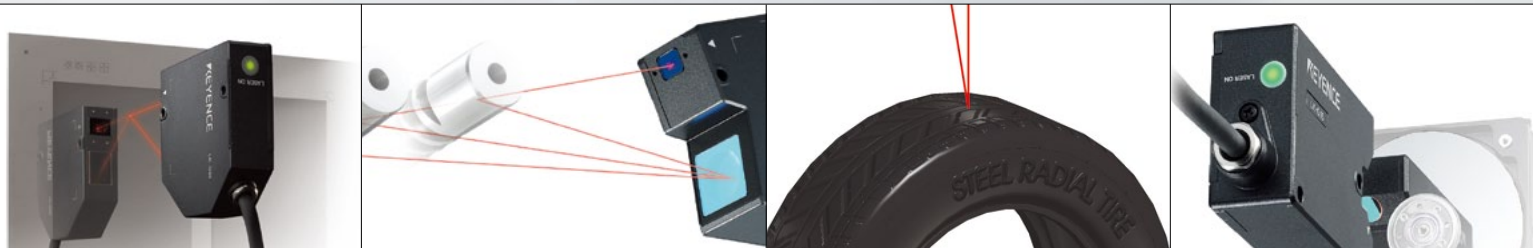




# CCD Laser Displacement Sensor

G E N E R A L C A T A L O G

LK-G Series



Super Precision/High Accuracy/Long Distance  
Innovative CCD Laser Displacement Sensors

High speed sampling

50 kHz

High accuracy

$\pm 0.02\%$

High repeatability

$0.01\ \mu\text{m}$

Long range measurement

Max 1,000 mm (39.37")

# LK-G Series Lineup

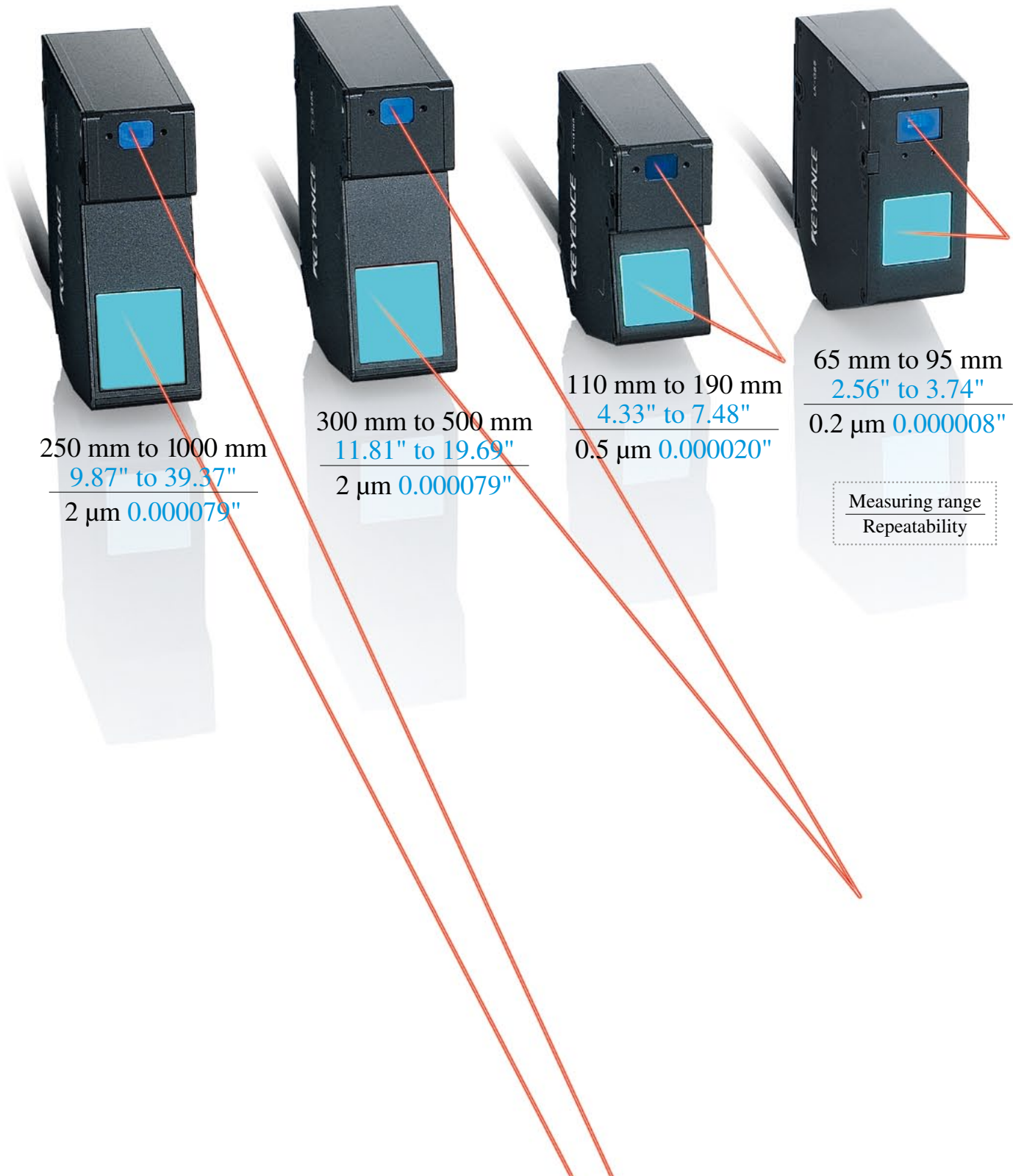
Overwhelming specifications achieve higher accuracy and solve previously impossible applications. Cutting-edge technology and a wide array of sensor heads offer stunning performance for any application.

Ultra long-range  
LK-G502/507

Long-range  
LK-G402/407

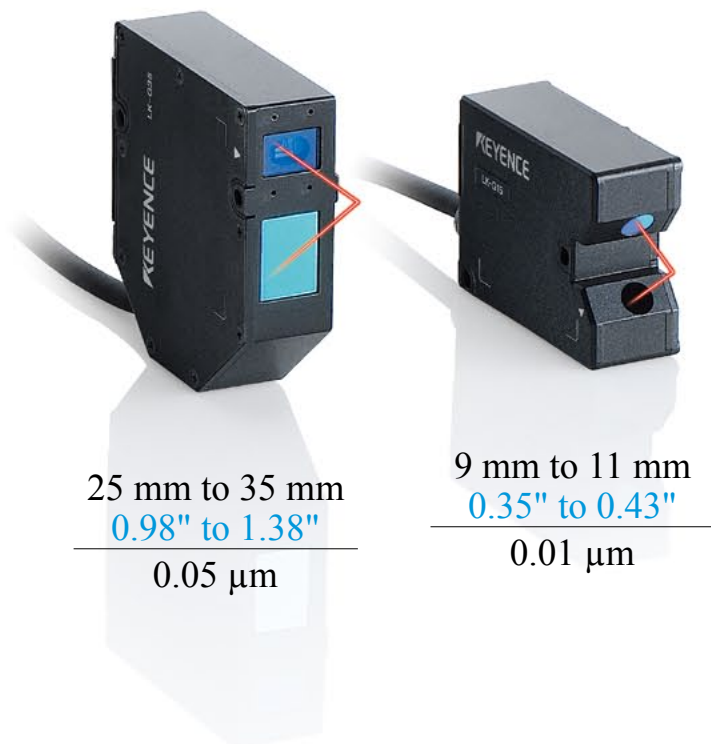
Mid-range  
LK-G152/157

Multi-purpose  
LK-G82/87



High-accuracy  
LK-G32/37

Super precision  
LK-G10/15



25 mm to 35 mm  
0.98" to 1.38"  
0.05  $\mu$ m

9 mm to 11 mm  
0.35" to 0.43"  
0.01  $\mu$ m

Multifunction controller with  
built-in display and data storage



All-in-one controller  
LK-G3001(P)V



Separate controller  
LK-G3001(P)



Display panel  
LK-GD500

## ► P.6-7

# Advanced Specifications

Unmatched technology has achieved specifications that are the best in the industry.



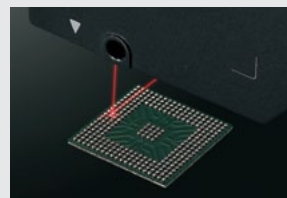
High speed sampling

50 kHz



High accuracy

$\pm 0.02\%$



High repeatability

0.01  $\mu$ m

## ► P.8-9

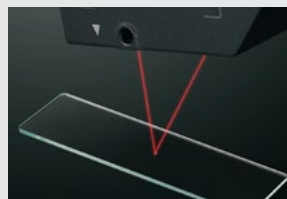
# Newly-developed Algorithms

Newly-developed algorithms ensure highly accurate measurement of targets that were difficult with conventional detection methods.



