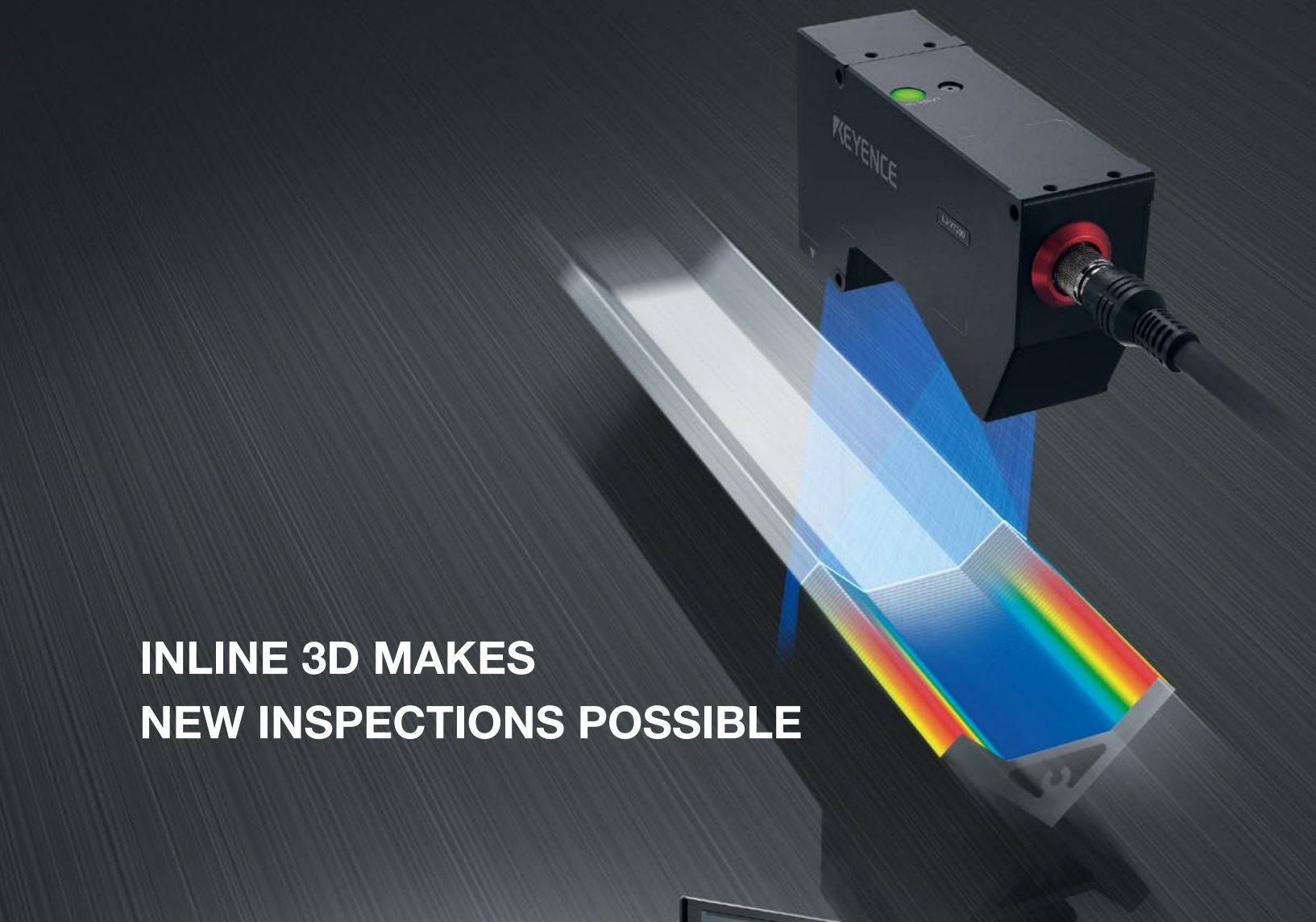
KEYENCE

Inline 3D Machine Vision System

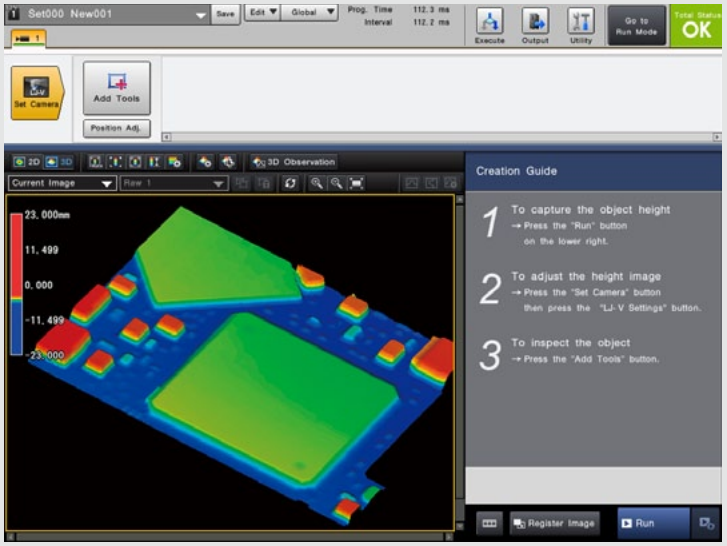
LJ-V 3D Laser Profiler + Machine Vision

LJ-V/CV-X200 Series



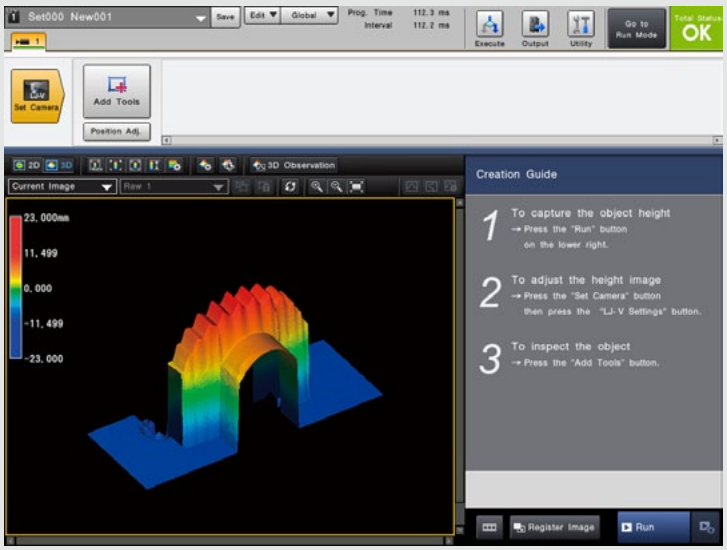
INLINE 3D MAKES NEW INSPECTIONS POSSIBLE

Coplanarity of a PCB



3D Inspection is realized for any workpiece

Even translucent objects

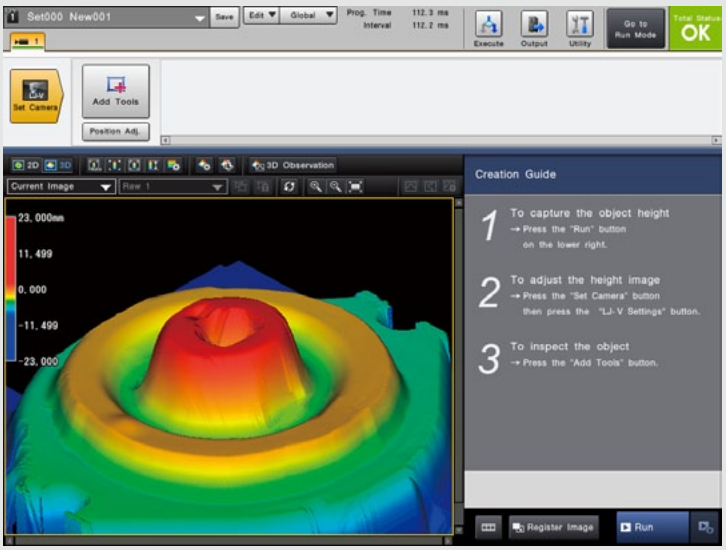


The LJ-V enables stable detection of various workpieces with ultra-high speed profiling of 64,000 profiles per second.
3D image processing is available for almost any workpiece by processing the profile data using the CV-X Series.

Image processing system
CV-X

Laser profile scanner
LJ-V

Flatness of black rubber



Height, width, position, cross-sectional area, volume

Conventional method: line-scan camera/area camera

Conventional camera & displacement sensor

The width and position can be inspected using area cameras or line-scan cameras but it was difficult to read characters on tire surfaces.

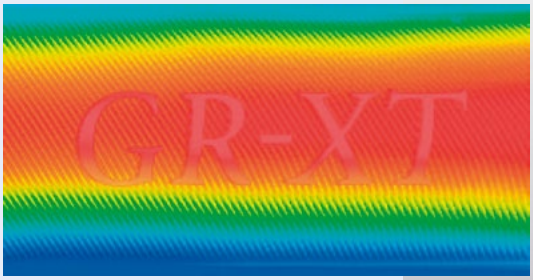
Reading characters on tires was impossible with standard cameras

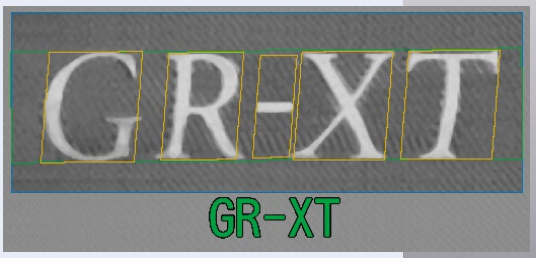
3D makes it possible

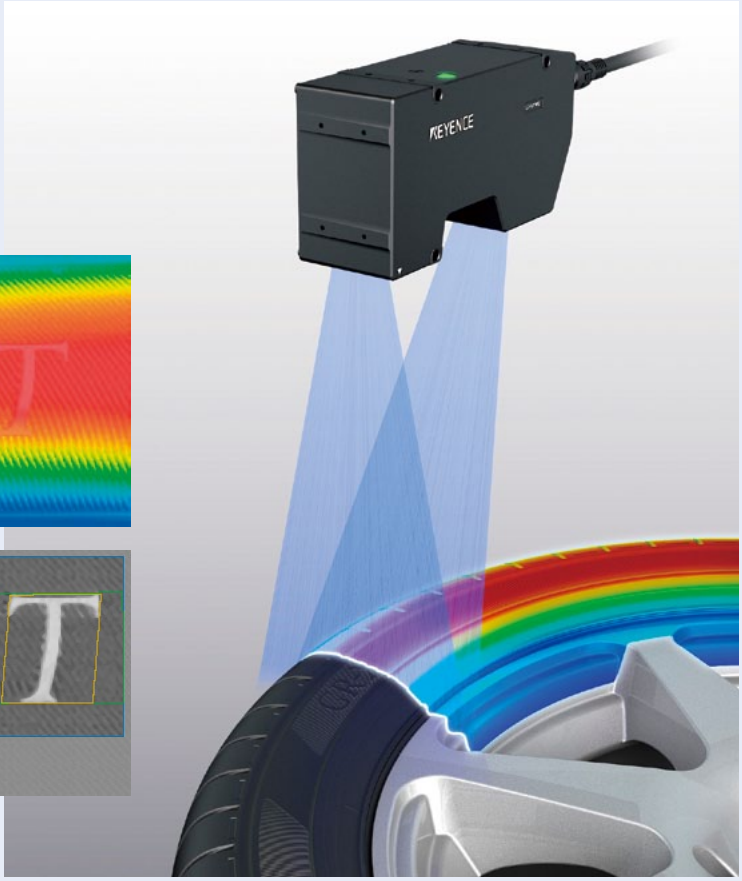
With 3D image processing

LJ-V + image processing

Stable inspection is realized for applications where detection used to be difficult with conventional image processing, such as character inspection on black rubber.





