

## COMPREHENSIVE IMAGING TECHNOLOGY



# VISION INSPECTION



Line Scan

**SURFACE INSPECTION**



21MP Camera

**FLAW DETECTION**

**PRESENCE/ABSENCE**



IV Series



CV-X & XG-X Series

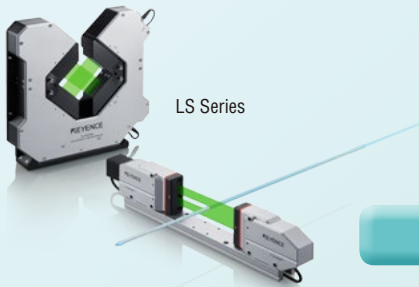
**OCR/ID READING**

# 1D

**COLOUR CHECKING**

# 2D

**EDGE MEASUREMENT**



LS Series

**GAUGING**

**1D AND 2D BARCODE**



BL/SR Series



TM Series



IM Series

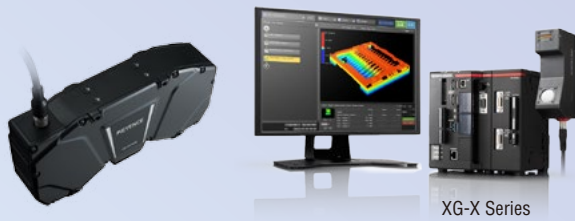
**WIDTH**

# SENSOR MEASUREMENT

## FLAW DETECTION



## 3D INSPECTION



# 3D

## ANGLE



## LINE PROFILING

## MICROSCOPES

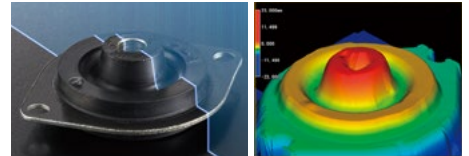
# LumiTrax™

- Intelligent illumination
- Shape Image/Texture Image
- Ultra High-speed CMOS sensor



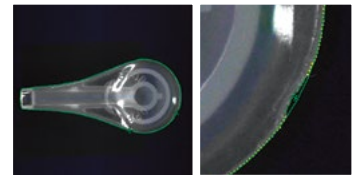
# 3D

- Height Measurement Tool
- 16-bit processing for height data
- Zero Plane specification



# 2D

- Up to 21MP camera resolution
- High-speed camera processing
- Multi-Camera System

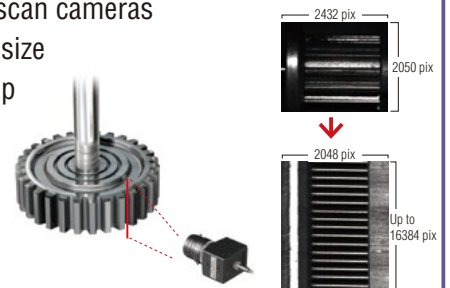


Original image

Detection of a flawed section

# LINE SCAN

- 2k, 4k & 8k Line scan cameras
- Compact camera size
- Easy camera setup








# LumiTrax™

CV-X

XG

XG-X

## CAMERA LINEUP

	5 megapixel camera	2 megapixel camera	0.31 to 0.47 megapixel camera			
	 <p>Supports LumiTrax™</p>	 <p>Supports LumiTrax™</p>	 <p>Supports LumiTrax™</p>			
Model	CA-HX500M CA-HX500C	CA-HX200M CA-HX200C	CA-HX048M		CA-HX048C	
Specs	×16 speed monochrome/ ×16 speed colour	×16 speed monochrome/ ×16 speed colour	×16 speed monochrome		×16 speed colour	
Capture range	2432 × 2040 pixels	1600 × 1200 pixels	784 × 596 pixels	512 × 480 pixels	784 × 596 pixels	512 × 480 pixels
Transfer time	27.6 ms <sup>*1</sup> /29.0 ms <sup>*1</sup> 50.3 ms <sup>*2</sup> /52.4 ms <sup>*2</sup>	11.6 ms <sup>*1</sup> /11.6 ms <sup>*1</sup> 20.1 ms <sup>*2</sup> /20.2 ms <sup>*2</sup>	2.9 ms <sup>*1</sup> 5.2 ms <sup>*2</sup>	1.7 ms <sup>*1</sup> 2.8 ms <sup>*2</sup>	2.9 ms <sup>*1</sup> 5.3 ms <sup>*2</sup>	1.7 ms <sup>*1</sup> 2.9 ms <sup>*2</sup>

\*1 When using CV-X200 Series, XG-8000 Series + CA-EC80HX/EC80L

\*2 When using the CV-X100 Series, CV-X200 Series + CA-EC80, XG-7000 Series, XG-8000 Series + CA-EC80

# LumiTrax™

A fusion of high-speed cameras with intelligent lighting and an advanced inspection algorithm

The LumiTrax™ system captures targets with a newly developed ultra high-speed camera and controlled partial lighting. The completely new capturing method analyses multiple images acquired with lighting from different directions to create shape (surface irregularity) and texture (pattern) images. This simplifies imaging that conventionally required considerable time and experience by eliminating the influence of variations in workpieces and ambient environment that prevent stable inspection.

## THE NEWLY DEVELOPED LumiTrax™ SYSTEM

Equipped with ultra high-speed CMOS sensor & dedicated control IC  
**CA-HX Series**



Equipped with ultra high-intensity LED lighting and partial illumination control circuit  
**CA-DRwxX Series**

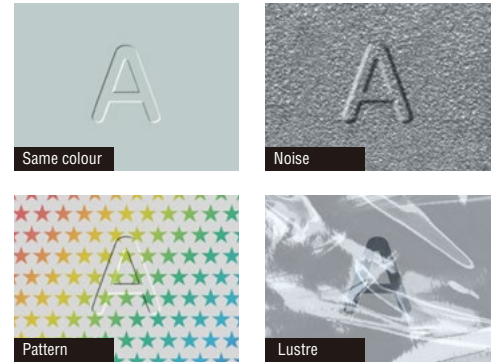


Analyses multiple images instantly to create shape and texture images  
**CV-X200 Series**  
**XG-8000 Series**

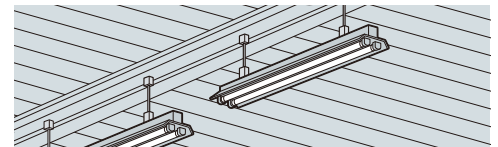


## DIFFICULTIES IN CONVENTIONAL IMAGING

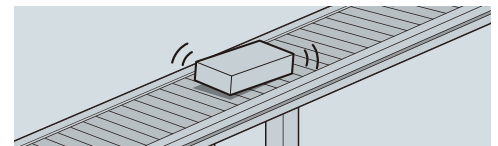
Various workpiece surface condition problems



Variable ambient environment (ambient light)



Variable workpiece orientation due to conveyance conditions

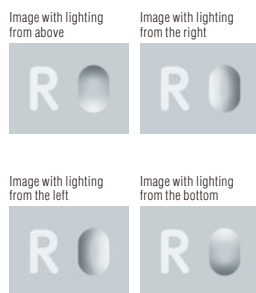
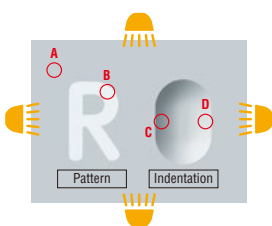


