

## POWER MEETS SIMPLICITY

CV-X Series Ver. 4.0

### Auto-Teach Inspection

An inspection tool that learns what a good part is.

### LumiTrax™

Integration of camera, lighting, and inspection algorithm for easy 3D inspection and glare reduction.



## DIGEST VERSION

CV-X Series

# LumiTrax™

## A FUSION OF HIGH-SPEED CAMERAS WITH INTELLIGENT LIGHTING AND AN ADVANCED PROCESSING ALGORITHM

LumiTrax™ is the fusion of high-speed cameras with intelligent, directional lighting and an advanced image processing algorithm. This revolutionary technology combines multiple images, acquired by lighting a target from different directions, to create shape images of the target for 3D inspection applications or texture images for glare reduction. LumiTrax™ eliminates the influences of surface variation and ambient environment that prevent stable inspection.



### THE NEWLY DEVELOPED LumiTrax™ SYSTEM

Equipped with ultra high-speed  
CMOS sensor & dedicated control IC  
**CA-HX Series**



Equipped with ultra high-intensity  
LED lighting and partial illumination  
control circuit  
**CA-DRW×X Series**



Analyzes multiple images instantly to  
create shape and texture images  
**Available for:**  
**CV-X400 Series**  
**XG-X2000 Series**



# AUTO-TEACH INSPECTION TOOL COLOR

## AN INSPECTION TOOL THAT LEARNS WHAT A GOOD PART IS

The Auto-Teach Inspection Tool learns individual differences in good parts to determine an acceptable range of variability. Parts that differ from this range are recognized as defective, even parts with defects unknown during the original set up can be rejected. Programming is performed by simply running good parts, eliminating the need for highly-experienced vision integrators. This is an inspection tool that makes it possible for anyone to achieve and maintain a stable inspection.



### JUST RUN GOOD PARTS



### SETTING COMPLETED



### NEW ALGORITHM!

Parts that are different from the learned good parts are detected as bad!



✓ Good part



✗ Different type



✗ Incomplete printing



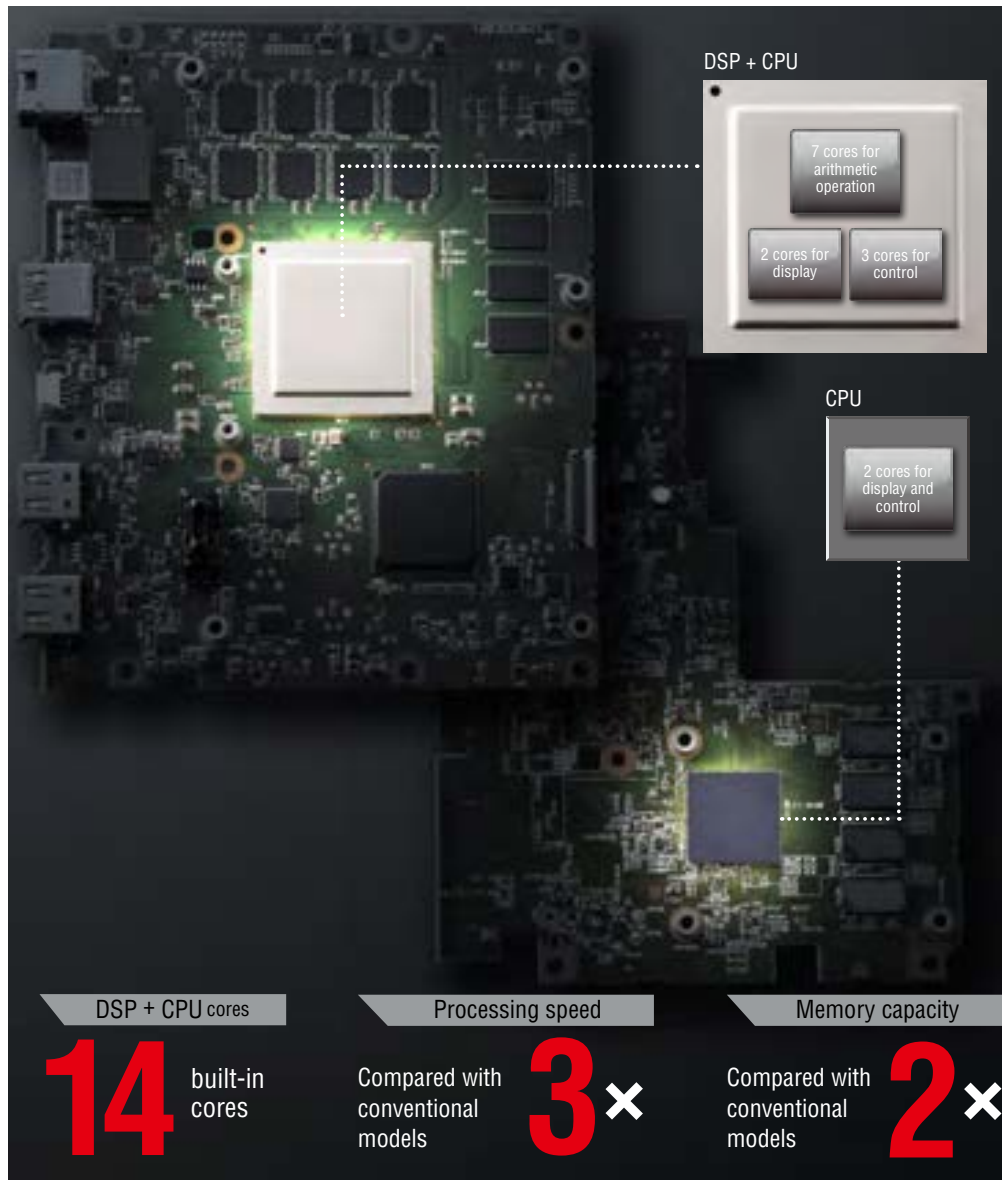
✗ Flaw

Defective parts not expected at the time of setting can also be detected.

# FASTEST PERFORMANCE IN THE INDUSTRY

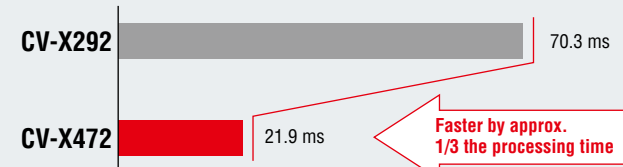
## HIGH-SPEED, HIGH-PERFORMANCE 14 CORE PROCESSING

CV-X400 core processors are auto-tuned maximizing performance.



### ADVANCED INSPECTION ENABLED BY HIGH-SPEED PROCESSING

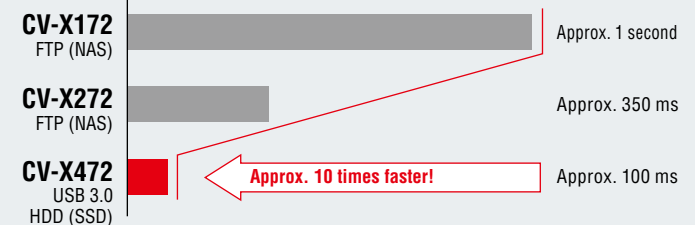
21 megapixel color camera flaw inspection processing speed



Abundant processing power is available even with multiple camera connections, including the 21 megapixel color camera or 3D cameras.

### SIMPLER, LARGER-CAPACITY IMAGE STORAGE

Time required for storing 5 megapixel monochrome images



Along with internal memory capable of storing approx. 12,700 VGA color images and over one hundred 21 megapixel color images, KEYENCE introduces the industry's first direct connection with USB 3.0 hard drives, making it possible to save images on large-capacity storage devices up to 2 TB. As with SD cards, hard drives are automatically recognized by the controller, eliminating the need for any configuration settings.



# THE INDUSTRY'S FASTEST CAMERAS

## HIGH-RESOLUTION CAMERA LINEUP

The addition of profile lasers for 3D dimensional measurement, LumiTrax for 3D inspection, and 21 megapixel cameras for the highest resolution requirements. KEYENCE provides a full lineup of the industry's fastest cameras and solutions to the most challenging inspections in manufacturing.

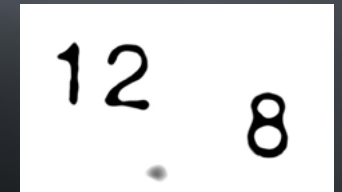
### 3D MEASUREMENT

Laser Dimensional Inspection



### LumiTrax™

3D defect and feature inspection

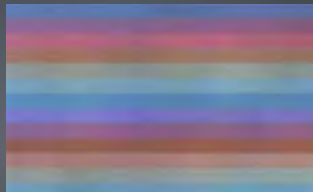


### 2D AREA CAMERAS

Up to 21 megapixel resolution



0.31 megapixels



21 megapixels






### VISION-GUIDED ROBOTS

Direct communication with 16 robot manufacturers and new PatternTrax™ location tool.



## TYPE

From 21 megapixel cameras for precision resolution requirements to the high-speed cameras for the fastest production rates, or compact cameras for the tightest mounting restraints to profile lasers for 3D measurement, KEYENCE offers the ideal solution for every inspection application.

	0.31M to 0.47M pixel camera				Laser profile measurement system	
	 16x HI-SPEED DIGITAL LumiTrax compatible		 ULTRA-SMALL DIGITAL			
Model	CA-HX048M		CA-HX048C		CV-S035M/CV-S035C	
Specs	×16 speed monochrome		×16 speed color		Compact monochrome Compact color	
Capture range	784 × 596 pixels	512 × 480 pixels	784 × 596 pixels	512 × 480 pixels	640 × 480 pixels	
Transfer time	2.9 ms*1 5.2 ms*2	1.7 ms*1 2.8 ms*2	2.9 ms*1 5.3 ms*2	1.7 ms*1 2.9 ms*2	16.0 ms	
					LJ-V Series	
					Head: 7 types	
					Z-axis: ±2.3 to ±145 mm X-axis: 7 to 180 mm	
					64000 profiles/sec	

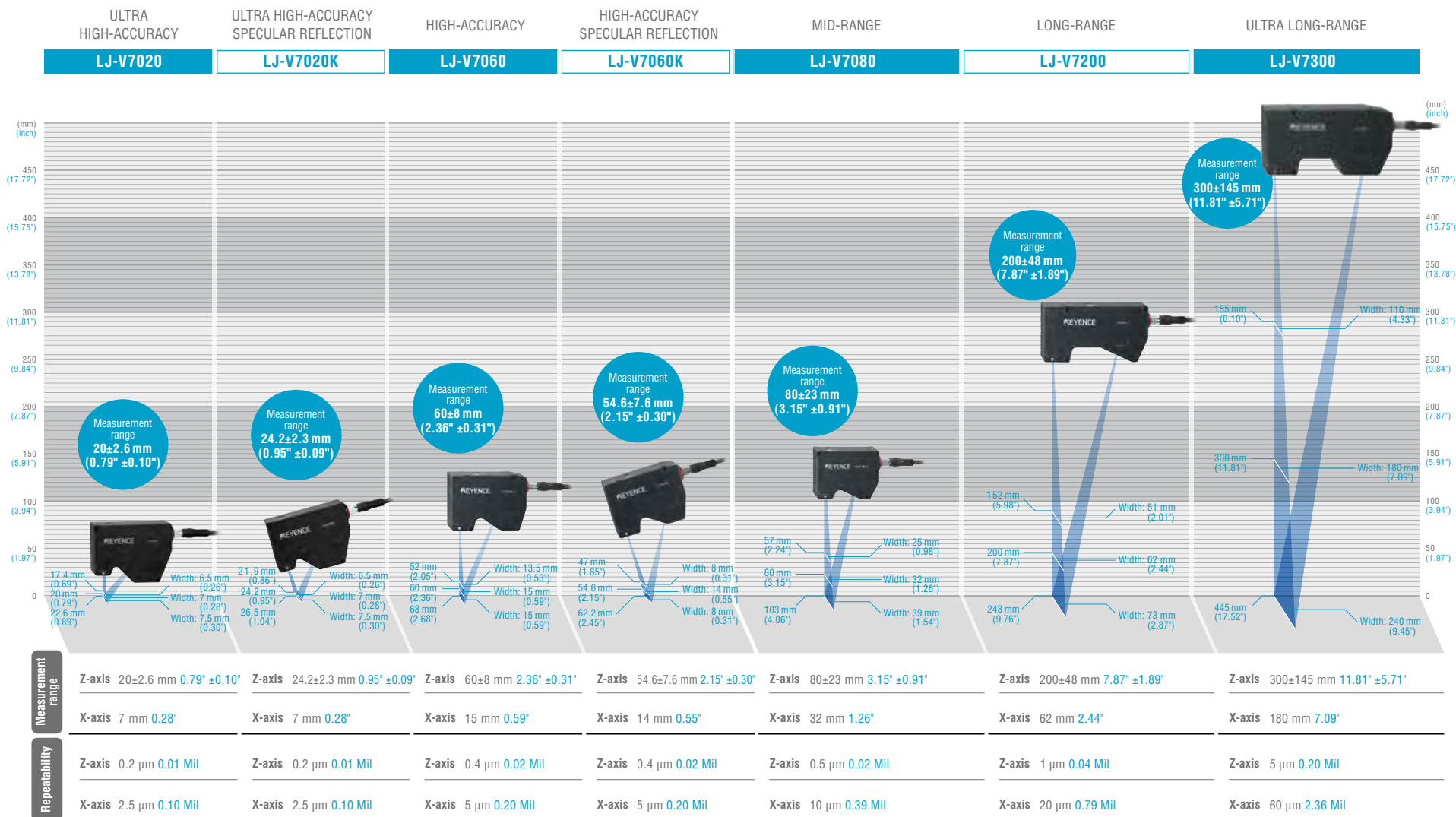
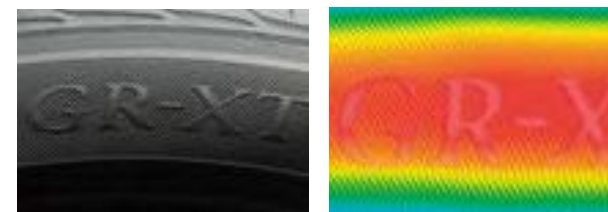
\*2 When using the CV-X100 Series, or the CV-X200 Series with CA-EC80

# SAMPLING AT 64,000 PROFILES/SEC. WORLD'S FASTEST!

The LJ-V Series has realized the fastest sampling speed in the world for 2D laser measuring instruments.\* This makes it possible to measure high-definition laser profiles of products on high-speed manufacturing lines without missing a single one. For example, the LJ-V Series can measure targets moving at 6.4 m 21.0/s with a 0.1 mm 0.004" pitch.

The LJ-V Series does not miss a single abnormal or defective part.

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



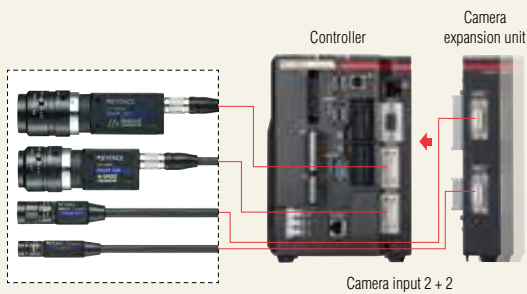
## MULTI-CAMERA, SIMULTANEOUS IMAGE ACQUISITION SYSTEM

A total of 22 types of cameras can be mixed for use. For example, it is possible to attach a monochrome camera and a color camera to 1 controller unit. Also, by connecting a camera expansion unit, it is possible to connect up to four 21M pixel cameras, 4 laser heads, or 2 laser head plus 2 area cameras. Because simultaneous image acquisition and simultaneous processing can be performed for all camera combinations, this system has the flexibility to support future additions and changes to inspection specifications.

