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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
utilizing 8 wavelengths of colored light





Intuitive Vision System
CV-X Series



Area Cameras

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

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™ 3A)





LumiTrax™

Fusion of intelligent camera, light and inspection algorithm

A VARIETY OF CAMERAS
TO MATCH ANY INSPECTION TYPE



A complete family of area cameras allows proper camera selection based upon line-speed, installation location, and inspection requirements.

From 64 megapixel cameras for precision resolution requirements to the high-speed cameras for the fastest production rates, or compact cameras for the tightest mounting restraints to Pattern Projection for 3D inspection, KEYENCE offers the ideal solution for every inspection application.

	64 megapixel camera	21 megapixel camera	5 megapixel camera	
	NEW 	NEW  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 color	85× speed monochrome/color	16× speed high-performance monochrome/color *1	16× speed environment-resistant monochrome/color *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/color *1	16× speed environment-resistant monochrome/color *2	Environment-resistant monochrome/color *2	16× speed compact monochrome/color
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/color *1	16× speed environment-resistant monochrome/color *2	Environment-resistant monochrome/color *2	7× speed compact monochrome/color
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, color 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.

	3D vision-guided robotics camera		
			
Model	RB-500	RB-800	RB-1200
Measurement range (L × W × H)	520 × 390 × 200 mm 20.47" × 15.35" × 7.87"	860 × 645 × 500 mm 33.86" × 25.39" × 19.69"	1260 × 1260 × 1000 mm 49.61" × 49.61" × 39.37"

MULTIPLE CONTROLLERS
AVAILABLE WITH THE SAME EASE-OF-USE



Selectable according to application, processing speed, capacity, and camera choice, with solid state design

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

		CV-X400 Series						
								
		High-speed model for area cameras				3D vision-guided robotics model	Model compatible with high-resolution cameras	
Model		CV-X402	CV-X422	CV-X452	CV-X472	CV-X482D	CV-X482F	CV-X492F
Main image processor		3-core DSP			7-core DSP			
Max. no. of connectable cameras		2	4			1 (RB) / 2 (area camera)	4	
Supported cameras	0.31 to 0.47 megapixels	✓	✓	✓	✓	✓	✓	✓
	2 megapixels	—	✓	✓	✓	✓	✓	✓
	5 megapixels	—	—	✓	✓	✓	✓	✓
	21 megapixels	—	—	—	—	—	✓*1	✓
	64 megapixels	—	—	—	—	—	—	✓
	3D vision-guided robots	—	—	—	—	✓	—	—

*1 LumiTrax™ image capture is not supported

		CV-X300 Series		
				
		Standard model for area cameras		
Model		CV-X302	CV-X322	CV-X352
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

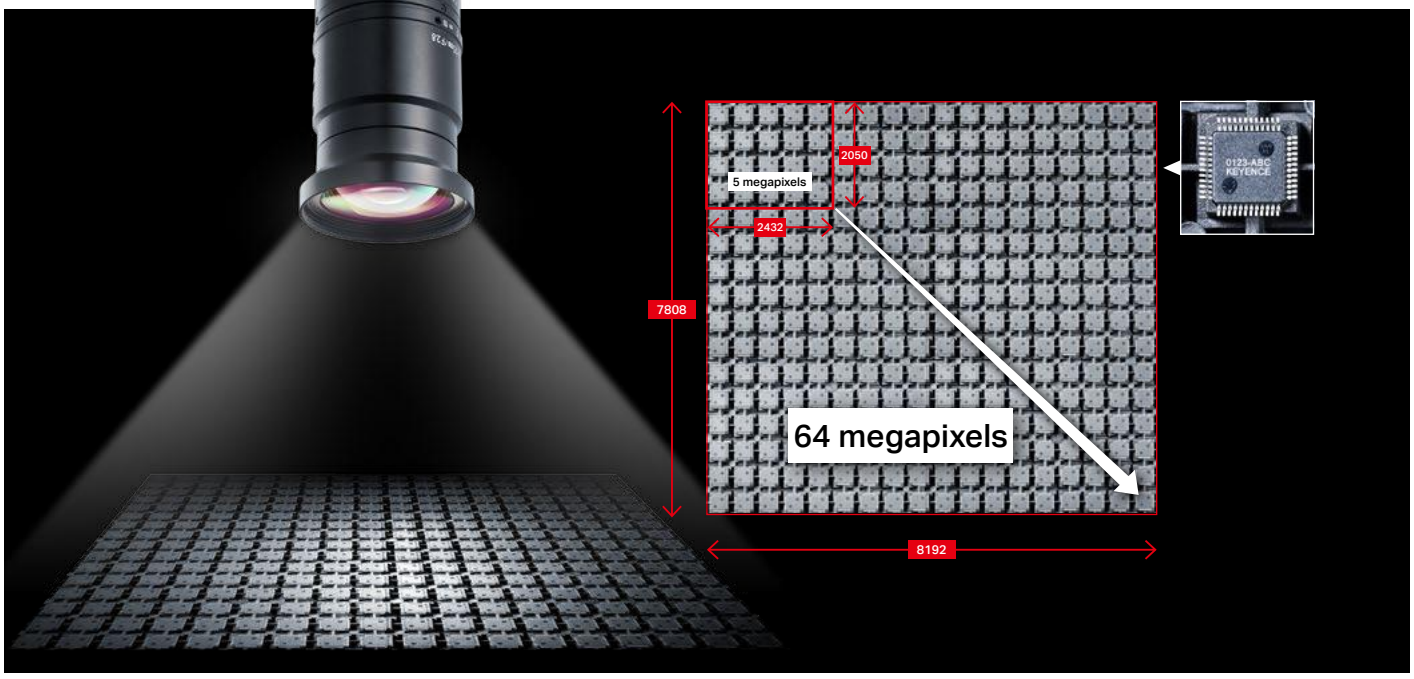
*1 LumiTrax™, Multi-Spectrum, and Pattern Projection functions not supported

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

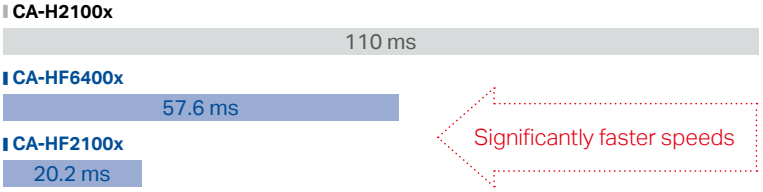
Built-in
angle sensor

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)



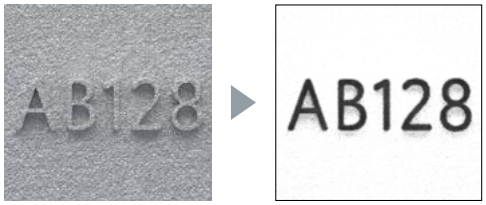
LumiTrax™ Support

High-speed control of directional lighting for advanced imaging

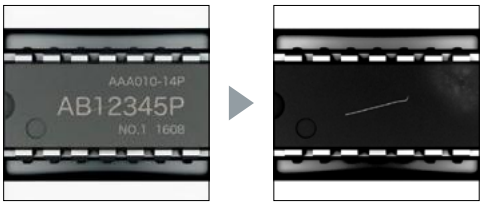
When using 21 megapixel mode



Stamping identification on cast products



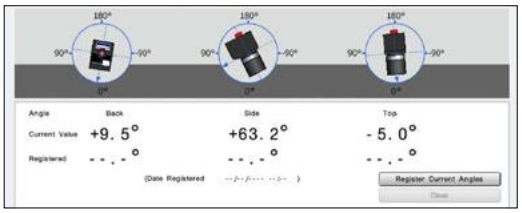
Defect inspection for IC molds



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.

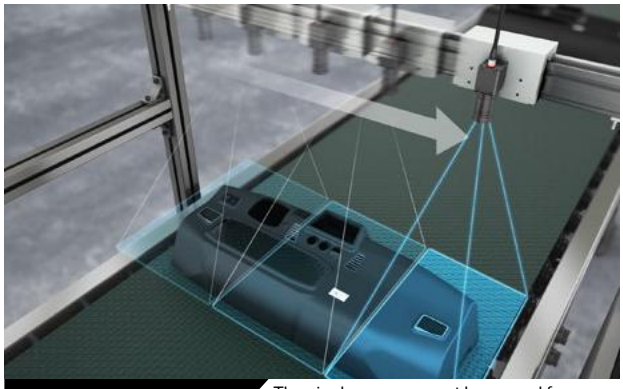
* The angle sensor checks for misalignment when the power is turned on and when settings are changed.



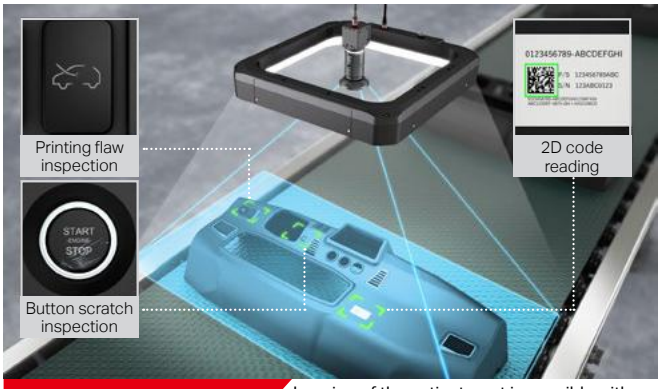
Simplified Inspections with Greater Accuracy

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

Vision Systems Design 2018 Innovators Awards PLATINUM

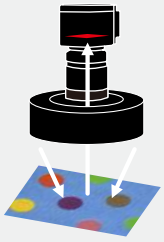
Full Spectrum Illumination and Powerful Algorithms

Multi-spectrum lighting incorporates LEDs in eight colors and a dedicated control circuit. Color or directional lighting control is automatically synchronized with an ultra high-speed camera without any complicated programming.
The combination of multi-spectrum illumination and powerful algorithms provides outstanding control of color, shape, gloss, and target variability.

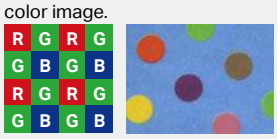


STANDARD COLOR VS. MULTI-SPECTRUM PROCESSING

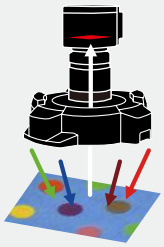
Color camera



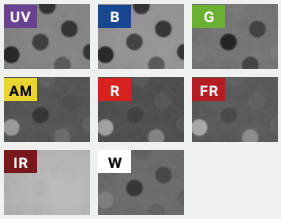
The imaging element receives white light reflected from the target through a color filter. This data is then used to create a color image.



Multi-Spectrum Image Capture



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



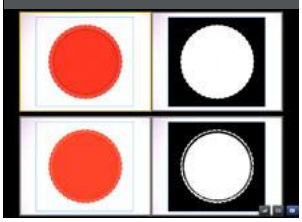
Color — Accurate Sorting, Even between Slight Color Differences



Inspection of Various Types of Plastic Caps

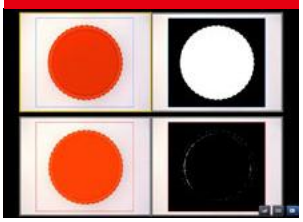


CONVENTIONAL COLOR CAMERA



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

MULTI-SPECTRUM MODE



Differences in color are clearly defined.

Shape — Detect Changes in Height with Directional Lighting



Stamped Character Inspection on Metal Casting

CONVENTIONAL IMAGING ISSUES



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

CONVENTIONAL CAMERA



Surface conditions interfere with extraction.

LumiTrax™ MODE



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

Target Variability — Lighting conditions can be optimized for each target depending on the color conditions



Printing Appearance Inspection



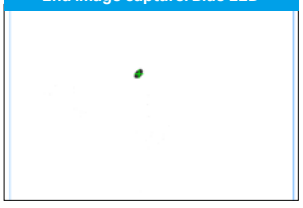
A red ink defect appears on a printing with a blue background.

1st image capture: Red LED



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

2nd image capture: Blue LED



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

HARDWARE THAT SUPPORTS INSPECTION STABILITY

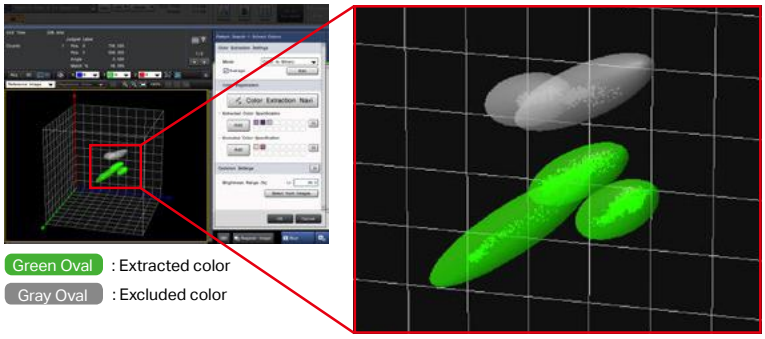
- Built-In Dedicated Illumination Control Circuit
- Ultra, High-Speed CMOS camera and Dedicated Control Circuit
- Lighting Equipped with 8 High-Brightness LEDs of Different Wavelengths
- Photodiode and Real-Time Intensity Control Circuit



SOFTWARE UTILITIES TO ENSURE STABLE INSPECTION

3D Display Function for Registered Colors

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



Green Oval : Extracted color
Gray Oval : Excluded color

Multi-Color Registration

(Support for Invalidation and Integration)

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

Addition/Invalidation



Up to 32 individual colors can be stored. This makes it possible to perform adjustment, even during operation, without effecting existing color settings.



Colors can not only be removed but also invalidated. This provides flexible testing without having to redo inspection.

Invalidated colors are not used for inspection, but the color information is saved.

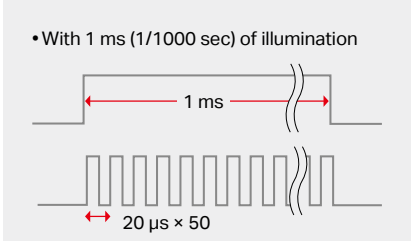
Real-Time Intensity Feedback Function

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 analyzed 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

Intelligent Camera
Equipped with ultra high-speed imaging CMOS sensor and dedicated control IC

+

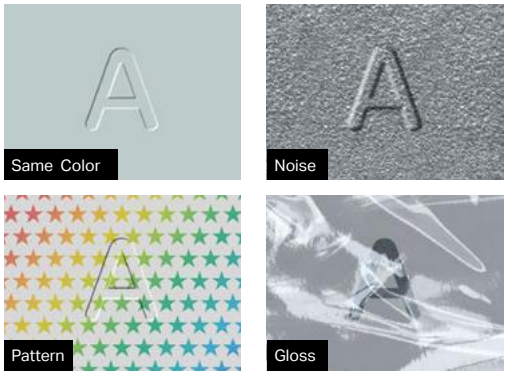
Segmented Lighting
Equipped with ultra high-intensity LED and circuit for separate lighting control

+

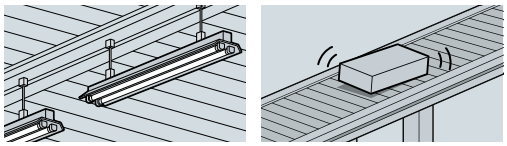
Powerful Processor
Analyzes multiple images instantaneously to create shape and texture images

CONVENTIONAL IMAGING PROBLEMS

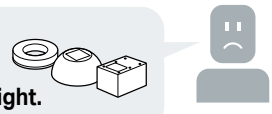
- **Various surface conditions**



- **Influence of the surrounding environment (ambient light)**
- **Workpiece orientation changes caused by transfer conditions**

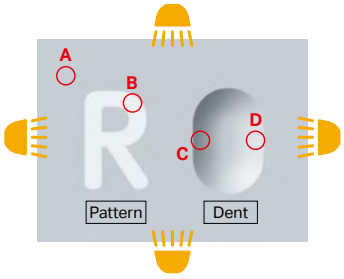


Trial and error must be performed to select the optimum light.



LumiTrax™ processing

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



Upper light image



Right light image



Left light image

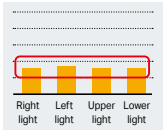


Lower light image



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

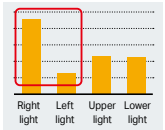
Pixel A light intensity



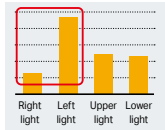
Pixel B light intensity



Pixel C light intensity



Pixel D light intensity



Texture image

Shape image



LumiTrax™ TUNING

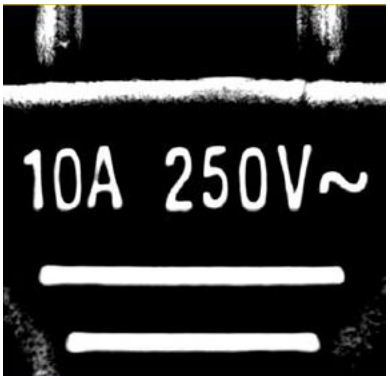
LumiTrax™ set up has never been easier! Simply follow the navigation and intuitively select one of the many displayed images, making it possible for anyone to easily create the optimal LumiTrax™ shape image.

Optimized LumiTrax™ shape image is complete!

