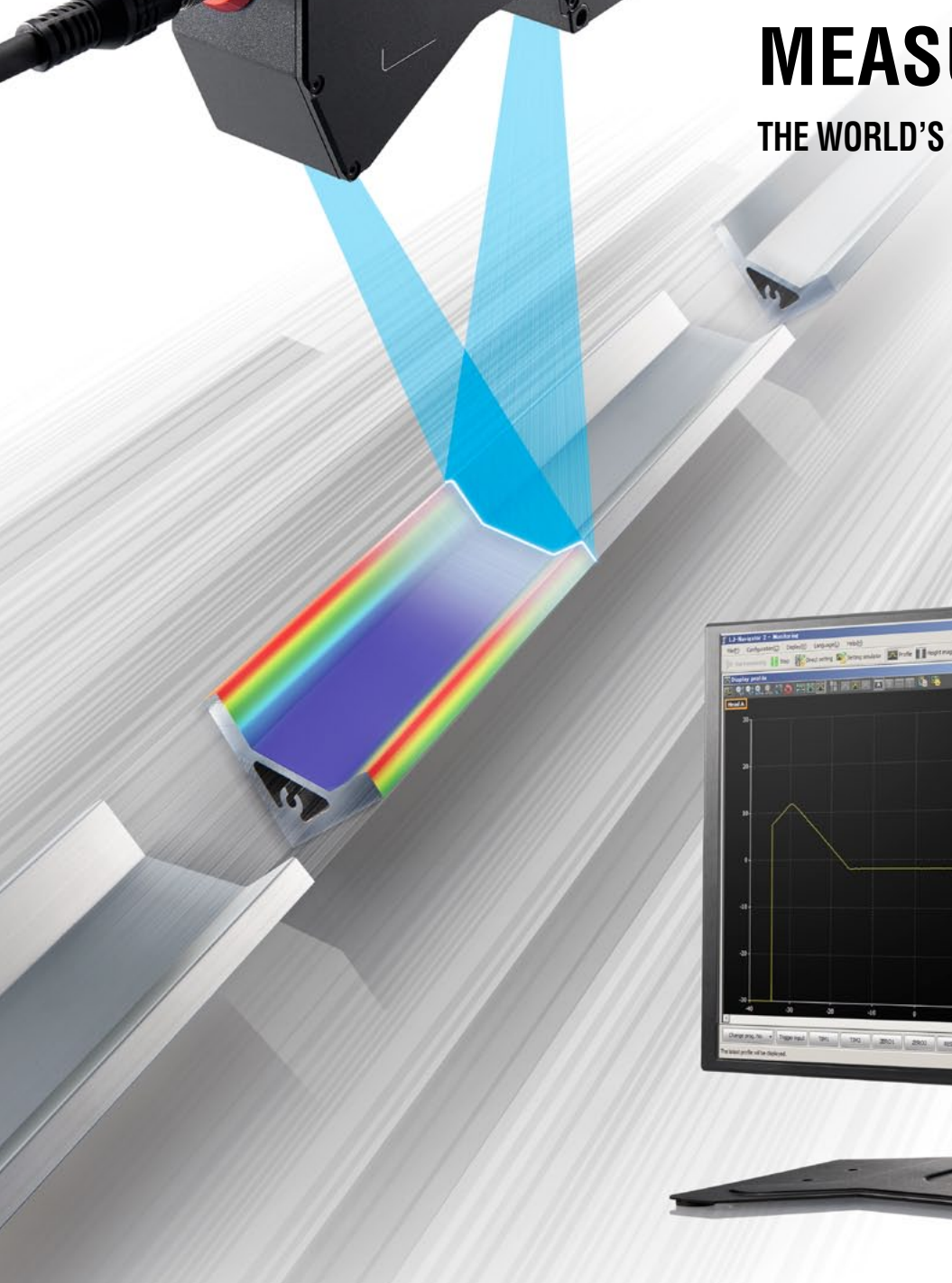




## INLINE PROFILE MEASUREMENT

THE WORLD'S FASTEST AT 64000 PROFILES/SEC.



# OFFERING A SOLUTION TO ANY PROBLEM

2D/3D Laser Scanner

LJ-V Series

## CONTACT-TYPE MEASURING SENSORS

With contact-type sensors, **scratches** are a concern. Additionally, **soft or compressible objects** can sometimes be troublesome and unmeasurable. It's also difficult to improve inspection variation caused by operator error.



Workpiece damage and  
human errors



## NON-CONTACT MEASUREMENT

Direct measurement using a laser

No damage to workpieces

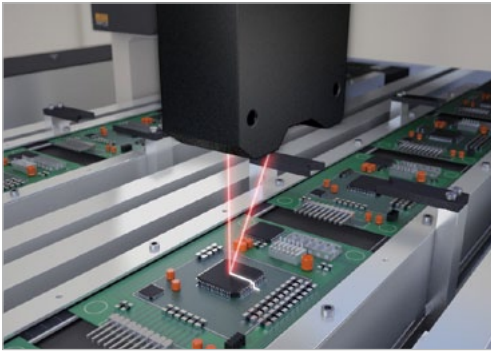
No variation in results from person to person

No need to stop the line



## 1D LASER DISPLACEMENT SENSORS

For measurements such as height difference and warpage, **installing multiple sensors** or **moving the sensor** is required. **Securing sufficient space** is also difficult, and measurements can be **time-consuming**.



Multiple units  
required



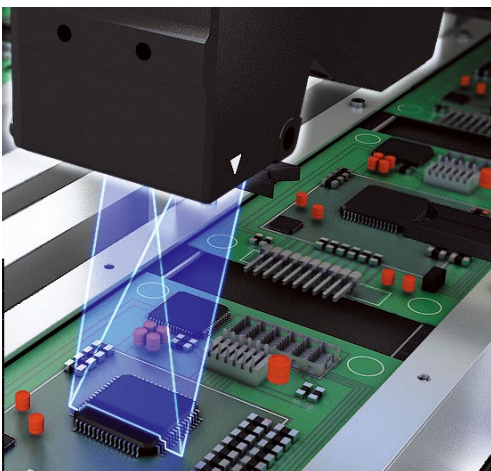
## ONE DEVICE FOR MULTIPLE SOLUTIONS

Measure once with a 2D laser

Multiple measurement modes

Compact, space-saving design

No need to move the sensor



## CAMERA INSPECTION MACHINES

**Installing lighting can be troublesome.**

Although area cameras and line cameras can be used to inspect aspects such as width or position; inspecting **height and height difference** is not possible.



X and Y planes  
only



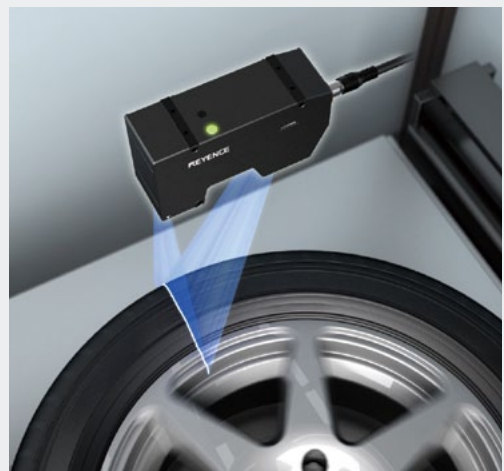
## X, Y, AND Z PLANES WITH A SINGLE DEVICE

3D imaging with  
additional image processing

No lights necessary

Height measurement is possible

No errors caused by color irregularity



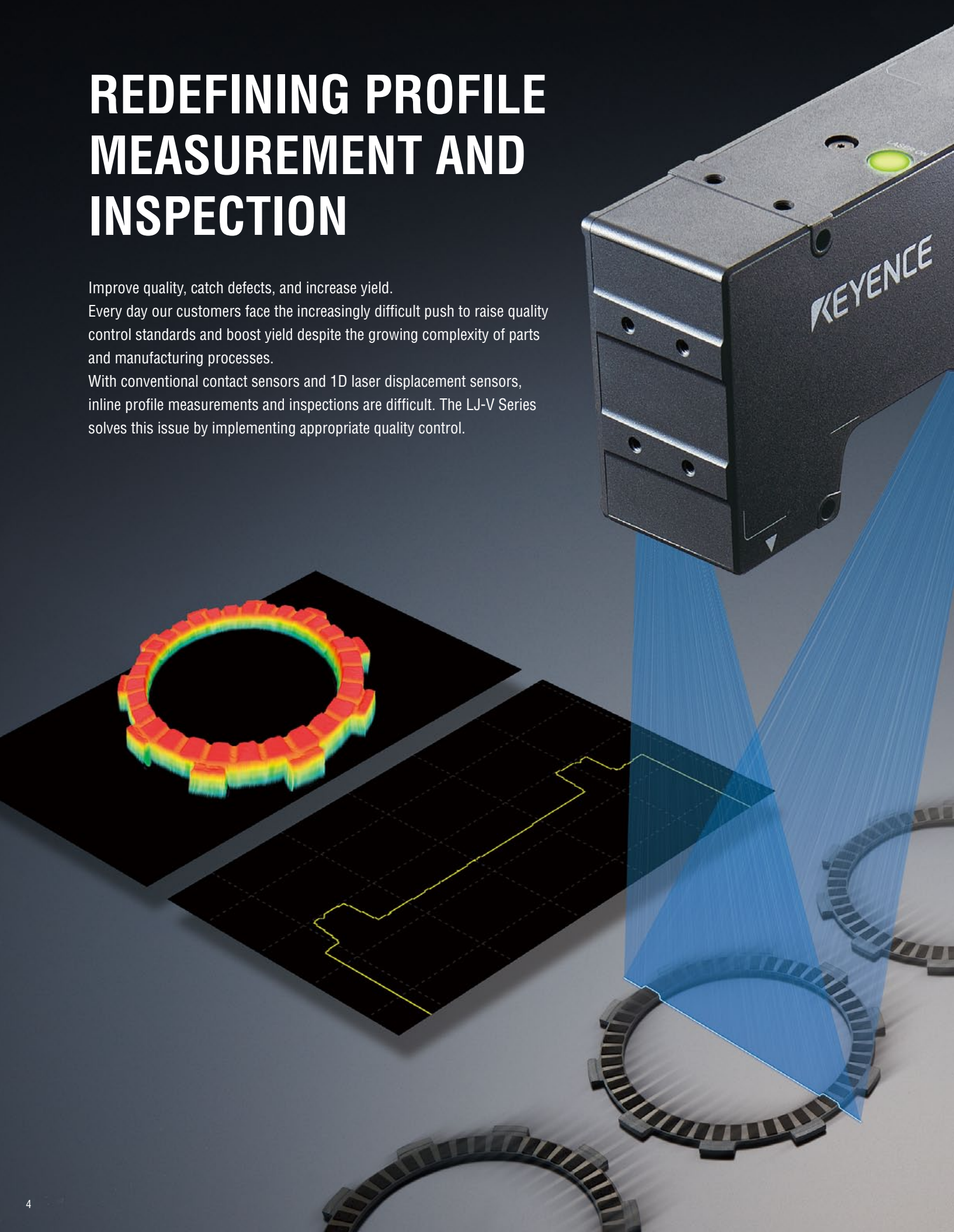


# REDEFINING PROFILE MEASUREMENT AND INSPECTION

Improve quality, catch defects, and increase yield.

Every day our customers face the increasingly difficult push to raise quality control standards and boost yield despite the growing complexity of parts and manufacturing processes.

With conventional contact sensors and 1D laser displacement sensors, inline profile measurements and inspections are difficult. The LJ-V Series solves this issue by implementing appropriate quality control.





WORLD'S FASTEST!

01

## ULTRA-HIGH-SPEED SAMPLING

The LJ-V Series is the fastest 2D laser measuring instrument in the world.\* This makes it possible to measure parts moving at extremely high speeds, in high definition, without missing a single one.

MOST VERSATILE

02

## OVERWHELMING WORKPIECE RESPONSE CAPABILITIES AND DETECTION STABILITY

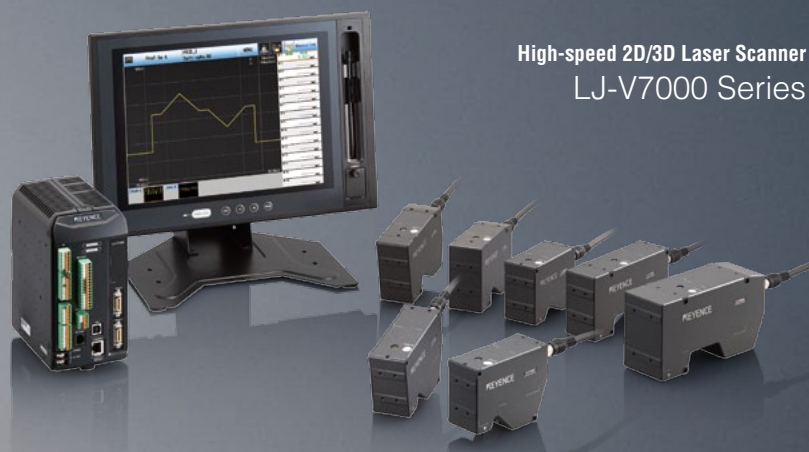
Profiles are accurately measured even in cases where black surfaces, inclines with low reflectivity and metallic surfaces with high reflectivity are mixed together under the same optical axis.  
Our newly developed HSE<sup>3</sup>-CMOS wide dynamic range has provided the LJ-V Series with improvements in both speed and detection stability.

INDUSTRY FIRST

03

## ALL TYPES OF MEASUREMENTS ARE POSSIBLE WITH THIS SINGLE DEVICE

The LJ-V Series is able to perform any measurement thanks to a variety of head variations and measurement modes, as well as 3D inspection when connected to an image processing system. In addition, the automatic setting optimization function makes operation easy for any user.



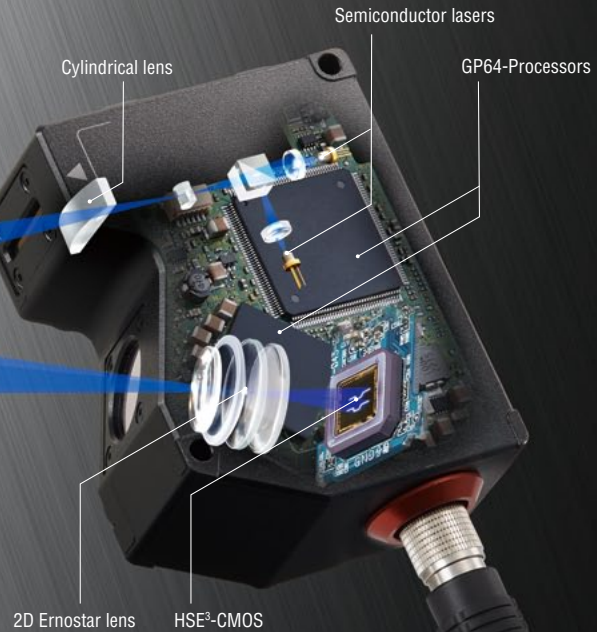
High-speed 2D/3D Laser Scanner  
LJ-V7000 Series

\* According to KEYENCE's investigation (as of June 2013)



## MEASUREMENT PRINCIPLE

The laser light is projected in a horizontal line by the cylindrical lens and diffusely reflects on the target object. This reflected light is focused on the HSE<sup>3</sup>-CMOS and by detecting changes in position and shape, displacement and shapes can be measured.



