KEYENCE

Customizable Vision System

XG-X Series

Covering Every Aspect of Image Processing With a Single Unit

Meeting All Needs for Image Processing With a Single Unit

This one unit supports various camera connections and image capture methods. It has options perfectly suited for solving a wide-range of problems, so there is no need to change the hardware or software, providing powerful support for solving the problems faced by KEYENCE customers.

Pattern Projection Lighting

Multi-Spectrum Image Capture

CONTACT YOUR NEAREST OFFICE FOR RELEASE STATUS

LumiTrax™

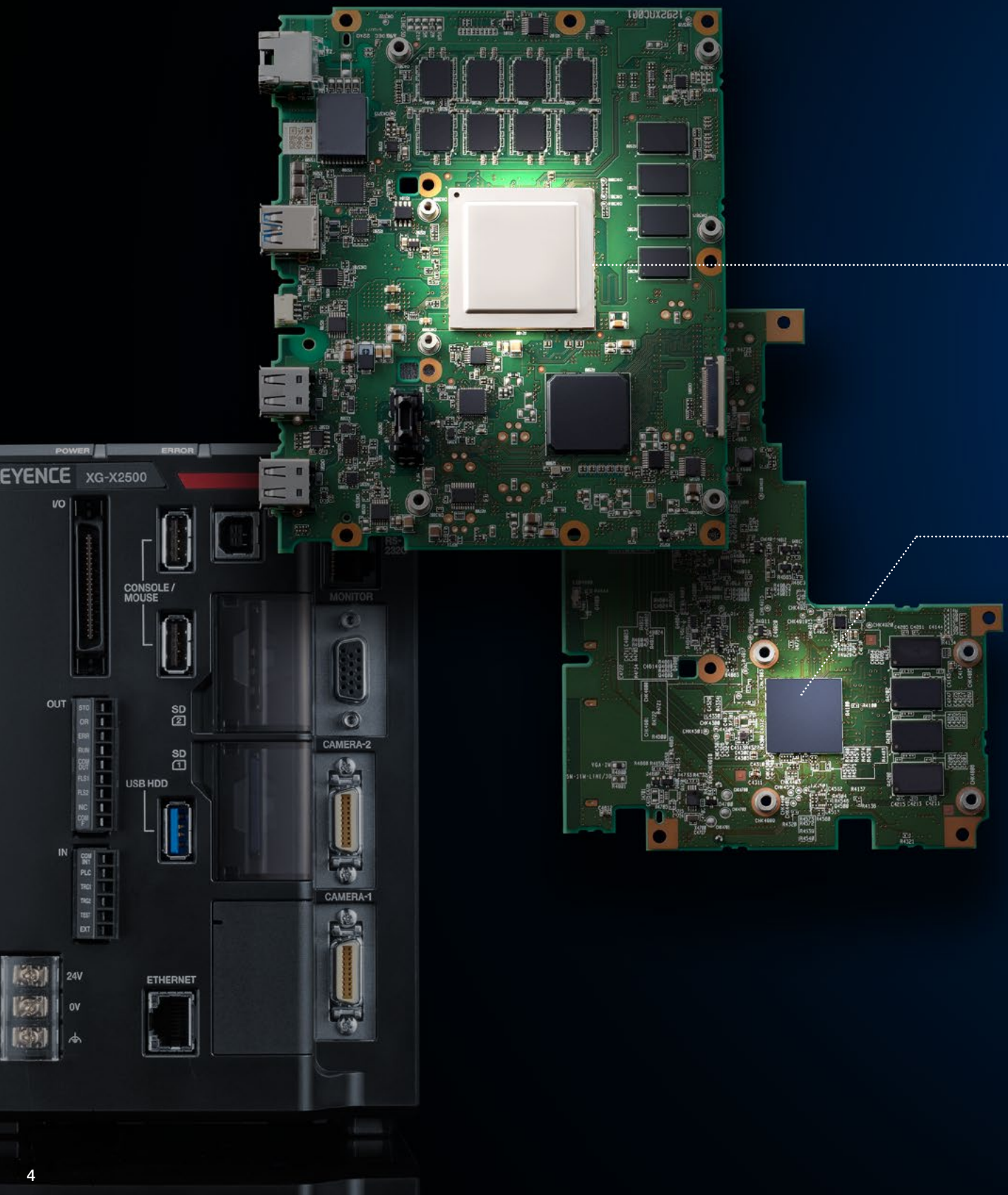
Vision-Guided Robots

Line Scan Cameras

In-Line 3D Inspection

Multi-Core Processors With the Highest Performance in the World Make It Possible to Link and Combine All Cameras and Lighting

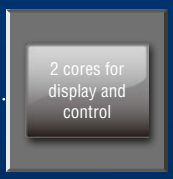
Becoming number 1 in application solving requires powerful hardware. Optimising the 14 cores has enabled stable, high-speed processing even of complicated inspections.



Stable, high-speed processing through parallel processing with 14* cores

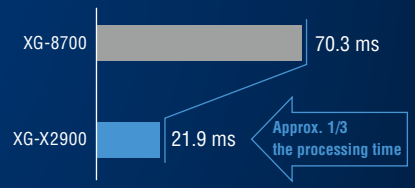
DSP + CPU

CPU



Abundant processing power is available even with multiple camera connections, including high-resolution 64 megapixel colour cameras, line scan cameras, and 3D inspection cameras. Furthermore, the largest-in-class image memory can store over 28,300 images captured with VGA colour cameras, or approximately 290 images captured with 21 megapixel colour cameras.

21 megapixel colour camera flaw inspection processing speed



* XG-X2700/X2800/X2900 has 14 cores.
XG-X2000/X2200/X2500 has 8 cores.
XG-X1000/X1200/X1500 has 7 cores.

DSP + CPU cores

Compared with conventional models

3×

Processing speed

Compared with conventional models

3×

Memory capacity

Compared with conventional models

4×

Seamless Creation of Inspection Results with VisionEditor

Flowchart programming offers the flexibility to bring your concepts to life.

"XG-X VisionEditor" is software designed for quick development of vision inspection applications, creation of user interfaces, easy debugging, simulations, and more.

Flowchart view

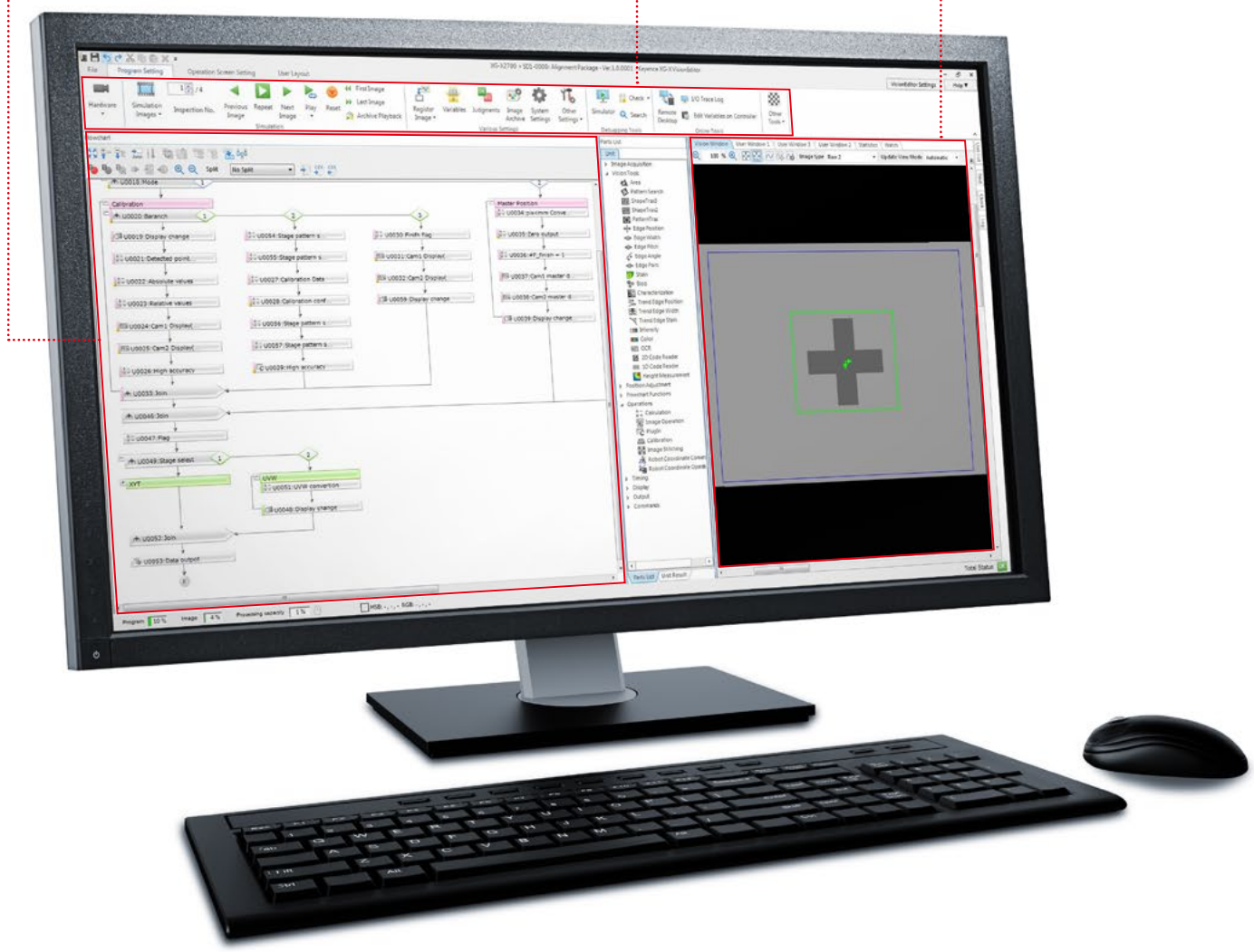
Flowcharts can be constructed easily just by dragging processing units from the parts list and dropping them here. In addition, error presences per unit can be displayed, allowing for simple debugging on the flowchart.

Ribbon

The large ribbon includes a collection of main operations. Frequently used functions can be added to the Quick Access toolbar. Simulations can also be performed easily on a PC.

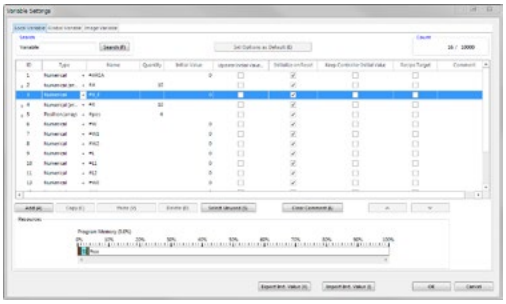
Vision window

In addition to displaying captured images, configured processing results, such as preprocessing filters, can be displayed in real time.



Variable processing

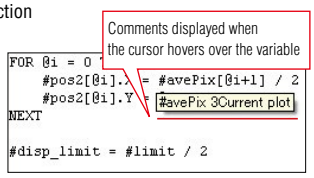
A wide range of variables can be defined, including image, positional, linear, numerical, and array-based. Variables are not limited to a single program and can be set for global use.



Variable setting screen

Variable comment function

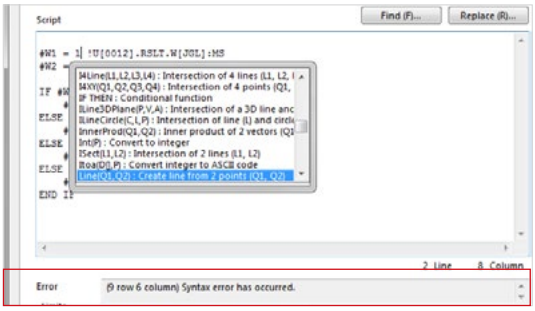
Each variable can be assigned comments indispensable to debugging and program review. So, as the flowchart becomes large and complicated, variable selection becomes simple.



Flexible calculation & processing

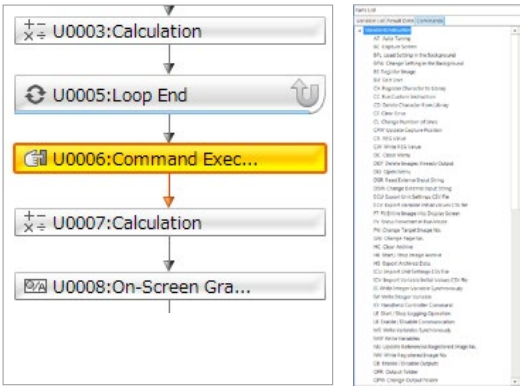
Calculations and scripts are also essential in customisation. The XG-X Series allows for over 150 different functions and commands that can be quickly created by dragging functions from the parts list. An auto-complete function and error location display help reduce troubleshooting time due to syntax errors.

Up to 5000 characters per single calculation



Automatic and interactive command processing

Control commands allow for seamless interaction between the vision system and a machine's controls or PLC. Commands like program switching, image capture, reset, start/stop operation log, changing to a different displayed image, zooming in on a defect based on an inspection result, or saving image data for a certain part failure are all possible. These commands can even be automated as part of the program flowchart, and custom commands can be created to combine specified built-in commands into a single command.



Command list

Examples of Built-in Commands

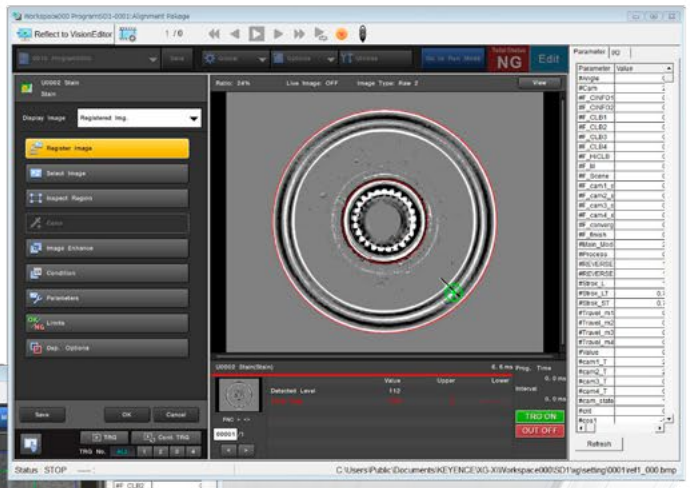
System control	Common commands include: program switching, image save, trigger input enable/disable, mode switching (run/stop), reset, write variables, clear history data, export history data, image capture, start/stop operation log
User interaction	Common commands include: open/close dialogue boxes, image switching, image zoom, image scroll, change password, switch user accounts

Advanced Interaction with Vision Controllers

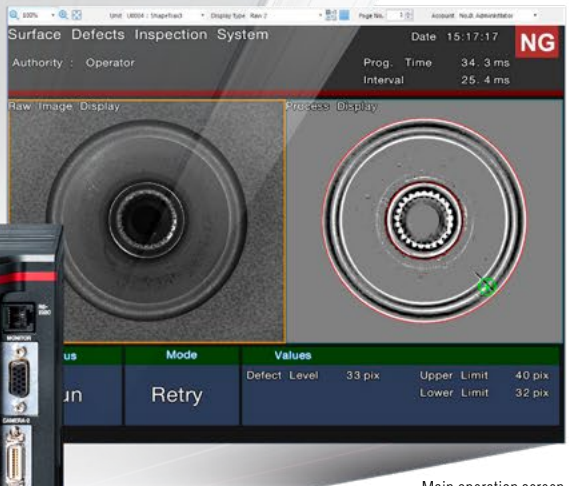
Access interface designed for ease of use

Inspection flows created using VisionEditor can be uploaded to controllers with a single click.
In addition, remote connection to controllers allows for real-time monitoring of a process or adjusting settings directly on vision controller firmware, avoiding the necessity of travelling on-site or experiencing a particularly harsh factory automation environment.

Inspection tools setting menu



Flow editing menu



Main operation screen

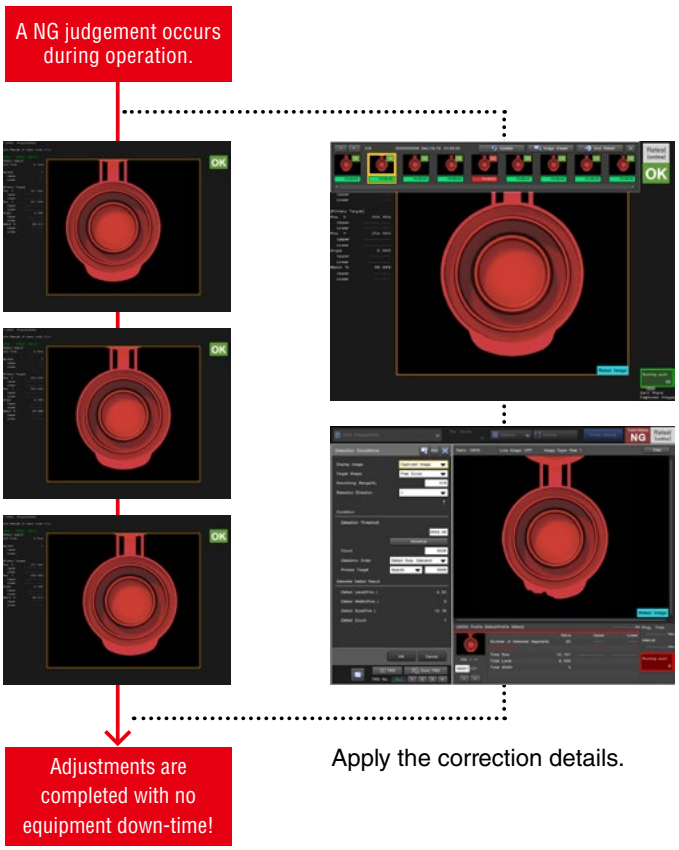
Easier-to-use controllers

3-way operation using handheld controllers, a mouse, and touch panels.

Even more stable configuration of settings

[Retest and edit programs with no interruption]

The XG-X Series supports nonstop retesting, which can be used to retest images and make adjustments without stopping the inspection processing, even while the line is in operation. While retesting archived images, it is possible to apply adjustments to the program after checking that the details are optimal. This makes it possible to confidently troubleshoot problems, while minimising down-time and eliminating repeated part inspections.



Select images intuitively from the image bar to execute retests.

To investigate the cause of a malfunction, just select an image from the image bar to execute a retest. The success of any changes made to the program or the need for further adjustment can be immediately confirmed using the measured results of each unit.

Program correction during operation

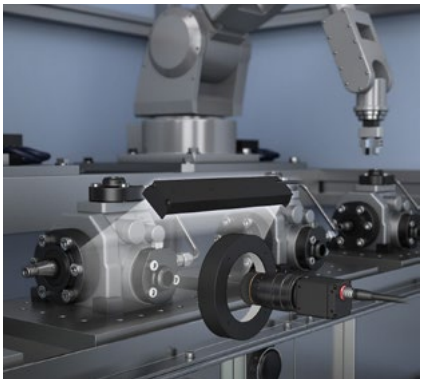
Program details can be edited using an archived image from the image bar as the input image. The inspection area and the setting parameters are accurately changed and checked.

Quick changeover

[Background setting changes]

Program settings can be changed over in just 5 ms, the fastest in the industry.* Simplified configuration for fast program settings, including support for inspection of multiple product types or multiple inspection across large parts.

* Some restrictions apply when performing background settings changeover. Contact KEYENCE for details.
Frequent inspection settings changeovers can affect the service life of the SD card. Please back up settings regularly.



Program 0001 inspection with side-attached components

Settings changeover in just 5 ms!

Appearance inspection of metal processed surfaces after settings changeover to Program 0002

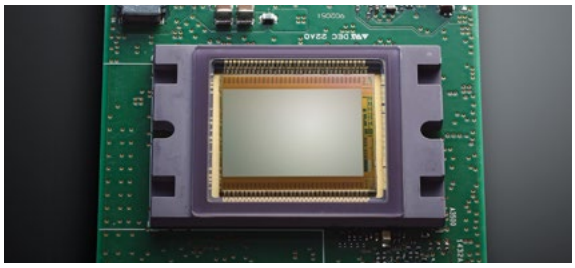
New Solutions Made Possible through 3D Image Processing

High-accuracy 3D inspection over the entire field of view

Field of view	Repeatability	Inspection interval
60 mm	1 µm	0.6 seconds

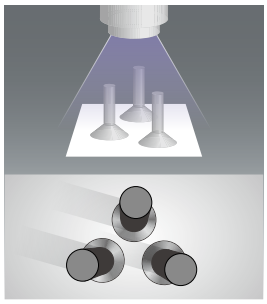
High resolution over large field of view

The 9.44 megapixel image sensor allows high resolution 2D and 3D images to be obtained over a wide field of view.

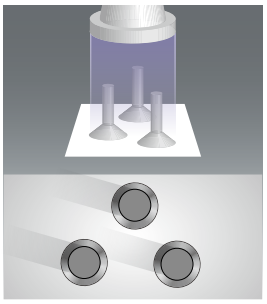


Telecentric lens with no positional deviation

The use of high-resolution telecentric lenses suppresses the effects of view angle resulting in accurate size observation as well as eliminating blind spots on the image.



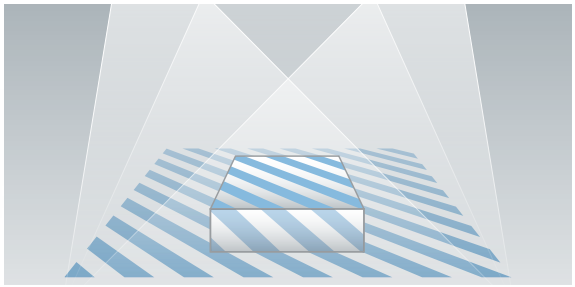
Normal lens



Telecentric lens

Four non-directional RGB projectors

Utilising pattern projection from four different directions enables imaging with no blind spots and with no directionality effects. The use of individual RGB illumination makes it possible to obtain highly accurate colour images similar to cameras with 3 image sensors (RGB).

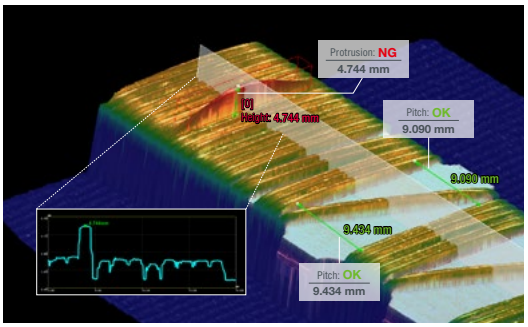


Applications

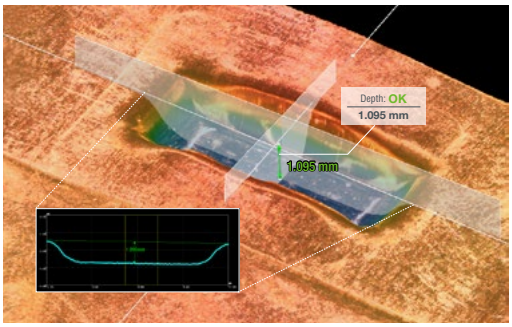
Simple extraction of unexpected 3D changes

■ In-line 3D appearance/dimension inspection of any target

Appearance and dimension inspection of wound wire

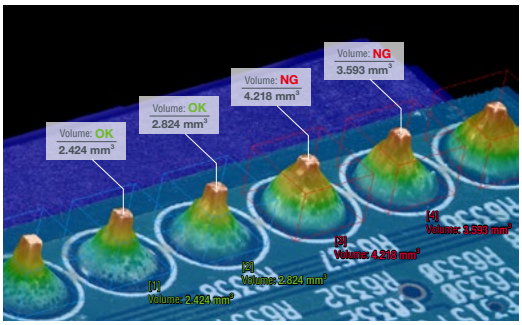


Punch dimension inspection

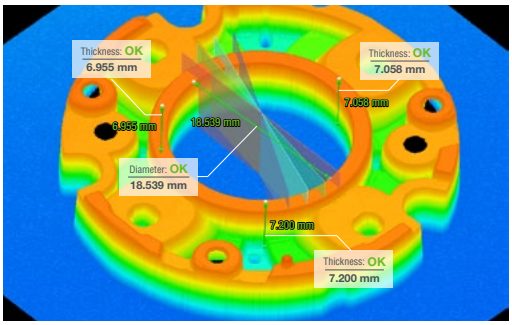


Inspection algorithm combining ease of use and accuracy

Solder appearance inspection



Resin-moulded product appearance inspection

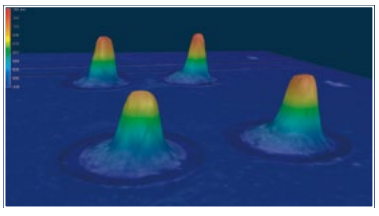


For in-line 3D inspection

XR Series

Image processing based on height information with 3D shape detection using bi-directional pattern projection lighting

Solder fillet inspection

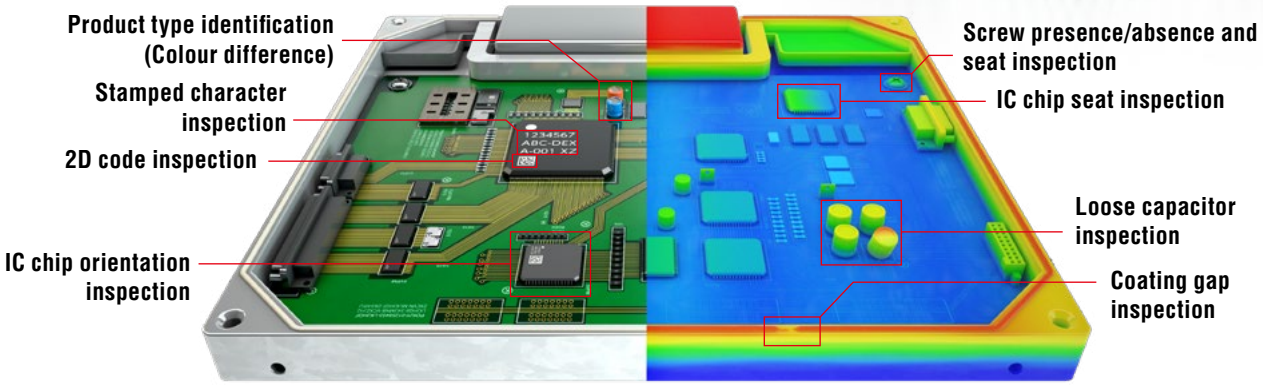


Pattern Projection Lighting

Simultaneous 2D + 3D inspection

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

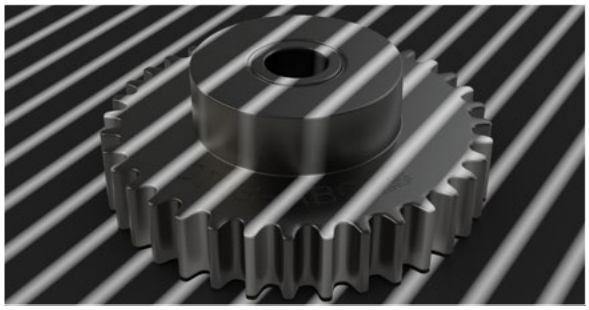
The lighting incorporates Pattern Projection from eight light sources. This enables inspection without influence from target surface conditions or contrast by adding height data to conventional 2D inspection. The result is dramatically improved inline inspection stability.