BEFORE



AFTER



STEP 1

Select inspection type

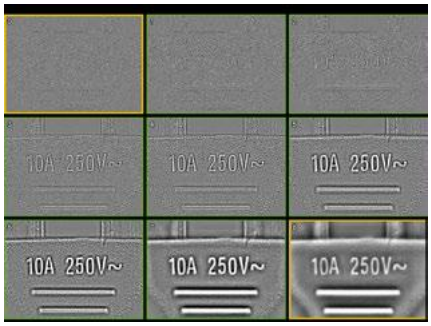


Presence/ Absence | Flaw Detection | ID & OCR/OCV (Raised Char.) | ID & OCR/OCV (Incised Char.)

First, select the type of inspection.

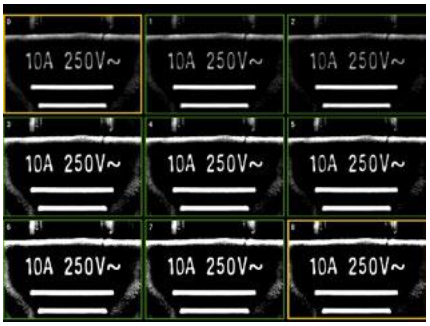
STEP 2

Select the image with the sharpest feature extraction



STEP 3

Select the optimal contrast

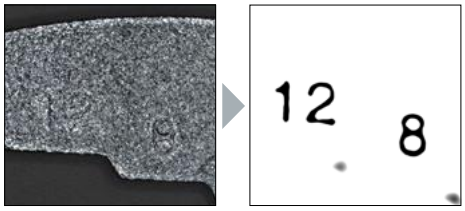


Simply choose the best image from multiple options to automatically set the ideal parameters.

Application examples (1)

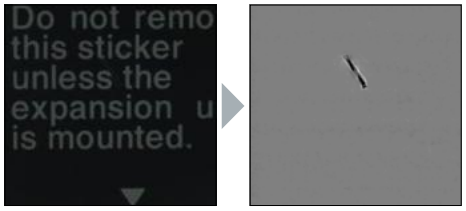
Extracting only the shape (irregularities) information regardless of the surface conditions

Stamped character inspection on metal casting



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

Printing defect inspection

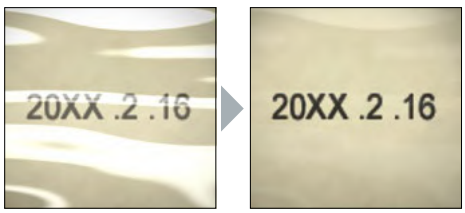


Images are created in which only the slits are extracted without being affected by the complex printed background.

Application examples (2)

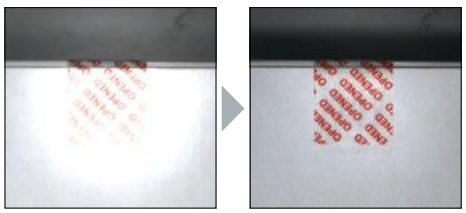
Suppressing glare and ambient light to extract only textures (pattern)

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 canceled, which makes it possible to perform stable inspections.

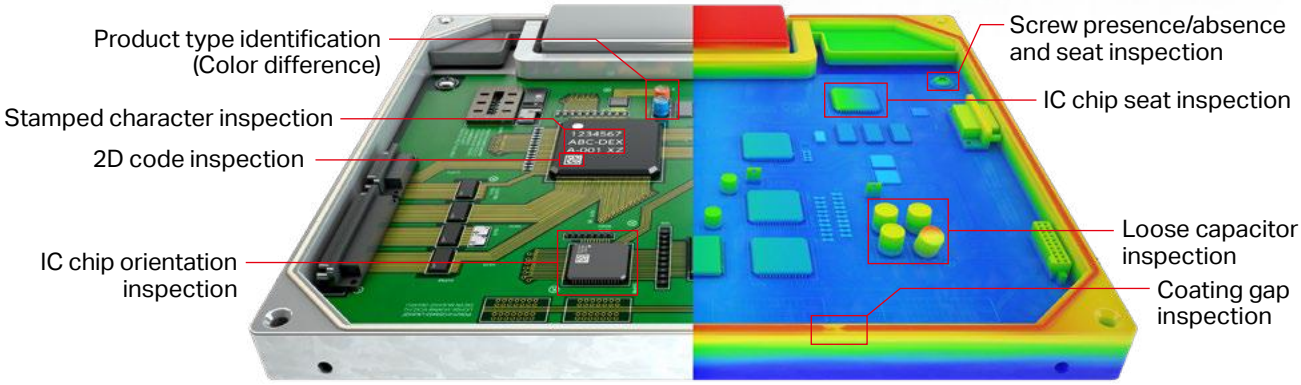
Pattern Projection Lighting

Simultaneous 2D + 3D inspection

Inspection with no blind spots through 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.

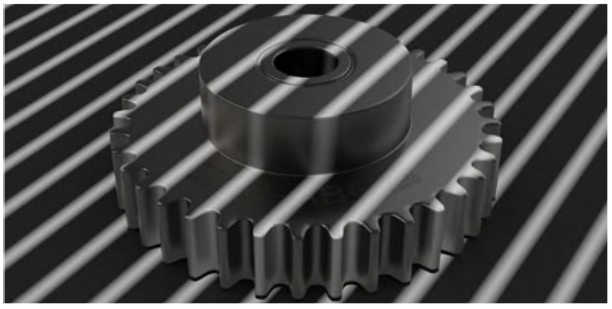




3D inspection lighting

Pattern projection accurately captures target appearance

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

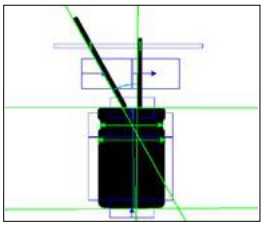


2D inspection lighting

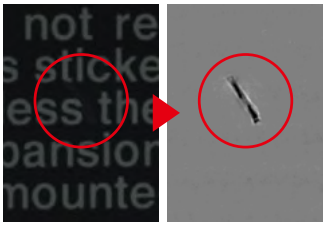
LumiTrax™ support for resolving problems with conventional imaging

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



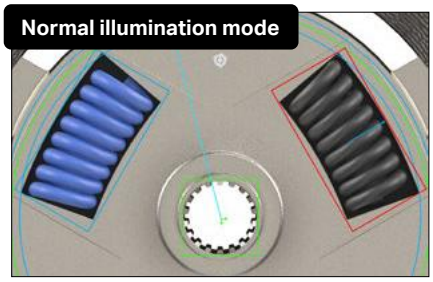
Available inspection applications that incorporate height data alongside conventional image processing inspection



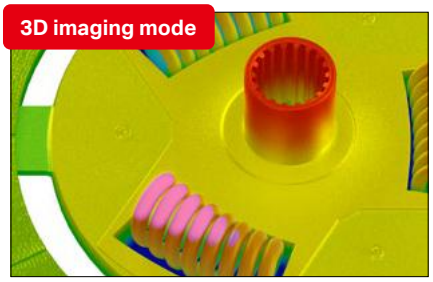
Clutch disc inspection

The color camera enables spring color difference checks in addition to inspection for center misalignment. Inspection for spring mispositioning is also possible with 3D difference checks.

Normal illumination mode

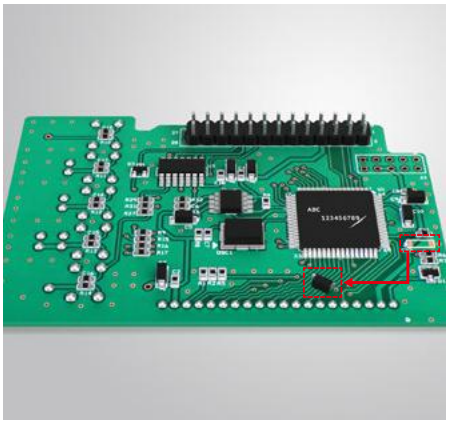


3D imaging mode



Normal illumination mode This mode is ideal for product type difference checks using spring colors and assembly position inspection for center components.

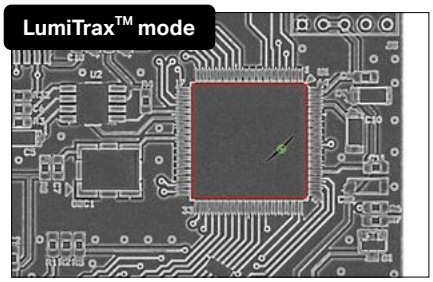
3D imaging mode This mode uses 3D detection tools for inspections of spring misalignment across multiple locations.



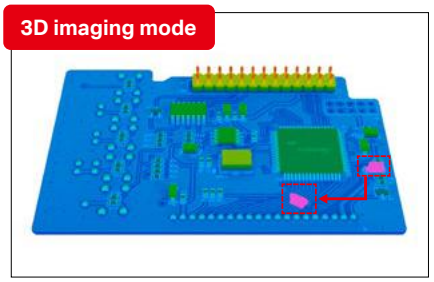
Appearance and foreign particle inspection on PCBs

Inspecting for defects only with no influence from chip surface markings is possible using LumiTrax™ mode. Meanwhile, 3D detection tools enable inspection for loose components or foreign particles on PCBs.

LumiTrax™ mode

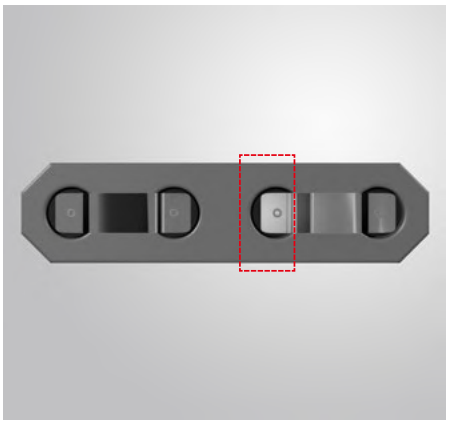


3D imaging mode



LumiTrax™ mode This mode inspects for chip surface defects only with no influence from surface markings.

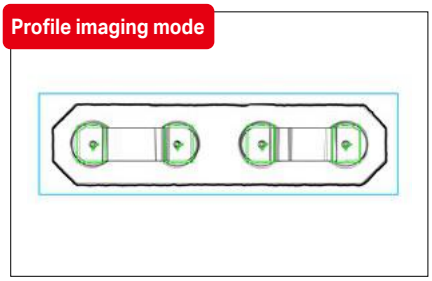
3D imaging mode This mode captures variations in the overall PCB and uses 3D detection tools to inspect for fallen or foreign particles.



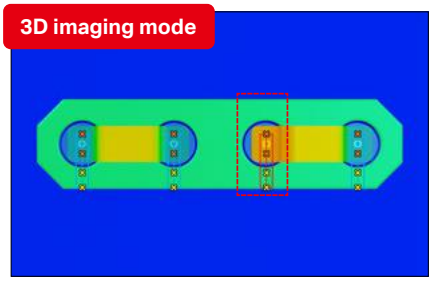
Lithium-ion battery terminal inspection

In addition to profile imaging mode for capturing profiles and inspects terminal positions, 3D imaging mode can be used to capture terminal height data to inspect for terminal weld disassembly.

Profile imaging mode



3D imaging mode



Profile imaging mode Profile capturing helps stabilize searches by emphasizing the appearance of terminals with low contrast.

3D imaging mode Utilize this mode to inspect for terminal height differences with standard battery cover positions using profile detection tools.

AUTO-TEACH INSPECTION TOOL

An inspection tool that learns what a good part is.

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



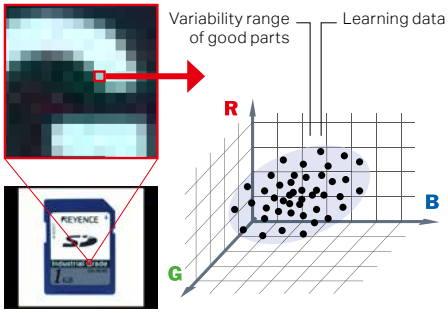
Parts that are different from the learned good parts are detected as bad!





LEARNING FULL COLOR INFORMATION

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



HELPFUL IN REALIZING EASY OPERATION

CUT INCORRECT LEARNING FUNCTION

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

SET AUTO-THRESHOLD FUNCTION

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

IDEAL FOR THE FOLLOWING APPLICATIONS

1 Frequent programming is required due to many product types

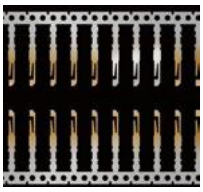
Misarrangement inspection for boxes of tissues



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

2 There are many points to inspect

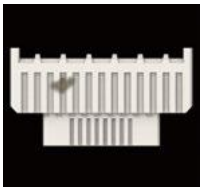
Plating defect inspection for lead frames



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

3 Complex shapes to inspect

Flaw inspection for connector housings



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

4 Variations in good parts

Assembly defect inspection for instrument panel buttons

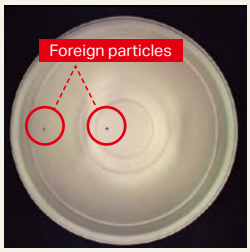


This tool learns and inspects variations such as different thicknesses caused by different lighting conditions, which can occur naturally among good parts. This prevents good parts from being rejected mistakenly.

DEFECT

Powerful & flexible appearance inspection tool

This tool detects defects, flaws and other contamination by comparing them to the surrounding area. In addition to excellent 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 inside surface and bottom of a container.



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



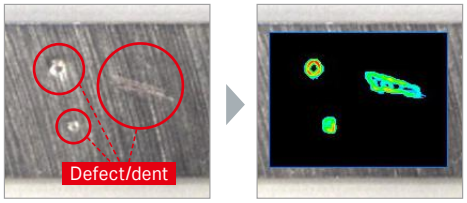
The defect inspection tool can stably detect the foreign particles alone by ignoring shading differences.

Contrast image

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

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

Defect detection for a metal plate



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

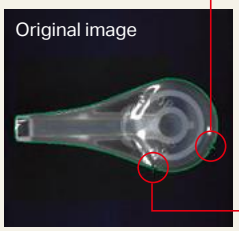
Relationship between contrast image colors and defect levels



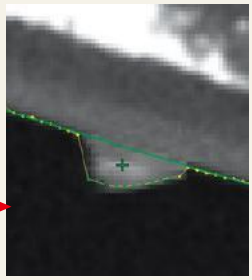
PROFILE DEFECT

Edge defect inspection tool optimized for burr and flaw inspection

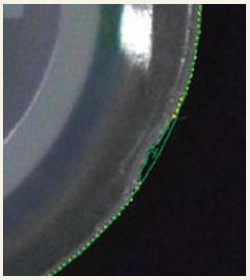
This tool extracts a profile from the edges of a workpiece and recognizes the sections that show a large difference from the profile such as burrs or flaws. In addition to circles and straight lines, ovals and profiles with complex shapes consisting of free curves are supported, based on edge information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



Burr/flaw detection for a plastic mold. Automatically generates a best-fit reference line to the profile of a part including curves.



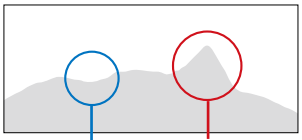
Detection of a burred section

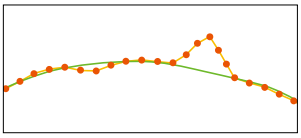


Detection of a flawed section

Applicable to various defects

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





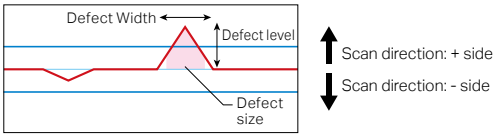


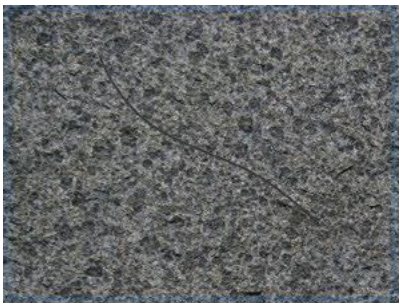
IMAGE ENHANCE FILTERS

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

SCRATCH DEFECT EXTRACTION

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

LINEAR DEFECT ON A METAL COMPONENT



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

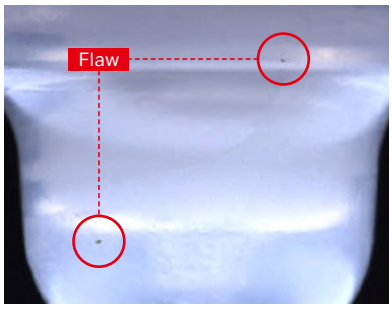


Only linear defects are extracted by ignoring background noise.

SHADING CORRECTION

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

APPEARANCE INSPECTION FOR A PLASTIC MOLD



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



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

NOISE ISOLATION

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

RECOGNITION OF CHARACTERS PRINTED ON CARDBOARD

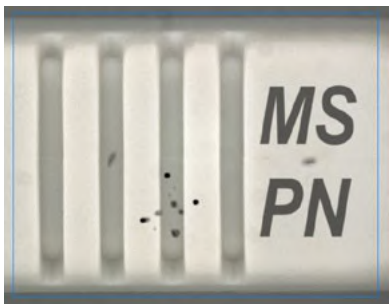


Characters cannot be extracted properly due to white and black fibers contained in the cardboard.



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

DEFECT INSPECTION FOR A PLASTIC MOLD



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



Only black defects smaller than the specified area are extracted.

