Comprehensive Machine Vision
Intuitive, Quick, Flexible, High Performance and Fully Customizable

XG-7000 Series
Ver.4.0
The ever-evolving KEYENCE imaging system continues to offer the solutions and support that meet global customer's needs.

Image processing solutions used by the professionals
Complete selection including peripherals and free trials
Instant delivery throughout the world
Direct support from a highly trained team

Peripheral Equipment
The majority of the extensive product line up such as cameras, controllers, lighting equipment and peripherals are available for immediate delivery. KEYENCE offers a complete solution and the support for all your image processing needs.
Solve all your application needs

2003
High-speed general-purpose vision system incorporating twin processors and digital transfer camera is released.

2004
Upgrades in features and functionality with the introduction of 2 Megapixel cameras.

2005 to 2008
The CV-3000 and CV-5000 raise the bar for machine vision performance with 4 monochrome / color camera connectivity, unmatched speed, and the industry’s most user friendly programming interface.

2010
Providing a new approach to vision with customization and simple operating methods that overcome all hurdles.
XG Performance

Flexible hardware
Powerful Inspection Toolset
User friendly interface
Intuitive programming flow
Increasing speed, stability and quality to stay at the forefront of the vision market

HARDWARE
Reliable and ultra high-speed hardware design
3+1 Processor
Solid state hard drive
Integrated lighting controller
5 Megapixel camera support

PRE-PROCESSING
Optimizing the image using advanced pre-processing functions
Filters
Image operation
Calibration unit
Color processing

CAMERAS
Simultaneous capture of up to 4 cameras,
16 color and monochrome camera options
- High speed (7x) 310K & 2 Megapixel
- High resolution 5 Megapixel
- Ultra small 12mm
TOOL SET
Abundant inspection algorithms, variables and calculations.

- Stain
- Trend edge
- Trend edge stain
- OCR
- 2D
- Image calibration
- Pattern search
- Calculation / Scripting
- Loop
- Branching

INPUT/OUTPUT
Simpler, customizable control

- Discrete I/O
- FTP server
- EtherNet/IP
- TCP/IP
- RS-232
- CC-Link
- PLC-Link
- USB

GUI CREATION
A custom user-interface anybody can use

- Vision terminal
- Simulator +
- Mouse operation
- Simple pendant adjustment

VISION EDITOR
Development of a complete vision solution

- C Plug In
- ActiveX Control
- Flowchart creation
- Debugging
- Testing
- Customization
Simple setup using the handheld controller

Creation of a program can be done on-line using the handheld controller. After creation, verification and editing can be conducted to increase the inspection accuracy without stopping the line using the 'Online Re-Test' function during operation. This allows the re-testing of stored images even during operation based on images saved to the internal buffer or to an FTP server. Program changes can be tested on-site without influencing the current production.
PC interaction with mouse control

Programs can be created and settings can be easily adjusted on the PC while on-line. Image processing being conducted on-site or in a separate factory location can be accessed in real-time on a PC screen, and easily adjusted with a mouse. Furthermore, multiple controllers can be connected simultaneously via a network, so a PC can be used in place of a VGA monitor for setup and interfacing purposes.

Settings can also be verified offline. Using stored images output by the controller during operation, the PC simulator mimics on-site result data on a simple simulator. Even if the equipment cannot be stopped, the statistical analysis function of the simulator conducts the same action as the actual controller. After confirming the optimal settings with the simulator, the program setting can be uploaded to the controller providing seamless and efficient interaction with the controller.
## Applications

<table>
<thead>
<tr>
<th>Part Identification/Defect Inspection</th>
<th>Measurement/Positioning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electrical/Electronic</strong></td>
<td><strong>Automotive/Metal</strong></td>
</tr>
<tr>
<td>Visual inspection of chip (SMD) LEDs</td>
<td>Checking for adhering piston chips</td>
</tr>
<tr>
<td>Visual inspection of a chip capacitor</td>
<td>Inspecting motor wire bundles and checking for solder defects</td>
</tr>
<tr>
<td>Visual inspection of crystal oscillators</td>
<td>Camshaft mold cavity inspections</td>
</tr>
</tbody>
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</tr>
</thead>
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<tr>
<td>Checking for adhering piston chips</td>
<td>Checking workpiece seating in hot-forging dies</td>
</tr>
<tr>
<td>Formed-in-place gasket (FIPG) coating inspection</td>
<td>Label inspection (position/appearance)</td>
</tr>
<tr>
<td><em>Coating break</em></td>
<td>Chip inspection on bottle rims</td>
</tr>
<tr>
<td><em>No wire defect</em></td>
<td>Interior inspection of containers</td>
</tr>
<tr>
<td><em>New circle detection algorithm (trend edge tool)</em></td>
<td>Inspection of pinholes and foreign materials on a sheet</td>
</tr>
</tbody>
</table>

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<tr>
<th><strong>Measurement/Positioning</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>A virtual circle is determined from the partial arc of a wafer to output the wafer center</td>
</tr>
</tbody>
</table>

*Different diameter and overall length*  
*Coating break*  
*Bundle defect*  
*Workpiece position drift*
**Color Inspection/OCR/2D Code Reading/Counting**

- **Dimenstional/Visual Inspection of Capacitors**
  - Side view
  - Top view
  - Simultaneous measurement of pitch and coplanarity

- **Character Recognition of Part Numbers and 2D Code Reading**
  - Detecting BAT marks with red ink

- **Checking Orientation through Embossed Tape**
  - Pass
  - Marking omission

- **Electrical/Electronic**
  - **Automotive/Metal**
    - Random picking of bushing parts by robots
    - Detecting bead positions
    - Example: Screw position detection

- **Checking Improperly Closed Caps**
  - Pass
  - Improper orientation

- **Food, Pharmaceutical and Others**
  - **Checking the Liquid Level**
  - Inspecting expiration date
  - Counting the number of tablets

- **Counting Items in a Carton**
  - Counting items in a carton
  - Type/orientation differentiation of drink boxes
KEYENCE always strives to create the industry standard and best performance for ASIC/CPU based vision systems. Placing a heavy emphasis on the benefits of parallel processing and processor architecture has helped keep KEYENCE at the forefront of technology. In addition to the “A.C.E.II” (color image processing engine), KEYENCE has achieved stable, high-speed processing by combining 2 DSPs (image processing and screen display) and a RISC-CPU for overall control and communication into one dedicated hardware package.

