KEYENCE

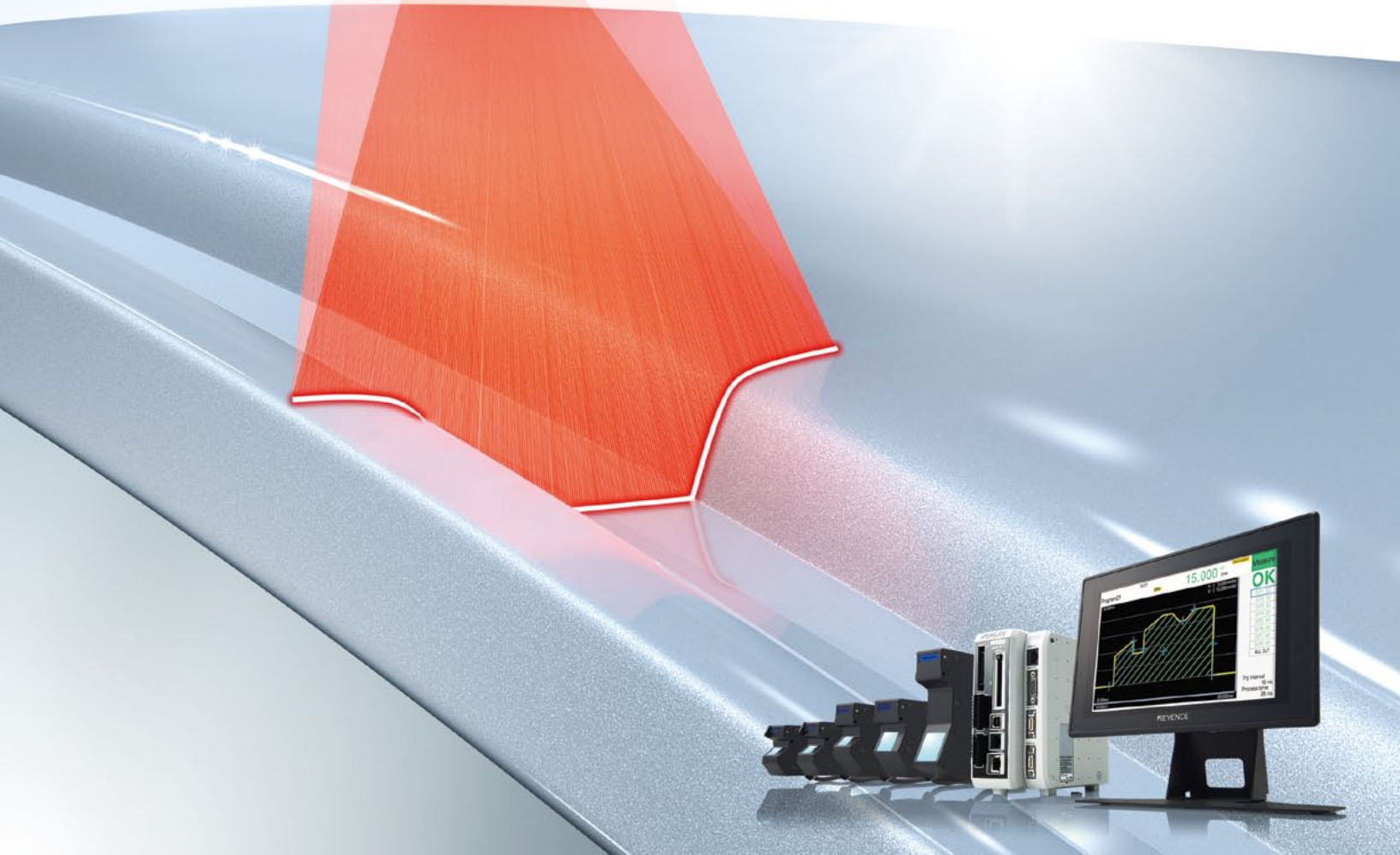
High-accuracy 2D Laser Displacement Sensor

LJ-G Series

CE

INSTANTANEOUS
TWO AXIS MEASUREMENT

2D DISPLACEMENT SENSOR



Ideal for high accuracy inline / offline measurements

High precision X and Z axis measurement provides an accurate reproduction of surface profiles.
An optimum mode can be selected from among 28 measurement modes to perform the simultaneous measurement of height, width, cross-sectional area, feature position, and step-height. Furthermore, the system provides and industry-leading simultaneous measurement of up to eight features.
More complex evaluations can be performed by performing onboard calculations based on extracted values.

BEST IN CLASS

Simultaneous measurement/ judgment of 8 features

KEYENCE advanced processing technology allows high simultaneous evaluation of multiple features without the need for multiple inspection systems.

■ Measurements

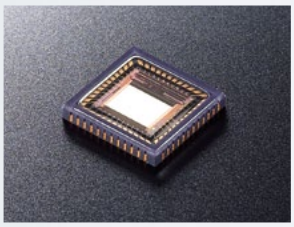
Peak height	Bottom height
Average height	Gap
Width/position	Cross sectional area
Angle/intersection	Profile comparison

FIRST IN THE WORLD

E³-CMOS image sensor provides stable measurements

The E³-CMOS with a 300 times wider dynamic range than conventional devices is built into the system. The LJ-G Series precisely follow the surface profile of any target in the X and Z axes. It can reliably measure a variety of different materials including black rubber, white ceramic, and metal.

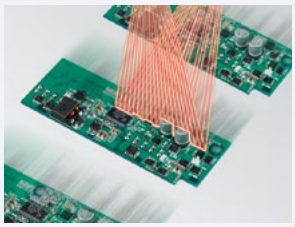
*E³-CMOS: Enhanced Eye Emulation C-MOS



FASTEST IN CLASS

High-speed sampling of 3.8 ms, high-accuracy of ±0.1% of F.S.

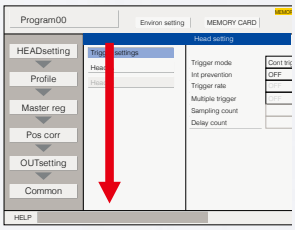
The Quatro link system achieves the highest sampling speed in its class, 3.8 ms. The LJ-G Series can follow high-speed production lines or moving targets. In addition, a 2D Ernostar lens is used to provide the highest accuracy optical system in its class.