3D inspection lighting

Pattern projection accurately captures target appearance

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

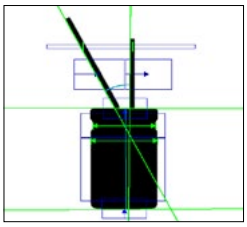


2D inspection lighting

LumiTrax™ support for resolving problems with conventional imaging

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

Dimension inspection

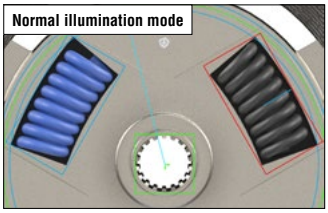


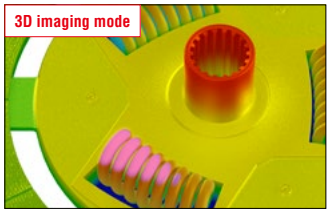
Appearance inspection

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

Clutch disc inspection

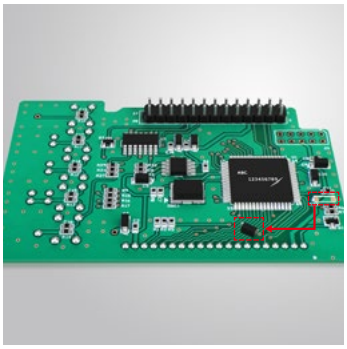
Capable of inspection for centre misalignment as well as spring colour difference checks with a colour camera. Also inspects for spring spillage in 3D difference checks.





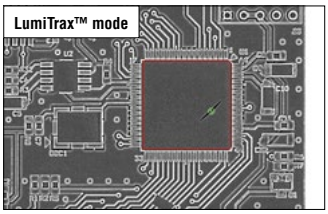
Normal illumination mode
Product type difference checks using spring colours and assembly position inspection for centre components.

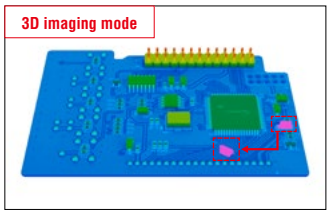
3D imaging mode
Inspects for spring spillage across multiple locations with 3D differentiation tools.



Appearance and foreign particle inspection on PCBs

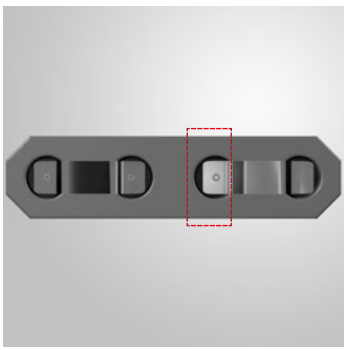
Inspect for defects only, without influence from chip surface markings using LumiTrax™ mode. Inspect for fallen or foreign particles on PCBs with 3D detection tools.





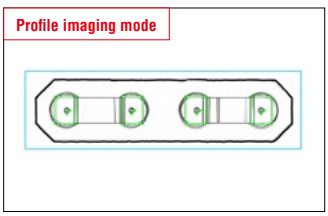
LumiTrax™ mode
Inspect for chip surface defects only, without influence from surface markings.

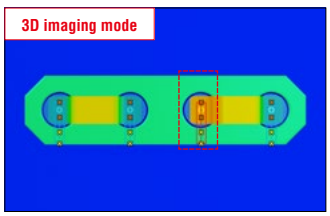
3D imaging mode
Capture variations in the overall PCB with 3D detection tools to inspect for the presence of fallen or foreign particles.



Lithium-ion battery terminal inspection

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





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

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

A fusion of 8-colour lights and an advanced algorithm

Completely New Colour Inspection Algorithm

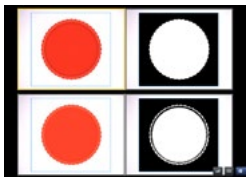
Using a high-speed monochrome camera in combination with 8-wavelength lighting provides vastly superior capabilities compared with colour inspection with conventional colour cameras (RGB).
This allows users to achieve accurate sorting, even of the slightest differences in colour.

Colour

Accurate Sorting Even between Slight Colour Differences

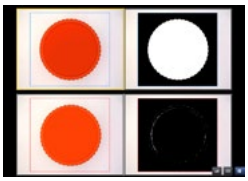
Inspection of Various Types of Plastic Caps

Conventional colour camera



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

Multi-spectrum mode



Differences in colour are clearly defined.

Appearance

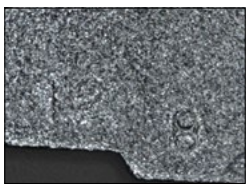
Detect Height Changes While Removing Glare

Stamped Character Inspection on Metal Casting

Problems with Conventional Imaging

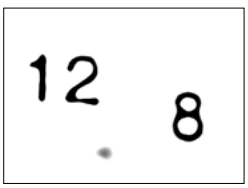
Difficult imaging conditions require trial and error for selecting the optimum light.

Conventional Cameras



The state of the surface makes extraction impossible.

LumiTrax™ MODE

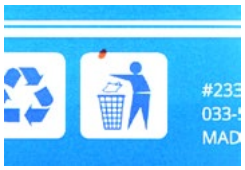


Extraction of only shape (irregularity) information regardless of surface conditions

Multiple Product Types

The combination of multiple images and lighting colours enable the optimum lighting colour for each inspection item.

Multi-Capture Imaging (Lighting Colour Variation)

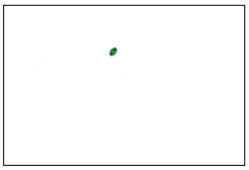


A red ink defect appears on a printing with a blue background.

1st image capture: Red LED

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

2nd image capture: Blue LED



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

Hardware and Software 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

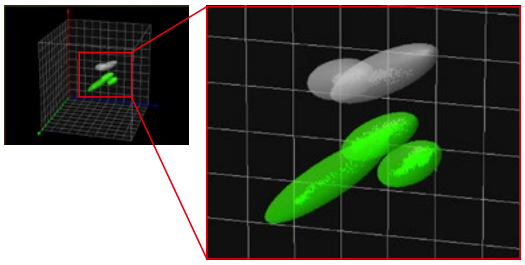
Photodiode and Real-Time Intensity Control Circuit

Greater Inspection Stability

3D Display Function for Registered Colours

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

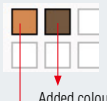
Green Oval : Extracted colour
Grey Oval : Excluded colour



Multi-Colour Registration (Support for Invalidation and Integration)

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

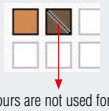
Addition And Invalidation



Added colour

Existing colour

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

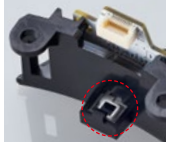


Invalidated colours are not used for inspection, but the colour information is saved.

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

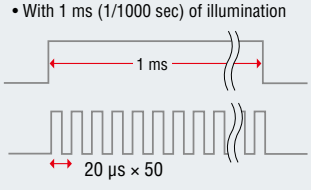
Real-Time Intensity Feedback Function

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.

Integration of Camera, Lighting and Inspection Algorithm

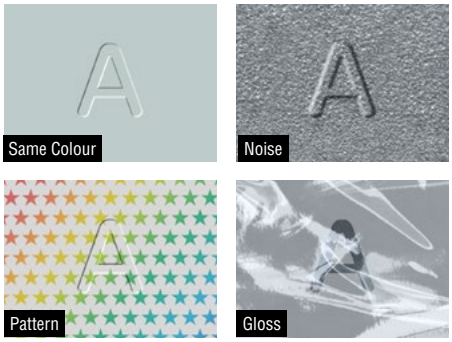
LumiTrax™

The newly developed LumiTrax™ system eliminates problems

Intelligent Camera	+	Segmented Lighting	+	Powerful Processor
Equipped with ultra high-speed imaging CMOS sensor and dedicated control IC		Equipped with ultra high-intensity LED and circuit for separate lighting control		Analyses multiple images instantaneously to create shape and texture images

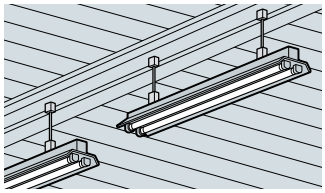
CONVENTIONAL IMAGING PROBLEMS

▮ Various surface conditions

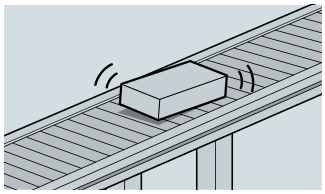


Trial and error must be performed to select the optimum light.

▮ Influence of the surrounding environments (ambient light)

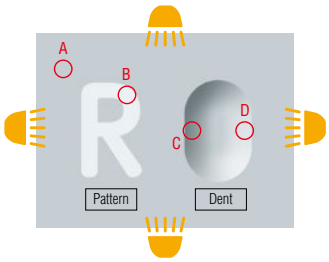


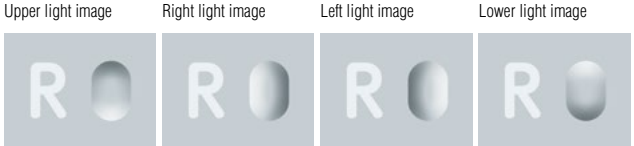
▮ Workpiece orientation changes caused by transfer conditions



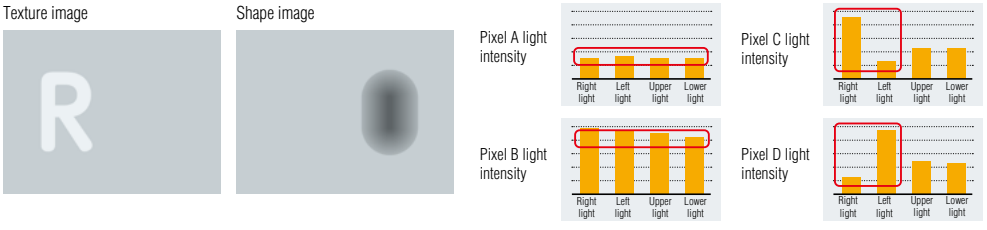
LumiTrax™ processing

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





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

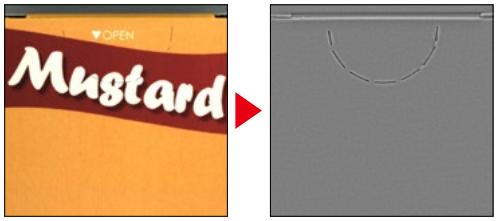


Applications in various industries solved with LumiTrax™

Stamped character inspection

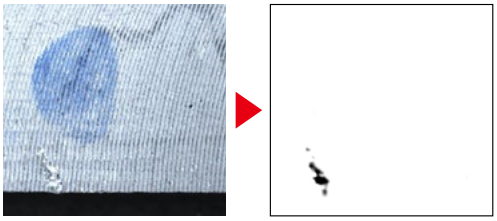
The stamped characters, which are bumpy, are inspected while ignoring the characters printed on the package.

Package opening perforation presence inspection



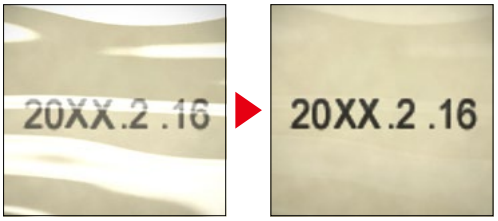
Even if a pattern is present in the background, inspection can be performed since it is possible to obtain the shape alone.

Chip inspection on a metal surface



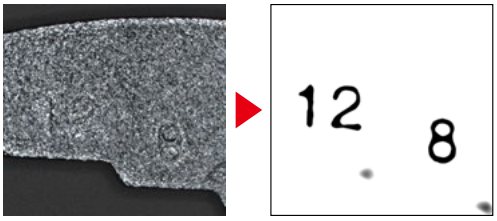
Factors such as remaining cleaning agent, dirt, and minor hairline fractures are cancelled so that only deep defects such as scratches and chips are detected.

Printed character inspection on a film surface



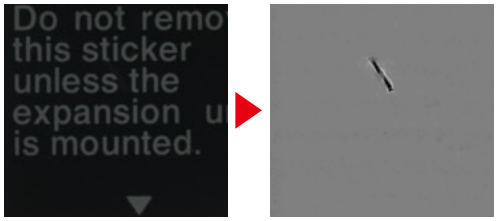
Glare, which affects inspections negatively, is eliminated to enable stable inspections.

Metal casting surface carved seal inspection



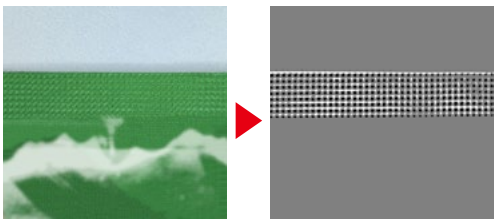
From a random casting surface, the carved seals with greater concave-convex information are emphasised.

Chip inspection on a printed surface



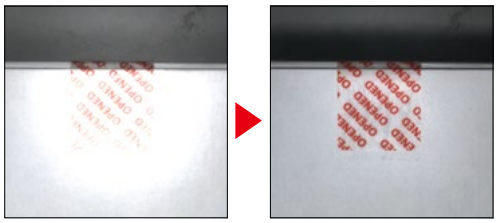
Images in which only the chips are extracted are created without being affected by the complex printed background.

Heat seal width inspection



The roughness information of sealed parts, for which changes are difficult to detect by means of colour or shading, are captured and extracted.

Tape presence inspection



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

New imaging modes for detecting defects not possible with traditional line scan cameras

LumiTrax™ Specular Reflection Mode

Various defects can occur due to a target's material or processing methods. With LumiTrax™ specular reflection mode, multiple images can be generated from a single image capture, allowing users to select the image data as required for the targeted defect.

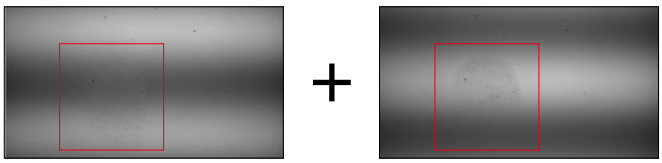
Using the dedicated lighting allows for looped image capturing while the position of the emitted stripe pattern is changed in high-speed.

Lighting Lineup

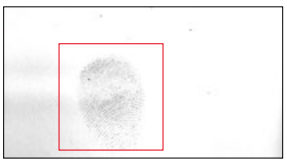
For line scan cameras

CA-DZW10X **CA-DZW30X** **CA-DZW50X**

Images with different stripe patterns are combined.

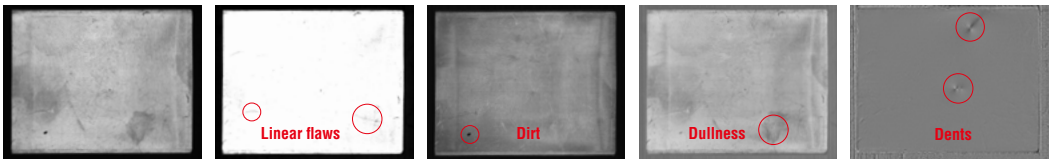


Create an image with only the defective area extracted.



Different calculation methods are used to create multiple images.

Main image types created through a single captured image



Normal image | Specular reflection image | Diffuse reflection image | Gloss ratio image | Shape image

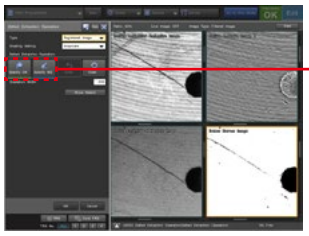
Image type	Image creation method	Main applications
Normal image	Averaging of all captured images	Determination of the overall image and as a basis for position correction
Specular reflection image	Extraction of only specular reflection areas of the striped pattern	Inspection of glossy surfaces for linear flaws, rubbing flaws, etc.
Diffuse reflection image	Extraction of diffuse reflections by comparing normal images and specular reflection images	Inspection of foreign particles and dirt
Gloss ratio image	Extraction of variations in gloss by comparing specular reflection images and diffuse reflection images	Inspection of surface dullness and flaws on cylinders and other surfaces
Shape image	Extraction of changes such as uneven surfaces through analysis of waviness that occurs in the striped pattern	Inspection of dents, shallow unevenness, etc.

Minute flaw detection algorithm for difficult inspections

Image calculation function (Defect extraction)

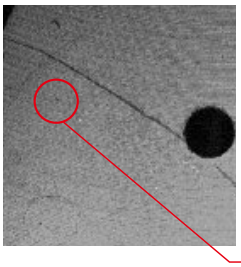
The LumiTrax™ specular reflection mode allows for easy separation of normal areas and defective areas simply by clicking on the multiple images generated. Because multiple imaging conditions are used, extraction according to the characteristics of the defect is possible.

Inspecting for dirt, linear flaws, and pinholes generated on the same surface



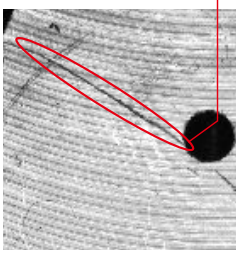
Users separately extract normal areas and defective areas from the captured image.

Diffuse reflection image



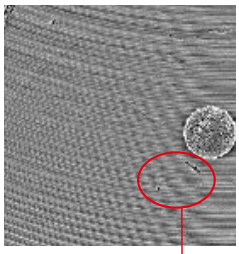
Click the dirt!

Specular reflection image



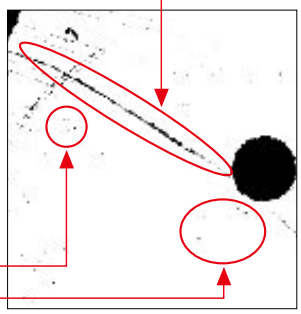
Click the linear flaw!

Shape image



Click the pinholes!

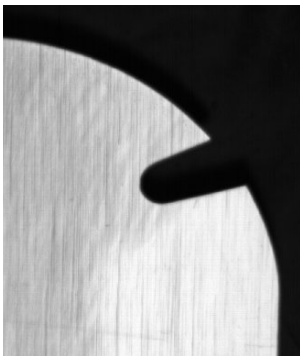
Extracted image



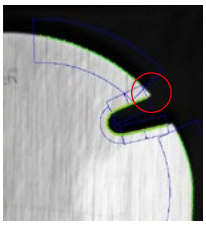
Clicked defects are extracted.

Multi-Profile defect

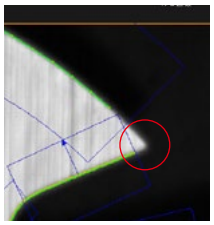
Extraction of complex shapes is possible simply by clicking the contour area. Reference lines are generated even for rounded surfaces and acute corners. Any burrs or flaws detected beyond a reference line are considered defects.



Conventional method



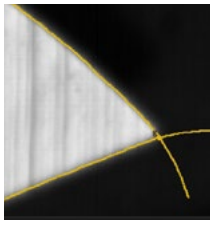
Inspection is performed through a combination of 20 circles and polygons.



Dead zones still occur at the end surfaces.

Multi-Profile defect

Simply click on the edge of the surface to be inspected.



Regions are automatically generated along the contour with no dead angles.

Utilities that support stable image capturing

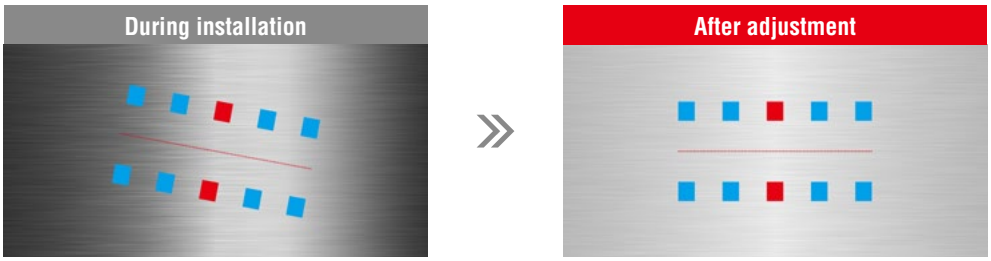
Line scan camera system with easy image creation for quick setup

Image creation with conventional systems is time-consuming. Not to mention, optical-axis alignment can be difficult. These built-in utilities solve these common problems with line scan cameras.

Line scan camera with built-in LED pointer

CA-HL02MX/HL04MX/HL08MX

An LED pointer is built in to each of these cameras. This allows the user to instantly determine the image capture area when installing the camera.



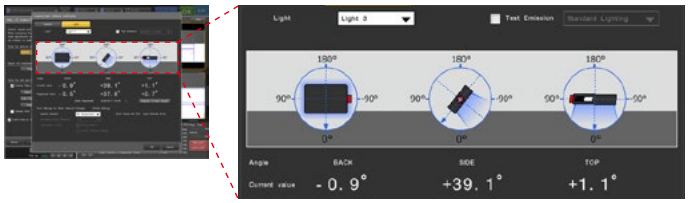
Users can instantly determine whether the optical axis has deviated from the target.

Line Scan Camera Settings Navigator

Using sensors incorporated in the camera and lights, Line Scan Camera Settings Navigator allows users to manage the position of each device digitally. This greatly reduces time spent on optical-axis alignment, a conventionally time-consuming task.

Line scan cameras

LED lighting



CONTACT YOUR NEAREST OFFICE FOR RELEASE STATUS

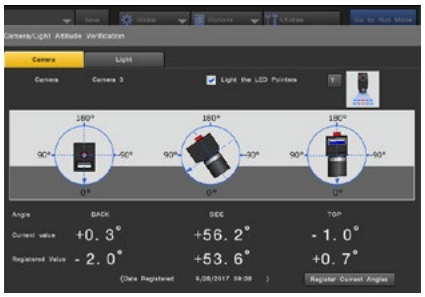
Quick image creation!

Simple 4-step Line Scan Camera Settings Navigator

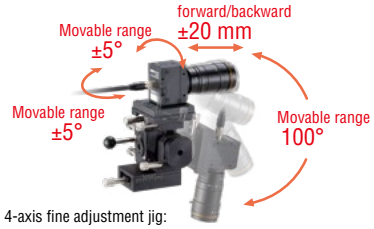
STEP 1 Turn on the LED pointer and align the optical axis

To turn on a camera's LED pointer, simply check the box.

STEP 2 Adjust the angle of the line scan camera and the LED lighting

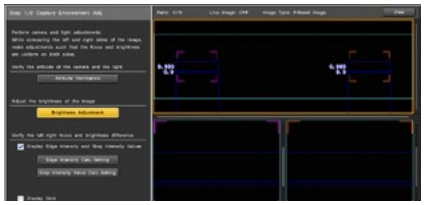


The positions of cameras and lights can both be checked using numerical values for the front, side, and top. Adjustment is even easier when using the dedicated jig.



4-axis fine adjustment jig:
CA-S20D

STEP 3 Set the focus and brightness of the line scan camera



The focus and brightness are also represented numerically, allowing for value-based adjustment.

STEP 4 Set the X/Y ratio

Using a dedicated encoder enables automatic calculation of the optimal X/Y imaging ratio at the push of a button.

Encoder relay unit
CA-EN100U

Dedicated encoder
CA-EN100H

▮ High-resolution, high-speed output

Support for up to 150000 pulses/revolution allows for high-resolution output at a minimum of 0.0024° (8.64 seconds). High-speed output is also possible at a maximum output frequency of 1.6 MHz.

▮ IP65-compatible

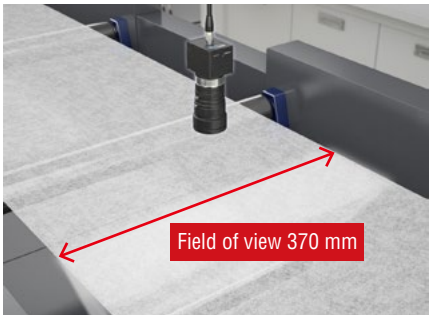
Added consideration for environmental resistance has resulted in a design that is even more resistant to water and dust, making devices easier to use in the worksite.
(This does not include the head or shaft areas.)

* If there is a chance that the shaft through-hole area will be exposed to oil droplets, use a cover or take other necessary precautions.

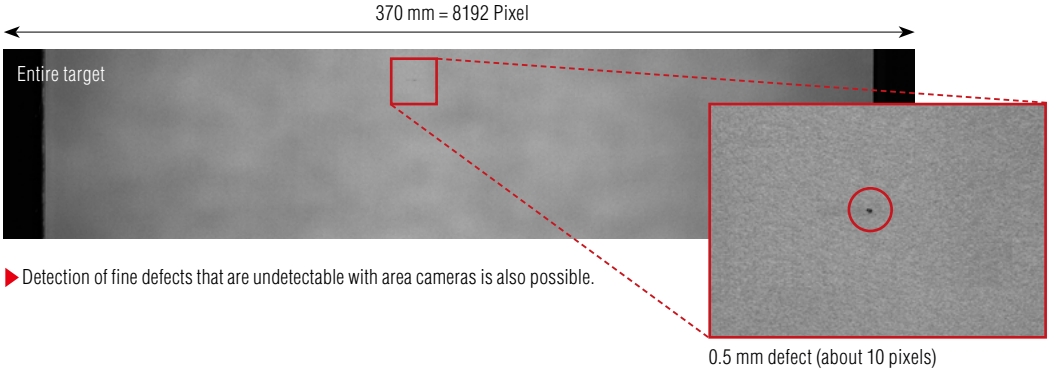
There is No Substitution for Resolution

Line scan camera

Obtain up to 67 megapixel images with a single camera



Large-capacity images with a valid pixel count of 67 megapixels (8192 × 8192 pixels) are transmitted at 368 ms, 16 times faster than conventional models. Inspections requiring multiple area cameras can be performed with just 1 line scan camera and under uniform lighting conditions.

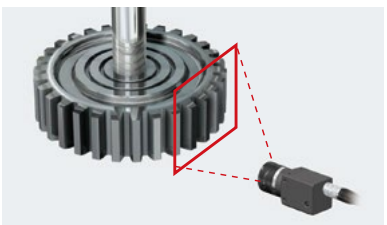


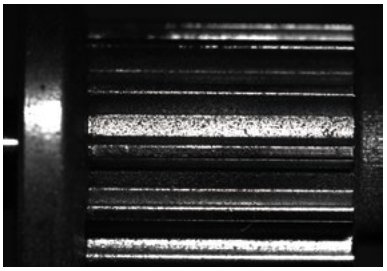
▶ Detection of fine defects that are undetectable with area cameras is also possible.

