NEW Ultra High-Speed, Multi-Camera, High-Performance Image Processing System
XG-8000 Series

Supports Line Scan Cameras

INTERCHANGEABLE CAMERA SYSTEM

MACHINE VISION INSPECTION

SUPPORTS LINE SCAN & AREA CAMERAS

An image processing system with the ultimate camera selection
A highly flexible image processing system that can be used quickly with simple camera set up and connection

The interchangeable camera module type controller that supports line scan cameras makes it easy to incorporate a line scan camera system that traditionally could only be done with complex, specialized machinery.

**XG LINE SCAN SYSTEM**

- XG Series Line Scan Camera

**XG SERIES FEATURES**

- Compatibility issues are eliminated since all the hardware is from the same manufacturer.
- Simple connection of the camera to the controller allowing the user to obtain images quickly.
- Robust solid state hardware design.
- Minimal programming knowledge required.

**CONVENTIONAL LINE SCAN SYSTEM**

- Company A
- Company B
- Company C
- Company D

**CONVENTIONAL PROBLEMS**

- Compatibility issues arise due to connecting multiple devices from different manufacturers.
- A great amount of time and effort is needed in order to capture good images.
- Concerns with freezing or crashes due to the PC-based design.
- Specialized programming knowledge is typically necessary.

**Strobe lighting**

LED illumination is popular for machine vision due to its flexibility and lifetime characteristics. However, due to complex wiring and sequencing, the fast switching performance of LEDs is not always utilized and the light is emitted continuously. The CA-DC21E automatically enables strobing of light sources without the need for extra wiring or complex programming. This results in a significantly longer service life of the lighting.

**Integrated lighting controller results in reduced setup time spent on wiring and controls**

**Unique support for C-mount lenses with a high-definition pixel count 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.

**EXAMPLE**

Comparison of the WD required for a field of view of 100 mm 3.94"
Expansion via camera modules that support area or line scan type cameras

The expansion and interconnection of different cameras is possible through the combination of the camera expansion unit (XG-E800) and the camera input unit (XG-EC80/XG-EC80L). Area and line scan cameras are supported with a single controller allowing the same ease of use for both types of cameras providing the ultimate application flexibility.

CAMERA COMPATIBILITY CHART

<table>
<thead>
<tr>
<th>Model</th>
<th>AREA CAMERA</th>
<th>LINE SCAN CAMERA</th>
<th>No. of connected camera units</th>
<th>Encoder input</th>
<th>Touch panel support</th>
</tr>
</thead>
<tbody>
<tr>
<td>XG-8502L</td>
<td>300,000 pixels</td>
<td>2,000,000 pixels</td>
<td>5,000,000 pixels</td>
<td>200 pixels</td>
<td>400 pixels</td>
</tr>
<tr>
<td>XG-8702L</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

*When using line scan cameras only, up to 2 cameras can be connected at once. When using a mixed connection, up to 2 area cameras and 1 line scan camera can be connected at once.

A user-friendly design that makes it easy to understand the installation condition at a single glance

Ease of use has been emphasized in order to reduce the amount of time, effort and difficulty of implementing a line scan camera, which have traditionally been issues with conventional line scan camera installations. The XG-8000 Series is equipped with an interface that makes it easy to understand and install the line scan camera into the application.

Understand optical axis consistency at a single glance

LED INDICATOR

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.

Adjust for variations of received light intensity in the camera

WAVEFORM VIEWER

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 for 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.
Simple Camera Connection and Setting Allows for Quick Image Generation

Connect the Camera to the Controller

The camera is ready to capture images as soon as it is connected to the controller. This eliminates the work hours that are typically consumed with setting up image capturing on a conventional line scan camera.

Set Image Capture Conditions

All parameters related to image capture are located in the Image Capture Unit of the XG program. The detailed settings are configured in a straightforward, top to bottom order.

1. Capture Options
   - Shutter Speed: Sets the exposure time for each line scan.
   - Sensitivity: Adjusts camera sensitivity to increase or decrease brightness.

2. Camera Settings
   - When using individual capture: Specifies the number of lines to generate a single image.
   - When using continuous capture: Specifies the number of lines and the number of overlapping lines in the flow direction when generating a continuous type image.

3. Trigger Settings
   - Trigger Options: Select internal or external (start) triggers.
   - Specify Time Interval: When using the internal timer, input the line trigger cycle (us/L). When using an encoder, input the number of encoder pulses (counts) per line.

Adjust Focus and Aperture

Adjusts the focus and aperture of the lens utilizing the LED indicators located on the back of the camera for reference.

Correct for Inconsistent Image Brightness

Misalignment of the light mounting position or workpiece position can cause uneven lighting in the captured image. Using the intensity waveform that has been generated in the waveform viewer as reference, correction can be performed before the image data is transferred to the controller.

The powerful visual inspection tools and image filters of the XG exceed the limitations of a conventional line scan camera systems.

