50 mA max. (40 V max.), residual voltage of 1 V max.
- PNP open-collector output rating: 50 mA max. (30 V max.), residual voltage of 1 V max.
- Non-voltage input rating: ON voltage of 1 V max., OFF current of 0.6 mA max.
- Voltage input rating: Input max. voltage 26.4 V, min. ON voltage 10.8 V, OFF current 0.6 mA max.

*1 Add the current consumption values for all units when connecting the display settings panel and expansion units. When the LS-9006D or LS-9030D is connected, it counts as two heads.

Display and settings panel

Model		LS-D1000
Display interface	Measured value display	Measured value display: 2 colors, 8 digits, 16 segments OUT number display: Monochrome, 2 digits, 7 segments Tolerance judgment display: HH, HI, GO, LO, LL. Monochrome Control status display: TIM, ZERO indicator. Monochrome
	Program number display	Monochrome, 2 digits, 7 segments
	Position monitor display	1D display: 2 colors, 32 levels 2D display: Monochrome, 7 x 7 matrix display
	Display update cycle	5 times/sec.
Operation input interface		Numeric keypad, function key, lock key timing input key, zero input key, reset input key, escape key, arrow keys (4)
Display and settings panel connection port		2
Power supply		Supplied from the controller
Rating	Current consumption	0.19 A max.
Environmental resistance	Ambient temperature	0 to +50°C 32 to 122°F
	Relative humidity	20 to 85% RH (no condensation)
Enclosure rating		IP65 (When panel attached, front surface only)
Weight		Approx. 400 g

OS environment for using the LS-H2 (LS-Navigator 2) Setting Support Software

Item		Required environment
Operating System		Windows 10*1 Windows 7 (SP1 or later)*2 Windows Vista (SP2 or later)*3 Windows XP (SP3 or later)*4
Supported languages		Japanese, English, German, Simplified Chinese, Traditional Chinese
CPU		Core 2 Duo 2 GHz or more
Memory capacity		2 GB or more
L2 cache memory		2 MB or more
Free space in hard disk		10 GB or more
Display		XGA (1024 × 768 pixels) or more, 256 colors or more
Interface	USB	USB 2.0 HI-SPEED supported (USB 1.1 Full-SPEED compatible)*5
	Ethernet	Ethernet 1000BASE-T/100BASE-TX*6

If you wish to use the send to Excel function, please check that one of the Excel versions listed below is installed on your computer.
Excel 2010 (32 bit/64 bit), Excel 2007, Excel 2003, Excel 2002
*1 Home, Pro, and Enterprise editions are supported. *2 Home Premium, Professional, and Ultimate editions are supported. *3 Ultimate, Business, Home Premium, and Home Basic editions are supported.
*4 Professional and Home editions are supported. *5 Connection through a USB hub is not included in the guarantee. *6 Connection to LAN and connection via a router is not included in the guarantee.

BCD output unit

Model		CB-BD100
LED display		POWER-ON LED
Output terminal	BCD output *1	NPN open-collector output x 4 ports
	Strobe output	NPN open-collector output x 4 outputs
	OUT selection output	NPN open-collector output x 4 outputs
Input terminal	OUT selection input	Non-voltage input x 4 inputs
Power source		Supplied from the controller
Rating	Current consumption	0.16 A max.
Environmental resistance	Ambient temperature	0 to +50°C 32 to 122°F
	Relative humidity	20 to 85% RH (no condensation)
Weight		800 g

· Up to 1 unit can be connected to the controller.
· NPN open-collector output rating: 30 mA max. (30 V max.), residual voltage of 0.5 V max.
· Non-voltage input rating: ON voltage of 1 V max., OFF current of 0.6 mA max.
*1 Selectable from BCD output (29 bits, signed), binary output (25 bits, negative numbers are represented by the two's complement), and judgment output.

EtherNet/IP™ unit

Model		CB-EP100
Compatible network		EtherNet/IP™ and displacement sensor-specific protocols (socket communication)
Ethernet	Compliant standards	IEEE 802.3 (10BASE-T), IEEE 802.3u (100BASE-TX)
	Transmission speed	10 Mbps (10BASE-T), 100 Mbps (100BASE-TX)
	Transmission media	STP or Category 3 or higher UTP (10BASE-T), STP or Category 5 or higher UTP (100BASE-TX)
	Maximum cable length	100 m 328.1' (Distance between the unit and Ethernet switch)
	Maximum number of connectable hubs*1	4 hubs (10BASE-T), 2 hubs (100BASE-TX)
EtherNet/IP™	Supported functions	Cyclic communication (Implicit messaging), Message communication (Explicit messaging), Compatible with UCMM and Class 3
	Number of connections	64
	RPI	0.5 ms to 10000 ms (in 0.5 ms)
	Tolerable communication bandwidth for cyclic communication	6000 pps
	Message communication	UCMM, Class 3
	Conformance test	Compatible with Version A9
Power supply voltage		24 VDC ±10%, including ripple (P-P) (supplied from the controller unit of the laser scanner)
Current consumption		0.12 A max.
Environmental resistance	Ambient temperature	0 to +50°C 32 to 122°F
	Relative humidity	20 to 85% RH (no condensation)
Weight		Approx. 470 g

*1 The number of connectable hubs is not limited when using a switching hub.

PROFINET unit

Model		CB-PN100
Compatible network		PROFINET IO communication
Ethernet	Compliant standards	IEEE 802.3u*1
	Transmission speed	100 Mbps, full duplex (100BASE-TX)
	Transmission media	STP or Category 5e or higher UTP
	Maximum cable length	100 m 328.1'
PROFINET IO	Supported functions	Data I/O communication
		Record data communication
	Number of connectable PROFINET IO controllers	1
	Update time	2 ms to 2048 ms
	GSDML	Version 2.25
	Conformance class	Conformance Class A compliant
	Conformance test version	Based on Version 2.2.4
	Applicable protocol	LLDP, DCP
Power supply voltage		24 V ±10% (supplied from the controller unit of the laser scanner)
Current consumption		0.12 A max.
Weight		Approx. 470 g

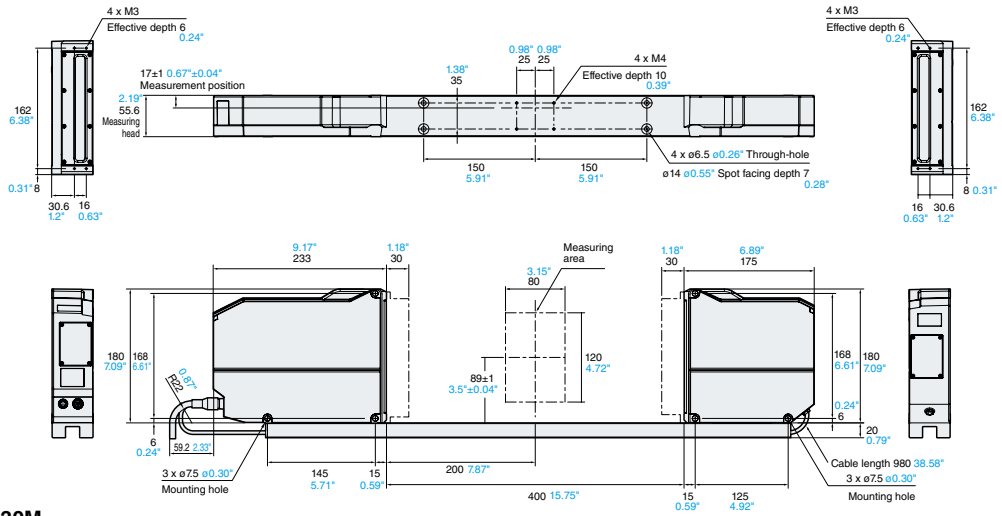
*1 Although this unit conforms to IEEE 802.3u and can establish 100 Mbps full duplex communication using AutoNegotiation function, it does not have AutoCrossOver and AutoPolarity functions that are normally required for the PROFINET IO standard. Select a straight or cross cable according to the Ethernet port of the device to be connected.