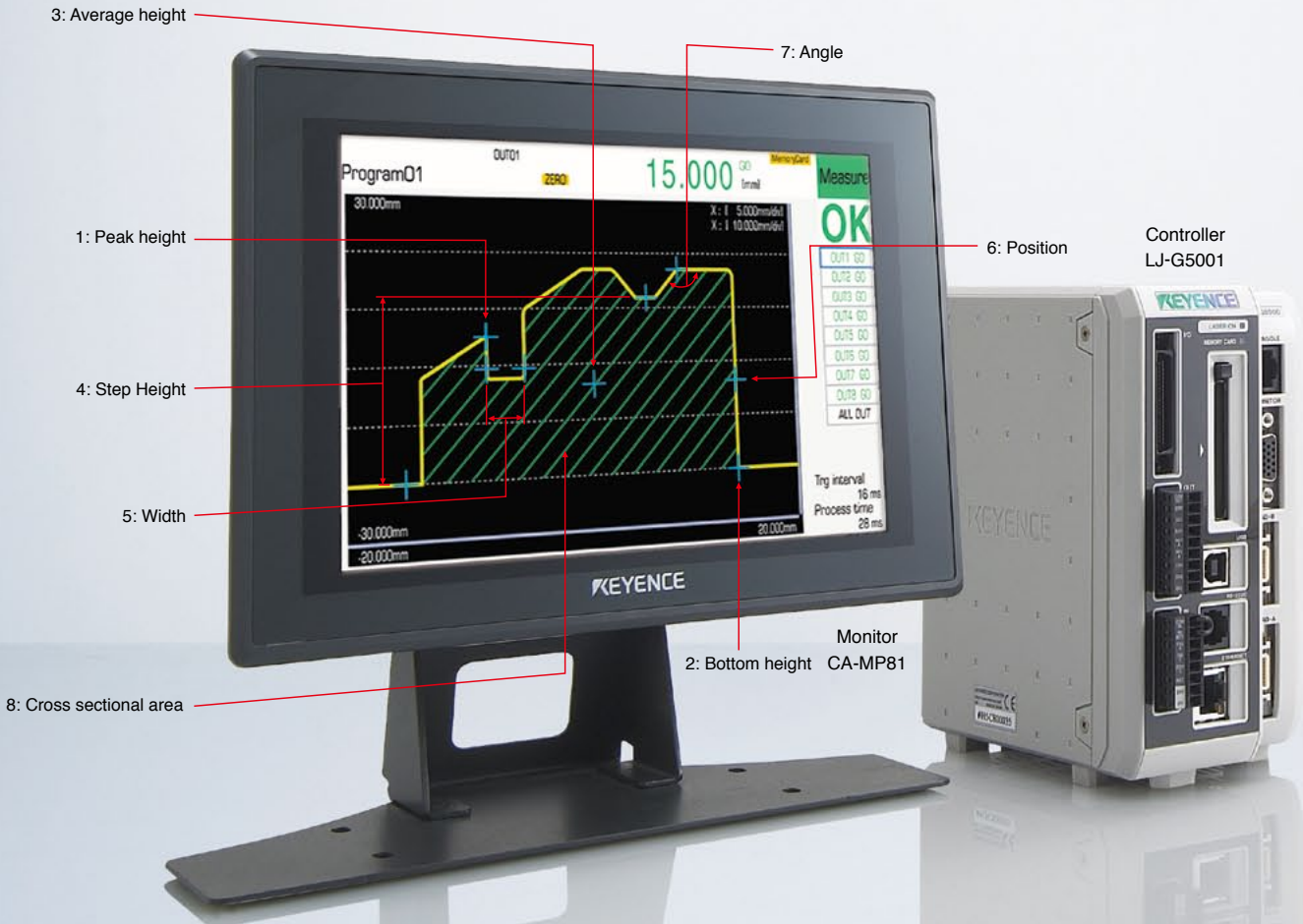
FIRST IN CLASS

Easy setting with the simple setting menu

Novice users can easily configure settings following the simple menu. Setup via a PC is also simplified thanks to the optional support software.



Measure up to 8 features at the same time



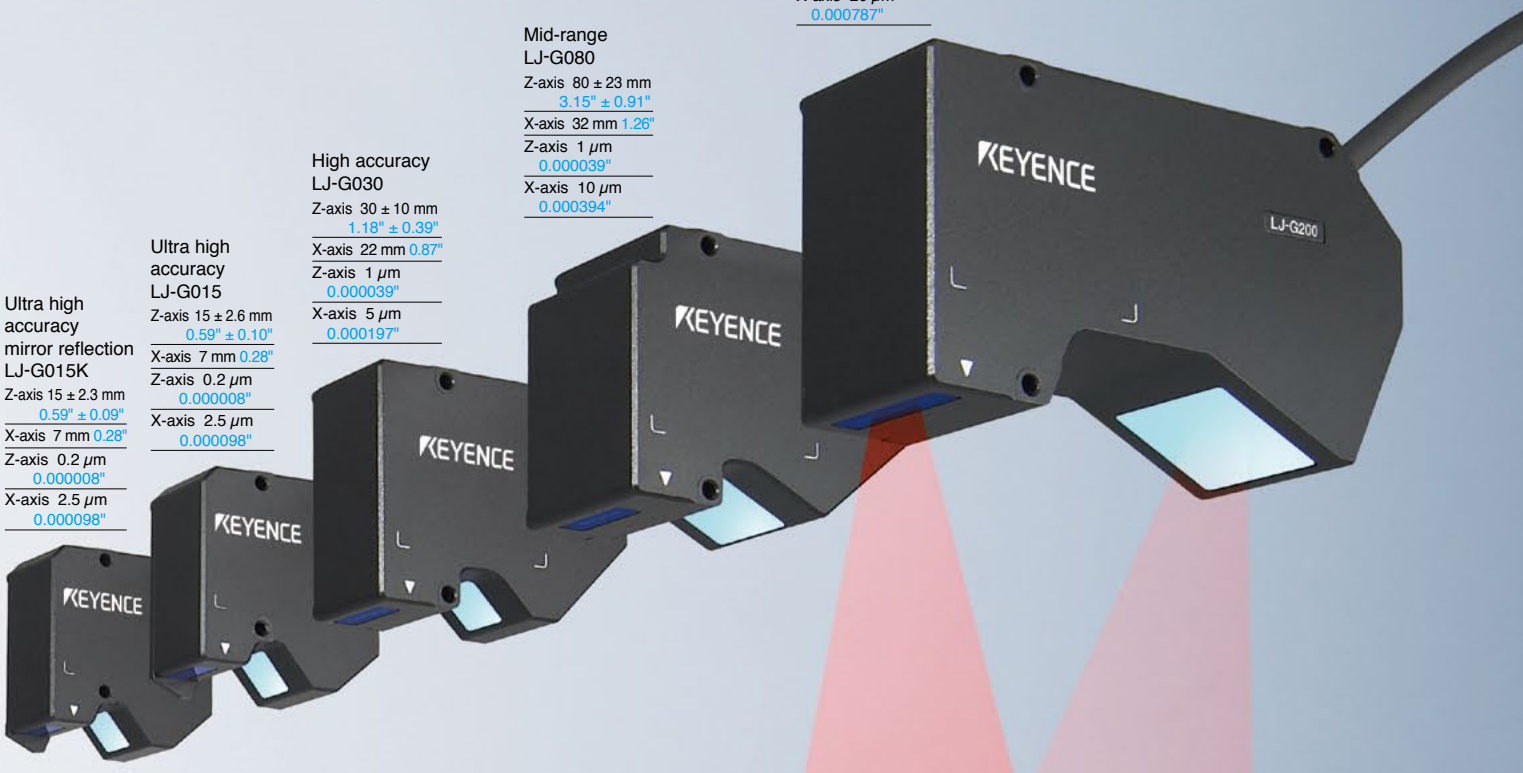
Ultra high accuracy mirror reflection
LJ-G015K
Z-axis 15 ± 2.3 mm
0.59" ± 0.09"
X-axis 7 mm 0.28"
Z-axis 0.2 μm
0.000008"
X-axis 2.5 μm
0.000098"

