INLINE PROFILE MEASUREMENT
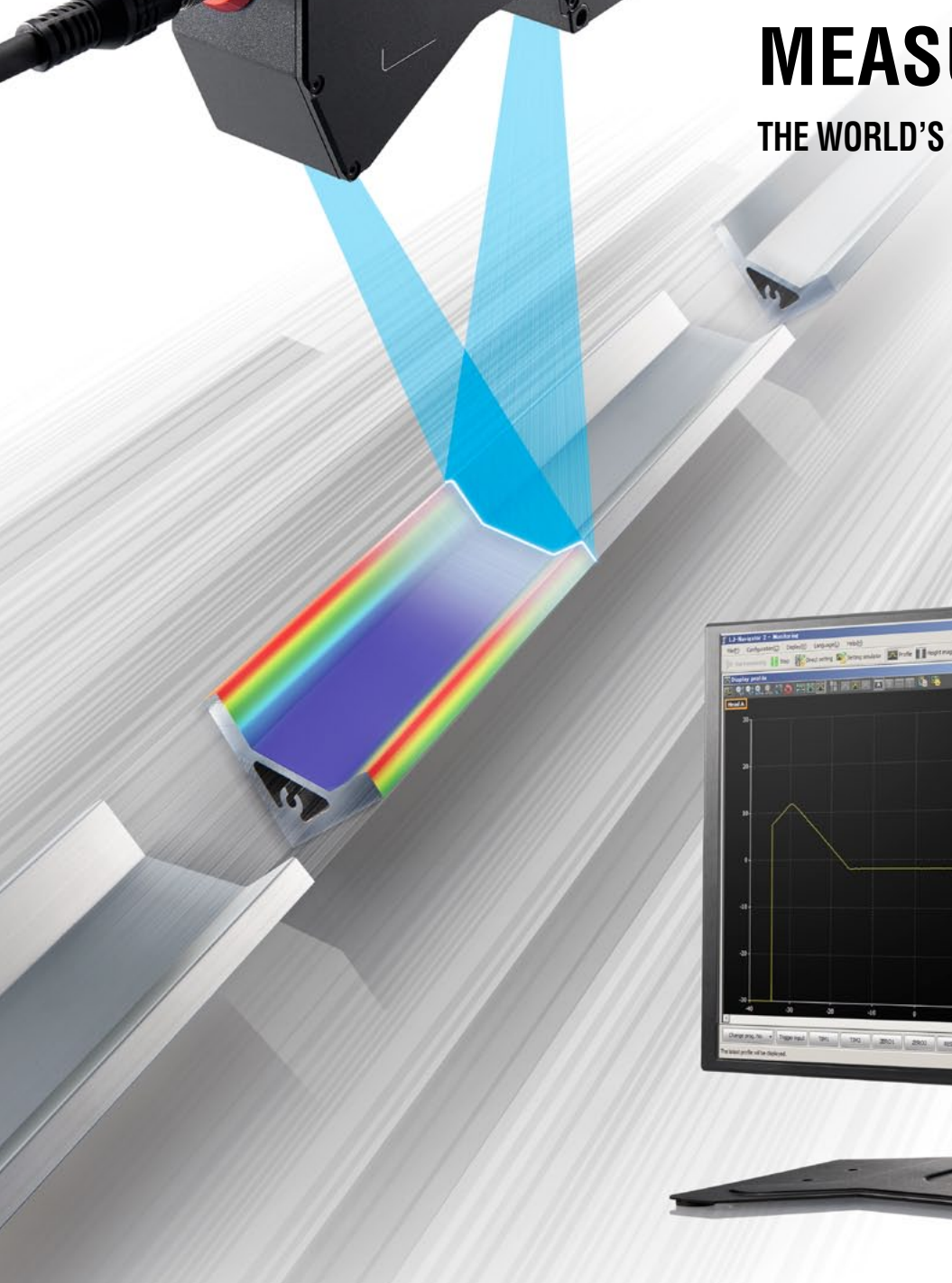
THE WORLD'S FASTEST AT 64000 PROFILES/SEC.

OFFERING
A SOLUTION
TO ANY PROBLEM

2D/3D Laser Scanner

LJ-V Series

CONTACT-TYPE MEASURING SENSORS

With contact-type sensors, **scratches** are an inevitable concern. In addition, **soft objects** can sometimes be troublesome and unmeasurable. User-caused **variations in the inspection results** also prove difficult to improve.

Workpiece contact and human errors

NON-CONTACT MEASUREMENT
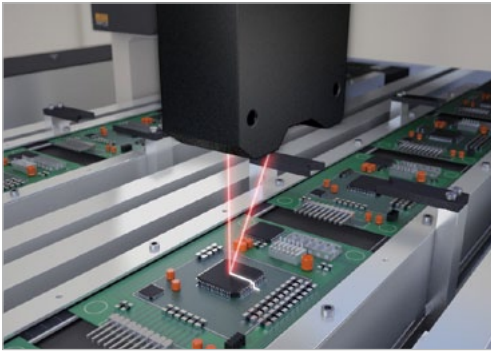
Direct measurement using a laser

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 necessary. **Securing sufficient space** is also difficult, and measurements are **time-consuming**.
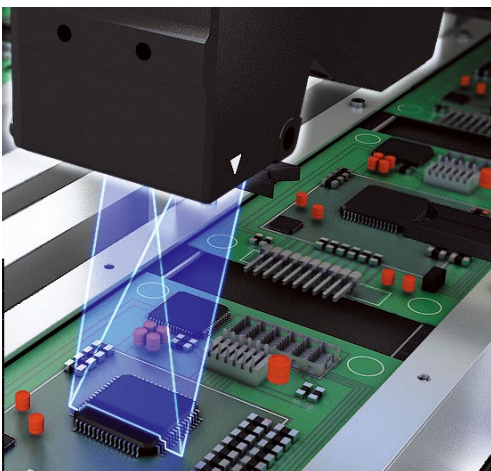

Multiple units required

▼

ONE DEVICE FOR MULTIPLE SOLUTIONS

Measure once with a 2D laser

Various measurement modes
Compact, space-saving design
No need to move the sensor

CAMERA INSPECTION MACHINES

Installing lighting can be troublesome, in 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.
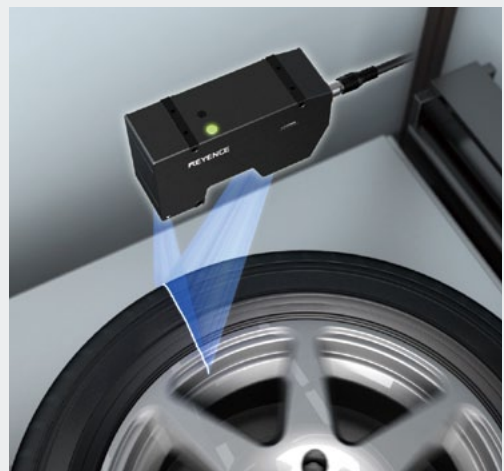

X and Y planes only

▼

X, Y, AND Z PLANES WITH A SINGLE DEVICE

3D imaging with additional image processing

| No lights necessary |
| :---: |
| Height measurement |
| No color errors caused by color irregularity |

REDEFINING PROFILE MEASUREMENT AND INSPECTION

Improving quality, catching defects, and increasing 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.
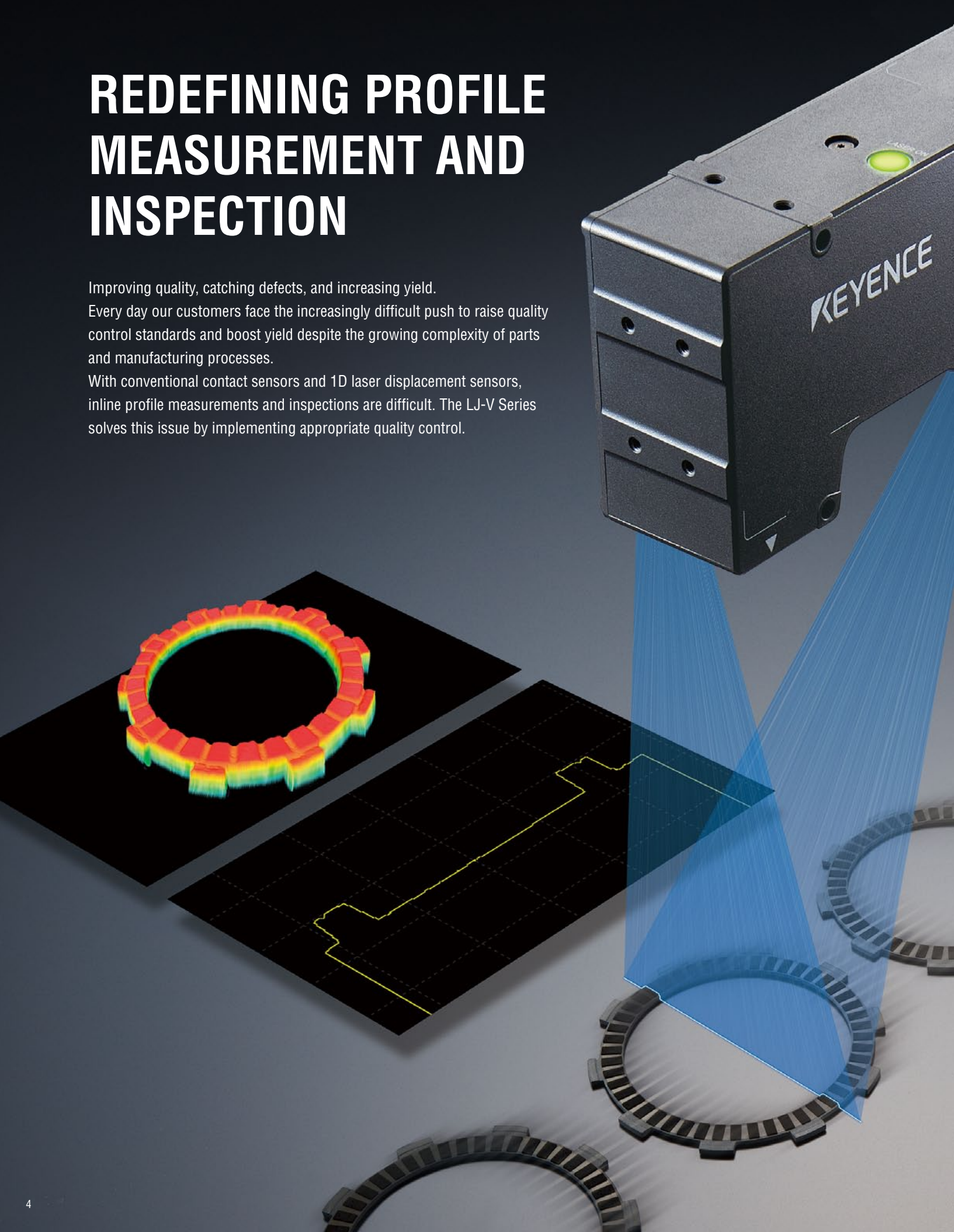
WORLD'S FASTEST!

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.

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

INDUSTRY'S VARIETY!

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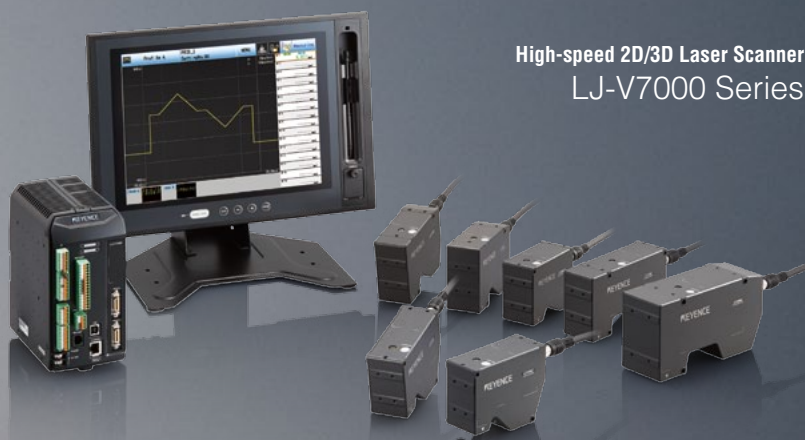
High-speed 2D/3D Laser Scanner
LJ-V7000 Series

Semiconductor lasers

Cylindrical lens

GP64-Processors

2D Ernostar lens   HSE³-CMOS

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 formed on the HSE³-CMOS and by detecting changes in position and shape, displacement and shapes are measured.
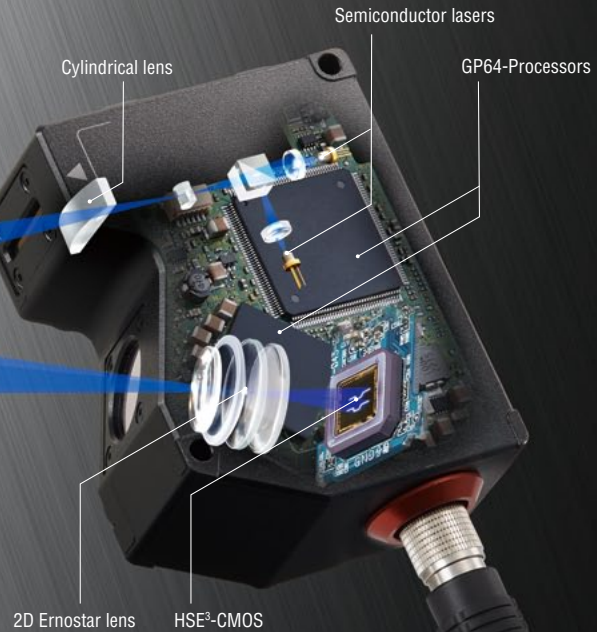
01

