KEYENCE

NEW **Inline 3D Inspection Image Processing System**

LJ-V connection-compatible
CV-X/XG-X Vision System

CE

INLINE 3D MAKES NEW INSPECTIONS POSSIBLE

DIGEST VERSION

3D Inspection Makes the Impossible Possible

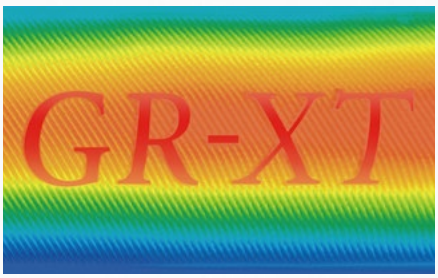
Robust

×OCR
×Orientation
×Presence/Absence

THE ONLY COMPLETE 3D SOLUTION

3 Keys to 3D Success

Character inspection on black rubber.



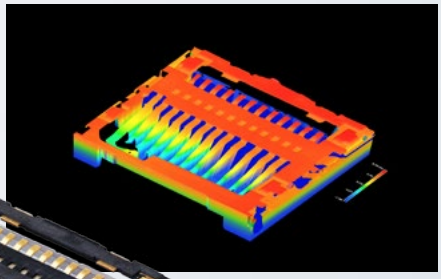
The LJ-V (Laser profile scanner) enables stable detection of various workpieces with ultra-high speed profiling of 64,000 profiles per second. 3D image processing is available for almost any workpiece by processing the profile data using the CV-X/XG-X Series.

Accurate

×3D Measurement
×Flatness and Warpage
×Multiple Calculation

BEST LASER PROFILING TECHNOLOGY
BEST 3D IMAGE PROCESSING
BEST PRESENTATION WITH ENCODER

Coplanarity and pitch measurement



NEW

Inline 3D Inspection Image Processing System

LJ-V connection-compatible CV-X Series/XG-X Series

Height/dimension inspection

Improving yields by visualizing height information

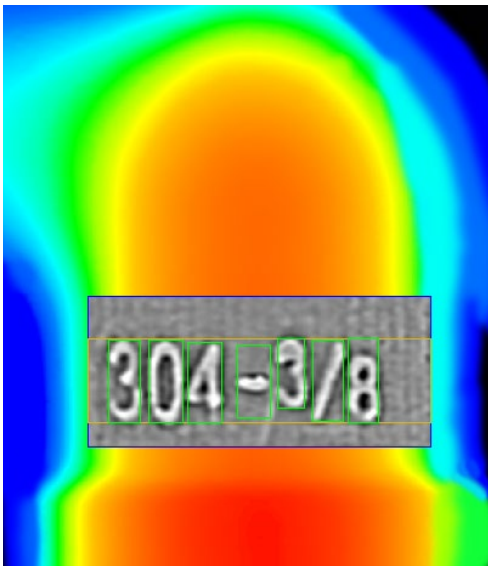
Low contract inspection of characters on a metal surface

2D inspection

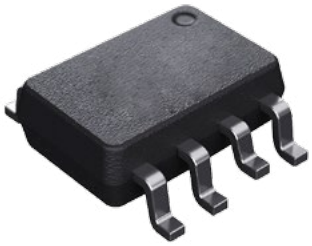
Reading was not stable using only intensity information.

Not affected by background or noise

3D inspection solves it!

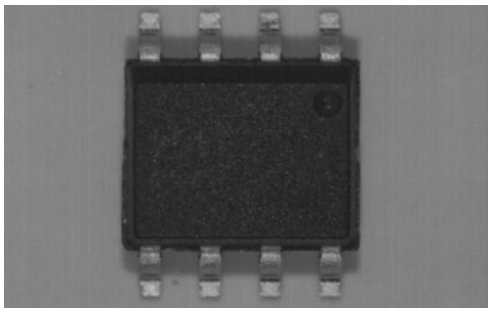


Canceling uneven backgrounds allows for stable OCR inspection.



Coplanarity inspection of electronic components

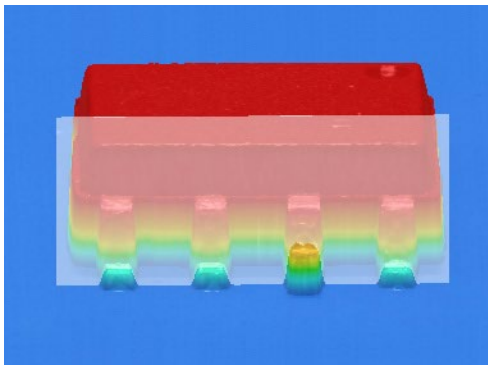
2D inspection

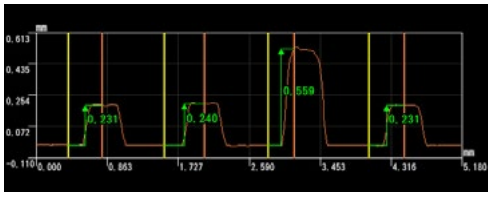


With 2D inspection, it is impossible to determine height information.

Quantifying height information

3D inspection solves it!



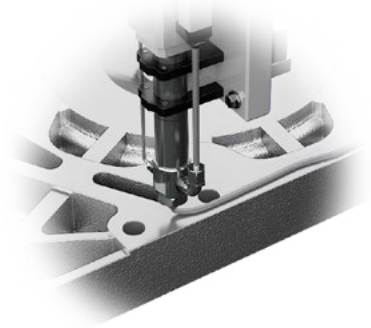


3D inspection of the terminals allows for judgment based on height.

Profile inspection

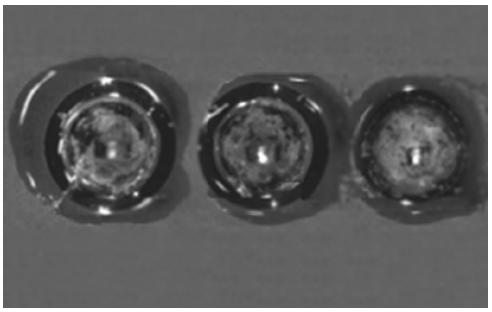
Ensuring stable detection through inspection using both intensity and height information

Inspection of solder fillet



Profile inspection of adhesive applications

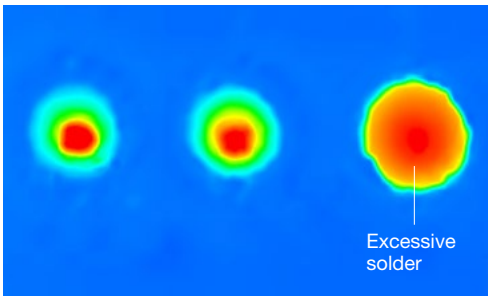
2D inspection

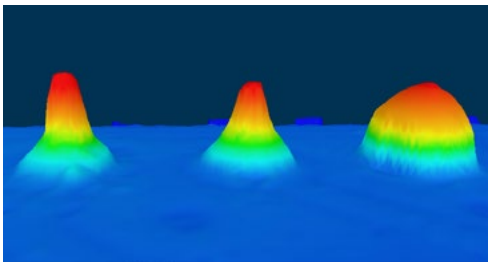


Inspection was not stable using only intensity information.

Checking X, Y, and Z with one unit

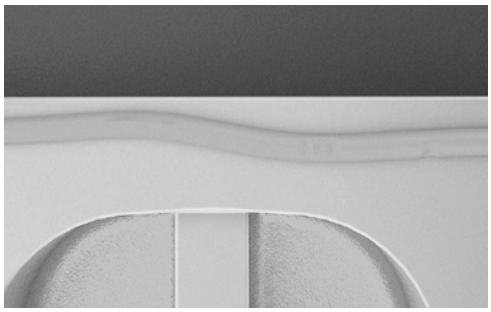
3D inspection solves it!





Adding the height (Z) information to X/Y information enables inspection using volume or cross sectional area.

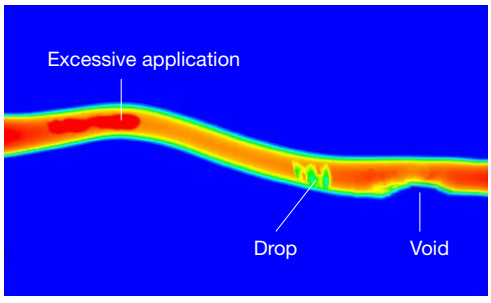
2D inspection

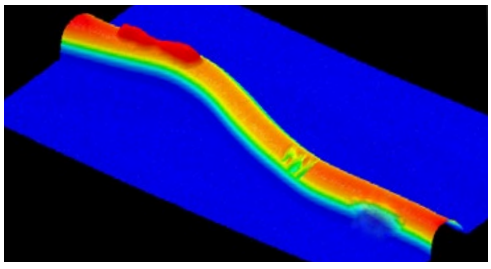


Depending on the background color, low contrast inspection is not stable.