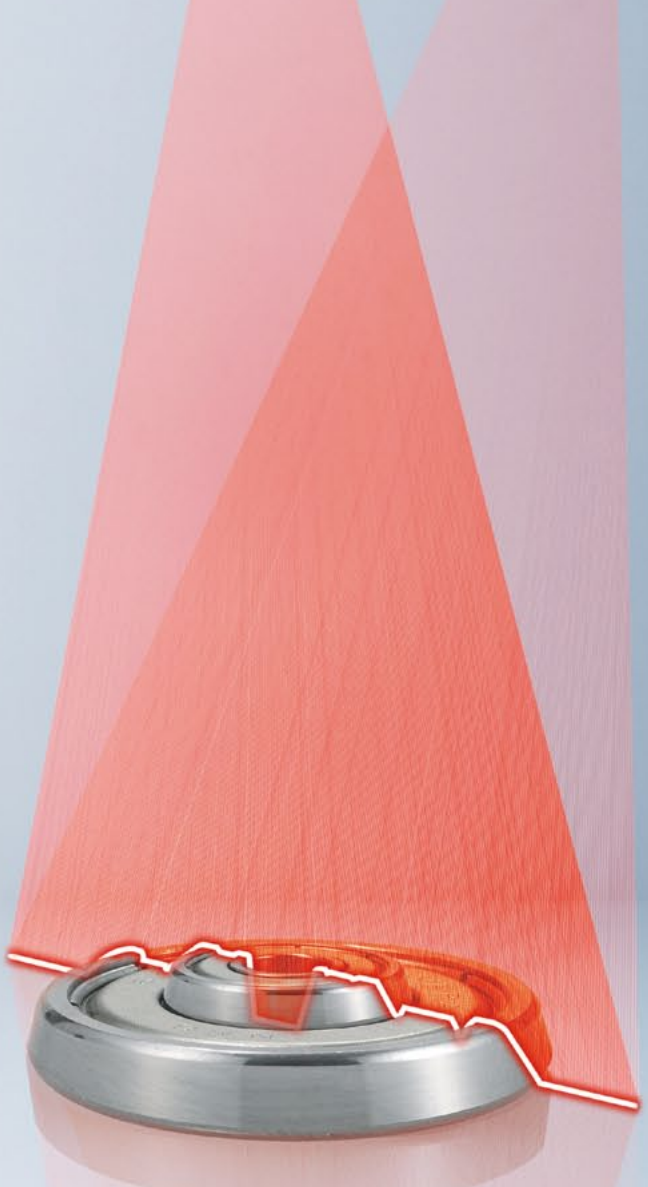
Ultra high accuracy
LJ-G015
Z-axis 15 ± 2.6 mm
0.59" ± 0.10"
X-axis 7 mm 0.28"
Z-axis 0.2 μm
0.000008"
X-axis 2.5 μm
0.000098"

High accuracy
LJ-G030
Z-axis 30 ± 10 mm
1.18" ± 0.39"
X-axis 22 mm 0.87"
Z-axis 1 μm
0.000039"
X-axis 5 μm
0.000197"

Mid-range
LJ-G080
Z-axis 80 ± 23 mm
3.15" ± 0.91"
X-axis 32 mm 1.26"
Z-axis 1 μm
0.000039"
X-axis 10 μm
0.000394"

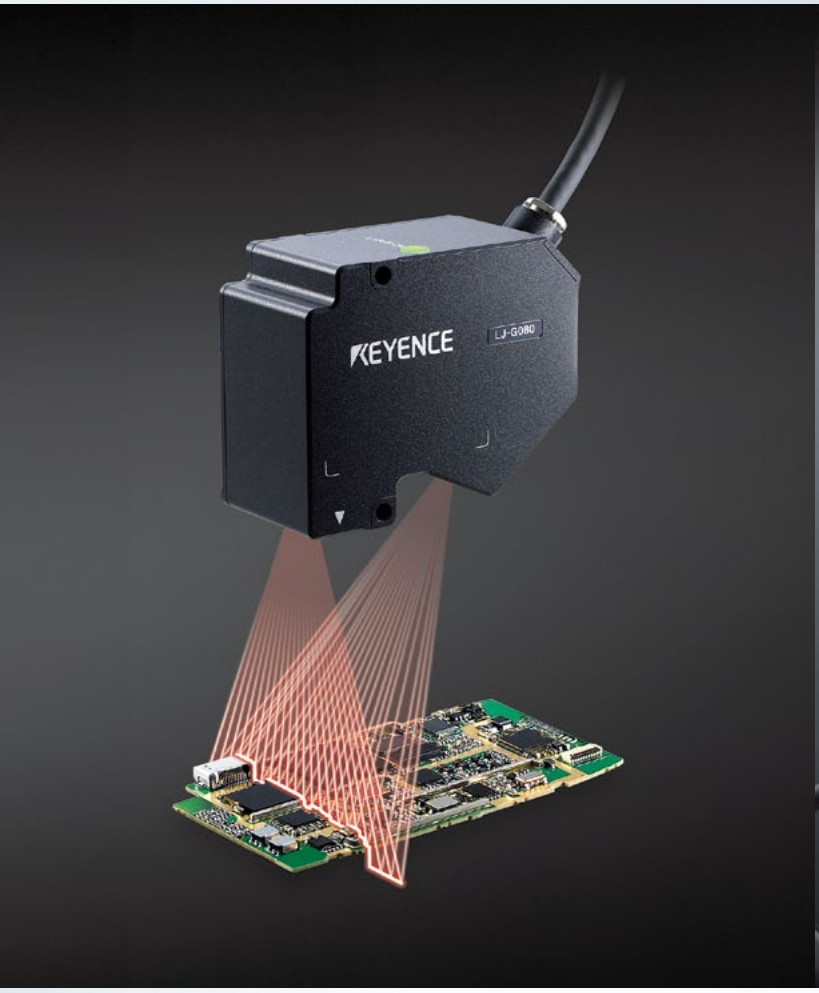
Long-range
LJ-G200
Z-axis 200 ± 48 mm
7.87" ± 1.89"
X-axis 62 mm 2.44"
Z-axis 2 μm
0.000079"
X-axis 20 μm
0.000787"



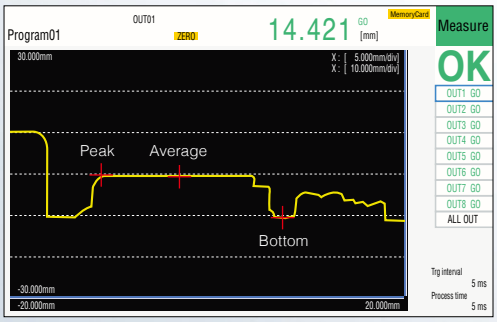


Evolution of the 2D Laser Displacement Sensor

Being a world leader in laser displacement technology, KEYENCE employed the cutting edge concepts developed for our 1D displacement products for use in a brand new 2D system.
With the implementation of this technology we are able to present a state-of-the-art system based on proven technology.



Height and warpage



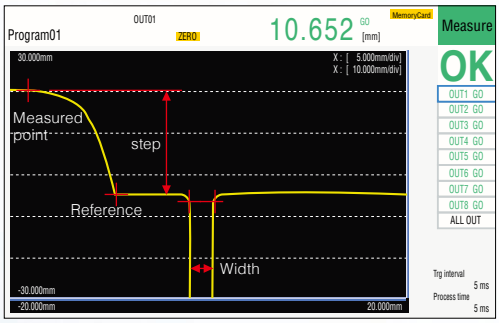
Peak, bottom and average heights measurement

Peak, bottom and average heights can be measured within a specified range.

Warpage measurement

A simple to use tool set allows simple evaluation of warpage over a given area.

Width and step height



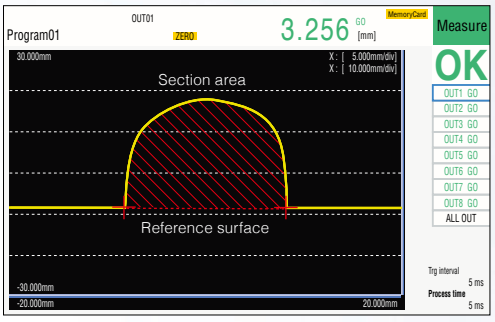
Step height measurement

A step height can be easily extracted by evaluating the difference in the z-axis between any two designated features.