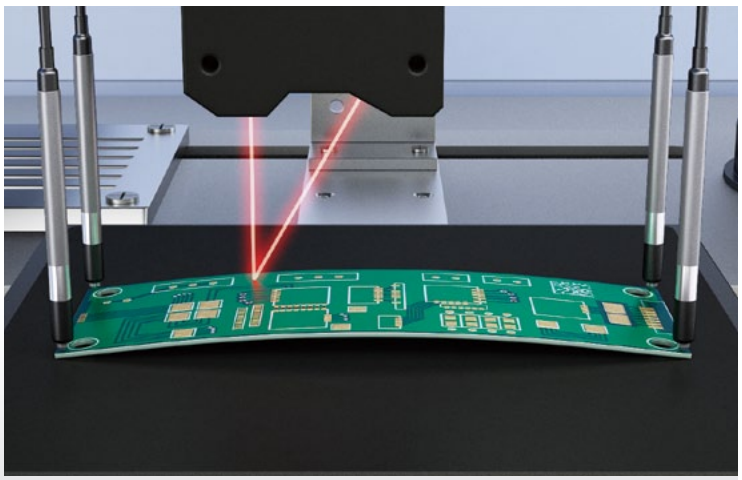


Flatness and warpage

Conventional method: Laser displacement sensor or contact-type sensor

Conventional profile measurements using points and lines

Profile measurements are made using points and lines. For contact type sensors, it is necessary to select a head for each desired measurement area. For laser displacement type sensors, scan time in the X and Y axis is required.



Inspection was inconsistent even with the combination of a laser displacement sensor and a contact sensor

3D solves this problem

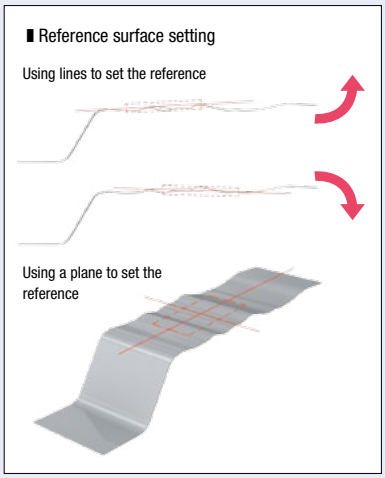
With 3D image processing

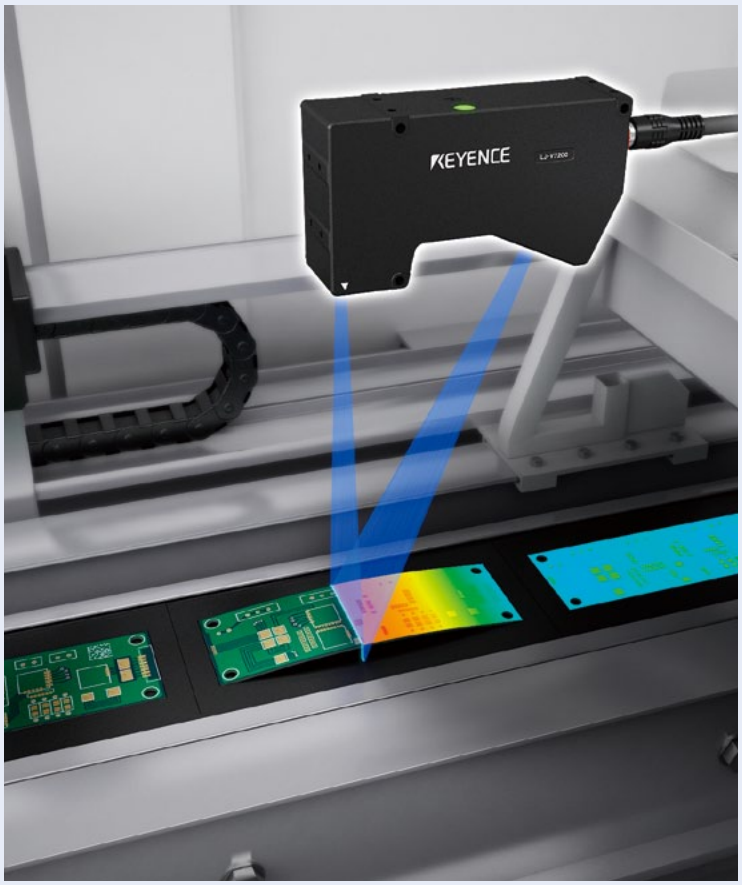
LJ-V + image processing

The LJ-V Series 3D profiler allows quick and easy flatness/warpage measurement. Surfaces can be scanned with a single pass upon which internal profile measurements and surface adjustments can be made.

Plane Tilt Correction

It is difficult to properly correct for tilt of a surface by using only line profiles. With the LJ-V/CV-X200 Series, correction can be performed using the entire surface to enable accurate hight measurement despite variations in part presentation.



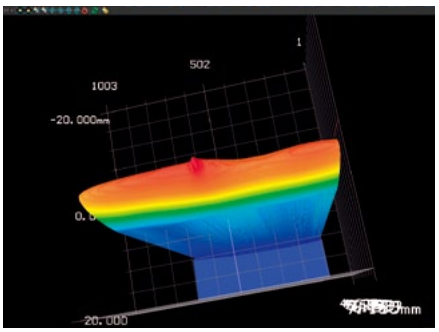


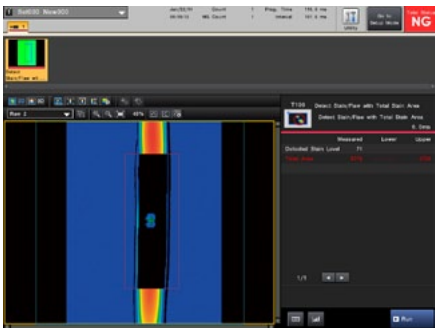
The CV-X 3D image processing system enables processing that was impossible with the LJ-V profile scanner only.

LJ-V7200

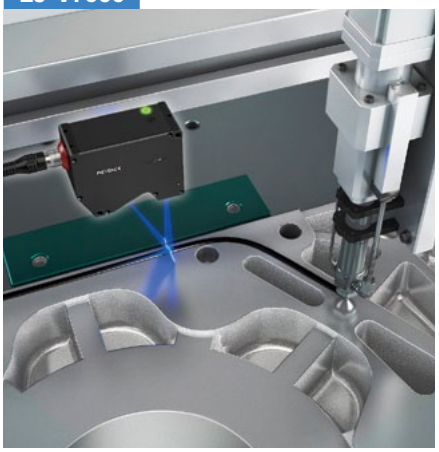
Inspection of cracks and dent shapes on rubber-coated cables

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



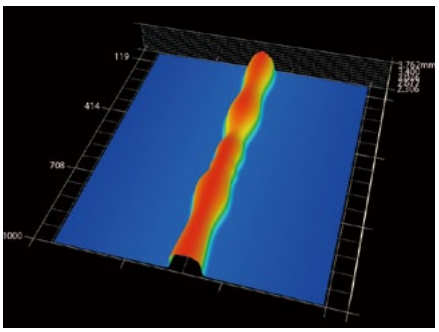


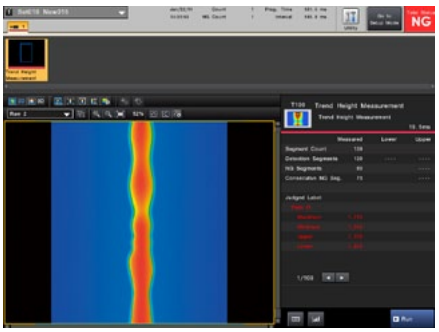
LJ-V7060



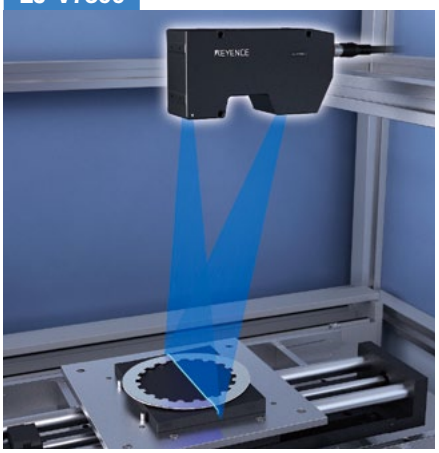
Inspection of width, height, and volume of sealants

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



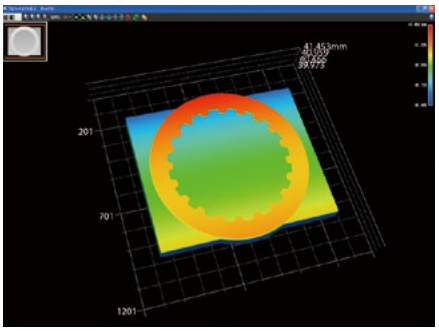


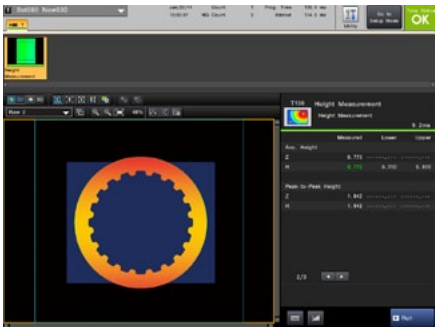
LJ-V7300



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 Ensures stable inspection by individually correcting variation among products.



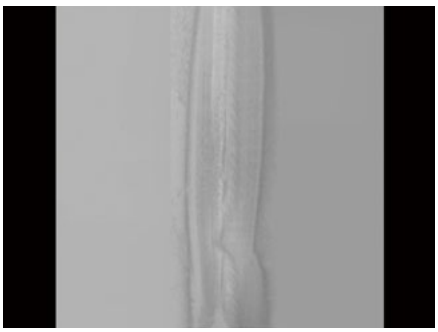


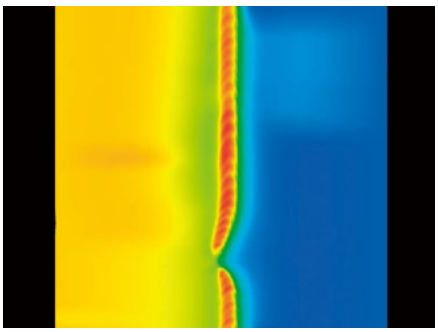
A combination with the LJ-V profile scanner enables detection that used to be impossible with image processing only.

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 Stable inspection is possible without being influenced by the surface condition of workpieces.