[Comparison with conventional processing]

**Conventional**

![Conventional System Diagram]

**XG-7000 Series**

![XG-7000 System Diagram]

Achieving faster processing speeds by sharing imaging processing tasks between multiple processors.

**Example of ultra high-speed processing**

**Electric component surface inspection 3 ms**

Using a 7x high-speed 310,000-pixel color camera with a 240 CCD line field of view to capture edge angle, an inspection containing position correction, binary area and color defect inspections takes 3 ms!

**Highly Reliable Fan-Less/ Solid State Drive (SSD) Design**

Fans and conventional HDD’s have moving components that will eventually wear out. By not having moving components, long-term continuous reliable operation is possible. The XG-7000 Series has sophisticated heat dissipation technology allowing for a fan-less design even while putting heavy loads on processors running at ultra high speeds. In addition, this design is particle emission-free and therefore suitable for use in clean-room environments.
EXPANDABLE HARDWARE

KEYENCE Continues to Develop Innovative Hardware
Resulting in the World's First Expandable Machine Vision Controller

**INDUSTRY FIRST**

**Expandable Controller**

By connecting additional modules to the side of the controller, the optimum system can be setup as well as allowing future expansion when needed.

**INDUSTRY FIRST**

**Multi-Camera, Simultaneous Acquisition**

The XG-7000 Series allows for the seamless use of up to 14 different camera models. Depending on the inspection required, the most suitable camera can be selected and combined with other cameras on the same controller. For instance camera 1 and 2 could be high speed monochrome cameras for simple part position, where as camera 3 could be a 5 million pixel color camera for part quality inspection. Up to 4 cameras can be connected by adding the camera expansion module. The system runs all 4 cameras simultaneously*, (including the data-intensive 5 million-pixel color camera).

This controller flexibility also allows for easy upgrading and changes to be made based on changes in the inspection criteria. If another camera is needed, it can be specified based on the task required and easily added to the system.

* Connection of 1 million-pixel or more cameras is limited to the XG-7502/7702 only, 5 million-pixel camera connection limited to the XG-7702 only

**[Multi-camera system]**

Select up to four cameras out of 16 models

**[Combination examples]**

*Up to 4 lighting expansion modules can be connected to the main controller. Each single unit has 2 lighting connections (connector and terminal style) so that up to eight 12 or 24 VDC lights can be connected.***

**WORLD’S FIRST**

**LED Light Control Expansion Unit**

Easily control dedicated lighting without any extra wiring

Light settings

Lighting can be easily controlled as part of the image processing flowchart by setting the lighting conditions in the light settings tab within the image capture unit. By using multiple image capture units with different lighting patterns or intensities within a single processing flowchart, multiple image capture and advanced light sequencing is made easy. In addition, as the light intensity value is a variable that can be referenced, dynamic changes can be made to a program after an inspection has been processed.

Conventional methods require PLC control with large numbers of I/O.

No I/O allocation, no wiring and no PLC programming is necessary

The ON/OFF status, strobing and intensity of 8 lights is possible in each image capture unit.

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# CAMERAS

**Wide Range of Camera Variety Covering Every Possible Need and Performance Criteria**

Whether the application calls for high quality inspection with a color megapixel camera, fast processing inspection with a 7x high-speed camera, or mounting a compact camera in a tight environment, the wide variety of XG-7000 Series camera line-up can provide the ideal solution.

<table>
<thead>
<tr>
<th>Type</th>
<th>Model</th>
<th>Specification</th>
<th>CCD capture range (pixels)</th>
<th>Image transfer time (ms)</th>
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<tbody>
<tr>
<td>5 million-pixel</td>
<td>XG-H500M</td>
<td>11x high-speed monochrome</td>
<td>2432 × 2050</td>
<td>61.2</td>
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<tr>
<td>camera series</td>
<td>XG-H500C</td>
<td>11x high-speed color</td>
<td>2432 × 2050</td>
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<tr>
<td>2 million-pixel camera</td>
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<td>310,000 pixel camera</td>
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[Difference in defect detection ability based on number of pixels]

**310,000 pixels**
Lines are out of focus and cannot be detected.

**2 million pixels**
Broken pattern is out of focus and lacks the clarity for an accurate inspection. The image requires a smaller field of view.

**5 million pixels**
Details appear sharp and the break can be accurately detected.
CONTROLLER OPERATION

Direct Flowchart Interaction and Manipulation Without PC Software

The controller supports direct interaction with the image processing flowchart without a PC. Enabling editing, addition, movement and configuration of different vision units with the handheld console. With the easy to navigate GUI, the time taken to make adjustments is kept to a minimum.

NEW

Controller Flowchart Editing Gives the User Complete Control

Overall flow chart display

The full flowchart can be displayed on screen for a full view of the operation. Navigation on large scale flowcharts is quick, easy and stress free as the area needing to be viewed can be selected from the map with the display cursor.

Unit operation & judgment display

Each unit on the flowchart has an indicator to show whether it is being processed and its pass/fail status (OK/NG). This enables current state of the image processing flow to be easily checked at a glance.

Condition display:
- Unit processed, judgment - pass (OK)
- Unit processed, judgment - fail (NG)
- Unit not processed

Unit direct view

The detailed results and settings of a unit can be verified simply by placing the cursor over the relevant unit on the flowchart.

Conditional branching

The conditional branching used in an image processing flowchart can also be configured and displayed. Branches can be displayed in different colors and minimized to help with effective programming.

Conventional model

Conventional systems have a single flow structure. So a “jump to” command is required making navigation and understanding very hard.

Real branching structure

The XG-7000’s intuitive design shows the branches as physical divides allowing for easy understanding and navigation. Units can be simply inserted in the correct branch as required making setup changes quick and simple.
PREPROCESSING FILTERS

Highlight and Improve features that previously could not be seen. Remove features and aspects of an image for stable inspection.

The XG-7000 Series includes 21 types of preprocessing image enhancement filters that can dramatically improve the raw camera image based on changes that are caused from differences in the target or the target’s environment. In using these original KEYENCE filters correctly, an optimal image for processing can be created resulting in an improvement in inspection stability and performance. This can help reduce mis-detection and inspection errors and give a high level of confidence to using machine vision.