Width measurement

Width can be determined in the X-axis (lateral direction) by specifying any two points.

Profile and cross-sectional area



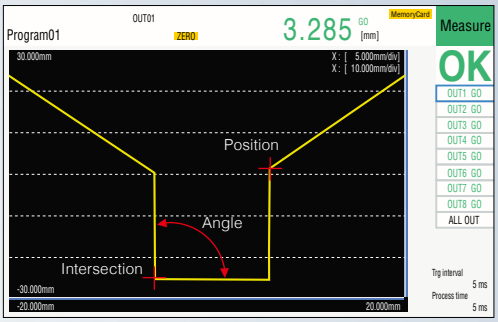
Profile measurement

Measures the maximum change in the z-axis when compared to the registered master profile.

Cross-sectional area measurement

Measures an area enclosed by the reference surface and the detected profile.

Angle, intersection and position



Angle measurement

Measures the angle between two designated intersecting lines.

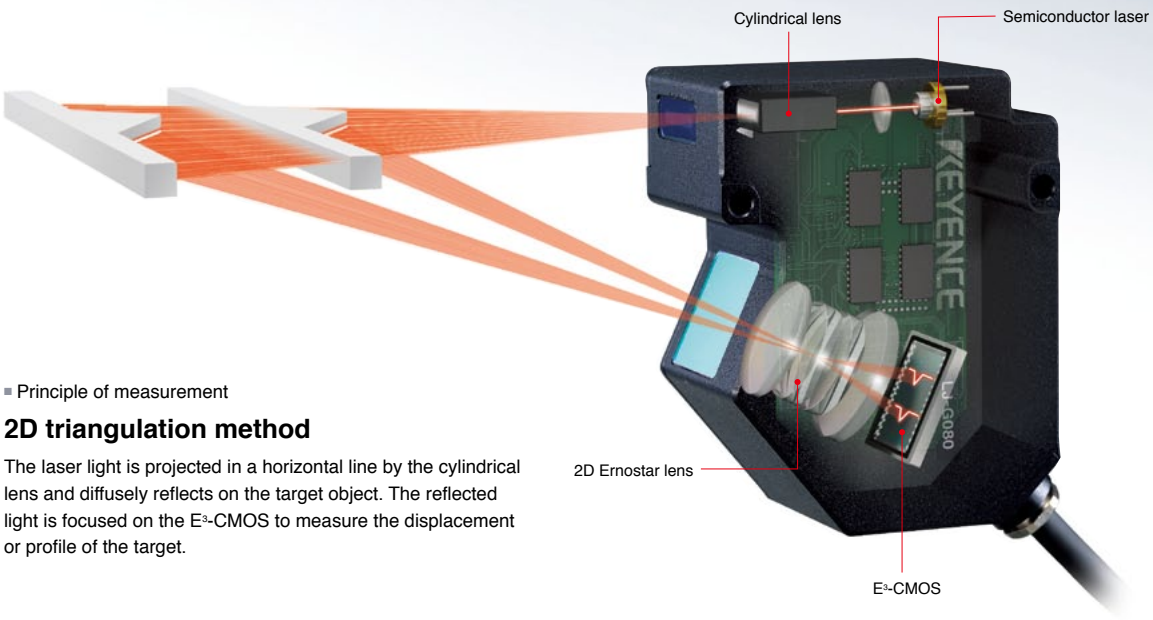
Intersection measurement

A measurement value is the coordinate of the intersection position, x or z, based on two projected lines.

Position measurement

Measures the coordinate of a specified point (position).

Unique design for high-accuracy measurements



■ Principle of measurement

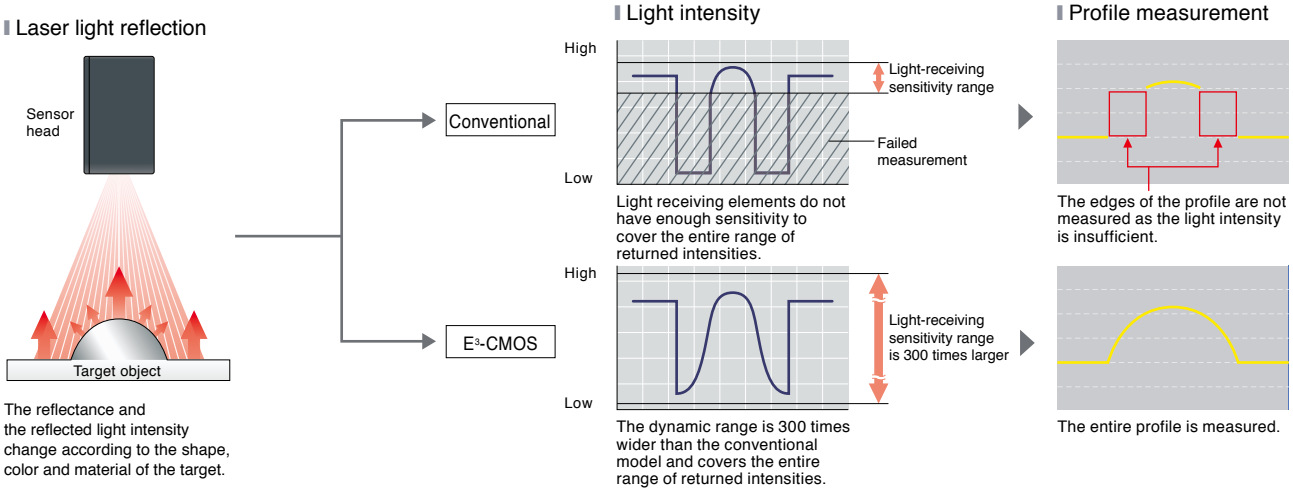
2D triangulation method

The laser light is projected in a horizontal line by the cylindrical lens and diffusely reflects on the target object. The reflected light is focused on the E³-CMOS to measure the displacement or profile of the target.

The LJ-G MEASURES ANY SUBSTANCE: E³-CMOS EQUIPPED

The E³-CMOS image sensor, developed for machine vision, has a 300 times wider dynamic range than a conventional sensors and a significantly improved signal to noise ratio.
This allows simultaneous measurements of drastically different targets such as black rubber (with weak reflection) and polished metal (with strong reflection).

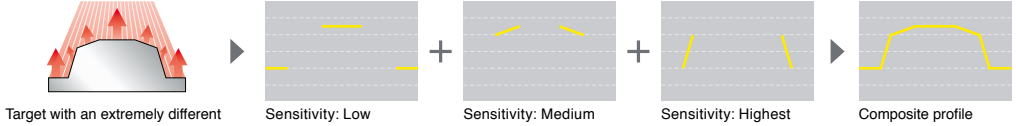
*E³-CMOS sensor: Enhanced Eye Emulation C-MOS image sensor