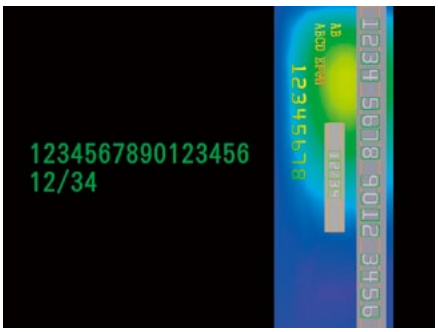




LJ-V7060

OCR for card numbers

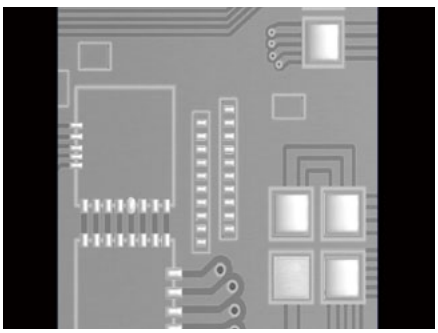
Conventional camera OCR was difficult due to the influence of the background.
LJ-V + CV-X Stable OCR is possible by detecting the difference in height.

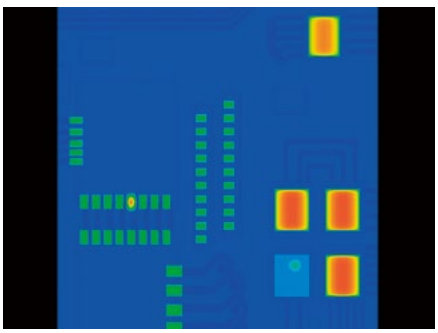


LJ-V7060

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 Ensures inspection of presence, bridge, and volume of soldering.





Height Measurement Tool

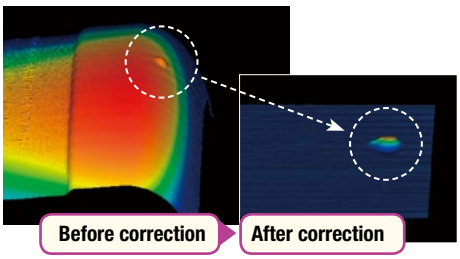
Measuring height, area, and volume from 3D data

Inspection using 16-bit height data is realized. 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 inspection area 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 changes its orientation. A different reference plane can be specified 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.

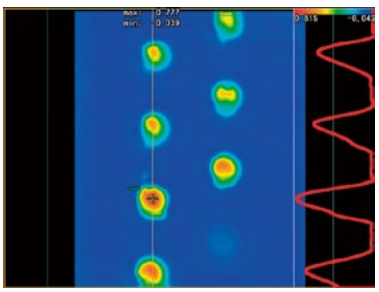


Height and volume of burrs can be measured even on metal curved-surfaces using the free-form plane type of zero plane.

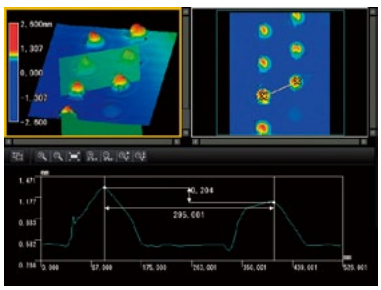
Profile display and 3D observation

Supports height cross-section profile display and enables display and simple measurement of a profile between two points specified freely using the mouse. Thus, it is easy to check whether appropriate settings were made. For gray images, intensity profile display with 256 tone levels is available.

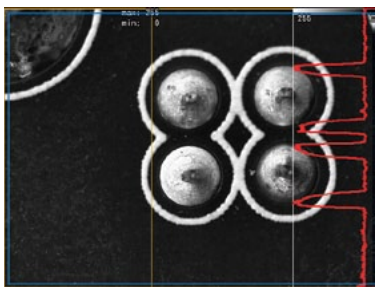
Height image profile



3D observation

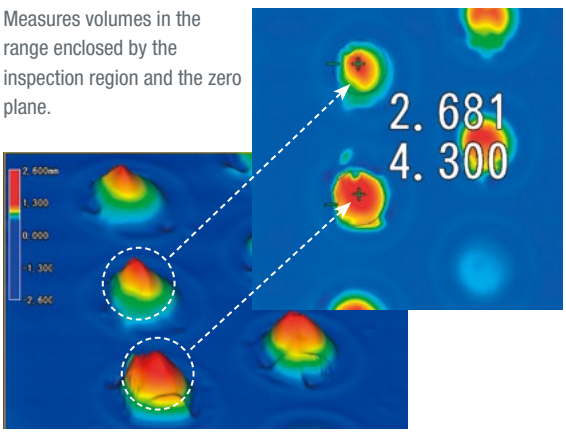


Grayscale image profile



Area and volume measurement

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

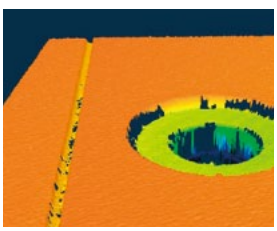


16-bit pre-processing dedicated for height images

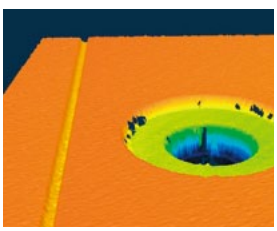
Pre-processing dedicated for height images is provided.

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

Height image



Pre-processed image



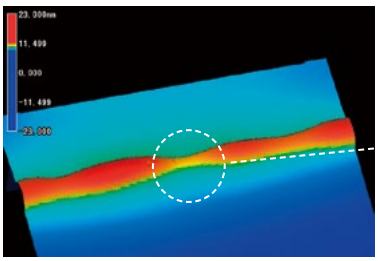
Using pre-processing for grooves, which have largely varying luster, makes it possible to perform stable measurements.

Trend Height Measurement Tool

Performs height measurement at more than one point in a single region

This tool performs height measurement at multiple points in a specified region. The tool enables detection of a maximum/minimum value among the maximum heights calculated in each small region and detection of a plane/circle based on height information from multiple points.

Even sealant height…



Stable detection of areas with insufficient height

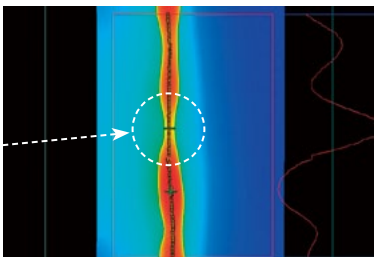
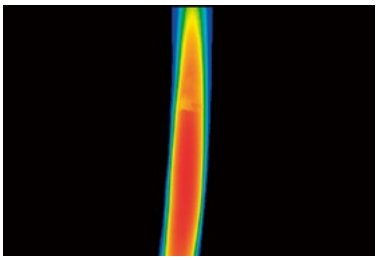


Image Region Generator Tool

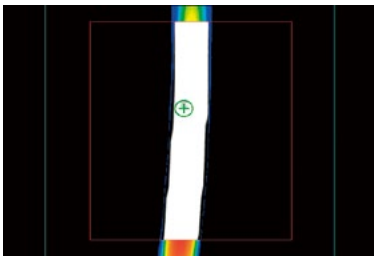
Creates an arbitrary region according to height

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

Even flaws on the cable…



Automatic region creation enables stable detection



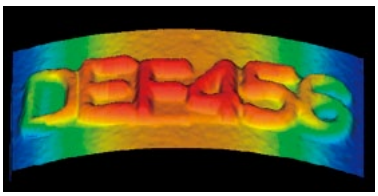
All of the conventional functions of the CV-X can be used by converting 3D data to grayscale images

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, established CV-X functions. Targets hard to detect with conventional image processing can now be detected by combining, for example, plane extraction or free-form plane extraction.

Standard area camera image

Height image



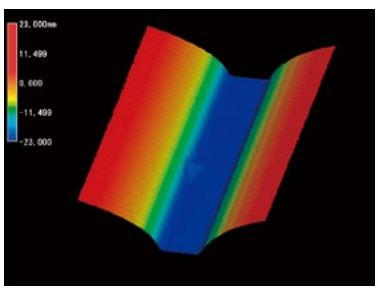
Height-extracted image (Free-form plane) + OCR

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

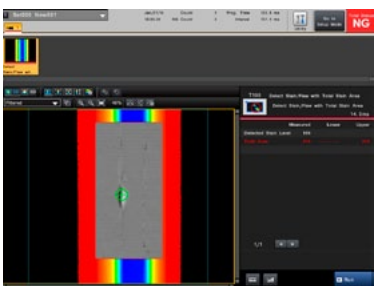
Area cameras cannot detect dents because images are shaded due to the influence of complex curves and surface irregularities. Inspection becomes possible by extracting changes in height based on the information of a free-form plane.

Workpiece photo

Height data obtained with LJ-V



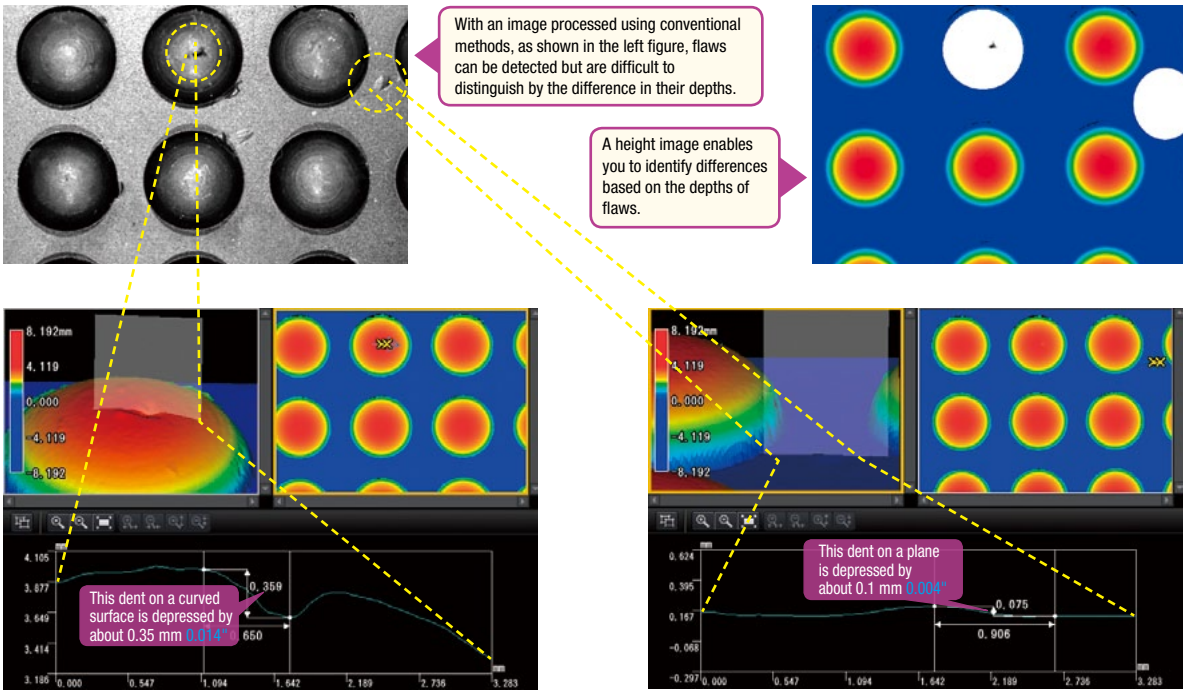
Detection image



3D enables inspection beyond the limits of image processing

Easy detection with 3D measurement

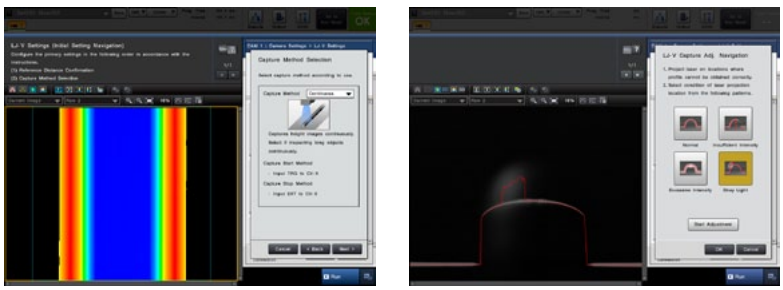
3D measurement makes it easy to detect flaws that used to be difficult to detect without advanced lighting techniques. Flaws can be inspected for their true depth.