**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 gray 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.

**Blur Filter (Bidirectional Smoothing)**

With this image enhancement filter, any fine background patterns or image noise can be blended into the background and removed. This filter can be used numerous times to get the desired level of blending as well as in individual directions to keep a distinct aspect to one dimension of the image.
Blob Filter

Blob filtering of certain grouped image elements based on attributes (surface area, shape size etc), enables only the desired areas to be processed.

**Width measurement of a welded section**

Measuring the width of a weld after cancelling shadows, dents and removing spatter & excess from the weld section.

Contrast Conversion

The contrast conversion filter helps enhance contrast by emphasizing or reducing ranges of gray scale without causing shadows or overexposure. This helps increase edge strength, unify levels of gray or reduce noise on an image.

**Defining PCB components and connections**

By increasing the difference between the board and mounted components the areas for inspection are easily highlighted.

Preserve Intensity (Illumination compensation)

The Preserve Intensity filter automatically corrects for any intensity changes in the image due to light deterioration or external lighting fluctuations. The level of intensity in the captured image is compared to a pre-determined standard on a reference image and the difference is applied before processing.

Screw position inspection

For each inspection unit, you can combine filters creating optimal images for an inspection.

**Multiple processing**

A total of 21 types of preprocessing filters can be set and each filter can be processed up to 13 times per unit. For each unit, filters can be combined together in the optimal combination for that single inspection.

**Filter order and sequencing**

The preprocessing sequence can be easily changed by moving filters up and down the list.

**On-screen effects and results**

Preprocessing results are displayed in real-time on the screen. Making it quick and easy to see and set the optimal combination in the minimal time.
Create a single image from multiple images through a host of advanced image combining functions

The XG-7000 Series has a multitude of image calculation functions, including mathematical (addition, subtraction, multiplication, division), logical operations, bit calculations, rotating/parallel translations, zoom, trapezoidal correction and pixel number conversion. Being able to combine multiple images into one resolves a number of issues that have made some conventional inspections difficult.

**Image calculation example 1  
Multi-Lighting and Image Composition**

Even with defects on the same target, optimal lighting can differ for different cases of flaws (projections/depressions) and stains (shade intensity). Although two image captures and two different lighting techniques are used for individual defect inspection of the target. The combination of the two images and defects can be put together to be processed and displayed together.

**Image calculation example 2  
Changing Light Intensity and Image Composition**

On some targets that have high walls and a range of surface heights (such as metal parts) overexposure and under-exposure can often be required for correct illumination. This is especially true if the nature of the reflectivity of the target changes from part to part as well. By capturing several images using different shutter speeds an overall uniform image can be obtained.

**Image calibration including tilt, and lens distortion correction**

The XG-7000 removes conventional image processing problems caused by camera mounting angle and lens distortion. The camera can be calibrated precisely, orientated about its axis and have its origin offset from its location for true measurement, scaling and position processing.

**Tilt correction**

The calibration function corrects for the camera angle that occurs during mounting. Unlike trapezoidal correction, this accurately corrects the entire image by making use of numerous calibration patterns across its field of view. This resultant normalized image is also effective for image processing when forced to mount the camera at an angle due to space restrictions.

**Lens distortion correction**

The calibration function also corrects for lens distortion. A uniform image can be acquired on the entire screen, allowing for accurate dimensional measurements, positioning and part inspection to be achieved.
Optimal color processing for stable inspections using the new color extraction engine “A.C.E.II”

The XG-7000 Series is equipped with a new color extraction engine. The A.C.E.II is based on the HSB color model (closest color model to the human sensory system) to attain high color extraction performance that stabilizes previously unstable color processing schemes. The XG-7000 Series also feature “fine color processing” to extract full color information exactly the way the camera captures it. This technology significantly broadens the range of color processing applications previously accomplished by machine vision systems.

Color to Gray Processing

Color to Gray processing can optimize the shade gradation using hue, saturation, and brightness. This makes it possible to convert images with low contrast into images with defined shade differences. Unlike conventional full color processing, which picks up all tone changes and makes distinction difficult, color shade processing can optimize the shade difference between a user-specified color and the background.

KEYENCE’s original color shade processing

Standard color shade processing

This process converts all colors to a certain level of grey. Making similar or close colors hard to differentiate between, as well as not accounting for saturation and brightness levels and potential changes.

KEYENCE color to gray processing

Unlike conventional color extraction where small color changes are hard to distinguish and saturation & brightness are not accounted for, the KEYENCE color extraction works with all three aspects. As Hue, Saturation & Brightness are all adjustable, small changes in color or shade can be adjusted for and reliable stable processing is ensured.

The edge required for detection

Fine Color Processing

Fine color processing directly processes full color information exactly as the color camera captures it. This is ideal for detecting stains on sheets, films and non-woven cloths where the stain can appear in any color with respect to the background. No setup is required for color extraction, allowing users to complete the inspection with one simple operation.

Overcoming the weaknesses of full color processing

Intensity cancellation function (glare removal)

The newly added intensity cancellation function solves a common problem of detecting all the changes when using full color processing on color images. This function delivers stable detection performance by ignoring glare and lighting variations on the target background, and detecting only the area where hue and saturation differences exist.

Even in targets with varying lighting conditions

Detects only the defect
A wide array of setting parameters and strong visualization tools makes this the industry standard in surface defect inspection.

The stain inspection tool finds defects such as stains and flaws by comparing the intensity of a user defined pixel grouping to that of its surroundings. For stable reliable inspections, stains can be grouped and filtered based on size, shape and contrast level. In addition the contrast view enables real time visualization on the performance of the tool to a user both during run and setup modes. Helping enable easy setup whilst maintaining consistent performance allowing for quick easy on machine tuning.

**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, stain inspection mode can compare the differences with the surroundings, allowing reliable detection of only the foreign particles.

**Contrast View Display**
Using the colors blue, light blue, green, yellow and red, the contrast view display assigns a color 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.

**Bad mark detection on PCBs (Contrast view)**
The contrast view can be used not only during setup, but also during operation, leading to practical uses in various situations. Including the including of error causes during operation, as well as verification of whether or not current parameters are suitable.