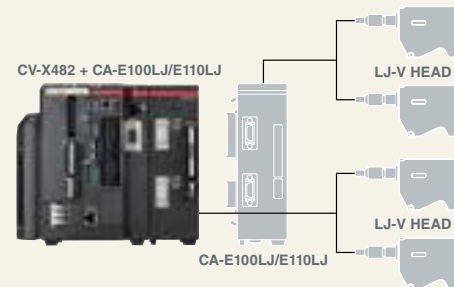
(\*The expansion unit can be connected to the CV-X422/CV-X452/CV-X472/CV-X482/CV-X152/CV-X172)

### MULTI-CAMERA SYSTEM

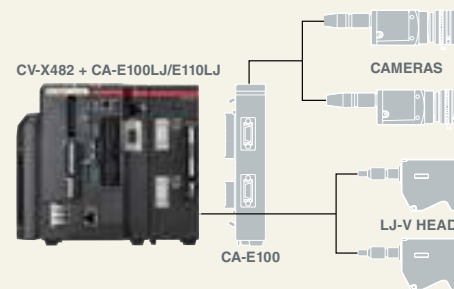
Connect up to 4 cameras from a selection of 22 cameras



### CAN BE CONNECTED WITH UP TO FOUR LASER HEADS



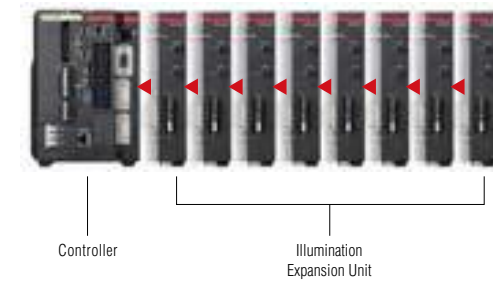
### CAN ALSO BE CONNECTED WITH TWO LASER HEADS AND TWO AREA CAMERAS



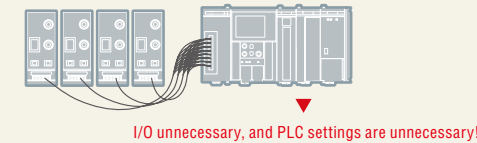
## ILLUMINATION EXPANSION UNIT

### EASY LIGHT CONTROL WITHOUT CUMBERSOME WIRING

Up to 8 lighting expansion modules can be connected to the main controller. Each unit has 2 lighting connections (connector and terminal style) so up to sixteen 12 or 24 VDC lights can be connected.



### Problems with conventional methods: PLC control via a number of I/O is necessary

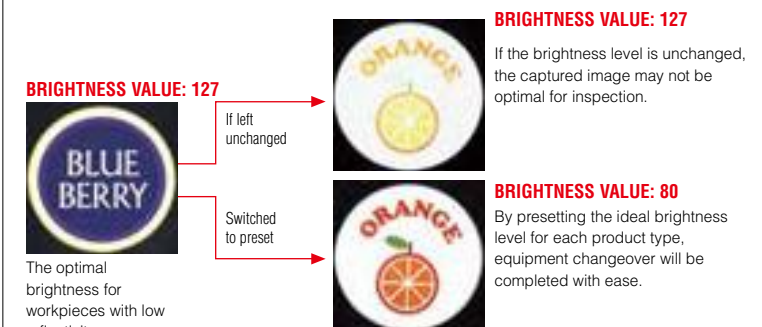


### APPLICATION EXAMPLE

#### BRIGHTNESS PRESETS FOR EACH INSPECTION SETTING

##### AUTOMATIC LIGHT INTENSITY ADJUSTMENT FOR EACH PRODUCT TYPE

When the product being inspected changes, different lighting settings may be required to capture the optimum image. It is possible to automatically change to the light intensity when a different product is inspected.






# MULTIPLE CONTROLLERS AVAILABLE WITH THE SAME EASE-OF-USE

Selectable according to application, processing speed, capacity, and camera choice, with HDD-less design

Our lineup includes eight types of controllers available according to the number and types of cameras to be connected and processing speed. It is no longer necessary to use multiple devices with different functionality for each inspection category.



**ALL MODELS  
ARE  
HDD-LESS**



HDD-less

## CV-X400 Series **NEW**



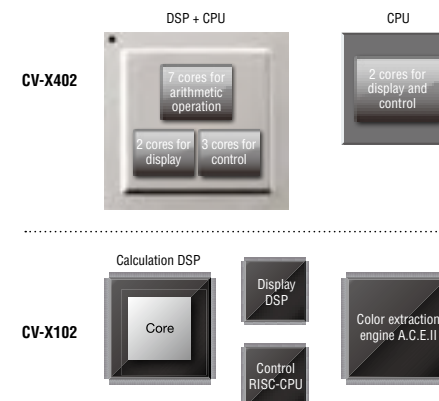
High-speed model for area cameras

Model that supports 3D

Model		CV-X402	CV-X422	CV-X452	CV-X472	CV-X482
Main image processor		3-core DSP			7-core DSP	
Max. no. of connectable cameras		2	4	4	4	4
Supported cameras	0.31M to 0.47M pixel	✓	✓	✓	✓	✓
	2M pixel	—	✓	✓	✓	✓
	5M pixel	—	—	✓	✓	✓
	21M pixel	—	—	—	✓	✓
	CA-HX048C/M	✓	✓	✓	✓	✓
	CA-HX200C/M	—	✓	✓	✓	✓
	CA-HX500C/M	—	—	✓	✓	✓
	LJ-V	—	—	—	—	✓

## **NEW** Multi-core DSP-integrated CV-X400 Series

Stable high-speed processing is made possible by parallel processing with 14 cores, the largest offering in the industry.



# LumiTrax™ TUNING NEW

LumiTrax™ set up has never been easier! Simply follow the navigation and intuitively select one of the many displayed images, making it possible for anyone to easily create the optimal LumiTrax shape image.



Optimized  
LumiTrax shape  
image is complete!

## STEP 1 Select inspection type



First, select the type of inspection.

## STEP 2 Select the image with the sharpest feature extraction



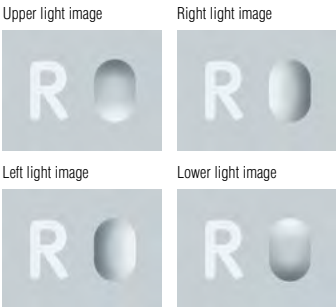
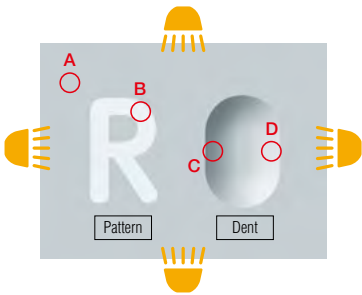
Simply choose the best image from multiple options to automatically set the ideal parameters.

## STEP 3 Select the optimal contrast

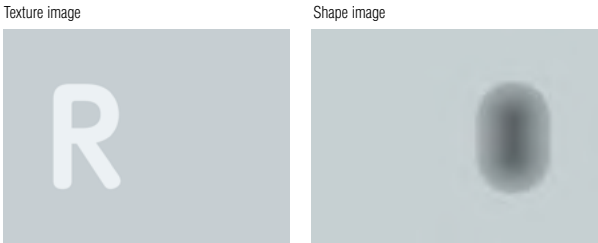
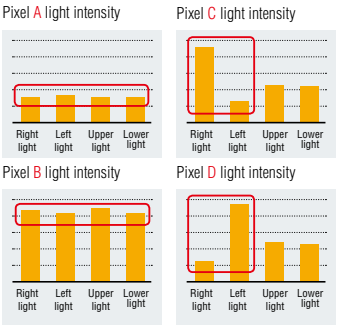


## LumiTrax processing

1. Ultra high-speed images are captured with controlled, partial lighting from different directions.



2. The difference in light intensity at each pixel among the different images is analyzed and used to separate shape (surface irregularity) and texture (pattern) images for processing.



## APPLICATION EXAMPLES 1

### Extracting only the shape (irregularities) information regardless of the surface conditions

#### EMBOSSD CHARACTER INSPECTION



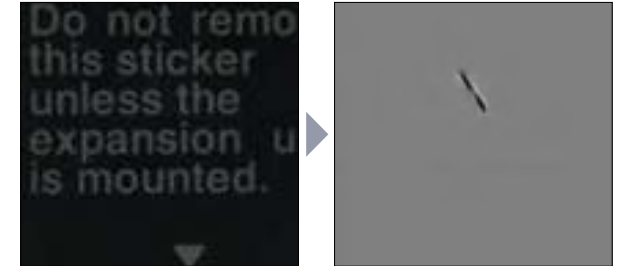
The embossed characters are inspected while ignoring the characters printed on the package.

#### CHIP INSPECTION ON A METAL SURFACE



Factors such as remaining cleaning agent, dirt, and minor hairline fractures are canceled so that only deep defects such as scratches and chips are detected.

#### PRINTING DEFECT INSPECTION



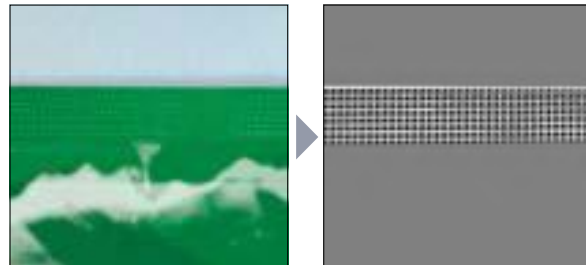
Images are created in which only the slits are extracted without being affected by the complex printed background.

#### STAMPED CHARACTER INSPECTION ON METAL CASTING



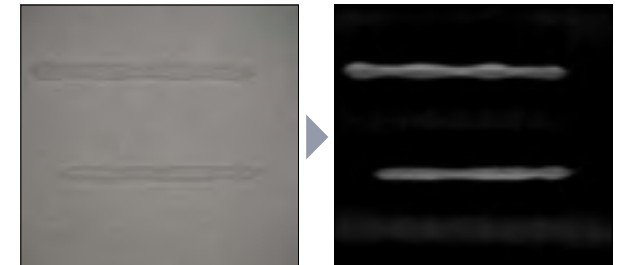
From a random casting surface, the Stamped character with greater concave-convex information are emphasized.

#### HEAT SEAL WIDTH INSPECTION



Captures and extracts surface irregularities in the seal which are difficult to capture based on the color and shade alone.

#### HOT GLUE BEAD PRESENCE INSPECTION



Accurately extracts only the hot glue bead even when the background is the same color.

## APPLICATION EXAMPLES 2

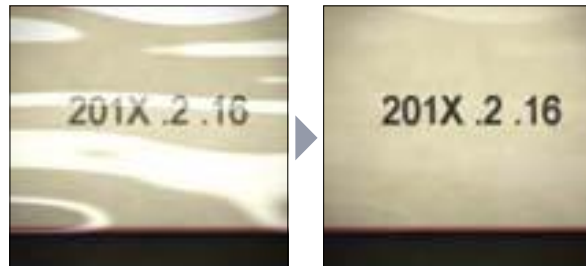
### Suppressing glare and ambient light to extract only textures (pattern)

#### PACKAGE PERFORATION INSPECTION



Even if a pattern is present in the background, inspection can be performed since it is possible to obtain the shape alone.

#### PRINTED CHARACTER INSPECTION ON A FILM SURFACE



Glare, which affects inspections negatively, is eliminated to enable stable inspections.

#### TAPE PRESENCE INSPECTION



Even when unexpected specular reflection occurs due to workpieces being tilted, the glare can be canceled, which makes it possible to perform stable inspections.


# AUTO-TEACH INSPECTION TOOL COLOR

An inspection tool that learns what a good part is.

The newly incorporated Auto-Teach Inspection Tool uses the camera to learn variations and individual differences that exist in the good parts and recognizes those that fall outside these parameters as defective parts. This algorithm eliminates unstable elements to successfully guide on-site inspection. Settings are performed just by running good parts, and eliminates the conventional need for highly-experienced vision integrators and complicated programming. This is an inspection tool that makes it possible for anyone to achieve and maintain a stable inspection.



Just run  
good parts




**SETTING  
COMPLETED!**


Good parts learned!

**NEW ALGORITHM!**


**Parts that are different from the learned good parts are detected as bad!**



✓ Good



✗ Different type




✗ Incomplete printing



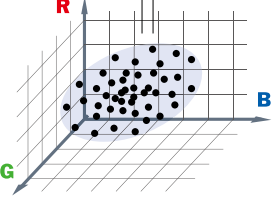
✗ Flaw

Defectives not expected at the time of setting can also be detected.



Variability range of good parts

Learning data



**LEARNING FULL COLOR INFORMATION**

By learning the full color information for each pixel, defects can be detected that are impossible to find using monochrome inspections while still allowing for normal color variation among good parts.

**HELPFUL IN REALIZING EASY OPERATION**

**CUT INCORRECT LEARNING FUNCTION**

Defective parts are automatically excluded, even if they are mixed-in during auto-teach eliminating the potential for human error.

**SET AUTO-THRESHOLD FUNCTION**

Automatically calculates and sets threshold values from the learned good parts.

IDEAL FOR THE FOLLOWING APPLICATIONS

## 1. Frequent programming is required due to many product types

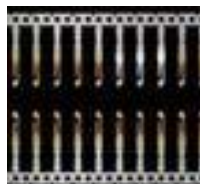
Misarrangement inspection for boxes of tissues



Setting is completed just by running good parts. A wide variety of product features, including color, shape, and pattern can be handled with a single tool.

## 2. There are many points to inspect

Plating defect inspection for lead frames



Defect inspection in many locations that generally requires a long time for programming can be covered by a single Auto-Teach Inspection Tool.

## 3. Complex shapes to inspect

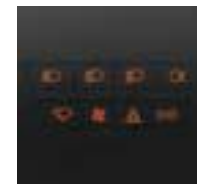
Flaw inspection for connector housings



Since this tool learns the entire part including the profile, you do not have to set multiple inspection regions to line up with the different surfaces on a complex work surface.

## 4. Variations in good parts

Assembly defect inspection for instrument panel buttons



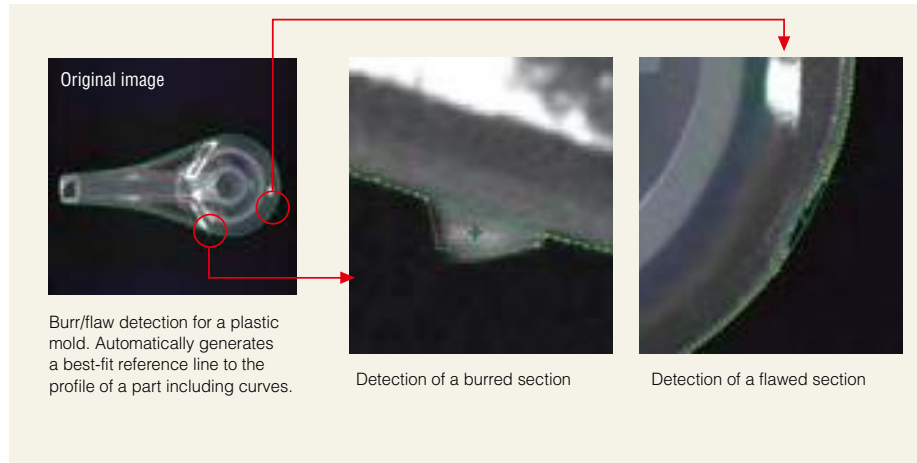
This tool learns and inspects variations such as different thicknesses caused by different lighting conditions, which can occur naturally among good parts. This prevents good parts from being rejected mistakenly.



## TREND EDGE STAIN

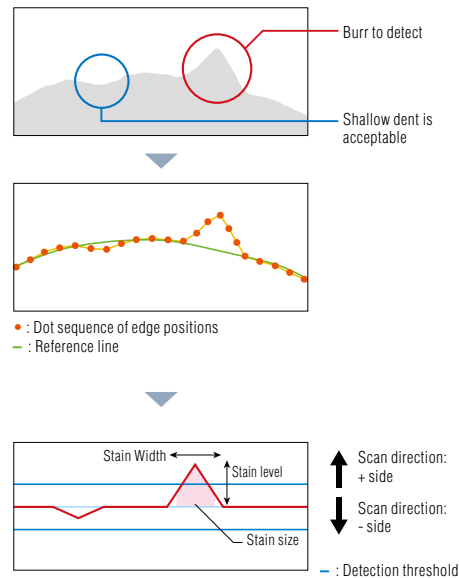
### Edge defect inspection tool optimized for burr and flaw inspection

This tool extracts a profile from the edges of a workpiece and recognizes the sections that show a large difference from the profile such as burrs or flaws. In addition to circles and straight lines, ovals and profiles with complex shapes consisting of free curves are supported, based on edge information of up to 5000 points.