Dimensions

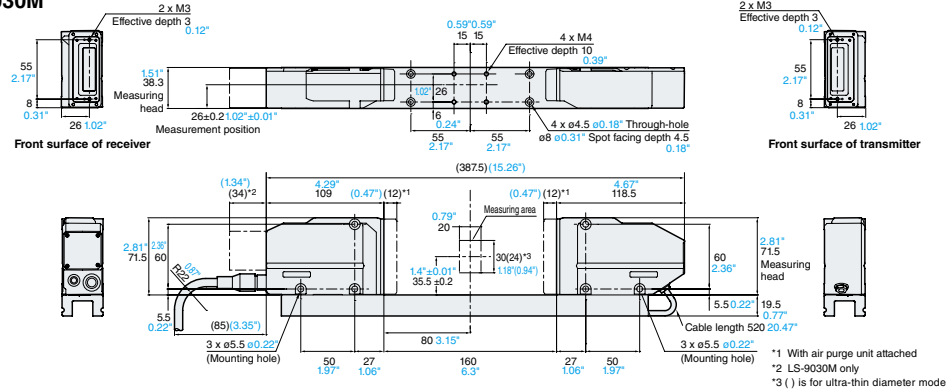
Unit: mm inch

Measuring head

LS-9120M

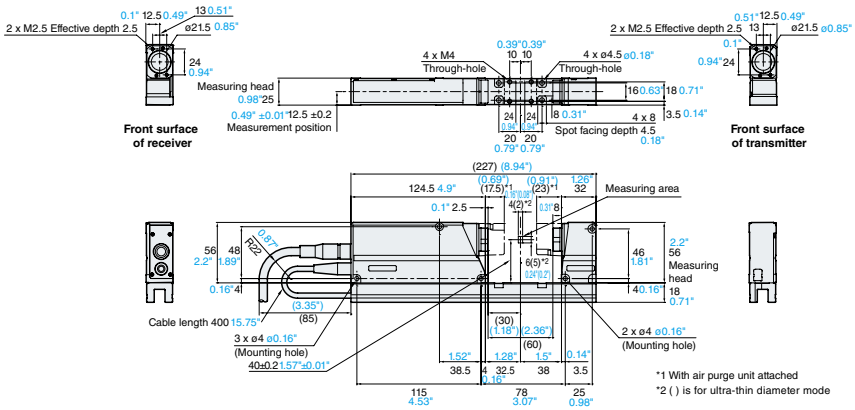


LS-9030/LS-9030M



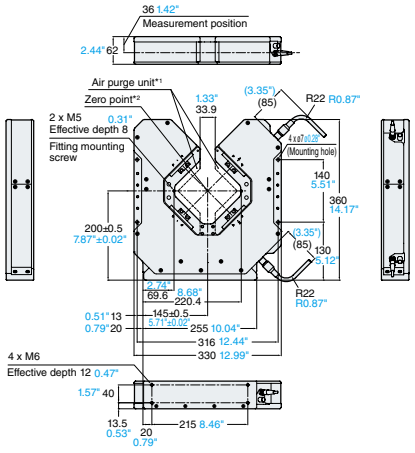
*1 With air purge unit attached
*2 LS-9030M only
*3 ( ) is for ultra-thin diameter mode

LS-9006/LS-9006M

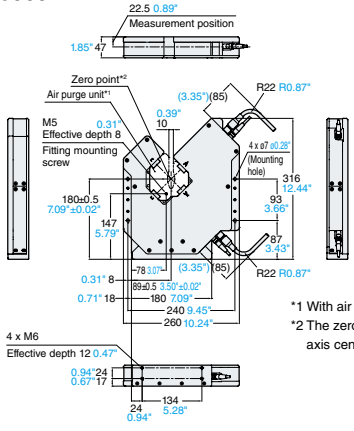


*1 With air purge unit attached
*2 ( ) is for ultra-thin diameter mode

LS-9030D



LS-9006D

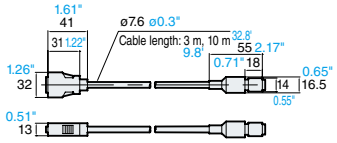


*1 With air purge unit attached
*2 The zero point represents the intersection of the optical axis center of X-axis head and that of the Y-axis head.

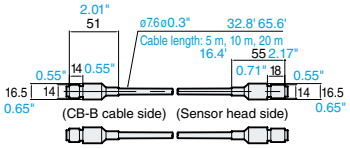
Unit: mm inch

Cable

CB-B3/CB-B10

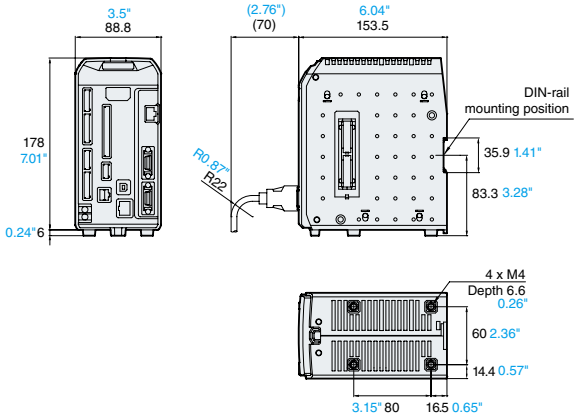


CB-B5E/CB-B10E/CB-B20E

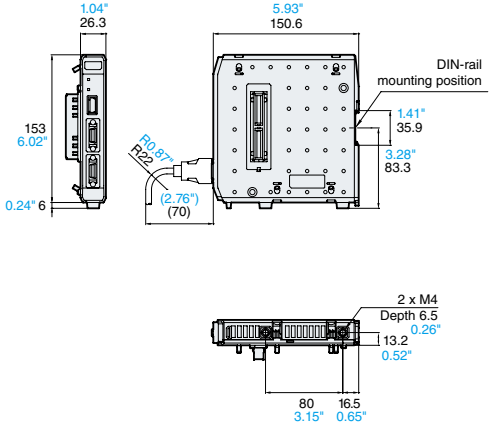


Controller

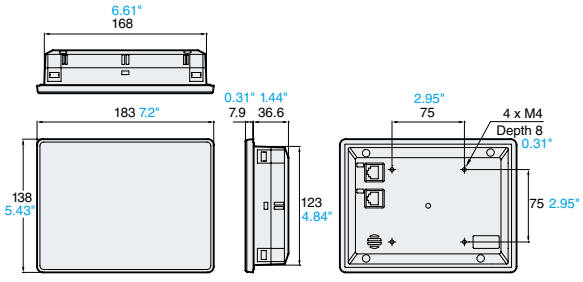
LS-9501/LS-9501P



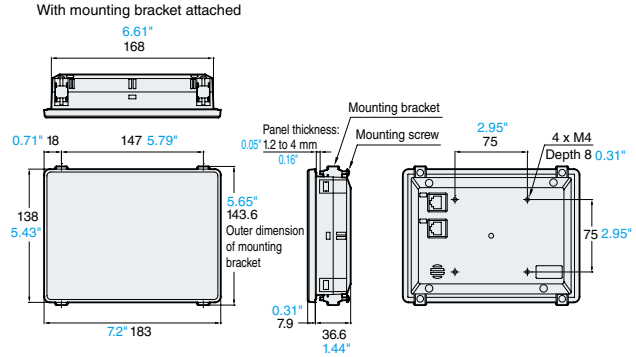
LS-HA100



LS-D1000



With mounting bracket attached



CCD Optical Micrometer

LS-7000 Series

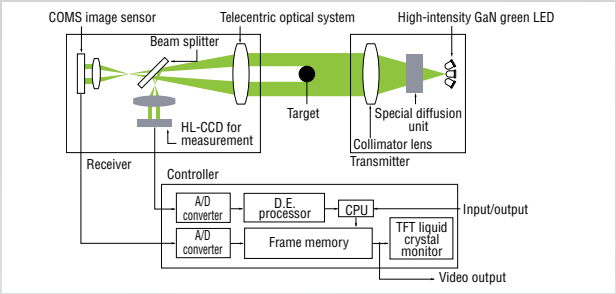
CE

Features

- High repeatability 0.06 µm
- High speed 2400 samples/second
- Maintenance-free design

Optical System Achieving High-speed, High-accuracy, and High-durability

Speed, accuracy, and durability have been improved by advanced optical technology, using a high-intensity Green LED, a telecentric lens, and the HL-CCD in the receiver.



