KEYENCE

Intuitive Vision System

CV-X Series

Power Meets Simplicity

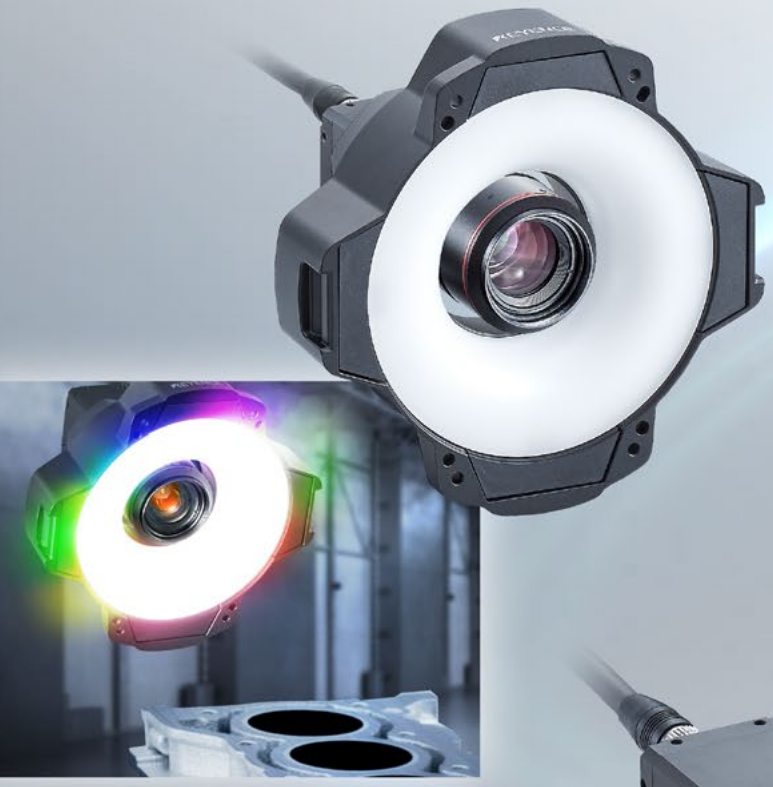
CV-X Series

One system does it all!
Reliable solutions for all inspection needs

CV-X is a global standard model with the latest algorithms embodied in a user-friendly design.
The CV-X Series offers solutions to any of your inspection needs and stable operation at any manufacturing site.

Multi-Spectrum Image Capture

Accurately captures the slightest contrast difference
utilising 8 wavelengths of coloured light



Intuitive Vision System
CV-X Series

Area Cameras

Resolution up to 64 megapixels
A vast camera lineup to satisfy any application need

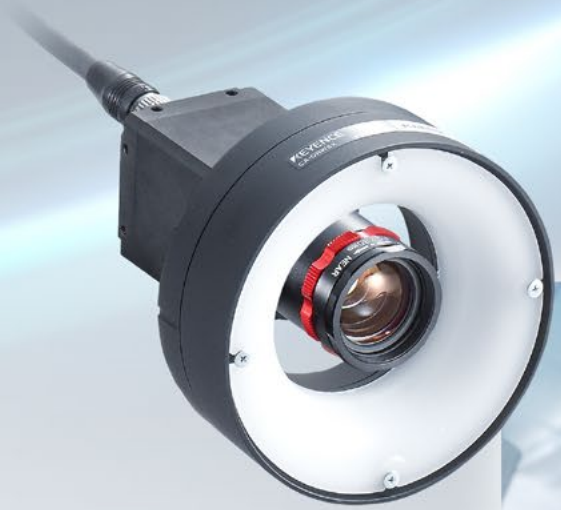
CONTACT YOUR NEAREST OFFICE FOR RELEASE STATUS

Pattern Projection Lighting

Simultaneous 2D + 3D inspection enables stable detection with the addition of height data

Vision-Guided Robots

Supports direct communication with robots from many manufacturers
Features a new search algorithm (ShapeTrax™3)



LumiTrax™

Fusion of intelligent camera, light and inspection algorithm

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

HDD-less

CV-X400 Series



		High-speed model for area cameras			Model compatible with high-resolution cameras	
Model		CV-X400	CV-X420	CV-X450	CV-X470	CV-X480F	CV-X490F
Main image processor		3-core DSP			7-core DSP		
Max. no. of connectable cameras		2	4				
Supported cameras	0.31 to 0.47 megapixels	✓	✓	✓	✓	✓	✓
	2 megapixels	—	✓	✓	✓	✓	✓
	5 megapixels	—	—	✓	✓	✓	✓
	21 megapixels	—	—	—	—	✓*1	✓
	64 megapixels	—	—	—	—	—	✓

*1 LumiTrax™ image capture is not supported

ALL MODELS ARE HDD-LESS

HDD-less

CV-X300 Series

		Standard model for area cameras		
Model		CV-X300	CV-X320	CV-X350
Main image processor		2-core DSP		
Max. no. of connectable cameras		2	4	
Supported cameras	0.31 to 0.47 megapixels	✓*1	✓*1	✓*1
	2 megapixels	—	✓*1	✓*1
	5 megapixels	—	—	✓*1

*1 LumiTrax™, Multi-Spectrum, and Pattern Projection functions not supported

CONTACT YOUR NEAREST OFFICE FOR RELEASE STATUS

CAMERAS SELECTABLE
DEPENDING ON INSPECTION NEEDS

A vast lineup of area cameras selectable according to production line speed, installation space, and inspection target.

With cameras up to 64 megapixel resolution, the optimal pixel count, size and speed can be selected to address any application challenge that arises.

	64 megapixel camera	21 megapixel camera	5 megapixel camera	
		 LumiTrax™	 LumiTrax™ / Multi-Spectrum / Pattern Projection	 IP64 rated
Model	CA-HF6400M/CA-HF6400C	CA-HF2100M/CA-HF2100C	CA-H500MX / CA-H500CX	CA-H500M / CA-H500C
Specifications	90× speed monochrome / 88× speed colour	85× speed monochrome / 85× speed colour	16× speed high-performance monochrome / 16× speed high-performance colour *1	16× speed environment-resistant monochrome / 16× speed environment-resistant colour *2
Capture range	8192 × 7808 pixels	5104 × 4092 pixels	2432 × 2040 pixels	2432 × 2050 pixels
Transfer time	57.6 ms/59.2 ms	20.2 ms	27.7 ms / 29.2 ms	28.4 ms

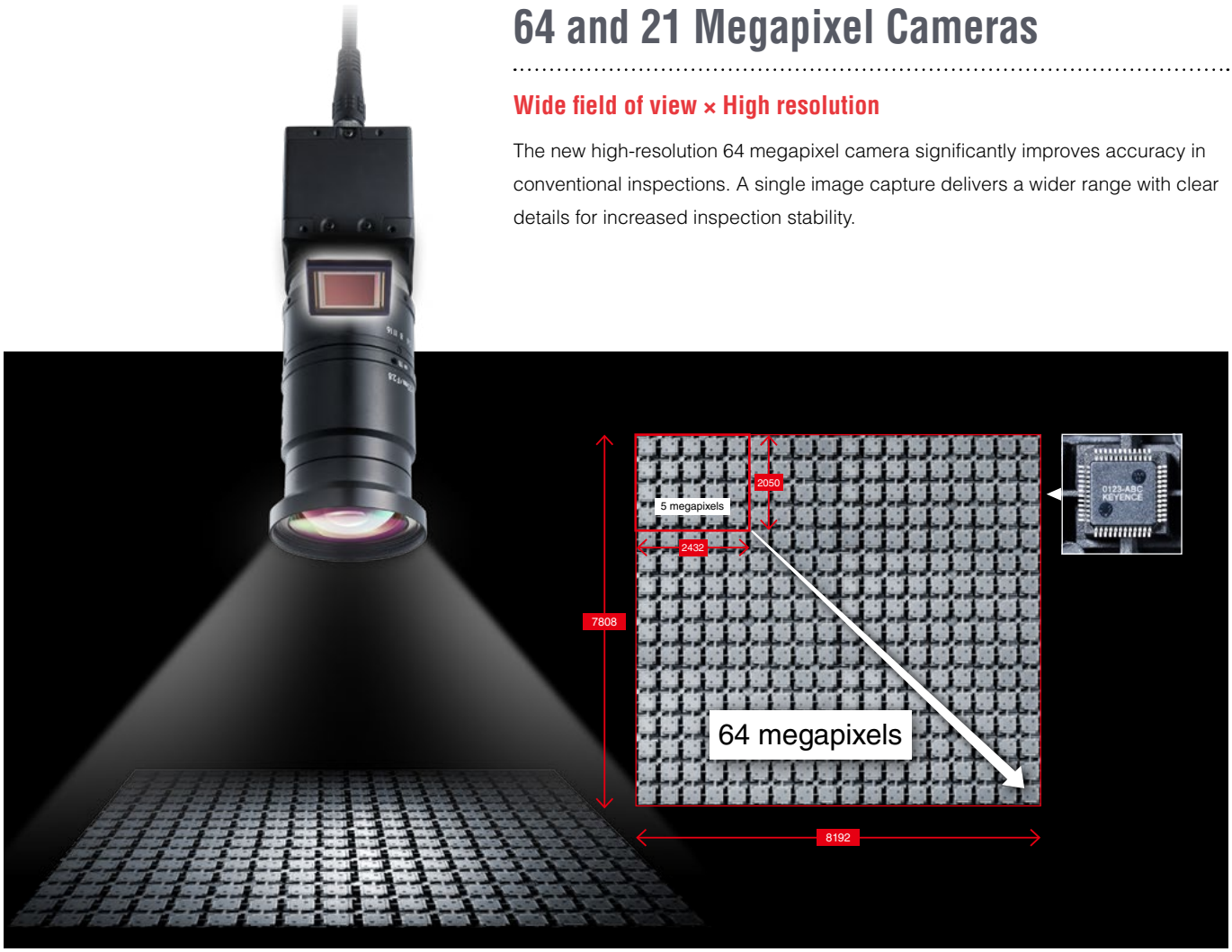
	2 megapixel camera			
	 LumiTrax™ / Multi-Spectrum / Pattern Projection	 IP64 rated	 IP64 rated	
Model	CA-H200MX / CA-H200CX	CA-H200M / CA-H200C	CA-200M / CA-200C	CA-HS200M / CA-HS200C
Specifications	16× speed high-performance monochrome / 16× speed high-performance colour *1	16× speed environment-resistant monochrome / 16× speed environment-resistant colour *2	Environment-resistant monochrome / Environment-resistant colour *2	16× speed compact monochrome / 16× speed compact colour
Capture range	1600 × 1200 pixels	1600 × 1200 pixels	1600 × 1200 pixels	1600 × 1200 pixels
Transfer time	11.7 ms	11.8 ms	56.5 ms	14.2 ms

	0.31 to 0.47 megapixel camera			
	 LumiTrax™ / Multi-Spectrum / Pattern Projection	 IP64 rated	 IP64 rated	
Model	CA-H048MX / CA-H048CX	CA-H035M / CA-H035C	CA-035M / CA-035C	CA-HS035M / CA-HS035C
Specifications	16× speed high-performance monochrome / 16× speed high-performance colour *1	16× speed environment-resistant monochrome / 16× speed environment-resistant colour *2	Environment-resistant monochrome / Environment-resistant colour *2	7× speed compact monochrome / 7× speed compact colour
Capture range	784 × 596 pixels / 512 × 480 pixels	640 × 480 pixels	640 × 480 pixels	640 × 480 pixels
Transfer time	2.9 ms / 1.7 ms	2.9 ms	16.5 ms	4.5 ms

*1 With the CV-X400, colour cameras support LumiTrax™ and Pattern Projection modes, and monochrome cameras support LumiTrax™, Multi-Spectrum, and Pattern Projection modes.

*2 Use with KEYENCE-specified IP64-rated lens and environment-resistant cable to use as an IP64-rated environment-resistant camera.

ULTRA-HIGH-RESOLUTION CAMERAS



64 and 21 Megapixel Cameras

Wide field of view × High resolution

The new high-resolution 64 megapixel camera significantly improves accuracy in conventional inspections. A single image capture delivers a wider range with clear details for increased inspection stability.

High-accuracy inspection over a wide field of view

Valid pixel count:
64 million pixels

Take advantage of high-accuracy inspections over a wider field of view with 12.8 times more pixels than a 5 megapixel camera. The global shutter allows inspection even on production lines with moving targets.

Usable with high-speed lines

Image transfer time:
57.6 ms

The image-transfer frequency of 1.1 GHz—over 5 times that of conventional systems—opens the door to high-speed, ultra-resolution inspections that were not possible before. This increased speed also allows for LumiTrax™ support with the 21 megapixel model.

Simplified installation

Built-in
angle sensor

Despite the high pixel count, the camera retains the same physical size as conventional models. The camera is also equipped with an angle sensor that provides powerful support for installation and notifies users of any misalignment.

More Pixels and Faster Operating Speeds

Transfer images up to 5.6 times faster (based on comparison with CA-H2100x) for improved inspection accuracy even with high-speed lines.

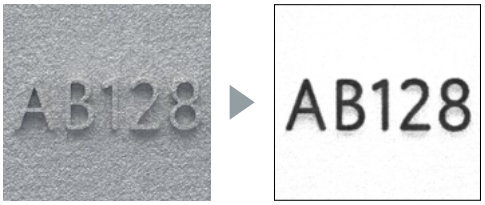
Image transfer time comparison (KEYENCE cameras)

LumiTrax™ Support

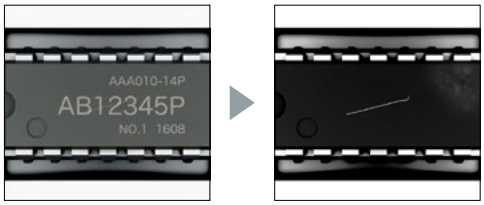
High-speed control of directional lighting for advanced imaging

When using 21 megapixel mode

▮ Stamping identification on cast products



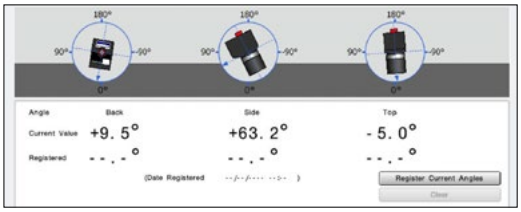
▮ Defect inspection for IC moulds



Drastically Simplifying Camera Installation

The angle sensor quantifies the installation angle for simpler initial installation and also notifies users of any camera misalignment during operation, ensuring the shortest-possible recovery time if a problem occurs.

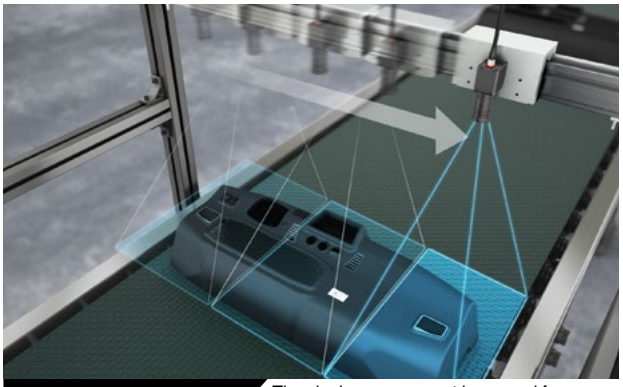
* The angle sensor checks for misalignment when the power is turned on and when settings are changed.



Simplified Inspections with Greater Accuracy

Wide field of view for shortened inspection time

Automobile instrument panel inspection

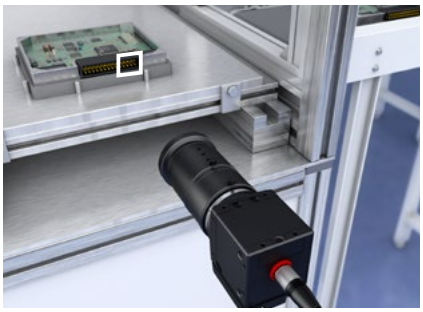


Conventional camera The single camera must be moved for inspection.

High-resolution camera Imaging of the entire target is possible with just one camera.

Clear imaging of every detail for stable inspection with just one camera

PCB connector inspection



Conventional camera The resolution is insufficient for inspection.

High-resolution camera Detailed inspection is possible.

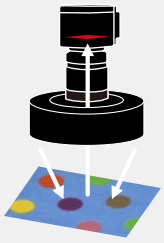
MULTI-SPECTRUM IMAGE CAPTURE

A Fusion of 8 Coloured Lights and an Inspection Algorithm

Multi-spectrum lighting incorporates LEDs in eight colours and dedicated control circuit. Colour or directional lighting control is automatically synchronised with an ultra high-speed camera without any complicated programming. Outstanding control of colour, shape, gloss, and target variability in three different modes thanks to a combination of multi-spectrum illumination and powerful algorithms.

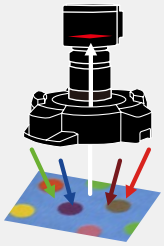
STANDARD COLOUR VS. MULTI-SPECTRUM PROCESSING

Colour camera

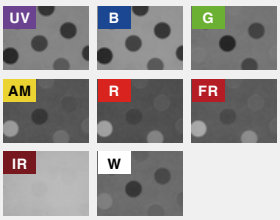


The imaging element receives white light reflected from the target through a colour filter. This data is then used to create a colour image.

Multi-Spectrum Image Capture

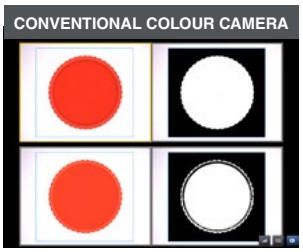


Colour analysis is performed for every pixel based on eight grey-scale images taken at different wavelengths.

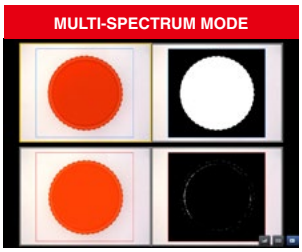


Colour — Accurate Sorting, Even between Slight Colour Differences

Inspection of Various Types of Plastic Caps



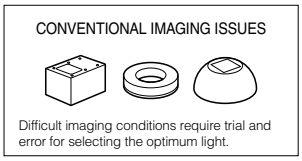
Although some differences are noticeable, the extracted colours are largely the same.

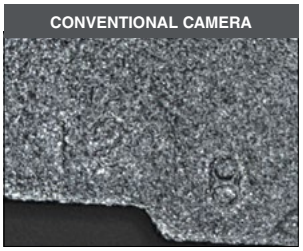


Differences in colour are clearly defined.

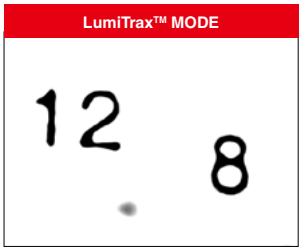
Shape — Detect Changes in Height with Directional Lighting

Stamped Character Inspection on Metal Casting





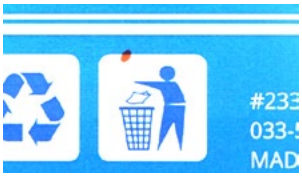
Surface conditions interfere with extraction.



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

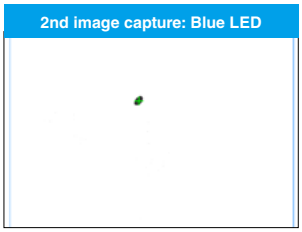
Target Variability — Lighting conditions can be optimised for each target depending on the colour conditions

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.

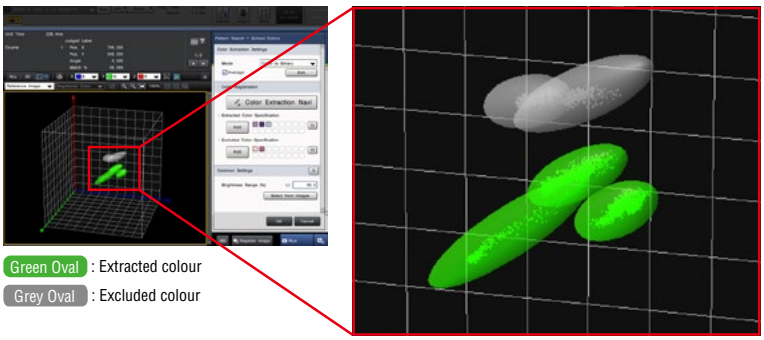
HARDWARE THAT SUPPORTS INSPECTION STABILITY

- Built-In Dedicated Illumination Control Circuit
- Ultra, High-Speed CMOS camera and Dedicated Control Circuit CA-HxX 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.



Green Oval : Extracted colour
Grey Oval : Excluded colour

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

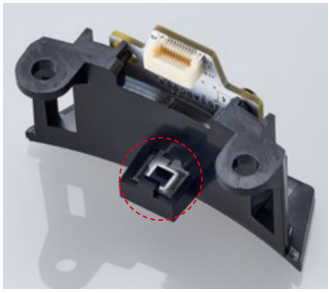
Up to 32 individual colours can be stored. This makes it possible to perform adjustment, even during operation, while keeping the existing settings.

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.

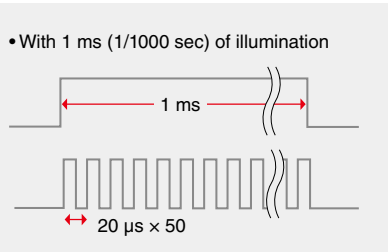
Real-Time Intensity Feedback Function

A built-in photodiode and real-time intensity control circuit provide LED emission level feedback control. Maintaining original brightness prevents deterioration in inspection capability due to LED degradation over time.



Photodiode and correction circuit within the lighting

Illumination Time Chart



For every illumination, monitoring and feedback are performed every 20 µs 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-HxX Camera
Equipped with ultra high-speed imaging CMOS sensor and dedicated control IC

+

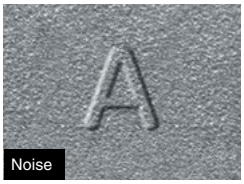
CA-DRWxX/CA-DRMxX/ CA-DQW40X Lighting
Equipped with ultra high-intensity LED and circuit for separate lighting control

+

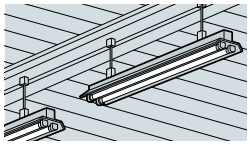
CV-X400 Controller
Analyses multiple images instantaneously to create shape and texture images

CONVENTIONAL IMAGING PROBLEMS

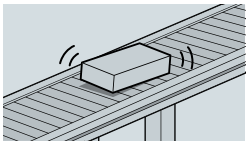
- Various surface conditions



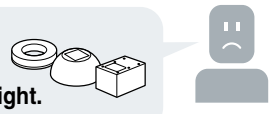
- Influence of the surrounding environment (ambient light)



- Workpiece orientation changes caused by transfer conditions

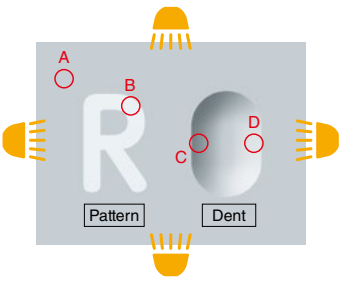


Trial and error must be performed to select the optimum light.

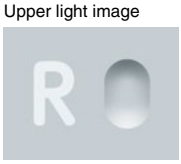


LumiTrax™ processing

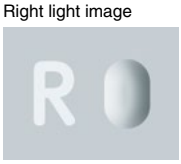
1. Lights are emitted from different directions and imaging is performed at ultra high speed.



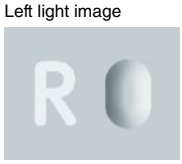
Upper light image



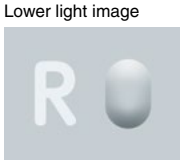
Right light image



Left light image

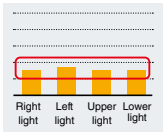


Lower light image

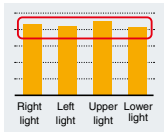


2. The changes in light intensity of each pixel among the different images are analysed to split the shapes (irregularities) and textures (pattern) into separate images.

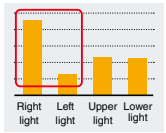
Pixel A light intensity



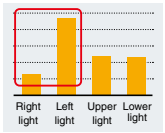
Pixel B light intensity



Pixel C light intensity

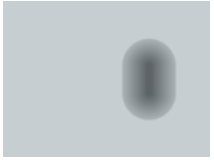


Pixel D light intensity



Texture image

Shape image

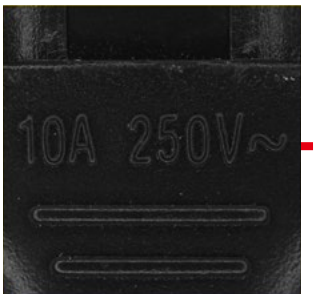


LumiTrax™ TUNING

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.

Optimised set-up is complete!

BEFORE



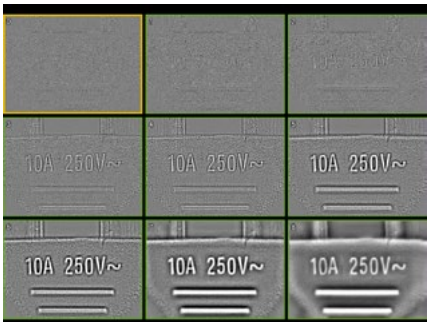
AFTER

STEP 1
Select inspection target

Presence/ Absence | Flaw detection | ID and OCR/OCV (Raised Char.) | ID and OCR/OCV (Incised Char.)

First, select the target for the inspection.