01

# ULTRA-HIGH-SPEED SAMPLING

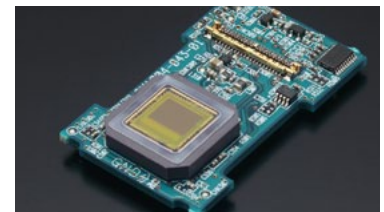
NEWLY DEVELOPED

WORLD'S GREATEST

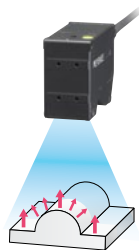
**MAKING STABLE MEASUREMENTS OF ANY TARGET POSSIBLE EVEN AT ULTRA HIGH SPEED**

## ▷ HSE<sup>3</sup>-CMOS \* HS = High Speed, E<sup>3</sup> = Enhanced Eye Emulation

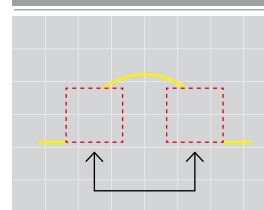
The LJ-V7000 Series is equipped with the newly developed HSE<sup>3</sup>-CMOS. In addition to improved speed, the dynamic range has been further improved over the established and conventional E<sup>3</sup>-CMOS. Even with the extremely short exposure time of 15.5  $\mu$ s (64 kHz) it has achieved sensitivity that allows it to reliably measure a range of surfaces from black (small amount of reflection) surfaces to those with luster (large amount of reflection) due to its wide dynamic range.



### STOPPED TARGET

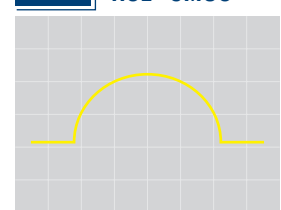


### Conventional model



Measurement is impossible due to insufficient returned light intensity.

### LJ-V HSE<sup>3</sup>-CMOS

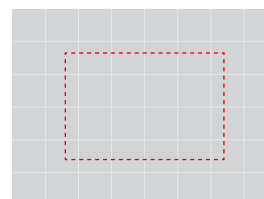
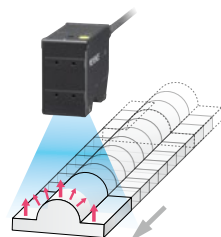


All ranges could be measured.

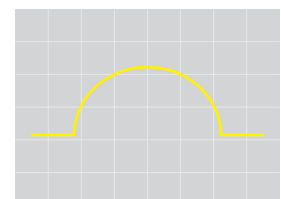
### MOVING TARGET

DYNAMIC RANGE

**2400×**



Because there is even less light intensity, the measurement could not be performed at all.



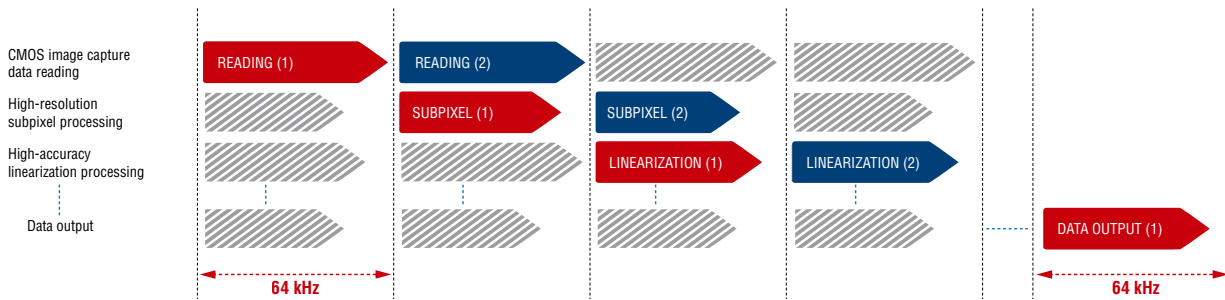
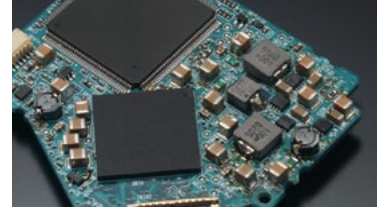
Even though the exposure time is short, all ranges could be measured without issue.

## ACHIEVING ULTRA HIGH-SPEED MEASUREMENTS AT 64 kHz

### ▷ GP64-Processor\*

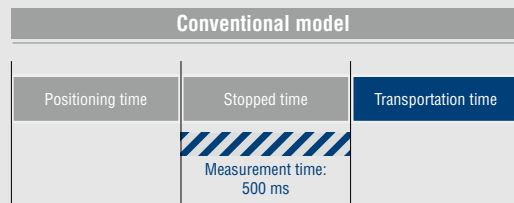
\* G = Generating, P = Profiles

We have developed a new custom integrated circuit that can perform ultra-high-speed pipeline processing. In addition to reading CMOS image capture data and performing high-resolution subpixel processing, it can also perform high-precision linearization and data output. This allows for the measurement of objects moving at high-speeds with room to spare.

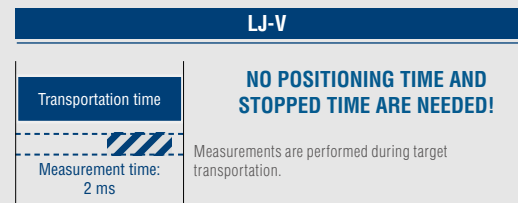


## MERITS PROVIDED BY ULTRA HIGH-SPEED SAMPLING

### REDUCED INSPECTION CYCLE TIME!

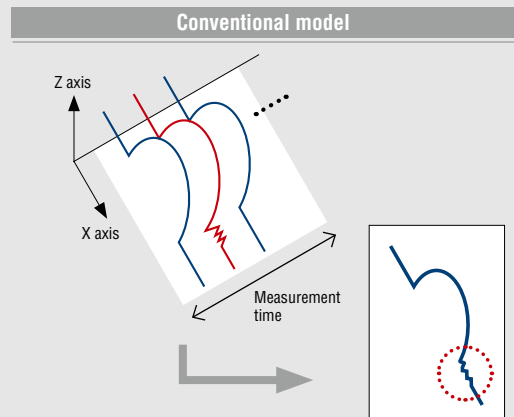


With the conventional method, it takes time to perform the three processes of product positioning, stopping, and transportation and ejection in order to perform an accurate inspection.



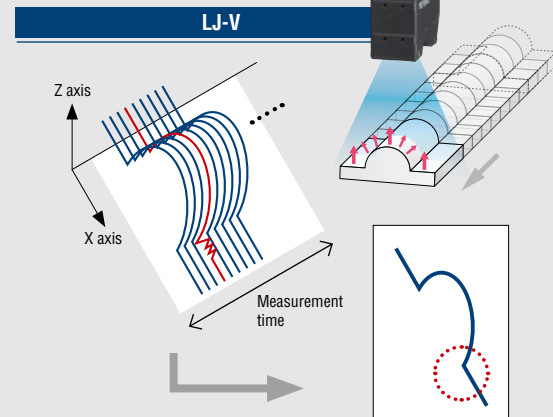
With the LJ-V Series, the measurement time is 240 times shorter than that of the conventional method, which makes it possible to finish inspections within the product transportation time, which leads to improved cycle time.

### STABILIZED MEASURED VALUES!



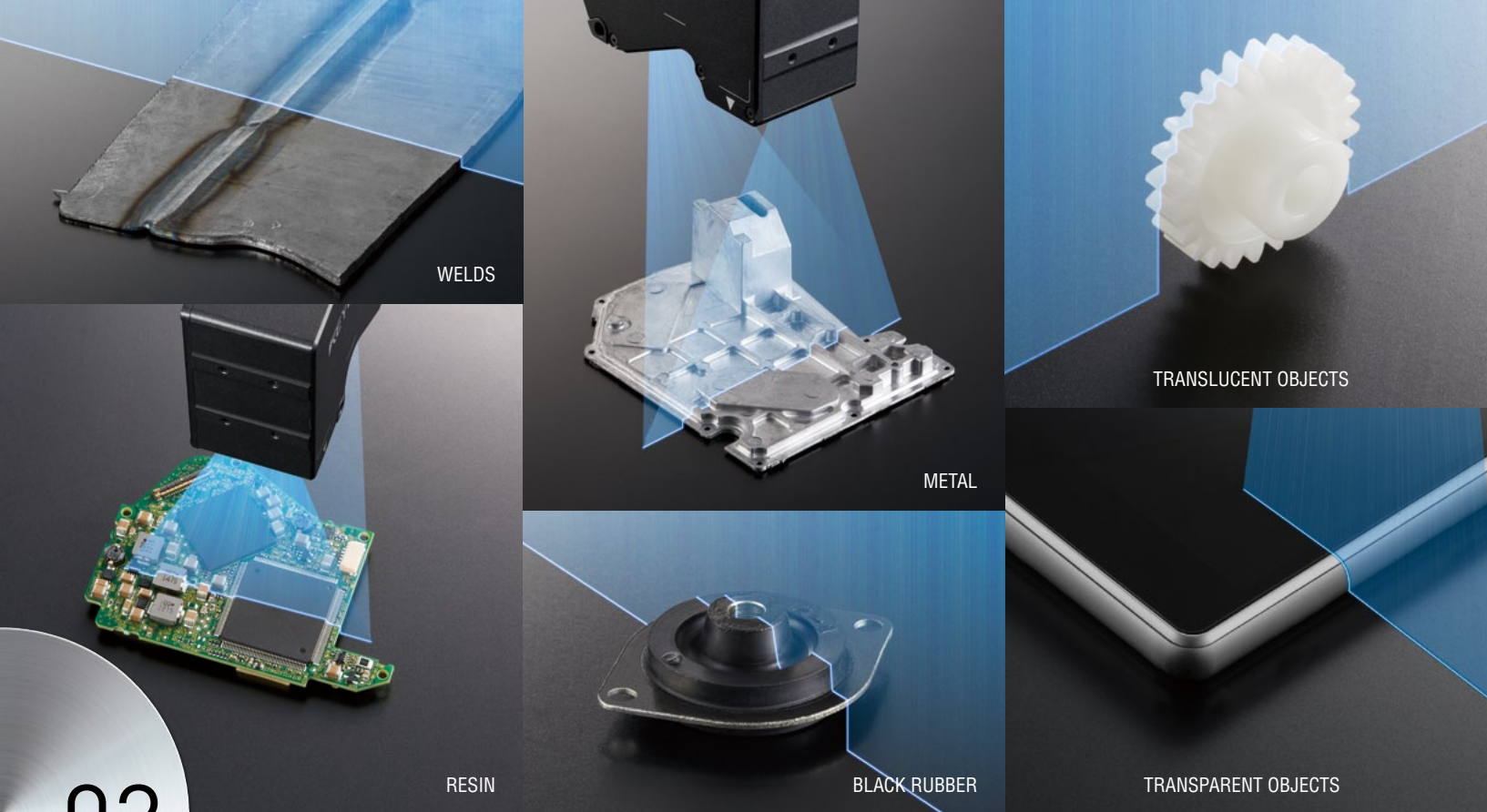
#### RESULT OF AVERAGING 3 PROFILES

With conventional models, measurement stability was limited due to insufficient sampling speeds necessary to hit the required cycle times.



#### RESULT OF AVERAGING 720 PROFILES

The LJ-V Series provides significantly higher profile stability by utilizing ultra-high-sampling at as high as 240 times that of conventional models to allow for profile averaging as well as abnormal value elimination using median filters.



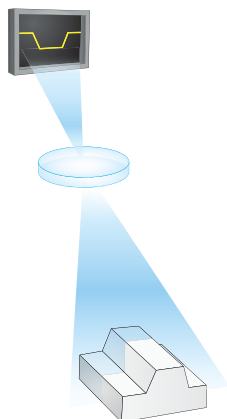
# OVERWHELMING WORKPIECE RESPONSE CAPABILITIES AND DETECTION STABILITY

**WORLD'S FIRST**

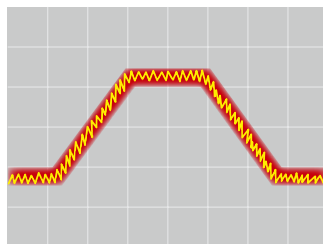
**FORMS ULTRA-STABLE AND HIGHLY ACCURATE PROFILE IMAGES**

## ▷ Blue laser optical system

The LJ-V7000 Series is the first 2D laser displacement sensor 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 maximum limit with a 2D Ernstar lens. This generates a stabilized, high-precision profile. Additionally the received light density for the laser has been increased to successfully secure a greater level of received light intensity. This achieves ultra-stable and highly accurate measurements with all types of targets that are typically difficult to detect.

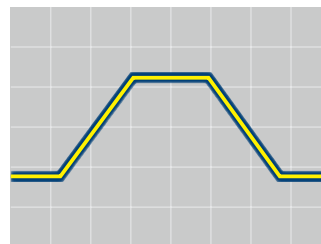


**RED LASER (CONVENTIONAL)**



With a conventional red laser, the beam that formed the image is thick, resulting in the generation of variation in the profile.