Principle diagram of the LS-7000 Series

The green LED light is distributed as a uniform, collimated beam and is applied to a target. The edge between the bright and dark area on the CCD is detected and used to calculate a measured value, such as an outer diameter.

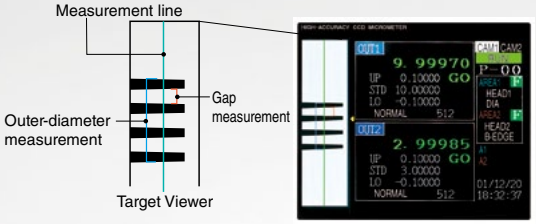
Excellent repeatability of ±0.06 µm, 4 times better than conventional systems

By using LED and CCD technologies, repeatability is four times greater than with a conventional laser scan micrometers.

Easy operation and quick inspection

Target viewer for easy position adjustment

The sensor incorporates a CMOS monitor camera to capture a real-time image of a target. Measurement conditions can be checked on the LCD monitor. The target viewer function allows the optical axis to be aligned exactly with the desired measurement point, even if a target has a complicated shape or is very small.
The measuring area for the current measurement mode is displayed in real time. (LS-7070M/LS-7030M/LS-7010M)



High-durability

Best in its class

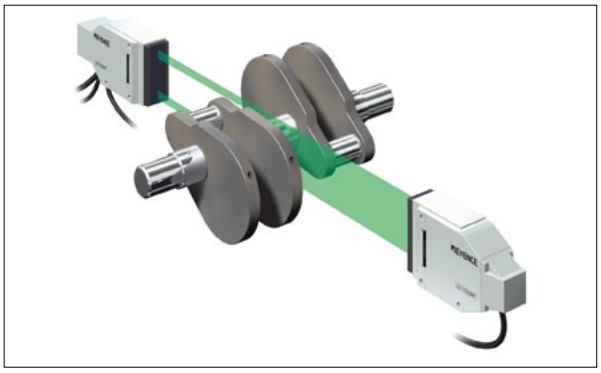
CCD without moving parts & Long-life LED

The laser scan method was reviewed thoroughly. Resulting in the combination of Green LED and HL-CCD that solved the problem of motor durability, which had been the weak point of the laser-scanning method. Furthermore, the long-life LED achieved continued reliability over the long term.

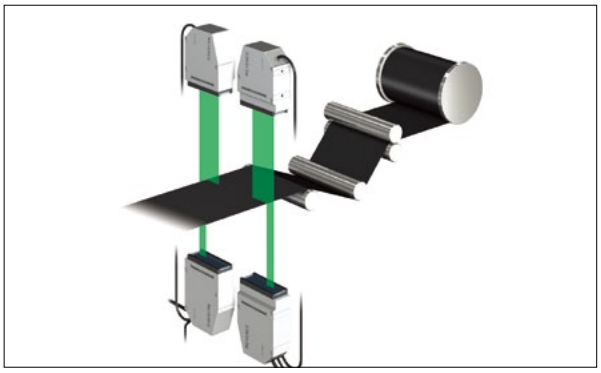
HL-CCD

Green LED

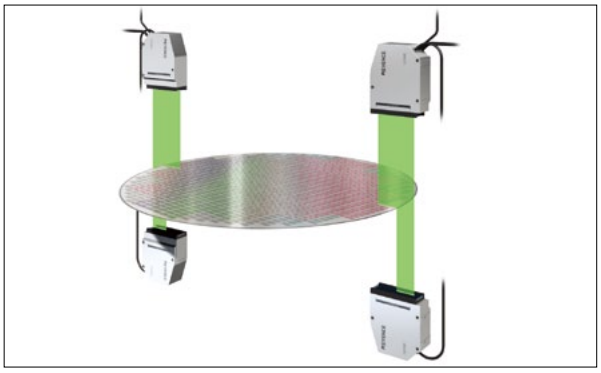
Applications



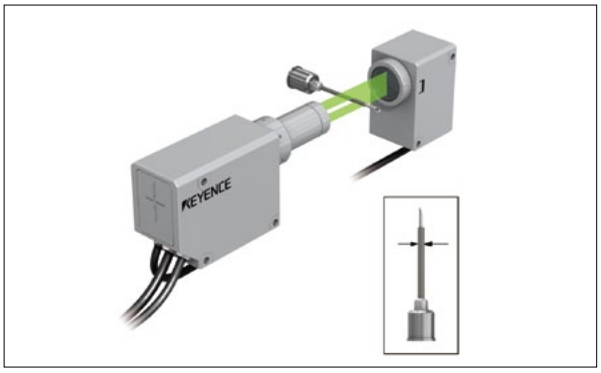
Measuring the deflection of a crank journal



Measuring the width of a sheet



Measuring the outer diameter of a wafer



Measuring the outer diameter of a catheter

Lineup

Measuring head

Type	Wide range		Standard		Super fine	
	With monitor	No monitor	With monitor	No monitor	With monitor	No monitor
Model	**LS-7070M**	**LS-7070**	**LS-7030M**	**LS-7030**	**LS-7010M**	**LS-7010**
Appearance						
Measuring range	0.5 to 65 mm 0.02" to 2.56"		0.3 to 30 mm 0.01" to 1.18"		0.04 to 6 mm 0.002" to 0.24"	
Measurement accuracy	±3 µm ±0.000118"		±2 µm ±0.000079"		±0.5 µm ±0.000020"	
Repeatability	±0.2 µm ±0.000008"		±0.15 µm ±0.000006"		±0.06 µm	

Controller

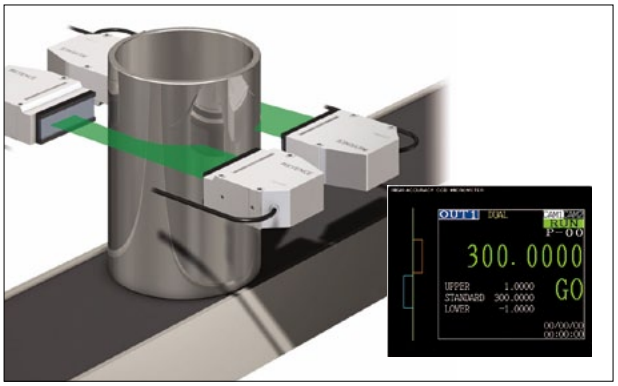
Type	High-performance	Standard
Model	**LS-7601**	**LS-7001**
Appearance		
Measurement indicator	Monitor display	Red LED 7-level display

Function

Dual-head mode

Measuring the outer diameter of a metal pipe

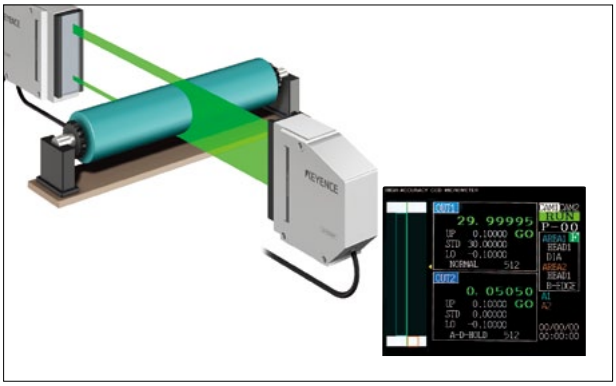
This simple, special mode measures large diameter targets or wide sheet materials. Complicated calculations or other settings are unnecessary.



One-head simultaneous measurement

Measuring both the outer diameter and eccentricity of a copy roller simultaneously

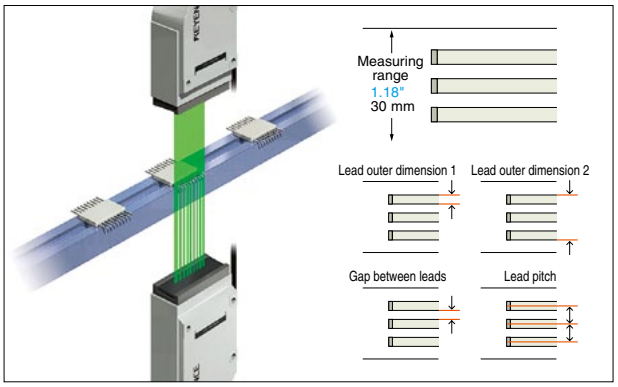
One measuring head allows simultaneous measurement using two measurement modes, such as measuring the outer diameter and eccentricity.