LJ-V Settings

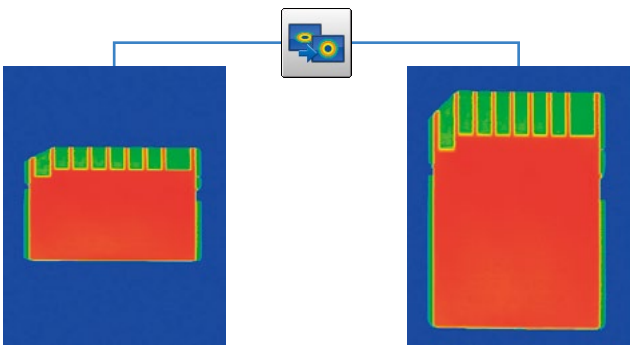
The CV-X navigates the optimum settings for the LJ-V

The LJ-V parameters can be set directly from the CV-X. The items required for the optimum LJ-V settings are configured in guided steps. Easy adjustment is possible simply by following the guide.



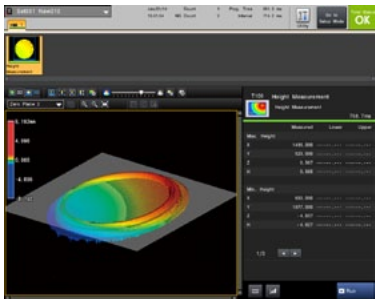
Equipped with the function that adjusts height images to an aspect ratio of 1:1

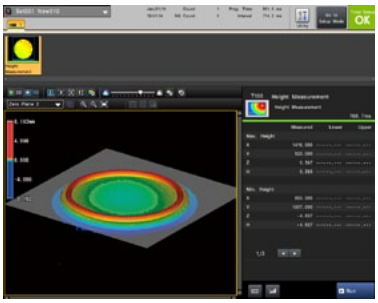
The aspect ratio can be adjusted to 1:1 easily by simply following the guide.



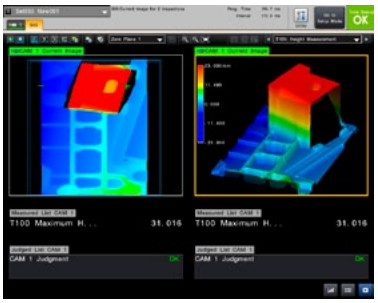
Supports 3D viewer directly on the controller

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



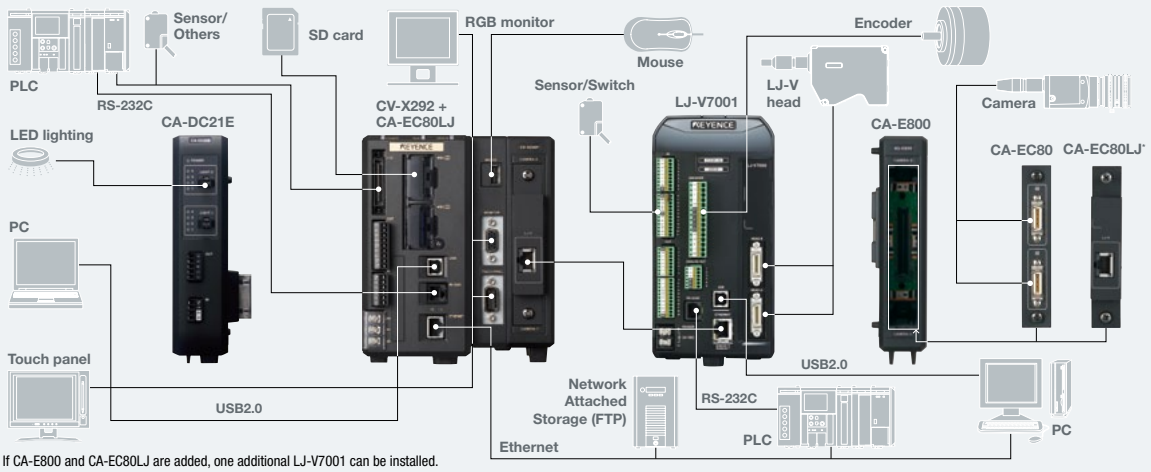


Appropriate settings are possible while checking the zero plane conditions in 3D images.



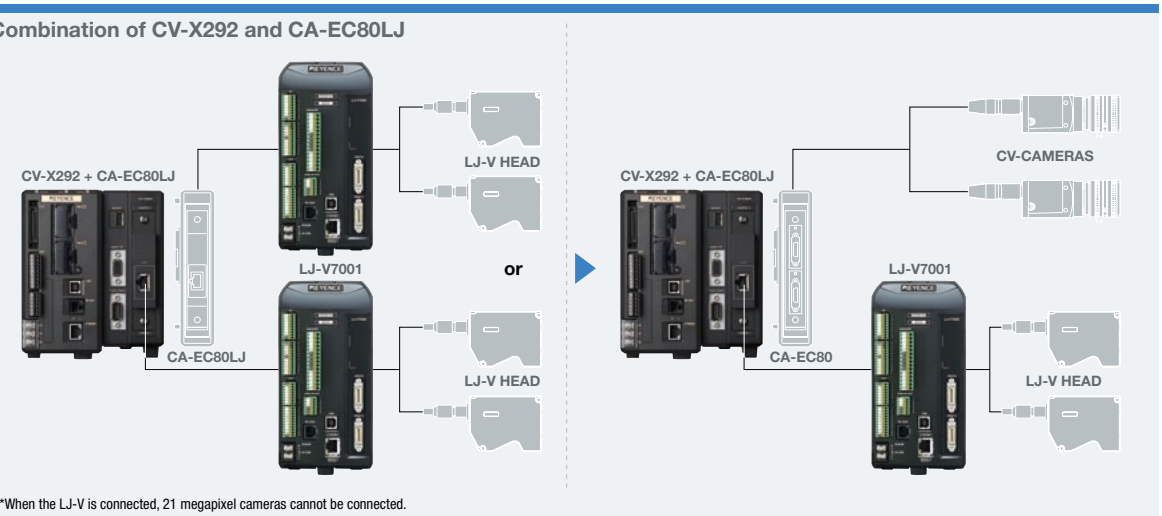
Simultaneous display of 2D and 3D images is supported.

LJ-V + CV-X system configuration



* If CA-E800 and CA-EC80LJ are added, one additional LJ-V7001 can be installed.

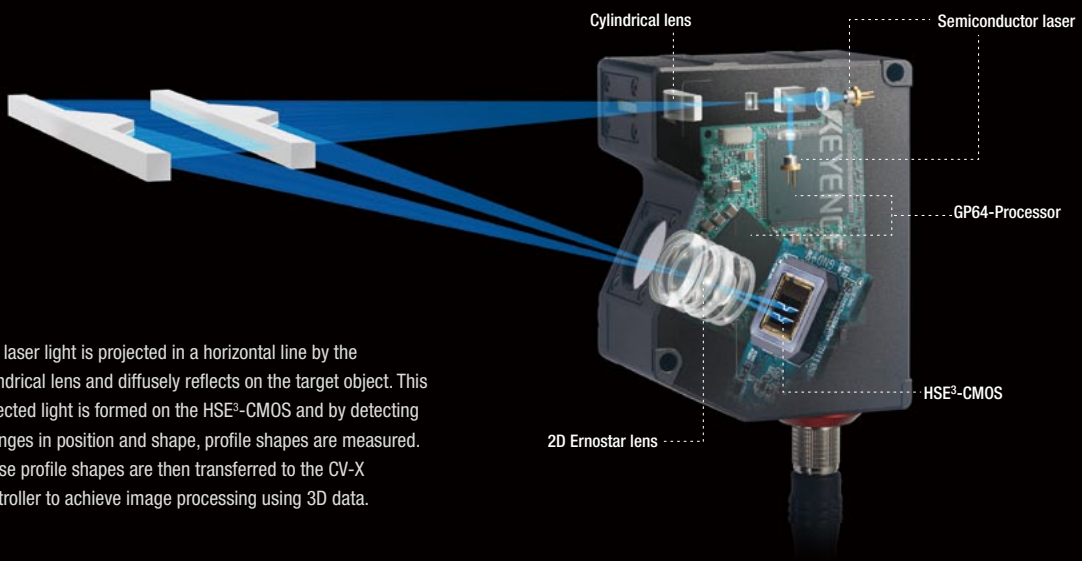
Specifications of mixed connection for CV-X



*When the LJ-V is connected, 21 megapixel cameras cannot be connected.

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

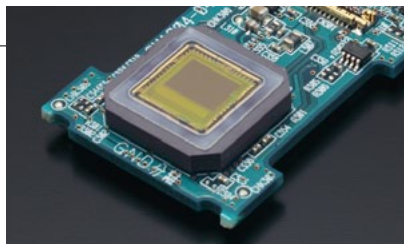
2D triangulation method



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 controller to achieve image processing using 3D data.

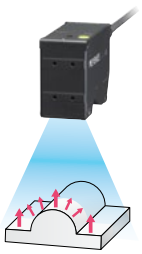
Making possible stable measurements of any target even at ultra high speed

HSE³-CMOS * HS = High Speed, E³ = Enhanced Eye Emulation

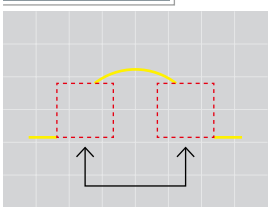


The LJ-V7000 Series is equipped with the newly developed HSE³-CMOS. In addition to improved speed, the dynamic range has been further improved over the established and conventional E³-CMOS. Even with the extremely short exposure time of 64 kHz (15.6 µs), it has achieved sensitivity that allows it to reliably measure a range of surfaces from black (small amount of reflection) surfaces to those with luster (large amount of reflection) as well a wide dynamic range.

Stopped workpiece



Conventional model



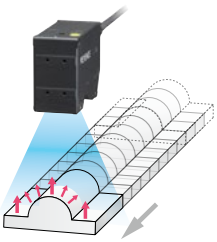
Measurement is impossible due to insufficient light intensity.

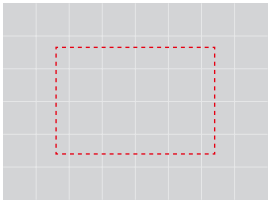
LJ-V HSE³-CMOS

All ranges could be measured.

Moving workpiece

Dynamic range **2400x**





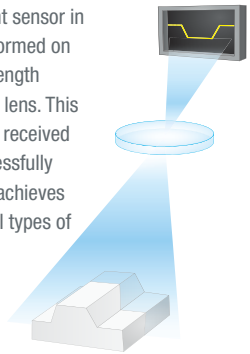
Because there is even less light intensity, the measurement could not be performed at all.

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

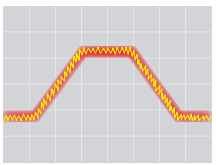
Forms ultra-stable and highly accurate profile images

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.