**BLUE LASER (LJ-V)**



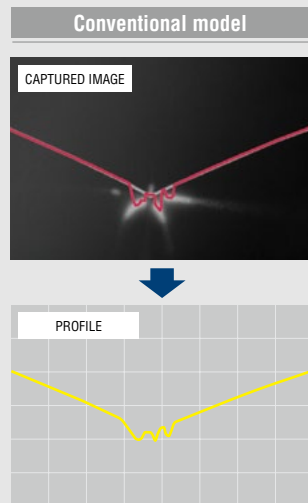
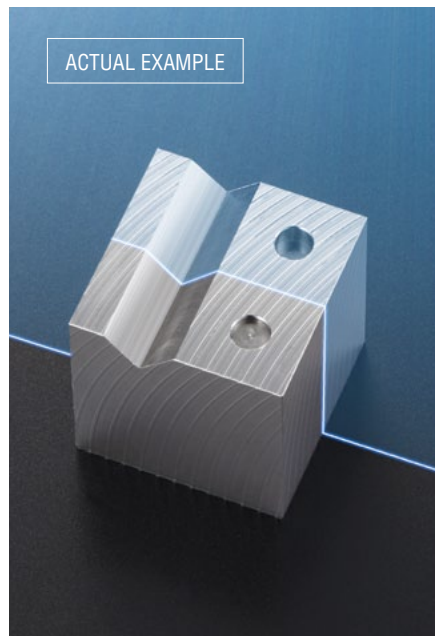
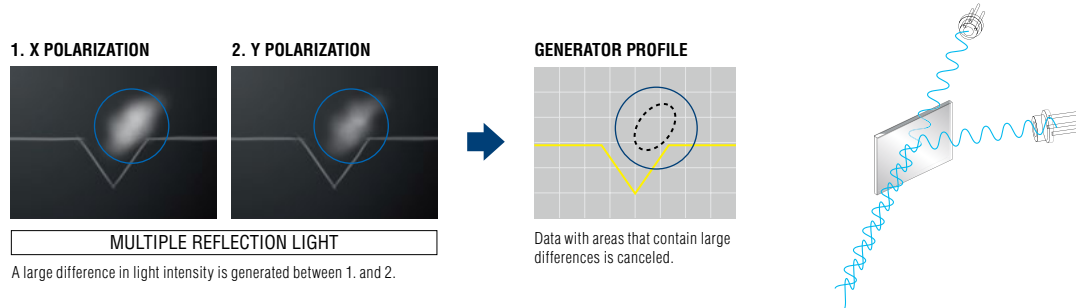
With a blue laser, the image forming beam becomes sharp to enable the measurement of shapes with excellent accuracy.



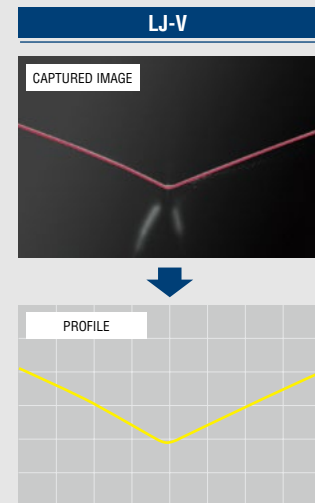
## IDENTIFIES UNNECESSARY LIGHT REFLECTIONS

### ▷ Double polarization function

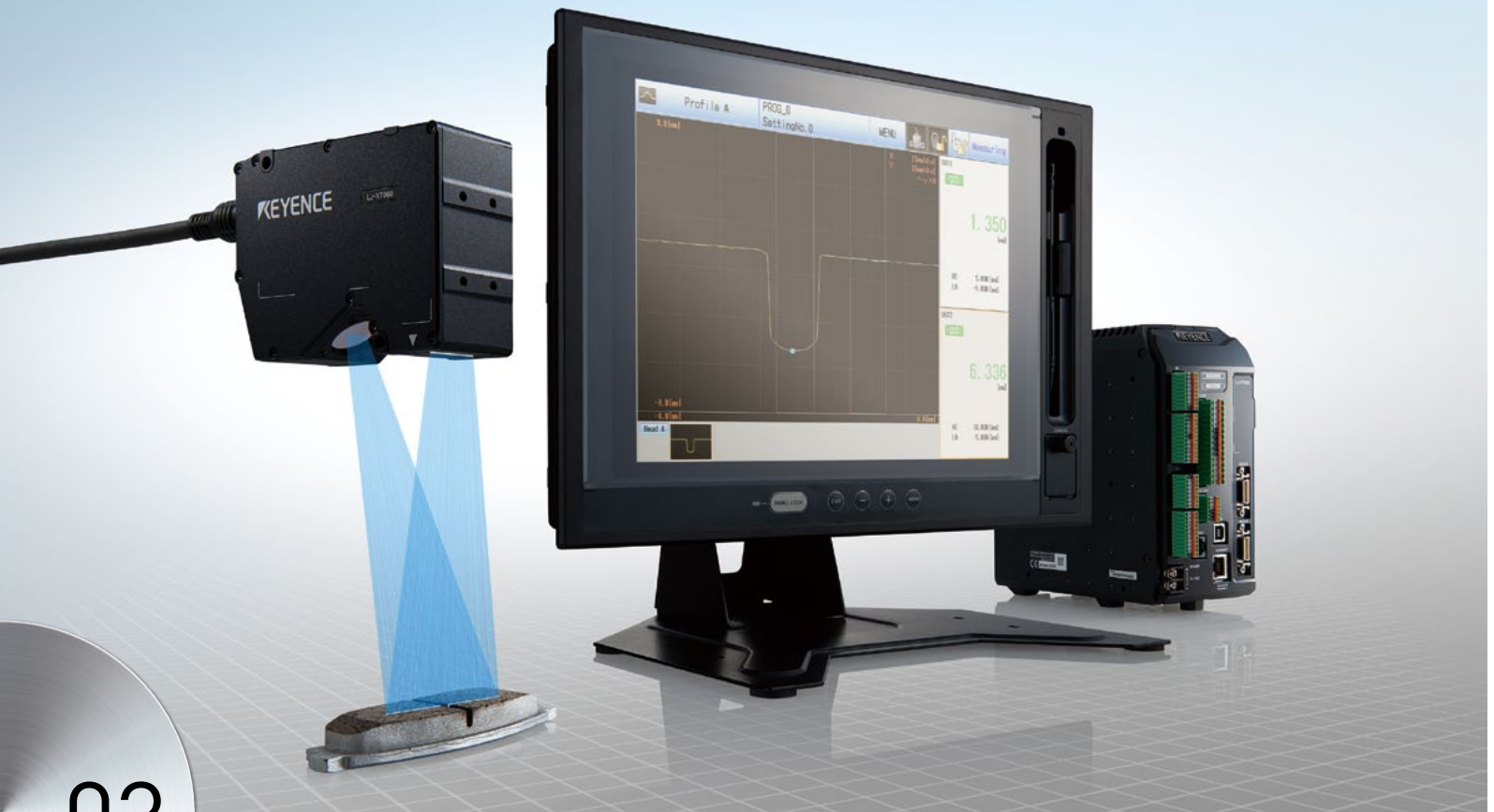
We have developed the world's first double polarization function, which distinguishes and cancels multiple reflection light that acts as an obstacle to measurement. Light is shined on the intersection between the X-polarization and Y-polarization to calculate differences in the amount of received light for each unit of image capture data. Multiple reflection light has the characteristic of generating differences in the amount of received light for X-polarization and Y-polarization, and this characteristic is used to cancel data for areas that have large differences. This function is especially beneficial in the measurement of metals with complex shapes and complicated areas.



The strong influence of the diffuse reflected light causes errors in the data.



LJ-V Series cancels the diffuse reflected light to perform stable measurements.



03

# ALL TYPES OF MEASUREMENTS ARE POSSIBLE WITH THIS SINGLE DEVICE



## STEP 1

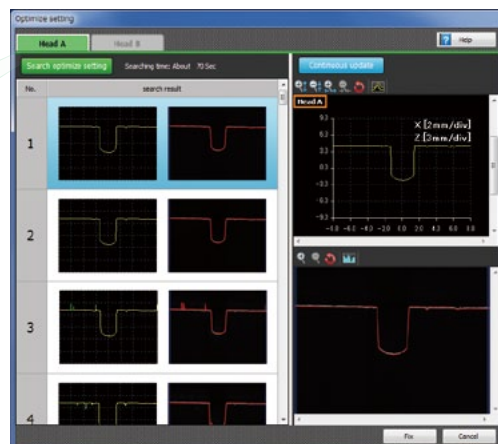
### IMAGING CAPTURE SETTINGS — One-click optimization for easy use by anyone —

#### ▷ Automatic setting optimization function

In order to obtain a stable and clean waveform, adjusting parameters like laser power, light sensitivity, and exposure time is necessary. By incorporating an automatic setting optimization function, conventional adjustment operations can be done with just one click.

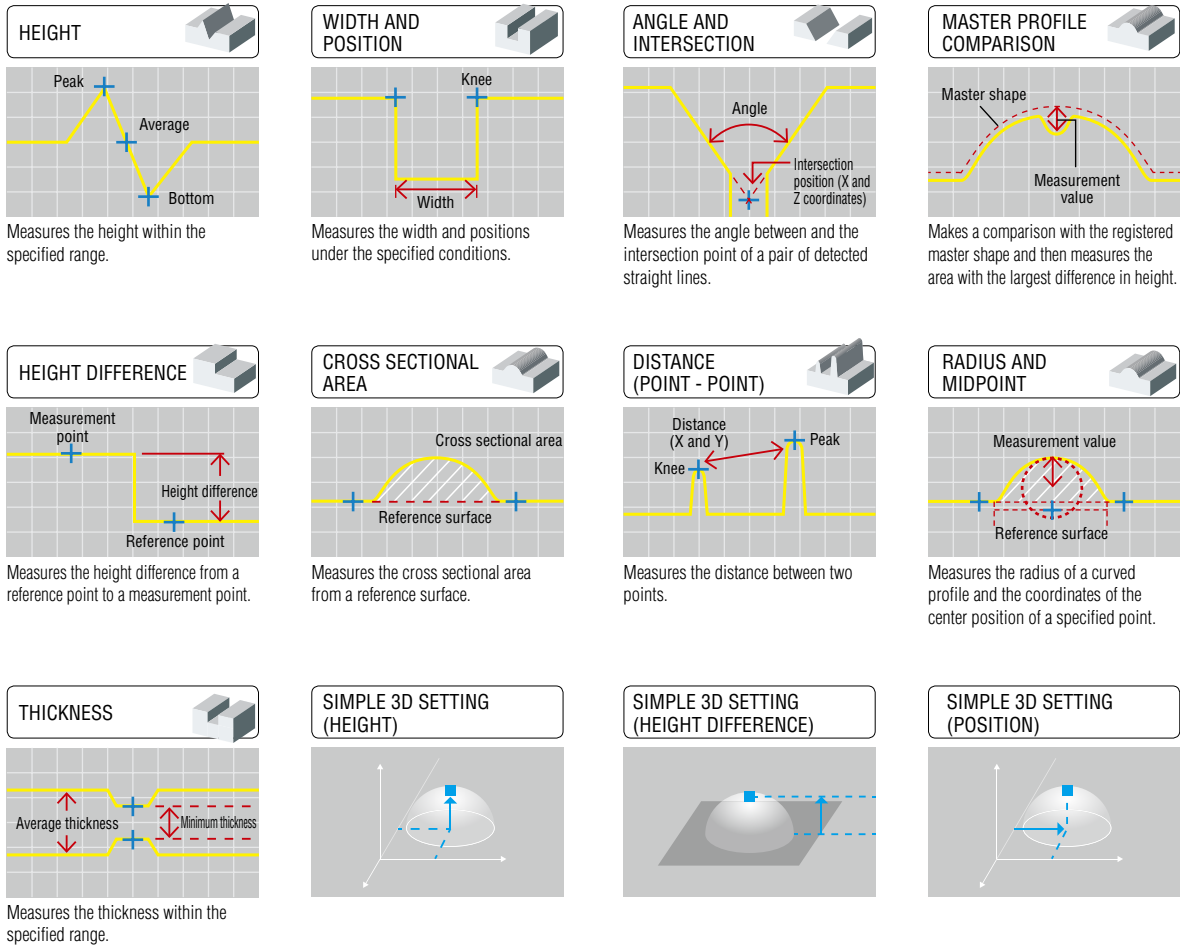
Search optimize setting

JUST  
CLICK  
THIS  
BUTTON!



## STEP 2

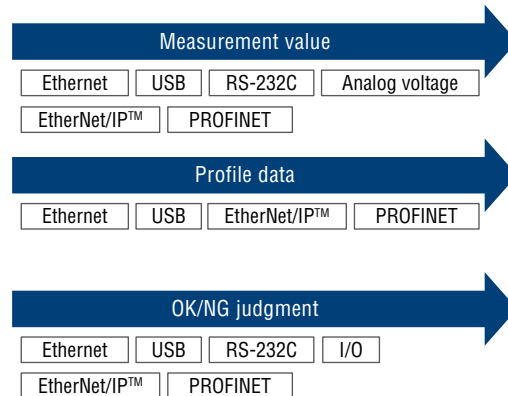
# MEASUREMENT SETTINGS — 74 different measurement modes for a wide variety of inspections —



## STEP 3

# OUTPUT SETTINGS — Communication options for every application —

## ▷ OUTPUT METHOD



PC



PLC, etc.

Ethernet and USB can also be used with DLLs.



# OUR AIM IS ON-SITE EASE OF USE

## SELECTABLE 3-WAY OPERATION

A touch panel monitor is available, so that it is possible to perform on-site monitoring or setting operations during measurement. It is also possible to perform operation using a PC or a LCD color monitor.



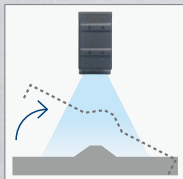
Touch panel HMI  
CA-MP120T

## AN EMPHASIS ON INLINE MEASUREMENT

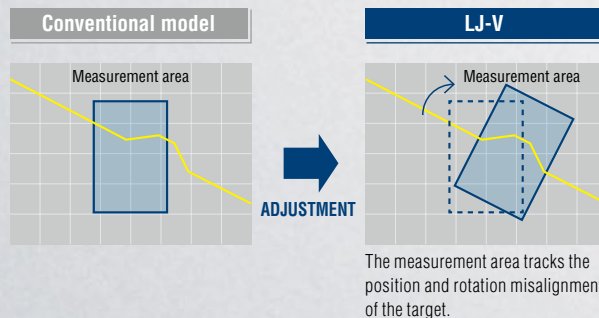
### INLINE POSITION ADJUSTMENT FUNCTION (X, Y, AND Z)

Corrects positional misalignment of the target, eliminating errors in the measurement results due to target tilt. Accurate measurements are possible even in cases where the target is moving at random or when it is difficult to perform positioning.

$\theta \rightarrow X$  adjustment  
(angle then x position)



If the position of the workpiece becomes misaligned...



The measurement area tracks the position and rotation misalignment of the target.



LCD color monitor  
CA-MP120

PC

## VARIOUS SPECIFICATIONS THAT INCLUDE ALL ON-SITE NEEDS

### DIRECT ENCODER INPUT

Can perform encoder synchronized measurement up to a top speed of 64 kHz. Can measure shapes in the direction of movement with high-speed and with an accurate pitch.

### HIGH-FLEX CABLE

Has adopted a high flex cable as standard. Can be installed on robots and other movable parts without worry.

### IP67 RATED SENSOR HEAD AND CONNECTION CABLE

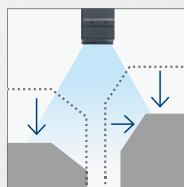
In addition to the sensor head, the connection cable also supports an IP67 enclosure rating. There are no problems even in dirty or dusty manufacturing environments.