**Trial and error needed to determine the optimum lighting**

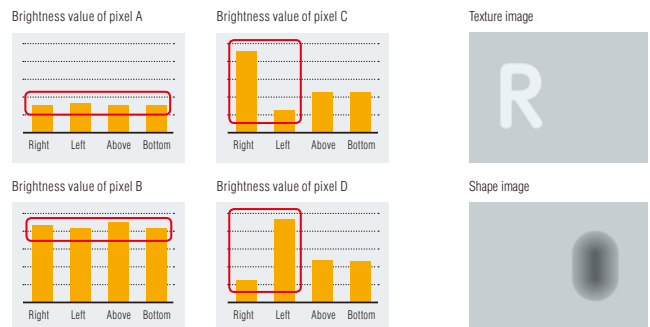


## Principle of LumiTrax™ processing



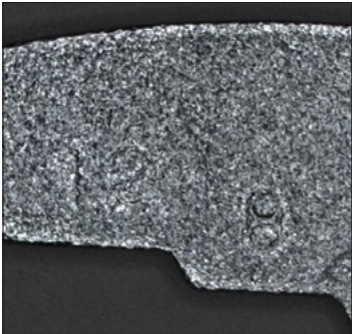
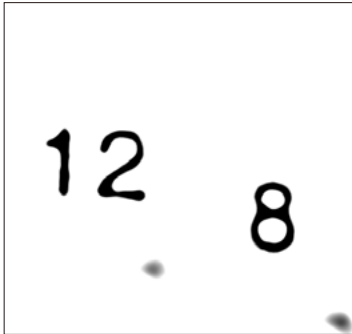
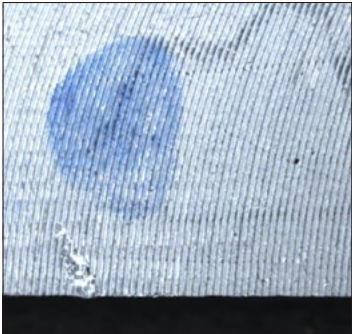


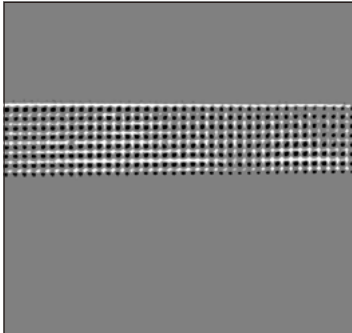
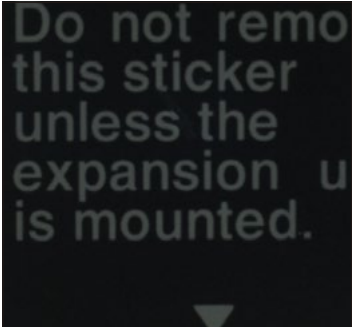

1. Ultra high-speed capture with controlled partial lighting from different directions is executed.



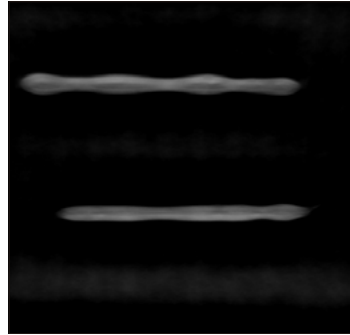
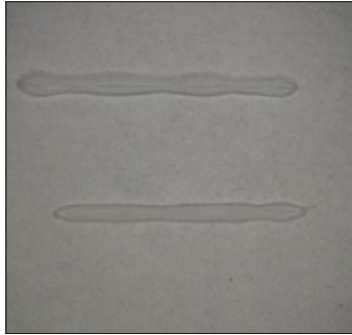
2. Analyses changes in the brightness value at each pixel, and separates shape (surface irregularity) and texture (pattern) for image processing.



**Extracting only shape (surface irregularity) information without being affected by surface conditions**

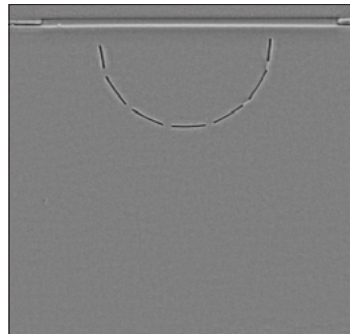
<p><b>ENGRAVING INSPECTION</b></p>			<p>Inspects only the engraved section that has surface irregularities while ignoring package printing.</p>
<p><b>STAMPED CHARACTER INSPECTION ON METAL CASTING SURFACE</b></p>			<p>Highlights stamped characters on an uneven casting surface.</p>
<p><b>METAL SURFACE DEFECT INSPECTION</b></p>			<p>Ignores residual washing fluid, stains, fine hairlines, etc. Detects only deep defects such as dents and chips.</p>
<p><b>HEAT SEAL WIDTH INSPECTION</b></p>			<p>Captures and extracts surface irregularities in the seal which are difficult to capture based on the colour and shade.</p>
<p><b>PRINTING DEFECT INSPECTION</b></p>			<p>Extracts only defects and creates an image without being affected by complicated printing on the background.</p>

**HOT GLUE BEAD  
PRESENCE/  
ABSENCE  
INSPECTION**



Accurately extracts only the hot glue bead even when the background is the same colour.

**PACKAGE  
PERFORATION  
PRESENCE/  
ABSENCE  
INSPECTION**

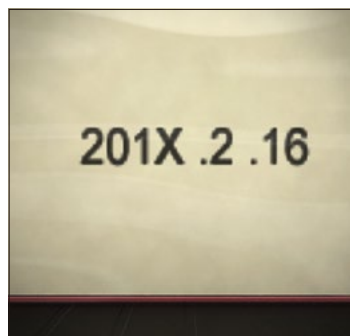
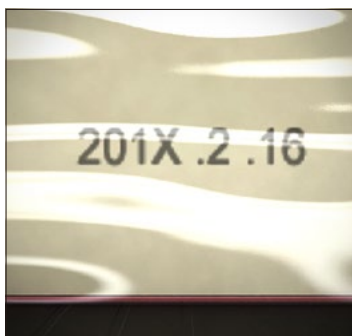


It is possible to inspect perforations even on a patterned background because only the shape is extracted.