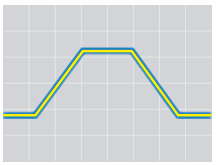


Red laser (conventional)



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)

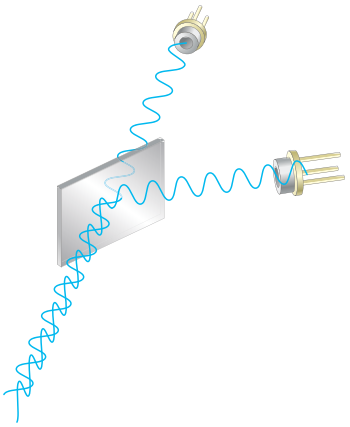


With a blue laser, the image forming beam becomes sharp, enabling the measurement of shapes with excellent accuracy.

Identifies unnecessary multiple reflection light

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.



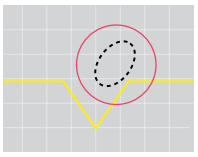
(1) (X polarization) Captured image

(2) (Y polarization) Captured image

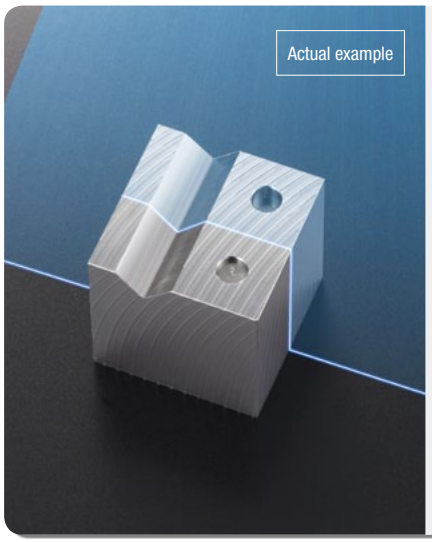
Multiple reflection light

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

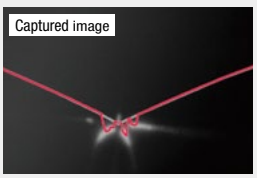
Generated profile



Data of areas that contain large differences are canceled.

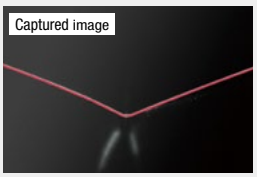


Conventional model



The strong influence of the diffused reflection light causes errors in the data.

LJ-V



The LJ-V Series cancels the diffused reflection light to perform stable measurements.

Sensor Head

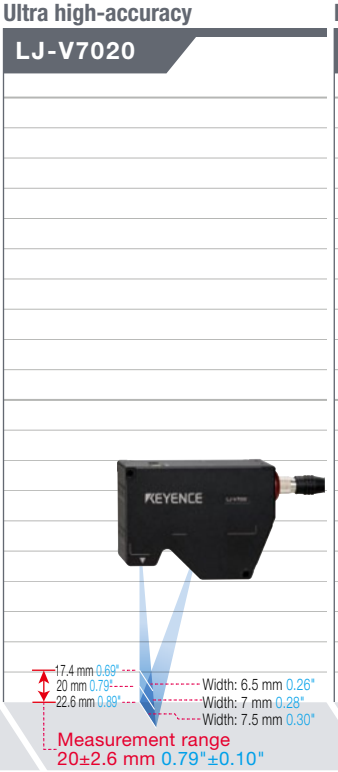
Ultra high-accuracy specular target

LJ-V7020K

Measurement range	Z-axis	24.2±2.3 mm 0.95"±0.09"
	X-axis	7 mm 0.28"
Repeatability	Z-axis	0.2 µm 0.01 Mil
	X-axis	2.5 µm 0.10 Mil

Ultra high-accuracy

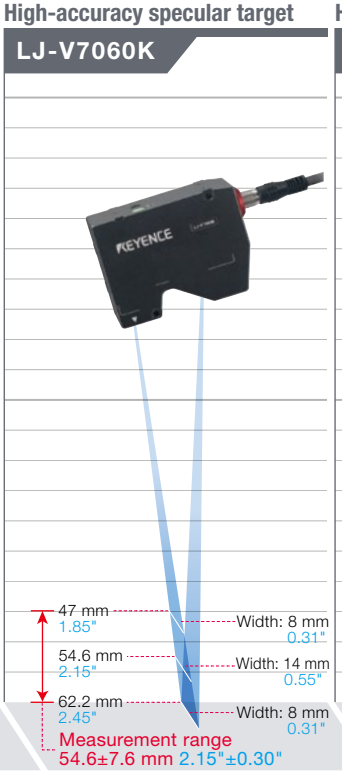
LJ-V7020



Measurement range	Z-axis	20±2.6 mm 0.79"±0.10"
	X-axis	7 mm 0.28"
Repeatability	Z-axis	0.2 µm 0.01 Mil
	X-axis	2.5 µm 0.10 Mil

High-accuracy specular target

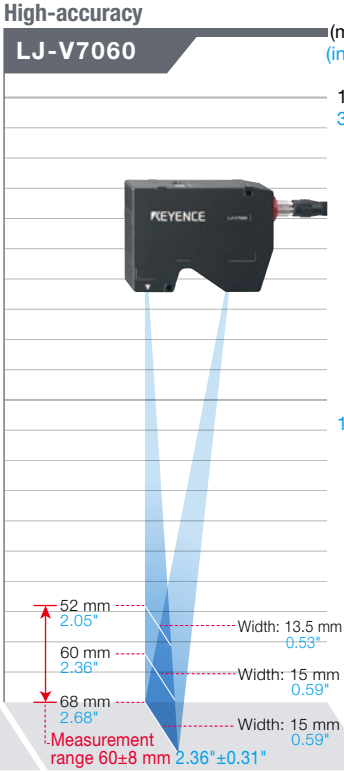
LJ-V7060K



Measurement range	Z-axis	54.6±7.6 mm 2.15"±0.30"
	X-axis	14 mm 0.55"
Repeatability	Z-axis	0.4 µm 0.02 Mil
	X-axis	5 µm 0.20 Mil

High-accuracy

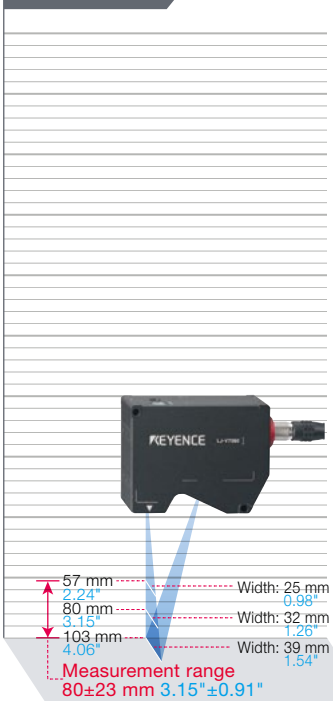
LJ-V7060



Measurement range	Z-axis	60±8 mm 2.36"±0.31"
	X-axis	15 mm 0.59"
Repeatability	Z-axis	0.4 µm 0.02 Mil
	X-axis	5 µm 0.20 Mil

Mid-range

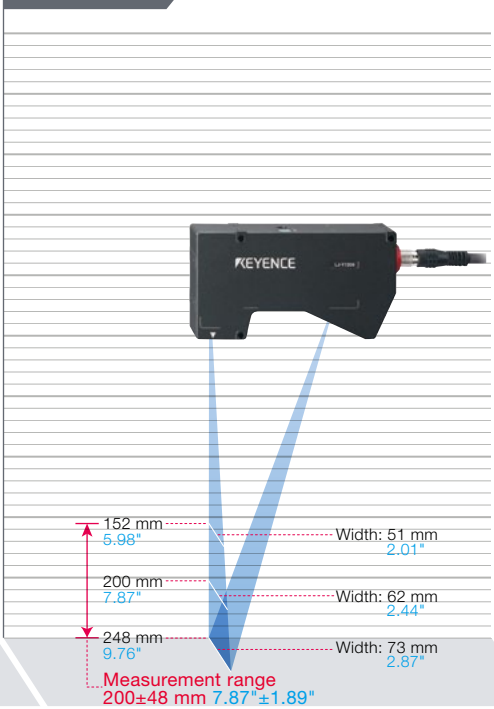
LJ-V7080



Measurement range	Z-axis	80±23 mm 3.15"±0.91"
	X-axis	32 mm 1.26"
Repeatability	Z-axis	0.5 µm 0.02 Mil
	X-axis	10 µm 0.39 Mil

Long range

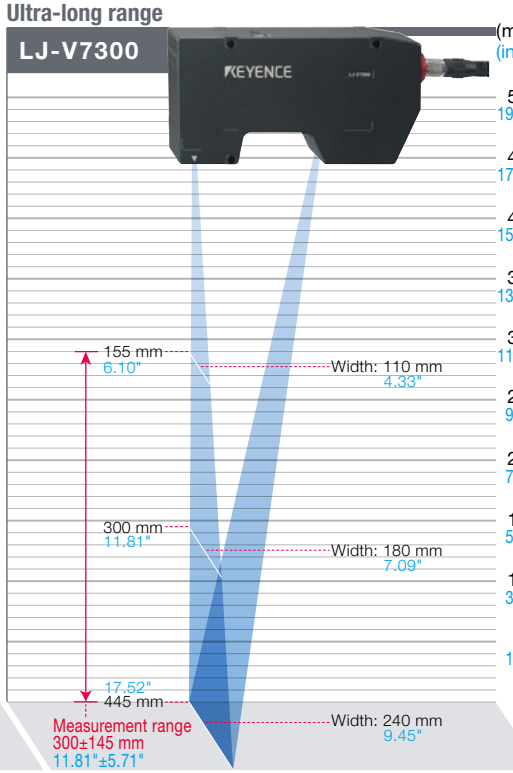
LJ-V7200



Measurement range	Z-axis	200±48 mm 7.87"±1.89"
	X-axis	62 mm 2.44"
Repeatability	Z-axis	1 µm 0.04 Mil
	X-axis	20 µm 0.79 Mil

Ultra-long range

LJ-V7300



Measurement range	Z-axis	300±145 mm 11.81"±5.71"
	X-axis	180 mm 7.09"
Repeatability	Z-axis	5 µm 0.20 Mil
	X-axis	60 µm 2.36 Mil

LJ-V Controller

Controller
LJ-V7001

Settings monitor software
LJ-H2

For the supported operating systems, please contact KEYENCE.

Cable

USB cable
(LJ-H2 accessory)
OP-66844 (2 m 6.6')

LJ-V connection Ethernet cable
OP-87736 (2 m 6.6')

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

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

CV-X Controller

Controller
CV-X292 +
CA-EC80LJ

Expansion unit

Camera expansion module
CA-E800

Area camera unit
CA-EC80

LJ-V unit
CA-EC80LJ

LED light control expansion module
CA-DC21E

Mouse (accessory)

PC software DVD-ROM
CV-H1X (Accessory)

For the supported operating systems, please contact KEYENCE.

Area camera

11x speed,
5 megapixel camera
CV-H500C (color)
CV-H500M (monochrome)

7x speed,
2 megapixel camera
CV-H200C (color)
CV-H200M (monochrome)

7x speed,
310,000 pixel camera
CV-H035C (color)
CV-H035M (monochrome)

2 megapixel camera
CV-200C (color)
CV-200M (monochrome)

310,000 pixel camera
CV-035C (color)
CV-035M (monochrome)

Ultra-compact,
2 megapixel camera
CV-S200C (color)
CV-S200M (monochrome)

Ultra-compact,
310,000 pixel camera
CV-S035C (color)
CV-S035M (monochrome)

Please contact KEYENCE for area camera cables.

