

## POWER MEETS SIMPLICITY

CV-X Series Ver. 4.0



### New Controller CV-X400 Series

Advanced parallel processing with the largest number of cores in the industry  
Stable high-speed processing

### LumiTrax™

Integration of camera, lighting, and inspection algorithm

## DIGEST VERSION

CV-X Series

# THE EVOLUTION OF KEYENCE MACHINE VISION SYSTEMS

KEYENCE has been an innovative leader in the machine vision field for more than 30 years. Its high speed and high performance machine vision systems have been continuously improved upon and now allows even greater usability and stability when solving today's most difficult applications.

In 2008, the XG-7000 Series was released as a "high-performance image processing system that solves every challenge", followed by the CV-X100 Series as an "image processing sensor with the ultimate usability" in 2012.

And in 2013, an "inline 3D inspection image processing system" was added to our lineup. In this way, KEYENCE has continued to develop next-generation image processing systems based on our accumulated state-of-the-art technologies.

KEYENCE is committed to introducing new cutting-edge products that go beyond the expectations of its customers.

THE FIRST IMAGE  
PROCESSING SENSOR

VX Series



CV-100/300 Series



CV-500/700 Series

XV-1000 Series



CV-2000 Series



CV-3000 Series



CV-5000 Series

## FIRST PHASE 1980s to 2002

Started development of image processors in preparation for releasing a general-purpose image processing sensor. The CV-100 Series was released as the industry's first low-cost image processing sensor. This was a first for image processors, which had been expensive and difficult to handle.

Released the CV-300 Series using a colour camera, followed by the CV-500/700 Series compact image processing sensors with integrated monitors. KEYENCE had expanded the image processing sensor market and gradually established our position in the market.

## SECOND PHASE 2003 to 2007

Released the CV-2000 Series compatible with x2 speed digital cameras and added first-in-class 2M pixel CCD cameras to our lineup.

Released the CV-3000 Series that can simultaneously accept up to four cameras of eight different types, including monochrome and colour. Released the CV-5000 Series that features a 5M pixel camera, highest in its class, and multiple new algorithms.

## Performance

Highest problem solving capability satisfying every need.

### XG-X/XG Series



## Usability

Stable and long-term operation readily available for anybody.

### CV-X Series



## Cost

Presence detection at a reasonable cost.

### IV Series



Various lenses and lighting systems are also available

## THIRD PHASE *2008 and beyond*

Released the XG-7000 Series that features faster performance through distributed processing, a wide variety of flexible inspection tools, and a user-customisable interface. This Series has become the standard system that solves every challenge.

Released the global standard CV-X100 Series that supports 13 languages and achieves both best problem solving performance and intuitive usability for anyone. Released the IV Series vision sensor which enables easy image discrimination.

KEYENCE started supporting connection of LumiTrax compatible cameras, 21M pixel cameras, line scan cameras, 3D cameras, and laser profile measurement systems. Inline height measurement and other various inspections have been enabled by the XG-8000/CV-X200 Series.

## THREE FEATURES TO SUPPORT THE GLOBAL STANDARD

- **State-of-the-art algorithms that can be used by anyone.**
- **Quick setup and long-term operation are ensured.**
- **The best match can be selected from a wide variety of products.**

For long-term, stable image processing, not only “high inspection performance” is necessary, but it is also extremely important that “anyone” can perform “initial settings,” “operation,” and “maintenance.”

On the basis of KEYENCE’s expertise that we have accumulated over the years, we have designed the CV-X Series such that these important factors are “functions” that can be handled by anyone.

Version 3.0 offers even higher problem solving performance with the addition of 21M pixel cameras.

Version 3.1 offers the LumiTrax™ function, which integrates the camera, lighting, and inspection. This makes it possible to create the optimal inspection conditions at high speed. Meanwhile, Version 4.0 includes the industry’s highest-performance controller as well as the latest search functions, allowing for the highest chance of image processing. In order to provide a wide variety of choices suited for every challenge and to ensure stable operation at every production site, the CV-X Series will continue to evolve.



## High-Speed, High-Capacity Machine Vision System

# CV-X Series **Ver. 4.0**



EtherNet/IP™



## AVAILABLE HARDWARE AND SOFTWARE → P. 6

Eight types of controllers available depending on processing speed and capacity

**NEW**

MULTI-CORE DSP-INTEGRATED  
CV-X400 Series



22 types of cameras available depending on inspection category

ULTRA HIGH-RESOLUTION  
21M PIXEL CAMERA

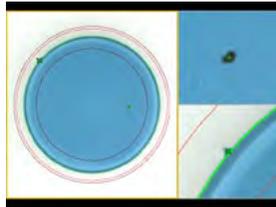
**16x** 21MEGA  
DIGITAL



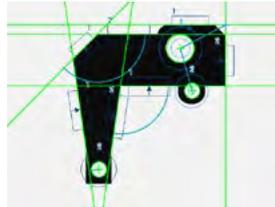
## ALGORITHMS THAT ADDRESS EVERY INSPECTION REQUIREMENT → P. 10



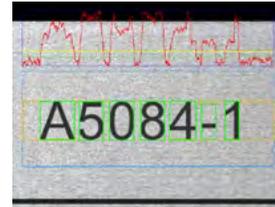
LumiTrax™



Appearance inspection



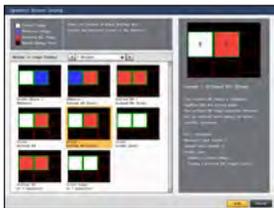
Dimension inspection



Character recognition

Multiple algorithms are provided to address various inspection requirements such as appearance inspection, dimension measurement, and character recognition. KEYENCE's latest algorithms, which have continued to evolve based on our experience, support stable inspection on site.

## HIGH USABILITY THAT ENSURES LONG-TERM OPERATION → P. 22



Operation screen catalogue

Users can easily create operation screens with high visibility and custom menus that only show items to be adjusted frequently. This allows anyone to set up ready-to-use conditions.



Camera installation replication



User manual auto-generator

Various utilities are provided to help long-term stable image processing, including functions for preserving capture conditions, protecting program assets, and creating operation manuals automatically.

# 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, separate devices with different operability for each inspection category.



**ALL MODELS ARE HDD-LESS**

| CV-X100 Series   |                      |                 |                 | CV-X400 Series <span style="color: red;">NEW</span>   |         |         |         |
|--|----------------------|-----------------|-----------------|---|---------|---------|---------|
|  |                      |                 |                 |   |         |         |         |
| Standard model   |                      |                 |                 | High-speed model for area cameras   |         |         |         |
| Model  | CV-X100              | CV-X150         | CV-X170         | CV-X400   | CV-X420 | CV-X450 | CV-X470 |
| Main image processor   | DSP                  |                 |                 | 3-core DSP  |         |         |         |
| Max. no. of connectable cameras  | 2                    | 4               | 4               | 2   | 4       | 4       | 4       |
| Supported cameras  | 0.31M to 0.47M pixel | ✓               | ✓               | ✓   | ✓       | ✓       | ✓       |
|  | 2M pixel             | —               | ✓               | ✓   | ✓       | ✓       | ✓       |
|  | 5M pixel             | —               | —               | ✓   | —       | ✓       | ✓       |
|  | 21M pixel            | —               | —               | —   | —       | —       | ✓       |
|  | CA-HX048C/M          | ✓ <sup>*1</sup> | ✓ <sup>*1</sup> | ✓ <sup>*1</sup>   | ✓       | ✓       | ✓       |
|  | CA-HX200C/M          | —               | ✓ <sup>*1</sup> | ✓ <sup>*1</sup>   | —       | ✓       | ✓       |
|  | CA-HX500C/M          | —               | —               | ✓ <sup>*1</sup>   | —       | —       | ✓       |

\*1 The LumiTrax function is not supported.

|               | 21M pixel camera  |  | 5M pixel camera  |  | 2M pixel camera   |  |  |   |   |   |
|---------------|---|--|--|--|---|--|--|---|---|---|
|               |  |  | <br>LumiTrax compatible |  |  |  | <br>LumiTrax compatible |  |  |  |
| Model         | CA-H2100M/CA-H2100C   |  | CA-HX500M/CA-HX500C  |  | CV-H500M/CV-H500C   |  | CA-HX200M/CA-HX200C  | CV-H200M/CV-H200C   | CV-200M/CV-200C   | CV-S200M/CV-S200C   |
| Specs         | ×16 speed monochrome<br>×16 speed colour  |  | ×16 speed monochrome<br>×16 speed colour   |  | ×11 speed monochrome<br>×11 speed colour  |  | ×16 speed monochrome<br>×16 speed colour   | ×7 speed monochrome<br>×7 speed colour  | Monochrome<br>Colour  | Compact monochrome<br>Compact colour  |
| Capture range | 5104 × 4092 pixels  |  | 2432 × 2040 pixels   |  | 2432 × 2050 pixels  |  | 1600 × 1200 pixels   | 1600 × 1200 pixels  | 1600 × 1200 pixels  | 1600 × 1200 pixels  |
| Transfer time | 109.9 ms  |  | 27.6 ms <sup>*1</sup> / 29.0 ms <sup>*1</sup><br>50.3 ms <sup>*2</sup> / 52.4 ms <sup>*2</sup>           |  | 61.2 ms   |  | 11.6 ms <sup>*1</sup> / 11.6 ms <sup>*1</sup><br>20.1 ms <sup>*2</sup> / 20.2 ms <sup>*2</sup>             | 29.2 ms   | 58.5 ms   | 58.5 ms   |

|               | 0.31M to 0.47M pixel camera  |  |   |  |   |   |                                      |
|---------------|--|--|---|--|---|---|--------------------------------------|
|               | <br>LumiTrax compatible |  |  |  |  |  |                                      |
| Model         | CA-HX048M  |  | CA-HX048C   |  | CV-H035M/CV-H035C   | CV-035M/CV-035C   | CV-S035M/CV-S035C                    |
| Specs         | ×16 speed monochrome   |  | ×16 speed colour  |  | ×7 speed monochrome<br>×7 speed colour  | Monochrome<br>Colour  | Compact monochrome<br>Compact colour |
| Capture range | 784 × 596 pixels   | 512 × 480 pixels                             | 784 × 596 pixels  | 512 × 480 pixels                             | 640 × 480 pixels  | 640 × 480 pixels  | 640 × 480 pixels                     |
| Transfer time | 2.9 ms <sup>*1</sup><br>5.2 ms <sup>*2</sup>   | 1.7 ms <sup>*1</sup><br>2.8 ms <sup>*2</sup> | 2.9 ms <sup>*1</sup><br>5.3 ms <sup>*2</sup>                                      | 1.7 ms <sup>*1</sup><br>2.9 ms <sup>*2</sup> | 4.7 ms  | 16.0 ms   | 16.0 ms                              |

\*1 When using the CV-X400 Series, or the CV-X200 Series with CA-EC80HX/EC80L

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

## CAMERAS SELECTABLE DEPENDING ON INSPECTION CATEGORY

A total of 22 types of area cameras selectable according to production line speed, installation space, and inspection target.

An ultra high-resolution 21M pixel camera has been newly added to our conventional lineup offering optimal pixel count, size, and transfer time for each inspection item. With these much expanded choices, all on-site challenges have a solution.



# SOFTWARE FOR DIFFERENT TYPES OF APPLICATIONS

Select the ideal software for your application and budget.

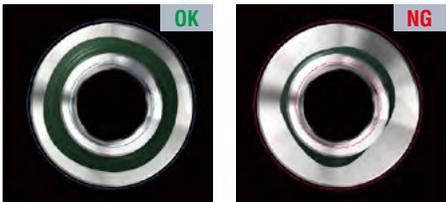
We offer six software packages to meet your requirements for image sensor applications and budget.

A single user interface is used to configure the settings for appearance inspection, dimension measurement, character recognition and other inspections. It's now easier than ever to perform operations for a wide variety of inspection applications.

### LIMITED FUNCTION/ENTRY TYPE

#### LOW-COST MODEL (E TYPE)

|                                    |
|------------------------------------|
| Presence/discrimination inspection |
| Position detection                 |
| Intensity inspection               |



AVAILABLE TOOLS

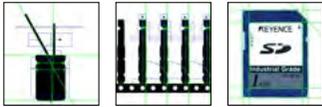
|                         |                |                 |                         |               |
|-------------------------|----------------|-----------------|-------------------------|---------------|
| Presence/Discrimination | Position/Angle | Graphic Display | Mathematical Operations | Function List |
|-------------------------|----------------|-----------------|-------------------------|---------------|

### DEDICATED APPLICATION TYPE

#### DIMENSION INSPECTION MODEL (M TYPE)

|                      |
|----------------------|
| Position detection   |
| Dimension inspection |

Even the following complex object shapes can be measured quite easily.



Dimensions and angles    Pitch and distance    Displacement

AVAILABLE TOOLS

|                     |                 |                         |           |
|---------------------|-----------------|-------------------------|-----------|
| Dimensions/Geometry | Graphic Display | Mathematical Operations | Connector |
|---------------------|-----------------|-------------------------|-----------|

#### RECOGNITION INSPECTION MODEL (R TYPE)

|   |
|---|
| Presence/discrimination inspection        |
| Position detection                        |
| Recognition inspection (OCR, 1D/2D codes) |

This one device is all you need to perform recognition inspections.