Cancel unwanted shading on metallic curved surfaces

Cancels uneven lighting produced by curved surface areas on cylindrical workpieces and extracts only arbitrary flaws such as bright or dark defects.
Multi-Camera, Simultaneous Acquisition System

The XG-8000 Series offers the choice of up to 16 types of area cameras and 3 types of line scan cameras. This allows the same XG programming interface to be used no matter which camera is connected and provides the flexibility to easily adapt to changes that may occur with the inspection criteria.

**MULTI-CAMERA SYSTEM EXAMPLE: XG-8702L**

<table>
<thead>
<tr>
<th>16 types of area cameras</th>
<th>3 types of line scan camera</th>
</tr>
</thead>
</table>

**DIFFERENT CAMERA COMBINATION EXAMPLE**

The entire circumference of the cylinder side is captured into a single image using the line scan camera while it is rotated. The top surface is captured with an area camera and the entire workpiece is inspected in one cycle. The combination of two different types of cameras results in reduced inspection times and cost.

## Target classification function

A utility that classifies detected targets based on defined features and then shows a mapping display and thumbnail images of the targets.

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.

- **Cancel surface roughness on plastic products**
  - Detects only long, line-shaped flaws while ignoring the surface roughness.
  - Micro-flaws are canceled and only the desired flaws are stably detected.

- **Cancel uneven texture on metal workpieces**
  - Uneven textures unique to forged parts are canceled and only deep flaws generated by dents are detected.
The advantages of implementing line scan cameras

Compared to area cameras that capture the entire image in one capture, line scan cameras, which build the image by capturing one line of pixels at a time, have the following advantages depending on the type of application.

**ADVANTAGE 1**

**High quality image with uniform lighting**
Lighting only needs to be applied to a single area of the workpiece which results in a more evenly lit target compared to an area type camera.

**ADVANTAGE 2**

**Expanded image of the side surface of a cylinder**
Because the entire circumferential surface of a cylinder can be inspected as a single image, the inspection program can be set up very easily.

**ADVANTAGE 3**

**Extremely high resolution inspection**
Since the image is generated line by line in the target movement direction, a much larger pixel array can be used compared to an area camera resulting in drastically improved inspection accuracy.

**ADVANTAGE 4**

**Reduced inspection completion time**
The XG-8000 allows inspection on fast moving lines due to high-speed camera scanning and processing.

**APPLICATIONS**

**CYLINDER INSPECTION**

**EXAMPLE: VISUAL INSPECTION OF A GEAR**

<table>
<thead>
<tr>
<th>With an area camera</th>
<th>Using a 5 megapixel area camera (2432 x 2050 pix)</th>
</tr>
</thead>
</table>

Captures a single area of the part in one image. Since it is a round part, inspection is difficult due to the radius and uneven lighting. Also, multiple overlapping inspections need to be performed to analyze the entire circumference.

<table>
<thead>
<tr>
<th>With a line scan camera</th>
<th>Using the XG-HL02M line scan camera (2048 pix)</th>
</tr>
</thead>
</table>

Captures the image one line at a time and then expands the entire circumference into one single image. Lighting is very uniform and the inspection of the whole part is done in one process. Inspection accuracy is greatly improved and processing time is reduced.

**OTHER APPLICATION EXAMPLES:**

**Defects on blow molded parts**
Before blow molding, the entire opening and body of the part can be inspected in one image when the part is rotated.

**Visual inspection of a bearing**
Achieves the visual inspection of curved surfaces, which is difficult to perform with an area camera, by capturing stabilized images with even lighting.

**Visual inspection of a roller**
Defects on the surface of long metal rollers can be inspected with high-accuracy using one or two line scan cameras.
Maximum 16384 pix

2050 pix

Using a 5 megapixel area camera (2432 x 2050 pix)

The entire workpiece is displayed but there are unnecessary void areas on the top and bottom.

Uniform lighting is obtained across the entire part surface.

When using an area type camera to inspect the entire workpiece, it is difficult to obtain even lighting over the whole surface. Also, the pixel array in the XY direction is limited by the camera so multiple image captures may be necessary to secure a resolution that can satisfy the application.

When using a line scan camera, only the X direction pixel array is fixed based off the camera while the Y direction is expanded according to the part movement direction. Much larger pixel arrays are possible with up to 8192 x 8192 pixels (or 4096 x 16384) in one single image. Very high detection accuracy is realized in one inspection process.

**ADVANTAGE 1**

**ADVANTAGE 3**

**ADVANTAGE 4**

**OTHER APPLICATION EXAMPLES:**

**Inspection of broken solar cell patterns**

By using a high-pixel line scan camera to generate a detailed image of patterns printed on a solar cell, high-accuracy inspection is possible.

**Visual inspection of lead frames**

Visual inspection of the surface of plated lead frames and plate position inspection are accurately performed during transfer.

**Visual inspection after printing electrodes**

By using line scan cameras with line lights for targets that require a wide-field, uniform lighting is achieved and high-definition inspection is possible.

**CONTINUOUS INSPECTION**

**APPLICATION EXAMPLES:**

**Dimensional inspection of a rubber sheet**

Width measurement, which typically requires 2 area cameras on each edge, is performed with a single high resolution line scan camera, resulting in increased accuracy and reductions in cost.