Monitor/touch panel/accessories

12" LCD
multi-touch supporting,
dedicated touch panel
CA-MP120T

XGA monitor
CA-MP120

CA-MP120(T)
Protection seal
OP-87263

CA-MP120(T)
monitor stand
OP-87262

CA-MP120(T)
pole-mounting bracket
OP-42279

CA-MP120T accessories
OP-87258
(3 m 9.8' touch panel RS-232C cable)
OP-87259
(10 m 32.8' touch panel RS-232C cable)

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

* An RGB monitor cable and touch panel RS-232C cable are required when using the CA-MP120T.

Mouse stand
OP-87601

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

Communication cable

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

Communication cable conversion connector
For 9 pins: **OP-26486**
For 25 pins: **OP-26485**
For 9-pin SYSMAC: **OP-84384**
For 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')

SPECIFICATIONS

Controller **CV-X292**

Controller model*1	NPN	CV-X292
	PNP	CV-X292P
Number of pixels		With LJ-V connected: 512 (H) x 16384 (L), approx. 8.39M pixels 1024 (H) x 8192 (L), approx. 8.39M pixels 2048 (H) x 4096 (L), approx. 8.39M pixels With CA-H2100C/H2100M connected: • 21M-pixel mode: 5104 (H) x 4092 (V), approx. 20.89M pixels • 5M-pixel mode: 2432 (H) x 2050 (V), approx. 4.99M pixels With CV-H500C/H500M connected: • 5M-pixel mode: 2432 (H) x 2050 (V), approx. 4.99M pixels With CV-200C/S200C/H200C/200M/S200M/H200M connected: • 2M-pixel mode: 1600 (H) x 1200 (V), 1.92M pixels • 1M-pixel mode: 1024 (H) x 960 (V), approx. 0.98M pixels With CV-035C/S035C/035M/S035M/H035C/H035M connected: • 0.31M-pixel mode: 640 (H) x 480 (V), approx. 0.31M pixels • 0.24M-pixel mode: 512 (H) x 480 (V), approx. 0.24M pixels
Camera input		With CA-EC80LJ mounted: one LJ-V (supports LJ-V7001/7001P) With CA-EC80L mounted: one color/monochrome 21M pixel area camera (supports CA-H2100C/H2100M) With CA-EC80 mounted: two color/monochrome area cameras (supports CV-H500C/200C/S200C/H200C/035C/S035C/H035C/H500M/200M/S200M/H200M/035M/S035M/H035M, mixed connection possible)
	Number of connectable units	Via connection with expansion unit CA-E800, one more LJ-V can be installed when the CA-EC80LJ is installed (up to 2 in total), one more 21M pixel camera when the CA-EC80L is installed (up to 2 in total), or two more area cameras when the CA-EC80 is installed (up to 4 in total) (mixed connection possible). The CA-EC80LJ and CA-EC80L cannot be connected together.
	Trigger input	Simultaneous/individual capture with up to 4 cameras can be selected (up to 2 cameras for simultaneous capture when the CA-E800 is not connected)
Main image processor		Multi-core DSP (High-Speed)
Number of setting registrations		Up to 1000 settings (depending on SD card capacity and setting contents) for SD card 1 and SD card 2 individually and external switching is possible
Number of reference images		Each setting supports 400 images per LJ-V or 900 images per area camera (depending on SD card capacity), compress and save functions and reference image registration of position adjusted images
Memory card		• SD card slot x2 (SDHC compatible) • Supports OP-87133 (512 MB: standard equipment on the SD1 slot for the CV-X250/X200/X150/X100), CA-SD1G (1 GB: standard equipment on the SD1 slot for the CV-X290/X270/X170), CA-SD4G (4 GB)
Camera settings		• Shutter speed adjustment • Sensitivity adjustment (1.0 to 9.0)
	Trigger	• Supports external triggers (TRG1 to 4) and internal triggers • Supports pre-capture • Supports trigger delays for each camera • Supports random triggers
	Capture area settings: Processing area setting function	• Possible to specify a 0.98M-pixel area (1024 (H) x 960 (V)) in any position as the image processing area within 1.92M pixels (1M-pixel mode) • Possible to specify a 0.24M-pixel area (512 (H) x 480 (V)) in any position as the image processing area within 0.32M pixels* (standard mode) * 0.31M pixels when CV-H035C/H035M is connected
	Capture area settings: Capture start/end line setting function	For the LJ-V, any number of lines can be set within the maximum number of lines according to the number of horizontal pixels set for each camera (LJ-V). For an area camera, an arbitrary capture start/end line can be set within the image capture range (the CV-H200C and H200M do not allow less than 100 lines to be captured).
	Calibration	• Corrects lens and perspective distortion on the current image through calibration using calibration patterns (only when a monochrome camera is connected and in progressive mode) • Possible to print calibration patterns.
	HDR	• Possible to correct underexposure/overexposure and adjust brightness/contrast • Supports multi-capture
	Multi-Capture	Up to 8 capture counts
	Gain control	Offset (-255 to +255), Span adjustment (1.0 to 7.9)
	White balance	Manual setting with white target
	Lighting	Capable of lighting and adjustment to light intensity for each camera (when using optional light control expansion unit CA-DC21E)
Number of configurable tools		Up to 100 for each camera
Utility		• Can store the image amounts listed below as an archive to the image memory for the main unit • Supports two archive conditions: auto, total status NG
	Archived image settings: Archive condition (automatic)	With area camera connected: • Max. 1024 images (monochrome camera, 0.24M pixels) • Max. 31 images (monochrome camera, 21M pixels) • Max. 143 images (color camera, 5M pixels) • Max. 1024 images (monochrome camera, 0.31M pixels) • Max. 1024 images (color camera, 0.24M pixels) • Max. 25 images (color camera, 21M pixels) • Max. 397 images (monochrome camera, 2M pixels) • Max. 1024 images (color camera, 0.31M pixels) • Max. 149 images (monochrome camera, 5M pixels) • Max. 389 images (color camera, 2M pixels) With LJ-V connected: • Max. 38 images (2048 x 4096, common to continuous and sheet-fed capture) • Max. 38 images (1024 x 8192, common to continuous and sheet-fed capture) • Max. 38 images (512 x 16384, continuous capture) • Max. 39 images (512 x 15000, sheet-fed capture)
	Archived image settings: Archive condition (total status NG)	With area camera connected: • Max. 1024 images (monochrome camera, 0.24M pixels) • Max. 55 images (monochrome camera, 21M pixels) • Max. 276 images (color camera, 5M pixels) • Max. 1024 images (monochrome camera, 0.31M pixels) • Max. 1024 images (color camera, 0.24M pixels) • Max. 45 images (color camera, 21M pixels) • Max. 784 images (monochrome camera, 2M pixels) • Max. 1024 images (color camera, 0.31M pixels) • Max. 288 images (monochrome camera, 5M pixels) • Max. 768 images (color camera, 2M pixels) With LJ-V connected: • Max. 68 images (2048 x 4096, common to continuous and sheet-fed capture) • Max. 69 images (1024 x 8192, common to continuous and sheet-fed capture) • Max. 69 images (512 x 16384, continuous capture) • Max. 70 images (512 x 15000, sheet-fed capture)
		• Supports output of archived image to SD cards, PC program and FTP server • Supports output to folders for each camera • For image output, it is possible to select from three options: always, CAM judgment NG images only, or total status NG only • Supports image output preferred setting
	Statistics: Amount of data	Max 20000 pieces of data per item, max. 128 items (supports batch saving to SD card)
	Statistics: Statistical items	Max. value, min. value, average value, deviation (3σ), OK/NG count in total status, yield rate, process capability index (Cpk, Cpu, Cpl)
	Statistics: Type	Measured list, trend graph, histogram, process monitor
Output settings	Judgment settings	Supports the selection of tools for CAM judgment and partial judgment A max. of 100 groups can be used for partial judgment
	OR terminal	• Supports the selection of terminal output status when outputting total status from the OR terminal • Supports the selection of OR terminal outputting timing
	OUT terminal	Supports the setting of items output from the parallel I/O connectors (OUT 6 to OUT 21) for tool, in-tool, partial, and CAM judgment values
	RS-232C (non-procedural)	Supports the selection of output items when outputting non-procedural results with RS-232C (max. 256 items)
	Ethernet (non-procedural)	Supports the selection of output items when outputting non-procedural results with Ethernet (max. 256 items)
	SD card 2	Supports the selection of output items when outputting results to SD card (max. 256 items)
	PC program	Supports the selection of output items when outputting results to PC program (max. 256 items)
	PLC-Link	Supports the selection of output items when outputting results with PLC-Link (RS-232C/Ethernet) (max. 256 items)
	EtherNet/IP	Supports the selection of output items when outputting results with EtherNet/IP (max. 64 items for bit allocation and max. 256 items for byte allocation)
	PROFINET	Supports the selection of output items when outputting results with PROFINET (max. 64 items for bit allocation and max. 256 items for byte allocation)
	FTP	Supports the selection of output items when outputting results to an FTP server (max. 256 items)
	Image output	Supports settings for image output to PC program, FTP servers or SD card
Support functions	Setting auxiliary functions: Screen display Maximize/minimize	Possible within a range of 1% to 2500% when operating, the display position can be controlled in relation to the measurement position (individual zoom settings are possible when displaying multiple screens)
	Setting auxiliary functions: Edge differential display waveform	Can display edge differentiated waveform graphics with measurement values during operation
	Setting auxiliary functions: Profile display	Can display all detect position graphics for trend edge position and width during operation
	Setting auxiliary functions: Contrast	Can display graphics for stain detection (stain level) during operation
	Setting auxiliary functions: Cutout projection waveform display	OCR automatic cutout projection waveform graphics can be displayed during operation
	Setting auxiliary functions: Stain level waveform display	The stain level wave of trend edge stain can be displayed during operation
	Setting auxiliary functions: Connector dimension graphical display	Connector dimensional graphics can be displayed during operation
	Setting auxiliary functions: 3D display (only when the LJ-V is connected)	Height images can be displayed in 3D
	Setting auxiliary functions: Profile viewer (only when the LJ-V is connected)	Supports display of profiles sectioned by line segment, horizontal line, vertical line, or circle for height images and measurement for profiles (Point-to-Point Height, Block Measurements, Angle of 2 Lines, Block-to-Block Height)
	SD card saving function	Supports measured values, judgment results, measurement images (can be compressed), archived images (can be compressed), captured images, statistics data, RS-232C communication logs, setting contents, and direct saving during inspection operations (not including setting contents)
	Context menu	Image capture function, change user account function, reset, trigger reset, remove SD Card 2
Interface	Control input: External trigger input	4 points (2 of which support special function assignment), Input rating: 26.4 V max., 3 mA min, can select from simultaneous/individual capture with up to 4 cameras
	Control input: External trigger input	Can set individual trigger delays (0 to 999 ms) for each trigger input
	Control input: Control input	16 points (4 of which support special function assignment) Input rating: 26.4 V max., 2 mA min.
	Control output: Common output	27 points (11 of which support special function assignment, includes 4 high speed outputs), NPN open collector, 50 mA max. (30 V max.)
	Control output: Total status output	1 point, NPN open collector, 50 mA max. (30 V max.) Supports total status hold control, one-shot output (1 to 9999 ms)
	Monitor output	Analog RGB output XGA 1024 x 768 (24 bit color, 60 Hz)
	Operation indicator	Power, Operation, ERROR LED display
	RS-232C	Can perform numerical value output, control I/O, and switching of CA Series touch panel interface functions, supports a max. baud rate of up to 230400 bps (cannot be used with PLC-Links using the RS-232C port)
	PLC-Link	• Can output numerical values and perform control input/output using the Ethernet or RS-232C port (EtherNet/IP and PROFINET are exclusively used with PLC-Link. When using the RS-232C port, non-procedural RS-232C communication is exclusively used with PLC-Link.) • The following PLCs are supported via link unit:*2 KEYENCE: KV-700 Series, KV-1000 Series, KV-3000 Series, KV-5000 Series, KV-5500 Series, KV Nano Series Mitsubishi Electric: MELSEC A Series (RS-232C only), Q Series, L Series, FX Series (RS-232C only) OMRON: SYSMAC C Series (RS-232C only), CJ/CS1/CP1 Series YASKAWA Electric Corporation: MP900 Series (RS-232C only)/MP2000 Series
	Ethernet	• Can output numerical values and perform control input/output • Can output measured value and image data to a PC and upload/download settings via the included PC program software • Supports FTP client and FTP server • VNC server (for non-PC clients, only displaying the monitor screen is supported) • Supports BOOTP function • 1000BASE-T/100BASE-TX/10BASE-T
	USB	• Can output measured value and image data to a PC and upload/download settings via the included PC program software • Dedicated to USB2.0
	EtherNet/IP	• Numerical value and control input/output using the Ethernet port enabled (cannot be used in conjunction with PLC-link/PROFINET). • Cyclic (implicit) communication (max. 1436 bytes) possible. Message communication possible. • Maximum connections: 32. • In conformity with conformance test Version.CT10.
	PROFINET	• Numerical value and control input/output using the Ethernet port enabled (cannot be used in conjunction with PLC-link/EtherNet/IP). • Cyclic communication (max. 1408 bytes) possible. Record data communication possible. • In conformity with Conformance Class A.
	Mouse	Possible to control various menus via an optional dedicated mouse (OP-87506: included with the controller)
	Touch panel	Settings can be operated from a CA Series touch panel using the TOUCH PANEL or RS-232C port (When using the RS-232C port, non-procedural RS-232C communication and PLC-Link are exclusively used with a touch panel.)
Illumination control		By connecting the optional Illumination Expansion Unit CA-DC21E, lighting and intensity control*3 for the LED illumination is possible. CA-DC21E: 2 ch/unit, up to 4 units can be connected, supports 12 V/24 V outputs
Language		Switched among English, Japanese, Simplified Chinese, Traditional Chinese, Korean, Thai, German, French, Italian, and Spanish (Mexican)
Rating	Voltage	24 VDC ±10%
	Consumption current	Area camera: 3.6 A (when 2 cameras are connected)/4.6 A (when 4 cameras are connected) LJ-V: 2.6 A (when 1 camera is connected)/2.8 A (when 2 cameras are connected), all at maximum load including rush current during start up
Environmental resistance	Operating ambient temperature	0 to +45°C 32 to 113°F
	Operating ambient humidity	35 to 85% RH (no condensation)
Weight		Approx. 1600 g