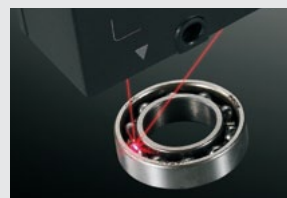
RPD algorithm

Translucent  
targets



Multi-ABLE control

Transparent  
targets



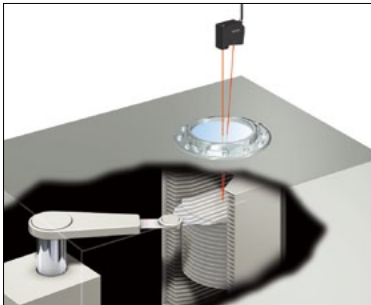
MRC algorithm

Multiple  
reflections

# Application

## SEMICONDUCTOR/LCD

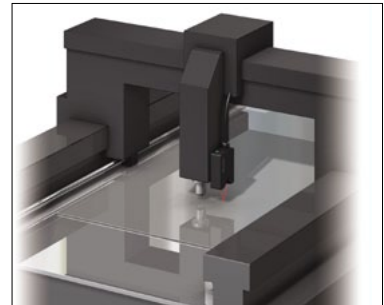
---



Detecting displacement of a wafer



Thickness inconsistency of a silicon wafer



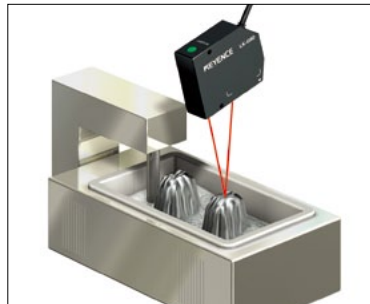
Focus adjustment of LCD board inspection machine

## ELECTRONIC/ELECTRIC COMPONENTS

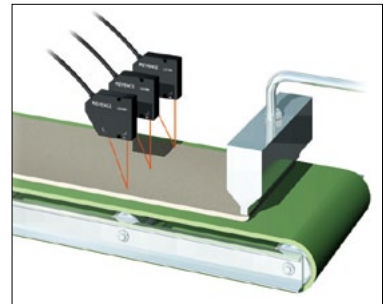
---



Measuring the warpage of a PCB



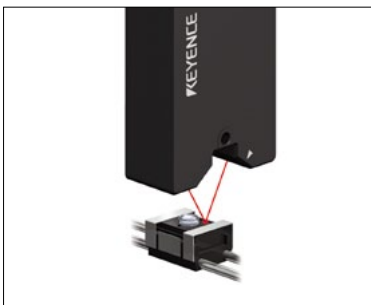
Measuring the height of solder jet



Measuring sheet thickness

## OA/MEDIA

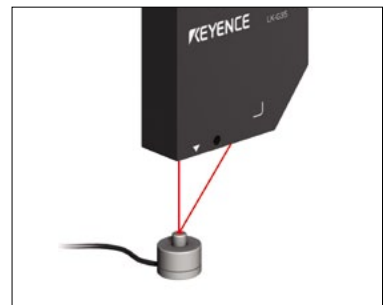
---



Focus adjustment of optical pickup



Adjusting HDD arm assembly



Measuring the vibration of a piezo actuator

## AUTOMOTIVE/TRANSPORTATION

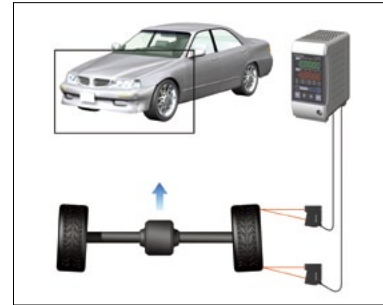
---



Measuring the runout of a disc rotor



Measuring the height of liquid sealant



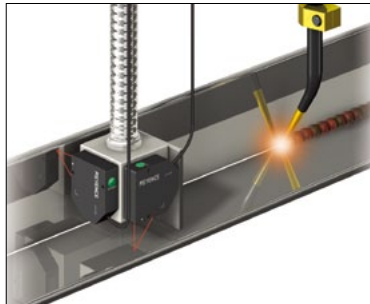
Adjusting toe-in/camber angle

## METAL

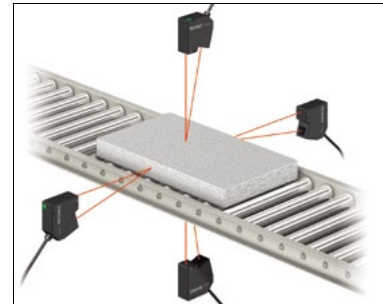
---



Detecting double-fed steel plates



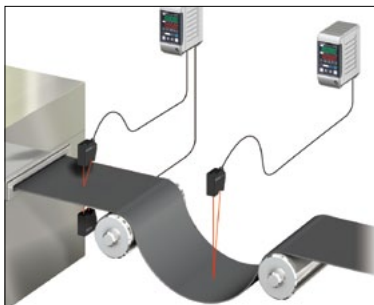
Height control of welding process



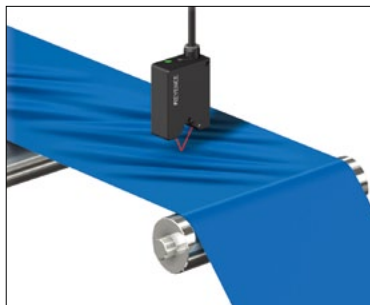
Measuring the thickness/width of a steel plate

## PLASTIC/RUBBER/FILM

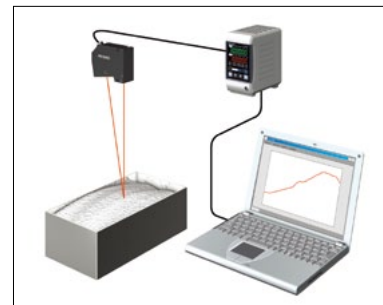
---



Thickness measurement/loop control of a rubber sheet



Measuring the thickness of a film



Measuring the height of urethane foam

# Advanced technology for high performance

## ABLE

ABLE intelligently controls the three elements of laser emission time, laser power, and gain (CCD amplification factor).

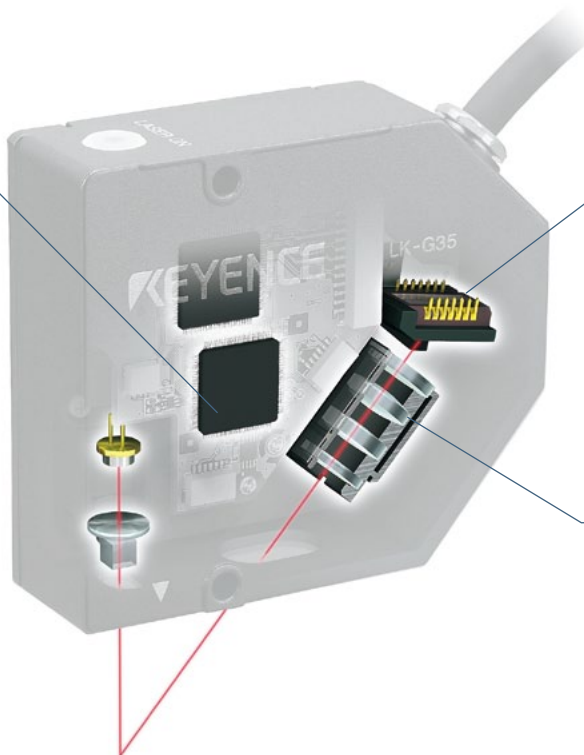
\* ABLE= Active Balanced Laser control Engine

## LI-CCD

Demonstrates higher accuracy, speed, and sensitivity.

## HIGH ACCURACY LENS UNIT

The high-accuracy Ernstar lenses integrated with the sensor head achieves highly accurate and highly stable measurements.

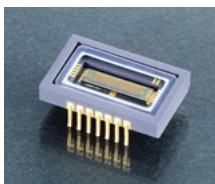
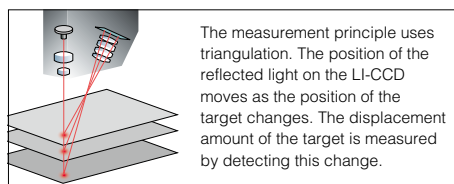


## LI-CCD\*

Errors in pixel edges are reduced to achieve accuracy that is two times greater than conventional models.

Since a CCD has digital output characteristics for each pixel, the errors caused by gradual outputs generated at the edge of pixels was a barrier to higher accuracy. As a countermeasure, KEYENCE has developed an LI-CCD that outputs the position of reflected light in a pixel, achieving excellent accuracy that is two times higher than conventional models. In addition, the dedicated design of the sensor has achieved a speed that is 25 times faster and a sensitivity 10 times better than conventional models.

\* LI-CCD= Linearized CCD

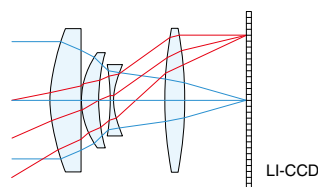


## HIGH ACCURACY LENS UNIT

Reducing errors caused by aberrations

KEYENCE has designed a new light-receiving unit for concentrating reflected light onto the LI-CCD. The newly-developed, high-accuracy Ernstar lens drastically reduce spot distortion caused by aberrations. In addition, a special die-cast housing integrating the sensor head with the lenses is employed, achieving excellent rigidity.