Measuring area designation

Measuring IC lead pitch

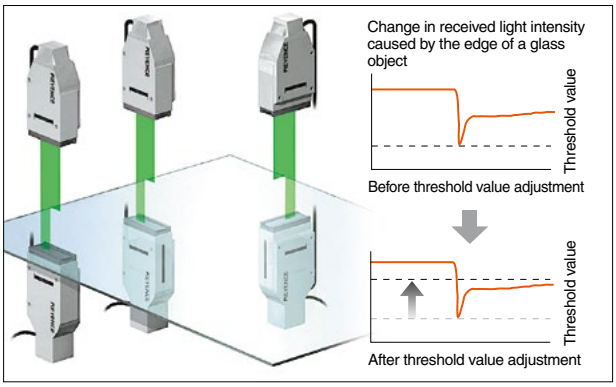
The measuring area can be designated according to the inspection purpose, such as measurement of the IC lead gap or pitch.



Transparent object measurement

Checking the width or edge position of a glass plate

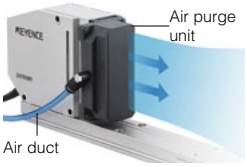
Even transparent objects that were difficult to detect with conventional micrometers can be measured. The edge detection level can be easily changed via the controller.



Air purge unit (Optional) & IP64 Rating

OP-79428 [for LS-7030 (M)]
OP-79429 [for LS-7070 (M)]

Attaching the air purge unit in front of the measuring head and feeding an air flow prevents dirt or dust from accumulating on the head surface.



Controller-compatible IP64 head

The head stores compensation data to ensure compatibility with the controller. This greatly improves Measurement accuracy and head maintainability.
In addition, the measuring head conforms to IP64. It is drip-proof and suitable for harsh environments.

Specifications

Controller

Type			High-performance	Standard
Model			**LS-7601**	**LS-7001**
Appearance				
No. of connectable measuring heads			2 (All types)	2 (LS-7070/LS-7030/LS-7010 only)
Display	Measurement display		TFT 5.5-inch LCD display	Main display: 7-segment red LED (Character height: 20.3 mm 0.80") Sub-display: 7-segment red LED (Character height: 9.9 mm 0.39") x 3
	Minimum display unit		0.01 µm to 100 µm 0.0039" (7-level selectable)	
	Display range		±99.99999 to ±9999.9 mm (Linked to minimum display unit setting, mm/inches selectable)	
	Measurement position monitor		Monitor image (When the measuring head with the monitor function is connected.)	7-level display with a red LED
	Tolerance check output display		5-level LCD indicator	Green LED (GO), Red LED x 2 (HI, LO)
Terminal block	Alarm output		NPN open-collector output (N.C.)	
	5-level comparator output		NPN open-collector output for OUT1	
	Comparator ready output			
	Strobe output			
	Synchronous input		Non-voltage input for OUT1	
	Reset input			
	Auto-zero input			
	Program selection input		Non-voltage input x 4 inputs	
	Statistical processing input		Non-voltage input for OUT1	—
	Analog output		±10 V x 2 outputs	
Connector I/O	SUB mode*1	5-level comparator output	NPN open-collector output for OUT2	
		Comparator ready output		
		Strobe output		
		Statistical processing output	NPN open-collector output x 2 outputs	—
		Function output	Selectable from focus, area check, and difference check, NPN open-collector output x 2 outputs	
	BCD mode*1	BCD output	Measurement data output (Sign + 7 digits), OUT1/OUT2 selectable, NPN open-collector output	
		BCD selection output	NPN open-collector output	
		BCD selection input	Non-voltage input	
	Synchronous input		Non-voltage input for OUT2	
	Reset input			
	Auto-zero input			
	Statistical processing input		Non-voltage input for OUT2	—
RS-232C interface			Measurement data output and control I/O, printer (Baud rate can be selected up to 115.200 bps)	
Video output			Conforming to the NTSC system (RCA connector)	—
Power supply voltage*2			24 VDC ±10%	
Current consumption*2			1.2 A max.	0.7 A max.
Enclosure rating			IP64 (Panel surface only)	
Ambient temperature			0 to 40°C 32 to 104°F	
Relative humidity			35 to 85%, No condensation	
Weight			Approx. 1010 g	Approx. 820 g

*1 Either SUB mode or BCD mode can be selected.
*2 AC power supply can be used when the LS-S11 (AC power supply stand) is connected.
The rating of the NPN open-collector inside the terminal block is: 100 mA max. (40 V max.), with a residual voltage of 0.5 V max. The rating of the NPN open-collector inside the connector I/O is: 30 mA max. (30 V max.), with a residual voltage of 0.5 V max. The rating of non-voltage input is: ON voltage of 1 V max., OFF current of 0.6 mA max.

Specifications

Measuring head

Type	Large-diameter type		Wide measurement range		Super fine measurement	
Monitor camera	Provided	Not provided	Provided	Not provided	Provided	Not provided
Model	**LS-7070M**	**LS-7070**	**LS-7030M**	**LS-7030**	**LS-7010M**	**LS-7010**
Appearance						
Measuring range	0.5 to 65 mm 0.02" to 2.56"		0.3 to 30 mm 0.01" to 1.18"		0.04 to 6 mm 0.002" to 0.24"	
Smallest detectable object	0.5 mm 0.02"		0.3 mm 0.01"		0.04 mm 0.002"	
Transmitter/receiver distance	250 ±50 mm 9.84"±1.97"		160 ±40 mm 6.30"±1.57"		60 mm 2.36"	
Light source	GaN green LED					
CCD scanning range	Approx. 69 mm 2.72"		Approx. 33 mm 1.30"		Approx. 7 mm 0.28"	
Measurement accuracy	±3 µm ±0.000118"*1		±2 µm ±0.000079"*3		±0.5 µm ±0.000020"*5	
Repeatability	±0.2 µm ±0.000008"*2		±0.15 µm ±0.000006"*4		±0.06 µm*6	
No. of samples*7	2,400 samples/sec.					
Monitor function	Provided	Not provided	Provided	Not provided	Provided	Not provided
Enclosure rating*8	IP64					
Ambient temperature	0 to 50°C 32 to 122°F					
Relative humidity	35 to 85%, No condensation					
Weight	Transmitter: Approx. 540 g, Receiver: Approx. 770 g, Base: Approx. 660 g	Transmitter: Approx. 540 g, Receiver: Approx. 730 g, Base: Approx. 660 g	Transmitter: Approx. 420 g, Receiver: Approx. 570 g, Base: Approx. 430 g	Transmitter: Approx. 420 g, Receiver: Approx. 470 g, Base: Approx. 430 g	Transmitter: Approx. 140 g, Receiver: Approx. 380 g, Base: Approx. 220 g	Transmitter: Approx. 140 g, Receiver: Approx. 340 g, Base: Approx. 220 g

*1 The error when a moving rod 20 mm 0.79" in diameter is measured in the measuring area of 20 x 40 mm 0.39" x 0.79".
*2 The value of ±2σ when the outer diameter of a rod 20 mm 0.79" in diameter is measured at the center of the measuring area while the number of averaging measurements is set to 512.
*3 The error when a moving rod 10 mm 00.39" in diameter is measured in the measuring area of 10 x 20 mm 0.39" x 0.79".
*4 The value of ±2σ when the outer diameter of a rod 10 mm 0.39" in diameter is measured at the center of the measuring area while the number of averaging measurements is set to 512.
*5 The error when a moving rod 1.0 mm 0.04" in diameter is measured in the measuring area of 2 x 4 mm 0.08" x 0.16".
*6 The value of ±2σ when the outer diameter of a rod 1.0 mm 0.04" in diameter is measured at the center of the measuring area while the number of averaging measurements is set to 512.
*7 1200 samples/sec. when the mutual interference prevention function is used.
*8 The connector section is excluded.