APPLICATION 2

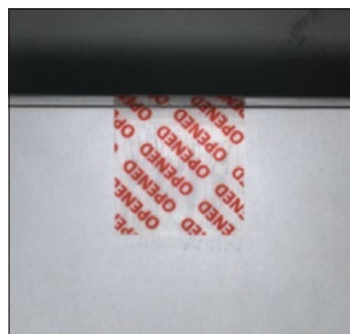
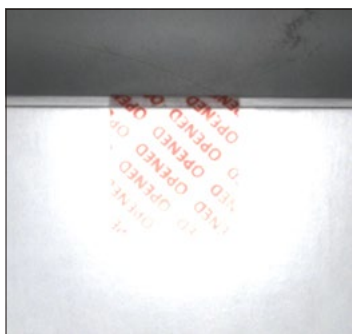
**Extracts only the texture (pattern) information while suppressing glare and ambient light**

**PRINT  
INSPECTION  
ON FILM**



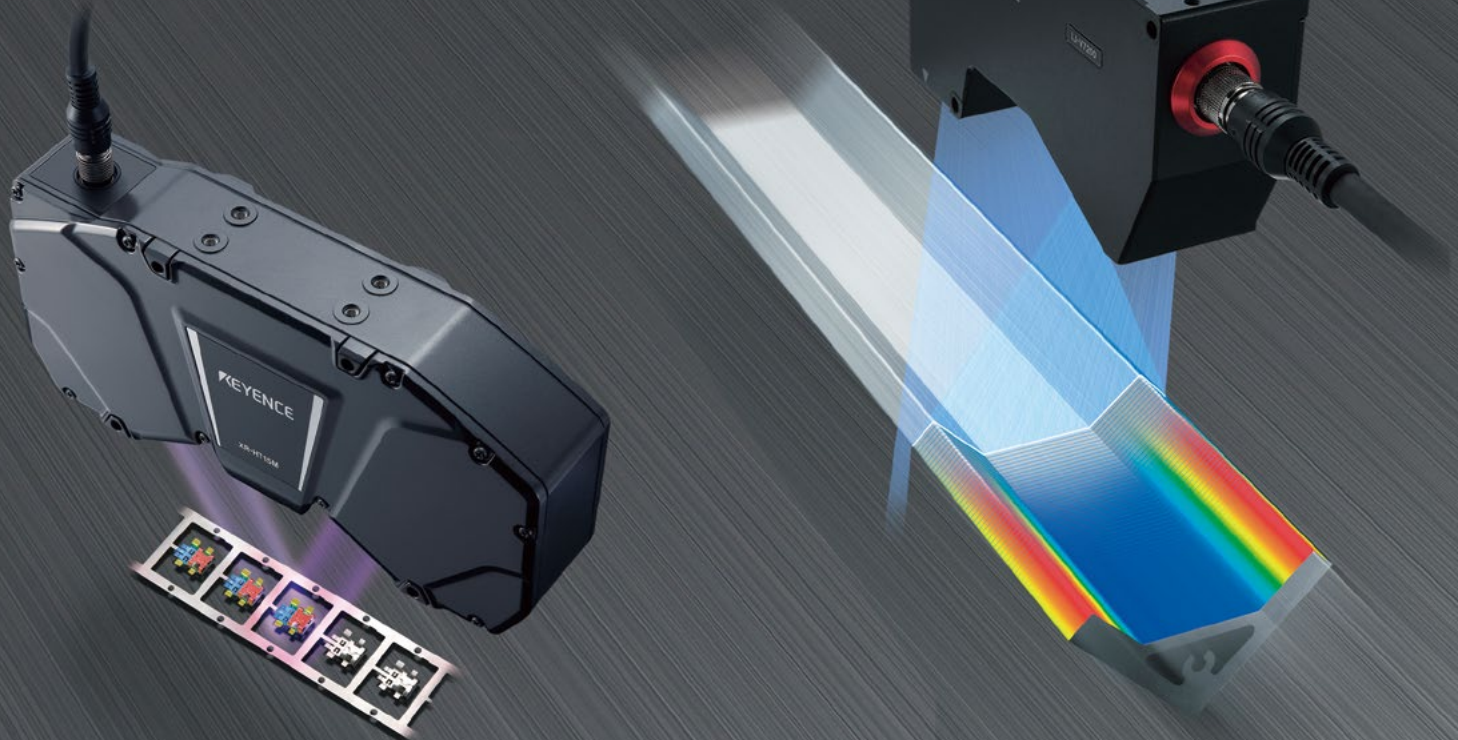
Stabilises inspection by eliminating glare that has adverse effects on inspection.

**SEALING TAPE  
PRESENCE/  
ABSENCE  
INSPECTION**



Allows stable inspection by cancelling glare even in cases of sudden specular reflection due to the workpiece being tilted.

# INLINE 3D MAKES NEW INSPECTIONS POSSIBLE



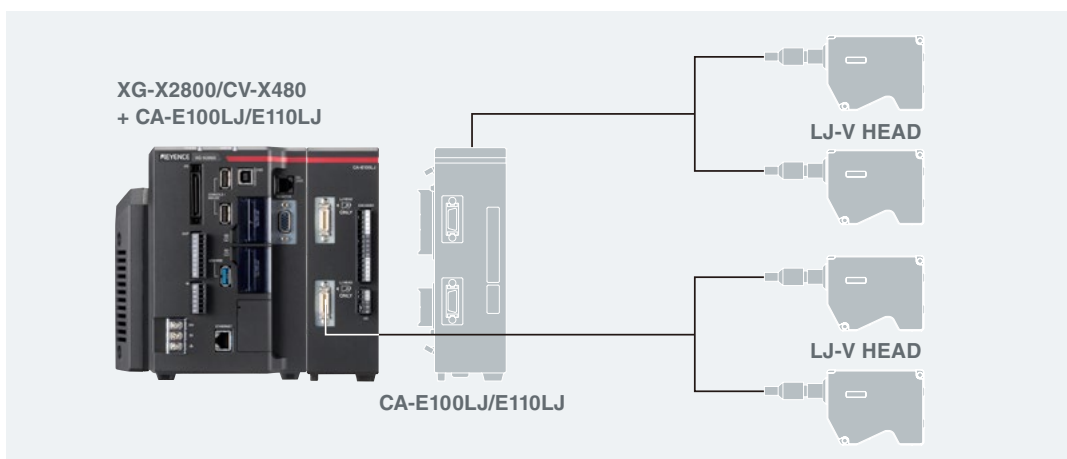
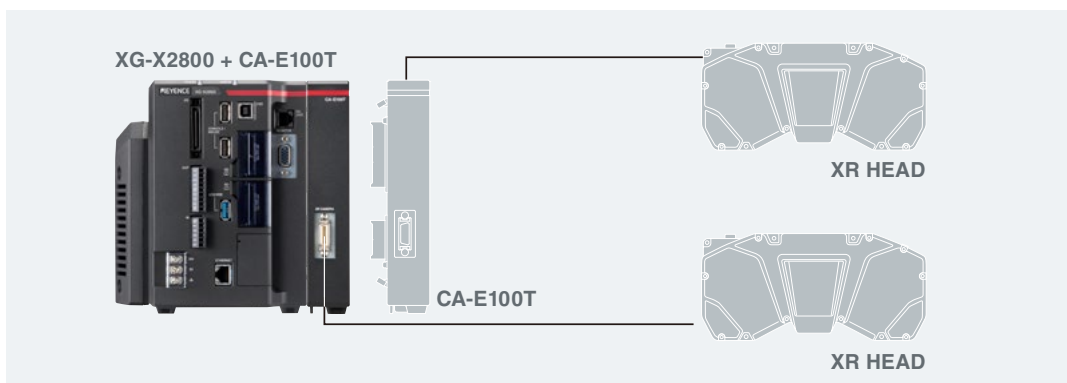
## 3D SYSTEM