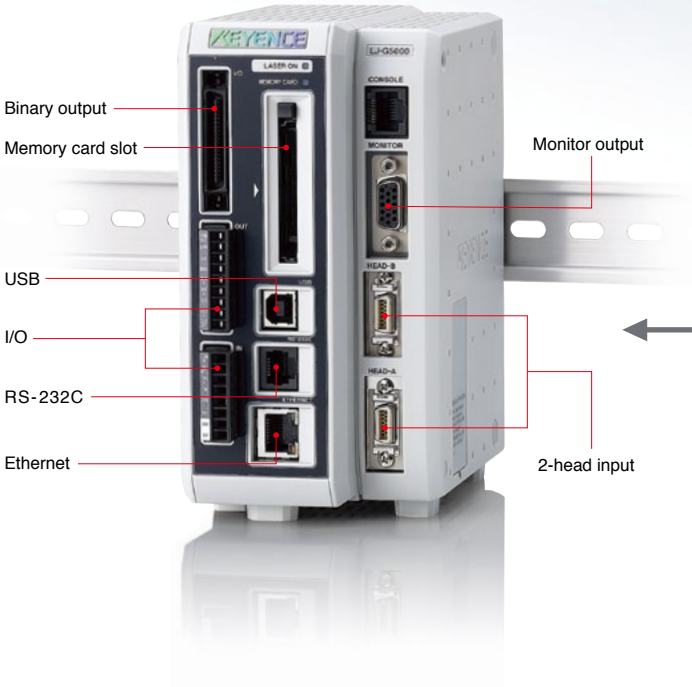
ASAP (Automatic Sensitivity Adjustment by Pixel)

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

Dynamic range 6000x



Multifunctional controller satisfies any need



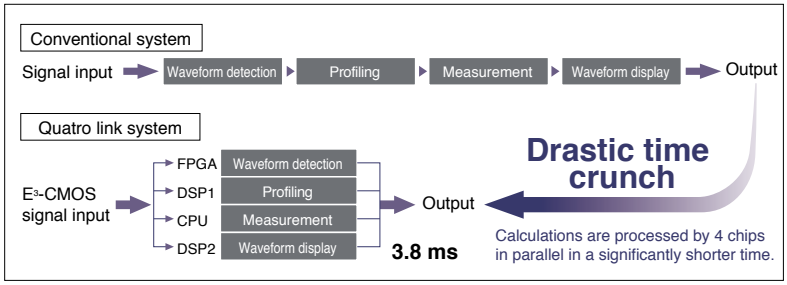
Simple setting and analysis with a PC

Setting support software: LJ-Navigator (LJ-H1W)

With the optional software package, settings can be easily configured and data can be saved and analyzed with a PC.

SAMPLING SPEED OF 3.8 ms QUATRO LINK SYSTEM

Four dedicated data processors are arranged in parallel inside the controller. The Quatro link system simultaneously conducts four processes to achieve a sampling speed of 3.8 ms. This allows faster measurements on production lines.



LARGE CAPACITY MEMORY FOR SAVING DATA

The LJ-G5000 series has a large amount of memory built into the controller.
An additional memory card slot is included to store the production records of mass-produced products.

Handling many product types

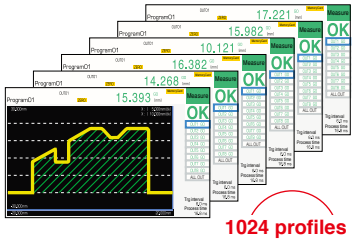
The memory in the controller stores up to 16 programs. When the setting call function from the memory card is used, up to 160 programs can be stored to handle various product types.

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

Handles up to 160 unique configurations

Profile storage

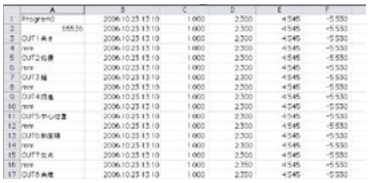
For analyzing NG records or production history.



1024 profiles can be stored

Data storage

For controlling daily production records or for traceability.



65536 data points can be stored

Simple procedure for setup and high-accuracy measurements

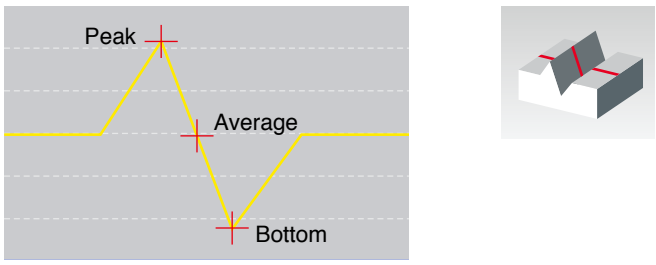
QUICK AND EASY SETTING

Uncomplicated setup menu

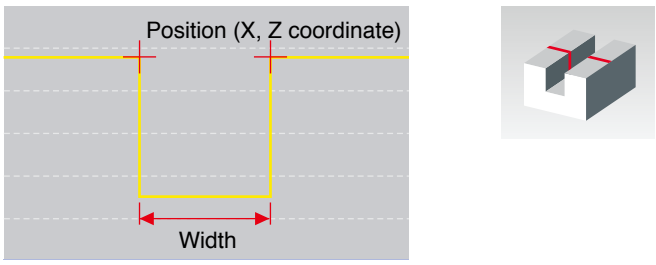
The setup menu is designed so novice users can effortlessly configure settings. Configuration via a PC is also simplified thanks to the optional setting support software (LJ-H1W).

MEASUREMENT MENUS

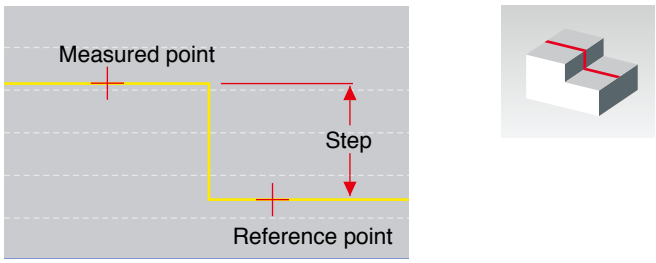
HEIGHT Measures height in a specified range.



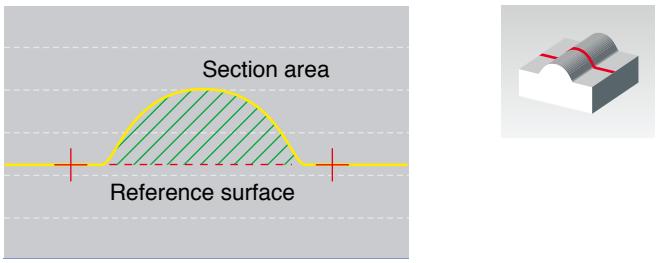
WIDTH/POSITION Measures width/position of a designated feature.



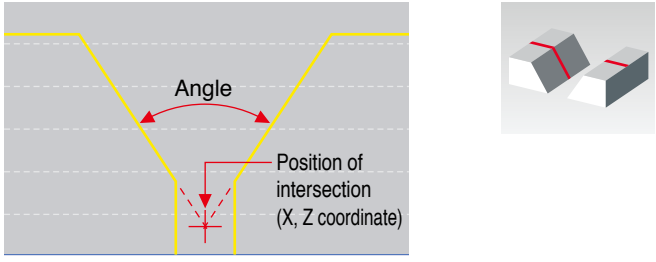
STEP Determines the height difference between a measured point and a reference point.



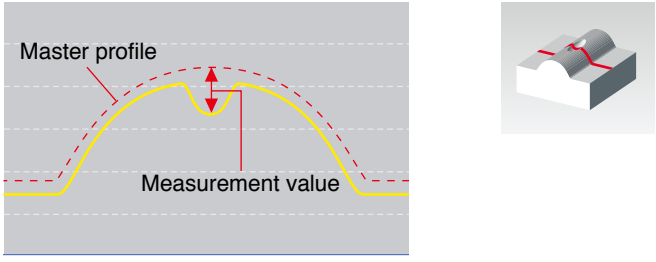
CROSS-SECTIONAL AREA Measures the area enclosed by the target on the basis of a reference surface.



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



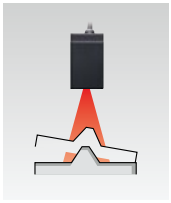
PROFILE COMPARISON Compares the target profile with the master profile to measure the largest difference.