**Dent detection on a metal shaft surface**
Initial confirmation there is a greater stain level for the dents and scratches (green & red) than the background.

**Stable detection during processing**
Stable detection during processing Visually adjusting the optimal parameters whilst using the contrast view display

**Crack detection of a tablet (before grouping filter)**
The stain tool also picks out the granules and other changes that are of a similar stain level.

**Crack detection of a tablet (after grouping filter)**
Filtering of defects down to long thin cracks only using area and axis ratio.

**INDUSTRY FIRST**
**Grouping Filter**
Various group filter settings are also available for the stain tool to enable processing and sorting of stains and defects. Filters include basic fill and area based functions as well as degree of circularity, major axes length, aspect ratios and axis ratios. Such settings support the filtering of defects for more efficient pass/fail and sorting applications based on defect size and shape.
TREND EDGE STAIN INSPECTION TOOL

**Optimized multi-point profile inspection for burr/chip applications**

This tool extracts the profile from the edge of a target and uses it to recognize slight differences such as burrs and chips. In addition to simple geometric shapes such as circles and straight lines, the tool can also be used on complex contours such as ovals, and continually adjusting free form curves.

**Loose winding, projection inspection**

Even if the standard target shape changes from target to target during a process, the free curve will still map the normal profile of the target. At the same time, lots of individual edge points are detected ensuring the projection is recognized as well.

**Extensive Parameter Settings Support Various Defects**

Due to the wide range of parameters, it is possible to filter out defects based on inspection criteria. Optimal settings can be chosen based on aspects such as +/- defects (burrs/chips), defect level, width, and area.

**Map the inspection region to the ever changing target image or setup complex fixed inspection regions**

The XG gives a wide range of image inspection region options. Simple (rectangle, circles, arcs etc) and complex shapes (multi-node, multi-region) can be easily drawn on the image. Additionally, a region can be designated and mapped to the binary boundaries of an image for ever changing target shape and size inspections. The vision inspection region can adjust for geometric shapes like circles and straight lines or more complex contours such as ovals or free-from curves.

**[Image differentiation processing filters]**

**Subtraction**

Produces the difference from two images by subtracting the input image from the master (registered image).

**Lead frame chip inspection**

As a true subtraction is performed even complex targets with defects can be easily processed as the difference is left over on a uniform background.

**Foreign particle inspection inside a cup**

As part position is not always repeatable so stable defect detection is still possible as the edge line, border and background are removed from the initial raw acquired image.

**FIRST IN ITS CLASS**

**PROCESSED IMAGE REGION FUNCTION**

Stain detection on a plastic mold

Automatic inspection region adjustment on complex shapes based on their binary image. Enabling stable detection on any target even without position adjustment.

**Real-time image extraction**

As this filter processes in real time on the acquired image only, so part movement doesn’t affect the image used for defect inspection. The filter extracts the small areas of change (such as stains and defects) in the image, where as the larger and uniform areas (such as the edge lines and background) are removed. Leaving a stable image for stain detection.
**POSITION AND DIMENSION INSPECTION SOLUTIONS**

Sophisticated Dimension Profiling Tools

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**TREND EDGE FUNCTION**

**Measure profiles within a single designated area**

The Trend Edge tool detects edges at user-specified pitches within the inspection region and outputs all data for each detected point, in addition to the maximum, minimum and average values. Previously, this required multiple inspection regions and calculation settings, but now the same inspection can be completed by configuring a single trend edge inspection tool. The multiple edge points obtained can also be used to draw approximated best fit lines and circles for further processing.

**[Detection principle]**

The Trend Edge tool cascades from one segment to the next scanning for an edge based on the segment shift width. As edges are detected so the width (trend edge width tool) and position (trend edge position tool) for each segment is calculated.

**[Other image inspection tools]**

**Edge tools**

In addition to the powerful trend edge tools, basic edge tools can be used as well for inspection and positional referencing. These edge tools include edge position, edge width, edge pitch, edge gap, edge angle, and edge pairs.

**Edge inspection tools**

<table>
<thead>
<tr>
<th>Tool</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edge position</td>
<td>Finds the absolute position of multiple detected edges</td>
</tr>
<tr>
<td>Edge width</td>
<td>Finds the width between multiple detected edges</td>
</tr>
<tr>
<td>Center pitch</td>
<td>Finds the center pitch between multiple edges</td>
</tr>
<tr>
<td>Gap pitch</td>
<td>Finds the gap pitch between multiple edges</td>
</tr>
<tr>
<td>Edge angle</td>
<td>Finds the angle between two edges</td>
</tr>
<tr>
<td>Edge Pairs</td>
<td>Finds the width between multiple edges after pairing edges based on detecting criteria</td>
</tr>
</tbody>
</table>

**Pattern search tools**

The XG-7000 Series makes full use of the fast 3+1 processor architecture, processing 25 times faster than a conventional system for a full 360 degree pattern match. Using high speed normalized correlation, matching is ensured to be more stable and quicker than ever before even with lighting variations. Due to the dedicated hardware, multiple patterns and the intensive processing of 5 million pixel images can all be performed in a short time resulting in stable XY position and full 360 degree angle data.

**Conventional system**

25 times higher speed

**XG-7000 Series**

Search conditions: Search area of 512 x 480, pattern area of 128 x 128, 360 degrees of rotation, single detection

---

**Condenser profile measurement**

Multiple measurements and identification of narrow or wide points across a single target are easily possible with one single tool.

Each segment edge position can be clearly identified for easy confirmation.

Primary target identification

Easy definitive settings are possible with the edge waveform that can be displayed per segment.

**Linear processing**

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.

**Circular/Arc processing**

Detecting PCB hole centers

Trend edge can calculate the center 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.

**OCR tools**

Stable and powerful OCR is easily possible with the OCR toolset on the XG-7000. User defined characters can be imported into a fully customizable library along with standard fonts. Flexible tuning and setup is also made possible with a variety of methods for character extraction and detection.

**Automatic calendar support**

Based on the internal clock of the XG-7000 controller the OCR toolset can be setup with offsets, zero suppression and date time tolerances for any date/time inspection.