### Applicable to various stains

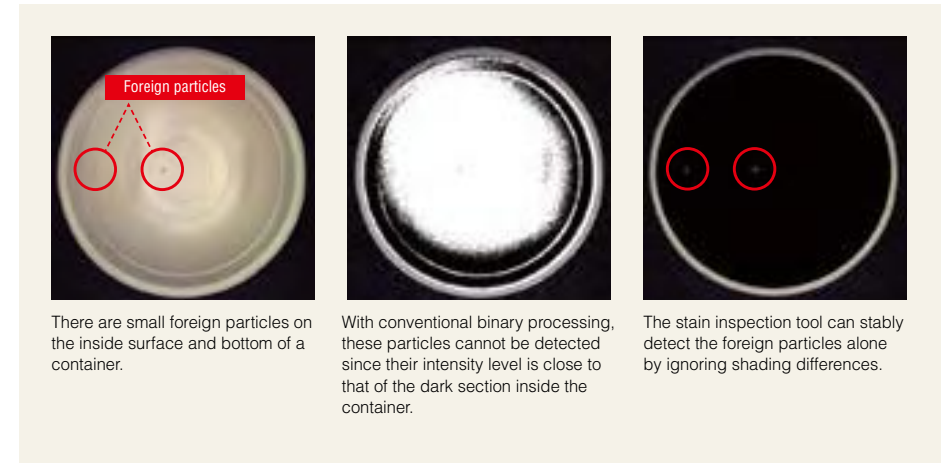
With a variety of parameters, certain defects can be distinguish from others. Settings can be optimized according to inspection category, such as +/- from the reference line (burrs/flaws) and width/size that exceeds a threshold.



## STAIN

### Powerful & flexible appearance inspection tool

This tool detects stains, flaws and other defects by comparing them against the surrounding shading level. In addition to excellent detection ability, the tool also features a function to only identify defects that you want to detect, by size, density, shape, and count.

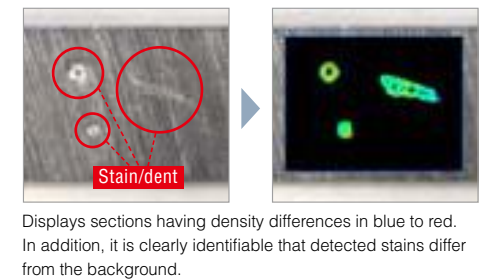


### Contrast image

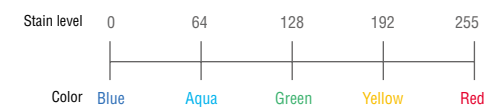
This function displays levels of defects with different colors depending on the intensity differences from surrounding areas. You can check visually and intuitively how different the areas you really want to detect are from the background and noise.

Since the contrast image can be checked not only during programming, but also during operation. This can be utilized effectively in various scenarios, such as investigating the cause of a false reject.

### Stain detection for a metal plate



### Relationship between contrast image colors and stain levels



## IMAGE ENHANCE FILTERS

24 types of image enhancement filters are provided to significantly compensate for changes in inspection conditions caused by part variations and external environments. KEYENCE's original algorithms generate optimal images for inspection to improve stability and reduce scrapping of good product due to inspection error.

### SCRATCH DEFECT EXTRACTION

Eliminates noise information within the inspection region and only highlights linear information. This filter is particularly effective for linear defect inspection for workpieces having rough surface conditions.

#### LINEAR STAIN ON A METAL COMPONENT



A linear stain cannot be detected due to minute rough edges on the background.

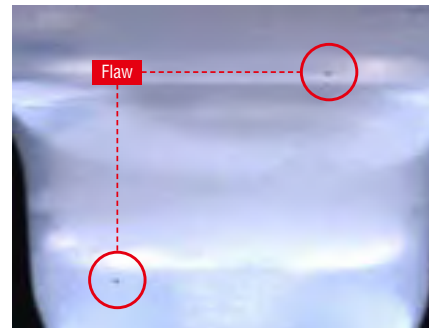


Only linear stains are extracted by ignoring background noise.

### SHADING CORRECTION

Cancels shading or uneven brightness occurring on the workpiece surface to optimize images for inspection. Even if shading conditions change every time, this filter corrects images in real time to only extract defective sections.

#### APPEARANCE INSPECTION FOR A PLASTIC MOLD



Shading occurs on the workpiece surface due to the shape consisting of curves.

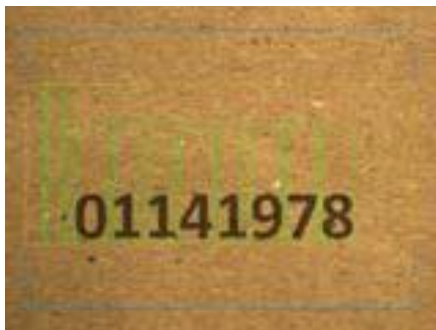


Only stains are extracted by cancelling random shading in real time.

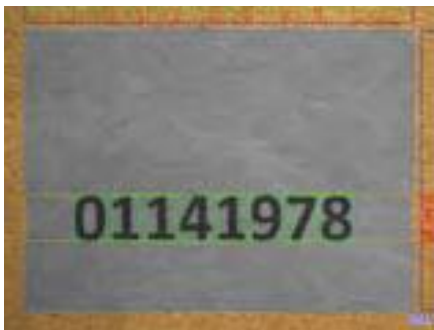
### NOISE ISOLATION

Eliminates or extracts noise having a specified area or smaller. This filter is effective for ignoring a rough background that hinders image processing or for extracting subtle defects for easier detections.

#### RECOGNITION OF CHARACTERS PRINTED ON CARDBOARD



Characters cannot be extracted properly due to white and black fibers contained in the cardboard.



Only bright and dark noise are removed and the printing condition remains unaffected.

#### STAIN INSPECTION FOR A PLASTIC MOLD



Minute flaws and irregularities exist on the background and the surface with printed characters.



Only black stains smaller than the specified area are extracted.

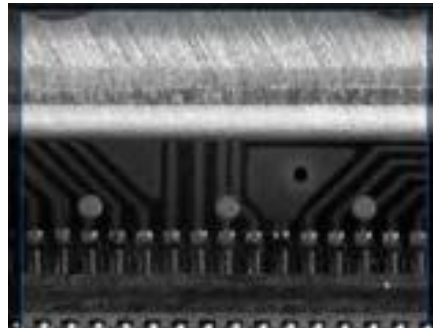
## CONTRAST EXPANSION

Expands the density distribution within the inspection region to increase the contrast of an image. This filter stabilizes inspection when gradation necessary for image processing cannot be obtained due to the reflectance of workpieces.

### VARIOUS CIRCUIT BOARD PATTERN INSPECTIONS



The location is at the back of the workpiece, so the light intensity is insufficient, which makes it impossible to recognize the circuit board pattern.



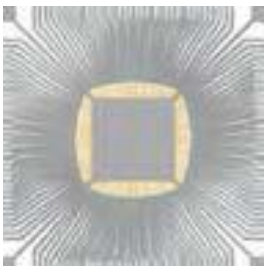
The circuit board pattern can be recognized clearly. Because the filter determines the expansion width from the density distribution within the inspection region, images without overexposure and underexposure can be captured.

## SUBTRACTION

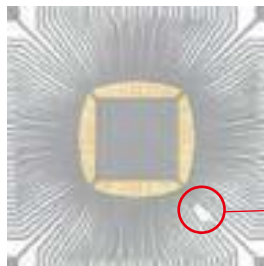
Compares the current image with a previously registered master image to extract sections that differ. It is also possible to take individual differences in non-defective workpieces into account and adjust how much differences should be recognized as defective.

### INSPECTION FOR A BROKEN SECTION OF A LEAD FRAME

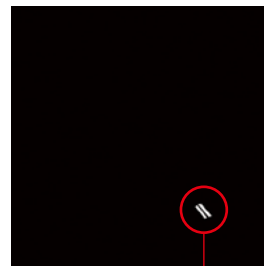
Reference image (OK product)



Current image (NG product)



Subtracted image



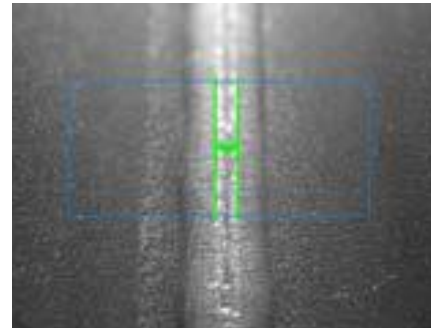
Only the defective section is extracted.

Only defective sections are extracted even for targets having complex shapes such as lead frames.

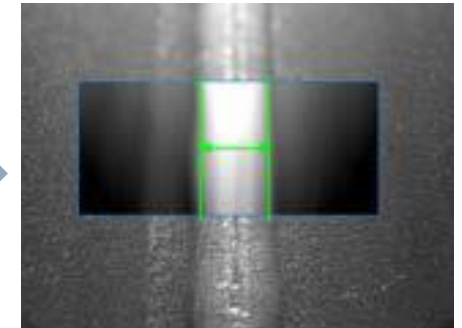
## BLUR

Blurs the inspection region to remove a significant amount of fine background patterns or noise. This filter offers more stable inspection by intentionally blurring images to eliminate aspects that need not be inspected.

### WIDTH INSPECTION FOR A WELDED PIPE SECTION



Edges are detected in areas outside the welded section due to hairlines on the metal surface or sputter deposited on surrounding areas.



The blur filter allows for stable width measurement by eliminating unnecessary featured points other than the welded section.

## PRESERVE INTENSITY

Corrects changes in image brightness due to light intensity fluctuation. This filter reduces variation in measured values caused by intensity fluctuation by correcting the brightness difference from the reference image at every capture.

### POSITION INSPECTION FOR SCREW MOUNTING

Current image (normal light)



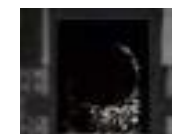
Current image (lowered light)



Even if light is lowered, the same binary conditions are preserved as with normal light.



Binary image



Binary image  
Without preserve intensity

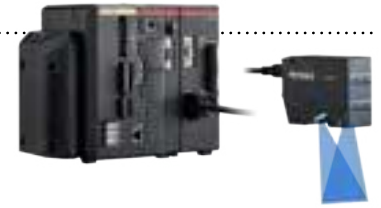


Binary image  
With preserve intensity

# 3D MACHINE VISION NEW

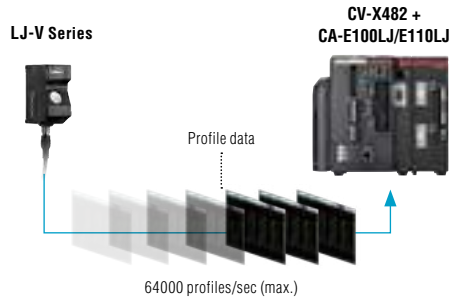
## 3D makes the impossible possible

3D measurement using height data is now supported, including height, area, and volume measurement. Using the height-extraction function, 3D data can be converted into a gray-scale image based off the selected height range. By applying an existing image processing algorithm to this image, inspection that has been difficult with an area camera is now possible.



### Ultra high-speed 3D shape measurement using light-section method

3D shapes of various targets can be measured while moving at high speed using the LJ-V Series, in-line profile measurement system featuring ultra high-speed sampling at 64 kHz.



### Conventional method: laser displacement sensor + area camera

#### Conventional camera + displacement sensor

Inspects heights with a laser displacement sensor and widths and positions with a camera. This requires adjustment of installation conditions on each device and does not synchronize data between the two devices, making volumes and cross-sections difficult to calculate.



### 3D MACHINE VISION

#### LJ-V + CV-X482 + CA-E100LJ/E110LJ

Height, width, position, cross-sectional area, and volume can all be inspected in one system. Target displacement can also be corrected in real time.



### Low contrast between target and background? - Problem solved!

#### OCR FOR STAMPING ON A CAST COMPONENT

With an area camera, stable character recognition is difficult due to variations in background conditions and poorly defined stamped edges. Using 3D height information, the background can be distinguished clearly from characters.



Workpiece photo



Height image



Height extracted image + OCR tool

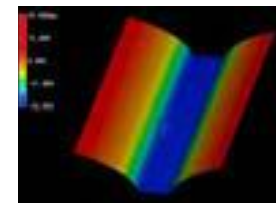
### Defects missed on curved surfaces? - Problem solved!

#### FLAW/DENT INSPECTION FOR A PLASTIC MOLD

With an area camera, dents cannot be detected due to shading caused by complicated curved surfaces or concaved/convex shapes. Such detection becomes possible by extracting height deviation from free-form plane information.



Workpiece photo



Height image



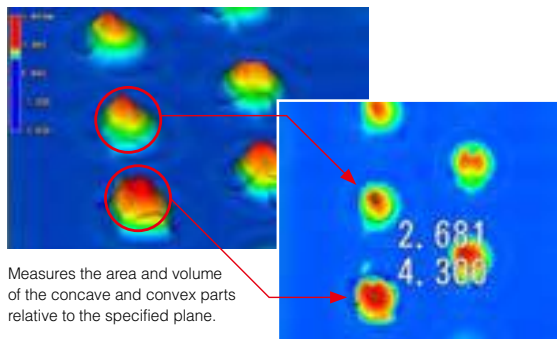
Height extracted image + stain tool



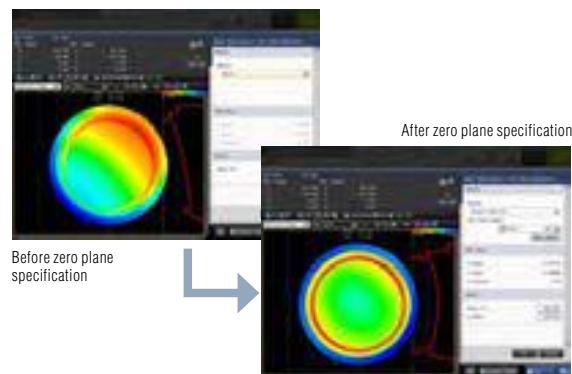
## HEIGHT MEASUREMENT TOOL

Measures dimensions such as minimum/maximum heights, convex/concave areas and volumes based on 3D data. Flexible measurement is ensured by specifying any plane within the screen as a zero plane.

### Area/volume measurement



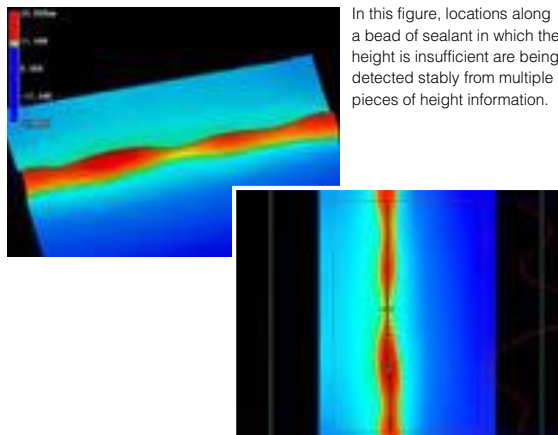
### Zero plane specification



Since a zero plane can be specified as a reference for height measurement, stable measurement is ensured, even if the targets change orientation.