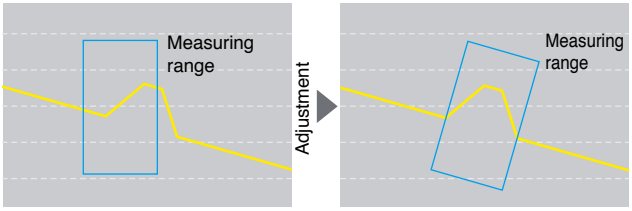
USEFUL ADJUSTMENT FUNCTIONS

POSITION ADJUSTMENT FUNCTION

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



Displacement of target

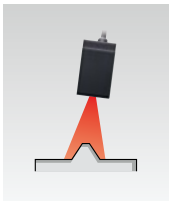


Since the workpiece is not in the measurement range, a precise measurement cannot be carried out.

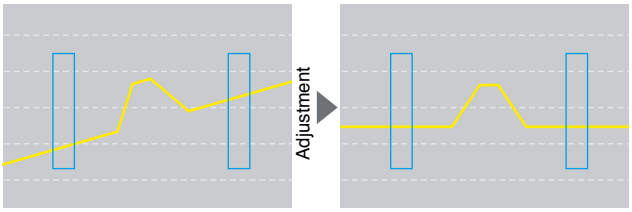
The measurement range moves according to the displacement of the workpiece for precise measurement.

TILT CORRECTION

This simplifies the installation of the sensor head and eliminates measurement errors.



Inclination of the sensor head to the workpiece

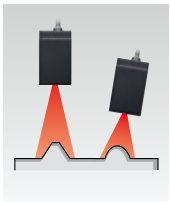


Due to the inclination of the sensor head, the workpiece is not properly measured.

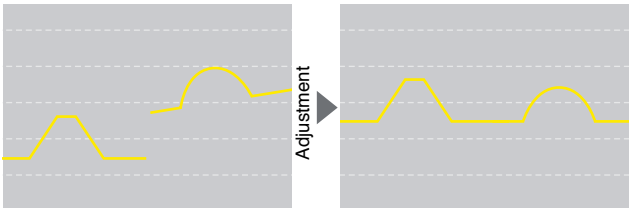
The inclination adjustment adjusts the angle of the sensor head for precise measurement.

PROFILE LINK FUNCTION

When two sensor heads are connected to a controller in parallel, the individual head profiles can be combined into a single profile. This significantly simplifies dual head installations and eliminates measurement errors.



Installation position of two sensor heads



The profiles of two sensor heads are not linked and proper measurement is impossible.

The profile link function compiles the profiles from two sensor heads as a profile for precise measurement.

TWO-SENSOR HEAD CONNECTION

Two sensor heads can be connected to a controller. The sensor heads can be arranged face-to-face or in parallel.

IP67

The LJ-G Series heads are designed to be rugged and operate in otherwise difficult environments.

CONTROLLER/SENSOR HEAD COMPATIBILITY

Adjustment data is stored in the sensor head for compatibility, so sensor heads can be exchanged.

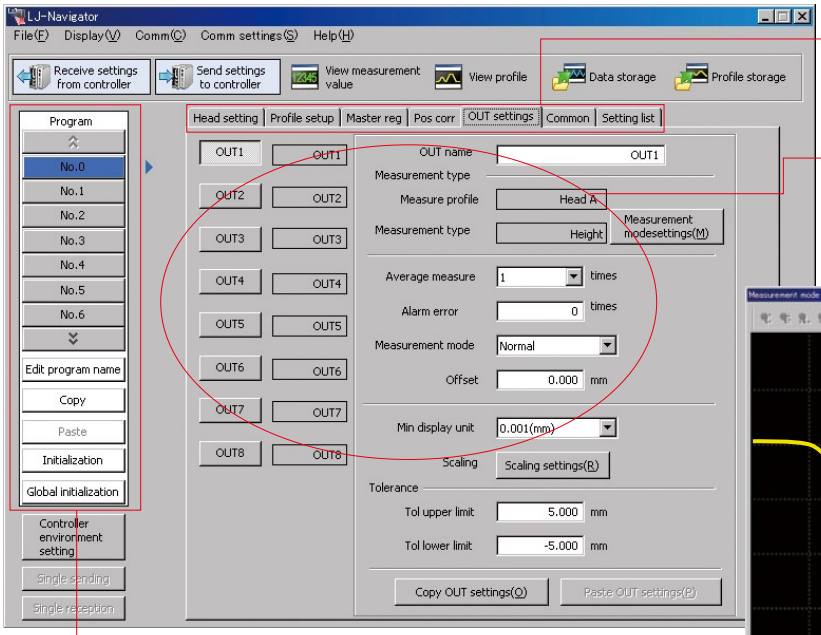
HIGH-FLEX CABLE

The high-flex cable is standard one the LJ-G Series. This makes the sensor head easy to install on a moving fixture.

“Easy setup” and “Data storage/analysis” via a PC

Easy setup

Just by selecting from an easy to use menu, anyone can easily configure the system with no training.



Quick setup menu

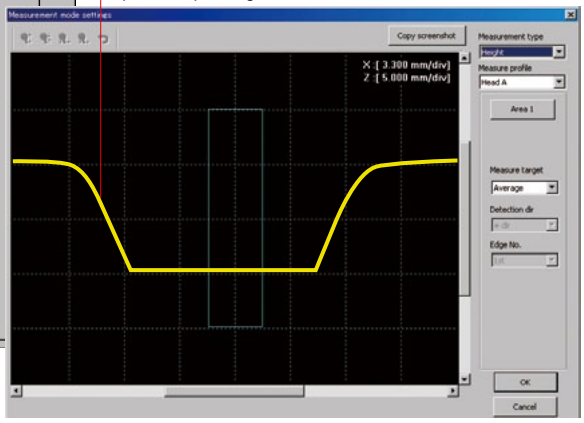
Select from Mater Registration, Position Correction Menu, Output Setup, etc.
Selected items can be checked and configured with a few clicks.

OUT settings

You can configure up to 8 discrete feature settings.

Direct configuration mode

Measurement range can be directly specified onto the target profile depending on the measurement content.



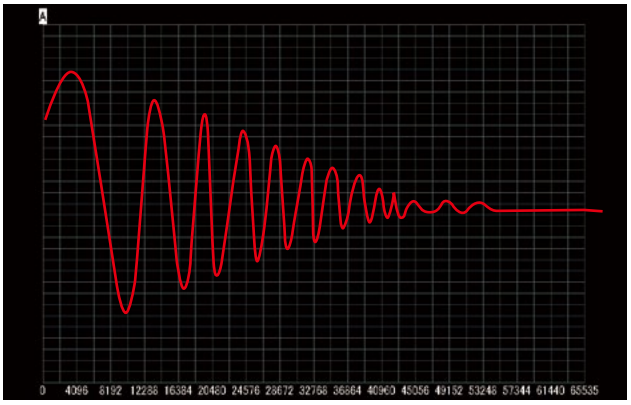
16 types of program switching

You can collectively manage and configure program switching, copy, initialization, etc.