### High-accuracy Ernstar lens

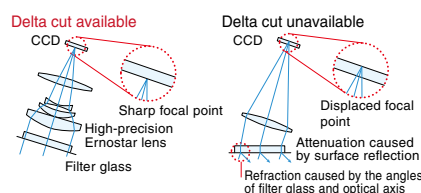


The optical system is composed of four lenses characterized by very small aberrations. With its excellent imaging performance, light entering from various angles can be concentrated to a single point.

## DELTA CUT TECHNOLOGY\*

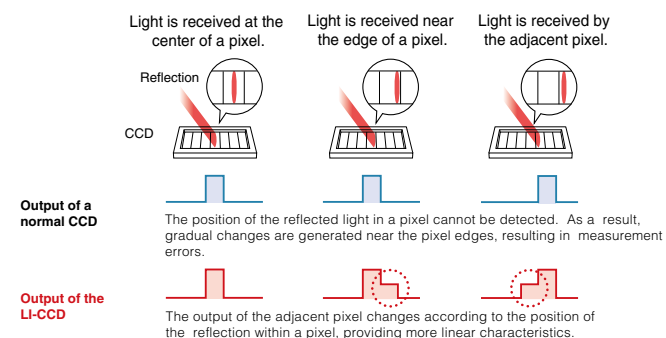
Accurate reception of reflected light from a long distance is the key to high precision. KEYENCE has reviewed the cabinet design and developed a delta cut technology that reduces reflection on a filter glass surface.

### Comparison with conventional products



\*LK-G157/G407/G507 Series

### Principle of the LI-CCD that achieves high-accuracy measurements

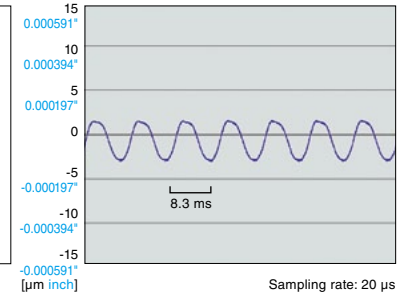


## ULTRA-HIGH SPEED SAMPLING OF 50 kHz

The LI-CCD features high-speed sampling rate 25 times faster than conventional models. High-speed digital processing of signals from the LI-CCD is performed by a special waveform-processor (Digital Signal Processor), satisfying both high-speed and high-accuracy measurements. Targets traveling, rotating, or vibrating at high speed can be measured reliably.



Detecting the runout of a HDD

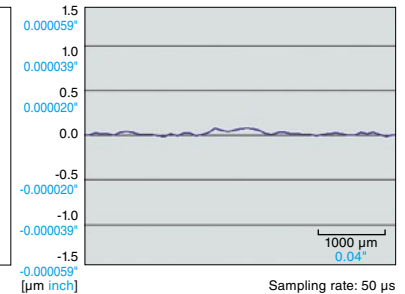


## HIGH-ACCURACY OF $\pm 0.02\%$

KEYENCE has redesigned the optical system in order to achieve high-accuracy measurement. Incorporating Ernstar optical systems with a LI-CCD produces excellent linearity characteristics. It precisely focuses/detects reflection from targets to provide almost double the accuracy of conventional models. Thus, the LK-G Series is designed for product miniaturization and high-accuracy measurement.

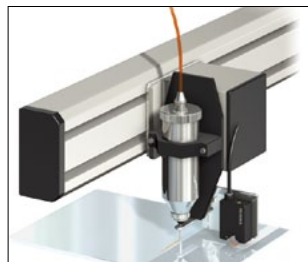


Measuring the thickness of a silicon wafer

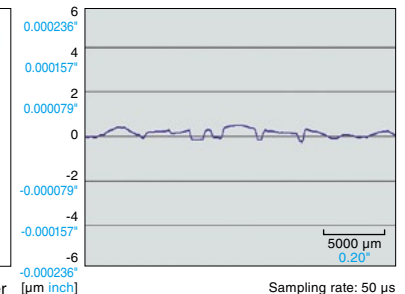


## HIGH REPEATABILITY OF 0.01 $\mu\text{m}$

The CPU, which is integrated in the sensor head, digitizes all signals sent to the controller, dramatically reducing disturbance noise. A highly rigid die-cast body is used to reduce deviations caused by temperature changes, and a LI-CCD with 10 times better sensitivity than conventional models is used to reduce signal noise. These design revisions, targeting high accuracy applications, have successfully produced a repeatability that is 20 times better than conventional models.



Controlling the nozzle height of a dispenser

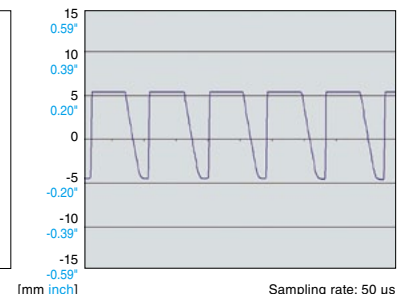


## LONG RANGE MEASUREMENT OF 1000 mm (39.37")

Delta cut technology realizes high-accuracy measurement at a long detecting distance that is difficult with conventional models. Seven sensor heads meet a surprisingly wide measuring range from 9 mm 0.98" to 1000 mm 39.37" and a broad range of needs.



Measuring the shape of a tire



The ABLE function, along with newly developed measurement algorithms, provide measurement of diffuse, transparent, or translucent targets.



## ABLE\*

Sensing the surface conditions to control laser light intensity to the optimal level

ABLE technology senses the surface of a target and adjusts the intensity of laser light to an optimal level. ABLE intelligently controls the three elements of laser emission time, laser power, and gain (CCD amplification factor), achieving a wide adjustment range of light intensity that is up to 90 times wider than conventional models. In addition, speed is 120 times faster than conventional methods.

\*ABLE=Active Balanced Laser control Engine.

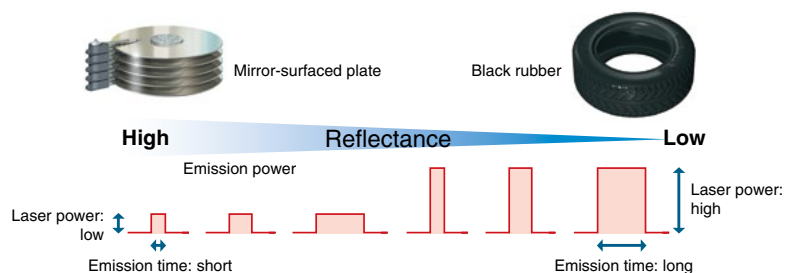
### Up to 90 times the adjustment range of conventional models

	Laser power	Emission time	Adjustment range
LK-G Series	8×	1662× (0.6 to 997 μs)	13296×
Conventional model	—	150× (3.2 to 480 μs)	150×

### Real-time control at 120 times the speed of conventional models

	Sampling rate	Adjustment speed
LK-G Series	20 μs	0.06 ms
Conventional model	512 μs	7 ms

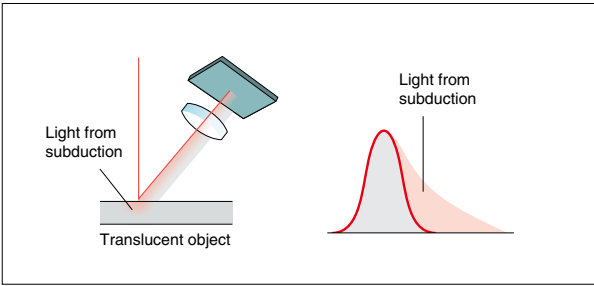
The shift of laser emission time and laser power with a target



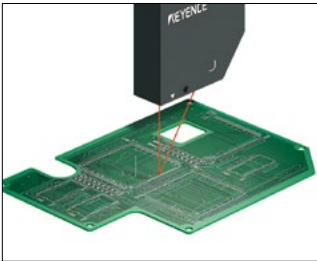
# The newly-developed algorithms support various applications

## RPD\* ALGORITHM

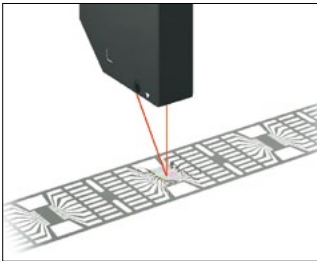
\*RPD=Real Peak Detect



Laser light enters the 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).