STEP 2
Select the most appropriate feature size

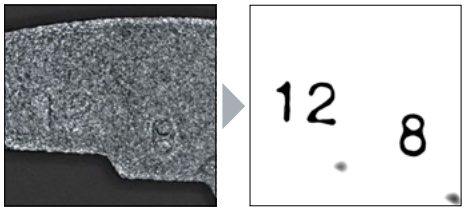


STEP 3
Select the optimal contrast

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

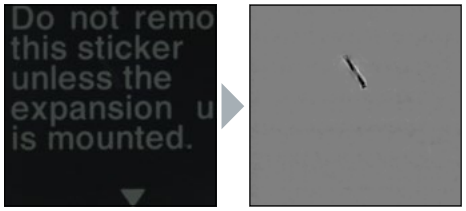
Application examples (1) Extracting only the shape (irregularities) information regardless of the surface conditions

Metal casting surface carved seal inspection



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

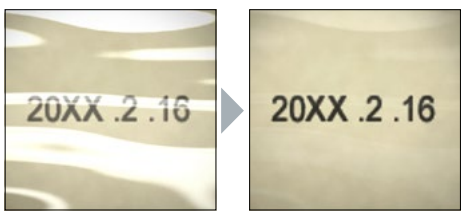
Chip inspection on a printed surface



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

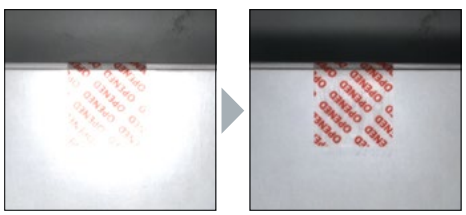
Application examples (2) Suppressing glare and ambient light to extract only textures (pattern)

Printed character inspection on a film surface



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

Tape presence inspection



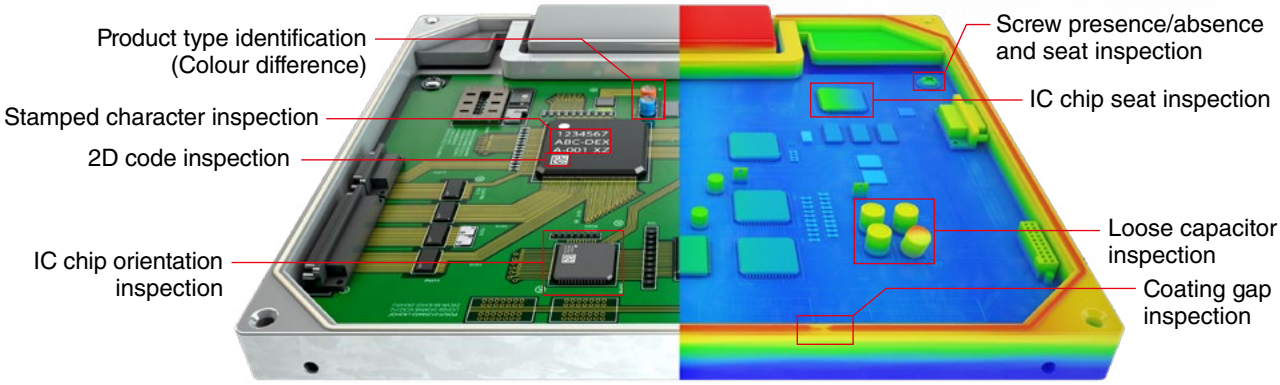
Even when unexpected specular reflection occurs due to workpieces being tilted, the glare can be cancelled, which makes it possible to perform stable inspections.

Pattern Projection Lighting

Simultaneous 2D + 3D inspection

Inspection with no blind spots with the use of eight-directional light transmission

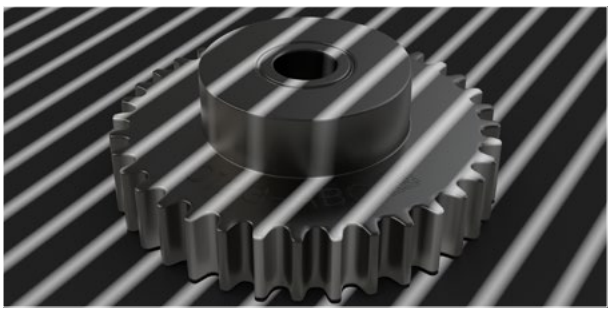
The lighting incorporates Pattern Projection from eight light sources. This enables inspection without influence from target surface conditions or contrast by adding height data to conventional 2D inspection. The result is dramatically improved inline inspection stability.



3D inspection lighting

Pattern projection accurately captures target appearance

Multiple stripe patterns are projected at high speed. An ultra-high-speed CMOS sensor and processor analyse the light reflected from the targets in real-time to generate a 3D height image.

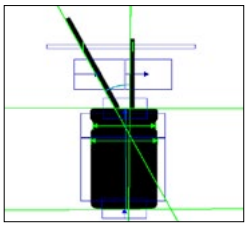


2D inspection lighting

LumiTrax™ support for resolving problems with conventional imaging

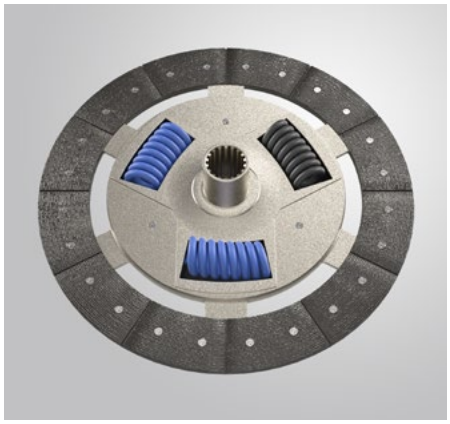
Take advantage of numerous KEYENCE proprietary algorithms including LumiTrax™ Capture Mode, Auto-Teach Inspection, and Measurements and Dimensions Tools. This ensures stable inspection without influence from surface conditions or variations between good parts.

Dimension inspection



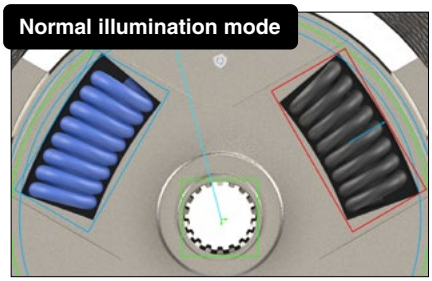
Appearance inspection

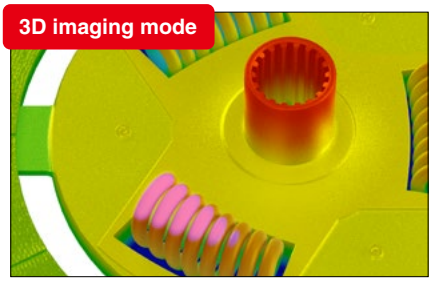
Solve inspection applications that incorporate height data alongside conventional image processing inspection



Clutch disc inspection

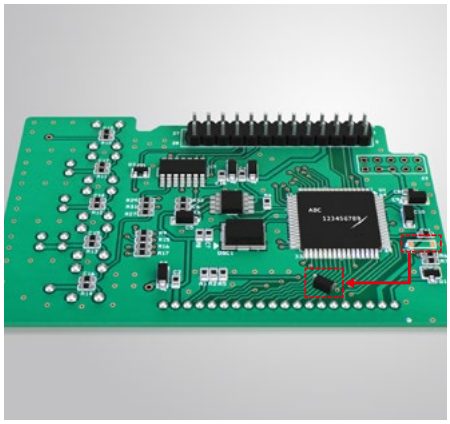
Capable of inspection for centre misalignment as well as spring colour difference checks with a colour camera. Also inspects for spring spillage in 3D difference checks.





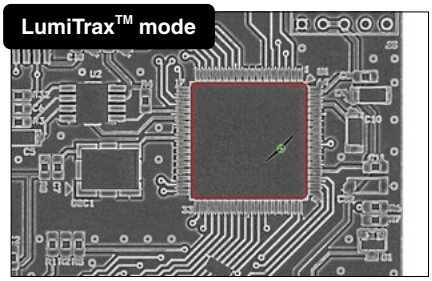
Normal illumination mode Product type difference checks using spring colours and assembly position inspection for centre components.

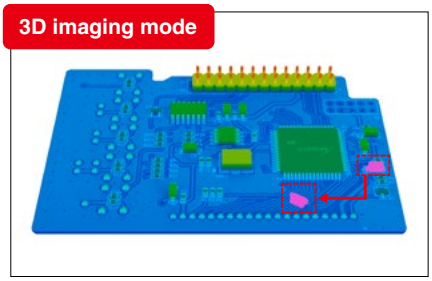
3D imaging mode Inspects for spring spillage across multiple locations with 3D differentiation tools.



Appearance and foreign particle inspection on PCBs

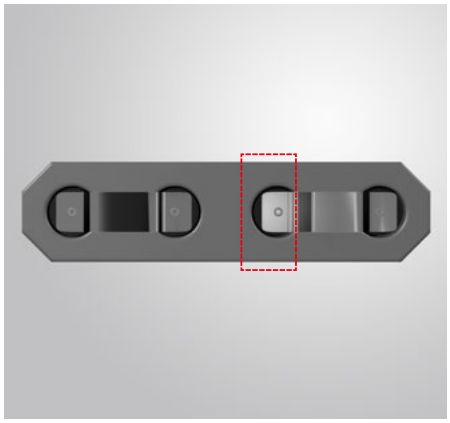
Inspect for defects only, without influence from chip surface markings using LumiTrax™ mode. Inspect for fallen or foreign particles on PCBs with 3D detection tools.





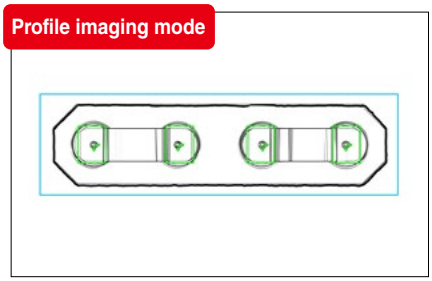
LumiTrax™ mode Inspect for chip surface defects only, without influence from surface markings.

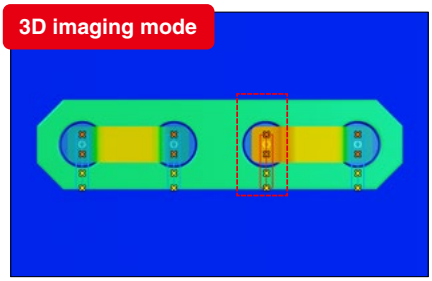
3D imaging mode Capture variations in the overall PCB with 3D detection tools to inspect for the presence of fallen or foreign particles.



Lithium-ion battery terminal inspection

Captures profiles and inspects terminal positions. Captures terminal height data in 3D imaging modes to inspect for terminal weld disassembly.





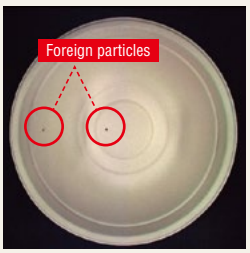
Profile imaging mode Profile capture stabilises searching by emphasising the appearance of terminals with low contrast.

3D imaging mode Inspect for terminal height differences with battery cover standard positions using profile detection tools.

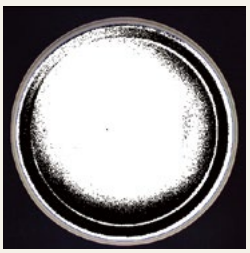
DEFECT

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.



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.

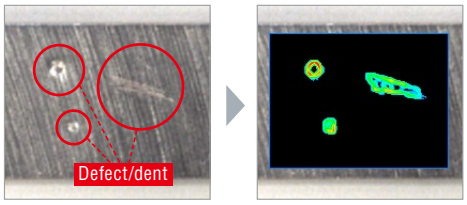
The defect inspection tool can stably detect the foreign particles alone by ignoring shading differences.

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.

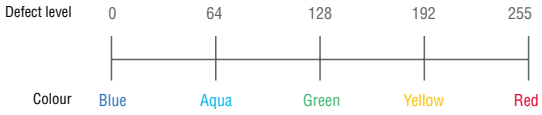
Since the contrast image can be checked not only during setting but also during operation, this can be utilised effectively in various scenarios, such as investigating the cause of a wrong detection.

Defect detection for a metal plate



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

Relationship between contrast image colours and defect levels

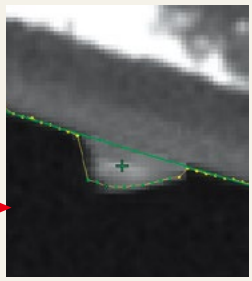


TREND EDGE DEFECT

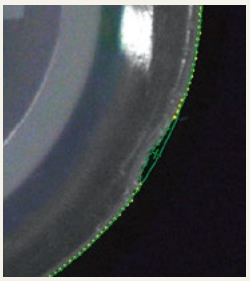
Edge defect inspection tool optimised for burr and flaw detection inspection

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.

Burr/flaw detection for a plastic mould Automatically generates a reference line of the profile of a workpiece including curves.



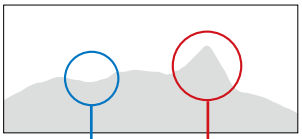
Detection of a burred section

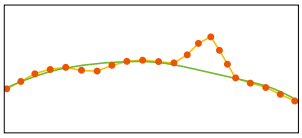


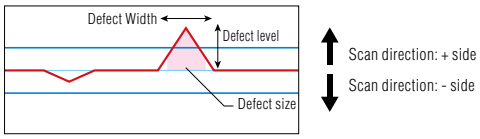
Detection of a flawed section

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 (burrs/flaws detection) and width/size that exceeds a threshold.





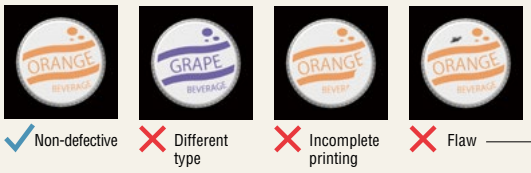


AUTO-TEACH INSPECTION TOOL

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

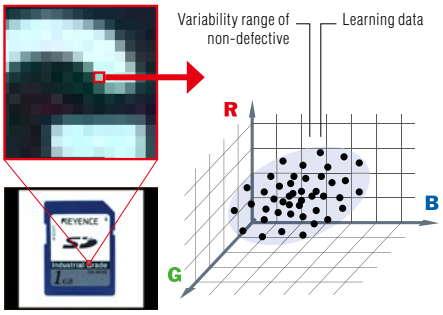
The auto-teach inspection tool uses the image sensor to learn variations and individual differences that exist in the non-defective workpieces and recognises workpieces that differ from these as defective workpieces. These algorithms, which are unlimitedly close to the human sensation, eliminate unstable 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.

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



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

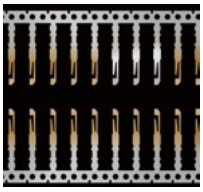
1 Setting is often required due to multiple product types

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

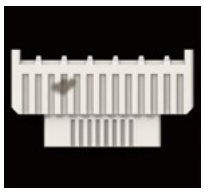
Plating defect inspection for lead frames



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

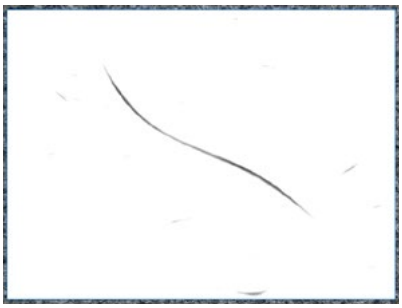
24 types of image enhancement filters are provided to significantly compensate for changes in inspection conditions caused by workpiece conditions and external environments. KEYENCE's original algorithms generate optimal images for inspection to improve stability and reduce scrapping of non-defective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

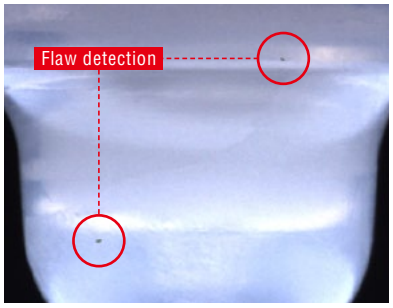


Only linear defects are extracted by ignoring background noise.

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



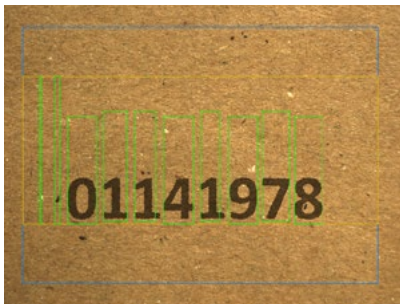
Shading occurs on the workpiece surface due to the shape consisting of curves.

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.

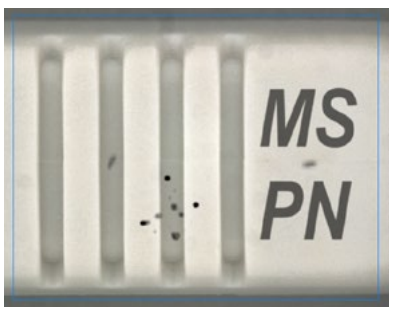
RECOGNITION OF CHARACTERS PRINTED ON CARDBOARD



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



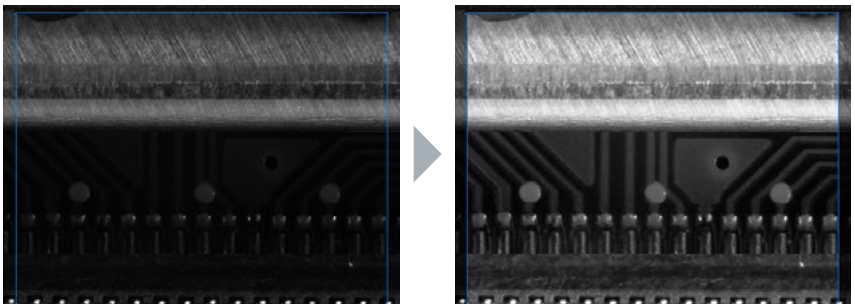
Minute flaw detection exist on the background having printed characters and surface irregularities.

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



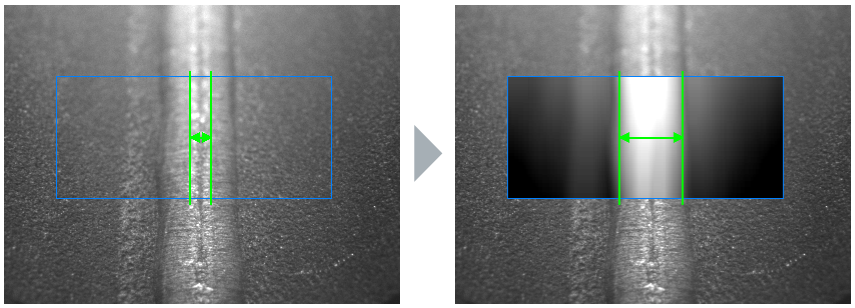
The location is at the back of the workpiece, so the light intensity is insufficient, which makes it impossible to recognise the circuit board pattern.

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



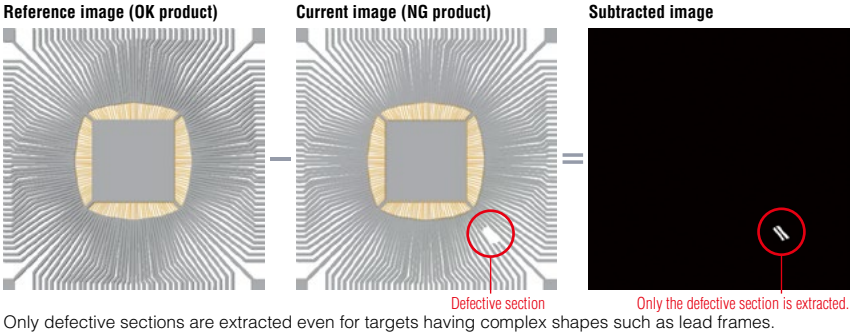
Edges are detected in areas outside the welded section due to hairlines on the metal surface or sputter deposited on surrounding areas.

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

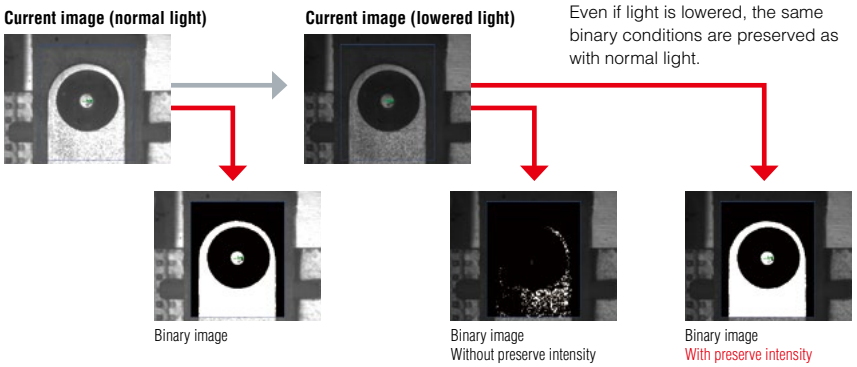


Only defective sections are extracted even for targets having complex shapes such as lead frames.

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



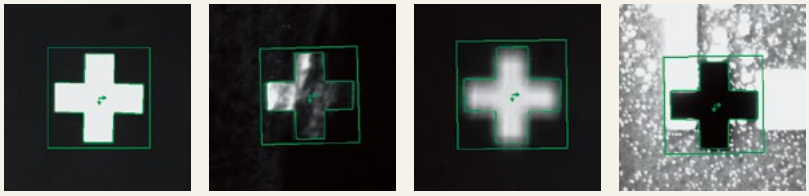
ShapeTrax™ 3

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 a 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

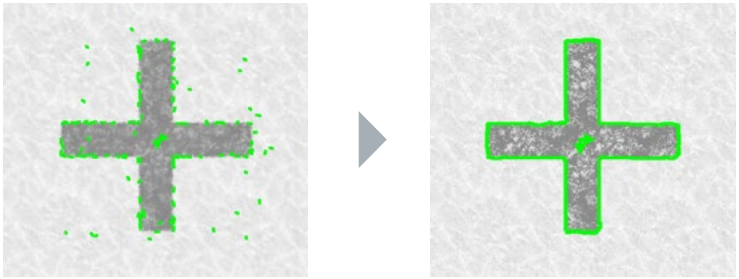
The set-up to extract the profile of workpieces that conventionally required experience can now be optimised automatically, allowing a simple, easy-to-use menu. Anyone can make use of the maximum potential of ShapeTrax™3 for any workpiece.

CONVENTIONAL

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

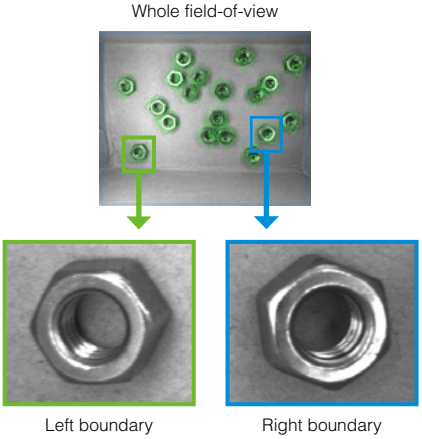
ShapeTrax™3

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.



Industry-first “Responsive” Search

Rotational Direction Search

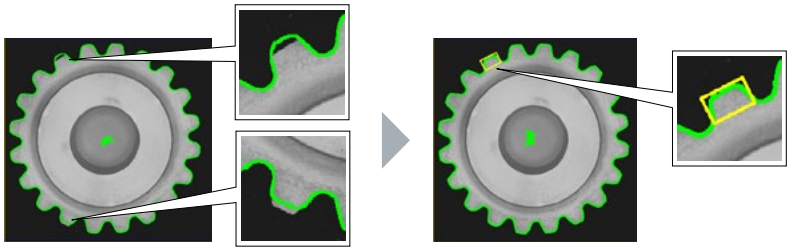
For shapes such as circles or equilateral polygons, our new algorithm delivers stable, high-speed inspection of workpieces that possess special characteristics while rotating.

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.

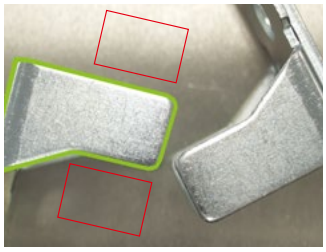
Using rotational direction search

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

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.



CONTACT YOUR NEAREST OFFICE FOR RELEASE STATUS

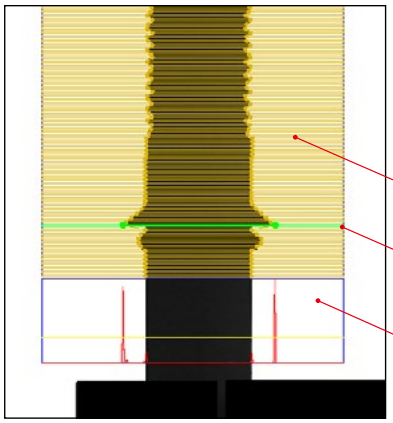
PROFILE POSITION/WIDTH

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.

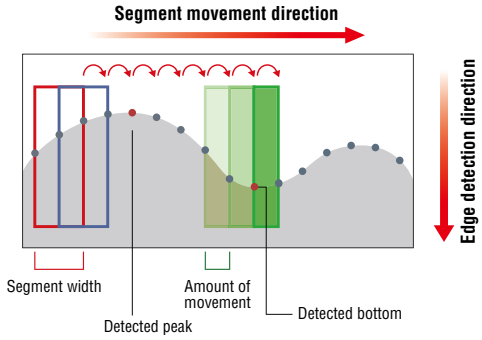
Dimension measurement for a bolt

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

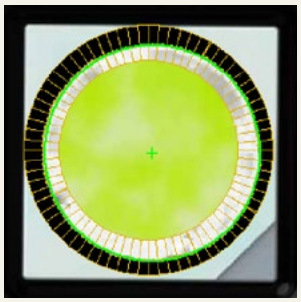


PRINCIPLE OF DETECTION:

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.

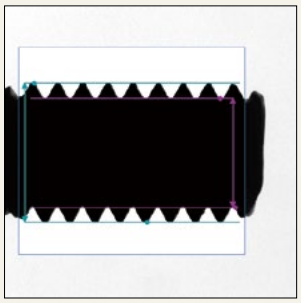


VIRTUAL CIRCLE



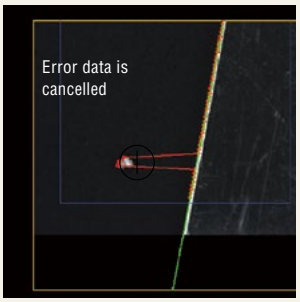
When a circular workpiece is detected, edge alignment detection is performed multiple times and used to approximate a virtual circle. This allows for stable calculation of the centre alignment and diameter.