ULTRA-HIGH-SPEED SAMPLING

**NEWLY DEVELOPED**   **WORLD'S GREATEST**

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

▷ **HSE³-CMOS**   * HS = High Speed, E³ = Enhanced Eye Emulation
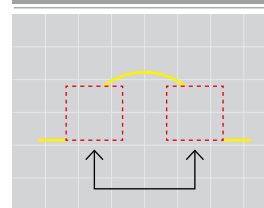
The LJ-V7000 Series is equipped with the newly developed HSE³-CMOS. In addition to improved speed, the dynamic range has been further improved over the established and conventional E³-CMOS. Even with the extremely short exposure time of 64 kHz (15.6 µs) it has achieved sensitivity that allows it to reliably measure a range of surfaces from black (small amount of reflection) surfaces to those with luster (large amount of reflection) due to it's wide dynamic range.
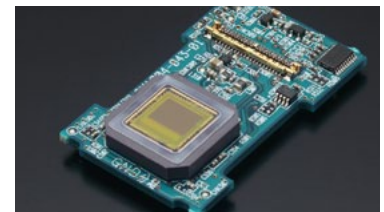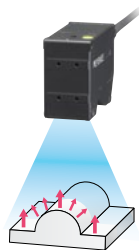
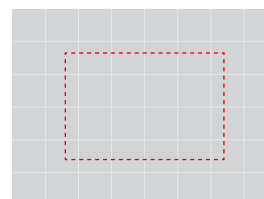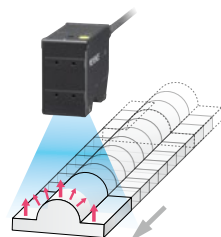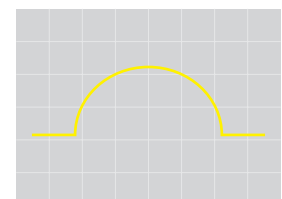| **STOPPED TARGET**		**Conventional model**	**LJ-V** **HSE³-CMOS**
		Measurement is impossible due to insufficient light intensity.	All ranges could be measured.
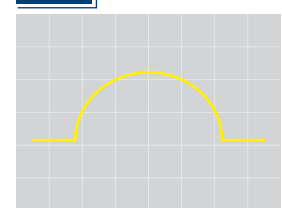
MOVING TARGET

DYNAMIC RANGE
2400×

Because there is even less light intensity, the measurement could not be performed at all.
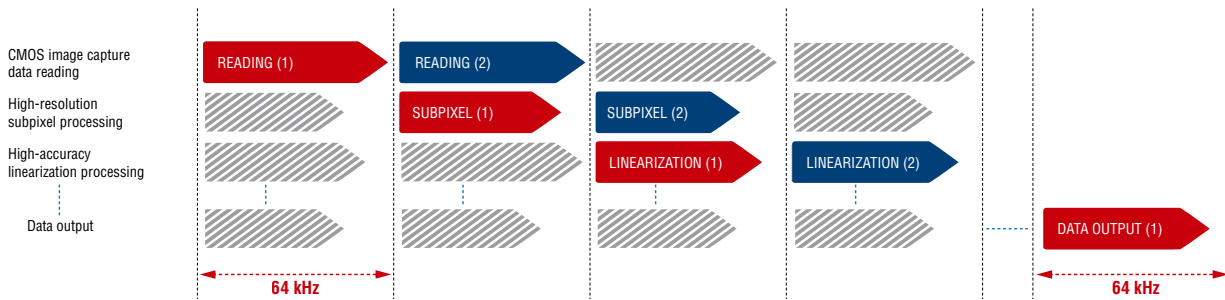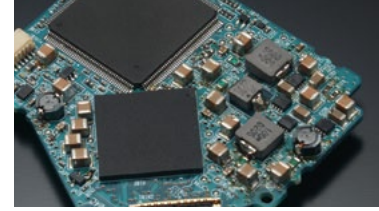
Even though the exposure time is short, all ranges could be measured without issue.

ACHIEVING ULTRA HIGH-SPEED MEASUREMENTS AT 64 kHz
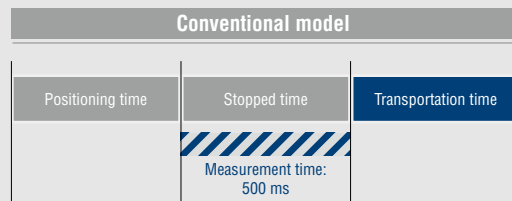
▷ **GP64-Processor**[*]   * G = Generating, P = Profiles

We have developed a new custom IC that can perform ultra-high-speed pipeline processing that in addition to reading CMOS image capture data and performing high-resolution subpixel processing, also performs high-precision linearization and data output. This allows for the measurement of objects moving at high-speeds with room to spare.
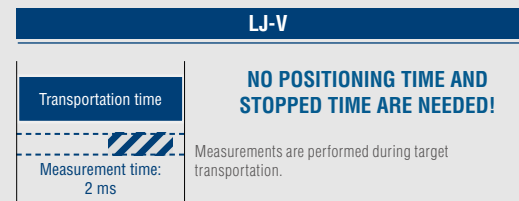
CMOS image capture data reading	READING (1)	READING (2)		
High-resolution subpixel processing		SUBPIXEL (1)	SUBPIXEL (2)	
High-accuracy linearization processing			LINEARIZATION (1)	LINEARIZATION (2)
Data output				DATA OUTPUT (1)

64 kHz   **64 kHz**

MERITS PROVIDED BY ULTRA HIGH-SPEED SAMPLING

REDUCED INSPECTION CYCLE TIME!

Conventional model

| Positioning time	Stopped time	Transportation time

Measurement time: 500 ms

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.

LJ-V

Transportation time

NO POSITIONING TIME AND STOPPED TIME ARE NEEDED!

Measurement time: 2 ms

Measurements are performed during target transportation.

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!

Conventional model

Z axis

X axis
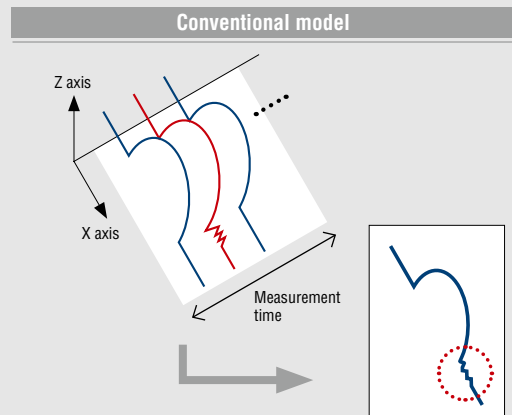
Measurement time

RESULT OF AVERAGING 3 PROFILES

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

LJ-V

Z axis

X axis

Measurement time
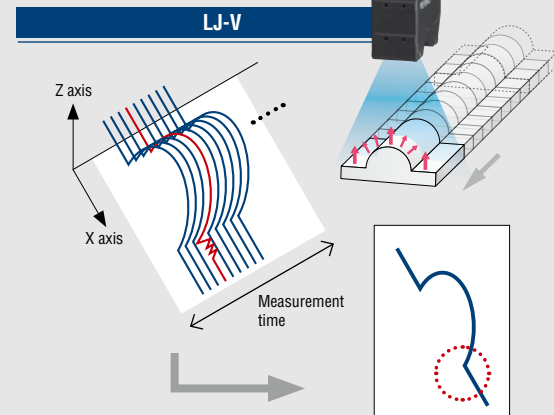
RESULT OF AVERAGING 720 PROFILES

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.

WELDS

METAL

TRANSLUCENT OBJECTS

RESIN

BLACK RUBBER

TRANSPARENT OBJECTS

02
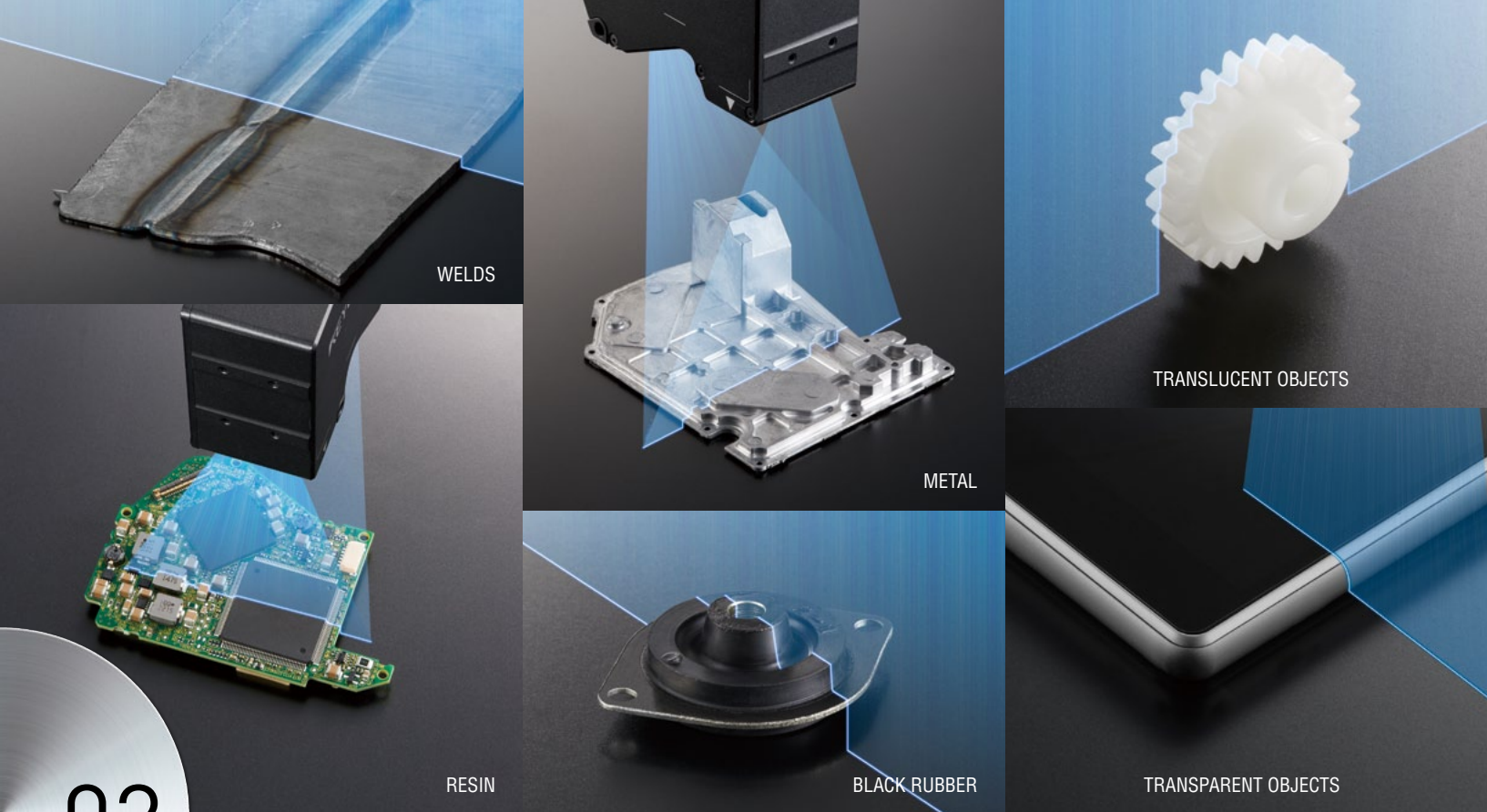
OVERWHELMING WORKPIECE RESPONSE CAPABILITIES AND DETECTION STABILITY

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 Ernostar lens. This generates a stabilized high-precision profile. Also, 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 measurement with all types of targets that are typically difficult to detect.
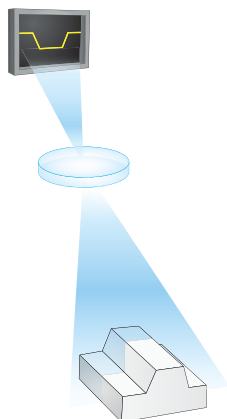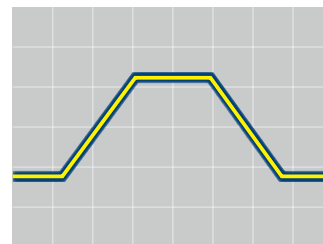

RED LASER (CONVENTIONAL)
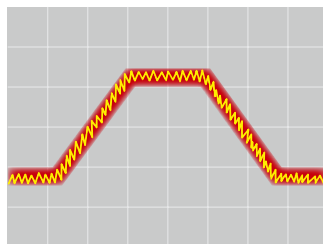
BLUE LASER (LJ-V)

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

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

8

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. The power of this function is demonstrated in the measurement of metals with complex shapes and complicated areas.

1. X POLARIZATION
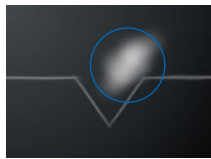
2. Y POLARIZATION
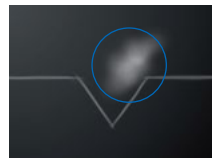
MULTIPLE REFLECTION LIGHT

A large difference in light intensity is generated between 1. and 2.