Data storage

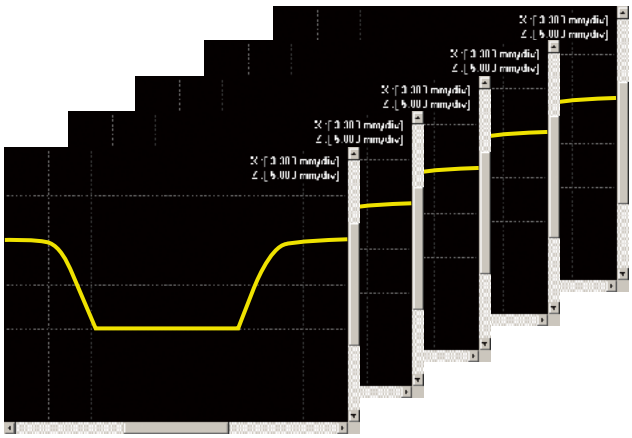
Data storage

You can view the measurement data stored in the controller. Data for all 8 outputs can be stored, the software provides easy to use overlay, zoom, and various other data analysis functions. For a more detailed analysis, data can be stored as a CSV file and viewed in Excel.



Profile storage

Measured profile data is stored in the controller. The measurement value of any point can be read from the stored data or exported in CSV format.



SPECIFICATION

Controller

Model		LJ-G5001	LJ-G5001P
Sensor head compatibility		Compatible	
Number of connectable sensors		2 units max.*3	
Display	Minimum display unit	0.1 μm*1., 0.001 mm², 0.01° (Inch mode : 0.00001 inch)	
	Maximum display range	±99999.9 mm, ±999999 mm², ±99999.9° (Inch mode : ±999.999 inch)	
Input terminal block	Laser remote interlock input	Non-voltage 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, out put 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, non-voltage input	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 GR-M256 (256 MB), and NR-M1G (1 GB). (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)
*3. When mounting two heads, make sure that head A and B are of the same type. Measurement is not possible if two different types of heads are connected.

Sensor head

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 1.98"	39 mm 1.54"	73 mm 2.87"
Light source			Red semiconductor laser				
		Wavelength	650 nm (Visible light)				655 nm (Visible light)
		Laser Class	Class II (FDA CDRH 21CFR Part 1040.10)				
		Output	0.95 mW				
Spot diameter (at reference distance)			Approx. 32 μm x 12 mm 0.001260" x 0.47"		Approx. 40 μm x 25 mm 0.001575" x 0.98"	Approx. 80 μm x 46 mm 0.003150" x 1.81"	Approx. 180 μm x 70 mm 0.007087" x 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 pitch)*4			3.8 ms				
Temperature characteristics			0.02% of F.S./°C				
Environmental resistance		Enclosure rating	IP67 (IEC60529)				
		Ambient illumination*5	Incandescent lamp or fluorescent lamp: 5,000 lux max.				
		Ambient temperature	0 to 50°C (32 to 122°F)				
		Relative humidity	35 to 85% (No condensation)				
		Vibration	10 to 55 Hz, multiple 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. When the measuring range is the minimum in the initial setting and the smoothing is set to 1.
*5. The illumination on the receiver of the sensor head when targeting an illuminated white paper.

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

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	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.

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

Component list selection guide

Sensor Head

Type	Ultra high-accuracy specular target model		Ultra high-accuracy model		High-accuracy model	
Model	LJ-G015K		LJ-G015		LJ-G030	
Measuring range	Z axis	15 ± 2.3 mm	0.59 ± 0.09"	15 ± 2.6 mm	0.59 ± 0.1"	30 ± 10 mm	1.18 ± 0.39"
	X axis	7 mm	0.28"	7 mm	0.28"	22 mm	0.87"
Repeatability	Z axis	0.2 µm	0.000008"	0.2 µm	0.000008"	1 µm	0.000039"
	X axis	2.5 µm	0.000098"	2.5 µm	0.000098"	5 µm	0.000197"

Controller

Controller
LJ-G5001(P)

Controllers

NPN output type	**LJ-G5001**
PNP output type	**LJ-G5001P**

Console (Optional)
OP-82125

Setting support software LJ-H1W (Optional)

USB cable 2 m 6.6'
OP-66844

Monitor

High-resolution monitor
CA-MP81

Monitor stand
OP-42278

	Mid-range model		Long-range model	
	LJ-G080		LJ-G200	
	80 ± 23 mm	3.15" ± 0.91"	200 ± 48 mm	7.87" ± 1.89"
	32 mm	1.26"	62 mm	2.44"
	1 µm	0.000039"	2 µm	0.000079"
	10 µm	0.000394"	20 µm	0.000787"

Communication Cables

Cable between the sensor head and the controller LJ-GC (2 m, 5 m, 10 m, 20 m, 30 m) (6.6', 16.4', 32.8', 65.6', 98.4')