**Date and time encryption support**

Encrypted dates and times can also be recognized through cross referencing to a user defined lookup table.

**Selectable character extraction methods**

Characters can be extracted in 3 different ways based on the appearance of the string. Methods include automatic based on edge detection principles, ratio for equal spaced characters and fixed for user selection of individual characters.

**Recognition correlation and stability level reporting**

Each character match results in a best, next best correlation percentage match and stability level. These three items can be used in setup as a guide for the stability of the inspection as well as a quick identifier in production for helping prevent any potential quality problems before they happen.
Simultaneously identify and process with the new 2D code reader tool

The inclusion of a 2D code reading tool enables the XG-7000 Series to not only read codes but also perform vision based inspections on targets. By removing the need for both a conventional 2D code reader and a camera for image processing, space, time and money can all be saved with the use of this tool.

Variables

Freely share parameters, results and values throughout the whole vision program

Variables can be used as a means to change parameters, process results or store numerical values. This gives the XG-7000 Series the ultimate in flexibility for internal processing and interacting with menus and external devices. Such a degree of flexibility enables the system to be fully designed and used as desired without restrictions.

Calculations

Powerful script based calculation functionality

Over 100 functions are available for use in the calculation unit of the XG-7000 Series. Essential for processing and customization, calculations can be used to perform a variety of tasks include variable definition, geometric processing, mathematical equations, scripting and logic based functions. Calculation units also support, copy and paste, comment entry and error checking functions for full flexibility.

Multiple calculation input

Multiple equations can be specified in one calculation unit for script like processing.

Up to 5000 characters per calculation unit

With a large amount of space to enter calculations, scripts and comments, any function should be possible to process.

Copy and paste support

Quick, easy creation and replication

Error checking function

In the event that calculations are mis-entered the error checking function can display the error and location making corrections quick and easy.
New Tools Designed to Assist with Online Performance Tracking and Reporting

**NEW**

Online OK/NG Batch Analysis

While the system is processing parts online, the batch results from a series of images (taken from the main memory, a SD card or the FTP server) can be displayed. This allows for the easy confirmation of changes in settings without affecting inspection performance. In addition to the batch testing, Master OK (pass) and NG (fail) images can also be used for comparison purposes. The batch analysis function makes it very easy for a user to fully understand a systems performance at any time without having to collect data or take the system offline.

**Conventional performance analysis**

When initially dialling in a system or making modifications to existing settings, it becomes very easy to lose sight of the original requirements of the inspection. OK images become NG and vice versa and it becomes harder and harder to meet the desired standard.

**Batch Testing**

By retesting images against master images, it is easy to confirm whether there are any changes in the inspection standards compared to the initial standard. If changes have occurred having master OK and NG images to work with makes it simple to compare and adjust settings without affecting the original intent of the inspection.

**NEW**

Customized Screens and Interfaces

The XG-7000 Series supports the creation of custom screens directly on the controller. A fully customized screen can be easily created to display a wide range of results, images or graphics as required. Multiple intuitive screens can be designed for different views of the image processing results.
The Retest function of the XG-7000 Series allows images stored from inspections to be selected, retested, and edits to be made while the controller still fully processes other inspections online. This allows the user to make program adjustments in order to optimize the settings without effecting the current inspection process or causing any downtime on the machine.

**Online Re-testing and Flowchart Editing**

**NG occurs during operation**

**Inspection processing carries on as normal in the background**

**Easy image selection**

From the image strip a thumbnail version of the image can be selected. Additional images can be loaded from saved locations and identification is easy through the OK/NG color coding. All the Retest feature settings are available from the same menu allowing for easy setup and use.

**Retest**

By simply picking the image from the image strip, retesting is performed. From the results and information generated by the retest adjustments can be made accordingly. Batch retesting can also be performed for a deeper understanding of the process and changes that need to be made.

**Edit Flowchart Program**

Changes can be made to the units in the flowchart based on the retest image and results to optimize the settings.

**Confirm settings and avoid mistakes**

In Retest mode, the image strip can be accessed from any screen. This means you can seamlessly switch between current and retest images while changing parameters to ensure settings can be reliably be confirmed for correct operation.
Save only the desired images for analysis and simulation

The image output buffer enables images to be streamed to a variety of external devices (such as an FTP server) making it easy to test and analyze with the simulator software and statistical functions of the XG-7000 Series. Being able to define how and what images are stored where significantly helps with the separation, analysis and retesting of failed inspections. Using the simulator and statistical tools together makes the correction and the optimization of settings very easy.

[Setting optimization using the XG-7000 Series]

**Required items for setting optimization**

| Image Storage | 1. Save a large volume of images  |
|               | 2. Specify locations based on conditions |
| Simulation    | 1. Work with the XG-7000 Series controller environment for testing on a PC  |
|               | 2. Re-test and simulate results with stored images |
| Statistical Analysis | 1. Superior analysis and understanding of processed items |
|               | 2. Automatic generation of statistical results including maximum, minimum, yield and standard deviation |

**FTP Images Direct to a Network or HDD Drive**

Images can not only be saved directly to the SD card used in the controller but also transferred directly to NAS* (Network Attached Storage) through a LAN connection. Long-term image storage can also be conducted by connecting an easily sourced large capacity (10Gb, 100Gb, 1Tb etc) external HDD. In addition, by using the image output buffering option, continuous NG images will not be lost.

*NAS refers to a storage device that is designed for use on networks and contains file server software. Unlike USB based external drives that can be only connected point to point and need to be configured, a NAS device becomes immediately part of the network when it is connected, making it available for all other devices to use. Thus simplifying data browsing and file sharing.

**PC Simulation and Remote Support via a PC and Mouse**

Interact directly with the XG-7000 GUI via your PC and mouse. Existing settings can be tested and simulated with saved images via the PC simulator. Furthermore, the XG Vision Terminal software offers remote connectivity and data logging capability.

**Statistical Analysis Function**

Any measurement data or variable value can be displayed as a trend graph or histogram. The result data includes information on yield rates as well as standard statistical data (such as max., min., average, SD and 6 values). Up to 100,000 data points can be plotted and saved, allowing for processes to be tracked and optimal settings to be set and recorded.
A diverse selection of integration options and utilities for use in any facility

The XG-7000 Series supports a wide range of interfaces, protocols and I/O devices. Ranging from CC-Link, PLC-Link, Ethernet IP, USB, RS-232C, discrete I/O and SD cards. All these combined give the XG-7000 the ultimate flexibility for easy integration. Coupled with easy to use monitoring tools, integration man hours and costs can be easily reduced.