**Inspection of pinholes and dirt on a sheet**

Achieves visual inspection of foreign objects, flaws, and pinholes on film or sheets on a high-speed production line.

**Visual inspection of stamped metal material**

High-speed inspection is performed on pressed parts that are continuously punched. High-speed inspection at resolutions that are much higher than conventional devices is achieved, leading to improved inspection accuracy.
PART NUMBER LIST

<table>
<thead>
<tr>
<th>Part number</th>
<th>CA-LM0210</th>
<th>CA-LML0210</th>
</tr>
</thead>
<tbody>
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<td></td>
</tr>
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</tr>
<tr>
<td>12.5 mm F 4.7</td>
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<tr>
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<tr>
<td>WD (mm, at reference magnification)</td>
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<tr>
<td>Resolution (μm)</td>
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<td>+0.04”</td>
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<tr>
<td>Weight</td>
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<td>Approx.440g</td>
</tr>
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</table>

*1: When using with a line camera, an aperture of around F 2.8 is recommended. This improves the peripheral resolution.

*2: Indicates specification for compatible CCD size. Value in parenthesis applies to 2/3” or 1/2” CCD size.

SPECIALIZED LENS DESIGNED FOR LINE SCAN CAMERAS

Uses an original optical design to drastically reduce distortion that is easily generated with close-proximity image capture.

LENS CHART

When using the CA-LHM Series

<table>
<thead>
<tr>
<th>Part number</th>
<th>CA-LML0210</th>
<th>CA-LML0210</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optical magnification</td>
<td>x0.25 to x1</td>
<td>x0.25 to x1</td>
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<tr>
<td>Field of view (at reference magnification)</td>
<td>8192 pixels (When using the XG-HL08M)</td>
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<tr>
<td>F-stop range (aperture)</td>
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<td>+0.25</td>
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<tr>
<td>WD (mm, at reference magnification)</td>
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<td>TV distortion (Max.)</td>
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<tr>
<td>Resolution (μm)</td>
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LENS CHART

When using the CA-LHW Series

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<tbody>
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<td>Field of view (at reference magnification)</td>
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LENS CHART

When using the CA-LHL Series

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LENS CHART

When using the CA-LM Series

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<td>x0.25 to x1</td>
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<td>Field of view (at reference magnification)</td>
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<tr>
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<tr>
<td>+0.25</td>
<td>+0.25</td>
<td></td>
</tr>
<tr>
<td>+0.25</td>
<td>+0.25</td>
<td></td>
</tr>
<tr>
<td>WD (mm, at reference magnification)</td>
<td>+0.25</td>
<td>+0.25</td>
</tr>
<tr>
<td>+0.25</td>
<td>+0.25</td>
<td></td>
</tr>
<tr>
<td>+0.25</td>
<td>+0.25</td>
<td></td>
</tr>
<tr>
<td>TV distortion (Max.)</td>
<td>+0.10%</td>
<td>+0.10%</td>
</tr>
<tr>
<td>+0.10%</td>
<td>+0.10%</td>
<td></td>
</tr>
<tr>
<td>+0.10%</td>
<td>+0.10%</td>
<td></td>
</tr>
<tr>
<td>Resolution (μm)</td>
<td>+0.04”</td>
<td>+0.04”</td>
</tr>
<tr>
<td>+0.04”</td>
<td>+0.04”</td>
<td></td>
</tr>
<tr>
<td>+0.04”</td>
<td>+0.04”</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>Approx.440g</td>
<td>Approx.440g</td>
</tr>
</tbody>
</table>

LENS CHART

When using the CA-LM Series

<table>
<thead>
<tr>
<th>Part number</th>
<th>CA-LM0210</th>
<th>CA-LM0210</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optical magnification</td>
<td>x0.25 to x1</td>
<td>x0.25 to x1</td>
</tr>
<tr>
<td>Field of view (at reference magnification)</td>
<td>8192 pixels (When using the XG-HL08M)</td>
<td></td>
</tr>
<tr>
<td>F-stop range (aperture)</td>
<td>+0.25</td>
<td>+0.25</td>
</tr>
<tr>
<td>+0.25</td>
<td>+0.25</td>
<td></td>
</tr>
<tr>
<td>+0.25</td>
<td>+0.25</td>
<td></td>
</tr>
<tr>
<td>WD (mm, at reference magnification)</td>
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</tr>
<tr>
<td>+0.25</td>
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<td></td>
</tr>
<tr>
<td>+0.25</td>
<td>+0.25</td>
<td></td>
</tr>
<tr>
<td>TV distortion (Max.)</td>
<td>+0.10%</td>
<td>+0.10%</td>
</tr>
<tr>
<td>+0.10%</td>
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<td></td>
</tr>
<tr>
<td>+0.10%</td>
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<td></td>
</tr>
<tr>
<td>Resolution (μm)</td>
<td>+0.04”</td>
<td>+0.04”</td>
</tr>
<tr>
<td>+0.04”</td>
<td>+0.04”</td>
<td></td>
</tr>
<tr>
<td>+0.04”</td>
<td>+0.04”</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>Approx.440g</td>
<td>Approx.440g</td>
</tr>
</tbody>
</table>
CA-LHW DIMENSIONS (FOR 2K/4K LINE SCAN CAMERAS)