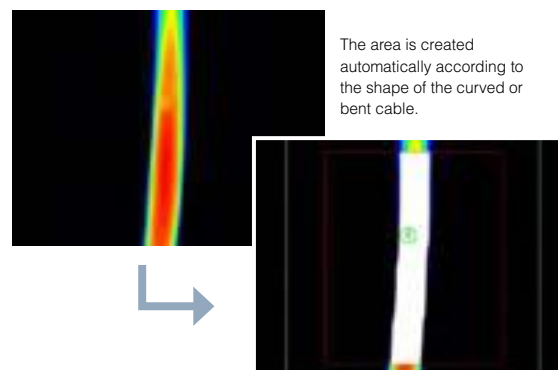
## TREND HEIGHT MEASUREMENT TOOL

Executes multiple height measurements across one region. It is possible to find the maximum/minimum values and to calculate the best-fit circle or plane among the peak values calculated for each small cross-sections of the main region.



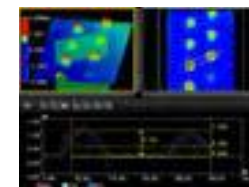
## IMAGE REGION GENERATOR

Converts the specified height range into an inspection region. Even if a workpiece changes in shape, inspection will automatically occur only on surfaces within the defined height range.



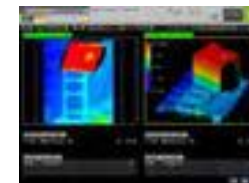
## 3D OBSERVATION

On a captured 3D image, a 2D profile can be displayed between any two points by specifying them with the mouse. This allows the user to verify the inspection range and settings instantaneously.



## CONTROLLER 3D DISPLAY

For improved visualization, a 3D image can be displayed as an operation screen or together with processed images in a multi-screen display.

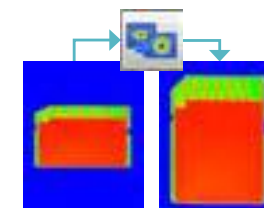


## LJ-V CAPTURE OPTIONS

LJ-V parameters can be set directly in the CV-X program and optimized according to the workpiece by simply following a step-by-step process.



Navigation to the optimum settings

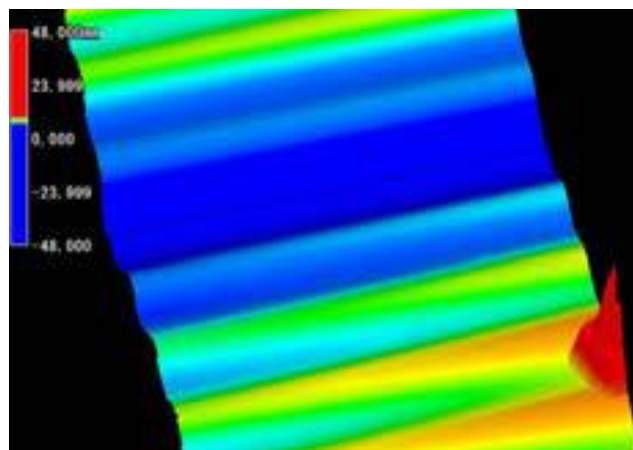


Vertical-horizontal ratio adjustment tool

## VIBRATION CORRECTION First-in-class NEW

Vibrations that occur during part scanning are analyzed in real time, making it possible to extract only the correct height data.

### CONVENTIONAL



Previously, vibration during workpiece conveyance affected measurement data.

### Using this function



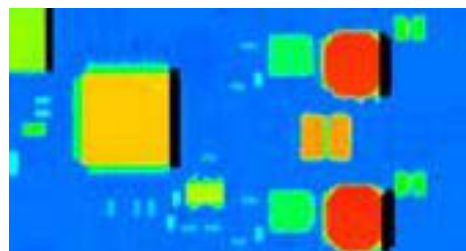
The actual shape of the workpiece can be obtained.

## BLIND AREA ELIMINATION

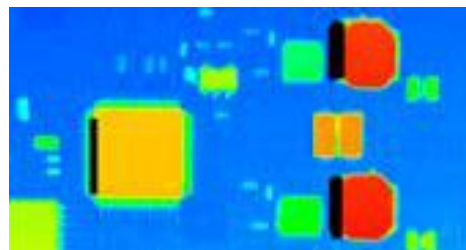


Profile information from two directions are combined to complement the blind area that could not be measured using conventional triangulation measurement.

### Head A

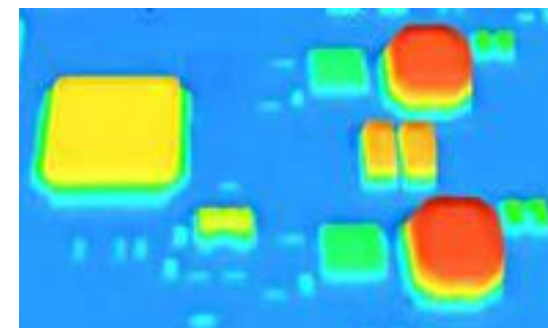


### Head B



COMBINE

### Composite image



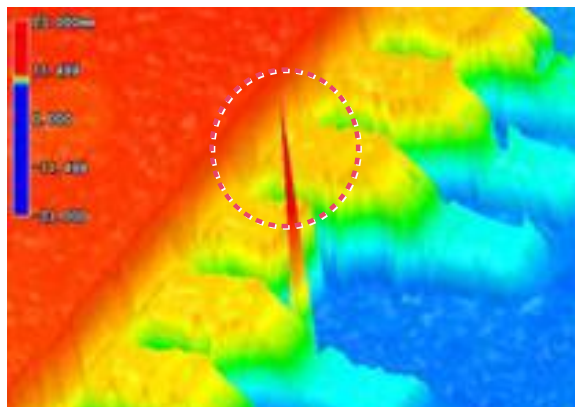
Comprehensive, composite data is generated by eliminating blind areas by using two heads.

Each image is missing data on the respective blind areas.

## SPIKE NOISE CUT NEW

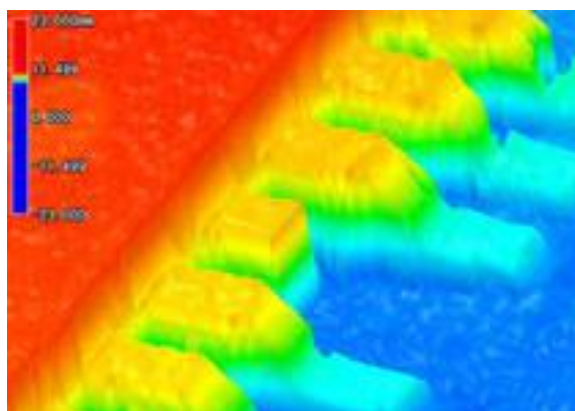
This function eliminates non-continuous noise spikes to ensure stable measurement.

### CONVENTIONAL



Noise spikes that occur at workpiece edges can affect the accuracy of measurements.

### Spike Noise Cut



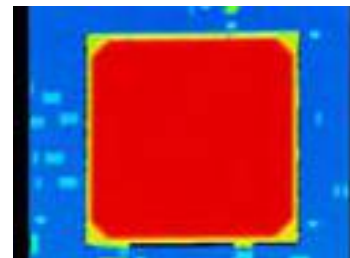
Only noise spikes are removed to ensure stable measurement.

## SIMULTANEOUS GRAYSCALE IMAGE ACQUISITION NEW

Simultaneous processing of 2D and 3D inspections is made possible by obtaining grayscale images from the laser scan\*.



### Height



### Grayscale



Simultaneous acquisition of height and grayscale images enables character inspection as well as position adjustment using images where there is no height difference, supporting a wider range of applications.

\* This function is only available with certain models. Please contact KEYENCE for more details.

## Programmable dedicated encoder

With the ability to set the pulse count to any value in the range of 64 to 150,000 pulses per rotation, the introduction of encoders according to image capture requirements has become easier than ever before. The encoder no longer needs to be selected based on the axial rotation speed, roller diameter, field of view, or other factors that previously had to be taken into account.



Encoder relay unit  
**CA-EN100U**



Dedicated encoder  
**CA-EN100H**

### High resolution and fast output

Supporting up to 150,000 pulses per rotation, high resolution pulse output at as little as 0.0024° (8.64 sec.) can be achieved. Fast output frequencies up to 1.6 MHz are also possible.

### IP65 compliant

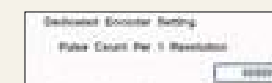
To make it easier to use on-site, it is designed to be protected from water and dust infiltration (excluding head and axis parts), with other environmental resistance also taken into consideration.

\* If the axis hole section can be exposed to oil, attach a cover or take other protective measures.



Installation example

### Controller settings




# DIMENSIONS/GEOMETRY TOOL

High-precision dimension inspection can be done intuitively through simple mouse operations


In most cases, dimension/geometric measurement for image processing requires multiple tools and complicated calculation processing. With the CV-X Series, dimensions/geometry tools can be performed with an easy point-and-click method. Points, lines, and circle information from other tools can also be referenced making it much easier to develop programs with multiple dimensions requiring inspection.

## CONVENTIONAL

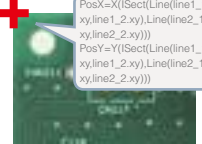
Combination of multiple settings and calculations are required



Create settings that will detect a line in the left area



Create settings that will detect a line in the top area




Calculate intersecting coordinates between 2 lines with the calculation function

```
PosX=X!(Sect(Line(line1_1.xy,line1_2.xy),Line(line2_1.xy,line2_2.xy)))
PosY=Y!(Sect(Line(line1_1.xy,line1_2.xy),Line(line2_1.xy,line2_2.xy)))
```

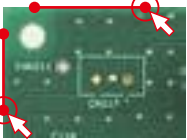
## DIMENSIONS/GEOMETRY TOOL

Settings completed by simply clicking on the desired features




Two Lines Intersection

Select the feature to be executed, and



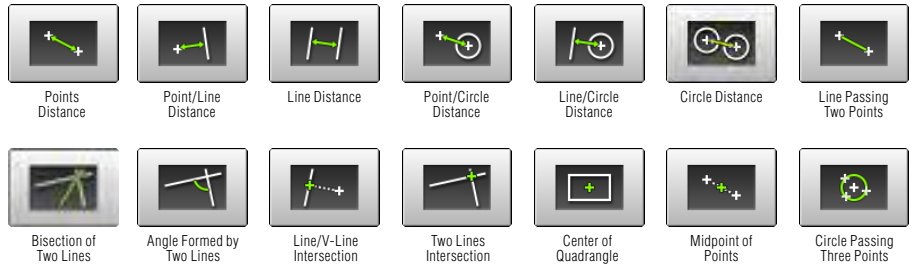
Just specify target lines with the mouse




**DETECTED!**

**EASY DETECTION!**  
It is also possible to reference coordinates, circles, or lines from other tools that have already been created!

A vast variety of geometry tools the user can select from



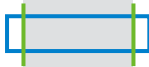
Easy scaling with any image size



Scaling


For applications where you would like actual values instead of pixels, it is possible to easily convert with the specialized scaling utility.

1 Measure the target (Can select width or pitch)

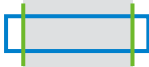


312.8 px

2 Input the actual values for the inspection region



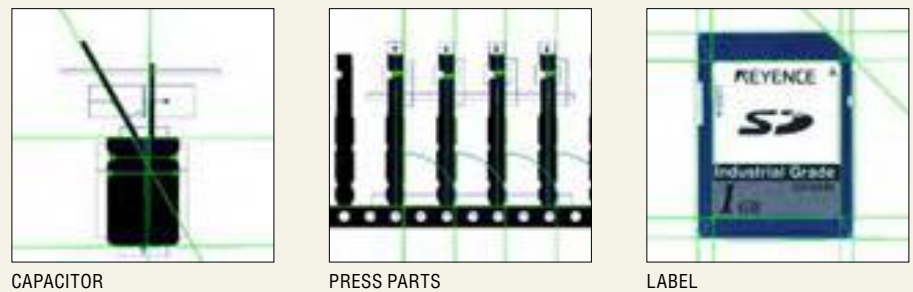
3 Convert to actual values and display



10 mm  
0.39"

## APPLICATION

Even objects with complex shapes such as below can be measured quite easily.





# OCR

## Stable and reliable character recognition tool that displays extracted conditions and stability

This tool recognizes characters printed or stamped on a product. To cope with printing conditions constantly changing on site, KEYENCE has put utmost emphasis on visualizing important factors for character recognition such as character extraction, stability and character library.

### Light intensity fluctuation-resistant



By using gray-scale processing, as opposed to binary processing, inspection is ensured even if the ambient light varies. In addition, the character extraction method is used so that the user can understand recognition conditions easily.

### VISUALIZATION WITH WAVEFORMS



"Character extraction", the most important factor for character inspection, is now visualized with waveforms. The user can determine "stability" instantaneously since these waveforms can also be checked during operation.

### Stability visible with numeric values



"Correlation," showing the matching percentage compared to a registered character, and "Stability," showing the margin in correlation compared to the most similar character, are checked for each character.

### Flexible user library



Actual printed characters are registered within the library as they appear. Stable recognition is ensured with sub-pattern registration even if print quality varies.

### CALENDAR TOLERANCE FUNCTION

Functions equivalent to those available on dedicated machines are provided, including offset, tolerance, and zero-suppression.

### DATE ENCRYPTION SUPPORT

Supports encrypted date printing by converting judged characters using an encryption table.

# 1D/2D CODE READERS

## Executes reading and image processing inspection simultaneously

Reads the 1D/2D codes printed on the target workpieces. Since code reading and inspection using another image processing tool can be done simultaneously, this function leads to space saving and cost reduction compared with conventional cases where 1D/2D code readers and image processor are installed separately.

### 1D CODE



### 2D CODES



Within the same workpiece, appearance inspection is performed simultaneously with reading of the 2D code.

### PRINT QUALITY VERIFICATION FUNCTION

This newly added function to verify 1D/2D code printing quality enables in-line checking of relative changes in printing quality while simultaneously reading.

Complies with ISO/IEC 15415, AIM DPM-1-2006, and SAE AS9132.

Notice: This function is designed to capture relative changes in print quality and thus cannot be used as a print quality verification system for absolute value evaluation.



# VISION-GUIDED ROBOTICS

## Easily develop a vision-guided robotic system

The CV-X Series communicates directly with a variety of robots, synchronizes the coordinate systems of the vision system and robot, and provides stable vision-guided robotic operation.



### Direct communication with the robot controller (Simple connection)

Easily establish direct communication between the robot and the CV-X by simply selecting the robot manufacturer. The CV-X can also perform jog operations on the robot, simplifying the development of the machine vision guidance.



### Auto-calibration function

Calibration is the most difficult aspect of constructing and running a system linking a robot and vision system. The auto-calibration function provides highly-accurate and effortless calibration. The result is reliable and stable calibration without the subjectivity of a manual process.

#### CONVENTIONAL PROBLEMS

- Manual operation is time-consuming.
- Accuracy varies between operators.
- Difficult to readjust when installation shifts occur.
- Difficult to reproduce identical environments in different locations.

#### WITH KEYENCE'S AUTO-CALIBRATION FUNCTION

- ▶ **Easy operation with a single click**
- ▶ **High accuracy regardless of operator**
- ▶ **Calibration can immediately be executed to quickly recover from any positional shift**
- ▶ **Fast and accurate reproducibility regardless of location**

### Easy navigation

Simply select the application type you want to implement for machine vision guidance. Easily configure the settings by following the step-by-step procedure. Even first-time users, new to vision-guided robotics, can implement a system without any trouble.



## Search tool with ultimate performance, speed, and accuracy even under inferior image conditions

A highly-stable search can be performed even if changes occur in the target, such as chips, flaws, and contrast changes. This tool also offers very accurate search performance as a position adjustment reference for other inspection tools.

### HIGH ROBUSTNESS

Allows accurate searching even if the capture conditions change from the original registered image.