Communication Monitoring Tools

The XG-7000 Series comes fully equipped with on-controller monitoring tools to aid with debugging and installation. Wiring and I/O connections can be easily confirmed with the I/O diagnostic tool and RS-232C communication can be monitored reducing human error and any potential installation oversights.

Ethernet IP Support

To enable easy integration into many existing facilities across many industries the XG-7000 Series fully supports Ethernet IP communication. Connectivity can be established with any PLC supporting Ethernet IP via a standard LAN network.

INDUSTRY FIRST

CC-Link Unit (Supports Ver.1.10 and 2.00)

Smooth easy PLC connectivity

Remote device communication is possible by connecting a CC-Link device (such as a PLC) and the CA-NCL10E (connected to the side of the main controller). Smooth and easy integration of the XG-7000 into the PLC is possible with simple wiring, connectivity and setting through the PLC link function.

* The CC-Link is a registered trademark of the Mitsubishi Electric Corporation.
The 1 Gbps Ethernet port can be used as an Ethernet IP or PLC link connection, ensuring easy connectivity and control among various PLC’s without the need for complex ladder logic. The same port can be used for the connection of FTP server and NAS devices, as well as enabling remote management of multiple controllers via a single PC on a LAN.

USB 2.0 port

The USB connection allows for easy 1-2-1 PC connectivity for the transfer of settings, image and measurement based data.

LED lighting and CC link expansion modules

Connect the light expansion module (CA-DC20E) and the CC-Link communication module (CA-NCL10E).

Removable mass storage capability

First in the industry to support the SDHC standard*, allowing information to be saved to removable mass storage SD cards up to 4 GB. Two SD slots are available as a standard giving total storage capacity to 8Gb. All files including setting files, configuration data and measurement result data can be stored and read at high speeds.

* Reading SDHC (high capacity SD cards) with a PC requires a dedicated card reader (commercially available).

**FIRST IN THE INDUSTRY**

Camera port

Quick easy connection of any camera with quick disconnect camera cables. Max length up to 51 m (167.3').

**FIRST IN THE INDUSTRY**

Removable mass storage capability

Camera expansion module

Connect the XG-E700 camera expansion module when 3 or 4 cameras are needing to be used.

Camera expansion unit XG-E700

**FIRST IN THE INDUSTRY**

Ethernet (TCP/IP, Ethernet IP) communication

(PLC Link / FTP / Remote Connectivity)

The 1 Gbps Ethernet port can be used as a Ethernet IP or PLC link connection, ensuring easy connectivity and control among various PLC’s without the need for complex ladder logic. The same port can be used for the connection of FTP server and NAS devices, as well as enabling remote management of multiple controllers via a single PC on a LAN.

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PRODUCT LINEUP

Controllers

<table>
<thead>
<tr>
<th>Camera</th>
<th>Connector shape</th>
<th>Cable length</th>
<th>Extension cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>5000,000-pixel camera</td>
<td>CA-CN1</td>
<td>1 m (3.3’)</td>
<td>CA-CN17</td>
</tr>
<tr>
<td>2000,000-pixel camera</td>
<td>CA-CN3</td>
<td>3 m (9.8’)</td>
<td>CA-CN10</td>
</tr>
<tr>
<td>310,000-pixel camera</td>
<td>CA-CN5</td>
<td>5 m (16.4’)</td>
<td>CA-CN10L</td>
</tr>
<tr>
<td>Camera expansion module</td>
<td>CA-CN10</td>
<td>10 m (32.8’)</td>
<td>CA-CN17L</td>
</tr>
<tr>
<td>LED light control expansion module</td>
<td>CA-CN17R</td>
<td>17 m (55.8’)</td>
<td>CA-CN17RE</td>
</tr>
</tbody>
</table>

Camera Cables

<table>
<thead>
<tr>
<th>Camera cables</th>
<th>Connector shape</th>
<th>Type</th>
<th>Cable length</th>
<th>Extension cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard-speed camera cable</td>
<td>CA-CN3</td>
<td>Straight</td>
<td>3 m (9.8’)</td>
<td>CA-CN10</td>
</tr>
<tr>
<td>Standard-speed camera cable</td>
<td>CA-CN5</td>
<td>L-type</td>
<td>10 m (32.8’)</td>
<td>CA-CN10L</td>
</tr>
<tr>
<td>Standard-speed camera cable</td>
<td>CA-CN10</td>
<td>L-type</td>
<td>17 m (55.8’)</td>
<td>CA-CN17L</td>
</tr>
<tr>
<td>Standard-speed camera cable</td>
<td>CA-CN17R</td>
<td>L-type</td>
<td>23 m (75.5’)</td>
<td>CA-CN17RE</td>
</tr>
<tr>
<td>High-speed camera cable</td>
<td>CA-CN13</td>
<td>Straight</td>
<td>3 m (9.8’)</td>
<td>CA-CN17</td>
</tr>
<tr>
<td>High-speed camera cable</td>
<td>CA-CN15L</td>
<td>L-type</td>
<td>10 m (32.8’)</td>
<td>CA-CN17L</td>
</tr>
<tr>
<td>High-speed camera cable</td>
<td>CA-CN10LX</td>
<td>L-type</td>
<td>17 m (55.8’)</td>
<td>CA-CN17LX</td>
</tr>
</tbody>
</table>

Extension Cables

<table>
<thead>
<tr>
<th>Extension cables</th>
<th>Connector to amplifier</th>
<th>Type</th>
<th>Cable length</th>
<th>Extension cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA-CN10U</td>
<td>Standard-speed camera cable</td>
<td>3 m (9.8’)</td>
<td>CA-CN10</td>
<td></td>
</tr>
<tr>
<td>CA-CN10X</td>
<td>Standard-speed camera cable</td>
<td>10 m (32.8’)</td>
<td>CA-CN10L</td>
<td></td>
</tr>
<tr>
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<td></td>
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<td>CA-CN17</td>
</tr>
<tr>
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<td>CA-CN15LX</td>
<td>L-type</td>
<td>10 m (32.8’)</td>
<td>CA-CN17L</td>
</tr>
</tbody>
</table>