CA-LHW8

CA-LHW16

CA-LHW35

CA-LHW50

CA-LHL DIMENSIONS (FOR 8K LINE SCAN CAMERAS)

CA-LHL16

CA-LHL25

CA-LHL35

TELECENTRIC MACRO LENS FOR LINE SCAN CAMERAS

CA-LM DIMENSIONS

CA-LM0210 (2k/4k line scan cameras)

OP-87337 (Dedicated mounting stand for the macro lens)

Location of mounting screws for the stand main unit

OP-87319 (F-mount adaptor for 8k line scan cameras)

Lens center
CA-DZ SERIES

Line Lights

High-intensity LED lights designed for line scan camera applications
Emits stable light intensity in a line shape

LINEUP

<table>
<thead>
<tr>
<th>Part number</th>
<th>LED color</th>
<th>Weight</th>
<th>Power consumption*</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA-DZx5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CA-DZx15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CA-DZx30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CA-DZx45</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DIMENSIONS

Unit: mm inch

CA-DZx5

CA-DZx15

CA-DZx30

CA-DZx45

*CA-DC100 cannot be used to provide maximum intensity as power consumption exceeds 20 W.
*When using a line camera with the CA-DC21E, set light configuration to DC mode.
*The CA-DZx5, CA-DZx15, CA-DZx30, and CA-DZx45 are LED class 2.

OPTIONAL PARTS

One-sided matte processing diffusion plate

Two-sided matte processing diffusion plate

Diffusion unit for transmission

Part number Applicable light
OP-87328 CA-DZx5
OP-87329 CA-DZx15
OP-87330 CA-DZx30
OP-87331 CA-DZx45

One-sided matte processing plate is included with the main line light unit.

Two-sided matte processing plate has a diffusion rate that is much higher than one-sided matte plate.

Limits light diffusion and enhances the edges of the target for dimensional type measurements (backlight).

Part number Applicable light
OP-87324 CA-DZx5
OP-87325 CA-DZx15
OP-87326 CA-DZx30
OP-87327 CA-DZx45

Limits light diffusion and enhances the edges of the target for dimensional type measurements (backlight).
**PRODUCT LINEUP**

**Controllers**
- Supports all cameras up to the 5M pixel area cameras and the 8K pixel line scan camera
  - XG-8702L
- Supports all cameras up to the 2M pixel area cameras and the 2K line scan camera
  - XG-8502L

**Line scan cameras**
- 8x high-speed, 2048 pixels
  - Linear camera
  - XG-HL02M
  - (Monochrome)
- 16x high-speed, 4096 pixels
  - Linear camera
  - XG-HL04M
  - (Monochrome)
- 16x high-speed, 8192 pixels
  - Linear camera
  - XG-8702L
  - XG-8000 Series only
- Supports all cameras up to the 5M pixel area cameras and the 8K pixel line scan camera
  - XG-8702L

**Expansion unit**
- Camera expansion module
  - XG-EC80L
- Camera expansion input unit
  - XG-EC80L
- Area camera input unit
  - XG-EC80
- LED light control expansion module
  - CA-DC21E

**Others**
- Dedicated touch panel
  - CA-MP120T
- Handheld controller
  - OP-84231
  - OP-84236 (blank)
- Image processing system integration software
  - XG-H8NE2
- Please see p. 14 for the supported OS.

**Optional Accessories**

**Camera cables**
- Cable type: Connector shape
  - High-speed camera cable
    - Straight
    - L-type
  - High-speed high flex robot cable
    - Straight
    - L-type

**Amplifier for extension cables**
- CA-CHX10U
  - (for high-speed cameras)

**Camera cables may be extended up to 30 m (98.4 ft).**

**Accessories for the CA-MP120T**
- Monitor stand: OP-87262
- Monitor cable
  - OP-87260 (3 m 9.8')
  - OP-87261 (10 m 32.8')
- Console junction cable
  - OP-87268 (3 m 9.8')
  - OP-87269 (10 m 32.8')
- Y split cable
  - OP-84457 (1 m 3.3')

**Communication cable**
- OP-26486: 9 pins
- OP-26485: 25 pins
- For 9-pin SYSMAC: OP-84384
- For 9-pin MELSEC: OP-86830

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

**Industrial SD card**
- CA-SD4G: 4GB (SDHC)
- CA-SD1G: 1GB
- OP-87133: 512MB

**Communication cable**
- OP-26487 (2.5 m 8.2')
- Standard lighting cable
  - CA-D2 (2 m 6.6')
  - CA-D5 (5 m 16.4')
- High flex lighting cable
  - CA-D3 (3 m 9.8')
  - CA-D5R (5 m 16.4')
  - CA-D10R (10 m 32.8')
  - CA-D17R (17 m 55.8')

**USB cable**
- OP-66844 (2 m 6.6')

**Standard lighting cable**
- OP-66843 (3 m 9.8')
- OP-66842 (3 m 9.8')
- OP-87055 (10 m 32.8')

**Monitor stand**
- OP-87262

**RS-232C communication cable**
- OP-87260 (3 m 9.8')
- OP-87261 (10 m 32.8')

**RGB Monitor cable**
- OP-84457 (1 m 3.3')

**Console junction cable**
- OP-87268 (3 m 9.8')
- OP-87269 (10 m 32.8')

**Monitor stand**
- OP-87262

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

**Camera cables**
- High-speed camera cable
  - Straight
  - L-type
- High-speed high flex robot cable
  - Straight
  - L-type

**Camera cables**
- The dedicated extension cable is necessary in order to connect an amplifier to a camera or between two amplifiers.