Hardware environment for the LS-H1W (LS-Navigator)

Model	**LS-H1W**
CPU	Pentium III, 400 MHz or higher
Supported OS	Windows 10*1 Windows 7 (SP1 or later)*2 Windows Vista (SP2 or later)*3 Windows XP (SP3 or later)*4
Memory capacity	64 MB or more
Display	VGA (800 x 600 pixels) or more, 256 colors or more
Hard disk space	10 MB or more
Interface	RS-232C (serial port) interface required
Excel	Excel 2010/2007/2003/2002/2000

*1 Home, Pro, and Enterprise editions are supported.
*2 Home Premium, Professional, and Ultimate editions are supported.
*3 Ultimate, Business, Home Premium, and Home Basic editions are supported.
*4 Professional and Home editions are supported.

Sensor head cables

Model	Cable length
Cable between the controller and measuring head	
LS-C3A	3 m 9.84'
LS-C10A	10 m 32.8'
LS-C30A	30 m 98.42'
Camera cable between the controller and measuring head	
LS-C3AM	3 m 9.84'
LS-C10AM	10 m 32.8'
LS-C30AM	30 m 98.42'
Cable between the receiver and transmitter	
OP-42182	1 m 3.28'
OP-42183	3 m 9.84'

AC power supply stand LS-S11

Model	**LS-S11**
Applicable controller	**LS-7001/LS-7601**
Power supply voltage	100 to 240 VAC ±10%, 50/60 Hz
Current consumption	110 VA max.
Ambient temperature	0 to 40°C 32 to 104°F
Relative humidity	35 to 85%, No condensation
Weight	Approx. 1.7 kg

Options

AC power supply stand
LS-S11

Air purge unit
OP-79428
[For LS-7030(M)]

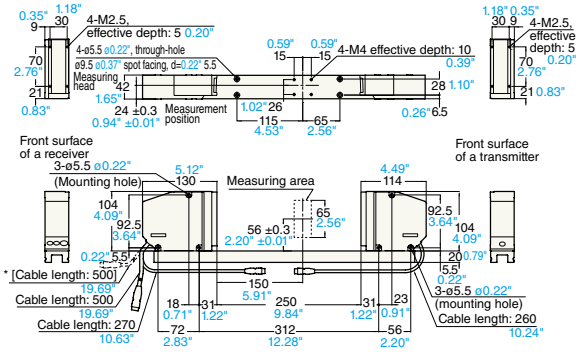
Air purge unit
OP-79429
[For LS-7070(M)]

Dimensions

Measuring heads

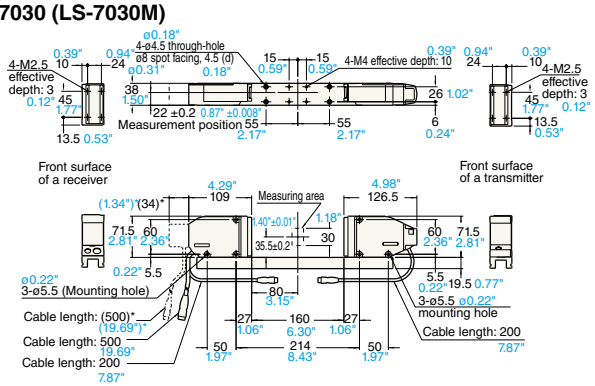
Unit: mm inch

LS-7070 (LS-7070M)



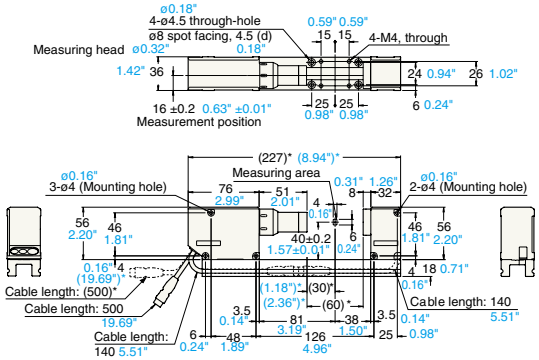
* Figures in parentheses are the values for the **LS-7070M**.

LS-7030 (LS-7030M)



* Figures in parentheses are the values for the **LS-7030M**.

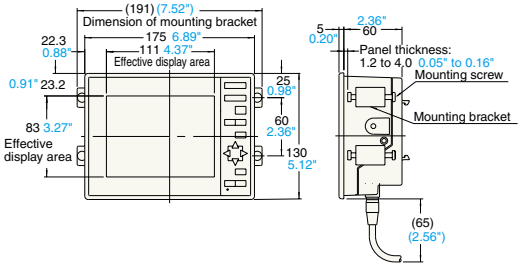
LS-7010 (LS-7010M)



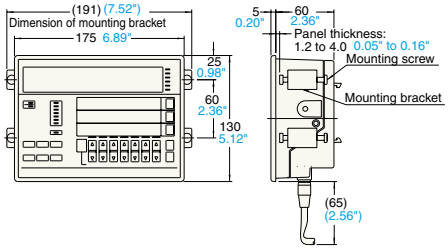
* Figures in parentheses are the values for the **LS-7010M**.

Controllers

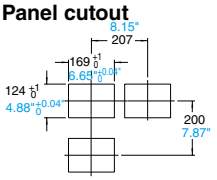
LS-7601



LS-7001



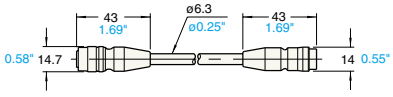
Panel cutout



Cables

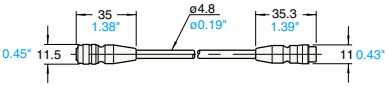
Cable between the controller and sensor head

LS-CxxA



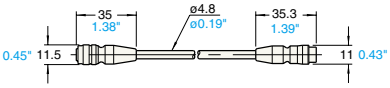
Camera cable between the controller and sensor head

LS-CxxAM



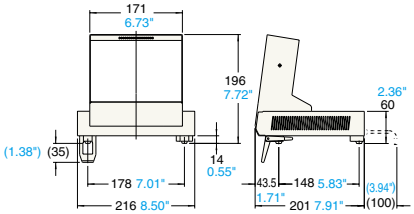
Cable between the receiver and transmitter

OP-4218x



AC power supply stand

LS-S11



High-speed 2D Optical Micrometer

TM-3000 Series

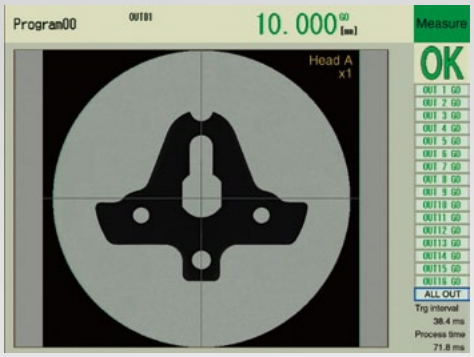
CE

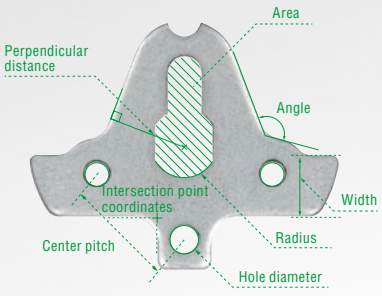
Features

- Multi-point 2D measurement
- Tilt correction for inline measurement
- High-speed sampling of 5.5 ms

Because the system works in two dimensions it can...

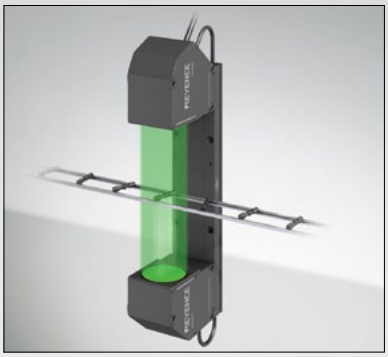
Simultaneously measure dimensions that require both X and Y values. In addition, inspection time is reduced due to the elimination of motion components.



