

POWER MEETS SIMPLICITY

CV-X Series Ver. 4.2



New Controller CV-X400 Series

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

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.

CV-3000 Series



CV-5000 Series



CV-2000 Series



XV-1000 Series



THE FIRST IMAGE PROCESSING SENSOR

VX Series



CV-500/700 Series



CV-100/300 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 alignment 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



Various lenses and lighting systems are also available

Usability

Stable and long-term operation readily available for anybody.

CV-X Series



Cost

Presence detection at a reasonable cost.

IV Series



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 absence.

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; and support for 3D shape measurement.

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. Version 4.2 incorporates Multi-Spectrum Image Capture Mode, combining full spectrum illumination with state-of-the-art algorithms. Now even slight color differences between workpieces can be recognized, allowing for accurate sorting. 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.

Intuitive Vision System **CV-X Series**



AVAILABLE HARDWARE ➔ P. 6

Eight types of controllers available depending on processing speed and capacity

NEW

MULTI-CORE DSP-INTEGRATED
CV-X400 Series



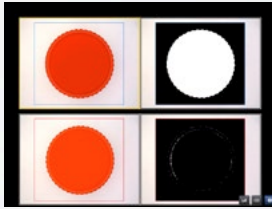
22 types of cameras available depending on inspection category

ULTRA HIGH-RESOLUTION
21M PIXEL CAMERA

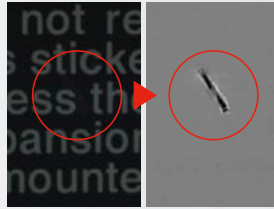
**16x 21MEGA
DIGITAL**



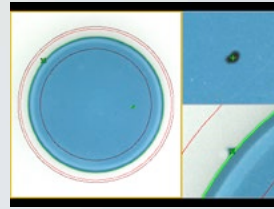
ALGORITHMS THAT ADDRESS EVERY INSPECTION REQUIREMENT ➔ P. 8



Multi-Spectrum Image Capture



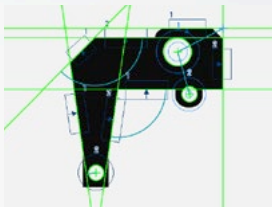
LumiTrax™



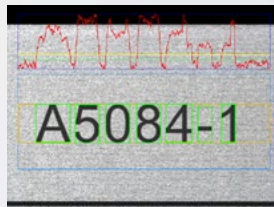
Appearance Inspection



Auto-Teach Inspection



Dimension inspection



Character recognition

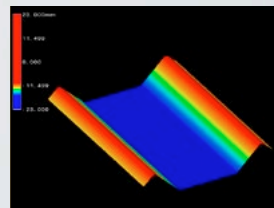
INSPECTION TOOLS FOR EVERY CHALLENGE ➔ P. 20



Vision-Guided robotics



Connector inspection

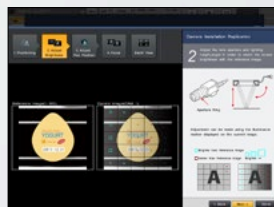


3D measurement

HIGH USABILITY THAT ENSURES LONG-TERM OPERATION ➔ P. 26



Operation screen catalogue



Camera installation replication



Statistical analysis function



User manual auto-generator

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



Model	
Main image processor	
Max. no. of connectable cameras	
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

CV-X400 Series NEW



High-speed model for area cameras					Model that supports 3D
CV-X400	CV-X420	CV-X450	CV-X470	CV-X480	
	3-core DSP		7-core DSP		
2	4	4	4	4	
✓	✓	✓	✓	✓	
—	✓	✓	✓	✓	
—	—	✓	✓	✓	
—	—	—	✓	✓	
✓	✓	✓	✓	✓	
—	✓	✓	✓	✓	
—	—	✓	✓	✓	
—	—	—	—	✓	

ALL MODELS ARE HDD-LESS



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	21M pixel
	CA-HX048C/M
	CA-HX200C/M
	CA-HX500C/M
	LJ-V

CV-X100 Series



Standard model		
CV-X100	CV-X150	CV-X170
	DSP	
2	4	4
✓	✓	✓
—	✓	✓
—	—	✓
—	—	—
✓ ^{*1}	✓ ^{*1}	✓ ^{*1}
—	✓ ^{*1}	✓ ^{*1}
—	—	✓ ^{*1}
—	—	—

*1 The LumiTrax™ function is not supported.

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.
Supports direct connection with LJ-V for 3D profile measurement.

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. 3D profile measurement is possible by additionally using the LJ-V head. With these much expanded choices, all on-site challenges have a solution.

	21M pixel camera		5M pixel camera		
	16x 21MEGA DIGITAL 		16x 5MEGA DIGITAL LumiTrax™/Multi-Spectrum compatible		
Model	CA-H2100M/CA-H2100C		CA-HX500M/CA-HX500C		CV-H500M/CV-H500C
Specs	×16 speed monochrome ×16 speed colour		×16 speed monochrome ×16 speed colour		×11 speed monochrome ×11 speed colour
Capture range	5104 × 4092 pixels		2432 × 2040 pixels		2432 × 2050 pixels
Transfer time	109.9 ms		27.6 ms ^{*1} / 29.0 ms ^{*1} 50.3 ms ^{*2} / 52.4 ms ^{*2}		61.2 ms

	2M pixel camera			
	16x MEGA DIGITAL LumiTrax™/Multi-Spectrum compatible	7x MEGA DIGITAL 	MEGA DIGITAL 	SUPER-SMALL DIGITAL
Model	CA-HX200M/CA-HX200C	CV-H200M/CV-H200C	CV-200M/CV-200C	CV-S200M/CV-S200C
Specs	×16 speed monochrome ×16 speed colour	×7 speed monochrome ×7 speed colour	Monochrome Colour	Compact monochrome Compact colour
Capture range	1600 × 1200 pixels	1600 × 1200 pixels	1600 × 1200 pixels	1600 × 1200 pixels
Transfer time	11.6 ms ^{*1} / 11.6 ms ^{*1} 20.1 ms ^{*2} / 20.2 ms ^{*2}	29.2 ms	58.5 ms	58.5 ms

	0.31M to 0.47M pixel camera					Laser profile measurement system
	16x HI-SPEED DIGITAL LumiTrax™/Multi-Spectrum compatible	7x HI-SPEED DIGITAL 	HI-SPEED DIGITAL 	ULTRA-SMALL DIGITAL 		
Model	CA-HX048M	CA-HX048C	CV-H035M/CV-H035C	CV-035M/CV-035C	CV-S035M/CV-S035C	LJ-V Series
Specs	×16 speed monochrome	×16 speed colour	×7 speed monochrome ×7 speed colour	Monochrome Colour	Compact monochrome Compact colour	Head: 7 types
Capture range	784 × 596 pixels 512 × 480 pixels	784 × 596 pixels 512 × 480 pixels	640 × 480 pixels	640 × 480 pixels	640 × 480 pixels	Z-axis: ±2.3 to ±145 mm X-axis: 7 to 180 mm
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}	4.7 ms	16.0 ms	16.0 ms
						64000 profiles/sec

*1 When using the CV-X400 Series

*2 When using the CV-X100 Series

CONTACT YOUR NEAREST OFFICE FOR RELEASE STATUS

MULTI-SPECTRUM IMAGE CAPTURE

Full Spectrum Illumination and Powerful Algorithms NEW

Multi-spectrum lighting incorporating LEDs in eight colours and a dedicated control circuit.

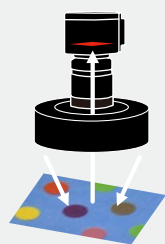
Synchronised lighting, colour control, segmented lighting, and high-speed image capture without complicated PLC integration.

Outstanding control of colour, shape, gloss, and target variability in three different modes thanks to a combination of full spectrum illumination and powerful algorithms.

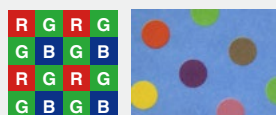


STANDARD COLOUR VS. MULTI-SPECTRUM PROCESSING

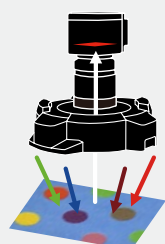
Colour camera



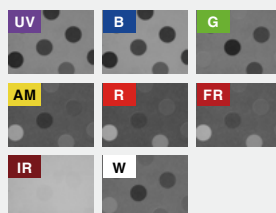
The imaging element receives white light reflected from the target through a colour filter. This data is then used to create a colour image.



Multi-Spectrum Image Capture



Colour analysis is performed for every pixel based on eight grey-scale images taken at different wavelengths.

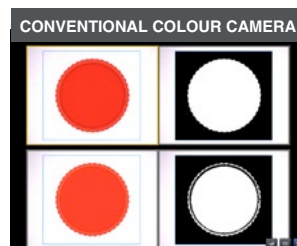


Colour

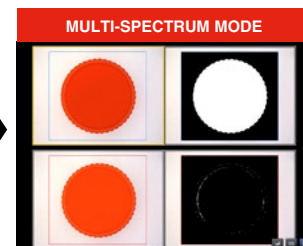
Accurate Sorting, Even between Slight Colour Differences



Inspection of Various Types of Plastic Caps



Although some differences are noticeable, the extracted colours are largely the same.



Differences in colour are clearly defined.

Shape

Detect Changes in Height with Directional Lighting

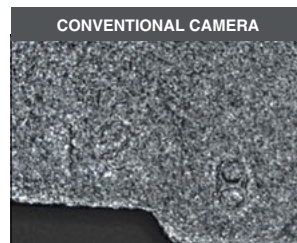


Stamped Character Inspection on Metal Casting

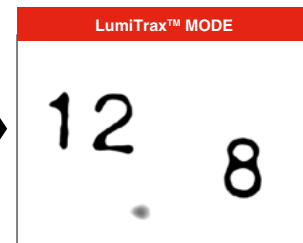
CONVENTIONAL IMAGING ISSUES



Difficult imaging conditions require trial and error for selecting the optimum light.



Surface conditions interfere with extraction.



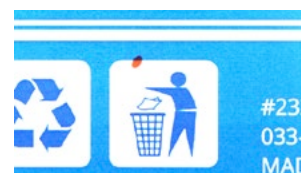
Extraction of only shape (irregularity) information regardless of surface conditions

Target Variability

Lighting conditions can be optimised for each target depending on the colour conditions



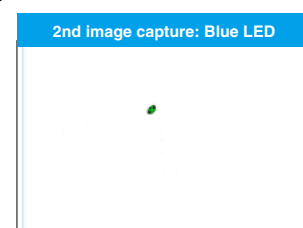
Printing Appearance Inspection



A red ink defect appears on a printing with a blue background.



Illumination using a red LED capable of clearly viewing the pattern is performed for alignment shift correction.



To erase the printed pattern for defect inspection, illumination using the same blue colour is performed.

HARDWARE THAT SUPPORTS INSPECTION STABILITY

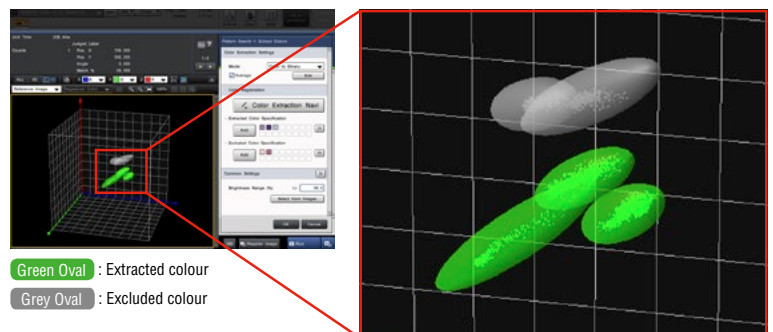
- | Built-In Dedicated Illumination Control Circuit
- | Ultra, High-Speed CMOS camera and Dedicated Control Circuit CA-HX Series
- | Lighting Equipped with 8 High-Brightness LEDs of Different Wavelengths CA-DRMxX Series
- | Photodiode and Real-Time Intensity Control Circuit



SOFTWARE UTILITIES TO ENSURE STABLE INSPECTION

3D Display Function for Registered Colours

The distribution of registered colours can be displayed in 3D, indicating how different the registered selected and excluded colours are and allowing visualisation of whether the inspection is stable and free from interference from other colours.

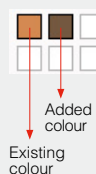


Multi-Colour Registration

(Support for Invalidation and Integration)

Registration of up to 32 extracted colours and 32 excluded colours is possible. This makes it possible to handle a variety of inspection targets through added colour extraction without losing existing colour information. In addition, the ability to integrate or invalidate colours later allows for optimisation while always checking results.

