ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

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**Full-service, independent repair center**
with experienced engineers and technicians on staff.

**We buy your excess, underutilized, and idle equipment**
along with credit for buybacks and trade-ins.

**Custom engineering**
so your equipment works exactly as you specify.

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**Expert team | Trust guarantee | 100% satisfaction**

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KEYENCE

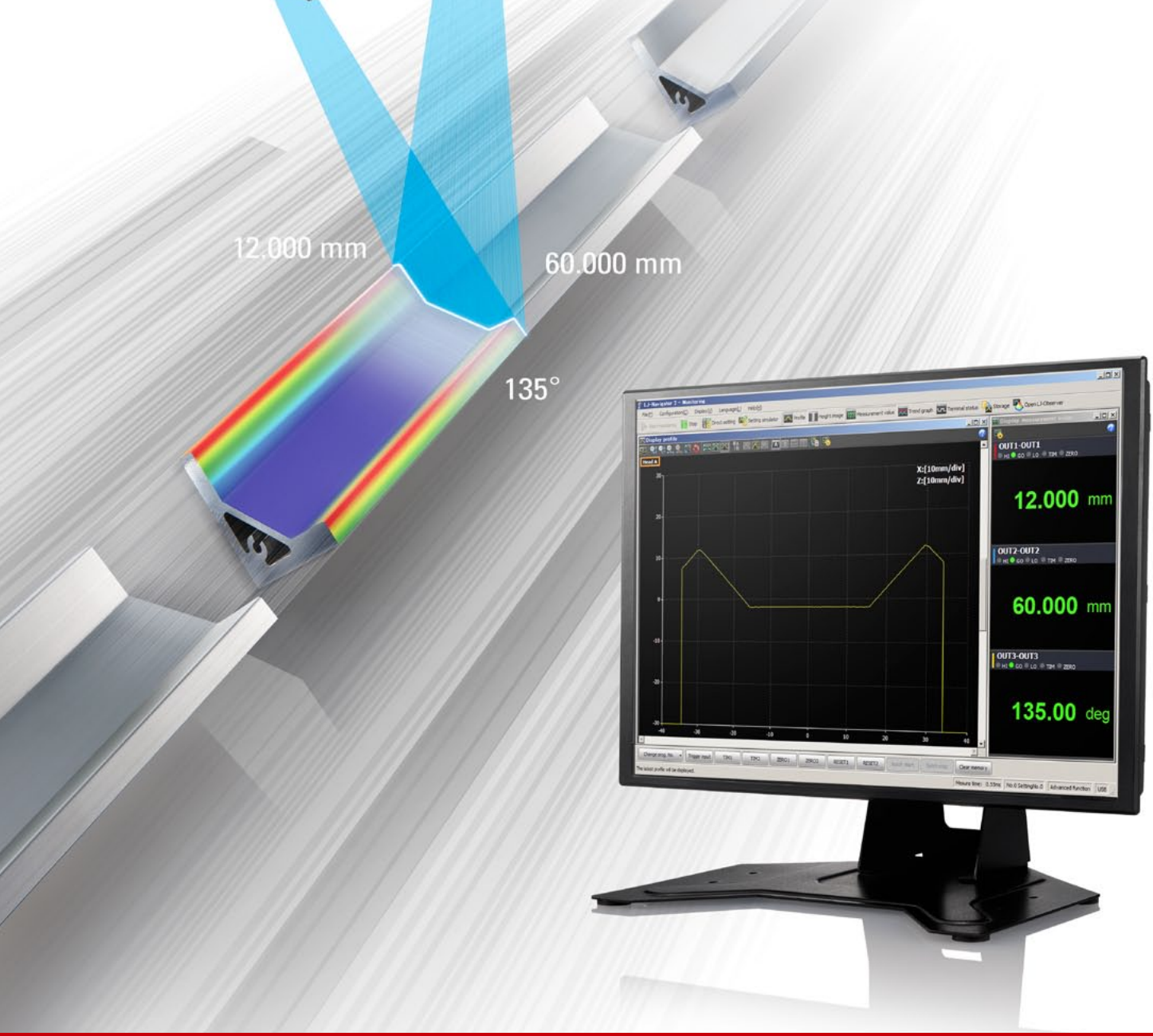
**High-speed 2D/3D Laser Scanner**
LJ-V7000 Series

CE




# INLINE PROFILE MEASUREMENT

## THE WORLD'S FASTEST AT 64000 PROFILES/SEC.






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# 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

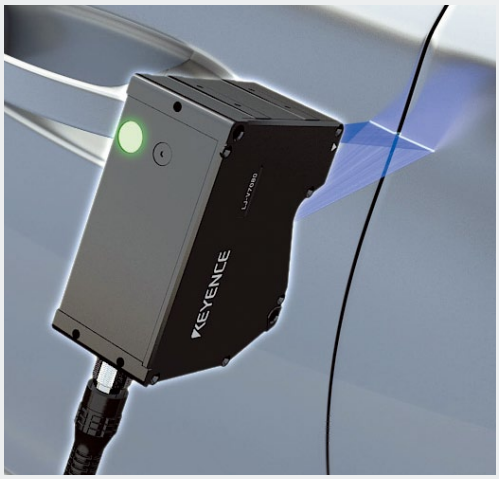
## NON-CONTACT MEASUREMENT

Direct measurement using a laser

**No damage to workpieces**

**No variation in results from person to person**

**No need to stop the line**

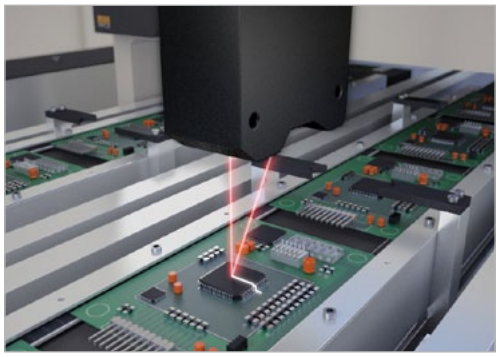





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## 1D LASER DISPLACEMENT SENSORS

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

## 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.

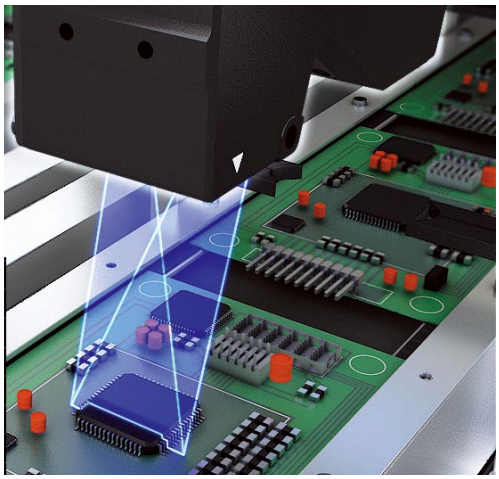


X and Y planes only

## ONE DEVICE FOR MULTIPLE SOLUTIONS

Measure once with a 2D laser

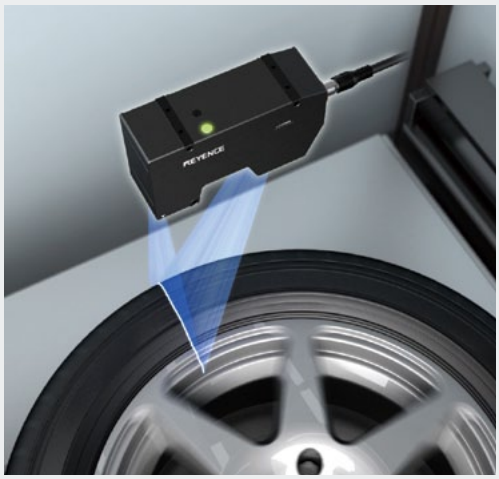
- **Various measurement modes**
- **Compact, space-saving design**
- **No need to move the sensor**



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

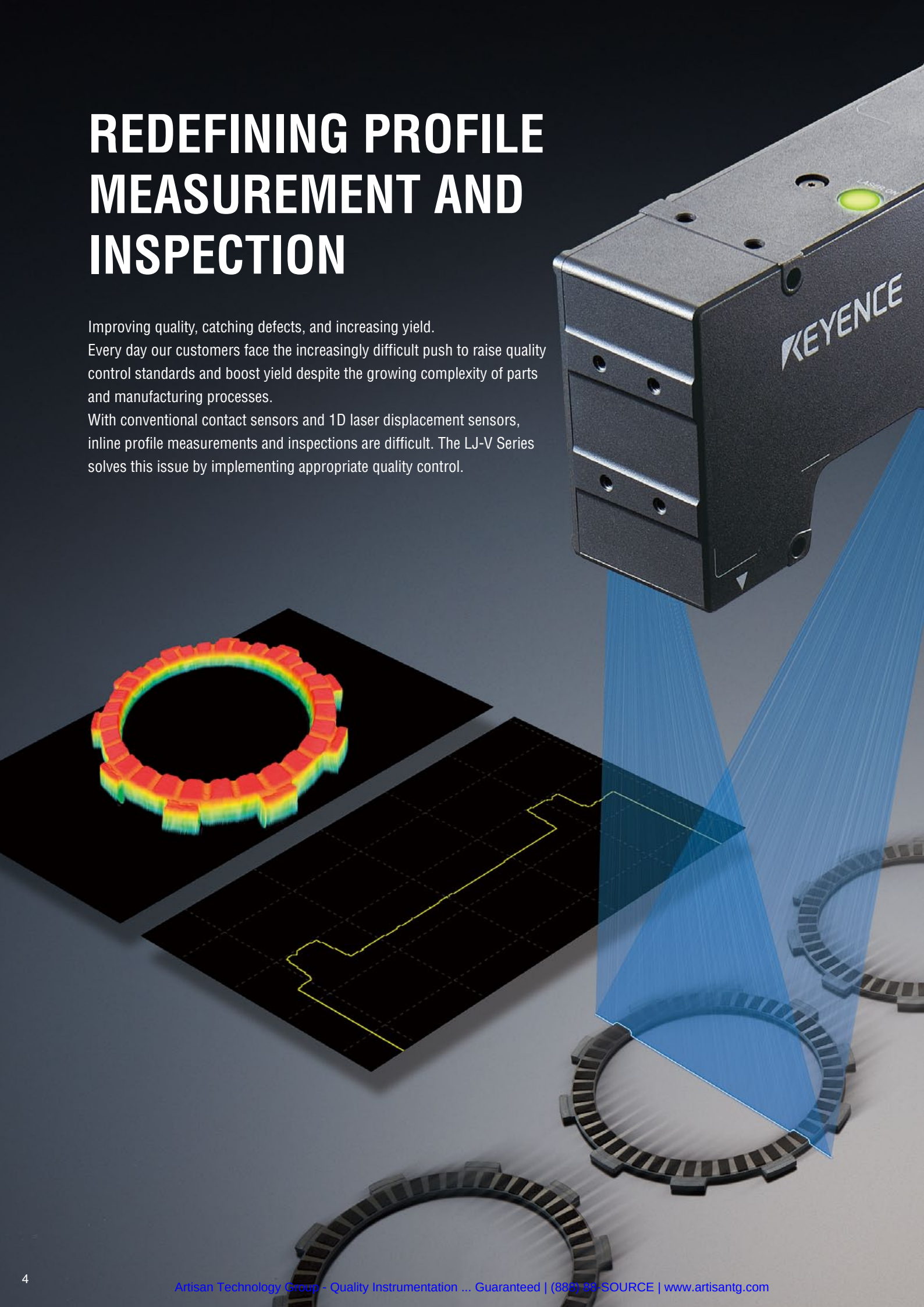
3D imaging with additional image processing

- **No lights necessary**
- **Height measurement**
- **No colour errors caused by colour 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.






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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.