CV-X

XG

XG-X

### Connections for 3D Inspection



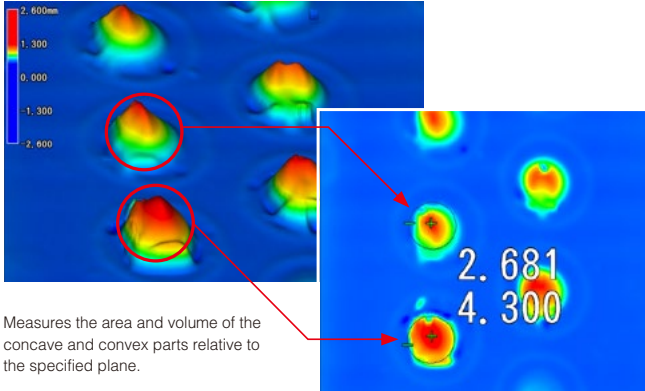
CONTACT YOUR NEAREST OFFICE FOR RELEASE STATUS



## HEIGHT MEASUREMENT TOOL

Measures dimensions such as minimum/maximum heights, convex/concave areas and volumes based on 3D data. Flexible measurement is ensured by specifying any plane within the screen as a zero plane.

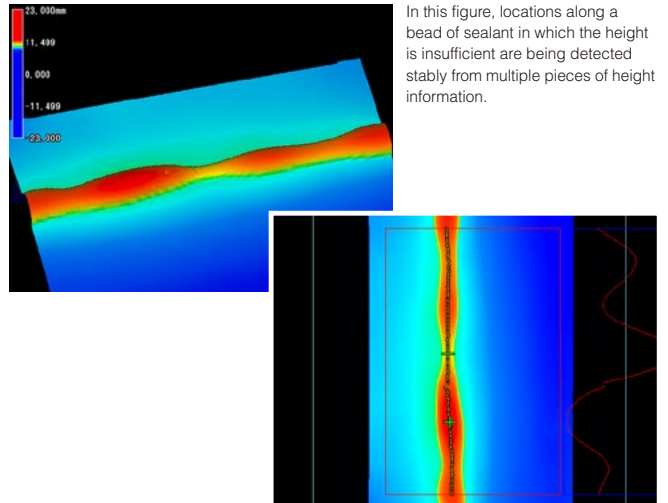
### AREA/VOLUME MEASUREMENT



Measures the area and volume of the concave and convex parts relative to the specified plane.

## TREND HEIGHT MEASUREMENT TOOL

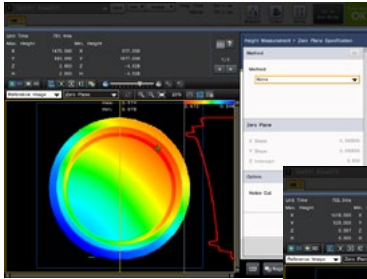
Executes multiple height measurements across one region. It is possible to find the maximum/minimum values and to calculate the best-fit circle or plane among the peak values calculated for each small cross-sections of the main region.



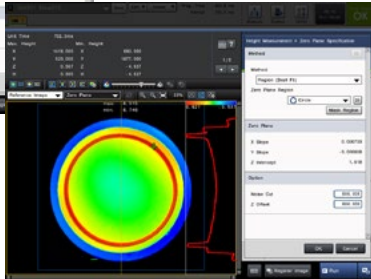
In this figure, locations along a bead of sealant in which the height is insufficient are being detected stably from multiple pieces of height information.

## ZERO PLANE SPECIFICATION

Before zero plane specification



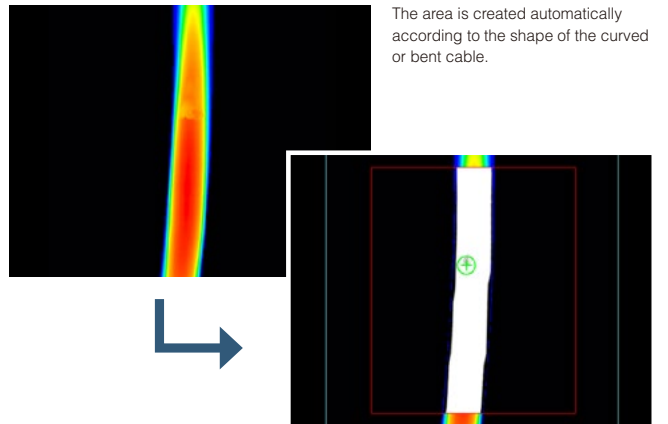
After zero plane specification



Since a zero plane can be specified as a reference for height measurement, stable measurement is ensured, even if the targets change orientation.

## IMAGE REGION GENERATOR

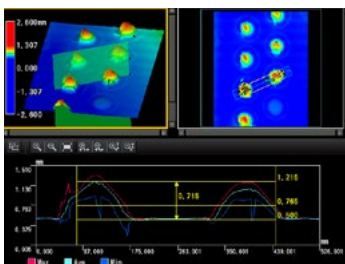
Converts the specified height range into an inspection region. Even if a workpiece changes in shape, inspection will automatically occur only on surfaces within the defined height range.



The area is created automatically according to the shape of the curved or bent cable.

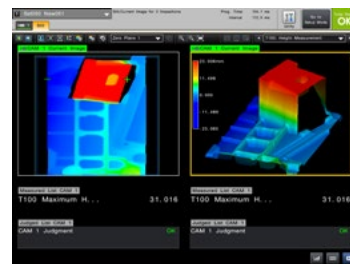
## 3D OBSERVATION

On a captured 3D image, a 2D profile can be displayed between any two specified points. This allows the user to verify the inspection range and settings instantaneously.



## CONTROLLER 3D DISPLAY

For improved visualisation, a 3D image can be displayed as an operation screen or together with processed images in a multi-screen display.



# 21 MEGAPIXEL CAMERA

**THERE IS NO SUBSTITUTION FOR RESOLUTION**

A 21 megapixel image, with a resolution of 5104 × 4092, can be captured at a rate of 9 FPS (110 ms). This allows an inspection of small defects in a wide field-of-view that are impossible to detect with lower resolution cameras.



# 2D AREA CAMERA

CV-X

XG

XG-X

## CAMERA LINEUP

	21 megapixel camera	5 megapixel camera	2 megapixel camera Series			0.31 megapixel camera Series		
	16x 21MEGA DIGITAL	11x 5MEGA DIGITAL	7x MEGA DIGITAL	MEGA DIGITAL	SUPER-SMALL DIGITAL	7x HI-SPEED DIGITAL	HI-SPEED DIGITAL	ULTRA-SMALL DIGITAL
Model	CA-H2100M CA-H2100C	CV-H500M XG-H500M CV-H500C XG-H500C	CV-H200M XG-H200M CV-H200C XG-H200C	CV-200M XG-200M CV-200C XG-200C	CV-S200M XG-S200M CV-S200C XG-S200C	CV-H035M XG-H035M CV-H035C XG-H035C	CV-035M XG-035M CV-035C XG-035C	CV-S035M XG-S035M CV-S035C XG-S035C
Specs	×16 speed monochrome/ ×16 speed colour	×11 speed monochrome/ ×11 speed colour	×7 speed monochrome/ ×7 speed colour	Monochrome/ Colour	Compact monochrome/ Compact colour	×7 speed monochrome/ ×7 speed colour	Monochrome/ Colour	Compact monochrome/ Compact colour
Capture range	5104 × 4092 pixels	2432 × 2050 pixels	1600 × 1200 pixels	1600 × 1200 pixels	1600 × 1200 pixels	640 × 480 pixels	640 × 480 pixels	640 × 480 pixels
Transfer time	109.9 ms	61.2 ms	29.2 ms	58.5 ms	58.5 ms	4.7 ms	16.0 ms	16.0 ms