Addition And Invalidation



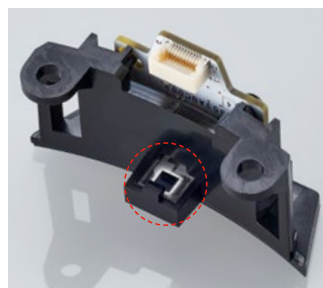
Up to 32 individual colours can be stored. This makes it possible to perform adjustment even during operation without sacrificing colour information.



Colours can not only be removed but also invalidated. This provides flexible testing without having to redo inspection. Invalidated colours are not used for inspection, but the colour information is saved.

Real-Time Intensity Feedback Function

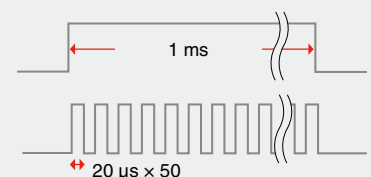
The photodiode and real-time intensity control circuit within the lighting is used for feedback control of the LED light intensity. Setting the current brightness to the regularly used brightness prevents drops in inspection capabilities due to deterioration caused by LED ageing.



Photodiode and correction circuit within the lighting

Illumination Time Chart

- With 1 ms (1/1000 sec) of illumination



For every illumination, monitoring and feedback are performed every 20 μ s to adjust the brightness to a consistent intensity.

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



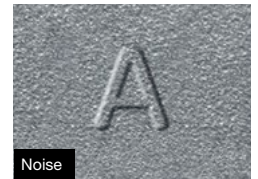
**CA-DRWxX/
CA-DRMxX Series**
Equipped with ultra high-intensity LED and circuit for separate lighting control



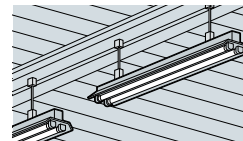
CV-X400 Series
Analyses multiple images instantaneously to create shape and texture images

CONVENTIONAL IMAGING PROBLEMS

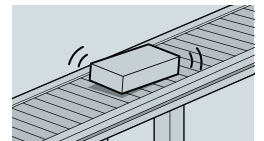
• Various surface conditions



• Influence of the surrounding environment (ambient light)



• Workpiece orientation changes caused by transfer conditions

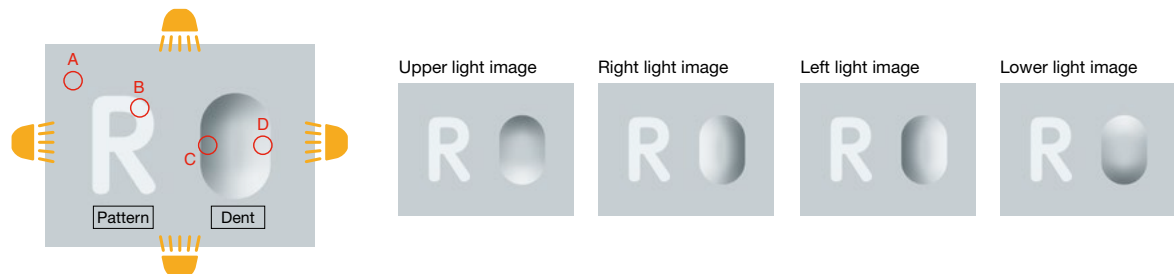


Trial and error must be performed to select the optimum light.

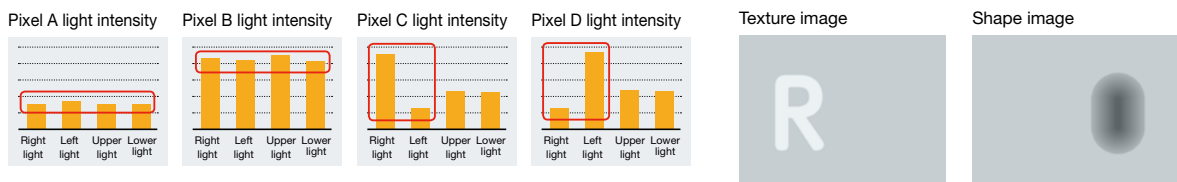


LumiTrax™ processing

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

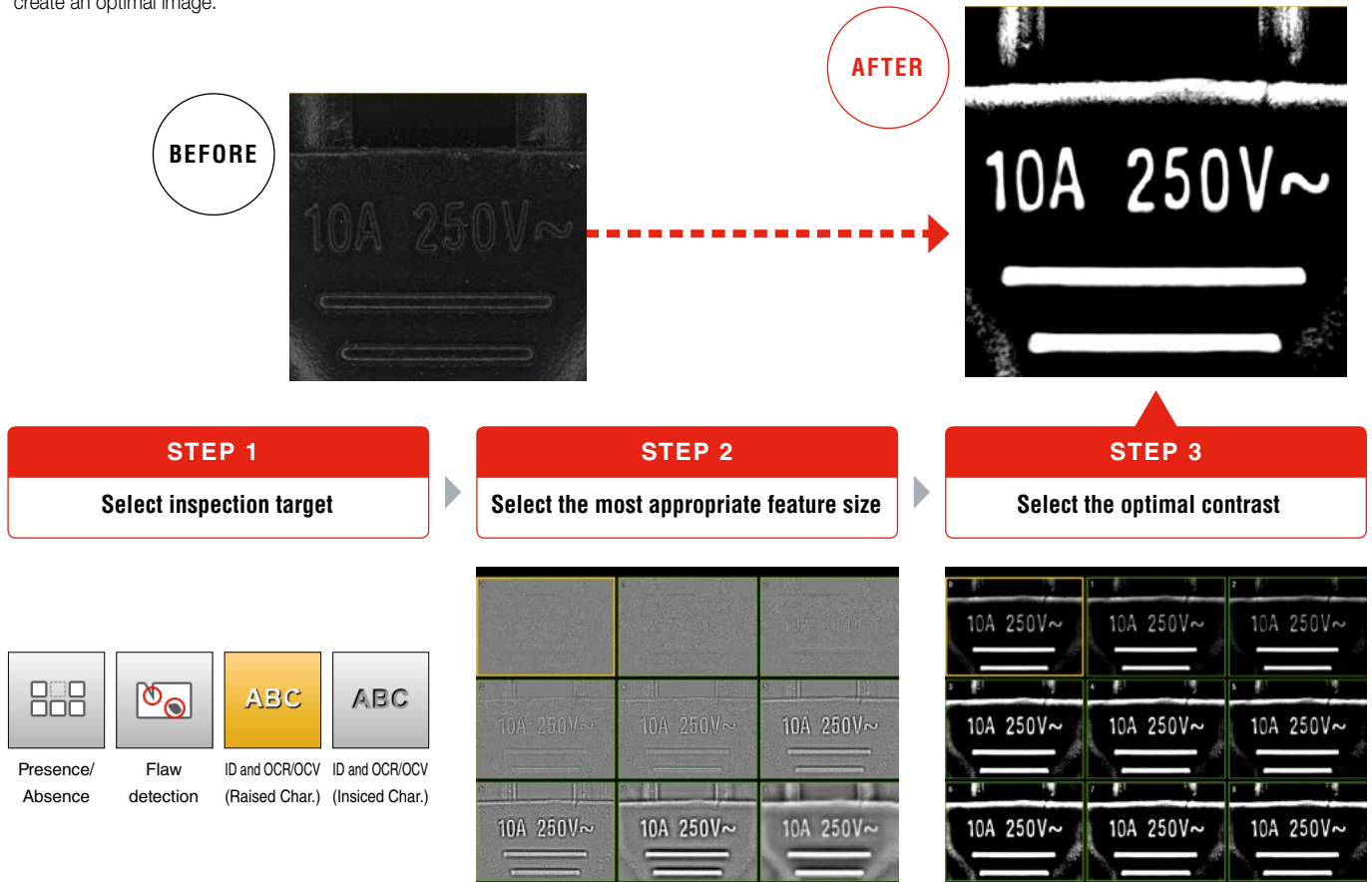


2. The changes in light intensity of each pixel among the different images are analysed to split the shapes (irregularities) and textures (pattern) into separate images.



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.

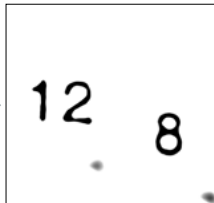
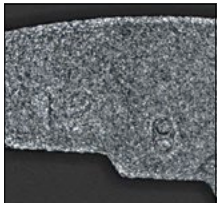


First, select the target for the inspection.

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

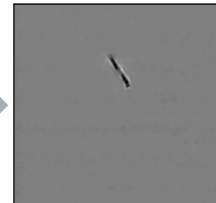
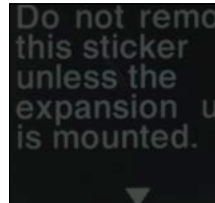
Application examples (1) Extracting only the shape (irregularities) information regardless of the surface conditions

■ Metal casting surface carved seal inspection



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

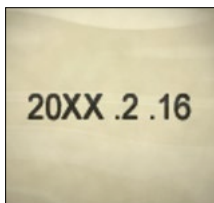
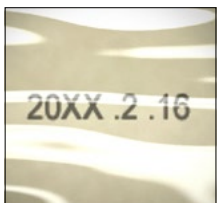
■ Chip inspection on a printed surface



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

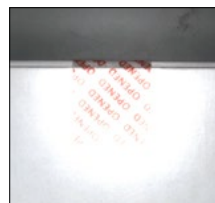
Application examples (2) Suppressing glare and ambient light to extract only textures (pattern)

■ 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 cancelled, which makes it possible to perform stable inspections.

APPEARANCE/ABSENCE INSPECTION

DEFECT

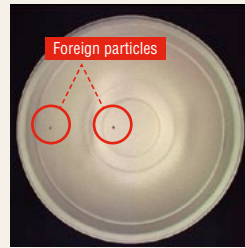
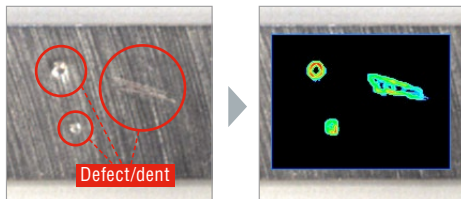
De-facto standard appearance inspection tool that “visualises” inspection stability

This tool detects defects, flaws detection 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, intensity, shape, and count.

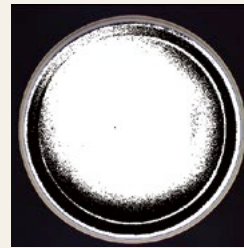
Contrast image

This function displays defects by colouring them 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.

Defect detection for a metal plate



There are small foreign particles on the inner side surface and bottom of a container.



With conventional binary processing, these particles cannot be detected since their brightnesses are close to that of the dark section inside the container.



The defect inspection tool can stably detect the foreign particles alone by ignoring shading differences.

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.

Relationship between contrast image colours and defect levels

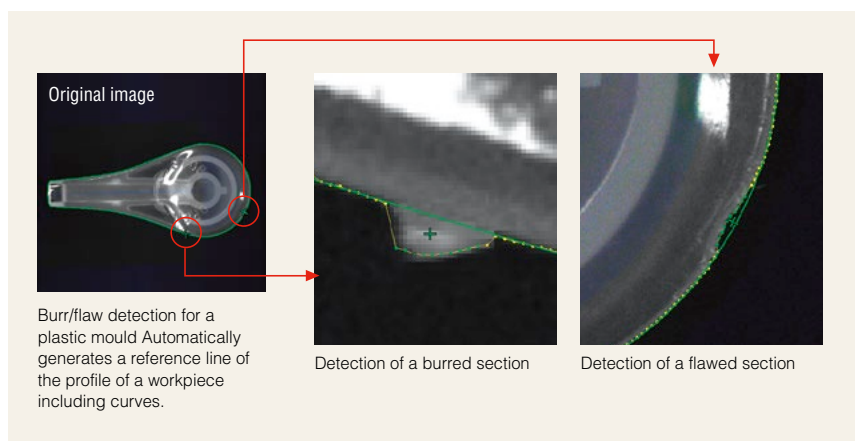


TREND EDGE DEFECT

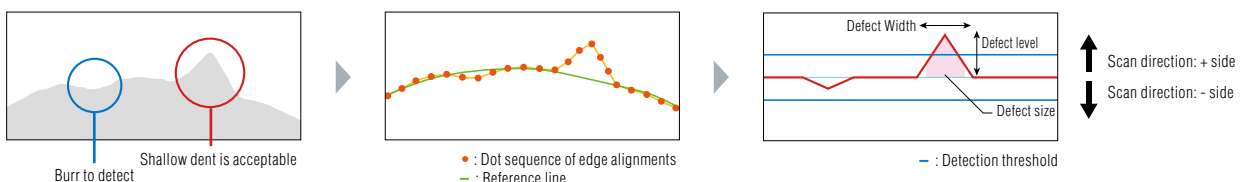
Edge defect inspection tool optimised for burr and flaw detection inspection

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 detection. 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 defects



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 (burr/flaws detection) 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

NEW INVENTION!