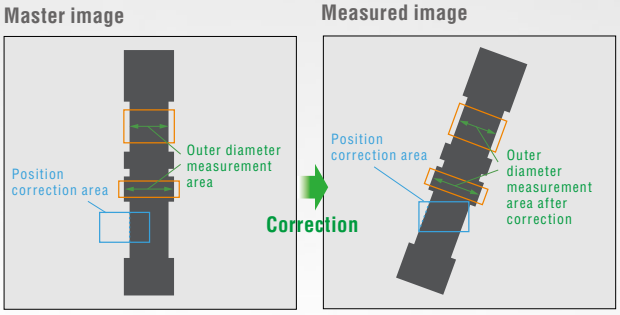


Position correction function [edge correction/pattern correction]

Automatically corrects misalignments and tilt of the target which is directly linked to measurement errors. Can measure accurately even when positioning is difficult or objects are conveyed in random orientations.

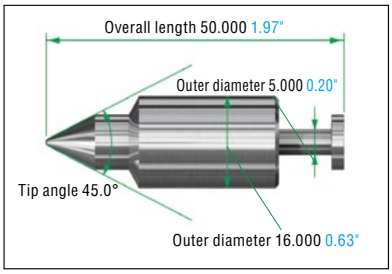


Because the measurement area autotracks according to the position and tilt of objects within the compensation area, it can be measured accurately.

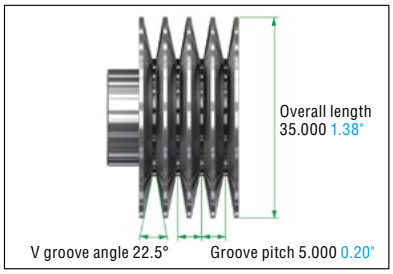


Applications

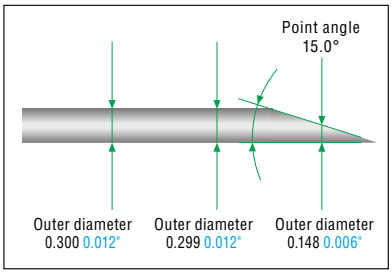
Unit: mm inch



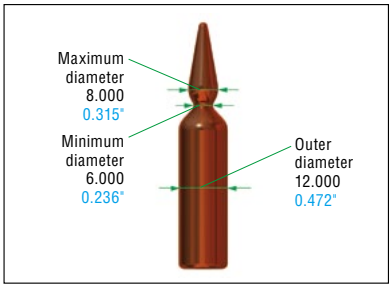
Measures outer diameter/tip angle of needle valves



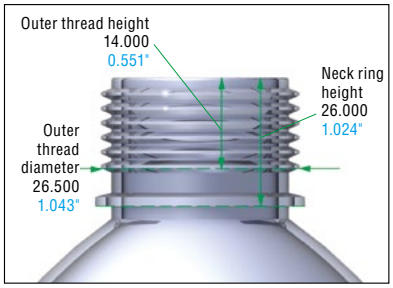
Measures pulley groove pitches/V groove angles



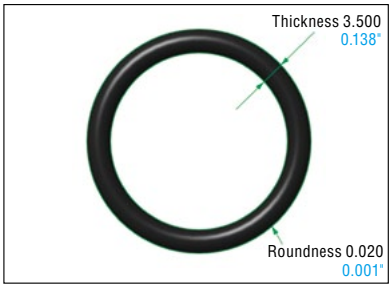
Measures multi-point outer diameter/point angle of injection needles



Measures maximum diameter/minimum diameter of ampules



Measures outer diameter and threading a PET bottle



Measures roundness/thickness of O-rings

Lineup

Sensor head

Type	Model	Appearance
ø6 mm ø0.24" type	**TM-006**	
ø40 mm ø1.57" type	**TM-040**	
ø65 mm ø2.56" type	**TM-065**	

Controller

Type	Model	Appearance
Standard type	**TM-3001**	
PNP Output type	**TM-3001P**	

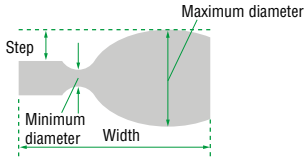
Features

Diverse measurement modes

A flexible combination of 15 types of basic measurement modes, and 8 types of auxiliary measurement modes, can support a variety of inspections.

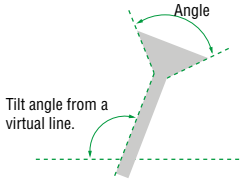
Outer diameter/Step/Width

Measures a maximum diameter/minimum diameter within the specified area, and a step/width between the detected edges.



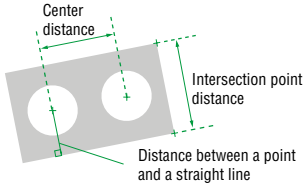
Angle

Measures an angle between two detected straight lines, and a tilt angle from a virtual line.



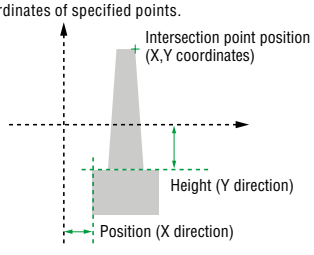
Distance/Intersection Point Distance

Measures a center of the circles and intersection point, distance between 2 specified points, distance from a point to a straight line.



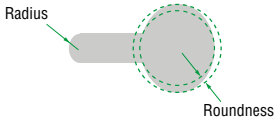
Height / Position/Coordinates

Measures height/ position of detected edges and coordinates of specified points.



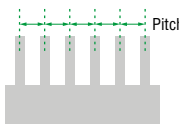
Radius/Roundness

Measures radius and roundness of specified arc.



Pitch

Measures a maximum/minimum/average pitch within the specified area.



Specifications

Sensor head

Model		TM-006	TM-040	TM-065
Measuring range		ø6 mm ø0.24"	ø40 mm ø1.57"	ø65 mm ø2.56"
Smallest detectable object		0.04 mm 0.001"	0.3 mm 0.01"	0.5 mm 0.02"
Transmitter/receiver distance		60 mm 2.36"	180 mm 7.09"	270 mm 10.63"
Light source		GaN Green LED	InGaN Green LED	
Measurement accuracy		±0.5 µm ±0.000020"*1	±2 µm ±0.000079"*3	±3 µm ±0.000118"*5
Repeatability		±0.06 µm*2	±0.15 µm ±0.000006"*4	±0.2 µm ±0.000008"*6
Sampling cycle (trigger interval) *7		5.5ms (33ms at the initial setting)		
Environmental resistance	Enclosure rating *8	IP64		
	Ambient temperature	0 to 50°C 32 to 122°F		
	Relative humidity	35 to 85% (No condensation)		
Material		Aluminum		
Weight	Transmitter	Approx. 140g	Approx. 560g	Approx. 1280g
	Receiver	Approx. 340g	Approx. 720g	Approx. 1460g
	Base	Approx. 220g	Approx. 630g	Approx. 1500g

*1 In a measurement area of 2 mm 0.08"× ø4 mm ø0.16" error when measuring width of KEYENCE standard object (glass calibration scale).
*2 Value of ±2σ measuring the width of KEYENCE standard object (glass calibration scale) in the center of the measurement area, an average 16 times, average 1.3 mm 0.05" line.
*3 In a measurement area of 10 mm 0.39"× ø26 mm ø1.02" error when measuring width of KEYENCE standard object (glass calibration scale).
*4 Value of ±2σ measuring the width of KEYENCE standard object (glass calibration scale) in the center of the measurement area, an average 16 times, average 8 mm 0.31" line.
*5 Error when measuring width of KEYENCE standard object (glass calibration scale) in a measurement area of 20 mm 0.79"× ø40 mm ø1.57".
*6 Value of ±2σ measuring the width of KEYENCE standard object (glass calibration scale) in the center of the measurement area, an average 16 times, average 14 mm 0.55" line.
*7 When measurement area is minimum, others are initial settings
*8 Apart from connector component