Allows for stable detection with even lighting

Area Cameras

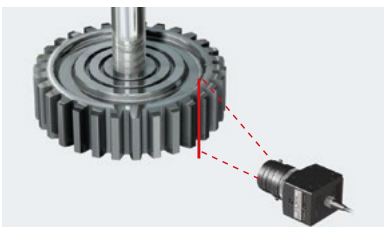
Area cameras cannot record optimum images due to the glare on the R part.

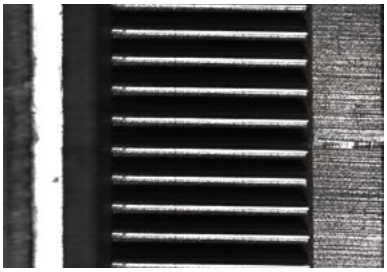




Line Scan Cameras

By recording images from an evenly lit part one line at a time, glare on the R part is eliminated.





Largest number of pixels in its class for high-resolution, wide-field inspection

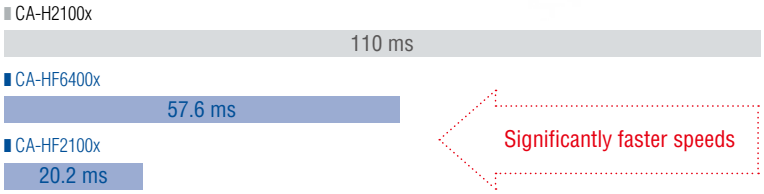
64/21 megapixel cameras

The 64 megapixel camera significantly improves accuracy in conventional inspections. The ability to capture a wider range with clear details using just a single camera helps ensure stable inspection. The increased transfer speeds also enable support for LumiTrax™ imaging.

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)

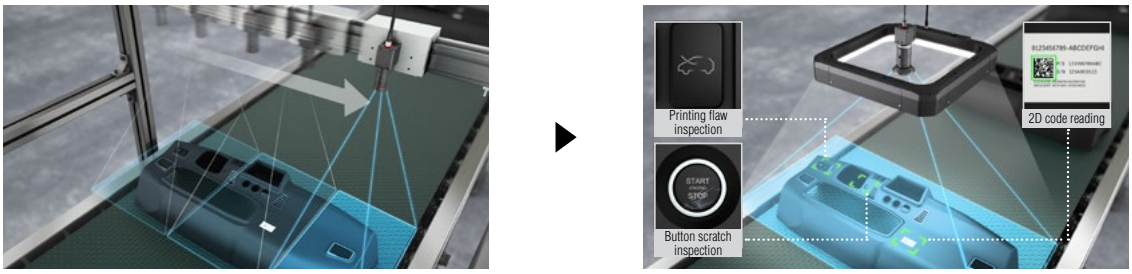


Applications

Wide field of view for shortened inspection time

When inspecting large targets, either the camera or the target must be moved to ensure accuracy, resulting in longer inspection times. With a high-resolution camera, however, the entire target can be imaged with a single capture, without sacrificing accuracy, and inspection can be performed with the shortest possible machine takt time. This also helps simplify equipment installation.

Automobile instrument panel inspection



Conventional camera

High-resolution camera

Stable high-resolution, high-accuracy inspection

For inspections with multi-pin connectors, insufficient resolution can have a negative impact on inspection accuracy. High-resolution cameras ensure stable operation at the best possible resolution even for larger targets. This also eliminates the risk of camera calibration errors that are common with conventional multi-camera systems.

PCB connector inspection

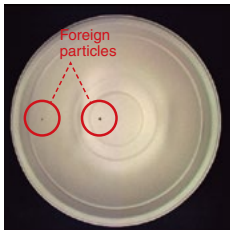
Conventional camera

High-resolution camera

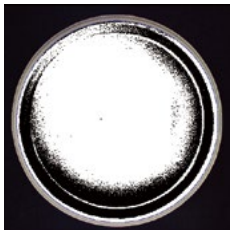
Ultimate Defect Detection Tool

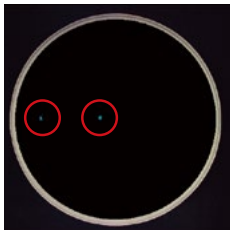
Defect Appearance inspection tool that offers superior detection stability

The defect tool detects flaws and other defects by checking for consistent intensity across a region.
In addition to high detection ability, the tool also features a function that will filter the desired defects to detect, by size, intensity difference, shape, and count.



Original image


Binary image (Blob/Area Tool)


Defect inspection tool (stability screen)

▮Foreign particle detection on the inside of a container

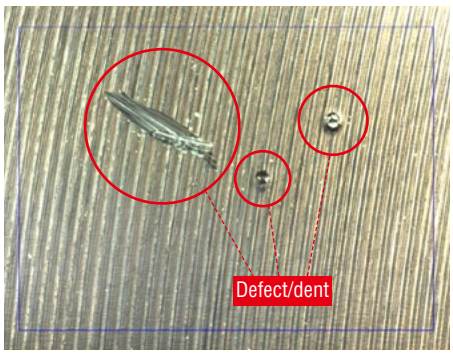
Conventional binary processing would not be able to detect the foreign particles as there is very little contrast between the particles and the dark portions of the container, however, defect inspection tool can compare the differences with the surroundings, allowing reliable detection of only the foreign particles.

Contrast view display

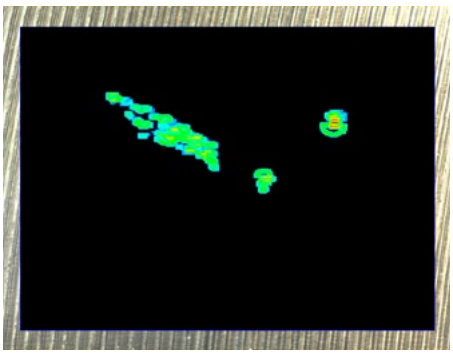
Using the colours blue, light blue, green, yellow and red, the contrast view display assigns a colour to defects according to the intensity difference between them and the surrounding area. The contrast view display updates in real time so you are able to see the defect position and intensity differences, allowing visual and intuitive confirmation of the differences between the defect you want to detect in comparison with the background or noise.

The relationship between contrast view colours and the stain level (guideline)

▮Defect detection for a metal plate



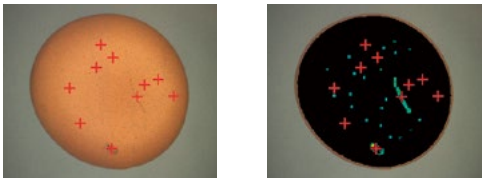
It is difficult to setup the defect tool parameters by values only on the standard camera image.


Using the contrast display, the intensity differences are clearly displayed in a colour coding so the parameters are easy to setup.

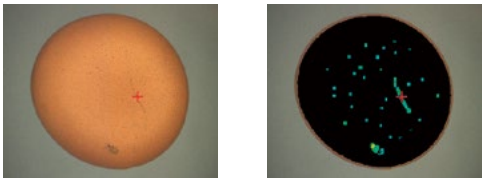
Grouping Filter Settings

After taking images of flaw detections as an entire group, it is possible to extract only images of the defects that you want. If only long, thin defects need to be detected, quality evaluation based on the appearance of the target can be performed. Various parameters can be set, such as area, circularity, main axis length, acicularity, length of the equivalent elliptical main shaft and countershaft ratio of the equivalent elliptical main shaft.

▮Pill crack detection (before grouping filter setting)


Reacts to ingredient particles and defects other than long thin cracks.

▮Pill crack detection (after grouping filter setting)

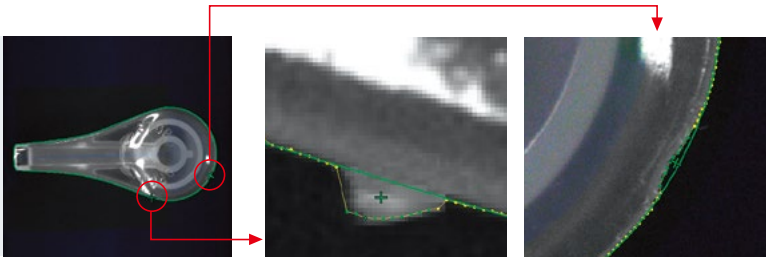

Only long thin cracks are detected by using the area filter and the acicularity filter.

Profile defect

Edge defect inspection tool optimised for burr and flaw inspection

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

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

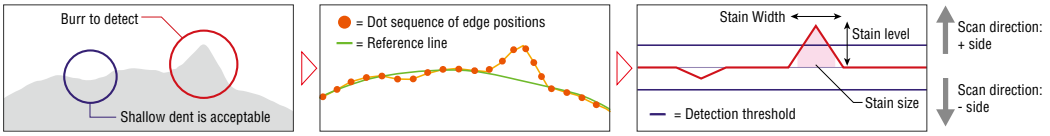


Detection of a burred section

Detection of a flawed section

Extensive Parameter Settings Support Various Defects

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



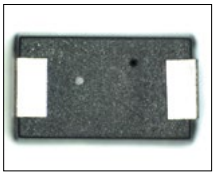
Characterisation tool

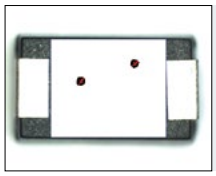
[Characteristics features × Intensity information = Defect extraction to meet any needs]

The characterisation tool allows targets to be identified and classified based on greyscale rather than binary data. This enables true characterisation and filtering of detected targets based on true image data. Additional information for classifying and identifying defects that cannot be obtained through binarisation such as volume and level of change is also possible with this tool.

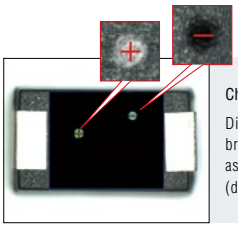
Differentiation of a variety of defects on a condenser

Light & dark defects Sorting bright and dark defects.



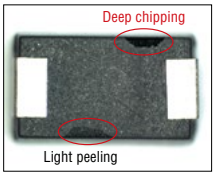


Blob (binary)
After binary conversion, both defects look alike.



Characterisation
Divides defects into bright (displayed as +) and dark (displayed as -).

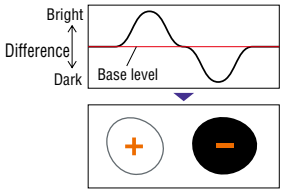
Shallow and deep defects Differentiating between deep chipping and light peeling.



Blob (binary): Area measurement
With area there is no noticeable difference.

Characterisation: Volume measurement
Differentiation is achieved by measuring the volume for each shade.

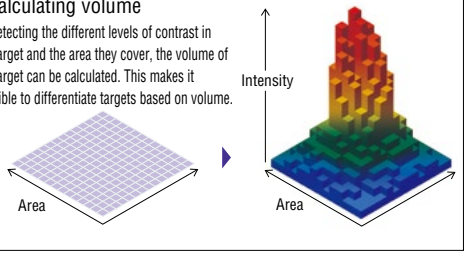
Sorting defects



The characterisation tool uses a base reference value and the contrast of the defect to sort targets into bright and dark types.

Calculating volume

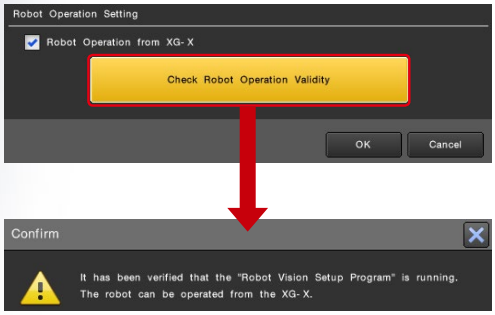
By detecting the different levels of contrast in the target and the area they cover, the volume of the target can be calculated. This makes it possible to differentiate targets based on volume.



Fusion of Image Processing and Robotics

Easy connection to robots

Programming for robots from various companies is available for creating a vision-guided robot system. This allows for seamless integration between the XG-X Series and robots.



Excellent compatibility that allows for use with any product

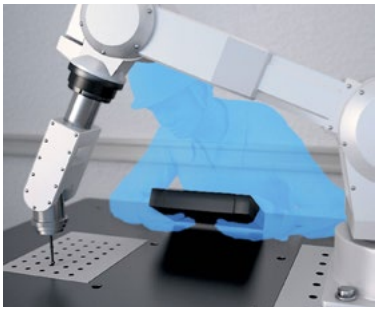
Simply selecting the manufacturer of the robot to use easily enables direct communication between the robot and the XG-X device. This allows for jog operations, auto-calibration, and other cooperation between the XG-X and the robot.

ABB	DAIHEN	DENSO
EPSON	FANUC	HIRATA
IAI	JANOME	KAWASAKI
KUKA	MITSUBISHI	NACHI
STAUBLI	SHIBAURA MACHINE	UNIVERSAL ROBOTS
YAMAHA	YASKAWA MOTOMAN	Custom

Automatic Calibration

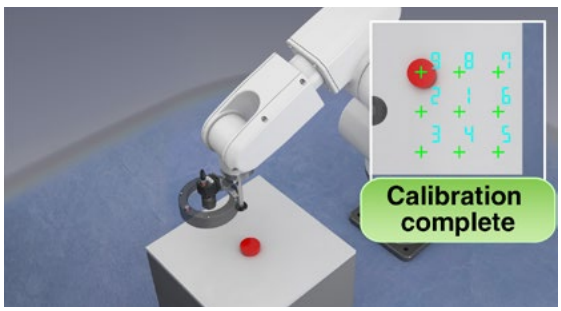
Problems with conventional methods
(manual method)

- Time-consuming manual configuration
- Accuracy varies between operators
- Readjustment is difficult if displacement occurs
- Reproduction at equipment delivery destinations takes time and effort



Benefits of KEYENCE's Vision-Guided Robots

- Easy, one-click operation
- Continuously high accuracy, no matter the user
- Immediate execution and restoration even with installation position deviations
- Quick, reliable reproducibility at any location



Proprietary Alignment System

High-resolution cameras

Highly accurate alignment over a wide field of view with 64/21 megapixel cameras

Easy configuration

Easy-to-navigate step-type settings menus

Flexible customizability

Customisable for wide range of alignment applications

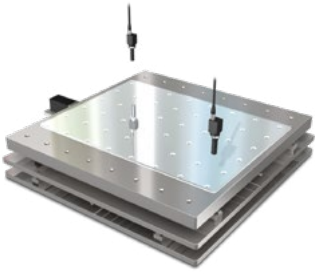
High-accuracy alignment through easy operation

The XG-X Series boasts special functions for high-accuracy alignment.
These functions make it easier to perform tasks that required extensive calculations with conventional models, resulting in an easy to use and configure interface.
Conventional processing is also available.

Twice as fast start-up

With conventional alignment devices, start-up involved a wide variety of preparation, including focus adjustment and calibration.
The XG-X Series solves this problem by offering simple adjustment processes for each adjustment phase.

Compatibility with various system configurations

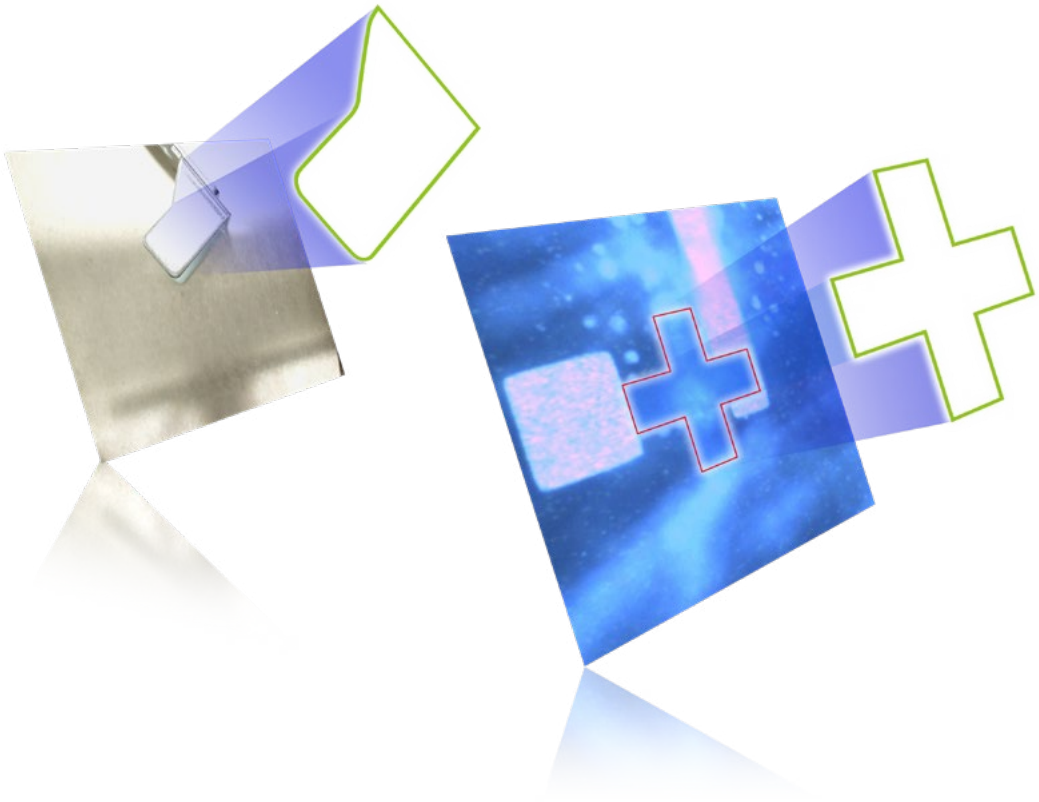


Two-camera centre alignment

One-camera centre of gravity alignment

Four-camera side alignment

Perform Stress-Free, Fast, Applicable Searches



ShapeTrax™3

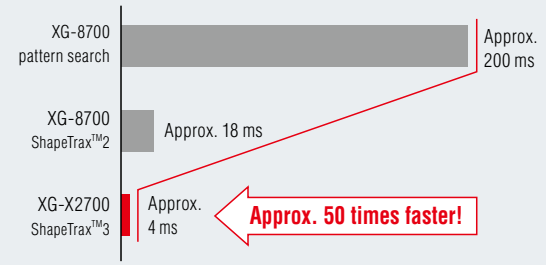
ShapeTrax™3 allows for accurate searches even under adverse conditions. Configuration of settings has also been simplified.

Even with unclear images and noisy images captured under low-contrast environments, noise and necessary information is determined automatically to achieve stable searches at high speeds.

Significantly increased processing speed

At a maximum of 50 times the conventional processing speed, a substantial increase in speed has been achieved by reexamining processing algorithms from the base level.

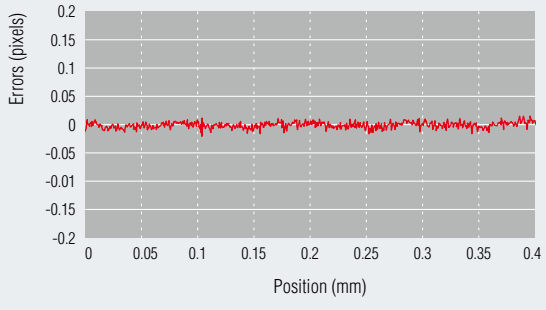
360-degree search with 5 megapixel camera



Ultra high accuracy

The linearity and repeatability are both 0.025 pixels, the highest level in the industry.
This tool satisfies demand for improved search accuracy by searching targets more finely and accurately.

Linearity data (typical example)



Newly developed automatic feature extraction algorithm

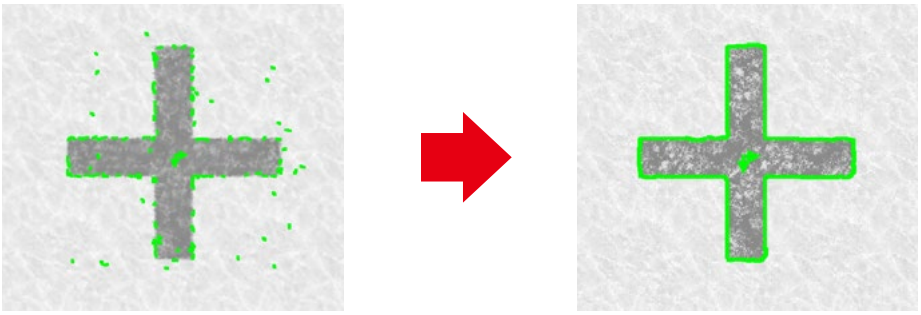
Whereas conventionally workers needed to be familiar with workpieces in order to extract contours, the XG-X automatically optimises settings, allowing menus and operation to be kept simple. Any worker is able to harness the full power of ShapeTrax™3 for any workpiece.

Conventional

With noisy markings, suitable contour extraction required an understanding of complex parameters.

ShapeTrax™3

Image noise is analysed automatically, making it possible to extract contours just as envisioned. Regardless of who configures the settings, searches that take full advantage of the device's performance can be performed.



The industry's first "applied-skill" search

Rotation direction-added search

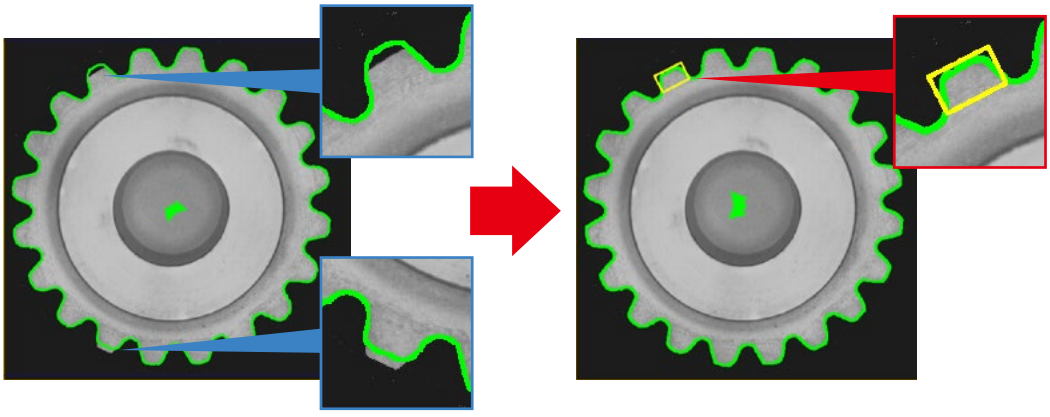
This new algorithm allows for both stabilised detection and faster speeds for circular, regular polygonal, and other shaped workpieces with partial features in the direction of rotation.

Conventional

Even when trying to accurately determine angles where teeth are short, the percentage of features for the entire workpiece is small, making stable inspection using only searching difficult.

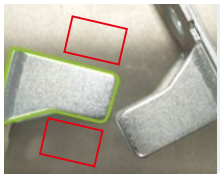
Using rotation direction-added search

Once the position of the workpiece is detected, an additional search for features present in the direction of rotation is performed, allowing for stable, high-speed angle determination even for only slight features.



Detection target selection conditions

When performing robot picking and the like, analysis of the profile feature for slight differences is performed at the same time as space determination for gripping the workpiece. This eliminates the need for complex branch condition settings and calculations, anyone is able to use the device to its fullest potential easily.



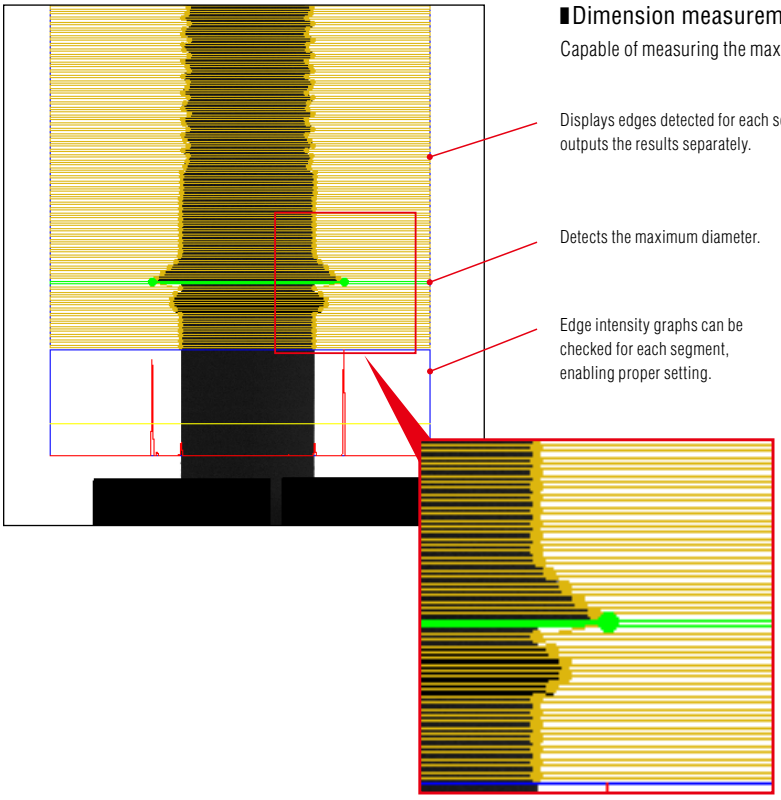
Simply by adding regions at both ends of the workpiece to the target selection conditions, determining whether there is enough space for the gripper to enter can be performed at the same time as the search.

Measure Up to 5000 Points within One Region

Trend edge

Instant profile measurement for an entire area

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

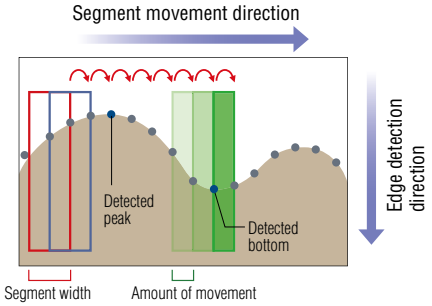


Dimension measurement for a bolt

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

[PRINCIPLE OF DETECTION]

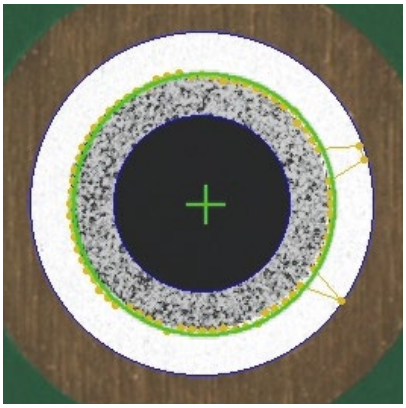
A segment of a specified width moves within the inspection region at a specified pitch in an overlapping pattern to detect edges at each position. Since the segment shift can be specified in 1/100 pixel units, all edges can be detected completely within the region.