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



Non-defective



Different type



Incomplete printing



Flaw detection

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

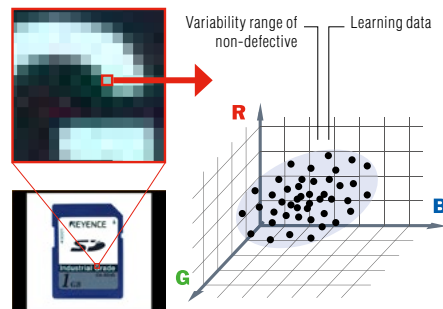
**SETTING
COMPLETED!**

Non-defectives learnt!



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.

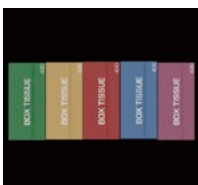
SET AUTO THRESHOLD FUNCTION

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

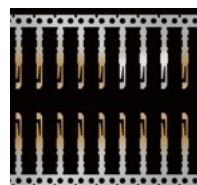
Misarrangement inspection for boxes of tissues



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

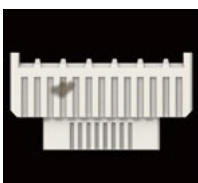
Plating defect inspection for lead frames



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

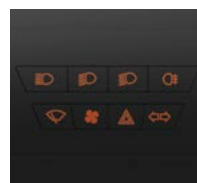
Flaw detection inspection for connector housings



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.

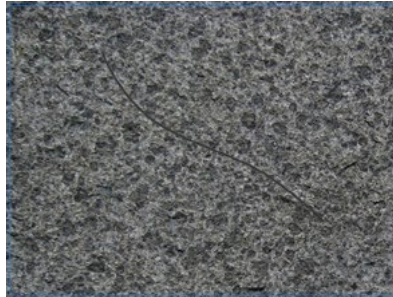
IMAGE ENHANCE FILTERS

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 DEFECT ON A METAL COMPONENT



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

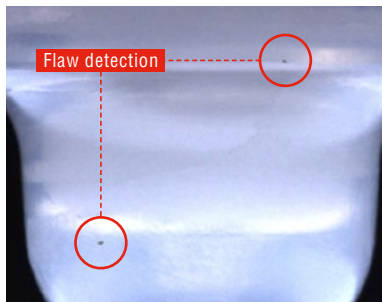


Only linear defects are extracted by ignoring background noise.

■ 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.

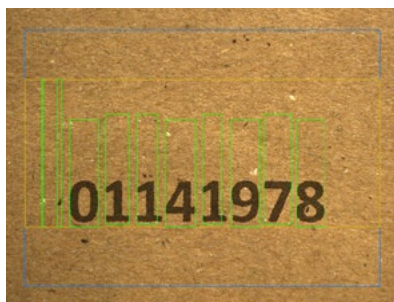


Only defects are extracted by cancelling random shading in real time.

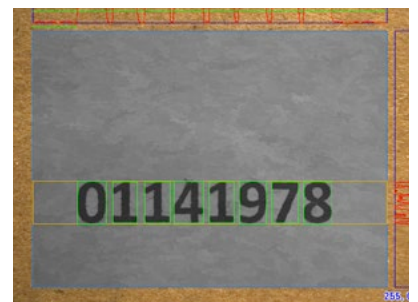
■ NOISE ISOLATION

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 defects.

■ RECOGNITION OF CHARACTERS PRINTED ON CARDBOARD



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

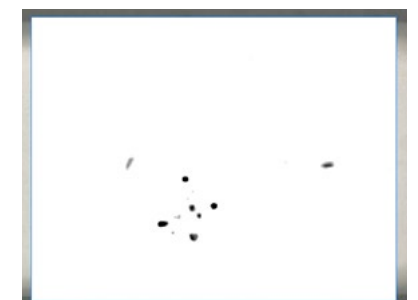


Only bright and dark noise are removed and the printing condition remains unaffected.

■ DEFECT INSPECTION FOR A PLASTIC MOULD



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

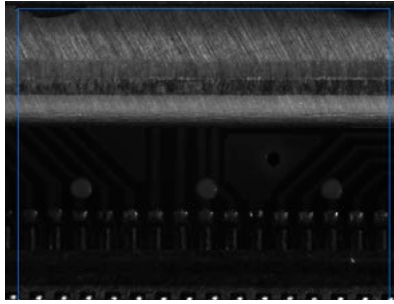


Only black defects of the specified area or smaller are extracted.

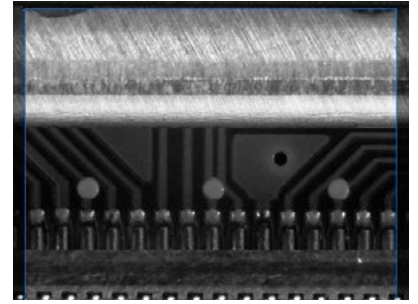
■ CONTRAST EXPANSION

Expands the intensity 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.

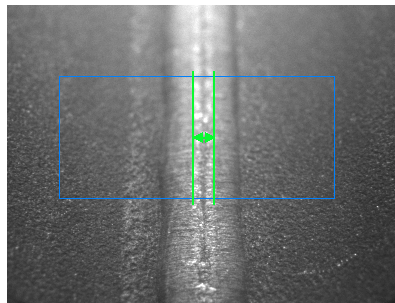


The circuit board pattern can be recognised clearly. Because the filter determines the expansion width from the intensity distribution within the inspection region, images without overexposure and underexposure can be captured.

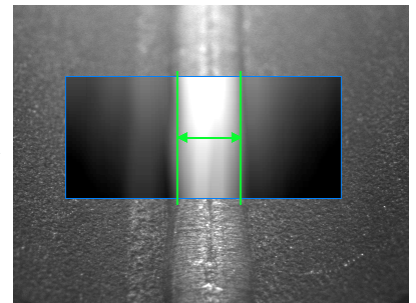
■ BLUR

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.



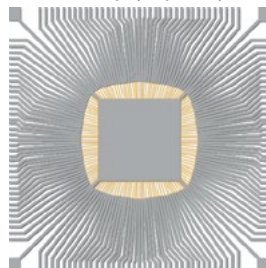
The blur filter allows a stable width measurement by eliminating unnecessary featured points other than the welded section.

■ SUBTRACTION

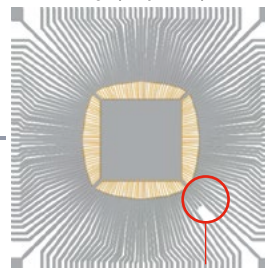
Compares the target with a preregistered master quality image to extract sections that differ. It is also possible to take individual differences in non-defective workpieces into account and adjust how much differences should be recognised as defective.

■ INSPECTION FOR A BROKEN SECTION OF A LEAD FRAME

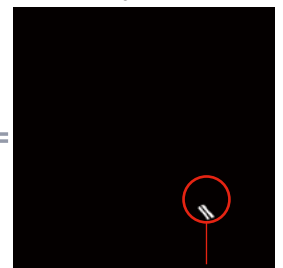
Reference image (OK product)



Current image (NG product)



Subtracted image



Defective section

Only the defective section is extracted.

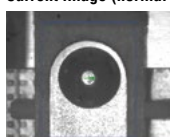
Only defective sections are extracted even for targets having complex shapes such as lead frames.

■ PRESERVE INTENSITY

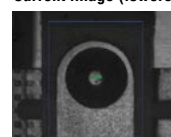
Corrects changes in image brightness due to light intensity fluctuation. This filter reduces variation in measured values caused by intensity fluctuation by correcting the brightness difference from the reference image at every capture.

■ ALIGNMENT INSPECTION FOR SCREW MOUNTING

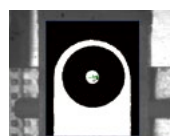
Current image (normal light)



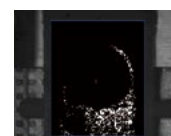
Current image (lowered light)



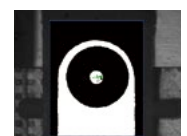
Even if light is lowered, the same binary conditions are preserved as with normal light.



Binary image



Binary image
Without preserve intensity



Binary image
With preserve intensity

ALIGNMENT/DIMENSION MEASUREMENT

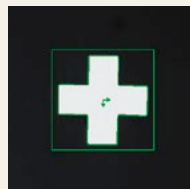
ShapeTrax™ 3

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 an alignment adjustment reference for other tools.

HIGH ROBUSTNESS

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



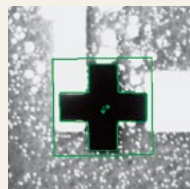
Registered image



Defect



Unclear profile



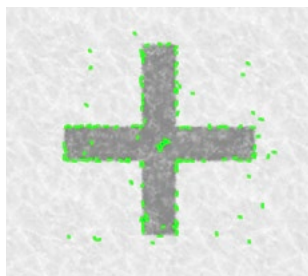
Inverted tones

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 ShapeTrax™3 for any workpiece.

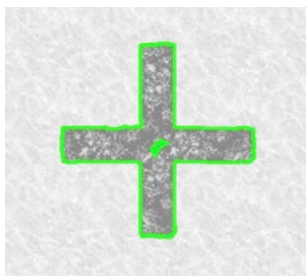
CONVENTIONAL

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



ShapeTrax™3

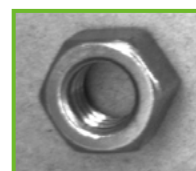
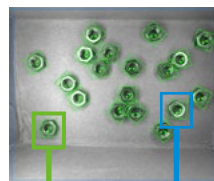
ShapeTrax™3 automatically analyses noise in images and appropriately extracts profiles as humans visualise them. Anyone can create settings to take advantage of search and use its full performance potential.



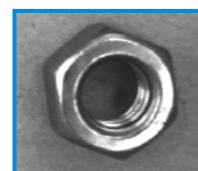
Distortion Tolerance

Configuring distortion tolerance increases detection stability by accounting for lens distortion, tilting of the search target, and other sources of distortion.

Whole field-of-view



Left boundary



Right boundary

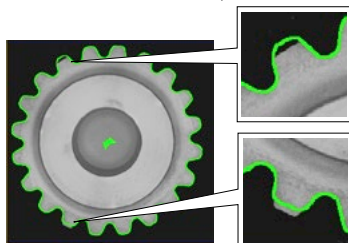
Industry-first “Responsive” Search

Rotational Direction Search NEW

For shapes such as circles or equilateral polygons, our new algorithm delivers stable, high-speed inspection of workpieces that possess special characteristics while rotating.

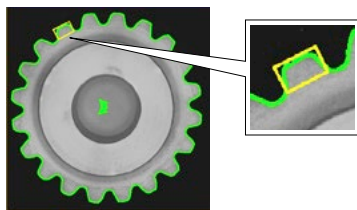
CONVENTIONAL

Stable detection of precise alignments is difficult for small teeth because they make up a relatively small proportion of the characteristics of the whole piece.



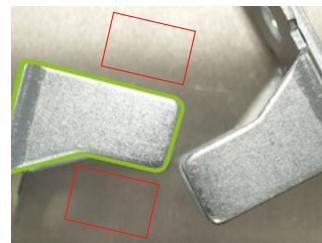
Using rotational direction search

Detecting the alignment of the target and then immediately searching for its characteristics while in rotation allows for stable, high-speed detection of even minute details and alignments.



Detection Target Selection Conditions NEW

This function can operate simultaneously with processes such as robot picking by detecting differences between one side and another based on minute details, or detecting spaces to chuck workpieces. Anyone can easily use this function, as it requires no complicated branch condition settings or calculations.



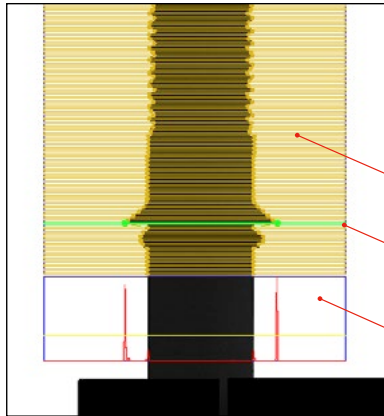
PROFILE POSITION/WIDTH

Measures up to 5000 points within one region

This tool detects up to 5000 edges within the inspection region and outputs their alignments and widths. In addition to all edge data, maximum/minimum/average widths, tip alignment, 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.

I Dimension measurement for a bolt

Capable of measuring the maximum diameter of a bolt or the core diameter of a screw thread.



