INLINE 3D MAKES NEW INSPECTIONS POSSIBLE
3D Inspection is realized for any workpiece
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.
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

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-K200 Series, correction can be performed using the entire surface to enable accurate height 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.

**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.

**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.

**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.

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.

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.

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.

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.

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.

- **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.
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.

With an image processed using conventional methods, as shown in the left figure, flaws can be detected but are difficult to distinguish by the difference in their depths.

A height image enables you to identify differences based on the depths of flaws.

This dent on a curved surface is depressed by about 0.35 mm / 0.014".

This dent on a plane is depressed by about 0.1 mm / 0.004".

A height image enables you to identify differences based on the depths of flaws.

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.

LJ-V + CV-X system configuration

Specifications of mixed connection for CV-X

Combination of CV-X292 and CA-EC80LJ

*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 as a wide dynamic range.

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

**Stopped workpiece**

Measurement is impossible due to insufficient light intensity.

**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.

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.
### Sensor Head

<table>
<thead>
<tr>
<th>Ultra high-accuracy specular target</th>
<th>Ultra high-accuracy</th>
<th>High-accuracy specular target</th>
<th>High-accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LJ-V7020K</strong></td>
<td><strong>LJ-V7020</strong></td>
<td><strong>LJ-V7060K</strong></td>
<td><strong>LJ-V7060</strong></td>
</tr>
<tr>
<td>Measurement range</td>
<td>Measurement range</td>
<td>Measurement range</td>
<td>Measurement range</td>
</tr>
<tr>
<td>Z-axis: 24.2±2.3 mm, 0.79°±0.10°</td>
<td>Z-axis: 20±2.6 mm, 7 mm 0.28°</td>
<td>Z-axis: 47 mm, 14 mm 0.5°</td>
<td>Z-axis: 60±8 mm, 15 mm 0.59°</td>
</tr>
<tr>
<td>Repeatability: 0.2 µm, 0.01 Mil</td>
<td>Repeatability: 0.2 µm, 0.01 Mil</td>
<td>Repeatability: 0.4 µm, 0.02 Mil</td>
<td>Repeatability: 0.4 µm, 0.02 Mil</td>
</tr>
<tr>
<td>X-axis: 7 mm 0.28°</td>
<td>X-axis: 7 mm 0.28°</td>
<td>X-axis: 14 mm 0.5°</td>
<td>X-axis: 15 mm 0.59°</td>
</tr>
</tbody>
</table>

### Mid-range

<table>
<thead>
<tr>
<th><strong>LJ-V7080</strong></th>
<th><strong>LJ-V7200</strong></th>
<th><strong>LJ-V7300</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement range</td>
<td>Measurement range</td>
<td>Measurement range</td>
</tr>
<tr>
<td>Z-axis: 80±23 mm, 3.15°±0.91°</td>
<td>Z-axis: 200±48 mm, 62 mm 2.44°</td>
<td>Z-axis: 300±145 mm, 11.81±5.71°</td>
</tr>
<tr>
<td>Repeatability: 0.5 µm, 0.02 Mil</td>
<td>Repeatability: 1 µm, 0.04 Mil</td>
<td>Repeatability: 5 µm, 0.20 Mil</td>
</tr>
<tr>
<td>X-axis: 32 mm 1.28°</td>
<td>X-axis: 200±48 mm, 62 mm 2.44°</td>
<td>X-axis: 180 mm 7.09°</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Repeatability: 20 µm, 0.79 Mil</td>
</tr>
</tbody>
</table>

### Repeatability

- **LJ-V7080K**: 0.2 µm, 0.01 Mil
- **LJ-V7020**: 0.2 µm, 0.01 Mil
- **LJ-V7060K**: 0.4 µm, 0.02 Mil
- **LJ-V7060**: 0.4 µm, 0.02 Mil
- **LJ-V7080**: 0.5 µm, 0.02 Mil
- **LJ-V7200**: 1 µm, 0.04 Mil
- **LJ-V7300**: 5 µm, 0.20 Mil

### Measurement range

- **LJ-V7020**: 20±2.6 mm, 7 mm 0.28°
- **LJ-V7060**: 60±8 mm, 15 mm 0.59°
- **LJ-V7080**: 80±23 mm, 3.15°±0.91°
- **LJ-V7200**: 200±48 mm, 62 mm 2.44°
- **LJ-V7300**: 300±145 mm, 11.81±5.71°
### Repeatability

**Z-axis**
- **Range**: 24.2±2.3 mm / 0.95±0.09"
- **Measurement**: 26.5 mm / 1.04"
- **Width**: 7 mm / 0.28"
- **Resolution**: 0.2 / 0.01 Mil

**X-axis**
- **Range**: 21.9 mm / 0.86"
- **Measurement**: 20±2.6 mm / 0.79±0.10"
- **Width**: 7.5 mm / 0.30"
- **Resolution**: 0.1 / 0.004 Mil