Not affected by contrast

3D inspection solves it!





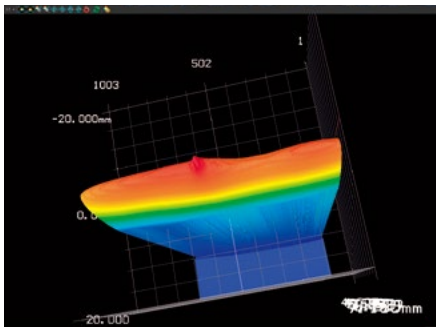
Unlike conventional detection based on contrast differences in intensity information, profile changes and breaks can be detected easily.

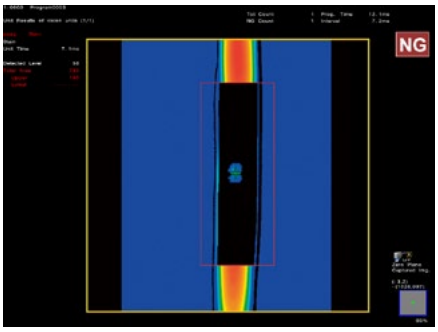
The CV-X/XG-X 3D image processing system enables processing that was impossible with the LJ-V profile scanner only.

LJ-V7200

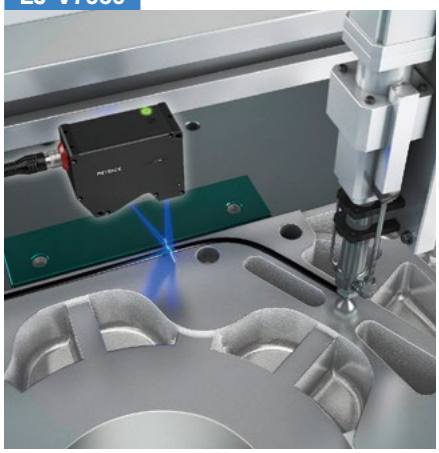
Inspection of pock and dent shapes on rubber-coated cables

Conventional laser displacement sensor Difficult to detect dents on curved surfaces and gentle depressions.
LJ-V + CV-X/XG-X Ensures stable detection even for high-speed production lines.



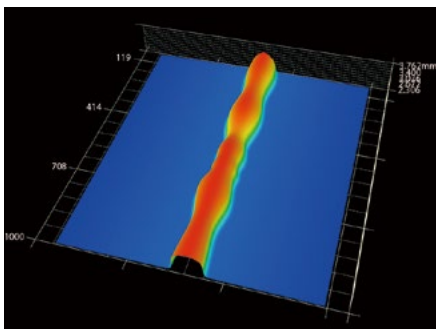


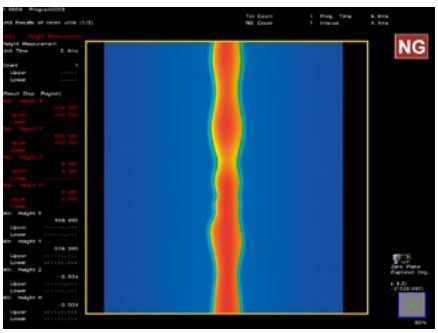
LJ-V7060



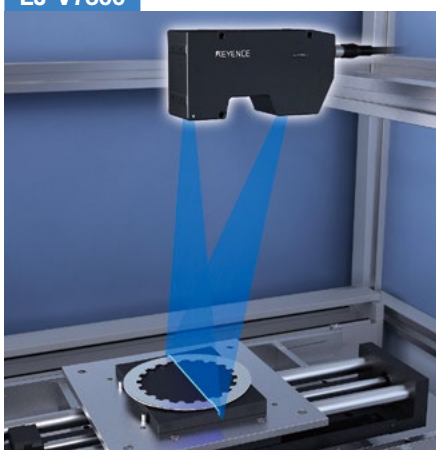
Inspection of width, height, and volume of sealants

Conventional laser displacement sensor Difficult to inspect area and volume with displacement sensors.
LJ-V + CV-X/XG-X Enables flexible inspection of height, width, and volume, etc.



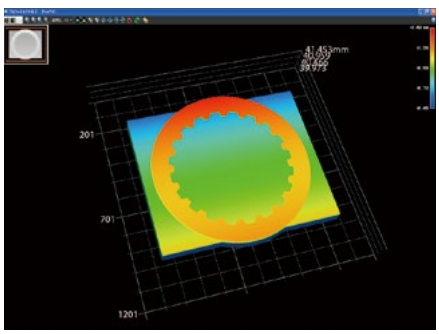


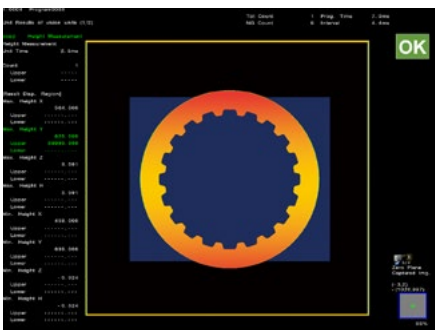
LJ-V7300



Measurement of flatness of clutch plates

Conventional contact-type displacement sensor and laser displacement sensor Difficult to perform stable inspection due to the influence of the overall waviness or inclination of each product.
LJ-V + CV-X/XG-X Ensures stable inspection by individually correcting variation among products.



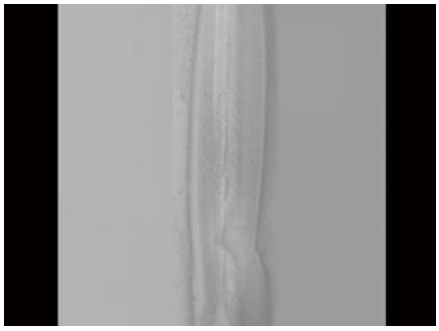


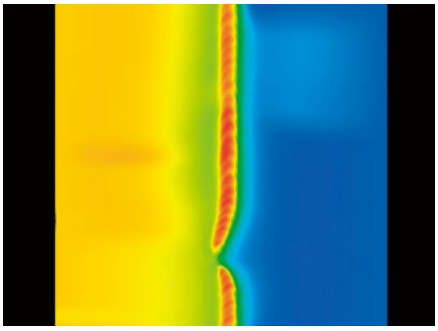
A combination with the LJ-V profile scanner enables detection that used to be impossible with image processing only.

LJ-V7080

Shape inspection of welding on tailored blanks

Conventional camera Inspection with cameras was difficult due to the unstable surface condition of workpieces.
LJ-V + CV-X/XG-X Stable inspection is possible without being influenced by the surface condition of workpieces.





LJ-V7060

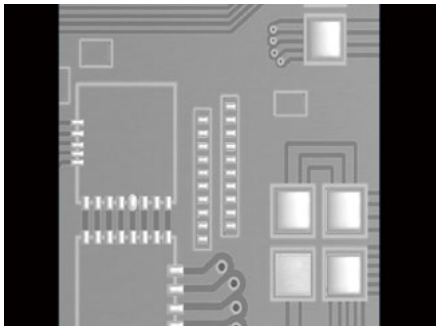
OCR for card numbers

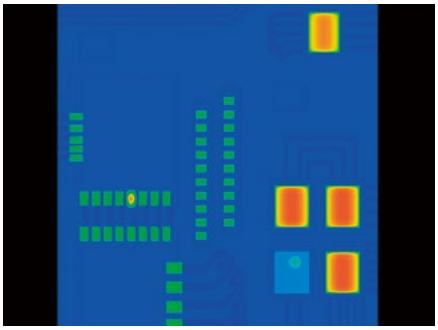
Conventional camera OCR was difficult due to the influence of the background.
LJ-V + CV-X/XG-X Stable OCR is possible on any kind of card.