GENERATOR PROFILE
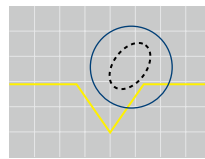
Data with areas that contain large differences is canceled.
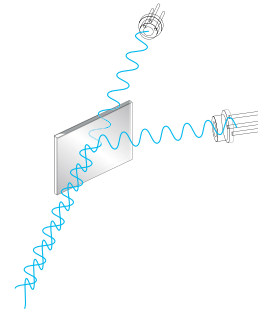
ACTUAL EXAMPLE
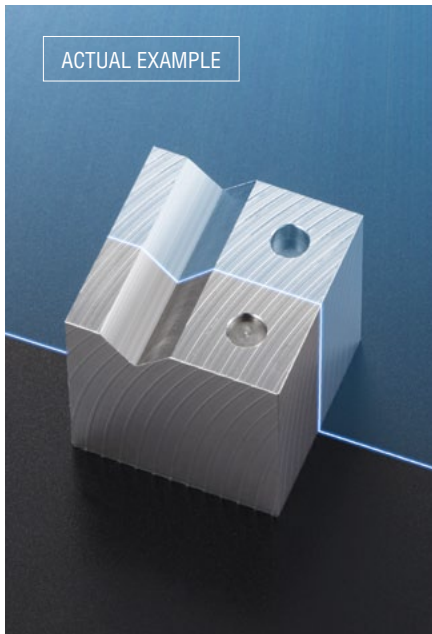
Conventional model

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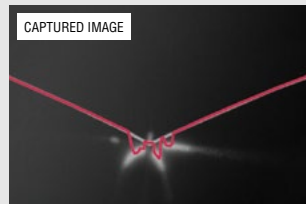
PROFILE
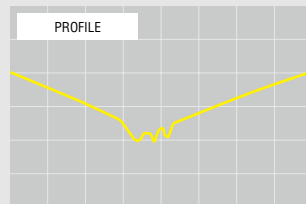
The strong influence of the diffuse reflected light causes errors in the data.

LJ-V

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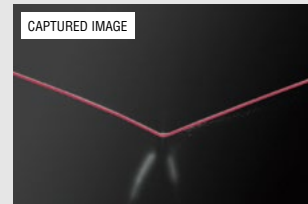
PROFILE
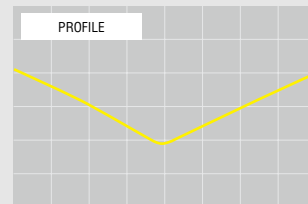
LJ-V Series cancels the diffuse reflected light to perform stable measurements.

ALL TYPES OF MEASUREMENTS ARE POSSIBLE WITH THIS SINGLE DEVICE

STEP **1** ➤ STEP **2** ➤ STEP **3**

IMAGING CAPTURE
SETTINGS

MEASUREMENT
SETTINGS

OUTPUT
SETTINGS

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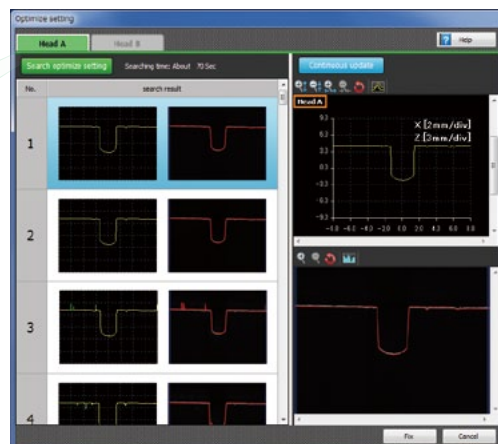
MEASUREMENT SETTINGS — 74 different measurement modes for a wide variety of inspections —

HEIGHT

Peak
Average
Bottom

Measures the height within the specified range.

WIDTH AND POSITION

Knee
Width

Measures the width and positions under the specified conditions.

ANGLE AND INTERSECTION

Angle
Intersection position (X and Z coordinates)

Measures the angle between and the intersection point of a pair of detected straight lines.

MASTER PROFILE COMPARISON

Master shape
Measurement value

Makes a comparison with the registered master shape and then measures the area with the largest difference in height.

HEIGHT DIFFERENCE

Measurement point
Height difference
Reference point

Measures the height difference from a reference point to a measurement point.

CROSS SECTIONAL AREA

Cross sectional area
Reference surface

Measures the cross sectional area from a reference surface.

DISTANCE (POINT - POINT)

Distance (X and Y)
Peak
Knee

Measures the distance between two points.

RADIUS AND MIDPOINT

Measurement value
Reference surface

Measures the radius of a curved profile and the coordinates of the center position of a specified point.

THICKNESS

Average thickness
Minimum thickness

Measures the thickness within the specified range.

SIMPLE 3D SETTING (HEIGHT)

SIMPLE 3D SETTING (HEIGHT DIFFERENCE)

SIMPLE 3D SETTING (POSITION)

OUTPUT SETTINGS — Output modes available for a variety of uses —

▷ **OUTPUT METHOD**

Measurement value

| Ethernet | USB | RS-232C | Analog voltage |

| EtherNet/IP™ | PROFINET |

Profile data

| Ethernet | USB | EtherNet/IP™ | PROFINET |

OK/NG judgment

| Ethernet | USB | RS-232C | I/O |

| EtherNet/IP™ | PROFINET |
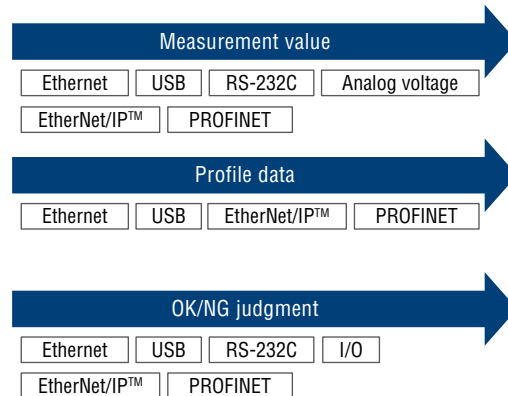
PC

PLC, etc.

Ethernet and USB can also be used with DLLs.

11

OUR AIM IS ON-SITE EASE OF USE

SELECTABLE 3-WAY OPERATION

A touch panel has been prepared 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
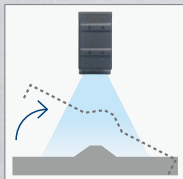
IN-LINE POSITION ADJUSTMENT FUNCTION (X, Y, AND Z)

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

θ→X adjustment
(angle then x position)

If the position of the workpiece becomes misaligned...

Conventional model

Measurement area

ADJUSTMENT

LJ-V

Measurement area

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

LCD color monitor
CA-MP120

PC
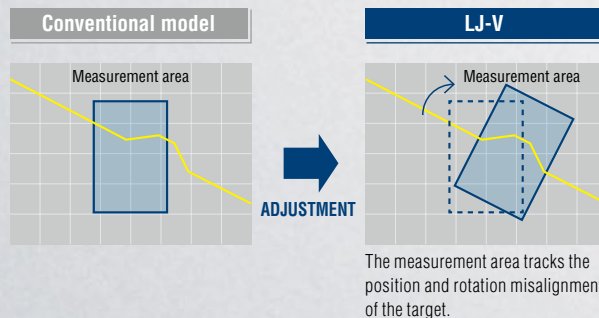
VARIOUS SPECIFICATIONS THAT INCLUDE ALL ON-SITE NEEDS

SUPPORTS 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 environments like processing plants where spray easily comes on to the product.

PASSES IMPACT RESISTANCE TEST IEC 60068-2-27

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

DOUBLE XZθ ADJUSTMENT FUNCTION

The LJ-V7000 Series is equipped with a new function that makes it possible to individually set various adjustments in 2 areas. This is effective when measuring gaps, angles, or height differences of two targets that move independently.
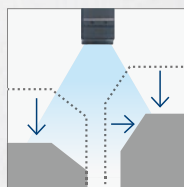
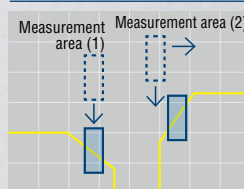If the position of individual workpieces becomes misaligned...

Conventional model

Measurement area (1)

Measurement area (2)

ADJUSTMENT

LJ-V

Measurement area (1)
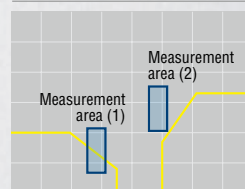
Measurement area (2)

Because position adjustment was applied to a single side as a reference, measurement could not be properly performed.
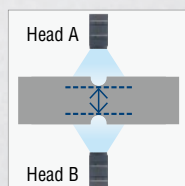
Because original adjustment is applied individually to measurement areas (1) and (2), measurement can be properly performed.

DUAL-HEAD ADJUSTMENT FUNCTION

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

Ex. Minimum thickness measurement

Head A

Head B

If the workpiece tilts...

Conventional model

Head A Measurement area

Head B Measurement area

The actual thickness is a different value.

ADJUSTMENT

LJ-V

Head A Measurement area

Head B Measurement area

The correct thickness can be measured.
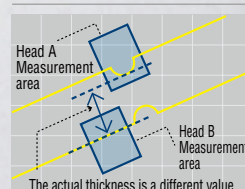
The θ adjustment center of rotation for each head differs, so the measurement area for head B becomes misaligned.

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

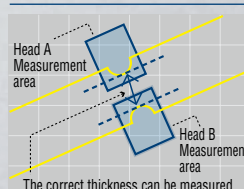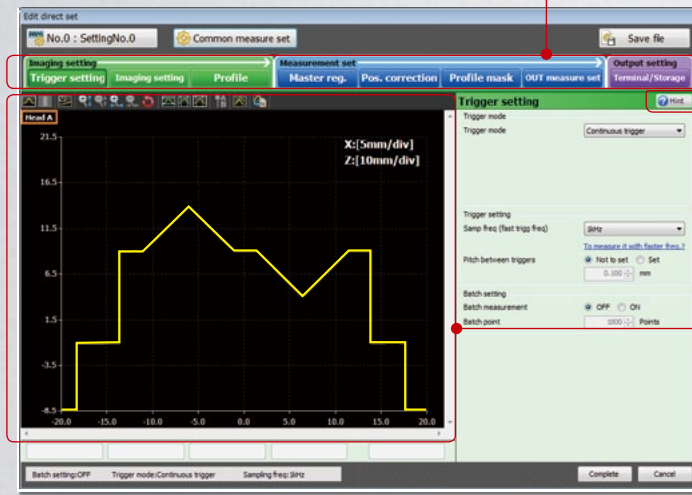## SIMPLE PROGRAMING — LJ-Navigator2 —

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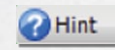
EASY SETTINGS

EASY NAVIGATION SETTINGS

Anyone can perform setting intuitively by following the navigation in the order of image capture settings, measurement settings, and output settings.

HINT FUNCTIONS THAT DON'T REQUIRE THE MANUAL

"Hint" icons have been prepared for each screen.
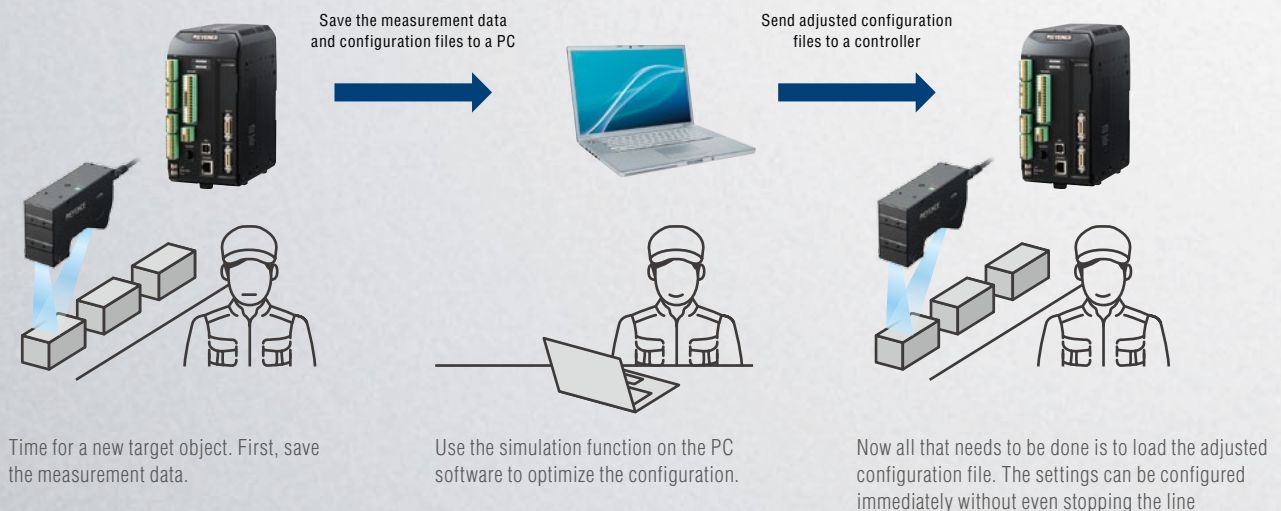
SETTINGS APPLIED IN REAL-TIME

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 change 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

Save the measurement data and configuration files to a PC

Send adjusted configuration files to a controller

Time for a new target object. First, save the measurement data.