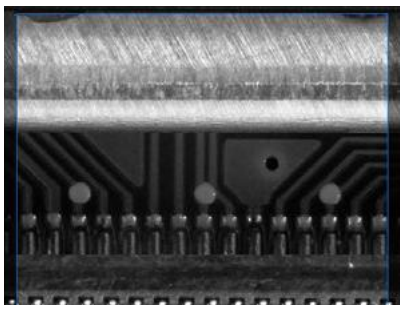
CONTRAST EXPANSION

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

VARIOUS CIRCUIT BOARD PATTERN INSPECTIONS



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

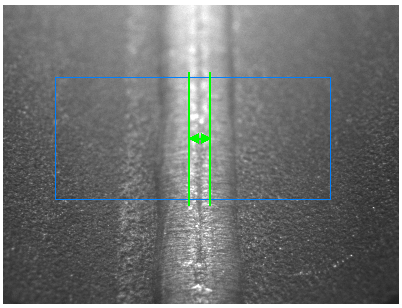


The circuit board pattern can be recognized clearly. Because the filter determines the expansion width from the intensity distribution within the inspection region, images without overexposure and underexposure can be captured.

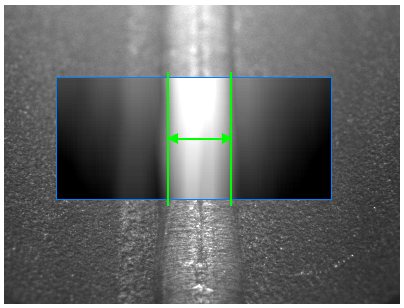
BLUR

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

WIDTH INSPECTION FOR A WELDED PIPE SECTION



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



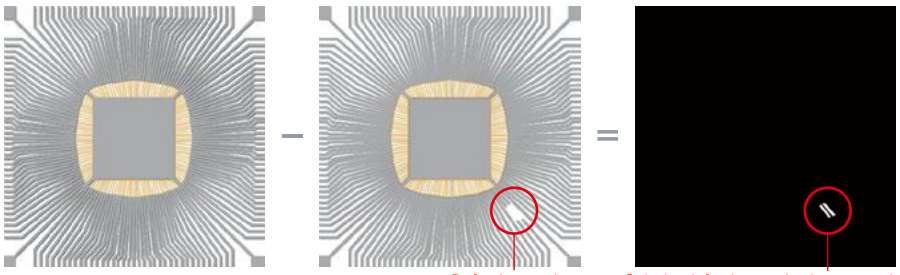
The blur filter allows for stable width measurement by eliminating unnecessary featured points other than the welded section.

SUBTRACTION

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

INSPECTION FOR A BROKEN SECTION OF A LEAD FRAME

Reference image (OK product) **Current image (NG product)** **Subtracted image**



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

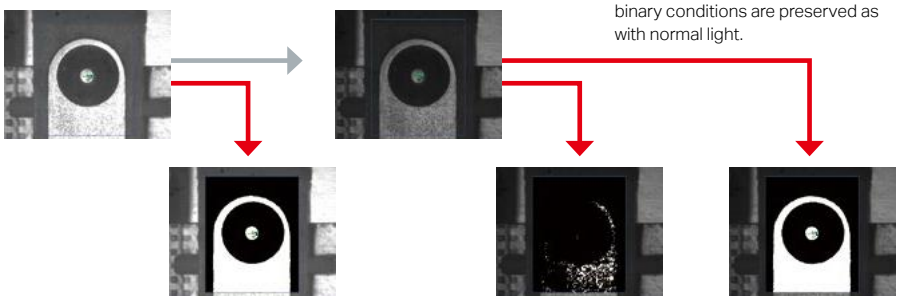
PRESERVE INTENSITY

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

ALIGNMENT INSPECTION FOR SCREW MOUNTING

Current image (normal light) **Current image (lowered light)**

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



Binary image

Binary image
Without preserve intensity

Binary image
With preserve intensity

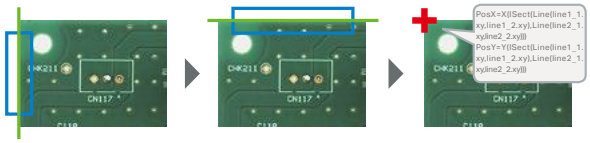
MEASUREMENTS & DIMENSIONS

High-precision dimension inspection can be done intuitively through simple point and click 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 performed with an easy point-and-click method. Points, lines, and circle information from other tools can also be referenced making it much easier to develop programs with multiple dimensions requiring inspection.

CONVENTIONAL

Combination of multiple settings and calculations are required



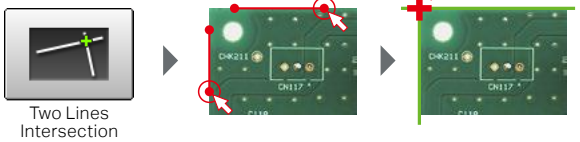
Create settings that will detect a line in the left area

Create settings that will detect a line in the top area

Calculate intersecting coordinates between 2 lines with the calculation function

MEASUREMENTS & DIMENSIONS TOOL

Settings completed by simply clicking on the desired features



Two Lines Intersection

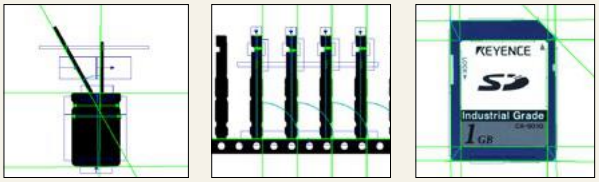
Select the feature to be executed, and

Just specify target lines with the mouse

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

APPLICATION

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



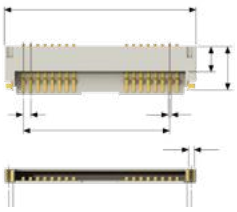
CAPACITOR | PRESS PARTS | LABEL

CONNECTOR TOOLS

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

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

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



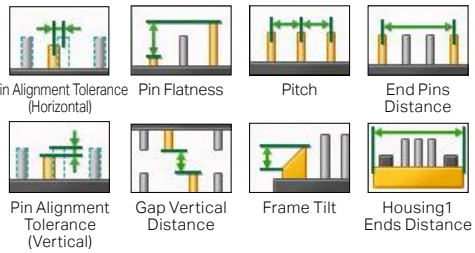
Connector inspection that requires various items to be inspected for each product type and shape

Can be completed just by following steps specific to connector inspection

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

SETTING COMPLETED!







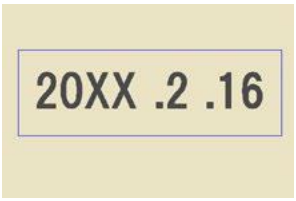
RECOGNITION INSPECTION

OCR2

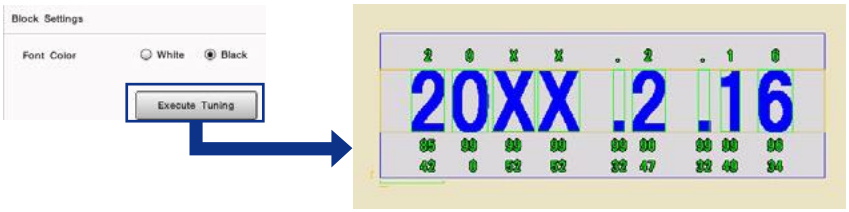
Simple and Reliable Character Recognition Tool

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.

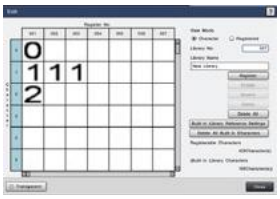
STEP1 Set the area



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



Customizable 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 READERS

Executes reading and image processing inspection simultaneously

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

Supports a variety of codes

1D CODE



2D CODES



DataMatrix



QR code



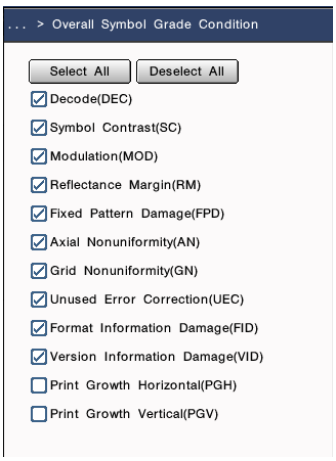
Within the same workpiece, appearance inspection is performed simultaneously with reading of the 2D code.

Print quality verification function

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

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

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



2D VISION-GUIDED ROBOTICS

Easily develop a vision-guided robotic system

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



Auto-calibration function

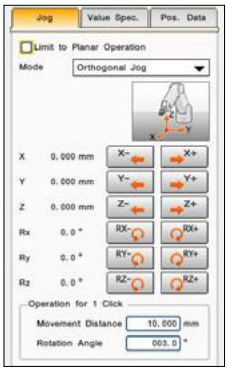
Calibration is the most difficult aspect of constructing and running a system linking a robot and vision system. The auto-calibration function provides highly-accurate and effortless calibration. The result is reliable and stable calibration without the subjectivity of a manual process.

CONVENTIONAL PROBLEMS	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)

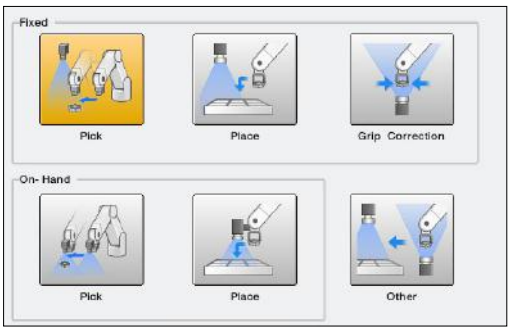
Easily establish direct communication between the robot and the CV-X by simply selecting the robot manufacturer (supports a wide range of manufacturers in the industry). The CV-X can also perform jog operations on the robot, simplifying the development of the machine vision guidance.





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.

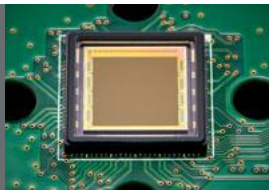
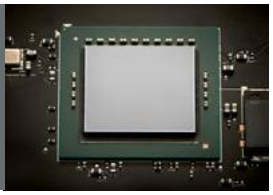


3D VISION-GUIDED ROBOTICS

Designed specifically for 3D vision-guided robotics

Integrated design with four cameras and a single projector



Four camera image capture designed to eliminate blind spots	
High-precision CMOS sensor	
High-speed processor	
Specially designed projector	

Equipped with a newly-developed 3D scanning function

Calculates the optimal solution from 136 captured images in 0.5 seconds



Simple setup

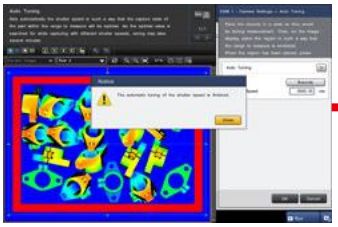


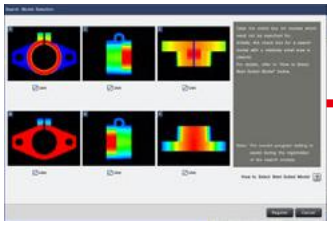
Image creation

Automatic brightness adjustment



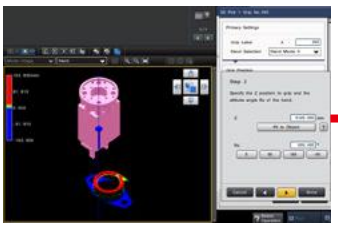
Calibration

One-click 3D auto-calibration



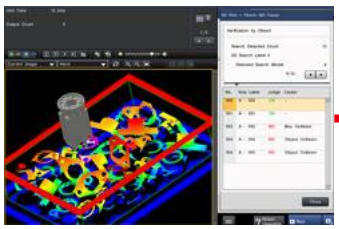
Search settings

Simple setup just by loading CAD data



Gripper settings

Click to operate—No robot settings required



Inspection

Confirm NG factors at a glance

Previously time-consuming setup can now be done in as little as 15 minutes

Configuration complete

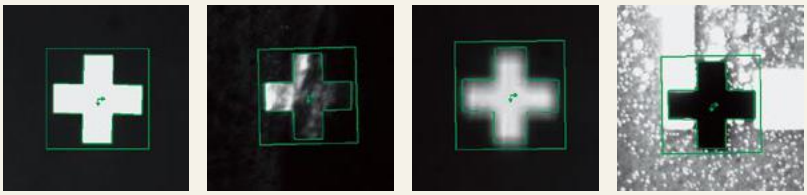
ShapeTrax™ 3A

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 also offers high search performance 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

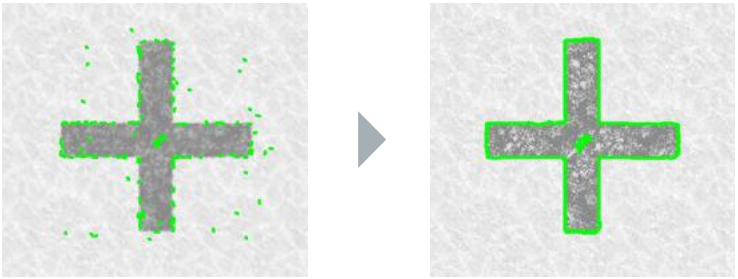
The set-up to extract the profile of workpieces that conventionally required experience can now be optimized automatically, allowing a simple, easy-to-use menu. Anyone can make use of the maximum potential of ShapeTrax™ 3A for any workpiece.

CONVENTIONAL

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

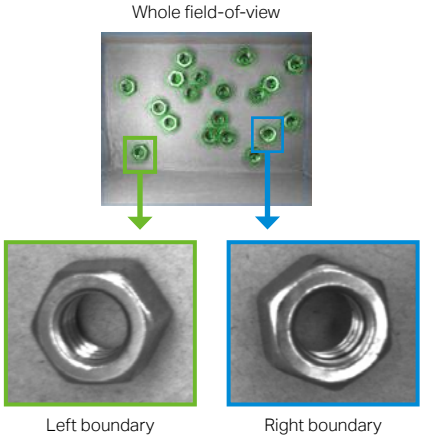
ShapeTrax™ 3A

ShapeTrax™ 3A automatically analyzes noise in images and appropriately extracts profiles as humans visualize 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.



Left boundary | Right boundary

Industry-first "Responsive" Search

Rotational Direction Search

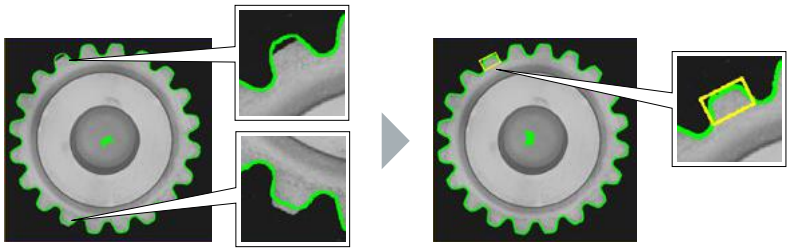
For shapes such as circles or equilateral polygons, our new algorithm delivers stable, high-speed inspection of workpieces that possess special characteristics while rotating.

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.

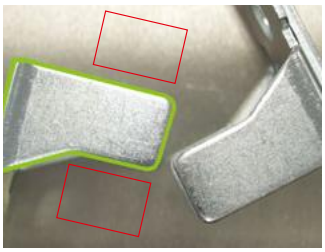
Using rotational direction search

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

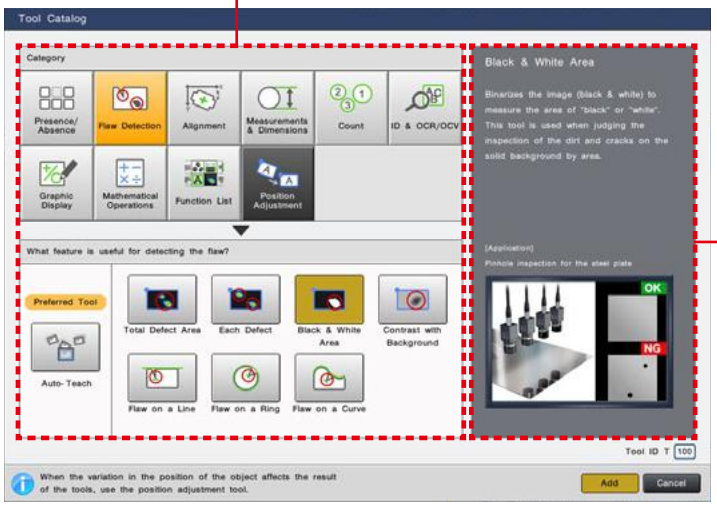
This function can operate simultaneously with processes such as robot picking by detecting differences between one side and another based on minute details, or detecting spaces to chuck workpieces. Anyone can easily use this function, as it requires no complicated branch condition settings or calculations.



TOOL SELECTION CATALOG BASED ON APPLICATION

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

A tool catalog 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 CATALOG

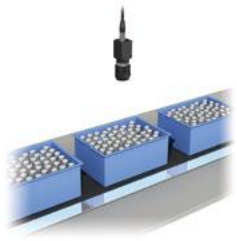
The tools have been categorized according to application, based on common industry inspection applications. It allows the user to intuitively find the best tool for their application.