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.

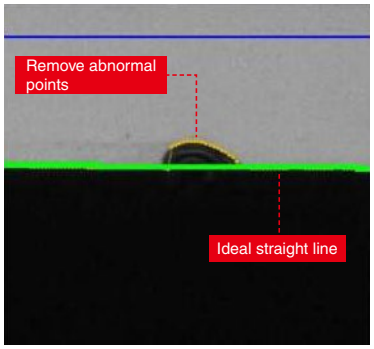
APPROXIMATE LINE

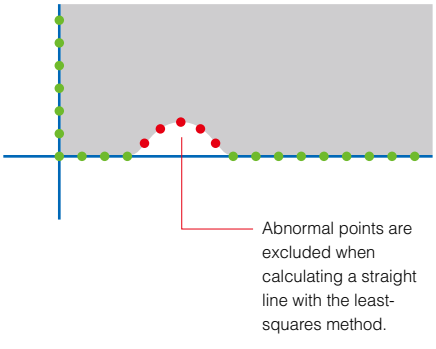


Approximating a line based on multiple sets of edge location data for the edge of a circuit board allows accurate detection of alignment.

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.



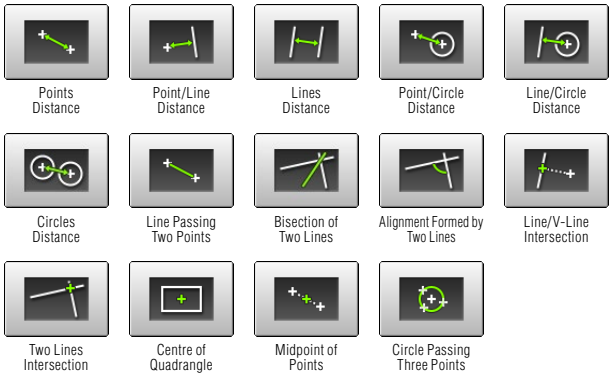


MEASUREMENTS & DIMENSIONS TOOL

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"



Easy scaling with any image size

Scaling

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

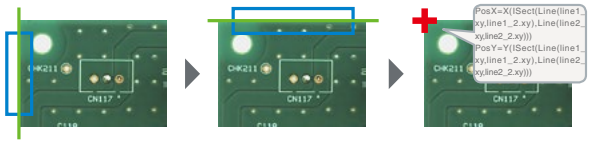
1 Measure the target
(Can select width or pitch)

2 Input the actual values for the inspection region

3 Convert to actual values and display

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

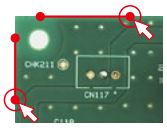
Calculate intersecting coordinates between 2 lines with the calculation function

MEASUREMENTS & DIMENSIONS TOOL

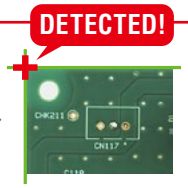
Settings completed by simply using the mouse

Two Lines Intersection

Select the feature to be executed, and

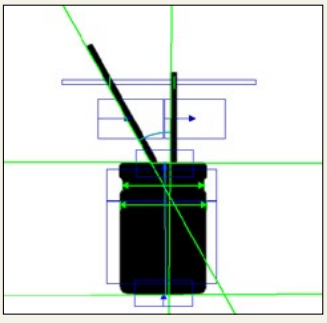


Just specify target lines with the mouse

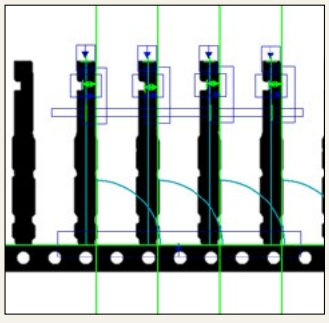


EASY DETECTION!
It is also possible to reference coordinates, circles, or lines from other tools that have already been created!

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



CAPACITOR



PRESS PARTS

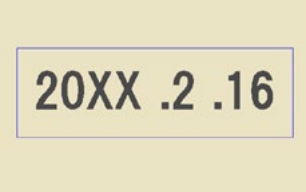
LABEL

OCR2

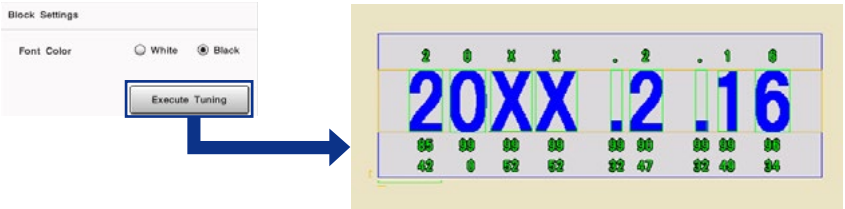
Simple and Reliable Character Recognition Tool

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.

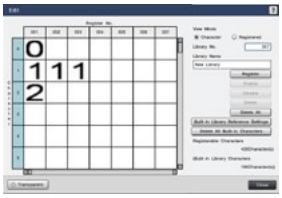
STEP1 Set the area



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.

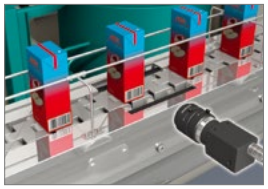
Supports a variety of codes

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

Easily develop a vision-guided robotic system

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

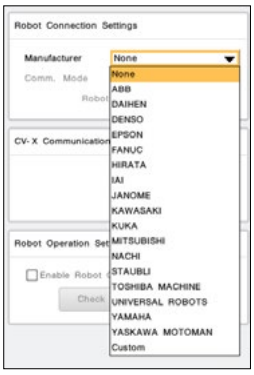
Auto-calibration function

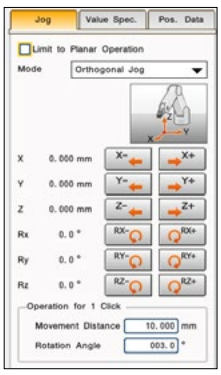
Calibration is the most difficult aspect of constructing and running a system linking a robot and vision system. The auto-calibration function provides highly-accurate and effortless calibration. The result is reliable and stable calibration without the subjectivity of a manual process.

CONVENTIONAL PROBLEMS	WITH KEYENCE'S AUTO-CALIBRATION FUNCTION
Manual operation is time-consuming.	▶ **Easy operation with a single click**
Accuracy varies between operators.	▶ **High accuracy regardless of operator**
Difficult to readjust when installation shifts occur.	▶ **Calibration can immediately be executed to quickly recover from any positional shift**
Difficult to reproduce identical environments in different locations.	▶ **Fast and accurate reproducibility regardless of location**

Direct communication with the robot controller (Simple connection)

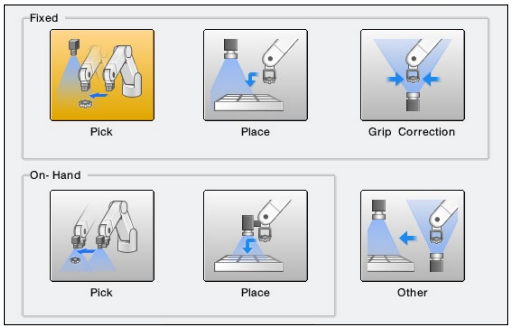
Easily establish direct communication between the robot and the CV-X by simply selecting the robot manufacturer (Supports products from 17 manufacturers). The CV-X can also perform jog operations on the robot, simplifying the development of the machine vision guidance.





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.



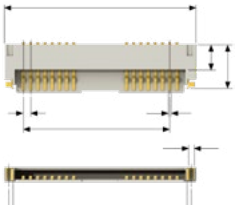
CONTACT YOUR NEAREST OFFICE FOR RELEASE STATUS

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

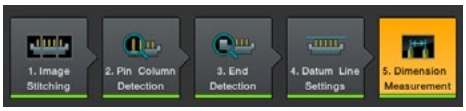


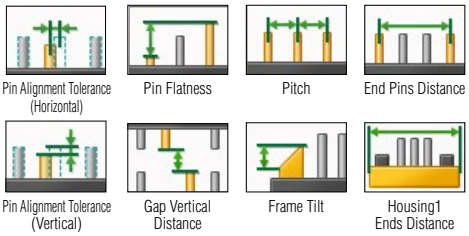
Connector inspection that requires various items to be inspected for each product type and shape

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

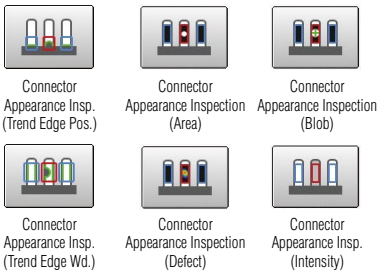
SETTING COMPLETED!





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 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.

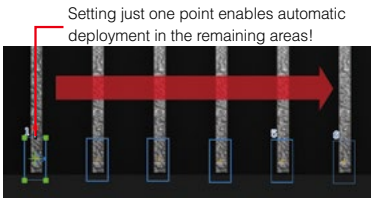


IMAGE STITCHING FUNCTION

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

CONNECTOR ADJUSTMENT MENU

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

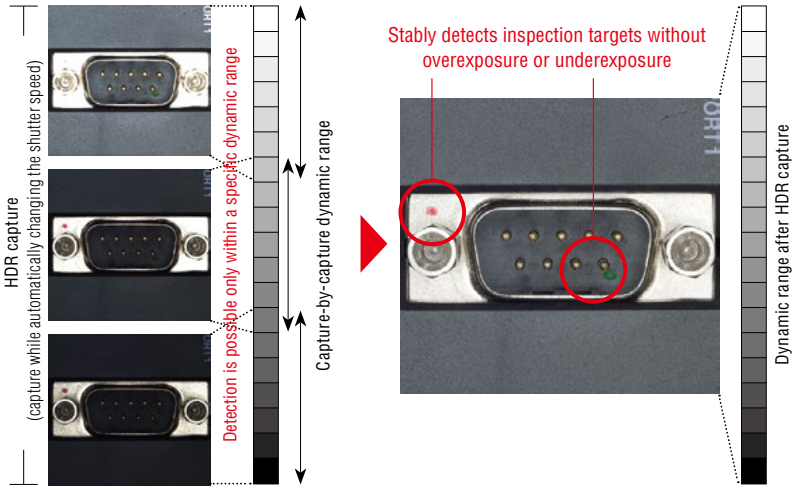
CONNECTOR-DEDICATED OPERATION SCREEN

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

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.



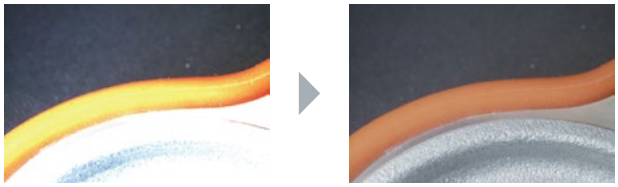
Glare removal

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.

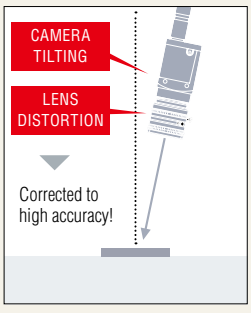


Conventional　　HDR capture

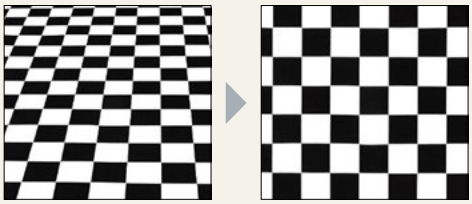
CALIBRATION

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.



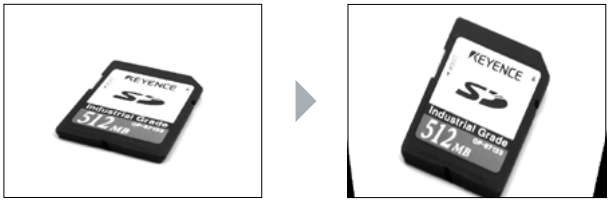
CORRECTION USING A CALIBRATION PATTERN



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

Corrects “tilting”

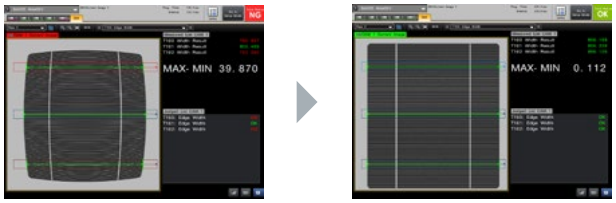
Corrects camera tilting that may occur during installation. This is also effective when a camera is installed at an alignment due to installation space restrictions.



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

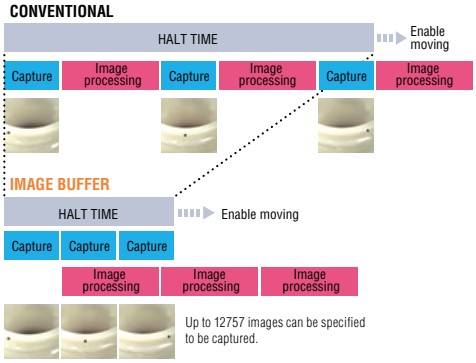
Image capture is performed at top speed simultaneously storing the image inside the device and concurrently executing image processing. No restriction will be imposed on the halt time or moving speed regarding the object, therefore the designed maximum performance can be exerted.

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.



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

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.

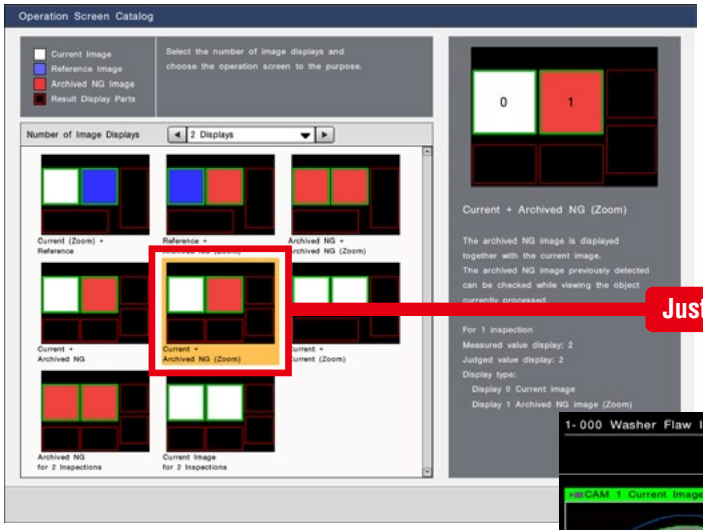
Since triggers can be input at any timing according to transfer system movement, equipment cycle time can be improved dramatically.

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

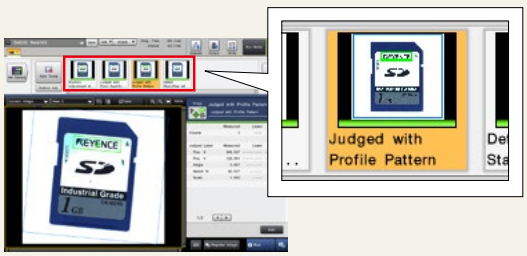
JUST SELECT THE SCREEN LAYOUT FOR THE SITUATION

- 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.

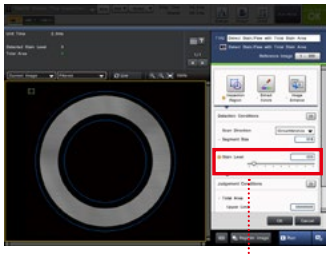
TOUCH PANEL SUPPORT

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.

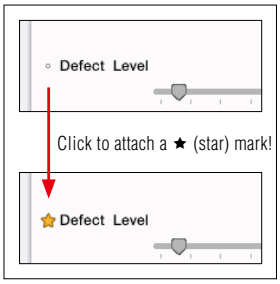
A “custom menu” that realises the optimal operation with a single click

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...

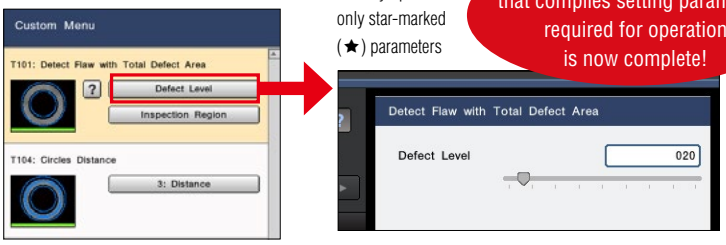


When it seems that these parameters are adjusted often...

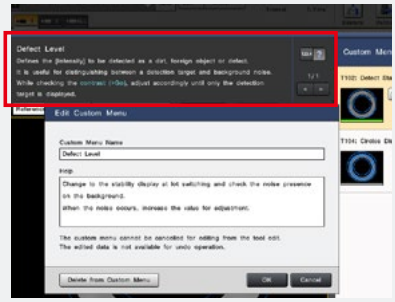


Directly open only star-marked (★) parameters

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.

16 LANGUAGES SUPPORTED

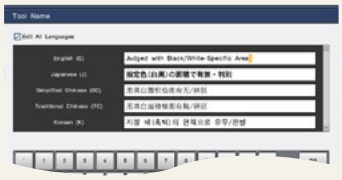
MULTI-LANGUAGE INPUT SYSTEM INCORPORATED

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	Spanish (Mexican)	Utilidad / Ir al modo de ejecución / Estado total OK
Simplified Chinese	实用功能 / 至运行模式 / 综合判定 OK	Thai	ยูทิลส์ / ไปโหมดดำเนินงาน / การตัดสินรวม OK
Traditional Chinese	實用功能 / 至運轉模式 / 綜合判定 OK	Indonesian	Utilitas / Buka Mode Jalan / Status Total OK
French	Utilitaire / Passer en mode exécution / Statut total OK	Portuguese (Brazilian)	Utilidade / Modo Execução / Status Total OK
German	Erweit. / Wechseln zum Run-Modus / Gesamtstatus OK	Vietnamese	Tiện ích / Đi tới Chế độ Chạy / T. thái OK
Italian	Utility / Passa alla modalità esecuzione / Stato generale OK	Japanese	ユーティリティ / 運転モードへ / 総合判定 OK
Korean	유틸리티 / 운전 모드로 / 종합 판정 OK	Czech	Nástroje / Přejít do RUN módu / Celkový stav OK
Hungarian	Segédfu... / Ugrás termelési módra / Összállapot OK	Polish	Użytec. / Tryb RUN / Całk. status OK

THE CHARACTER STRING INPUT ON THE CONTROLLER ALSO SUPPORTS MULTIPLE LANGUAGES

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



UTILITIES

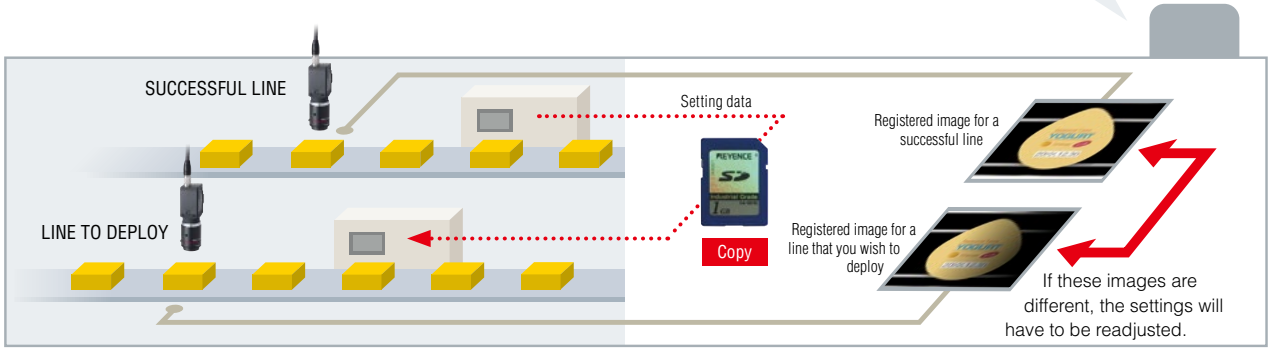
Easy-to-use utilities applying “Professional knowledge” from on-site experiences

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.”

“Camera Installation Replication” for applying configured inspection conditions anywhere

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.



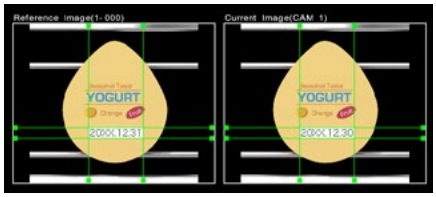
CAMERA INSTALLATION REPLICATION

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:

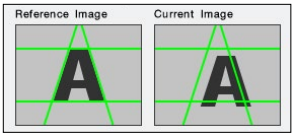
1. Matching an image for a line to deploy with the reference image for a successful line.
2. Making a comparison with the reference image at the point in time when the settings were created to check “if the conditions are always the same”.

ALIGNMENT ADJUSTMENT TOOL

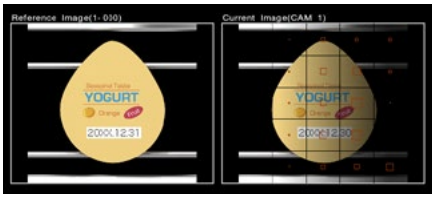


Successful line Line to deploy

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.

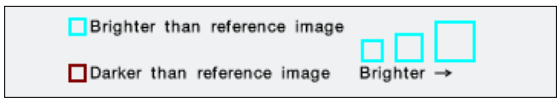


BRIGHTNESS ADJUSTMENT TOOL

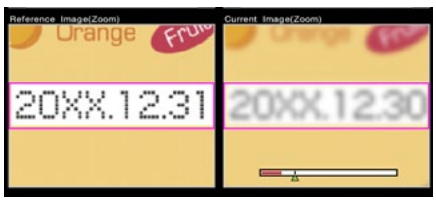


Successful line Line to deploy

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

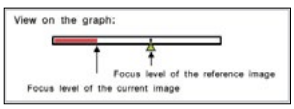


FOCUS TOOL



Successful line Line to deploy

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



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

CONVENTIONAL I HAVE NO IDEA WHERE I SHOULD START ADJUSTMENT

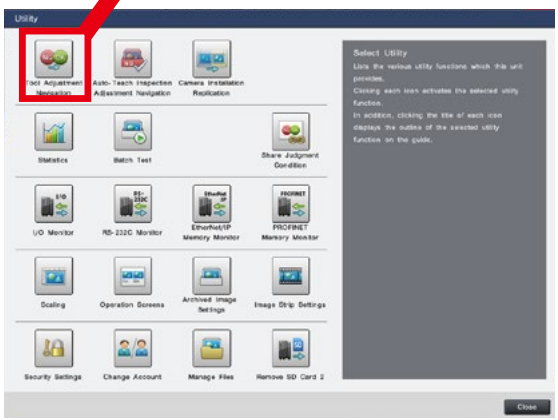
- I can’t figure out which tool I should adjust…
- A alignment adjustment failure may be the cause of the false judgement...
- I’m at a loss as to which image I should adopt for correcting the tool setting...

TOOL ADJUSTMENT NAVIGATION NAVIGATION FOR ACCURATE AND OPTIMAL ADJUSTMENT

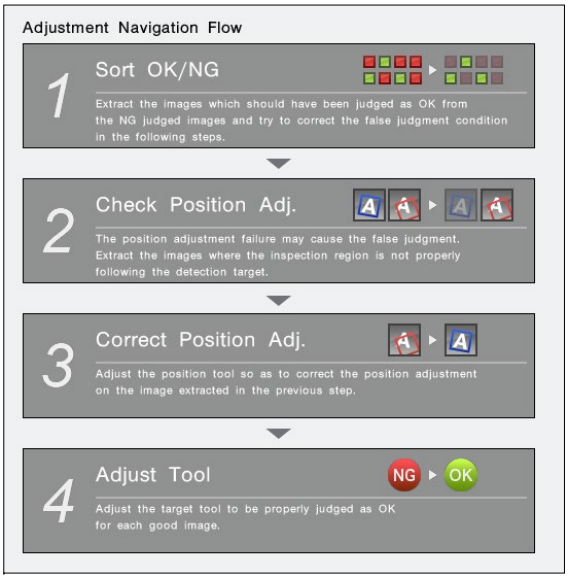
Step-by-step adjustment!

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

Click!

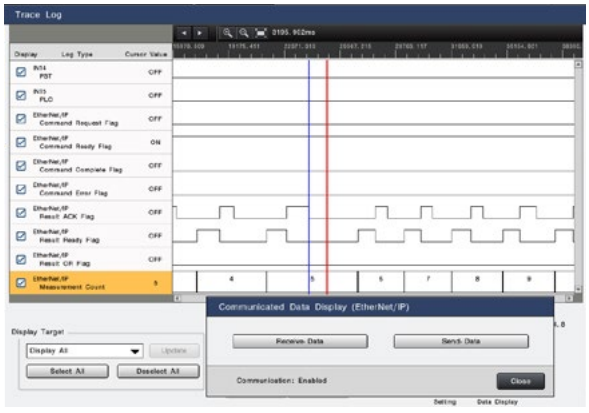


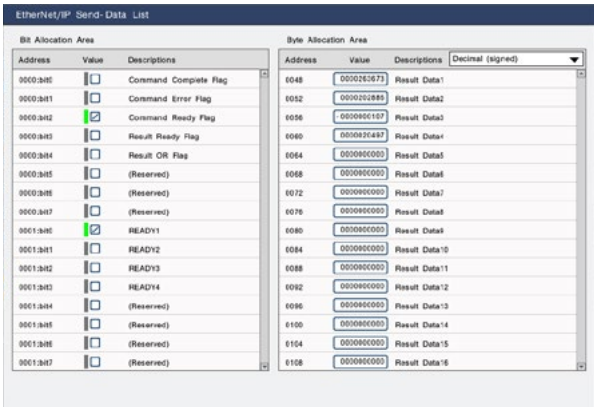
Navigating adjustment procedures when non-defective workpieces have been mis-detected



Communication state view is only one click away. [Trace log]

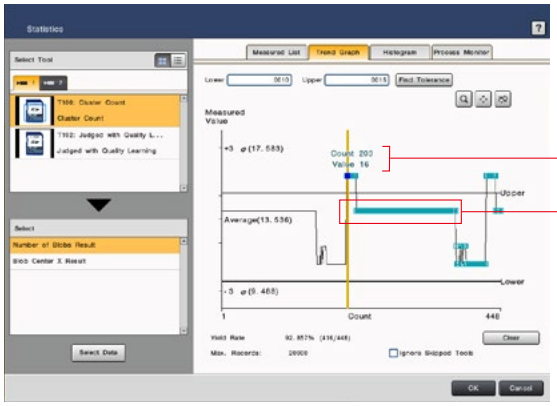
The Trace Log function provides you with a time-series view of the controller’s internal processing and terminal data communication (PLC link, EtherNet/IP™, and PROFINET). The log data can be retrieved with just the controller and is available to anyone.
You can also use Simulation-Software to view the collected log data for remote investigation and analysis of any problems on site.