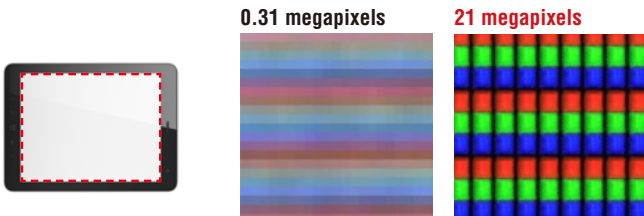
# THE 21 MEGAPIXEL CAMERA PROVIDES ULTRA HIGH-ACCURACY FOR LARGE INSPECTION AREAS

## STABLE DETECTION OF SLIGHT DEFECTS

The same field of view captures a more accurate image

### Inspection of LCD pixel arrays

The same target area within the red frame captured by each camera type.

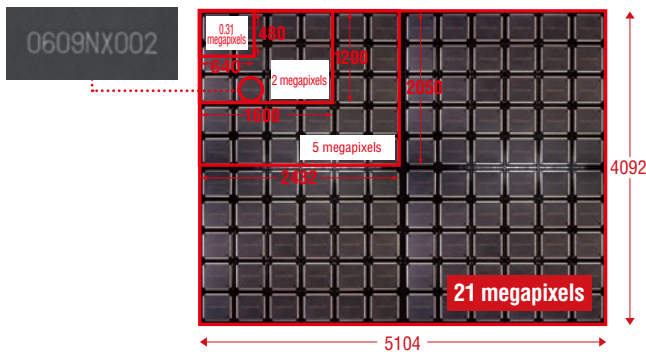


## CAPTURE THE TARGET WITH A WIDER FIELD-OF-VIEW

The same accuracy over a wider area

### Print inspection of integrated circuits on a tray

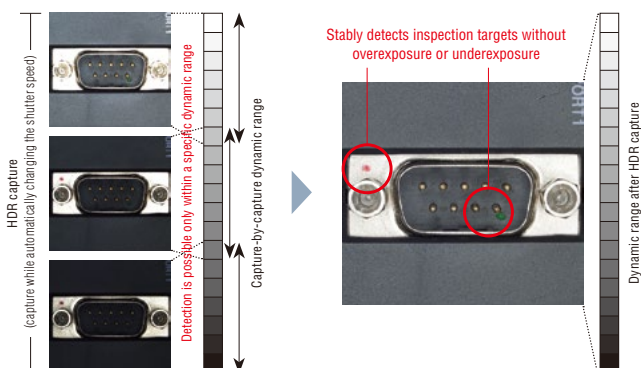
The field-of-view adjusted to make the print resolution the same for each camera type.



## HDR

### High dynamic range captures quality images on difficult targets

Captures multiple images while automatically changing the shutter speed and combines them at high speed to generate images without overexposure or underexposure. Images ideal for processing can be captured even when parts have uneven glossiness or intensity due to variations in surface conditions or environmental changes.



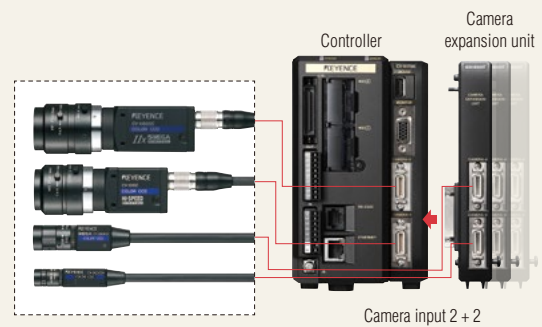
# MULTI-CAMERA, SIMULTANEOUS IMAGE ACQUISITION SYSTEM

A multitude of camera types can be mixed for use. For example, it is possible to attach a monochrome camera and a colour camera to a single controller unit. Also, by connecting a camera expansion unit, it is possible to connect up to two 21 megapixel cameras, four 5 megapixel or lower cameras\*, 4 laser heads, or 2 laser head plus 2 area cameras. Because simultaneous image acquisition and simultaneous processing can be performed for all camera combinations, this system has the flexibility to support future additions and changes to inspection specifications.

(\*The expansion unit can be connected to the CV-X250/CV-X270/CV-X290/CV-X150/CV-X170/XG-7001/XG-7501/XG-7701/XG-8000/XG-8500/XG-8700)

## MULTI-CAMERA SYSTEM

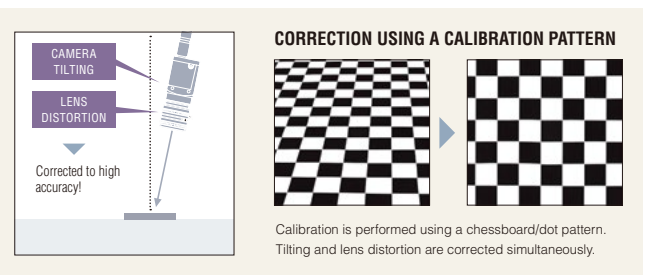
Connect up to 4 cameras from a selection of 24 cameras



## CALIBRATION

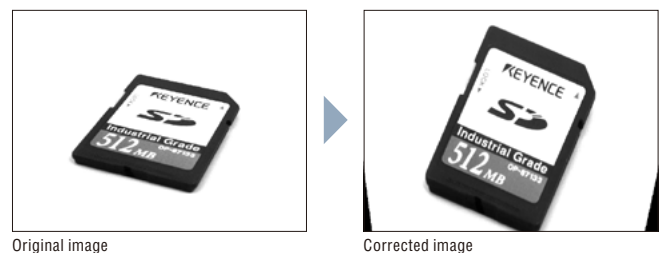
### Removes effects of lens distortion or camera tilting

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



### Corrects tilting

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



# INTERCHANGEABLE CAMERA SYSTEM

MACHINE VISION INSPECTION

SUPPORTS LINE SCAN & AREA CAMERAS

An image processing system with the ultimate camera selection



## LINE SCAN CAMERA

XG

XG-X

A USER-FRIENDLY DESIGN THAT MAKES IT EASY TO UNDERSTAND THE INSTALLATION CONDITION AT A SINGLE GLANCE



Model	XG-HL02M
Applicable lens	1 in. C-mount
Number of pixels	2048
Max. expanded image size	2048 × 16384
Scan speed	24 μs/line
Pixel clock	100 MHz (8× transfer)



Model	XG-HL04M
Applicable lens	1 in. C-mount
Number of pixels	4096
Max. expanded image size	4096 × 16384
Scan speed	24 μs/line
Pixel clock	200 MHz (16× transfer)

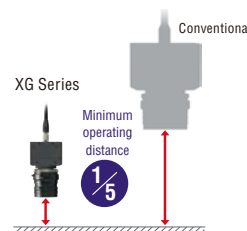
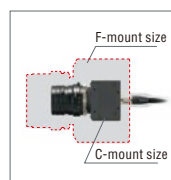


Model	XG-HL08M
Applicable lens	2 in. (M40 P0.75 )lens*
Number of pixels	8192
Max. expanded image size	8192 × 8192
Scan speed	45 μs/line
Pixel clock	200 MHz (16× transfer)

\*Supports F-mount conversion adapter

## UNIQUE SUPPORT FOR C-MOUNT LENSES WITH A HIGH-DEFINITION PIXELCOUNT OF 4096 PIXELS

The industry's smallest line scan camera is achieved with the adoption of a high-sensitivity, compact CMOS image sensor. By supporting C-mount lenses, the line up of available lenses has been greatly expanded. This results in high flexibility in the installation conditions allowing mounting in spaces that were impossible with conventional line scan systems.