Circular/Arc processing

Detecting PCB hole centres

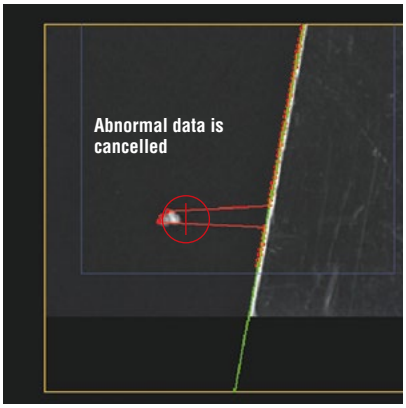
Trend edge can calculate the centre position and diameter of a circle by detecting multiple edge points around a curve, using this data to project a best fit circle. Abnormal edge positions can be filtered and ignored before drawing the virtual circle to allow for reliable measurements.



Linear processing (Abnormal point removal)

Detecting the position of glass substrate edges

The trend edge tool can map a virtual straight line from all of the edge positions along a substrates edge. With the ability to filter and ignore abnormal points the virtual straight line can be used for accurate position, angle, reference and geometric data.



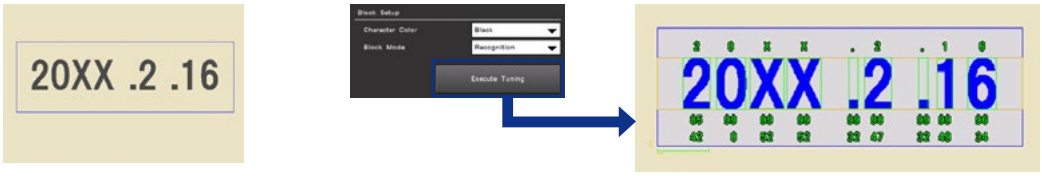
Capable of Handling All Inspection Needs

OCR2

Simple and Reliable Character Recognition Tool

A tool that checks printed and engraved characters on products.
Simply select the area for inspection and with a press of a button, the image processing settings will automatically be tuned for the best results.
Any user can set the tool up.

STEP1 Set the area ▶▶▶ **STEP2** Carry out tuning and identify characters at the click of a button!



Customisable user dictionary

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

Highly robust

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

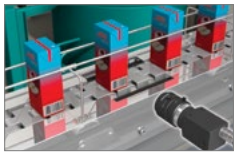
1D/2D code reading

Executes reading and image processing inspection simultaneously

Various inspections, such as inspections of the external appearance and dimensions, can be performed simultaneously with the reading of 1D and 2D codes printed on the target or with the inspection of the quality of the printed 1D and 2D codes. By removing the need for both conventional 1D & 2D code readers and a camera for image processing, space and money can be saved with the use of this tool.

Capable of handling various types of codes

1D CODE



Simultaneous reading of barcodes and characters

2D CODES

DataMatrix

QR code

Composite Code

Print quality verification function

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

Supported standards

1D: ISO/IEC 15416
2D: ISO/IEC 15415, AIM DPM-1-2006, SAE AS9132

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

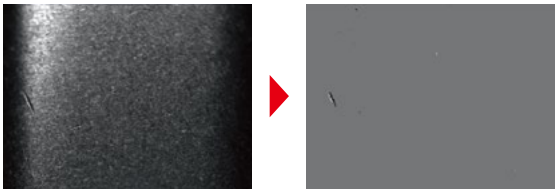
Notice:
This function is designed to capture relative changes in print quality and thus cannot be used as a print quality verification system for absolute value evaluation.

Highlight and Improve Features That Previously Could Not Be Seen. Remove Features and Aspects of an Image for Stable Inspection.

Shading correction (real time)

Shading correction is a real time filter that evens out any large random shadows or glare on a target surface, leaving behind smaller defined points which are often associated to being flaws or defects. As this is a grey scale processing filter, it dynamically changes the processed image based on the input image rather than being based on a fixed binary setting level. This ensures consistency with target variation and changes in the raw image.

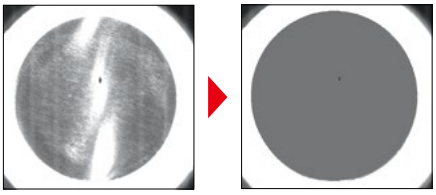
▮ Surface quality on a metal roller



Original image　　After preprocessing

Shading correction can be used to extract just bright, dark or both bright and dark defects depending on the nature of the surface.

▮ Defect detection on the bottom of a can



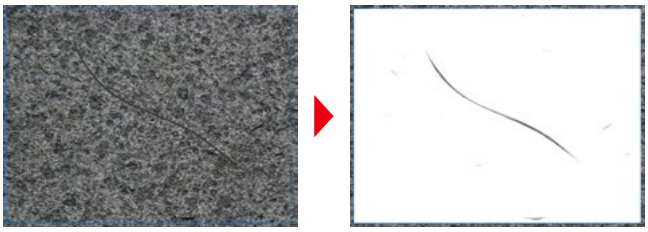
Original image　　After preprocessing

Cancelling out the hot-spots caused by changes in the target surface creates a uniform background that makes it possible to detect defects.

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



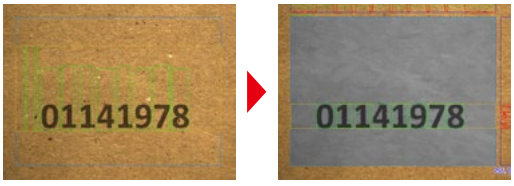
Original image　　After preprocessing

Only linear defects are extracted by ignoring background noise.

Noise isolation

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

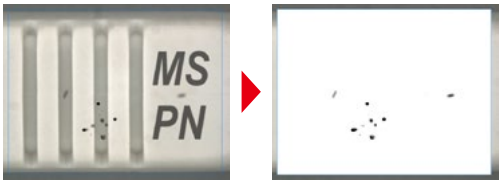
▮ Recognition of characters printed on cardboard



Original image　　After preprocessing

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

▮ Defect inspection for a plastic mould



Original image　　After preprocessing

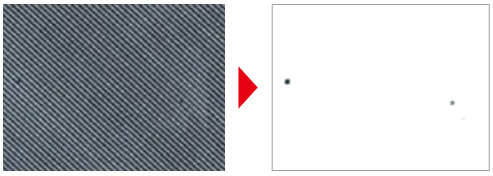
Only black defects smaller than the specified area are extracted.

KEYENCE's Proprietary Algorithms for an Optimal and Stable Inspection

Bidirectional smoothing

Has an effect that removes a significant amount of fine background patterns or noise.
This filter can be set to have an effect that performs smoothing in individual directions (X/Y), thus making it applicable for a wide range of applications, including counting individual items.

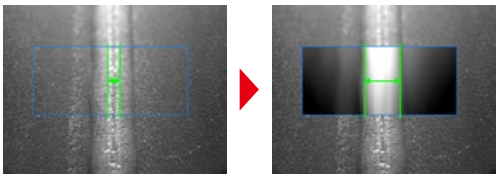
Foreign particle detection on a striped pattern



Original image　　After preprocessing

By eliminating the striped texture to the target, foreign particles can be detected.

Width inspection for a welded pipe section



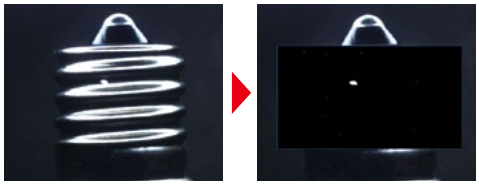
Original image　　After preprocessing

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

Individual filter processing direction

As for the blur filter, all directions can now be applied for "shading correction", "image extraction", "expand, and "shrink" filters. Being able to choose the processing direction helps to enhance the image according to how the feature appears.

Individual filter processing direction

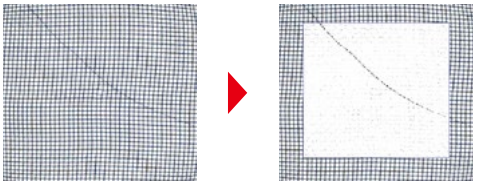


Original image　　After preprocessing

[Filter used: Shading correction] Processing direction: X

The defective area is isolated by removing the directional shading on the thread.

Foreign material detection on a lattice pattern

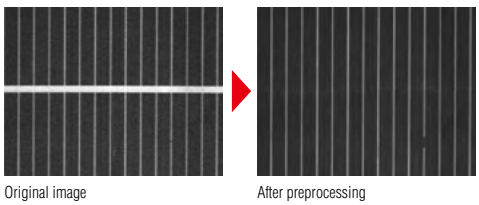


Original image　　After preprocessing

[Filter used: Image extraction] Processing direction: X -> Processing direction: Y

The background lattice pattern is removed by applying the filter multiple times while changing the processing direction.

Inspection of grid lines on a solar cell

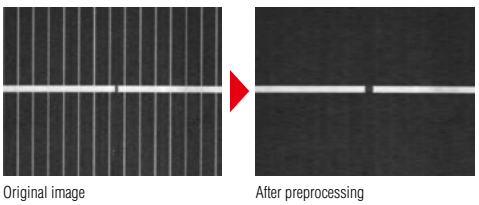


Original image　　After preprocessing

[Filter used: Shrink] Processing direction: Y

The break is enhanced while the width of the grid lines remain and the bus bar is removed for stable inspection.

Inspection of bus bars on a solar cell



Original image　　After preprocessing

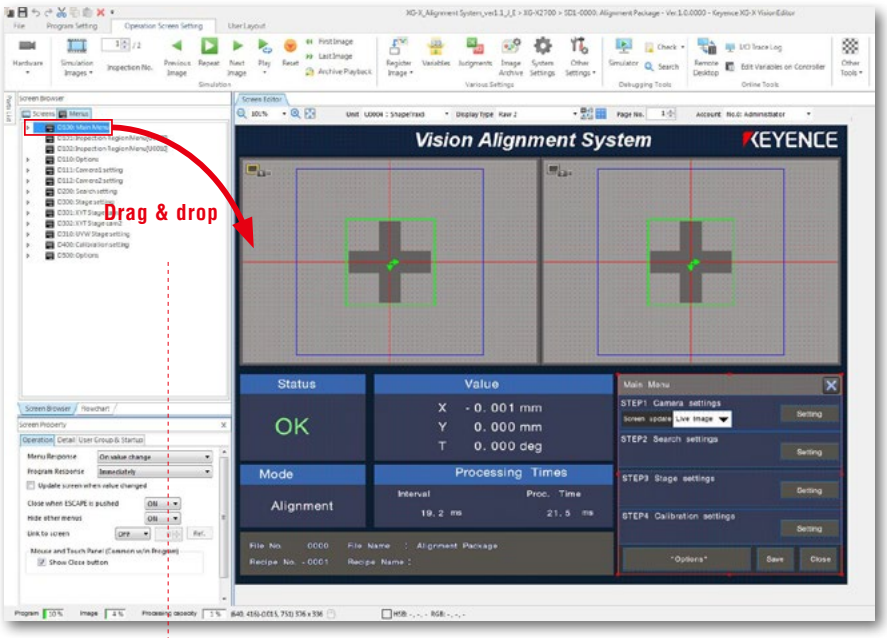
[Filter used: Shrink] Processing direction: X

The grid lines on the background are removed by shrinking the image in the X direction broadening the break in the bus bar.

Fully Customisable Operator Screens & Menus

Screen Editor

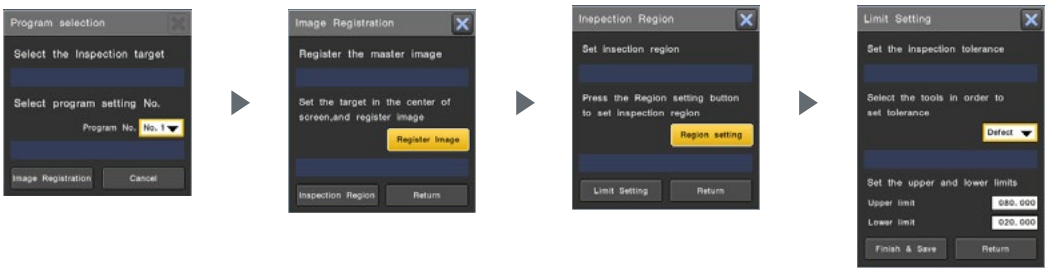
Controller display screens and operating interfaces can be created easily using the Screen Editor.



Drag & drop items from the list to the screen for simple GUI building.

Custom menu creation

Step by step procedures for changes such as product change over or shift adjustments can be simplified with customised operator menus.



By creating menus for a step by step process (such as calibration) there are no reasons why adjustments shouldn't be made or settings being incomplete and steps missed.

Conventional Systems

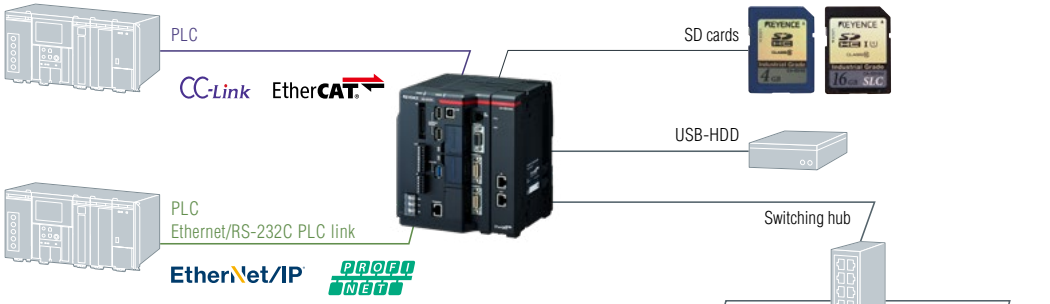
Due to different adjustment methods and different personnel making changes, cases often emerge where the setting is incorrect or varies between operators. With conventional systems complex parameter driven menus may need to be understood. It takes time and resources for operators to be trained and sometimes due to the complex menu interface the ability to operate the machine is limited to a few people.

Custom dialogue

Necessary steps and required settings can be put together to match up with the process. Menus can also be attributed to the relevant aspects of the image processing flowchart. This helps make sure that any operator of any level can easily be guided through the process required on the machine.

Save image and data for analysis and simulation

Supports a variety of connections between PLCs from various manufacturers and exchanges results and commands via the data memory just by selecting the connection destination manufacturer/device. As standard, the main unit is equipped with I/O, RS-232C, Ethernet, USB, and SD card slots. Furthermore, it is also possible to check communication with the communication monitor. This achieves significant reductions in cost, time, and effort.



XG-H1XE
- **VisionEditor**
  Upload/download/add or edit settings files
- **VisionTerminal**
  Measurements/image file logging/remote desktop function

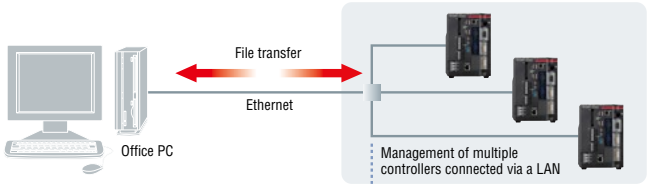
VNC

ActiveX

EtherCAT® is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

Remote data logging & monitoring software XG-X VisionTerminal

The XG-X VisionTerminal software enables the remote monitoring, logging and support of any XG-X Series controller connected to a PC via a standard network. Maintenance man-hours, down-time and business trips can be significantly reduced as problems can be resolved remotely with the transfer of setting files and image data.



Main functions

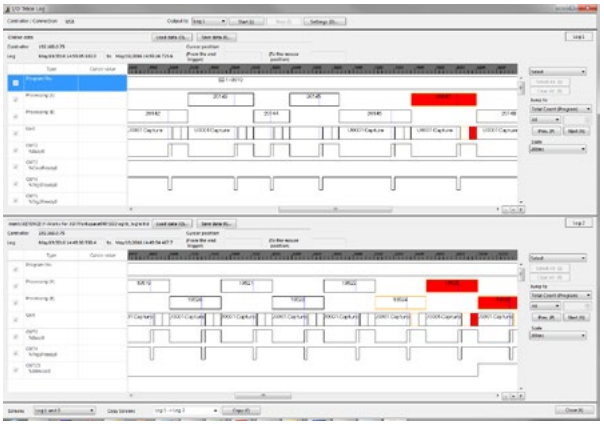
Remote desktop function …Enables the verification and remote operation of a connected controller, without extra data being sent and interfering with controller processing.

Logging function ..... Enables the display, logging of measurement results and storage of image data to a PC folder from an inspection with any connected controller. This function also supports the accumulation output buffer of the controller to ensure complete data collection.

File acquisition function … Enables the transferring of setting data files and image data files between the XG-X Series controller and a PC.

Trace log function

The trace log function is a great tool to help with processing and I/O troubleshooting. Giving integrators and developers the capability for checking and monitoring the sequencing of units being processed, I/O signals and commands. The results display can be split and the processing time for each unit along with other information can be easily displayed. The trace log can also be saved and be used at a later date as a reference guide.



Camera lineup

		Model	Specification	Function	Capture range (pixels)	Image transfer time
64 megapixel camera series		**CA-HF6400M** **CA-HF6400C**	90× high-speed monochrome 88× high-speed colour	High speed	8192 × 7808	57.6 ms 59.2 ms
21 megapixel camera series		**CA-HF2100M** **CA-HF2100C**	85× high-speed monochrome 85× high-speed colour	High speed	5104 × 4092	20.2 ms
5 megapixel camera series		**CA-H500MX** **CA-H500CX**	16× high-speed monochrome 16× high-speed colour	High speed, high performance*1	2432 × 2040	27.7 ms 29.2 ms
		**CA-H500M** **CA-H500C**	16× high-speed monochrome 16× high-speed colour	High speed, environment resistant*2	2432 × 2050	28.4 ms
2 megapixel camera series		**CA-H200MX** **CA-H200CX**	16× high-speed monochrome 16× high-speed colour	High speed, high performance*1	1600 × 1200	11.7 ms
		**CA-H200M** **CA-H200C**	16× high-speed monochrome 16× high-speed colour	High speed, environment resistant*2	1600 × 1200	11.8 ms
		**CA-200M** **CA-200C**	Monochrome Colour	Environment resistant*2	1600 × 1200	56.5 ms
		**CA-HS200M** **CA-HS200C**	16× high-speed compact monochrome 16× high-speed compact colour	High speed, compact	1600 × 1200	14.2 ms
0.47 megapixel camera series		**CA-H048MX** **CA-H048CX**	16× high-speed monochrome 16× high-speed colour	High speed, high performance*1	784 × 596	2.9 ms
					512 × 480	1.7 ms
0.31 megapixel camera series		**CA-H035M** **CA-H035C**	16× high-speed monochrome 16× high-speed colour	High speed, environment resistant*2	640 × 480	2.9 ms
		**CA-035M** **CA-035C**	Monochrome Colour	Environment resistant*2	640 × 480	16.5 ms
		**CA-HS035M** **CA-HS035C**	7× high-speed compact monochrome 7× high-speed compact colour	High speed, compact	640 × 480	4.5 ms

*1 Colour cameras support LumiTrax™ image capture and pattern projection lighting, and monochrome cameras support LumiTrax™ image capture, Multi-Spectrum image capture, pattern projection lighting, and LumiTrax™ specular reflection mode image capture.
*2 To use this camera as an IP64-rated, environment-resistant camera, use it with a KEYENCE-specified IP64-rated lens and an environment-resistant cable.

		Model	Applicable lens	Number of pixels	Max. expanded image size	Scan speed	Pixel clock
Line scan camera series	 LumiTrax™ specular reflection mode	**CA-HL02MX**	1 in. C-mount	2048	2048 × 16384	6.1 µs/line	165 kHz
		CA-HL04MX	1 in. C-mount	4096	4096 × 16384	10.2 µs/line	97.7 kHz
		CA-HL08MX	2 in. special mount (M40 P0.75) lens*1	8192	8192 × 8192	10.2 µs/line	97.7 kHz

*1 F-mount lenses supported with an F-mount conversion adapter.

3D cameras

		Model	Field of view XY (Reference distance)	Z range (from reference distance)	Repeatability (σ)
XT		**XT-024**	24 × 24 mm	±2 mm	±0.5 µm
		XT-060	60 × 60 mm	±6 mm	±1 µm
XR		**XR-HT15M**	12.5 × 12.5 mm	±1.5 mm	1 µm*1
		XR-HT40M	35.5 × 35.5 mm	±5.0 mm	2 µm*1

*1 Value for KEYENCE standard plane workpieces when binning is ON and a 3 × 3 average filter is used once.

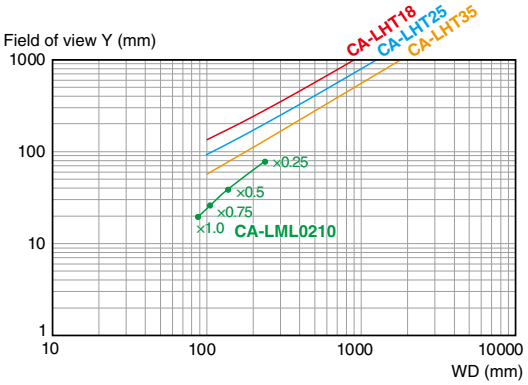
Controller lineup

The XG-X Series offers the same ease of use for all applications without having to select between a stand-alone type for simple applications and a PC-based type for more difficult applications. With a wide selection of devices that allows for selection of the best controller to fit the situation—including the application, required processing speed and capacity, and connected cameras—the lineup's offerings will become the industry standard for tomorrow's image processing selection.

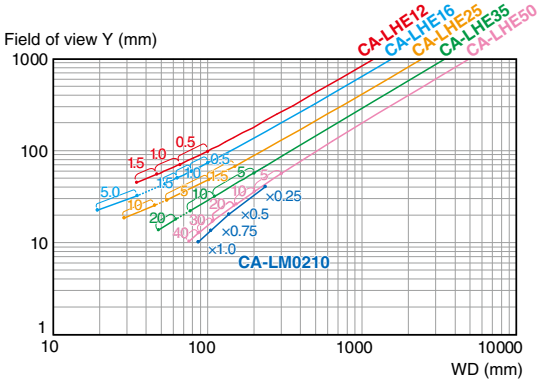
			Area camera-only models							Models compatible with high-resolution cameras	
											
Model			**XG-X1000**	**XG-X1200**	**XG-X1500**	**XG-X2000**	**XG-X2200**	**XG-X2500**	**XG-X2700**	**XG-X2800**	**XG-X2900**
DSP + CPU, total number of cores (number of calculation DSP cores)			7 (2)			8 (high-speed DSP: 3)			14 (high-speed DSP: 7)		
Supported cameras	0.31 to 0.47 megapixels	**CA-(H)035x CA-HS035x CA-H048xX**	✓*1	✓*1	✓*1	✓	✓	✓	✓	✓	✓
	2 megapixels	**CA-(H)200x CA-HS200x CA-H200xX**	—	✓*1	✓*1	—	✓	✓	✓	✓	✓
	5 megapixels	**CA-H500x CA-H500xX**	—	—	✓*1	—	—	✓	✓	✓	✓
	21 megapixels	**CA-HF2100x**	—	—	—	—	—	—	—	✓*5	✓
	64 megapixels	**CA-HF6400x**	—	—	—	—	—	—	—	—	✓
	Line scan camera	**CA-HL02MX CA-HL04MX CA-HL08MX**	—	—	—	—	—	—	—	✓*2 *3	✓*2
	XR	**XR-HT15M XR-HT40M**	—	—	—	—	—	—	—	✓*2	✓*2
	XT	**XT-024 XT-060**	—	—	—	—	—	—	—	✓*2	✓*2
Built-in camera interface			2	2	2	2	2	2	2	—*4	—*4
Dedicated touch panel (RS-232C)			✓	✓	✓	✓	✓	✓	✓	✓	✓

*1 Image capture modes other than normal illumination mode are not supported.
*2 When connected to an XT or XR camera, do not use with the 3D capture mode of an area camera or with a line scan camera.
*3 LumiTrax™ specular reflection mode is not supported.
*4 Use in combination with a separate camera input unit.
*5 LumiTrax™ image capture is not supported.