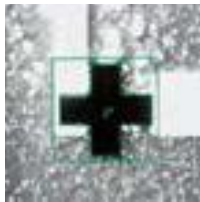
Registered image



Defect

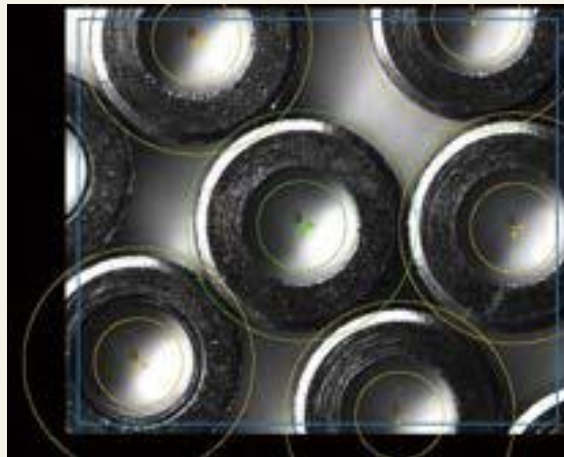


Unclear profile



Inverted tones

### Reliable detection even with target overlap or partial targets



Even if the search target has some overlap with its neighbors or protrudes outside the inspection region, stable detection can still be performed.

### Search can be performed on up to 2000 targets



Up to 2000 patterns of the same target can be detected with one tool. Searching for many small parts in a large field-of-view is possible when using the 21 megapixel camera.

### Multiple methods of specifying the target detection order

→ X: Ascend

← X: Descend

↓ Y: Ascend

↑ Y: Descend

Match%: Ascend

Match%: Descend

↻ Clockwise

↻ Counterclockwise

↗ From Upper Left (Left to Right)

↘ From Upper Left (Downward)

↖ From Upper Right (Right to Left)

↙ From Upper Right (Downward)

↗ From Lower Left (Left to Right)

↖ From Lower Left (Upward)

↘ From Lower Right (Right to Left)

↙ From Lower Right (Upward)

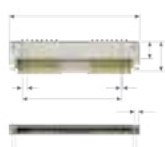
Detection order options have been increased over previous search tools offering higher flexibility in outputting result data.

# CONNECTOR TOOLS

Complex connector inspection settings can be completed by simply following guided steps

Conventionally, inspection setting for connectors with various items and points to be measured require a significant amount of man-hours. With the CV-X connector tools, this can be done by any user by simply following the guided steps.

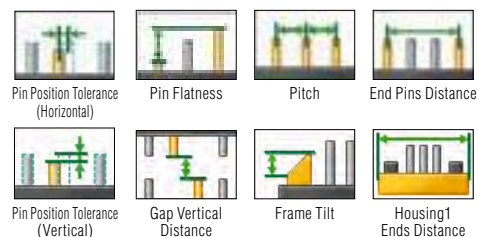
**Our step method enables ANY USER to carry out connector inspection EASILY**



Connector inspection that requires various items to be inspected for each product type and shape

Can be completed just by following steps specific to connector inspection

All you have to do for dimension measurement is to select from various pre-defined connector inspection tools



**SETTING COMPLETED!**

## INSPECTION TOOLS THAT FULLY SUPPORT APPEARANCE INSPECTION

Existing tools can be incorporated into appearance inspection for resin overlaps, short shots, and flaws on housings. Connector inspection is fully supported with KEYENCE's accumulated appearance inspection expertise for image processing.



Appearance Insp. (Trend Edge Pos.)



Appearance Insp. (Area)



Appearance Insp. (Blob)



Appearance Insp. (Trend Edge Wd.)



Appearance Insp. (Stain)



Appearance Insp. (Intensity)

## CONNECTOR APPEARANCE INSPECTION

Stain, Blob, Area, Intensity, Trend Edge Position, and Trend Edge Width tools are "multi-region" compatible, which enables simultaneous deployment in multiple areas. This significantly reduces setting and adjustment man-hours required for connector-specific multi-point inspection.

Setting just one point enables automatic deployment in the remaining areas!



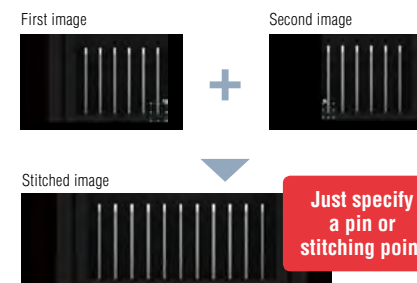
## CONNECTOR ADJUSTMENT MENU



Purpose-specific, guided navigation is available, including "Change Component" and "Change Pin Number". This allows anyone to make necessary modifications like adapting a program to a similar product type with a different number of pins.

## IMAGE STITCHING FUNCTION

Multiple split-captured images can easily be stitched into one image.



Just specify a pin or stitching point

## CONNECTOR-DEDICATED OPERATION SCREEN

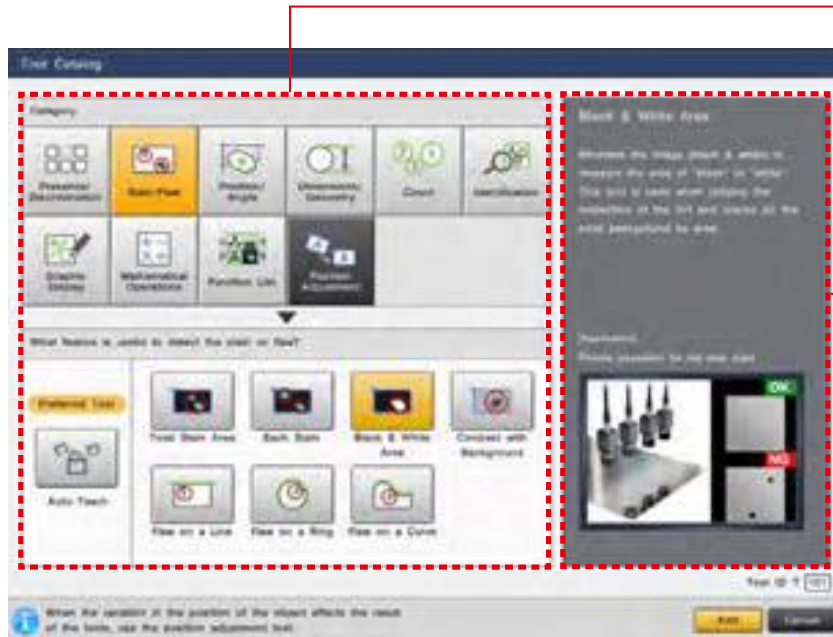


The operation screen most suitable for the connector inspection can be created just by selecting from the catalog.



# TOOL SELECTION CATALOG BASED ON APPLICATION

Just select the desired application type, instead of the traditional tool name



## TOOL CATALOG

The tools have been categorized according to application, based on common industry inspection applications. It allows the user to intuitively find the best tool for their application.

## APPLICATION NAVIGATOR

A description and typical application for each tool is displayed for optimal selection of the correct inspection type.



## INTUITIVE MENU ORGANIZATION

The setting menus are arranged so that they are very graphical and easy to understand in order to help guide the user through the proper setup of each tool.

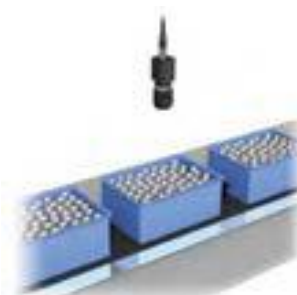
## HELP GUIDE FUNCTION

A help guide is incorporated that includes a description of the parameter that is being adjusted for a clear understanding of what is being changed.



**APPLICATION**

When setting to count the expected number of workpieces in a case...



**Conventional**


**Inspection is difficult to setup as the user cannot reliably determine which algorithm is the best choice.**

↓

**Tool catalog**

**Just select the inspection category from the tool catalog**

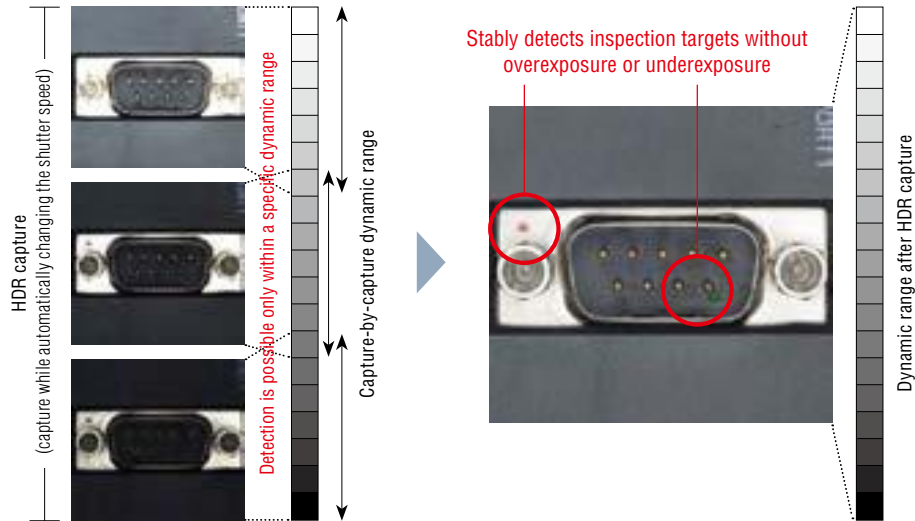
Counting tools are outlined in the "Count" category so there is no confusion.



## HDR

### High dynamic range captures quality images on difficult targets

Captures multiple images while automatically changing the shutter speed and combines them at high speed to generate images without overexposure or underexposure. Images ideal for processing can be captured even when on-site capture conditions vary or inspection targets contain uneven glossiness or mixed intensities.



#### Glare removal

Stable capture results can be obtained even for targets with a high reflectance such as metal workpieces.

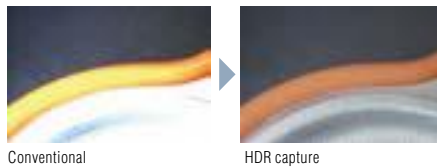


Conventional

HDR capture

#### Lighting variation removal

Effective also when lighting conditions vary depending on the workpiece shape.



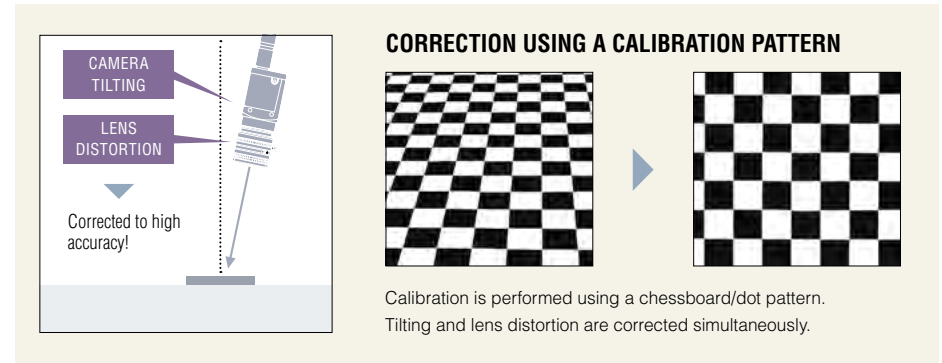
Conventional

HDR capture

## CALIBRATION

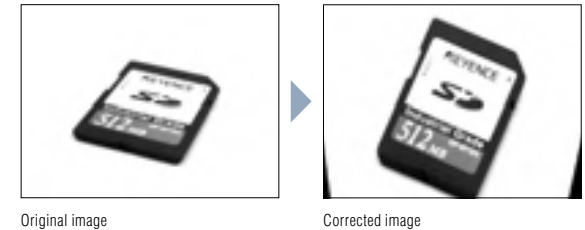
### Removes effects of lens distortion or camera tilting

Removes effects due to installation and hardware related factors such as camera tilting and lens distortion. This function offers consistent capture conditions.



#### Corrects tilting

Corrects camera tilting that may occur during installation. This is also effective when a camera is installed at an angle due to installation space restrictions.

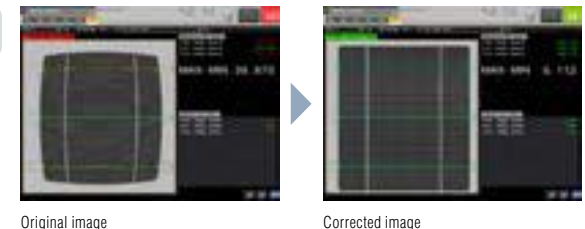


Original image

Corrected image

#### Corrects lens distortion

Addresses the problem where measurement results differ between image center and edge due to lens distortion.



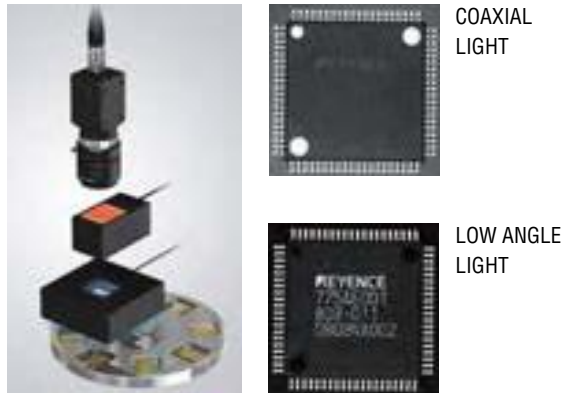
Original image

Corrected image

## MULTI-CAPTURE

### Optimizes one inspection cycle

Multiple images can be captured under different lighting conditions, allowing processing and outputting results from all images in one inspection cycle.



Lighting is switched to optimize illumination for each inspection item, including direction marks, prints, and leads.

#### CONVENTIONAL

To switch between two types of lighting, the "capture -> inspect -> output" cycle had to be performed twice. Two triggers had to be input and two outputs also had to be handled by an external PLC.

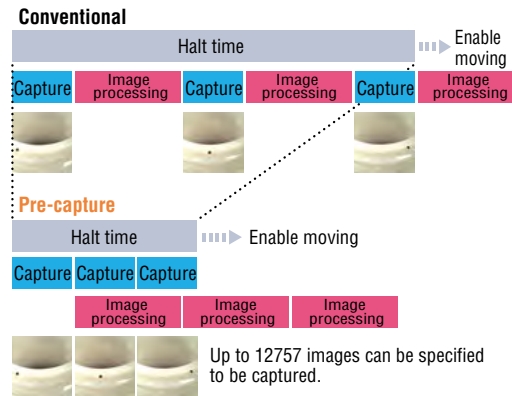
#### MULTI-CAPTURE

Images under two types of lighting can be captured with one trigger. This means there is only one output for each workpiece.

## PRE-CAPTURE

### Parallel inspection during capture at top speed

Image capture is performed at top speed simultaneously storing the image inside the device and concurrently executing image processing. No restriction will be imposed on the halt time or moving speed regarding the object, therefore the designed maximum performance can be exerted.



Even for a workpiece rotating at high speed, images are captured at top speed for the entire circumference, after which the pre-captured images are inspected collectively when the workpiece is fed.

#### CONVENTIONAL

Since repetition of "capture -> inspect -> output" required a longer time for one cycle of inspection, the workpiece rotation speed had to be lowered for inspection. As a result, the performance of the whole equipment was lowered.

#### PRE-CAPTURE

Since a workpiece can be captured repeatedly at top speed even while rotating, inspection is possible without increasing the processing time. Performance can be improved further by combining with a high-speed camera.

## RANDOM TRIGGER

### Capture according to equipment movement

Random trigger is supported, and makes it possible to input triggers without synchronization with the process currently being executed. There is no reliance on current image processing conditions, and it is possible to perform image capture that matches equipment movement.



Since triggers can be input at any timing according to transfer system movement, equipment cycle time can be improved dramatically.

#### CONVENTIONAL

The index stopping time had to be extended to align timing or two controller units had to be used.

#### RANDOM TRIGGER

Because there is no latency for image processing, operation without stopping the equipment is possible even with a single controller.

# UTILITIES

Easy-to-use utilities applying professional knowledge from on-site experiences.