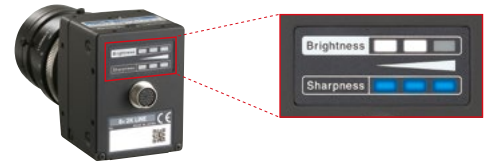
Support for C-mount lenses allows for the use of lenses with short focal lengths. The minimum operating distance has been reduced to approximately 1/5 of conventional systems.

### EXAMPLE

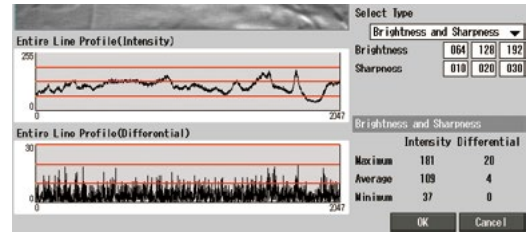
Comparison of the WD required for a field of view of 100 mm

## UNDERSTAND OPTICAL AXIS CONSISTENCY AT A SINGLE GLANCE LED INDICATOR Industry's first

The typically difficult task of obtaining the correct camera mounting is made easy using visual LED indicators right on the camera that show the level of light intensity and sharpness being received. This drastically reduces the amount of time needed for line scan camera installation.



LED indicators on the back of the camera display the focus and intensity information of the image currently being captured using a 3-level indicator. The individual threshold levels can be user specified in order to obtain the best results under the specific application conditions.



## WAVEFORM VIEWER

Adjust for variations of received light intensity in the camera

Uneven brightness is typical when performing wide range image capture with line scan cameras. The built-in waveform viewer on the XG-8000 displays the intensity shading information of the image captured by the camera.

The shading correction function of the XG can be used to adjust an uneven lighting condition across the field of view. The shade correction is performed in the camera before the image transfer so it does not have an effect on the processing time which is very important with high-speed production lines.

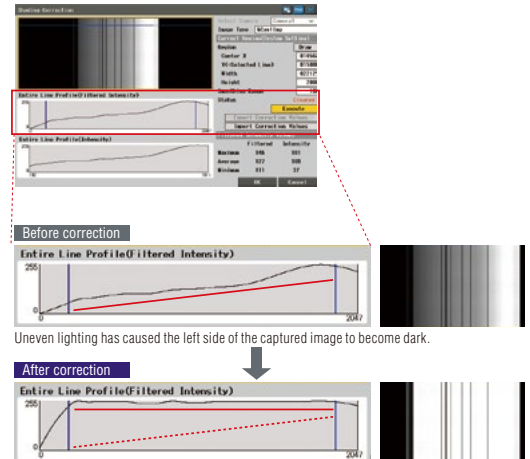


Image correction is executed after capture based off reference levels. After correction, an image is created that has even intensity across the entire field of view.

## TARGET CLASSIFICATION FUNCTION

Desired targets or unwanted flaws can be detected using the variety of inspection tools that are available on the XG Series. The detected targets can then be automatically classified and sorted based on user-defined conditions. The thumbnail image of each defect can be displayed and output to an SD card or a FTP drive. The mapping display allows the confirmation of detected target positions even if the work piece is a curved shape or large sheet.

The detected targets are automatically extracted to a specified size and displayed as thumbnail images.

The mapping results for each classification condition are displayed in the viewer.

The measured data for each detected target is displayed in the results list.



## LINE SCAN CAMERA CONNECTIVITY FOR INSPECTION OF WEB OR ROTATING TARGETS

Line scan cameras can be connected to the XG-8000L Series. Compared to area cameras that capture the entire image in one capture, line scan cameras build an image by capturing one line of pixels at a time. This allows even lighting of hard to light targets like webs and cylindrical parts which makes inspection much easier. The 8K line scan camera can produce an image of up to 67 megapixels.



Inspection of foreign objects, flaws, or pinholes on films or sheets can be achieved even on high-speed production lines.



Defects on a metal roller surface can be inspected accurately by using a line scan camera.

# CV-X Series

CV-X



## POWER MEETS SIMPLICITY

### AUTO-TEACH INSPECTION TOOL COLOUR

An inspection tool that learns by simply running good parts.

The newly incorporated Auto-Teach Inspection Tool learns individual differences in good parts to determine an acceptable range of variations and recognises the parts that differ as defective. These algorithms eliminate the common obstacles to successful on-site programming. Set-up is performed by simply running good parts, eliminating the need for highly-experienced vision integrators and complicated programming. This is an inspection tool that makes it possible for anyone to achieve and maintain a stable inspection.



#### NEW ALGORITHM!

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



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

## TOOL SELECTION CATALOGUE BASED ON APPLICATION

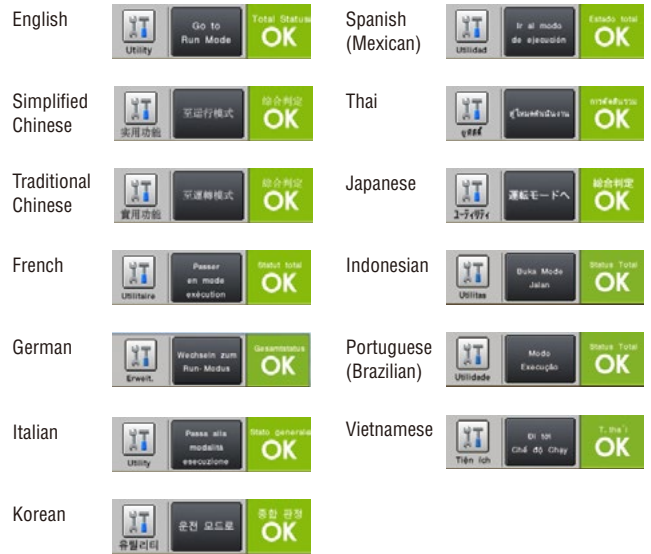
Just select the desired application type, instead of the traditional tool