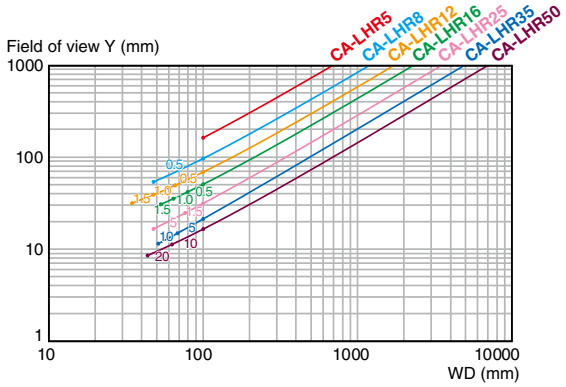
▮CA-HF6400C/CA-HF6400M
(When the **CA-LHT** Series is attached)



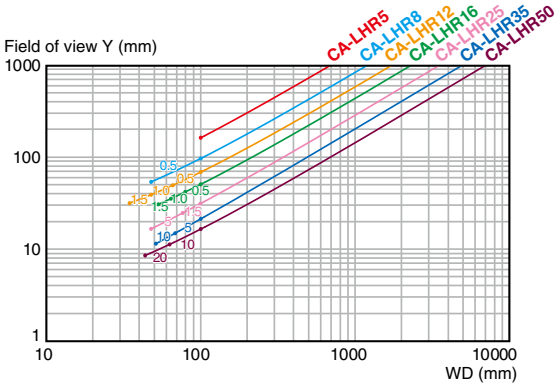
▮CA-HF2100C/CA-HF2100M
(When the **CA-LHE** Series is attached)



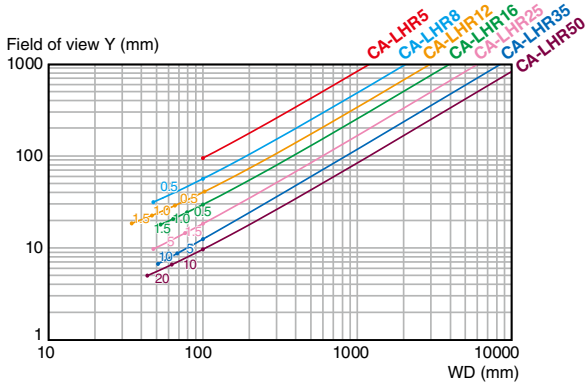
▮CA-H500CX/CA-H500MX
(When the **CA-LHR** Series is attached)



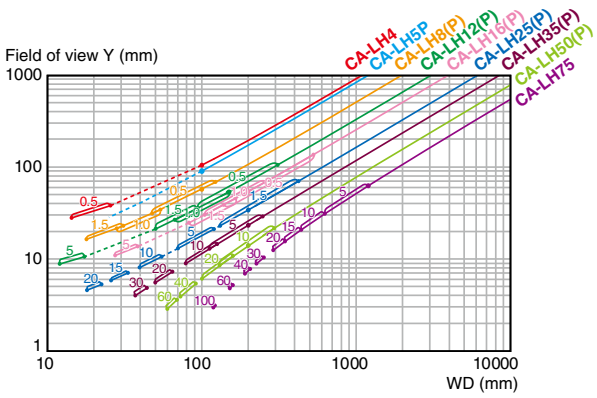
▮CA-H500C/CA-H500M
(When the **CA-LHR** Series is attached)



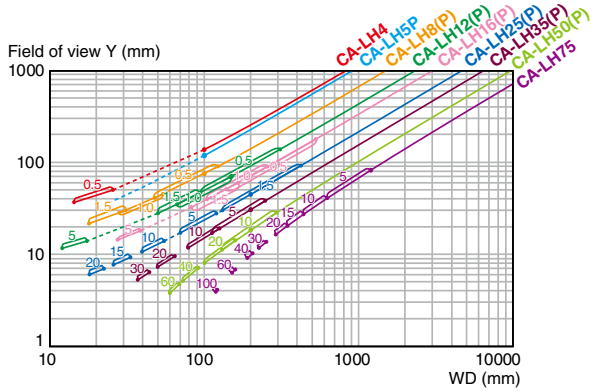
▮CA-H200CX/CA-H200MX
(When the **CA-LHR** Series is attached)



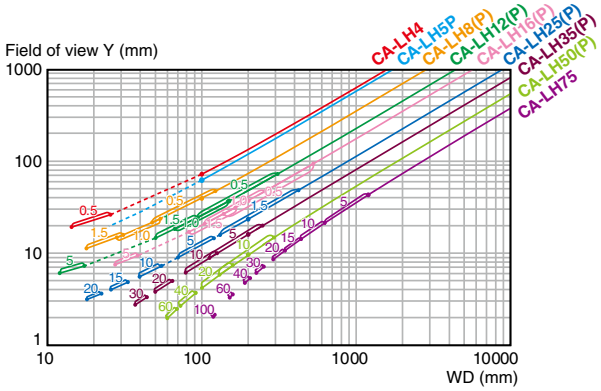
▮CA-H200CX/CA-H200MX
(When the **CA-LH/LHxP** Series is attached)



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

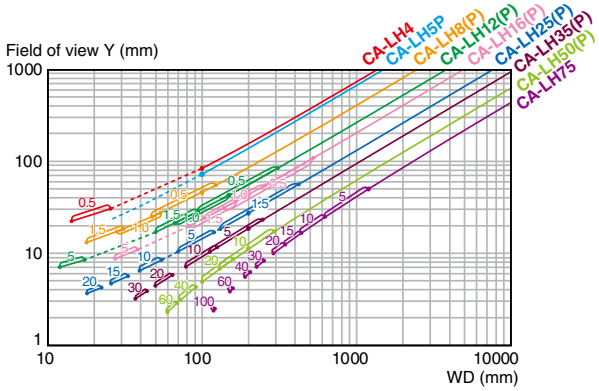


▮CA-H048CX/CA-H048MX
(When the **CA-LH/LHxP** Series is attached)



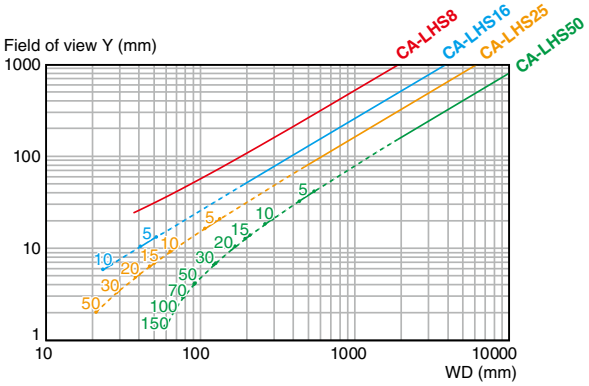
▮CA-035C/CA-035M/CA-H035C/CA-H035M

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



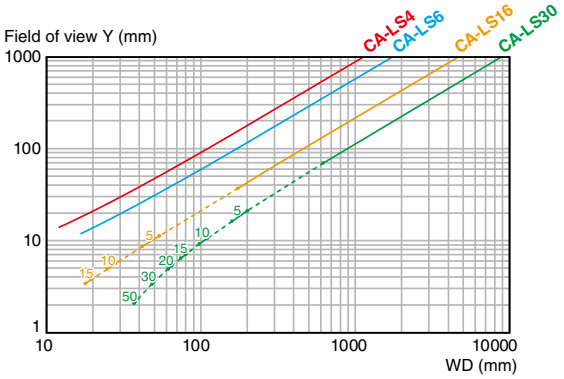
▮CA-HS200C/CA-HS200M

(When the **CA-LHS** Series is attached)



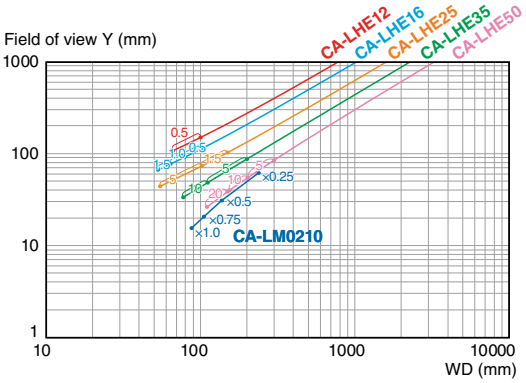
▮CA-HS035C/CA-HS035M

(When the **CA-LS** Series is attached)



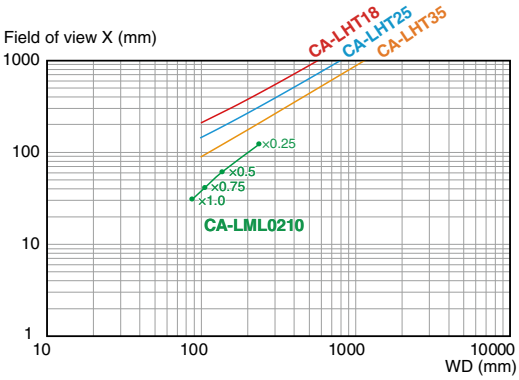
▮CA-HL02MX/CA-HL04MX

(When the **CA-LHE** Series is attached)



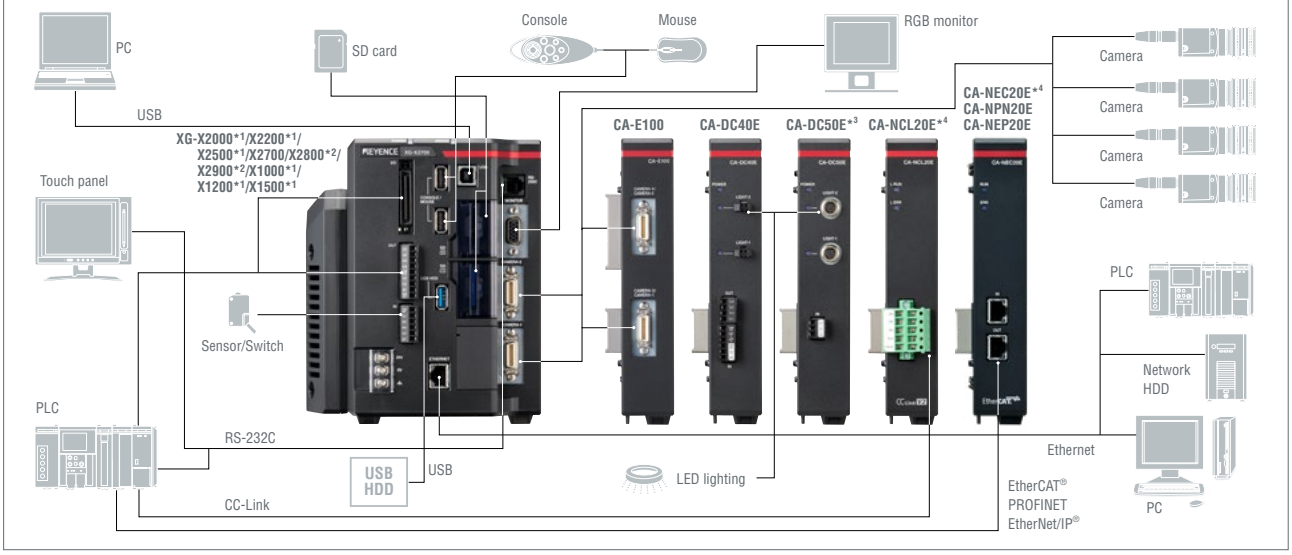
▮CA-HL08MX

(When the **CA-LHT** Series is attached)



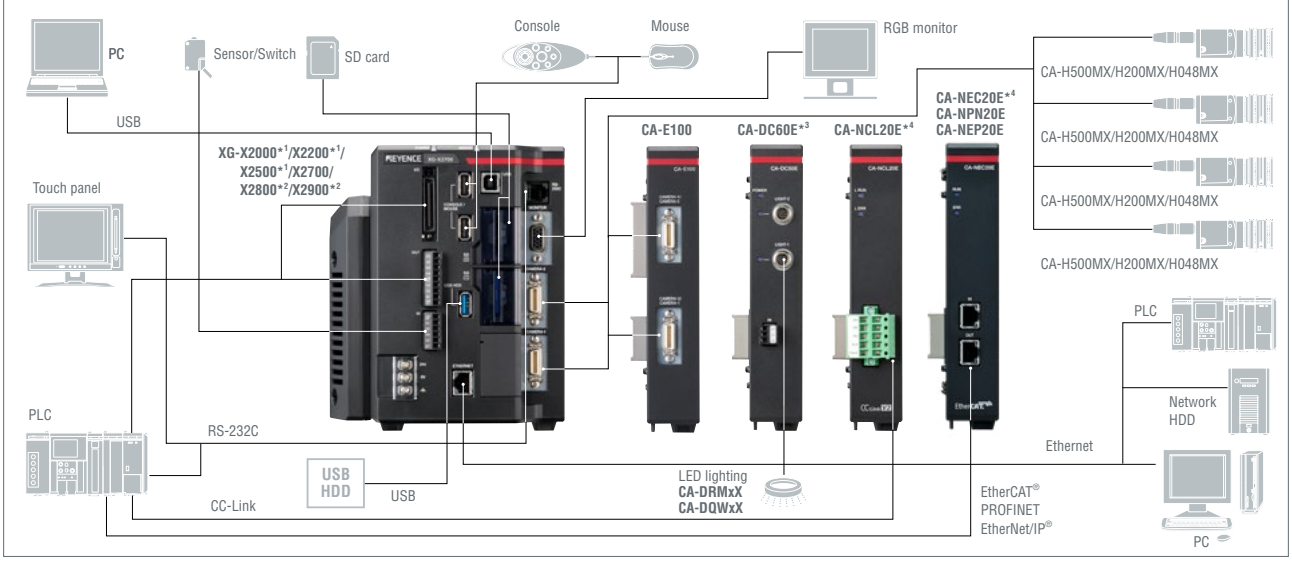
* Using close up rings may result in distortion and lower resolution around the edges of the image area/image sensor. For other field of view graphs, refer to the user's manual.

System configuration diagram XG-X2000/X2200/X2500/X2700/X2800/X2900/X1000/X1200/X1500

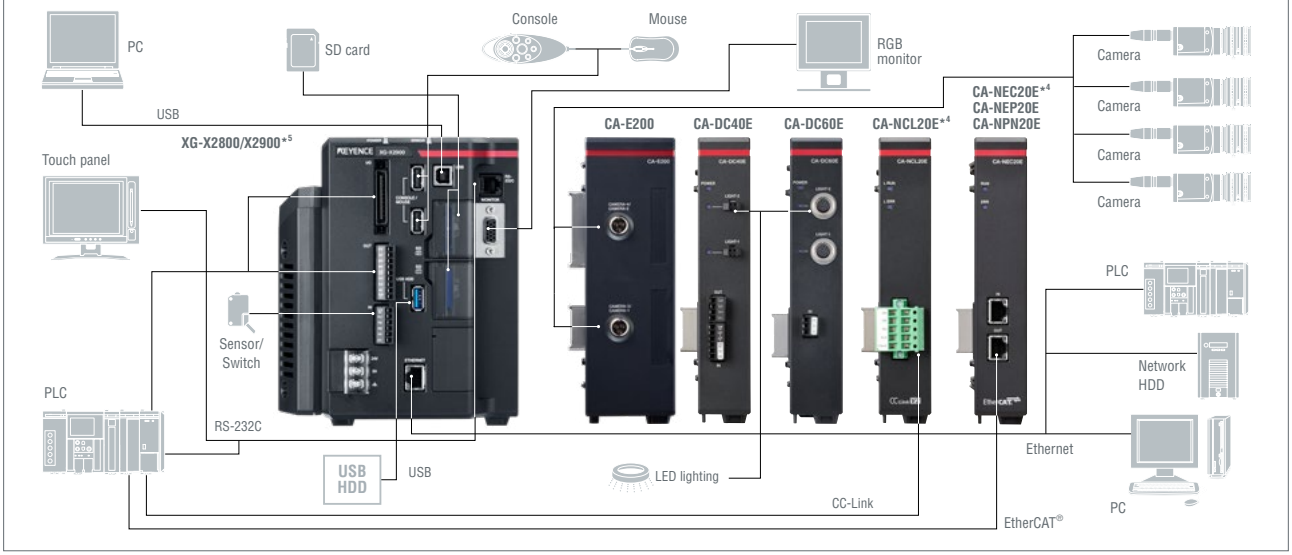


*1 Fan units cannot be connected to XG-X2000/X2200/X2500/X1000/X1200/X1500. *2 XG-X2800/X2900 has no camera connection ports, must use with at least one camera input unit.
*3 LumiTrax™ mode is unavailable when used with the XG-X1000 Series. CA-DRWxX lights can be used as standard high-intensity lighting *4 The CA-NCL20E and the CA-NEC20E cannot be connected at the same time.

System configuration diagram XG-X2000/X2200/X2500/X2700/X2800/X2900 (When using Multi-Spectrum image capture/LumiTrax™ specular reflection mode (area camera)/pattern projection lighting)

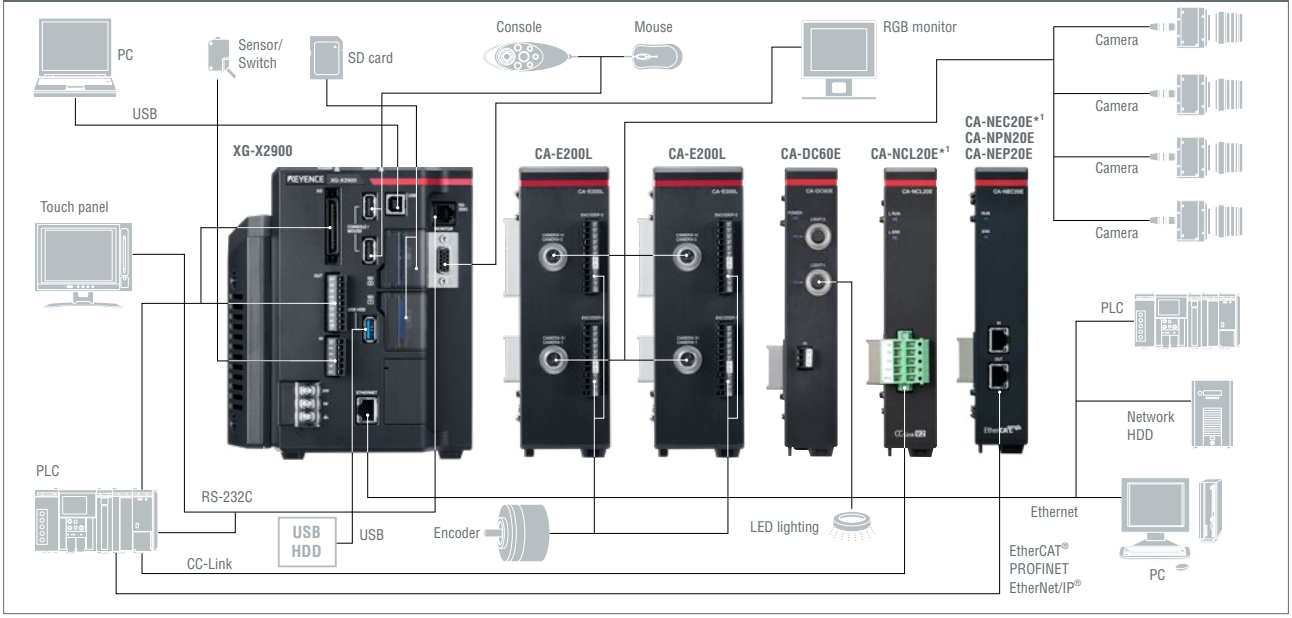


System configuration diagram XG-X2800/X2900 (when using a high-resolution camera (CA-HFxM/C))

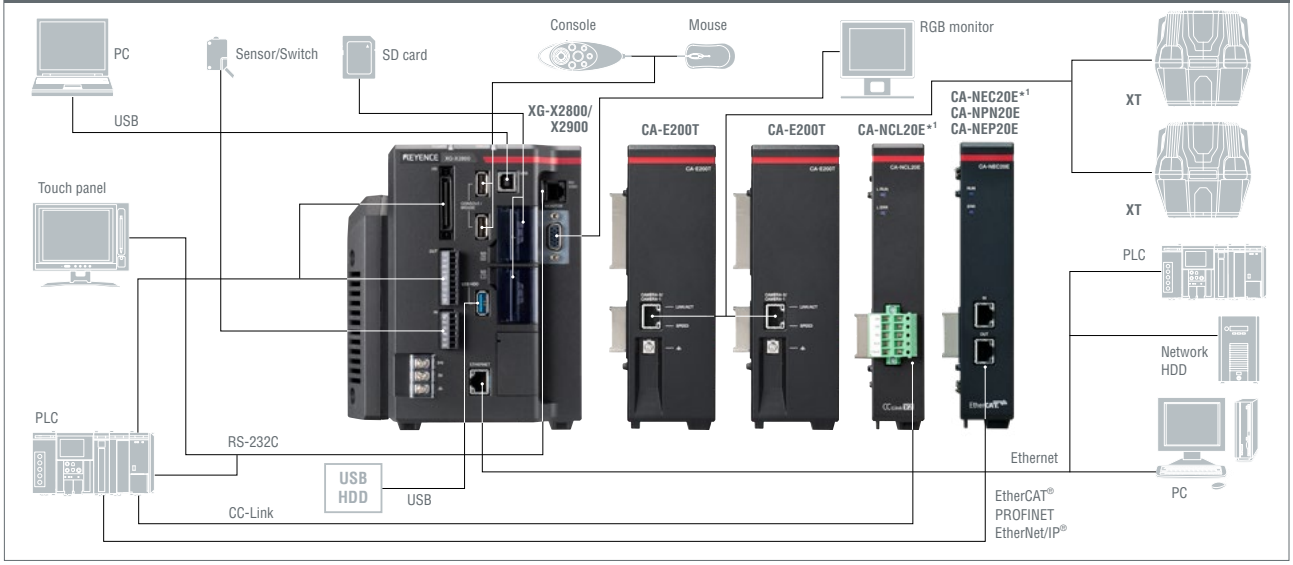


*1 Fan units cannot be connected to XG-X2000/X2200/X2500. *2 XG-X2800/X2900 has no camera connection ports, must use with at least one camera input unit.
*3 LumiTrax™-Specular Reflection mode can only be used on the XG-X2900 controller. *4 The CA-NCL20E and the CA-NEC20E cannot be connected at the same time.
*5 The CA-HF6400x and LumiTrax™ imaging with the CA-HF2100x can only be used with the XG-X2900.

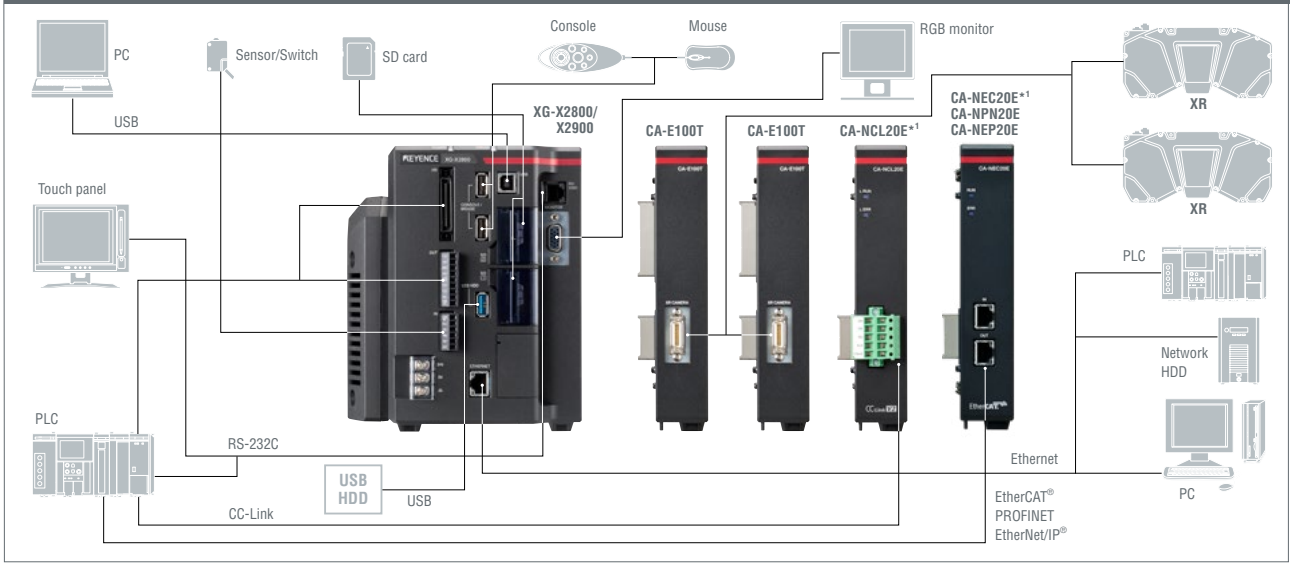
System configuration diagram XG-X2900 (When using a line scan camera/LumiTrax™ Specular Reflection mode)



System configuration diagram XG-X2800/X2900 (When connected to XT)



System configuration diagram XG-X2800/X2900 (When connected to XR)



*1 Only one communication expansion unit (CA-NCL20E/NEC20E/NEP20E/NPN20E) can be connected.

Controller

5 megapixel
camera-compatible
XG-X2700/XG-X2500/XG-X1500

2 megapixel
camera-compatible
XG-X2200/XG-X1200

0.47 megapixel
camera-compatible
XG-X2000/XG-X1000

Line scan camera/
XT/XR/21/64 megapixel
camera-compatible
XG-X2800/XG-X2900

Expansion unit

Area camera
input unit
CA-E100

High-resolution area
camera input unit
CA-E200

Dedicated to the
XG-X2000 Series

Line scan camera
input unit
CA-E100L

Dedicated to the
XG-X2000 Series

XR camera
input unit
CA-E100T

Dedicated to the
XG-X2000 Series

XT camera input unit
CA-E200T

Dedicated to the
XG-X2000 Series

High-speed transmission
line scan camera
input unit
CA-E200L

Dedicated to the
XG-X2000 Series

LED light control
expansion unit
CA-DC40E

LumiTrax™-compatible light
control expansion unit
CA-DC50E[*1]

Multi-Spectrum/pattern projection/
LumiTrax™ specular reflection
mode-compatible light control
expansion unit
CA-DC60E

Dedicated to the
XG-X2000 Series

CC-Link unit
CA-NCL20E

EtherCAT® unit
CA-NEC20E

PROFINET module
CA-NPN20E

EtherNet/IP® module
CA-NEP20E

*1 LumiTrax™ mode is unavailable when used with the XG-X1000 Series.
CA-DRWxX lights can be used as standard high-intensity lighting.

Area Cameras

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

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

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

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

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

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

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

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

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

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

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

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

Line Scan Cameras

8192 pixels
High-speed Line scan camera
CA-HL08MX (Monochrome)

4096 pixels
High-speed Line scan camera
CA-HL04MX (Monochrome)

2048 pixels
High-speed Line scan camera
CA-HL02MX (Monochrome)

XT/XR

24 mm type
XG-X controller model
XT-024

60 mm type
XG-X controller model
XT-060

40 mm type
XG-X controller model
XR-HT40M
GigE model
XR-HT40MD

15 mm type
XG-X controller model
XR-HT15M
GigE model
XR-HT15MD

Programmable Encoder

Encoder head unit
CA-EN100H

Encoder relay unit
CA-EN100U

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

Accessories

Camera cables

L-shaped connector

Models

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

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

Camera cable compatibility

Cable type	Area cameras					Line scan cameras
	CA-HF6400x/HF2100x	**CA-H500x/H200x/H035x**	**CA-H500xX/H200xX/H048xX**	**CA-200x/035x**	**CA-HS200x/HS035x**	**CA-HLxMX**
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.

Amplifier for extension cables
CA-CHX10U

Camera cables can be extended up to 37 m*.

* The maximum length varies depending on the camera model. Contact us for details.

The dedicated extension cable is necessary in order to connect an amplifier to a camera or between two amplifiers. Contact KEYENCE for details.

XT camera cable
CA-CD2 (2 m)
CA-CD5 (5 m)
CA-CD10 (10 m)

XT power supply cable
OP-88356 (2 m)
OP-88357 (5 m)
OP-88358 (10 m)

Monitor/Touch panel

Multi-touch enabled 12" touch panel
CA-MP120T
12" colour LCD monitor
CA-MP120
8.4" colour LCD monitor
CA-MP82

CA-MP120T/MP120 monitor stand
OP-87262

CA-MP120T protective film
OP-87263

Options for CA-MP120T
For XG-X Series:
OP-87264
(Touch panel modular RS-232C cable, 3 m)
OP-87265
(Touch panel modular RS-232C cable, 10 m)

CA-MP120T/MP120 pole-mounting bracket
OP-42279

Monitor cable
OP-66842 (3 m)
OP-87055 (10 m)

* A RGB monitor cable and touch panel RS-232C cable are required when using the CA-MP120T.

Communication cable

Parallel I/O cable
OP-51657 (3 m)

Communication cable conversion connector
OP-26486: 9 pins
For 9-pin SYSMAC: **OP-84384**
For 9-pin MELSEC: **OP-86930**

* When connecting the MELSEC-FX3/FX5, which requires a 9-pin connection, use the OP-26486.

RS-232C communication cable
OP-26487 (2.5 m)

1 Gbps Ethernet cable
OP-66843 (3 m)

USB cable
OP-66844 (2 m)

PC connection cable for XR
CA-CD2 (2 m)
CA-CD5 (5 m)
CA-CD10 (10 m)

XR power supply cable
CA-CP2 (2 m)
CA-CP5 (5 m)
CA-CP10 (10 m)

Others

Image processing system integration software
XG-H1XE
See the chart below for information on supported operating systems.