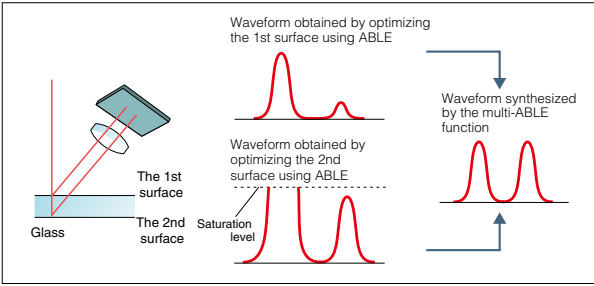


Measuring the warpage of a PCB

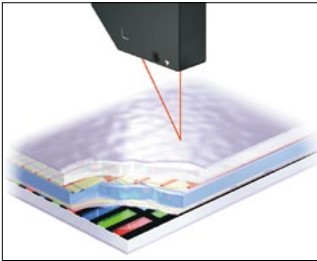


Measuring the profile of an IC plastic mold

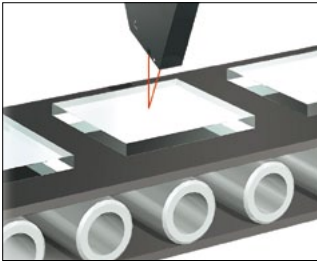
## MULTI-ABLE CONTROL



The reflected light at each layer is sensed to optimize the intensity of laser light. Highly accurate thickness measurements are enabled by synthesizing the waveform of each layer.



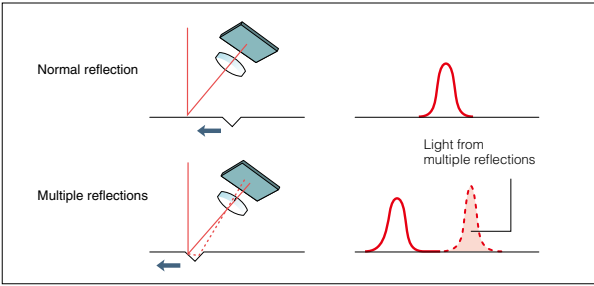
Measuring the swell of liquid crystal glass



Measuring the thickness of a glass plate

## MRC\* ALGORITHM

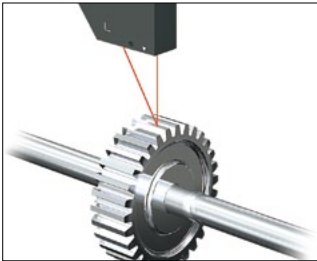
\*MRC=Multiple Reflection Cancel



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".



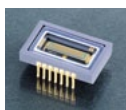
Measuring the shape of BGA



Measuring the thickness of a glass plate

# Advanced components provide superior measurements

## CCD LIGHT RECEIVING ELEMENT



The wide CCD increases measurement stability.

## CYLINDRICAL LENS



Special lens widens the beam spot.

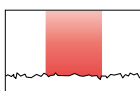
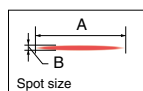
## FLEXIBLE CABLE

Can be attached to movable parts.

## WIDE SPOT OPTICAL SYSTEM

Two types of laser beam spot diameters are available: wide-spot and small-spot. Select the type that best fits your application.

### WIDE SPOT TYPE High measurement stability



Diffused reflections caused by surface irregularities of a rough-surfaced target are averaged, preventing data fluctuations.

Position

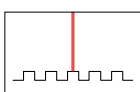
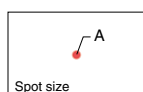
Thickness

Length

Vibration

	LK-G15	LK-G37	LK-G87	LK-G157	LK-G407	LK-G507
A	500 $\mu$ m 0.0197"	850 $\mu$ m 0.0335"	1100 $\mu$ m 0.0433"	1700 $\mu$ m 0.0669"	8300 $\mu$ m 0.3268"	9500 $\mu$ m 0.3740"
B	20 $\mu$ m 0.0008"	30 $\mu$ m 0.0012"	70 $\mu$ m 0.0028"	120 $\mu$ m 0.0047"	290 $\mu$ m 0.0114"	300 $\mu$ m 0.0118"

### SMALL SPOT TYPE



The ultra-small spot of 30  $\mu$ m 0.0012" detects minute targets reliably. Optimal for profile measurements.

Shape

Gap

Warpage

Minute

	LK-G10	LK-G32	LK-G82	LK-G152	LK-G402	LK-G502
A	$\phi$ 20 $\mu$ m 0.0008"	$\phi$ 30 $\mu$ m 0.0012"	$\phi$ 70 $\mu$ m 0.0028"	$\phi$ 120 $\mu$ m 0.0047"	$\phi$ 290 $\mu$ m 0.0114"	$\phi$ 300 $\mu$ m 0.0118"

## FIELD PROVEN DESIGN CONCEPTS

### IP67 RATING

The excellent water-proof construction enables using the product in processing sites or other locations where water splashes onto the product.

\* Measurements may become unstable due to light refraction when water or oil adheres to the front side of the lens.



### ND FILTER (OPTION : LK-F1 and LK-F2)

When measuring a target with strong luster or a mirror surface, the ND filter attenuates the laser light to its optimal intensity, ensuring more accurate measurement.



### FLEXIBLE CABLE

Flexible cables are available as standard. The product can be securely attached to a robot or other movable parts.

### COMPATIBILITY OF HEADS

Sensors of different types can be used with a single controller.

# Multifunction controller with built-in display and data storage

Various functions with advanced specifications and unparalleled detection performance are concentrated into a compact controller.

All-in-one controller  
**LK-G3001(P)V**



Display panel  
**LK-GD500**



Separate controller  
**LK-G3001(P)**



## COMPACT ALL-IN-ONE CONTROLLER SUPPORTS 2-HEAD CONNECTION

2 Ch

Large-size  
2-color LED

Measurement

Judgment

Statistic

Two channels are available for sensor head connection, display and judgment. In addition, seven measurement modes and statistic functions are featured to support a wide range of measurement requirements



### Easy-to-operate, simple setting

The current settings are displayed on a user-friendly display, which allows any user to configure the settings easily.



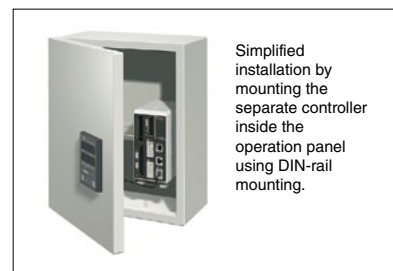
### Featuring a large, easy-to-see 2-color LED

The ECO mode is featured to turn off the display when visual monitoring is not required.

## SEPARATE INSTALLATION OF THE DISPLAY AND OPERATION PANEL

The display (LK-GD500) and operation unit can be mounted on the outside of a control panel and the separate controller (LK-G3001) can be mounted inside the control panel using a DIN-rail. The separate controller (LK-G3001) can also be operated without a display\*. A system with multiple channels can now be constructed at low cost.

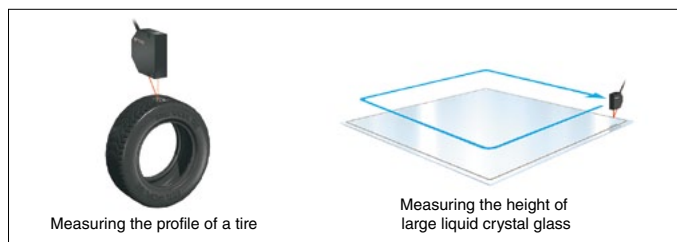
\* LK-GD500 or LK-Navigator software is required for setup.



Simplified installation by mounting the separate controller inside the operation panel using DIN-rail mounting.

## DATA STORAGE FUNCTION

65,000-point memory is integrated internally in order to store the 50 kHz ultra-high-speed sampling data. Sometimes it is necessary to enhance the tact time in obtaining data from a target traveling at high speed or to mount the unit to a device. In this case, high-speed processing of all data items is enabled by temporarily storing the data to the internal memory and retrieving the data during the period before the next measurement.