**Camera cables**
- The dedicated extension cable is necessary in order to connect an amplifier to a camera or between two amplifiers.
Vision toolset

**Supports**
- Simultaneous capture of up to 4 cameras
- Multiple combinations, repeat capturing, background capturing
- HDR image capture (without background capturing)

**Image Input**
- Image acquisition

**Processing regions**
- Shapes include: rectangle, rotating rectangle, circle, oval, ring arc, polygon (up to 12 sides), composite area (2 regions, including masks, processed binary (gray) image regions. Also supports parameter variable referencing.
- 4 regions per unit can be set for the mask region (not including composite areas). Supports measurement of pixel region area, region volume referencing.

**Image Enhancement filters**
- Filters: expand, shrink, average, median, edge enhancement, edge extraction X, edge extraction Y. Supports: blur, sharpen, Laplacian, binary subtraction, preserve intensity, contrast conversion, real-time differential, real-time slope correction, binary (thresholding), color (Ho) conversion, expansion, shrink, binarizing. Processing: Multiple processing of the same filter up to 9 times (for binary, subtractive, preserve intensity, contrast conversion, real-time differential, real-time slope correction, binary (thresholding), binarizing) is once only. Filter combinations (13 filters for binary, subtractive and binarizing) can only use once. Also supports parameters variable referencing.

**Color extraction function** (valid for color cameras only)
- Color to binary conversion, color shade processing, free color channel mode only. RGB average (Color correlates with HSB color space). Also supports parameter variable referencing.

**Sizing**
- Ability to turn ON/OFF scaling coefficients for the XY and length measurements for each camera. Also supports parameter variable referencing.

**Unit Execute Condition**
- Selection to execute/execute unit. Also supports parameter variable referencing.

**Positional**

**Pattern Search**
- 360 degree orientation and recognition of up to 99 patterns. Support for up to 4 mask regions, origin and reference point adjustment. Processing based on post image variables or registered (saved) images.

**Edge Position**
- Simultaneous position measurements up to 3600 units points in a linear or radial (circle, arc) fashion.

**Trend Edge Position**
- Average, maximum, minimum position, angle (when using circumference and arcs) measurements in a single region divided up into a maximum of 5000 segments. Best fit line and circle processing (using least square method) including abnormal point removal.

**Blob**
- Center of gravity position, major axis inclination (180 degrees/360 degrees conversions) measurements up to 9999 dectects.

**Image Output**
- Measurement of the angle based on the straight line connecting two detected edge points.

**Positional**

**Position Adjustment**
- Supports X, Y +/- 180 degree adjustment data from units, calculations and variables for positional correction of other tools based on 1 or 2 point correction.

**Flowchart Control**

**Loops**
- Repeated unit processing. Also supports parameter variable referencing.

**Calculation & Image Processing**

**Image Operation**
- Creates images based on multi-image processing or through mathematical processing.

**Image Operation**
- Conducts operations on images, supporting combinations 1x1, nx1 and nxn (to a maximum of 32 images)

**C Plug In**
- C language source files can be compiled both controller and PC simulation environments.

**Calibration**
- Calibration of images and processing due to lens distortion and camera placement. Supports both coordinate of coordinate position and image for correct processing. Supports adjustable calibration via multiple images up to 16, pixel point selection on 0-4000 pixels per image and region selection. Calibration teaching pattern (grid and non-grid) can also be obtained to be printed out.

**Timing and Processing Control**

**Time**
- Pauses the processing flow for a specific time limit (2 to 1 hours). Also supports parameter variable referencing.

**Taper**
- Start a user defined time (0-7)

**Taper conditions apply**
- Pauses the processing flow with the expiration of a user time (0-7)

**Terminal I/O Delay**
- Pauses the processing flow based on the AND / OR conditional changes of terminal block and parallel input, output (digital/analogue), CX/K, digitizing edge, rising edge. Supports: CC-I Link and EtherCAT/JAPPI Bit devices.

**Variable Delay**
- Pauses the processing flow based on AND / OR conditional comparison of variables and numerical values

**User Data**
- Pauses the processing flow and the opened menu is used

**Graphics**
- Displays data (fixed, numerical, alphabetical, decimal conversion, graphics, rectangle, rotated rectangle, circle, oval, ring arc, polygon, line, table, polygon). Selects data and variables. Along with support for parameter variable referencing.

**Outputs**
- Outputs arbitrary measurement results to parallel output terminals, with support for cyclic (stripping up to 8 cycles).

**Outputs**
- Outputs arbitrary measurement results to parallel output terminals, with support for cyclic (stripping up to 8 cycles).