OCR    1D code    2D code

AVAILABLE TOOLS

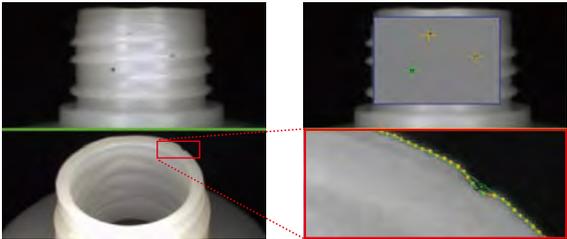
|                         |                |                |                 |
|-------------------------|----------------|----------------|-----------------|
| Presence/Discrimination | Position/Angle | Identification | Graphic Display |
| Mathematical Operations | Function List  |                |                 |

### STANDARD TYPE

#### STANDARD MODEL (A/F TYPE)

|   |                       |
|---|-----------------------|
| Presence/discrimination inspection        | Dimension inspection  |
| Recognition inspection (OCR, 1D/2D codes) | Positioning           |
| Appearance inspection                     | Auto-Teach inspection |

The industry standard for appearance inspections



Equipped with industry-standard tools for appearance inspections, including stain mode and trend edge stain mode. This model is the new industry standard.

AVAILABLE TOOLS

|                         |                         |                |       |                |                     |           |
|-------------------------|-------------------------|----------------|-------|----------------|---------------------|-----------|
| Presence/Discrimination | Stain/Flex              | Position/Angle | Count | Identification | Dimensions/Geometry | Connector |
| Graphic Display         | Mathematical Operations | Function List  |       |                |                     |           |

ONLY AVAILABLE ON THE F TYPE

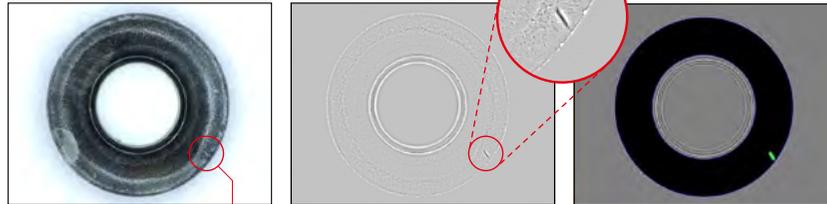
## FLAGSHIP TYPE

### HIGH-SPEED, HIGH-CAPACITY MODEL (A/F TYPE)

|  |                       |
|--|-----------------------|
| Presence/<br>discrimination inspection       | Dimension inspection  |
| Recognition inspection<br>(OCR, 1D/2D codes) | Positioning           |
| Appearance inspection                        | Auto-Teach inspection |

### Equipped with our new "LumiTrax™" algorithm

#### Appearance inspections of metal workpieces



Current image

Stain location

Image with LumiTrax

Image after processing

### Equipped with our new "LumiTrax™" algorithm

This algorithm overcomes glare, printing, pattern backgrounds, and varying surface conditions. This innovative capturing method detects only the targeted items.

#### AVAILABLE TOOLS



#### ONLY AVAILABLE ON THE F TYPE



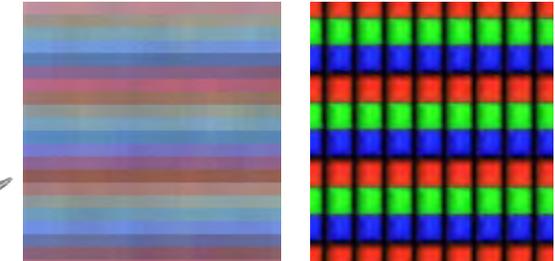
## HIGH-END TYPE

### HIGH-PERFORMANCE MODEL (A/F TYPE)

#### High-resolution 21M pixel camera



#### Accurate detections of microscopic stains

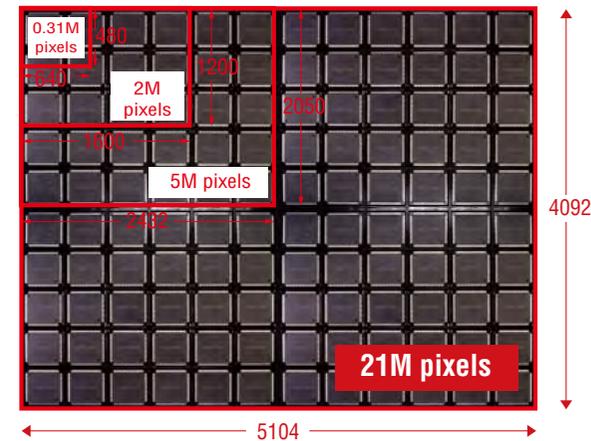


0.31M pixels

21M pixels

Inspections that were difficult with conventional cameras can now be done clearly and cover the smallest detail. This enables highly accurate determinations.

#### Wider field of view captures the target



Inspections conventionally performed by moving the camera or with multiple cameras can now be performed with a single stationary camera.

#### AVAILABLE TOOLS



#### ONLY AVAILABLE ON THE F TYPE



# LumiTrax™

## Integration of camera, lighting, and inspection algorithm

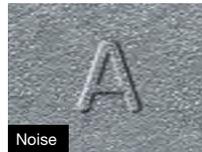
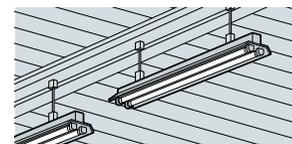
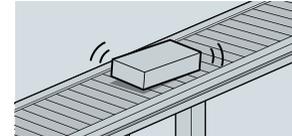
LumiTrax uses our newly developed ultra high-speed camera and ultra high-speed segmented lighting to capture the target workpiece. This is an absolutely new imaging method in which multiple images that were taken with lights lit from different directions are analysed in order to generate shape (irregularities) and texture (pattern) images. This makes it possible to eliminate the workpiece variations and influence of the environment that prevent stable inspections, which enables anyone to easily perform imaging—a task that conventionally required large amounts of time and experience.



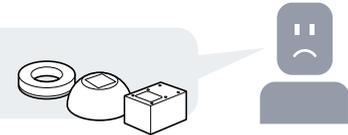
The newly developed LumiTrax™ system eliminates problems

- CA-HX Series**  
Equipped with ultra high-speed imaging CMOS sensor and dedicated control IC
- +**
- CA-DRWxX Series**  
Equipped with ultra high-intensity LED and circuit for separate lighting control
- +**
- CV-X400 Series**  
Analyses multiple images instantaneously to create shape and texture images

### CONVENTIONAL IMAGING PROBLEMS

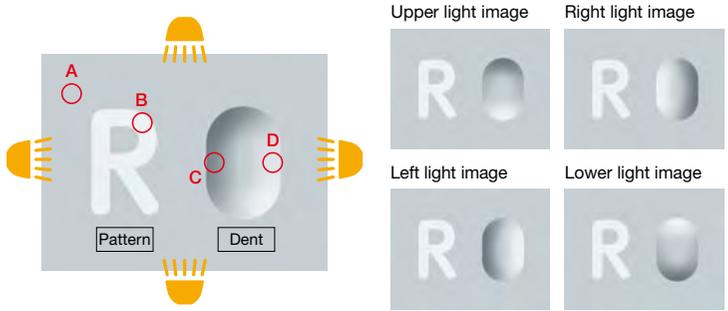
- Various surface conditions
  -  Same Colour
  -  Noise
  -  Pattern
  -  Gloss
- Influence of the surrounding environment (ambient light)
  - 
- Workpiece orientation changes caused by transfer conditions
  - 

Trial and error must be performed to select the optimum light.

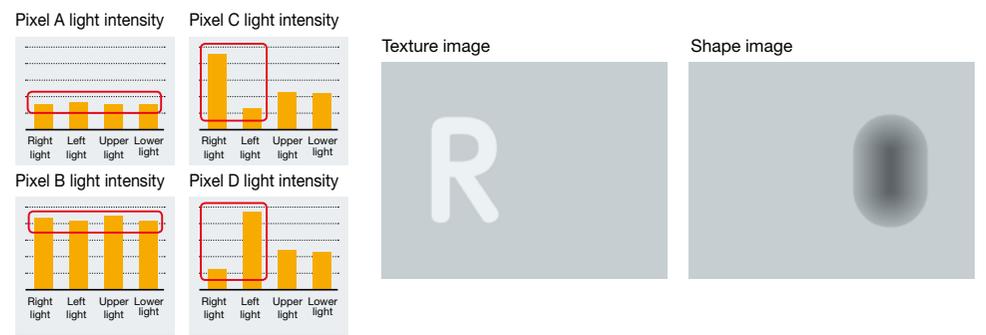


### LumiTrax processing

1. Lights are lit from different directions and imaging is performed at ultra high speed.



2. The changes in light intensity of each pixel among the different images are analysed to split the shapes (irregularities) and textures (pattern) into separate images.



# LumiTrax™ TUNING NEW

Setting up LumiTrax™ has never been easier. Simply follow the navigation and intuitively select one of the many displayed images. This makes it possible for anyone to easily create an optimal image.

**BEFORE**



**AFTER**

Optimised set-up is complete!

**STEP 1** Select inspection target



First, select the target for the inspection.

**STEP 2** Select the most appropriate feature size



Simply choose the best image out of multiple options. No parameter setting required.

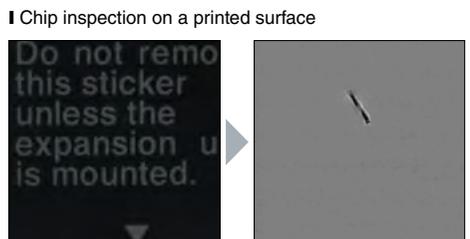
**STEP 3** Select the optimal contrast



**Application examples (1)** Extracting only the shape (irregularities) information regardless of the surface conditions

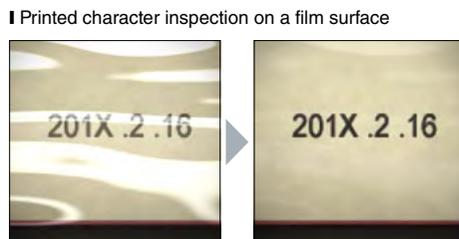


From a random casting surface, the carved seals with greater concave-convex information are emphasised.

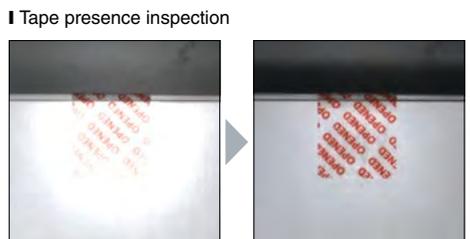


Images in which only the chips are extracted are created without being affected by the complex printed background.

**Application examples (2)** Suppressing glare and ambient light to extract only textures (pattern)



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



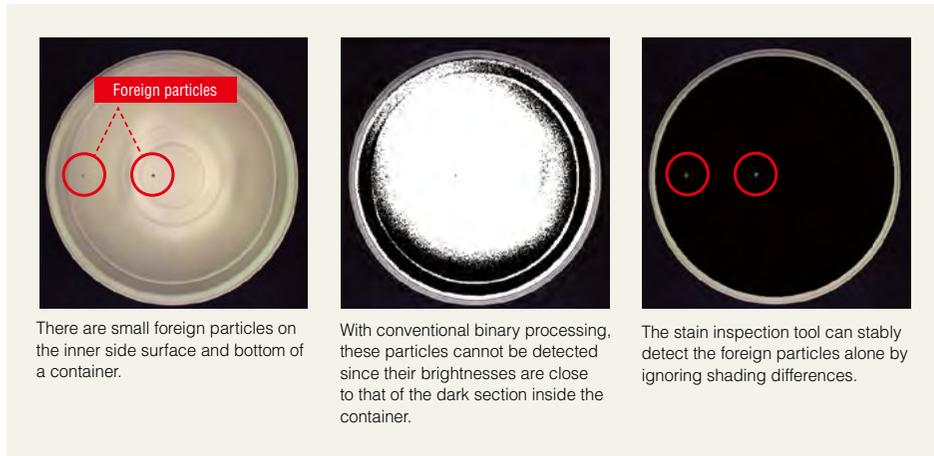
Even when unexpected specular reflection occurs due to workpieces being tilted, the glare can be cancelled, which makes it possible to perform stable inspections.

# APPEARANCE/DISCRIMINATION INSPECTION

## STAIN

De-facto standard appearance inspection tool that “visualises” inspection stability

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

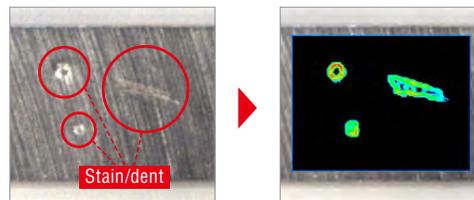


### Contrast image

This function displays defects by colouring them depending on the density 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 setting but also during operation, this can be utilised effectively in various scenarios, such as investigating the cause of a wrong detection.