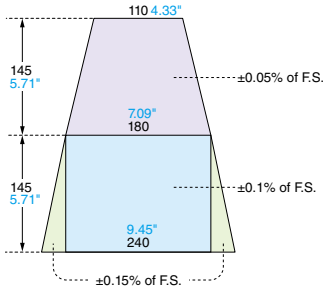
*1 A type with P-suffix at the end of its main unit model is a PNP open-collector. *2 Models that are equipped with an Ethernet port on the CPU unit support direct connection with the Ethernet port.
*3 The CA-DC21E supports PWM/DC.

SPECIFICATIONS

LJ-V Sensor Head

Model			LJ-V7020K*11	LJ-V7020*11	LJ-V7060K	LJ-V7060	LJ-V7080	LJ-V7200	LJ-V7300
Mounting conditions			Specular reflection	Diffuse reflection	Specular reflection	Diffuse reflection			
Reference distance			24.2 mm 0.95"	20 mm 0.79"	54.6 mm 2.15"	60 mm 2.36"	80 mm 3.15"	200 mm 7.87"	300 mm 11.81"
Measurement range	Z-axis (height)		±2.3 mm 0.09" (F.S.=4.6 mm 0.18")	±2.6 mm 0.10" (F.S.=5.2 mm 0.20")	±7.6 mm 0.30" (F.S.=15.2 mm 0.60")	±8 mm 0.31" (F.S.=16 mm 0.63")	±23 mm 0.91" (F.S.=46 mm 1.81")	±48 mm 1.89" (F.S.=96 mm 3.78")	±145 mm 5.71" (F.S.=290 mm 11.42")
	X-axis (width)	NEAR side	6.5 mm 0.26"	6.5 mm 0.26"	8 mm 0.31"	13.5 mm 0.53"	25 mm 0.98"	51 mm 2.01"	110 mm 4.33"
		Reference distance	7 mm 0.28"	7 mm 0.28"	14 mm 0.55"	15 mm 0.59"	32 mm 1.26"	62 mm 2.44"	180 mm 7.09"
		FAR side	7.5 mm 0.30"	7.5 mm 0.30"	8 mm 0.31"	15 mm 0.59"	39 mm 1.54"	73 mm 2.87"	240 mm 9.45"
Light source			Blue semiconductor laser						
		Wavelength	405 nm (visible beam)						
		Laser class (IEC60825-1 FDA(CDRH) Part 1040.10*1)	Class 2M Laser Product*12		Class 2 Laser Product	Class 2M Laser Product*12	Class 2 Laser Product		
		Output	10 mW		4.8 mW	10 mW	4.8 mW		
Spot size (reference distance)			Approx. 14 mm x 35 µm 0.55" x 1.37 Mil		Approx. 21 mm x 45 µm 0.83" x 1.77 Mil		Approx. 48 mm x 48 µm 1.89" x 1.89 Mil	Approx. 90 mm x 85 µm 3.54" x 3.35 Mil	Approx. 240 mm x 610 µm 9.45" x 24.02 Mil
Repeatability*2	Z-axis (height)*3		0.2 µm 0.01 Mil		0.4 µm 0.02 Mil		0.5 µm 0.02 Mil	1 µm 0.04 Mil	5 µm 0.20 Mil
	X-axis (width)*4		2.5 µm 0.10 Mil		5 µm 0.20 Mil		10 µm 0.39 Mil	20 µm 0.79 Mil	60 µm 2.36 Mil
Linearity	Z-axis (height)*5		±0.1% of F.S.						±0.05 to ±0.15% of F.S.*6
Profile Data interval	X-axis (width)		10 µm 0.39 Mil		20 µm 0.79 Mil		50 µm 1.97 Mil	100 µm 3.94 Mil	300 µm 11.81 Mil
Sampling cycle (trigger interval)*7			Top speed: 16 µs (high-speed mode) Top speed: 32 µs (advanced function mode)						
Temperature characteristics			0.01% of F.S./°C						
Environmental resistance	Enclosure rating*8		IP67 (IEC60529)						
	Ambient operating illuminance*9		Incandescent lamp: 10000 lux max						
	Ambient temperature*10		0 to +45°C 32 to 113°F						
	Operating Ambient humidity		20 to 85% RH (No condensation)						
	Vibration resistance		10 to 57 Hz, 1.5 mm 0.06" double amplitude in X, Y, and Z directions, 3 hours respectively						
	Impact resistance		15G/6 msec						
Material			Aluminum						
Weight			Approx. 410 g		Approx. 450 g		Approx. 400 g	Approx. 550 g	Approx. 1000 g

*1 The laser classification for FDA(CDRH) is implemented based on IEC60825-1 in accordance with the requirements of Laser Notice No. 50.
*2 This value is from a case in which measurement has been performed with a reference distance at an average frequency of 4096 times.
*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 64x smoothing and 8x averaging. All other settings are default.
*6 The linearity will differ depending on the measurement area. (See the diagram on the right.)
*7 When the measurement area is at its minimum, binning is ON, image capture mode is set to standard, and parallel image capture is ON in high-speed mode. All other settings are default. When the measurement area is at its minimum, binning is ON and image capture mode is set to standard in advanced function mode. 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 When measuring white paper, this is the illuminance for the light-receiving surface of the sensor head when light has been shined onto white paper.
*10 The sensor head must be mounted on a metal plate for use.
*11 The double polarization function cannot be used.
*12 Do not look into the beam directly using any optical instruments (such as eye loupes, magnifiers, microscopes, telescopes, or binoculars). Viewing the laser output with an optical instrument may pose an eye hazard.



LJ-V Controller

Model		LJ-V7001	LJ-V7001P
No. of connectable sensors		Max. 2 units	
Display	Minimum display unit	0.1 µm 0.004 Mil, 0.00001 mm², 0.01°	
	Maximum display range	±99999.9 mm 3937.00", ±999999 mm²	
Input terminal block	Laser remote interlock input	Non-voltage input	
	Encoder input	NPN/PNP open-collector output (5 V, 12 V, 24 V), line-driver output	
	Trigger inputs	Non-voltage input	Voltage input
	Timing 1, 2 input		
	Auto-zero 1, 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 x 4 inputs	Voltage input x 4 inputs
Output terminal block	Analog voltage output	±10 V x 2 outputs, Output impedance: 100 Ω	
	OUT comparator output	NPN open collector output x 12 outputs (Can freely assign 16 OUTs x 3 stage judgment results)	PNP open collector output x 12 outputs (Can freely assign 16 OUTs x 3 stage judgment results)
	Strobe output	NPN open collector output	PNP open collector output
	Disable trigger output		
	Memory FULL output		
	Ready output		
	Error output	NPN open collector output (N.C.)	PNP open collector output (N.C.)
Ethernet interface		1000BASE-T/100BASE-TX	
USB Interface		USB 2.0 high speed compliant (USB 1.1 Full-SPEED compatible)	
RS-232C interface		Measurement data output and control I/O (Can select a baud rate of up to 115,200 bits/s)	
Rating	Voltage	24 VDC, including ±10% ripple (P-P)	
	Maximum current consumption	1.3 A or less when connected to 1 head/1.9 A or less when connected to 2 heads	
Environmental resistance	Operating ambient temperature	0 to +50°C 32 to 122°F	
	Operating ambient humidity	20 to 85% RH (No condensation)	
Weight		Approx. 1500 g	

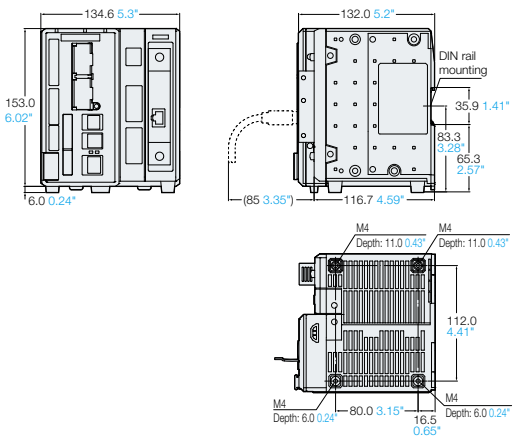
- The rating for NPN open-collector output is up to 50 mA (40 V or less), residual voltage of up to 1 V.
- The rating for PNP open-collector output is up to 50 mA (30 V or less), residual voltage of up to 1 V.
- The rating for non-voltage input is up to 1 V for ON voltage and up to 0.6 mA for OFF current.
- The rating for voltage input is a maximum input voltage of 26.4 V, a minimum ON voltage of 10.8 V, and up to 0.6 mA for OFF current.