LJ-V7060

Inspection of soldering bridge/volume

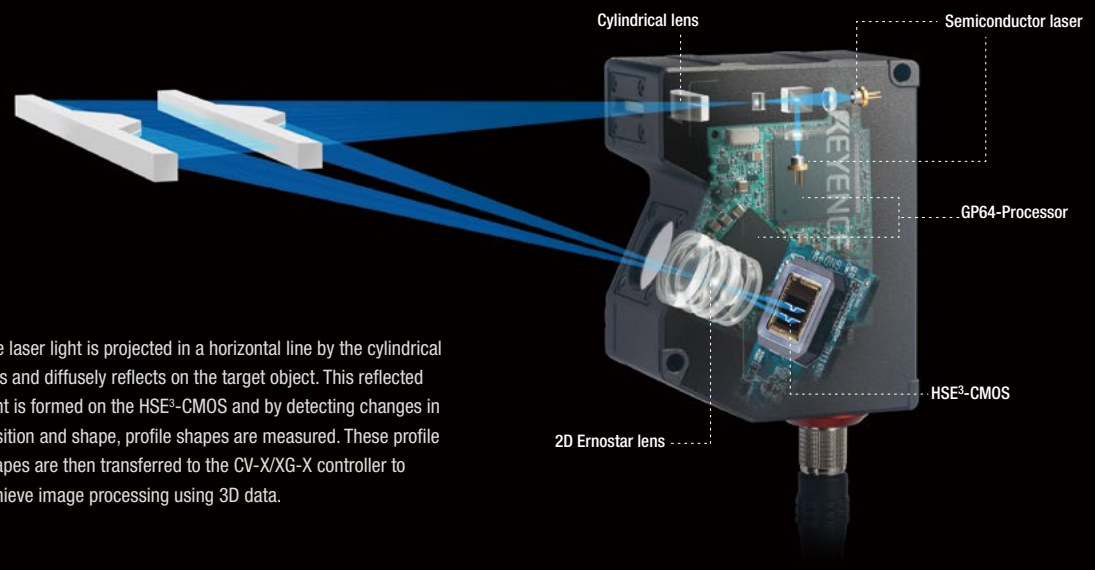
Conventional camera Inspection was difficult due to the influence of PCB patterns and soldered surface conditions.
LJ-V + CV-X/XG-X Ensures inspection of presence, bridge, and volume of soldering.





Ultra-high-speed 3D Shape Measurement through Light-Section Method

2D triangulation method



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, profile shapes are measured. These profile shapes are then transferred to the CV-X/XG-X controller to achieve image processing using 3D data.

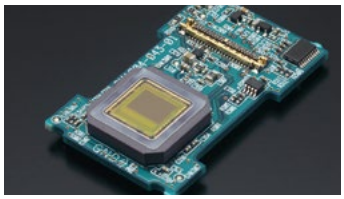
Making stable measurements of any target possible even at ultra high speed

Newly developed | World's greatest

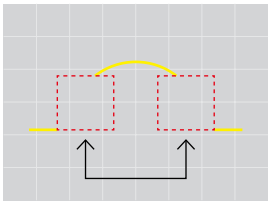
HSE³-CMOS

* 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.

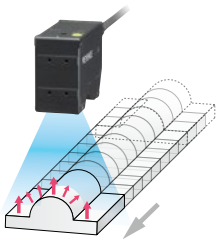


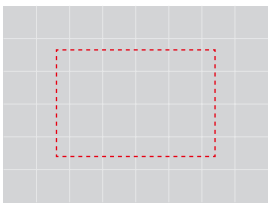
Stopped target

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

Moving target

DYNAMIC RANGE
2400×

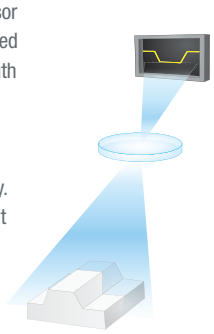


	
Because there is even less light intensity, the measurement could not be performed at all.	Even though the exposure time is short, all ranges could be measured without issue.

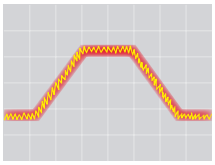
Forms ultra-stable and highly accurate profile images

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.

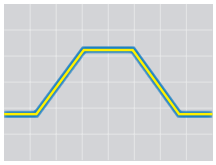


Red laser (conventional)



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)



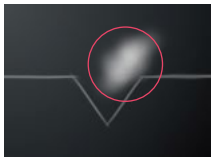
With a blue laser, the image forming beam becomes sharp, enabling the measurement of shapes with excellent accuracy.

Identifies unnecessary light reflections

Double polarization function

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

1. X polarization

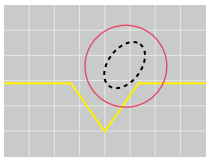


2. Y polarization

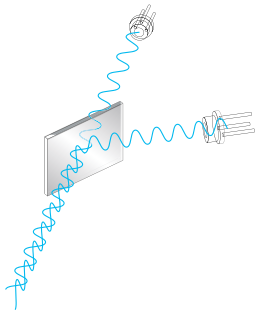
Multiple reflection light

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

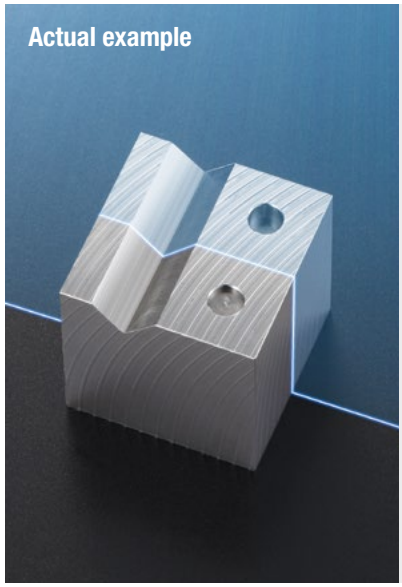
Generator profile



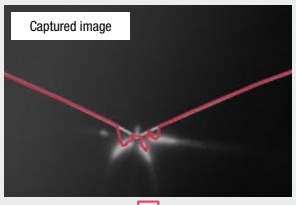
Data with areas that contain large differences is canceled.



Actual example

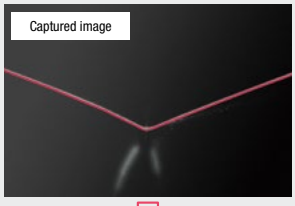


Conventional model



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

LJ-V



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

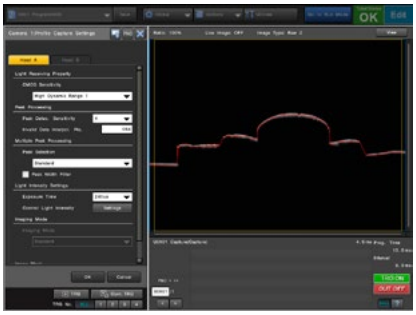
LJ-V head direct connection

A new input unit (CA-E100LJ/E110LJ) has been developed that can be connected directly to the LJ-V head. This allows the LJ-V to be set from the CV-X/XG-X controller.

Configuring the LJ-V settings

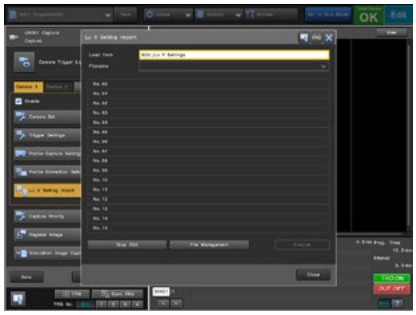
The settings of the LJ-V head can be completed with the CV-X/XG-X controller. Since settings changed within the image capture unit are reflected in the height image in real time, optimum settings can be made quickly.

Profile capture setting



The wave pattern of a received-light image can also be displayed with the CV-X/XG-X controller.

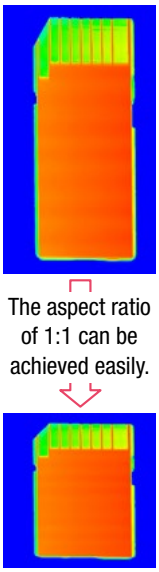
LJ-V setting import



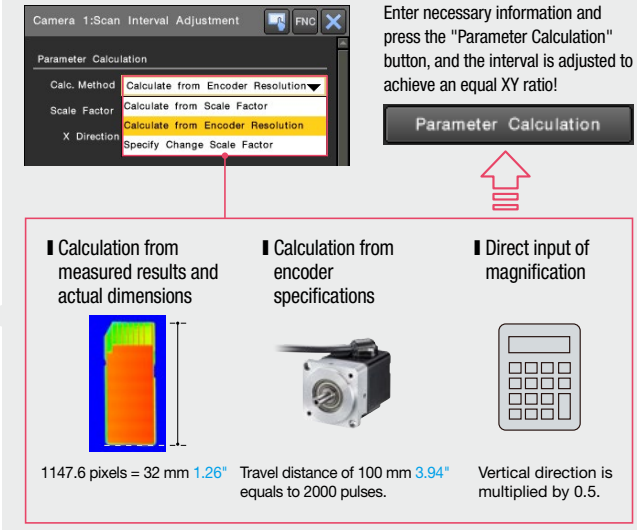
The import function allows the loading of settings from an LJ-V7000 that is already in use.