### PASSES IMPACT RESISTANCE TEST IEC 60068-2-27

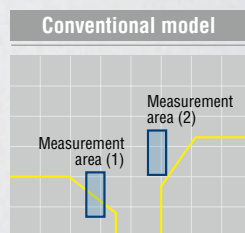
Equipped with high shock resistance that is necessary for industrial robots.

## DOUBLE XZ $\theta$ ADJUSTMENT FUNCTION

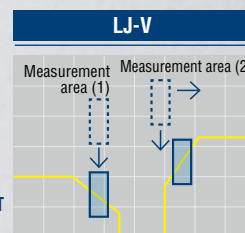
The LJ-V7000 Series is equipped with a new function that makes it possible to individually set corrections on two separate features. This is effective when measuring gaps, angles, or height differences of two targets that move independently.



If the position of individual workpieces becomes misaligned...



Because position adjustment was applied to a single side as a reference, measurement could not be properly performed.

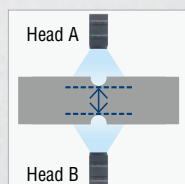


Because original adjustment is applied individually to measurement areas (1) and (2), measurement can be properly performed.

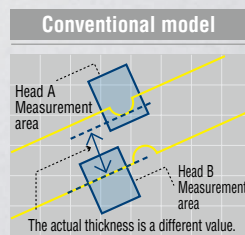
## DUAL-HEAD ADJUSTMENT FUNCTION

By understanding the positional relationship of both heads, it is possible to match the  $\theta$  adjustment for both heads. Even when measuring targets with variation or incline changes, it is possible to measure the correct points.

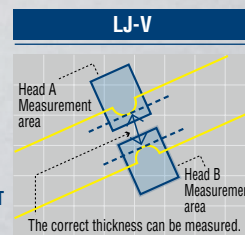
Ex. Minimum thickness measurement



If the workpiece tilts...



The  $\theta$  adjustment center of rotation for each head differs, so the measurement area for head B becomes misaligned.



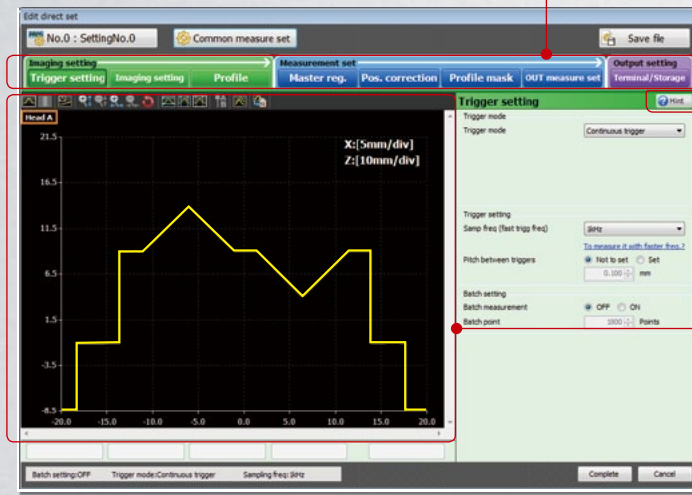
The  $\theta$  adjustment center of rotation for both heads match, so the measurement area is not misaligned.



## SIMPLE PROGRAMING — LJ-Navigator2 —

View measurement results, configure settings, and transfer data all from one easy to use software package.

## EASY SETTINGS

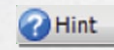


### EASY NAVIGATION SETTINGS

Anyone can perform setting intuitively by following the navigation bar from left to right, starting with image capture settings, followed by measurement settings, and ending with output settings.

### HINT FUNCTIONS THAT DON'T REQUIRE THE MANUAL

"Hint" icons have been prepared for each screen.



### SETTINGS APPLIED IN REAL-TIME

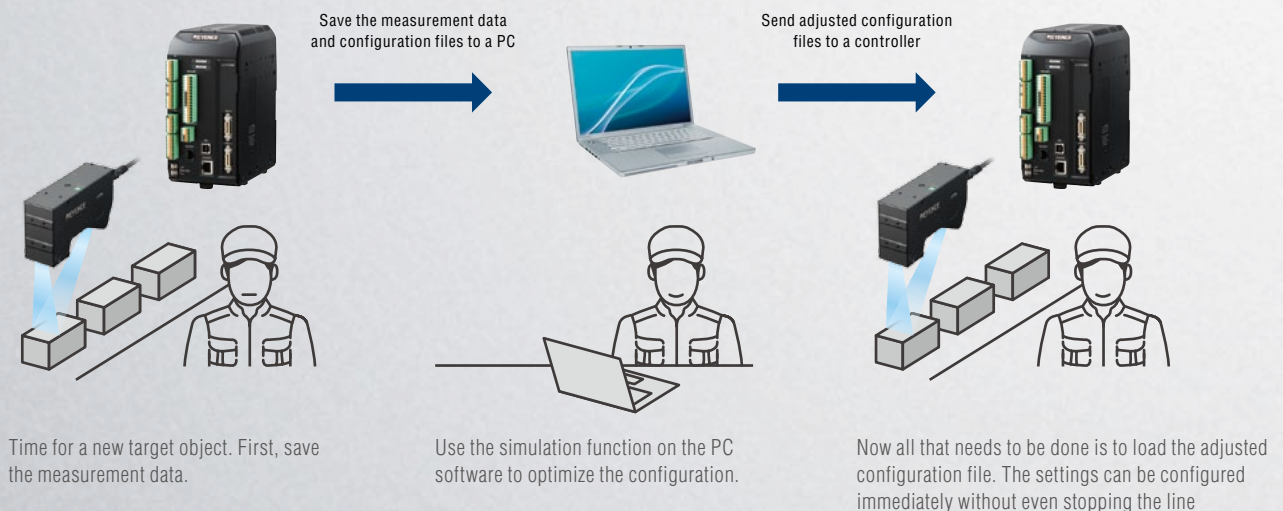
The measurement conditions are applied to the settings screen profile in realtime.

There is no need to return to the measurement screen for confirmation, making it possible to greatly reduce the time and effort spent on set up.

## SIMULATION FUNCTION

Saved measurement data or data obtained in real time can be used to optimize measurement settings and position adjustments before re-measuring. This feature helps solve problems in as little time as possible, such as when settings must be changed or when optimization is necessary due to the addition of a new target object.

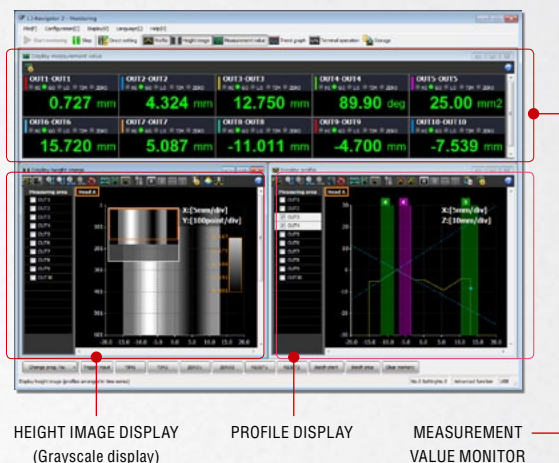
### USEFUL APPLICATIONS





## MULTI-SCREEN FUNCTION

It is possible to simultaneously check your favorite screens, including measurement values, measurement profiles, height image displays (grayscale displays), and measurement value trend graphs. It is possible to freely determine the screen size and placement to construct your own custom screen.



## PROFILE STORAGE FUNCTION

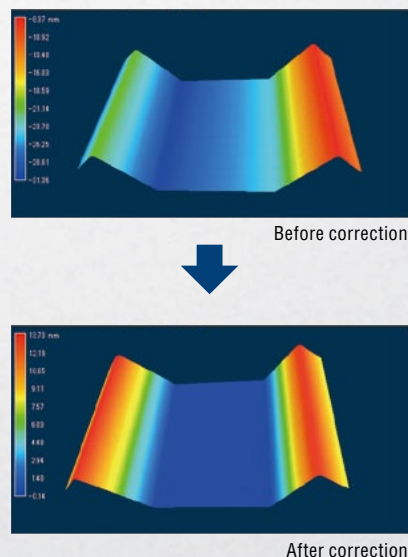
It is possible to store approx. 160000 profiles. You can also store measurement values for 16 outputs at the same time. The LJ-V7000 Series is equipped with various analysis functions, which are useful for the verification of defects and for research and development.



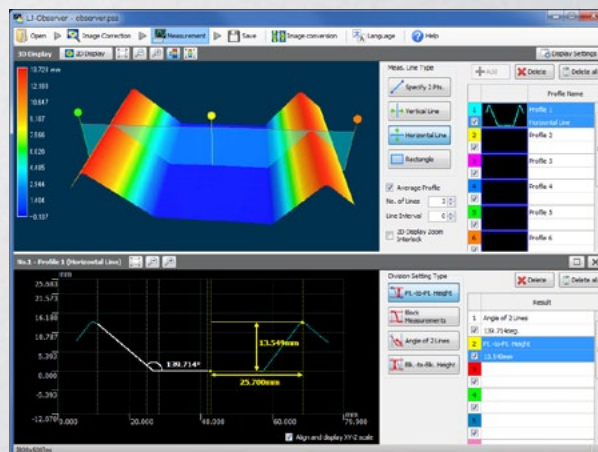
# OFFLINE PROFILE OBSERVATION — LJ-Observer —

This tool uses saved measurement data to provide a 3D view and allows for simple profile measurement.

## 3D VIEWER AND SURFACE SLANT ADJUSTMENT



## SIMPLE PROFILE MEASUREMENT FUNCTION



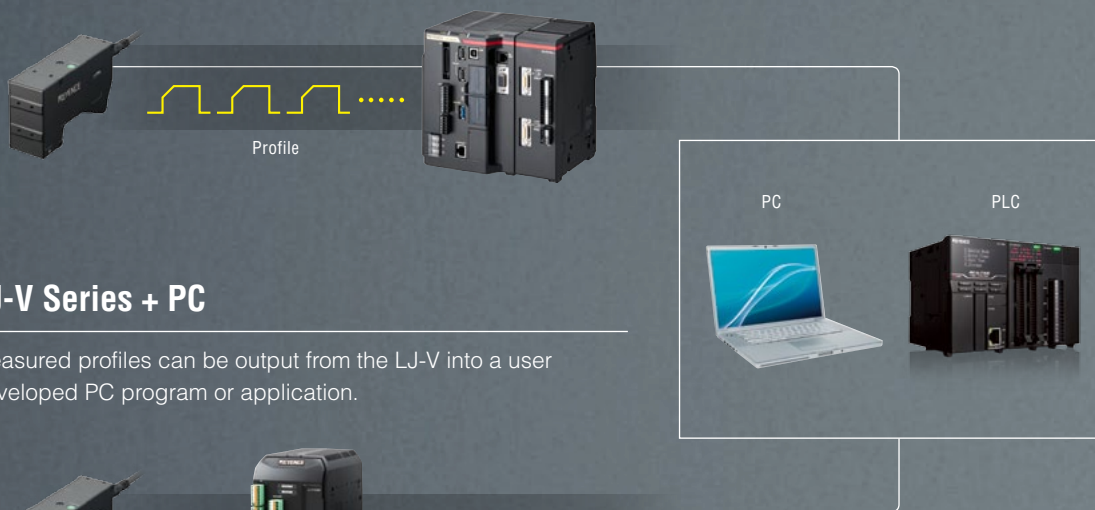
Extracting a desired cross-section for 3D data allows for measurement of height, horizontal distance, and angle.

# INLINE 3D MEASUREMENT

## TWO TYPES OF SELECTABLE 3D MEASUREMENT SYSTEMS

### LJ-V Series + Image Processing System

By loading 2D profiles acquired by the LJ-V Series into the CV-X controller and stitching them together, it is possible to apply image processing to a 3D image.



### LJ-V Series + PC

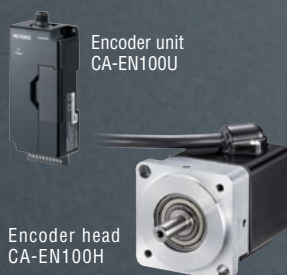
Measured profiles can be output from the LJ-V into a user developed PC program or application.



## Usable with encoders

The number of pulses can be set arbitrarily, making it possible to install an encoder to best suit the imaging conditions (Support for 64 to 150000 pulses).

Unlike with conventional products, there's no need to select an encoder based on features such as the rotation speed of the shaft, the roller diameter, or the field of view.



**High-resolution  
and  
high-speed output**

**IP65-compatible**

With up to 150,000 pulses per revolution, it has a high-resolution output at a minimum of 0.0024° (8.64 seconds). High-speed output is also possible at a maximum output frequency of 16 MHz.

Its environmentally resistant design make it even more resistant to water and dust, making devices even easier to use in the worksite (This does not include the head or shaft areas).

\* If there is a chance that the shaft through-hole area will be exposed to oil droplets, use a cover or take other necessary precautions.



## LJ-V SERIES + IMAGE PROCESSING SYSTEM

Combining the advanced profiling capabilities of the LJ-V Series with the Image Processing System opens new doors for quality inspection.

LJ-V7000 Series

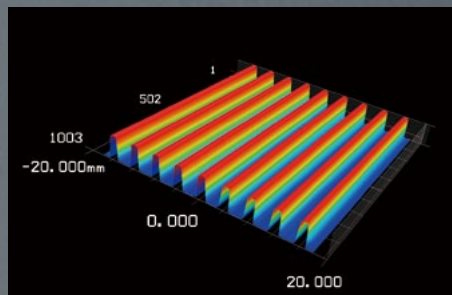


Image Processing System

### Measured Value Acquisition

The continuous profile data measured with the LJ-V Series is loaded into the Image Processing System.

3D DATA

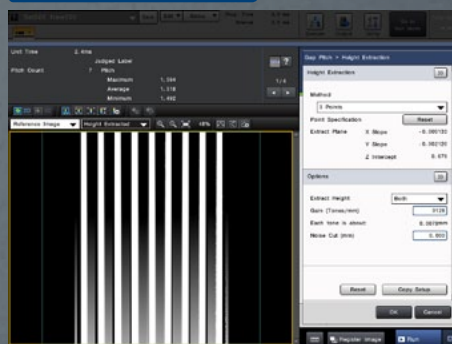


### Image Processing

Within the Image Processing System, the height data is converted to a gray-scale image with 256 gradations.

The Image Processing System utilizes 21 built-in pre-processing filters, such as real-time gray-scale adjustment and a blob filter to obtain the optimum image for the inspection.