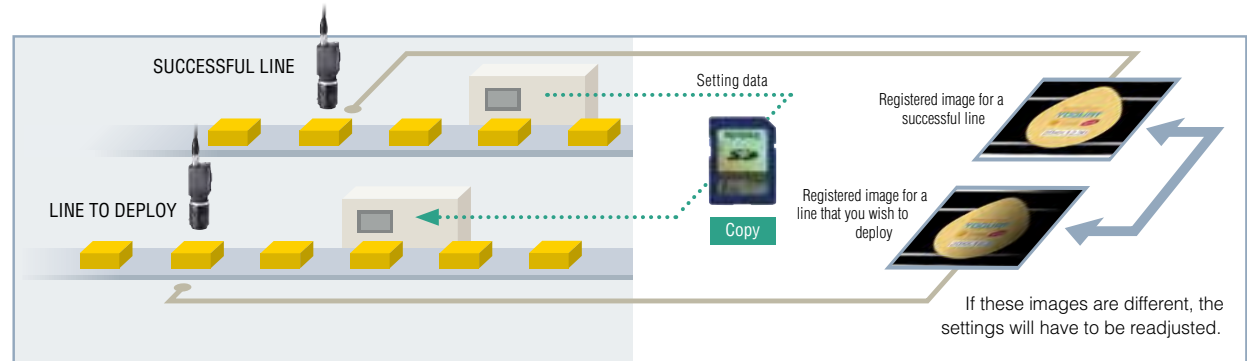
There are many useful utilities for various situations, such as duplicating an inspection environment on another line, making adjustments due to many false detections and managing the inspection process in real time.

Navigation that always guarantees a consistent image capture environment without relying on location.

## Camera Installation Replication

### CONVENTIONAL

Traditionally, when an inspection needs to be replicated on another line or if the mounting location of the camera and lighting is accidentally altered, it is difficult to duplicate the identical camera conditions. Therefore, a substantial amount of time for adjustments may be required to ensure successful inspections.



### CAMERA INSTALLATION REPLICATION

### THE CAMERA INSTALLATION CONDITIONS OF THE NEIGHBORING SUCCESSFUL LINE ARE REPLICATED

The current image can be matched with the same capture conditions as those of the reference image. This is useful for:

1. Matching an image for a line to deploy with the reference image from a successful line.
2. Making a comparison with the reference image at the point in time when the settings were created to check "if the conditions are still the same".



POSITION  
ADJUSTMENT  
TOOL



Successful line

Line to deploy



Draws grid lines in featured areas of the reference image. The position of the camera is adjusted using the grid lines on the current image side that is moving in tandem as a guideline.



BRIGHTNESS  
ADJUSTMENT  
TOOL



Successful line

Line to deploy

Shows areas with different brightness from the reference image in color so that you can adjust them to reduce the difference.

■ Brighter than reference image

■ Darker than reference image

Brighter →

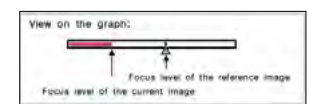


FOCUS TOOL



Successful line

Line to deploy



A comparison with the focal condition of the reference image is displayed in a bar graph. The focus of the lens is adjusted to match the level of focus for the reference image.



# MACHINE VISION SYSTEM DATABASE

EASY LONG-TERM STORAGE AND MANAGEMENT OF IMAGE INSPECTION DATA

CA-H1DB/CA-AD1

VisionDatabase allows long-term storage and analysis of inspection data linked directly to machine vision images.

## MACHINE VISION DATA LINKED DIRECTLY WITH INSPECTION IMAGES

In a manufacturing environment, 100% inspection of products with machine vision is often a critical component of insuring quality and customer satisfaction. However, when inspection results need to be analyzed to determine the cause of an unexpected production problem or to investigate a customer complaint, integrating an effective system of storing inspection data with the corresponding machine vision images has traditionally been very difficult and expensive. VisionDatabase makes it easy to collect, search, analyze, and verifying machine vision inspection results.

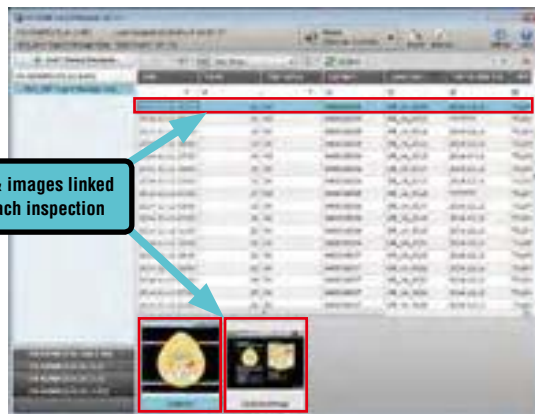
## STORAGE OF INSPECTION DATA LINKED TO IMAGES

Easily compare result data with the actual machine vision image captured at the time of inspection. One million or more\* data sets can be managed safely, because VisionDatabase automatically traces changes in inspections settings and output items during operation.

\* The maximum number of data sets that can be stored depends on the usage environment.



Data & images linked for each inspection



## BACKUP/EXPORT SETTINGS FUNCTION

Makes a backup of inspection settings. These functions support retesting with backup images and export of edited inspection settings.



## EXTERNAL PROCESS DATA LINK

Links image data to external data, such as serial numbers or lot codes sent from a barcode reader or PLC, for data management and searching.

Total Status	Lot Number	Serial ID
NG	FCLO/B	OR_14_0028
OK	TCLQ/A	OR_14_0001

## SEARCH WITH CUSTOM FILTERS

Saves original search conditions for quick retrieval of desired data.



## MACHINE VISION SYSTEM DATABASE: VisionDatabase



Database PC software  
**CA-H1DB**



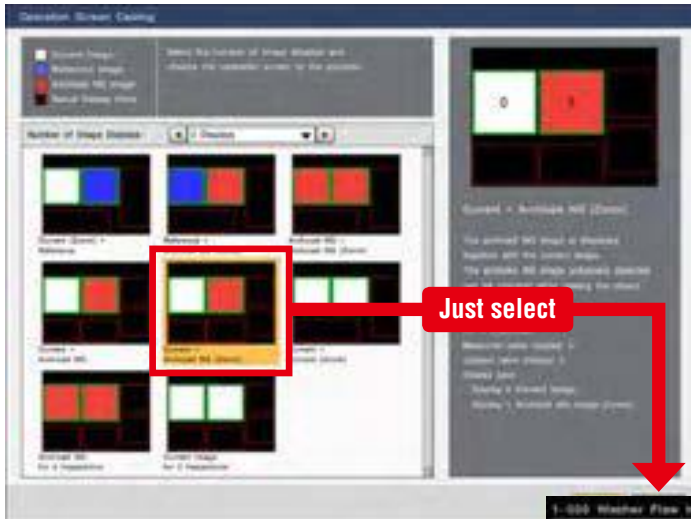
Add-on SD card for controller function  
**CA-AD1**

# USER INTERFACE

No complicated customization is required. Just select a template.

To greatly simplify the customization of operation screens and improve visualization of the process, an operation screen catalog function is incorporated along with many custom functions.

## Just select the best screen from the Operator Screen Catalog



Just selecting the number of display screens you wish to have will show a selection of screen layouts for various situations in catalog format.

### JUST SELECT THE SCREEN LAYOUT FOR THE SITUATION

- To display the current image with the latest NG image side by side.
- To show images from multiple cameras on a single display.
- To automatically zoom in the NG-judged area.
- To display an image side-by-side with the reference image at initial setting so that changes from the start can be checked.

### Point

- Parameters, whose tolerances have been set, are automatically added to a list that displays judged and measured values.
- Even when tools are added later, additions to the display are performed in conjunction.
- Units set with scaling are automatically displayed.



## INTUITIVE OPERATION WHEN CREATING SETTINGS

### TOOL BAR DISPLAYING THUMBNAIL PREVIEWS

Added tools are displayed in thumbnails. Because the inspection region is displayed in a thumbnail, it becomes easy to understand which part is being inspected.



## INTUITIVE OPERATION WITH A MOUSE

The icon-based, easy-to-understand GUI enables intuitive operation with a mouse. In addition, the region can be manipulated on the display directly with a mouse during setting.



## TOUCH PANEL SUPPORT (CV-X400/X200 Series only)

A touch panel can now be connected so that you can enhance on-site efficiency. This ensures easy operation even where a mouse is not available. Program adjustment efficiency can be improved further through combination with a custom menu.



\* Microsoft is a registered trademark of Microsoft Corporation in the United States and other countries.

# A Custom Menu function that realizes the optimal operation with a single click

During operation, some parameters are adjusted often, and some are kept hidden to prevent misoperation. When using the custom menu function, the optimal operator menu can be created just by placing a "★" on parameters that are often adjusted.

JUST MARK THE PARAMETERS WHEN PERFORMING SETTINGS...

When it seems that these parameters are adjusted often...

Click to attach a ★ (star) mark!

Directly open only star-marked (★) parameters

A specialized menu that compiles setting parameters required for operation is now complete!

## OPERATION COMMENT FUNCTION INCLUDED



The operation comment can be displayed on the help field. The display of information that is necessary to set the timing, situation, and guidelines can be input.

## 13 LANGUAGES SUPPORTED

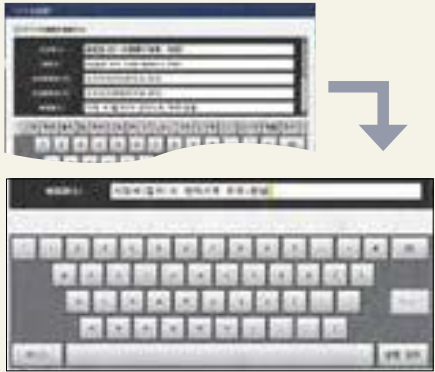
## MULTI-LANGUAGE INPUT SYSTEM INCORPORATED

In addition to conventional display language switching, the character input function also supports multiple languages. It is possible to perform direct input for each language with things such as the tool names or the custom menu comment function and operation screen display character strings without switching the language for the system itself.

English		Italian		Portuguese (Brazilian)	
Simplified Chinese		Korean		Vietnamese	
Traditional Chinese		Spanish (Mexican)		Japanese	
French		Thai			
German		Indonesian			

## THE CHARACTER STRING INPUT ON THE CONTROLLER ALSO SUPPORTS MULTIPLE LANGUAGES

A soft keyboard that supports multiple languages is displayed during entry.



# USER MANUAL AUTO-GENERATOR/PC SOFTWARE

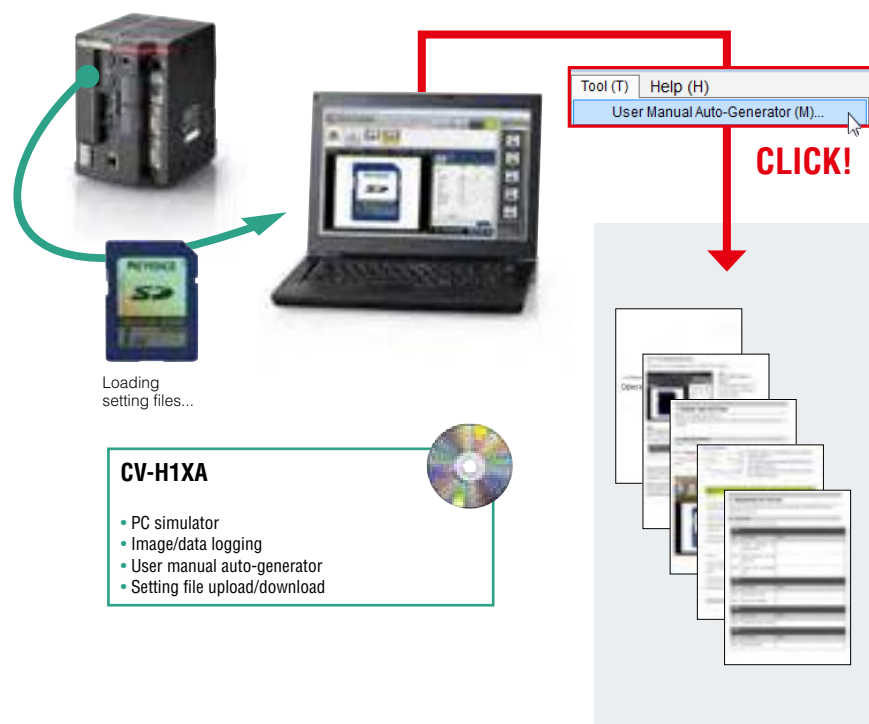
## PC software that strongly supports operation

The User Manual Auto-Generator function, PC Simulator function and the ability to collect image and measurement data are all included with the free PC software.

## CUSTOMIZED USER MANUAL ENSURES OPTIMAL OPERATION FOR ALL USERS

### USER MANUAL AUTO-GENERATOR

#### CUSTOMIZED MANUAL CREATION IN A SINGLE CLICK!



### EXAMPLE OF CREATED MANUAL CONTENTS

Cover sheet



How to view the operation screen



A list of tools

2. Adjustment for the tool	
Adjusting the tool setting by using the image storage system to determine the setting adjustment of each tool.	
2.1. Tool List	
The following tools are used for the setting.	
Tool No.	Tool Name
1001	Basic tool
1002	Image storage system
1003	Image storage system
1004	Image storage system
1005	Image storage system
1006	Image storage system
1007	Image storage system
1008	Image storage system
1009	Image storage system
1010	Image storage system

Basic tool settings



An explanation of the main parameters



#### MULTIPLE LANGUAGE SUPPORT

User manuals can be created in thirteen languages according to the languages of setting files.

#### TOOL SETTING TIPS

It is possible to insert Tips describing how each tool's parameter is typically adjusted.

#### MS WORD OUTPUT

Outputs in Microsoft Word format. It is possible to freely delete unnecessary parts, and add comments.

#### TIME SAVING

Many man-hours are saved when creating a customized user manual for the inspection.



## REPRODUCES THE SAME CONDITIONS ON A PC AS ON SITE: PC SIMULATOR FUNCTION

### PC SIMULATOR



Download the program, including both the OK and NG images, from the controller running on site.

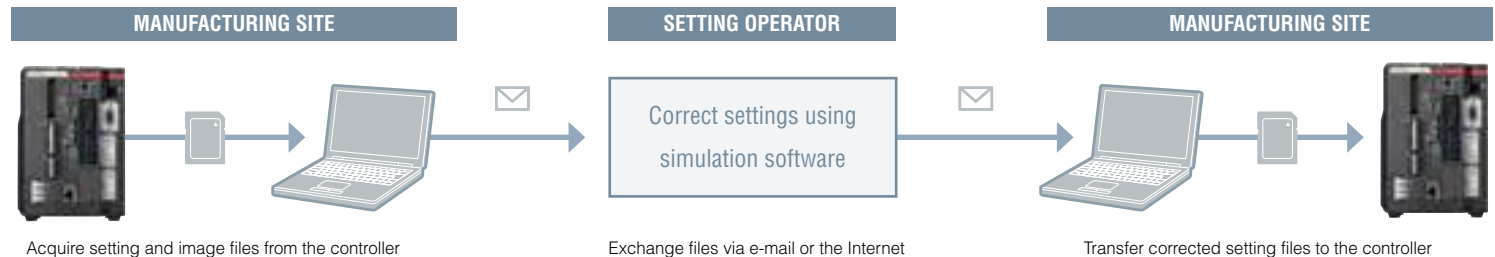


Using simulation software installed on a PC, programming and verification using images can be performed, even at a remote site.



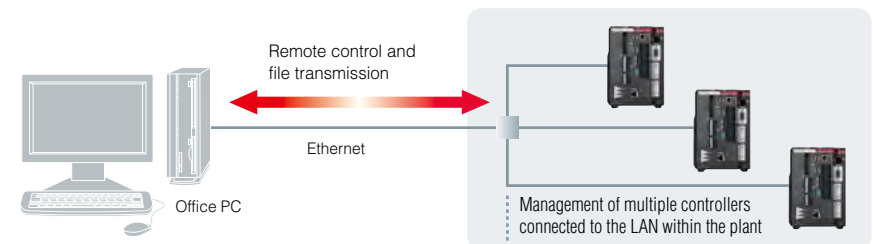
### APPLICATION SAMPLE

Exchange e-mail with a programmer at a remote site



## Acquire image files and measurement data into a PC and operate controllers remotely: Data Logging & Remote Desktop Function

Images and measurement results from a connected controller can be acquired into a PC. Using the remote desktop function, maintenance man-hours can be reduced significantly since tasks that require travel to on-site locations can be accomplished remotely, including setting change for a controller at another plant.