Monitor cable 3 m 9.8'
OP-66842

Expansion cable 3 m 9.8'
OP-51657

Ethernet cable 3 m 9.8'
OP-66843

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

Communication cable 9-pin conversion connector
OP-26401

Communication cable 25-pin conversion connector
OP-96369

Options

Memory card
NR-M1G: 1 GB

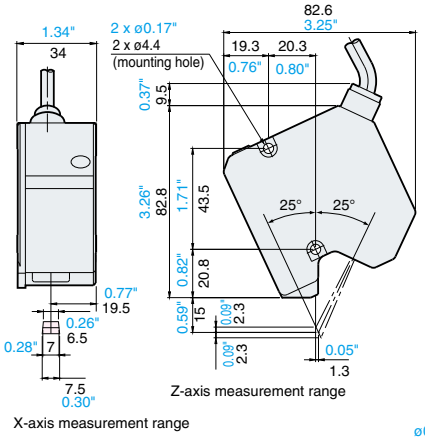
Memory card adaptor
C-A1

Dimensional Drawings

Sensor Heads

Unit: mm inch

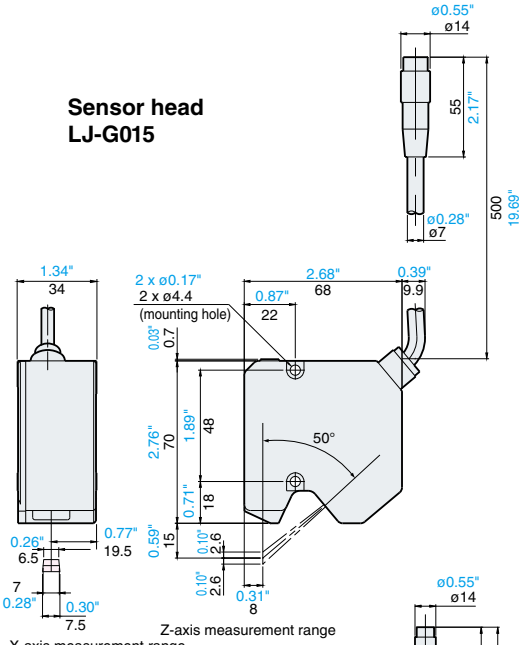
Sensor head LJ-G015K



Z-axis measurement range

X-axis measurement range

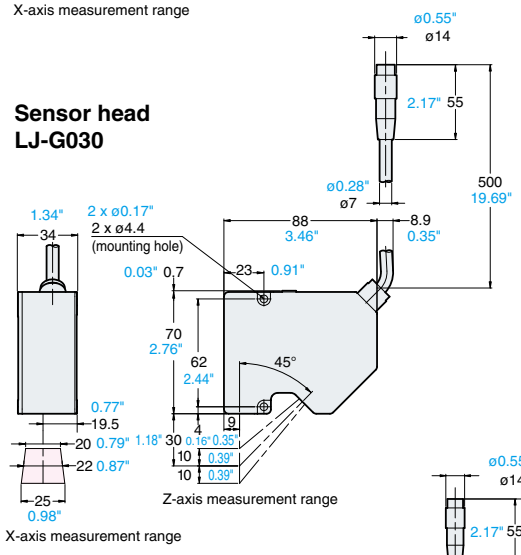
Sensor head LJ-G015



Z-axis measurement range

X-axis measurement range

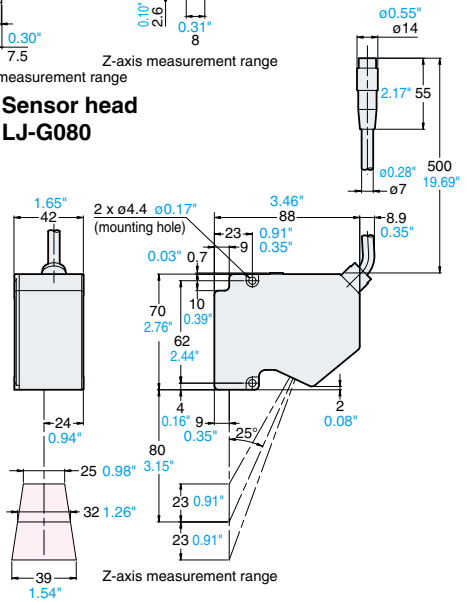
Sensor head LJ-G030



Z-axis measurement range

X-axis measurement range

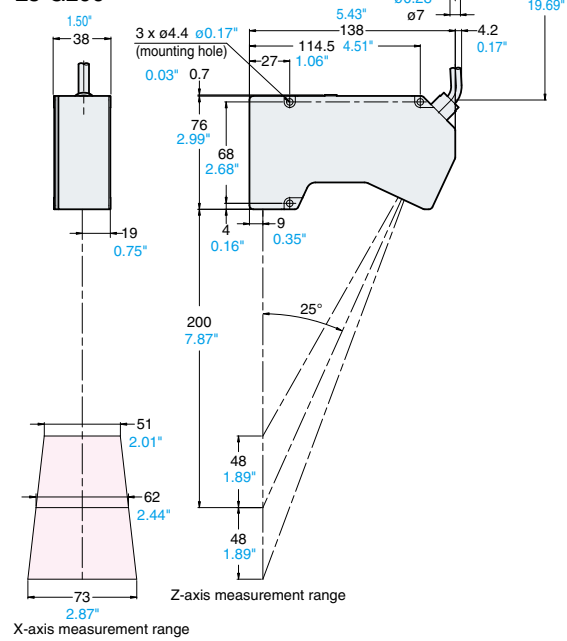
Sensor head LJ-G080



Z-axis measurement range

X-axis measurement range

Sensor head LJ-G200



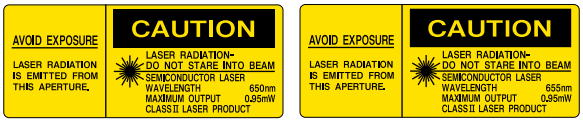
Z-axis measurement range

X-axis measurement range

WARNING

The LJ-G Series conforms to the following FDA standard:

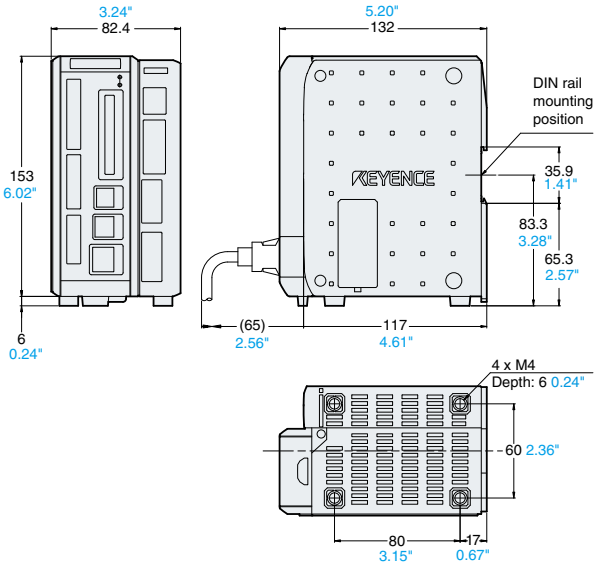
Model	LJ-G015K/LJ-G015/LJ-G030/LJ-G080/LJ-G200
FDA (CDRH) 21CFR Part 1040.10	Laser Class Ⅱ



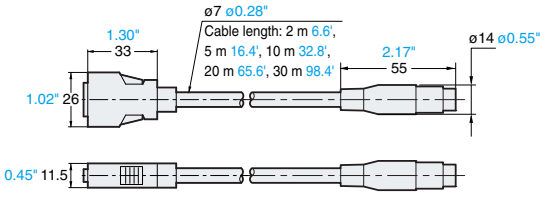
Controller

Unit: mm inch

Controller
LJ-G5001(P)



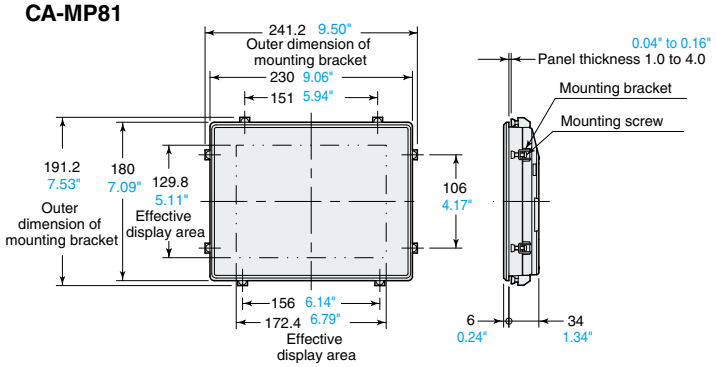
Cable between the sensor head and the controller
LJ-GC2/LJ-GC5/LJ-GC10/LJ-GC20/LJ-GC30



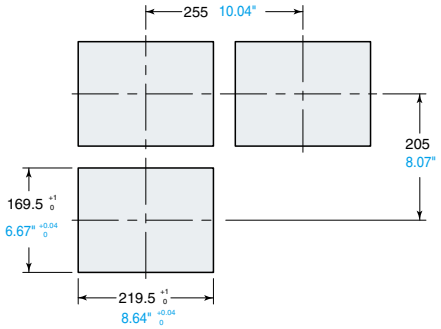
Monitor

Unit: mm inch

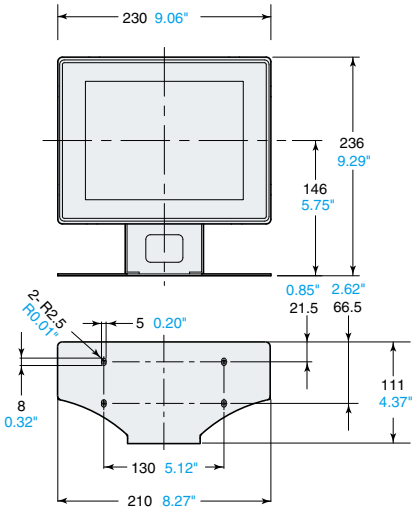
LCD monitor
CA-MP81

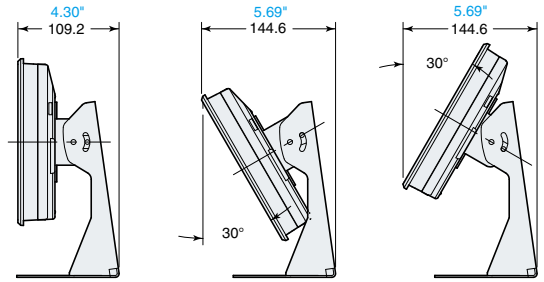


Panel cutout dimensions



Stand
OP-42278





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