HEIGHT GRAY-SCALE PROCESSING

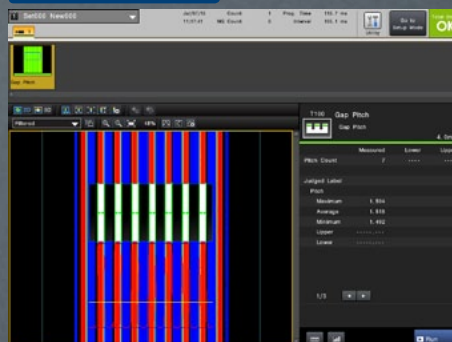


AS FAST AS  
2 MS PER  
INSPECTION!

### Inspection and Measurement

Performing image processing on height data makes a wide range of inspections possible. Not only can you perform accurate measurements utilizing surface planes such as measuring relative heights and volumes, you can also detect defects such as scratches and chips on any surface.

IMAGE PROCESSING RESULT



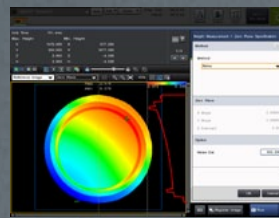


# MEASURING HEIGHT, AREA, AND VOLUME FROM 3D DATA

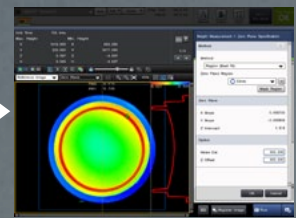
## Zero Plane Specification

As the reference plane for height measurement, a “zero plane” can be specified separately for each workpiece. This ensures stable measurement even if workpieces change their orientation. You can also specify a different reference plane for each measurement point. In addition, setting a free-form plane for zero plane specification is also possible. This allows for calculation of properties such as height and depth on a curved surface.

Before correction



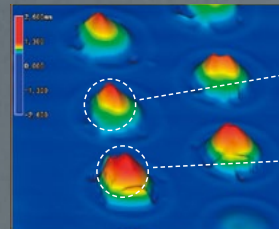
After correction



Even if a workpiece is inclined, the zero plane is automatically set according to the workpiece to obtain an accurate shape.

## Area and Volume Measurement

Measures volumes in the range enclosed by the inspection region and the “zero plane”.

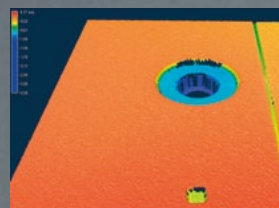


## 16-bit Pre-Processing Dedicated for Height Images

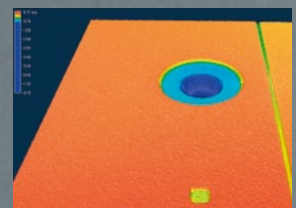
Pre-processing dedicated for height images is provided.

Five types of pre-processing are available: Median, Average, Gaussian, Smoothing, and Invalid Pixel Interpolation. This creates stable measurement for each workpiece.

Using pre-processing for grooves, which have largely varying luster, makes it possible to perform stable measurements.



Height image



Pre-processed image

# TAKE FULL ADVANTAGE OF ALL THE FUNCTIONALITY FOUND IN CONVENTIONAL VISION SYSTEMS

## Height extraction

Based on 3D data, a grayscale image is automatically generated with emphasis on the height you want to check. This allows you to continuously use all conventional, established XG/CV-X functions. Targets which are hard to detect with conventional image processing can now be detected by combining multiple tools, such as free-form plane extraction and OCR.

## Supports difficult-to-detect workpieces by extracting concavities and convexities from free-form plane shapes

Area cameras cannot detect dents because images are shaded due to the influence of complex curves and surface irregularities. Inspection becomes possible by extracting height change of points based on the information of a free-form plane.

Workpiece photo



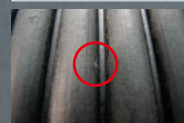
Height data



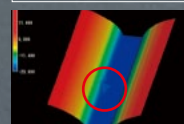
Height-extracted image (Free-form plane) + OCR



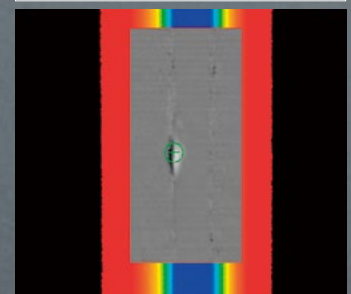
Workpiece photo



Height data



Detection image



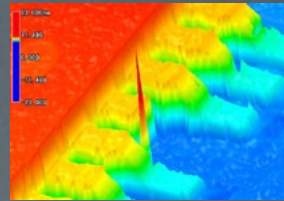


# NEW FUNCTIONS FOR MORE STABLE 3D INSPECTION

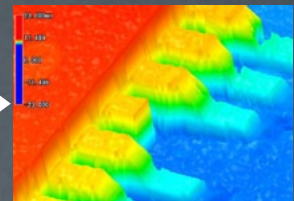
## Projection Noise Removal

The LJ-V Series includes algorithms designed to exclude suddenly generated noise. Noise removal sizes can be individually specified for the X and Y directions, enabling support for a wide range of workpieces.

Original image



After noise reduction

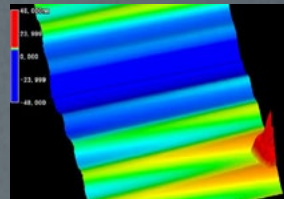


## Vibration Compensation Filter

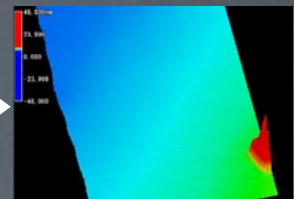
Stable detection is possible by suppressing noise caused by vibrations and eccentricity during conveyance. This allows for reduced fluctuations in data - a common bottleneck with inline inspection.

Noise caused by vibration

Original image

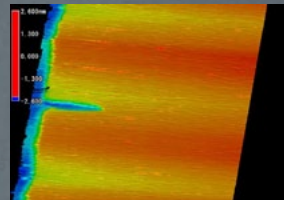


Processed image

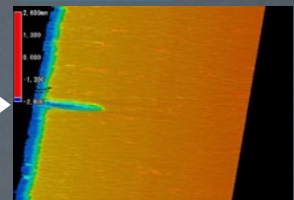


Noise caused by eccentricity

Original image



Processed image

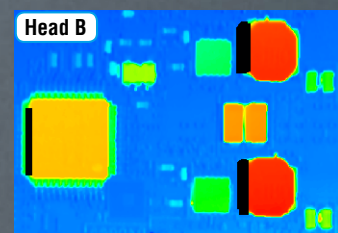
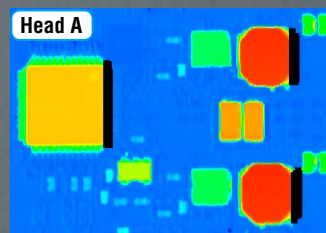


## DUAL HEAD Dead Angle Removal Function

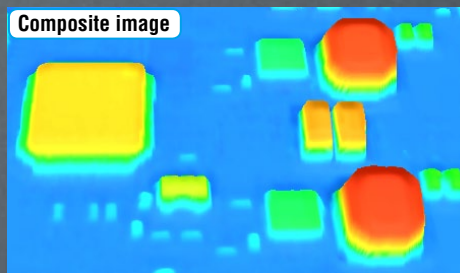
Profile data from two directions is combined in order to provide dead angle information that could not otherwise have been measured.



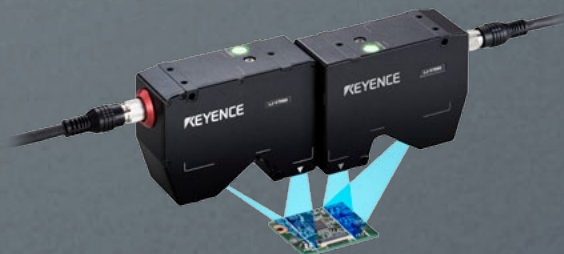
Data is missing because there is a dead angle in both images.



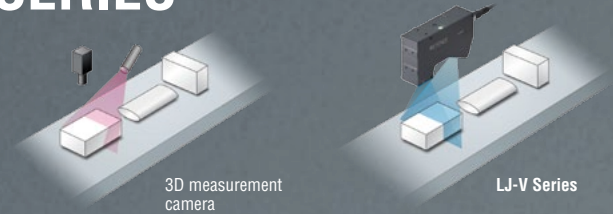
Composition



It is possible to create an image without any missing points by using the "Dual head dead angle removal function".

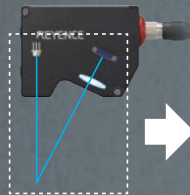


# OPTICAL FOCUS AND DEPTH OF FIELD ADVANTAGES OF THE LJ-V SERIES

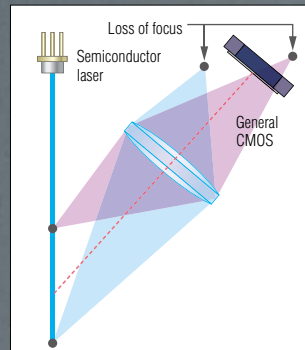


## Better Optical Design

Cameras that are not equipped with auto focus or a similar technology have a set focus position which makes it impossible to obtain an accurate profile if the distance between the camera and target changes. The LJ-V Series uses a special optical system, which enables the LJ-V Series to always capture images that are in the measurement range.

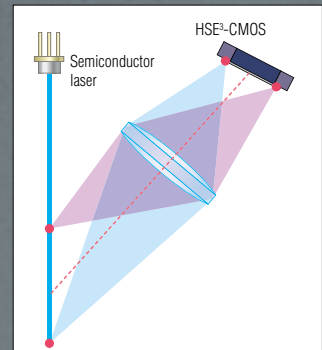


### Typical 3D camera



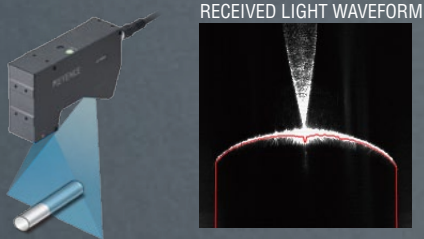
With the LJ-V Series, even if the target's position changes, the image will not go out of focus.

### LJ-V Series

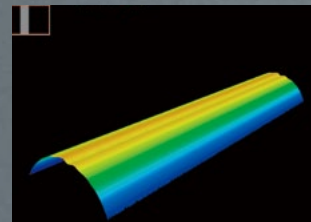


## Better Dynamic Range

For general 3D cameras, the light receiving element has a narrow dynamic range leading to measurement errors caused by the amount of light reflected from the target. The LJ-V Series can perform stable measurements without light saturation even if the amount of reflected light is large.

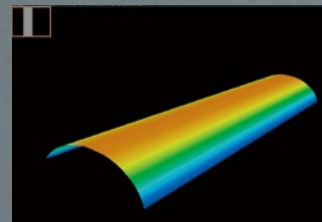


### Typical 3D camera



The area around the peak of the target object is saturated.

### LJ-V Series

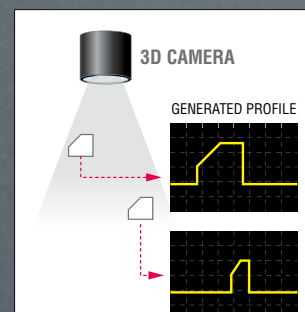


Stable measurements can be performed.

## Better Ease of Use

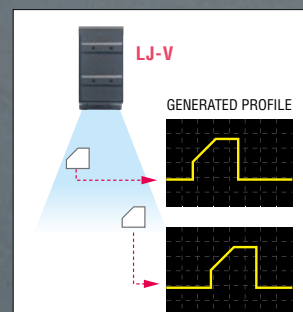
When using a 3D camera, the height and width data of individual pixels differs due to the positional relationship of the laser light source and the receiver, so a calibration must be performed for each pixel. With the LJ-V Series, there is no need for the user to perform additional calibration.

### Typical 3D camera



If the position of the workpiece changes, the profile that is obtained will differ.

### LJ-V Series

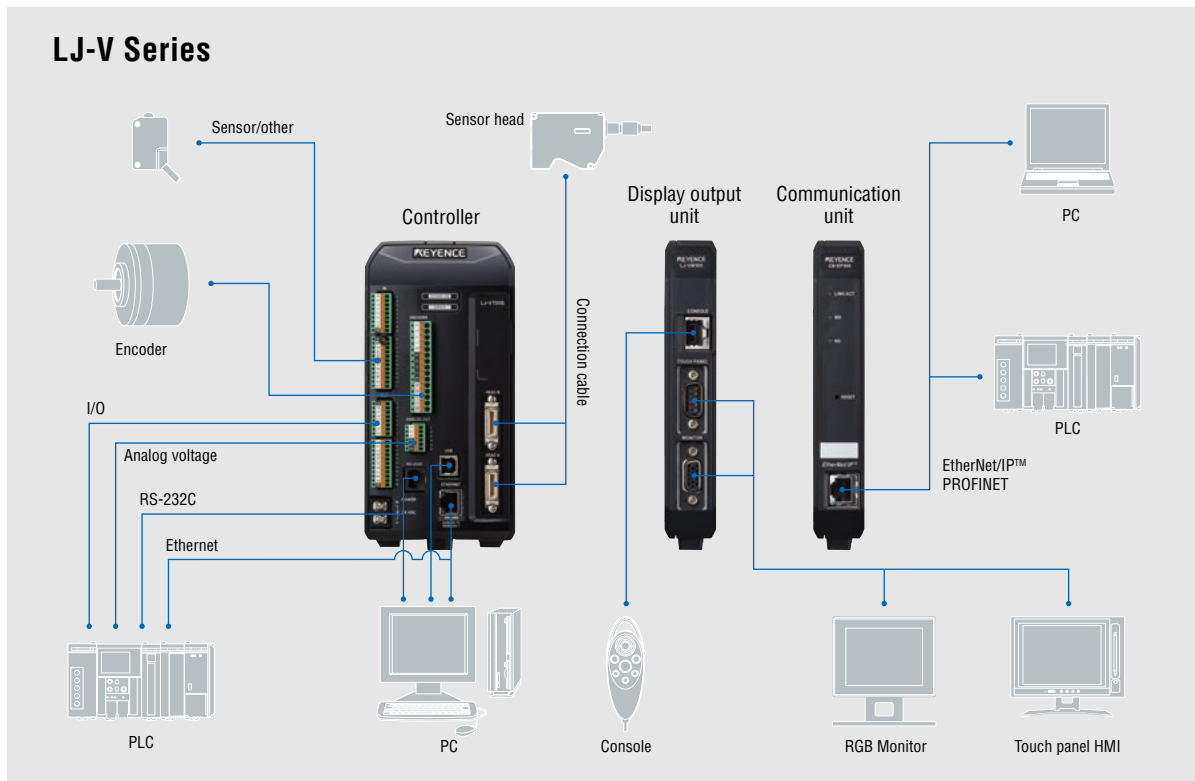


It is possible to obtain the real measurements and the same profile no matter where measurement is performed within the measurement area.