Use the simulation function on the PC software to optimize the configuration.

Now all that needs to be done is to load the adjusted configuration file. The settings can be configured immediately without even stopping the line

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.

HEIGHT IMAGE DISPLAY
(Grayscale display)

PROFILE DISPLAY
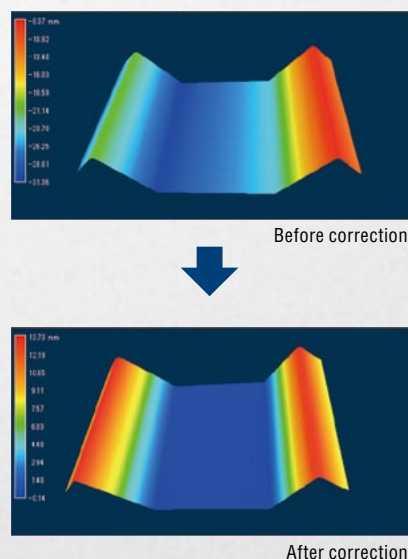
MEASUREMENT
VALUE MONITOR
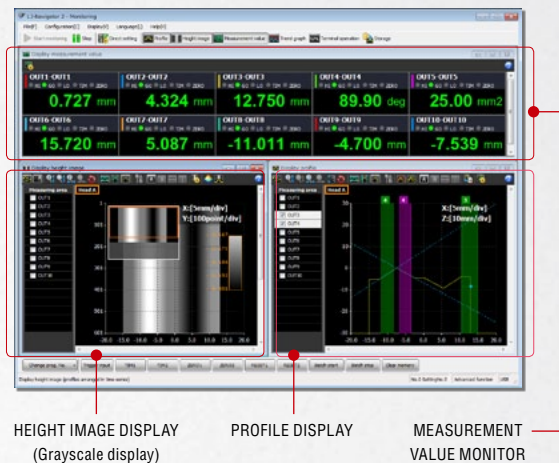
PROFILE STORAGE FUNCTION

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 is useful for the verification of defects and for research and development.

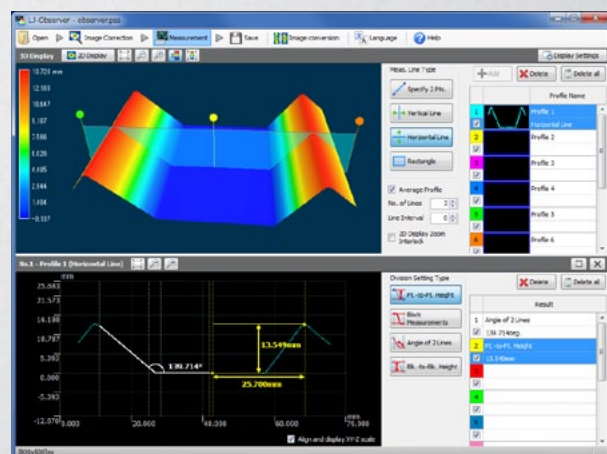# OFFLINE PROFILE OBSERVATION — LJ-Observer —

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

3D VIEWER AND SURFACE SLANT ADJUSTMENT

Before correction

After correction

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, it is possible to apply image processing to the created 3D image.

Profile

PC

PLC
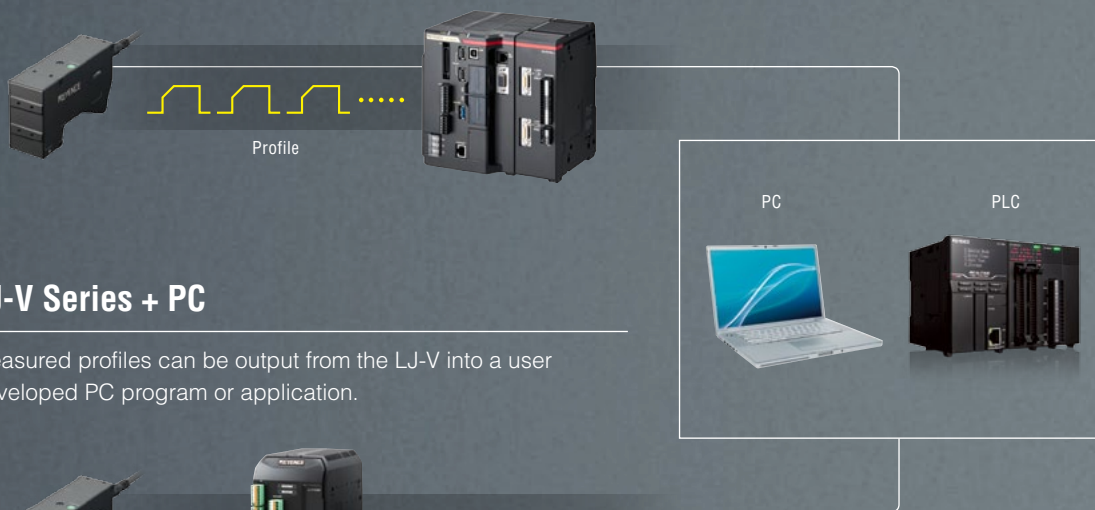
LJ-V Series + PC

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

Profile

Profile output

Usable with encoders

The number of pulses can be set arbitrarily, making it possible to install an encoder with unprecedented simplicity to best suit the imaging conditions (Support for 64 to 150000 pulses).
Unlike with conventional products, there's no need to select encoders based on aspects such as the rotation speed of the shaft, the roller diameter, or the field of view.

Encoder unit
CA-EN100U
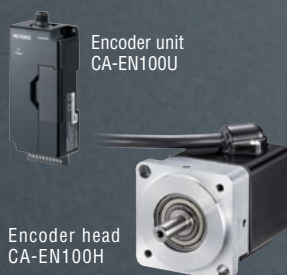
| High-resolution and high-speed output |

Support for up to 150000 pulses allow for 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.

| IP65-compatible |

Added consideration for environmental resistance has resulted in a design that is 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).

Encoder head
CA-EN100H

* 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. Image processing can be performed on 3D measurement data to open new doors in the realm of 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.
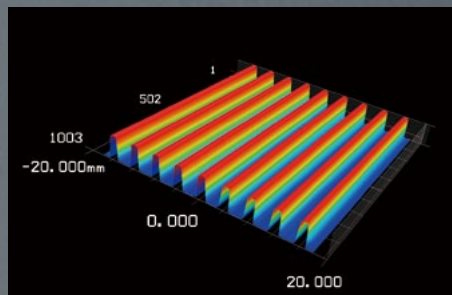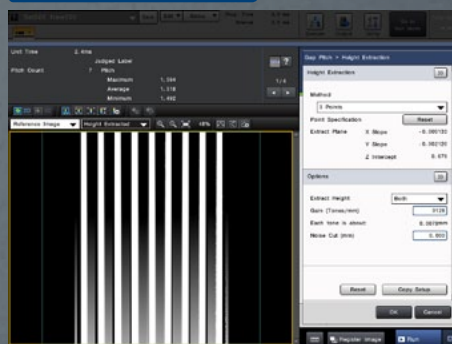
3D DATA

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!
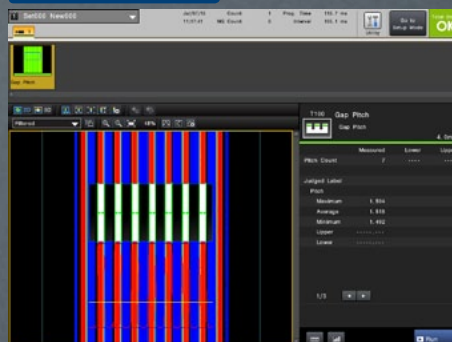
Inspection and Measurement

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, but 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 always 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 such properties as height and depth on a curved surface.
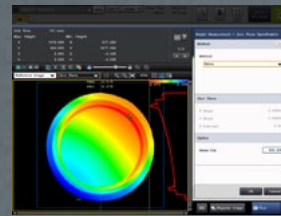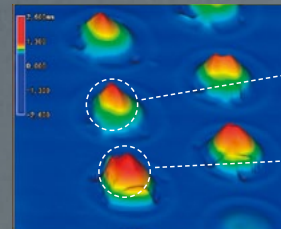

Before correction　**After correction**
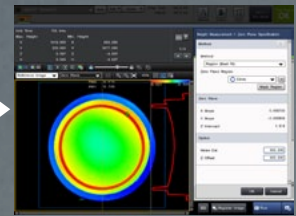
Even if a workpiece is inclined, the zero plane is automatically set according to the workpiece to obtain an accurate shape.

Area and Volume Measurement

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

2.681
4.300

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.
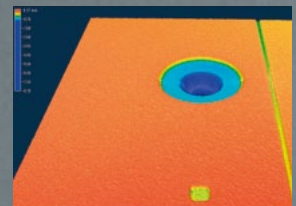
Height image　　**Pre-processed image**

TAKE FULL ADVANTAGE OF ALL THE FUNCTIONALITY FOUND IN CONVENTIONAL IMAGING EQUIPMENT

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 hard to detect with conventional image processing can now be detected by combining, for example, free-form plane extraction and OCR.

Workpiece photo

Height data

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

Also 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.
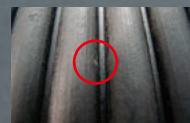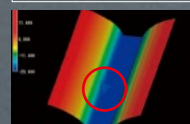

Workpiece photo

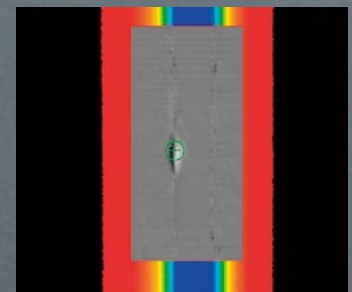**Height data**

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
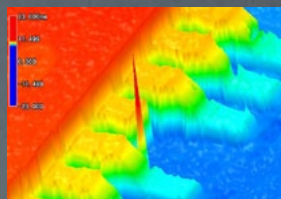
After noise reduction
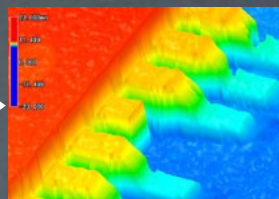
Vibration Compensation Filter

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

Noise caused by vibration

Original image
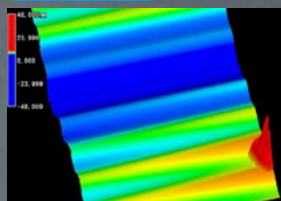
Processed image
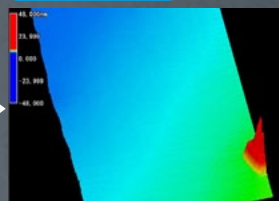
Noise caused by eccentricity

Original image
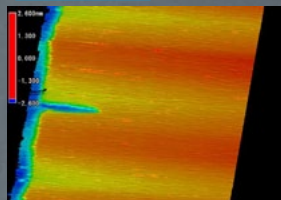
Processed image
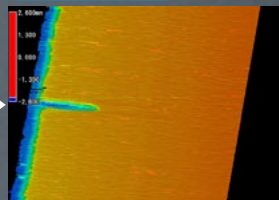
DUAL HEAD Dead Angle Removal Function

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

Actual workpiece

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

Head A

Head B
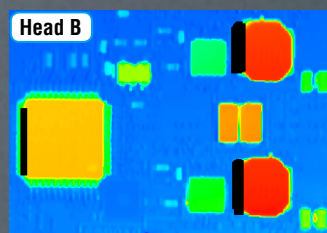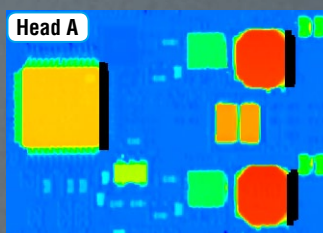
Composition

Composite image
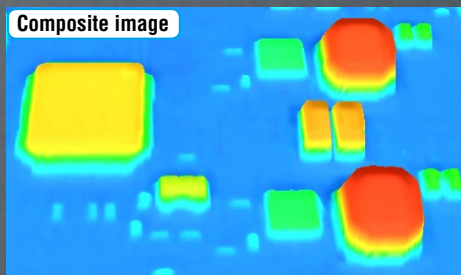
It is possible to create an image without any missing points by using the "Dual head dead angle removal function".
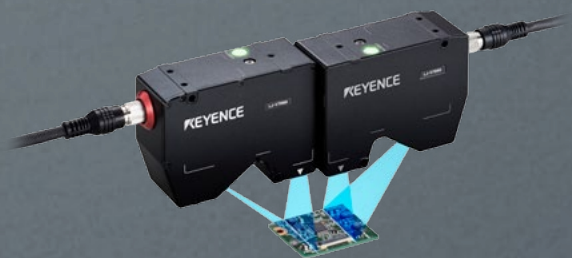
OPTICAL FOCUS AND DEPTH OF FIELD ADVANTAGES OF THE LJ-V SERIES

3D measurement camera
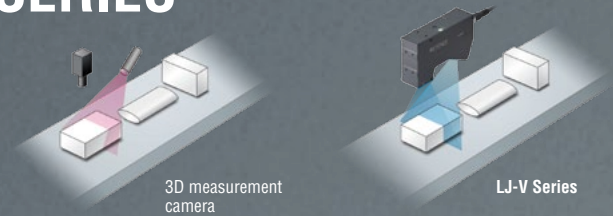
LJ-V Series

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	LJ-V Series
Loss of focus	HSE³-CMOS
Semiconductor laser	Semiconductor laser
General CMOS	

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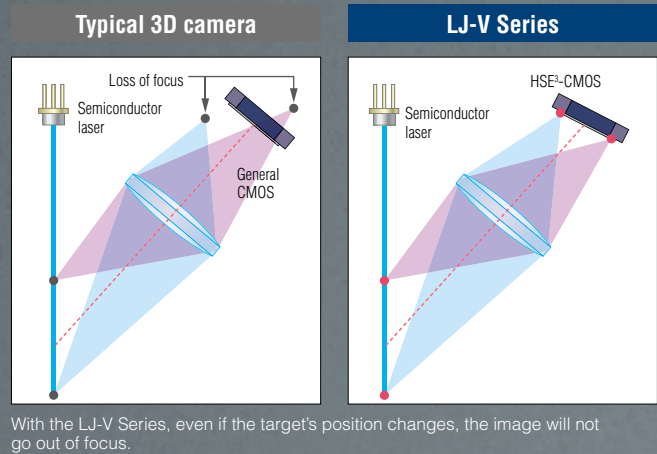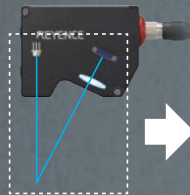
Better Dynamic Range

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.