* 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

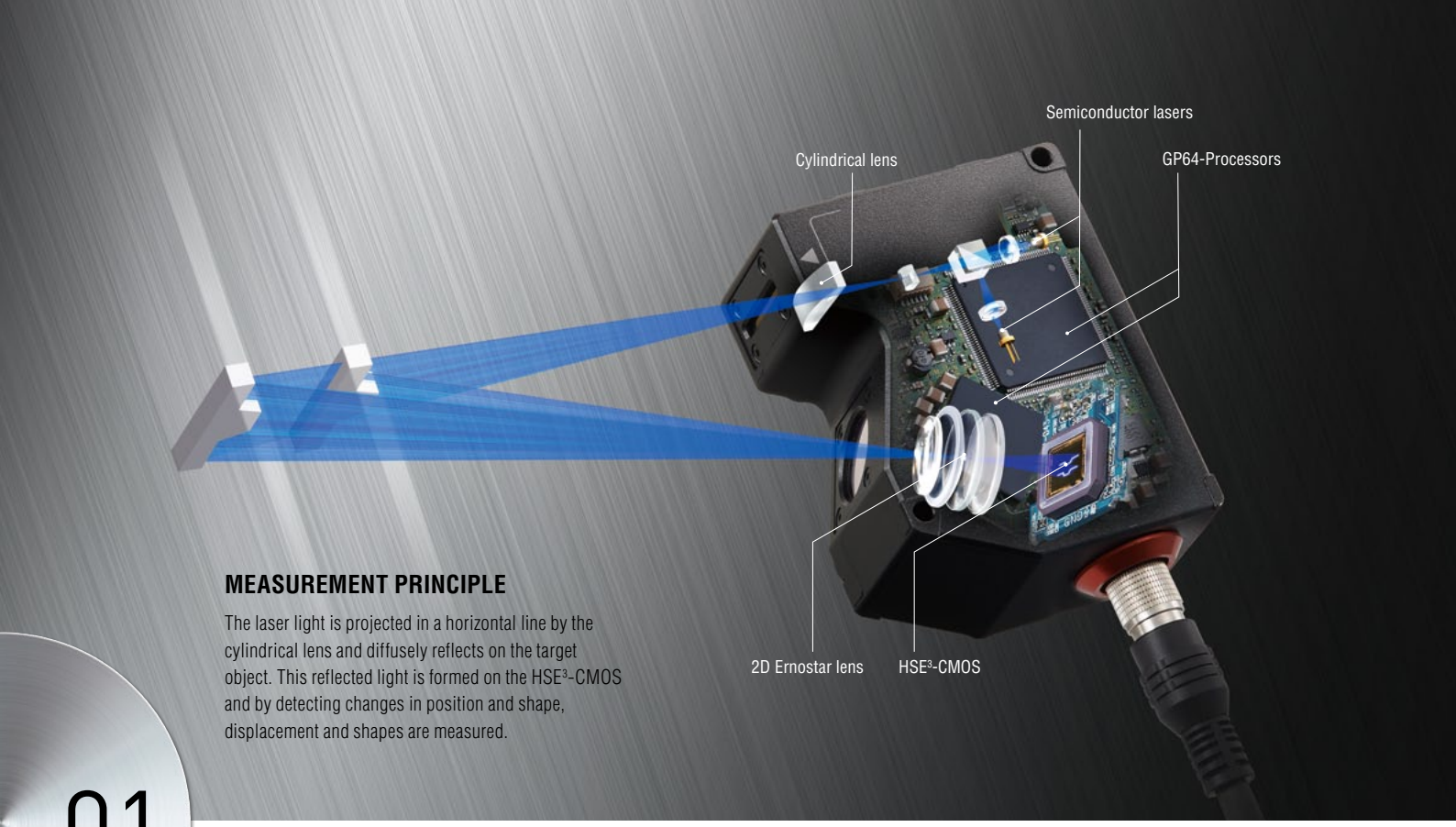
## ALL TYPES OF MEASUREMENTS ARE POSSIBLE WITH THIS SINGLE DEVICE

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 optimisation function makes operation easy for any user.



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

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### 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

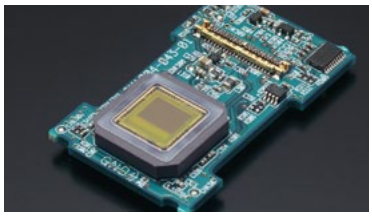
**NEWLY DEVELOPED** **WORLD'S GREATEST**

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

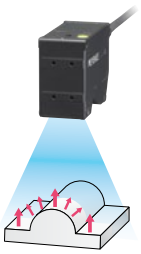
### ▷ HSE³-CMOS

* 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 lustre (large amount of reflection) due to it's wide dynamic range.

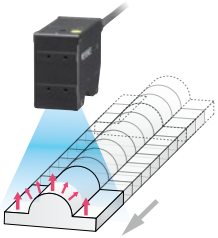


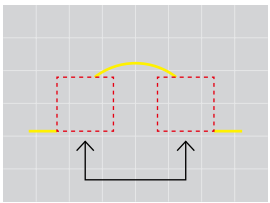
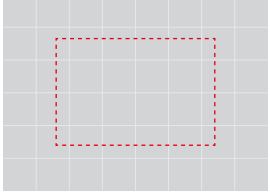
**STOPPED TARGET**



**MOVING TARGET**

DYNAMIC RANGE
**2400×**



| Conventional model | LJ-V HSE³-CMOS |
|---|---|
|  |  |
| Measurement is impossible due to insufficient light intensity. | All ranges could be measured. |
|  |  |
| 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. |



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NEWLY DEVELOPED

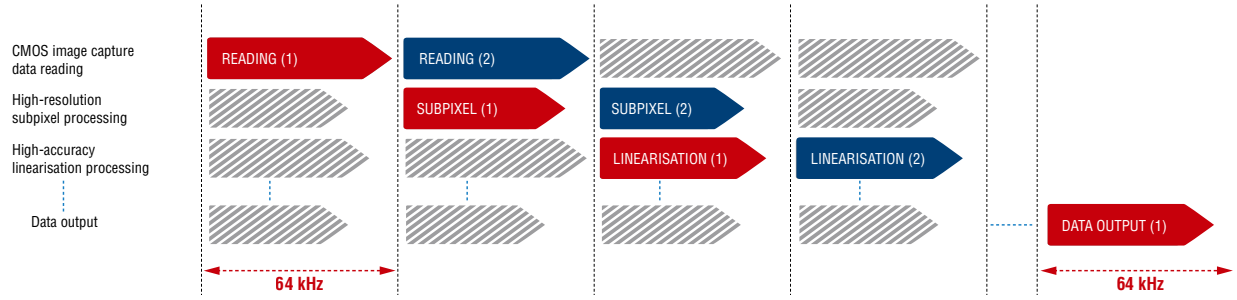
# ACHIEVING ULTRA HIGH-SPEED MEASUREMENTS AT 64 kHz

## ▷ 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 linearisation and data output. This allows for the measurement of objects moving at high-speeds with room to spare.

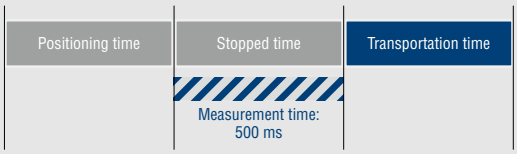





# MERITS PROVIDED BY ULTRA HIGH-SPEED SAMPLING

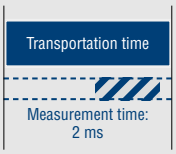
## REDUCED INSPECTION CYCLE TIME!

### Conventional model




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



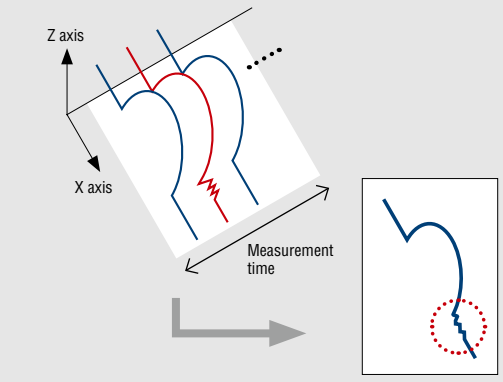

**NO POSITIONING TIME AND STOPPED TIME ARE NEEDED!**

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.

## STABILISED MEASURED VALUES!

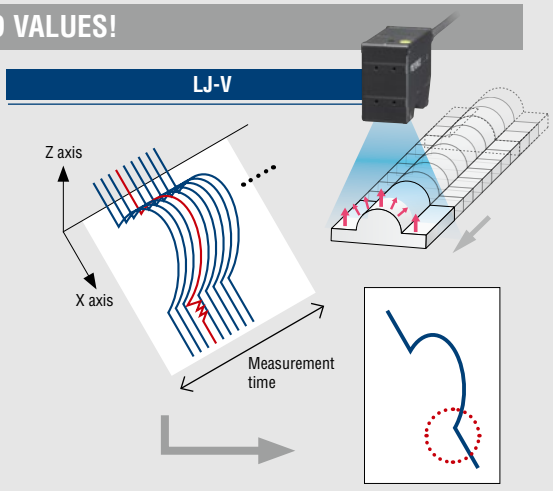
### Conventional model




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

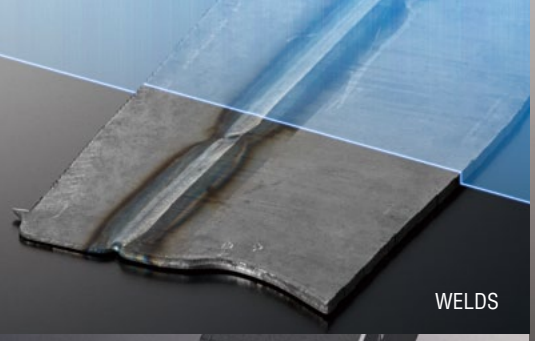


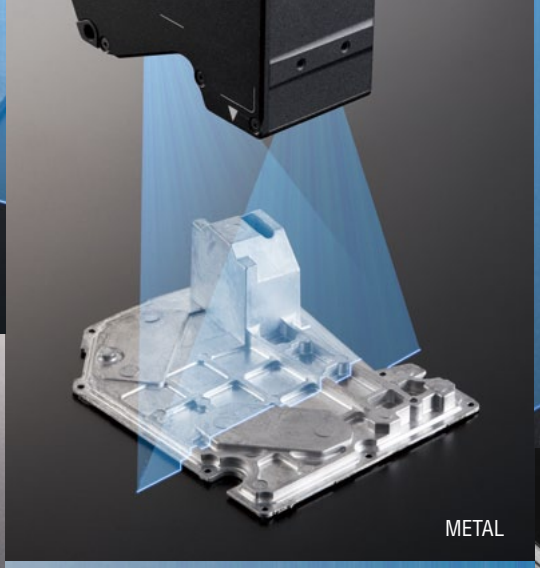

RESULT OF AVERAGING 720 PROFILES

The LJ-V Series provides significantly higher profile stability by utilising 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.



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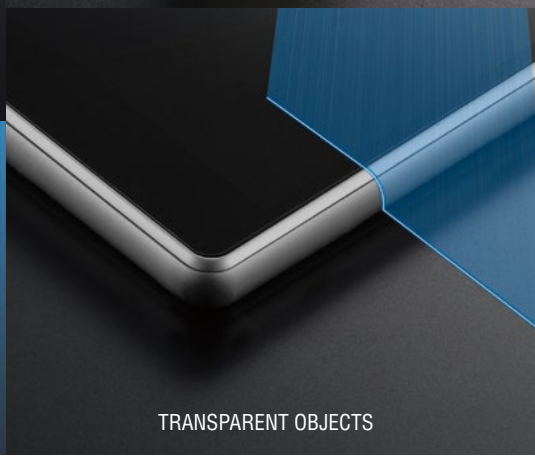













02

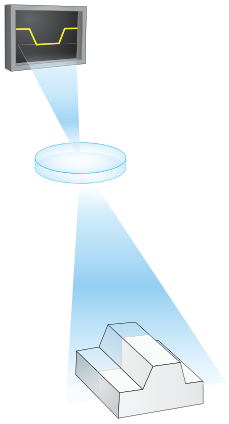
# OVERWHELMING WORKPIECE RESPONSE CAPABILITIES AND DETECTION STABILITY

**WORLD'S FIRST**

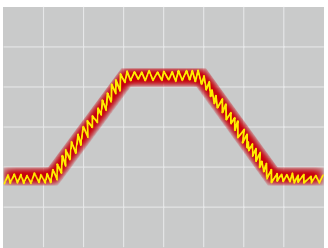
## FORMS ULTRA-STABLE AND HIGHLY ACCURATE PROFILE IMAGES

### ▷ 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 stabilised 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.

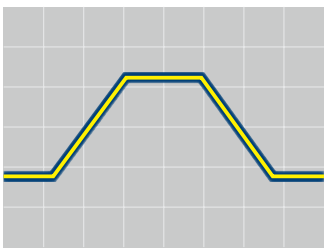


**RED LASER (CONVENTIONAL)**



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.