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.

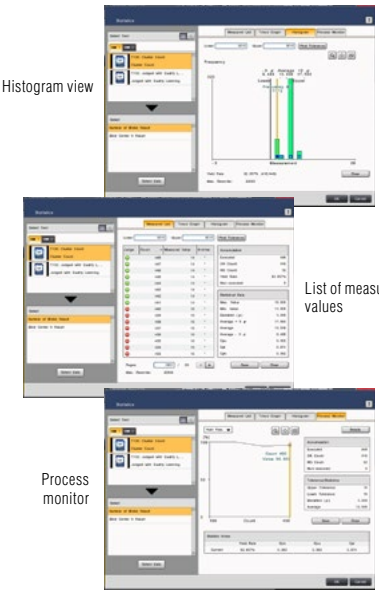


VERTICAL CURSOR

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

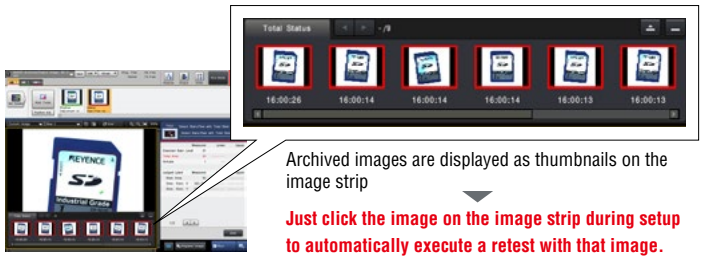
IMAGE SAVE MARK

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



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.



Archived images are displayed as thumbnails on the image strip

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

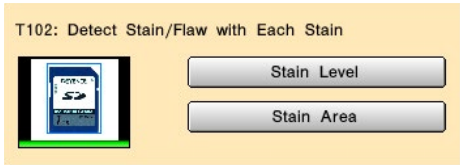
Maximum number of images* that can be saved, organised by connected camera

Camera type	Number of images saved to the internal memory		Number of images saved to the 16 GB SD card
	CV-X480	CV-X350	
Monochrome 0.24 megapixel	1024	1024	61628
Colour 0.24 megapixel	1024	1024	21441
Monochrome 0.31 megapixel	1024	1024	49302
Colour 0.31 megapixel	1024	1024	17006
Monochrome 0.47 megapixel	1024	1024	32875
Colour 0.47 megapixel	1024	1024	11470
Monochrome 2 megapixel	1024	762	8360
Colour 2 megapixel	1024	729	2802
Monochrome 5 megapixel	547	274	3223
Colour 5 megapixel	517	246	1079
Monochrome 21 megapixel	90	—	773
Colour 21 megapixel	66	—	257

* The values for the internal memory are typical values when a single camera is connected using CV-X480 or CV-X350 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.

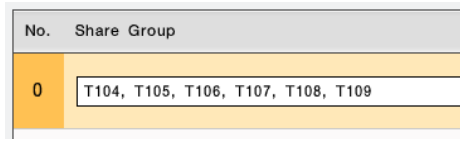
Tolerance overwrite function

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.



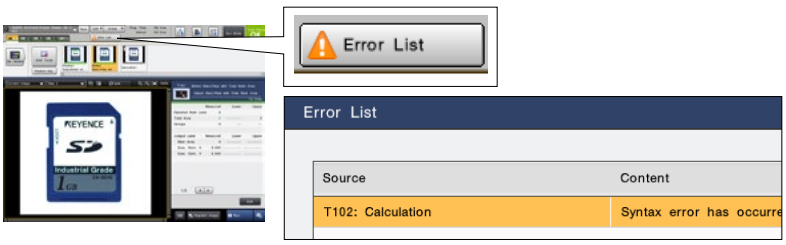
Judgement conditions sharing function

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.



Error notification

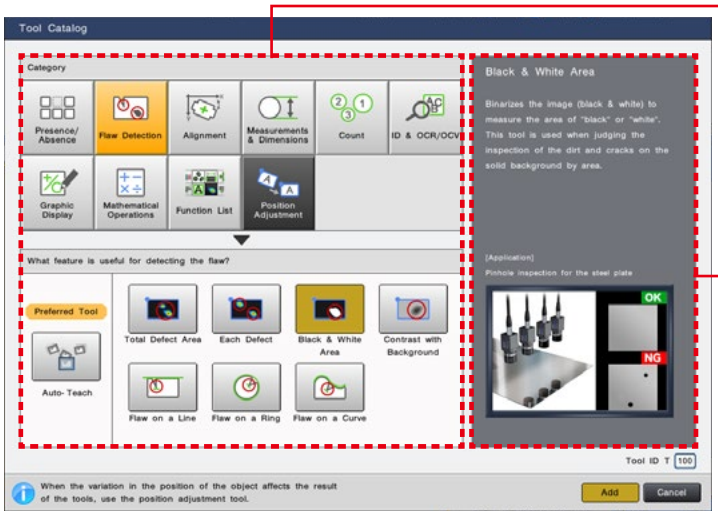
Displays setting errors in a list. It is also possible to select the error from the list screen and jump to the corresponding area.



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

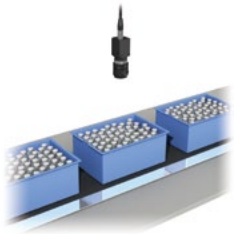
The tools have been categorised according to application, based on the longstanding knowledge of the KEYENCE CORPORATION. It allows you to intuitively find the best tool for the inspection.

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.

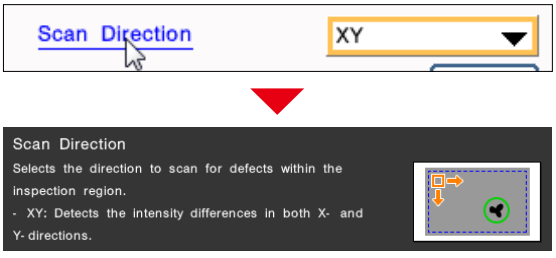
Count

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.

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.



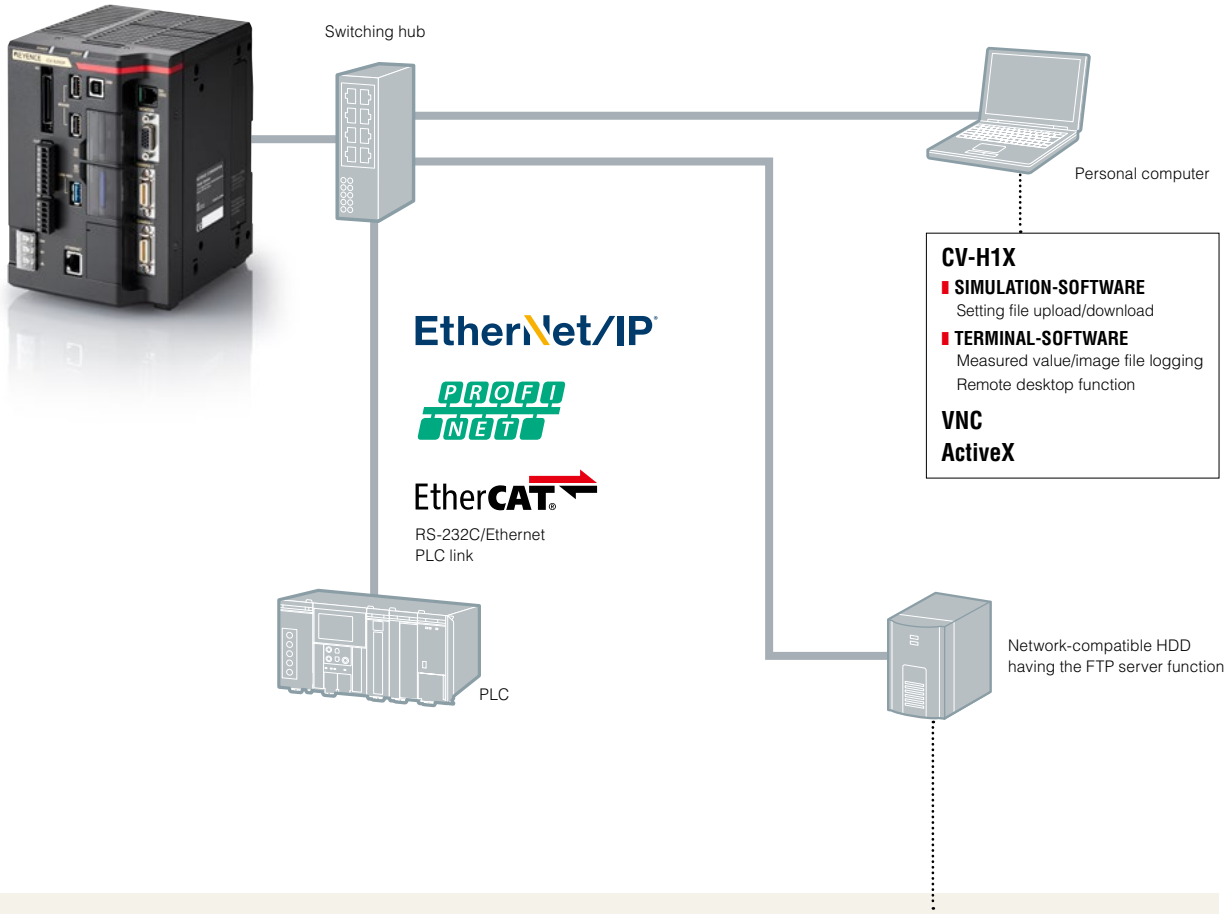
COMMUNICATION AND CONTROL

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™, PROFINET, and EtherCAT®, 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 CV-X Series is equipped with I/O monitoring and trace log functions that allow you to check the communication state, which can help you troubleshoot in case of an error.

EtherNet/IP™- AND PROFINET-COMPATIBLE

EtherNet/IP

PROFINET

EtherCAT

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.

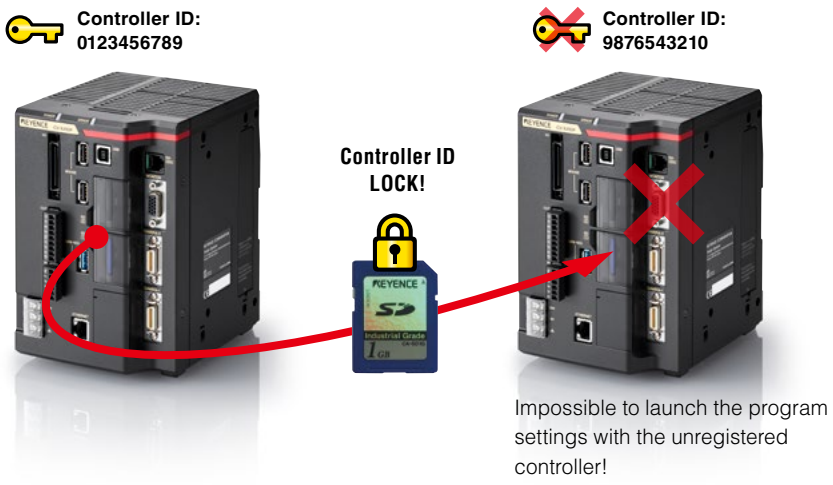
SECURITY/ACCOUNT

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

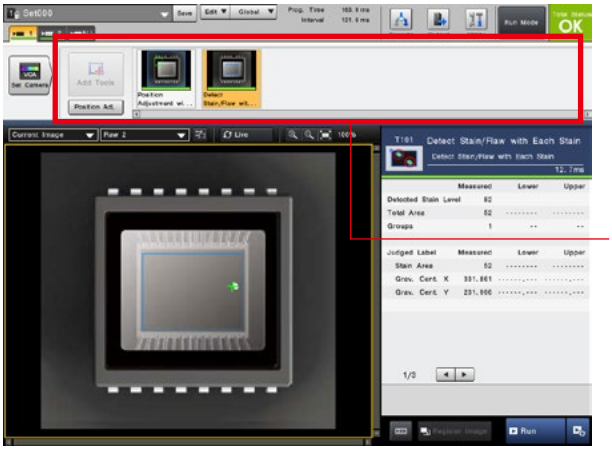
This is a function that does not start program settings with controllers other than those that have the specified unique ID (controller ID). This is useful in protecting against the copying of program assets and unintended controller operation.



Impossible to launch the program settings with the unregistered controller!

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.



Tool edit lock

Viewing and editing of program setting contents are locked!

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”

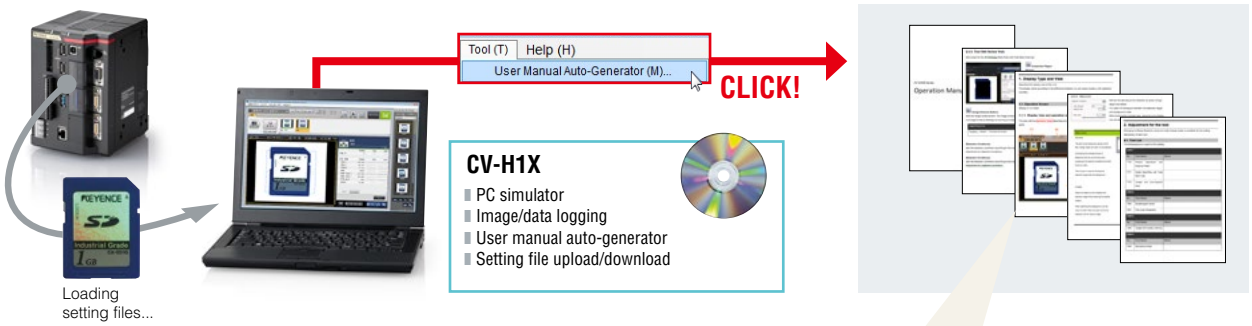
CONVENTIONAL

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

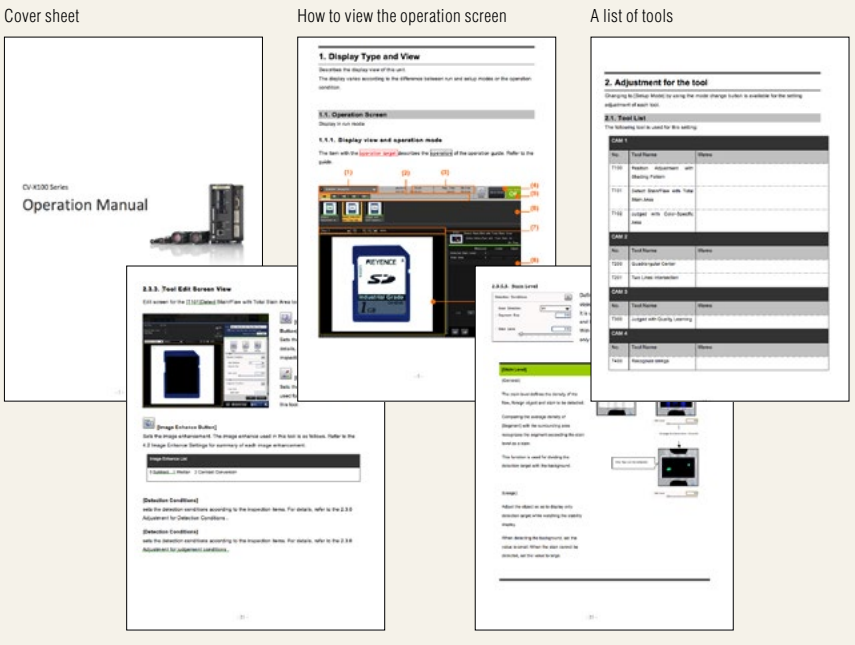
I want to have on-site operators refer to the manual but I want to summarise only the functions I need.

USER MANUAL AUTO-GENERATOR

CUSTOMISED MANUAL CREATION IN A SINGLE CLICK!



EXAMPLE OF CREATED MANUAL CONTENTS



MULTIPLE LANGUAGE SUPPORT

User manuals can be created in 16 languages according to the language of the 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

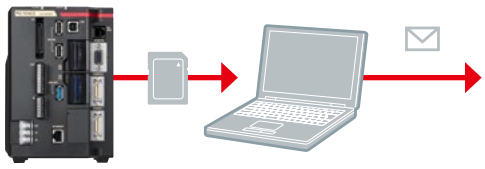
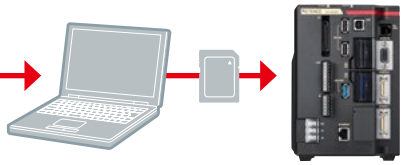
According to changes in manufactured items, I need to add settings, but the site is remote

PC SIMULATOR

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

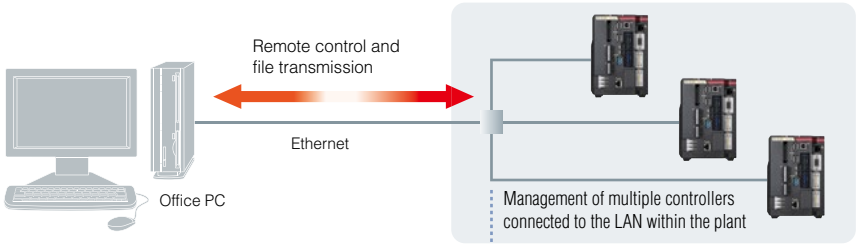
Using simulation software installed on a PC, setting creation and verification using images can be performed even at a remote site just as on an on-site machine.

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

MANUFACTURING SITE	SETTING OPERATOR	MANUFACTURING SITE
	Correct settings using simulation software	
Acquire setting and image files from the controller	Exchange files via e-mail or the Internet	Transfer corrected setting files to the controller

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.

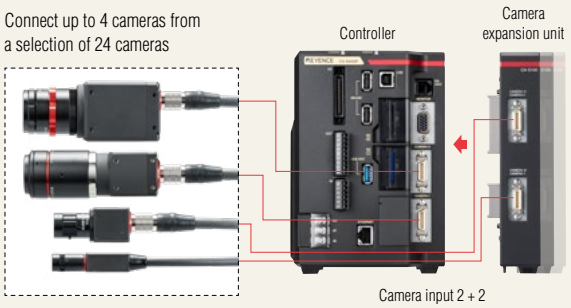


MULTI-CAMERA, SIMULTANEOUS IMAGE ACQUISITION SYSTEM

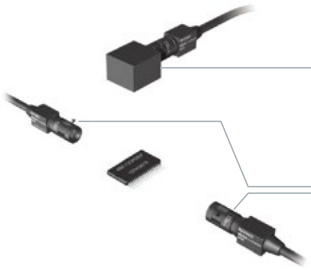
A total of 24 types of cameras can be mixed for use. For example, it is possible to attach a monochrome camera as CAM 1 and a colour camera as CAM 2 to 1 controller unit. Camera combinations best suited for the inspection can be applied. Also, by connecting a camera expansion unit, it is possible to connect up to four 64 megapixel 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.

(* When the CV-X480/CV-X490 is used)

Multi-Camera System



APPLICATION EXAMPLE



CAM 1

Moulding flaw detection inspection, print inspection

2 megapixel compact colour camera + side view unit

CAMs 2, 3

Coplanarity inspection

2 megapixel monochrome compact camera

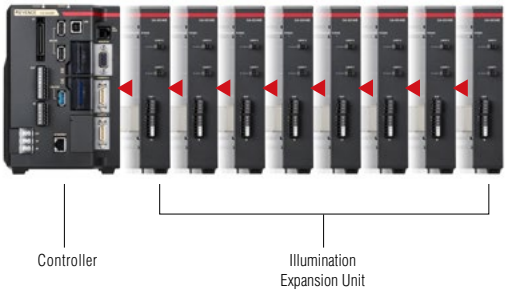
When performing simultaneous inspection with multiple cameras, it is possible to reduce total system cost by selecting the best cameras according to the application.

ILLUMINATION EXPANSION UNIT

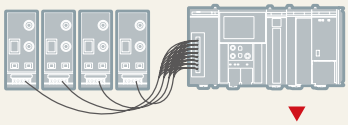
EASY LIGHT CONTROL WITHOUT CUMBERSOME WIRING

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



I/O unnecessary, and PLC settings are unnecessary!

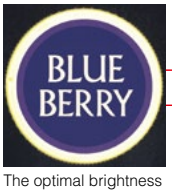
APPLICATION EXAMPLE

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

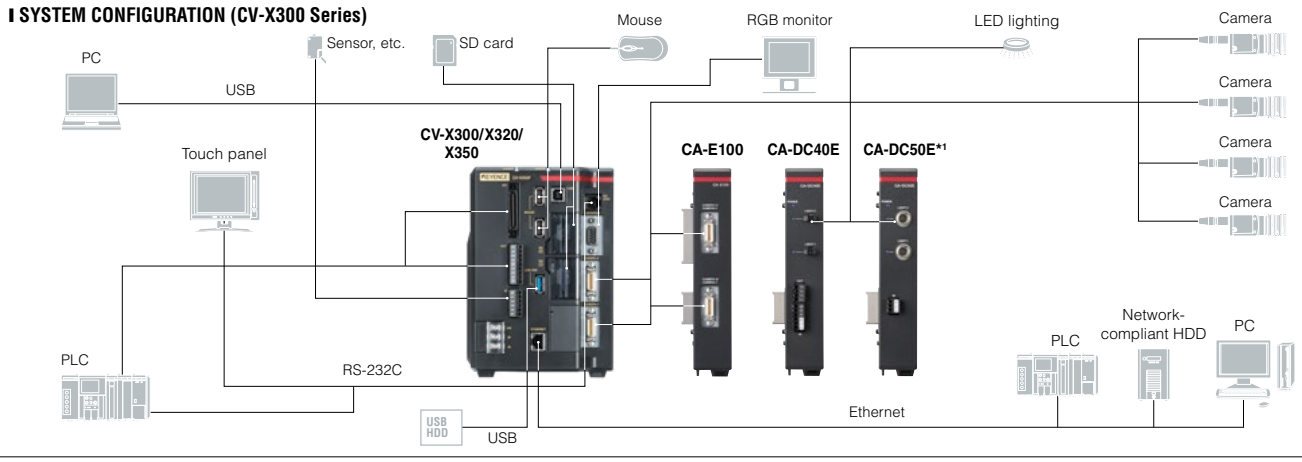
If the brightness volume remains the same, the captured image may not be optimal for inspection.