APPLICATION NAVIGATOR

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

APPLICATION

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



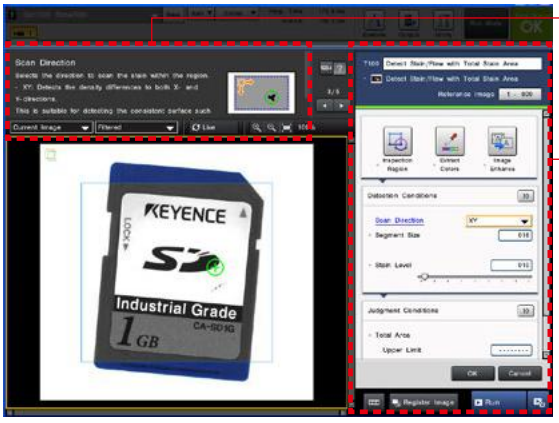
CONVENTIONAL

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

TOOL CATALOG

Just select the inspection category from the tool catalog

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

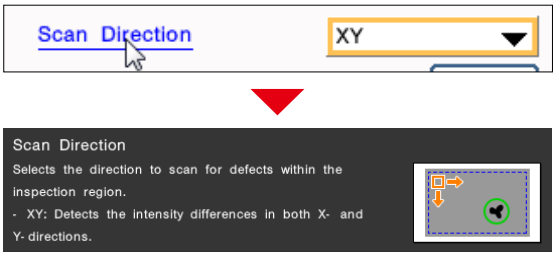


HELP GUIDE FUNCTION

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

INTUITIVE MENU ORGANIZATION

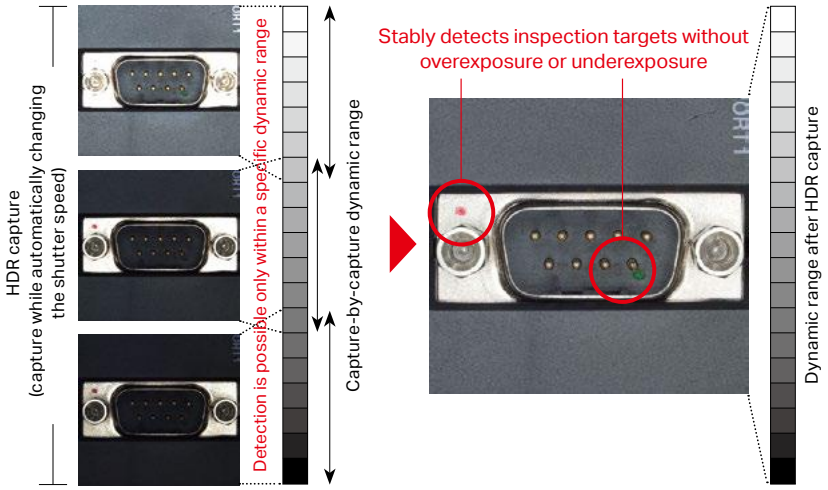
The setting menus are arranged so that they are very graphical and easy to understand in order to help guide the user through the proper setup of each tool.



HDR

High dynamic range captures quality images on difficult targets

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



Glare removal

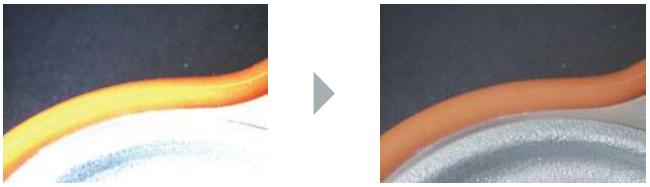
Stable capture results can be obtained even for targets with a high reflectance such as metal workpieces.



Conventional | HDR capture

Lighting variation removal

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

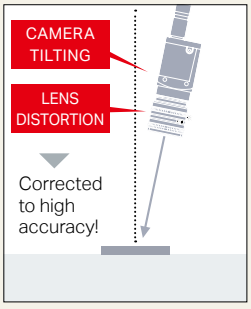


Conventional | HDR capture

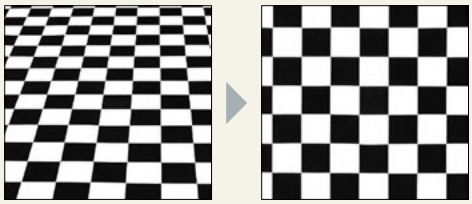
CALIBRATION

Removes effects of lens distortion or camera tilting

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



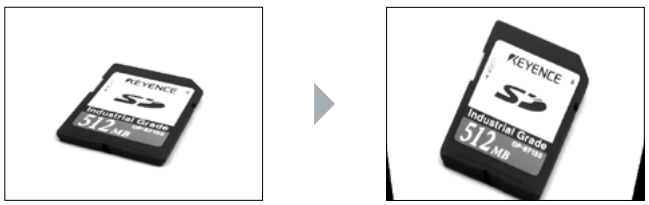
CORRECTION USING A CALIBRATION PATTERN



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

Corrects tilting

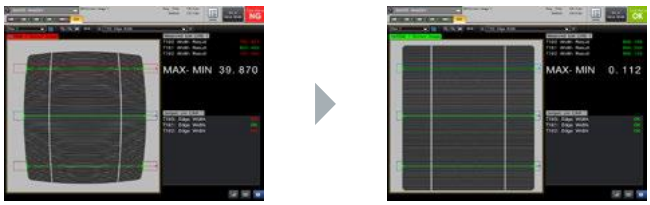
Corrects camera tilting that may occur during installation. This is also effective when a camera is installed at a position due to installation space restrictions.



Original image | Corrected image

Corrects lens distortion

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



Original image | Corrected image

MULTI-CAPTURE

Optimizes one inspection cycle

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

CONVENTIONAL

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

MULTI-CAPTURE

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





COAXIAL LIGHT



LOW ANGLE LIGHT

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

IMAGE BUFFER

Parallel inspection during capture at top speed

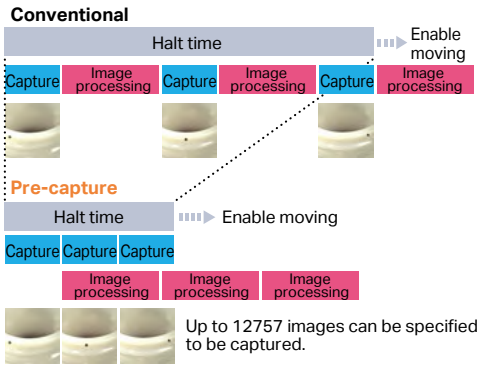
Image capture is performed at top speed simultaneously storing the image inside the device and concurrently executing image processing. No restriction will be imposed on the halt time or moving speed regarding the object, therefore the designed maximum performance can be exerted.

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 synchronization with the process currently being executed. There is no reliance on current image processing conditions, and it is possible to perform image capture that matches equipment movement.

CONVENTIONAL

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

ASYNCHRONOUS TRIGGER

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.

UTILITIES

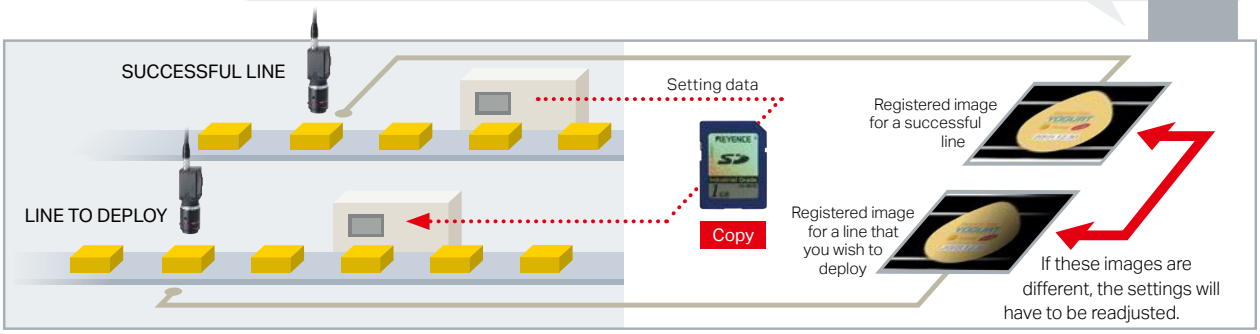
Easy-to-use utilities applying professional knowledge from on-site experiences.

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

"Camera Installation Replication" for applying configured inspection conditions anywhere

CONVENTIONAL

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



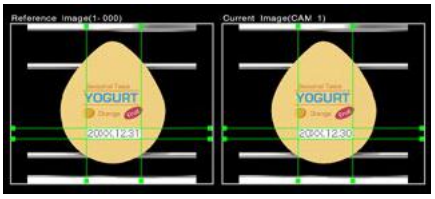
CAMERA INSTALLATION REPLICATION

THE CAMERA INSTALLATION CONDITIONS OF THE NEIGHBORING SUCCESSFUL LINE ARE REPLICATED

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

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

ALIGNMENT ADJUSTMENT TOOL

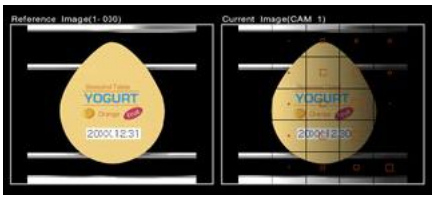


Successful line Line to deploy

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.

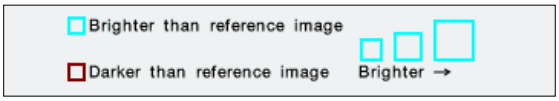


BRIGHTNESS ADJUSTMENT TOOL

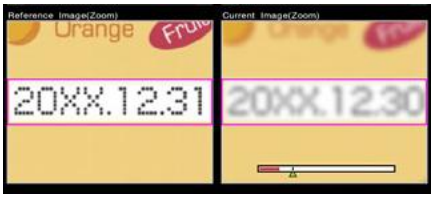


Successful line Line to deploy

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

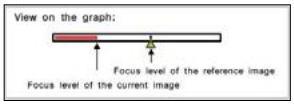


FOCUS TOOL



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

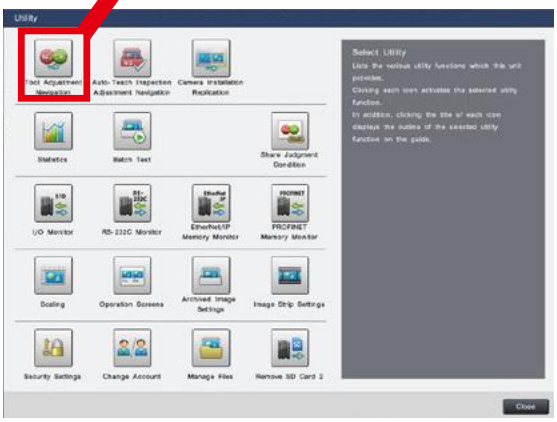
- I can’t figure out which tool I should adjust…
- An alignment adjustment failure may be the cause of the false judgment…
- I’m at a loss as to which image I should adopt for correcting the tool setting…

TOOL ADJUSTMENT NAVIGATION NAVIGATION FOR ACCURATE AND OPTIMAL ADJUSTMENT

Step-by-step adjustment!

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

Click!

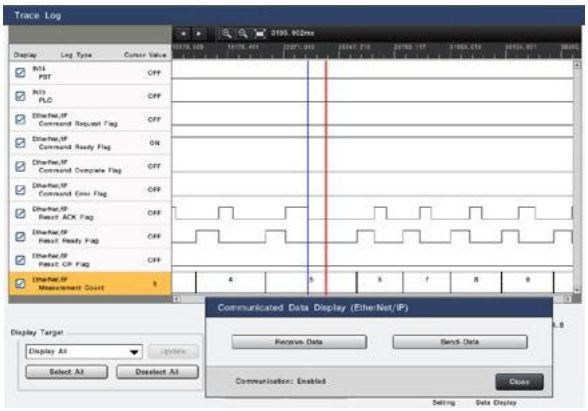


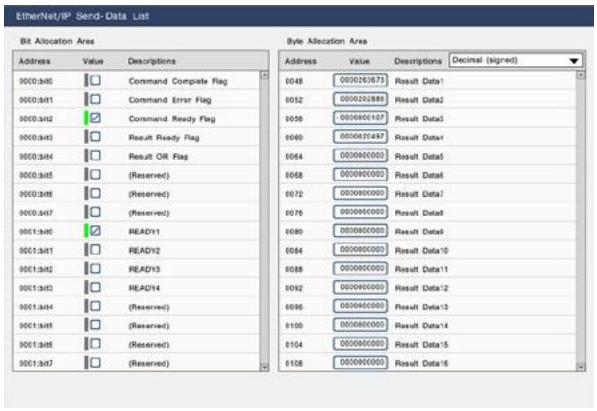
Navigating adjustment procedures
when non-defective workpieces have been mis-detected



Communication status viewer [Trace log]

The Trace Log function provides a timing chart view of the controller’s internal processing and I/O data communication. The log data can be retrieved directly on the controller and is available to any user. The Simulator software can be used to view the collected log data for remote investigation and analysis of any problems on site.



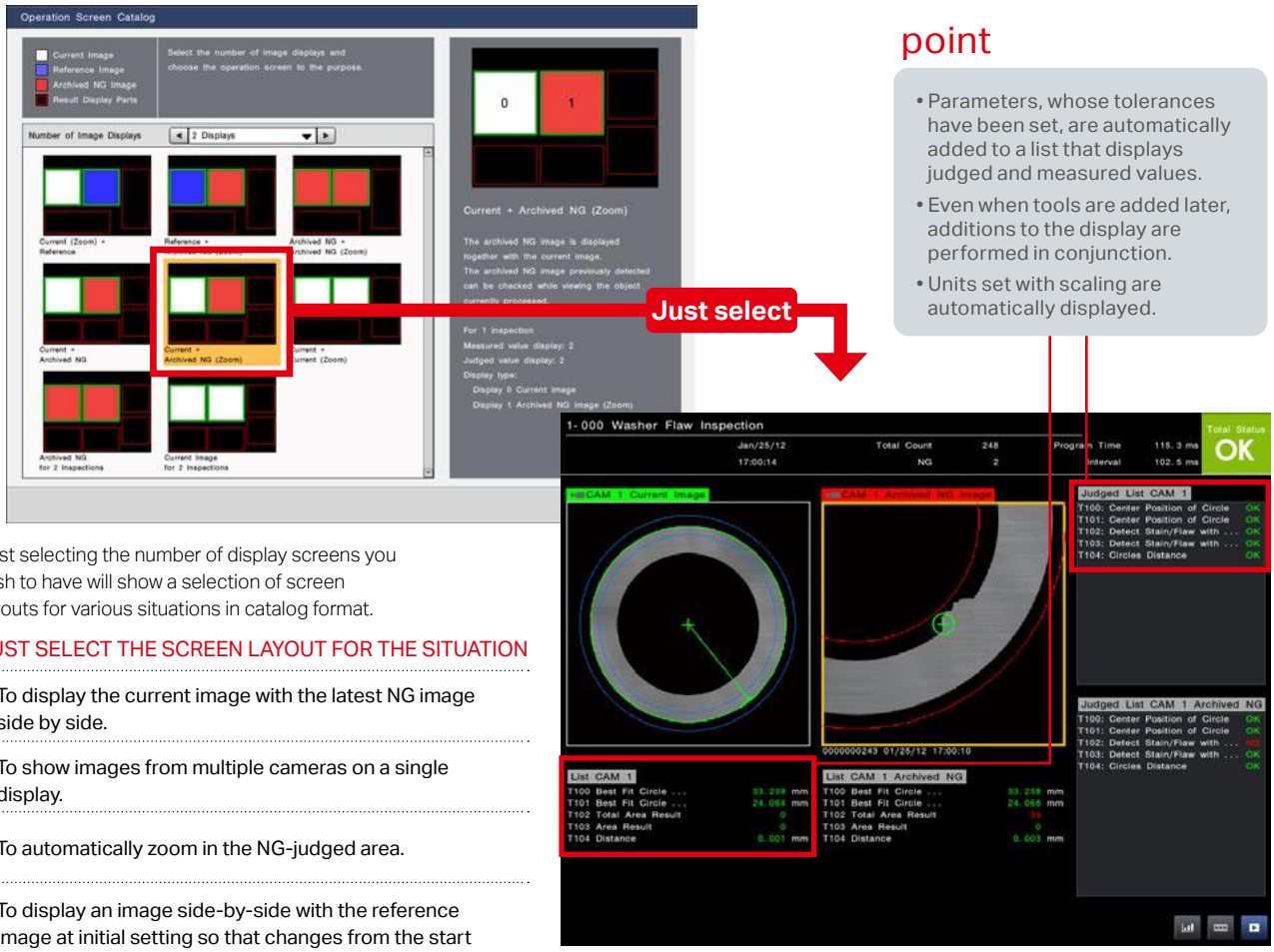


USER INTERFACE

No complicated customization is required.
Just select a template.

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

Just select the best screen from the Operator Screen Catalog



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

JUST SELECT THE SCREEN LAYOUT FOR THE SITUATION

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

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. Program adjustment efficiency can be improved further through combination with a custom menu.

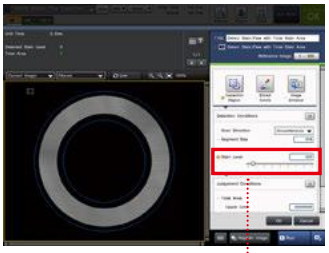


* Microsoft is a registered trademark of Microsoft Corporation in the United States and other countries.

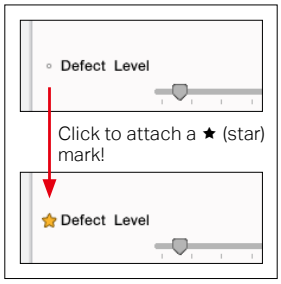
A Custom Menu function that realizes the optimal operation with a single click

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

JUST MARK THE PARAMETERS WHEN PERFORMING SETTINGS...