Controller

Model		TM-3001	TM-3001P
Sensor head compatibility		Compatible	
Number of connectable sensors *1		2 units max.	
Display	Minimum display unit	0.01 µm, 0.001 mm², 0.01°	
	Maximum display range	±9999.99 mm, ±99999.9 mm², ±99999.9°	
Input terminal block	Laser remote interlock input	Non-voltage input	Non-voltage input
	Trigger input (for Head A)		Voltage input
	Timing 1 input		
	Auto-zero 1 input		
	Reset input		
Output terminal block	Analog voltage output	±10 V x 2 outputs, output impedance: 100 Ω	
	Total judgment output	NPN open-collector output	PNP open-collector output
	Error output	NPN open-collector output (N.C.)	PNP open-collector output (N.C.)
	Process output	NPN open-collector output	PNP open-collector output
	Trigger input enable output		
	Adjusted error output		
Expansion connector	Trigger input (for Head A)	Non-voltage input	Voltage input
	Timing 2 input		
	Auto-zero 2 input		
	Program switching input	Non-voltage input, 4 inputs	Voltage input, 4 inputs
	Memory card save input	Non-voltage input	Voltage input
	Judgment/Binary output*2	3-level judgment output: OUT1 to OUT16, total judgment output Binary output: OUT1 to OUT16 measured data output (21 bits) NPN open-collector output	3-level judgment output: OUT1 to OUT16, total judgment output Binary output: OUT1 to OUT16 measured data output (21 bits) PNP open-collector output
	Strobe output	NPN open-collector output	PNP open-collector output
	Trigger input enable output		
Analog RGB monitor output		SVGA (800 x 600 pixels)	
RS-232C interface		Measured data output and control input/output (Maximum baud rate: 115200 bps, selectable)	
USB interface		In conformity with USB Revision 2.0 HI-SPEED (USB 1.1 Full-SPEED compatible)	
Ethernet interface		1000BASE-T/1000 BASE-TX/10 BASE-T	
Memory card		SD card CA-SD4G (4GB), CA-SD1G (1GB) support	
Major functions		Position correction function, OUT name change function, select measurement mode (outer diameter, height, step height, position, width, distance, intersection distance, angle, radius, roundness, coordinates, area, search, ring test, pitch) functions, OUT function between operators, auxiliary measurements (straight edge, circular edge, the edge bounding line, center line, intersection, straight line between two points, any line, any point), functions, scaling function, average function, measurement function, measurement value alarm setting function, tolerance setting function, auto-zero function, storage (data/image) function, memory card storage function, program memory function, trigger mode change function, mutual interference prevention function, adjustable measuring range function, detection threshold value change function, mask function, attitude correction function, display language switching function, support software setting function, trigger interval-measurement time display function, others	
Ratings	Power supply voltage	24 VDC ±10%, Ripple: 10% (P to P) or less	
	Current consumption	1 head connected 480mA max./ 2 heads connected 550mA max.	
Environmental resistance	Ambient temperature	0 to 50°C 32 to 122°F	
	Relative humidity	35 to 85% (No condensation)	
Material		Polycarbonate	
Weight		Approx. 1120g	

*1 1 or 2 units can be connected only with the same head model
*2 OUT 1 to OUT 8 decision result, OUT 9 to OUT 16 decision result, time share output of binary measurement data.
• The rating of the NPN/PNP open collector output (output terminal block): 50 mA (30 V or less) max., residual voltage: 1.4 V or less (50 mA) 1.0 V (20 mA)
• The rating of the NPN/PNP open collector output (expansion connector): 50 mA (30 V or less) max., residual voltage: 1.0 V or less
• Rating for non-voltage input, ON voltage 1V max., OFF current 0.3mA max. (trigger input terminal, ON voltage 5V max., OFF current 1mA max.)
• Voltage rating, maximum rating 26.4V, ON voltage 10.8V, OFF current 0.3mA (trigger input terminal maximum rating 26.4V, ON voltage 10.8V, OFF current 1mA)

Operating system environment

CPU	Pentium III 1GHz min. (recommended 1.7GHz min.)
Support OS	Windows 10*1 Windows 7 (SP1 or later)*2
	Windows Vista (SP2 or later)*3
	Windows XP (SP3 or later)*4
Memory capacity	512MB min. (1GB min. recommended)
Resolution of display	XGA (1024 x 768 pixels) min, 256 colors min.
Free disk space	1GB min.
Interface	As described above, all those mounted, USB2.0/1.1*5, Ethernet*6

* For your OS, use environments above that recommended.
*1 Home, Pro, and Enterprise editions are supported.
*2 Home Premium, Professional, and Ultimate editions are supported.
*3 Ultimate, Business, Home Premium, and Home Basic editions are supported.
*4 Professional and Home editions are supported.
*5 Connection through a USB hub is not included in the guarantee.
*6 Connection to LAN and connection via a router is not included in the guarantee.

Controller

Controller
TM-3001(P)

Controller lineup

NPN Output type	**TM-3001**
PNP Output type	**TM-3001P**

Sensor head

Sensor head
ø6 mm ø0.24" type
TM-006

Sensor head
ø40mm ø1.57" type
TM-040

Sensor head
ø65mm ø2.56" type
TM-065

Console (Optional)
OP-82125

Setting and support software
TM-H1

USB cable
OP-66844

Monitor

High-resolution monitor
CA-MP81

Monitor stand
OP-42278

Cable - connector

Cable between head and controller
CB-A××
(0.7, 2, 5, 10, 20, 30m)
(2.3', 6.6', 16.4', 32.8', 65.6', 98.4')

Transmitter to receiver expansion cable
OP-87033 (1m 3.3')
OP-87034 (3m 9.8')

Cable between controller - monitor
OP-66842 (3m 9.8')

I/O connector cable
OP-51657 (3m 9.8')

Ethernet cable
OP-66843 (3 m 9.8')

RS-232C communication cable
OP-96368 (2.5m 8.2')

D-sub9 pin conversion connector
OP-26401

D-sub25 pin conversion connector
OP-96369

Option

Protective cover
OP-87035 (2 per pack)
(for **TM-040**)
OP-87036 (2 per pack)
(for TM-065)

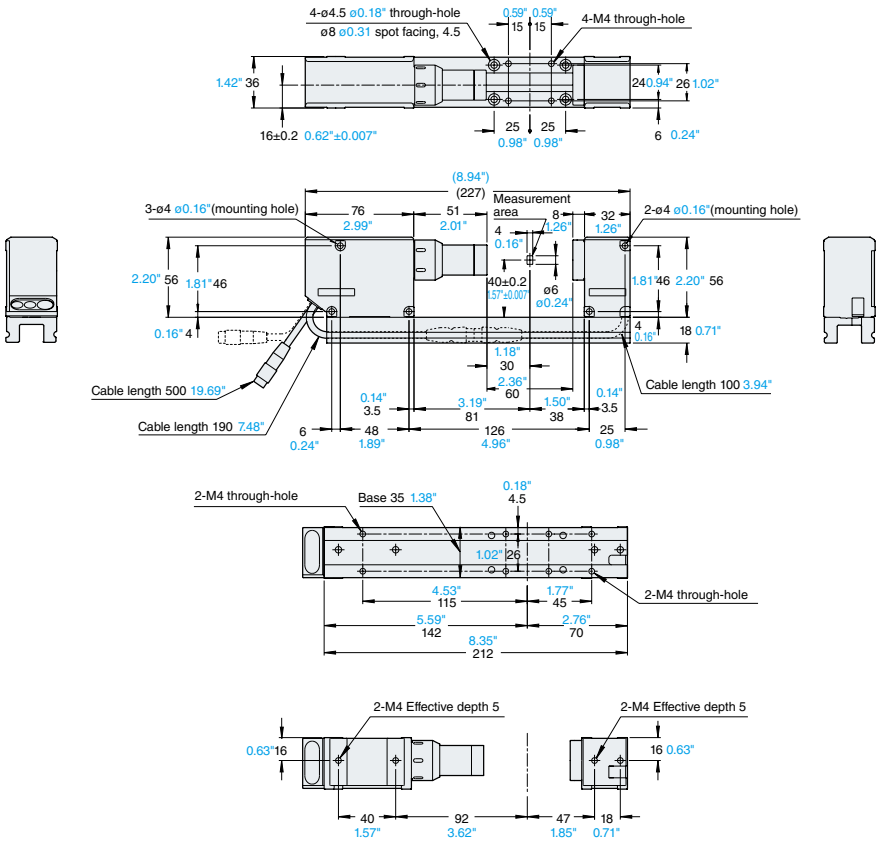
Memory card
CA-SD4G (4GB)
CA-SD1G (1GB)