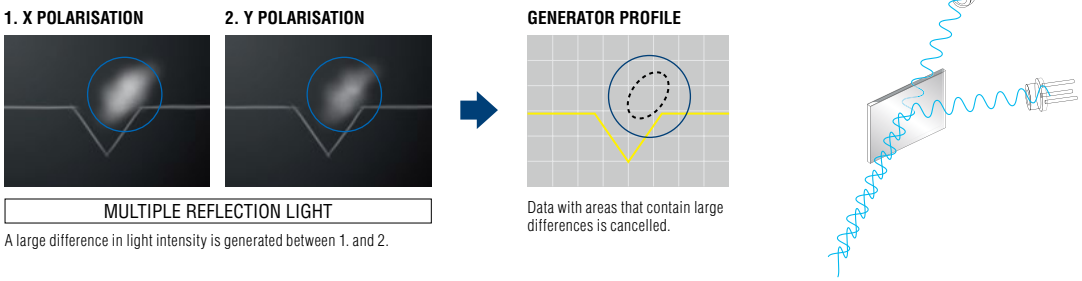
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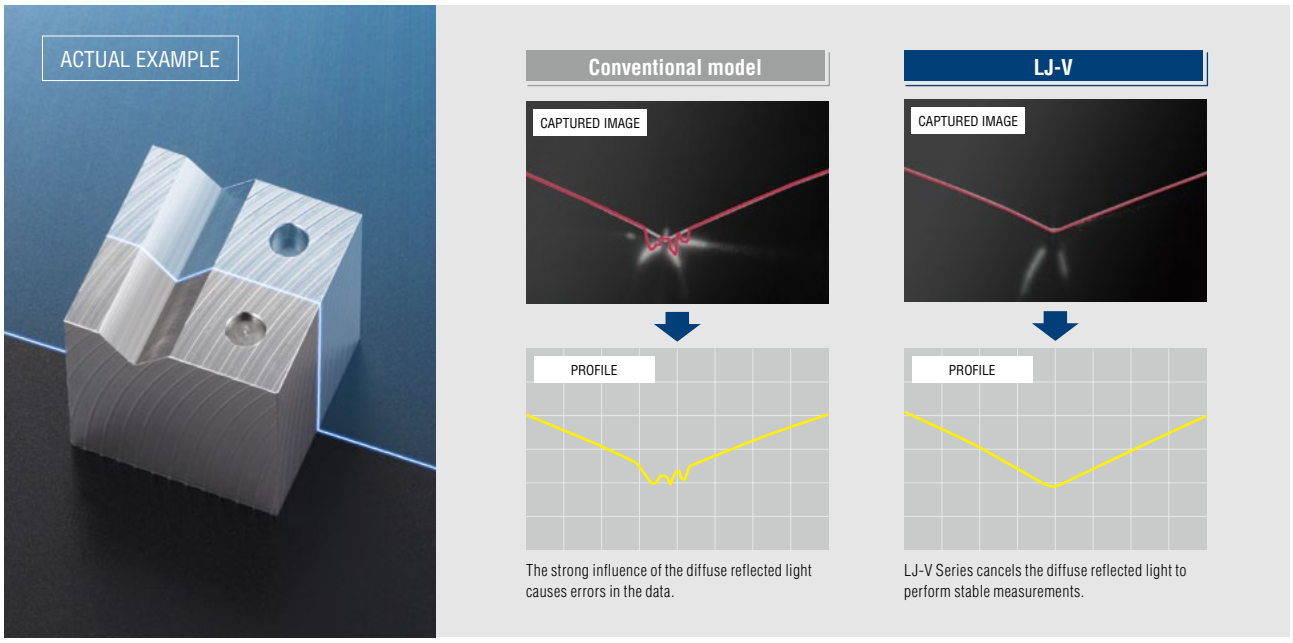
WORLD'S FIRST

# IDENTIFIES UNNECESSARY LIGHT REFLECTIONS

## ▷ Double polarisation function

We have developed the world's first double polarisation function, which distinguishes and cancels multiple reflection light that acts as an obstacle to measurement. Light is shined on the intersection between the X-polarisation and Y-polarisation 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-polarisation and Y-polarisation, 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.






03

# ALL TYPES OF MEASUREMENTS ARE POSSIBLE WITH THIS SINGLE DEVICE

STEP 1 IMAGING CAPTURE SETTINGS → STEP 2 MEASUREMENT SETTINGS → STEP 3 OUTPUT SETTINGS

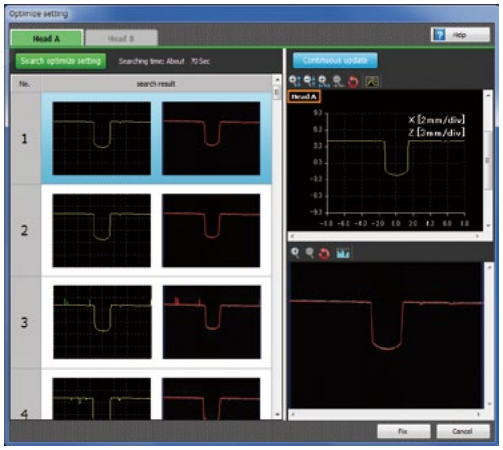
STEP 1

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

### ▷ Automatic setting optimisation 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 optimisation function, conventional adjustment operations can be done with just one click.



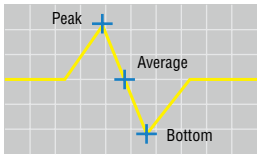


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STEP 2

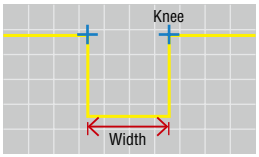
## MEASUREMENT SETTINGS — 74 different measurement modes for a wide variety of inspections —

### HEIGHT



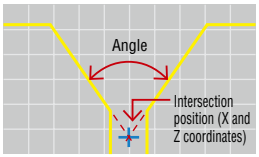

Measures the height within the specified range.

### WIDTH AND POSITION



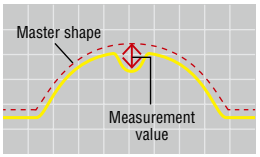

Measures the width and positions under the specified conditions.

### ANGLE AND INTERSECTION



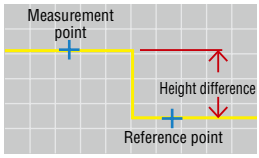

Measures the angle between and the intersection point of a pair of detected straight lines.

### MASTER PROFILE COMPARISON



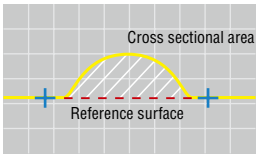

Makes a comparison with the registered master shape and then measures the area with the largest difference in height.

### HEIGHT DIFFERENCE



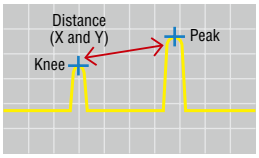

Measures the height difference from a reference point to a measurement point.

### CROSS SECTIONAL AREA



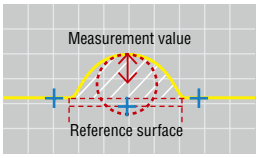

Measures the cross sectional area from a reference surface.

### DISTANCE (POINT - POINT)



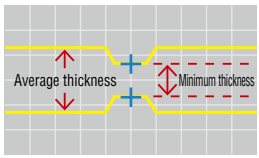

Measures the distance between two points.

### RADIUS AND MIDPOINT



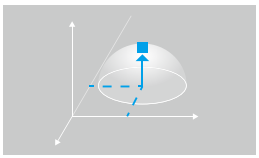

Measures the radius of a curved profile and the coordinates of the centre position of a specified point.

### THICKNESS

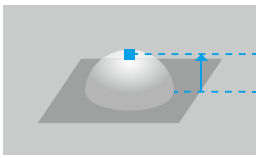



Measures the thickness within the specified range.

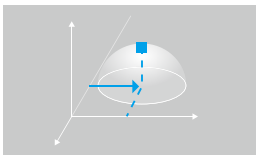
### SIMPLE 3D SETTING (HEIGHT)



### SIMPLE 3D SETTING (HEIGHT DIFFERENCE)



### SIMPLE 3D SETTING (POSITION)



STEP 3

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

### ▷ OUTPUT METHOD



**Measurement value**

Ethernet | USB | RS-232C | Analogue voltage | EtherNet/IP™ | PROFINET

**Profile data**

Ethernet | USB | EtherNet/IP™ | PROFINET

**OK/NG judgement**

Ethernet | USB | RS-232C | I/O | EtherNet/IP™ | PROFINET



PC



PLC, etc.

Ethernet and USB can also be used with DLLs.

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# 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 colour monitor.



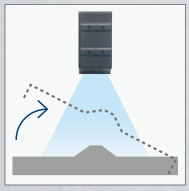

Touch panel HMI
**CA-MP120T**

# AN EMPHASIS ON INLINE MEASUREMENT

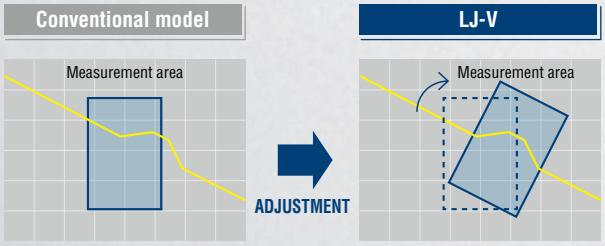
## IN-LINE POSITION ADJUSTMENT FUNCTION (X, Y, AND Z)

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...




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



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PC

LCD colour monitor
**CA-MP120**

## VARIOUS SPECIFICATIONS THAT INCLUDE ALL ON-SITE NEEDS

### SUPPORTS ENCODER INPUT

Can perform encoder synchronised 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

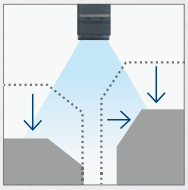
In addition to the sensor head, the connection cable also supports an IP67 enclosure rating. There are no problems even in environments like processing plants where spray easily comes on to the product.

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

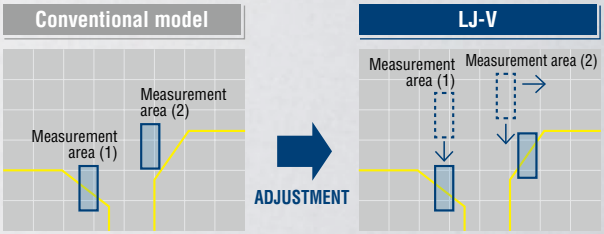
Equipped with high shock resistance that is necessary for industrial robots.

## 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...



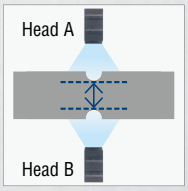

Because position adjustment was applied to a single side as a reference, measurement could not be properly performed.

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

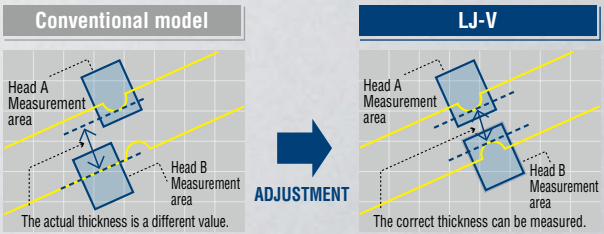
## DUAL-HEAD ADJUSTMENT FUNCTION

By understanding the positional relationship of both heads, it is possible to match the *θ* adjustment centre 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




If the workpiece tilts...




The *θ* adjustment centre of rotation for each head differs, so the measurement area for head B becomes misaligned.

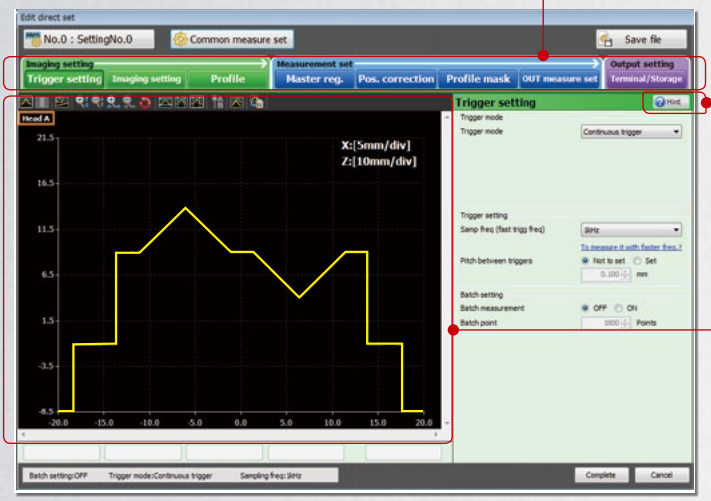
The *θ* adjustment centre of rotation for both heads match, so the measurement area is not misaligned.

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# SIMPLE PROGRAMMING — 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.