### Stain detection for a metal plate



Displays sections having density differences in blue to red. In addition, it is clearly identifiable that stains to detect differ from the background.

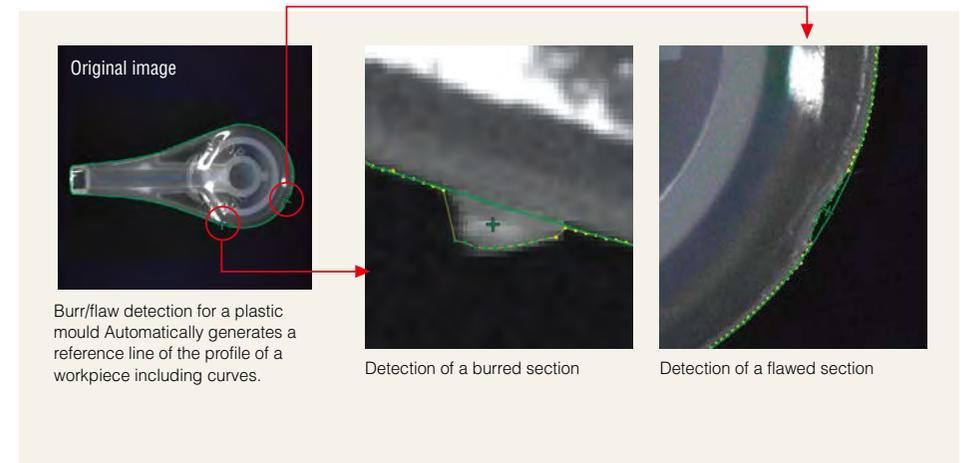
### Relationship between contrast image colours and stain levels



## TREND EDGE STAIN

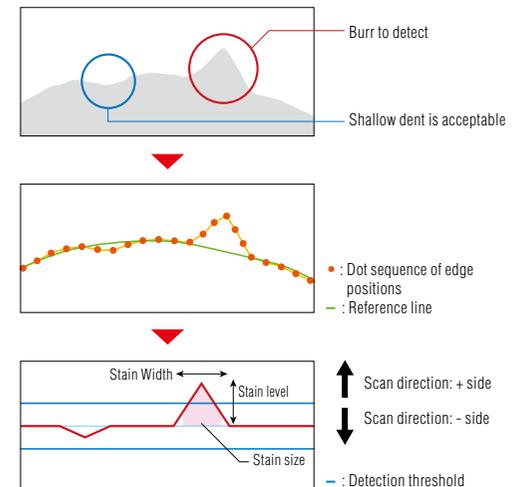
Edge defect inspection tool optimised for burr and flaw inspection

This tool extracts a profile from the edges of a workpiece and recognises the sections that show a large difference from the profile 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, you can distinguish defects you want to detect from the others. Settings can be optimised according to inspection category, such as +/- from the reference line (burrs/flaws) and width/size that exceeds a threshold.



# AUTO-TEACH INSPECTION TOOL Colour

An inspection tool that “auto-teaches”;  
Just running non-defective workpieces completes the application setup

The newly incorporated “Auto-Teach Inspection Tool” uses the image sensor to learn variations and individual differences that exist in the non-defective workpieces and recognises workpieces that differ from these as defective workpieces. These algorithms, which are unlimitedly close to the human sensation, eliminate unstable elements to successfully guide on-site inspection. Settings are performed just by running non-defective workpieces, and resolves the conventional need for high expertise and the complication of settings. This is an inspection tool that makes it possible for anyone to achieve and maintain the stable inspection.



Just run non-defective workpieces



**SETTING COMPLETED!**

Non-defectives learnt!

NEW INVENTION!

“THOSE DIFFERENT FROM LEARNT NON-DEFECTIVES” ARE DETECTED AS “DEFECTIVES”.



○ Non-defective



✗ Different type

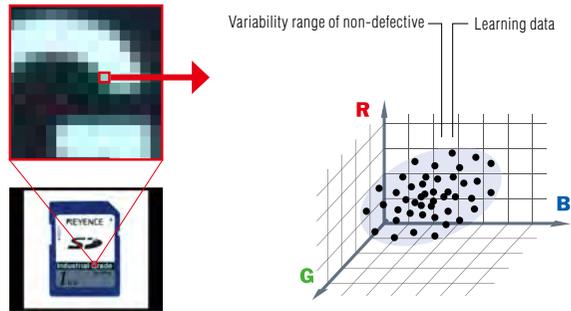


✗ Incomplete printing



✗ Flaw

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



LEARNING FULL COLOUR INFORMATION

The variability range of the non-defective workpieces is determined by learning all full colour information by pixel. What cannot be determined if the image were only in black and white, such as colour irregularities of non-defective workpieces, are also correctly learnt.

HELPFUL IN REALISING EASY OPERATION

CUT INCORRECT LEARNING FUNCTION

Defective workpieces are automatically excluded even if they are mixed-in during auto-teach. The image sensor eliminates human errors during auto-teach.

SET AUTO THRESHOLD FUNCTION

Automatically calculates and sets threshold values from the learned non-defective workpieces.

## IDEAL FOR THE FOLLOWING APPLICATIONS

### 1 Setting is often required due to multiple product types

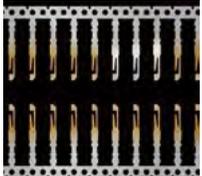
Misarrangement inspection for boxes of tissues



Setting is completed just by running non-defective workpieces. A wide variety of product type elements, including colour, 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 with many points to inspect and generally requiring a long time for setting can be covered by the “Auto-Teach Inspection Tool” alone.

### 3 Complex shaped parts to inspect

Flaw inspection for connector housings



Since this tool learns the entire workpiece including the profile, you do not have to set multiple regions according to complex shapes of workpieces.

### 4 Variable non-defectives

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 for non-defective workpieces. This prevents non-defective workpieces from being rejected mistakenly.

# IMAGE ENHANCE FILTERS

24 types of image enhancement filters are provided to significantly compensate for changes in inspection conditions caused by workpiece conditions and external environments. KEYENCE's original algorithms generate optimal images for inspection to improve stability and reduce scrapping of non-defective workpieces 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.

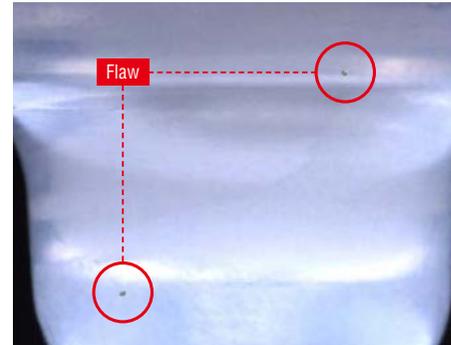


Only linear stains are extracted by ignoring background noise.

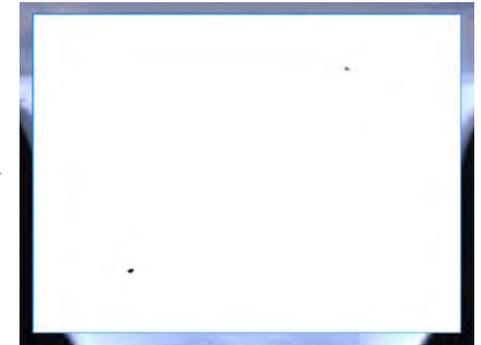
## ■ SHADING CORRECTION

Cancels shading or uneven brightness occurring on the workpiece surface to optimise 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 MOULD



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

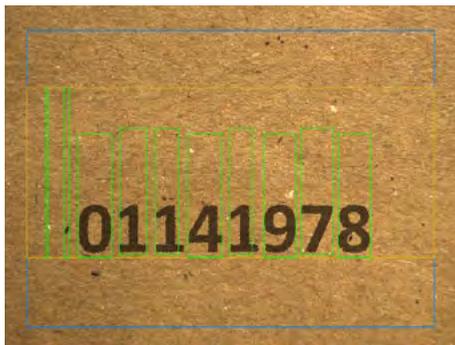


Only stains are extracted by cancelling random shading in real time.

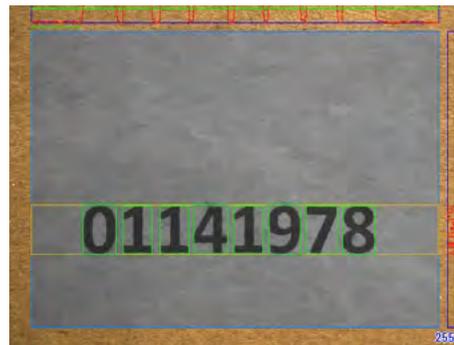
## ■ NOISE ISOLATION

Eliminates or, in contrast, extracts noise having a specified area or smaller. This filter is effective when a rough background hinders image processing or to detect subtle stains.

RECOGNITION OF CHARACTERS PRINTED ON CARDBOARD



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



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

STAIN INSPECTION FOR A PLASTIC MOULD



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



Only black stains of the specified area or smaller are extracted.

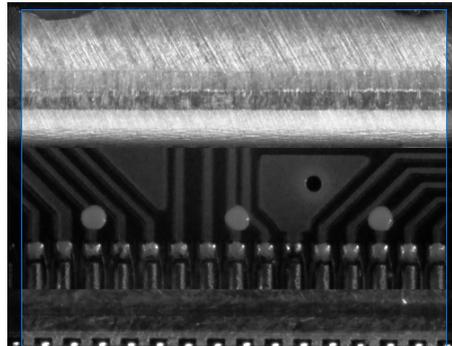
## CONTRAST EXPANSION

Expands the density distribution within the inspection region to increase the contrast of an image. This filter stabilises 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 recognise the circuit board pattern.

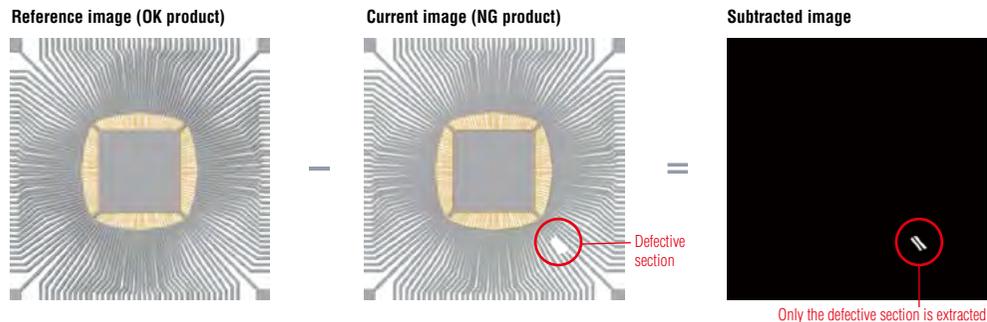


The circuit board pattern can be recognised clearly. Because the filter determines the expansion width from the density distribution within the inspection region, images without overexposure and underexposure can be captured.

## SUBTRACTION

Compares the target with a preregistered master quality 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 recognised as defective.

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

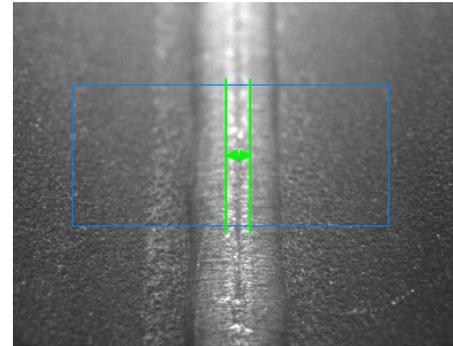


Only defective sections are extracted even for targets having complex shapes such as lead frames.

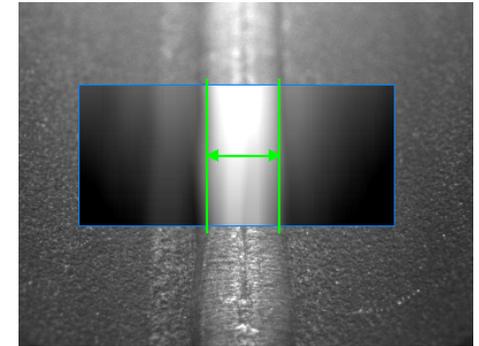
## BLUR

Blurs the inspection region to remove a significant amount of fine background patterns or noise. This filter offers a more stable inspection by intentionally blurring images to eliminate featured points that doesn't need to 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.

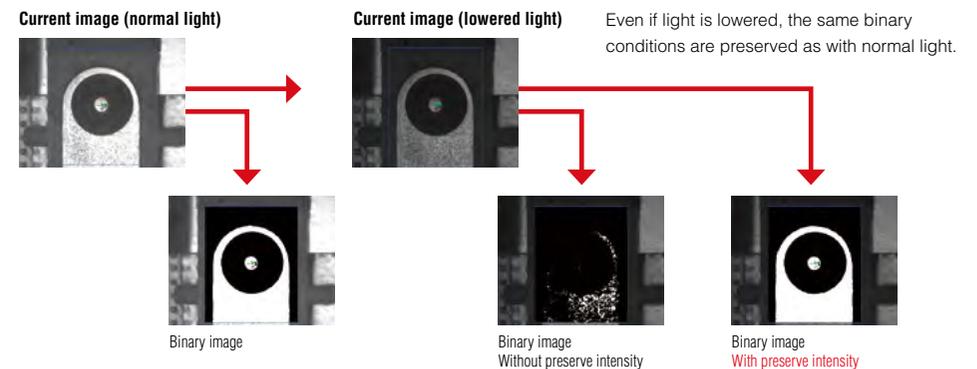


The blur filter allows a stable width measurement by eliminating unnecessary featured points other than the welded section.