Line scan interval adjustment function

This tool calculates the line scan interval to display a captured image with an aspect ratio of 1:1. The optimum method can be selected, including conversion from measurement results and actual dimensions or calculation from encoder specifications.



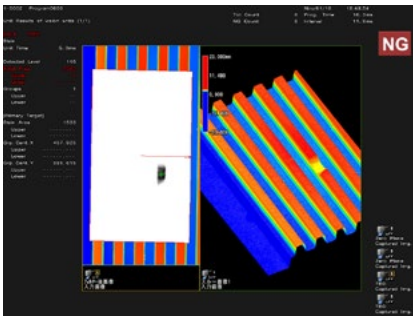
The aspect ratio of 1:1 can be achieved easily.



3D controller display

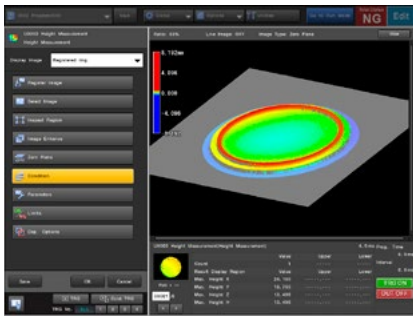
The controller can display 3D images in various program settings. 3D display is possible even on the operation screen, which provides flexible operation views such as side-by-side display of images before and after measurement processing.

Operation screen



An image after height extraction and a 3D image are displayed side-by-side and updated for every measurement.

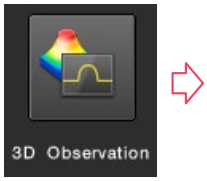
Zero plane display

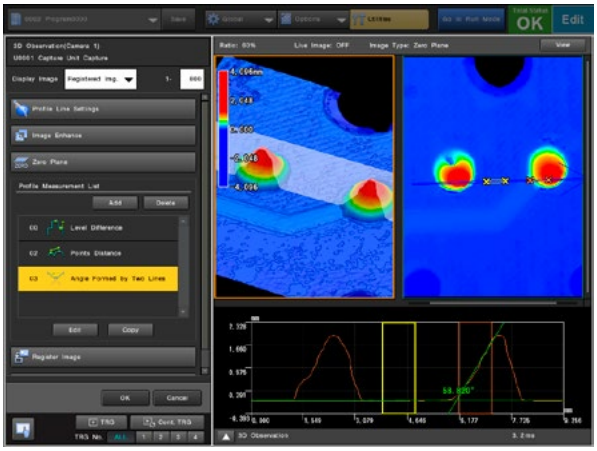


The zero plane used for measurement (measurement reference plane) can also be displayed as an on-screen graphic. This allows visual confirmation of measurement status.

3D observation utilities

Specify a desired profile for the captured height image to observe details. A number of tools are included to allow you to check the height or height difference on the profile with easy operations. This allows simple inspection and setting optimization.

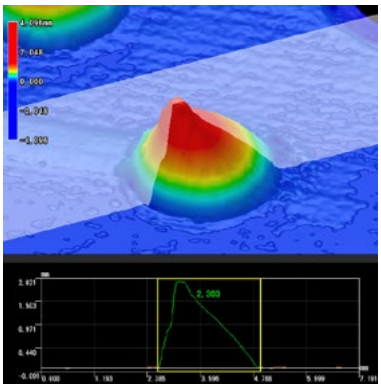




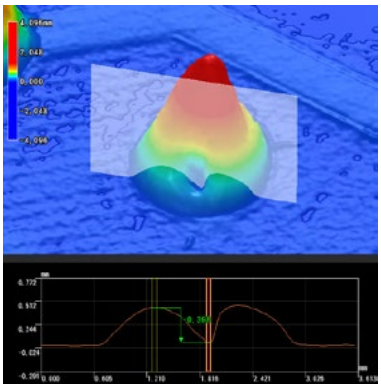
The following measurements are possible for an arbitrary profile line:

- Height
- Level Difference
- Position
- Center Position
- Width
- Angle from Horizontal
- Angle Formed by Two Lines
- Radius of Circle
- Cross-Section Area
- Points Distance
- Point/Line Distance

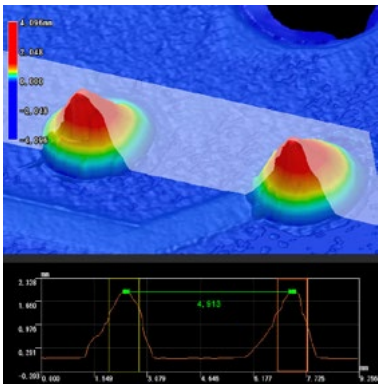
Measurement example 1 Cross-Section Area



Measurement example 2 Level Difference



Measurement example 3 Points Distance

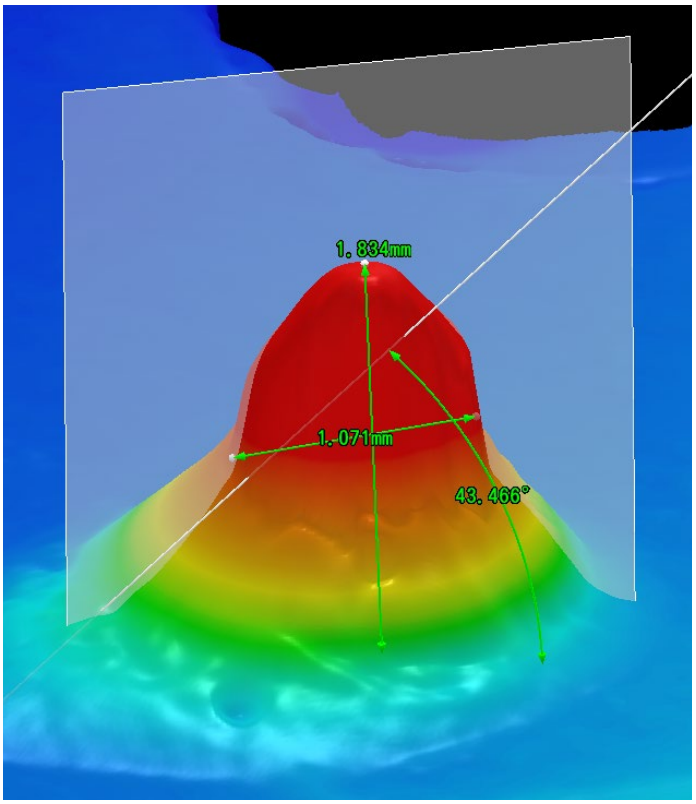


Easy 3D Shape and Appearance Inspection

Inline visualization and quantification of 3D shapes

3D dimensions/geometry

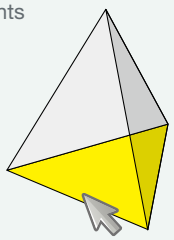
XG-X Only



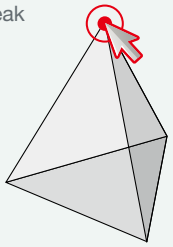
In most cases, dimension and geometry measurement based on image processing requires complicated arithmetic processing. The XG-X Series offers the 3D Dimensions/Geometry tool category to complete this complicated processing simply by clicking on the image. Pre-defined point/line information of other tools can also be referenced, so that inspection settings can be configured for simpler and easier operation.

Easy operation just by selecting the measurement location

Specify the three points that will make up the reference plane.

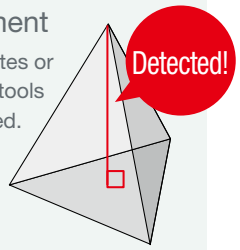


Simply specify the peak point on the target.



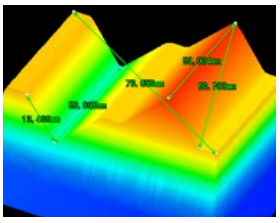
Easy measurement

Pre-defined coordinates or planes/lines of other tools can also be referenced.