Measuring the profile of a tire

Measuring the height of large liquid crystal glass

## MULTIPLE I/O REQUIRES NO OPTICAL PARTS

USB

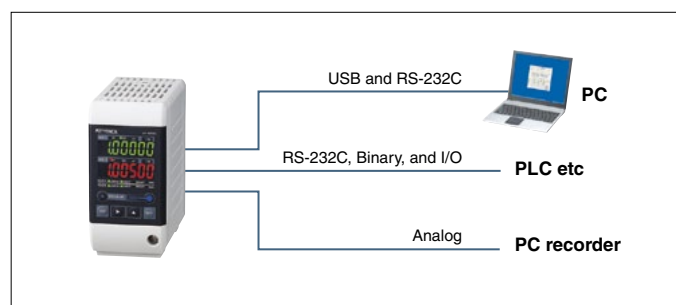
RS-232C

Binary

I/O

Analog

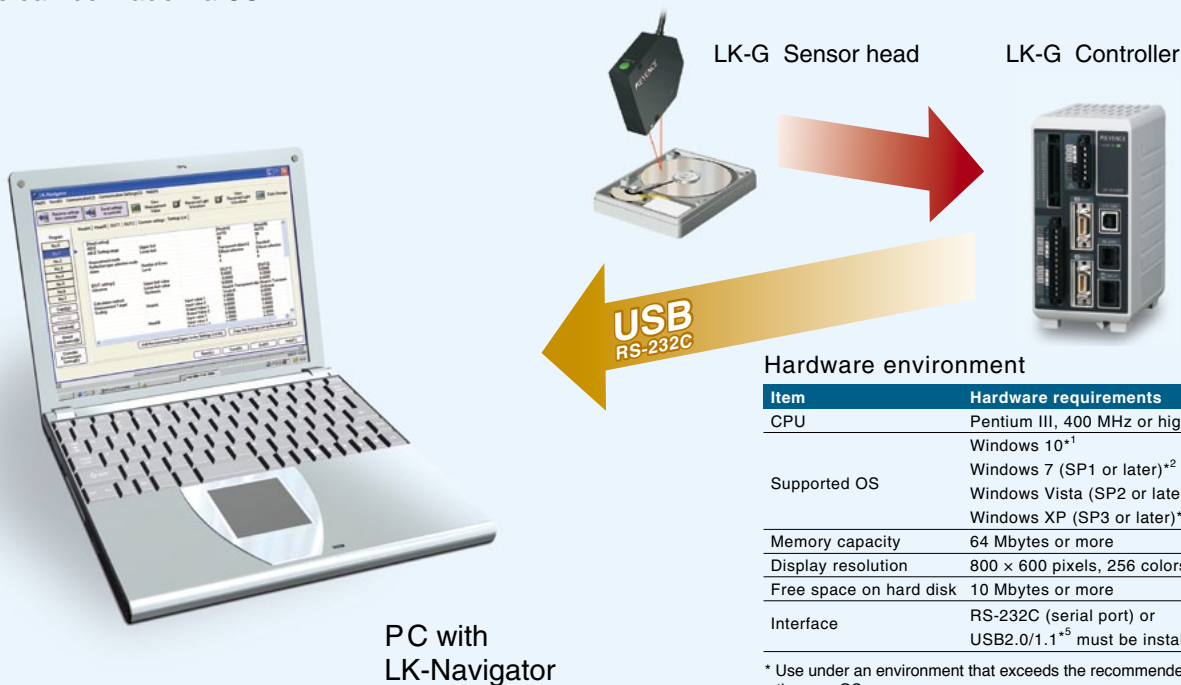
Five types of I/O including USB are available as standard. A wide range of needs are supported, from data gathering with a PC using USB to high-speed digital control with a PLC using binary outputs. High-speed output can be performed at 50 kHz. (Excluding the RS-232C)



# Simple setting and analysis on a PC

## Setting support software LK-Navigator

LK-Navigator supports optimal setting of the LK-G and data gathering from a PC. Settings can be made via USB.



### Hardware environment

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

<sup>\*</sup> Use under an environment that exceeds the recommended environment of the your OS.

<sup>\*1</sup> Home, Pro, and Enterprise editions are supported.

<sup>\*2</sup> Home Premium, Professional, and Ultimate editions are supported.

<sup>\*3</sup> Ultimate, Business, Home Premium, and Home Basic editions are supported.

<sup>\*4</sup> Professional and Home editions are supported.

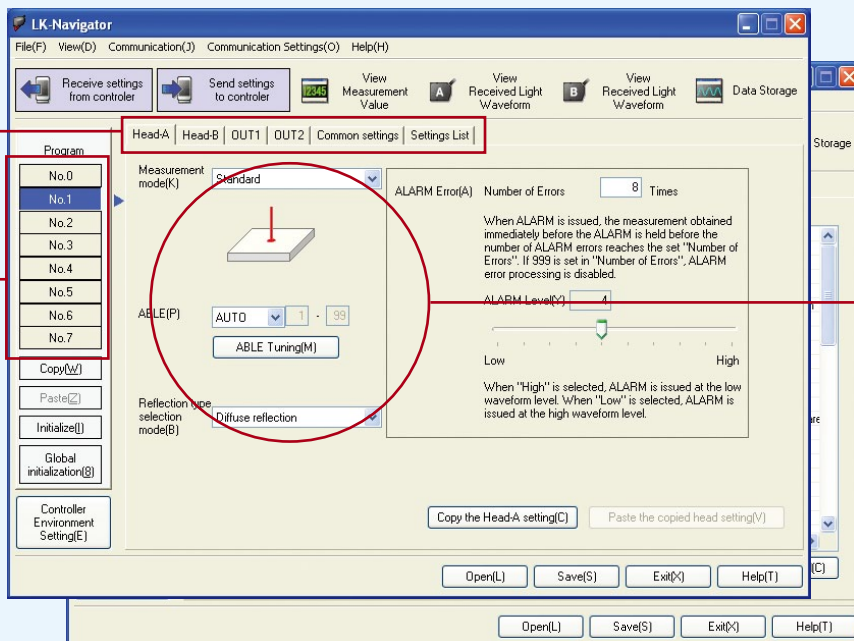
<sup>\*5</sup> Connection through a USB hub is not included in the guarantee.

## EASILY PROGRAM OPTIMAL SETTINGS

Simply follow the menu to select the settings. The navigator, with illustrations and explanations, allows any user to make settings easily.

Quick set-up  
Menu

Quick set-up  
8 programs

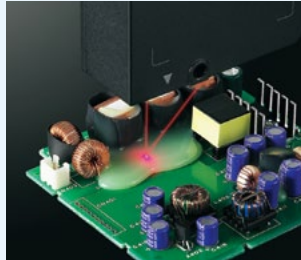


Quick set-up  
detecting mode

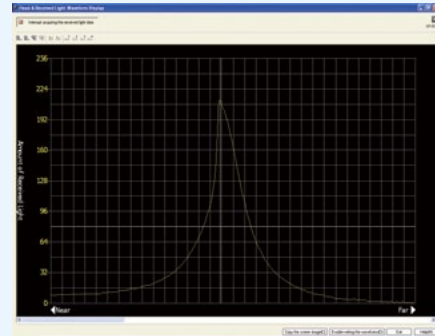
# Display of received-light waveform

The waveform of received-light intensity formed on the CCD can be displayed. This feature is highly effective for measuring transparent targets in which two or more received-light waveforms are generated.

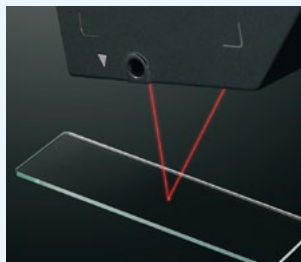
## TRANSLUCENT TARGET



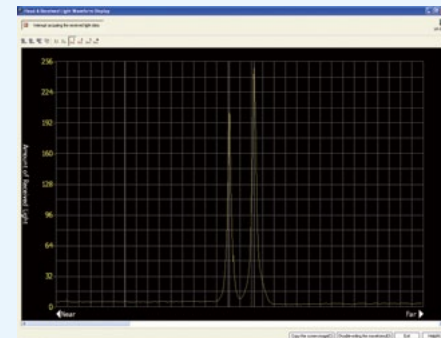
Height measurement of PCB resin



## TRANSPARENT TARGET

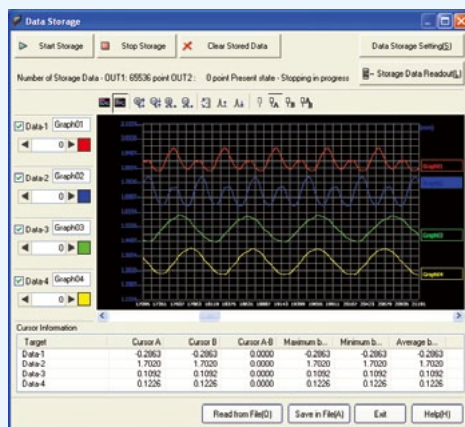


Thickness measurement of glass plate



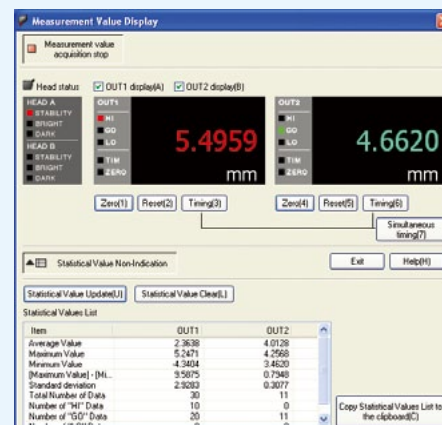
## DATA STORAGE FUNCTION

The data stored in the internal memory of the LK-G can be displayed visually and acquired by a PC. It features enlarging, reducing, and overlapping of the display, reading of measurements using the cursor, and other functions for data analysis.



## DISPLAY OF MEASUREMENT & STATISTICS VALUES







The controller's display can be reproduced on a PC. The measurement condition can be monitored in real time while configuring the settings. Using the statistic function allows the user to check the status of the system.