XG-X Series
USB handheld controller
OP-87983

Dedicated mouse
OP-87506

Mouse stand
OP-87601

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

Dedicated 24 VDC power supply
CA-U4
CA-U5

The XG-X Series manual set OP-M**** is not included with the controller.
A PDF version is included with the integrated development environment software XG-H1XE.

XR camera air purge unit
XR-AP1
Air purge function keeps the sensor head clean. Air purge units are recommended for sideways or upward sensor installations.

Calibration target
For XT-024: **OP-88400**
For XT-060: **OP-88401**
For XR-HT15M(D): **OP-87740**
For XR-HT40M(D): **OP-87741**
By using the calibration target for the XR/XT Series, accuracy can be maintained even if temporal changes in measurements occur.

Height difference gauge
OP-87742
As a tool for checking accuracy, this reference gauge provides readings traceable to international standards.

Dedicated stand for XT
OP-88427

Supported OS and recommended running environment for XG-H1XE

Supported OS	• Microsoft Windows 10 Home, Pro, Enterprise (64 bit version) • Cannot be used with an OS that is not listed above.
Running environment	• CPU: Intel® Core™ i3 processor equivalent or higher • RAM: 8 GB or more • HDD: 8 GB or more (with additional space for storing images required) Besides these, if installation of Microsoft .NET Framework is necessary, 4.5 GB or more of free space is required in addition to the above. • Monitor: 1024 × 768 pixels or more (1280 × 1024 pixels or more recommended). • An internet connection for accessing the webpage for submitting the activation code request and a means of receiving activation code via e-mail is required.

* Microsoft is either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.
Intel and Intel Core are registered trademarks of Intel Corporation in the United States and other countries.

Controller (XG-X2700/XG-X2500/XG-X2200/XG-X2000)

Model		XG-X2700	XG-X2500	XG-X2200	XG-X2000
Camera input		Two colour/monochrome cameras, up to 4 inputs can be connected by connecting 1 optional area camera input unit CA-E100.			
	Trigger input	Simultaneous/individual capture with up to 4 cameras can be selected (up to 2 cameras for simultaneous capture when the CA-E100 is not connected)			
Supported cameras/ Number of pixels		• 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	• 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	• 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-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
Main image processor		DSP (Fast type)	DSP		
Program memory		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			
Screen capacity		Maximum 1000 screens for each program (depending on SD card size), Image compression, Support for image registration and partial image registration from a position-corrected image, Externally switchable according to variables.			
Memory card		• SD card slot × 2 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 Supports OP-87133 (512 MB: standard equipment on the SD1 slot), CA-SD1G (1 GB), CA-SD4G (4 GB), and CA-SD16G (16 GB)	
Image archive		With area camera connected: • Max. 12757 images (monochrome camera, 0.24 megapixels) • Max. 10221 images (monochrome camera, 0.31 megapixels) • Max. 6730 images (monochrome camera, 0.47 megapixels) • Max. 1638 images(monochrome camera, 2 megapixels) • Max. 613 images (monochrome camera, 5 megapixels) • Max. 12441 images (colour camera, 0.24 megapixels) • Max. 9998 images (colour camera, 0.31 megapixels) • Max. 6609 images (colour camera, 0.47 megapixels) • Max. 1598 images (colour camera, 2 megapixels) • Max. 583 images (colour camera, 5 megapixels)	With area camera connected: • Max. 12757 images (monochrome camera, 0.24 megapixels) • Max. 10221 images (monochrome camera, 0.31 megapixels) • Max. 6730 images (monochrome camera, 0.47 megapixels) • Max. 1638 images (monochrome camera, 2 megapixels) • Max. 613 images (monochrome camera, 5 megapixels) • Max. 12441 images (colour camera, 0.24 megapixels) • Max. 9998 images (colour camera, 0.31 megapixels) • Max. 6609 images (colour camera, 0.47 megapixels) • Max. 1598 images (colour camera, 2 megapixels) • Max. 583 images (colour camera, 5 megapixels)	With area camera connected: • Max. 4091 images (monochrome camera, 0.24 megapixels) • Max. 3277 images (monochrome camera, 0.31 megapixels) • Max. 2156 images (monochrome camera, 0.47 megapixels) • Max. 520 images (monochrome camera, 2 megapixels) • Max. 3985 images (colour camera, 0.24 megapixels) • Max. 3200 images (colour camera, 0.31 megapixels) • Max. 2111 images (colour camera, 0.47 megapixels) • Max. 490 images (colour camera, 2 megapixels)	With area camera connected: • Max. 2181 images (monochrome camera, 0.24 megapixels) • Max. 1747 images (monochrome camera, 0.31 megapixels) • Max. 1148 images (monochrome camera, 0.47 megapixels) • Max. 2122 images (colour camera, 0.24 megapixels) • Max. 1702 images (colour camera, 0.31 megapixels) • Max. 1120 images (colour camera, 0.47 megapixels)
Interface	Assignable input	• 20 connection points (including four high-speed terminals that can be assigned to trigger input) • Input rating: 26.4 V or lower, or 1.2 mA or greater (2.2 mA or greater for high-speed input terminals)			
	Assignable output	• 28 connection points (including four high-speed terminals that can be assigned to external trigger-linked FLASH output) • Photo MOSFET*1: Max. 50 mA (30 V or less)			
	Monitor output	Analogue RGB output, XGA (1024 × 768, 24-bit colour)			
	Unit indicators	Power, ERROR LED display			
	RS-232C	• Functionality switchable between numerical data output, control I/O, and CA Series touch panel interface (Cannot be used in conjunction with PLC links using RS-232C) • Supports a maximum baud rate of 230400 bps			
	PLC link	• Can output numerical values and perform control input/output using the Ethernet or RS-232C port (Cannot be used in conjunction with CC-Link, EtherNet/IP®, PROFINET, EtherCAT®) • The following PLCs are supported via link unit*2: 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 Series, SYSMAC C Series (RS-232C only), SYSMAC CP1 Series YASKAWA Electric Corporation: MP2000 Series/MP900 Series (RS-232C only)			
	Ethernet	• Can output numerical values and perform control input/output • Connecting to KEYENCE PC application software enables not only the above functions but also makes it possible to upload and download inspection settings, perform a variety of simulations, send and receive a variety of data including image data, and use the remote desktop function. • Supports FTP client and server functions, an SFTP Client function, a VNC server function (for non-PC clients, only displaying the monitor screen is supported), and a BOOTP function • Jumbo frame support (when connected to CA-NEC20E/NEP20E/NPN20)			
	USB	• Connecting to KEYENCE PC application software makes it possible to output numerical values, perform control I/O, upload and download inspection settings, perform a variety of simulations, send and receive a variety of data including image data, and use the remote desktop function. • Dedicated to USB 2.0			
	CC-Link	• By connecting the optional CC-Link unit CA-NCL20E, numerical value output and control input/output are enabled (Cannot be used in conjunction with PLC-Link, EtherNet/IP®, PROFINET or EtherCAT®) • Supports ver. 1.10 and ver. 2.00 remote device stations			
	EtherCAT®	• Connecting the optional EtherCAT® unit CA-NEC20E enables numerical value output and control I/O (Cannot be used in conjunction with PLC-Link, EtherNet/IP®, or PROFINET.) • Process data object communication (cyclic communication) (Input: max. 536 bytes, output: max. 532 bytes) • Message communication (non-cyclic communication) • Supports CoE • Explicit Device Identification • Conforms to conformance test V2.1.0.2.			
	EtherNet/IP®	• Numerical data input/output and control input/output enabled via the Ethernet port or optional CA-NEP20E EtherNet/IP® unit (Cannot be used in conjunction with PLC-link, CC-Link, PROFINET or 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) / CT16 (CA-NEP20E)			
	PROFINET	• Numerical data input/output and control input/output enabled via the Ethernet port or optional CA-NPN20E PROFINET unit (Cannot be used in conjunction with PLC-link, CC-Link, EtherNet/IP®, or EtherCAT®) • Supports cyclic communication (max. 1408 bytes (Ethernet port) / 1248 bytes (CA-NPN20E)) • Supports non-cyclic communication (recorded data) • Conforms to Conformance Class A (Ethernet port) / C (CA-NPN20E)			
	SNTP	Unit's date and time auto-corrects when unit is connected to SNTP server			
	USB console	• Possible to control various menus via an optional USB console (OP-87983) • Supports the assignment of operations to console buttons			
	Mouse	Possible to control various menus via an optional dedicated mouse (OP-87506)			
	Touch panel	• Settings can be operated from a CA Series touch panel using the RS-232C port (Cannot be used in conjunction with RS-232C no-protocol communication, PLC links using RS-232C, or EtherCAT®) • Supports dedicated touch menus and operation buttons			
	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			
Language		Japanese/English/Simplified Chinese/Traditional Chinese/German (initial language set at first startup)			
Illumination control		By connecting the optional light expansion unit CA-DC40E/DC50E/DC60E, lighting and intensity control for the LED illumination is possible.*3			
Cooling fan		CA-F100 fan unit is included (attached) to the controller.	None		
Rating	Voltage	24 VDC ±10%			
	Current consumption	3.8 A			3.1 A
Environmental resistance	Operating ambient temperature	0 to 45°C (when installed on a DIN rail)/0 to 40°C (when installed on a surface)			
	Operating ambient humidity	35 to 85% RH (no condensation)			
Weight		Approx. 1800 g	Approx. 1600 g		

*1 Positive common connections supporting NPN input devices and negative common connections supporting PNP input devices are both possible. *2 Models equipped with the Ethernet port in the CPU unit support Ethernet port direct connection.
*3 Up to 8 light control expansion units can be connected (max. two CA-DC50E/DC60E units out of 8).

Controller (XG-X2800)

Model		XG-X2800	
Camera input*1		• With area camera input unit CA-E100 connected: 2 colour/monochrome cameras per CA-E100, up to 4 cameras via a maximum of 2 units can be connected. • With line scan camera input unit CA-E100L connected: 2 line scan cameras or two monochrome/colour cameras per CA-E100L, 4 cameras max. with 2 camera input units • With high-speed line scan camera unit CA-E200L connected: 2 high-speed line scan cameras per CA-E200L, 4 cameras max. with 2 camera input units	• With XR camera input unit CA-E100T connected: 1 3D camera per CA-E100T, 2 cameras max. with 2 camera input units • With XT camera input unit CA-E200T connected: 1 XT camera per CA-E200T, 2 cameras max. with 2 camera input units
	Trigger input	Simultaneous/individual capture with up to 4 cameras/heads can be selected (up to 2 cameras/heads for simultaneous capture when one camera input unit is connected)	
Supported cameras/ Number of pixels	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 • 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
	High-speed line scan camera	• CA-HL08MX 8192 (H) × 8192 (L), approx. 67.11 megapixels • CA-HL04MX 4096 (H) × 16384 (L), approx. 67.11 megapixels	• CA-HL02MX 2048 (H) × 16384 (L), approx. 33.55 megapixels
	XR camera	• XR-HT40M 2048 (H) × 2048 (L), approx. 4.19 megapixels	• XR-HT15M 1408 (H) × 1408 (L), approx. 1.98 megapixels
	XT camera	XT-024/060 3072 (H) × 3072 (V), approx. 9.44 megapixels	
Main image processor		DSP (Fast type)	
Program memory		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	
Screen capacity		Maximum 1000 screens for each program (depending on SD card size), Image compression, Support for image registration and partial image registration from a position-corrected image, Externally switchable according to variables.	
Memory card		• SD card slot × 2 • Supports OP-87133 (512 MB), CA-SD1G (1 GB: standard equipment on the SD1 slot), CA-SD4G (4 GB), and CA-SD16G (16 GB)	
Image archive		• Can store the image amounts listed below as an archive to the image memory of the main unit	
	Area camera	• Max. 12757 images (monochrome camera, 0.24 megapixels) • Max. 10221 images (monochrome camera, 0.31 megapixels) • Max. 6730 images (monochrome camera, 0.47 megapixels) • Max. 1638 images (monochrome camera, 2 megapixels) • Max. 613 images (monochrome camera, 5 megapixels) • Max. 122 images (monochrome camera, 21 megapixels)	• Max. 12441 images (colour camera, 0.24 megapixels) • Max. 9998 images (colour camera, 0.31 megapixels) • Max. 6609 images (colour camera, 0.47 megapixels) • Max. 1598 images (colour camera, 2 megapixels) • Max. 583 images (colour camera, 5 megapixels) • Max. 110 images (colour camera, 21 megapixels)
	Line Scan Camera	• Max. 71 images (CA-HL02MX continuous capture, 2048 × 16384 pixels) • Max. 151 images (CA-HL02MX continuous capture, 2048 × 8192 pixels) • Max. 71 images (CA-HL02MX individual capture, 2048 × 16384 pixels) • Max. 31 images (CA-HL04MX continuous capture, 4096 × 16384 pixels)	• Max. 68 images (CA-HL04MX continuous capture, 4096 × 8192 pixels) • Max. 31 images (CA-HL04MX individual capture, 4096 × 16384 pixels) • Max. 28 images (CA-HL08MX continuous capture, 8192 × 8192 pixels) • Max. 31 images (CA-HL08MX individual capture, 8192 × 8192 pixels)
	XR camera	• Max. 494 images (XR 15 mm type, height image and greyscale image saved) • Max. 2028 images (XR 15 mm type, binning: ON, height image and greyscale image saved)	• Max. 220 images (XR 40 mm type, height image and greyscale image saved) • Max. 953 images (XR 40 mm type, binning: ON, height image and greyscale image saved)
	XT camera	• Max. 192 images (XT-024/060, binning ON, or binning OFF with narrow field of view)	• Max. 40 images (XT-024/060, binning OFF, or binning ON with expansion)
Interface	Assignable input	• 20 connection points (including four high-speed terminals that can be assigned to trigger input) • Input rating: 26.4 V or lower, or 1.2 mA or greater (2.2 mA or greater for high-speed input terminals)	
	Assignable output	• 28 connection points (including four high-speed terminals that can be assigned to external trigger-linked FLASH output) • Photo MOSFET*2: Max.50 mA (30 V or less)	
	Encoder input	• When the CA-E100L/E200L is connected: 2 inputs per unit, 4 inputs total for 2 units max. • RS-422 line-driver output (Multi-drop support*3, Supports 5 V output included: max. 150 mA) and open collector output (24 V devices only with CA-E100L/E200L) included	
	Monitor output	Analogue RGB output, XGA (1024 × 768, 24-bit colour)	
	Unit indicators	Power, ERROR LED display	
	RS-232C	• Functionality switchable between numerical data output, control input/output, and CA Series touch panel interface (Cannot be used in conjunction with PLC links using RS-232C) • Supports a maximum baud rate of 230400 bps	
	PLC link	• Can output numerical values and perform control input/output using the Ethernet or RS-232C port (Cannot be used in conjunction with CC-Link, EtherNet/IP®, PROFINET, EtherCAT®) • The following PLCs are supported via link unit*4: 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 Series, SYSMAC C Series (RS-232C only), SYSMAC CP1 Series YASKAWA Electric Corporation: MP2000 Series/MP900 Series (RS-232C only)	
	Ethernet	• Can output numerical values and perform control input/output • Connecting to KEYENCE PC application software enables not only the above functions but also makes it possible to upload and download inspection settings, perform a variety of simulations, send and receive a variety of data including image data, and use the remote desktop function. • Supports FTP client and server functions, an SFTP Client function, a VNC server function (for non-PC clients, only displaying the monitor screen is supported), and a BOOTP function • Jumbo frame support (when connected to CA-NEC20E/NEP20E/NPN20)	
	USB	• Connecting to KEYENCE PC application software makes it possible to output numerical values, perform control I/O, upload and download inspection settings, perform a variety of simulations, send and receive a variety of data including image data, and use the remote desktop function. • Dedicated to USB 2.0	
	CC-Link	• By connecting the optional CC-Link unit CA-NCL20E, numerical value output and control input/output are enabled (Cannot be used in conjunction with PLC-Link, EtherNet/IP®, PROFINET or EtherCAT®) • Supports ver. 1.10 and ver. 2.00 remote device stations	
	EtherCAT®	• Connecting the optional EtherCAT® unit CA-NEC20E enables numerical value output and control input/output (Cannot be used in conjunction with PLC-Link, CC-Link, EtherNet/IP®, or PROFINET.) • Process data object communication (cyclic communication) (Input: max. 536 bytes, output: max. 532 bytes) • Message communication (non-cyclic communication) • Supports CoE • Explicit Device Identification • Conforms to conformance test V2.1.0.2.	
	EtherNet/IP®	• Numerical data input/output and control input/output enabled via the Ethernet port or optional CA-NEP20E EtherNet/IP® unit (Cannot be used in conjunction with PLC-link, CC-Link, PROFINET or 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) / CT16 (CA-NEP20E)	
	PROFINET	• Numerical data input/output and control input/output enabled via the Ethernet port or optional CA-NPN20E PROFINET unit (Cannot be used in conjunction with PLC-link, CC-Link, EtherNet/IP®, or EtherCAT®) • Supports cyclic communication (max. 1408 bytes (Ethernet port) / 1248 bytes (CA-NPN20E)) • Supports non-cyclic communication (recorded data) • Conforms to Conformance Class A (Ethernet port) / C (CA-NPN20E)	
	SNTP	Unit's date and time auto-corrects when unit is connected to SNTP server	
	USB console	• Possible to control various menus via an optional USB console (OP-87983) • Supports the assignment of operations to console buttons	
	Mouse	Possible to control various menus via an optional dedicated mouse (OP-87506)	
	Touch panel	• Settings can be operated from a CA Series touch panel using the RS-232C port (Cannot be used in conjunction with RS-232C no-protocol communication or PLC links using RS-232C) • Supports dedicated touch menus and operation buttons	
	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	
Language		Japanese/English/Simplified Chinese/Traditional Chinese/German (initial language set at first startup)	
Illumination control		By connecting the optional light expansion unit CA-DC40E/DC50E/DC60E, lighting and intensity control for the LED illumination is possible.*5	
Cooling fan		CA-F100 fan unit is included (attached) to the controller.	
Rating	Voltage	24 VDC ±10%	
	Current consumption	5.3 A	
Environmental resistance	Operating ambient temperature	0 to 45°C (when installed on a DIN rail)/0 to 40°C (when installed on a surface)	
	Operating ambient humidity	35 to 85% RH (no condensation)	
Weight		Approx. 1750 g	

*1 At least one camera input unit is required (controller has no built-in camera inputs). *2 The output common can be configured for NPN or PNP input devices.
*3 Supported on the CA-E100L/E200L. *4 Models equipped with the Ethernet port in the CPU unit support Ethernet port direct connection. *5 Up to 8 light control expansion units can be connected (max. two CA-DC50E/DC60E units out of 8).

Controller (XG-X2900)

Model		XG-X2900	
Camera input*1		• With area camera input unit CA-E100 connected: 2 colour/monochrome cameras per CA-E100, up to 4 cameras via a maximum of 2 units can be connected. • With line scan camera input unit CA-E100L connected: 2 line scan cameras or two monochrome/colour cameras per CA-E100L, 4 cameras max. with 2 camera input units • With high-speed line scan camera unit CA-E200L connected: 2 high-speed line scan cameras per CA-E200L, 4 cameras max. with 2 camera input units	• With XR camera input unit CA-E100T connected: 1 3D camera per CA-E100T, 2 cameras max. with 2 camera input units • With XT camera input unit CA-E200T connected: 1 XT camera per CA-E200T, 2 cameras max. with 2 camera input units
	Trigger input	Simultaneous/individual capture with up to 4 cameras/heads can be selected (up to 2 cameras/heads for simultaneous capture when one camera input unit is connected)	
Supported cameras/ Number of pixels	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 • 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
	High-speed line scan camera	• CA-HL08MX 8192 (H) × 8192 (L), approx. 67.11 megapixels • CA-HL04MX 4096 (H) × 16384 (L), approx. 67.11 megapixels	• CA-HL02MX 2048 (H) × 16384 (L), approx. 33.55 megapixels
	XR camera	• XR-HT40M 2048 (H) × 2048 (L), approx. 4.19 megapixels	• XR-HT15M 1408 (H) × 1408 (L), approx. 1.98 megapixels
	XT camera	• XT-024/060 3072 (H) × 3072 (V), approx. 9.44 megapixels	
Main image processor		DSP (Fast type)	
Program memory		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	
Screen capacity		Maximum 1000 screens for each program (depending on SD card size), Image compression, Support for image registration and partial image registration from a position-corrected image, Externally switchable according to variables.	
Memory card		• SD card slot × 2 • Supports OP-87133 (512 MB), CA-SD1G (1 GB), CA-SD4G (4 GB: standard equipment on the SD1 slot), and CA-SD16G (16 GB)	
Image archive		Can store the image amounts listed below as an archive to the image memory of the main unit	
	Area camera	• Max. 29005 images (monochrome camera, 0.24 megapixels) • Max. 23241 images (monochrome camera, 0.31 megapixels) • Max. 15306 images (monochrome camera, 0.47 megapixels) • Max. 3732 images (monochrome camera, 2 megapixels) • Max. 1421 images (monochrome camera, 5 megapixels) • Max. 307 images (monochrome camera, 21 megapixels)	• Max. 28297 images (colour camera, 0.24 megapixels) • Max. 22744 images (colour camera, 0.31 megapixels) • Max. 15043 images (colour camera, 0.47 megapixels) • Max. 3675 images (colour camera, 2 megapixels) • Max. 1386 images (colour camera, 5 megapixels) • Max. 292 images (colour camera, 21 megapixels)
	Line Scan Camera	• Max. 185 images (CA-HL02MX continuous capture, 2048 × 16384 pixels) • Max. 387 images (CA-HL02MX continuous capture, 2048 × 8192 pixels) • Max. 185 images (CA-HL02MX individual capture, 2048 × 16384 pixels) • Max. 88 images (CA-HL04MX, continuous capture, 4096 × 16384 pixels)	• Max. 182 images (CA-HL04MX continuous capture, 4096 × 8192 pixels) • Max. 88 images (CA-HL04MX individual capture, 4096 × 16384 pixels) • Max. 85 images (CA-HL08MX continuous capture, 8192 × 8192 pixels) • Max. 88 images (CA-HL08MX individual capture, 8192 × 8192 pixels)
	XR camera	• Max. 1170 images (XR 15 mm type, height image and greyscale image saved) • Max. 4729 images (XR 15 mm type, binning: ON, height image and greyscale image saved)	• Max. 540 images (XR 40 mm type, height image and greyscale image saved) • Max. 2231 images (XR 40 mm type, binning: ON, height image and greyscale image saved)
	XT camera	• Max. 534 images (XT-024/060, binning ON, or binning OFF with narrow field of view)	• Max. 125 images (XT-024/060, binning OFF, or binning ON with expansion)
Interface	Assignable input	• 20 connection points (including four high-speed terminals that can be assigned to trigger input) • Input rating: 26.4 V or lower, or 1.2 mA or greater (2.2 mA or greater for high-speed input terminals)	
	Assignable output	• 28 connection points (including four high-speed terminals that can be assigned to external trigger-linked FLASH output) • Photo MOSFET*2: Max.50 mA (30 V or less)	
	Encoder input	• When the CA-E100L/E200L is connected: 2 inputs per unit, 4 inputs total for 2 units max. • RS-422 line-driver output (Multi-drop support*3, Supports 5 V output included: max. 150 mA) and open collector output (24 V devices only with CA-E100L/E200L) included	
	Monitor output	Analogue RGB output, XGA (1024 × 768, 24-bit colour)	
	Unit indicators	Power, ERROR LED display	
	RS-232C	• Functionality switchable between numerical data output, control input/output, and CA Series touch panel interface (Cannot be used in conjunction with PLC links using RS-232C) • Supports a maximum baud rate of 230400 bps	
	PLC link	• Numerical data output and control input/output enabled via the RS-232C port or Ethernet port (Cannot be used in conjunction with CC-Link, EtherNet/IP®, PROFINET or EtherCAT®) • The following PLCs are supported via link unit*4: 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 Series, SYSMAC C Series (RS-232C only), SYSMAC CP1 Series YASKAWA Electric Corporation: MP2000 Series/MP900 Series (RS-232C only)	
	Ethernet	• Can output numerical values and perform control input/output • Connecting to KEYENCE PC application software enables not only the above functions but also makes it possible to upload and download inspection settings, perform a variety of simulations, send and receive a variety of data including image data, and use the remote desktop function. • Supports FTP client and server functions, an SFTP Client function, a VNC server function (for non-PC clients, only displaying the monitor screen is supported), and a BOOTP function • Jumbo frame support (when connected to CA-NEC20E/NEP20E/NPN20)	
	USB	• Connecting to KEYENCE PC application software makes it possible to output numerical values, perform control I/O, upload and download inspection settings, perform a variety of simulations, send and receive a variety of data including image data, and use the remote desktop function. • Dedicated to USB 2.0	
	CC-Link	• By connecting the optional CC-Link unit CA-NCL20E, numerical value output and control input/output are enabled (Cannot be used in conjunction with PLC-Link, EtherNet/IP®, PROFINET or EtherCAT®) • Supports ver. 1.10 and ver. 2.00 remote device stations	
	EtherCAT®	• Connecting the optional EtherCAT® unit CA-NEC20E enables numerical value output and control input/output (Cannot be used in conjunction with PLC-Link, CC-Link, EtherNet/IP® or PROFINET.) • Process data object communication (cyclic communication) (Input: max. 536 bytes, output: max. 532 bytes) • Message communication (non-cyclic communication) • Supports CoE • Explicit Device Identification • Conforms to conformance test V2.1.0.2.	
	EtherNet/IP®	• Numerical data input/output and control input/output enabled via the Ethernet port or optional CA-NEP20E EtherNet/IP® unit (Cannot be used in conjunction with PLC-link, CC-Link, PROFINET or 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) / CT16 (CA-NEP20E)	
	PROFINET	• Numerical data input/output and control input/output enabled via the Ethernet port or optional CA-NPN20E PROFINET unit (Cannot be used in conjunction with PLC-link, CC-Link, EtherNet/IP®, or EtherCAT®) • Supports cyclic communication (max. 1408 bytes (Ethernet port) / 1248 bytes (CA-NPN20E)) • Supports non-cyclic communication (recorded data) • Conforms to Conformance Class A (Ethernet port) / C (CA-NPN20E)	
	SNTP	Unit's date and time auto-corrects when unit is connected to SNTP server	
	USB console	• Possible to control various menus via an optional USB console (OP-87983) • Supports the assignment of operations to console buttons	
	Mouse	Possible to control various menus via an optional dedicated mouse (OP-87506)	
	Touch panel	• Settings can be operated from a CA Series touch panel using the RS-232C port (Cannot be used in conjunction with RS-232C no-protocol communication or PLC links using RS-232C) • Supports dedicated touch menus and operation buttons	
	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	
Language		Japanese/English/Simplified Chinese/Traditional Chinese/German (initial language set at first startup)	
Illumination control		By connecting the optional light expansion unit CA-DC40E/DC50E/DC60E, lighting and intensity control for the LED illumination is possible.*5	
Cooling fan		CA-F100 fan unit is included (attached) to the controller.	
Rating	Voltage	24 VDC ±10%	
	Current consumption	5.3 A	
Environmental resistance	Operating ambient temperature	0 to 45°C (when installed on a DIN rail)/0 to 40°C (when installed on a surface)	
	Operating ambient humidity	35 to 85% RH (no condensation)	
Weight		Approx. 1750 g	

*1 At least one camera input unit is required (controller has no built-in camera inputs). *2 The output common can be configured for NPN or PNP input devices.
*3 Supported on the CA-E100L/E200L. *4 Models equipped with the Ethernet port in the CPU unit support Ethernet port direct connection. *5 Up to 8 light control expansion units can be connected (max. two CA-DC50E/DC60E units out of 8).