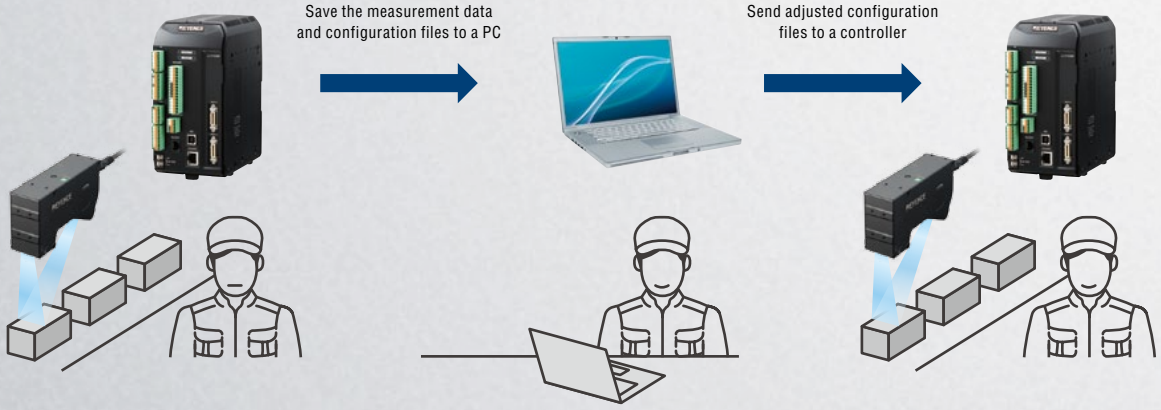

### SETTINGS APPLIED IN REAL-TIME

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 optimisation is necessary due to the addition of a new target object.

### USEFUL APPLICATIONS




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

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

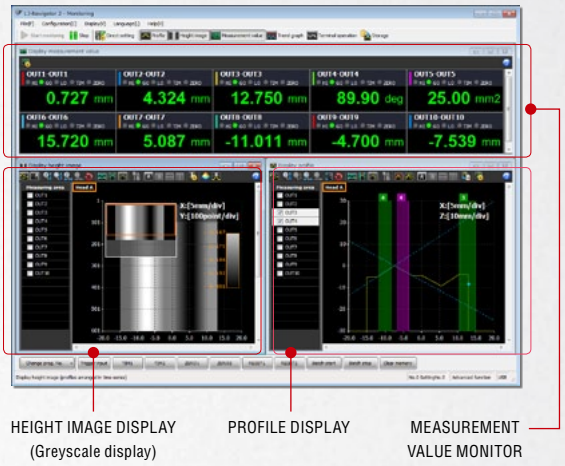
Now all that needs to be done is to load the adjusted configuration file. The settings can be configured immediately without even stopping the line



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## MULTI-SCREEN FUNCTION

It is possible to simultaneously check your favourite screens, including measurement values, measurement profiles, height image displays (greyscale 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

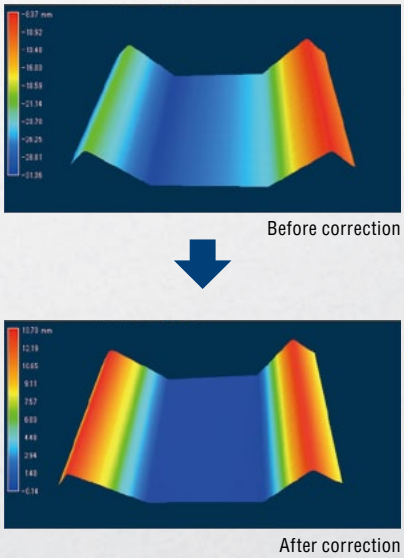
It is possible to store approx. 160000 profiles. You can also store measurement values for 16 outputs at the same time.
The LJ-V7000 Series is equipped with various analysis functions, which is useful for the verification of defects and for research and development.



# OFFLINE PROFILE OBSERVATION — LJ-Observer —

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

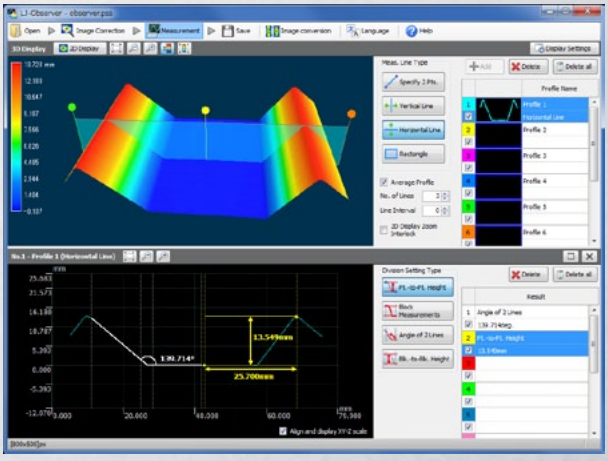
## 3D VIEWER AND SURFACE SLANT ADJUSTMENT



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.



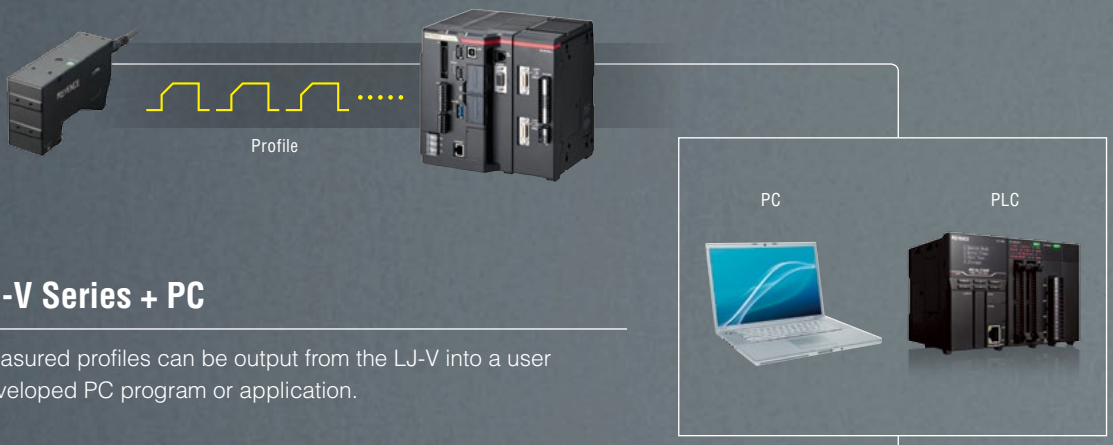
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# INLINE 3D MEASUREMENT

## 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.




### 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 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



Encoder head
CA-EN100H

**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).

* 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.



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# 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**



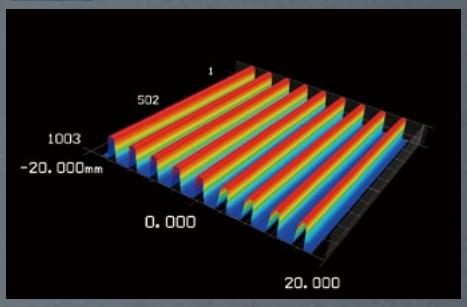


Image Processing System

## Measured Value Acquisition

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

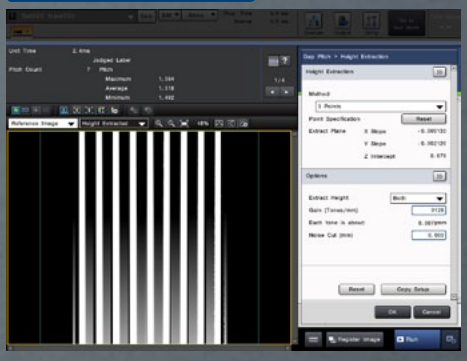
**3D DATA**




## Image Processing

Within the Image Processing System, the height data is converted to a grey-scale image with 256 gradations.
The Image Processing System utilises 21 built-in pre-processing filters, such as real-time grey-scale adjustment and a blob filter to obtain the optimum image for the inspection.

**HEIGHT GREY-SCALE PROCESSING**

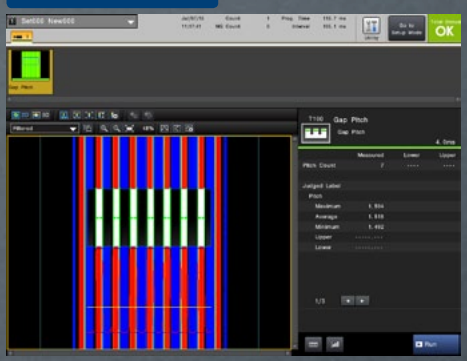


AS FAST AS 2 MS PER INSPECTION!

## Inspection and Measurement

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

**IMAGE PROCESSING RESULT**



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

## Zero Plane Specification

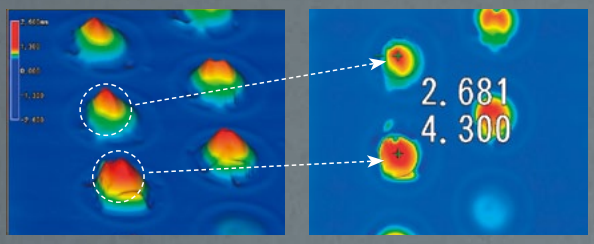
As the reference plane for height measurement, a “zero plane” can be specified separately for each workpiece. This always ensures stable measurement even if workpieces change their orientation. You can also specify a different reference plane for each measurement point. In addition, setting a free-form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




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”.

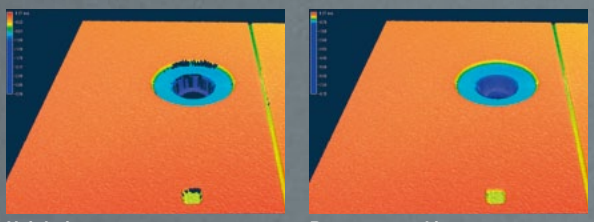



## 16-bit Pre-Processing Dedicated for Height Images

**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 lustre, makes it possible to perform stable measurements.



Height image | Pre-processed image

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

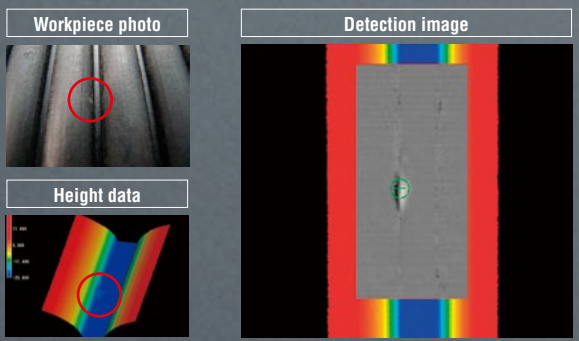
## Height extraction

Based on 3D data, a greyscale 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.




## 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.



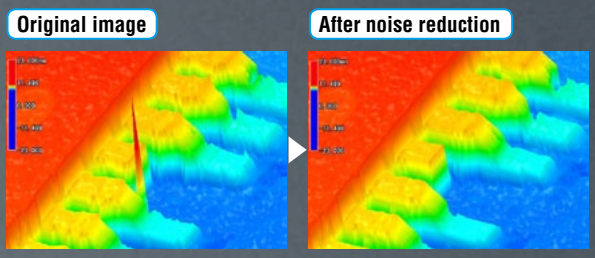



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# NEW FUNCTIONS FOR MORE STABLE 3D INSPECTION

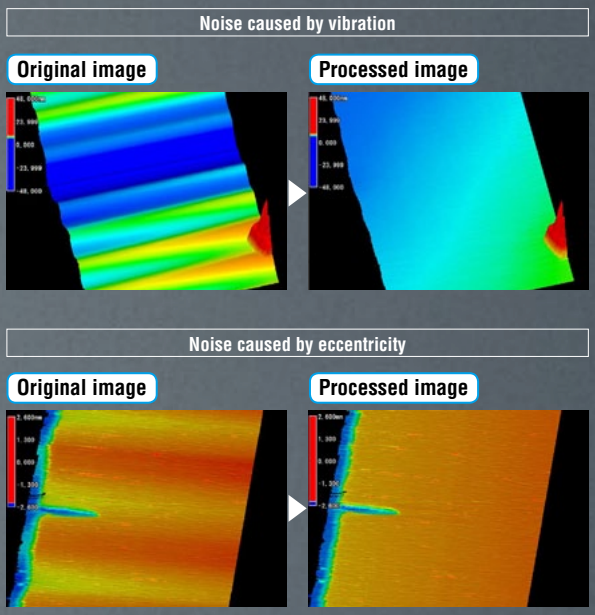
## Projection Noise Removal

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.