Measurement data and statistics for both outputs 1 and 2

Selection guide

Sensor Heads

TYPE		MODEL	MEASURING RANGE	REPEATABILITY	SPOT DIAMETER
Super Precision	Small spot	LK-G10	 Measuring range 0.39"±0.04" 10±1 mm	0.01 µm	ø0.0008" ø20 µm
	Wide beam	LK-G15			0.0008" × 0.0197" 20 × 500 µm
High Accuracy	Small spot	LK-G32	 Measuring range 1.18"±0.2" 30±5 mm	0.05 µm	ø0.0012" ø30 µm
	Wide beam	LK-G37			0.0012" × 0.0335" 30 × 850 µm
Multi-Purpose	Small spot	LK-G82	 Measuring range 3.15"±0.59" 80±15 mm	0.000008" 0.2 µm	ø0.0028" ø70 µm
	Wide beam	LK-G87			0.0028" × 0.0433" 70 × 1100 µm
Long Distance	Small spot	LK-G152	 Measuring range 5.91"±1.57" 150±40 mm	0.000020" 0.5 µm	ø0.0047" ø120 µm
	Wide beam	LK-G157			0.0047" × 0.0669" 120 × 1700 µm
High-speed Long Distance	Small spot	LK-G402	 Measuring range 15.75"±3.94" 400±100 mm	0.000079" 2 µm	ø0.0114" ø290 µm
	Wide beam	LK-G407			0.0114" × 0.3268" 290 × 8300 µm
Ultra Long Distance	Small spot	LK-G502	 Measuring range 19.69"-9.84"/+19.69" 500-250/+500 mm	0.000079" 2 µm	ø0.0118" ø300 µm
	Wide beam	LK-G507			0.0118" × 0.3740" 300 × 9500 µm

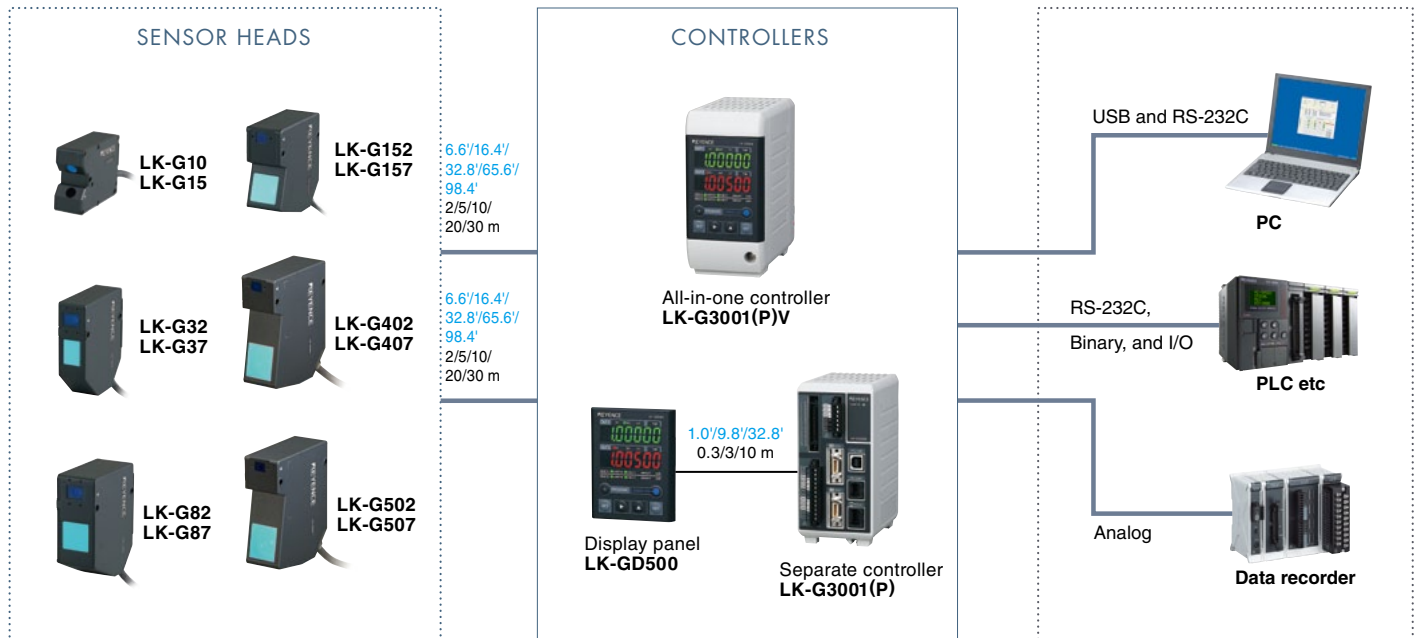
Controllers

TYPE	OUTPUT	
	NPN	PNP
ALL-in-one	LK-G3001V	LK-G3001PV
Separate Display	LK-G3001	LK-G3001P

Dimming filter

For the LK-G3x/LK-G8x  
LK-F1  
For the LK-G15x/LK-G40x/LK-G50x  
LK-F2

## System



## Specifications



### Controllers

Type		All-in-one model	Separate monitor model <sup>1</sup>
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 $\mu$ m	
	Display range	$\pm 9,999.99$ mm to $\pm 9,999.99$ $\mu$ m (Selectable from six levels)	
	Refresh rate	10 times/sec	
Terminal block	Analog voltage output	$\pm 10$ V $\times$ 2 outputs, output impedance: 100 $\Omega$	
	Analog current output	4 to 20 mA $\times$ 2 outputs, maximum load resistance: 350 $\Omega$	
	Timing/Reset/Auto-zero input	For OUT1, non-voltage or voltage input <sup>3</sup> .	
	Laser remote interlock input	Non-voltage input <sup>3</sup> .	
	Comparator output	For OUT1, NPN or PNP open-collector output <sup>2</sup> .	
Expansion connector	Alarm output	For OUT1, NPN or PNP open-collector output <sup>2</sup> (N.C.)	
	Timing/Reset/Auto-zero input	For OUT2, non-voltage or voltage input <sup>3</sup> .	
	Program switching input	Non-voltage or voltage input <sup>3</sup> $\times$ 3 inputs	
	Laser-Off input	For Head A/Head B, non-voltage or voltage input <sup>3</sup> .	
	Comparator output	For OUT2, NPN or PNP open-collector output <sup>2</sup> .	
Binary	Alarm output	For OUT2, NPN or PNP open-collector output <sup>2</sup> (N.C.)	
	Binary output	Measured data output (21 bits), OUT1/OUT2 selectable, NPN or PNP open-collector output <sup>2</sup> .	
	Strobe output	NPN or PNP open-collector output <sup>2</sup> .	
	Binary selector output	NPN or PNP open-collector output <sup>2</sup> .	
	Binary selector input	Non-voltage or voltage input <sup>3</sup> .	
RS-232C interface		Measured data output and control input/output (Maximum baud rate: 115,200 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, Connection of setting support software, Selectable head-mounting, etc.	
Power supply voltage		24 VDC $\pm 10\%$ , 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, No condensation	
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.

# Specifications

## Sensor heads

Model		LK-G10/G15	LK-G32/ G37	
Mounting mode		—	Diffused reflection	Specular reflection
Reference distance		0.39" 10 mm	1.18" 30 mm	0.93" 23.5 mm
Measuring range <sup>1.</sup>		±0.04" ±1 mm	±0.2" ±5 mm	±0.18" ±4.5 mm
Light source	Red semiconductor laser			
	Wavelength	650 nm (visible light)		650 nm (visible light)
	Laser Class	Class II (FDA CDRH 21CFR PART1040.10)		
	Output	0.3 mW		
Spot diameter (at reference distance)		Approx. 0.0008" × 0.0197" 20 × 500 μm (G15), Approx. ø0.0008" ø20 μm (G10)		Approx. 0.0012" × 0.0335" 30 × 850 μm (G37), Approx. ø0.0012" ø30 μm (G32)
Linearity <sup>2.</sup>		±0.03% of F.S. (F.S.=±0.04" ±1 mm)		±0.05% of F.S. (F.S.= ±0.2" ±5 mm)
Repeatability <sup>3.</sup>		0.02 μm (0.01 μm)		0.05 μm
Sampling frequency		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.= ±0.04" ±1 mm)		0.01% of F.S./°C (F.S.= ±0.2" ±5 mm)
Environmental resistance	Enclosure rating	IP67 (IEC60529)		
	Ambient luminance	Incandescent lamp or fluorescent lamp: 10,000 lux max.		
	Ambient temperature	0 to +50°C (32 to 122°F), No condensation		
	Relative humidity	35 to 85%, No condensation		
	Resistance to vibrations	10 to 55 Hz, multiple amplitude 0.06" 1.5 mm; two hours in each direction of X, Y, and Z		
Material		Aluminum die-cast		
Weight (including the cable)		Approx. 190 g		Approx. 280 g

1. The range is obtained by measuring KEYENCE's standard target (ceramic).

LK-G10/G15: When the sampling rate is 20 μs, the range becomes +0.37 mm +0.01" (FAR side) to -1 mm -0.04" (NEAR side).