Switched to preset

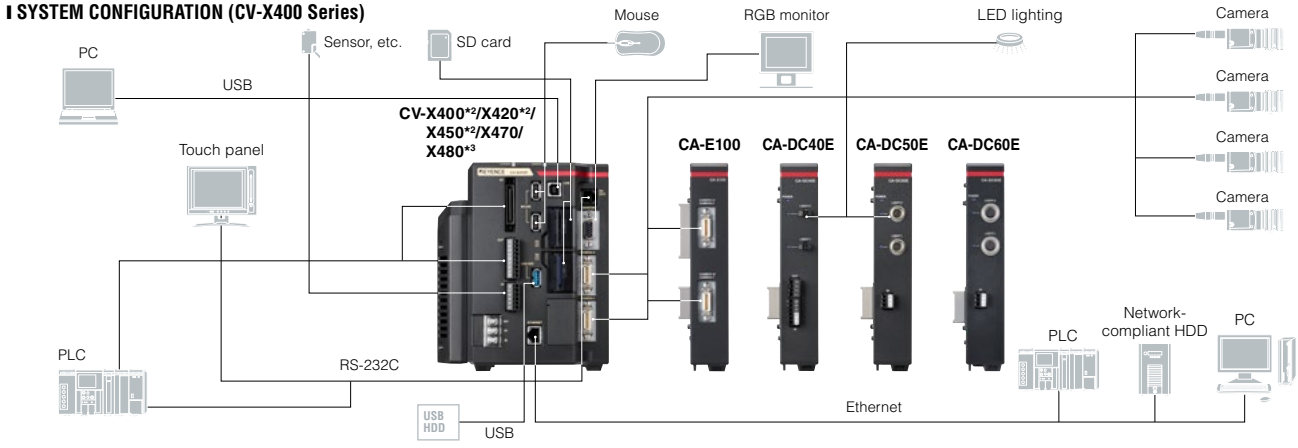
BRIGHTNESS VALUE: 80

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

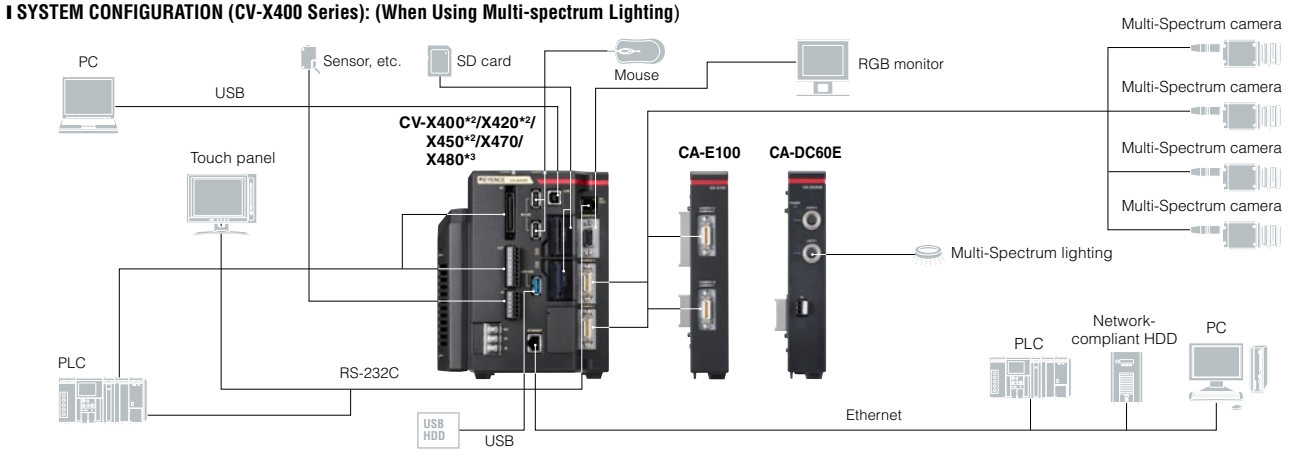
SYSTEM CONFIGURATION (CV-X300 Series)



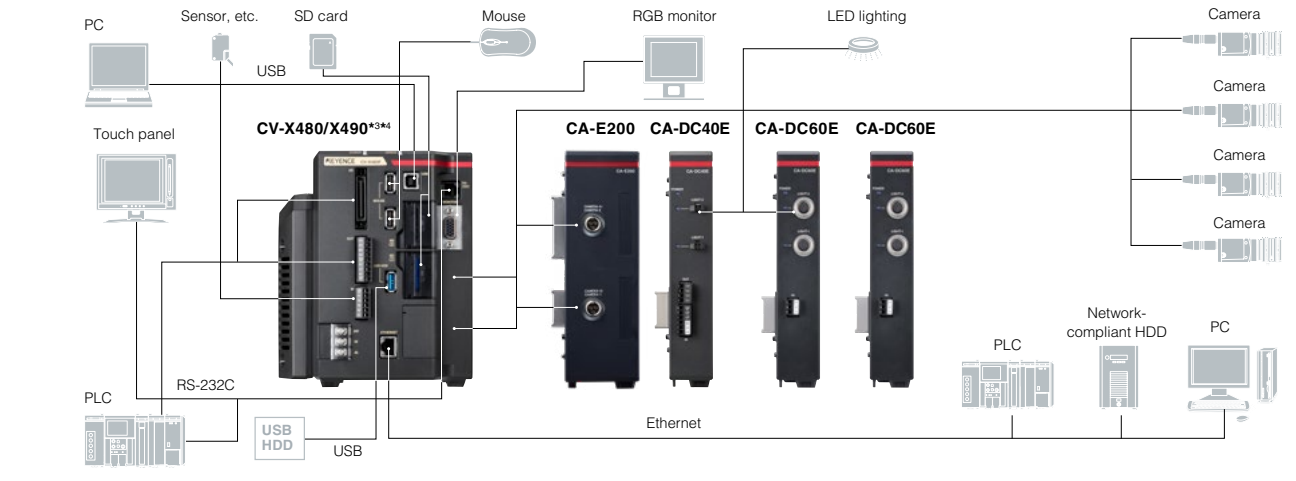
SYSTEM CONFIGURATION (CV-X400 Series)



SYSTEM CONFIGURATION (CV-X400 Series): (When Using Multi-spectrum Lighting)



SYSTEM CONFIGURATION (CV-X480/X490) — (When Using a High-resolution Camera (CA-HFxM/C))



*1 LumiTrax™ mode is unavailable when used with CV-X300/X320/X350. CA-DRWxX lights can be used as standard high-intensity lighting.
*2 Fan unit cannot be connected to CV-X400/X420/X450.
*3 The CV-X480/X490 has no camera connection port. Use in combination with a camera input unit or similar device.
*4 LumiTrax™ imaging with the CA-HF6400x and CA-HF2100x is supported only with the CV-X490.

Controller

5 megapixel camera
supporting type
CV-X470/CV-X450/CV-X350

2 megapixel camera
supporting type
CV-X420/CV-X320

0.47 megapixel camera
supporting type
CV-X400/CV-X300

High-resolution camera
supporting type
CV-X490/CV-X480

Accessories

Mouse
(Accessory)

PC software
DVD-ROM
CV-H1X

OS compatible with **CV-H1X** software and recommended operating environment

Supported OS	Microsoft Windows 10 Home, Pro, Enterprise • Supported OS languages: English, Japanese, Chinese (Traditional/Simplified), Korean, Thai, German, French, Italian, Spanish (Mexico), Portuguese (Brazil), Vietnamese, Indonesian, Czech, Hungarian, and Polish. • All OS other than the above are not supported.
CPU	Intel® Core™ i3 processor (or equivalent) or better
RAM	8 GB or more
Required free space on hard disk	8 GB or more (does not include storage for image data)
Display resolution	Minimum: 1024 × 768 pixels, Recommended: 1280 × 1024 pixels or more
Document creation software	Microsoft Word 2007 SP3 or later / 2010 SP2 or later / 2013 / 2016

Area camera

88× speed colour /
90× speed monochrome
64 megapixel camera
CA-HF6400C (Colour)
CA-HF6400M (Monochrome)

85× speed,
LumiTrax™-compatible
21 megapixel camera
CA-HF2100C (Colour)
CA-HF2100M (Monochrome)

16× speed, high-performance
5 megapixel camera
CA-H500CX (Colour)
CA-H500MX (Monochrome)

16× speed, high-performance
2 megapixel camera
CA-H200CX (Colour)
CA-H200MX (Monochrome)

16× speed, high-performance
0.47 megapixel camera
CA-H048CX (Colour)
CA-H048MX (Monochrome)

16× speed, environment-resistant
5 megapixel camera
CA-H500C (Colour)
CA-H500M (Monochrome)

16× speed, environment-resistant
2 megapixel camera
CA-H200C (Colour)
CA-H200M (Monochrome)

Environment-resistant
2 megapixel camera
CA-200C (Colour)
CA-200M (Monochrome)

16× speed, environment-resistant
0.31 megapixel camera
CA-H035C (Colour)
CA-H035M (Monochrome)

Environment-resistant
0.31 megapixel camera
CA-035C (Colour)
CA-035M (Monochrome)

Ultra-compact (16×)
2 megapixel camera
CA-HS200C (Colour)
CA-HS200M (Monochrome)

Ultra-compact (7×)
0.31 megapixel camera
CA-HS035C (Colour)
CA-HS035M (Monochrome)

▮ Expansion unit

Area camera input unit
CA-E100

High-resolution area camera input unit
CA-E200

LED light control expansion unit
CA-DC40E

Light control expansion unit for LumiTrax™
CA-DC50E[*1]

Light control expansion unit for Multi-Spectrum/ Pattern Projection
CA-DC60E

EtherCAT® unit
CA-NEC20E

PROFINET unit
CA-NPN20E

EtherNet/IP™ unit
CA-NEP20E

*1 LumiTrax™ mode is unavailable when used with CV-X300/X320/X350.
CA-DRWxX lights can be used as standard high-intensity lighting.

Optional accessories

Camera cable

L-type connector

Models

Cable type	Connector shape	Camera cable length				Extension cable	Repeater cable
		3 m	5 m	10 m	17 m	5 m, 10 m	3 m, 5 m, 10 m
Standard	Straight	**CA-CH3**	**CA-CH5**	**CA-CH10**	—	—	**CA-CH3X** (3 m) **CA-CH10X** (10 m)
	L-shaped	**CA-CH3L**	**CA-CH5L**	**CA-CH10L**	—	—	—
High-flex, environment-resistant	Straight	—	**CA-CH5BP**	**CA-CH10BP**	—	**CA-CH5BPE** (5 m)	—
High-flex	Straight	**CA-CH3R**	**CA-CH5R**	**CA-CH10R**	**CA-CH17R***1	—	**CA-CH3BX** (3 m) **CA-CH5BX** (5 m) **CA-CH10BX** (10 m)
For high-speed transmission cameras	Straight	**CA-CF3**	**CA-CF5**	**CA-CF10**	—	**CA-CF5E** (5 m) **CA-CF10E** (10 m)	—
	L-shaped	**CA-CF3L**	**CA-CF5L**	**CA-CF10L**	—	—	—

*1 The max. cable length varies depending on the use of extension cables/amplifiers. Contact KEYENCE for details.

Camera cable compatibility

Cable type	Area cameras				
	CA-HF6400x/HF2100x	**CA-H500x/H200x/H035x**	**CA-H500xX/H200xX/H048xX**	**CA-200x/035x**	**CA-HS200x/HS035x**
CA-CH3 (L/R)	—	✓	✓	✓	✓
CA-CH5 (L/R/BP)	—	✓	✓	✓	✓
CA-CH10 (L/R/BP)	—	✓	✓	✓	✓
CA-CH17R	—	—	—	*1	—
CA-CF3 (L)	✓	—	—	—	—
CA-CF5 (L)	✓	—	—	—	—
CA-CF10 (L)	✓	—	—	—	—

*1 The CA-CH17R cable can only be used for connecting the CA-035x camera.

Repeater for camera cable extension
CA-CHX10U

Camera cable extension is possible at a maximum length of 37 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.

Monitor/touch panel

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

12-inch colour LCD monitor
CA-MP120

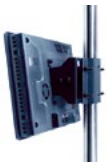
8.4-inch colour LCD monitor
CA-MP82

Optional accessories for CA-MP120T
OP-87264 (3 m touch panel modular RS-232C cable)
OP-87265 (10 m touch panel modular RS-232C cable)

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.



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 9-pin SYSMAC **OP-84384**
For 9-pin MELSEC* **OP-86930**

* When connecting the MELSEC-FX3, 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**
CV-X Series Setup Manual (English) **OP-M1840**
CV-X Series User's Manual (English) **OP-M1845**

The CV-X Series Setup Manual and User's Manual are not included with the controller.
The PDF files of all manuals are provided on CV-H1X.

Controller model *1		CV-X490	CV-X480
Camera input		2 colour/monochrome area cameras can be connected to a CA-E100/E200/E200L area camera input unit, and up to 4 cameras can be connected using 2 area camera input units (mixed connections permitted*2).	
			2 LJ-V heads of the same model can be connected to a CA-E100LJ/E110LJ LJ-V input unit, and up to 4 heads can be connected using 2 input units (mixed connections permitted*2).
	Trigger input	Simultaneous/individual capture*3 with up to 4 cameras/heads can be selected. (Up to 2 cameras for simultaneous capture when one camera input unit is connected)	
Supported cameras/Number of pixels		CA-035C/035M/H035M/H035C/HS035C/HS035M • 0.31 megapixel mode: 640 (H) × 480 (V), approx. 0.31 megapixels • 0.24 megapixel mode: 512 (H) × 480 (V), approx. 0.24 megapixels CA-H048CX/H048MX • 0.47 megapixel mode: 784 (H) × 596 (V), approx. 0.47 megapixels • 0.31 megapixel mode: 640 (H) × 480 (V), approx. 0.31 megapixels • 0.24 megapixel mode: 512 (H) × 480 (V), approx. 0.24 megapixels CA-200C/200M/H200C/H200M/HS200C/HS200M • 2 megapixel mode: 1600 (H) × 1200 (V), approx. 1.92 megapixels • 1 megapixel mode: 1024 (H) × 960 (V), approx. 0.98 megapixels CA-H200CX/H200MX • 2 megapixel mode: 1600 (H) × 1200 (V), approx. 1.92 megapixels CA-H500C/H500M • 5 megapixel mode: 2432 (H) × 2050 (V), approx. 4.99 megapixels CA-H500CX/H500MX • 5 megapixel mode: 2432 (H) × 2040 (V), approx. 4.96 megapixels • 2 megapixel mode: 1600 (H) × 1200 (V), approx. 1.92 megapixels CA-HF2100C/HF2100M • 21 megapixel mode: 5104 (H) × 4092 (V), approx. 20.89 megapixels • 5 megapixel mode: 2432 (H) × 2050 (V), approx. 4.99 megapixels CA-HF6400C/HF6400M • 64 megapixel mode: 8192 (H) × 7808 (V), approx. 63.96 megapixels • 41 megapixel mode: 7168 (H) × 5768 (V), approx. 41.35 megapixels • 21 megapixel mode: 5104 (H) × 4092 (V), approx. 20.89 megapixels	CA-035C/035M/H035M/H035C/HS035C/HS035M • 0.31 megapixel mode: 640 (H) × 480 (V), approx. 0.31 megapixels • 0.24 megapixel mode: 512 (H) × 480 (V), approx. 0.24 megapixels CA-H048CX/H048MX • 0.47 megapixel mode: 784 (H) × 596 (V), approx. 0.47 megapixels • 0.31 megapixel mode: 640 (H) × 480 (V), approx. 0.31 megapixels • 0.24 megapixel mode: 512 (H) × 480 (V), approx. 0.24 megapixels CA-200C/200M/H200C/H200M/HS200C/HS200M • 2 megapixel mode: 1600 (H) × 1200 (V), approx. 1.92 megapixels • 1 megapixel mode: 1024 (H) × 960 (V), approx. 0.98 megapixels CA-H200CX/H200MX • 2 megapixel mode: 1600 (H) × 1200 (V), approx. 1.92 megapixels CA-H500C/H500M • 5 megapixel mode: 2432 (H) × 2050 (V), approx. 4.99 megapixels CA-H500CX/H500MX • 5 megapixel mode: 2432 (H) × 2040 (V), approx. 4.96 megapixels • 2 megapixel mode: 1600 (H) × 1200 (V), approx. 1.92 megapixels CA-HF2100C/HF2100M • 21 megapixel mode: 5104 (H) × 4092 (V), approx. 20.89 megapixels • 5 megapixel mode: 2432 (H) × 2050 (V), approx. 4.99 megapixels
Main image processor		DSP (Fast type)	
Number of setting registrations		Up to 1000 settings (depending on SD card capacity and setting contents) for SD card 1 and SD card 2 individually and external switching is possible	
Number of reference images		Each setting supports 900 images per area camera or 400 images per LJ-V (depending on SD card capacity), compressed save function, and registration of alignment-adjusted images	
Memory card		• SD card slot ×2 (SDHC compatible) • Supports OP-87133 (512 MB), CA-SD1G (1 GB), CA-SD4G (4 GB: standard equipment on the SD1 slot), and CA-SD16G (16 GB)	• SD card slot ×2 (SDHC compatible) • Supports OP-87133 (512 MB), CA-SD1G (1 GB: standard equipment on the SD1 slot), CA-SD4G (4 GB), and CA-SD16G (16 GB)
Number of configurable tools		Up to 100 for each camera	

*1 The letter at the end of the model number indicates the available tool functions on the controller. Contact KEYENCE for more details.
*2 The LJ-V cannot be used at the same time with a 21 megapixel camera or with LumiTrax™.
*3 Because simultaneous capture is always used for LJ-V heads connected to the same LJ-V input unit, two LJ-V input units will be required for individual capture.

Controller model *1			CV-X490	CV-X480
Utilities	Archived image settings		• Can store the image amounts listed below as an archive to the image memory of the main unit • Supports three archive conditions: auto, latest, and total status NG • Supports changing of the memory distribution between archive saving and image output	
		Archive condition (automatic)	With area camera connected: • Max. 1024 images (monochrome camera, 0.24 megapixels) • Max. 1024 images (monochrome camera, 0.31 megapixels) • Max. 1024 images (monochrome camera, 0.47 megapixels) • Max. 1024 images (monochrome camera, 1 megapixel) • Max. 1024 images (monochrome camera, 2 megapixels) • Max. 682 images (monochrome camera, 5 megapixels: CA-H500M) • Max. 686 images (monochrome camera, 5 megapixels: CA-H500MX) • Max. 142 images (monochrome camera, 21 megapixels: CA-HF2100M) • Max. 66 images (monochrome camera, 41 megapixels) • Max. 39 images (monochrome camera, 64 megapixels) • Max. 1024 images (colour camera, 0.24 megapixels) • Max. 1024 images (colour camera, 0.31 megapixels) • Max. 1024 images (colour camera, 0.47 megapixels) • Max. 1024 images (colour camera, 1 megapixel) • Max. 1024 images (colour camera, 2 megapixels) • Max. 665 images (colour camera, 5 megapixels: CA-H500C) • Max. 669 images (colour camera, 5 megapixels: CA-H500CX) • Max. 128 images (colour camera, 21 megapixels: CA-HF2100C) • Max. 39 images (colour camera, 41 megapixels) • Max. 17 images (colour camera, 64 megapixels)	With area camera connected: • Max. 1024 images (monochrome camera, 0.24 megapixels) • Max. 1024 images (monochrome camera, 0.31 megapixels) • Max. 1024 images (monochrome camera, 0.47 megapixels) • Max. 1024 images (monochrome camera, 1 megapixel) • Max. 740 images (monochrome camera, 2 megapixels) • Max. 279 images (monochrome camera, 5 megapixels: CA-H500M) • Max. 280 images (monochrome camera, 5 megapixels: CA-H500MX) • Max. 50 images (monochrome camera, 21 megapixels: CA-HF2100M) • Max. 1024 images (colour camera, 0.24 megapixels) • Max. 1024 images (colour camera, 0.31 megapixels) • Max. 1024 images (colour camera, 0.47 megapixels) • Max. 1024 images (colour camera, 1 megapixel) • Max. 720 images (colour camera, 2 megapixels) • Max. 264 images (colour camera, 5 megapixels: CA-H500C) • Max. 265 images (colour camera, 5 megapixels: CA-H500CX) • Max. 37 images (colour camera, 21 megapixels: CA-HF2100C)
		Archive condition (latest, total status NG)	With area camera connected: • Max. 1024 images (monochrome camera, 0.24 megapixels) • Max. 1024 images (monochrome camera, 0.31 megapixels) • Max. 1024 images (monochrome camera, 0.47 megapixels) • Max. 1024 images (monochrome camera, 1 megapixel) • Max. 1024 images (monochrome camera, 2 megapixels) • Max. 1024 images (monochrome camera, 5 megapixels: CA-H500M) • Max. 1024 images (monochrome camera, 5 megapixels: CA-H500MX) • Max. 273 images (monochrome camera, 21 megapixels: CA-HF2100M) • Max. 122 images (monochrome camera, 41 megapixels) • Max. 71 images (monochrome camera, 64 megapixels) • Max. 1024 images (colour camera, 0.24 megapixels) • Max. 1024 images (colour camera, 0.31 megapixels) • Max. 1024 images (colour camera, 0.47 megapixels) • Max. 1024 images (colour camera, 1 megapixel) • Max. 1024 images (colour camera, 2 megapixels) • Max. 1024 images (colour camera, 5 megapixels: CA-H500C) • Max. 1024 images (colour camera, 5 megapixels: CA-H500CX/HX500C) • Max. 245 images (colour camera, 21 megapixels: CA-HF2100C) • Max. 70 images (colour camera, 41 megapixels) • Max. 30 images (colour camera, 64 megapixels)	With area camera connected: • Max. 1024 images (monochrome camera, 0.24 megapixels) • Max. 1024 images (monochrome camera, 0.31 megapixels) • Max. 1024 images (monochrome camera, 0.47 megapixels) • Max. 1024 images (monochrome camera, 1 megapixel) • Max. 1024 images (monochrome camera, 2 megapixels) • Max. 547 images (monochrome camera, 5 megapixels: CA-H500M) • Max. 549 images (monochrome camera, 5 megapixels: CA-H500MX) • Max. 90 images (monochrome camera, 21 megapixels: CA-HF2100M) • Max. 1024 images (colour camera, 0.24 megapixels) • Max. 1024 images (colour camera, 0.31 megapixels) • Max. 1024 images (colour camera, 0.47 megapixels) • Max. 1024 images (colour camera, 1 megapixel) • Max. 1024 images (colour camera, 2 megapixels) • Max. 517 images (colour camera, 5 megapixels: CA-H500C) • Max. 520 images (colour camera, 5 megapixels: CA-H500CX) • Max. 66 images (colour camera, 21 megapixels: CA-HF2100C)
			• Supports output of each archived image to SD cards, PC program, FTP server, and USB HDD • Supports output to folders for each camera • Image output condition can be set to output all images, individual camera NG, or total status NG • Supports image output preferred setting • Supports LumiTrax™ and multi-spectrum image archive target setting	
	Statistics	Amount of data	Max 20000 pieces of data per item, max. 128 items (supports batch saving to SD card)	
		Statistical items	Max. value, min. value, average value, deviation (3σ), OK/NG count in total status, yield rate, process capability index (Cpk, Cpu, Cpl)	
		Type	Measured value list, trend graph, histogram, process monitor	
Support functions	SD card saving function		Supports measured values, judgement results, measurement images (can be compressed), archived images (can be compressed), captured images, statistics data, RS-232C communication logs, setting contents, and direct saving during inspection operations (not including setting contents)	
	Context menu		Image capture function, change user account function, reset, trigger reset, remove SD Card 2 and USB HDD	

*1 The letter at the end of the model number indicates the available tool functions on the controller. Contact KEYENCE for more details.

Controller model *1			CV-X490	CV-X480
Interface	Control input	External trigger input	4 points (2 of which support special function assignment)	
			Can set individual trigger delays (0 to 999 ms) for each trigger input.	
		Control input	16 points (4 of which support special function assignment) Input rating: 26.4 V max., 1.2 mA min.	
	Control output	Common output	27 points (11 of which support special function assignment, includes 4 high speed outputs), photo MOSFET*2, 50 mA max. (30 V max.)	
		Total status output	1 point, photo MOSFET*2, 50 mA max. (30 V max.) Supports total status hold control, one shot output (1 to 9999 ms)	
	Monitor output		Analogue RGB output XGA 1024 × 768 (24 bit colour, 60 Hz)	
	Operation indicator		Power, ERROR LED display	
	RS-232C		Value output and control I/O function can be switched to a CA Series touch panel interface; supports baud rates up to 230400 bps (when this is in use, PLC link using RS-232C port cannot be used).	
	PLC link		• Can output numerical values and perform control input/output using the Ethernet or RS-232C port. (EtherNet/IP™ and PROFINET cannot be used in conjunction with PLC link. When using the RS-232C port, non-procedural RS-232C communication cannot be used in conjunction with PLC link.) • The following PLCs are supported via link unit*3: KEYENCE: KV-8000/7000/5000/3000/1000/700 Series, KV Nano Series Mitsubishi Electric: MELSEC iQ-R/L/Q Series, MELSEC A Series, (RS-232C only), MELSEC iQ-F Series, MELSEC FX Series (RS-232C only) OMRON: SYSMAC CJ2/CJ1/CS1/CP1 Series, SYSMAC C Series (RS-232C only) YASKAWA Electric Corporation: MP2000 Series, MP900 Series (RS-232C only)	
	Ethernet		• Can output numerical values and perform control input/output • Supports output of measured values and image data to a PC, upload/download of settings, and the remote desktop function via the included PC program software • Supports FTP client, FTP server, and SFTP client functions • VNC server functions (for non-PC clients, only displaying the monitor screen is supported) • Supports BOOTP function • 1000BASE-T/100BASE-TX/10BASE-T • Supports jumbo frame (when connected to CA-NEC20E/NEP20E/NPN20E)	
	USB		• Supports output of measured values and image data to a PC, upload/download of settings, and the remote desktop function via the included PC program software • Dedicated to USB 2.0	
	EtherNet/IP™		• Numerical value and control input/output using Ethernet port or optional EtherNet/IP™ unit CA-NEP20E (cannot be used in conjunction with PLC link, PROFINET, and EtherCAT®) • Supports cyclic communication (max. 1436 bytes) and message communication • Maximum connections: 32 (Ethernet port) / 1: Exclusive Owner, 4: Input Only (CA-NEP20E) • Conforms to conformance test Version CT15 (Ethernet port) / CT17 (CA-NEP20E)	
	PROFINET		• Numerical value input and control input/output using Ethernet port or optional PROFINET unit CA-NPN20E (cannot be used in conjunction with PLC link, EtherNet/IP™, and EtherCAT®) • Supports cyclic communication (max. 1408 bytes (Ethernet port) / 1252 bytes (CA-NPN20E)) • Supports non-cyclic (record data) communication • Conforms to Conformance Class A (Ethernet port) / C (CA-NPN20E)	
	EtherCAT®		• Numerical value output and control input/output using optional EtherCAT® unit CA-NEC20E (cannot be used in conjunction with PLC link, EtherNet/IP™, and PROFINET) • Supports cyclic communication (process data object communication) (Input: max. 536 bytes / Output: max. 532 bytes) • Supports non-cyclic communication (mailbox communication) • Supports CoE • Explicit Device Identification • Conforms to conformance test V2.2.1.0	
	SNTP		Automatic date and time correction when connected to SNTP server	
	Mouse		Possible to control various menus via an optional dedicated mouse (OP-87506: included with the controller)	
	Touch panel		Settings can be operated from a CA Series touch panel using the RS-232C port (When this is in use, non-procedural RS-232C communication and PLC link cannot be used)	
	USB HDD		By connecting the HDD (max. 2 TB) to the dedicated USB port (supports USB 3.0, bus-powered, rated output 900 mA), image and other data can be output	
Illumination control			By connecting the optional light expansion unit CA-DC40E/DC50E/DC60E, lighting and intensity control for the LED illumination is possible.*4	
Cooling fan			CA-F100 fan unit is included (attached) to the controller.	
Language			Switchable between English, Simplified Chinese, Traditional Chinese, Korean, Thai, German, French, Italian, Spanish (Mexico), Indonesian, Portuguese (Brazil), Vietnamese, Czech, Hungarian, Polish, and Japanese	
Rating	Voltage		24 VDC ±10%	
	Current consumption		5.3 A	
Environmental resistance	Operating ambient temperature		0 to +45°C (DIN rail mount) / 0 to +40°C (bottom side mount)	
	Operating ambient humidity		35 to 85% RH (No condensation)	
Weight			Approx. 1750 g	

*1 The letter at the end of the model number indicates the available tool functions on the controller. Contact KEYENCE for more details.
*2 The output common can be configured for NPN or PNP input devices.
*3 Models that are equipped with an Ethernet port on the CPU unit support direct connection with the Ethernet port.
*4 Up to 8 light control expansion units can be connected (max. two CA-DC50E/DC60E units out of 8).