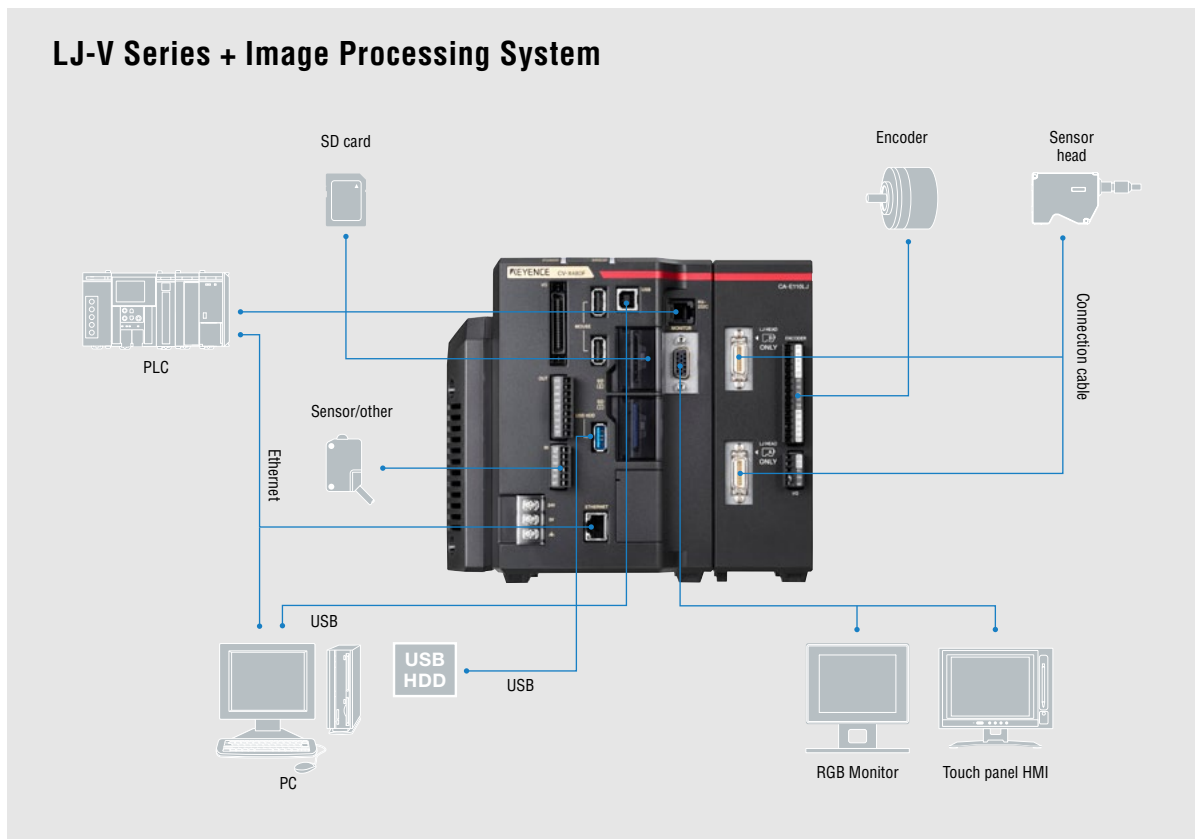


# SYSTEM CONFIGURATION

## LJ-V Series



## LJ-V Series + Image Processing System



# COMPONENTS SELECTION GUIDE

## SENSOR HEAD

Ultra high-accuracy	Ultra high-accuracy specular reflection	High-accuracy	High-accuracy specular reflection
LJ-V7020	LJ-V7020K	LJ-V7060	LJ-V7060K
<div> <div> <div>450 17.72"</div> <div>400 15.75"</div> <div>350 13.78"</div> <div>300 11.81"</div> <div>250 9.84"</div> <div>200 7.87"</div> <div>150 5.91"</div> <div>100 3.94"</div> <div>50 1.97"</div> <div>0</div> </div> <div> <div> <div>Measurement range</div> <div>20±2.6 mm (0.79"±0.1")</div> </div> <div> <div>Measurement range</div> <div>24.2±2.3 mm (0.95"±0.09")</div> </div> <div> <div>Measurement range</div> <div>60±8 mm (2.36"±0.31")</div> </div> <div> <div>Measurement range</div> <div>54.6±7.6 mm (2.15"±0.30")</div> </div> </div> </div>			
<div> <div> <div>17.4 mm 0.69"</div> <div>20 mm 0.79"</div> <div>22.6 mm 0.89"</div> </div> <div> <div>Width: 6.5 mm 0.26"</div> <div>Width: 7 mm 0.28"</div> <div>Width: 7.5 mm 0.30"</div> </div> <div> <div>0.86"</div> <div>21.9 mm 0.95"</div> <div>24.2 mm 0.95"</div> <div>26.5 mm 1.04"</div> </div> <div> <div>Width: 6.5 mm 0.26"</div> <div>Width: 7 mm 0.28"</div> <div>Width: 7.5 mm 0.30"</div> </div> <div> <div>52 mm 2.05"</div> <div>60 mm 2.36"</div> <div>68 mm 2.68"</div> </div> <div> <div>Width: 13.5 mm 0.53"</div> <div>Width: 15 mm 0.59"</div> <div>Width: 15 mm 0.59"</div> </div> <div> <div>47 mm 1.85"</div> <div>54.6 mm 2.15"</div> <div>62.2 mm 2.45"</div> </div> <div> <div>Width: 8 mm 0.31"</div> <div>Width: 14 mm 0.55"</div> <div>Width: 8 mm 0.31"</div> </div> </div>			
<div>Measurement range</div> <div>Z-axis 20±2.6 mm 0.79"±0.1"</div> <div>X-axis 7 mm 0.28"</div>	<div>Measurement range</div> <div>Z-axis 24.2±2.3 mm 0.95"±0.09"</div> <div>X-axis 7 mm 0.28"</div>	<div>Measurement range</div> <div>Z-axis 60±8 mm 2.36"±0.31"</div> <div>X-axis 15 mm 0.59"</div>	<div>Measurement range</div> <div>Z-axis 54.6±7.6 mm 2.15"±0.30"</div> <div>X-axis 14 mm 0.55"</div>
<div>Repeatability</div> <div>Z-axis 0.2 µm 0.000008"</div> <div>X-axis 2.5 µm 0.000099"</div>	<div>Repeatability</div> <div>Z-axis 0.2 µm 0.000008"</div> <div>X-axis 2.5 µm 0.000099"</div>	<div>Repeatability</div> <div>Z-axis 0.4 µm 0.000016"</div> <div>X-axis 5 µm 0.000197"</div>	<div>Repeatability</div> <div>Z-axis 0.4 µm 0.000016"</div> <div>X-axis 5 µm 0.000197"</div>

Required	Required
<div> <div>Head-to-controller cable</div> <div>CB-B3 (3 m 9.8')</div> <div>CB-B10 (10 m 32.8')</div> </div> <div> <div>Extension cable</div> <div>CB-B5E (5 m 16.4')</div> <div>CB-B10E (10 m 32.8')</div> <div>CB-B20E (20 m 65.6')</div> </div>	<div> <div>Controller</div> <div>LJ-V7000(P)</div> </div> <div> <div>Settings monitor software</div> <div>LJ-H3</div> </div> <div> <div>Controller variations</div> <div>NPN output type LJ-V7001</div> <div>PNP output type LJ-V7001P</div> </div>

\* For total lengths of 30 m 98.4', up to 2 extension cables may be added. Select products as required.

## Units/Options

EtherNet/IP™ unit  
**CB-EP100**  
PROFINET unit  
**CB-PN100**

Display output unit  
**LJ-VM100**

Monitor stand  
**OP-87262**

Image stitching unit  
**CA-E100LJ/CA-E110LJ**  
Encoder unit  
**CA-EN100U**  
Encoder head  
**CA-EN100H**  
Encoder head cable  
**CA-EN5 (5 m 16.4')/CA-EN10 (10 m 32.8')**

Ethernet cable  
**OP-87736 (2 m 6.6')**  
RS-232C cable  
**OP-96368 (2.5 m 8.2')**  
D-sub 9 pin connector  
**OP-26401**

# Middle range

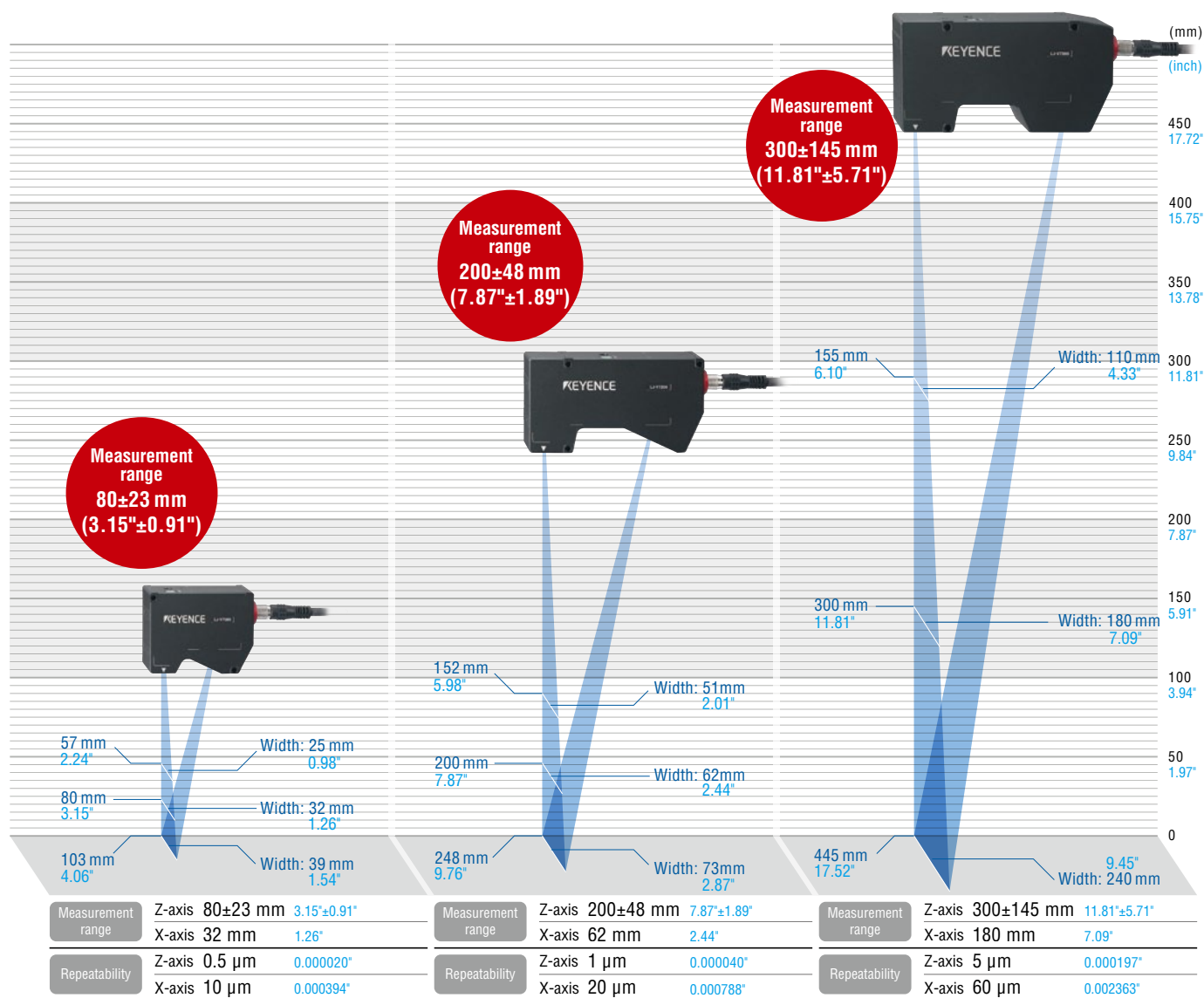
LJ-V7080

# Long range

LJ-V7200

# Ultra-long range

LJ-V7300

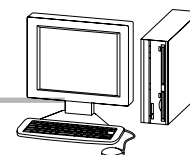


## Connect to PC

Connect using the USB cable or an Ethernet cable.



USB cable  
**OP-66844**



PC (not included)

## Connect to colour monitor



Display output unit  
**LJ-VM100**



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



Console  
**OP-87504**



LCD colour monitor  
**CA-MP120**

## Connect to touch panel



Display output unit  
**LJ-VM100**



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



Touch panel HMI extension cable  
**OP-87258 (3 m 9.8')**  
**OP-87259 (10 m 32.8')**



Touch panel HMI  
**CA-MP120T**



# 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 mm <sup>2</sup> , 0.01°	
	Maximum display range	±9999.99 mm, ±9999.99 mm <sup>2</sup>	
Input terminal block	Laser remote interlock input	Non-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	Non-voltage input × 4 inputs	Voltage input × 4 inputs
Output terminal block	Analog voltage output	±10 V × 2 outputs, Output impedance: 100 Ω	
	OUT comparator output	NPN open collector output × 12 outputs (Can freely assign 16 OUTs × 3 stage judgment results)	PNP open collector output × 12 outputs (Can freely assign 16 OUTs × 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 bps)	
Rating	Voltage	24 VDC, including ±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	1000BASE-T/100BASE-TX
	USB*5	USB 2.0 high speed compliant (USB 1.1 Full-SPEED compatible)
Supported OS		Windows 10*1 Windows 7 (SP1 or later)*2 Windows Vista (SP2 or later)*3 Windows XP (SP3 or later)*4
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 Home, Pro, and Enterprise editions are supported.

\*2 Home Premium, Professional, and Ultimate editions are supported.

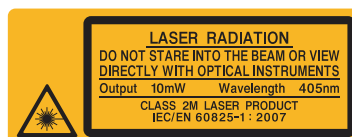
\*3 Ultimate, Business, Home Premium, and Home Basic editions are supported.

\*4 Professional and Home editions are supported.

\*5 Connection through a USB hub is not included in the guarantee.