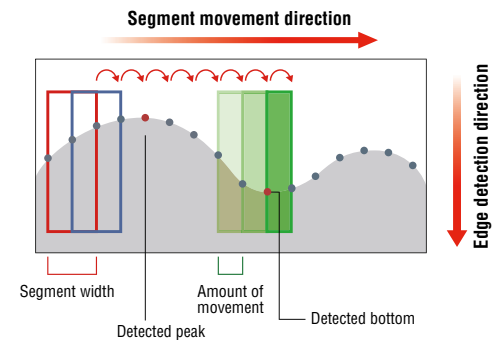
Displays edges detected for each segment and outputs the results separately.

Detects the maximum diameter.

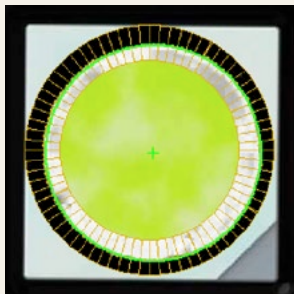
Edge intensity graphs can be checked for each segment, enabling proper setting.

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 alignment. Since the segment shift can be specified in 1/100 pixel units, all edges can be detected completely within the region.

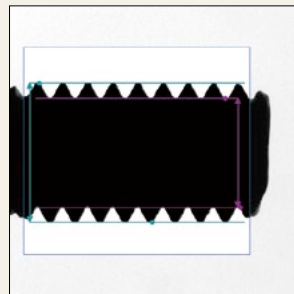


VIRTUAL CIRCLE



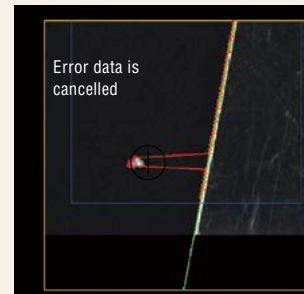
When a circular workpiece is detected, edge alignment detection is performed multiple times and used to approximate a virtual circle. This allows for stable calculation of the center alignment and diameter.

PEAK-TO-PEAK WIDTH



Multiple sets of edge data can be batch processed, and maximum, minimum and average width data acquired, allowing width between peaks to be calculated with high accuracy.

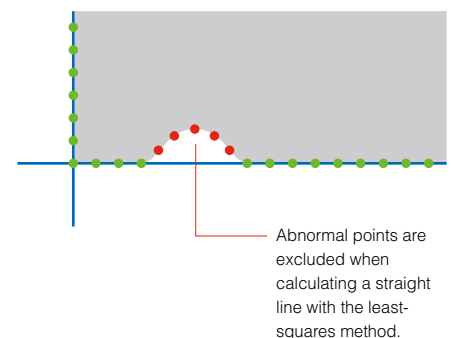
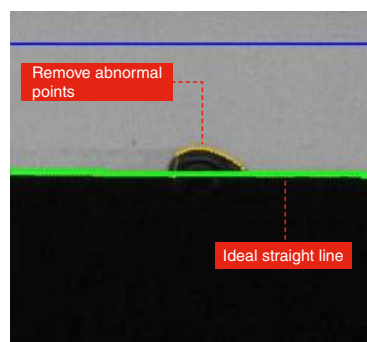
APPROXIMATE LINE



Approximating a line based on multiple sets of edge location data for the edge of a circuit board allows accurate detection of alignment.

Stable Detection with Deformation Compensation

When a straight line is drawn using the least-squares method, the measurement result can be affected by noise in the data. Turning deformation correction ON in this situation excludes unexpected noise from the measurement, resulting in stable detection.



MEASUREMENTS & DIMENSIONS 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, measurements & dimensions 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.

■ A rich variety of Measurements & Dimensions tools that allow you to “just choose”

Points Distance	Point/Line Distance	Lines Distance	Point/Circle Distance	Line/Circle Distance
Circles Distance	Line Passing Two Points	Bisection of Two Lines	Alignment Formed by Two Lines	Line/V-Line Intersection
Two Lines Intersection	Centre of Quadrangle	Midpoint of Points	Circle Passing Three Points	

■ Easy scaling with any image size

For applications where you would like actual values instead of pixel counts, it is possible to easily convert with the specialised scaling settings.

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

10.000 mm

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

MEASUREMENTS & DIMENSIONS TOOL

Settings completed by simply using the mouse

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!

APPLICATION

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

CAPACITOR

PRESS PARTS

LABEL

ID and OCR/OCV INSPECTION

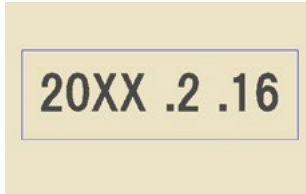
OCR2 NEW

Simple and Reliable Character Recognition Tool

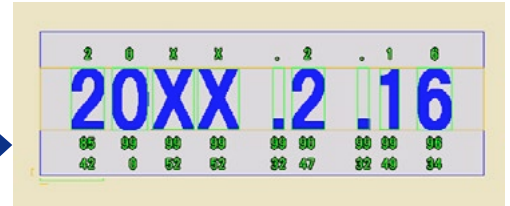
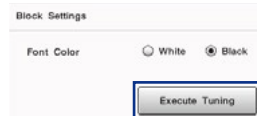
A tool that checks printed and engraved characters on products.

Simply select the area for inspection and with a press of a button, the image processing settings will automatically be tuned for the best results. Any user can set the tool up.

STEP1 Set the area



STEP2 Carry out tuning and identify characters at the click of a button!

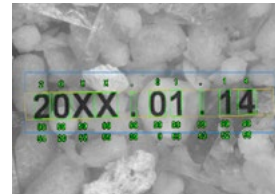


Customisable user dictionary



Built-in library can be used in combination with user-defined characters. Achieves stable ID and OCR/OCV through sub-pattern registration, even with variable print quality. The number of readable characters has also increased to 40, including the "+" symbol.

Highly robust



Achieves robust performance thanks to a newly developed algorithm, even with background noise or low contrast. Makes stable inspections possible.

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



2D CODES



DataMatrix



QR code



Simultaneous reading of barcodes and characters



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.

VISION-GUIDED ROBOTICS

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.



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

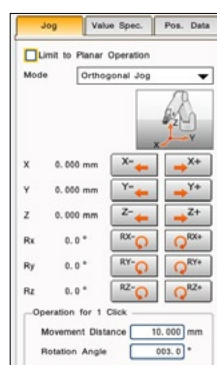
▶ High accuracy regardless of operator

▶ Calibration can immediately be executed to quickly recover from any positional shift

▶ Fast and accurate reproducibility regardless of location

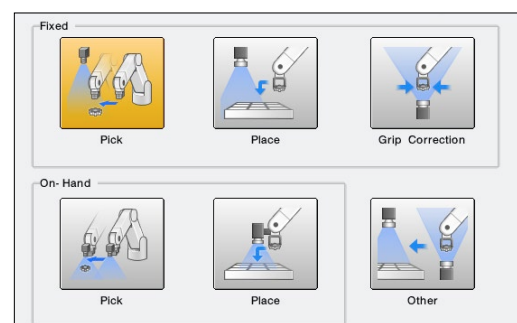
Direct communication with the robot controller (Simple connection)

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.



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.



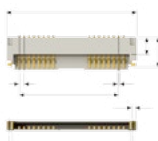
CONNECTOR INSPECTION

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

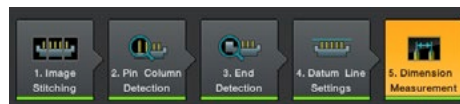


Connector inspection that requires various items to be inspected for each product type and shape

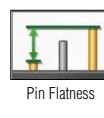
Can be completed just by following steps specific to connector inspection

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

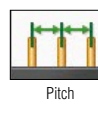
SETTING COMPLETED!



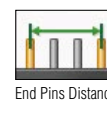
Pin Alignment Tolerance (Horizontal)



Pin Flatness



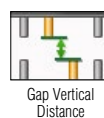
Pitch



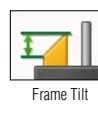
End Pins Distance



Pin Alignment Tolerance (Vertical)



Gap Vertical Distance



Frame Tilt



Housing1 Ends Distance



INSPECTION TOOLS THAT FULLY SUPPORT APPEARANCE INSPECTION

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



Connector Appearance Insp. (Trend Edge Pos.)



Connector Appearance Inspection (Area)



Connector Appearance Inspection (Blob)



Connector Appearance Insp. (Trend Edge Wd.)



Connector Appearance Inspection (Defect)



Connector Appearance Insp. (Intensity)

CONNECTOR APPEARANCE INSPECTION

"Defect", "Blob", "Area", "Intensity", "Profile Position" and "Profile 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!



IMAGE STITCHING FUNCTION

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

First image



Second image



Stitched image



Just specify a pin or stitching point

CONNECTOR ADJUSTMENT MENU



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

CONNECTOR-DEDICATED OPERATION SCREEN



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

3D INSPECTION

3D INSPECTION NEW

3D makes the impossible possible

3D measurement using height data is newly supported, including height, area, and volume measurement. Using the “height extraction” function, 3D data can be converted into a grey-scale image with the height you want to check enhanced. By applying an existing image processing algorithm to this image, inspection that has been difficult with an area camera is now enabled.



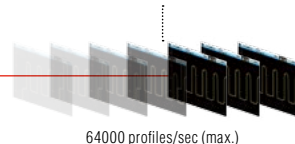
Ultra high-speed 3D shape measurement using light-section method

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

LJ-V Series



Profile data



64000 profiles/sec (max.)

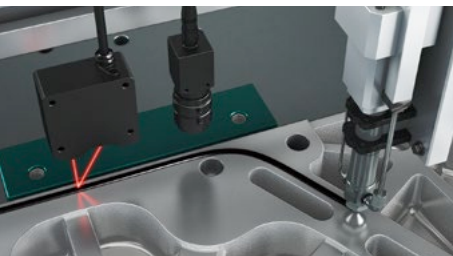
CV-X480+
CA-E100LJ/E110LJ



Conventional method: laser displacement sensor + area camera

Conventional camera + displacement sensor

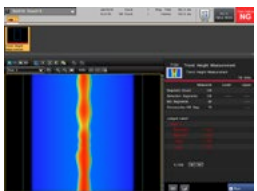
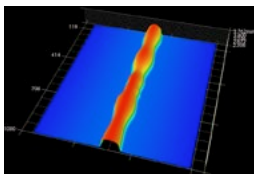
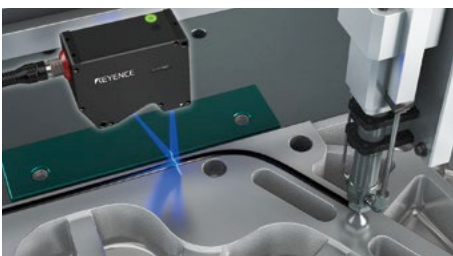
Inspects heights with a laser displacement sensor and widths and alignments with a camera. This requires adjustment of installation conditions on each device and does not synchronise data between the two devices, making volumes and section areas difficult to calculate.



3D IMAGE PROCESSING

LJ-V + CV-X480 + CA-E100LJ/E110LJ

Items to inspect can be set flexibly, including height, width, alignment, section area, and volume. Displacement of a target is also corrected in real time.



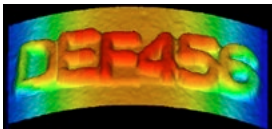
Not affected by the background

OCR FOR STAMPING ON A CAST COMPONENT

With an area camera, characters cannot be recognised stably since the background varies and stamped edge surfaces are not clear. By using 3D height information, the background can be distinguished clearly from characters.



Workpiece photo



Height image



Height extracted image + OCR

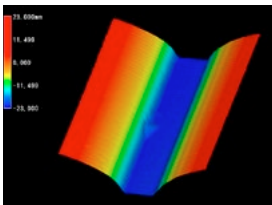
Defects on curved surfaces not missed based on height changes

FLAW DETECTION/DENT INSPECTION FOR A PLASTIC MOULD

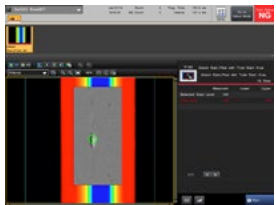
With an area camera, dents cannot be detected due to shading caused by complicated curved surfaces or concaved/convex shapes. Such detection becomes possible by extracting height change points from free-form plane information.



Workpiece photo



Height image

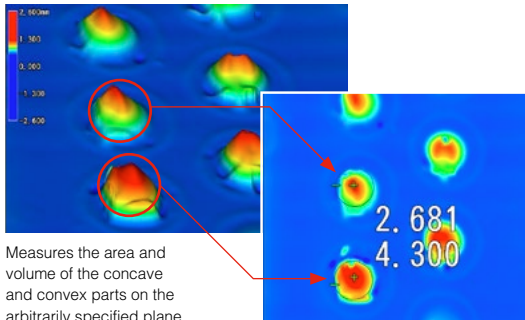


Height extracted image + defect

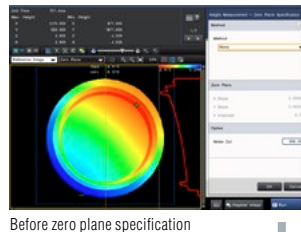
HEIGHT MEASUREMENT TOOL

Measures dimensions such as minimum/maximum heights, convex/concave areas and volumes based on 3D data. Flexible measurement is ensured since you can specify 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 plane for height measurement according to workpieces, stable measurement is ensured even if workpieces change in orientation.