**Ultra-high-accuracy**
- **Range**: 17.4 mm / 0.69"
- **Measurement**: 20±2.6 mm / 0.79±0.10"
- **Width**: 7 mm / 0.28"
- **Resolution**: 0.05 / 0.002 Mil

### Measurement Range

<table>
<thead>
<tr>
<th>Component</th>
<th>Range</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>X-axis</td>
<td>21.9 mm</td>
<td>0.86&quot;</td>
</tr>
<tr>
<td>Z-axis</td>
<td>24.2±2.3 mm</td>
<td>0.95±0.09&quot;</td>
</tr>
<tr>
<td>Ultra-high-accuracy</td>
<td>17.4 mm</td>
<td>0.69&quot;</td>
</tr>
</tbody>
</table>

### Communication Cables

<table>
<thead>
<tr>
<th>Type</th>
<th>Connector</th>
<th>Length</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parallel I/O cable</td>
<td>OP-51657 (3 m 9.8')</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication cable</td>
<td>OP-26486 (25 pins)</td>
<td>2 m 6.6'</td>
<td>For SYMDC, use the OP-51657.</td>
</tr>
<tr>
<td>RS-232 communication</td>
<td>OP-26487 (2.5 m 8.2')</td>
<td></td>
<td>Requires an RS-232 connector for SYMDC.</td>
</tr>
<tr>
<td>Ethernet cable</td>
<td>OP-66843 (3 m 9.8')</td>
<td></td>
<td>For SYMDC, use the OP-51657.</td>
</tr>
<tr>
<td>USB cable</td>
<td>OP-66844 (2 m 6.6')</td>
<td></td>
<td>For SYMDC, use the OP-51657.</td>
</tr>
</tbody>
</table>

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

### Controller CV-X292

**Controller model**

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CV-X292</td>
<td></td>
</tr>
<tr>
<td>CV-X292P</td>
<td></td>
</tr>
</tbody>
</table>

**Number of pixels**

- 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)

**Camera input**

- With CA-EC80 mounted: one color/monochrome 2M pixel area cameras (supports CV-H500C/H035C/035M/H035M, mixed connection possible)

**Number of connectable units**

- One camera can be connected when the CV-EC80LJ is mounted or three cameras can be connected when the CV-EC80LJ and CA-EC80L are used.

**Trigger input**

- Supports three trigger levels (high, low, normal). Supports trigger division (high, low, normal).

**Multi-image processor**

- Multi-point view (high-speed)

**Number of configurable tools**

- Up to 149 tools (including mask and tool combination)

**Memory card**

- Supports an external memory stick (HUB:1MB, etc.)

**Camera settings**

- Supports external trigger (H1, L1, and L2) and internal trigger

**Input/output**

- Supports single output (1 point)

**Utility**

- Amount of data: Max 2000 pieces of data per file, min. 100 pieces supports batch saving to the card

**Archived image settings**

- Supports output of archived image to SD cards, PC program, FTP server

**Archive condition**

- Supports the selection of output conditions for each archive setting

**Output scan**

- Supports the selection of output settings when outputting results to PLC program

**Output devices**

- Supports the selection of output settings when outputting results to external output

**Setting auxiliary functions**

- Supports display of profiles sectioned by line segment, horizontal line, vertical line, or circle for height images and measurement for profiles

**SD card saving function**

- Supports the selection of output settings when outputting results to external output

**Control input**

- 4 points (2 of which support special function assignment), Input rating: 24 V max., 3 mA min., can select from simultaneous/individual capture with up to 4 cameras

**Control output**

- 16 points (12 of which support special function assignment, includes 4 high speed outputs), NPN open collector, 50 mA max. (30 V max.)

**PLC connection**

- Supports PLC connection via link unit (PLC-Link) and supports the selection of output items when outputting results with PLC-Link (max. 256 items)

**Ethernet**

- Supports the selection of output settings when outputting results to external output

**PROFINET**

- Supports the selection of output settings when outputting results with PROFINET (max. 64 items for bit allocation and max. 256 items for byte allocation)

**FTP**

- Supports the selection of output settings when outputting results with FTP server (max. 64 items for bit allocation and max. 256 items for byte allocation)

**Menu**

- Supports the selection of output settings when outputting results to external output

**Mount monitor**

- Mount monitor

**Environment**

- Supports multi-capture (max. 64 items for bit allocation and max. 256 items for byte allocation)