Controller model *1			CV-X470	CV-X450	CV-X420	CV-X400
Camera input			Two colour/monochrome cameras			
			Up to 4 camera inputs available when connecting a CA-E100 to the main controller.			—
	Trigger input		Simultaneous/individual capture with up to 4 cameras can be selected. (up to 2 cameras for simultaneous capture when the CV-E100 is not connected)			Simultaneous/individual capture with up to 2 cameras can be selected.
Supported cameras / Number of pixels			With CA-035C/HS035C/H035C/035M/HS035M/H035M connected: • 0.31 megapixel mode: 640 (H) × 480 (V), approx. 0.31 megapixels • 0.24 megapixel mode: 512 (H) × 480 (V), approx. 0.24 megapixels With CA-H048CX/H048MX connected: • 0.47 megapixel mode: 784 (H) × 596 (V), approx. 0.47 megapixels • 0.31 megapixel mode: 640 (H) × 480 (V), approx. 0.31 megapixels • 0.24 megapixel mode: 512 (H) × 480 (V), approx. 0.24 megapixels With CA-200C/HS200C/H200C/200M/HS200M/H200M connected: • 2 megapixel mode: 1600 (H) × 1200 (V), approx. 1.92 megapixels • 1 megapixel mode: 1024 (H) × 960 (V), approx. 0.98 megapixels With CA-H200CX/H200MX connected: • 2 megapixel mode: 1600 (H) × 1200 (V), approx. 1.92 megapixels With CA-H500C/H500M connected: • 5 megapixel mode: 2432 (H) × 2050 (V), approx. 4.99 megapixels With CA-H500CX/H500MX connected: • 5 megapixel mode: 2432 (H) × 2040 (V), approx. 4.96 megapixels • 2 megapixel mode: 1600 (H) × 1200 (V), approx. 1.92 megapixels	With CA-035C/HS035C/H035C/035M/HS035M/H035M connected: • 0.31 megapixel mode: 640 (H) × 480 (V), approx. 0.31 megapixels • 0.24 megapixel mode: 512 (H) × 480 (V), approx. 0.24 megapixels With CA-H048CX/H048MX connected: • 0.47 megapixel mode: 784 (H) × 596 (V), approx. 0.47 megapixels • 0.31 megapixel mode: 640 (H) × 480 (V), approx. 0.31 megapixels • 0.24 megapixel mode: 512 (H) × 480 (V), approx. 0.24 megapixels With CA-200C/HS200C/H200C/200M/HS200M/H200M connected: • 2 megapixel mode: 1600 (H) × 1200 (V), approx. 1.92 megapixels • 1 megapixel mode: 1024 (H) × 960 (V), approx. 0.98 megapixels With CA-H200CX/H200MX connected: • 2 megapixel mode: 1600 (H) × 1200 (V), approx. 1.92 megapixels With CA-H500C/H500M connected: • 5 megapixel mode: 2432 (H) × 2050 (V), approx. 4.99 megapixels With CA-H500CX/H500MX connected: • 5 megapixel mode: 2432 (H) × 2040 (V), approx. 4.96 megapixels • 2 megapixel mode: 1600 (H) × 1200 (V), approx. 1.92 megapixels	With CA-035C/HS035C/H035C/035M/HS035M/H035M connected: • 0.31 megapixel mode: 640 (H) × 480 (V), approx. 0.31 megapixels • 0.24 megapixel mode: 512 (H) × 480 (V), approx. 0.24 megapixels With CA-H048CX/H048MX connected: • 0.47 megapixel mode: 784 (H) × 596 (V), approx. 0.47 megapixels • 0.31 megapixel mode: 640 (H) × 480 (V), approx. 0.31 megapixels • 0.24 megapixel mode: 512 (H) × 480 (V), approx. 0.24 megapixels With CA-200C/HS200C/H200C/200M/HS200M/H200M connected: • 2 megapixel mode: 1600 (H) × 1200 (V), approx. 1.92 megapixels • 1 megapixel mode: 1024 (H) × 960 (V), approx. 0.98 megapixels With CA-H200CX/H200MX connected: • 2 megapixel mode: 1600 (H) × 1200 (V), approx. 1.92 megapixels	With CA-035C/HS035C/H035C/035M/HS035M/H035M connected: • 0.31 megapixel mode: 640 (H) × 480 (V), approx. 0.31 megapixels • 0.24 megapixel mode: 512 (H) × 480 (V), approx. 0.24 megapixels With CA-H048CX/H048MX connected: • 0.47 megapixel mode: 784 (H) × 596 (V), approx. 0.47 megapixels • 0.31 megapixel mode: 640 (H) × 480 (V), approx. 0.31 megapixels • 0.24 megapixel mode: 512 (H) × 480 (V), approx. 0.24 megapixels
Main image processor			DSP (Fast type)	DSP		
Number of setting registrations			Up to 1000 settings (depending on SD card capacity and setting contents) for SD card 1 and SD card 2 individually and external switching is possible			
Number of reference images			Each setting supports 900 images per area camera (depending on SD card capacity), compressed save function, and registration of alignment-adjusted images			
Memory card			• SD card slot ×2 (SDHC compatible) • Supports OP-87133 (512 MB: standard equipment on the SD1 slot for the CV-X420/X400), CA-SD1G (1 GB: standard equipment on the SD1 slot for the CV-X480/X470/X450), CA-SD4G (4 GB), and CA-SD16G (16 GB)			
Number of configurable tools			Up to 100 for each camera			
Utilities	Archived image settings		• Can store the image amounts listed below as an archive to the image memory of the main unit • Supports three archive conditions: auto, latest, and total status NG • Supports changing of the memory distribution between archive saving and image output			
		Archive condition (automatic)	• Max. 1024 images (monochrome camera, 0.24 megapixels) • Max. 1024 images (monochrome camera, 0.31 megapixels) • Max. 1024 images (monochrome camera, 0.47 megapixels) • Max. 1024 images (monochrome camera, 1 megapixel) • Max. 740 images (monochrome camera, 2 megapixels) • Max. 279 images (monochrome camera, 5 megapixels: CA-H500M) • Max. 280 images (monochrome camera, 5 megapixels: CA-H500MX) • Max. 50 images (monochrome camera, 21 megapixels) • Max. 1024 images (colour camera, 0.24 megapixels) • Max. 1024 images (colour camera, 0.31 megapixels) • Max. 1024 images (colour camera, 0.47 megapixels) • Max. 1024 images (colour camera, 1 megapixel) • Max. 720 images (colour camera, 2 megapixels) • Max. 264 images (colour camera, 5 megapixels: CA-H500C) • Max. 265 images (colour camera, 5 megapixels: CA-H500CX) • Max. 37 images (colour camera, 21 megapixels)	• Max. 1024 images (monochrome camera, 0.24 megapixels) • Max. 1024 images (monochrome camera, 0.31 megapixels) • Max. 1024 images (monochrome camera, 0.47 megapixels) • Max. 1024 images (monochrome camera, 1 megapixel) • Max. 740 images (monochrome camera, 2 megapixels) • Max. 279 images (monochrome camera, 5 megapixels: CA-H500M) • Max. 280 images (monochrome camera, 5 megapixels: CA-H500MX) • Max. 1024 images (colour camera, 0.24 megapixels) • Max. 1024 images (colour camera, 0.31 megapixels) • Max. 1024 images (colour camera, 0.47 megapixels) • Max. 1024 images (colour camera, 1 megapixel) • Max. 720 images (colour camera, 2 megapixels) • Max. 264 images (colour camera, 5 megapixels: CA-H500C) • Max. 265 images (colour camera, 5 megapixels: CA-H500CX)	• Max. 1024 images (monochrome camera, 0.24 megapixels) • Max. 1024 images (monochrome camera, 0.31 megapixels) • Max. 1024 images (monochrome camera, 0.47 megapixels) • Max. 640 images (monochrome camera, 1 megapixel) • Max. 323 images (monochrome camera, 2 megapixels) • Max. 1024 images (colour camera, 0.24 megapixels) • Max. 1024 images (colour camera, 0.31 megapixels) • Max. 1024 images (colour camera, 0.47 megapixels) • Max. 619 images (colour camera, 1 megapixel) • Max. 307 images (colour camera, 2 megapixels)	• Max. 1024 images (monochrome camera, 0.24 megapixels) • Max. 868 images (monochrome camera, 0.31 megapixels) • Max. 568 images (monochrome camera, 0.47 megapixels) • Max. 1024 images (colour camera, 0.24 megapixels) • Max. 836 images (colour camera, 0.31 megapixels) • Max. 545 images (colour camera, 0.47 megapixels)

*1 The letter at the end of the model number indicates the difference of the installed software function. For details, see the "CV-X Series User's Manual".

Controller model *1			CV-X470	CV-X450	CV-X420	CV-X400
Utilities	Archived image settings	Archive condition (latest, total status NG)	• Max. 1024 images (monochrome camera, 0.24 megapixels) • Max. 1024 images (monochrome camera, 0.31 megapixels) • Max. 1024 images (monochrome camera, 0.47 megapixels) • Max. 1024 images (monochrome camera, 1 megapixel) • Max. 1024 images (monochrome camera, 2 megapixels) • Max. 547 images (monochrome camera, 5 megapixels: CA-H500M) • Max. 549 images (monochrome camera, 5 megapixels: CA-H500MX) • Max. 90 images (monochrome camera, 21 megapixels) • Max. 1024 images (colour camera, 0.24 megapixels) • Max. 1024 images (colour camera, 0.31 megapixels) • Max. 1024 images (colour camera, 0.47 megapixels) • Max. 1024 images (colour camera, 1 megapixel) • Max. 1024 images (colour camera, 2 megapixels) • Max. 517 images (colour camera, 5 megapixels: CA-H500C) • Max. 520 images (colour camera, 5 megapixels: CA-H500CX) • Max. 66 images (colour camera, 21 megapixels)	• Max. 1024 images (monochrome camera, 0.24 megapixels) • Max. 1024 images (monochrome camera, 0.31 megapixels) • Max. 1024 images (monochrome camera, 0.47 megapixels) • Max. 1024 images (monochrome camera, 1 megapixel) • Max. 1024 images (monochrome camera, 2 megapixels) • Max. 547 images (monochrome camera, 5 megapixels: CA-H500M) • Max. 549 images (monochrome camera, 5 megapixels: CA-H500MX) • Max. 1024 images (colour camera, 0.24 megapixels) • Max. 1024 images (colour camera, 0.31 megapixels) • Max. 1024 images (colour camera, 0.47 megapixels) • Max. 1024 images (colour camera, 1 megapixel) • Max. 1024 images (colour camera, 2 megapixels) • Max. 517 images (colour camera, 5 megapixels: CA-H500C) • Max. 520 images (colour camera, 5 megapixels: CA-H500CX)	• Max. 1024 images (monochrome camera, 0.24 megapixels) • Max. 1024 images (monochrome camera, 0.31 megapixels) • Max. 1024 images (monochrome camera, 0.47 megapixels) • Max. 1024 images (monochrome camera, 1 megapixel) • Max. 635 images (monochrome camera, 2 megapixels) • Max. 1024 images (colour camera, 0.24 megapixels) • Max. 1024 images (colour camera, 0.31 megapixels) • Max. 1024 images (colour camera, 0.47 megapixels) • Max. 1024 images (colour camera, 1 megapixel) • Max. 603 images (colour camera, 2 megapixels)	• Max. 1024 images (monochrome camera, 0.24 megapixels) • Max. 1024 images (monochrome camera, 0.31 megapixels) • Max. 1024 images (monochrome camera, 0.47 megapixels) • Max. 1024 images (colour camera, 0.24 megapixels) • Max. 1024 images (colour camera, 0.31 megapixels) • Max. 1024 images (colour camera, 0.47 megapixels)
			• Supports output of archived images to SD cards, PC program, FTP server and USB HDD • Supports output to folders for each camera • Image output condition can be set to output all images, individual camera NG or total status NG • Supports image output preferred setting • Supports LumiTrax™ image archive target setting			
	Statistics	Amount of data	Max 20000 pieces of data per item, max. 128 items (supports batch saving to SD card)			
		Statistical items	Max. value, min. value, average value, deviation (3σ), OK/NG count in total status, yield rate, process capability index (Cpk, Cpu, Cpl)			
		Type	Measured value list, trend graph, histogram, process monitor			
Support functions	SD card saving function		Supports measured values, judgement results, measurement images (can be compressed), archived images (can be compressed), captured images, statistics data, RS-232C communication logs, setting contents, and direct saving during inspection operations (not including setting contents)			
	Context menu		Image capture function, change user account function, reset, trigger reset, remove SD Card 2 and USB HDD			

*1 The letter at the end of the model number indicates the difference of the installed software function. For details, see the "CV-X Series User's Manual".

Controller model *1			CV-X470	CV-X450	CV-X420	CV-X400
Interface	Control input	External trigger input	4 points (2 of which support special function assignment) Input rating: 26.4 V max., 3 mA min, can select from simultaneous/individual capture with up to 4 cameras.			4 points (2 of which support special function assignment) Input rating: 26.4 V max., 3 mA min, can select from simultaneous/individual capture with up to 2 cameras.
			Can set individual trigger delays (0 to 999 ms) for each trigger input.			
		Control input	16 points (4 of which support special function assignment) Input rating: 26.4 V max., 2 mA min.			
	Control output	Common output	27 points (11 of which support special function assignment, includes 4 high speed outputs), photo MOSFET*2, 50 mA max. (30 V max.)			
		Total status output	1 point, photo MOSFET*2, 50 mA max. (30 V max.) Supports total status hold control, one shot output (1 to 9999 ms)			
	Encoder input		None			
	Monitor output		Analogue RGB output XGA 1024 × 768 (24 bit colour, 60 Hz)			
	Operation indicator		Power, ERROR LED display			
	RS-232C		Value output and control I/O function can be switched to a CA Series touch panel interface; supports baud rates up to 230400 bps (when this is in use, PLC-Link using RS-232C port cannot be used).			
	PLC link		• Can output numerical values and perform control input/output using the Ethernet or RS-232C port. (EtherNet/IP™ and PROFINET cannot be used in conjunction with PLC-Link. When using the RS-232C port, non-procedural RS-232C communication cannot be used in conjunction with PLC-Link.) • The following PLCs are supported via link unit*3: KEYENCE: KV-8000/7000/5000/3000/1000/700 Series, KV Nano Series Mitsubishi Electric: MELSEC iQ-R/L/Q Series, MELSEC A Series, (RS-232C only), MELSEC iQ-F Series, MELSEC FX Series (RS-232C only) OMRON: SYSMAC CJ2/CJ1/CS1/CP1 Series, SYSMAC C Series (RS-232C only) YASKAWA Electric Corporation: MP2000 Series, MP900 Series (RS-232C only)			
	Ethernet		• Can output numerical values and perform control input/output • Supports output of measured values and image data to a PC, upload/download of settings, and the remote desktop function via the free PC program software • Supports FTP client and FTP server functions • VNC server functions (for non-PC clients, only displaying the monitor screen is supported) • Supports BOOTP function • 1000BASE-T/100BASE-TX/10BASE-T			
	USB		• Supports output of measured values and image data to a PC, upload/download of settings, and the remote desktop function via the free PC program software • Dedicated to USB 2.0			
	EtherNet/IP™		• Numerical value and control input/output using the Ethernet port enabled (cannot be used in conjunction with PLC-link/PROFINET). • Cyclic (implicit) communication (max. 1436 bytes) possible. Message communication possible. • Maximum connections: 32 • Conforms to conformance test Version.CT15.			
	PROFINET		• Numerical value and control input/output using the Ethernet port enabled (cannot be used in conjunction with PLC-link/EtherNet/IP™). • Supports cyclic communication (max. 1408 bytes) and record data message communication. • In conformity with Conformance Class A.			
	SNTP		Unit's date and time auto-corrects when unit is connected to SNTP server			
	Mouse		Possible to control various menus via an optional dedicated mouse (OP-87506: included with the controller)			
	Touch panel		Settings can be operated from a CA Series touch panel using the RS-232C port (When this is in use, non-procedural RS-232C communication and PLC-Link cannot be used)			
	USB HDD		By connecting the HDD (max. 2 TB) to the dedicated USB port (supports USB 3.0, bus-powered, rated output 900 mA), image and other data can be output			
Illumination control			By connecting the optional light expansion unit CA-DC40E/DC50E/DC60E, lighting and intensity control for the LED illumination is possible.*4			
Cooling fan			CA-F100 fan unit is included (attached) to the controller.	None		
Language			Switchable between English, Simplified Chinese, Traditional Chinese, Korean, Thai, German, French, Italian, Spanish (Mexico), Indonesian, Portuguese (Brazil), Vietnamese, Czech, Hungarian, Polish, and Japanese			
Rating	Voltage		24 VDC ±10%			
	Current consumption		3.8 A			2.4 A
Environmental resistance	Operating ambient temperature		0 to 45°C (DIN rail mount) / 0 to 40°C (bottom side mount)			
	Operating ambient humidity		35 to 85% RH (No condensation)			
Weight			Approx. 1800 g	Approx. 1600 g		

*1 The letter at the end of the model number indicates the difference of the installed software function. For details, see the "CV-X Series User's Manual".
*2 The output common can be configured for NPN or PNP input devices.
*3 Models that are equipped with an Ethernet port on the CPU unit support direct connection with the Ethernet port.
*4 Up to 8 light control expansion units can be connected (max. two CA-DC50E/DC60E units out of 8).

Controller model*1			CV-X350	CV-X320	CV-X300
Camera input			Two colour/monochrome cameras		
			Up to 4 inputs can be connected by connecting 1 optional area camera input unit CA-E100		—
	Trigger input		Simultaneous/individual capture with up to 4 cameras can be selected (up to 2 cameras for simultaneous capture when the CA-E100 is not connected)		Simultaneous/individual capture with up to 2 cameras can be selected
Supported cameras / Number of pixels			With CA-035C/HS035C/H035C/035M/ HS035M/H035M connected: • 0.31 megapixel mode: 640 (H) × 480 (V), approx. 0.31 megapixels • 0.24 megapixel mode: 512 (H) × 480 (V), approx. 0.24 megapixels With CA-H048CX/H048MX connected: • 0.47 megapixel mode: 784 (H) × 596 (V), approx. 0.47 megapixels • 0.31 megapixel mode: 640 (H) × 480 (V), approx. 0.31 megapixels • 0.24 megapixel mode: 512 (H) × 480 (V), approx. 0.24 megapixels With CA-200C/HS200C/H200C/200M/ HS200M/H200M connected: • 2 megapixel mode: 1600 (H) × 1200 (V), approx. 1.92 megapixels • 1 megapixel mode: 1024 (H) × 960 (V), approx. 0.98 megapixels With CA-H200CX/H200MX connected: • 2 megapixel mode: 1600 (H) × 1200 (V), approx. 1.92 megapixels With CA-H500C/H500M connected: • 5 megapixel mode: 2432 (H) × 2050 (V), approx. 4.99 megapixels With CA-H500CX/H500MX connected: • 5 megapixel mode: 2432 (H) × 2040 (V), approx. 4.96 megapixels • 2 megapixel mode: 1600 (H) × 1200 (V), approx. 1.92 megapixels	With CA-035C/HS035C/H035C/035M/ HS035M/H035M connected: • 0.31 megapixel mode: 640 (H) × 480 (V), approx. 0.31 megapixels • 0.24 megapixel mode: 512 (H) × 480 (V), approx. 0.24 megapixels With CA-H048CX/H048MX connected: • 0.47 megapixel mode: 784 (H) × 596 (V), approx. 0.47 megapixels • 0.31 megapixel mode: 640 (H) × 480 (V), approx. 0.31 megapixels • 0.24 megapixel mode: 512 (H) × 480 (V), approx. 0.24 megapixels With CA-200C/HS200C/H200C/200M/ HS200M/H200M connected: • 2 megapixel mode: 1600 (H) × 1200 (V), approx. 1.92 megapixels • 1 megapixel mode: 1024 (H) × 960 (V), approx. 0.98 megapixels With CA-H200CX/H200MX connected: • 2 megapixel mode: 1600 (H) × 1200 (V), approx. 1.92 megapixels	With CA-035C/HS035C/H035C/035M/ HS035M/H035M connected: • 0.31 megapixel mode: 640 (H) × 480 (V), approx. 0.31 megapixels • 0.24 megapixel mode: 512 (H) × 480 (V), approx. 0.24 megapixels With CA-H048CX/H048MX connected: • 0.47 megapixel mode: 784 (H) × 596 (V), approx. 0.47 megapixels • 0.31 megapixel mode: 640 (H) × 480 (V), approx. 0.31 megapixels • 0.24 megapixel mode: 512 (H) × 480 (V), approx. 0.24 megapixels
Main image processor			DSP		
Number of setting registrations			Up to 1000 settings (depending on SD card capacity and setting contents) for SD card 1 and SD card 2 individually and external switching is possible		
Number of reference images			Each setting supports 900 images per camera (depending on SD card capacity), compress and save functions and reference image registration of alignment adjusted images		
Memory card			• SD card slot ×2 • Supports OP-87133 (512 MB: standard equipment on the SD1 slot for the CV-X320/X300), CA-SD1G (1 GB: standard equipment on the SD1 slot for the CV-X350), CA-SD4G (4 GB), CA-SD16G (16 GB)		
Number of configurable tools			Up to 100 for each camera		
Utilities	Archived image settings		Can store the image amounts listed below as an archive to the image memory of the main unit Supports three archive conditions: auto, latest, and total status NG Supports memory distribution selection		
		Archive condition (automatic)	• Max. 1024 images (monochrome camera, 0.24 megapixels) • Max. 1024 images (monochrome camera, 0.31 megapixels) • Max. 1024 images (monochrome camera, 0.47 megapixels) • Max. 764 images (monochrome camera, 1 megapixel) • Max. 386 images (monochrome camera, 2 megapixels) • Max. 142 images (monochrome camera, 5 megapixels: CA-H500M) • Max. 143 images (monochrome camera, 5 megapixels: CA-H500MX) • Max. 1024 images (colour camera, 0.24 megapixels) • Max. 1024 images (colour camera, 0.31 megapixels) • Max. 1024 images (colour camera, 0.47 megapixels) • Max. 741 images (colour camera, 1 megapixel) • Max. 370 images (colour camera, 2 megapixels) • Max. 128 images (colour camera, 5 megapixels: CA-H500C) • Max. 129 images (colour camera, 5 megapixels: CA-H500CX)	• Max. 1024 images (monochrome camera, 0.24 megapixels) • Max. 1024 images (monochrome camera, 0.31 megapixels) • Max. 766 images (monochrome camera, 0.47 megapixels) • Max. 359 images (monochrome camera, 1 megapixel) • Max. 179 images (monochrome camera, 2 megapixels) • Max. 1024 images (colour camera, 0.24 megapixels) • Max. 1024 images (colour camera, 0.31 megapixels) • Max. 740 images (colour camera, 0.47 megapixels) • Max. 342 images (colour camera, 1 megapixel) • Max. 164 images (colour camera, 2 megapixels)	• Max. 512 images (monochrome camera, 0.24 megapixels) • Max. 408 images (monochrome camera, 0.31 megapixels) • Max. 265 images (monochrome camera, 0.47 megapixels) • Max. 487 images (colour camera, 0.24 megapixels) • Max. 386 images (colour camera, 0.31 megapixels) • Max. 248 images (colour camera, 0.47 megapixels)
		Archive condition (latest, total status NG)	• Max. 1024 images (monochrome camera, 0.24 megapixels) • Max. 1024 images (monochrome camera, 0.31 megapixels) • Max. 1024 images (monochrome camera, 0.47 megapixels) • Max. 1024 images (monochrome camera, 1 megapixel) • Max. 762 images (monochrome camera, 2 megapixels) • Max. 274 images (monochrome camera, 5 megapixels: CA-H500M) • Max. 276 images (monochrome camera, 5 megapixels: CA-H500MX) • Max. 1024 images (colour camera, 0.24 megapixels) • Max. 1024 images (colour camera, 0.31 megapixels) • Max. 1024 images (colour camera, 0.47 megapixels) • Max. 1024 images (colour camera, 1 megapixel) • Max. 729 images (colour camera, 2 megapixels) • Max. 246 images (colour camera, 5 megapixels: CA-H500C) • Max. 247 images (colour camera, 5 megapixels: CA-H500CX)	• Max. 1024 images (monochrome camera, 0.24 megapixels) • Max. 1024 images (monochrome camera, 0.31 megapixels) • Max. 1024 images (monochrome camera, 0.47 megapixels) • Max. 708 images (monochrome camera, 1 megapixel) • Max. 348 images (monochrome camera, 2 megapixels) • Max. 1024 images (colour camera, 0.24 megapixels) • Max. 1024 images (colour camera, 0.31 megapixels) • Max. 1024 images (colour camera, 0.47 megapixels) • Max. 673 images (colour camera, 1 megapixel) • Max. 318 images (colour camera, 2 megapixels)	• Max. 1014 images (monochrome camera, 0.24 megapixels) • Max. 806 images (monochrome camera, 0.31 megapixels) • Max. 520 images (monochrome camera, 0.47 megapixels) • Max. 963 images (colour camera, 0.24 megapixels) • Max. 762 images (colour camera, 0.31 megapixels) • Max. 485 images (colour camera, 0.47 megapixels)
			• Supports output of each archived image to SD cards, PC program, FTP server and USB HDD • Supports output to folders for each camera • Image output condition can be set to output all images, individual camera NG or total status NG • Supports image output preferred setting		
	Statistics	Amount of data	Max 20000 pieces of data per item, max. 128 items (supports batch saving to SD card)		
		Statistical items	Max. value, min. value, average value, deviation (3σ), OK/NG count in total status, yield rate, process capability index (Cpk, Cpu, Cpl)		
		Type	Measured value list, trend graph, histogram, process monitor		
Support functions	SD card saving function		Supports measured values, judgement results, measurement images (can be compressed), archived images (can be compressed), captured images, statistics data, RS-232C communication logs, setting contents, and direct saving during inspection operations (not including setting contents)		
	Context menu		Image capture function, change user account function, reset, trigger reset, remove SD Card 2 and USB HDD		

*1 The letter at the end of the model number indicates the difference of the installed software function. For details, see the "CV-X Series User's Manual".