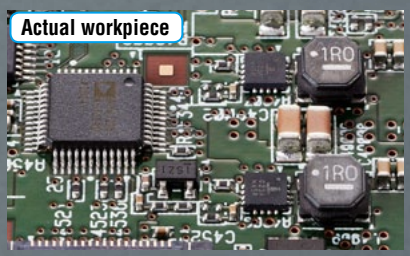

## Vibration Compensation Filter

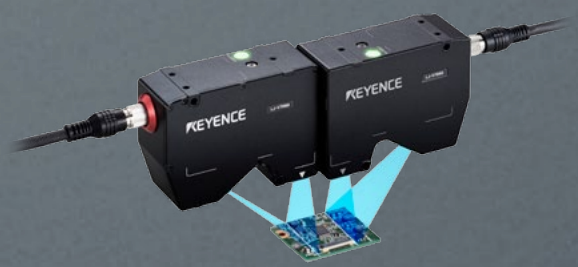
Stable detection is possible by suppressing noise caused by vibrations and eccentricity during conveyance. This allows for reduced fluctuations in data common bottlenecks with inline inspection.



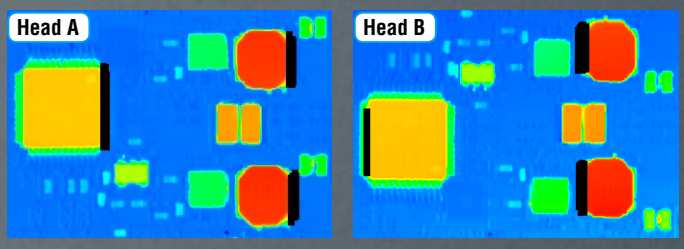

## Dual Head Dead Angle Removal Function

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

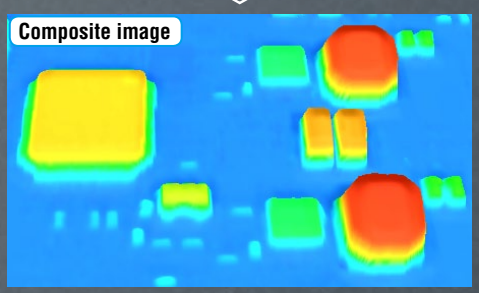



Data is missing because there is a dead angle in both images.



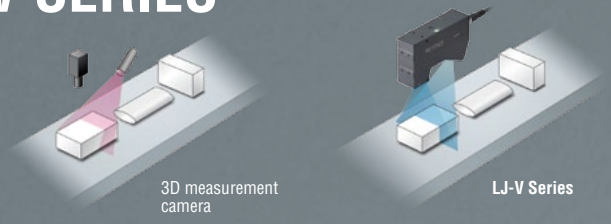

Composition




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

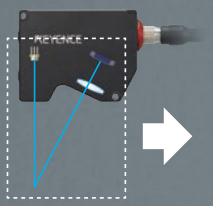
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# OPTICAL FOCUS AND DEPTH OF FIELD ADVANTAGES OF THE LJ-V SERIES

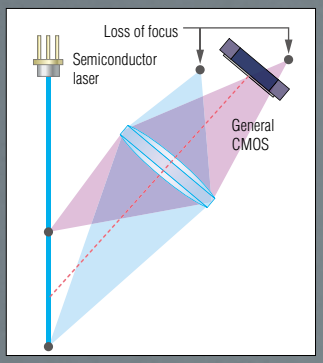



## Better Optical Design

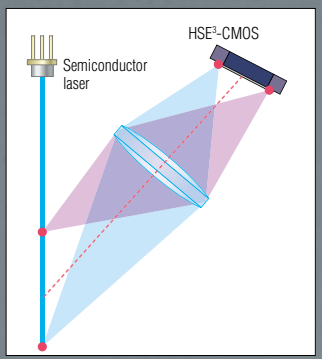
Cameras that are not equipped with auto focus or a similar technology have a set focus position which makes it impossible to obtain an accurate profile if the distance between the camera and target changes. The LJ-V Series uses a special optical system, which enables the LJ-V Series to always capture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



**Typical 3D camera**




**LJ-V Series**



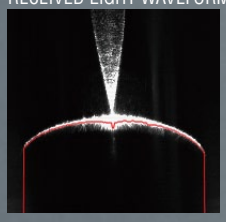

With the LJ-V Series, even if the target's position changes, the image will not go out of focus.

## Better Dynamic Range

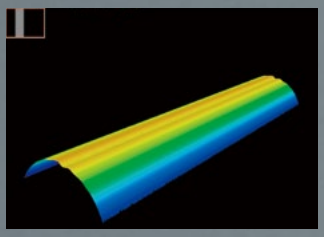
For general 3D cameras, the light receiving element has a narrow dynamic range leading to measurement errors caused by the amount of light reflected from the target. The LJ-V Series can perform stable measurements without light saturation even if the amount of reflected light is large.



RECEIVED LIGHT WAVEFORM

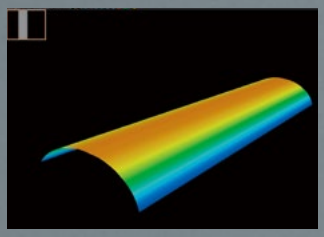


**Typical 3D camera**



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

**LJ-V Series**

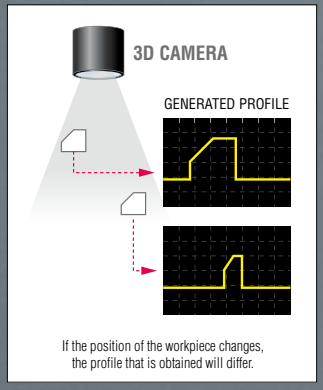


Stable measurements can be performed.

## Better Ease of Use

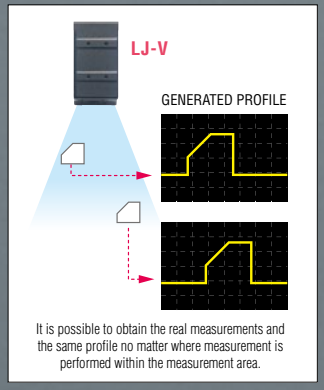
When using a 3D camera, the height and width data of individual pixels differs due to the positional relationship of the laser light source and the receiver, so a calibration must be performed for each pixel. With the LJ-V Series, there is no need for the user to perform additional calibration.

**Typical 3D camera**




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

**LJ-V Series**



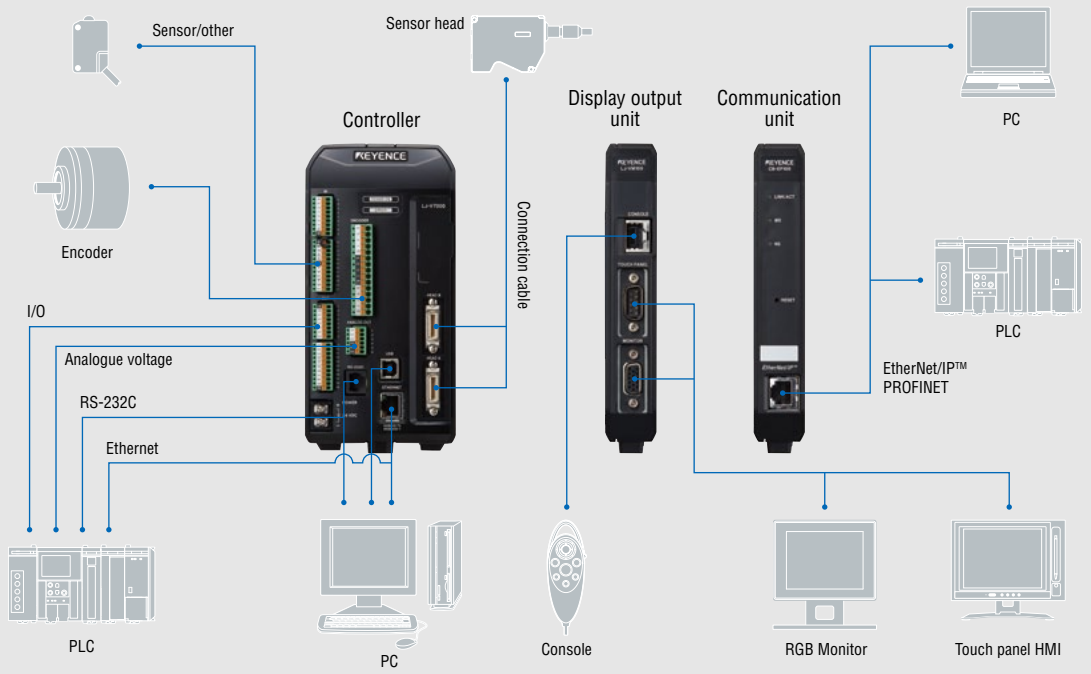

It is possible to obtain the real measurements and the same profile no matter where measurement is performed within the measurement area.



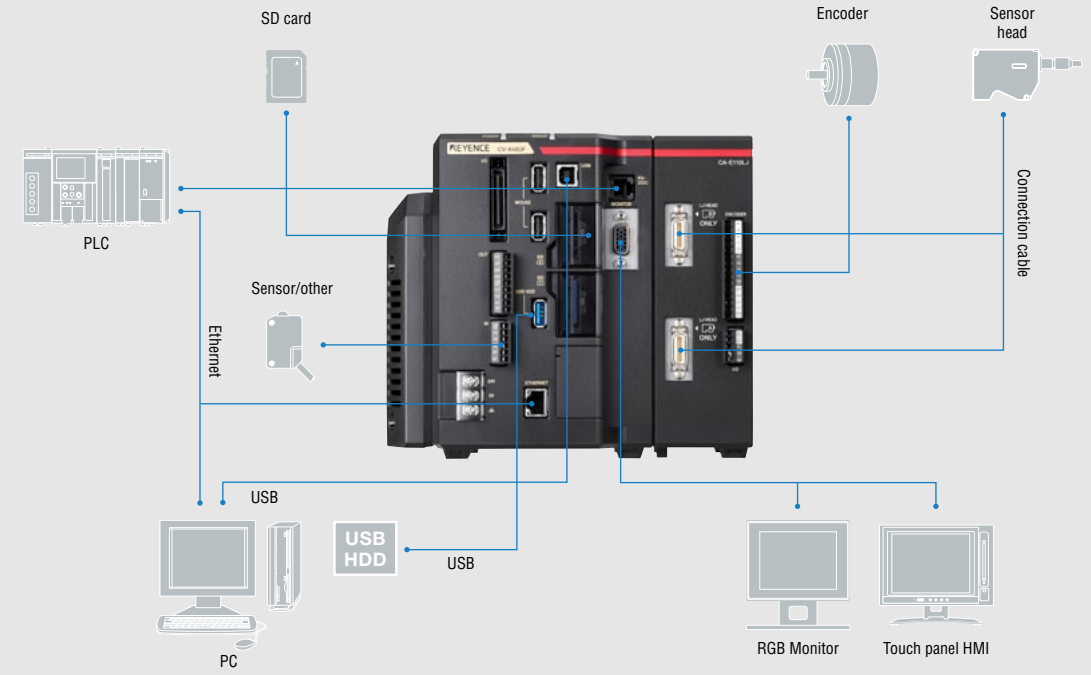
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# SYSTEM CONFIGURATION