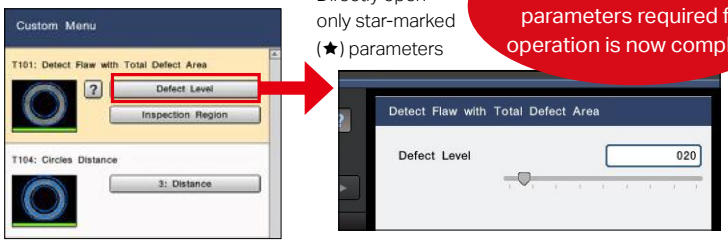


When it seems that these parameters are adjusted often...

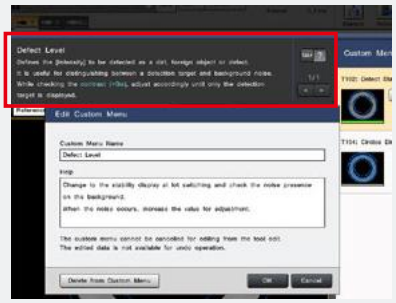


Directly open only star-marked (★) parameters

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



OPERATION COMMENT FUNCTION INCLUDED



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

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

English	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	ยูทิลิตี้ / ... / ... 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.





USER MANUAL AUTO-GENERATOR/PC SOFTWARE

PC software that strongly supports operation

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

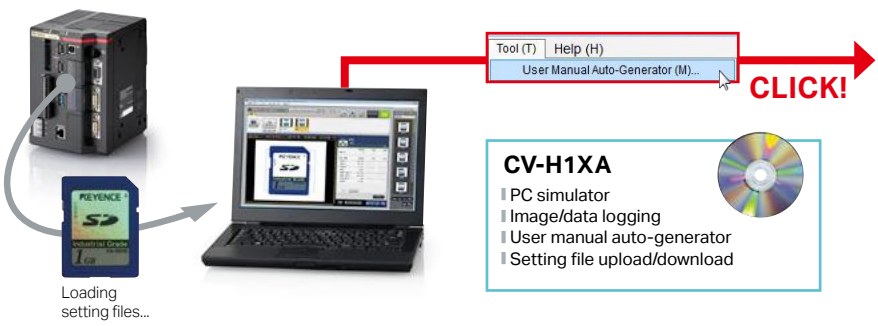
CUSTOMIZED USER MANUAL ENSURES OPTIMAL OPERATION FOR ALL USERS

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 summarize only the functions I need.

USER MANUAL AUTO-GENERATOR **CUSTOMIZED MANUAL CREATION IN A SINGLE CLICK!**



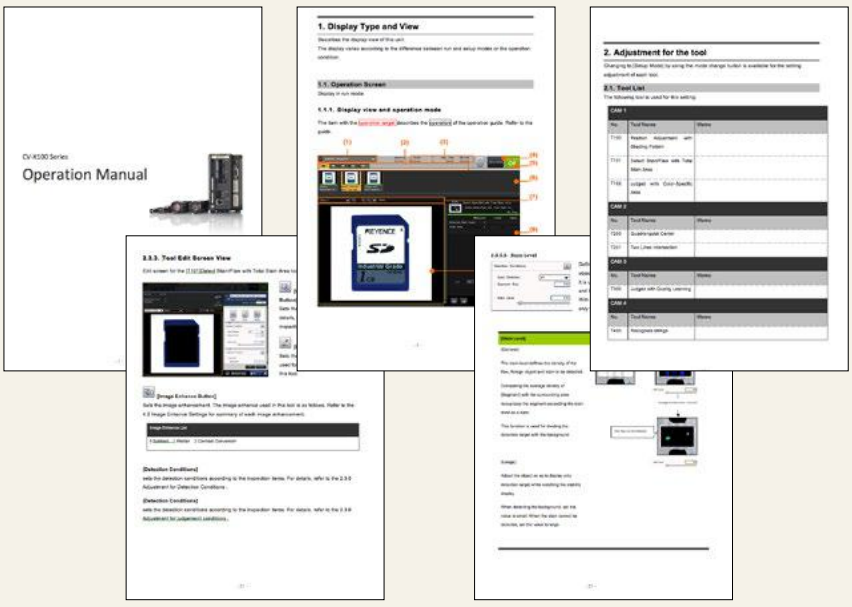


EXAMPLE OF CREATED MANUAL CONTENTS

Cover sheet

How to view the operation screen

A list of tools



Basic tool settings

An explanation of the main parameters

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.

TIME SAVING

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

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

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

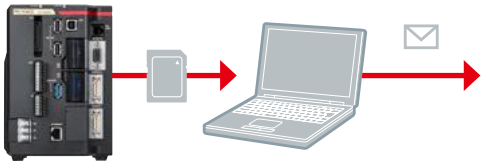
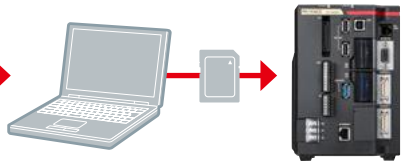


Download the program, including both the OK and NG images, from the controller running on site.

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

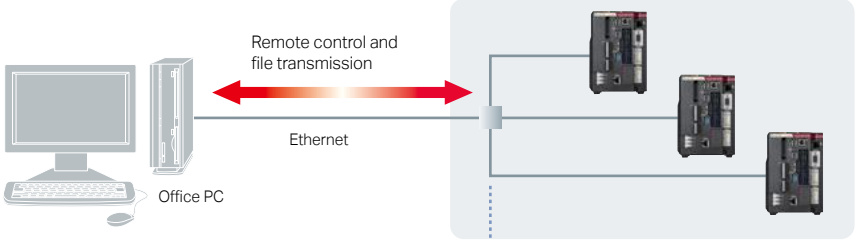


APPLICATION SAMPLE Exchange e-mail with a programmer at a remote site

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 a PC and operate controllers remotely: Data Logging & Remote Desktop Function

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



Management of multiple controllers connected to the LAN within the plant

MACHINE VISION SYSTEM DATABASE CA-H1DB/CA-AD1

Easy long-term storage and management of image inspection data

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

MACHINE VISION DATA LINKED DIRECTLY WITH INSPECTION IMAGES

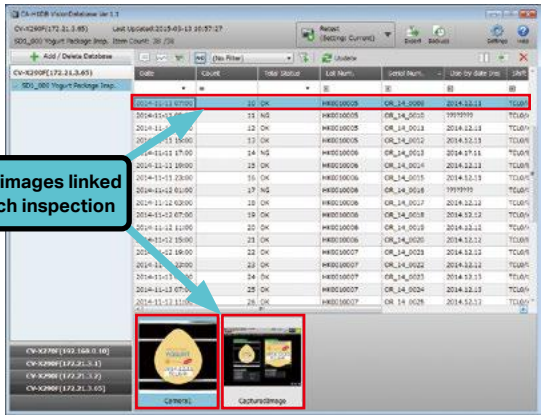
In a manufacturing environment, 100% inspection of products with machine vision is often a critical component of insuring quality and customer satisfaction. However, when inspection results need to be analyzed to determine the cause of an unexpected production problem or to investigate a customer complaint,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

STORAGE OF INSPECTION DATA LINKED TO IMAGES

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

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





MACHINE VISION SYSTEM DATABASE: VisionDatabase



Database PC software
CA-H1DB



Add-on SD card for controller function
CA-AD1

BACKUP/EXPORT SETTINGS FUNCTION

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



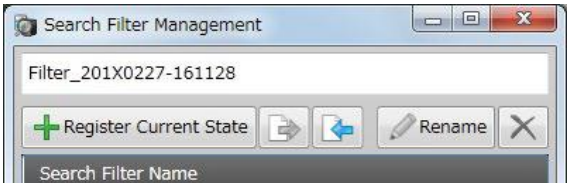
EXTERNAL PROCESS DATA LINK

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

Total Status	Lot Number	Serial ID
NG	FCL0/B	OR_14_0028
OK	TCL0/A	OR_14_0001

SEARCH WITH CUSTOM FILTERS

Saves original search conditions for quick retrieval of desired data.



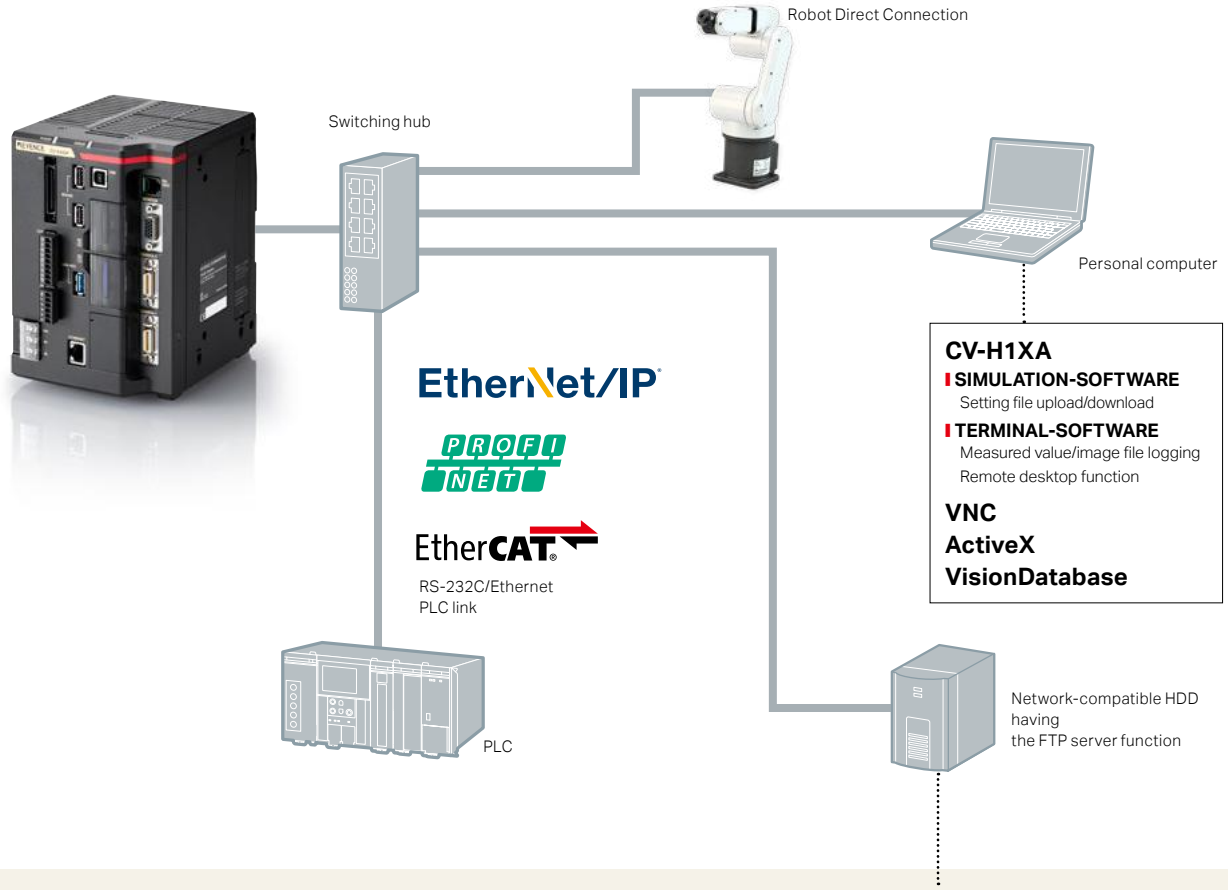
COMMUNICATION AND CONTROL

A wide variety of communication methods compatible with existing systems

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

COMMUNICATION INTERFACE

Supports linking to PLCs made by several manufacturers as well as EtherNet/IP®, 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

EtherNet/IP®- AND PROFINET-COMPATIBLE

EtherNet/IP
PROFINET
EtherCAT

FTP OUTPUT FUNCTION

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

VisionDatabase OUTPUT OPTION

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

COMMUNICATION MONITOR FUNCTION

The CV-X Series is equipped with I/O monitoring and trace log functions that allow the user to check the communication status which can help troubleshoot in case of errors.

COMPATIBLE WITH USB 3.0 STORAGE DEVICES

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

EtherCAT® is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.
Other proper nouns such as product names included in this catalog are trademarks or registered trademarks of their respective companies.

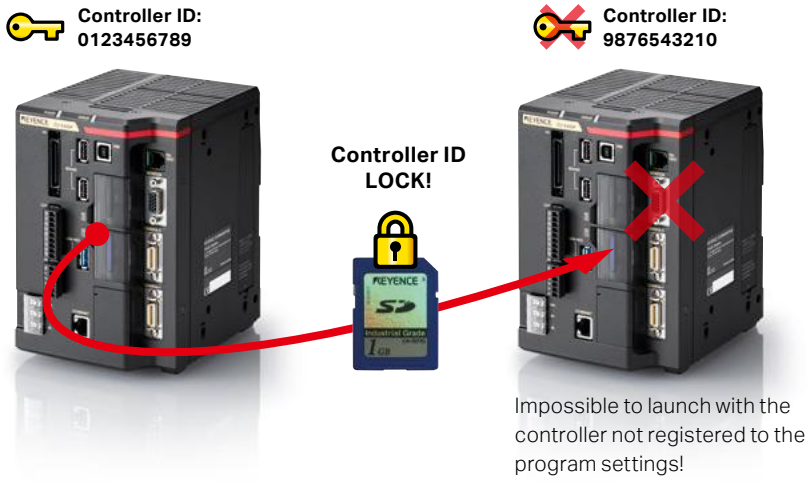
SECURITY/ACCOUNT

Robust security that protects program assets

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

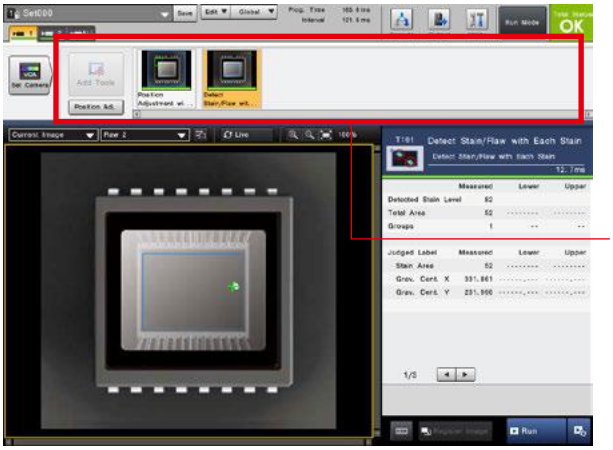
CONTROLLER ID LOCK

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



TOOL EDIT LOCK

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



PASSWORD SETTINGS

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



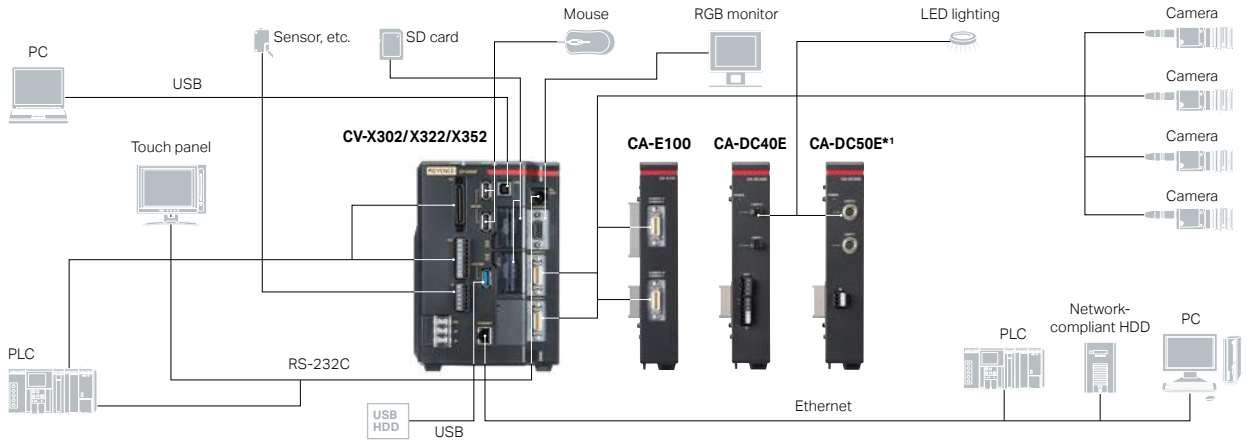
ACCOUNT SETTINGS OPERATING SETTING PROTECTION

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

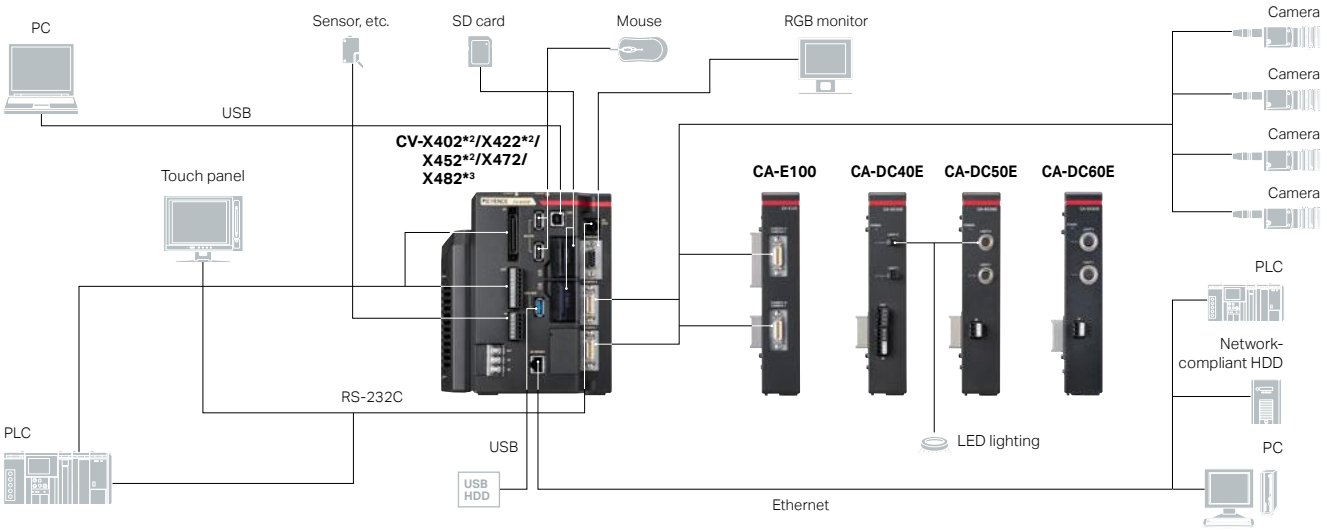
ADMIN	All operations are possible.
OPERATOR	Custom menu operation, change program, and saving are possible.
USER	Only viewing operations are possible.