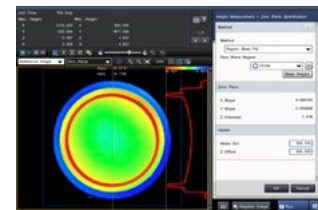
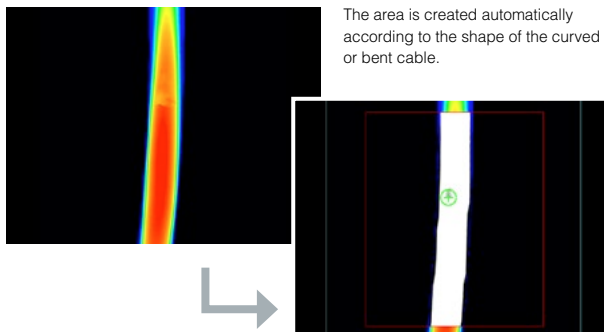


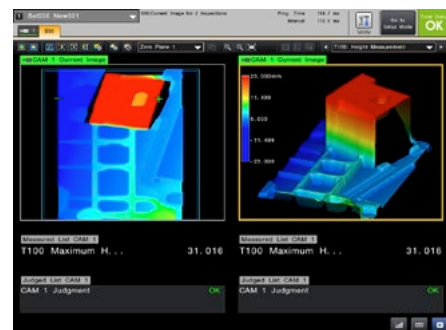
IMAGE REGION GENERATOR

Converts the specified height range into an inspection region as it is. Even if a workpiece changes in shape, a region is automatically generated according to the shape.



CONTROLLER 3D DISPLAY

A 3D image can be displayed as an operation screen. It also supports multiple screen display, such as displaying it alongside processed images, which enables operation with high visibility.

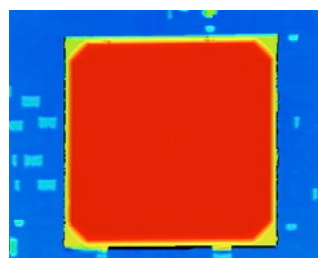


SIMULTANEOUS GREYSCALE IMAGE ACQUISITION NEW

Simultaneous processing of 2D and 3D inspections is made possible by obtaining greyscale images from LJ-V.



Height



Greyscale



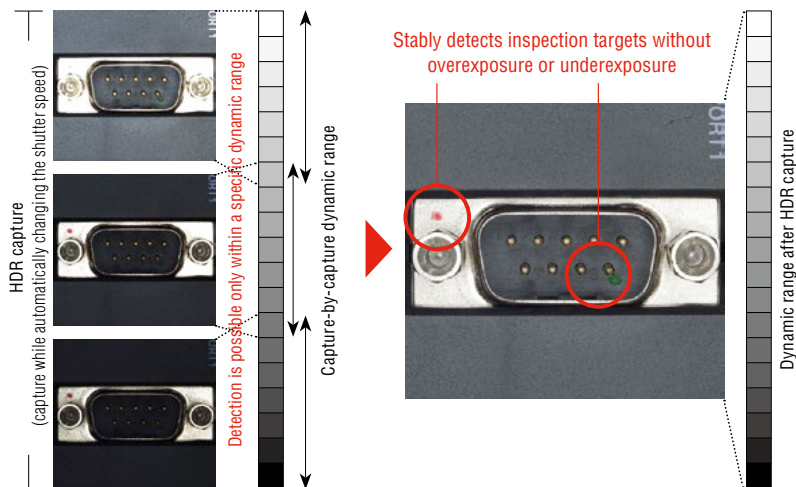
Simultaneous acquisition of height and greyscale images enables character inspection as well as alignment adjustment using images where there is no height difference, supporting a wider range of applications.

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.



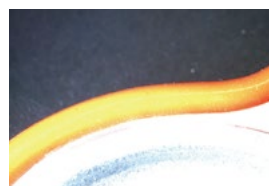
Conventional



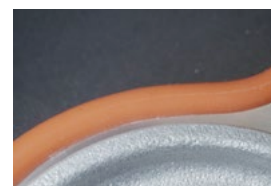
HDR capture

Lighting variation removal

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



Conventional

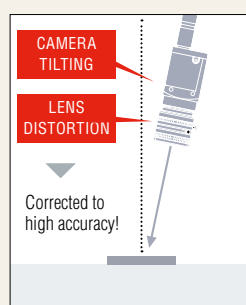


HDR capture

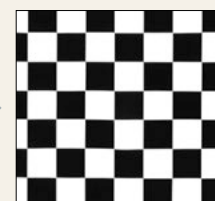
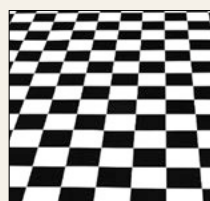
CALIBRATION

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.



CORRECTION USING A CALIBRATION PATTERN



Calibration is performed using a chessboard/dot pattern. Tilting and lens distortion are corrected simultaneously.

Corrects "tilting"

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



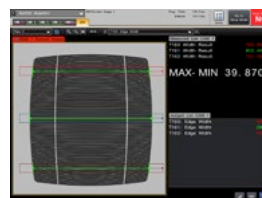
Original image



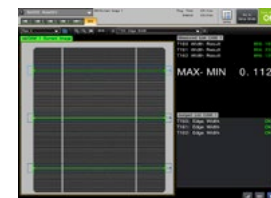
Corrected image

Corrects "lens distortion"

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



Original image



Corrected image

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.

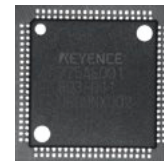
CONVENTIONAL

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.



COAXIAL LIGHT



LOW ALIGNMENT LIGHT

Lighting is switched optimally according to items to inspect, including direction marks, prints, and leads.

Image Buffer

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.

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.



IMAGE BUFFER

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.

CONVENTIONAL

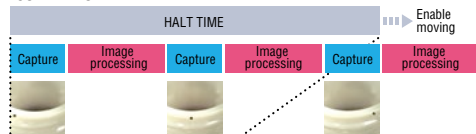
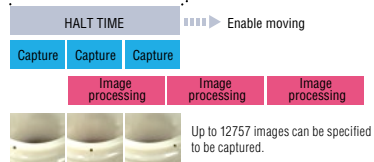


IMAGE BUFFER



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

ASYNCHRONOUS TRIGGER

Capture according to equipment movement

Asynchronous 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.

CONVENTIONAL

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



MULTI-CAPTURE

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



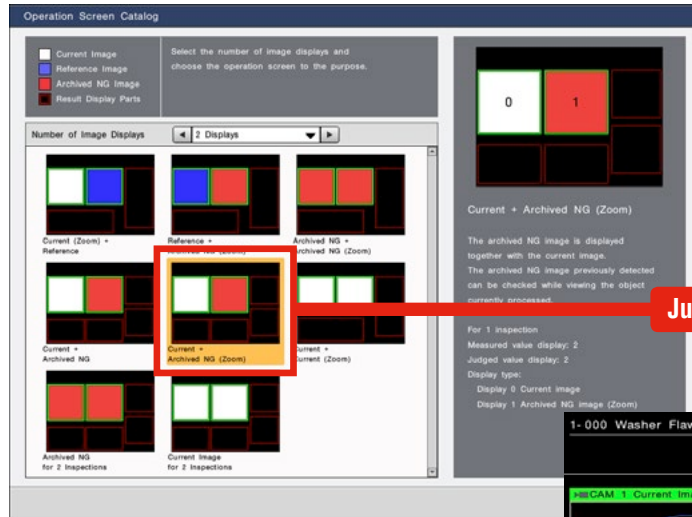
Since triggers can be input at any timing according to transfer system movement, equipment cycle time can be improved dramatically.

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

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

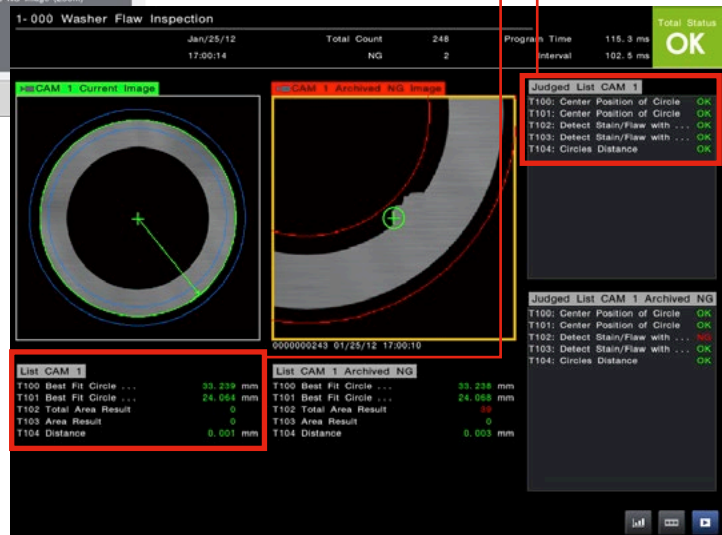
JUST SELECT THE SCREEN LAYOUT FOR THE SITUATION

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.

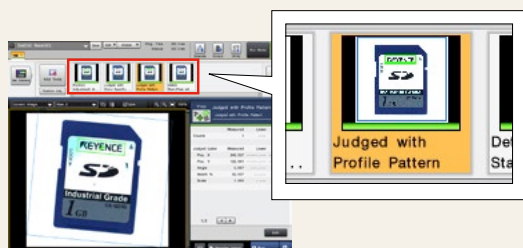
Display an image side by side with the reference image at initial setting so that changes from the start can be checked.



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.



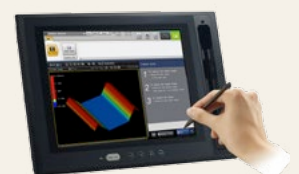
INTUITIVE OPERATION WITH A MOUSE

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 Series only)

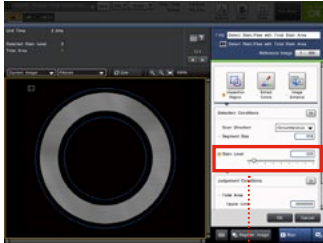
A touch panel can now be connected so that you can enhance on-site efficiency. This ensures easy operation even where a mouse is not available. Your efficiency can be improved further through combination with a custom menu.



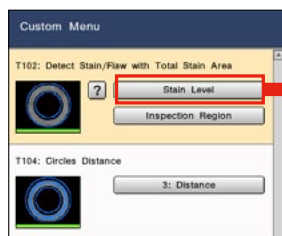
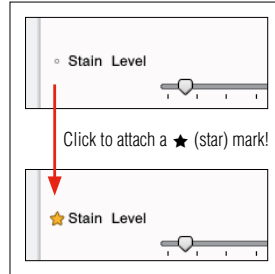
A “custom menu” that realises the optimal operation with a single click

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...

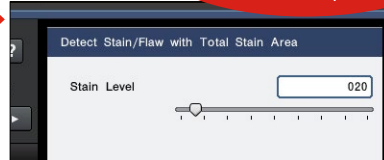


When it seems that these parameters are adjusted often...

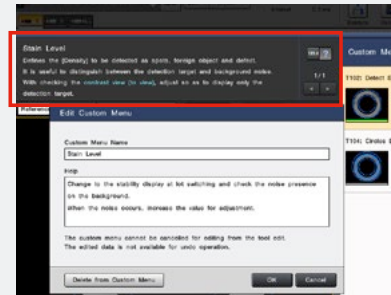


Directly open only star-marked (★) parameters

A specialised 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

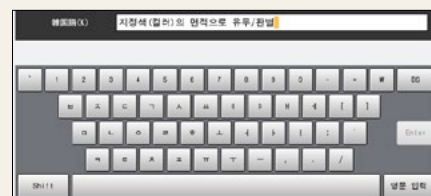
MULTI-LANGUAGE INPUT SYSTEM INCORPORATED

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

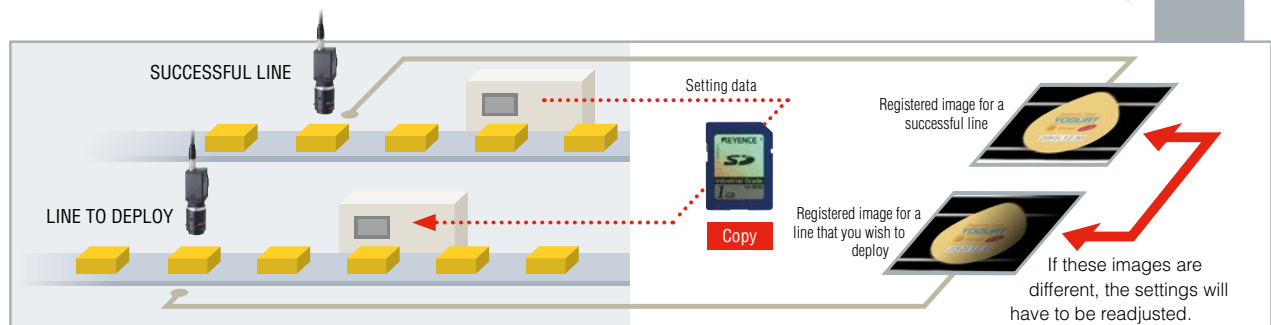
There are many useful utilities for various situations, such as “I want to add the inspection environment onto the neighbouring line as well.”, “I’m going to make adjustments due to often-occurring false detection for some reason.”, and “I want to manage the inspection process.”