RECEIVED LIGHT WAVEFORM

Typical 3D camera	LJ-V Series

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

Stable measurements can be performed.
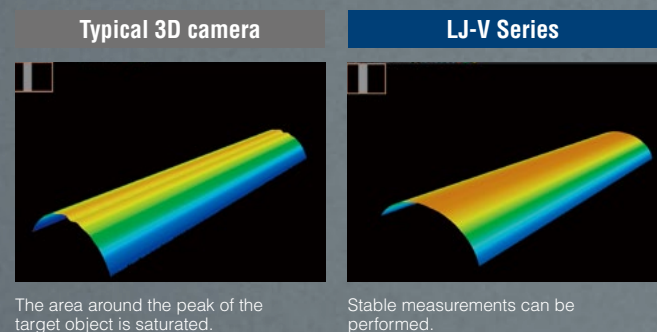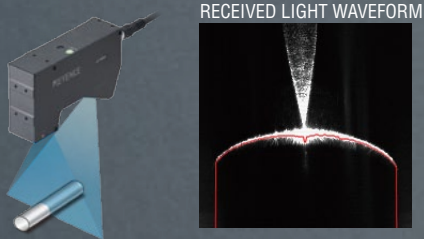
Better Ease of Use

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	LJ-V Series
3D CAMERA	LJ-V
GENERATED PROFILE	GENERATED PROFILE

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

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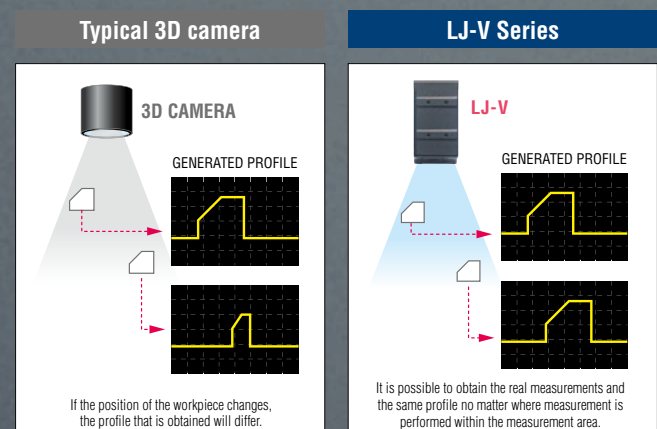
SYSTEM CONFIGURATION

LJ-V Series

Sensor/other

Sensor head

Controller

Display output unit

Communication unit

PC

Encoder

Connection cable

I/O

Analog voltage

RS-232C

Ethernet

EtherNet/IP™ PROFINET

PLC

PLC

PC

Console

RGB Monitor

Touch panel HMI

LJ-V Series + Image Processing System

SD card

Encoder

Sensor head

PLC

Connection cable

Sensor/other

Ethernet

USB

USB HDD

USB

RGB Monitor

Touch panel HMI

PC
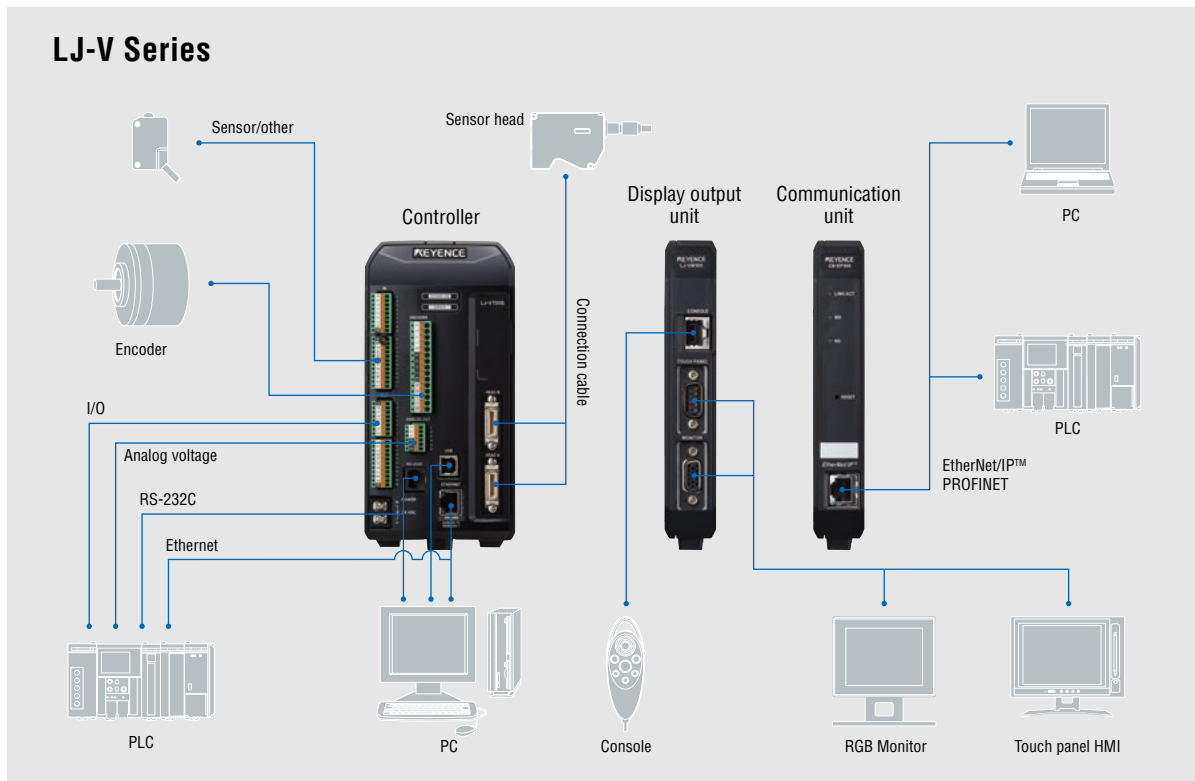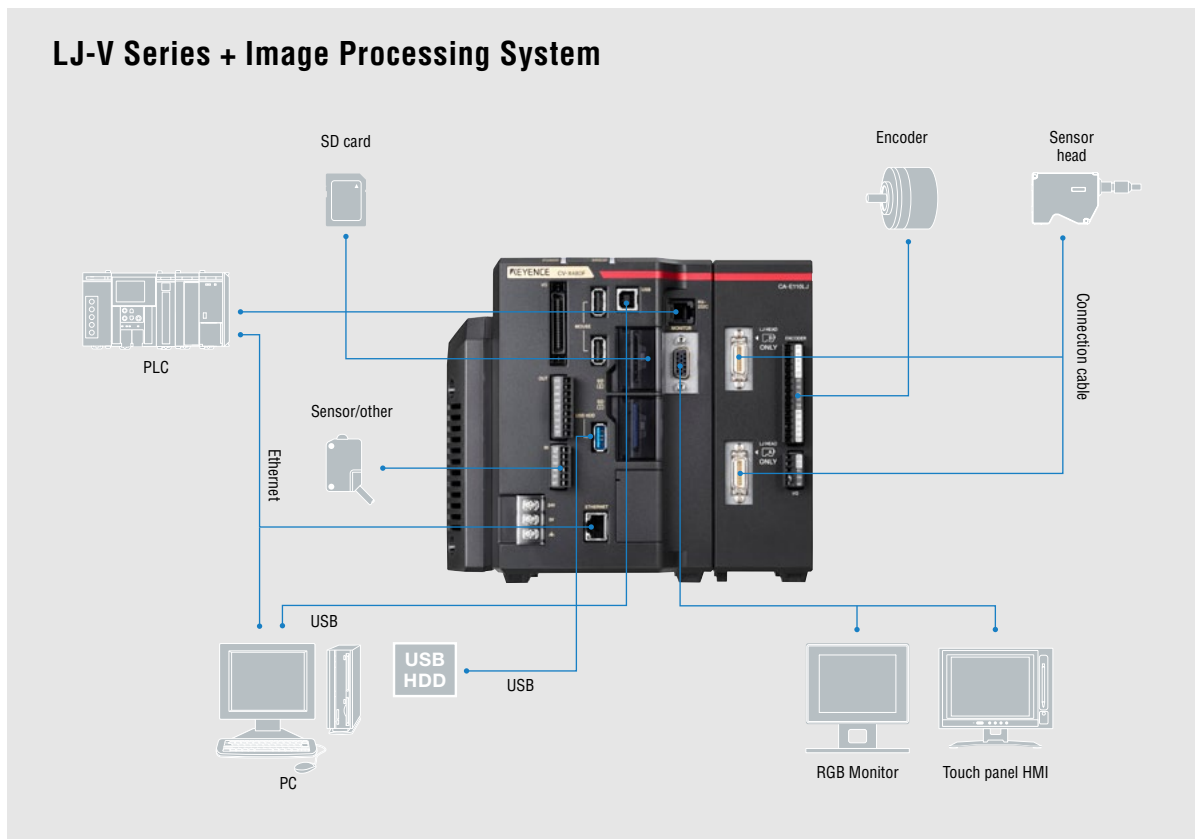
COMPONENTS SELECTION GUIDE

SENSOR HEAD

Ultra high-accuracy	Ultra high-accuracy specular reflection	High-accuracy	High-accuracy specular reflection
LJ-V7020	**LJ-V7020K**	**LJ-V7060**	**LJ-V7060K**

(mm)
(inch)

450 17.72"
400 15.75"
350 13.78"
300 11.81"
250 9.84"
200 7.87"
150 5.91"
100 3.94"
50 1.97"
0

Measurement range 20±2.6 mm (0.79"±0.1")

Measurement range 24.2±2.3 mm (0.95"±0.09")

Measurement range 60±8 mm (2.36"±0.31")

Measurement range 54.6±7.6 mm (2.15"±0.30")

LJ-V7020
17.4 mm 0.69"
20 mm 0.79"
22.6 mm 0.89"
Width: 6.5 mm 0.26"
Width: 7 mm 0.28"
Width: 7.5 mm 0.30"

Measurement range	Z-axis 20±2.6 mm	0.79"±0.1"
	X-axis 7 mm	0.28"
Repeatability	Z-axis 0.2 µm	0.000008"
	X-axis 2.5 µm	0.000099"

LJ-V7020K
21.9 mm 0.86"
24.2 mm 0.95"
26.5 mm 1.04"
Width: 6.5 mm 0.26"
Width: 7 mm 0.28"
Width: 7.5 mm 0.30"

Measurement range	Z-axis 24.2±2.3 mm	0.95"±0.09"
	X-axis 7 mm	0.28"
Repeatability	Z-axis 0.2 µm	0.000008"
	X-axis 2.5 µm	0.000099"

LJ-V7060
52 mm 2.05"
60 mm 2.36"
68 mm 2.68"
Width: 13.5 mm 0.53"
Width: 15 mm 0.59"
Width: 15 mm 0.59"

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

LJ-V7060K
47 mm 1.85"
54.6 mm 2.15"
62.2 mm 2.45"
Width: 8 mm 0.31"
Width: 14 mm 0.55"
Width: 8 mm 0.31"

Measurement range	Z-axis 54.6±7.6 mm	2.15"±0.30"
	X-axis 14 mm	0.55"
Repeatability	Z-axis 0.4 µm	0.000016"
	X-axis 5 µm	0.000197"

Required

Head-to-controller cable
CB-B3 (3 m 9.8')
CB-B10 (10 m 32.8')

Extension cable
CB-B5E (5 m 16.4')
CB-B10E (10 m 32.8')
CB-B20E (20 m 65.6')

Required

Controller
LJ-V7000(P)