## LJ-V Series

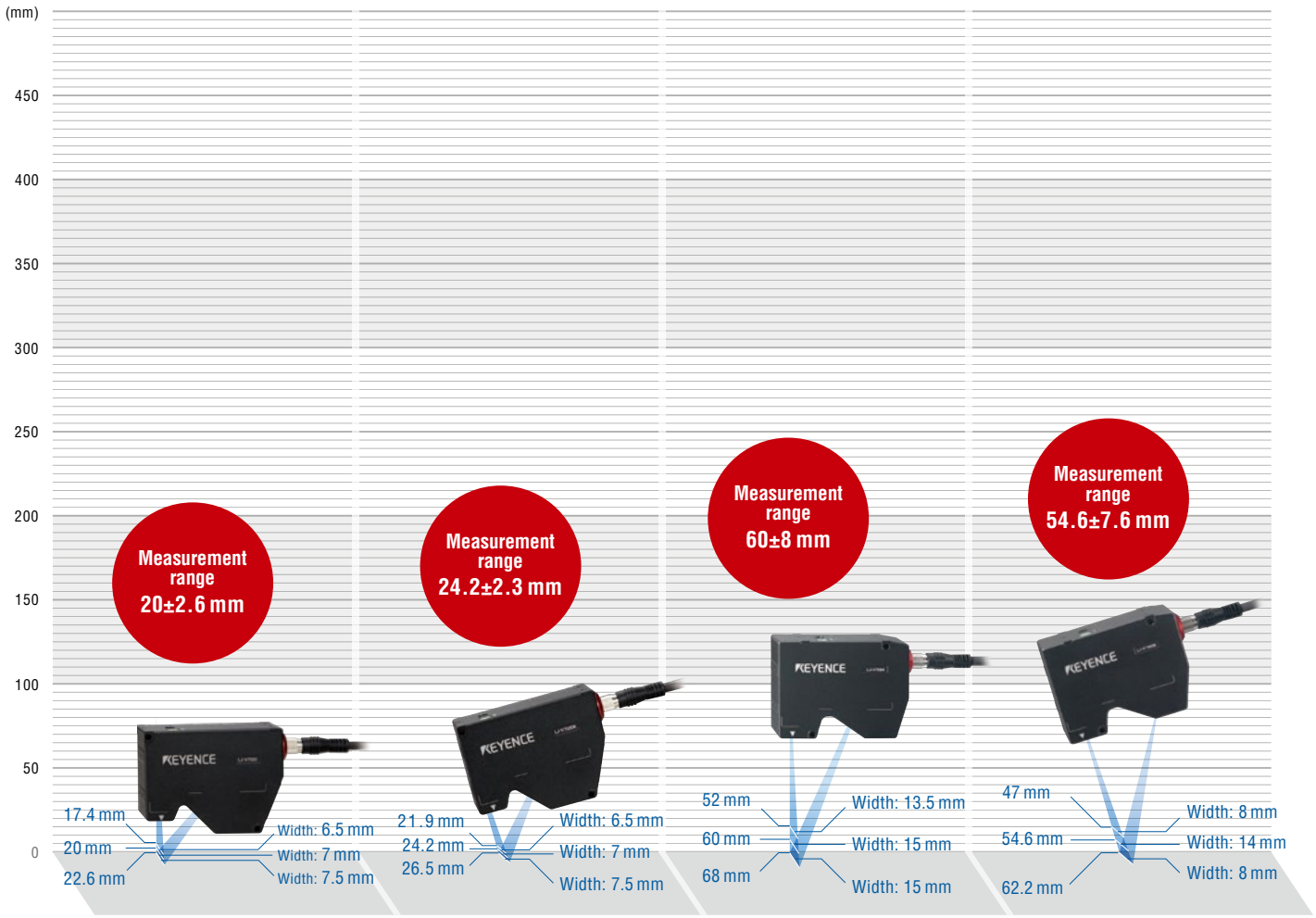



## LJ-V Series + Image Processing System

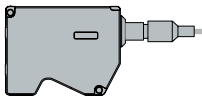


## SENSOR HEAD

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




| | | | |
|---|---|---|---|
| Measurement range: Z-axis 20±2.6 mm / X-axis 7 mm | Measurement range: Z-axis 24.2±2.3 mm / X-axis 7 mm | Measurement range: Z-axis 60±8 mm / X-axis 15 mm | Measurement range: Z-axis 54.6±7.6 mm / X-axis 14 mm |
| Repeatability: Z-axis 0.2 µm / X-axis 2.5 µm | Repeatability: Z-axis 0.2 µm / X-axis 2.5 µm | Repeatability: Z-axis 0.4 µm / X-axis 5 µm | Repeatability: Z-axis 0.4 µm / X-axis 5 µm |



**Required**



Head-to-controller cable
**CB-B3 (3 m)**
**CB-B10 (10 m)**



Extension cable
**CB-B5E (5 m)**
**CB-B10E (10 m)**
**CB-B20E (20 m)**

**Required**



Controller
**LJ-V7000(P)**

Controller variations

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



Settings monitor software
**LJ-H3**

* For total lengths of 30 m, 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**

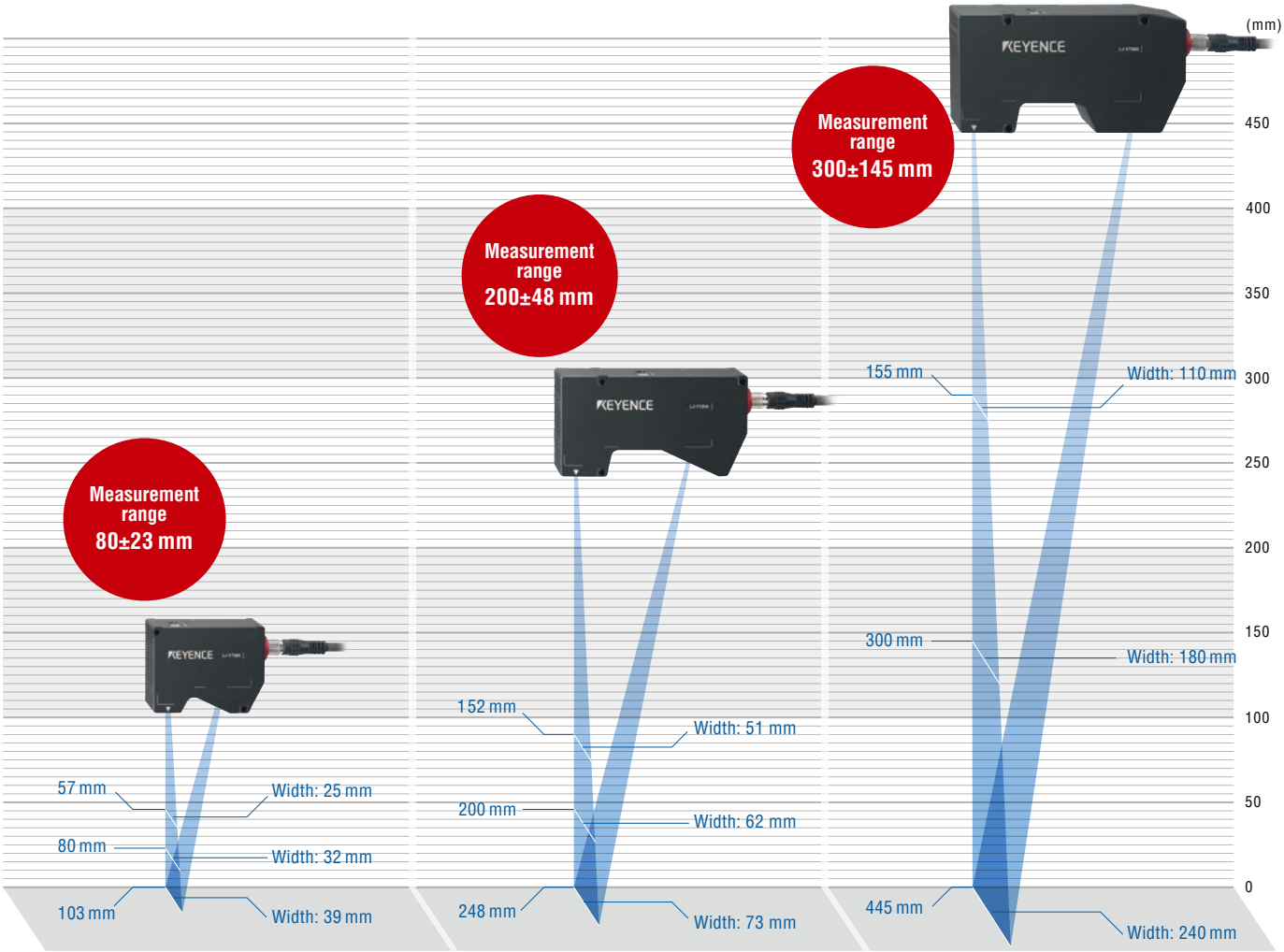
Image stitching unit
**CA-E100LJ/CA-E110LJ**
Encoder unit
**CA-EN100U**
Encoder head
**CA-EN100H**
Encoder head cable
**CA-EN5 (5 m)/CA-EN10 (10 m)**

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



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



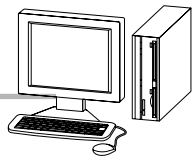

| | | | | | |
|---|---|---|---|---|---|
| Measurement range | Z-axis 80±23 mm<br>X-axis 32 mm | Measurement range | Z-axis 200±48 mm<br>X-axis 62 mm | Measurement range | Z-axis 300±145 mm<br>X-axis 180 mm |
| Repeatability | Z-axis 0.5 µm<br>X-axis 10 µm | Repeatability | Z-axis 1 µm<br>X-axis 20 µm | Repeatability | Z-axis 5 µm<br>X-axis 60 µm |

**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)**
**OP-87055 (10 m)**

+



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)**
**OP-87055 (10 m)**

+



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



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, 0.00001 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 | Analogue voltage output | ±10 V × 2 outputs, Output impedance: 100 Ω | |
| | OUT comparator output | NPN open collector output × 12 outputs<br>(Can freely assign 16 OUTs × 3 stage judgement results) | PNP open collector output × 12 outputs<br>(Can freely assign 16 OUTs × 3 stage judgement 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 | |
| | 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 | | Analogue RGB XGA (1024 × 768)<br>Touch panel monitor (CA-MP120T), specialised connector included |
| Voltage | | Supplied from the controller |
| Power consumption | | 2.5 W or less |
| Environmental resistance | Operating ambient temperature | 0 to +50°C |
| | 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<br>Windows 7 (SP1 or later)*2<br>Windows Vista (SP2 or later)*3<br>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.



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## PROFINET unit

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

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

## EtherNet/IP™ unit

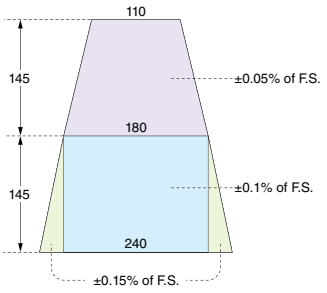
| Model | | CB-EP100 |
|---|---|---|
| Compatible network | | EtherNet/IP™ and displacement sensor-specific protocols (socket communication) |
| Ethernet | Compliant standards | IEEE 802.3 (10BASE-T), IEEE 802.3u (100BASE-TX) |
| | Transmission speed | 10 Mbps (10BASE-T), 100 Mbps (100BASE-TX) |
| | Transmission media | STP or Category 3 or higher UTP (10BASE-T), STP or Category 5 or higher UTP (100BASE-TX) |
| | Maximum cable length | 100 m (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 |
| | 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

| 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 | 20 mm | 54.6 mm | 60 mm | 80 mm | 200 mm | 300 mm |
| Measurement range | Z-axis (height) | | ±2.3 mm (F.S.=4.6 mm) | ±2.6 mm (F.S.=5.2 mm) | ±7.6 mm (F.S.=15.2 mm) | ±8 mm (F.S.=16 mm) | ±23 mm (F.S.=46 mm) | ±48 mm (F.S.=96 mm) | ±145 mm (F.S.=290 mm) |
| | X-axis (width) | NEAR side | 6.5 mm | 6.5 mm | 8 mm | 13.5 mm | 25 mm | 51 mm | 110 mm |
| | | Reference distance | 7 mm | 7 mm | 14 mm | 15 mm | 32 mm | 62 mm | 180 mm |
| | | Far side | 7.5 mm | 7.5 mm | 8 mm | 15 mm | 39 mm | 73 mm | 240 mm |
| 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 | | Approx. 21 mm × 45 µm | | Approx. 48 mm × 48 µm | Approx. 90 mm × 85 µm | Approx. 240 mm × 610 µm |
| Repeatability*2 | Z-axis (height)*3 | | 0.2 µm | | 0.4 µm | | 0.5 µm | 1 µm | 5 µm |
| | X-axis (width)*4 | | 2.5 µm | | 5 µm | | 10 µm | 20 µm | 60 µm |
| 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 | | 20 µm | | 50 µm | 100 µm | 300 µm |
| 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 | | | | | | |
| | Operating Ambient humidity | | 20 to 85% RH (No condensation) | | | | | | |
| | Vibration resistance | | 10 to 57 Hz, 1.5 mm double amplitude in X, Y, and Z directions, 3 hours respectively | | | | | | |
| | Impact resistance | | 15 G/6 msec | | | | | | |
| Material | | | Aluminium | | | | | | |
| 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 polarisation 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.