Controller (XG-X1500/XG-X1200/XG-X1000)

Model		XG-X1500	XG-X1200	XG-X1000
Camera input		Two colour/monochrome cameras Up to 4 inputs can be connected by connecting 1 optional area camera input unit CA-E100.		
	Trigger input	Simultaneous/individual capture with up to 4 cameras can be selected (up to 2 cameras for simultaneous capture when the CA-E100 is not connected)		
Supported cameras/ Number of pixels		• 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	• 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-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
Main image processor		DSP		
Program memory		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		
Screen capacity		Maximum 1000 screens for each program (depending on SD card size), Image compression, Support for image registration and partial image registration from a position-corrected image, Externally switchable according to variables.		
Memory card		• SD card slot × 2 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 Supports OP-87133 (512 MB: standard equipment on the SD1 slot), CA-SD1G (1 GB), CA-SD4G (4 GB), and CA-SD16G (16 GB)	
Image archive		Can store the image amounts listed below as an archive to the image memory of the main unit		
		• Max. 7341 images (monochrome camera, 0.24 megapixels) • Max. 5881 images (monochrome camera, 0.31 megapixels) • Max. 3871 images (monochrome camera, 0.47 megapixels) • Max. 939 images (monochrome camera, 2 megapixels) • Max. 344 images (monochrome camera, 5 megapixels) • Max. 7156 images (colour camera, 0.24 megapixels) • Max. 5749 images (colour camera, 0.31 megapixels) • Max. 3798 images (colour camera, 0.47 megapixels) • Max. 905 images (colour camera, 2 megapixels) • Max. 315 images (colour camera, 5 megapixels)	• Max. 1924 images (monochrome camera, 0.24 megapixels) • Max. 1541 images (monochrome camera, 0.31 megapixels) • Max. 1012 images (monochrome camera, 0.47 megapixels) • Max. 241 images (monochrome camera, 2 megapixels) • Max. 1871 images (colour camera, 0.24 megapixels) • Max. 1501 images (colour camera, 0.31 megapixels) • Max. 987 images (colour camera, 0.47 megapixels) • Max. 213 images (colour camera, 2 megapixels)	• Max. 1098 images (monochrome camera, 0.24 megapixels) • Max. 878 images (monochrome camera, 0.31 megapixels) • Max. 576 images (monochrome camera, 0.47 megapixels) • Max. 1065 images (colour camera, 0.24 megapixels) • Max. 852 images (colour camera, 0.31 megapixels) • Max. 558 images (colour camera, 0.47 megapixels)
Interface	Assignable input	• 20 connection points (including four high-speed terminals that can be assigned to trigger input) • Input rating: 26.4 V or lower, or 1.2 mA or greater (2.2 mA or greater for high-speed input terminals)		
	Assignable output	• 28 connection points (including four high-speed terminals that can be assigned to external trigger-linked FLASH output) • Photo MOSFET*1: Max. 50 mA (30 V or less)		
	Monitor output	Analogue RGB output, XGA (1024 × 768, 24-bit colour)		
	Unit indicators	Power, ERROR LED display		
	RS-232C	• Functionality switchable between numerical data output, control input/output, and CA Series touch panel interface (Cannot be used in conjunction with PLC links using RS-232C) • Supports a maximum baud rate of 230400 bps		
	PLC link	• Can output numerical values and perform control input/output using the Ethernet or RS-232C port (Cannot be used in conjunction with PLC-Link, EtherNet/IP® or PROFINET.) • The following PLCs are supported via link unit*2: 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 • Connecting to KEYENCE PC application software enables not only the above functions but also makes it possible to upload and download inspection settings, perform a variety of simulations, send and receive a variety of data including image data, and use the remote desktop function. • Supports FTP client and server functions, an SFTP Client function, a VNC server function (for non-PC clients, only displaying the monitor screen is supported), and a BOOTP function • Jumbo frame support (when connected to CA-NEC20E/NEP20E/NPN20)		
	USB	• Connecting to KEYENCE PC application software makes it possible to output numerical values, perform control I/O, upload and download inspection settings, perform a variety of simulations, send and receive a variety of data including image data, and use the remote desktop function. • Dedicated to USB 2.0		
	CC-Link	• By connecting the optional CC-Link unit CA-NCL20E, numerical value output and control input/output are enabled (Cannot be used in conjunction with EtherNet/IP®, PROFINET or EtherCAT®) • Supports ver. 1.10 and ver. 2.00 remote device stations		
	EtherNet/IP®	• Numerical data input/output and control input/output enabled via the Ethernet port or optional CA-NEP20E EtherNet/IP® unit (Cannot be used in conjunction with PLC-link, CC-Link, PROFINET or 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) / CT16 (CA-NEP20E)		
	PROFINET	• Numerical data input/output and control input/output enabled via the Ethernet port or optional CA-NPN20E PROFINET unit (Cannot be used in conjunction with PLC-link, CC-Link, EtherNet/IP®, or EtherCAT®) • Supports cyclic communication (max. 1408 bytes (Ethernet port) / 1248 bytes (CA-NPN20E)) • Supports non-cyclic communication (recorded data) • Conforms to Conformance Class A (Ethernet port) / C (CA-NPN20E)		
	EtherCAT®	• Connecting the optional EtherCAT® unit CA-NEC20E enables numerical value output and control input/output (Cannot be used in conjunction with PLC-Link, CC-Link, EtherNet/IP® or PROFINET.) • Process data object communication (cyclic communication) (Input: max. 536 bytes, output: max. 532 bytes) • Message communication (non-cyclic communication) • Supports CoE • Explicit Device Identification • Conforms to conformance test V2.1.0.2.		
	SNTP	Unit's date and time auto-corrects when unit is connected to SNTP server		
	USB console	• Possible to control various menus via an optional USB console (OP-87983) • Supports the assignment of operations to console buttons		
	Mouse	Possible to control various menus via an optional dedicated mouse (OP-87506)		
	Touch panel	• Settings can be operated from a CA Series touch panel using the RS-232C port (Cannot be used in conjunction with RS-232C no-protocol communication or PLC links using RS-232C) • Supports dedicated touch menus and operation buttons		
	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		
Language		Japanese/English/Simplified Chinese/Traditional Chinese/German (initial language set at first startup)		
Illumination control		By connecting the optional light expansion unit CA-DC40E/DC50E, lighting and intensity control for the LED illumination is possible.*3		
Cooling fan		None		
Rating	Voltage	24 VDC ±10%		
	Current consumption	3.8 A		3.1 A
Environmental resistance	Operating ambient temperature	0 to 45°C (when installed on a DIN rail)/0 to 40°C (when installed on a surface)		
	Operating ambient humidity	35 to 85% RH (no condensation)		
Weight		Approx. 1600 g		

*1 Positive common connections supporting NPN input devices and negative common connections supporting PNP input devices are both possible.
*2 Models equipped with the Ethernet port in the CPU unit support Ethernet port direct connection.
*3 Up to 8 light control expansion units can be connected (max. two CA-DC50E units out of 8).

Camera (CA-HF6400M/CA-HF6400C)

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

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

Camera (CA-HF2100M/CA-HF2100C)

LumiTrax™

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

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

Camera (CA-H500CX/H500MX)

LumiTrax™/Multi-Spectrum/LumiTrax™ specular-reflection mode/Pattern projection

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

Camera (CA-H200CX/H200MX)

LumiTrax™/Multi-Spectrum/LumiTrax™ specular-reflection mode/Pattern projection

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

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Camera (CA-H048CX/H048MX)

LumiTrax™/Multi-Spectrum/LumiTrax™ specular-reflection mode/Pattern projection

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

Camera (CA-H500C/CA-H500M)

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

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

Camera (CA-H200C/CA-H200M)

Model		CA-H200C	CA-H200M
Image receiving element		Colour CMOS, 7×/11×/16× high-speed reading using square-pixel	Monochrome CMOS, 7×/11×/16× high-speed reading using square-pixel
Unit cell size		4.5 µm × 4.5 µm	
Image size		Equivalent to 1/1.8"	
Valid pixel count		2 megapixel mode: 1600 (H) × 1200 (V), 1 megapixel mode: 1024 (H) × 960 (V),	
Scanning system		Progressive At 7× transfer speed: 28.9 ms *1, At 16× transfer speed: 11.8 ms *2	
Pixel transfer frequency		At 7× transfer speed: 86 MHz (43 MHz × 2) *1, At 16× transfer speed: 198 MHz *2	
Transfer system		Digital serial transfer	
Electronic shutter		Can be set to 0.05 to 9000 msec by specifying the following numerical inputs: 1/15, 1/30, 1/60, 1/120, 1/240, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/20000	
Lens mount		C-mount	
Enclosure rating		IP64*3	
Environmental resistance	Operating ambient temperature	0 to 45°C	
	Operating ambient humidity	35 to 85%RH	
Weight		Approx. 75 g (not including lens)	

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

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

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

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

Camera (CA-HS200C/CA-HS200M)

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

*1 Transfer speed setting: Standard
*2 Transfer speed setting: Fast

Camera (CA-H035C/CA-H035M)

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

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

Camera (CA-035C/CA-035M)

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

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

Camera (CA-HS035C/CA-HS035M)

Model	Camera unit	CA-HS035CH	CA-HS035MH
	Relay unit	CA-HS035CU	CA-HS035MU
Image receiving element		Colour CMOS, 7× high-speed reading using square-pixel	Monochrome CMOS, 7× high-speed reading using square-pixel
Unit cell size		7.4 µm × 7.4 µm	
Image size		Equivalent to 1/3"	
Valid pixel count		0.31 megapixel mode: 640 (H) × 480 (V), 0.24 megapixel mode: 512 (H) × 480 (V)	
Scanning system		Progressive 4.5 ms	
Pixel transfer frequency		86 MHz (43 MHz × 2)	
Transfer system		Digital serial transfer	
Electronic shutter		Can be set to 0.05 to 100 msec by specifying the following numerical inputs: 1/15, 1/30, 1/60, 1/120, 1/240, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/20000	
Lens mount		Special mount (M10.5 P0.5 male)	
Environmental resistance	Operating ambient temperature	0 to 40°C	
	Operating ambient humidity	35 to 85%RH	
Weight	Camera unit	Approx. 135 g (cable included, lens not included)	
	Relay unit	Approx. 75 g (not including lens)	

High-speed transmission line scan camera (CA-HL02MX/HL04MX/HL08MX)

LumiTrax™ specular-reflection mode compatible

Model		CA-HL02MX		CA-HL04MX			CA-HL08MX	
Image receiving element		15.4 mm monochrome CMOS image receiving element, 30× high-speed reading using square-pixel		15.4 mm monochrome CMOS image receiving element, 32× high-speed reading using square-pixel			30.8 mm monochrome CMOS image receiving element, 64× high-speed reading using square-pixel	
Unit cell size		15 µm × 7.5 µm*1	7.5 µm × 7.5 µm	15 µm × 7.5 µm*1	7.5 µm × 7.5 µm	3.75 µm × 3.75 µm	7.5 µm × 7.5 µm	3.75 µm × 3.75 µm
Valid pixel count	Processing area (individual)	1024 pixels 1024 (H) × 16384 (L) 1024 (H) × 8192 (V)	2048 pixels 2048 (H) × 16384 (L) 2048 (H) × 8192 (V)	1024 pixels 1024 (H) × 16384 (L) 1024 (H) × 8192 (V)	2048 pixels 2048 (H) × 16384 (L) 2048 (H) × 8192 (V)	4096 pixels 4096 (H) × 16384 (L) 4096 (H) × 8192 (V)	4096 pixels 4096 (H) × 16384 (L) 4096 (H) × 8192 (V)	8192 pixels 8192 (H) × 8192 (L) 8192 (H) × 8192 (V)
	Processing area (continuous)							
Minimum scan time		6.1 µs (165 kHz)*2		6.1 µs (165 kHz)*2		10.2 µs (97.7 kHz)*2	6.1 µs (165 kHz)*2	10.2 µs (97.7 kHz)*2
	LumiTrax (in specular reflection mode)	48.5 µs (20.6 kHz)*2		48.5 µs (20.6 kHz)*2		81.9 µs (12.2 kHz)*2	48.5 µs (20.6 kHz)*2	81.9 µs (12.2 kHz)*2
Pixel transfer frequency		188 MHz, 15×	375 MHz, 30×	188 MHz, 15×	375 MHz, 30×	400 MHz, 32×	750 MHz, 60×	800 MHz, 64×
Transfer system		Digital serial transfer						
Electronic shutter		User-defined settings (2 µs to 20000 µs, max. shutter speed limited to 4 µsec less than line scan interval during operation)						
Function		Shading correction (setting saved in camera)						
		Installation auxiliary function (LED pointer / Mounting angle monitor)						
		Binning function						
Lens mount		C-mount		C-mount			Special mount (M40 P0.75)	
Environmental resistance	Ambient temperature	0 to 40°C						
	Ambient humidity	35 to 85% RH (No condensation)						
Weight		Approx. 350 g (not including lens)		Approx. 350 g (not including lens)			Approx. 310 g (not including lens)	

*1 When using the binning function to use information from multiple image receiving elements for individual pixel data.
*2 When the line scan interval is configured for use with an encoder. When time-specified, the scan time may be lengthened by up to 1 µsec.

XT camera

Model		XT-024	XT-060
		24 mm type	60 mm type
Image sensor		Monochrome CMOS image sensor	
Image size (3D)		3072 × 3072 (1536 × 1536) pixels	3072 × 3072 (1536 × 1536) pixels
	XY data interval	7.85 µm (15.7 µm)	19.6 µm (39.2 µm)
Image size (2D)		3072 × 3072 (1536 × 1536) pixels	3072 × 3072 (1536 × 1536) pixels
	XY data interval	7.85 µm (15.7 µm)	19.6 µm (39.2 µm)
XYZ repeatability (σ)*1		0.5 µm*2	1 µm*2
Measurement accuracy	Height difference	±10 µm*3	±20 µm*3
	Width	±10 µm*3	±20 µm*3
Shutter speed		50 µs to 200 ms	50 µs to 200 ms
XY field of view	Near/Reference distance/Far	24.1 × 24.1 mm	60.2 × 60.2 mm
Z range (from reference distance)		±2 mm	±6 mm
WD (to standard surface)		200 mm	
Light source		LED (red, green, blue); Individually configurable up to 100 steps	
Connection		XG-X2900/X2800	
Display	LED display	Power supply, Operation mode	
Rating	Power voltage	24 VDC ±10%	
	Current consumption	3 A	
Environmental resistance	Operating ambient temperature	0 to 40°C	
	Operating ambient humidity	20 to 85% RH (no condensation)	
Dimensions		286 × 286 × 286 mm	
Weight		9.7 kg	10.1 kg

*1 When using an averaging filter (3 × 3) and a KEYENCE standard workpiece (binning ON). *2 Repeatability at centre of field of view ([60 mm type] Centre: 30 × 30 mm, [24 mm type] Centre: 12 × 12 mm).
*3 Using a KEYENCE height difference gauge. [60 mm type] Height difference: 2 mm/Width: 20 mm; [24 mm type] Height difference: 1 mm/Width: 10 mm

XR camera

Model		XR-HT15M	XR-HT40M	XR-HT15MD	XR-HT40MD
Image sensor		Monochrome CMOS image receiving element			
Image size in pixels*5		1408 × 1408 (704 × 704)	2048 × 2048 (1024 × 1024)	1408 × 1408 (704 × 704)	2048 × 2048 (1024 × 1024)
Shutter speed		50 µs to 200 ms	50 µs to 200 ms	50 µs to 200 ms	50 µs to 200 ms
Reference distance		84 mm			
Field of view XY	Near (FOV during XY normalisation)	12.3 × 12.3 mm (12.5 mm)	33.9 × 33.9 mm (35.0 mm)	12.3 × 12.3 mm (12.5 mm)	33.9 × 33.9 mm (35.0 mm)
	Reference distance	12.5 × 12.5 mm	35.5 × 35.5 mm	12.5 × 12.5 mm	35.5 × 35.5 mm
	Far	12.6 × 12.6 mm	37.0 × 37.0 mm	12.6 × 12.6 mm	37.0 × 37.0 mm
Z range (from reference distance)		±1.5 mm	±5 mm	±1.5 mm	±5 mm
Repeatability (σ) X, Y, Z		1 µm*1	2 µm*1	1 µm*1	2 µm*1
Data interval X, Y		9.5 µm (19 µm)	18.5 µm (37 µm)	9.5 µm (19 µm)	18.5 µm (37 µm)
Light source		LED (blue, red)			
Connected to		XG-X2800(P) + CA-E100T		1000Base-T-compliant PC and Ethernet card*2	
Image transfer method		Digital serial transfer		GigE Vision™	
Rating	Power supply voltage	-		24 V ±10%	
	Current consumption	-		1.2 A*3	
Functions		Image capture functions (height image, greyscale image), auxiliary functions (cross mark display, reference plane correction, 3D calibration)			
Environmental resistance	Ambient temperature*4	0°C to 40°C			
	Ambient humidity	35 to 85% RH (no condensation)			
	Vibration resistance	10 to 57 Hz: 0.75 mm p-p, 57 to 500 Hz: 5G, in X, Y, and Z directions, 3 hours respectively			
	Impact resistance	15 G/6 msec			
Dimensions		250.5 × 120.5 × 54 mm			
Weight		Approx. 2.5 kg	Approx. 2.4 kg	Approx. 2.5 kg	Approx. 2.4 kg

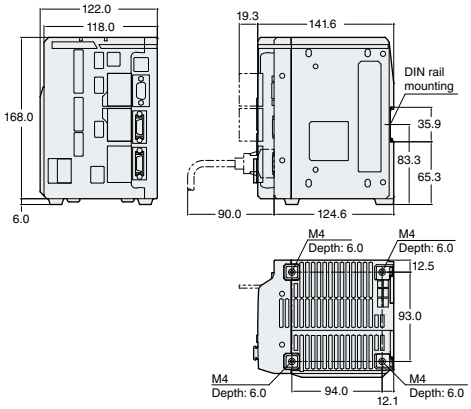
*1 Value for KEYENCE standard plane workpieces when binning is ON and a 3 × 3 average filter is used once. *2 • 1000Base-T-compliant PC and network card (NIC) are required. Intel® Gigabit Server Adapter or its equivalent is recommended. • Connections to LANs and connections through a switch or router are not covered under warranty. By using multiple network cards, up to 4 cameras can be simultaneously connected to 1 PC unit. *3 Steady state value. Select a power supply with sufficient capacity by taking inrush current into consideration. *4 0°C to 35°C in unidirectional light projection mode and when the trigger interval is not more than twice as long as the total exposure time. *5 Value in parentheses is with Binning ON.

Environment for running the software development kit for the PC connection model Microsoft Windows 7 Home Premium, Professional, Ultimate, Enterprise

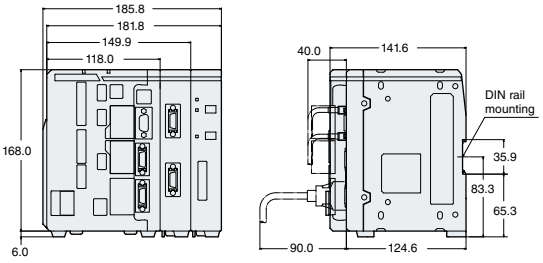
• For all operating systems, only Japanese and English versions are supported. • Supports the 64-bit version of Microsoft Windows 7 only. For all other operating systems, only the 32-bit version is supported.
• Cannot be used on operating systems not listed above. • CPU: Recommended: Intel Core-i5 2.5 GHz or higher • RAM: Recommended: 4 GB or higher • Video card: Required: Card compliant with DirectX9.0c or later, Video memory: 64 MB or more

Controller

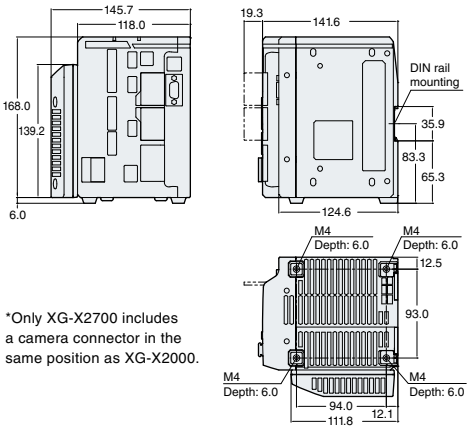
▮Controller **XG-X2000/X2200/X2500/X1000/X1200/X1500**



▮When mounting area camera input unit **CA-E100**/ Light control expansion module **CA-DC40E**

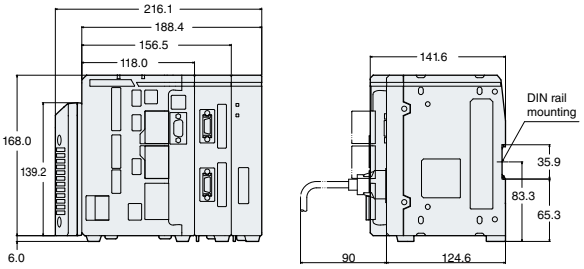


▮Controller **XG-X2700*/X2800/X2900**



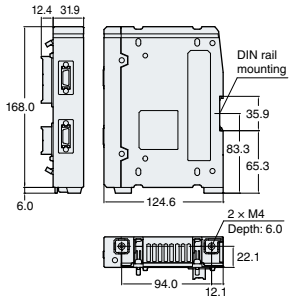
*Only XG-X2700 includes a camera connector in the same position as XG-X2000.

▮When mounting line scan camera input unit **CA-E100L***/CC-Link unit **CA-NCL20E**/ EtherCAT® unit **CA-NEC20E**/PROFINET module **CA-NPN20E**/EtherNet/IP® module **CA-NEP20E**

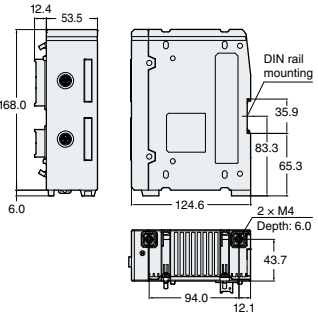


*CA-E100L can only be connected to XG-X2800.