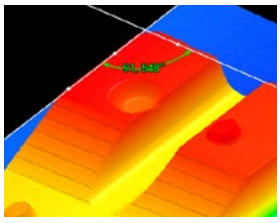


Perform 3D geometric operations for complex-shaped objects with ease

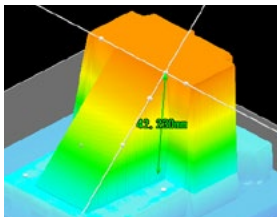
Point/Line Distance



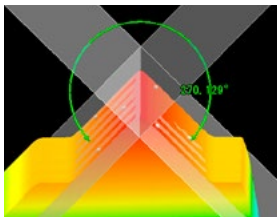
Angle Between Line and Plane



Line Intersection/Plane Distance



Angle Between Two Planes



Calculation Type	Measurement
Distance	•Points Distance •Point/Line Distance •Point/Plane Distance •Lines Distance •Line/Plane Distance •Planes Distance
Angle	•Angle Between Two Lines •Angle Between Line and Plane •Angle Between Two Planes
Point	•Point •Intersection of Two Lines •Line/Plane Intersection •Midpoint of Points •Point Between Point and Line •Point Between Point and Plane •Intersection of Point/Line •Intersection of Point/Plane
Line	•Line •Line Defined by Two Points •Center Line Between Point and Line •Line Projection onto Plane •Line Between Planes
Plane	•Plane •Center Plane Between Two Points •Center Plane Between Point and Plane •Plane Determined by Point and Line •Plane Determined by Two Lines
Sphere	•Sphere

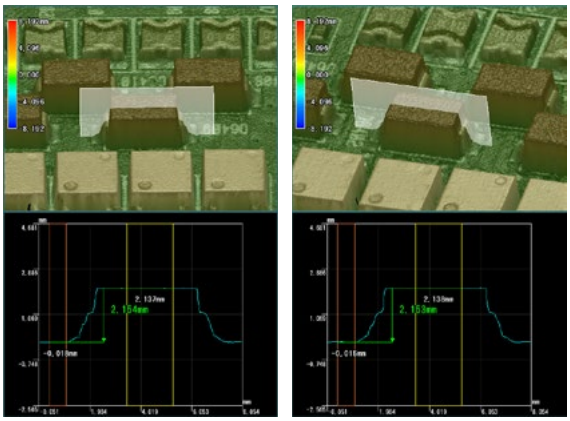
Incorporated measurement tool capable of capturing actual shapes

Profile measurement / Continuous profile measurement

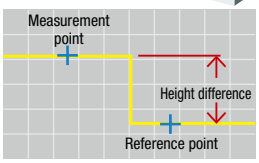
XG-X Only

Challenges with conventional methods (using general-purpose 2D profile measurement)	With 3D profile measurement
Because the position where the cross-section profile can be obtained is fixed, the target must be fixed using a jig or other means.	Corrections can be performed according to the position of the target, allowing for accurate measurement of the same location regardless of how the target is positioned.
Cross-section profiles can only be obtained from one direction.	Cross-section profiles can be obtained from any position and at any angle.

Position adjustment for accurate measurement of the same location feature even if the position of the target varies

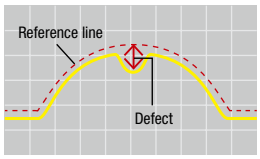


LEVEL DIFFERENCE



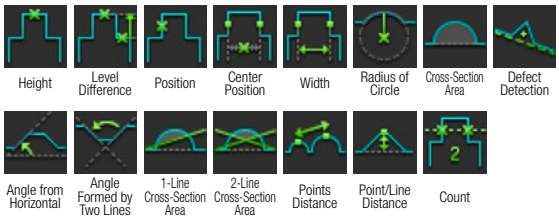
Measures the height difference from a reference point to a measurement point.

DEFECT DETECTION



Determines any deviation from the reference line to the profile line within the measurement range and measures the area of each deviation.

15 different measurement tools to cover all assumed 3D dimension inspections

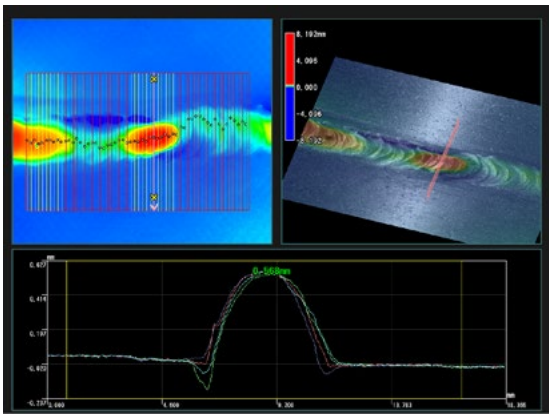


Profile inspection in up to 16,384 sections within a single area for recognition of extremely small changes

XG-X Only

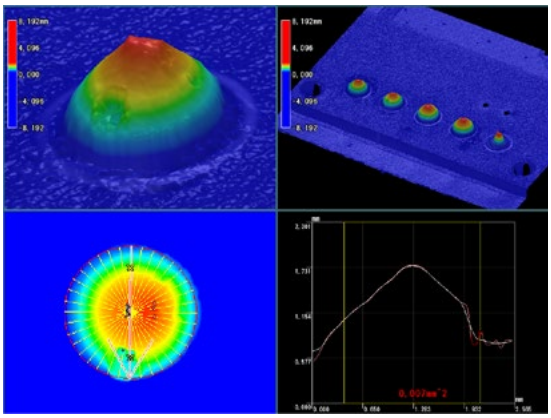
Profile measurement can be performed continuously for obtained cross sectional shapes and 3D shapes. This tool is effective for inspecting welding seams and other continuous targets as well as targets that need to be inspected from all angles such as solder. It can measure multiple cross sectional views to extract subtle changes in the profile.

Profile inspection of welding



This tool continuously measures height or cross sectional area and calculates the difference between the maximum and minimum values to achieve stable inspection.

Profile inspection of solder



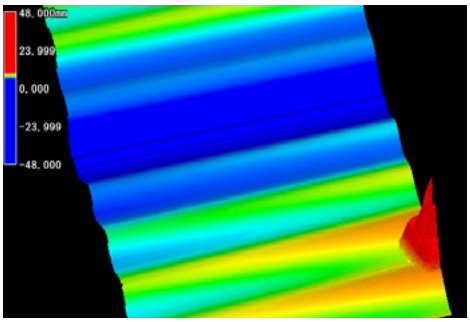
This tool can inspect the shape of solder from 360 degrees to extract subtle surface changes.

Vibration correction

First in Its Class

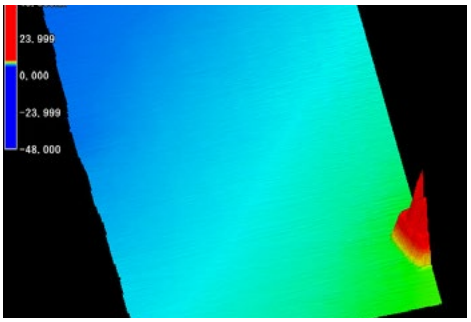
Vibrations that occur during workpiece transfer and others are analyzed in real time, making it possible to extract only the necessary data.

Conventionally



Vibrations that occur during workpiece transfer were included in the measured data.

After Processing

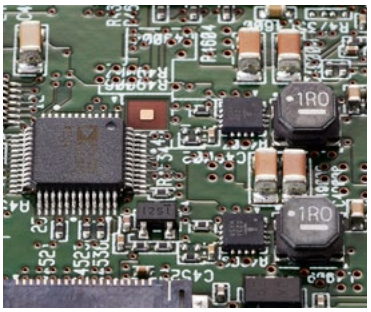


The vibrational components are removed and it is possible to obtain the true shape of the workpiece.

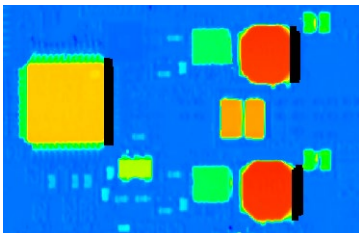
2-head dead angle cut

First in Its Class

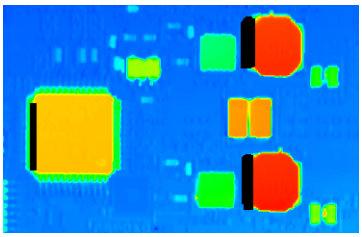
This makes it possible to generate high-precision 3D images without noises and dead angles that exceed the limit of the triangulation system.