## LASER WARNING/EXPLANATORY LABEL

LJ-V7020, LJ-V7020K, LJ-V7060



LJ-V7060K, LJ-V7080, LJ-V7200, LJ-V7300



## 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)
PROFINET IO	Transmission media
	STP or Category 5e or higher UTP
	Maximum cable length
	100 m <b>328.1'</b>
Supported functions	Data I/O communication
	Record data communication
	Number of connectable PROFINET IO controllers
	1
	Update time
	2 ms to 2048 ms
	GSDML
Conformance test version	Version 2.25
	Conformance class
	Conformance Class A compliant
	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)
EtherNet/IP™	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 <b>328.1'</b> (Distance between the unit and Ethernet switch)
Maximum number of connectable hubs*1	4 hubs (10BASE-T), 2 hubs (100BASE-TX)
	Supported functions
	Cyclic communication (Implicit messaging), Message communication (Explicit messaging), Compatible with UCM and Class 3
	Number of connections
RPI	64
	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 <b>32 to 122°F</b>
Weight	Operating ambient humidity
	20 to 85% RH (No condensation)
	Approx. 470 g

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

## Sensor head unit

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"	13.5 mm 0.53"	25 mm 0.98"	51 mm 2.01"	110 mm 4.33"
		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"
	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" × 0.003543"	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 0.000040"	5 μm 0.000197"	
	X-axis (width)*4	2.5 μm 0.000099"		5 μm 0.000197"		10 μm 0.000394"	20 μm 0.000788"	60 μm 0.002363"	
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 0.0004"		20 μm 0.0008"		50 μm 0.002"	100 μm 0.004"	300 μm 0.012"	
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	15 G/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 4,096 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.

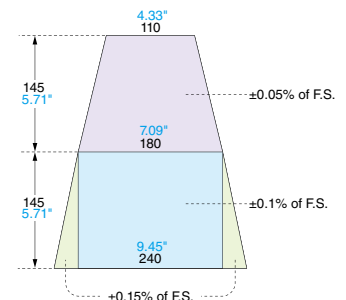
\*8 This value is from a case in which the sensor head cable (CB-B\*) or extension cable (CB-B\*E) has been connected.

\*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.

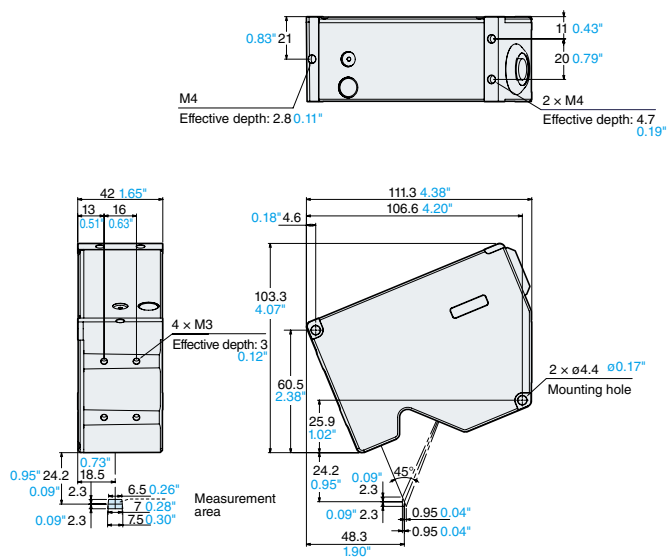
\*12 Do not look into the beam directly using any optical instruments (such as eye loupes, magnifiers, microscopes, telescopes, or binoculars). Viewing the laser output with an optical instrument may pose an eye hazard.



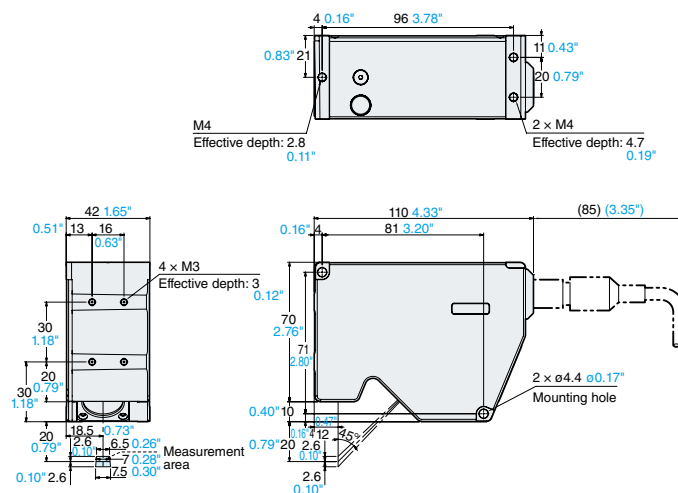
# DIMENSIONS

## Sensor head

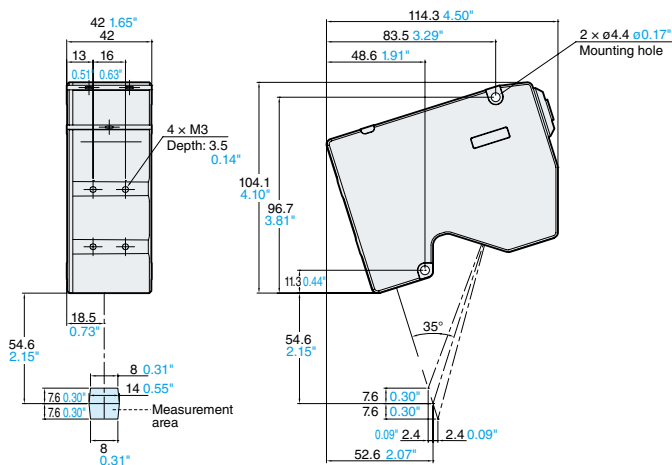
Ultra high-accuracy specular reflection model  
**LJ-V7020K**



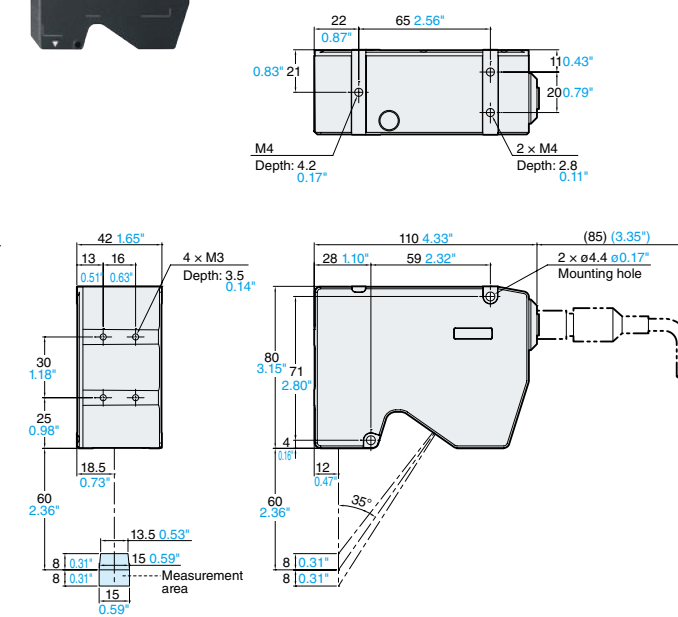
Ultra high-accuracy model  
**LJ-V7020**



High-accuracy specular reflection model  
**LJ-V7060K**

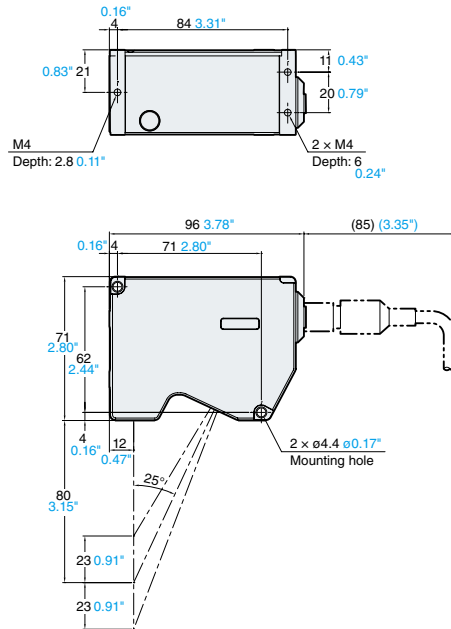


High-accuracy model  
**LJ-V7060**

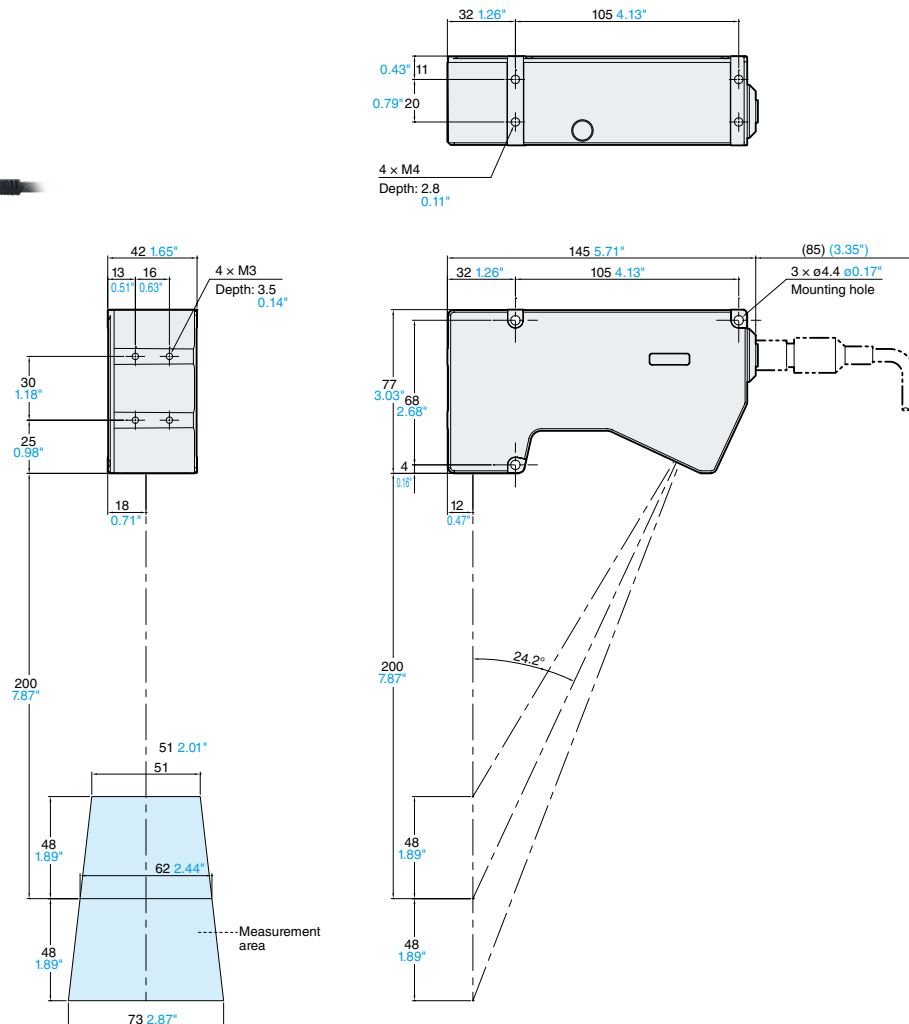




Middle-range model  
**LJ-V7080**



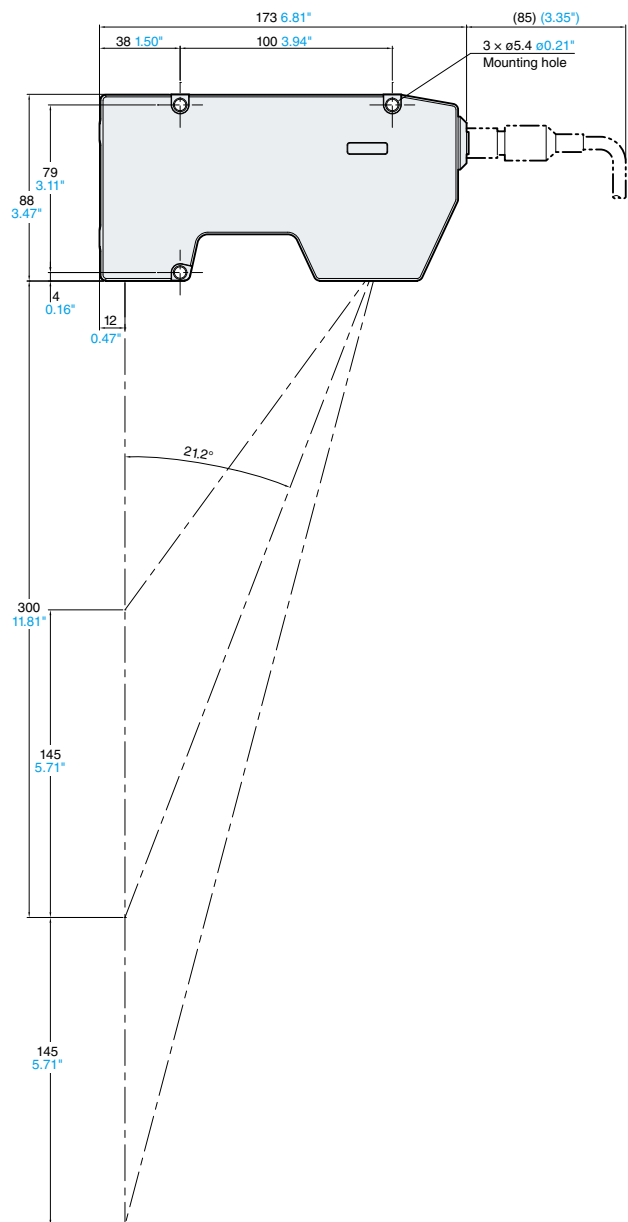
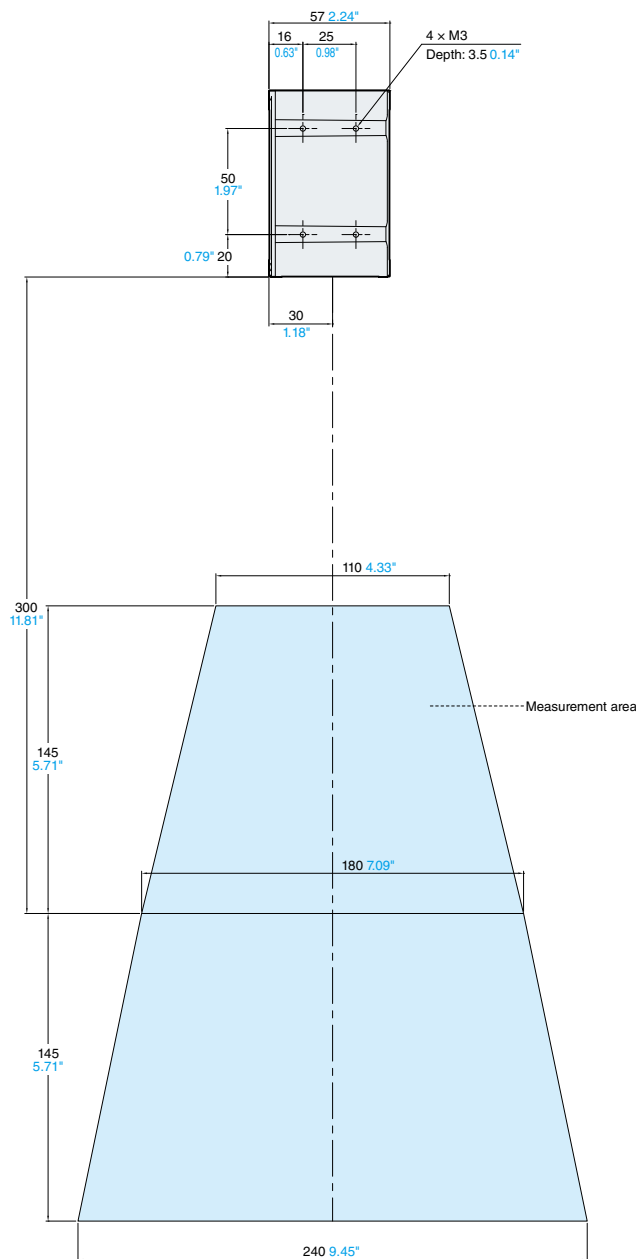
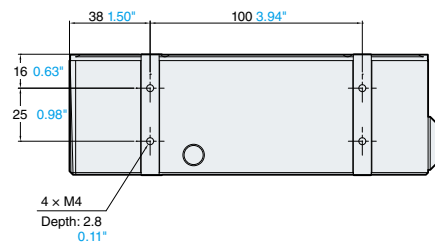
Long-range model  
**LJ-V7200**