TOOL CATALOGUE

APPLICATION NAVIGATOR

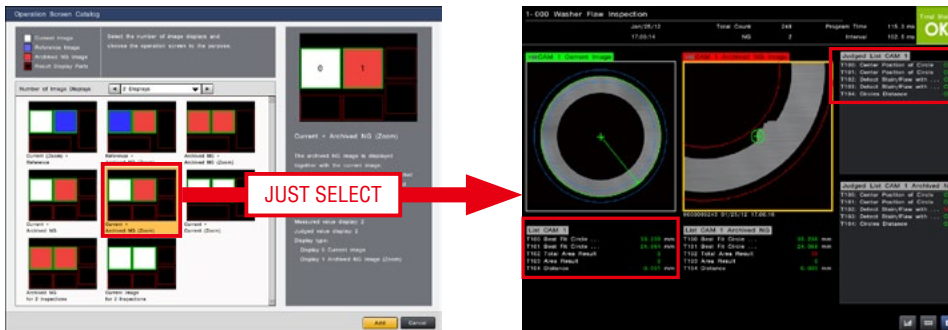
## MULTI-LANGUAGE INPUT SYSTEM INCORPORATED



## USER INTERFACE

No complicated customisation is required. Just select a display template

To greatly simplify the customisation of operation screens and improve visualisation of the process, an operation screen selection guide is incorporated along with many custom functions.



## CUSTOMISED USER MANUAL FUNCTION

Example of created manual contents



## MULTIPLE LANGUAGE SUPPORT

User manuals can be created in 13 languages according to the languages of the programs.

## MS WORD OUTPUT

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

## TOOL SETTING TIPS

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

## TIME SAVING

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

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# XG-X Series

XG-X

## THE POWER TO TAKE YOU AHEAD



### 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

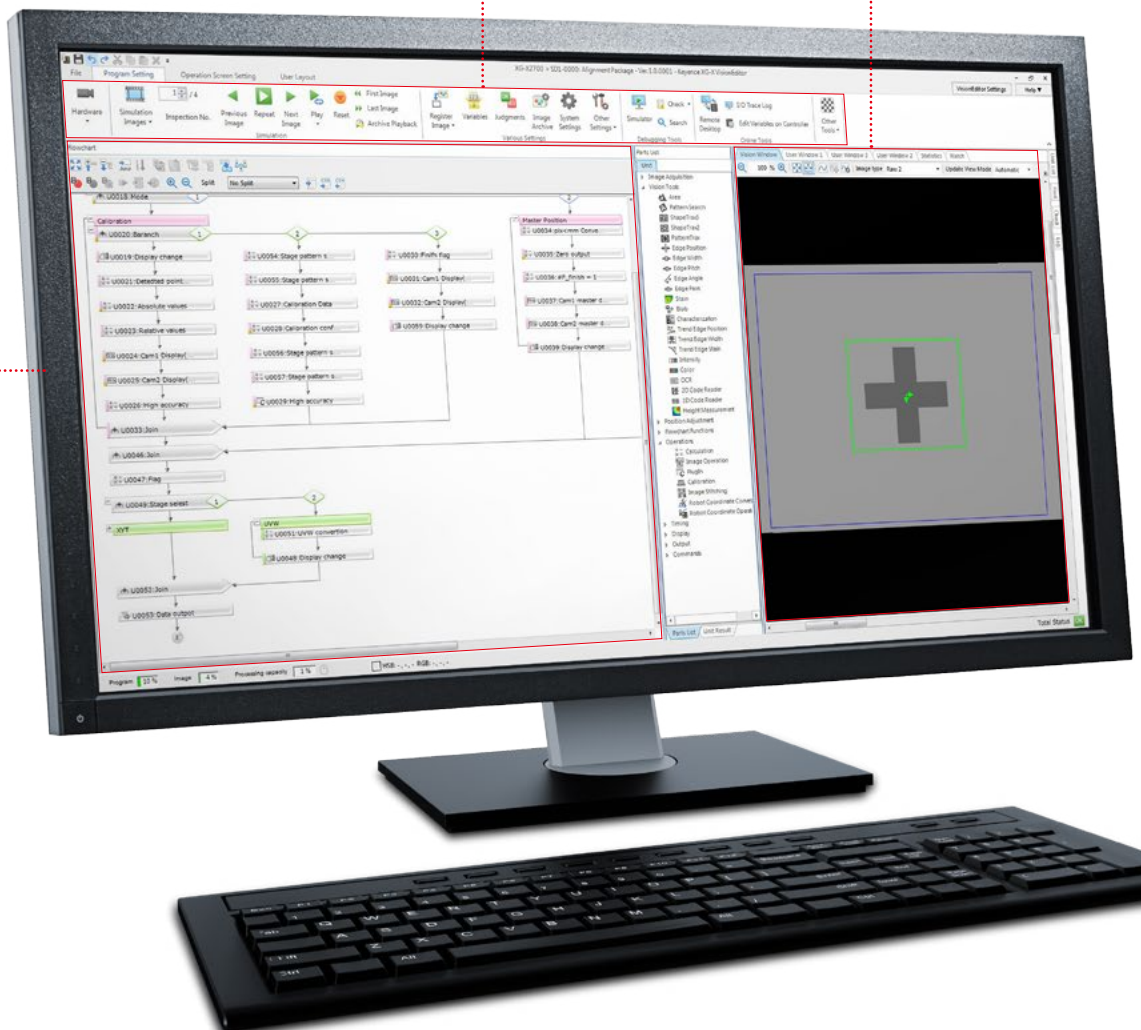
Flowcharts can be constructed easily just by dragging processing units from the parts list and dropping them here. In addition, error presences per unit can be displayed, allowing for simple debugging on the flowchart.

#### 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

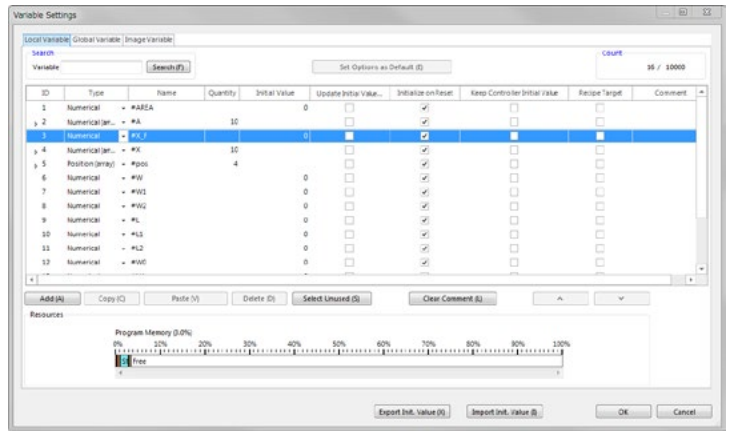
A wide range of variables can be defined, including image, positional, linear, numerical, and array-based. Variables are not limited to a single program and can be set for global use.