Accessories

<table>
<thead>
<tr>
<th>Accessories</th>
<th>Type</th>
<th>Cable length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitor cable</td>
<td>OP-66842</td>
<td>(3 m 9.8’)</td>
</tr>
<tr>
<td>OP-7855</td>
<td>(10 m 32.8’)</td>
<td></td>
</tr>
<tr>
<td>Industrial SD card</td>
<td>CA-SO4G</td>
<td>4GB (SDHC)</td>
</tr>
<tr>
<td>CA-SO1G</td>
<td>1GB</td>
<td></td>
</tr>
<tr>
<td>OP-87132</td>
<td>512MB</td>
<td></td>
</tr>
</tbody>
</table>

5 megapixel cameras

11x high-speed color camera
XG-H500C

7x high-speed color camera
XG-H200C

Color camera
XG-200C

Ultra-compact color camera
XG-S200C

7x high-speed monochrome camera
XG-H500M

7x high-speed monochrome camera
XG-H200M

Monochrome camera
XG-200M

Ultra-compact monochrome camera
XG-S200M

310,000 pixel cameras

7x high-speed color camera
XG-H035C

Color camera
XG-035C

Ultra-compact color camera
XG-S035C

7x high-speed monochrome camera
XG-H035M

Monochrome camera
XG-035M

Ultra-compact monochrome camera
XG-S035M

Parallel I/O & Data Output Cables

<table>
<thead>
<tr>
<th>Cables</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1Gbps Ethernet cable</td>
<td>OP-66843</td>
</tr>
<tr>
<td>USB cable</td>
<td>OP-66844</td>
</tr>
</tbody>
</table>

LED Lighting Cables

<table>
<thead>
<tr>
<th>Cables</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y split cable</td>
<td>CA-21W</td>
</tr>
<tr>
<td>Connector to terminal</td>
<td>OP-84457</td>
</tr>
</tbody>
</table>

Windows Compatibility

- Windows 2000 Professional
- Windows XP Professional
- Windows Vista Home Basic/Home Premium/Business/Ultimate/Enterprise
- Windows 7 Home Premium/Professional/Ultimate/Enterprise

Accessories

- 5 megapixel cameras
- 2 megapixel cameras
- 310,000 pixel cameras
- Camera Cables
- Extension Cables
- Parallel I/O & Data Output Cables
- LED Lighting Cables
- 5 megapixel cameras
- 2 megapixel cameras
- 310,000 pixel cameras
- Camera Cables
- Extension Cables
- Parallel I/O & Data Output Cables
- LED Lighting Cables
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- Parallel I/O & Data Output Cables
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27
## SPECIFICATIONS (SOFTWARE)

<table>
<thead>
<tr>
<th>Model</th>
<th>XG-IT/7NE2 (XG Vision Editor)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit configuration</strong></td>
<td></td>
</tr>
<tr>
<td>Maximum 1000 units per program (depending on internal memory capacity).</td>
<td></td>
</tr>
</tbody>
</table>

### Image Input

Supports the simultaneous capture of up to 4 cameras. Supports multiple combinations, repeat capturing and background capturing.

### Processing regions

- **Image Acquisition**: Supports 32 image inputs (16 inputs on the controller and 16 on the PC). Supports capturing 16 simultaneous images, each capable of 600 edge points and 999999 pixels.

### Pre-processing filters

- **Filter types**: Expand, Shrink, Average, Median, Edge Enhancement, Edge Extraction, X, Edge Extraction Y, Sobel, Prewitt, Roberts, Laplacian, Binary, Subtraction, Preserve intensity, Contrast conversion, Real-time differential, Real-time shake correction, Blur (softening), Custom (3x3 or 5x5), Custom (advanced) (Maximum 128x128 convolution, expansion, shrink, blob, Blurring, Multiple Processing of the same filter (up to 5 layers) for binary, Subtraction, Preserve intensity, Contrast conversion, Real-time differential, Real-time shake correction, Blur (softening), blob filter processing is once only), Filter combination (130 filters) (for binary, subtraction and blob can only be used once).

### Color extraction function

- **Color to binary conversion**, color shade processing, line color (stain mode only), RGB average (Color correlates with RGB color space). Also supports parameter variable referencing.

### Scaling

- **Ability to turn ON or OFF scaling coefficients for the X, Y, and length measurements for each camera**: Supports parameter variable referencing.

### Selectable Execution

- **Selection of whether to allow unit processing on controller or XG Vision Editor only**: Also supports parameter variable referencing.

### Area

- **Count the number of white or black pixels in a region**.

### Pattern Search

- **360 degree rotation and recognition of up to 99 patterns**: Support for up to 4 mask regions, origin and reference point adjustment. Post-processing on past image operations variables or registered (saved) images.

### Edge Position

- **Positional measurement**: Simultaneous positional measurements of up to 3600 edge 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 conversion) measurements of up to 99999 blobs.

### Inspection and measurement

- **Positional measurement**: Measurement of the distance between two edges (outer, inner, or specified).

### Edge Width

- **Up to 1800 Edge Pitch / Center Pitch (calculated from two edges) measurements from detected edge points**.

### Edge Angle

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

### Edge Eater

- **Up to 1800 Edge Pitch / Center Pitch measurements based on pairs of edges detected by 2 separate scans**.

### Trend Edge Width

- **Average, maximum, minimum width measurements between two edges (outer, inner) in a single region divided up into a maximum of 5000 segments**.

### Intensity

- **Measures pixel intensity value, and can be used as a reference for the preserve intensity filter**.

### Color extraction (valid for color cameras only)

- **RGB and HSB colorspace measurements**.

### OCR

- **Measures pixel intensity value, and can be used as a reference for the preserve intensity filter**.

### 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

- **Compilation branch of the flowchart (up to 64 splits)**: Also supports parameter variable referencing.

### Looping

- **Repetitive unit processing**. Also supports parameter variable referencing.

### Break

- **Loop exit**.