**Command**
- Issue various commands for controller functions based on image processing.

**Commands to All Units**
- Overall output giving a logical OR result output based on allocated units result.

**Total Error Processing**
- Overall error output giving a logical OR result output based on allocated units result.
**Model**

- **XG-H8NE2 (XG VisionEditor)**

**GUI Interface**

- **Menus**
  - Built-in Menus: Simulation
  - Menu settings: Allows for the creation of up to 900 users defined menus per program with support for external control and display. Menus can be used to interact with settings via variables and support numerous commands.

- **Variables**
  - Local Variable: Displays the mouse position, HS/RGB values when over an image, and image processing buffer parameters.
  - Global Variable: Displays image processing buffer parameters.
  - Image Variable: Displays image processing buffer parameters.

**Simulation**

- **Offline simulation model**
  - XG-H8NE2 (VisionEditor)
  - Enables offline simulation of BMP, JPG images (up to 640x480) that have been stored on a PC or loaded in though a connected controller.

**Development Functions**

- **Screens**
  - Frames: Up to 98 frames per program for high graphics, data, and values, with support for external switching.
  - Image Displays: Up to 8 image displays for associating with displaying current images, registered images or captured images.
  - Elements: Image display, main frame, top frame, basic elements: lines, characters, active character, horizontal lines, vertical lines, points, rectangles, circles, polygons, ruled line. Built in elements: Image display, inspection data, inspection time, camera screen information, zoom information, OK/NOK, signal, status (ON/OFF), sensor unit results, and variable list.

- **Menus**
  - Menu elements: File, numerical input, drop down menu, external button, confirmation button.

**Testing and Debugging**

- **Processing View**
  - Flowchart/Program: Creation, editing and deletion of all components used in image processing in a flowchart / program.

- **System Settings**
  - System Parameters: Control and upgrading of program and other file versions.

**Controller Management**

- **Processing Management**
  - Allocation of memory and resources for online editing and use of the UI command.

**Controller Adjustment**

- **Edit Unit Settings**
  - Selection of which units can be edited directly on the controller. Control over the level of changes capable based on user group and accounts. Control over the use of commands for displaying unit edit menu.

---

**Storage**

- **Image Variable**
  - Define up to 1024 variables (numerical, positional, line, and circle based) per program.

- **Local Variable**
  - Define up to 10000 variables (numerical, positional, line and circle based) per program.

- **Global Variable**
  - Define up to 1024 variables (numerical, positional, line, and circle based) per program.

**Variable Reference List**

- **Screen Editor**
  - Screen Management: Management of screens, elements and menu interfaces available on the controller in a hierarchal format.

**Password Protection & Security**

- **Password protection**
  - Password required to access program editing via XG VisionEditor.

---

**ARCHIVE PLAYBACK MODE**

- **Archive Playback Mode**
  - Enables reproduction of data archived at the time of recording based on BMP/JPEG images (up to 256 generations) and archived results that have been previously registered to the image archive.

---

**Cache**

- **Cache Settings**
  - Cache: Enables the caching of results for offline use.

---

**System Variables**

- **Simulator**
  - Off-line simulation:
    - Enables offline simulation as a PC, working with the GUI of the XG controller allowing the testing of up to 50000 images.
### SPECIFICATIONS (SOFTWARE)

<table>
<thead>
<tr>
<th>Model</th>
<th>XG-HINE2 (XG VisionEditor)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operating Systems</strong></td>
<td>Windows XP Home Edition/Professional SP2</td>
</tr>
<tr>
<td></td>
<td>Windows XP Home Basic, Home Premium, Business, Ultimate, Enterprise</td>
</tr>
<tr>
<td></td>
<td>Windows 7 Home Premium, Professional, Ultimate, Enterprise</td>
</tr>
<tr>
<td><strong>Supported OS</strong></td>
<td>Windows 8, Windows 10 (64-bit)</td>
</tr>
<tr>
<td><strong>Minimum Memory</strong></td>
<td>2 GB or higher</td>
</tr>
<tr>
<td><strong>Minimum Hard Drive</strong></td>
<td>16 GB or higher</td>
</tr>
<tr>
<td><strong>CPU</strong></td>
<td>Intel Core 2 Duo or AMD Athlon II X2 2.2 Ghz or higher</td>
</tr>
<tr>
<td><strong>RAM</strong></td>
<td>4 GB or higher</td>
</tr>
<tr>
<td><strong>USB</strong></td>
<td>USB 2.0 or higher</td>
</tr>
<tr>
<td><strong>Network</strong></td>
<td>10/100 Mbps Ethernet</td>
</tr>
</tbody>
</table>

**Additional Software**

- **XG Vision Terminal**: License free remote support, data logging (Image and data output), and management. For up to 8 controllers (via Ethernet or USB).
- **XG Vision Terminal**: License free remote support, data logging (Image and data output), and management. For up to 8 controllers (via Ethernet or USB).

**Supported Resolution**

- **4-camera simultaneous capture** can be selected (when XG-E800 is not connected, images from up to two area cameras can be captured at the same time).