Password setting for the purpose of changing accounts is possible.

SYSTEM CONFIGURATION (CV-X300 Series)

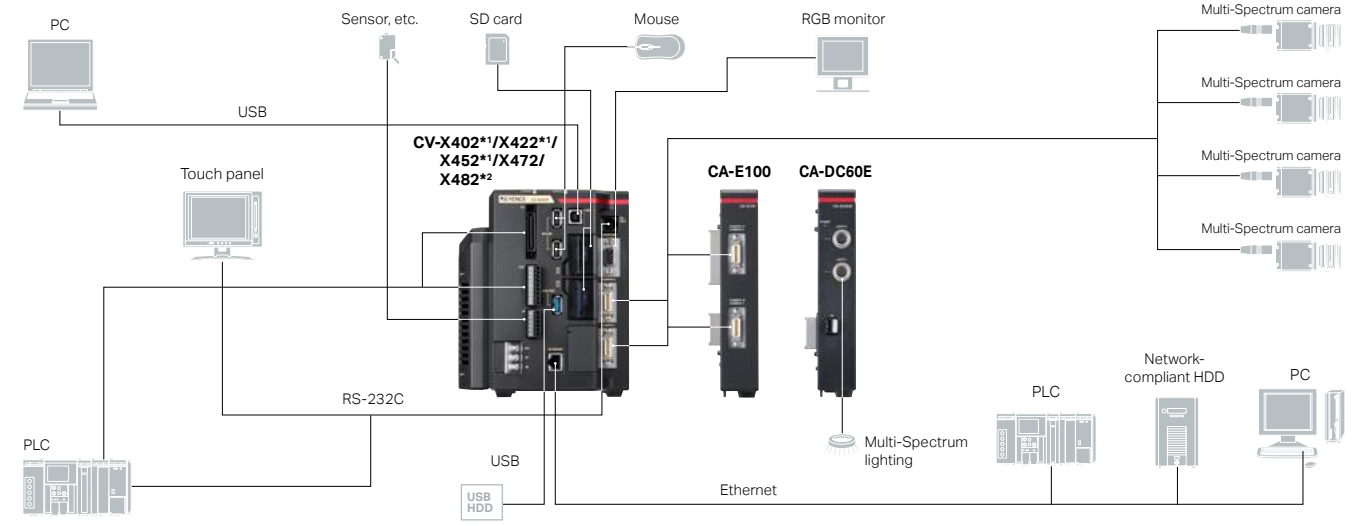


SYSTEM CONFIGURATION (CV-X400 Series)

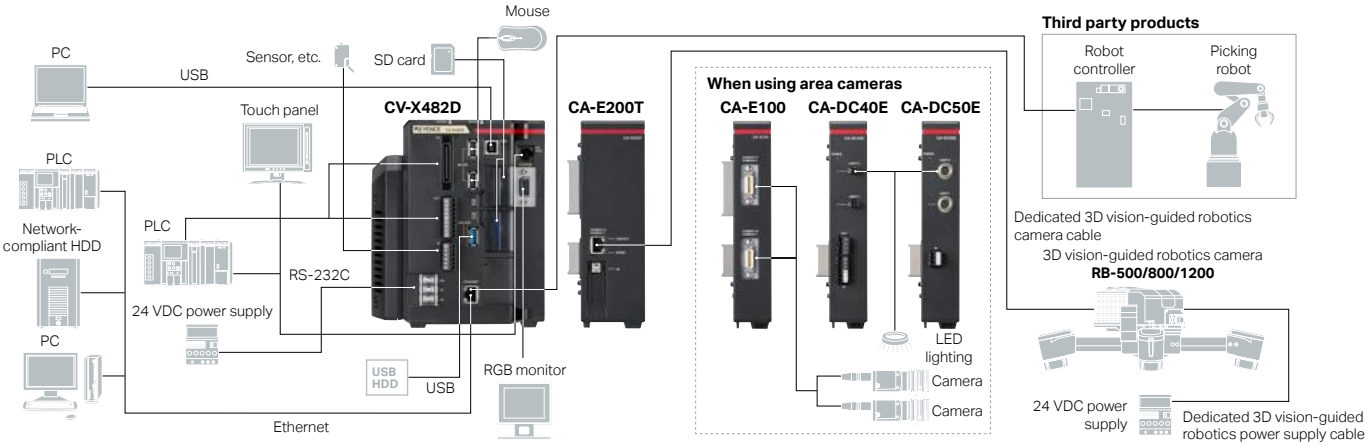


*1 LumiTrax™ mode is unavailable when used with CV-X302/X322/X352. CA-DRWxX lights can be used as standard high-intensity lighting.
*2 Fan unit cannot be connected to CV-X402/X422/X452.
*3 The CV-X482 has no camera connection port. Use in combination with a camera input unit or similar device.

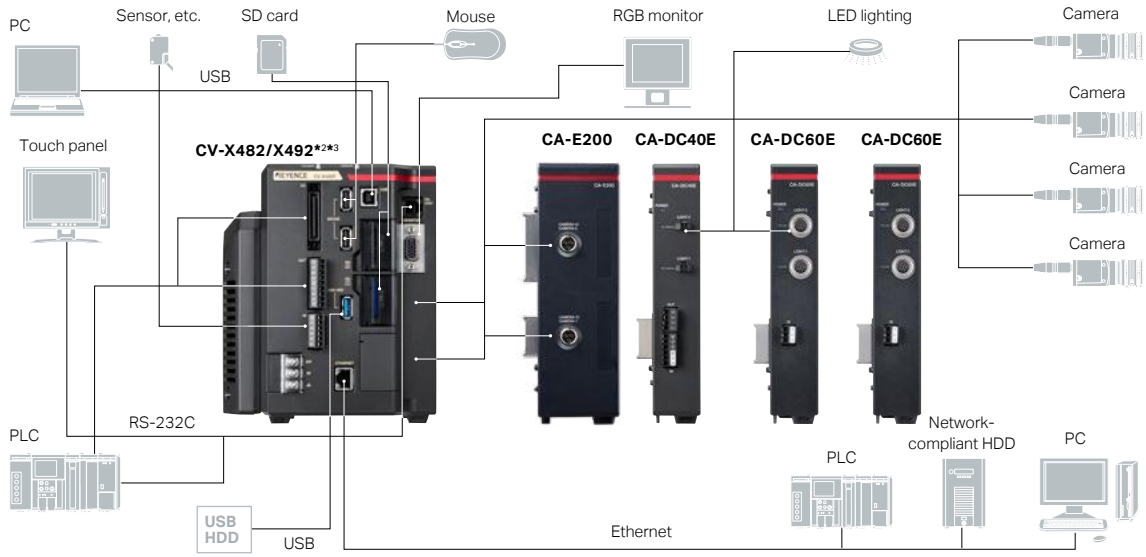
SYSTEM CONFIGURATION (CV-X400 Series) — (When Using Multi-spectrum Lighting)



SYSTEM CONFIGURATION (CV-X482D + 3D Vision-Guided Robot)



SYSTEM CONFIGURATION (CV-X482/X492) — (When Using a High-resolution Camera (CA-HFxM/C))



*1 Fan unit cannot be connected to CV-X402/X422/X452. *2 The CV-X482/X492 has no camera connection port. Use in combination with a camera input unit or similar device.
*3 LumiTrax™ imaging with the CA-HF6400x and CA-HF2100x is supported only with the CV-X492.

Controller



5 megapixel camera
supporting type
CV-X472/CV-X452/CV-X352

2 megapixel camera
supporting type
CV-X422/CV-X322

0.47 megapixel camera
supporting type
CV-X402/CV-X302



High-resolution camera
supporting type
CV-X492/CV-X482

3D vision-guided robotics
supporting type
CV-X482D

Accessories



Mouse
(Accessory)



PC software DVD-ROM
CV-H1XA

OS compatible with **CV-H1XA** 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 color /
90× speed monochrome
64 megapixel camera
CA-HF6400C (Color)
CA-HF6400M (Monochrome)



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



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

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



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



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

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

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

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

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



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



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

3D vision-guided robotics camera



RB-500
Measurement range:
520 × 390 × 200 (mm)
20.47" × 15.35" × 7.87"



RB-800
Measurement range:
860 × 645 × 500 (mm)
33.86" × 25.39" × 19.69"



RB-1200
Measurement range:
1260 × 1260 × 1000 (mm)
49.61" × 49.61" × 39.37"

Expansion unit



Area camera input unit
CA-E100



High-resolution area camera input unit
CA-E200



3D vision-guided robotics camera input unit
CA-E200T



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-X302/X322/X352.
CA-DRWxX lights can be used as standard high-intensity lighting.

Optional accessories

Camera cables



L-shaped connector

Amplifier for extension cables
CA-CHX10U

Models

Cable type	Connector shape	Camera cable length				Extension cable	Repeater cable
		3 m 9.8'	5 m 16.4'	10 m 32.8'	17 m 55.8'	5 m, 10 m 16.4', 32.8'	3 m, 5 m, 10 m 9.8', 16.4', 32.8'
Standard	Straight	**CA-CH3**	**CA-CH5**	**CA-CH10**	—	—	**CA-CH3X** (3 m 9.8') **CA-CH10X** (10 m 32.8')
	L-shaped	**CA-CH3L**	**CA-CH5L**	**CA-CH10L**	—	—	—
High-flex, environment-resistant	Straight	—	**CA-CH5BP**	**CA-CH10BP**	—	**CA-CH5BPE** (5 m 16.4')	—
High-flex	Straight	**CA-CH3R**	**CA-CH5R**	**CA-CH10R**	**CA-CH17R***1	—	**CA-CH3BX** (3 m 9.8') **CA-CH5BX** (5 m 16.4') **CA-CH10BX** (10 m 32.8')
For high-speed transmission cameras	Straight	**CA-CF3**	**CA-CF5**	**CA-CF10**	—	**CA-CF5E** (5 m 16.4') **CA-CF10E** (10 m 32.8')	—
	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.

Monitor/touch panel



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

12-inch
color LCD monitor
CA-MP120

8.4-inch
color LCD monitor
CA-MP82



CA-MP120(T)
monitor stand
OP-87262



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

CA-MP120(T)
Protection seal
OP-87263

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

Optional accessories for CA-MP120T
OP-87264 (3 m 9.8' touch panel modular RS-232C cable)
OP-87265 (10 m 32.8' touch panel modular RS-232C cable)

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

SD card



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





Communication cable



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



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 8.2')



Ethernet cable
OP-66843 (3 m 9.8')



USB cable
OP-66844 (2 m 6.6')

Other



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



Mouse stand
OP-87601



Camera mounting stage
CA-S2040

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

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

Controller model *1		CV-X492	CV-X482	CV-X482D
Camera input		2 color/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*3).		With CA-E200T 3D vision-guided robotics camera input unit connected: One 3D vision-guided robotics camera can be connected.
			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*3).	With CA-E100 area camera input unit connected*2: Up to 2 monochrome/color cameras can be connected.
	Trigger input	Simultaneous/individual capture*4 with up to 4 cameras/heads can be selected. (Up to 2 cameras for simultaneous capture when one camera input unit is connected)		Simultaneous/individual capture with up to 3 cameras can be selected (with CA-E200T and CA-E100 simultaneous connection only).
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	3D vision-guided robotics camera RB-500/800: 2048 (H) × 1536 (V), approx. 3.15 megapixels 1024 (H) × 768 (V), approx. 0.79 megapixels (using binning) RB-1200: 2048 (H) × 2048 (V), approx. 4.19 megapixels 1024 (H) × 1024 (V), approx. 1.05 megapixels (using binning) Area camera CA-035C/HS035C/H035C/035M/HS035M/H035M: • 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/HS200C/H200C/200M/HS200M/H200M: • 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
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		Each setting supports 400 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), 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)	• 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 area camera input unit (CA-E100) can be used only when the 3D vision-guided robotics camera input unit (CA-E200T) is connected simultaneously.
*3 The LJ-V cannot be used at the same time with a 21 megapixel camera or with LumiTrax™.
*4 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-X492	CV-X482	CV-X482D
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 (color camera, 0.24 megapixels) • Max. 1024 images (color camera, 0.31 megapixels) • Max. 1024 images (color camera, 0.47 megapixels) • Max. 1024 images (color camera, 1 megapixel) • Max. 1024 images (color camera, 2 megapixels) • Max. 665 images (color camera, 5 megapixels: CA-H500C) • Max. 669 images (color camera, 5 megapixels: CA-H500CX) • Max. 128 images (color camera, 21 megapixels: CA-HF2100C) • Max. 39 images (color camera, 41 megapixels) • Max. 17 images (color 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 (color camera, 0.24 megapixels) • Max. 1024 images (color camera, 0.31 megapixels) • Max. 1024 images (color camera, 0.47 megapixels) • Max. 1024 images (color camera, 1 megapixel) • Max. 720 images (color camera, 2 megapixels) • Max. 264 images (color camera, 5 megapixels: CA-H500C) • Max. 265 images (color camera, 5 megapixels: CA-H500CX) • Max. 37 images (color camera, 21 megapixels: CA-HF2100C)	• 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 (color camera, 0.24 megapixels) • Max. 1024 images (color camera, 0.31 megapixels) • Max. 1024 images (color camera, 0.47 megapixels) • Max. 1024 images (color camera, 1 megapixel) • Max. 720 images (color camera, 2 megapixels) • Max. 264 images (color camera, 5 megapixels: CA-H500C) • Max. 265 images (color camera, 5 megapixels: CA-H500CX)
		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 (color camera, 0.24 megapixels) • Max. 1024 images (color camera, 0.31 megapixels) • Max. 1024 images (color camera, 0.47 megapixels) • Max. 1024 images (color camera, 1 megapixel) • Max. 1024 images (color camera, 2 megapixels) • Max. 1024 images (color camera, 5 megapixels: CA-H500C) • Max. 1024 images (color camera, 5 megapixels: CA-H500CX/HX500C) • Max. 245 images (color camera, 21 megapixels: CA-HF2100C) • Max. 70 images (color camera, 41 megapixels) • Max. 30 images (color 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 (color camera, 0.24 megapixels) • Max. 1024 images (color camera, 0.31 megapixels) • Max. 1024 images (color camera, 0.47 megapixels) • Max. 1024 images (color camera, 1 megapixel) • Max. 1024 images (color camera, 2 megapixels) • Max. 517 images (color camera, 5 megapixels: CA-H500C) • Max. 520 images (color camera, 5 megapixels: CA-H500CX) • Max. 66 images (color camera, 21 megapixels: CA-HF2100C)	• 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 (color camera, 0.24 megapixels) • Max. 1024 images (color camera, 0.31 megapixels) • Max. 1024 images (color camera, 0.47 megapixels) • Max. 1024 images (color camera, 1 megapixel) • Max. 1024 images (color camera, 2 megapixels) • Max. 517 images (color camera, 5 megapixels: CA-H500C) • Max. 520 images (color camera, 5 megapixels: CA-H500CX)
			• 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*2		
	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, judgment 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.

*2 The CV-X482D only supports LumiTrax™ images.

Controller model *1			CV-X492	CV-X482	CV-X482D
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		Analog RGB output XGA 1024 × 768 (24 bit color, 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		By connecting the optional light expansion unit CA-DC40E/DC50E, lighting-up and intensity control for the LED lighting is possible.*5
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		Switchable between English, Simplified Chinese, German, French, Italian, and Japanese
Rating	Voltage		24 VDC ±10%		
	Current consumption		5.3 A		
Environmental resistance	Operating ambient temperature		0 to +45°C 32 to 113°F (DIN rail mount) / 0 to +40°C 32 to 104°F (bottom side mount)		
	Operating ambient humidity		35 to 85% RH (No condensation)		
Weight			Approx. 1750 g 3.86 lb		

*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). The CA-DC60E cannot be used with the CV-X482D.
*5 Up to eight light control expansion units can be connected (max. two CA-DC50E units out of eight).