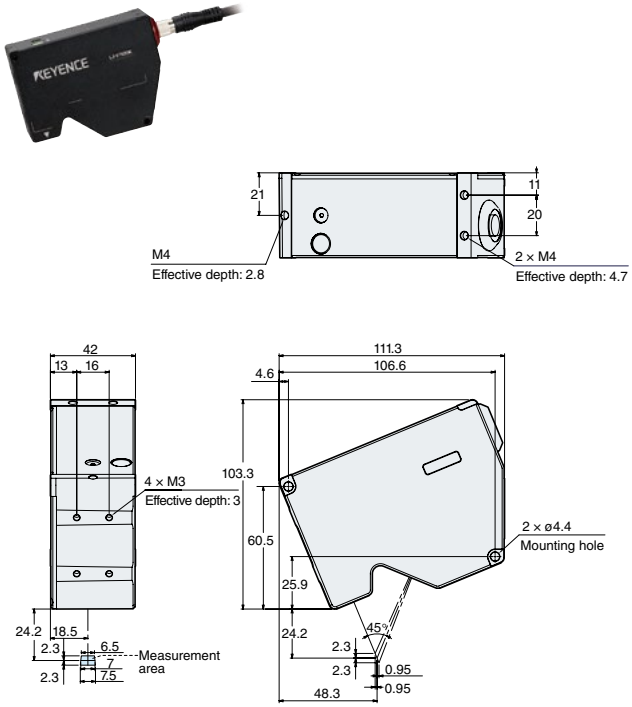



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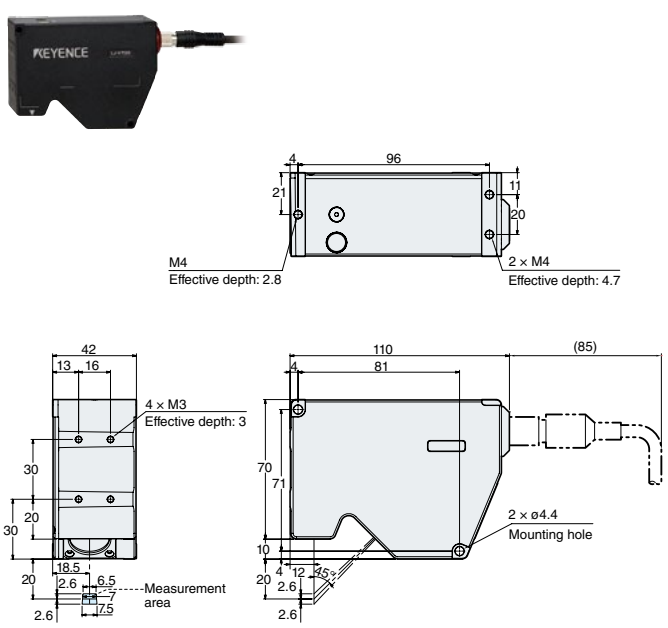
# DIMENSIONS

**Sensor head**

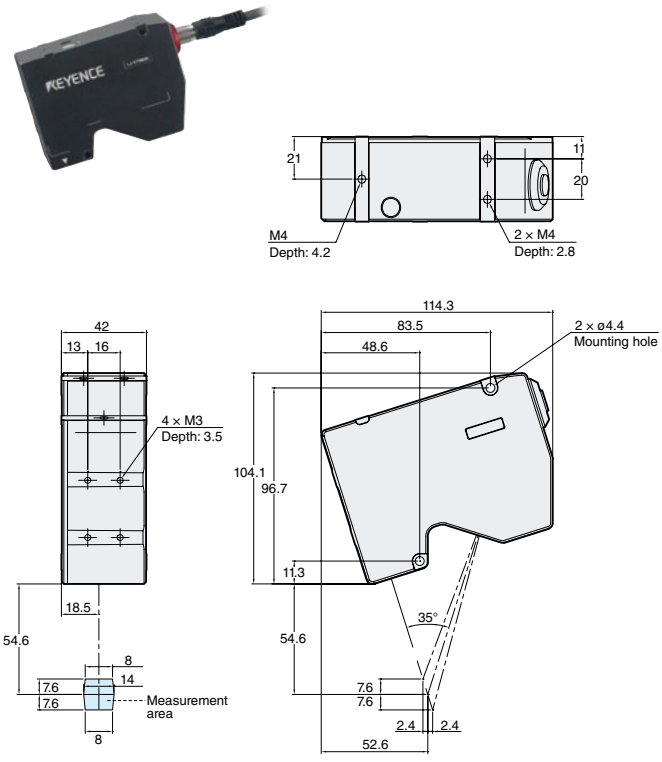
Ultra high-accuracy specular reflection model
**LJ-V7020K**



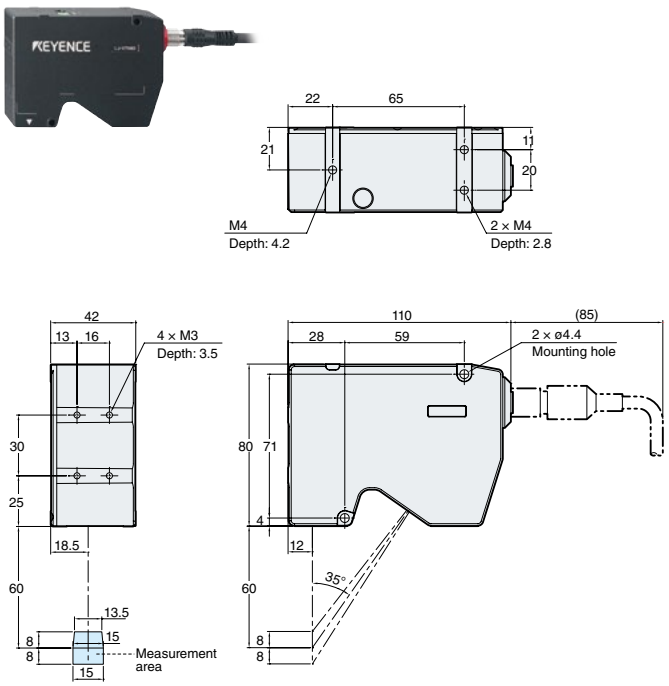

Ultra high-accuracy model
**LJ-V7020**




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




High-accuracy model
**LJ-V7060**



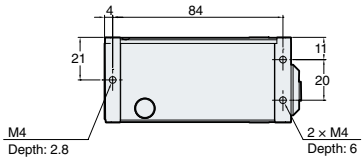


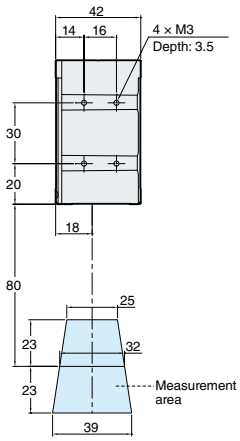

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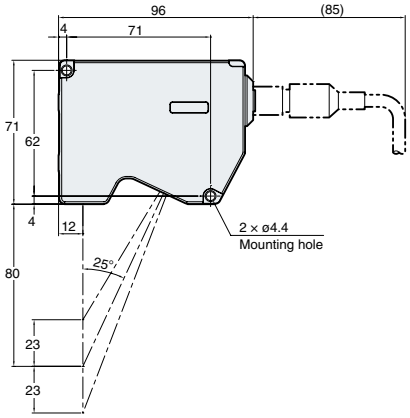
Unit: mm

Middle-range model
**LJ-V7080**



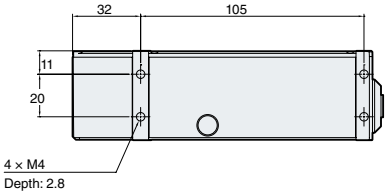


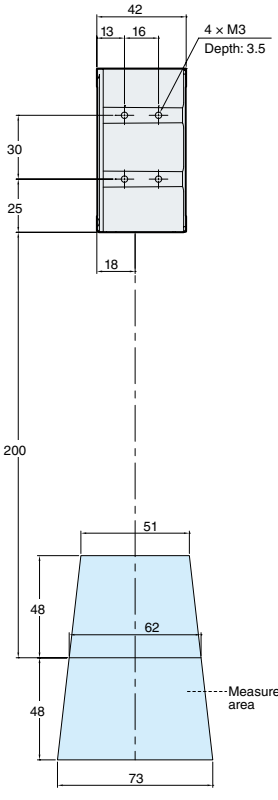



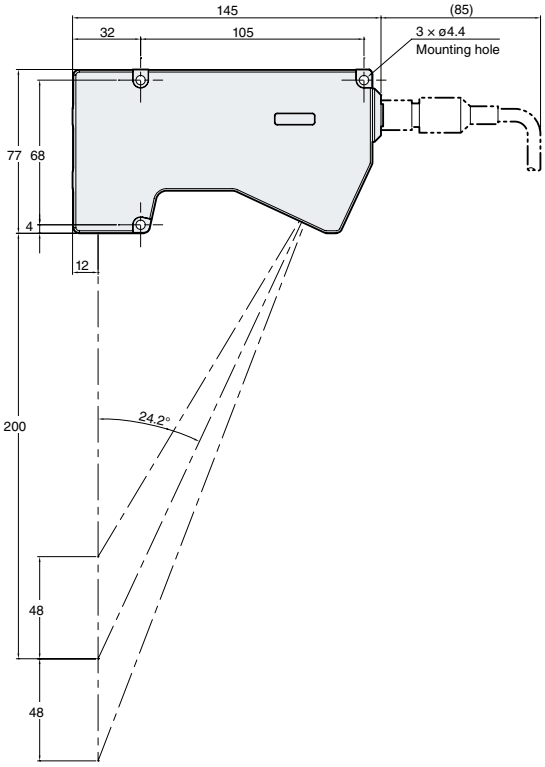




Long-range model
**LJ-V7200**







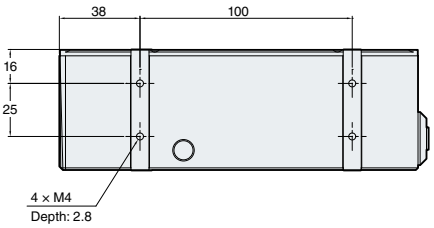

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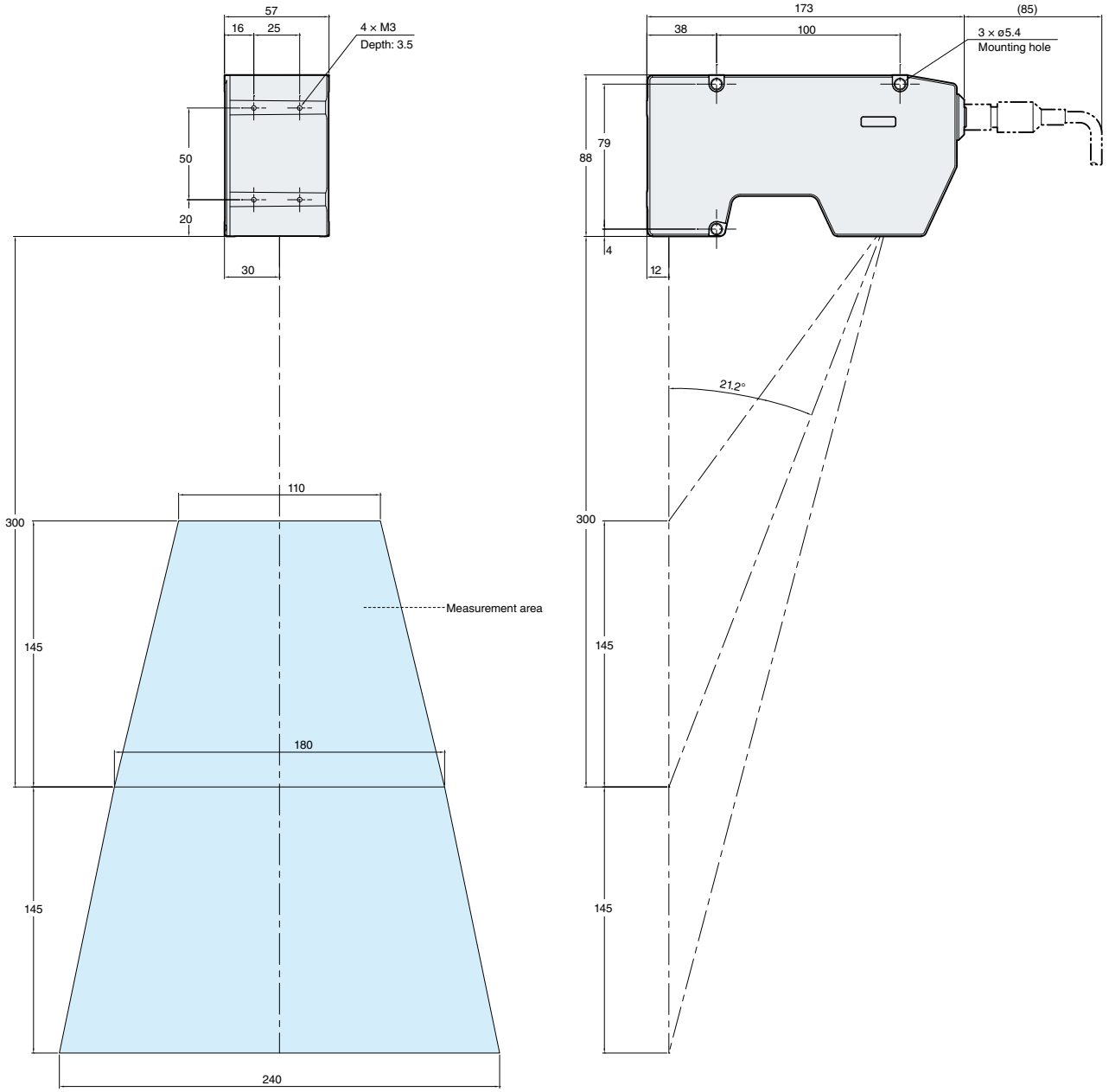
# DIMENSIONS