Controller model *1			CV-X350	CV-X320	CV-X300
Interface	Control input	External trigger input	4 points (2 of which support special function assignment) Input rating: 26.4 V max., 3 mA min, can select from simultaneous/individual capture with up to 4 cameras		4 points (2 of which support special function assignment) Input rating: 26.4 V max., 3 mA min, can select from simultaneous/individual capture with up to 2 cameras.
			Can set individual trigger delays (0 to 999 ms) for each trigger input.		
		Control input	16 points (4 of which support special function assignment) Input rating: 26.4 V max., 2 mA min.		
	Control output	Common output	27 points (11 of which support special function assignment, includes 4 high speed outputs), photo MOSFET*2, 50 mA max. (30 V max.)		
		Total status output	1 point, photo MOSFET*2, 50 mA max. (30 V max.) Supports total status hold control, one shot output (1 to 9999 ms)		
	Monitor output		Analogue RGB output XGA 1024 × 768 (24 bit colour, 60 Hz)		
	Operation indicator		Power, ERROR LED display		
	RS-232C		Value output and control I/O function can be switched to a CA Series touch panel interface; supports baud rates up to 230400 bps (when this is in use, PLC-Link using RS-232C port cannot be used).		
	PLC link		• Can output numerical values and perform control input/output using the Ethernet or RS-232C port. (EtherNet/IP™ and PROFINET cannot be used in conjunction with PLC-Link. When using the RS-232C port, non-procedural RS-232C communication cannot be used in conjunction with PLC-Link.) • The following PLCs are supported via link unit*3: KEYENCE: KV-8000/7000/5000/3000/1000/700 Series, KV Nano Series Mitsubishi Electric: MELSEC iQ-R/L/Q Series, MELSEC A Series, (RS-232C only), MELSEC iQ-F Series, MELSEC FX Series (RS-232C only) OMRON: SYSMAC CJ2/CJ1/CS1/CP1 Series, SYSMAC C Series (RS-232C only) YASKAWA Electric Corporation: MP2000 Series, MP900 Series (RS-232C only)		
	Ethernet		• Can output numerical values and perform control input/output • Supports output of measured values and image data to a PC, upload/download of settings, and the remote desktop function via the free PC program software • Supports FTP client and FTP server functions • VNC server functions (for non-PC clients, only displaying the monitor screen is supported) • Supports BOOTP function • 1000BASE-T/100BASE-TX/10BASE-T		
	USB		• Supports output of measured values and image data to a PC, upload/download of settings, and the remote desktop function via the free PC program software • Dedicated to USB 2.0		
	EtherNet/IP™		• Numerical value and control input/output using the Ethernet port enabled (cannot be used in conjunction with PLC-link/PROFINET). • Cyclic (implicit) communication (max. 1436 bytes) possible. Message communication possible. • Maximum connections: 32 • Conforms to conformance test Version.CT15.		
	PROFINET		• Numerical value and control input/output using the Ethernet port enabled (cannot be used in conjunction with PLC-link/EtherNet/IP™). • Supports cyclic communication (max. 1408 bytes) and record data message communication. • In conformity with Conformance Class A.		
	SNTP		Controller date and time automatically updates when unit is connected to SNTP server		
	Mouse		Possible to control various menus via an optional dedicated mouse (OP-87506: included with the controller)		
	Touch panel		Settings can be operated from a CA Series touch panel using the RS-232C port (When this is in use, non-procedural RS-232C communication and PLC-Link cannot be used)		
	USB HDD		By connecting the HDD (max. 2 TB) to the dedicated USB port (supports USB 3.0, bus-powered, rated output 900 mA), image and other data can be output		
Illumination control			By connecting the optional light expansion unit CA-DC40E/DC50E, lighting and intensity control for the LED illumination is possible.*4		
Language			Switchable between English, Simplified Chinese, Traditional Chinese, Korean, Thai, German, French, Italian, Spanish (Mexico), Indonesian, Portuguese (Brazil), Vietnamese, Czech, Hungarian, Polish, and Japanese		
Cooling fan			—		
Rating	Voltage		24 VDC ±10%		
	Current consumption		3.8 A		2.4 A
Environmental resistance	Operating ambient temperature		0 to 45°C (DIN rail mount) / 0 to 40°C (bottom side mount)		
	Operating ambient humidity		35 to 85% RH (No condensation)		
Weight			Approx. 1600 g		

*1 The letter at the end of the model number indicates the difference of the installed software function. For details, see the "CV-X Series User's Manual".
*2 The output common can be configured for NPN or PNP input devices.
*3 Models that are equipped with an Ethernet port on the CPU unit support direct connection with the Ethernet port.
*4 Up to 8 light control expansion units can be connected (max. two CA-DC50E units out of 8).

Camera (CA-HF6400M/CA-HF6400C)

Model		CA-HF6400C	CA-HF6400M
Image receiving element		Colour CMOS, 88× high-speed reading using square-pixel	Monochrome CMOS, 90× high-speed reading using square-pixel
Unit cell size		2.5 µm × 2.5 µm	
Image size		Equivalent to 2" (ø32 mm)*1	
Valid pixel count		64 megapixel mode: 8192 (H) × 7808 (V), 41 megapixel mode: 7168 (H) × 5768 (V), 21 megapixel mode: 5104 (H) × 4092 (V)	
Scanning system*2		Progressive 64 megapixel mode: 59.2 ms (4 ch), 117.2 ms (2 ch), 244.1 ms (1 ch) 41 megapixel mode: 40.4 ms (4 ch), 74.7 ms (2 ch), 160.0 ms (1 ch) 21 megapixel mode: 28.9 ms (4 ch), 39.2 ms (2 ch), 83.3 ms (1 ch)	Progressive 64 megapixel mode: 57.6 ms (4 ch), 114.1 ms (2 ch), 238.5 ms (1 ch) 41 megapixel mode: 40.4 ms (4 ch), 74.6 ms (2 ch), 156.8 ms (1 ch) 21 megapixel mode: 28.9 ms (4 ch), 39.2 ms (2 ch), 83.2 ms (1 ch)
Pixel transfer frequency		1085 MHz	1110 MHz
Transfer system		Digital serial transfer	
Electronic shutter		Can be set to 0.05 to 9000 msec by specifying the following numerical inputs: 1/15, 1/30, 1/60, 1/120, 1/240, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/20000	
Lens mount		Special mount (M40 P0.75)*3	
Environmental resistance	Operating ambient temperature	0 to +40°C	
	Operating ambient humidity	35 to 85%RH	
Weight		Approx. 350 g (not including lens)	

*1 Equivalent to 4/3" (ø23 mm) in 41 megapixel mode, and 1" (ø16 mm) in 21 megapixel mode. *2 Transfer time varies depending on the channel configuration.
*3 C-mount lenses can be used by replacing the lens mount on the camera with a C-mount adapter (OP-88578; sold separately). Note that 64 megapixel mode will not be supported.

Camera (CA-HF2100M/CA-HF2100C)

LumiTrax™

Model		CA-HF2100C	CA-HF2100M
Image receiving element		Colour CMOS, 85× high-speed reading using square-pixel	Monochrome CMOS, 85× high-speed reading using square-pixel
Unit cell size		2.5 µm × 2.5 µm	
Image size		Equivalent to 1" (ø16 mm)*1	
Valid pixel count		21 megapixel mode: 5104 (H) × 4092 (V), 5 megapixel mode: 2432 (H) × 2050 (V)	
Scanning system*2		Progressive 21 megapixel mode: 20.2 ms (4 ch), 39.4 ms (2 ch), 83.2 ms (1 ch) 5 megapixel mode: 10.8 ms (2 ch), 23.6 ms (1 ch)	Progressive 21 megapixel mode: 20.2 ms (4 ch), 39.3 ms (2 ch), 83.2 ms (1 ch) 5 megapixel mode: 10.8 ms (2 ch), 23.5 ms (1 ch)
Pixel transfer frequency		1038 MHz	1037 MHz
Transfer system		Digital serial transfer	
Electronic shutter		Can be set to 0.05 to 9000 msec by specifying the following numerical inputs: 1/15, 1/30, 1/60, 1/120, 1/240, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/20000	
Lens mount		C-mount	
Environmental resistance	Operating ambient temperature	0 to +40°C	
	Operating ambient humidity	35 to 85%RH	
Weight		Approx. 380 g (not including lens)	

*1 Equivalent to 1/2" (ø8 mm) in 5 megapixel mode. *2 Transfer time varies depending on the channel configuration.

Camera (CA-H500CX/H500MX)

LumiTrax™ / Multi-Spectrum / Pattern Projection

Model		CA-H500CX	CA-H500MX
Image receiving element		Colour CMOS, 11×/16× high-speed reading using square-pixel	Monochrome CMOS, 11×/16× high-speed reading using square-pixel
Unit cell size		3.45 µm × 3.45 µm	
Image size		Equivalent to 2/3"	
Valid pixel count		5 megapixel mode: 2432 (H) × 2040 (V), 2 megapixel mode: 1600 (H) × 1200 (V)	
Scanning system		Progressive	
		5 megapixel mode: (colour camera) / 29.2 ms	5 megapixel mode: (monochrome camera) / 27.7 ms
		2 megapixel mode: 11.7 ms	
Pixel transfer frequency		195 MHz	
Transfer system		Digital serial transfer	
Electronic shutter		Can be set to 0.017 to 100 msec by specifying the following numerical inputs: 1/15, 1/30, 1/60, 1/120, 1/240, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/20000, 1/50000	
Lens mount		C-mount	
Environmental resistance	Operating ambient temperature	0 to +40°C	
	Operating ambient humidity	35 to 85%RH	
Weight		Approx. 280 g (not including lens)	

Camera (CA-H200CX/H200MX)

LumiTrax™ / Multi-Spectrum / Pattern Projection

Model		CA-H200CX	CA-H200MX
Image receiving element		Colour CMOS, 11×/16× high-speed reading using square-pixel	Monochrome CMOS, 11×/16× high-speed reading using square-pixel
Unit cell size		3.45 µm × 3.45 µm	
Image size		Equivalent to 1/2"	
Valid pixel count		1600 (H) × 1200 (V)	
Scanning system		Progressive 11.7 ms	
Pixel transfer frequency		195 MHz	
Transfer system		Digital serial transfer	
Electronic shutter		Can be set to 0.017 to 100 msec by specifying the following numerical inputs: 1/15, 1/30, 1/60, 1/120, 1/240, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/20000, 1/50000	
Lens mount		C-mount	
Environmental resistance	Operating ambient temperature	0 to +40°C	
	Operating ambient humidity	35 to 85%RH	
Weight		Approx. 280 g (not including lens)	

Camera (CA-H048CX/H048MX)

LumiTrax™ / Multi-Spectrum / Pattern Projection

Model		CA-H048CX	CA-H048MX
Image receiving element		Colour CMOS, 11×/16× high-speed reading using square-pixel	Monochrome CMOS, 11×/16× high-speed reading using square-pixel
Unit cell size		4.8 µm × 4.8 µm	
Image size		Equivalent to 1/3"	
Valid pixel count		0.47 megapixel mode: 784 (H) × 596 (V), 0.31 megapixel mode: 640 (H) × 480 (V), 0.24 megapixel mode: 512 (H) × 480 (V)	
Scanning system		Progressive 0.47 megapixel mode: 2.9 ms, 0.31 megapixel mode: 2.0 ms, 0.24 megapixel mode: 1.7 ms	
Pixel transfer frequency		195 MHz	
Transfer system		Digital serial transfer	
Electronic shutter		Can be set to 0.022 to 1000 msec by specifying the following numerical inputs: 1/15, 1/30, 1/60, 1/120, 1/240, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/20000	
Lens mount		C-mount	
Environmental resistance	Operating ambient temperature	0 to +40°C	
	Operating ambient humidity	35 to 85%RH	
Weight		Approx. 190 g (not including lens)	

Camera (CA-H500C/CA-H500M)

Model		CA-H500C	CA-H500M
Image receiving element		Colour CMOS, 11×/16× high-speed reading using square-pixel	Monochrome CMOS, 11×/16× high-speed reading using square-pixel
Unit cell size		3.45 µm × 3.45 µm	
Image size		Equivalent to 2/3"	
Valid pixel count		4.99 megapixels, 2432 (H) × 2050 (V)	
Scanning system		Progressive 61.2 ms*1 / 28.4 ms*2	
Pixel transfer frequency		At 11× transfer speed: 132 MHz (66 MHz ×2) *1, At 16× transfer speed: 198 MHz *2	
Transfer system		Digital serial transfer	
Electronic shutter		Can be set to 0.05 to 9000 msec by specifying the following numerical inputs: 1/15, 1/30, 1/60, 1/120, 1/240, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/20000	
Lens mount		C-mount	
Enclosure rating		IP64*3	
Environmental resistance	Operating ambient temperature	0 to +50°C	
	Operating ambient humidity	35 to 85%RH	
Weight		Approx. 75 g (not including lens)	

*1 Transfer speed setting: Standard (11×) *2 Transfer speed setting: Fast (16×) *3 A KEYENCE-specified IP64-rated lens and environment-resistant cable must be used on the product.

Camera (CA-H200C/CA-H200M)

Model		CA-H200C	CA-H200M
Image receiving element		Colour CMOS, 7×/16× high-speed reading using square-pixel	Monochrome CMOS, 7×/16× high-speed reading using square-pixel
Unit cell size		4.5 µm × 4.5 µm	
Image size		Equivalent to 1/1.8"	
Valid pixel count		2 megapixel mode: 1600 (H) × 1200 (V), 1 megapixel mode: 1024 (H) × 960 (V)	
Scanning system		Progressive 2 megapixel mode: 28.9 ms*1 / 11.8 ms*2, 1 megapixel mode: 23.5 ms*1 / 9.6 ms*2	
Pixel transfer frequency		At 7× transfer speed: 86 MHz (43 MHz ×2) *1, At 16× transfer speed: 198 MHz *2	
Transfer system		Digital serial transfer	
Electronic shutter		Can be set to 0.05 to 9000 msec by specifying the following numerical inputs: 1/15, 1/30, 1/60, 1/120, 1/240, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/20000	
Lens mount		C-mount	
Enclosure rating		IP64*3	
Environmental resistance	Operating ambient temperature	0 to +45°C	
	Operating ambient humidity	35 to 85%RH	
Weight		Approx. 75 g (not including lens)	

*1 Transfer speed setting: Standard (7×) *2 Transfer speed setting: Fast (16×) *3 A KEYENCE-specified IP64-rated lens and environment-resistant cable must be used on the product.

Camera (CA-200C/CA-200M)

Model		CA-200C	CA-200M
Image receiving element		Colour CMOS, High-speed reading using square-pixel	Monochrome CMOS, High-speed reading using square-pixel
Unit cell size		4.5 µm × 4.5 µm	
Image size		Equivalent to 1/1.8"	
Valid pixel count		2 megapixel mode: 1600 (H) × 1200 (V), 1 megapixel mode: 1024 (H) × 960 (V)	
Scanning system		Progressive 2 megapixel mode: 56.5 ms, 1 megapixel mode: 45.8 ms	
Pixel transfer frequency		43 MHz	
Transfer system		Digital serial transfer	
Electronic shutter		Can be set to 0.05 to 9000 msec by specifying the following numerical inputs: 1/15, 1/30, 1/60, 1/120, 1/240, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/20000	
Lens mount		C-mount	
Enclosure rating		IP64*1	
Environmental resistance	Operating ambient temperature	0 to +45°C	
	Operating ambient humidity	35 to 85%RH	
Weight		Approx. 75 g (not including lens)	

*1 A KEYENCE-specified IP64-rated lens and environment-resistant cable must be used on the product.

■ Camera (CA-HS200C/CA-HS200M)

Model		CA-HS200C	CA-HS200M
Image receiving element		Colour CMOS, 7×/16× high-speed reading using square-pixel	Monochrome CMOS, 7×/16× high-speed reading using square-pixel
Unit cell size		3.45 µm × 3.45 µm	
Image size		Equivalent to 1/2"	
Valid pixel count		2 megapixel mode: 1600 (H) × 1200 (V), 1 megapixel mode: 1024 (H) × 960 (V)	
Scanning system		Progressive 2 megapixel mode: 28.4 ms*1 / 14.2 ms*2, 1 megapixel mode: 22.9 ms*1 / 11.5 ms*2	
Pixel transfer frequency		At 7× transfer speed: 86 MHz (43 MHz ×2) *1, At 16× transfer speed: 198 MHz *2	
Transfer system		Digital serial transfer	
Electronic shutter		Can be set to 0.05 to 9000 msec by specifying the following numerical inputs: 1/15, 1/30, 1/60, 1/120, 1/240, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/20000	
Lens mount		Special mount (M15.5 P0.5 male)	
Environmental resistance	Operating ambient temperature	0 to +45°C	
	Operating ambient humidity	35 to 85%RH	
Weight		Approx. 45 g (not including lens)	

*1 Transfer speed setting: Standard (7×) *2 Transfer speed setting: Fast (16×)

■ Camera (CA-H035C/CA-H035M)

Model		CA-H035C	CA-H035M
Image receiving element		Colour CMOS, 7×/16× high-speed reading using square-pixel	Monochrome CMOS, 7×/16× high-speed reading using square-pixel
Unit cell size		6.9 µm × 6.9 µm	
Image size		Equivalent to 1/3"	
Valid pixel count		0.31 megapixel mode: 640 (H) × 480 (V), 0.24 megapixel mode: 512 (H) × 480 (V)	
Scanning system		Progressive 4.8 ms*1 / 2.9 ms*2	
Pixel transfer frequency		At 7× transfer speed: 86 MHz (43 MHz ×2) *1, At 16× transfer speed: 198 MHz *2	
Transfer system		Digital serial transfer	
Electronic shutter		Can be set to 0.05 to 9000 msec by specifying the following numerical inputs: 1/15, 1/30, 1/60, 1/120, 1/240, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/20000	
Lens mount		C-mount	
Enclosure rating		IP64*3	
Environmental resistance	Operating ambient temperature	0 to +50°C	
	Operating ambient humidity	35 to 85%RH	
Weight		Approx. 75 g (not including lens)	

*1 Transfer speed setting: Standard (7×)
*2 Transfer speed setting: Fast (16×)
*3 A KEYENCE-specified IP64-rated lens and environment-resistant cable must be used on the product.

■ Camera (CA-035C/CA-035M)

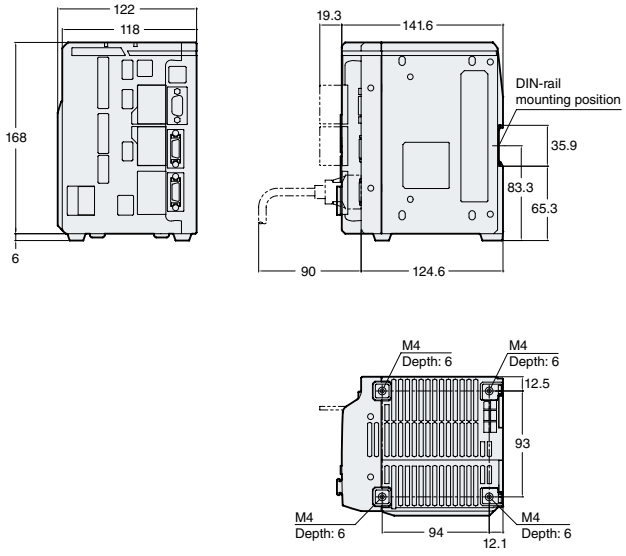
Model		CA-035C	CA-035M
Image receiving element		Colour CMOS, High-speed reading using square-pixel	Monochrome CMOS, High-speed reading using square-pixel
Unit cell size		6.9 µm × 6.9 µm	
Image size		Equivalent to 1/3"	
Valid pixel count		0.31 megapixel mode: 640 (H) × 480 (V), 0.24 megapixel mode: 512 (H) × 480 (V)	
Scanning system		Progressive 16.5 ms	
Pixel transfer frequency		25 MHz	
Transfer system		Digital serial transfer	
Electronic shutter		Can be set to 0.05 to 9000 msec by specifying the following numerical inputs: 1/15, 1/30, 1/60, 1/120, 1/240, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/20000	
Lens mount		C-mount	
Enclosure rating		IP64*1	
Environmental resistance	Operating ambient temperature	0 to +50°C	
	Operating ambient humidity	35 to 85%RH	
Weight		Approx. 75 g (not including lens)	

*1 A KEYENCE-specified IP64-rated lens and environment-resistant cable must be used on the product.

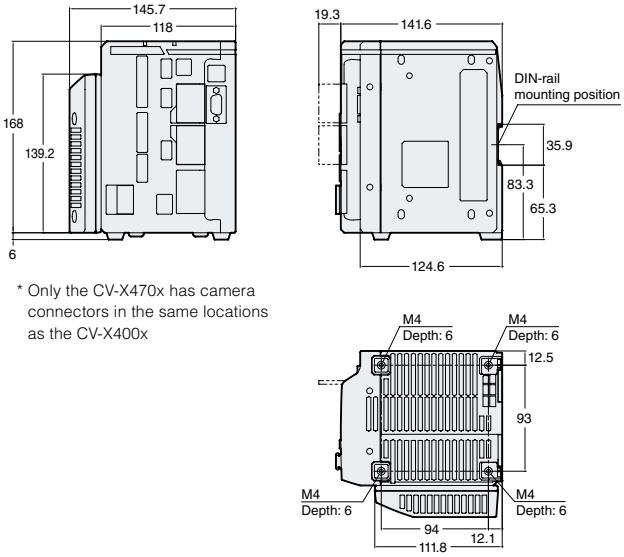
■ Camera (CA-HS035C/CA-HS035M)

Model	Camera unit	CA-HS035CH	CA-HS035MH
	Relay unit	CA-HS035CU	CA-HS035MU
Image receiving element		Colour CMOS, 7× high-speed reading using square-pixel	Monochrome CMOS, 7× high-speed reading using square-pixel
Unit cell size		7.4 µm × 7.4 µm	
Image size		Equivalent to 1/3"	
Valid pixel count		0.31 megapixel mode: 640 (H) × 480 (V), 0.24 megapixel mode: 512 (H) × 480 (V)	
Scanning system		Progressive 4.5 ms	
Pixel transfer frequency		86 MHz (43 MHz ×2)	
Transfer system		Digital serial transfer	
Electronic shutter		Can be set to 0.05 to 100 msec by specifying the following numerical inputs: 1/15, 1/30, 1/60, 1/120, 1/240, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/20000	
Lens mount		Special mount (M10.5 P0.5 male)	
Environmental resistance	Operating ambient temperature	0 to +40°C	
	Operating ambient humidity	35 to 85%RH	
Weight	Camera unit	Approx. 135 g (cable included, lens not included)	
	Relay unit	Approx. 60 g (not including lens)	

Controller **CV-X400/CV-X420/CV-X450**
CV-X300/CV-X320/CV-X350

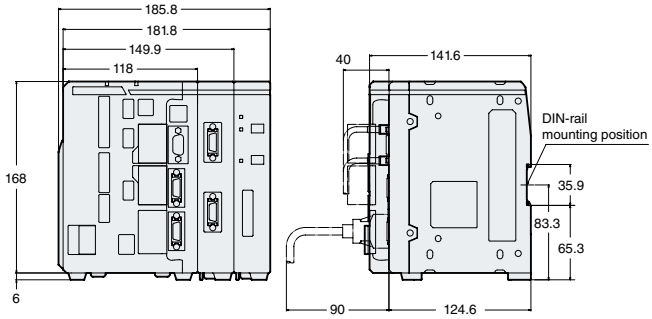


Controller **CV-X470/CV-X480/CV-X490**

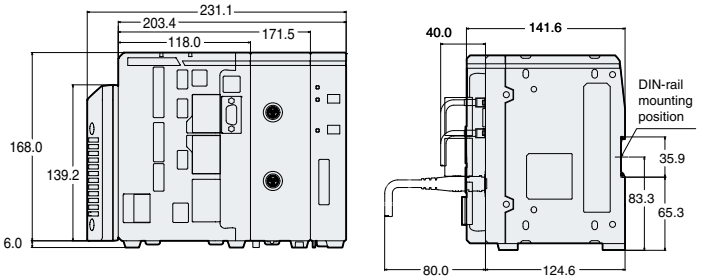


* Only the CV-X470x has camera connectors in the same locations as the CV-X400x

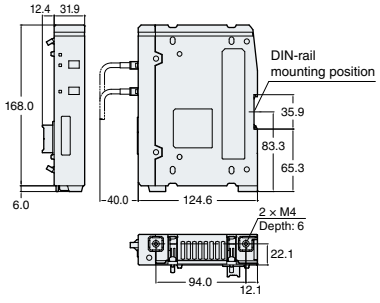
With area camera input unit **CA-E100** and
light control expansion unit **CA-DC40E** connected



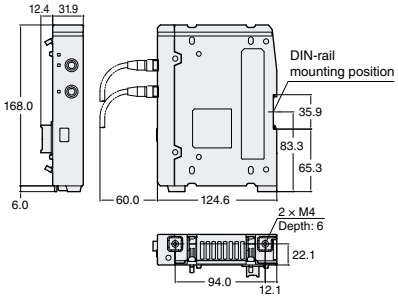
With high-resolution area camera input unit **CA-E200** and
light control expansion unit **CA-DC40E** connected



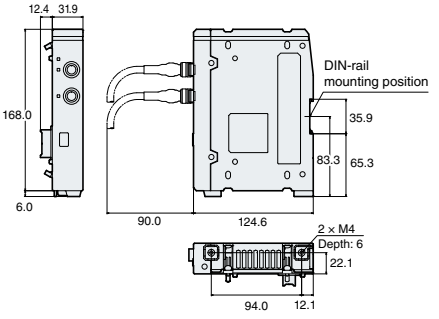
Light control expansion unit **CA-DC40E**