Composition 1

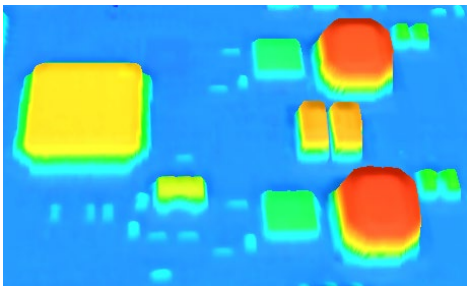


Composition 2



Composition

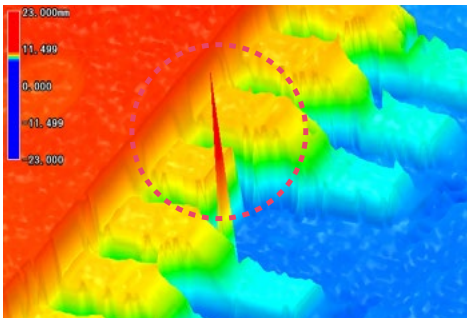
After Composition



Spike noise cut

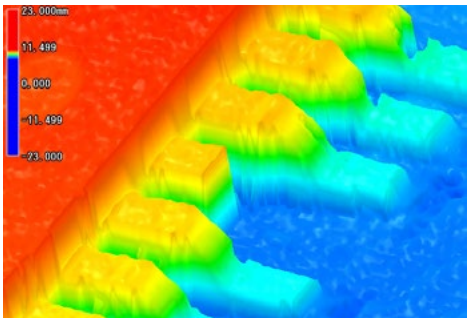
A sudden spike-shaped noise is eliminated, making stable measurements possible.

Conventionally



Measurements may become unstable due to spike-shaped noises occurring in such areas as the workpiece end face.

Spike Noise Cut

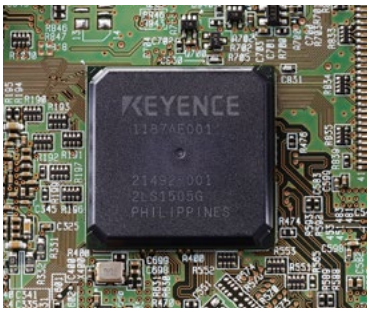


Spike noises alone are removed, realizing stable measurements.

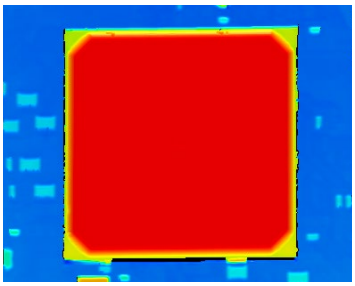
Simultaneous acquisition of grayscale image

First in Its Class

By acquiring the grayscale image from the LJ-V, inspections and position adjustment are made possible.



Height Image



Grayscale Image

By acquiring the height image and grayscale image simultaneously, such things as character inspection and position adjustment using the image of a part without height difference become possible. This makes a wider range of applications doable.

Note: This function is supported in particular models only. For details, please inquire of our sales representatives.

Programmable Encoder

The number of pulses/rev. can be freely set making it possible to easily obtain the best 1:1 image ratio possible. (Settings can be configured freely between 64 and 150000 pulses per rotation.)
Unlike with conventional products, there's no need to select encoders based on such aspects as the rotation speed of the shaft, the roller diameter, and consideration for the field of view.

Encoder relay unit
CA-EN100U

Dedicated encoder
CA-EN100H

▮ High-resolution, high-speed output

Support for up to 150000 pulses/revolution 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 1.6 MHz.

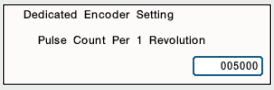
▮ IP65-compatible

Added consideration for environmental resistance has resulted in a design that is even more resistant to water and dust, making devices 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.

Installation image

Controller setting screen



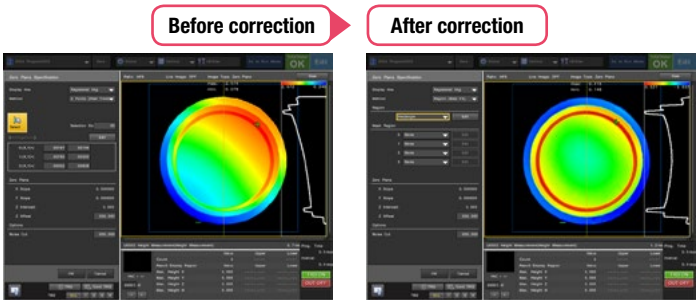
Height Measurement Tool

Measuring height, area, and volume from 3D data

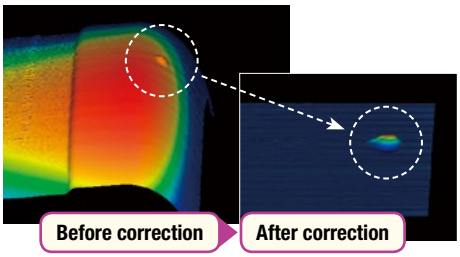
Inspection using 16-bit height data is processed. Simply by setting a region to inspect, maximum height, minimum height, convex area, concave area, convex volume, concave volume and others can be measured. More flexible inspection is achieved by specifying an arbitrary plane on the screen as the zero plane.

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.

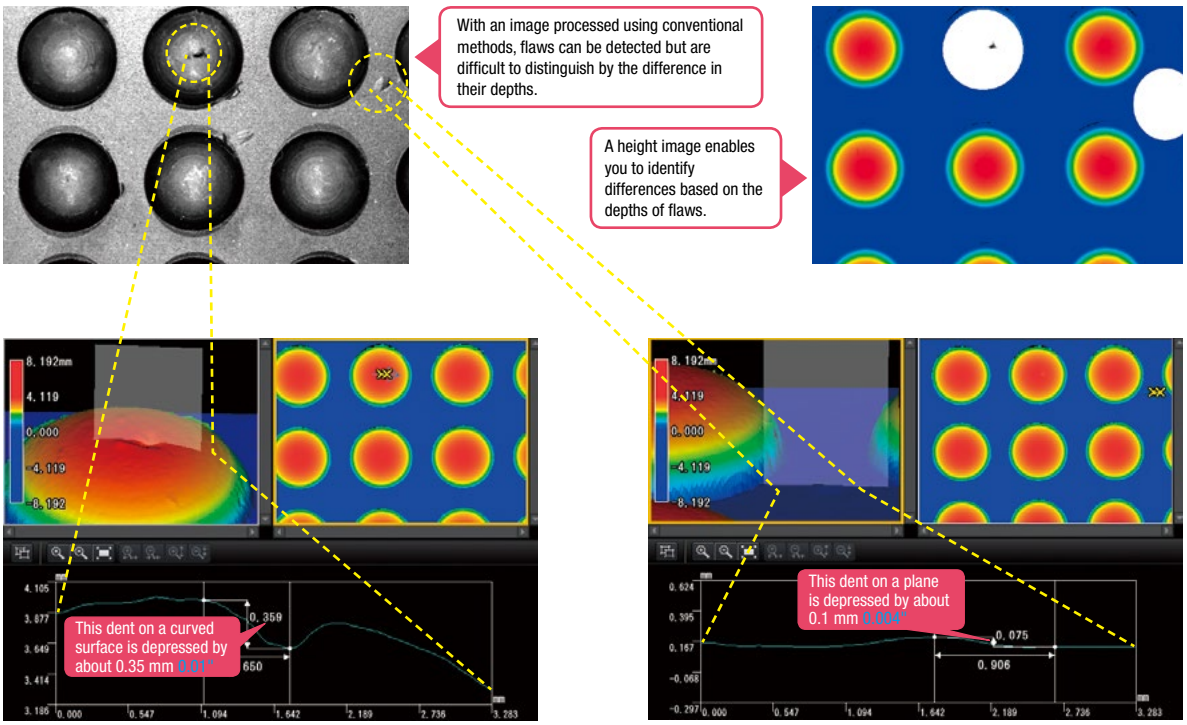


Height and volume of burrs can be measured even on metal curved-surfaces using the free-form plane as a reference surface.

3D enables inspection beyond the limits of image processing

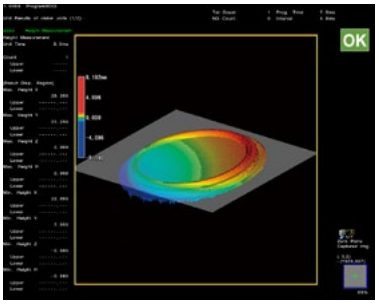
Easy detection with 3D measurement

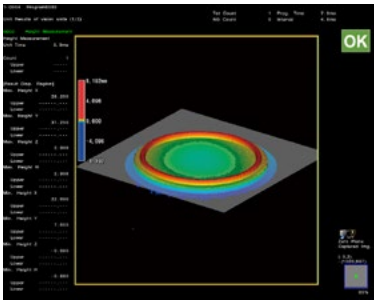
3D measurement makes it easy to detect flaws that used to be difficult to detect without advanced lighting techniques. Flaws can be inspected with their real depth.