Settings monitor software
LJ-H3

USB cable
OP-66844

Controller variations

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

* 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
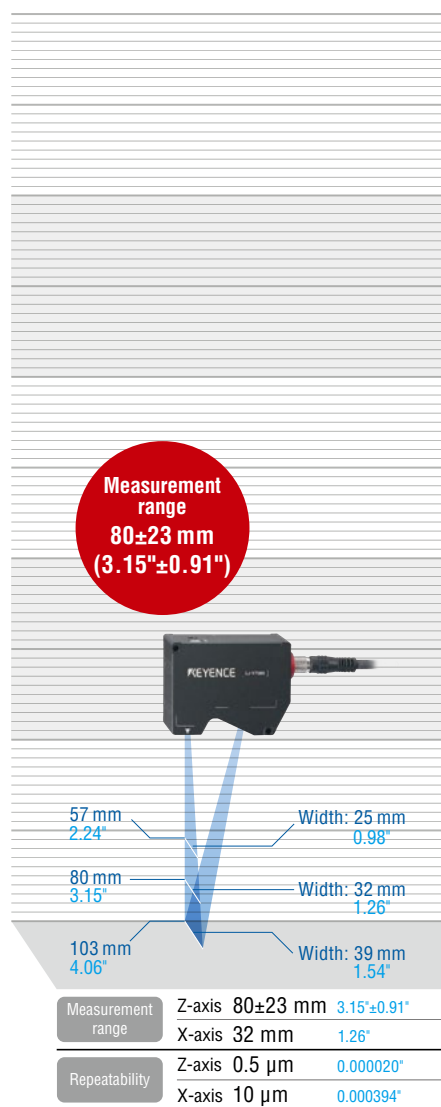**CA-E100LJ/CA-E110LJ**

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')
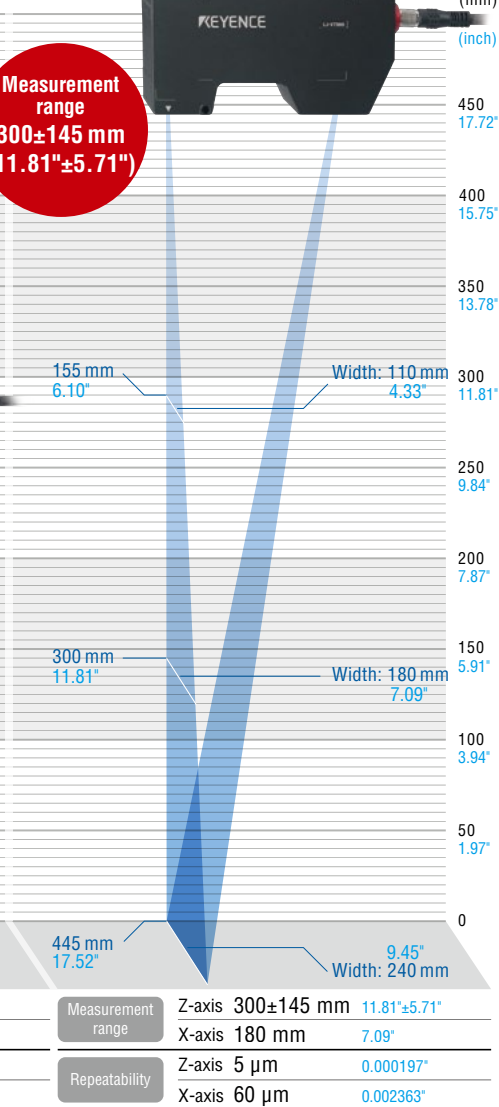
D-sub 9 pin connector
OP-26401

Middle range	Long range	Ultra-long range
LJ-V7080	**LJ-V7200**	**LJ-V7300**

(mm)
(inch)

Measurement range 300±145 mm (11.81"±5.71")

Measurement range 200±48 mm (7.87"±1.89")

Measurement range 80±23 mm (3.15"±0.91")

450 17.72"
400 15.75"
350 13.78"
300 11.81"
250 9.84"
200 7.87"
150 5.91"
100 3.94"
50 1.97"
0

155 mm 6.10" Width: 110 mm 4.33"
300 mm 11.81" Width: 180 mm 7.09"
445 mm 17.52" 9.45" Width: 240 mm

152 mm 5.98" Width: 51mm 2.01"
200 mm 7.87" Width: 62mm 2.44"
248 mm 9.76" Width: 73mm 2.87"

57 mm 2.24" Width: 25 mm 0.98"
80 mm 3.15" Width: 32 mm 1.26"
103 mm 4.06" Width: 39 mm 1.54"

| Measurement range	Z-axis 80±23 mm	3.15"±0.91"		Measurement range	Z-axis 200±48 mm	7.87"±1.89"		Measurement range	Z-axis 300±145 mm	11.81"±5.71"
	X-axis 32 mm	1.26"			X-axis 62 mm	2.44"			X-axis 180 mm	7.09"
Repeatability	Z-axis 0.5 µm	0.000020"		Repeatability	Z-axis 1 µm	0.000040"		Repeatability	Z-axis 5 µm	0.000197"
	X-axis 10 µm	0.000394"			X-axis 20 µm	0.000788"			X-axis 60 µm	0.002363"

Connect to PC

Connect using the USB cable included with the PC software or an Ethernet cable.

USB cable **OP-66844**
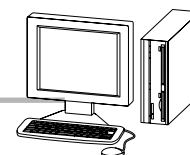
PC (not included)

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

CE

Controller

Model		LJ-V7001	LJ-V7001P
No. of connectable sensors		Max. 2 units	
Display	Minimum display unit	0.1 µm 0.000004*, 0.00001 mm², 0.01°	
	Maximum display range	±9999.99 mm, ±9999.99 mm²	
Input terminal block	Laser remote interlock input	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

CE

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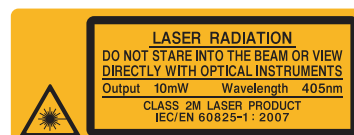*2 Home Premium, Professional, and Ultimate editions are supported.
*3 Ultimate, Business, Home Premium, and Home Basic editions are supported.
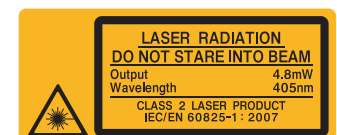*4 Professional and Home editions are supported.
*5 Connection through a USB hub is not included in the guarantee.

LASER WARNING/EXPLANATORY LABEL

LJ-V7020, LJ-V7020K, LJ-V7060

LASER RADIATION
DO NOT STARE INTO THE BEAM OR VIEW
DIRECTLY WITH OPTICAL INSTRUMENTS
Output   10mW   Wavelength   405nm
CLASS 2M LASER PRODUCT
IEC/EN 60825-1 : 2007

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

LASER RADIATION
DO NOT STARE INTO BEAM
Output   4.8mW
Wavelength   405nm
CLASS 2 LASER PRODUCT
IEC/EN 60825-1 : 2007

PROFINET unit CE

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

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

EtherNet/IP™ unit CE

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

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

Sensor head unit CE

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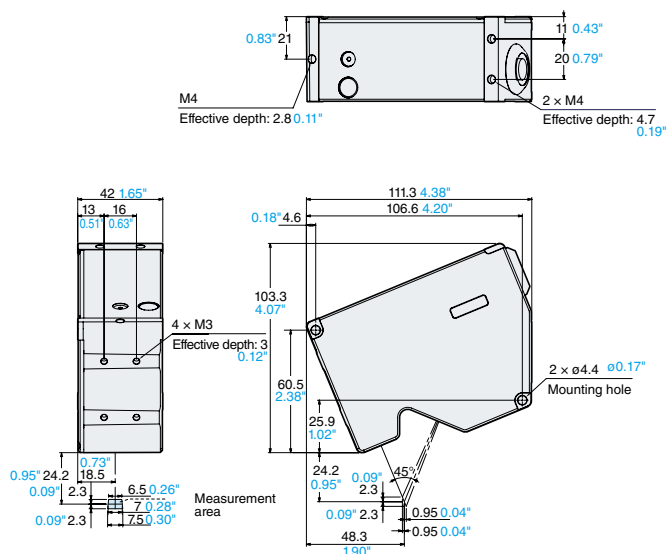*12 Do not look into the beam directly using any optical instruments (such as eye loupes, magnifiers, microscopes, telescopes, or binoculars). Viewing the laser output with an optical instrument may pose an eye hazard.
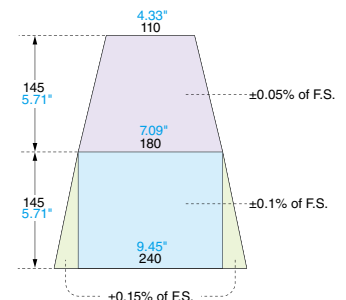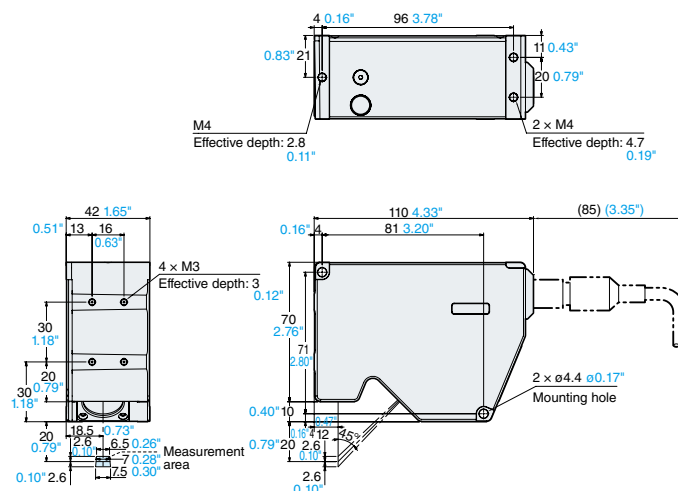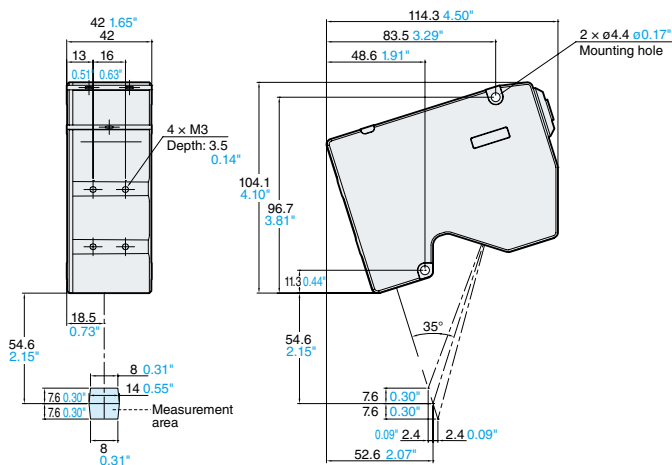
DIMENSIONS

Sensor head
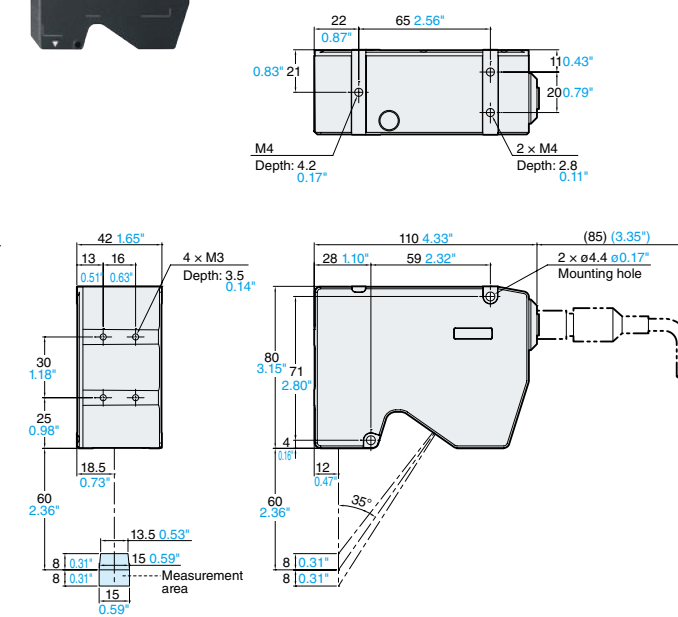
Ultra high-accuracy specular reflection model
LJ-V7020K
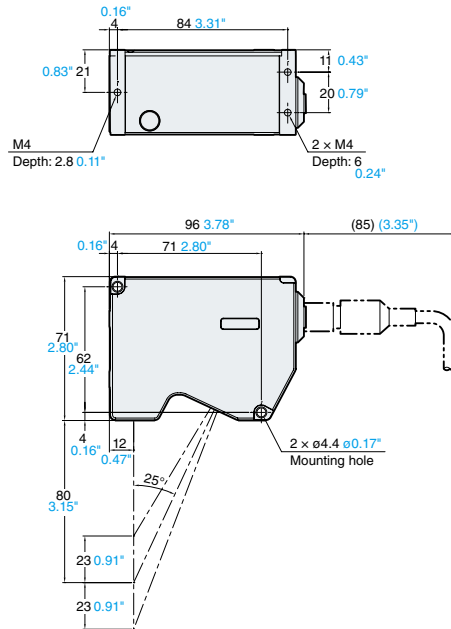