Controller model *1		CV-X472	CV-X452	CV-X422	CV-X402
Camera input		Two color/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-X422/X402), CA-SD1G (1 GB: standard equipment on the SD1 slot for the CV-X482D/X472/X452), 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 (color camera, 0.24 megapixels) • Max. 1024 images (color camera, 0.31 megapixels) • Max. 1024 images (color camera, 0.47 megapixels) • Max. 1024 images (color camera, 1 megapixel) • Max. 720 images (color camera, 2 megapixels) • Max. 264 images (color camera, 5 megapixels: CA-H500C) • Max. 265 images (color camera, 5 megapixels: CA-H500CX) • Max. 37 images (color 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 (color camera, 0.24 megapixels) • Max. 1024 images (color camera, 0.31 megapixels) • Max. 1024 images (color camera, 0.47 megapixels) • Max. 1024 images (color camera, 1 megapixel) • Max. 720 images (color camera, 2 megapixels) • Max. 264 images (color camera, 5 megapixels: CA-H500C) • Max. 265 images (color 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 (color camera, 0.24 megapixels) • Max. 1024 images (color camera, 0.31 megapixels) • Max. 1024 images (color camera, 0.47 megapixels) • Max. 619 images (color camera, 1 megapixel) • Max. 307 images (color 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 (color camera, 0.24 megapixels) • Max. 836 images (color camera, 0.31 megapixels) • Max. 545 images (color camera, 0.47 megapixels)

*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-X472	CV-X452	CV-X422	CV-X402
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 (color camera, 0.24 megapixels) • Max. 1024 images (color camera, 0.31 megapixels) • Max. 1024 images (color camera, 0.47 megapixels) • Max. 1024 images (color camera, 1 megapixel) • Max. 1024 images (color camera, 2 megapixels) • Max. 517 images (color camera, 5 megapixels: CA-H500C) • Max. 520 images (color camera, 5 megapixels: CA-H500CX) • Max. 66 images (color 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 (color camera, 0.24 megapixels) • Max. 1024 images (color camera, 0.31 megapixels) • Max. 1024 images (color camera, 0.47 megapixels) • Max. 1024 images (color camera, 1 megapixel) • Max. 1024 images (color camera, 2 megapixels) • Max. 517 images (color camera, 5 megapixels: CA-H500C) • Max. 520 images (color 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 (color camera, 0.24 megapixels) • Max. 1024 images (color camera, 0.31 megapixels) • Max. 1024 images (color camera, 0.47 megapixels) • Max. 1024 images (color camera, 1 megapixel) • Max. 603 images (color 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 (color camera, 0.24 megapixels) • Max. 1024 images (color camera, 0.31 megapixels) • Max. 1024 images (color 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, judgment 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-X472	CV-X452	CV-X422	CV-X402
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		Analog RGB output XGA 1024 × 768 (24 bit color, 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 32 to 113°F (DIN rail mount)/0 to 40°C 32 to 104°F (bottom side mount)			
	Operating ambient humidity		35 to 85% RH (No condensation)			
Weight			Approx. 1800 g 3.97 lb	Approx. 1600 g 3.53 lb		

*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-X352	CV-X322	CV-X302
Camera input			Two color/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-X322/X302), CA-SD1G (1 GB: standard equipment on the SD1 slot for the CV-X352), 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 (color camera, 0.24 megapixels) • Max. 1024 images (color camera, 0.31 megapixels) • Max. 1024 images (color camera, 0.47 megapixels) • Max. 741 images (color camera, 1 megapixel) • Max. 370 images (color camera, 2 megapixels) • Max. 128 images (color camera, 5 megapixels: CA-H500C) • Max. 129 images (color 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 (color camera, 0.24 megapixels) • Max. 1024 images (color camera, 0.31 megapixels) • Max. 740 images (color camera, 0.47 megapixels) • Max. 342 images (color camera, 1 megapixel) • Max. 164 images (color 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 (color camera, 0.24 megapixels) • Max. 386 images (color camera, 0.31 megapixels) • Max. 248 images (color 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 (color camera, 0.24 megapixels) • Max. 1024 images (color camera, 0.31 megapixels) • Max. 1024 images (color camera, 0.47 megapixels) • Max. 1024 images (color camera, 1 megapixel) • Max. 729 images (color camera, 2 megapixels) • Max. 246 images (color camera, 5 megapixels: CA-H500C) • Max. 247 images (color 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 (color camera, 0.24 megapixels) • Max. 1024 images (color camera, 0.31 megapixels) • Max. 1024 images (color camera, 0.47 megapixels) • Max. 673 images (color camera, 1 megapixel) • Max. 318 images (color 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 (color camera, 0.24 megapixels) • Max. 762 images (color camera, 0.31 megapixels) • Max. 485 images (color 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		

*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-X352	CV-X322	CV-X302
Utilities	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, judgment 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		
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		Analog RGB output XGA 1024 × 768 (24 bit color, 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 32 to 113°F (DIN rail mount)/0 to 40°C 32 to 104°F (bottom side mount)		
	Operating ambient humidity		35 to 85% RH (No condensation)		
Weight			Approx. 1600 g 3.53 lb		

*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 units out of 8).

Camera (CA-HF6400M/CA-HF6400C)

Model		CA-HF6400C	CA-HF6400M
Image receiving element		Color 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 0.10 Mil × 0.10 Mil	
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 32 to 104°F	
	Operating ambient humidity	35 to 85%RH	
Weight		Approx. 350 g 12.36 oz (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		Color 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 0.10 Mil × 0.10 Mil	
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 32 to 104°F	
	Operating ambient humidity	35 to 85%RH	
Weight		Approx. 380 g 13.41 oz (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		Color 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 0.14 Mil × 0.14 Mil	
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: (color 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 32 to 104°F	
	Operating ambient humidity	35 to 85%RH	
Weight		Approx. 280 g 9.88 oz (not including lens)	

Camera (CA-H200CX/H200MX)

LumiTrax™ / Multi-Spectrum / Pattern Projection

Model		CA-H200CX	CA-H200MX
Image receiving element		Color 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 0.14 Mil × 0.14 Mil	
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 32 to 104°F	
	Operating ambient humidity	35 to 85%RH	
Weight		Approx. 280 g 9.88 oz (not including lens)	

Camera (CA-H048CX/H048MX)

LumiTrax™ / Multi-Spectrum / Pattern Projection

Model		CA-H048CX	CA-H048MX
Image receiving element		Color 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 0.19 Mil × 0.19 Mil	
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 32 to 104°F	
	Operating ambient humidity	35 to 85%RH	
Weight		Approx. 190 g 6.71 oz (not including lens)	

Camera (CA-H500C/CA-H500M)

Model		CA-H500C	CA-H500M
Image receiving element		Color 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 0.14 Mil × 0.14 Mil	
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 32 to 122°F	
	Operating ambient humidity	35 to 85%RH	
Weight		Approx. 75 g 2.65 oz (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		Color 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 0.18 Mil × 0.18 Mil	
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 32 to 113°F	
	Operating ambient humidity	35 to 85%RH	
Weight		Approx. 75 g 2.65 oz (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		Color CMOS, High-speed reading using square-pixel	Monochrome CMOS, High-speed reading using square-pixel
Unit cell size		4.5 µm × 4.5 µm 0.18 Mil × 0.18 Mil	
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 32 to 113°F	
	Operating ambient humidity	35 to 85%RH	
Weight		Approx. 75 g 2.65 oz (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		Color 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 0.14 Mil × 0.14 Mil	
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 32 to 113°F	
	Operating ambient humidity	35 to 85%RH	
Weight		Approx. 45 g 1.59 oz (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		Color 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 0.27 Mil × 0.27 Mil	
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 32 to 122°F	
	Operating ambient humidity	35 to 85%RH	
Weight		Approx. 75 g 2.65 oz (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		Color CMOS, High-speed reading using square-pixel	Monochrome CMOS, High-speed reading using square-pixel
Unit cell size		6.9 µm × 6.9 µm 0.27 Mil × 0.27 Mil	
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 32 to 122°F	
	Operating ambient humidity	35 to 85%RH	
Weight		Approx. 75 g 2.65 oz (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)

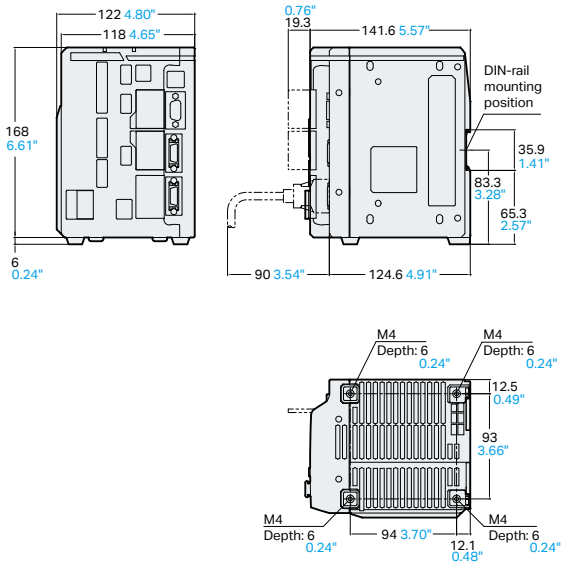
Model	Camera unit	CA-HS035CH	CA-HS035MH
	Relay unit	CA-HS035CU	CA-HS035MU
Image receiving element		Color CMOS, 7× high-speed reading using square-pixel	Monochrome CMOS, 7× high-speed reading using square-pixel
Unit cell size		7.4 µm × 7.4 µm 0.29 Mil × 0.29 Mil	
Image size		Equivalent to 1/3"	
Valid 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 32 to 104°F	
	Operating ambient humidity	35 to 85%RH	
Weight	Camera unit	Approx. 135 g 4.77 oz (cable included, lens not included)	
	Relay unit	Approx. 60 g 2.12 oz (not including lens)	

Camera (RB-500/RB-800/RB-1200)

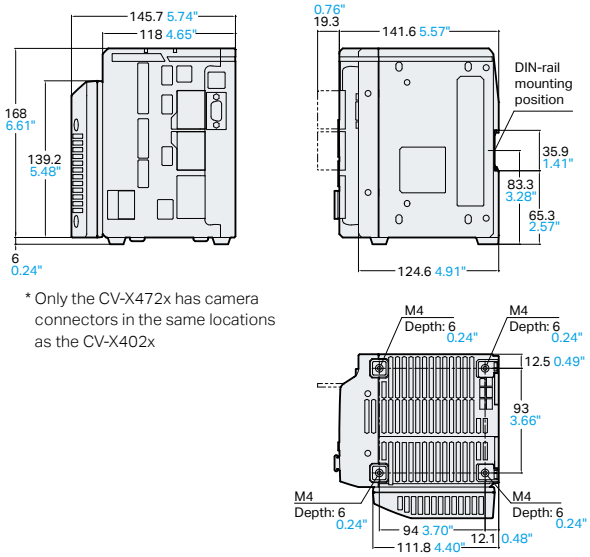
Model		RB-500	RB-800	RB-1200
Image receiving element		Monochrome CMOS image sensor		
Valid pixel count		2048 (H) × 1536 (V)		2048 (H) × 2048 (V)
	Using binning	1024 (H) × 768 (V)		1024 (H) × 1024 (V)
Measurement range (X, Y, Z) / mm inch		520 × 390 × 200 20.47" × 15.35" × 7.87"	860 × 645 × 500 33.86" × 25.39" × 19.69"	1260 × 1260 × 1000 49.61" × 49.61" × 39.37"
WD (to measurement top) / mm inch		1500 59.06"	1700 66.93"	2000 78.74"
Repeatability (±3σ)*		±0.1 mm 0.004"	±0.2 mm 0.008"	±0.4 mm 0.016"
Light source		LED (blue, green)		LED (blue)
Rating	Power voltage	24 V ±10%		
	Current consumption	6.0 A		4.5 A
Environmental resistance	Operating ambient temperature	0 to +45°C 32 to 113°F		
	Operating ambient humidity	35 to 85%RH (no condensation)		
Weight		Approx. 12 kg 26.46 lb	Approx. 14 kg 30.86 lb	Approx. 15 kg 33.07 lb

* Measurement values taken with binning off and with KEYENCE standard white plates used as the target workpiece.

Controller **CV-X402/CV-X422/CV-X452**
CV-X302/CV-X322/CV-X352

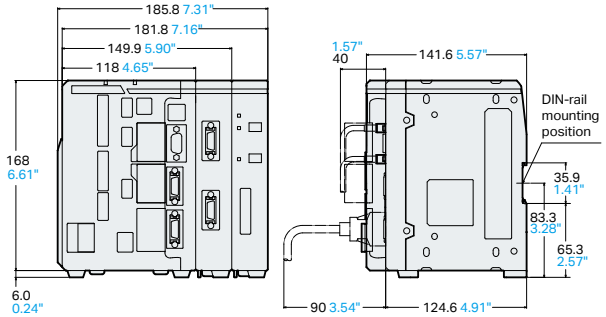


Controller **CV-X472/CV-X482/CV-X492**

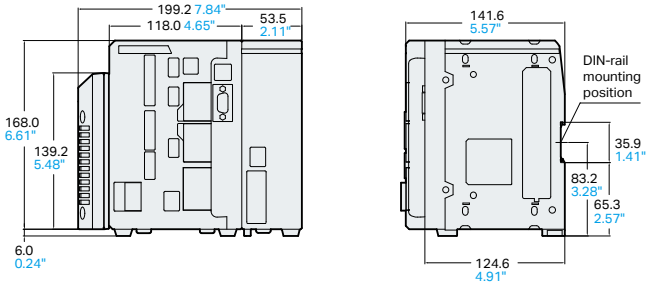


* Only the CV-X472x has camera connectors in the same locations as the CV-X402x

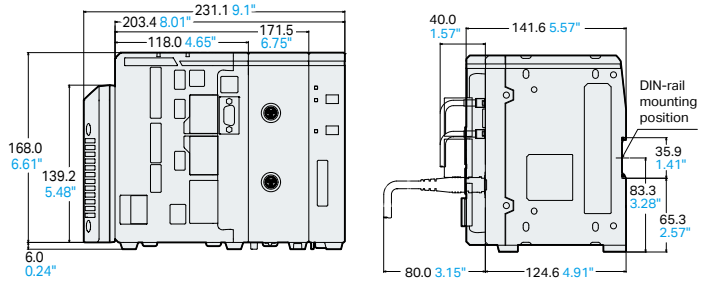
With area camera input unit **CA-E100** and light control expansion unit **CA-DC40E** connected

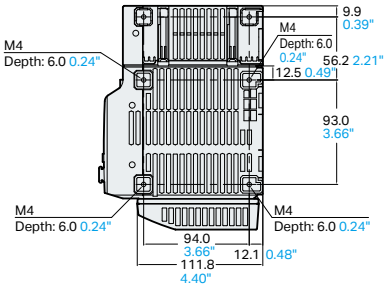


With 3D vision-guided robotics camera input unit **CA-E200T** connected

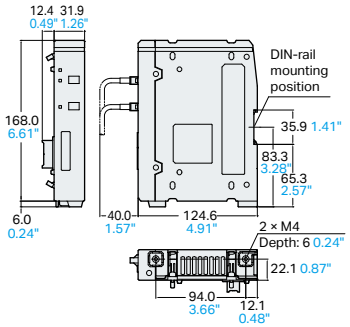


With high-resolution area camera input unit **CA-E200** and light control expansion unit **CA-DC40E** connected

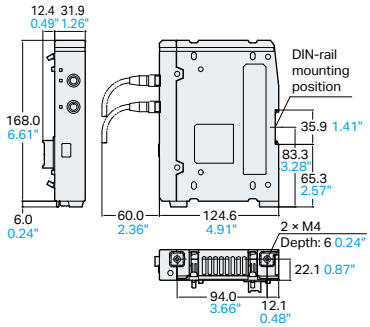




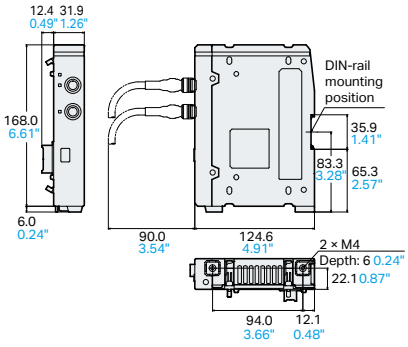
Light control expansion unit **CA-DC40E**



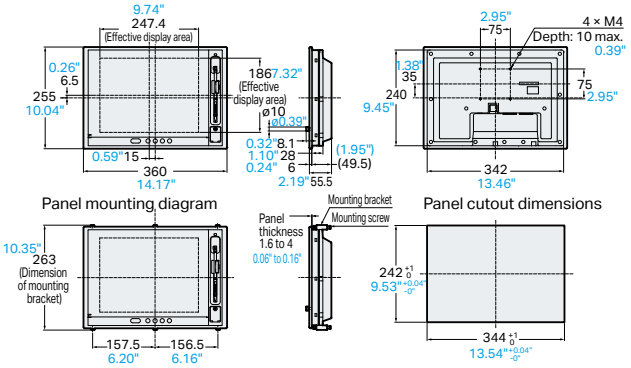
Light control expansion unit **CA-DC50E**