**Image Processing**

- **Up to 2400 images** (512 x 512 pixels)
- **Up to 3840 images** (512 x 512 pixels)
- **Up to 7680 images** (1024 x 1024 pixels)
- **Up to 12,288 images** (1280 x 1280 pixels)
- **Up to 24,576 images** (1280 x 1280 pixels)

**Camera Connectivity**

- **When mounting the XG-EC80 (monochrome area camera):** Supports color/monochrome area cameras (supports: XG-H500C/H500M/H200C/H200M/S200C/S200M/H200M/S200M)

**Image Capture**

- **Image Capture** supports the following functions:
  - **Area camera start** supports changes for each image capture through variable referencing.
  - **Line camera start** supports changes for each image capture through variable referencing.

**Image Processing**

- **Up to 2400 images** (512 x 512 pixels)
- **Up to 3840 images** (512 x 512 pixels)
- **Up to 7680 images** (1024 x 1024 pixels)
- **Up to 12,288 images** (1280 x 1280 pixels)
- **Up to 24,576 images** (1280 x 1280 pixels)

**Camera Setting**

- **When mounting the XG-EC80:** Can set an arbitrary line number within the maximum line number for each camera.

**Image Inversion**

- **When mounting the XG-EC80:** Supports inverting the image to the left or right/vertical inversion, 180° rotation.

**Image Archive**

- **With an area camera connected:** Enables the storage of up to 1024 images (color camera, 2,000,000 pixels) or up to 1024 images (monochrome camera, 2,000,000 pixels).

**Image Size**

- **Max. 100,000 points per item, max. 256 items (supports exporting to SD card)**

**USB Driver**

- USB driver (license free) specifically for connecting an XG-8000 controller via USB to either the XG Vision Editor, XG Vision Terminal or XG Simulator+ software. Supports with XG Vision Editor, XG Vision Terminal and XG Simulator+.

**XG Vision Terminal**

- License free remote support, data logging (Image and data output), and management. Supports up to 8 connected controllers (via Ethernet or USB).

**Image size**

- **Up to 8 images** (color camera, 2,000,000 pixels)
- **Up to 16 images** (color camera, 1,000,000 pixels)
- **Up to 32 images** (color camera, 310,000 pixels)
- **Up to 64 images** (color camera, 2,000,000 pixels)
- **Up to 128 images** (color camera, 1,000,000 pixels)
- **Up to 256 images** (color camera, 1,000,000 pixels)
- **Up to 512 images** (color camera, 2,000,000 pixels)
- **Up to 1024 images** (color camera, 4,000,000 pixels)
- **Up to 2048 images** (color camera, 4,000,000 pixels)
- **Up to 4096 images** (color camera, 4,000,000 pixels)

**Image Quality**

- **Up to 8192 (H) x 8192 (L), approx. 67.11 mega-pixels**
- **Up to 8192 (H) x 8192 (L), approx. 67.11 mega-pixels**
- **Up to 32,768 (H) x 32,768 (L), approx. 1.31 mega-pixels**

**Image Format**

- **.JPG (.JPG)**
- **.JPG (.JPG)**
- **.JPG (.JPG)**

**Image size**

- **Up to 1024 images** (color camera, 2,000,000 pixels)
- **Up to 1024 images** (color camera, 1,000,000 pixels)
- **Up to 1024 images** (color camera, 310,000 pixels)
- **Up to 1024 images** (color camera, 2,000,000 pixels)
- **Up to 1024 images** (color camera, 1,000,000 pixels)
- **Up to 1024 images** (color camera, 310,000 pixels)
- **Up to 1024 images** (color camera, 2,000,000 pixels)
- **Up to 1024 images** (color camera, 1,000,000 pixels)

**Image size**

- **Up to 1024 images** (color camera, 4,000,000 pixels)
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**Image size**

- **Up to 1024 images** (color camera, 4,000,000 pixels)
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**Specifications (Controller)**

### Interface

**PLC link**
- 16-bit communication interface is supported (can be connected to CC-Link or EtherCAT).
- Supports 32-bit communication interface connection (can be connected to EtherCAT).

**EtherCAT**
- Supports direct communication (max. 1436 bytes) between host controllers and EtherCAT in EtherCAT.
- Supports communication with the Ethernet controller (max. 1436 bytes).
- Supports communication with the Ethernet controller (max. 1436 bytes).

**USB**
- Supports communication with the Ethernet controller (max. 1436 bytes).
- Supports communication with the Ethernet controller (max. 1436 bytes).

**Ethernet**
- Supports communication with the Ethernet controller (max. 1436 bytes).
- Supports communication with the Ethernet controller (max. 1436 bytes).

### Programing Assistance

**Assignable Input**
- Supports direct communication (max. 1436 bytes)
- Supports direct communication (max. 1436 bytes).

**Assignable Output**
- Supports direct communication (max. 1436 bytes)
- Supports direct communication (max. 1436 bytes).

**Encoder Input**
- Supports direct communication (max. 1436 bytes)
- Supports direct communication (max. 1436 bytes).

**Monitor output**
- Supports direct communication (max. 1436 bytes)
- Supports direct communication (max. 1436 bytes).

**Operation indicators**
- Supports direct communication (max. 1436 bytes)
- Supports direct communication (max. 1436 bytes).