**Weight**

- Approx. 1600 g
II LJ-V Sensor Head

### SPECIFICATIONS

#### Model

<table>
<thead>
<tr>
<th>Model</th>
<th>LJ-V7020K*1</th>
<th>LJ-V7020P*1</th>
<th>LJ-V7060K</th>
<th>LJ-V7060</th>
<th>LJ-V7080</th>
<th>LJ-V7200</th>
<th>LJ-V7300</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting conditions</td>
<td>Specular reflection</td>
<td>Diffuse reflection</td>
<td>Specular reflection</td>
<td>Diffuse reflection</td>
<td>Specular reflection</td>
<td>Diffuse reflection</td>
<td>Specular reflection</td>
</tr>
<tr>
<td>Reference distance</td>
<td>24.2 mm 0.95&quot;</td>
<td>20 mm 0.78&quot;</td>
<td>54.6 mm 2.15&quot;</td>
<td>60 mm 2.4&quot;</td>
<td>80 mm 3.15&quot;</td>
<td>200 mm 7.87&quot;</td>
<td>380 mm 14.96&quot;</td>
</tr>
<tr>
<td>Measurement range</td>
<td>2-axis (height)</td>
<td>±0.1% of F.S.</td>
<td>±0.1% of F.S.</td>
<td>±0.1% of F.S.</td>
<td>±0.1% of F.S.</td>
<td>±0.1% of F.S.</td>
<td>±0.1% of F.S.</td>
</tr>
<tr>
<td>2-axis (height)</td>
<td>NEAR side</td>
<td>6.5 mm 0.26&quot;</td>
<td>6.5 mm 0.26&quot;</td>
<td>8 mm 0.31&quot;</td>
<td>13.5 mm 0.53&quot;</td>
<td>25 mm 0.98&quot;</td>
<td>51 mm 2.01&quot;</td>
</tr>
<tr>
<td>K-axis (width)</td>
<td>FAR side</td>
<td>7.5 mm 0.30&quot;</td>
<td>7.5 mm 0.30&quot;</td>
<td>8 mm 0.31&quot;</td>
<td>15 mm 0.58&quot;</td>
<td>38 mm 1.54&quot;</td>
<td>73 mm 2.87&quot;</td>
</tr>
</tbody>
</table>

#### Light source

- Wavelength: 405 nm (visible beam)
- Laser class: Class 2M Laser Product
- Part 1040.10*1 (IEC60825-1 FDA (CDRH))
- Laser OFF input: ±0.05% to ±0.15% of F.S.*4
- Non-voltage input x 4 inputs
- Voltage input x 4 inputs
- Program switch input
- Laser remote interlock input
- Encoder input

#### Input terminal block

- Trigger inputs
- Timing 1, 2 input
- Auto-zero 1, 2 input
- Reset 1, 2 input
- Start measurement/stop input
- Start storage/stop input
- Clear memory input
- OFF input
- Program switch input

#### 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)
- Strobe output
- Disable trigger output
- Memory FULL output
- Head output
- Error output

#### Environmental characteristics

- Temperature characteristics: 0.01% of F.S. ±0.3°C
- Enclosure rating: IP67 (IEC60529)
- Ambient operating illuminance: Infrared lamp: 1000 lux max
- Ambient temperature: 0 to +40°C (32 to 104°F)
- Vibration resistance: 10 to 57 Hz, ±0.05 to ±0.15% of F.S.*4
- Impact resistance: ±9999999 mm 3937.00", ±999999 mm 3937.00"

#### Electrical characteristics

- Maximum current consumption: ±24 VDC, including ±10% ripple (P-P)
- Maximum current consumption: 1.3 A or less when connected to 1 head/3.8 A or less when connected to 2 heads
- Maximum current consumption: 0 to +50°C 32 to 122°F
- Operating ambient humidity: 20 to 85% RH (No condensation)

#### Output terminal

- 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)
- Error output

#### Non-voltage input

- Voltage input

#### II LJ-V Controller

### No. of connectable sensors

<table>
<thead>
<tr>
<th>Model</th>
<th>LJ-V7001</th>
<th>LJ-V7001P</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of connectable sensors</td>
<td>Max. 2 units</td>
<td>Max. 3 stage judgment results</td>
</tr>
</tbody>
</table>

#### Display

- Minimum display unit: 0.1 μm 0.0004 milli, 0.00001 milli, 0.01*
- Maximum display range: ±999999 999999 999 milli, ±999999 999999 999 milli

#### 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
- Timing 1, 2 input
- Auto-zero 1, 2 input
- Reset 1, 2 input
- Start measurement/stop input
- Clear memory input
- Start storage/stop input
- Laser OFF input
- Program switch input

#### 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)
- Strobe output
- Disable trigger output
- Memory FULL output
- Head output
- Error output
- NPN open collector output (N.C.)
- PNP open collector output

#### 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)
- Top speed: 16 μs (high-speed mode)
- Top speed: 32 μs (advanced function mode)

#### Laser class

- 405 nm (visible beam)
CV-X292 + CA-EC80LJ

II Controller CV-X292 + CA-EC80LJ

II With camera expansion unit CA-E800 equipped

II With light control expansion unit CA-DC21E equipped

Mouse stand

II Mouse stand OP-87601

Mouse

II Mouse OP-87506

Monitor

II XGA monitor CA-MP120

LJ-V controller

II Multi-function controller LJ-V7001

LJ-V cable

II Head connection cable CB-B3/CB-B10

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