## 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



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

# POSITION/DIMENSION MEASUREMENT

## ShapeTrax™ 3 NEW

Search tool with ultimate performance, speed, and accuracy under poor conditions

This tool uses profile information extracted from the target during search. The target can be searched stably even if changes occur such as chips, contrast reduction and size changes. This tool offers high search performance also as a position adjustment reference for other tools.

**HIGH ROBUSTNESS**  
Enables accurate search even if capture conditions change from those of the registered image.

Registered image      Defect      Unclear profile      Inverted tones

**Newly developed automatic feature extraction algorithm NEW**

The set-up to extract the profile of workpieces that conventionally required experience can now be optimised automatically, allowing a simple, easy-to-use menu. Anyone can make use of the maximum potential of ShapeTrax3 for any workpiece.

### CONVENTIONAL

In case of noisy marks, the user needed to understand complicated parameters to extract the appropriate profiles.



### ShapeTrax™ 3

ShapeTrax3 automatically analyses noise in images and appropriately extracts profiles as humans visualise them. Anyone can create settings to take advantage of search and use its full performance potential.



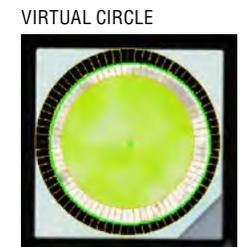
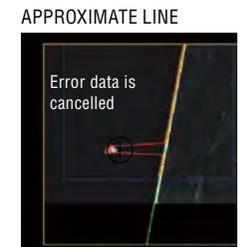
## TREND EDGE POSITION/WIDTH

Measures up to 5000 points within one region

This tool detects up to 5000 edges within the inspection region and outputs their positions and widths. In addition to all edge data, maximum/minimum/average widths, tip position, and peak-to-peak width can be measured without complicated calculations. It is also possible to extract the best fit circle or line from the information of the detected multiple points.

**Dimension measurement for a bolt**

- Capable of measuring the maximum diameter of a bolt or the core diameter of a screw thread.
- Displays edges detected for each segment and outputs the results separately.
- Detects the maximum diameter.
- Edge intensity graphs can be checked for each segment, enabling proper setting.



**PRINCIPLE OF DETECTION:**

A segment of a specified width moves within the inspection region at a specified pitch in an overlapping pattern to detect edges at each position. Since the segment shift can be specified in 1/100 pixel units, all edges can be detected completely within the region.

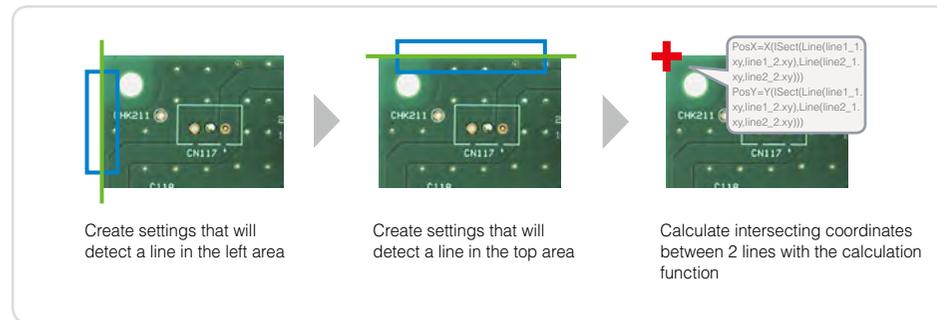
# DIMENSIONS/GEOMETRY TOOL

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 done with clicking alone. Points and straight line information from other tools can also be referenced, it is therefore possible to construct program settings that are simpler and easier to operate.

## CONVENTIONAL

Combination of multiple settings and calculations are required

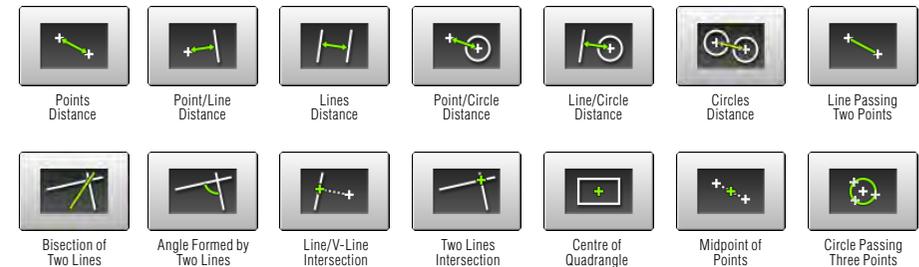


## DIMENSIONS/GEOMETRY TOOL

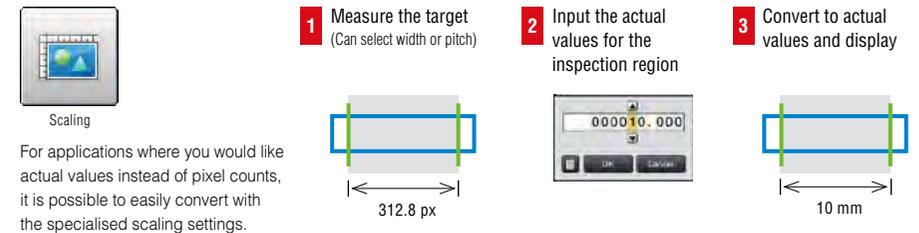
Settings completed by simply using the mouse



### A rich variety of geometry tools that allow you to “just choose”

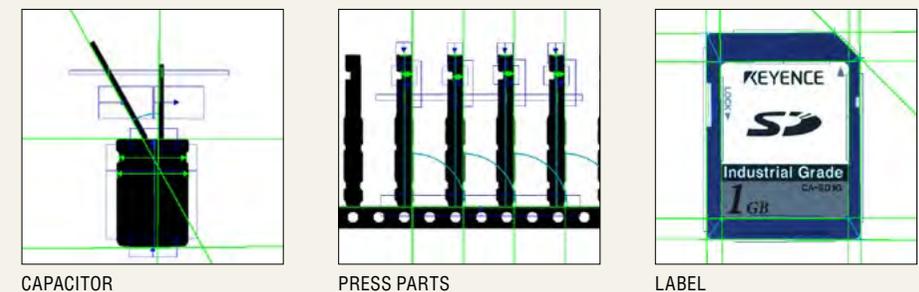


### Easy scaling with any image size



### APPLICATION

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



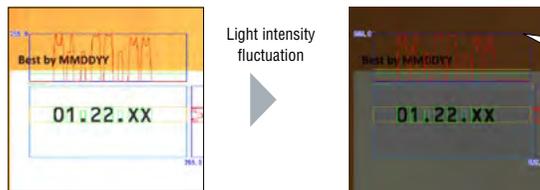
# IDENTIFICATION INSPECTION

## OCR

Stable and reliable character recognition tool that visualises extracted conditions and stability

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

### Light intensity fluctuation-resistant



Light intensity fluctuation

### VISUALISATION WITH WAVEFORMS



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

With grey-scale processing that does not use binary processing, stable inspection is ensured even if ambient light changes. In addition, the character extraction method is used so that the user can understand recognition conditions easily.

### Stability visible with numeric values

| Result List       |    |    |    |    |    |    |    |    |    |    |
|-------------------|----|----|----|----|----|----|----|----|----|----|
| Candidate 1       | 0  | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  |
| Correlation       | 99 | 99 | 99 | 99 | 99 | 99 | 99 | 99 | 99 | 99 |
| Candidate 2       | 8  | 2  | 1  | 9  | 1  | 3  | 8  | 2  | 3  | 8  |
| Correlation       | 80 | 28 | 44 | 51 | 38 | 42 | 51 | 40 | 54 | 51 |
| Stability         | 49 | 61 | 55 | 46 | 61 | 67 | 48 | 50 | 45 | 48 |
| Density Deviation | 94 | 94 | 94 | 94 | 93 | 93 | 92 | 92 | 94 |    |

"Correlation" that shows matching with a registered character and "Stability" that shows judgement margin for a similar character can be checked for each character.

### Flexible user library



Actual printed characters are registered with the library as they are. 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 READING

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 reductions compared with conventional cases where 1D/2D code readers and image processors are installed separately.

Also, the reading of PDF417, MicroPDF417, and Composite Code (CC-A, CC-B, CC-C) codes is now supported.

### Supports a variety of codes

#### 1D CODE



Simultaneous reading of barcodes and characters

#### 2D CODES



DataMatrix



QR code



Composite 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 performing reading at the same time.

Supported standards

1D: ISO/IEC 15416

2D: ISO/IEC 15415, AIM DPM-1-2006,

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.



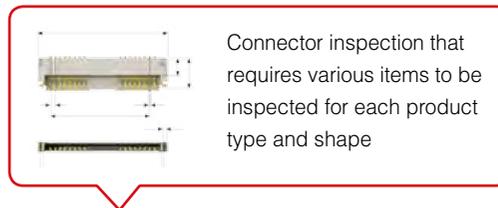
Detects defects in 1D code printing to judge the code as NG.

## CONNECTOR TOOLS

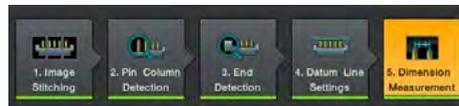
Complex connector inspection settings can be completed by simply following steps

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

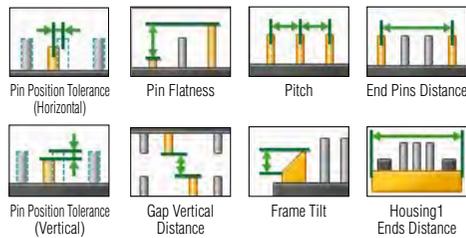
**Our step method enables ANYBODY to carry out connector inspection EASILY**



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

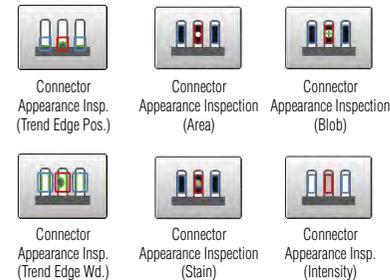


**SETTING COMPLETED!**



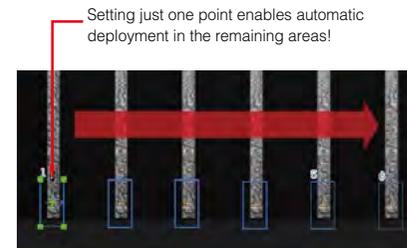
### INSPECTION TOOLS THAT FULLY SUPPORT APPEARANCE INSPECTION

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.



### 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.



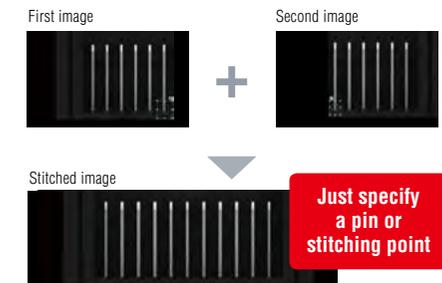
### CONNECTOR ADJUSTMENT MENU



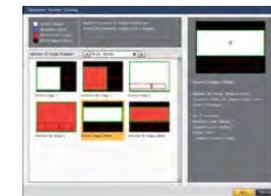
Purpose-specific, guided navigation is available, including "Change Component" and "Change Pin Number". This allows anyone to make necessary modification.

### IMAGE STITCHING FUNCTION

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



### CONNECTOR-DEDICATED OPERATION SCREEN



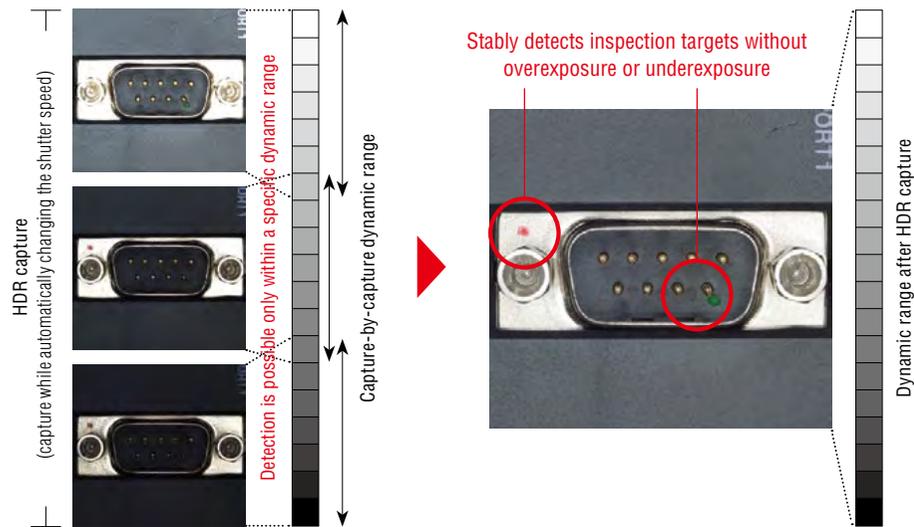
The operation screen most suitable for the connector inspection can be created just by selecting from the catalogue.