Dimensions

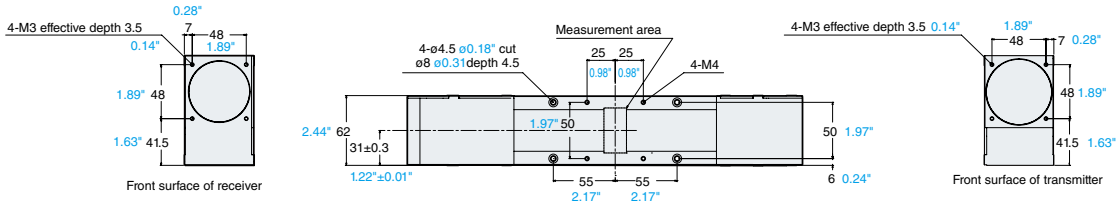
Sensor heads

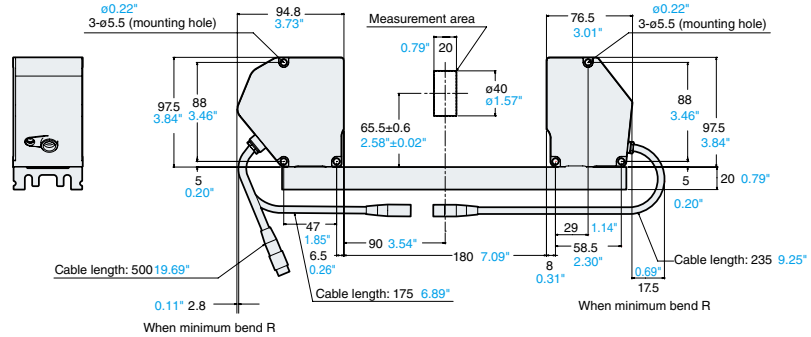
Unit: mm inch

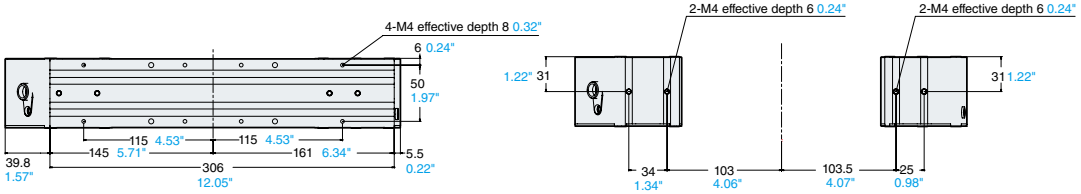
TM-006



TM-040

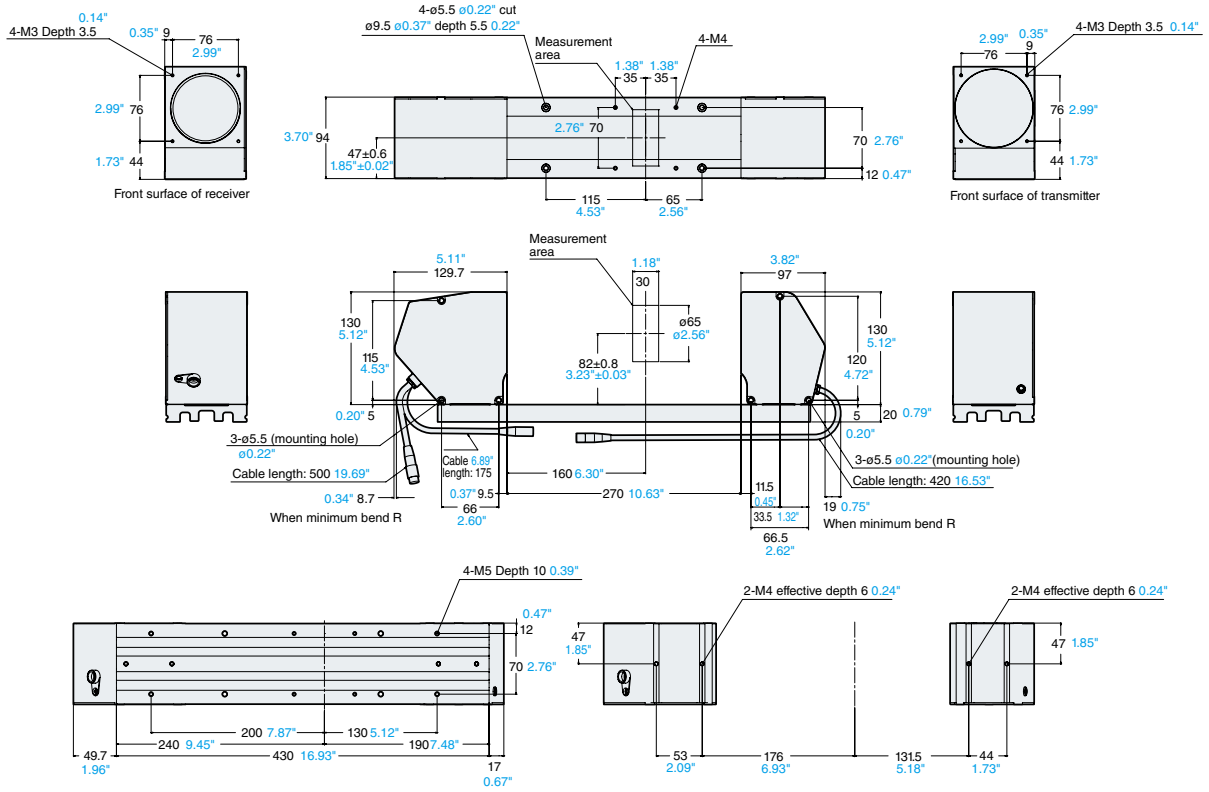




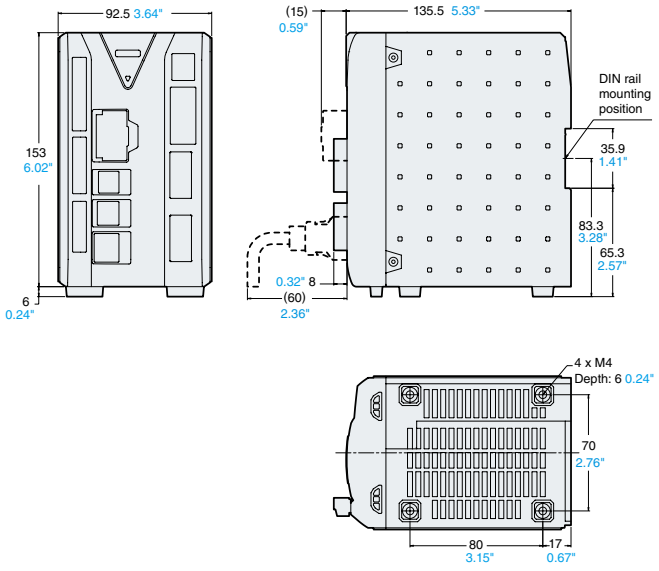


Unit: mm inch

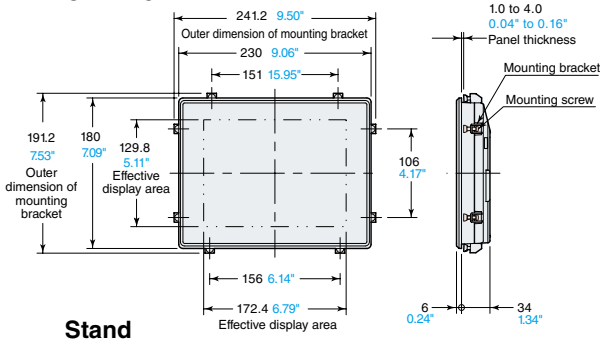
TM-065



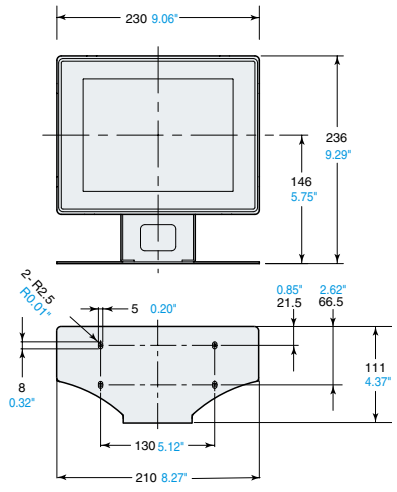
TM-3001(P)



LCD monitor CA-MP81



Stand OP-42278



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