### VARIABLE 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.

```
FOR @i = 0
  #pos2[@i].X = #avePix[@i+1] / 2
  #pos2[@i].Y = #avePix 3Current plot
NEXT
#disp_limit = #limit / 2
```

Comments displayed when the cursor hovers over the variable



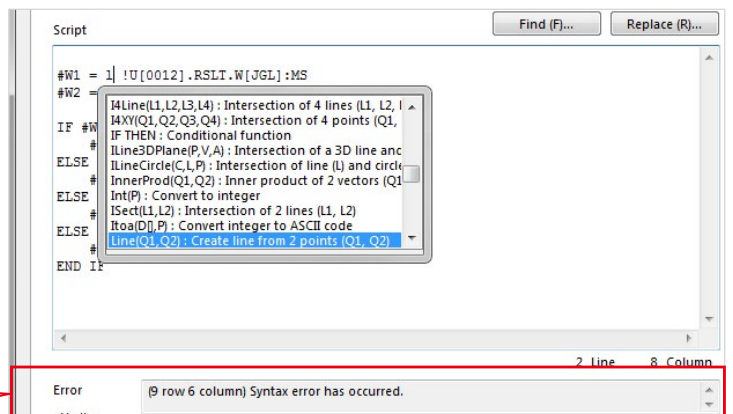
Variable setting screen

## 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.

Industry's widest variety

Up to 5000 characters per single calculation

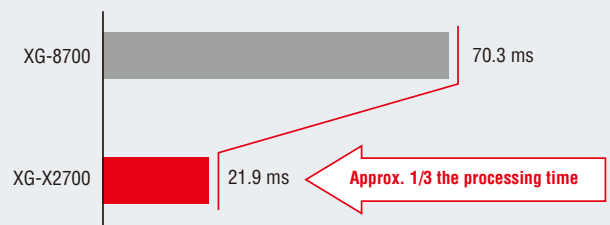


Automatic call out error checking function

## ADVANCED INSPECTION THROUGH HIGH-SPEED PROCESSING

Abundant processing power is available even with multiple camera connections, including the 21 megapixel colour camera, lines scan cameras, or 3D cameras.

21 megapixel colour camera flaw inspection processing speed



# CA Series



## VISION SYSTEM PERIPHERAL EQUIPMENT

### DIVERSE ILLUMINATION LINEUP THAT SUPPORTS A WIDE RANGE OF INSPECTIONS



Ring lights (direct)



Ring lights (multi-angle)



High-intensity LumiTrax™ lights



Bar lights



Dome lights



Back lights



Coaxial lights (on-axis)



Spot lights



Low angle lights



Square lights (direct)



Line lights



LED light controller

### WIDE LENS SELECTION TO FIT THE CAMERA TYPE AND THE REQUIRED ACCURACY



Standard lenses



High-resolution, low-distortion lenses



Telecentric macro lenses



Super-small camera, dedicated lenses



High-resolution lenses for line scan cameras



High-resolution, large-format, C-Mount lenses



Vibration-resistant models



Distortion-free, VPR-equipped, Telecentric macro lens



Variable-magnification Telecentric Macro Lens Supporting 4/3" Images



Monitors



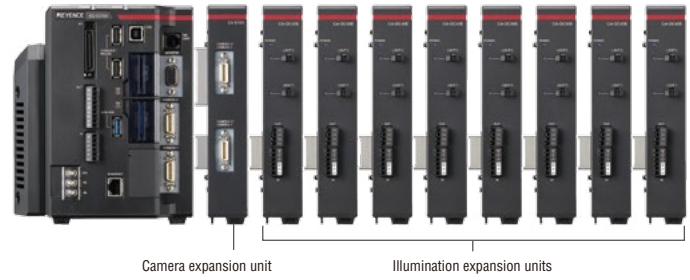
Multi-touch enabled 12" touch panel



24 VDC power supply

The LED light controllers can be connected directly to compatible vision systems with a minimal amount of wiring. The controller enables direct illumination control and light strobing with image capture trigger inputs, without the need for a PLC. Up to 8 light expansion units\* can be connected to a single vision system, allowing up to 16 lights to be controlled without wiring.

\* When the CA-DC40E is used. Only 2 of the CA-DC50E can be connected at a time (mixed connection with up to 6 more CA-DC40E is possible).



## WAVELENGTH CONVERSION SHEET FEATURES

### Wavelength conversion mechanism CA-DWC30/CA-LFxxY

Combining the wavelength conversion sheet, blue LED light, and blue cut filter create an absolutely new piece of light technology that can be used to realise back light images with reflected light.

#### Liquid surface inspection

Assume that there is no space to install a back light when performing liquid surface inspections at a filling machine and that reflected light has to be used instead. Even if the light is installed in a narrow space, back light images can be realised by wrapping the wavelength conversion sheet around the rotating object.

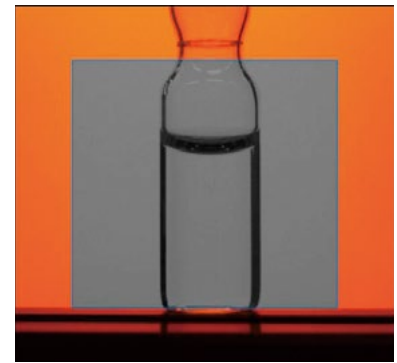


Using only blue reflected light



Due to the effect of the reflection from the workpiece surface, it is not possible to obtain a stable view of the liquid surface.

Using the wavelength conversion sheet



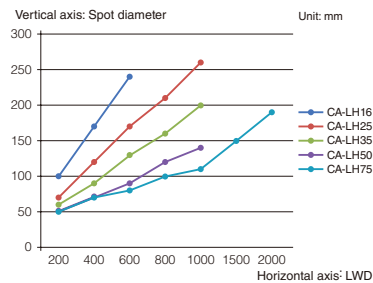
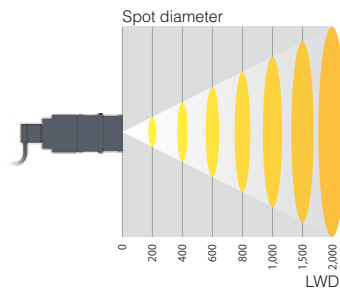
Only the liquid surface is clearly imaged as a back light image, which makes it possible to perform stable liquid surface inspections.

## EXAMPLES OF COMBINATIONS WITH THE C-MOUNT LENS ADAPTER FOR SPOT LIGHTS

### OP-87896

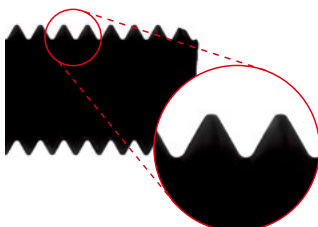
Attaching a C-mount lens adapter (OP-87896) to the tip of a spot light enables more varied applications.

A combination with an image processing lens enables highly uniform and clear spot light.



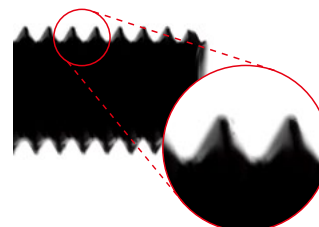
\* The graph represents the range in which the spot light can be used with guaranteed brightness. Check in advance whether the brightness is actually sufficient.

A combination with a telecentric lens makes it possible to also use the spot light as a parallel light source.



Telecentric back light image

A sharp image in which there is no wraparound light can be obtained.



Light source back light image

The edges are unclear due to the light reflected by the screw surface.

SCAN THIS CODE TO ACCESS WEB



<http://www.keyence.com/machinevision>



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



**SAFETY INFORMATION**

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

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