Ultra high-accuracy model
LJ-V7020

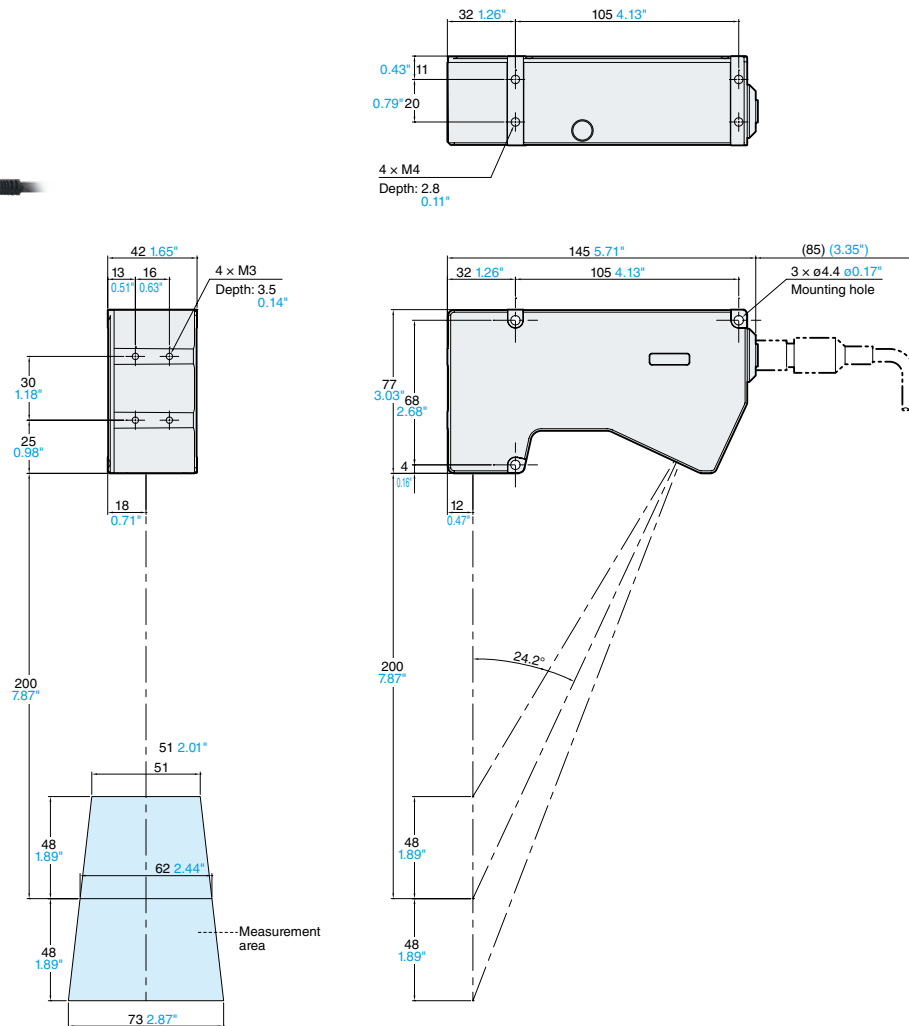High-accuracy specular reflection model
LJ-V7060K

High-accuracy model
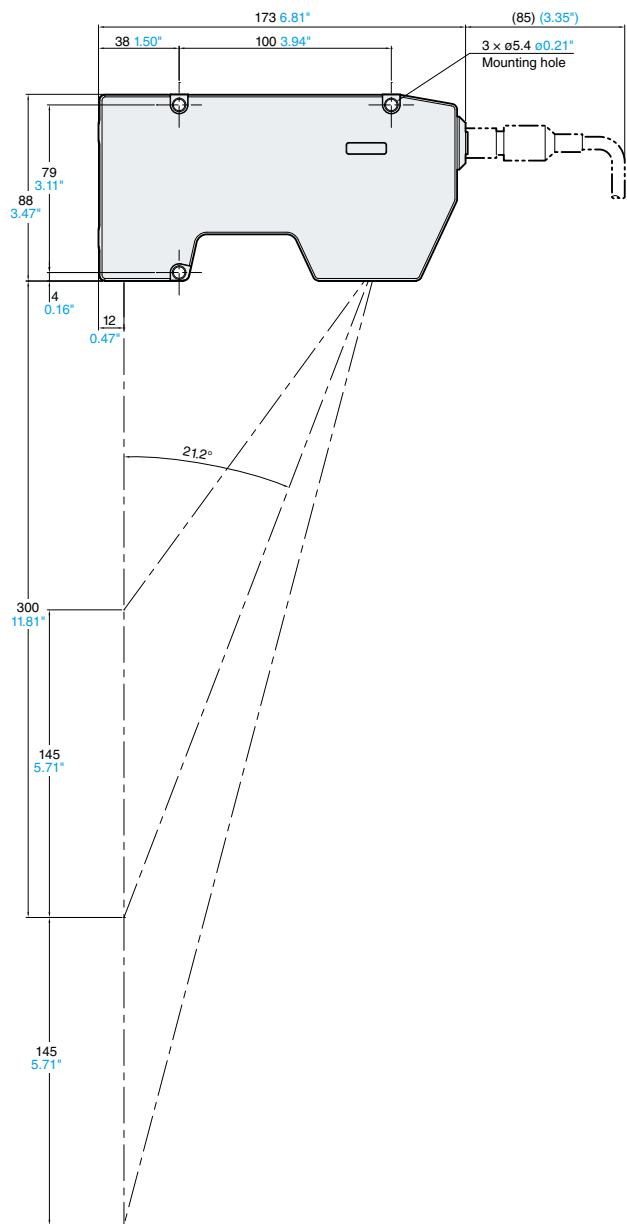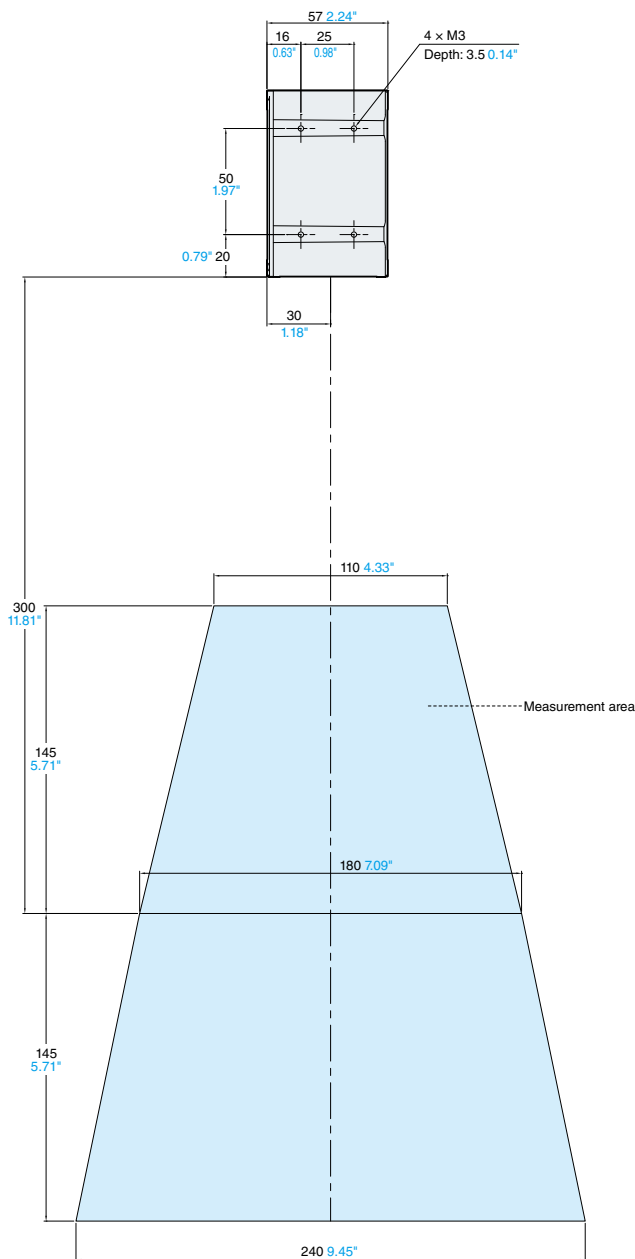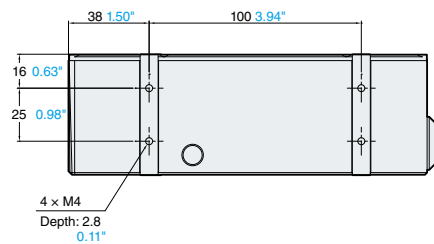**LJ-V7060**

Middle-range model
LJ-V7080

0.16"
4 84 3.31"
0.83" 21
11 0.43"
20 0.79"
M4
Depth: 2.8 0.11"
2 × M4
Depth: 6
0.24"

42 1.65"
14 16
0.55" 0.63"
4 × M3
Depth: 3.5
0.14"
30
1.18"
20 0.79"
18
0.71"
80
3.15"
25 0.98"
23
0.91"
32 1.26"
23
0.91"
39 1.54"
Measurement area

96 3.78"
(85) (3.35")
0.16" 4
71 2.80"
71
2.80"
62
2.44"
4
0.16"
12
0.47"
2 × ø4.4 ø0.17"
Mounting hole
25°
80
3.15"
23 0.91"
23 0.91"

Long-range model
LJ-V7200

32 1.26" 105 4.13"
0.43" 11
0.79" 20
4 × M4
Depth: 2.8
0.11"

42 1.65"
13 16
0.51" 0.63"
4 × M3
Depth: 3.5
0.14"
30
1.18"
25
0.98"
18
0.71"
200
7.87"
51 2.01"
51
48
1.89"
62 2.44"
48
1.89"
73 2.87"
Measurement area

145 5.71"
(85) (3.35")
32 1.26"
105 4.13"
3 × ø4.4 ø0.17"
Mounting hole
77
3.03" 68
2.68"
4
0.16"
12
0.47"
200
7.87"
24.2°
48
1.89"
48
1.89"

DIMENSIONS

Sensor head

Ultra-long range model
LJ-V7300

38 1.50"   100 3.94"

16 0.63"
25 0.98"

4 × M4
Depth: 2.8
0.11"

57 2.24"

16 0.63"   25 0.98"   4 × M3
Depth: 3.5 0.14"

50 1.97"

0.79" 20

30 1.18"

110 4.33"

300 11.81"

---------- Measurement area

145 5.71"

180 7.09"

145 5.71"

240 9.45"

173 6.81"   (85) (3.35")

38 1.50"   100 3.94"   3 × ø5.4 ø0.21"
Mounting hole

79 3.11"

88 3.47"

4 0.16"

12 0.47"

21.2°

300 11.81"

145 5.71"

145 5.71"

28

Controller/Cable/Monitor

Multi-function controller
LJ-V7001(P)
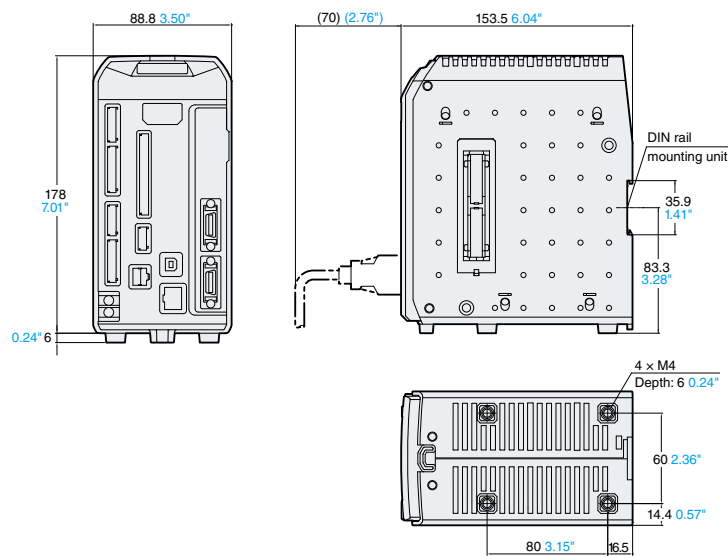
Display output unit
LJ-VM100
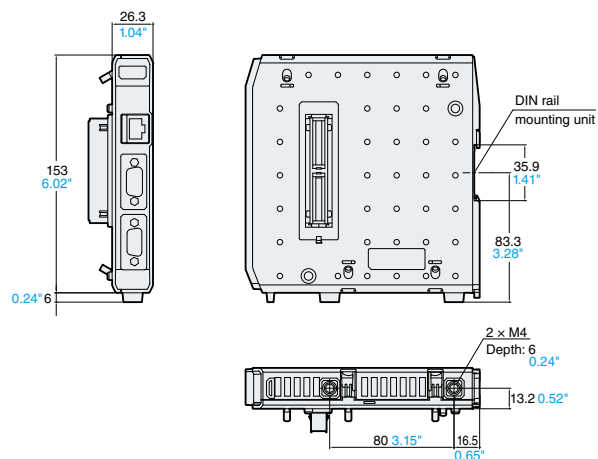
26.3 1.04"
153 6.02"
0.24" 6
DIN rail mounting unit
35.9 1.41"
83.3 3.28"
2 × M4
Depth: 6 0.24"
13.2 0.52"
80 3.15"
16.5 0.65"

88.8 3.50"
(70) (2.76")
153.5 6.04"
178 7.01"
0.24" 6
DIN rail mounting unit
35.9 1.41"
83.3 3.28"
4 × M4
Depth: 6 0.24"
60 2.36"
14.4 0.57"
80 3.15"
16.5 0.65"

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

26.3 1.04"
153 6.02"
0.24" 6
150.6 5.93"
DIN rail mounting unit
35.9 1.41"
83.3 3.28"
2 × M4
Depth: 6 0.24"
13.2 0.52"
80 3.15"
16.5 0.65"