# CAPTURE (IMAGING)

## HDR

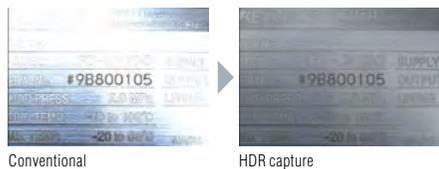
High dynamic range captures inspection targets as they are

Captures multiple images while automatically changing the shutter speed and composes 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.



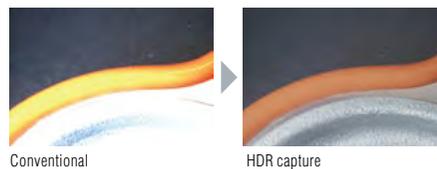
### Glare removal

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



### Lighting variation removal

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



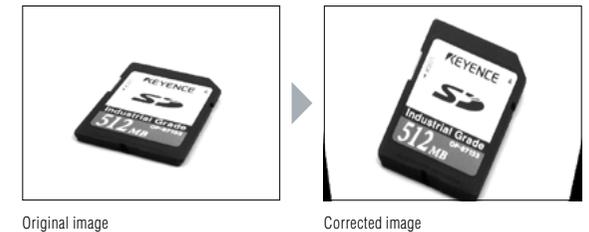
## CALIBRATION

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.

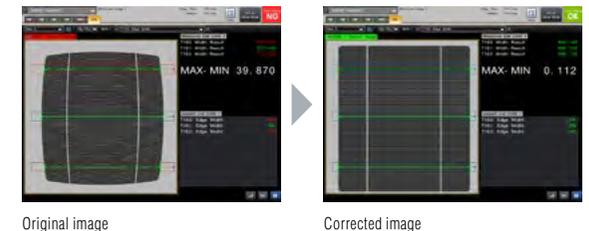
### Corrects “tilting”

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.



### Corrects “lens distortion”

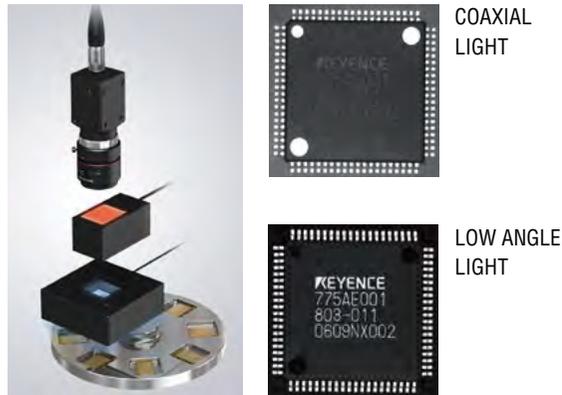
Addresses a problem where measurement results differ between image centre and edge due to lens distortion.



# MULTI-CAPTURE

## Optimises one inspection cycle

Multiple images are captured in one inspection cycle. A workpiece is captured while lighting and tools are switched while result output can still be done all together.



Lighting is switched optimally according to items to inspect, 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.

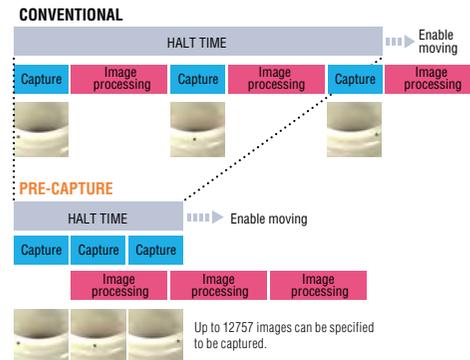
### MULTI-CAPTURE

Images using 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 synchronisation 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

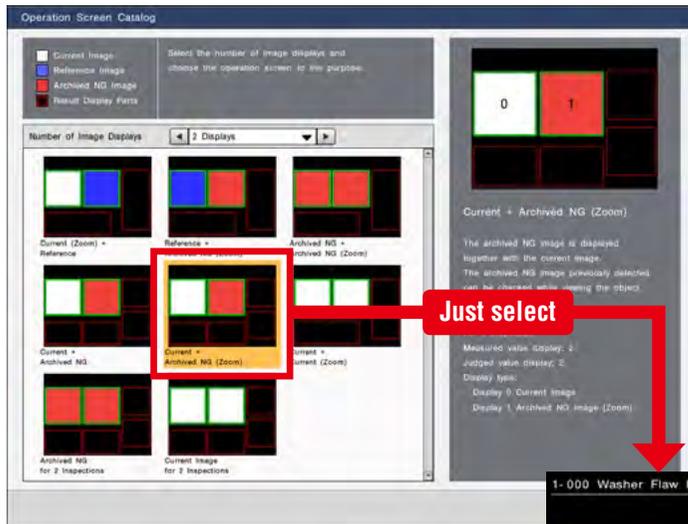
Because there is no latency for image processing, operation without stopping the equipment is possible even with a single controller.

# USER INTERFACE

No complicated customisation is required.  
Just select, quick start

In order to avoid customised screens that cannot be used unless customisation is performed, an operation screen catalogue function, “just select, quick start”, is incorporated along with a lot of the custom functions.

## Just select the best screen from the catalogue. “Operation Screen Settings”



### 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.

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

### JUST SELECT THE SCREEN LAYOUT FOR THE SITUATION

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



## 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)

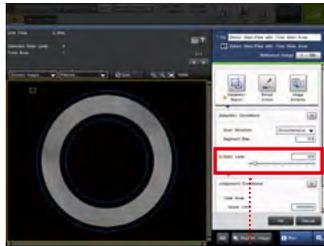
A touch panel can now be connected so that you can enhance on-site efficiency. This ensures easy operation even where a mouse is not available. Your efficiency can be improved further through combination with a custom menu.



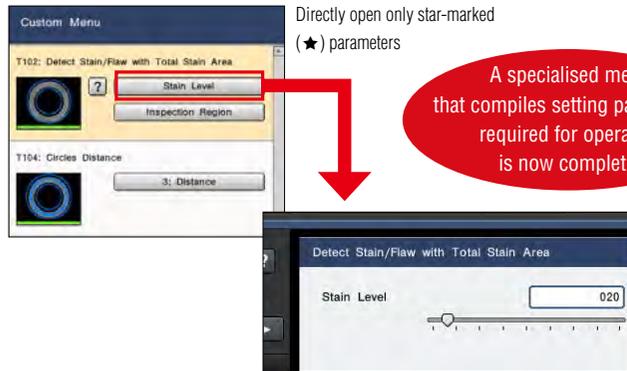
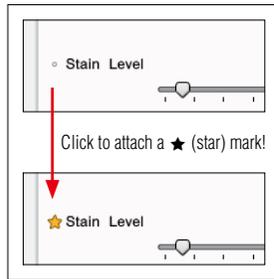
## A “custom menu” that realises the optimal operation with a single click

During operation, some parameters are often adjusted, and some are kept behind the operation 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.

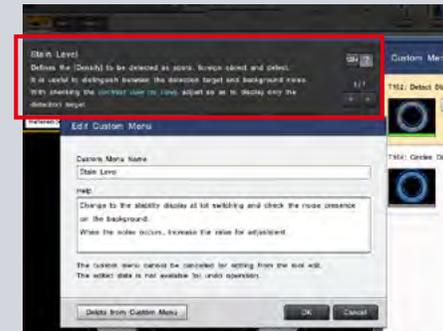
JUST MARK THE PARAMETERS WHEN PERFORMING SETTINGS...



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



### 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 elements such as the tool names or the custom menu comment function and operation screen display character strings without switching the language of the system itself.

|   |   |   |
|---|---|---|
| English<br>Utility   Go to Run Mode   Total Status OK             | Italian<br>Utility   Passa alla modalità esecuzione   Stato generale OK   | Portuguese (Brazilian)<br>Utilidade   Modo Execução   Status Total OK |
| Simplified Chinese<br>实用功能   至运行模式   综合判定 OK                      | Korean<br>유틸리티   운전 모드로   종합 판단 OK  | Vietnamese<br>Tiện ích   Chế độ Chạy   T. tình. OK                    |
| Traditional Chinese<br>實用功能   至運轉模式   綜合判定 OK                     | Spanish (Mexican)<br>Utilidad   Ir al modo de ejecución   Estado total OK | Japanese<br>ユーティリティ   運転モードへ   総合判定 OK                                |
| French<br>Utilitaire   Passer en mode execution   Status total OK | Thai<br>ยูทิลิตี้   ไปโหมดรัน   สถานะรวม OK                               |   |
| German<br>Erweit.   Wechseln zum Run-Modus   Gesamtsitz OK        | Indonesian<br>Utilitas   Buka Mode Jalan   Status Total OK                |   |

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

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



# UTILITIES

Easy-to-use utilities applying “Professional knowledge” from on-site experiences

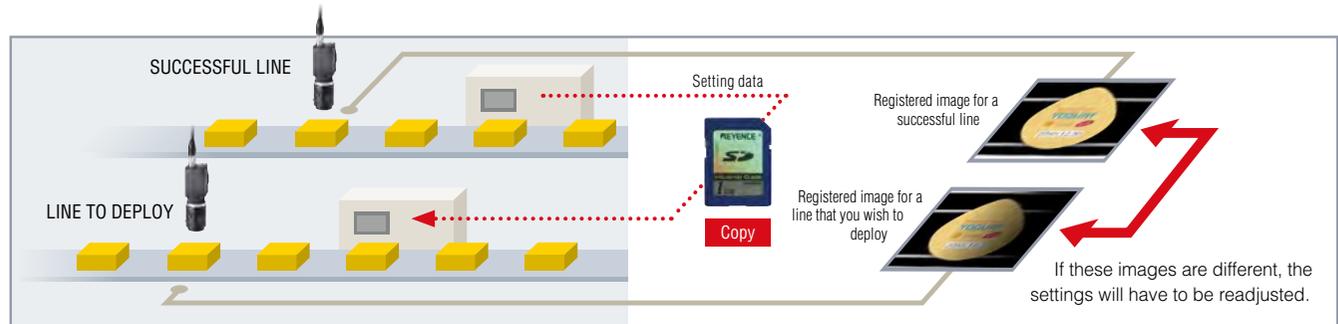
There are many useful utilities for various situations, such as “I want to add the inspection environment onto the neighbouring line as well.”, “I’m going to make adjustments due to often-occurring false detection for some reason.”, and “I want to manage the inspection process.”

## Navigation that “always guarantees a consistent image capture environment without relying on location”. “Camera Installation Replication”



### CONVENTIONAL

The production line has been extended, so I would like to expand the inspection environment without making changes. The setting data is copiable. If I could have replicated just the same camera installation, I wouldn’t have to readjust or start the settings all over again.



### CAMERA INSTALLATION REPLICATION

### THE CAMERA INSTALLATION CONDITIONS OF THE NEIGHBOURING 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 for 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 always the same”.

|   |  |  |
|---|--|--|
| <div data-bbox="174 1029 291 1093" data-label="Image"> </div> <div data-bbox="174 1101 291 1173" data-label="Section-Header"> <h4>POSITION ADJUSTMENT TOOL</h4> </div> <div data-bbox="347 1029 772 1220" data-label="Image"> </div> <div data-bbox="347 1228 772 1252" data-label="Caption"> <p>Successful line      Line to deploy</p> </div> <div data-bbox="168 1268 459 1412" data-label="Text"> <p>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.</p> </div> <div data-bbox="481 1268 772 1396" data-label="Image"> </div> | <div data-bbox="840 1029 952 1093" data-label="Image"> </div> <div data-bbox="840 1101 952 1173" data-label="Section-Header"> <h4>BRIGHTNESS ADJUSTMENT TOOL</h4> </div> <div data-bbox="1008 1029 1433 1220" data-label="Image"> </div> <div data-bbox="1008 1228 1433 1252" data-label="Caption"> <p>Successful line      Line to deploy</p> </div> <div data-bbox="828 1268 1422 1316" data-label="Text"> <p>Shows areas with different brightness from the reference image in colour so that you can adjust them to reduce the difference.</p> </div> <div data-bbox="840 1332 1422 1428" data-label="Image"> </div> | <div data-bbox="1489 1029 1601 1093" data-label="Image"> </div> <div data-bbox="1489 1101 1601 1125" data-label="Section-Header"> <h4>FOCUS TOOL</h4> </div> <div data-bbox="1657 1029 2094 1220" data-label="Image"> </div> <div data-bbox="1657 1228 2094 1252" data-label="Caption"> <p>Successful line      Line to deploy</p> </div> <div data-bbox="1489 1268 1792 1388" data-label="Text"> <p>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.</p> </div> <div data-bbox="1803 1268 2094 1364" data-label="Image"> </div> |
|---|--|--|

# Implement adjustment; for anyone, without questions, with certainty “Tool Adjustment Navigation”



## CONVENTIONAL

I HAVE NO IDEA WHERE I SHOULD START ADJUSTMENT

- I can't figure out which tool I should adjust...
- A position adjustment failure may be the cause of the false judgement...
- I'm at a loss as to which image I should adopt for correcting the tool setting...