**Sensor head**

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



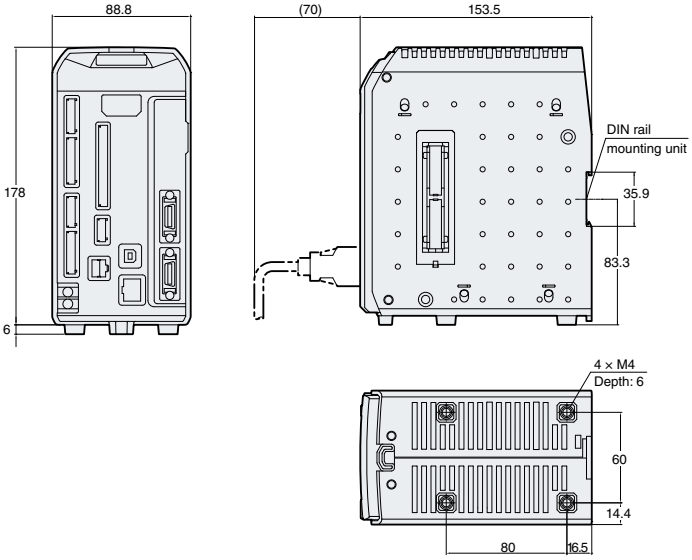





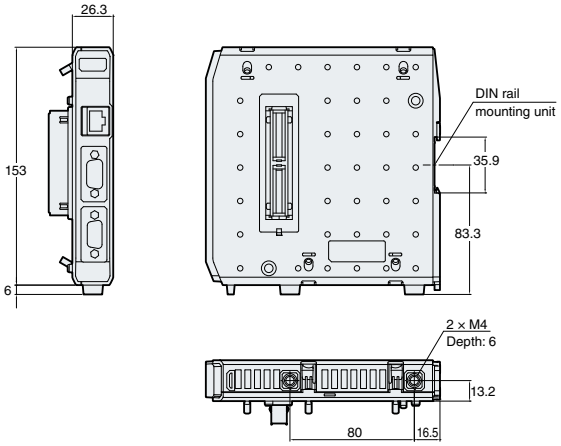

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Multi-function controller
**LJ-V7001(P)**

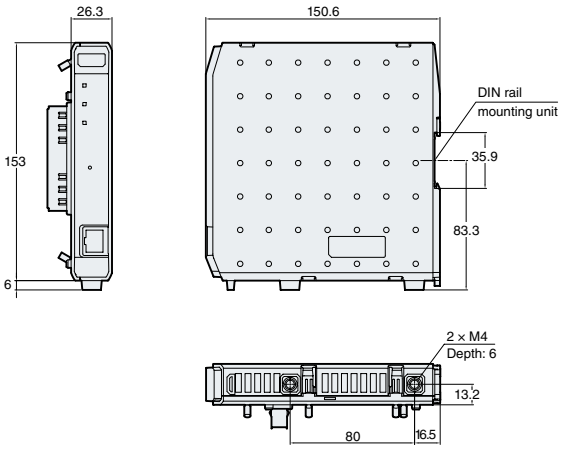




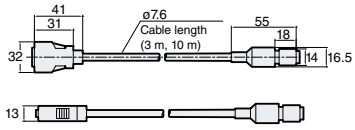

Display output unit
**LJ-VM100**



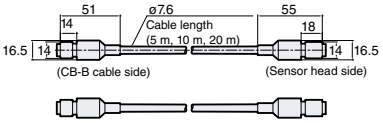

EtherNet/IP™ unit **CB-EP100**
PROFINET unit **CB-PN100**



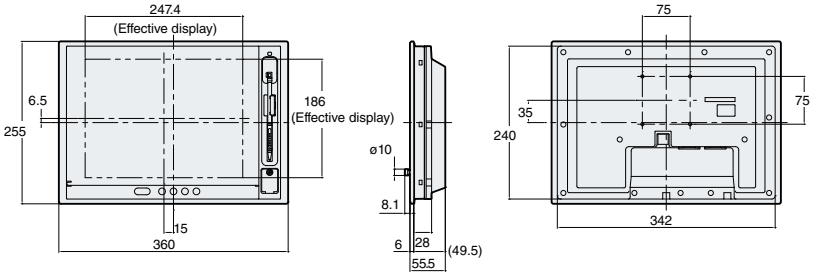

Head-to-controller cable
**CB-B3/CB-B10**



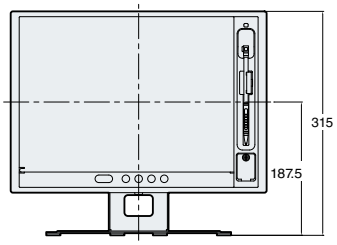

Extension cable
**CB-B5E/CB-B10E/CB-B20E**

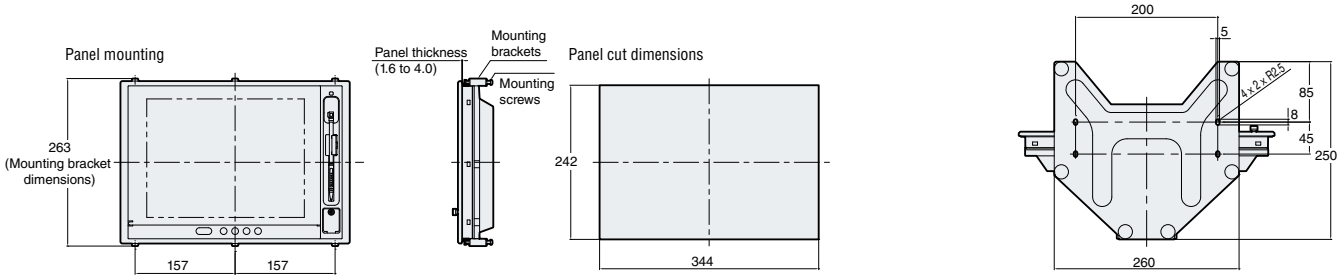



Touch panel HMI
**CA-MP120T**



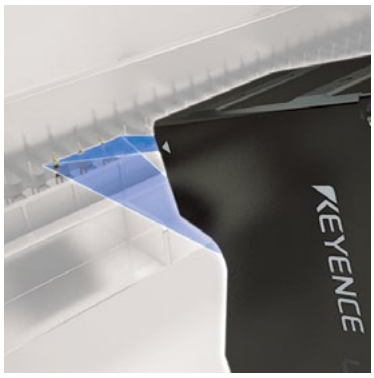

Specialised monitor stand
**OP-87262**



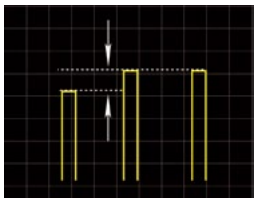



# 2D MEASUREMENT

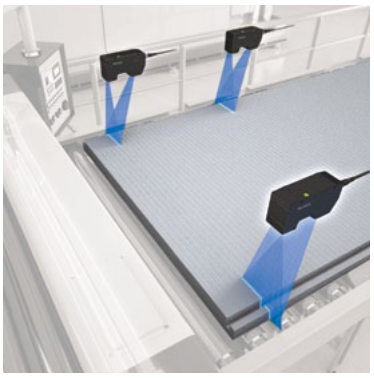
## HEIGHT AND STEP DIFFERENCE



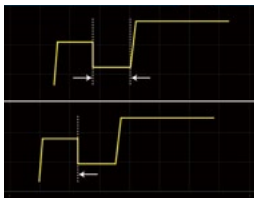

Pin height and step height measurement



## WIDTH AND POSITION



Building material board positioning



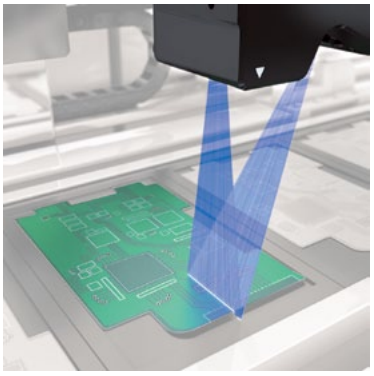
## PROFILE AND CROSS SECTION



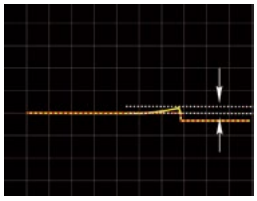

Sealant inspection



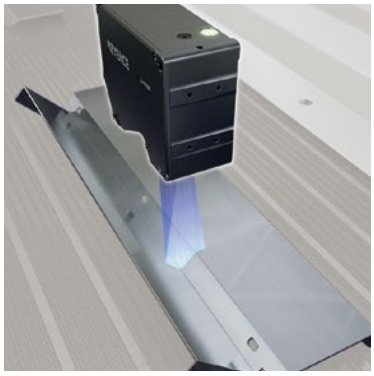
## WARPAGE AND FLATNESS



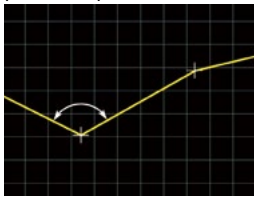
Warpage measurement of PCBs



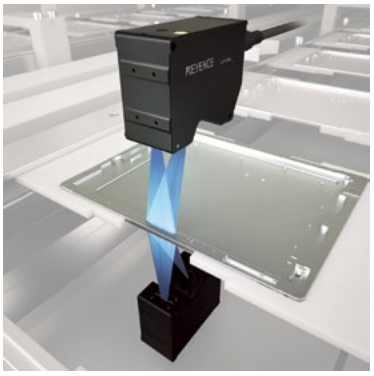
## ANGLE AND RADIUS



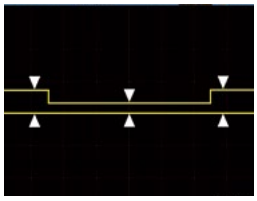
Angle measurement of processed products



## THICKNESS MEASUREMENT




Case thickness measurement





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# 3D MEASUREMENT (IMAGE PROCESSING)

## SOLDERING BRIDGE AND VOLUME INSPECTION

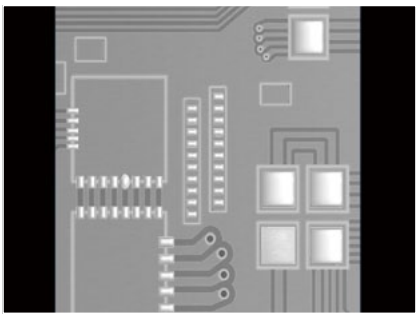


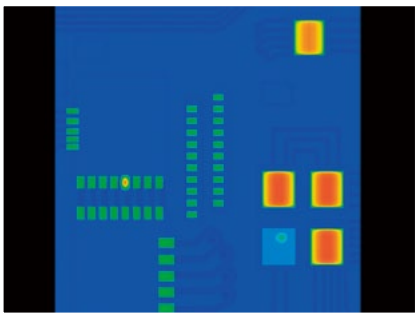
**Traditional cameras**

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

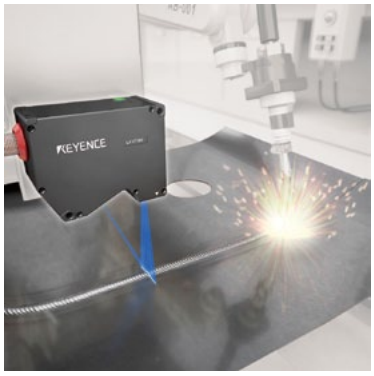
**LJ-V + Image processing**

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





## TAILORED BLANK WELDING APPEARANCE INSPECTION

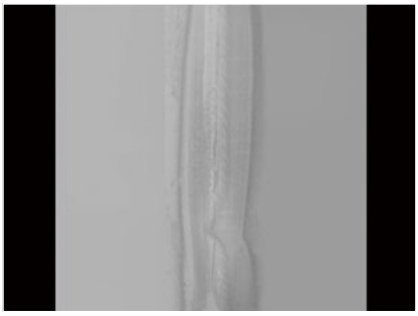


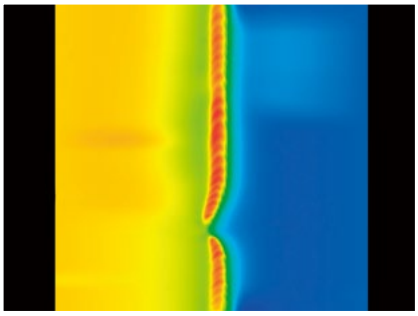

**Traditional cameras**

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.






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