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

41 1.61"
31 1.22"
ø7.6 ø0.30"
Cable length
(3 m, 10 m) (9.8', 32.8')
55 2.17"
0.71" 18
14 16.5 0.65"
0.55"
1.26" 32
0.51" 13
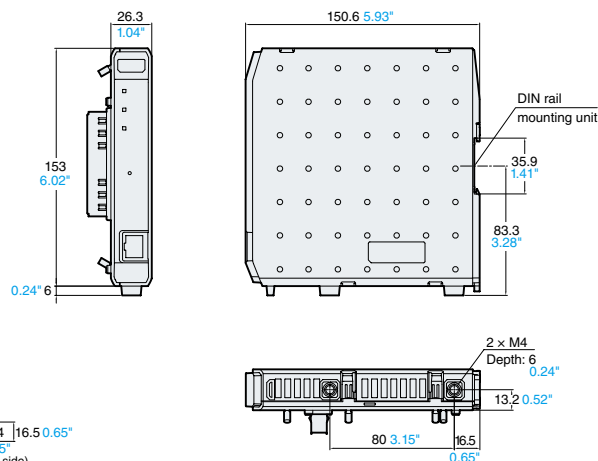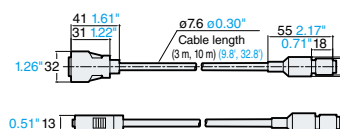
Extension cable
CB-B5E/CB-B10E/CB-B20E

51 2.01"
14 0.55"
ø7.6 ø0.30"
Cable length
(5 m, 10 m, 20 m) (16.4', 32.8', 65.6')
55 2.17"
0.71" 18
16.5 14
0.65" 0.55"
(CB-B cable side)
14 16.5 0.65"
0.55"
(Sensor head side)

Touch panel HMI
CA-MP120T

247.4 9.74"
(Effective display)
0.26" 6.5
255 10.04"
186 7.32"
(Effective display)
15 0.59"
360 14.17"
ø10 ø0.39"
8.1 0.32"
6 0.24"
28 1.10"
55.5 2.19"
(49.5) (1.95")
75 2.95"
75 2.95"
35 1.38"
240 9.45"
342 13.46"
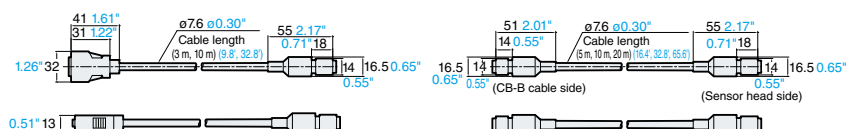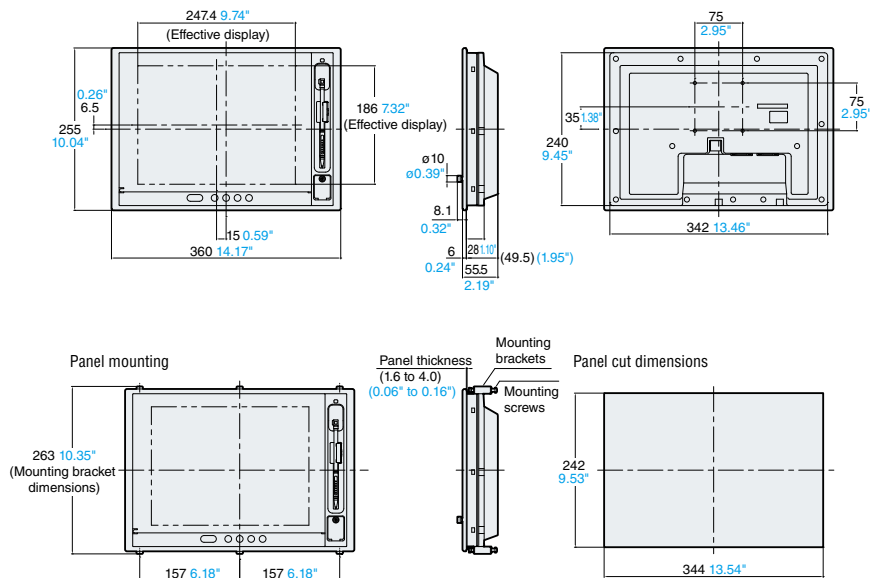
Specialized monitor stand
OP-87262

315 12.40"
187.5 7.38"
200 7.87"
5 0.20"
4 × 2 × R2.5
85 3.35"
0.31" 8
1.77" 45
250 9.84"
260 10.24"

Panel mounting

263 10.35"
(Mounting bracket dimensions)
157 6.18"
157 6.18"

Panel thickness
(1.6 to 4.0)
(0.06" to 0.16")
Mounting brackets
Mounting screws

Panel cut dimensions

242 9.53"
344 13.54"

29
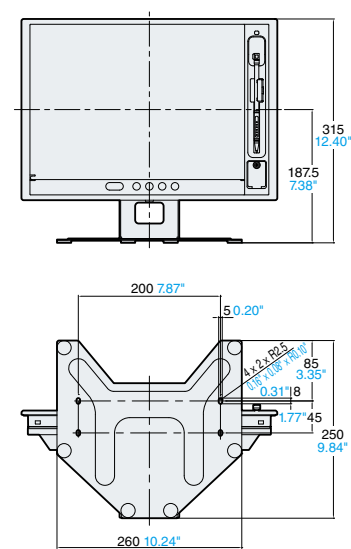
2D MEASUREMENT

HEIGHT AND STEP DIFFERENCE
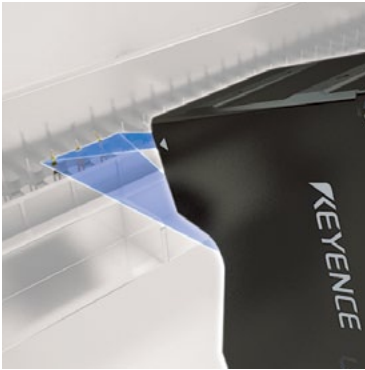
Pin height and step height measurement
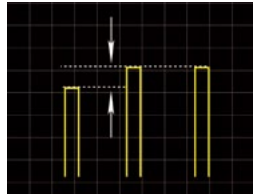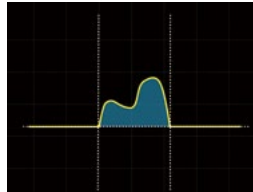
WIDTH AND POSITION
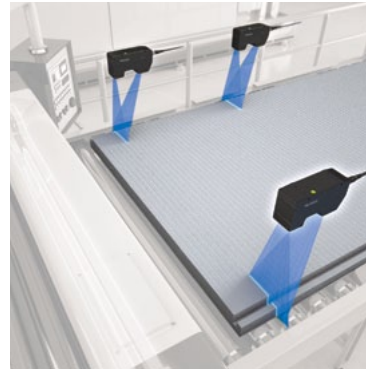
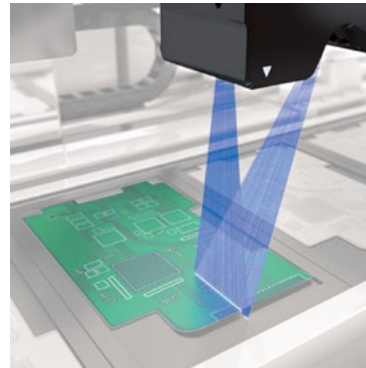Building material board positioning
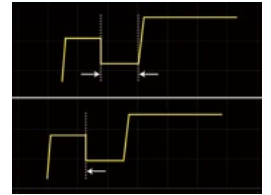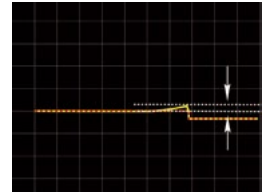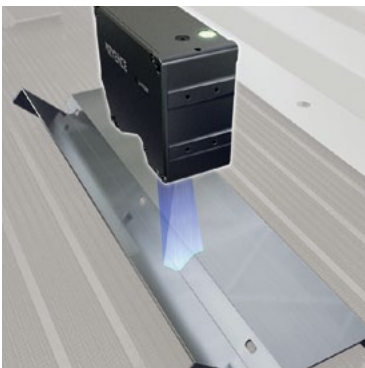
PROFILE AND CROSS SECTION

Sealant inspection

WARPAGE AND FLATNESS

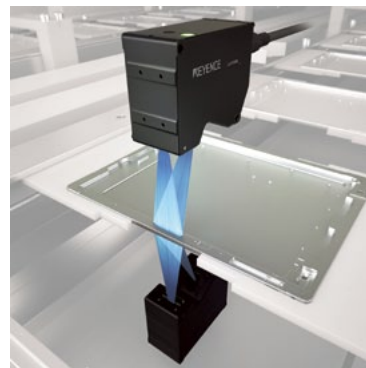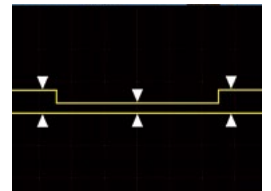Warpage measurement of PCBs

ANGLE AND RADIUS

Angle measurement of processed products

THICKNESS MEASUREMENT

Case thickness measurement

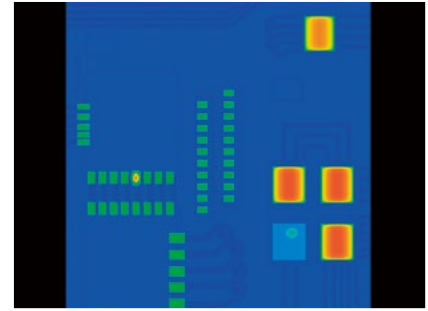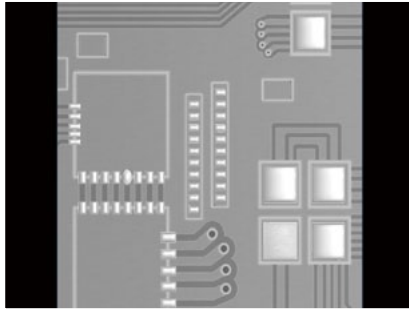# 3D MEASUREMENT (IMAGE PROCESSING)

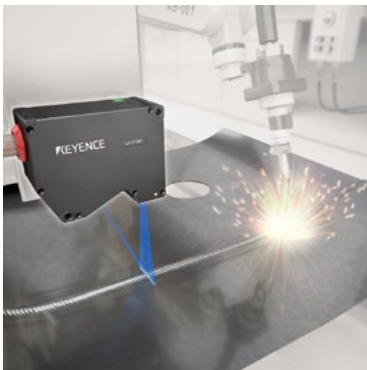SOLDERING BRIDGE AND
VOLUME INSPECTION

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.
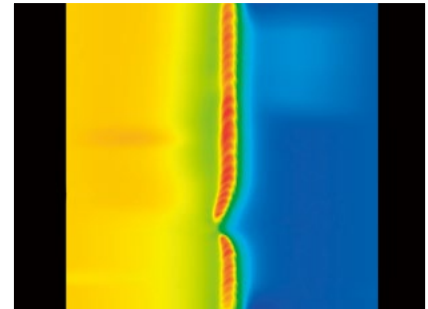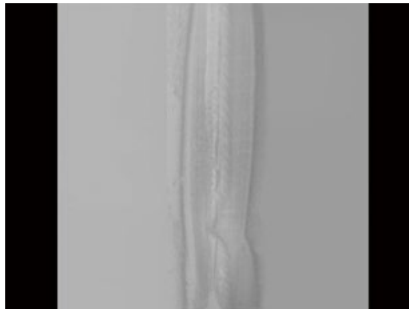

TAILORED BLANK WELDING
APPEARANCE INSPECTION

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.
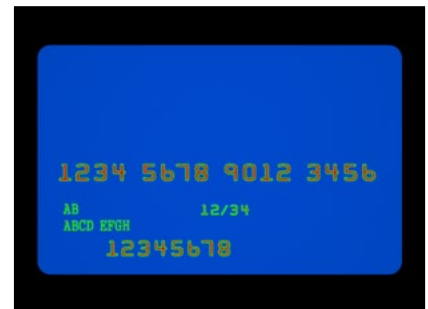

CARD NUMBER CHARACTER
RECOGNITION (OCR)

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.

www.keyence.com

KEYENCE

CALL TOLL FREE | TO CONTACT YOUR LOCAL OFFICE
1-888-KEYENCE
1 - 8 8 8 - 5 3 9 - 3 6 2 3

www.keyence.com

⚠ **SAFETY INFORMATION**
Please read the instruction manual carefully in order to safely operate any KEYENCE product.

CONTACT YOUR NEAREST OFFICE FOR RELEASE STATUS

KEYENCE CORPORATION OF AMERICA
Head Office 500 Park Boulevard, Suite 200, Itasca, IL 60143, U.S.A. **PHONE:** +1-201-930-0100 **FAX:** +1-855-539-0123 E-mail: keyence@keyence.com

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

KEYENCE CANADA INC.
Head Office PHONE: +1-905-366-7655 FAX: +1-905-366-1122 E-mail: keyencecanada@keyence.com
Montreal PHONE: +1-514-694-4740 FAX: +1-514-694-3206 Windsor PHONE: +1-905-366-7655 FAX: +1-905-366-1122

KEYENCE MEXICO S.A. DE C.V.
PHONE: +52-55-8850-0100 FAX: +52-81-8220-9097
E-mail: keyencemexico@keyence.com

KA1-1017

LJV-KA-C6-US 1126-2 611C88