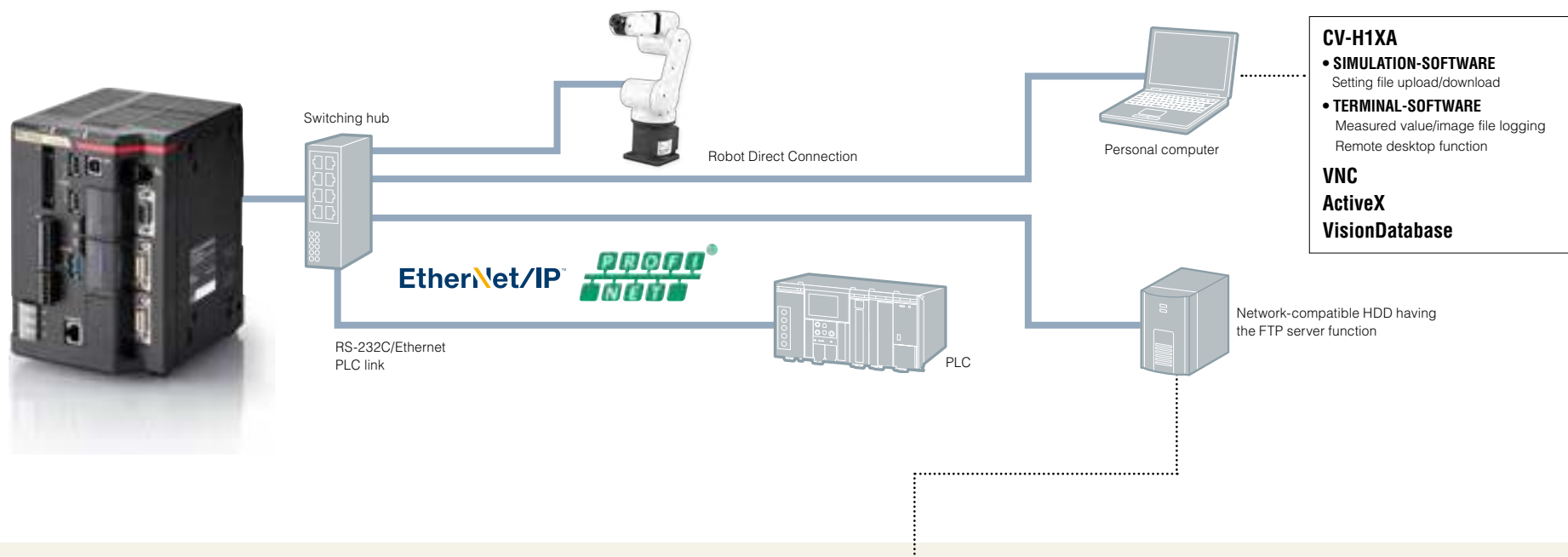
# COMMUNICATION AND CONTROL

## A wide variety of communication methods compatible with existing systems

A wide variety of communication methods are available to satisfy communication control needs, including logging of images and data, PLC control of the vision system through commands, and various display and monitor functions are available to improve operation and security. Various monitor functions useful at startup and other times are also available to improve operability and security.

## COMMUNICATION INTERFACE

Supports linking to PLCs made by several manufacturers as well as EtherNet/IP™ and PROFINET, which enables easy integration into an existing system. In addition, remote control via connection to a personal computer and image/result logging to an FTP server are also available.



### EtherNet/IP™- and PROFINET- compatible



### I/O MONITOR FUNCTION

Built-in monitor function checks communication for EtherNet/IP™, PROFINET, RS-232C, TCP/IP and discrete signals to troubleshoot problems quickly.

### PLC LINK

PLCs made by several manufacturers can be linked via RS-232C/Ethernet.

#### SUPPORTED PLC MANUFACTURERS:

- KEYENCE: KV Series
- Omron: SYSMAC Series
- Mitsubishi Electric: MELSEC Series
- YASKAWA Electric: MP Series

### FTP OUTPUT FUNCTION

Supports image/measured value output to an FTP server. Images can be saved for a long period of time by connecting a high-capacity HDD having the FTP server function.

### VisionDatabase OUTPUT OPTION

VisionDatabase allows long-term storage and analysis of inspection data linked directly to machine vision images.

### COMPATIBLE WITH USB 3.0 STORAGE DEVICES

Save images on large-capacity storage devices up to 2 TB. Hard disks will be recognized just by connecting to the controller, eliminating the need for configuration of communication and other settings.

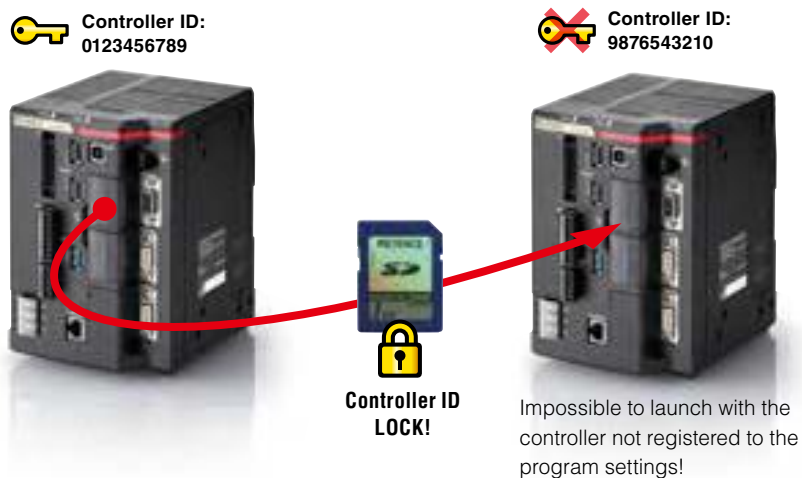
# SECURITY/ACCOUNT

## Robust security that protects program assets

For image sensor operation, it is important that the setting contents are easy to understand and can be easily accessed. On the other hand, there is an extremely strong need not to disclose program contents and prevent the copying of setting files. With the CV-X Series, robust security functions that answer these demands have been prepared and separated by purpose.

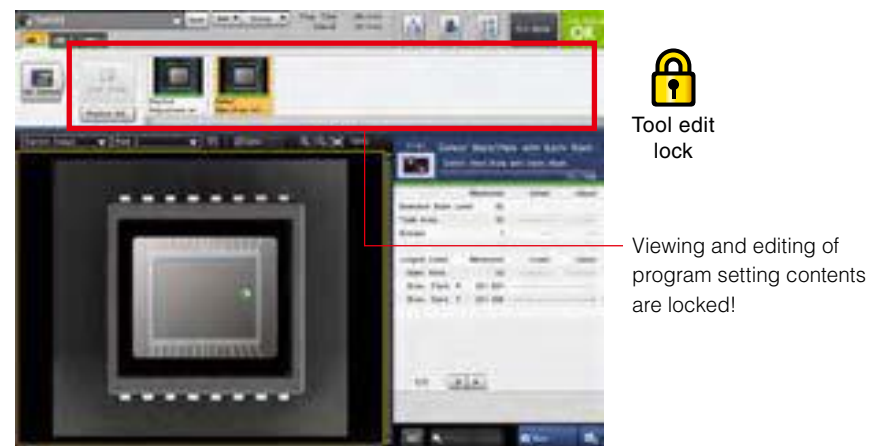
## CONTROLLER ID LOCK

This is a function that does not start program settings with controllers other than those that have the specified unique ID (controller ID). This is useful in protecting against the copying of program assets and unintended controller operation.



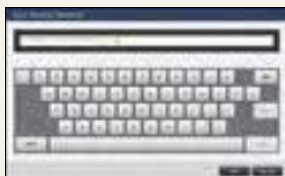
## TOOL EDIT LOCK

If a tool edit lock is applied, browsing or editing program setting contents will no longer be possible. This prevents the external outflow of programming knowledge, such as the parameter values or pre-processing filters used.



## PASSWORD SETTINGS

The entry of up to 32 characters is supported for the password. This feature meets demands for more secure password management.

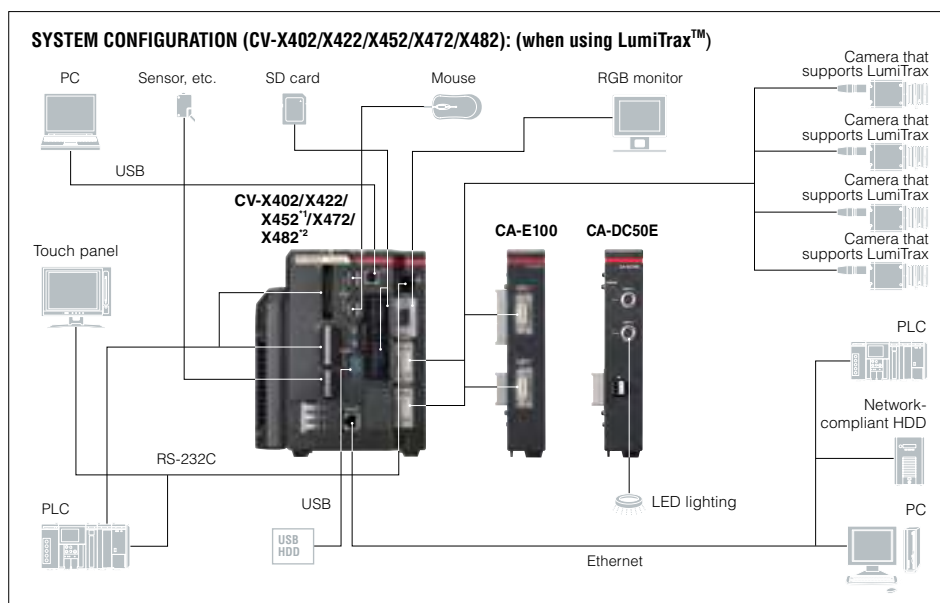
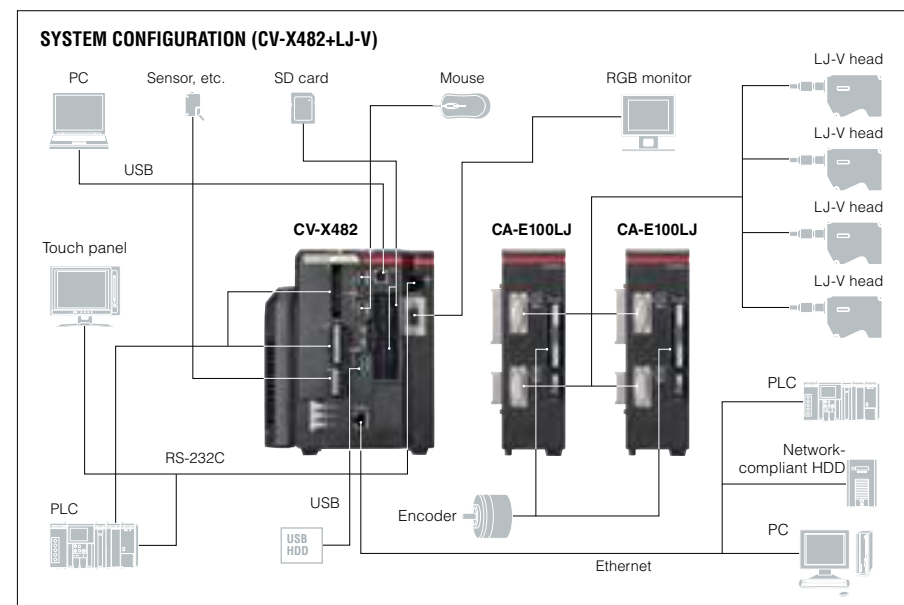
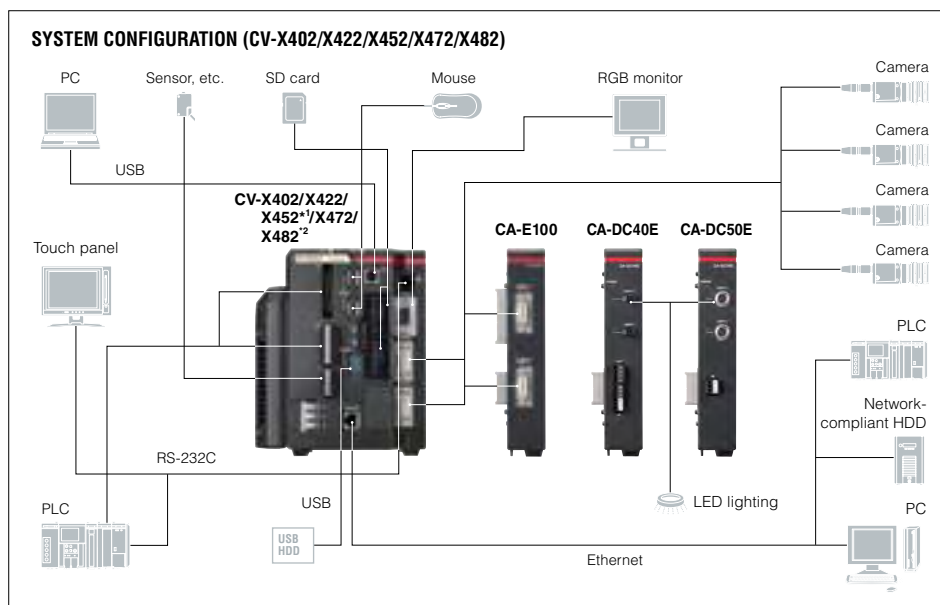


## ACCOUNT SETTINGS

### OPERATING SETTING PROTECTION

For a smooth operation after introduction, 3 types of accounts are provided. Using an account that is managed with a password prevents operation mistake and unnecessary setting changes.