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.



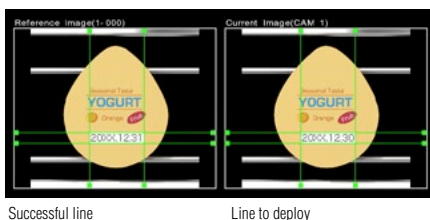
CAMERA INSTALLATION REPLICATION

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”.

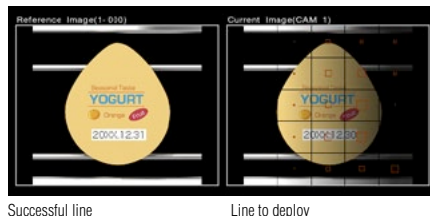
ALIGNMENT ADJUSTMENT TOOL



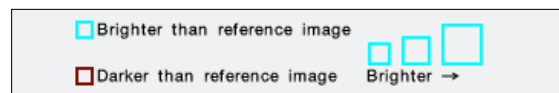
Draws grid lines in featured areas of the reference image. The alignment of the camera is adjusted using the grid lines on the current image side that is moving in tandem as a guideline.



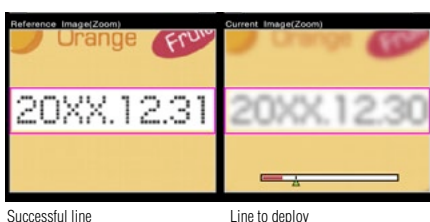
BRIGHTNESS ADJUSTMENT TOOL



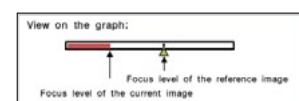
Shows areas with different brightness from the reference image in colour so that you can adjust them to reduce the difference.



FOCUS TOOL



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.



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



CONVENTIONAL

I HAVE NO IDEA WHERE I SHOULD START ADJUSTMENT

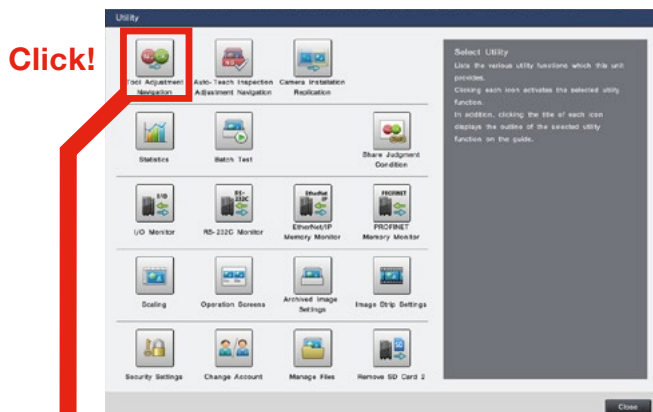
- I can't figure out which tool I should adjust...
- A alignment adjustment failure may be the cause of the false judgement...
- I'm at a loss as to which image I should adopt for correcting the tool setting...



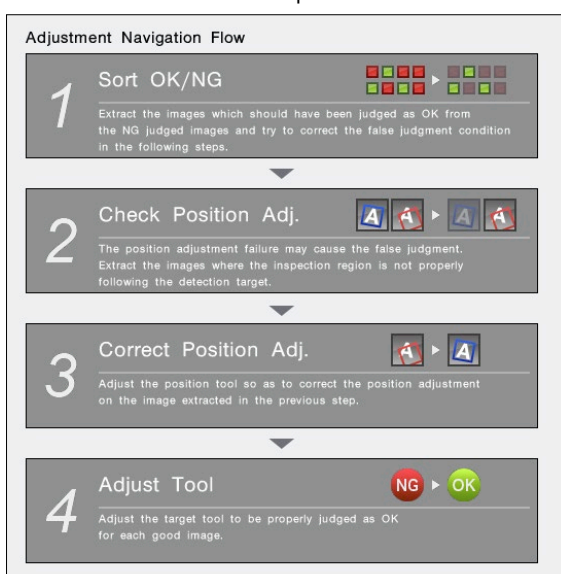
TOOL ADJUSTMENT NAVIGATION

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	

Start Adjustment

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



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

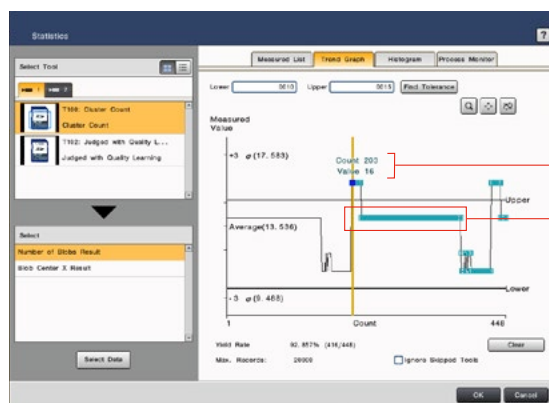
- 4 Only the images that need to be adjusted for the selected tool are extracted.

Adjust to be judged as OK		
0000000028	01/26/12	09:19:18
0000000027	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.



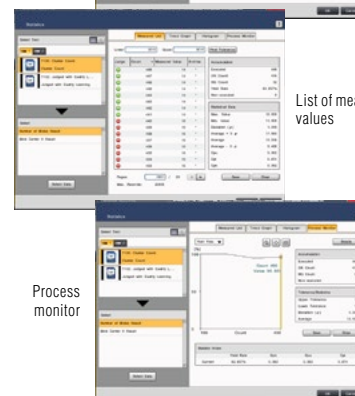
VERTICAL CURSOR

Displays the measured values and the total count for the selected cursor alignment.

IMAGE SAVE MARK

■ marked data has its image data saved. It is possible to check images by clicking.

Histogram view

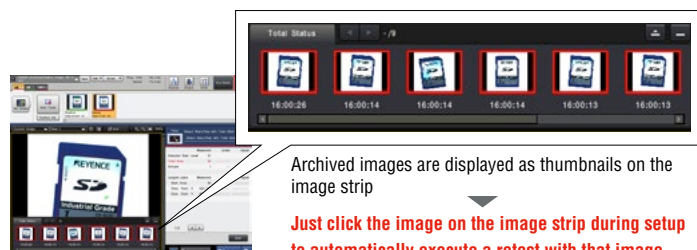


List of measured values

Process monitor

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.



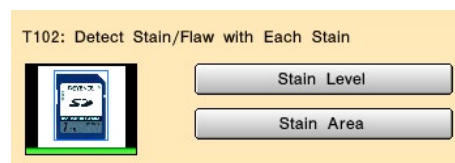
Maximum number of images* that can be saved, organised by connected camera

Camera type	Number of images saved to the internal memory		Number of images saved to the 16 GB SD card
	CV-X480	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-X480 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.

Tolerance overwrite function

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



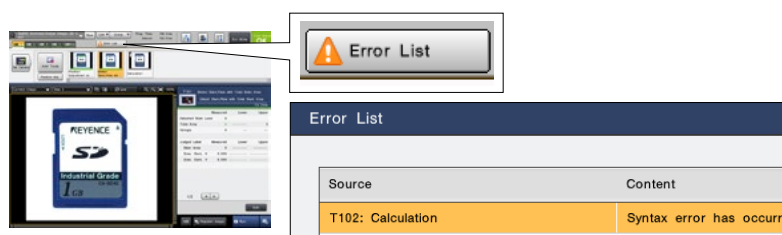
Judgement conditions sharing function

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.

No.	Share Group
0	T104, T105, T106, T107, T108, T109

Error notification

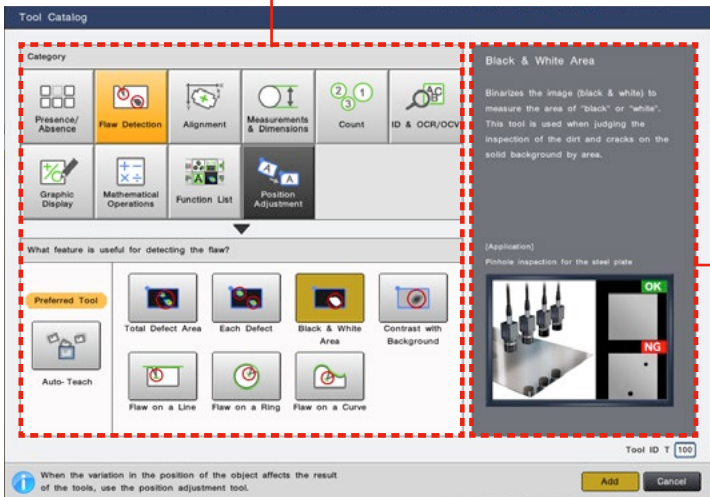
Displays setting errors in a list. It is also possible to select the error from the list screen and jump to the corresponding area.



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

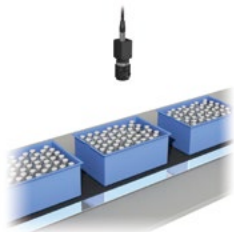
The tools have been categorised according to application, based on the longstanding knowledge of the KEYENCE CORPORATION. It allows you to intuitively find the best tool for the inspection.

APPLICATION NAVIGATOR

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

APPLICATION

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



CONVENTIONAL

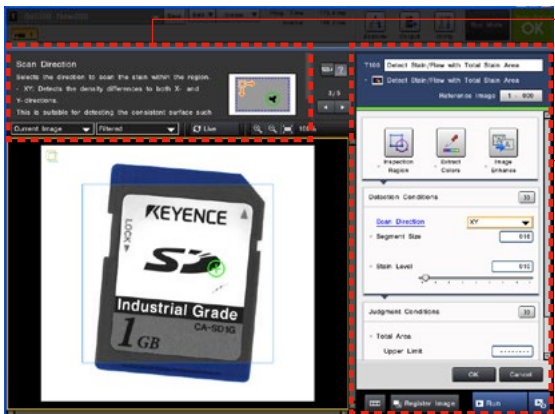
Settings cannot be performed because it cannot be reliably determined which algorithm is the best choice...



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.



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

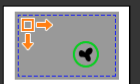
A guide function is incorporated and explains the parameter being set. By referencing the guide it is possible to check what kind of changes are occurring with the controller when adjusting the parameter.