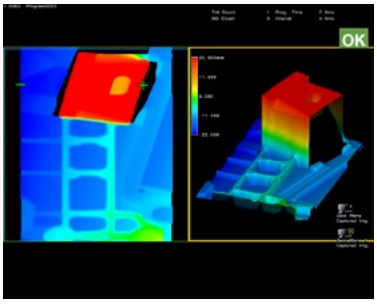
Supports 3D viewer using the controller

Real-time 3D display is possible using the controller. The 3D viewer allows more reliable settings and more visible operations as well as a zero plane display.





Appropriate settings are possible while checking the zero plane conditions in 3D images.



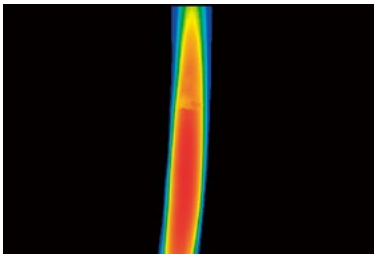
Simultaneous display of 2D and 3D images is supported.

Image Region Generator Tool

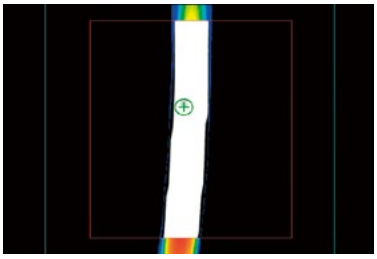
Creates a dynamic region according to height

This tool converts a specified height range into a virtual inspection region. Even if a workpiece shape changes, a region is automatically created accordingly.

Even flaws on the cable…



Automatic region creation allows a stable detection



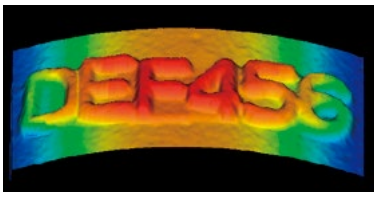
All of the CV-X/XG-X's conventional functions can still be used by converting 3D data to grayscale images

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 leading CV-X/XG-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 image



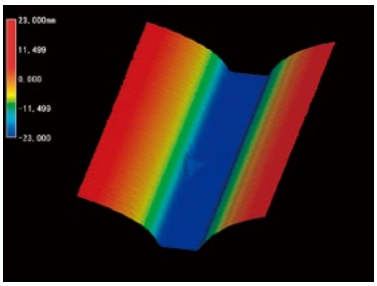
Height-extracted image (Free-form plane) + OCR

Also supports difficult-to-detect workpieces by extracting concavities and convexities from free-form plane shapes

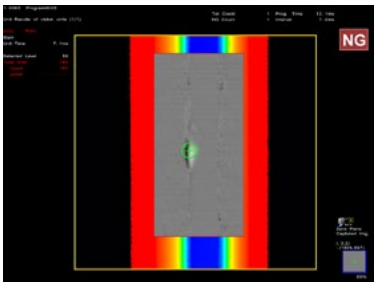
Area cameras cannot detect dents because images are shaded due to the influence of complex curves and surface irregularities. Inspection becomes possible by extracting height change of points based on the information of a free-form plane.

Workpiece photo

Height image



Detection image



Head unit

Ultra high-accuracy specular reflection

LJ-V7020K/LJ-V7020KB

Measurement range	Z-axis	24.2 ±2.3 mm 0.95" ±0.09"
	X-axis	7 mm 0.28"
Profile data interval	X-axis	10 µm 0.000394"
Repeatability	Z-axis	0.2 µm 0.000008"
	X-axis	2.5 µm 0.000099"

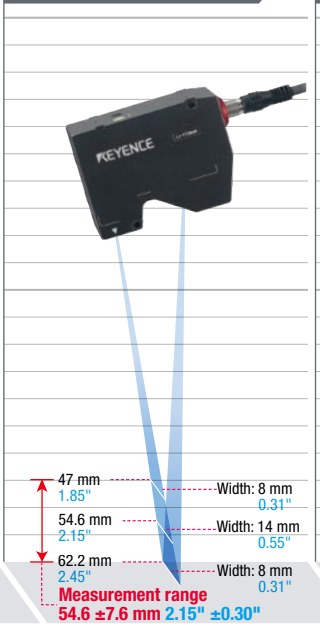
Ultra high-accuracy

LJ-V7020/LJ-V7020B

Measurement range	Z-axis	20 ±2.6 mm 0.79" ±0.10"
	X-axis	7 mm 0.28"
Profile data interval	X-axis	10 µm 0.000394"
Repeatability	Z-axis	0.2 µm 0.000008"
	X-axis	2.5 µm 0.000099"

High-accuracy specular reflection

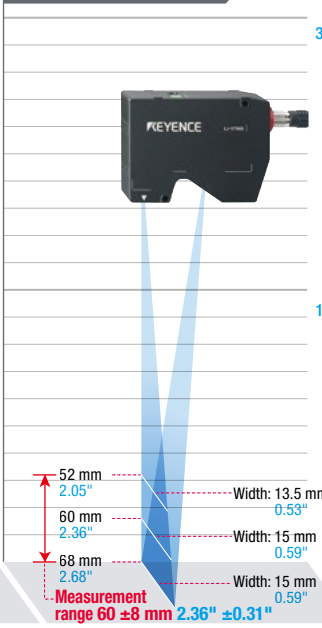
LJ-V7060K/LJ-V7060KB



Measurement range	Z-axis	54.6 ±7.6 mm 2.15" ±0.30"
	X-axis	14 mm 0.55"
Profile data interval	X-axis	20 µm 0.000788"
Repeatability	Z-axis	0.4 µm 0.000016"
	X-axis	5 µm 0.000197"

High-accuracy

LJ-V7060/LJ-V7060B



Measurement range	Z-axis	60 ±8 mm 2.36" ±0.31"
	X-axis	15 mm 0.59"
Profile data interval	X-axis	20 µm 0.000788"
Repeatability	Z-axis	0.4 µm 0.000016"
	X-axis	5 µm 0.000197"

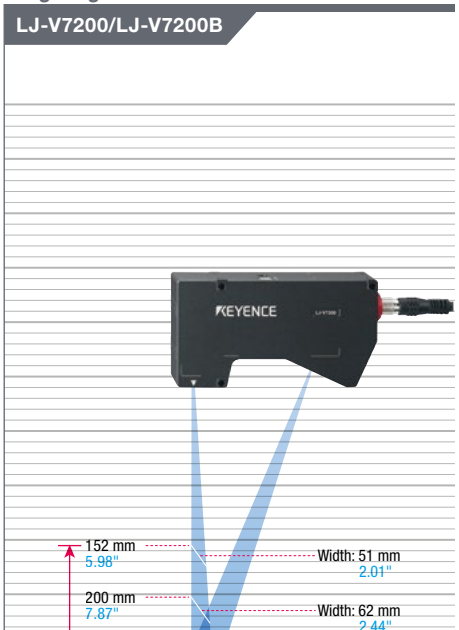
Middle range

LJ-V7080/LJ-V7080B

Measurement range	Z-axis	80 ±23 mm 3.15" ±0.91"
	X-axis	32 mm 1.26"
Profile data interval	X-axis	50 µm 0.001969"
Repeatability	Z-axis	0.5 µm 0.000020"
	X-axis	10 µm 0.000394"

Long range

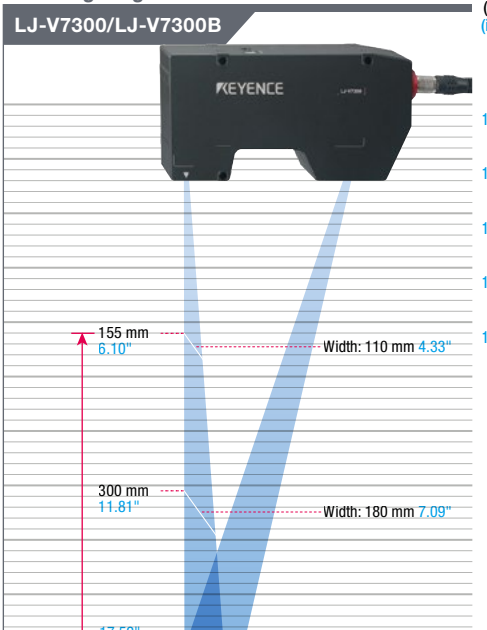
LJ-V7200/LJ-V7200B



Measurement range	Z-axis	200 ±48 mm 7.87" ±1.89"
	X-axis	62 mm 2.44"
Profile data interval	X-axis	100 µm 0.003937"
Repeatability	Z-axis	1 µm 0.000040"
	X-axis	20 µm 0.000788"