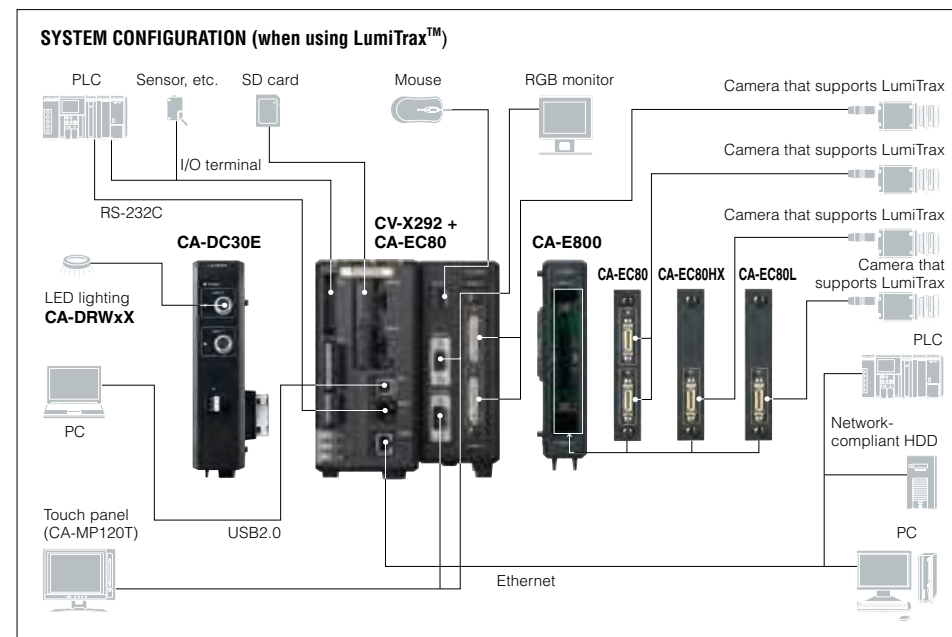
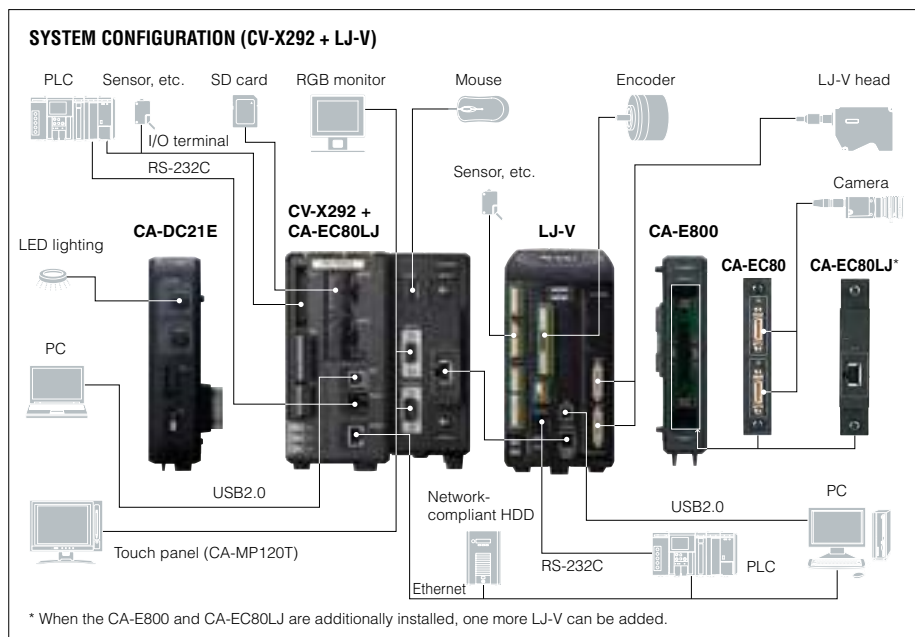
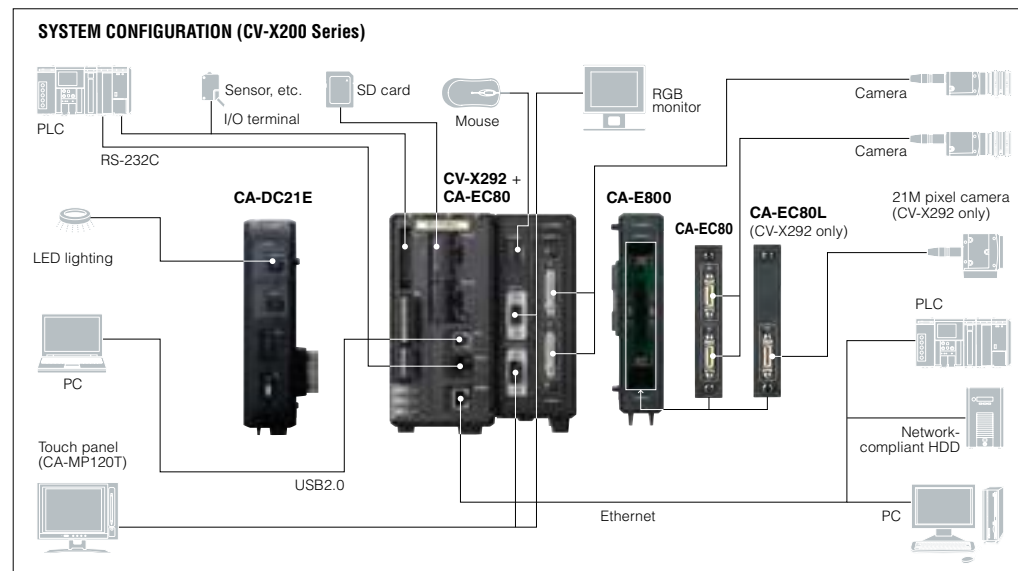
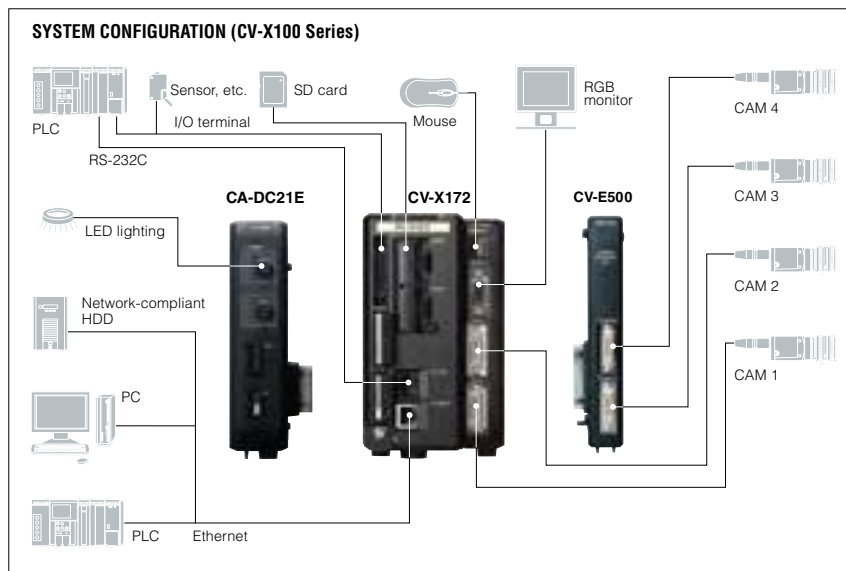
<b>ADMIN</b>	All operations are possible.	Password setting for the purpose of changing accounts is possible.
<b>OPERATOR</b>	Custom menu operation, change program, and saving are possible.	
<b>USER</b>	Only viewing operations are possible.	



\*1 Fan unit cannot be connected to CV-X402/X422/X452.

\*2 CV-X482 does not include a camera input unit, must attach at least one camera input unit to the controller (up to 2 are supported).





## Controller



5M pixel camera  
supporting type  
**CV-X452**

2M pixel camera  
supporting type  
**CV-X422**

0.47M pixel camera  
supporting type  
**CV-X402**



21M pixel camera  
supporting type  
**CV-X472**



21M pixel camera/  
LJ-V supporting type  
**CV-X482**



5M pixel camera  
supporting type  
**CV-X172**

2M pixel camera  
supporting type  
**CV-X152**

0.47M pixel camera  
supporting type  
**CV-X102**



5M pixel camera  
supporting type  
**CV-X272**

2M pixel camera  
supporting type  
**CV-X252**

0.47M pixel camera  
supporting type  
**CV-X202**



21M pixel camera/  
LJ-V supporting type  
**CV-X292**

\* In this picture,  
the CA-EC80L  
is attached to  
the controller.

## Accessories

Mouse  
(Accessory)



### PC software DVD-ROM **CV-H1XA**

Windows 10 (Home/Pro/Enterprise)  
Windows 7 (Home Premium/Professional/Ultimate/Enterprise)  
Windows Vista  
(Home Basic/Home Premium/Business/Ultimate/Enterprise)  
Supported OS languages: English, Japanese, Chinese  
(Simplified and Traditional), Korean, Thai, German, French,  
Italian, Spanish, Indonesian, Portuguese (Brazilian) and  
Vietnamese  
Supports the 64-bit/32-bit version of Microsoft Windows 7 or  
Windows 10. For Windows Vista, only the 32-bit version is  
supported.

## Area camera



21M pixel ×16 speed camera  
**CA-H2100C** (Color)  
**CA-H2100M** (Monochrome)



5M pixel ×16 speed camera  
**CA-HX500C** (Color)  
**CA-HX500M** (Monochrome)  
2M pixel ×16 speed  
camera  
**CA-HX200C** (Color)  
**CA-HX200M**  
(Monochrome)  
0.47M pixel ×16 speed  
camera  
**CA-HX048C** (Color)  
**CA-HX048M** (Monochrome)



5M pixel ×11 speed  
camera  
**CV-H500C** (Color)  
**CV-H500M**  
(Monochrome)  
2M pixel ×7 speed  
camera  
**CV-H200C** (Color)  
**CV-H200M**  
(Monochrome)  
0.31M pixel ×7 speed  
camera  
**CV-H035C** (Color)  
**CV-H035M**  
(Monochrome)

2M pixel camera  
**CV-200C** (Color)  
**CV-200M**  
(Monochrome)

0.31M pixel camera  
**CV-035C** (Color)  
**CV-035M**  
(Monochrome)



Ultra-compact camera  
2M pixel camera  
**CV-S200C** (Color)  
**CV-S200M**  
(Monochrome)



Ultra-compact camera  
0.31M pixel  
**CV-S035C** (Color)  
**CV-S035M**  
(Monochrome)

\* Microsoft is either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.  
Company and product names mentioned in this catalog are trademarks or registered trademarks of their respective companies.

Expansion unit



Area camera  
input unit  
**CA-E100**

Dedicated to  
the CV-X400  
Series



LJ-V Series  
input unit  
**CA-E100LJ/  
CA-E110LJ**

Dedicated to the  
CV-X400 Series



LED light  
control  
expansion unit  
**CA-DC40E**

Dedicated to the  
CV-X400 Series



Light control  
expansion unit  
that supports  
LumiTrax™  
**CA-DC50E**

Dedicated to the  
CV-X400 Series



Camera  
expansion  
unit  
**CV-E500**

Dedicated to  
the CV-X100  
Series



Camera  
expansion  
unit  
**CA-E800**

Dedicated to  
the CV-X200  
Series



Area camera  
input unit  
**CA-EC80**



21M pixel  
camera  
input unit  
**CA-EC80L**



LJ-V Series  
input unit  
**CA-EC80LJ**



CA-HX Series  
input unit  
**CA-EC80HX**



LED light  
control  
expansion unit  
**CA-DC21E**

Dedicated to  
the CV-X100/  
CV-X200 Series



Light control  
expansion unit  
that supports  
LumiTrax™  
**CA-DC30E**

Dedicated to  
the CV-X100/  
CV-X200 Series

Programmable encoder



Dedicated encoder  
**CA-EN100H**



Encoder relay unit  
**CA-EN100U**



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

## Camera cables



L-type connector

Amplifier for extension cables  
**CA-CN10U**  
(for standard-speed cameras)  
**CA-CH10U**  
(for high-speed cameras)

### Camera cables

Cable type	Connector shape	Cable length					
		1 m <b>3.3'</b>	3 m <b>9.8'</b>	5 m <b>16.4'</b>	10 m <b>32.8'</b>	17 m <b>55.8'</b>	Extension cable
Standard-speed camera cable	Straight	<b>CA-CN1</b>	<b>CA-CN3</b>	<b>CA-CN5</b>	<b>CA-CN10</b>	<b>CA-CN17</b>	—
	L-type	—	<b>CA-CN3L</b>	<b>CA-CN5L</b>	<b>CA-CN10L</b>	<b>CA-CN17L</b>	—
Standard high flex robot cable	Straight	—	<b>CA-CN3R</b>	<b>CA-CN5R</b>	<b>CA-CN10R</b>	<b>CA-CN17R</b>	<b>CA-CN7RE</b> (7 m <b>23.0'</b> )
High-speed camera cable	Straight	—	<b>CA-CH3</b>	<b>CA-CH5</b>	<b>CA-CH10</b>	—	—
	L-type	—	<b>CA-CH3L</b>	<b>CA-CH5L</b>	<b>CA-CH10L</b>	—	—
High-speed high flex robot cable	Straight	—	<b>CA-CH3R</b>	<b>CA-CH5R</b>	<b>CA-CH10R</b>	—	—
Extension cables (Must be used with amplifier)							
Standard-speed Extension cable	Straight	—	<b>CA-CN3X</b>	—	<b>CA-CN10X</b>	<b>CA-CN17X</b>	—
Standard high flex robot Extension cable	Straight	—	<b>CA-CN3RX</b>	—	<b>CA-CN10RX</b>	—	—
	Straight for Robot	—	<b>CA-CN3BE</b>	—	—	—	—
High-speed Extension cable	Straight	—	<b>CA-CH3X</b>	—	<b>CA-CH10X</b>	—	—
Standard high flex robot Extension cable	Straight	—	<b>CA-CH3RX</b>	—	<b>CA-CN10RX</b>	—	—
	Straight for Robot	—	<b>CA-CH3BE</b>	—	—	—	—

### List of supported connection of camera cables

Number of pixels of camera the cables can be connected to		Area camera				
		21,000,000 pixels	5,000,000 pixels	2,000,000 pixels	480,000 pixels	310,000 pixels
For high-speed camera	<b>CA-CH10</b>	✓	✓	✓	✓	✓
	<b>CA-CH5</b>	✓	✓	✓	✓	✓
	<b>CA-CH3</b>	✓	✓	✓	✓	✓
For standard camera	<b>CA-CN17</b>	—	—	—	—	✓
	<b>CA-CN10</b>	—	—	✓	—	✓
	<b>CA-CN5</b>	—	—	✓	—	✓
	<b>CA-CN3</b>	—	—	✓	—	✓
Maximum length	<b>CA-CN1</b>	—	—	✓	—	✓
	<b>CA-CN10U x1</b>	20 m <b>65.6'</b>	20 m <b>65.6'</b>	20 m <b>65.6'</b>	20 m <b>65.6'</b>	34 m <b>111.6'</b>
	<b>CA-CN10U x2</b>			30 m <b>98.4'</b>		51 m <b>167.3'</b>
	<b>CA-CH10U x1</b>	20 m <b>65.6'</b>	20 m <b>65.6'</b>	20 m* <b>65.6'</b>	20 m <b>65.6'</b>	20 m <b>65.6'</b>
	<b>CA-CH10U x2</b>	30 m <b>98.4'</b>	30 m <b>98.4'</b>	30 m <b>98.4'</b>	30 m <b>98.4'</b>	30 m <b>98.4'</b>

\* When connecting a CA-HX200 with the CV-X100 Series, up to 15 m **49.2'** is supported.

## Communication cable



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



Communication cable conversion connector  
For 9-pin **OP-26486**  
For 25-pin **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-232C communication cable  
**OP-26487** (2.5 m **8.2'**)



Ethernet cable  
**OP-66843** (3 m **9.8'**)



Ethernet cable for the LJ-V  
**OP-87736** (2 m **6.6'**)



USB cable  
**OP-66844** (2 m **6.6'**)

## Monitor/touch panel



12-inch multi-touch supporting touch panel  
**CA-MP120T**

XGA monitor  
**CA-MP120**



CA-MP120(T) monitor stand  
**OP-87262**

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

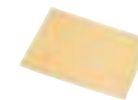
\* To use the CA-MP120T, RGB monitor cable and touch panel RS-232C cable are required.

Optional accessories for CA-MP120T  
For CV-X400/X200:  
**OP-87264** (3 m **9.8'** touch panel modular RS-232C cable)  
**OP-87265** (10 m **32.8'** touch panel modular RS-232C cable)

For CV-X200:  
**OP-87258** (3 m **9.8'** touch panel RS-232C cable)  
**OP-87259** (10 m **32.8'** touch panel RS-232C cable)



CA-MP120(T) Pole-mounting bracket  
**OP-42279**



CA-MP120(T) Protection seal  
**OP-87263**

## SD card



SD card (industrial-grade)  
16 GB **CA-SD16G**  
4 GB **CA-SD4G**  
1 GB **CA-SD1G**

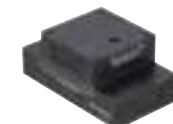
## Other



Dedicated 24 VDC power source  
**CA-U4** (6.5 Amps)  
**CA-U5** (12.5 Amps)



Mouse stand  
**OP-87601**



Camera mounting stage  
**CA-S2040**

Fan unit for the CV-X400 Series **CA-F100**

PDF manuals are available for download on visionsystem.com. Contact KEYENCE if a hard copy of the CV-X Series Setup Manual or User Manual is required (not included with the controller)



# ONE STOP INSPECTION SOLUTION PROVIDER



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TO CONTACT YOUR LOCAL OFFICE  
**1-888-KEYENCE**  
1-888-539-3623

[www.keyence.com](http://www.keyence.com)



**SAFETY INFORMATION**  
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