Scan Direction

XY

Scan Direction

Selects the direction to scan the stain within the region.
- XY: Detects the density differences to both X- and Y-directions.
This is suitable for detecting the consistent surface such



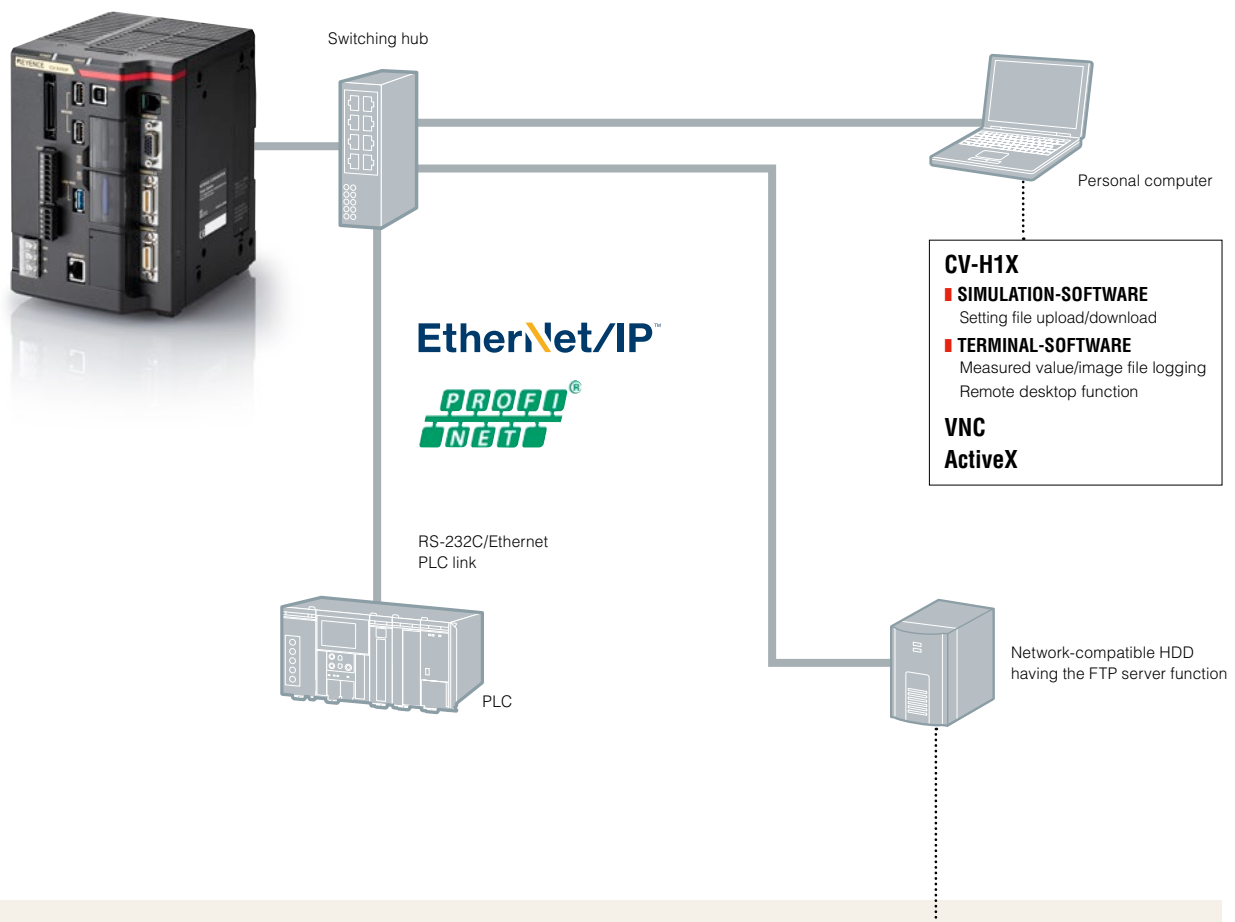
COMMUNICATION AND CONTROL

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

■ SMART MONITOR FUNCTION

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

EtherNet/IP™- and PROFINET- compatible

EtherNet/IP™



■ 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.

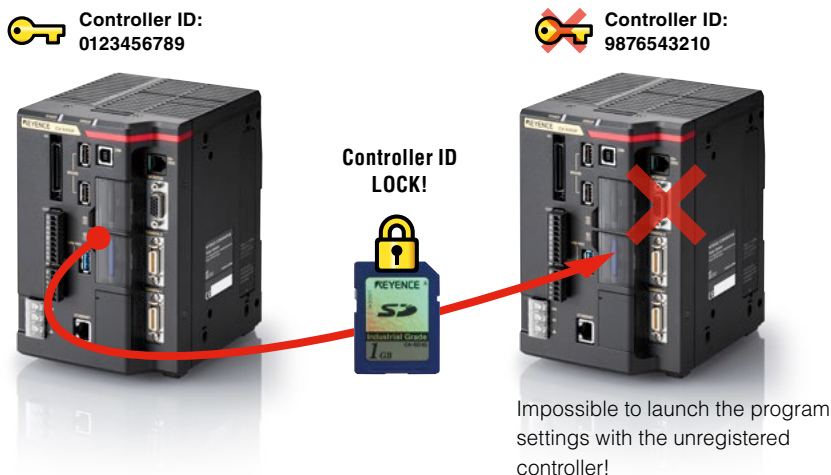
SECURITY/ACCOUNT

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.

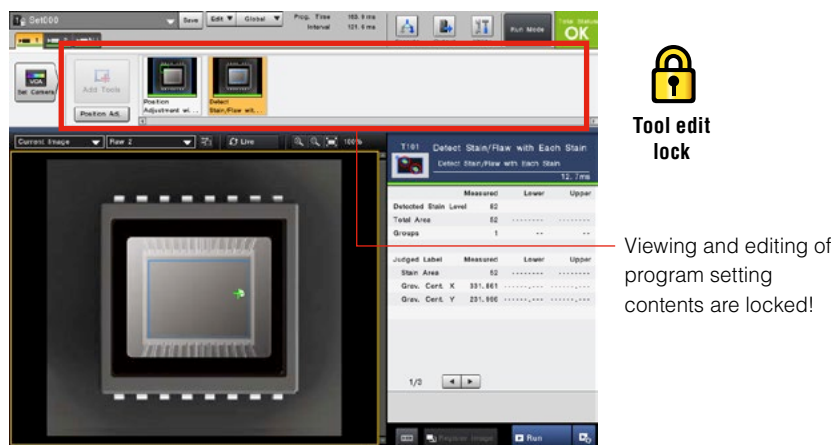
CONTROLLER ID LOCK

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...

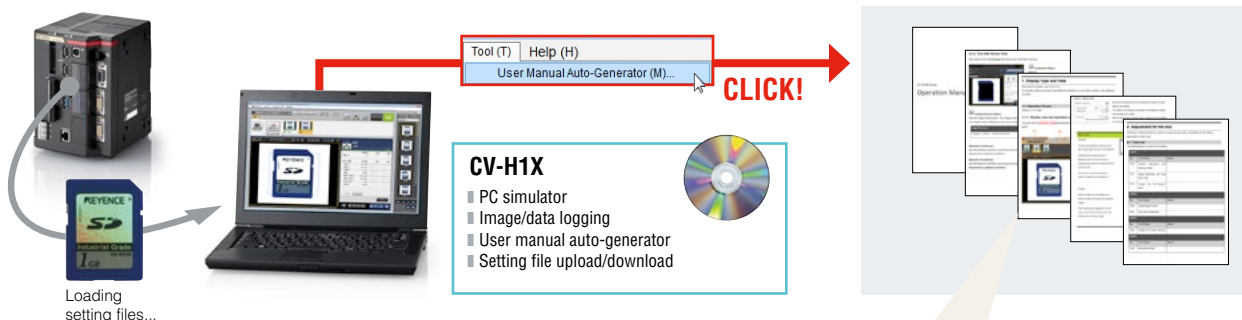


I want to have on-site operators refer to the manual but I want to summarise only the functions I need.



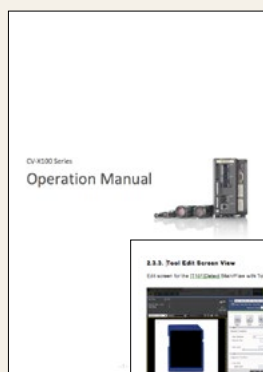
USER MANUAL AUTO-GENERATOR

CUSTOMISED MANUAL CREATION IN A SINGLE CLICK!



EXAMPLE OF CREATED MANUAL CONTENTS

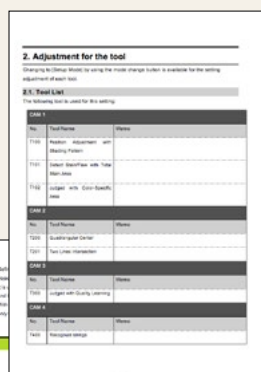
Cover sheet



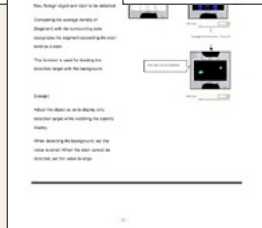
How to view the operation screen



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.

MS WORD OUTPUT

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

TOOL SETTING TIPS

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

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



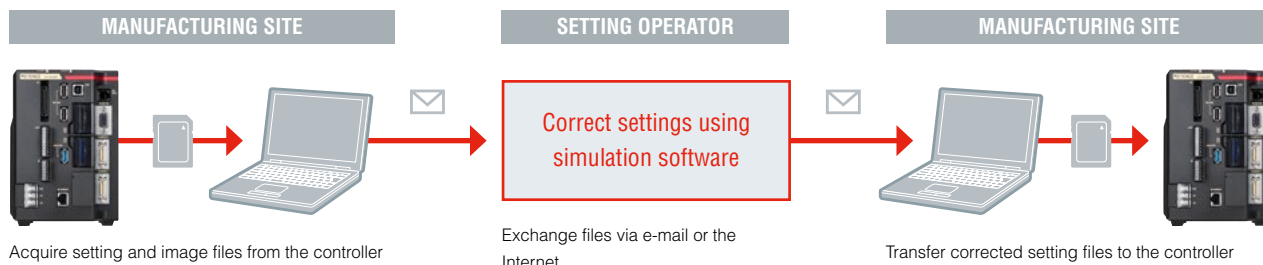
Download the setting file, including both the OK and NG images, from the controller running on site.



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.

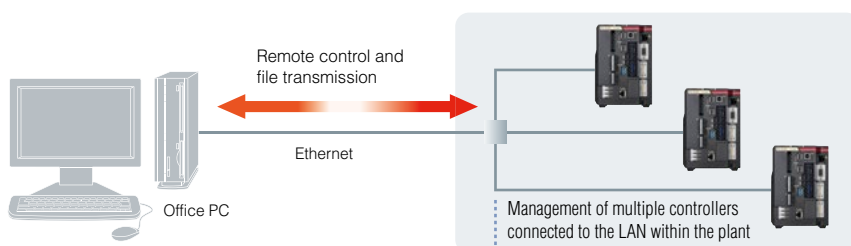


APPLICATION SAMPLE Exchange e-mail with a setting operator at a remote site



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

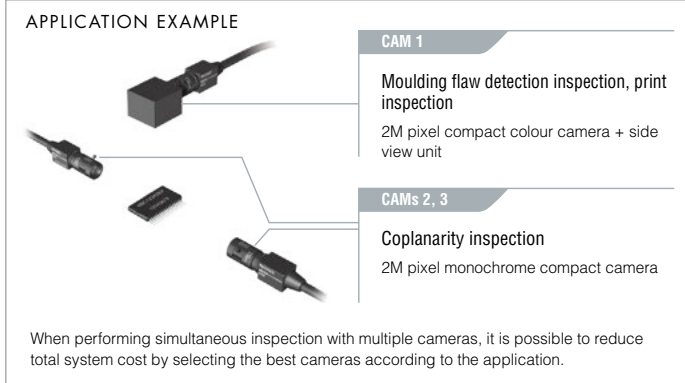
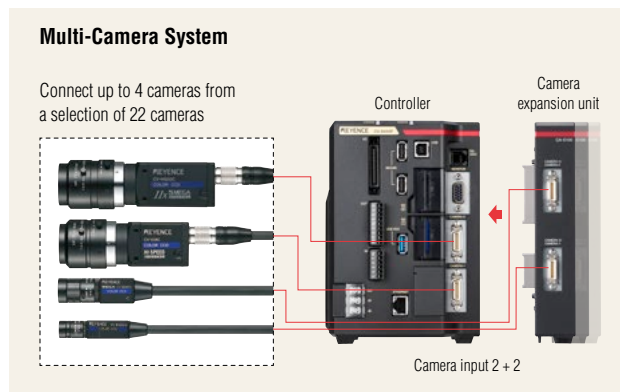
Images and measurement results on a remote controller can be acquired into your desktop PC. Using the remote desktop function, maintenance man-hours can be reduced significantly since tasks that require travel to on-site locations can be coped with remotely, including setting change for a controller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

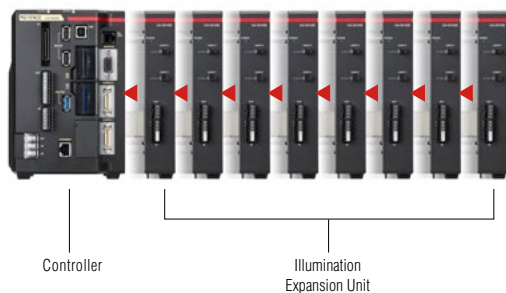
(*The expansion unit can be connected to the CV-X420/CV-X450/CV-X470/CV-X480/CV-X150/CV-X170)



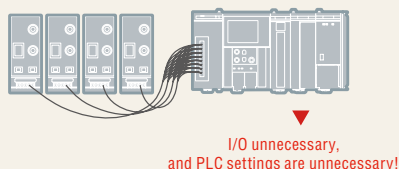
■ ILLUMINATION EXPANSION UNIT EASY LIGHT CONTROL WITHOUT CUMBERSOME WIRING

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 When the CA-DC40E is used. Max. two CA-DC50E/DC60E units out of 8 can be connected.