LK-G32/G37: When the sampling rate is 20 μs, the range becomes +1.8 mm +0.07" (FAR side) to -5 mm -0.20" (NEAR side) for diffuse reflection, and +1.6 mm +0.06" (FAR side) to -4.5 mm -0.18" (NEAR side) for specular reflection.

2. The range is obtained by measuring KEYENCE's standard target (ceramic) with the Standard mode.

3. The range is obtained by measuring KEYENCE's standard (SUS) with 4096 times of averaging at the reference distance. The range in parenthesis is the typical linearity obtained by measuring the target with 16384.

Model		LK-G82/ G87		LK-G152/G157	
Mounting mode		Diffused reflection	Specular reflection	Diffused reflection	Specular reflection
Reference distance		3.15" 80 mm	2.96" 75.2 mm	5.91" 150 mm	5.81" 147.5 mm
Measuring range <sup>1.</sup>		±0.59" ±15 mm	±0.55" ±14 mm	±1.57" ±40 mm	±1.54" ±39 mm
Light source	Wavelength	Red semiconductor laser 650 nm (visible light)			
	Laser Class	Class II (FDA CDRH 21CFR PART1040.10)			
	Output	0.95 mW			
Spot diameter (at reference distance)		Approx. 0.0028" × 0.0433" 70 × 1100 μm (G87), Approx. ø0.0028" ø70 μm (G82)		Approx. 0.0047" × 0.0669" 120 × 1700 μm (G157), Approx. ø0.0047" ø120 μm (G152)	
Linearity <sup>2.</sup>		±0.05% of F.S. (F.S.= ±0.59" ±15 mm)		±0.05% of F.S. (F.S.= ±1.57" ±40 mm)	
Repeatability <sup>3.</sup>		0.000008" 0.2 μm		0.000020" 0.5 μm	
Sampling frequency		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.= ±0.59" ±15 mm)		0.01% of F.S./°C (F.S.= ±1.57" ±40 mm)	
Environmental resistance	Enclosure rating	IP67 (IEC60529)			
	Ambient luminance	Incandescent lamp or fluorescent lamp: 10,000 lux max.		Incandescent lamp or fluorescent lamp: 5000 lux max.	
	Ambient temperature	0 to +50°C (32 to 122°F), No condensation			
	Relative humidity	35 to 85%, No condensation			
	Resistance to vibrations	10 to 55 Hz, multiple amplitude 0.06" 1.5 mm; two hours in each direction of X, Y, and Z			
Material		Aluminum die-cast			
Weight (including the cable)		Approx. 380 g		Approx. 290 g	

1. The range is obtained by measuring KEYENCE's standard target (ceramic).

LK-G82/G87: When the sampling rate is 20 μs, the range becomes -0.35" -9 (NEAR side) to -0.59" -15 mm (NEAR side) for diffuse reflection, and -0.34" -8.7 (NEAR side) to -0.55" -14 mm (NEAR side) for specular reflection.

LK-G152/G157: When the sampling rate is 20 μs, the range becomes -0.87" -22 (NEAR side) to -1.57" -40 mm (NEAR side) for diffuse reflection, and -0.87" -22 (NEAR side) to -1.54" -39 mm (NEAR side) for specular reflection.

2. The range is obtained by measuring KEYENCE's standard target (ceramic) with the Standard mode.

3. The range is obtained by measuring KEYENCE's standard (SUS) with 4096 times of averaging at the reference distance. The range in parenthesis is the typical linearity obtained by measuring the target with 16384.



Model		LK-G407/LK-G402		LK-G507/LK-G502	
Mounting mode		Diffused reflection	Specular reflection	Diffused reflection	Specular reflection
Reference distance		15.75" 400 mm	15.67" 398 mm	19.69" 500 mm	19.59" 497.5 mm
Measuring range <sup>1</sup>		3.94" ±100 mm	3.90" ±99 mm	-9.84" to 19.69" -250 to +500 mm	-9.80" to 19.61" -249 to +498 mm
Light source		Red semiconductor laser			
	Wavelength	655 nm (visible light)			
	Laser Class	Class II (FDA CDRH 21CFR PART1040.10)			
	Output	0.95 mW			
Spot diameter (at reference distance)		Approx. 0.0114" × 0.3268" 290 × 8300 μm (G407) Approx. 0.0114" ø290 μm (G402)		Approx. 0.0118" × 0.3740" 300 × 9500 μm (G507) Approx. 0.0118" ø300 μm (G502)	
Linearity <sup>2</sup>		±0.05% of F.S.(F.S.= ±3.94" ±100 mm)		±0.05% of F.S. (±0.0098" ±250 μm) <sup>4,5</sup> -9.84" to +9.84" -250 mm to +250 mm <high-accuracy range> ±0.02% of F.S. (±0.0039" ±100 μm) -9.84" to -1.97" -250 mm to -50 mm <long range> ±0.1% of F.S. (±0.0197" ±500 μm) -9.84" to +19.69" -250 mm to +500 mm (F.S. = ±9.84" ±250 mm)	
Repeatability <sup>3</sup>		0.000079" 2 μm			
Sampling frequency		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. = ±3.94" ±100 mm)		0.01% of F.S./°C (F.S. = ±9.84" ±250 mm)	
Enclosure rating		IP67 (IEC60529)			
Ambient light		Incandescent lamp or fluorescent lamp: 5000 lux max.			
Ambient temperature		0 to +50°C (32 to 122°F), No condensation			
Relative humidity		35 to 85%, No condensation			
Vibrations		10 to 55 Hz, multiple amplitude 0.06" 1.5 mm; two hours in each direction of X, Y, and Z			
Material		Aluminum die-cast			
Weight (including the cable)		Approx. 380 g			

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

#### Extension cable [Cable between the head and controller]

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

#### Extension cable [Cable for display panel]

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

#### ND filter

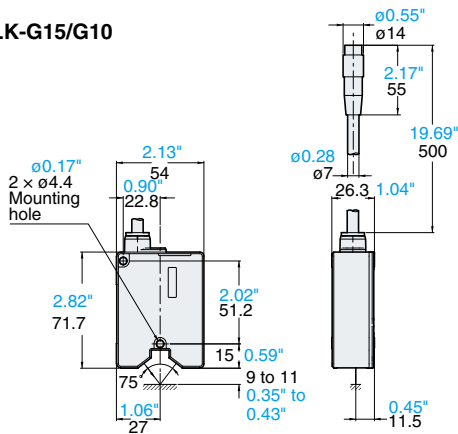
Model	Description
LK-F1 (for LK-G3x, LK-G8x)	Used when the mirror surface is measured at a mirror reflection setup.
LK-F2 (for LK-G15x, LK-G40x, LK-G50x)	Used when the mirror surface is measured at a mirror reflection setup.

#### Communication cable

RS-232C cable (2.5 m 8.2')  
**OP-96368**  
RS-232C conversion adapter (9-pin)  
**OP-26401**  
Expansion I/O cable (3 m 9.8')  
**OP-51657**