**Power, Error LED display**
- Supports direct communication (max. 1436 bytes)
- Supports direct communication (max. 1436 bytes).

**Operation indicators**
- Supports direct communication (max. 1436 bytes)
- Supports direct communication (max. 1436 bytes).

### Language

Japanese/English/Simplified Chinese/Traditional Chinese

**Illumination control**
- Supports direct communication (max. 1436 bytes)
- Supports direct communication (max. 1436 bytes).

**Rating**
- Supports direct communication (max. 1436 bytes)
- Supports direct communication (max. 1436 bytes).

**Environmental temperature**
- Supports direct communication (max. 1436 bytes)
- Supports direct communication (max. 1436 bytes).

**Ambient operating humidity**
- Supports direct communication (max. 1436 bytes)
- Supports direct communication (max. 1436 bytes).

**Weight**
- Supports direct communication (max. 1436 bytes)
- Supports direct communication (max. 1436 bytes).

*1 When connecting the XG-H035C/H035M camera, the process area cannot be changed when set to 640 H x 480 V mode and only the horizontal area can be changed when set to 512 H x 480 V mode.

*2 PLC models that have a built-in Ethernet port support a direct connection.

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**Specifications (Camera)**

### Line scan camera (XG-HL02M/HL04M/HL08M)

#### Model

<table>
<thead>
<tr>
<th>Model</th>
<th>XG-HL02ML*1</th>
<th>XG-HL04ML*1</th>
<th>XG-HL08ML*1</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDD</td>
<td>14.3 mm 35S monochrome CMOS image receptor, 16 high-speed reading using square-grid (4 outputs), 2048 pixels, 14.3 mm 35S monochrome CMOS image receptor, 16 high-speed reading using square-grid (4 outputs), 4096 pixels, 16 high-speed reading using square-grid (4 outputs), 8192 pixels, 16 high-speed reading using square-grid (4 outputs), 8192 pixels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resolution</td>
<td>2048 pixels, 2048 pixels, 4096 pixels, 4096 pixels, 8192 pixels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Scan Time</td>
<td>24 μs (2.4 MHz)</td>
<td>24 μs (2.4 MHz)</td>
<td>24 μs (2.4 MHz)</td>
</tr>
<tr>
<td>Pixel transfer frequency</td>
<td>100 MHz (50 MHz in 2 channels)</td>
<td>100 MHz (50 MHz in 2 channels)</td>
<td>100 MHz (50 MHz in 2 channels)</td>
</tr>
<tr>
<td>Transfer system</td>
<td>Digital serial transfer</td>
<td>Digital serial transfer</td>
<td>Digital serial transfer</td>
</tr>
<tr>
<td>Electronic shutter</td>
<td>User-defined setting (3 μs to 30,000 μs)*2</td>
<td>User-defined setting (3 μs to 30,000 μs)*2</td>
<td>User-defined setting (3 μs to 30,000 μs)*2</td>
</tr>
<tr>
<td>Functions</td>
<td>Shading correction (4 patterns)</td>
<td>Shading correction (4 patterns)</td>
<td>Shading correction (4 patterns)</td>
</tr>
<tr>
<td>Lens mount</td>
<td>C mount</td>
<td>C mount</td>
<td>C mount</td>
</tr>
<tr>
<td>Environmental resistance</td>
<td>Ambient temperature: 0 to 40°C; 32 to 104°F</td>
<td>Ambient temperature: 0 to 40°C; 32 to 104°F</td>
<td>Ambient temperature: 0 to 40°C; 32 to 104°F</td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 1600 g</td>
<td>Approx. 1600 g</td>
<td>Approx. 1600 g</td>
</tr>
</tbody>
</table>

*1 When using any of the line scan cameras, only the high-speed camera cable (CA-Chixx) can be used.

*2 The maximum shutter time is limited to 3 μs less than the line trigger cycle setting.

*3 P-mount lens adapter is optionally available (OP-87319).
AFTER SALES SUPPORT

Here at KEYENCE we pride ourselves on the quality of our after sales support on all our products and the XG-8000 Series is no exception. We offer many different types of support to assist with using KEYENCE's range of machine vision systems. In addition to our technically trained workforce, support services include: free training workshops, free software upgrades, example programs, technical guides, online resources and dedicated technical support.

XG Series User Support Webpage  http://www.visionsystem.com

In addition to the standard KEYENCE websites, there is a dedicated XG Series support website that is specifically designed for providing answers to questions, example programs and software to assist any XG user.

Example programs

Example programs can be downloaded with easy to use instructions enabling you to benefit from and gain experience on all the XG Series has to offer.

Free remote support and testing with the XG Simulator+

The “XG Simulator+” software can be downloaded free of charge from the XG User Support webpage enabling remote testing and support of any XG program.

By emailing images and setting files directly to KEYENCE technical support, we can answer any questions you may have concerning your application or program. New applications can also be sent directly to KEYENCE for free testing and evaluation by dedicated application engineers.