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



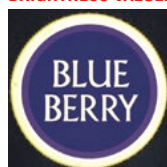
APPLICATION EXAMPLE

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.

BRIGHTNESS VALUE: 127



The optimal brightness for workpieces with low reflectivity...

If left unchanged



BRIGHTNESS VALUE: 127

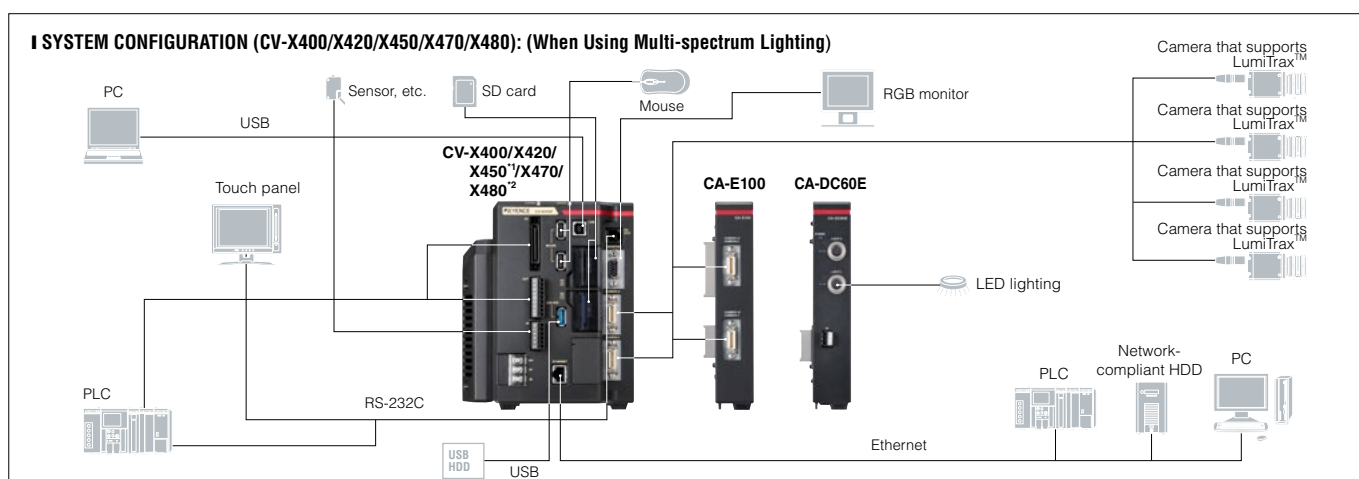
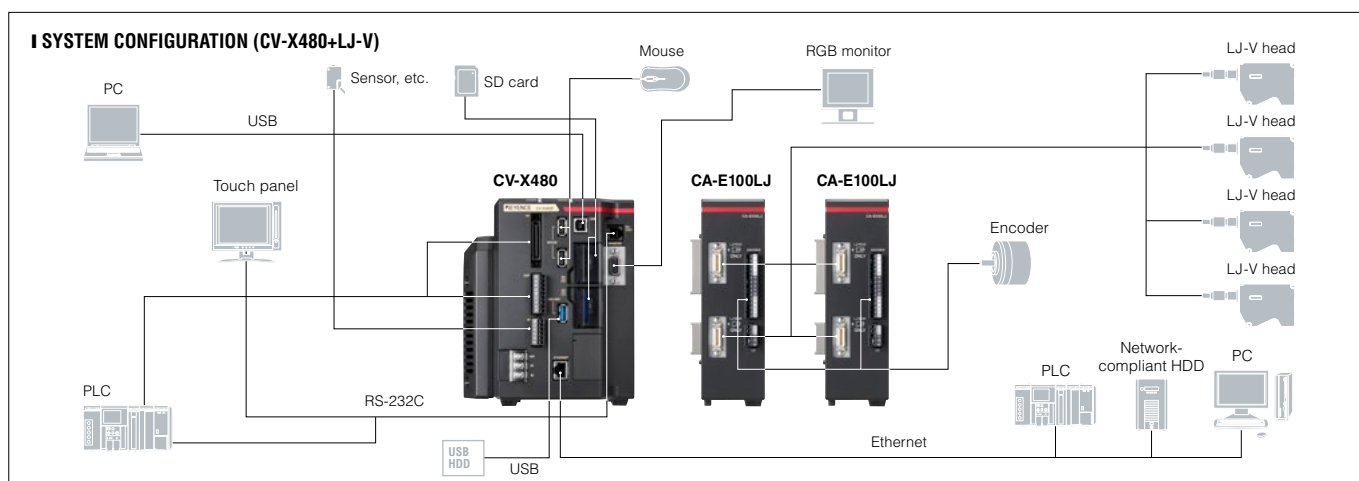
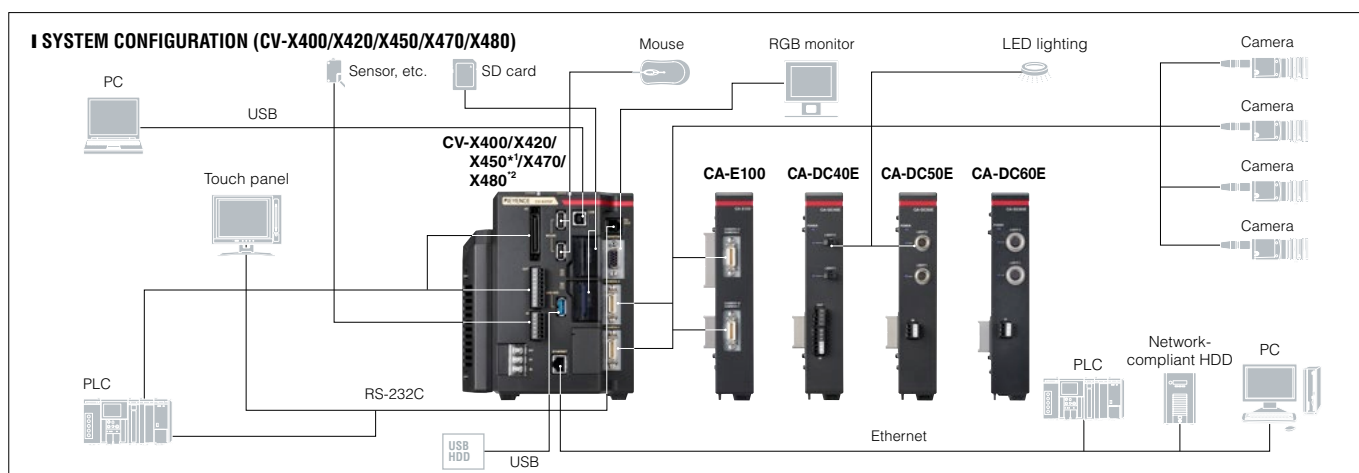
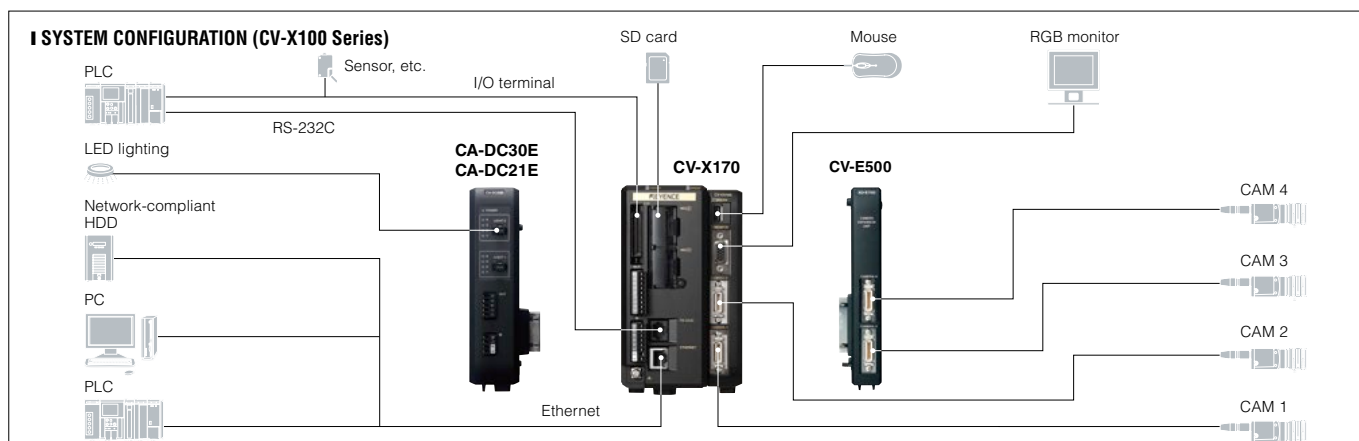
If the brightness volume remains the same, the captured image may not be optimal for inspection.

Switched to preset



BRIGHTNESS VALUE: 80

By presetting the best brightness volume according to the product type, equipment changeover will be completed with ease.



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

*2 CV-X480 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-X450

2M pixel camera
supporting type
CV-X420

0.47M pixel camera
supporting type
CV-X400



21M pixel camera
supporting type
CV-X470



21M pixel camera/
LJ-V supporting type
CV-X480



5M pixel camera
supporting type
CV-X170

2M pixel camera
supporting type
CV-X150

0.47M pixel camera
supporting type
CV-X100

Accessories



Mouse
(Accessory)



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

Windows 10 (Home/Pro/Enterprise)

Windows 7 (Home Premium/Professional/Ultimate/Enterprise)

Supported OS languages: English, Japanese, Chinese (Simplified and Traditional), Korean, Thai, German, French, Italian, Spanish, Indonesian, Portuguese (Brazilian) and Vietnamese
Only the 64-bit version is supported

* Microsoft and Windows are either trademarks or registered trademarks of Microsoft Corporation in the United States and/or other countries. Other company names and product names are also registered trademarks and/or trademarks of the respective companies.

* CV-H1X is not included in the controller. It can be downloaded from our support site or a software disk can be sent out via the sale representative, contact KEYENCE for details.

Area camera



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



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



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

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

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

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

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



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

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



Light control
expansion unit with
multi-spectrum
lighting support
CA-DC60E

Dedicated to the
CV-X400 Series



Camera
expansion
unit
CV-E500

Dedicated to the
CV-X100 Series



LED light control
expansion unit
CA-DC21E

Dedicated to the
CV-X100 Series



Light control
expansion unit
that supports
CA-DC30E

Dedicated to the
CV-X100 Series

Programmable Encoder



Dedicated encoder
CA-EN100H



Encoder relay unit
CA-EN100U

Included Accessories:
RS-422 Cable (2.5 m)
RS-232C Straight Cable (2.5 m)



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

Optional accessories

Camera cable



L-type connector

List of models

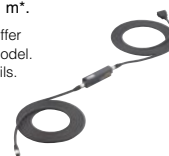
Cable type	Connector shape	Cable length					
		1 m	3 m	5 m	10 m	17 m	Extension cable
Standard	Straight	CA-CN1	CA-CN3	CA-CN5	CA-CN10	CA-CN17	—
	L-type	—	CA-CN3L	CA-CN5L	CA-CN10L	CA-CN17L	—
High-flex cable	Straight	—	CA-CN3R	CA-CN5R	CA-CN10R	CA-CN17R	CA-CN7RE (7 m)
For high-speed camera	Straight	—	CA-CH3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



Repeater for camera cable extension
CA-CN10U
 (for normal cameras)
CA-CH10U
 (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.

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
Number of pixels											
For high-speed camera	CA-CH10	✓	✓	✓	✓	—	—	✓	✓	—	—
	CA-CH5	✓	✓	✓	✓	—	—	✓	✓	—	—
	CA-CH3	✓	✓	✓	✓	—	—	✓	✓	—	—
For normal cameras	CA-CN17	—	—	—	—	—	—	—	—	✓	✓
	CA-CN10	—	—	—	—	✓	✓	—	—	✓	✓
	CA-CN5	—	—	—	—	✓	✓	—	—	✓	✓
	CA-CN3	—	—	—	—	✓	✓	—	—	✓	✓
	CA-CN1	—	—	—	—	✓	✓	—	—	✓	✓

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:

OP-87264 (3 m touch panel modular RS-232C cable)

OP-87265 (10 m touch panel modular 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**

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)



USB cable
OP-66844 (2 m)

Other



Dedicated 24 VDC power source
CA-U4
CA-U5



Mouse stand
OP-87601

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

SCAN THIS CODE TO ACCESS THE WEB



www.keyence.com/machinevision



Please visit: www.keyence.com



SAFETY INFORMATION

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

GLOBAL NETWORK

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SWITZERLAND
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TAIWAN
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THAILAND
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UK & IRELAND
Phone: +44 (0) 1908-696-900

USA
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VIETNAM
Phone: +84-4-3772-5555