# DIMENSIONS

## Sensor head

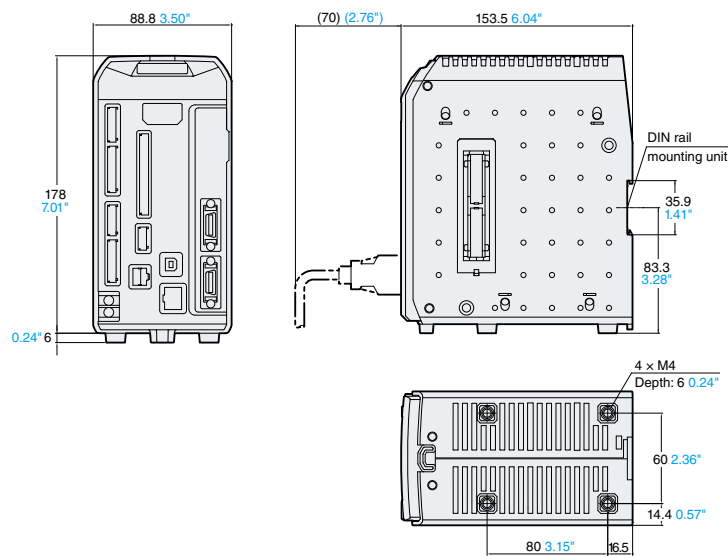
Ultra-long range model  
**LJ-V7300**



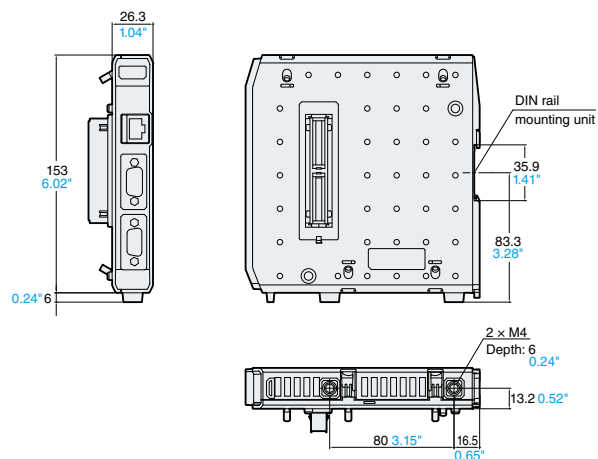
## Controller/Cable/Monitor



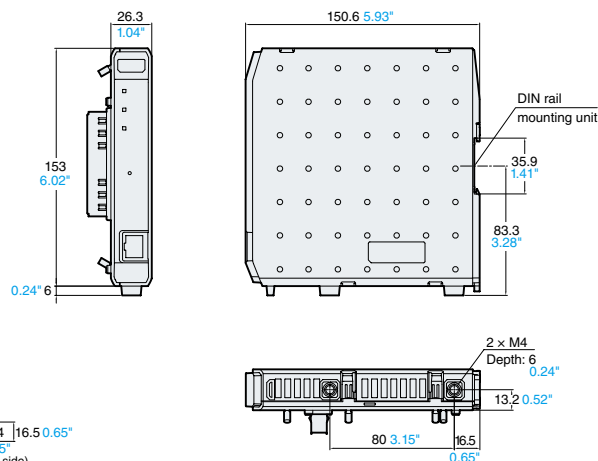
Multi-function controller  
**LJ-V7001(P)**



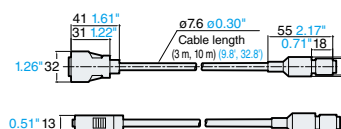
Display output unit  
**LJ-VM100**



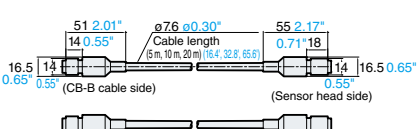
EtherNet/IP™ unit **CB-EP100**  
PROFINET unit **CB-PN100**



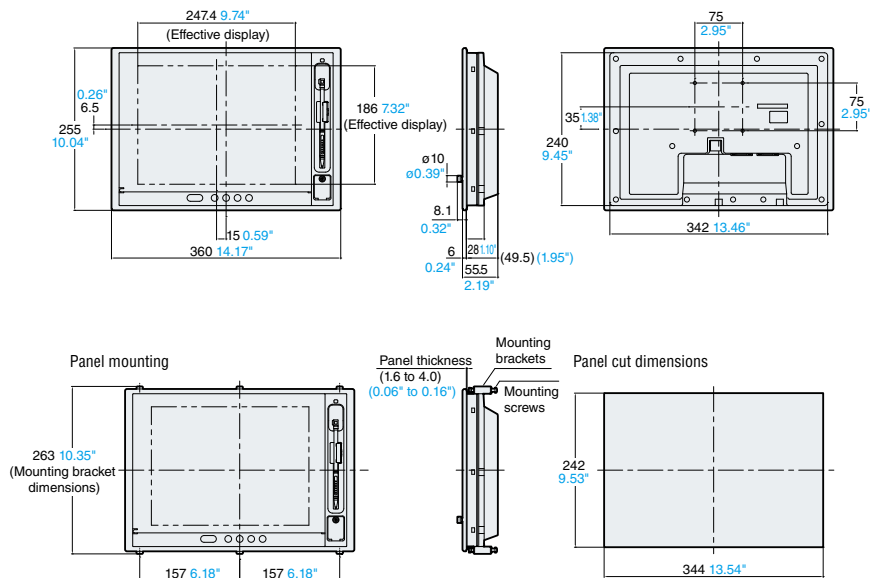
Head-to-controller cable  
**CB-B3/CB-B10**



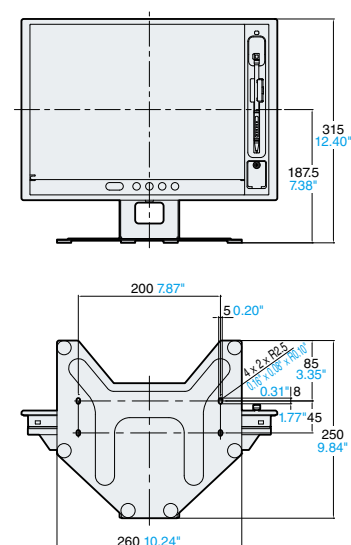
Extension cable  
**CB-B5E/CB-B10E/CB-B20E**



Touch panel HMI  
**CA-MP120T**



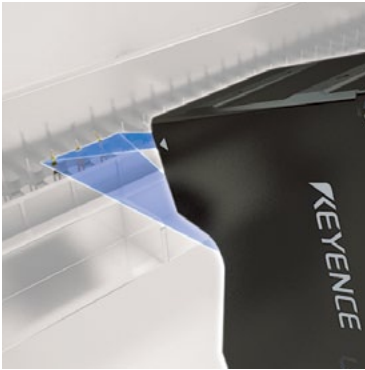
Specialized monitor stand  
**OP-87262**



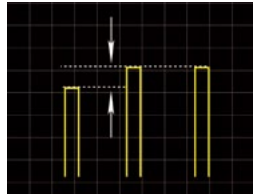


## 2D MEASUREMENT

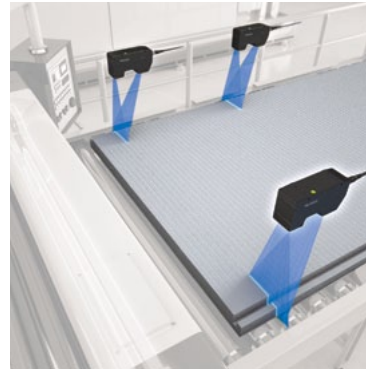
HEIGHT AND STEP DIFFERENCE



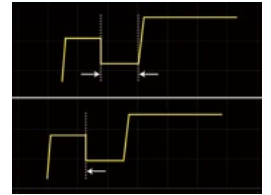
Pin height and step height measurement



WIDTH AND POSITION



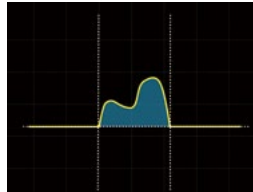
Building material board positioning



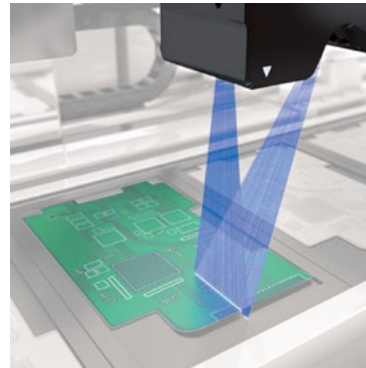
PROFILE AND CROSS SECTION



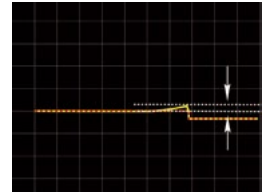
Sealant inspection



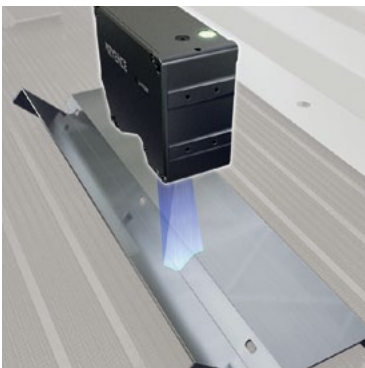
WARPAGE AND FLATNESS



Warpage measurement of PCBs



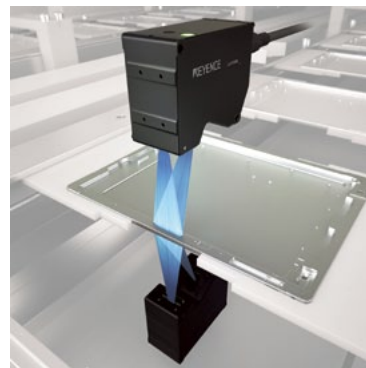
ANGLE AND RADIUS



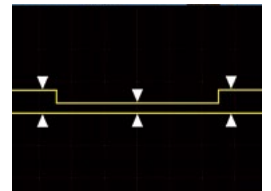
Angle measurement of processed products



THICKNESS MEASUREMENT



Case thickness measurement



## 3D MEASUREMENT (IMAGE PROCESSING)

### SOLDERING BRIDGE AND VOLUME INSPECTION

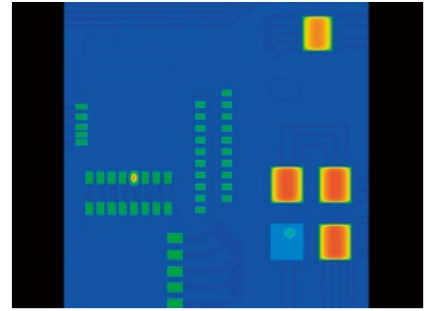
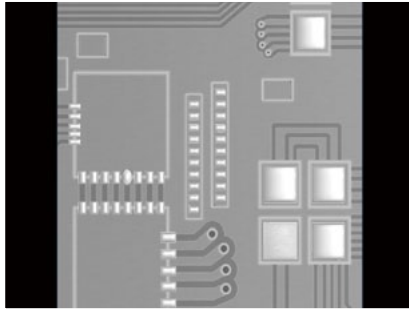


#### Traditional cameras

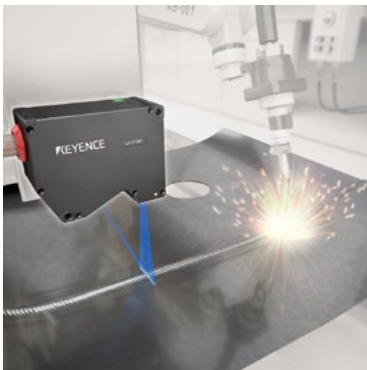
Inspection is difficult due to influence from PCB patterns and solder surface conditions.

#### LJ-V + Image processing

Inspections including solder presence, bridging, and volume can be performed.



### WELD BEAD INSPECTION

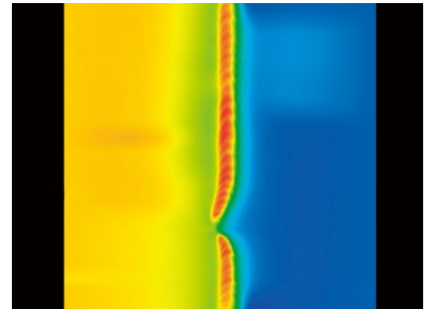
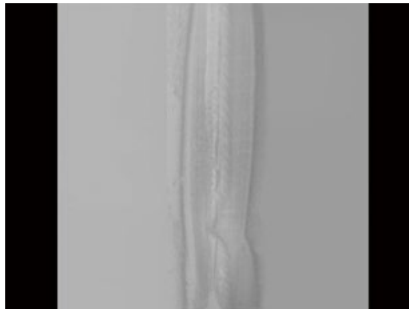


#### Traditional cameras

Inspection using the camera is difficult because the surface conditions of the workpiece are not stable.

#### LJ-V + Image processing

Stable inspection is possible regardless of the workpiece surface.



### CARD NUMBER CHARACTER RECOGNITION (OCR)

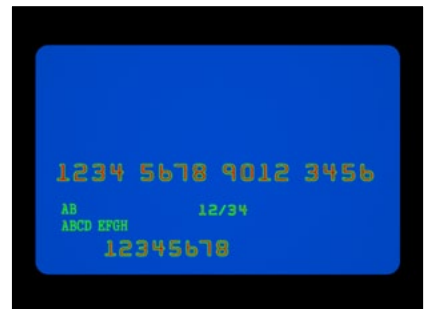


#### Traditional cameras

Detection is difficult due to influence from the background.

#### LJ-V + Image processing

Reliable character recognition (OCR) is possible no matter what kind of card is being used.



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

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