## TOOL ADJUSTMENT NAVIGATION

NAVIGATION FOR ACCURATE AND OPTIMAL ADJUSTMENT

When the utility is launched, navigation starts after analysing archived images

Navigating adjustment procedures when non-defective workpieces have been mis-detected



## EXAMPLE OF SETTING PROCEDURES

- 1 Select a tool that has a high NG count from the NG Ranking by Tools and then start adjustment!

| NG Ranking by Tools                           | NG Count |
|---|----------|
| T103: Detect Stain/Flaw with Total Stain Area | 22       |
| T100: Recognize strings                       | 16       |
| T101: Recognize strings                       |          |



- 2 Sort out the images that should be judged as OK.



- 3 When position adjustment is used, the user is automatically prompted to check the reference tool.

- 4 Only the images that need to be adjusted for the selected tool are extracted.

| Adjust to be judged as OK |          |          |
|---------------------------|----------|----------|
| 000000028                 | 01/26/12 | 09:19:18 |
| 000000027                 | 01/26/12 | 09:19:18 |

## UTILITIES

### To manage the process, not just the recording. “Statistics”

Up to 20,000 pieces of measurement data can be recorded with the controller alone. It is possible to easily check the value such as minimum, maximum, average, standard deviation, NG count, and yield rate. In addition to the trend graphs, a list of measured values and a histogram can be displayed. Also, by using the newly-included function, Process Monitor (process capability index: Cpk), it is possible to analyse the inspection processes more statistically.

The 'Statistics' utility interface includes several views:

- Histogram view:** Displays a distribution graph of measured values.
- List of measured values:** A table showing individual data points.
- Process monitor:** Shows a trend graph with upper and lower control limits.

Key features highlighted:

- VERTICAL CURSOR:** Displays the measured values and the total count for the selected cursor position.
- IMAGE SAVE MARK:** Marked data has its image data saved. It is possible to check images by clicking.

### Tolerance overwrite function

Judgement conditions and stain levels can be rewritten during operation. This enables you to adjust tolerance easily even where the relevant line cannot be stopped.

The interface for 'T102: Detect Stain/Flaw with Each Stain' includes buttons for:

- Stain Level
- Stain Area

### Judgement conditions sharing function



Judgement conditions can be shared between tools. This function is useful when the same inspection processing is required on multiple points on the screen, because a change made to one point is reflected onto the others.

The 'Share Judgment Condition' dialog box allows users to share settings across different inspection points.

### Archived Image/image output

Every single image can be saved within the main buffer capacity range. It is also possible to output images externally (to SD card, PC program, or FTP server) while saving to the main buffer.

The 'Total Status' window displays archived images as thumbnails on an image strip. A callout indicates: "Archived images are displayed as thumbnails on the image strip".

**Just click the image on the image strip during setup to automatically execute a retest with that image.**

Maximum number of images\* that can be saved, organised by connected camera

| Camera type            | Number of images saved to the internal memory |         | Number of images saved to the 16 GB SD card |
|------------------------|---|---------|---|
|                        | CV-X470                                       | CV-X170 |   |
| Monochrome 0.24M pixel | 11605   | 1001    | 61628                                       |
| Colour 0.24M pixel     | 11297   | 992     | 21441                                       |
| Monochrome 0.31M pixel | 9293  | 489     | 49302                                       |
| Colour 0.31M pixel     | 9071  | 484     | 17006                                       |
| Monochrome 0.47M pixel | 6110  | 489     | 32875                                       |
| Colour 0.47M pixel     | 5982  | 480     | 11470                                       |
| Monochrome 2M pixel    | 1469  | 105     | 8360  |
| Colour 2M pixel        | 1430  | 97      | 2802  |
| Monochrome 5M pixel    | 547   | 35      | 3223  |
| Colour 5M pixel        | 517   | 27      | 1079  |
| Monochrome 21M pixel   | 90  | —       | 773   |
| Colour 21M pixel       | 66  | —       | 257   |

\* The values for the internal memory are typical values when a single camera is connected using CV-X470 or CV-X170 and when storage conditions for archived images have been "total status NG". Those for the 16 GB SD card are typical values when a single camera is connected.

### Error notification

Displays setting errors in a list. It is also possible to select the error from the list screen and jump to the corresponding area.

The 'Error List' window displays a table of errors:

| Source            | Content                   |
|-------------------|---------------------------|
| T102: Calculation | Syntax error has occurred |

# TOOL SELECTION CATALOGUE BASED ON APPLICATION

Just select the desired application, instead of selecting an algorithm

A tool catalogue that makes it easy to understand which tool is best to use from the features that you wish to inspect has been adopted. This makes it possible for the users to select the best tools without comprehensively understanding all the included algorithms.

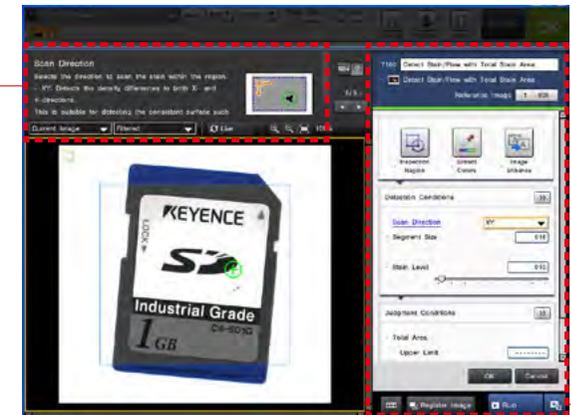


## TOOL CATALOGUE

The tools have been categorised according to application, based on the longstanding knowledge of the KEYENCE CORPORATION. It allows you to intuitively find the best tool for the inspection.

## APPLICATION NAVIGATOR

Information for the purpose of making optimal selections such as category explanations and typical applications that use each tool are displayed.

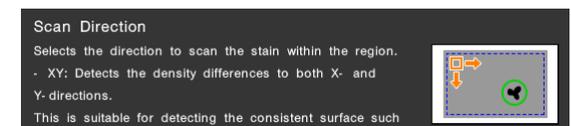


## SETTINGS MENU ORGANISED BY APPLICATION

Specialised and necessary parameters for applications have been arranged on the front screen of the menu. Settings creation that is simpler and easier to understand is possible.

## GUIDE FUNCTION

A guide function is incorporated and explains the parameter being set. By referencing the guide it is possible to check what kind of changes are occurring with the controller when adjusting the parameter.



### APPLICATION

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



### CONVENTIONAL

Settings cannot be performed because it cannot be reliably determined which algorithm is the best choice...



### TOOL CATALOGUE

Just select the inspection category from the tool catalogue

Relevant tools are grouped together under the "Count" category, so there is no confusion.



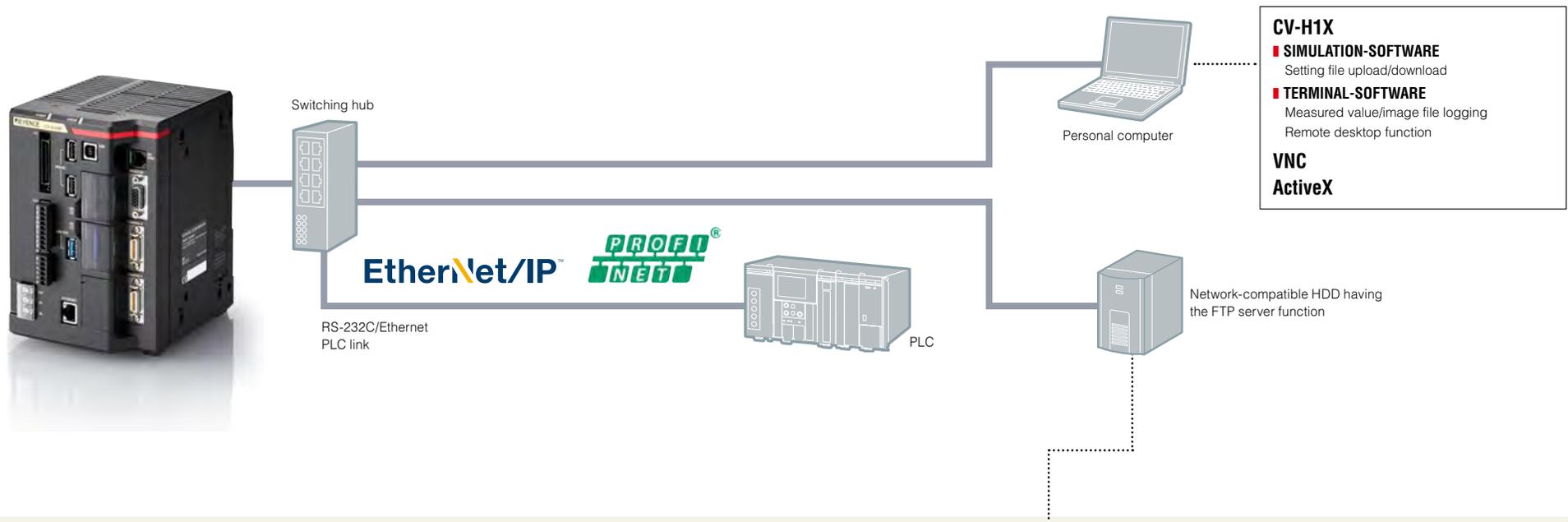
# COMMUNICATION AND CONTROL

A wide variety of communication methods compatible with existing systems

A wide variety of communication methods are adopted to satisfy communication control needs, including image and result data logging as well as the connection to an existing PLC to enable command control. Various monitor functions useful at start up and other times are also available to improve control, 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.



### 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

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

EtherNet/IP™



### SMART MONITOR FUNCTION

The integrated monitor function monitors communication to ensure quick detection of problems.

### FTP OUTPUT FUNCTION

Supports image and result data 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.

### COMPATIBLE WITH USB 3.0 STORAGE DEVICES

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

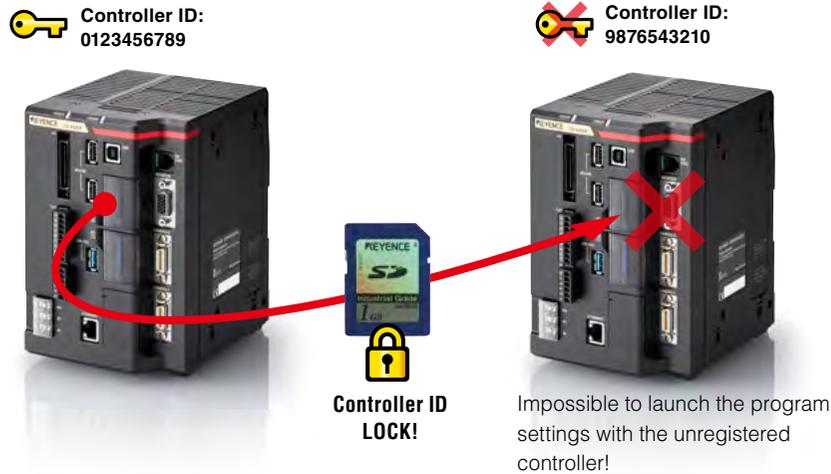
# SECURITY/ACCOUNT

Robust security that protects program assets

For vision system 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.

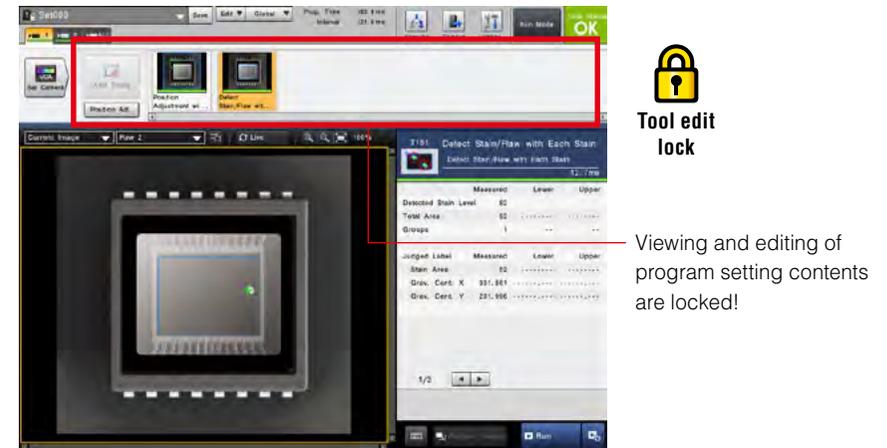
## CONTROLLER ID LOCK

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 setting know-how such as the setting 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.

**ADMIN**

All operations are possible.

**OPERATOR**

Custom menu operation, change programs, and saving are possible.

**USER**

Only viewing operations are possible.

Password setting for the purpose of changing accounts is possible.