DIMENSIONS

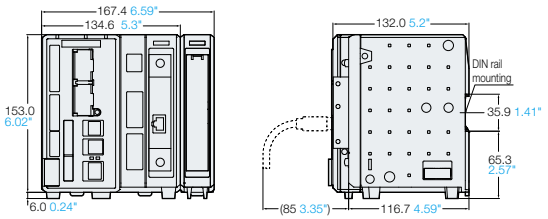
Unit: mm inch

CV-X292 + CA-EC80LJ

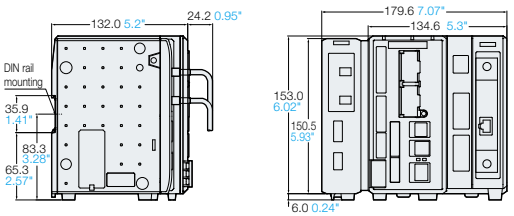
Controller **CV-X292 + CA-EC80LJ**



With camera expansion unit **CA-E800** equipped

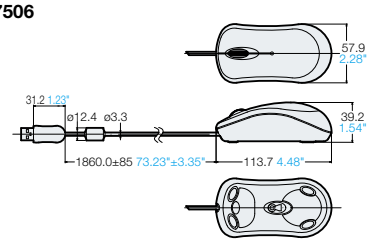


With light control expansion unit **CA-DC21E** equipped



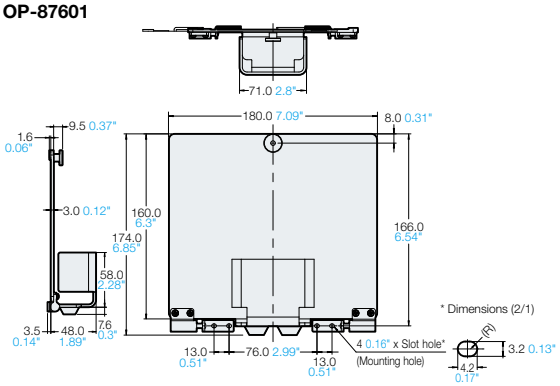
Mouse

Mouse **OP-87506**



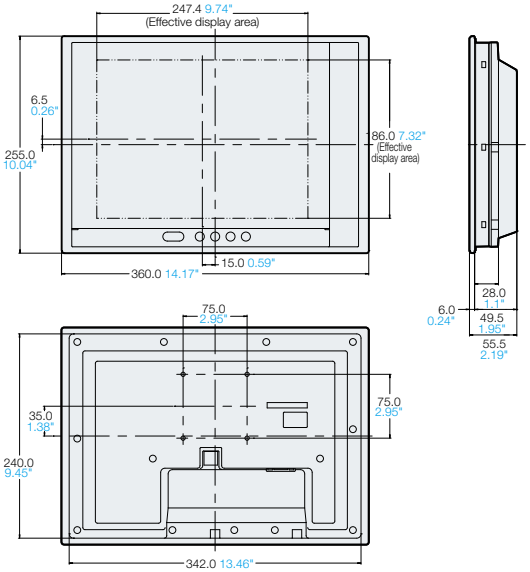
Mouse stand

Mouse stand **OP-87601**



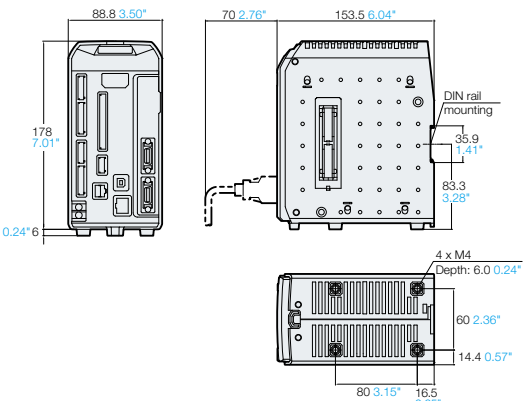
Monitor

XGA monitor **CA-MP120**



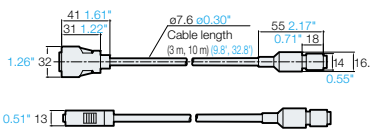
LJ-V controller

Multi-function controller **LJ-V7001**

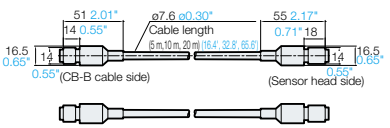


LJ-V cable

Head connection cable **CB-B3/CB-B10**



Head connection extension cable **CB-B5E/CB-B10E/CB-B20E**

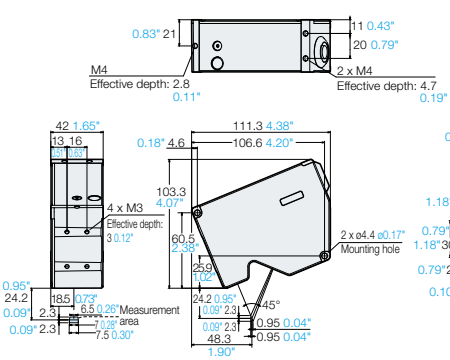


DIMENSIONS

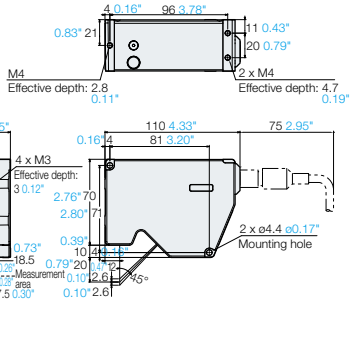
Unit: mm inch

LJ-V Sensor Head

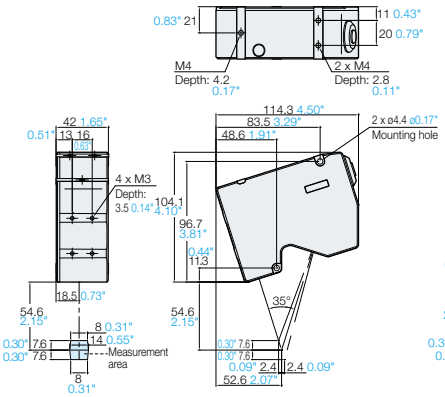
Ultra-high-accuracy specular target model
LJ-V7020K



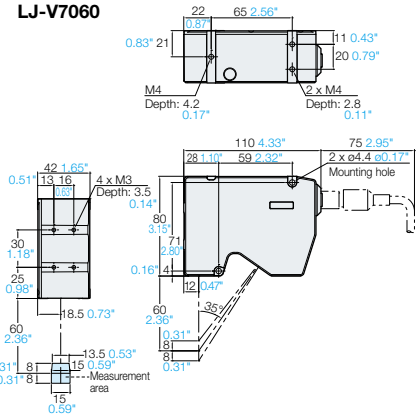
Ultra high-accuracy model
LJ-V7020



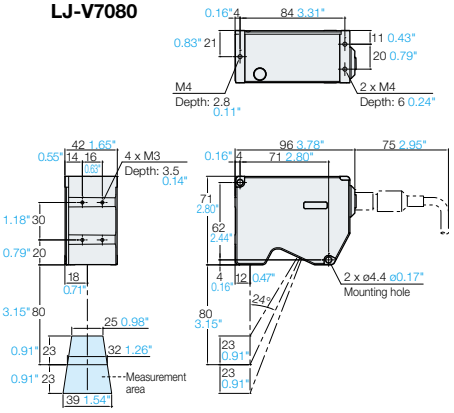
High-accuracy specular target model
LJ-V7060K



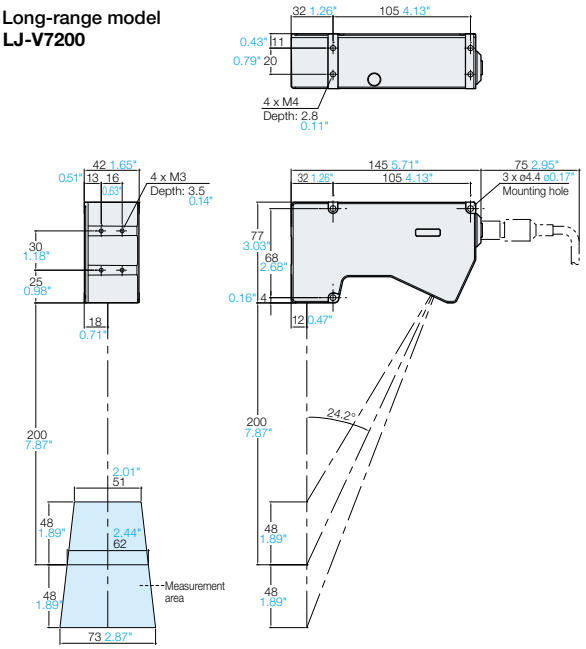
High-accuracy model
LJ-V7060



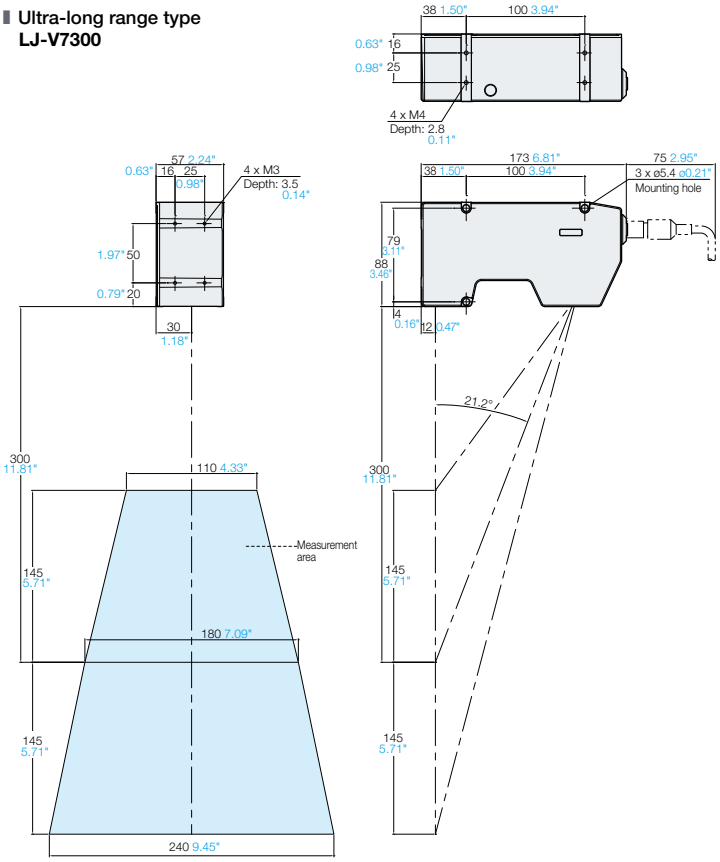
Mid-range model
LJ-V7080



Long-range model
LJ-V7200



Ultra-long range type
LJ-V7300



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

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