Ultra long range

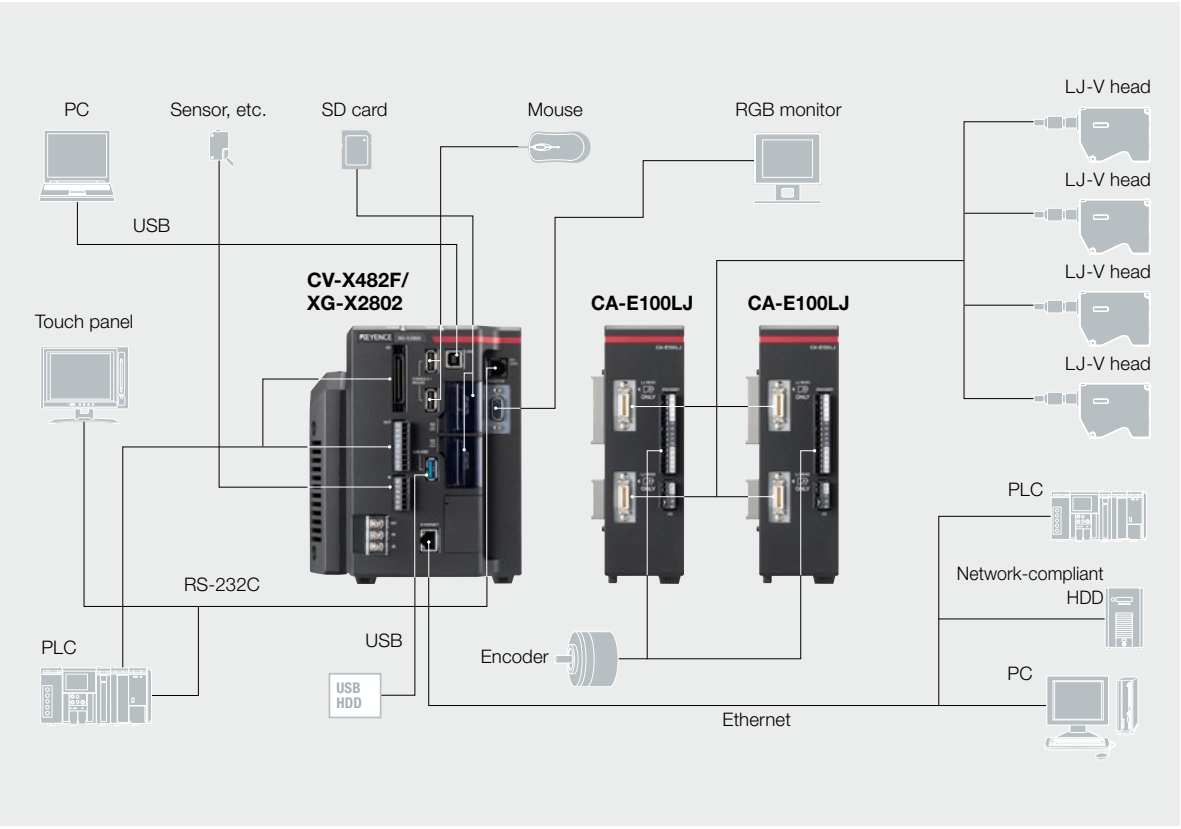
LJ-V7300/LJ-V7300B



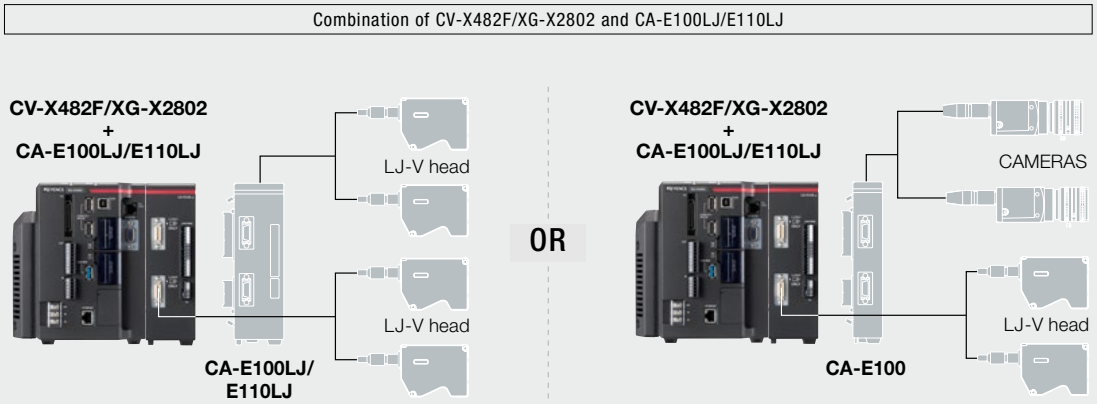
Measurement range	Z-axis	300 ±145 mm 11.81" ±5.71"
	X-axis	180 mm 7.09"
Profile data interval	X-axis	300 µm 0.011811"
Repeatability	Z-axis	5 µm 0.000197"
	X-axis	60 µm 0.002363"

The model with B at the end is Luminance output type.

SYSTEM CONFIGURATION (CV-X482F/XG-X2802+LJ-V)



Specifications of mixed connection for CV-X482F/XG-X2802



■ 21 megapixel cameras cannot be connected when LJ-V is connected with CV-X482F

Controller

Controller
CV-X482F/CV-X480LJ

Controller
XG-X2802/XG-X2800LJ

Head

LJ-V head

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

* Refer to page 18 for details.

Options

Cable for LJ-V Series

LJ-V head
connection cable
CB-B3 (3 m 9.8')
CB-B10 (10 m 32.8')

LJ-V head connection
extension cable
CB-B5E (5 m 16.4')
CB-B10E (10 m 32.8')
CB-B20E (20 m 65.6')

Expansion unit

LJ-V
input unit
CA-E100LJ/E110LJ

Area camera
input unit
CA-E100

LED light control
expansion unit
CA-DC40E

LumiTrax™ supporting
light control expansion unit
CA-DC50E

CC-Link
unit
CA-NCL20E

Dedicated to the XG-X Series

Monitor/touch panel

Multi-touch enabled
12" touch panel
CA-MP120T
12" LCD color monitor
CA-MP120

Monitor stand for
CA-MP120T/MP120
OP-87262

Screen protector for
CA-MP120T
OP-87263

Pole-mounting bracket for
CA-MP120T/MP120
OP-42279

Touch Panel Cable
OP-87258 (3 m 9.8')
OP-87529 (10 m 32.8')

RGB monitor cable
OP-66842 (3 m 9.8')
OP-87055 (10 m 32.8')

* The use of the CA-MP120T requires an RGB monitor cable and a touch panel modular RS-232C cable.

Communication cable

Extension I/O cable
OP-51657 (3 m 9.8')

Communication cable conversion connector
9-pin: **OP-26486**
25-pin: **OP-26485**
9-pin SYSMAC: **OP-84384**
9-pin MELSEC: **OP-86930**

* When connecting the MELSEC-FX, which requires a 9-pin connection, use the OP-26486.

RS-232 communication cable
OP-26487 (2.5 m 8.2')

Ethernet cable
OP-66843 (3 m 9.8')

USB cable
OP-66844 (2 m 6.6')

Other

Image processing system integration software
XG-H1XA
CV-H1XA

SD card (industrial grade)
16 GB: **CA-SD16G**
4 GB: **CA-SD4G**
1 GB: **CA-SD1G**
512 MB: **OP-87133**

Handheld controller (USB)
OP-87983

Dedicated to the XG-X2802

Dedicated mouse
OP-87506
Mouse stand
OP-87601

24 VDC power supply
CA-U4/U5

Dedicated encoder
CA-EN100H

Encoder relay unit
CA-EN100U

Encoder head cable
CA-EN5 (5 m 16.4')
CA-EN10 (10 m 32.8')

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

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