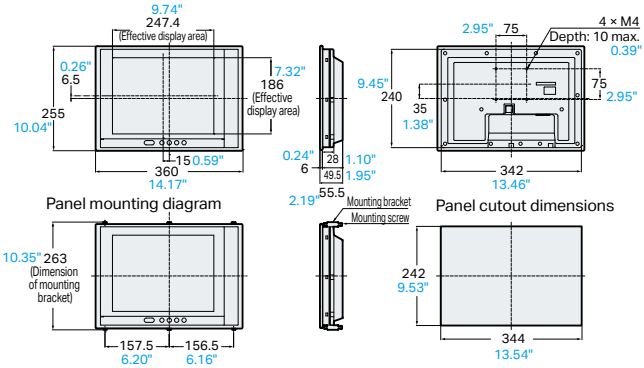
Light control expansion unit **CA-DC60E**



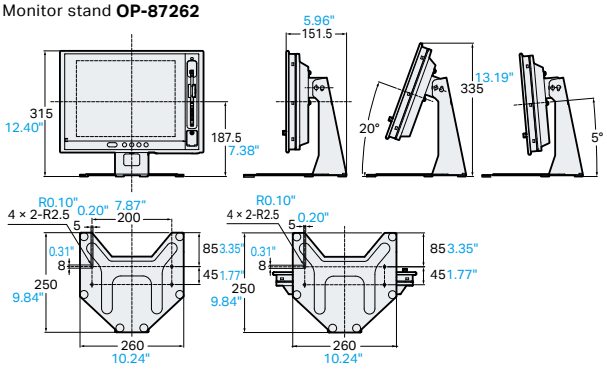
Touch panel LCD monitor **CA-MP120T**



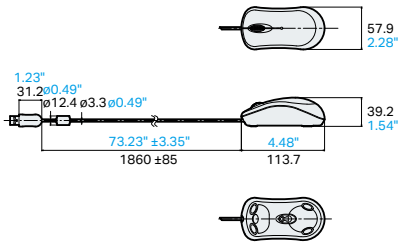
LCD monitor **CA-MP120**



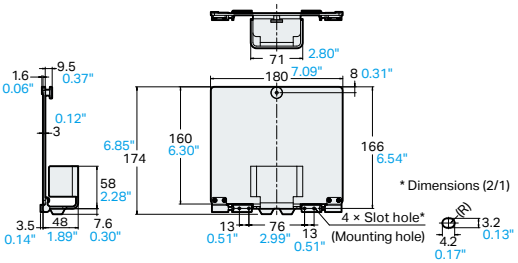
Monitor stand **OP-87262**



Dedicated USB mouse **OP-87506**

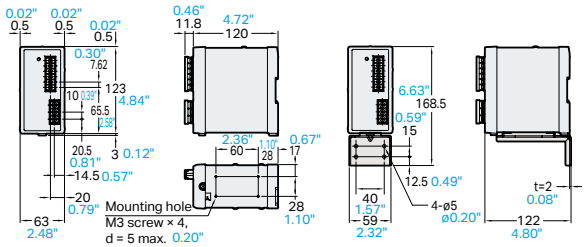


Mouse stand **OP-87601**

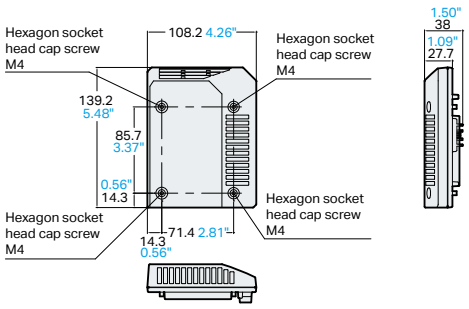


Dedicated 24 VDC power supply **CA-U4**

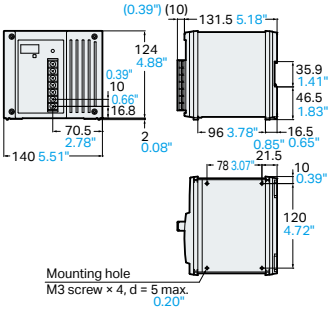
Front-mounting (using OP-42174)



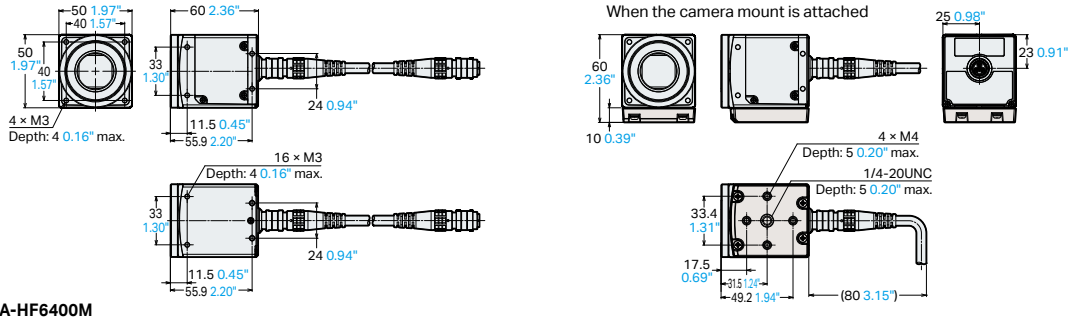
Fan unit **CA-F100**



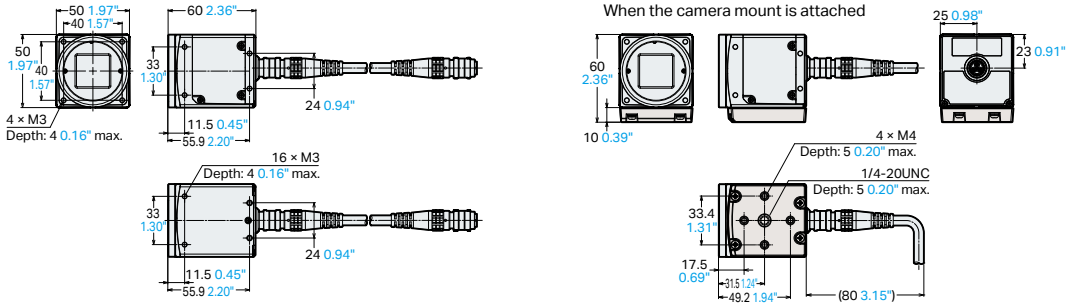
Dedicated 24 VDC power supply **CA-U5**



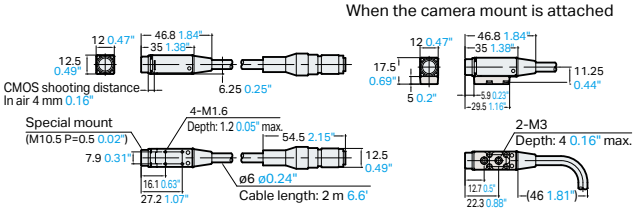
Camera **CA-HF2100C/CA-HF2100M**



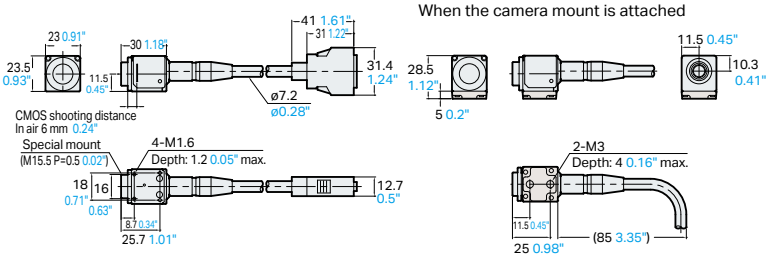
Camera **CA-HF6400C/CA-HF6400M**



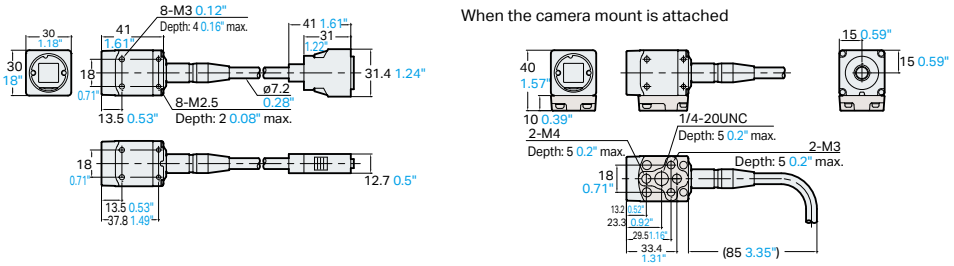
Camera **CA-HS035CH/CA-HS035MH**



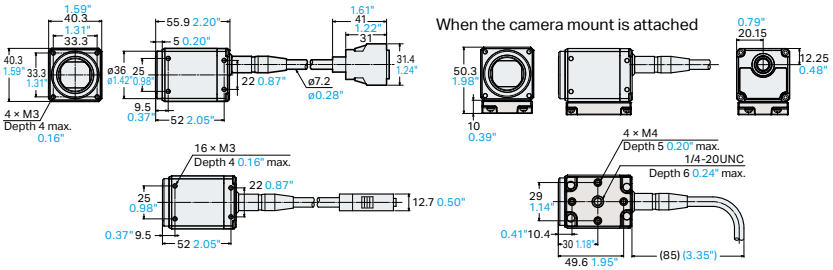
Camera **CA-HS200C/CA-HS200M**



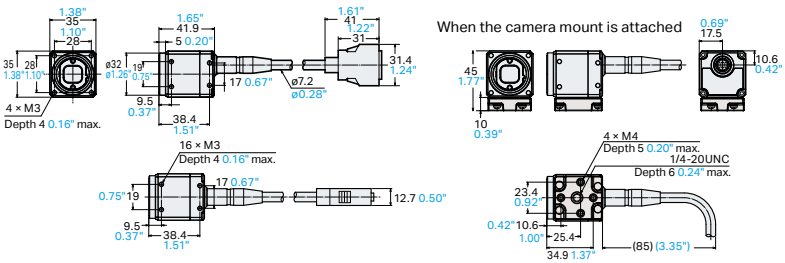
Camera **CA-H500C/CA-H500M/CA-H200C/CA-H200M/CA-200C/CA-200M/CA-H035C/CA-H035M/CA-035C/CA-035M**



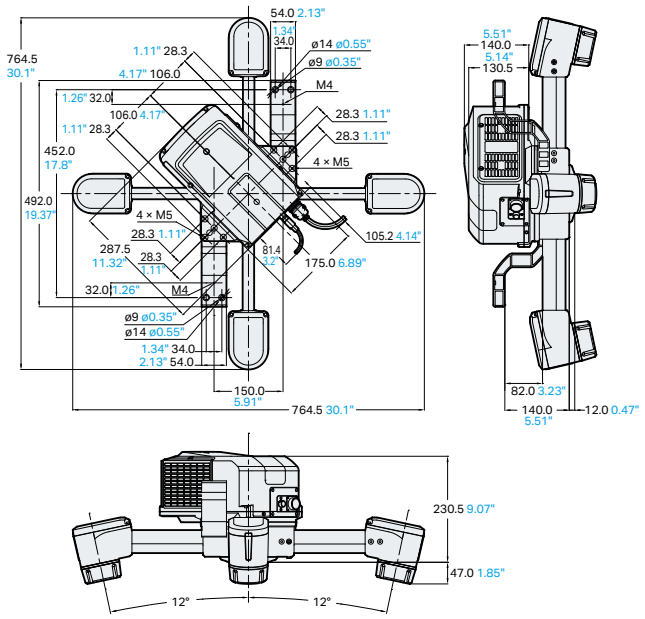
Camera **CA-H500CX/CA-H500MX/CA-H200CX/CA-H200MX**



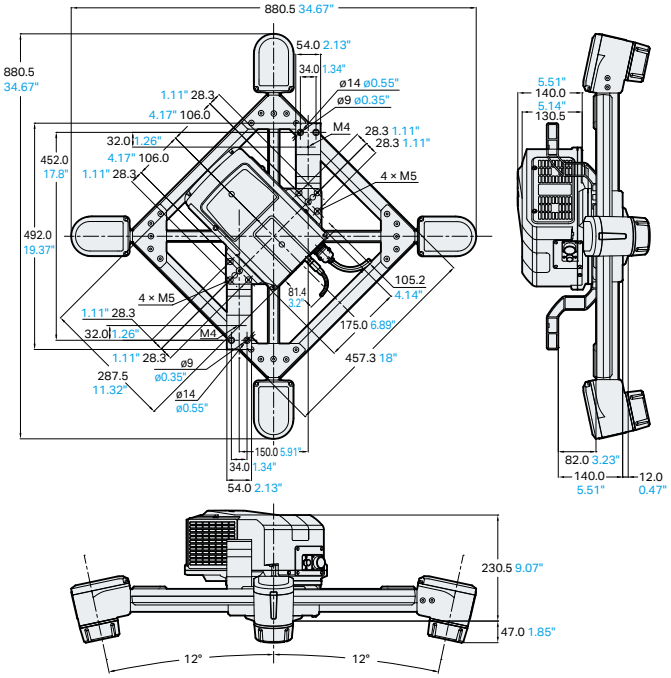
Camera **CA-H048CX/CA-H048MX**



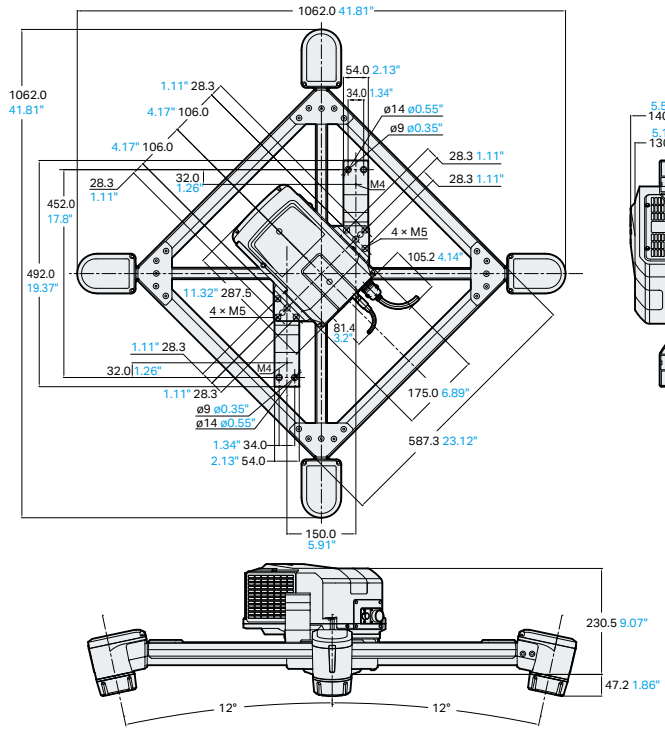
3D vision-guided robotics camera **RB-500**



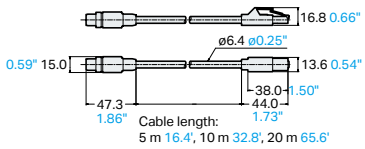
3D vision-guided robotics camera **RB-800**



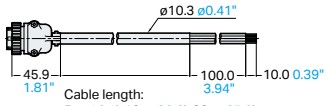
3D vision-guided robotics camera **RB-1200**



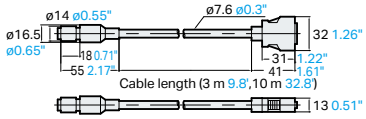
Dedicated 3D vision-guided robotics camera cable
CA-CD5/CA-CD10/CA-CD20



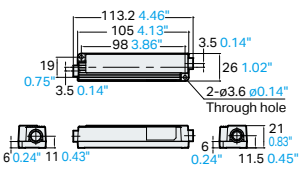
Dedicated 3D vision-guided robotics power supply cable
OP-88220/OP-88221/OP-88222



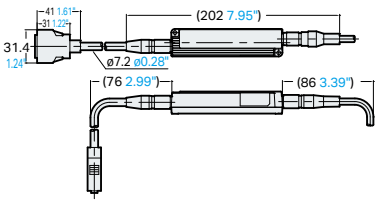
Environment-resistant camera cable
CA-CH3P (3 m 9.8')**/CA-CH10P** (10 m 32.8')



Camera control unit
CA-HS035CU/CA-HS035MU

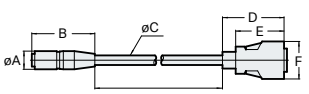


When camera cable is attached



Camera cable
CA-CH3 (3 m 9.8')**/CA-CH5** (5 m 16.4')**/**
CA-CH10 (10 m 32.8')

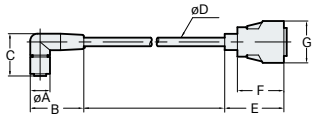
High-flex camera cable
CA-CH3R (3 m 9.8')**/CA-CH5R** (5 m 16.4')**/**
CA-CH10R (10 m 32.8')**/CA-CH17R** (17 m 55.8')



Cable length (3 m 9.8', 5 m 16.4', 10 m 32.8', 17 m 55.8')

	A	B	C	D	E	F
CA-CHx	12.5 0.49"	43 1.69"	7.2 0.28"	41 1.61"	31 1.22"	31.4 1.24"
CA-CHxR	14 0.55"	54 2.13"	7.6 0.30"	41 1.61"	31 1.22"	31.4 1.24"

L-shaped connector camera cable
CA-CH3L (3 m 9.8')**/CA-CH5L** (5 m 16.4')**/**
CA-CH10L (10 m 32.8')



Cable length (3 m 9.8', 5 m 16.4', 10 m 32.8')

	A	B	C	D	E	F	G
L-shaped connector camera cable **CA-CHxL**	14 0.55"	38 1.50"	30 1.18"	7.2 0.28"	41 1.61"	31 1.22"	31.4 1.24"

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