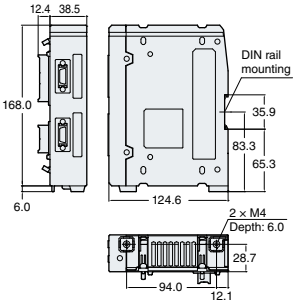
▮Area camera input unit **CA-E100**



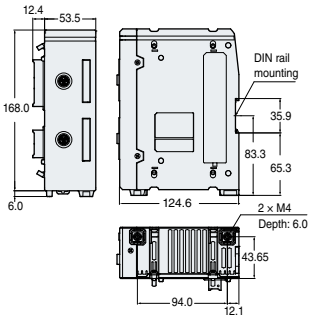
▮High-resolution area camera input unit **CA-E200**



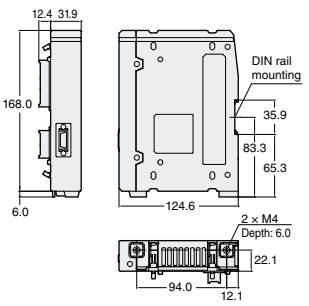
▮Line scan camera input unit **CA-E100L**



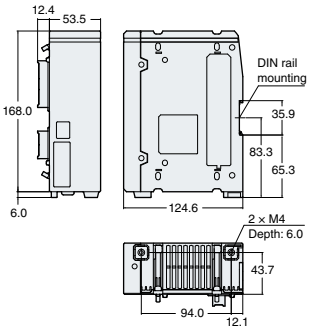
▮Line scan camera input unit **CA-E200L**



▮XR camera input unit **CA-E100T**



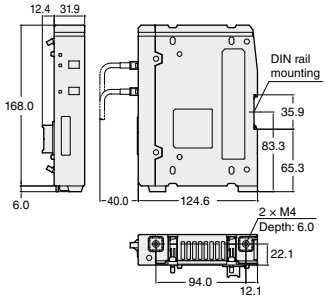
▮XT camera input unit **CA-E200T**



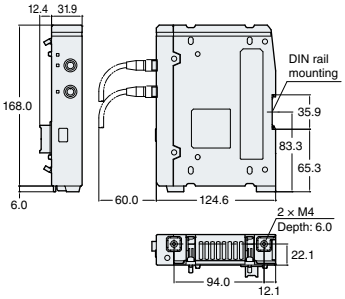
Unit: mm

Controller

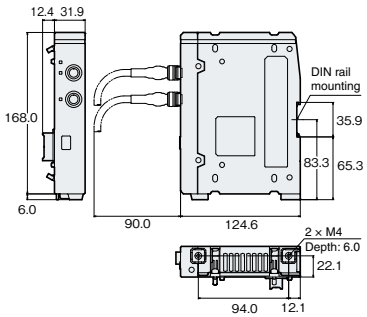
Light control expansion module **CA-DC40E**



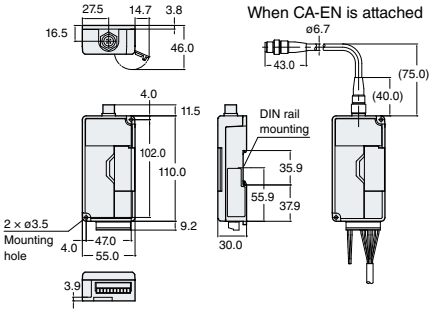
Light control expansion module **CA-DC50E**



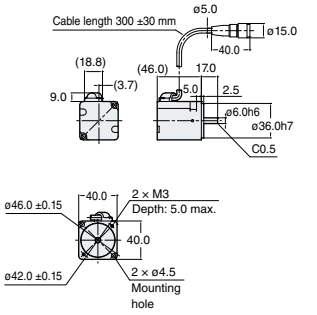
Light control expansion module **CA-DC60E**



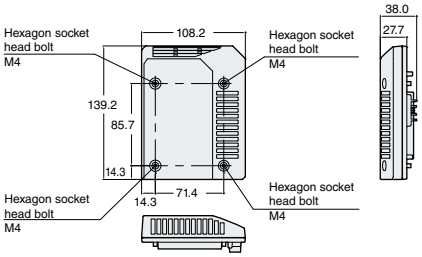
Encoder relay unit **CA-EN100U**



Dedicated encoder **CA-EN100H**

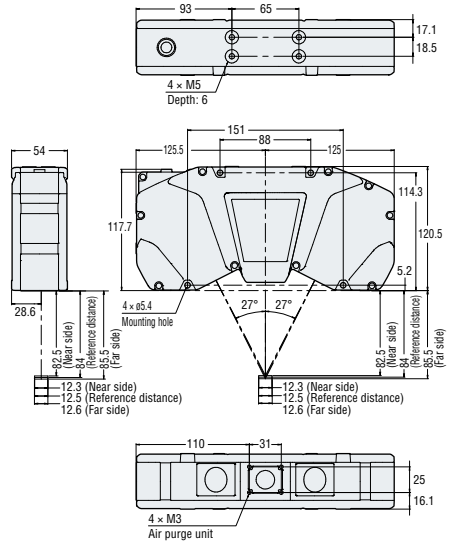


Fan unit **CA-F100**

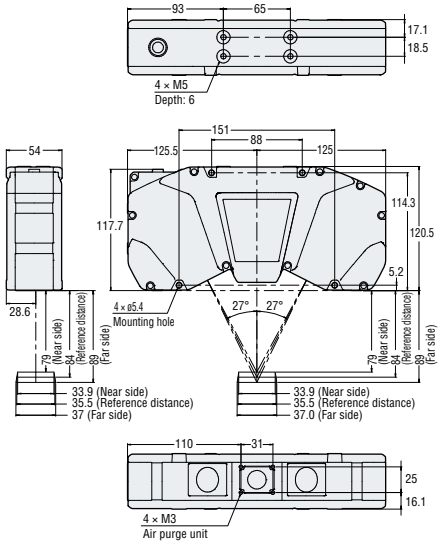


XR camera

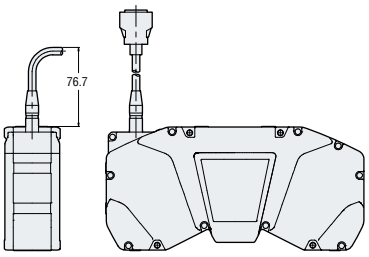
Camera **XR-HT15M**



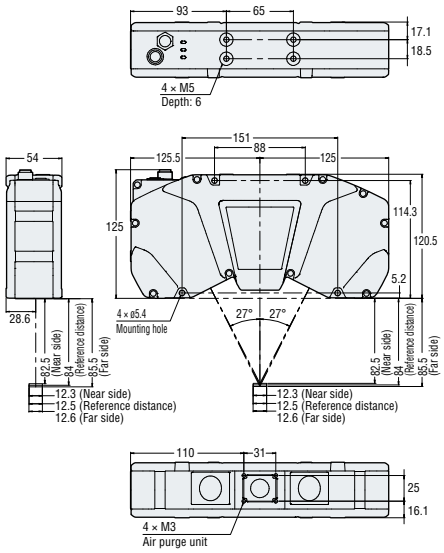
Camera **XR-HT40M**



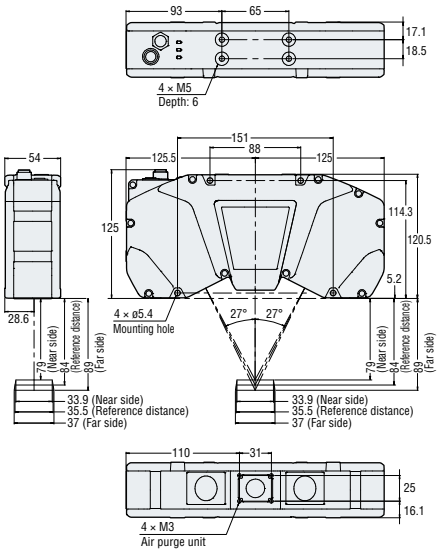
With **CA-CHx** cable



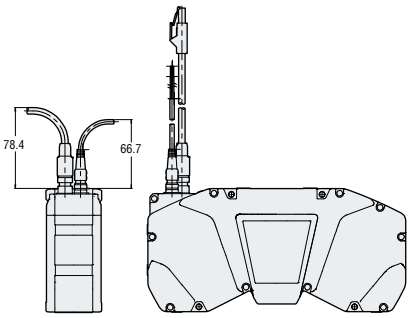
▮ Camera **XR-HT15MD**



▮ Camera **XR-HT40MD**

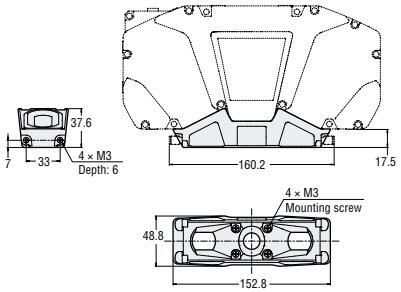


▮ With **CA-CDx/CA-CPx** cables



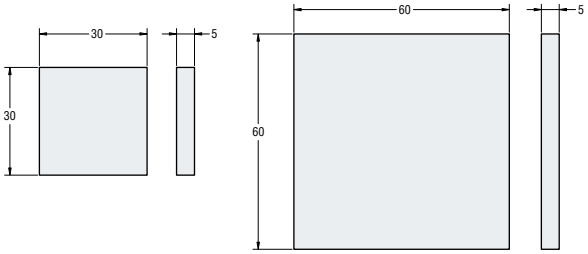
XR air purge unit

▮ Air purge unit **XR-AP1**



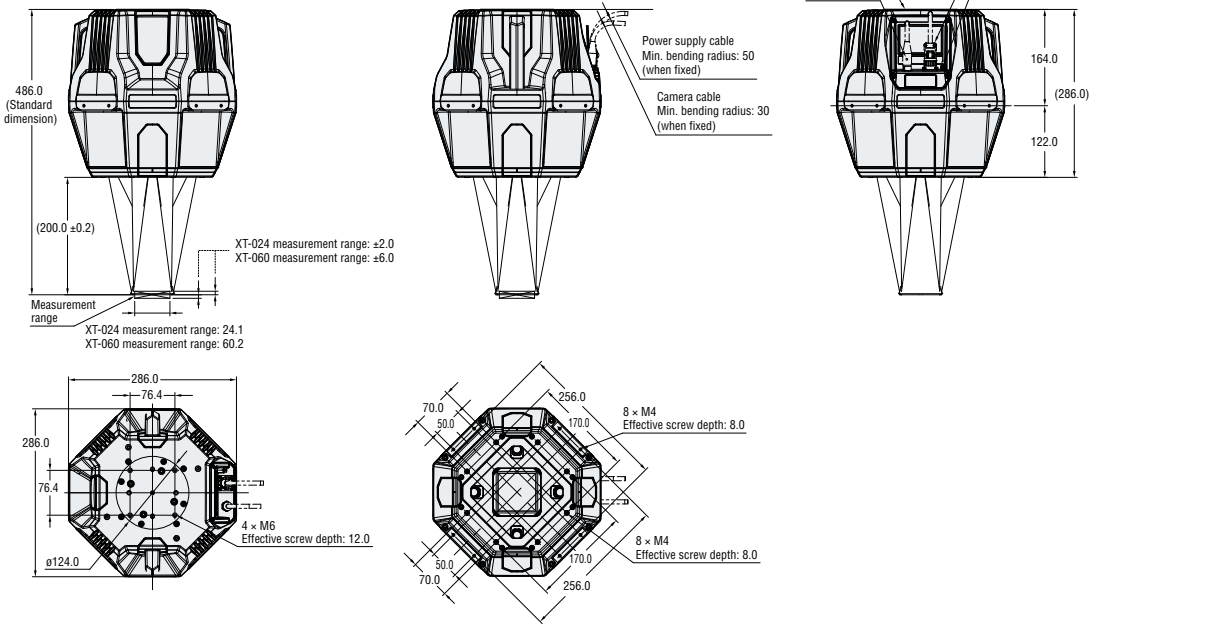
XR calibration targets

▮ For XR-HT15M(D): **OP-87740** ▮ For XR-HT40M(D): **OP-87741**



XT camera

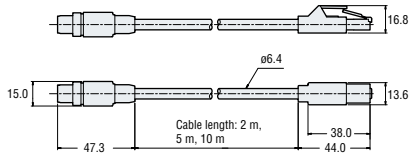
▮ Camera **XT-024/060**



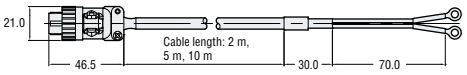
Unit: mm

XT/XR cable

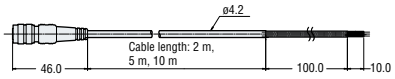
▮ XT cable/PC connection cable for XR
CA-CD2/CA-CD5/CA-CD10



▮ XT power supply cable **OP-88356/OP-88357/OP-88358**

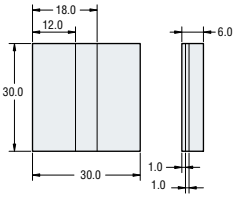


▮ XR power supply cable **CA-CP2/CA-CP5/CA-CP10**



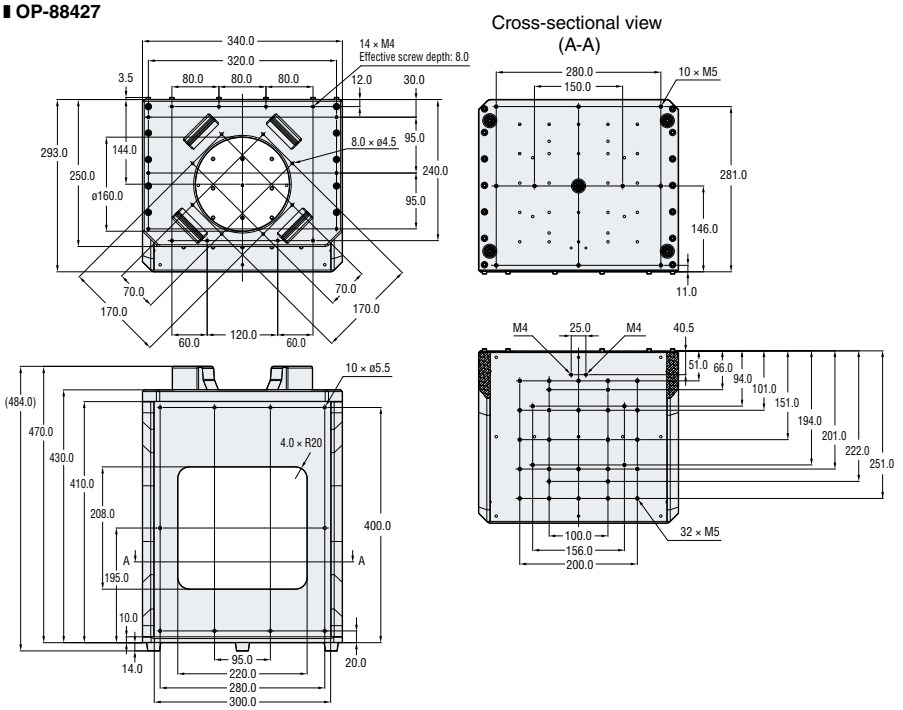
XT/XR height difference gauge

▮ Height difference gauge **OP-87742**



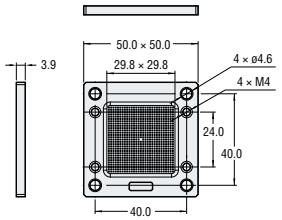
Dedicated stand for XT camera

▮ **OP-88427**

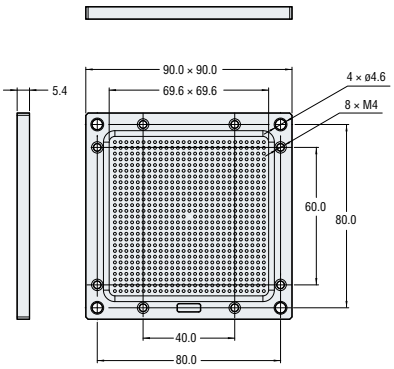


XT calibration target

▮ **OP-88400**

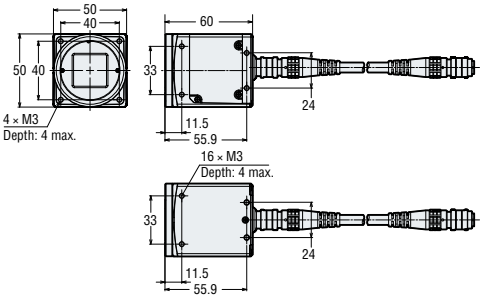


▮ **OP-88401**

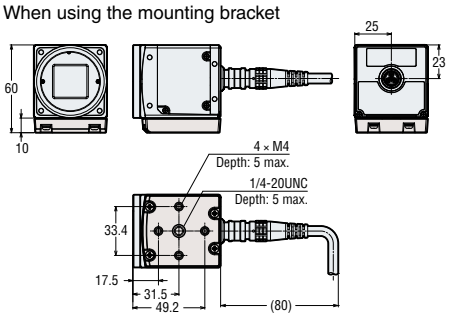


Camera

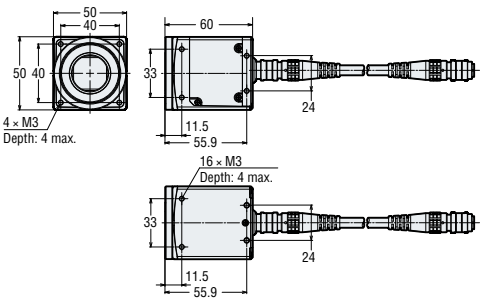
▮ Camera **CA-HF6400C/CA-HF6400M**



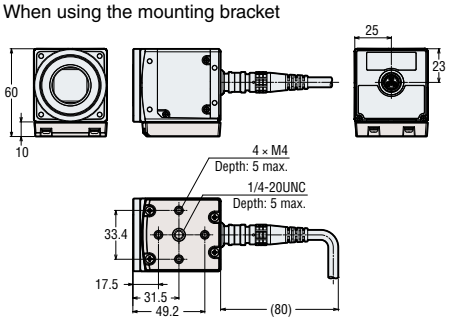
When using the mounting bracket



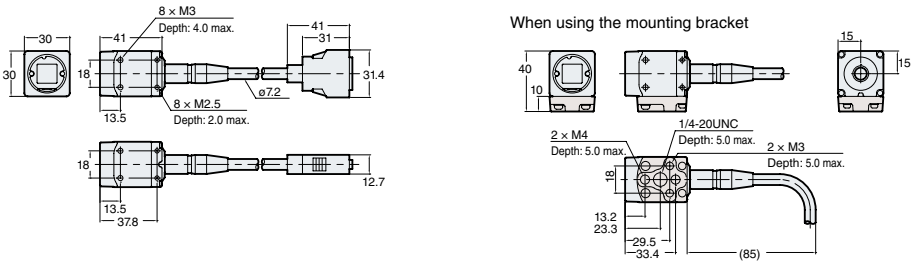
▮ Camera **CA-HF2100C/CA-HF2100M**



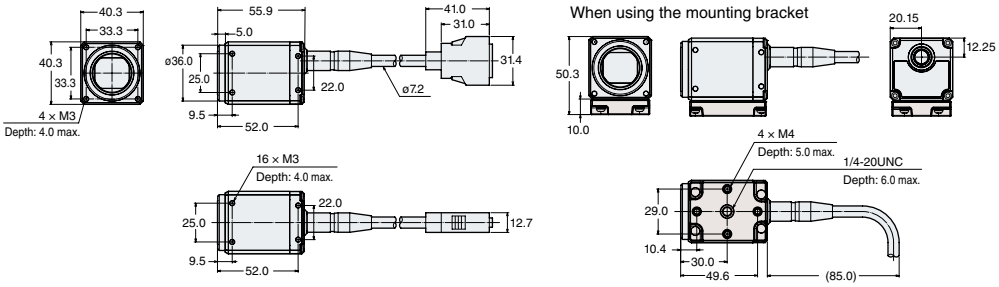
When using the mounting bracket



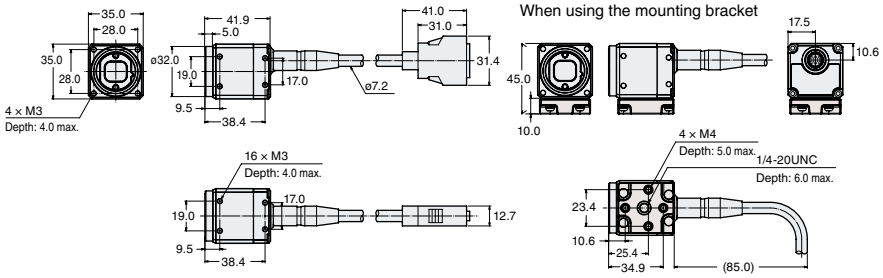
■Camera **CA-H500C/CA-H500M/CA-H200C/CA-H200M/CA-200C/CA-200M/CA-H035C/CA-H035M/CA-035C/CA-035M**



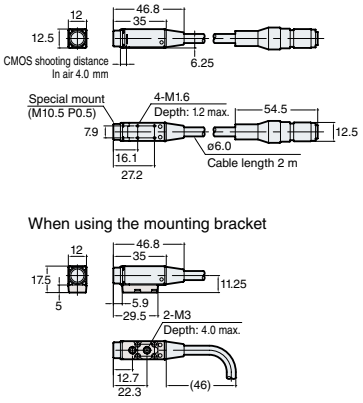
■Camera **CA-H500CX/CA-H500MX/CA-H200CX/CA-H200MX**



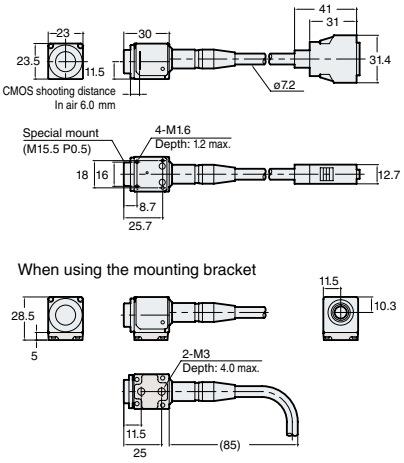
■Camera **CA-H048CX/CA-H048MX**



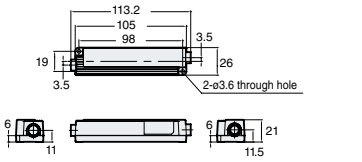
■Camera **CA-HS035CH/CA-HS035MH**



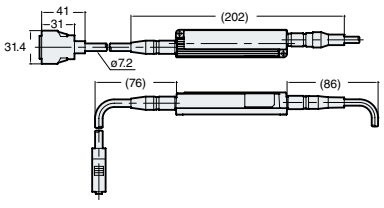
■Camera **CA-HS200C/CA-HS200M**



■ Camera control unit
CA-HS035CU/CA-HS035MU

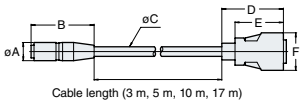


With cable connected



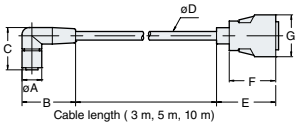
■Camera cable
CA-CH3 (3 m)/**CA-CH5** (5 m)/**CA-CH10** (10 m)

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



	A	B	C	D	E	F
CA-CHx	12.5	43.0	7.2	41.0	31.0	31.4
CA-CHxR	14.0	54.0	7.6	41.0	31.0	31.4

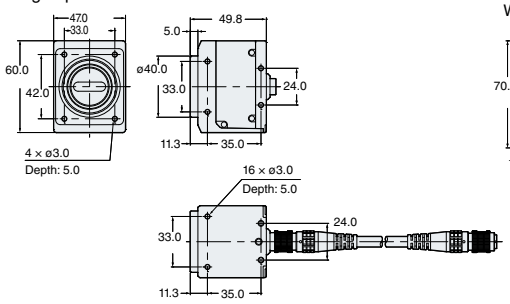
■L-shaped connector camera cable
CA-CH3L (3 m)/**CA-CH5L** (5 m)/**CA-CH10L** (10 m)



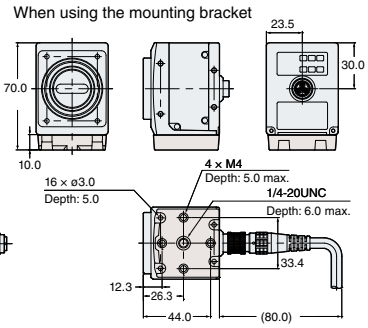
	A	B	C	D	E	F	G
CA-CHxL	14.0	38.0	30.0	7.2	41.0	31.0	31.4

Unit: mm

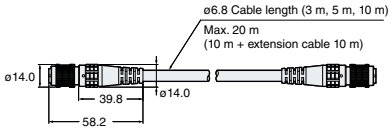
▮High-speed line scan camera **CA-HL02MX/HL04MX**



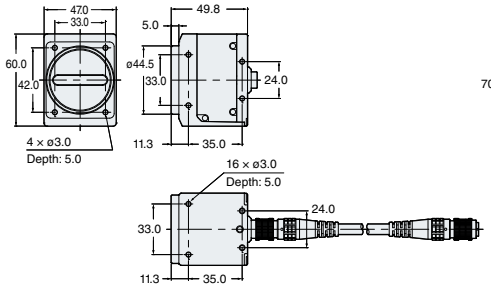
When using the mounting bracket



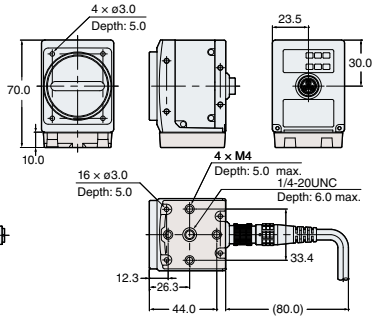
▮High-speed line scan camera cable **CA-CF3**(3 m)/**CA-CF5**(5 m)/**CA-CF10**(10 m)



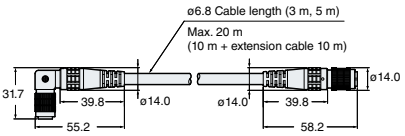
▮High-speed line scan camera **CA-HL08MX**



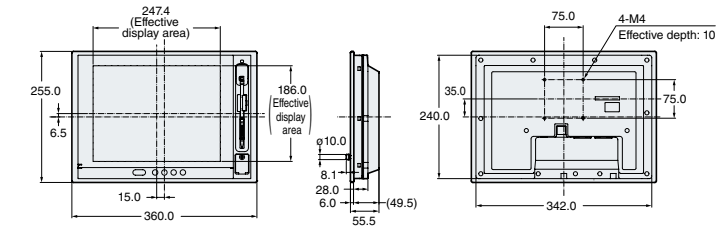
When using the mounting bracket

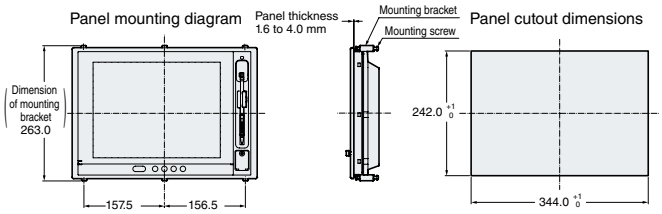


▮L-shaped connector cable for high-speed line scan cameras **CA-CF3L**(3 m)/**CA-CF5L**(5 m)/**CA-CF10L**(10 m)

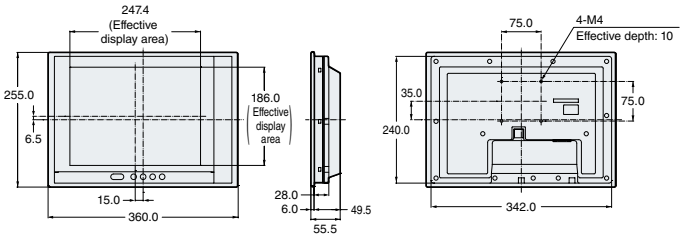


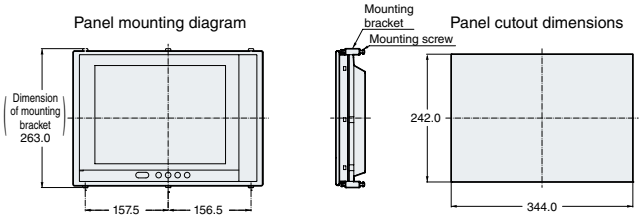
▮Touch panel HMI **CA-MP120T**



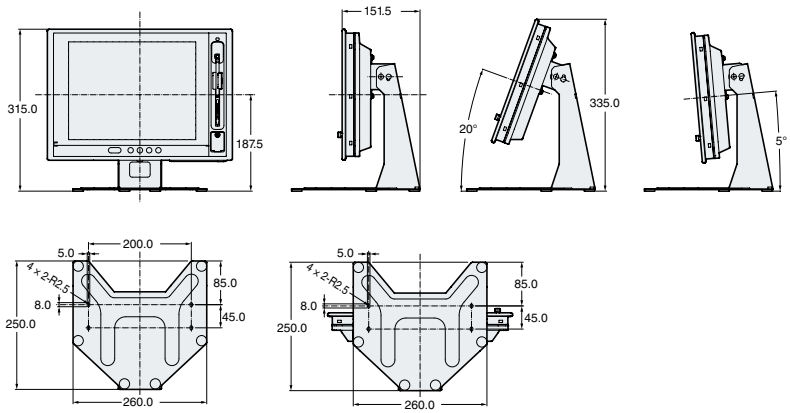


▮LCD monitor **CA-MP120**

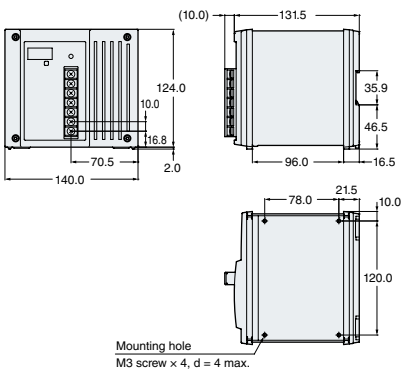




▮Monitor stand **OP-87262**



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



Refer to the Vision System Peripheral Equipment catalogue for dimension diagrams for lenses and close-up rings.

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