# USER MANUAL AUTO-GENERATOR/ PC SOFTWARE

PC software that strongly supports operation

The “user manual auto-generator” which creates a manual for previously created programs, the “PC simulation function” that reproduces controller operation on a PC, and PC software with the “data logging function”, which collects NG images and measurement data, have been included as standard.

## CUSTOMISED MANUAL FOR AN OPTIMAL OPERATION. “USER MANUAL AUTO-GENERATOR”

### CONVENTIONAL

An operation manual is required as reference material for a customer that has had the equipment installed...

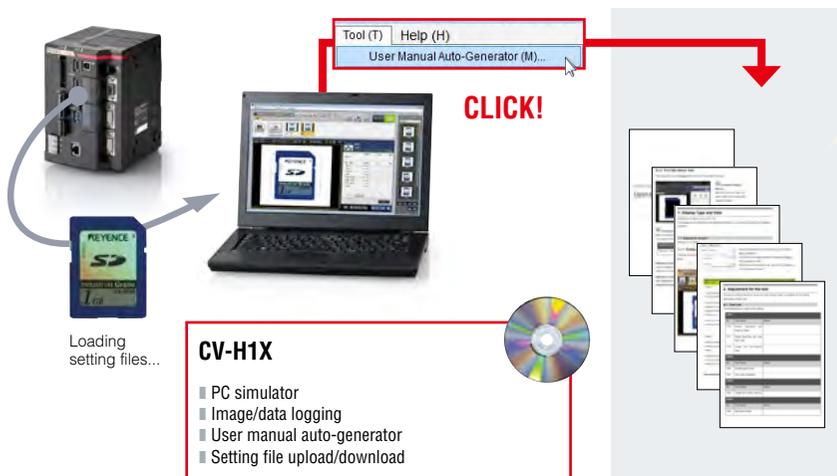


I want to have on-site operators refer to the manual but I want to summarise only the functions I need.



### USER MANUAL AUTO-GENERATOR

CUSTOMISED MANUAL CREATION IN A SINGLE CLICK!



### EXAMPLE OF CREATED MANUAL CONTENTS

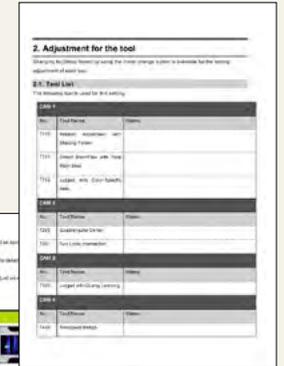
Cover sheet



How to view the operation screen



A list of tools



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.

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

## CONVENTIONAL

I cannot stop my production line for a long time although I want to make adjustments on site



According to changes in manufactured items, I need to add settings, but the site is remote



## PC SIMULATOR



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

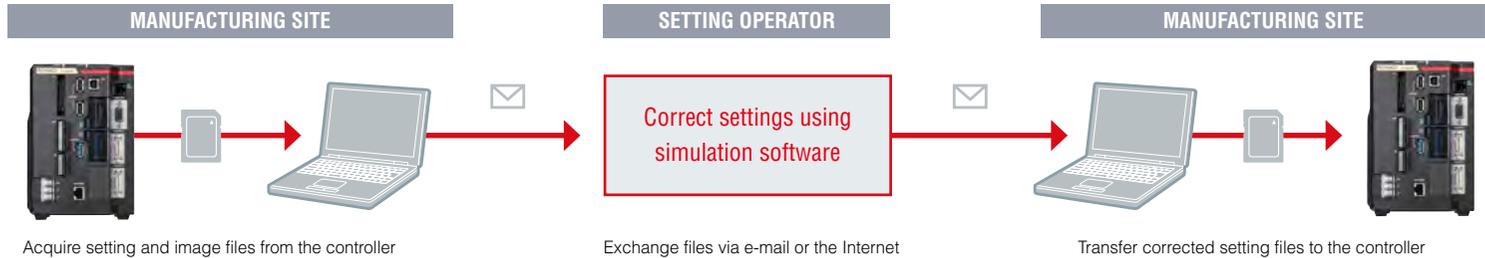


Using simulation software installed on a PC, setting creation and verification using images can be performed even at a remote site just as on an on-site machine.



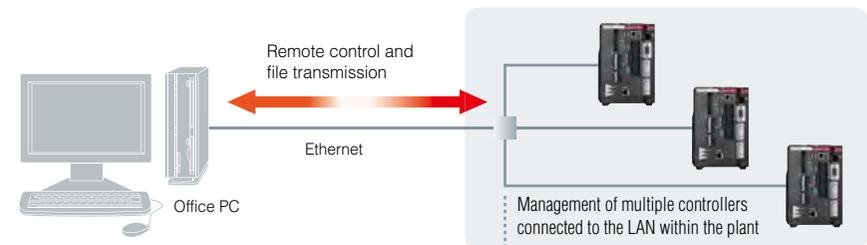
## APPLICATION SAMPLE

Exchange e-mail with a setting operator at a remote site



## Acquire image files and measurement data into your PC and operate them remotely: “Data logging/remote operation function”

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

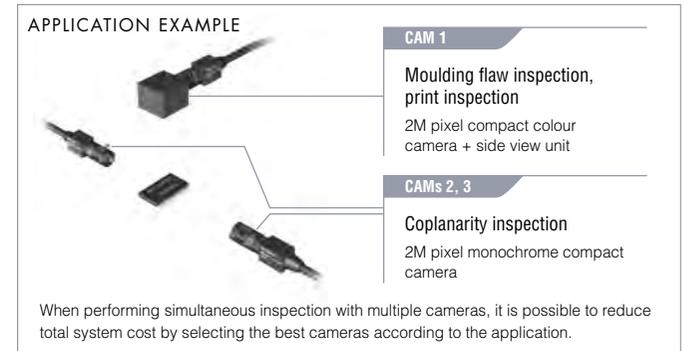
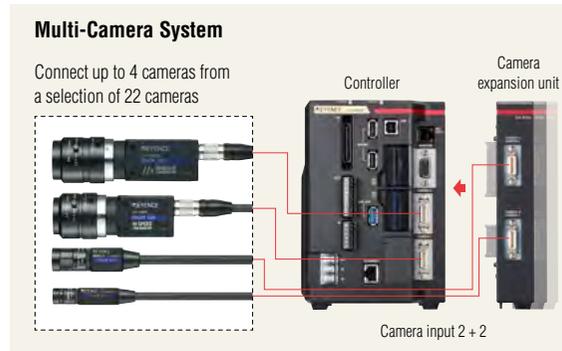


## ■ MULTI-CAMERA, SIMULTANEOUS IMAGE ACQUISITION SYSTEM Multi Camera System 22

A total of 22 types of cameras can be mixed for use.

For example, it is possible to attach a monochrome camera as CAM 1 and a colour camera as CAM 2 to 1 controller unit. Camera combinations best suited for the inspection can be applied. Also, by connecting a camera expansion unit, it is possible to connect up to 4 21M pixel cameras\*. Because simultaneous image acquisition and simultaneous processing can be performed for all camera combinations, this system can flexibly support future additions and changes to inspection specifications.

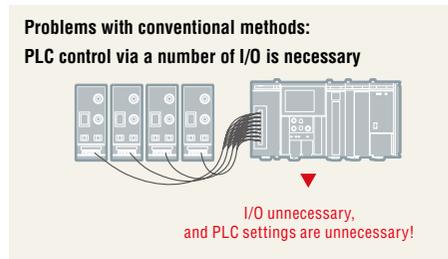
(\*The expansion unit can be connected to the CV-X420/CV-X450/CV-X470/CV-X150/CV-X170)



## ■ ILLUMINATION EXPANSION UNIT EASY LIGHT CONTROL WITHOUT CUMBERSOME WIRING

Up to 8 lighting expansion units\*1 can be connected to the main controller. Each unit has 2 lighting connections (connector and terminal style) so up to 16 12 or 24 VDC lights can be connected.

\*1 This applies to cases where the CA-DC40E is used. When the CA-DC50E is used, a maximum of two units can be connected (can also be combined with 6 CA-DC40E units).

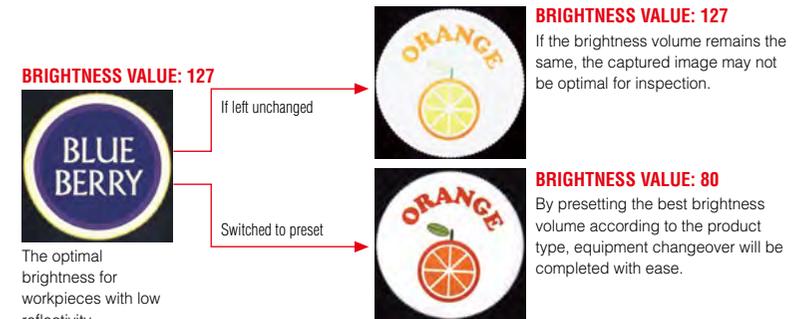


### APPLICATION EXAMPLE

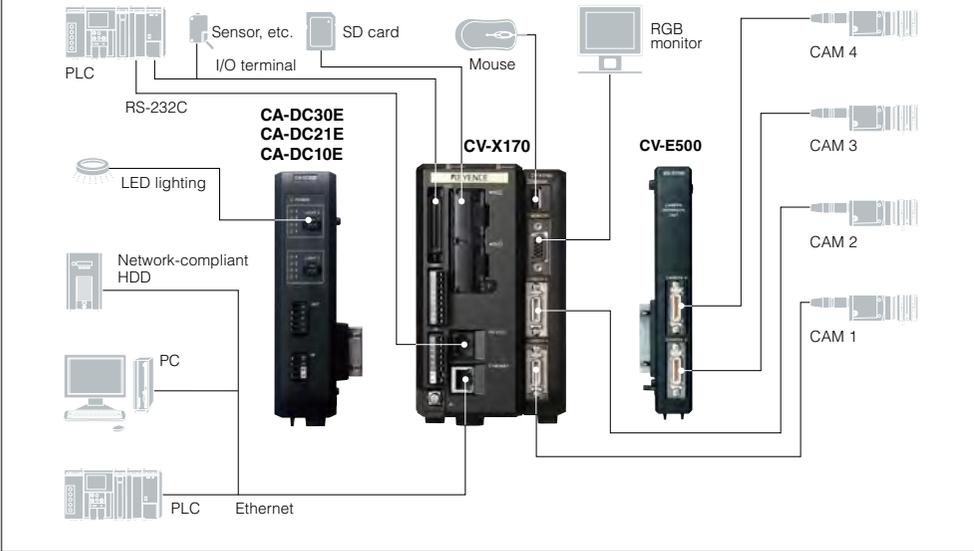
#### BRIGHTNESS PRESETS FOR EACH PROGRAM SETTING

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

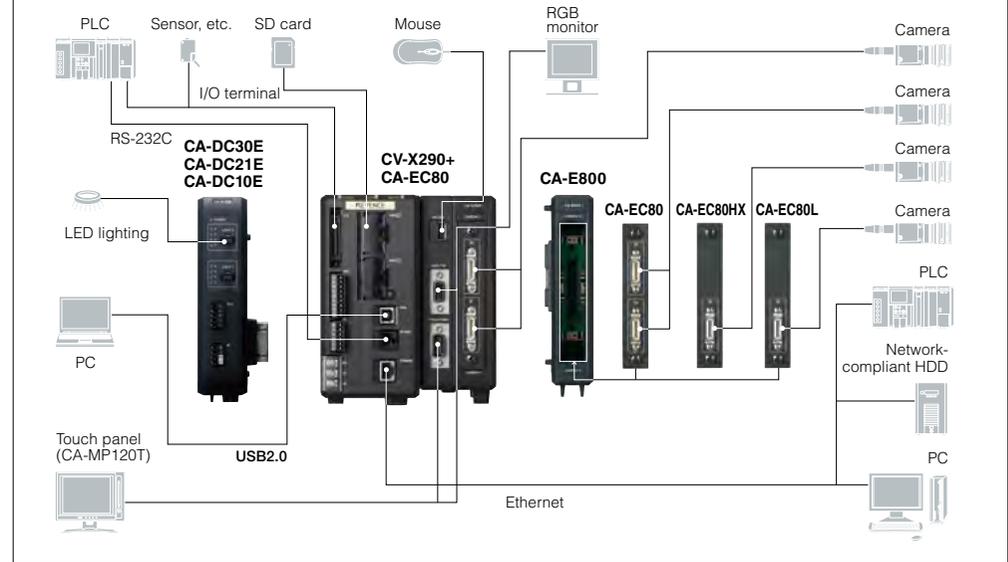
When the product being inspected changes, different lighting settings may be required to capture the optimum image. It is possible to automatically change to the light intensity when a different product is inspected.