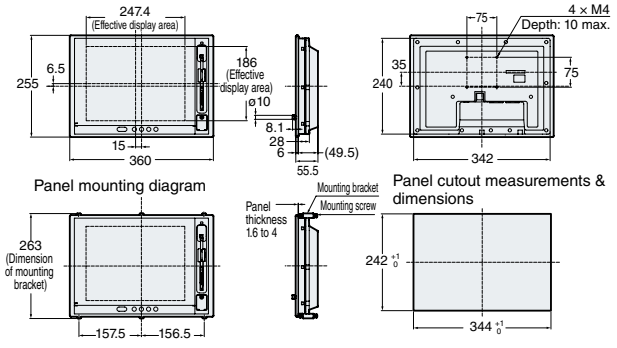
Light control expansion unit **CA-DC50E**



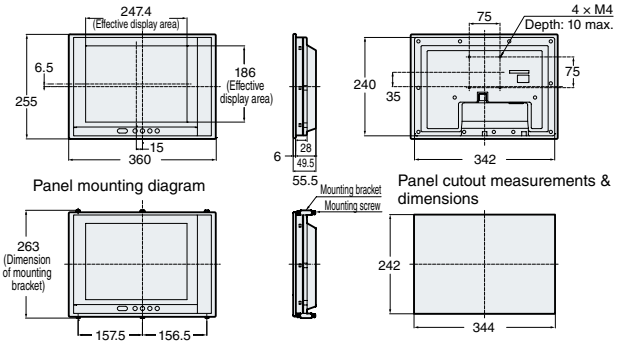
Light control expansion unit **CA-DC60E**



Touch panel LCD monitor **CA-MP120T**



LCD monitor **CA-MP120**



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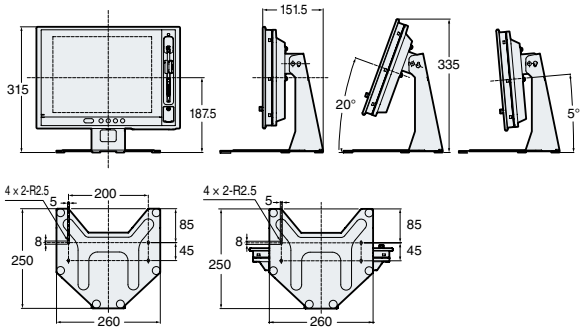
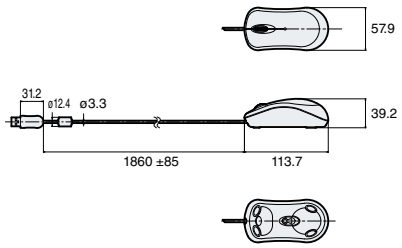
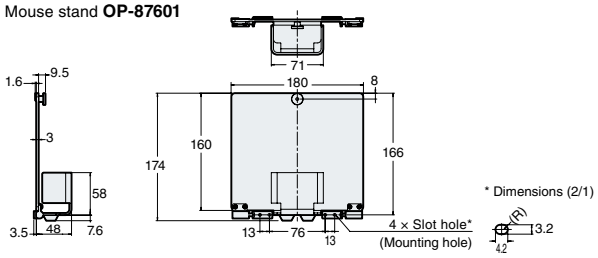
Monitor stand **OP-87262**



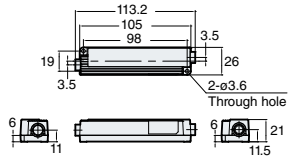
Dedicate USB mouse **OP-87506**



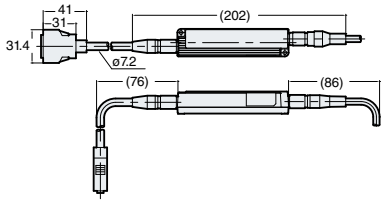
Mouse stand **OP-87601**



Camera control unit
CA-HS035CU/CA-HS035MU

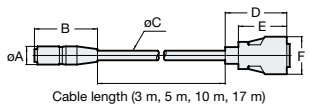


When camera cable is attached



Camera cable
CA-CH3 (3 m) **/CA-CH5** (5 m) **/CA-CH10** (10 m)

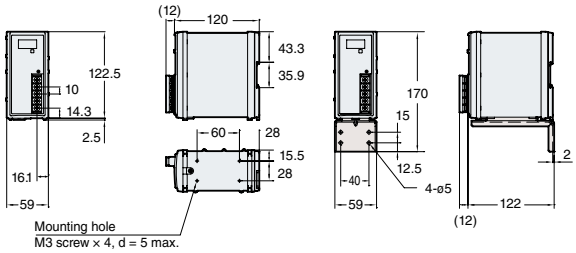
High-flex camera cable
CA-CH3R (3 m) **/CA-CH5R** (5 m) **/CA-CH10R** (10 m) **/CA-CH17R** (17 m)



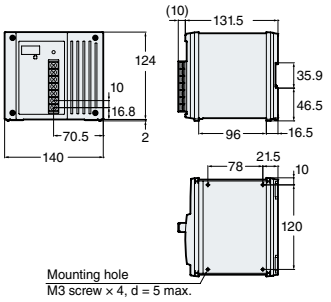
	A	B	C	D	E	F
CA-CHx	12.5	43	7.2	41	31	31.4
CA-CHxR	14.0	54	7.6	41	31	31.4

Dedicated 24 VDC power supply **CA-U4**

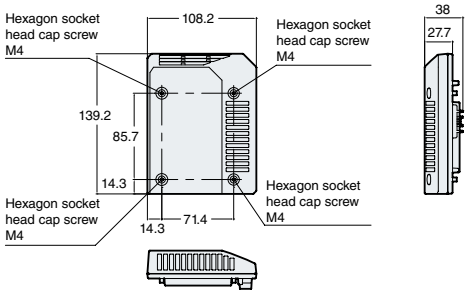
Front-mounting (using OP-42174)



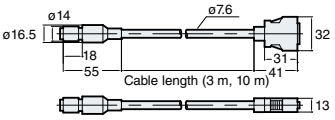
Dedicated 24 VDC power supply **CA-U5**



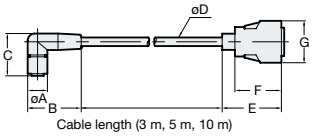
Fan unit **CA-F100**



Environment-resistant camera cable
CA-CH3P (3 m) **/CA-CH10P** (10 m)



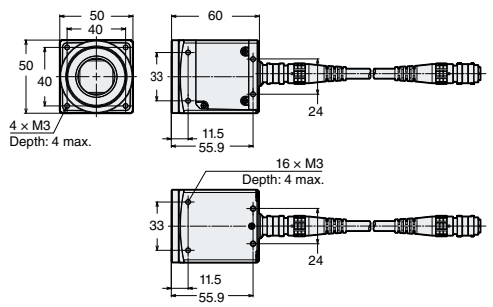
L-shaped connector camera cable
CA-CH3L (3 m) **/CA-CH5L** (5 m) **/CA-CH10L** (10 m)



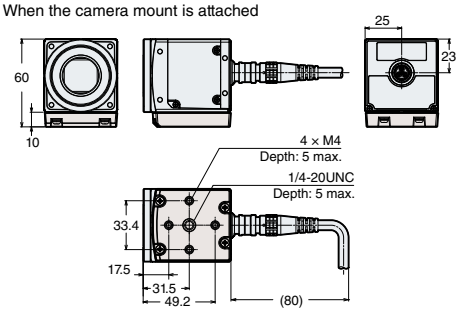
	A	B	C	D	E	F	G
L-shaped connector camera cable **CA-CHxL**	14	38	30	7.2	41	31	31.4

Unit: mm

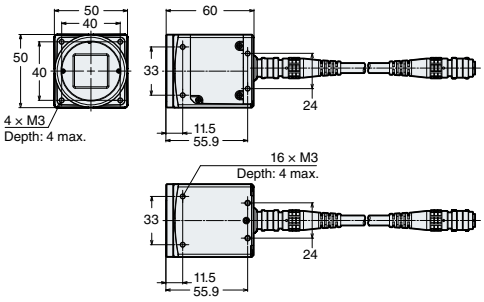
Camera **CA-HF2100C/CA-HF2100M**



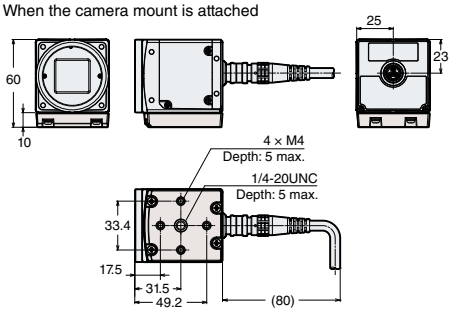
When the camera mount is attached



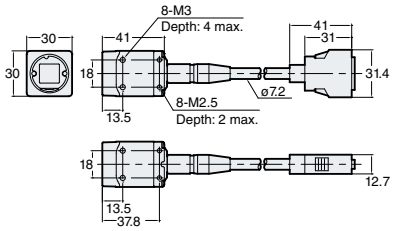
Camera **CA-HF6400C/CA-HF6400M**



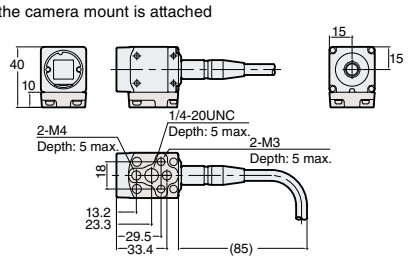
When the camera mount is attached



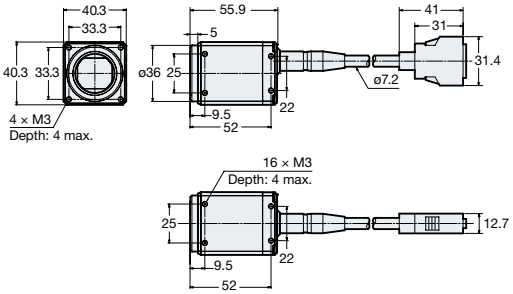
Camera **CA-H500C/CA-H500M/CA-H200C/CA-H200M/CA-200C/CA-200M/CA-H035C/CA-H035M/CA-035C/CA-035M**



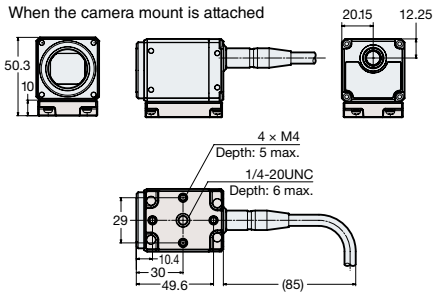
When the camera mount is attached



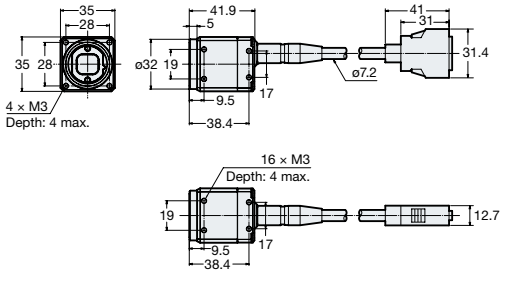
Camera **CA-H500CX/CA-H500MX/CA-H200CX/CA-H200MX**



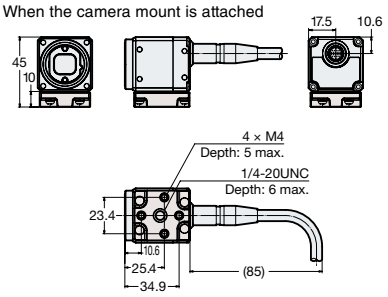
When the camera mount is attached



Camera **CA-H048CX/CA-H048MX**

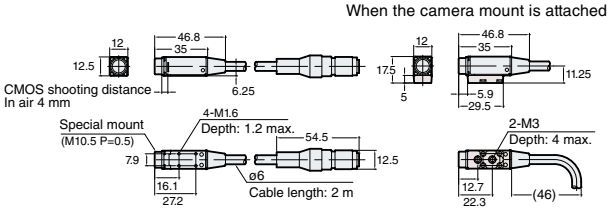


When the camera mount is attached



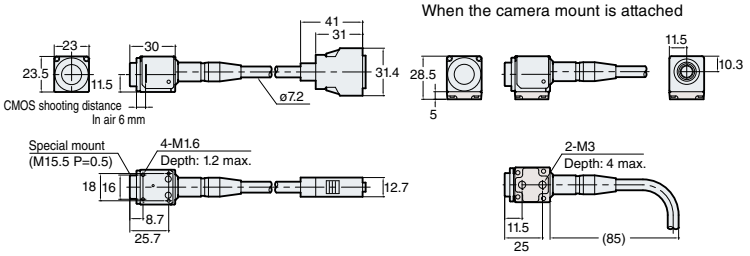
Camera **CA-HS035CH/CA-HS035MH**

When the camera mount is attached

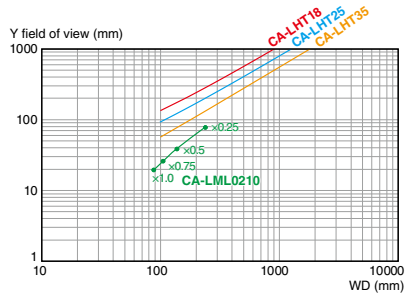


Camera **CA-HS200C/CA-HS200M**

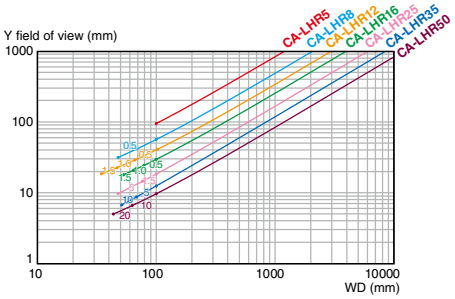
When the camera mount is attached



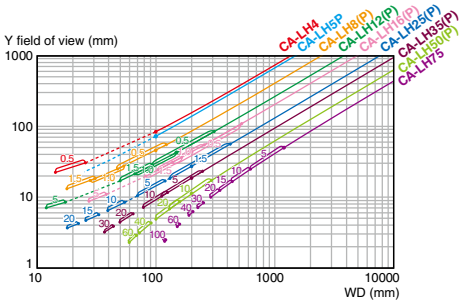
CA-HF6400C/CA-HF6400M
(When the **CA-LHT** Series is attached)



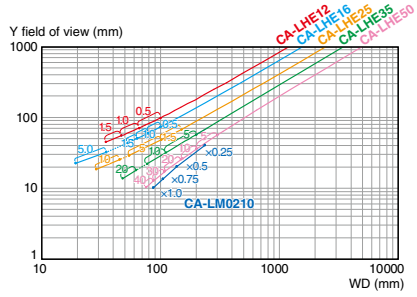
CA-H200CX/CA-H200MX
(When the **CA-LHR** Series is attached)



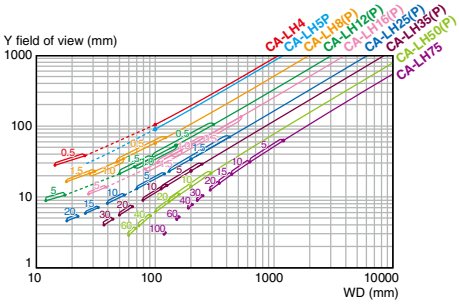
CA-035C/CA-035M/CA-H035C/CA-H035M
(When the **CA-LH/LHxP** Series is attached)



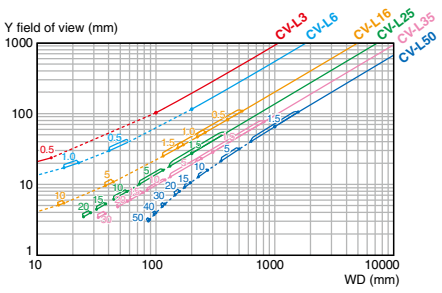
CA-HF2100C/CA-HF2100M
(When the **CA-LHE** Series is attached)



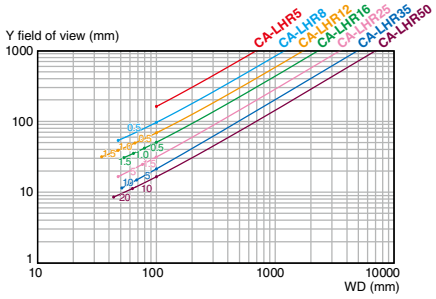
CA-H200CX/CA-H200MX
(When the **CA-LH/LHxP** Series is attached)



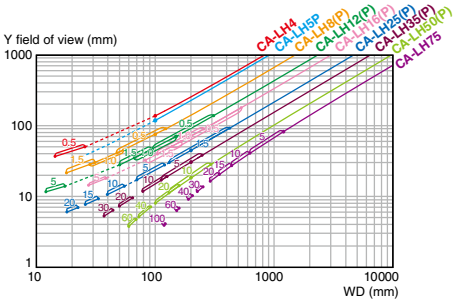
CA-035C/CA-035M/CA-H035C/CA-H035M
(When the **CV-L** Series is attached)



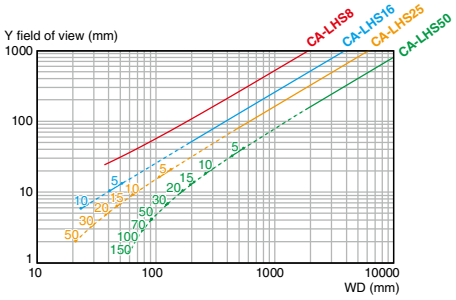
CA-H500CX/CA-H500MX
(When the **CA-LHR** Series is attached)



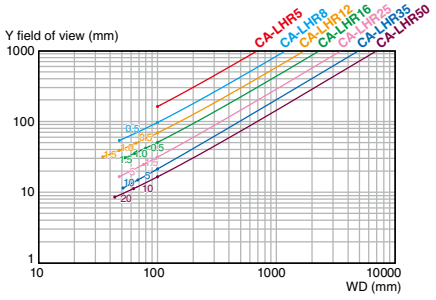
CA-200C/CA-200M/CA-H200C/CA-H200M
(When the **CA-LH/LHxP** Series is attached)



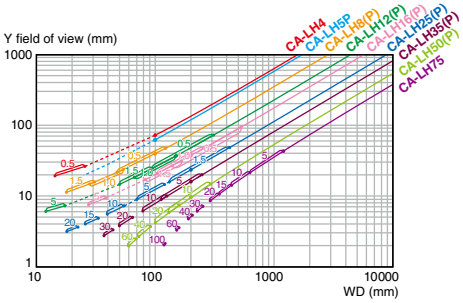
CA-HS200C/CA-HS200M
(When the **CA-LHS** Series is attached)



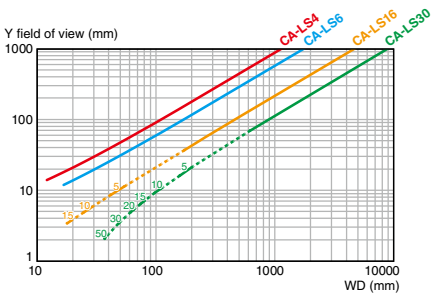
CA-H500C/CA-H500M
(When the **CA-LHR** Series is attached)



CA-H048CX/CA-H048MX (784 × 596)
(When the **CA-LH/LHxP** Series is attached)



CA-HS035C/CA-HS035M
(When the **CA-LS** Series is attached)



The numerical values in these graphs are just reference values. Therefore, adjustment may be necessary when installation is performed.
Using close up rings may result in distortion and lower resolution around the edges of the image area / image sensor.

Automobiles/Metals

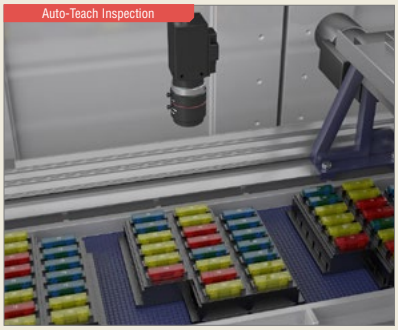
Presence/Absence

Inspection for desiccant on ECU


OK image


NG image

Incorrect fuse assembly inspection

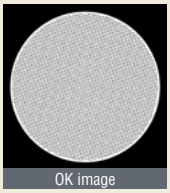


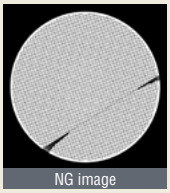

OK image


NG image

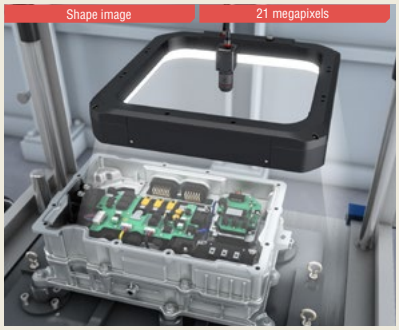
Flaw detection

DPF appearance inspection

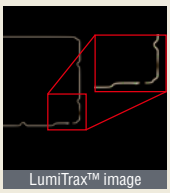

OK image


NG image

Sealant application inspection

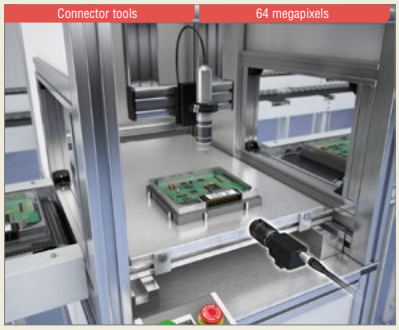


Through-the-lens image


LumiTrax™ image

Dimension inspection

Connector terminal bend inspection




OK image


NG image

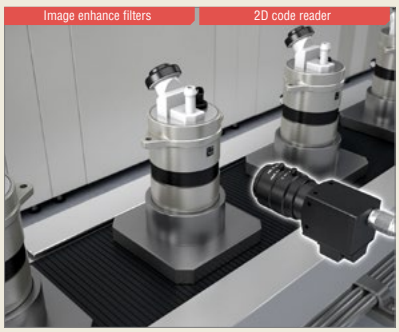
Spark plug dimension inspection


OK image


NG image

ID and OCR/OCV

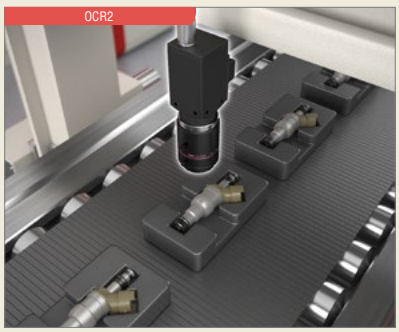
Fuel pump 2D code reading

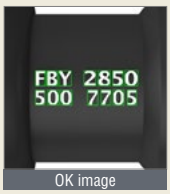



OK image

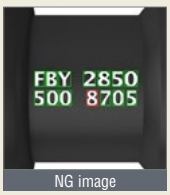

Tone inverted image

Injector part number OCR





OK image



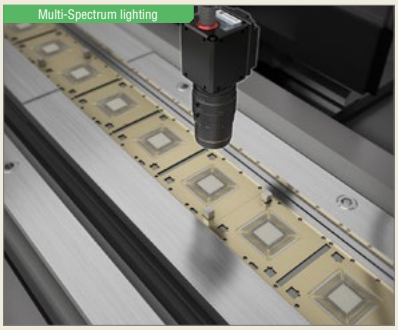
NG image

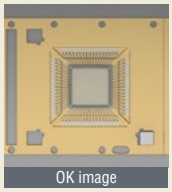
CONTACT YOUR NEAREST OFFICE FOR RELEASE STATUS

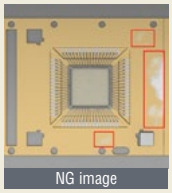
Electronic components

Presence/Absence

Lead frame plating inspection




OK image


NG image

Flaw detection

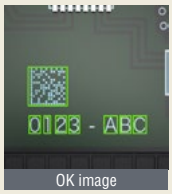
IC mould defect/blister inspection

Through-the-lens image


LumiTrax™ image

ID and OCR/OCV

Character identification on PCBs

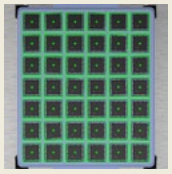


OK image

NG image

Positioning

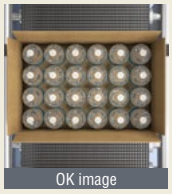
IC chip robot picking (displacement correction)


Detection image

Food/Medicine

Presence/Absence

Beverage bottle count


OK image


NG image

Flaw detection

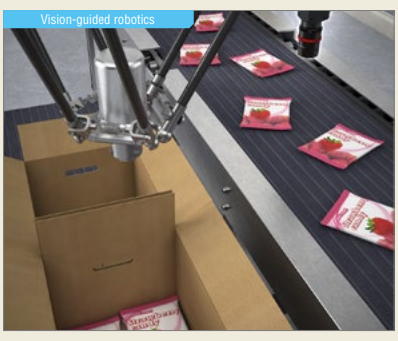
Food tray appearance inspection


OK image

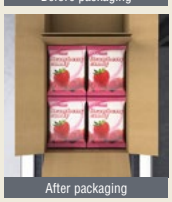
NG image

Positioning

Positioning for candy box packaging robots




Before packaging


After packaging

ID and OCR/OCV

Shelf life print inspection

OK image


NG image

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KEYENCE CORPORATION

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BELGIUM	**CZECH REPUBLIC**	**HUNGARY**	**JAPAN**	**NETHERLANDS**	**SINGAPORE**	**TAIWAN**	**VIETNAM**
+32 (0)15 281 222	+420 220 184 700	+36 1 802 7360	+81-6-6379-2211	+31 (0)40 206 6100	+65-6392-1011	+886-2-2721-1080	+84-24-3772-5555
BRAZIL	**FRANCE**	**INDIA**	**KOREA**	**PHILIPPINES**	**SLOVAKIA**	**THAILAND**	
+55-11-3045-4011	+33 1 56 37 78 00	+91-44-4963-0900	+82-31-789-4300	+63-(0)2-8981-5000	+421 (0)2 5939 6461	+66-2-078-1090	
CANADA	**GERMANY**	**INDONESIA**	**MALAYSIA**	**POLAND**	**SLOVENIA**	**UK & IRELAND**	
+1-905-366-7655	+49-6102-3656-0	+62-21-2966-0120	+60-3-7883-2211	+48 71 368 61 60	+386 (0)1 4701 666	+44 (0)1908-696-900	

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