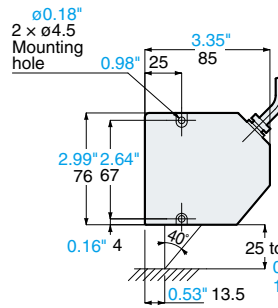
## Dimensions

### LK-G15/G10

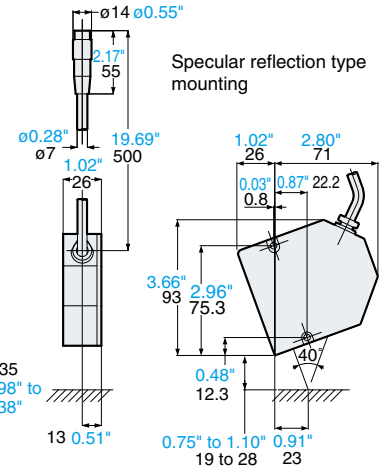


### LK-G32/G37

Diffused reflection type mounting

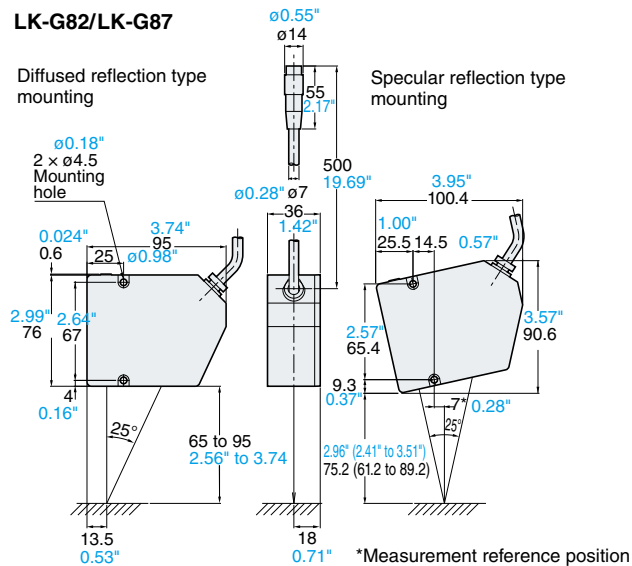


Specular reflection type mounting



### LK-G82/LK-G87

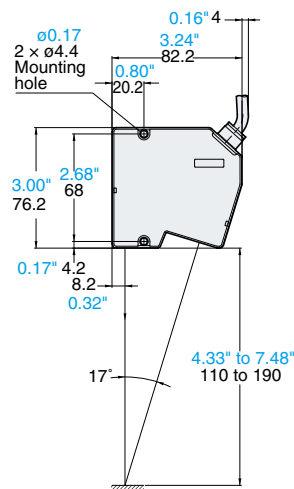
Diffused reflection type mounting



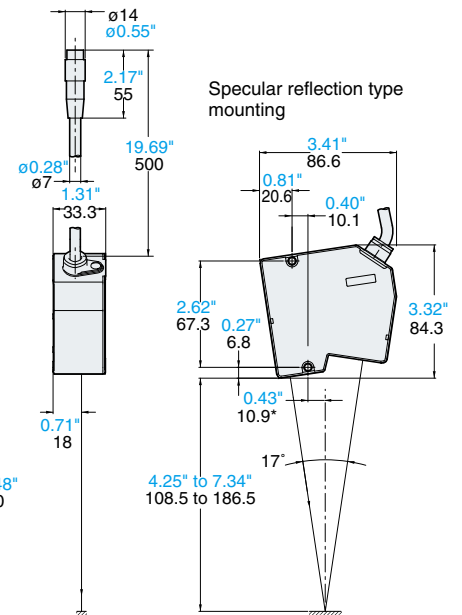
\*Measurement reference position

### LK-G152/G157

Diffused reflection type mounting



Specular reflection type mounting

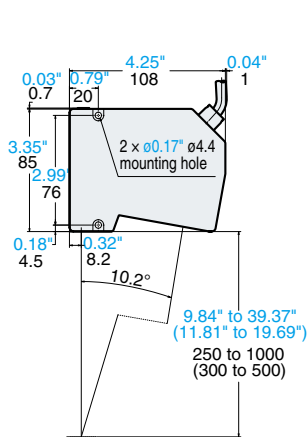


\*Measurement reference position

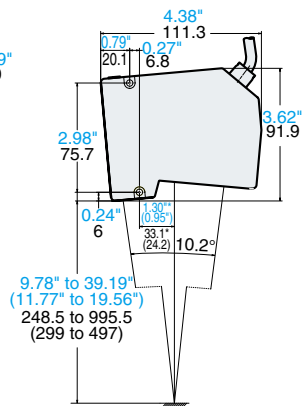
### LK-G407/LK-G402/LK-G507/LK-G502

Data in ( ) applies to LK-G407/LK-G402

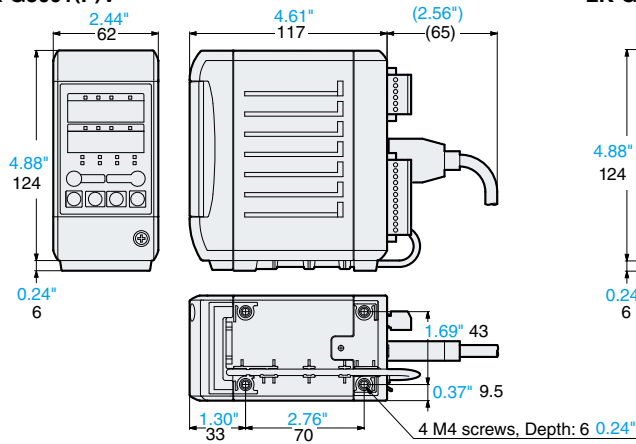
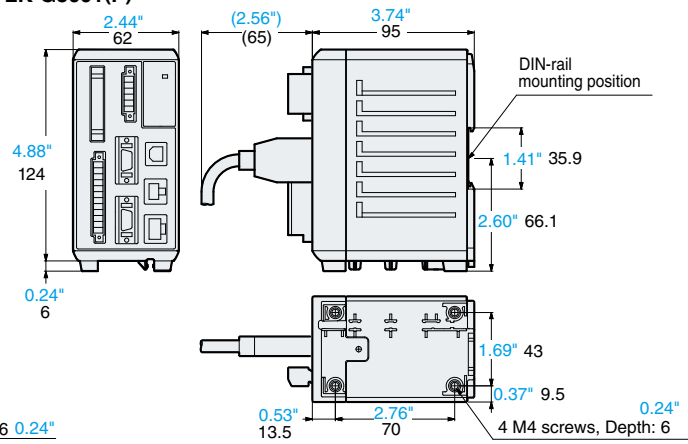
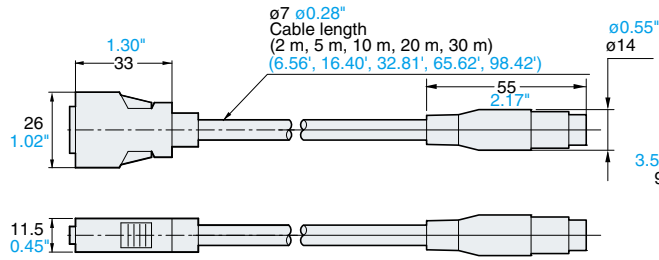
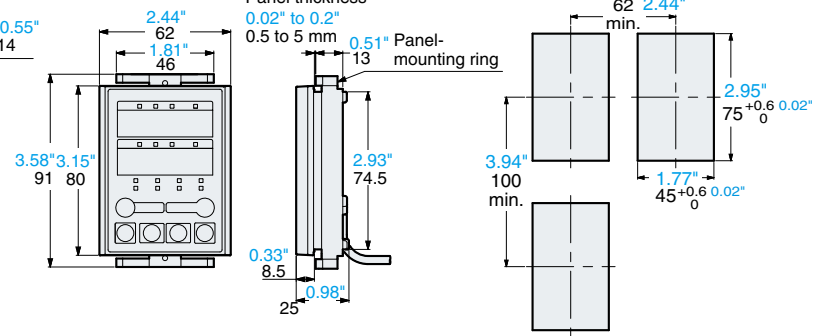
Diffused reflection type mounting



Specular reflection type mounting



\*Measurement reference position

**LK-G3001(P)V****LK-G3001(P)****LK-GC2/LK-GC5/LK-GC10/LK-GC20/LK-GC30****LK-GD500**



**CALL  
TOLL  
FREE**

TO CONTACT YOUR LOCAL OFFICE  
**1-888-KEYENCE**  
1 - 8 8 8 - 5 3 9 - 3 6 2 3

[www.keyence.com](http://www.keyence.com)



**SAFETY INFORMATION**

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

**GLOBAL NETWORK**

CONTACT YOUR NEAREST OFFICE FOR RELEASE STATUS.

**KEYENCE CORPORATION OF AMERICA**

**Head Office** 500 Park Boulevard, Suite 200, Itasca, IL 60143, U.S.A. PHONE: +1-201-930-0100 FAX: +1-855-539-0123 E-mail: [keyence@keyence.com](mailto:keyence@keyence.com)

<b>AL</b> Birmingham	<b>CA</b> San Jose	<b>CO</b> Denver	<b>IL</b> Chicago	<b>MI</b> Detroit	<b>MO</b> St. Louis	<b>NC</b> Raleigh	<b>PA</b> Philadelphia	<b>TN</b> Nashville	<b>WI</b> Milwaukee
<b>AR</b> Little Rock	<b>CA</b> Cupertino	<b>FL</b> Tampa	<b>IN</b> Indianapolis	<b>MI</b> Grand Rapids	<b>NJ</b> Elmwood Park	<b>OH</b> Cincinnati	<b>PA</b> Pittsburgh	<b>TX</b> Austin	
<b>AZ</b> Phoenix	<b>CA</b> Los Angeles	<b>GA</b> Atlanta	<b>KY</b> Louisville	<b>MN</b> Minneapolis	<b>NY</b> Rochester	<b>OH</b> Cleveland	<b>SC</b> Greenville	<b>TX</b> Dallas	
<b>CA</b> San Francisco	<b>CA</b> Irvine	<b>IA</b> Iowa	<b>MA</b> Boston	<b>MO</b> Kansas City	<b>NC</b> Charlotte	<b>OR</b> Portland	<b>TN</b> Knoxville	<b>WA</b> Seattle	

**KEYENCE CANADA INC.**

**Head Office** PHONE: +1-905-366-7655 FAX: +1-905-366-1122 E-mail: [keyencecanada@keyence.com](mailto:keyencecanada@keyence.com)  
**Montreal** PHONE: +1-514-694-4740 FAX: +1-514-694-3206 Windsor PHONE: +1-905-366-7655 FAX: +1-905-366-1122

**KEYENCE MEXICO S.A. DE C.V.**

PHONE: +52-55-8850-0100 FAX: +52-81-8220-9097  
E-mail: [keyencemexico@keyence.com](mailto:keyencemexico@keyence.com)