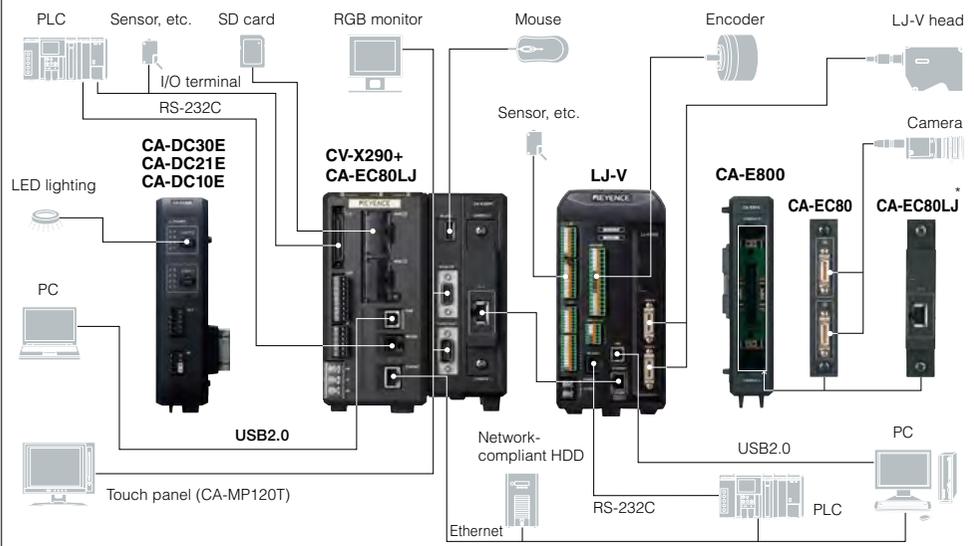
**SYSTEM CONFIGURATION (CV-X100 Series)**



**SYSTEM CONFIGURATION (CV-X200 Series)**

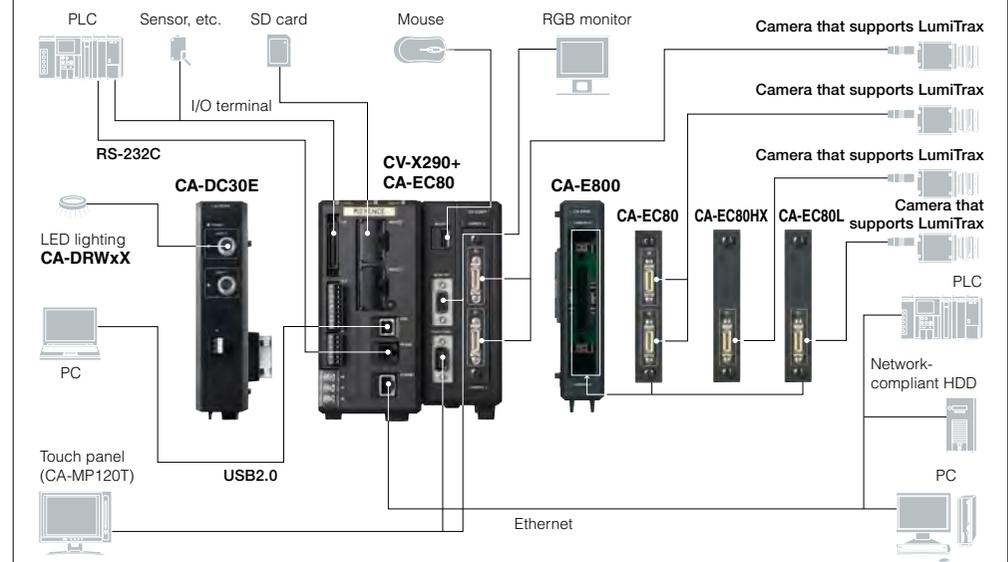


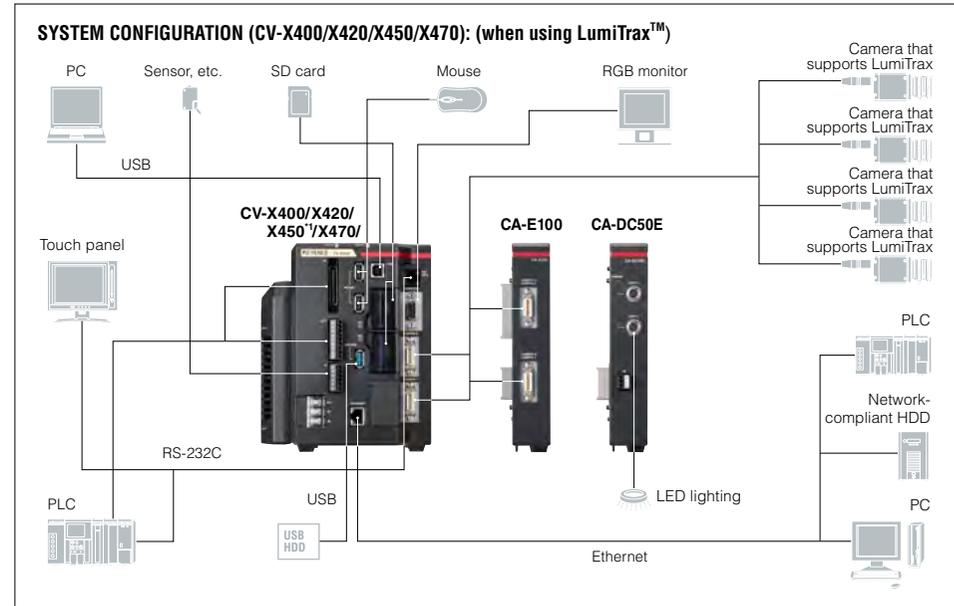
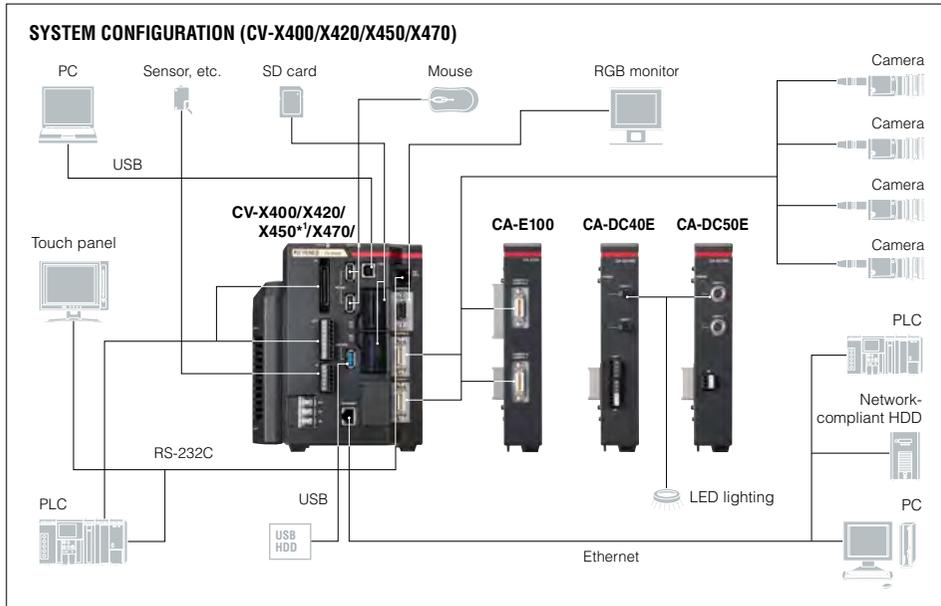
**SYSTEM CONFIGURATION (CV-X290 + LJ-V)**



\* When the CA-E800 and CA-EC80LJ are additionally installed, one more LJ-V can be added.

**SYSTEM CONFIGURATION (when using LumiTrax™)**





\*1 Fan unit cannot be connected to CV-X400/X420/X450.

■ Controller



5M pixel camera supporting type  
**CV-X450**

2M pixel camera supporting type  
**CV-X420**

0.47M pixel camera supporting type  
**CV-X400**



21M pixel camera supporting type  
**CV-X470**



5M pixel camera supporting type  
**CV-X170**

2M pixel camera supporting type  
**CV-X150**

0.47M pixel camera supporting type  
**CV-X100**



5M pixel camera supporting type  
**CV-X270**

2M pixel camera supporting type  
**CV-X250**

0.47M pixel camera supporting type  
**CV-X200**



21M pixel camera/LJ-V supporting type  
**CV-X290**

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

■ Area camera



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



5M pixel ×16 speed camera  
**CA-HX500C** (Colour)  
**CA-HX500M** (Monochrome)



2M pixel ×16 speed camera  
**CA-HX200C** (Colour)  
**CA-HX200M** (Monochrome)

0.47M pixel ×16 speed camera  
**CA-HX048C** (Colour)  
**CA-HX048M** (Monochrome)



5M pixel ×11 speed camera  
**CV-H500C** (Colour)  
**CV-H500M** (Monochrome)

2M pixel ×7 speed camera  
**CV-H200C** (Colour)  
**CV-H200M** (Monochrome)

0.31M pixel ×7 speed camera  
**CV-H035C** (Colour)  
**CV-H035M** (Monochrome)

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

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



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



Ultra-compact camera  
0.31M pixel  
**CV-S035C** (Colour)  
**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 catalogue are trademarks or registered trademarks of their respective companies.

■ Accessories

Mouse (Accessory)



PC software DVD-ROM **CV-H1X**

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 and Windows 10. For Windows Vista, only the 32-bit version is supported.

Expansion unit



Area camera input unit  
**CA-E100**

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/CA-DC10E**

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

\* The CA-DC21E is shown in this photograph.

## Optional accessories

### Camera cable



L-type connector

### List of models

| Cable type                      | Connector shape | Cable length |         |         |          |          | Extension cable |
|---------------------------------|-----------------|--------------|---------|---------|----------|----------|-----------------|
|                                 |                 | 1 m          | 3 m     | 5 m     | 10 m     | 17 m     |                 |
| Standard                        | Straight        | CA-CN1       | CA-CN3  | CA-CN5  | CA-CN10  | CA-CN17  | —               |
|                                 | L-type          | —            | CA-CN3L | CA-CN5L | CA-CN10L | CA-CN17L | —               |
| High-flex cable                 | Straight        | —            | CA-CN3R | CA-CN5R | CA-CN10R | CA-CN17R | CA-CN7RE (7 m)  |
| For high-speed camera           | Straight        | —            | CA-CH3  | CA-CH5  | CA-CH10  | —        | —               |
|                                 | L-type          | —            | CA-CH3L | CA-CH5L | CA-CH10L | —        | —               |
| High-flex for high-speed camera | Straight        | —            | CA-CH3R | CA-CH5R | CA-CH10R | —        | —               |

### Camera cable compatibility list

| Connectable cameras   |                  | CA-H2100x | CA-HX500x | CV-H500x | CA-HX200x | CV-H200x | CV-200x | CV-S200x | CA-HX048x | CV-H035x | CV-035x | CV-S035x |
|-----------------------|------------------|-----------|-----------|----------|-----------|----------|---------|----------|-----------|----------|---------|----------|
| For high-speed camera | Number of pixels | CA-CH10   | ✓         | ✓        | ✓         | ✓        | —       | —        | ✓         | ✓        | —       | —        |
|                       |                  | CA-CH5    | ✓         | ✓        | ✓         | ✓        | —       | —        | ✓         | ✓        | —       | —        |
|                       |                  | CA-CH3    | ✓         | ✓        | ✓         | ✓        | —       | —        | ✓         | ✓        | —       | —        |
| For normal cameras    |                  | CA-CN17   | —         | —        | —         | —        | —       | —        | —         | —        | ✓       | ✓        |
|                       |                  | CA-CN10   | —         | —        | —         | —        | ✓       | ✓        | —         | —        | ✓       | ✓        |
|                       |                  | CA-CN5    | —         | —        | —         | —        | ✓       | ✓        | —         | —        | ✓       | ✓        |
|                       |                  | CA-CN3    | —         | —        | —         | —        | ✓       | ✓        | —         | —        | ✓       | ✓        |
|                       | CA-CN1           | —         | —         | —        | —         | ✓        | ✓       | —        | —         | ✓        | ✓       |          |



Repeater for camera cable extension  
**CA-CNX10U**  
 (for normal cameras)  
**CA-CHX10U**  
 (for high-speed cameras)

Camera cable extension is possible at a maximum length of 51 m\*.

\* The maximum length will differ according to the camera model. Contact KEYENCE for details.

A dedicated extension cable is required for repeater ⇔ camera or repeater ⇔ repeater. Contact KEYENCE for details.



### Communication cable



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



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)



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



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



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

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

\* 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 touch panel modular RS-232C cable)  
**OP-87265** (10 m touch panel modular RS-232C cable)

For CV-X200:

**OP-87258** (3 m touch panel RS-232C cable)  
**OP-87259** (10 m touch panel RS-232C cable)



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



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

### SD card



SD card  
 16 GB **CA-SD16G**  
 4 GB **CA-SD4G**  
 1 GB **CA-SD1G**  
 512 MB **OP-87133**

### Other



Dedicated 24 VDC power source  
**CA-U4**  
**CA-U5**



Mouse stand  
**OP-87601**



Camera mounting stage  
**CA-S2040**

Fan unit for the CV-X400 Series **CA-F100**  
 Setup manual for the CV-X Series **OP-M1840**  
 User manual for the CV-X Series **OP-M1845**

The setup manual/user manual for the CV-X Series is not included with the controller.

**SCAN THIS CODE TO ACCESS THE WEB**



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



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



**SAFETY INFORMATION**

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

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