### Numerical/Scripting

- **Direct input of up to 5000 characters for multi calculation and scripting purposes**. Individual result based on time out settings and overall result (ANSI). Basic functions: addition, subtraction, multiplication, division, surplos, power, conditional binary operators: invert (NOT), logical multiplication (AND), logical sum (OR), exclusive OR (NOR). Comparative operators: equal to, not equal to, greater than, less than, greater than or equal to, less than or equal to, Mathematical functions: absolute value, circular variable substitution, straight-line variable substitution, straight-line variable substitution, circular variable substitution, character encoding conversion, average, average array processing, average index, average index (array processing), rounding up, rounding down, natural logarithm, common logarithm, maximum value, maximum value index, maximum value index (array processing), minimum value, minimum value index (array processing), minimum value index, minimum value index (array processing), circumference ratio (pi), angle (radian conversion, rounding, sort, square, square root, sum (array processing)).

### Geometric operation functions

- **Functionally**: sine value, cosine value, tangent value, arc sine value, arc cosine value, arc tangent value, arc tangent value (P1/P2). Geometric operation functions: center angle, 2 point angle, angle width, circle detection (3 point specification), circle detection (array processing), circle tangent point detection, coordinate system conversion, coordinate system conversion, 2, distance between two points, intersection point of 2-circle, intersection point of circle and line, straight-line detection (2 point specification), straight-line detection (array processing), angle of two lines, straight-line angle, distance between a point and a straight-line, distance between a point and a straight-line (signed), intersection point with a perpendicular line, bisector, center point, rotation, center, calculation of perpendicular bisector, pixel coordinates -> world coordinate conversion, world coordinates -> pixel coordinate conversion, multiple point calibration, vector addition, vector subtraction, vector cross product, vector inner product. Calendar functions: day offset (year/month/day)

### Calculation & Image Processing

- **Bit functions**: logical multiplication (AND), inversion (NOT), logical add (OR), exclusive OR (XOR), bit combining statement: FOR, FOR TO, NEXT, EXIT FOR, IF, IF THEN, END IF, DO WHILE, LOOP EXIT DO, User comments, row continuation supports error checking functionality.

### Image Operation

- **Create images based on multi image processing or mathematical image processing**: Image operation: conducts operations between images, supports combining (1+1), not and n (to a maximum of 32 images)

### Conversion

- **Conversion**: Conducts processing on a single image

### Image Operation Functions

- **Add, Subtract, Absolute Difference, Average, Multiply (with normalization)**, Multiply (without normalization), Max, Min, AND, OR, XOR, NAND, NOR, XOR, NXOR Conversion Functions: Add, Subtract, Absolute Difference, Multiply, Rotate/Translate, Zoom, Trimming Adjustment, Pixel Value Conversion.

### Color conversion

- **Color to binary conversion, color shade processing, line color (stain mode only)**, RGB average (Color correlates with RGB color space). Also supports parameter variable referencing.

### Shape processing

- **Shape processing**: Supports parameter variable referencing.

### Timing and Processing Control

- **Processing flow for a specified time (1ms to 1 hour)**. Also supports parameter variable referencing.

### Timer

- **Start a user defined timer (0-7)**.

### Terminal I/O Delay

- **Processing flow based on the AND / OR conditional changes of terminal block and parallel input, output signals (edge/level), 0/ON, OFF, rising edge, falling edge** (Supports C2-Link and EtherNet/IP communication).

### Variable Delay

- **Processing flow based on the AND / OR conditional comparison of variables and numerical values**.

### User Menu Delay

- **Pause the flow until the opened menu is closed**.
## SPECIFICATIONS (SOFTWARE)

<table>
<thead>
<tr>
<th>Model</th>
<th>XG-H7NE2 (XG Vision Editor)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Graphics</strong></td>
<td>On-screen Graphics</td>
</tr>
<tr>
<td>Display characters (fixed, numerical, active text, decimal conversion), graphics (rectangle, rotated rectangle, circle, oval, ring, arc, point, line, table, polygon), result data and variables. Along with support for parameter variable referencing.</td>
<td></td>
</tr>
<tr>
<td><strong>Outputs</strong></td>
<td>Terminal I/O Output</td>
</tr>
<tr>
<td>Assign data and results to 28 I/O terminals, with support for cyclic strobing (up to 8 cycles) through multiple series of data.</td>
<td></td>
</tr>
<tr>
<td>Data Output</td>
<td>Allows the output of up to 256 data or results items per unit to different locations including SD cards, RS-232, Ethernet, CC-Link, Ethernet/IP, PLC-Link and PC applications. Includes support for skipping of non-processed units, filenames, folder allocation, customized output data format and processing (image/output) priority.</td>
</tr>
<tr>
<td>Image Output</td>
<td>Allows the output of images to different locations including SD cards, FTP and PC applications. Includes support for filenames, folder allocation and processing (image/output) priority.</td>
</tr>
<tr>
<td><strong>Command</strong></td>
<td>Command Execution</td>
</tr>
<tr>
<td>Issue various commands for controller functions based on image processing.</td>
<td></td>
</tr>
<tr>
<td><strong>Common to All Units</strong></td>
<td>Total Status Processing</td>
</tr>
<tr>
<td>Overall output giving a logical OR result output based on allocated units results.</td>
<td></td>
</tr>
<tr>
<td>Total Error Processing</td>
<td>Overall error output giving a logical OR result output based on allocated units error results.</td>
</tr>
<tr>
<td><strong>GUI Interface</strong></td>
<td>Screens</td>
</tr>
<tr>
<td>Up to 100 screens per program, with support for external switching and access via user group / user accounts.</td>
<td></td>
</tr>
<tr>
<td>Frames</td>
<td>Up to 99 frames per program to host graphics, data and values, with support for external switching.</td>
</tr>
<tr>
<td>Image Displays</td>
<td>Up to 5 image displays for associating with displaying camera images, registered images or archived images. Support for displaying different process views of images and unit processing.</td>
</tr>
<tr>
<td>Elements</td>
<td>Image display, base frame, page frame. Basic elements (values, characters, active character, horizontal lines, vertical lines, points, rectangles, circles, polygons, curved lines) Built-in elements (image display, inspection date, inspection time, camera screen information, zoom information, OK/NG status, logo (BMP file), vision unit results, non-vision unit results, variable list, unit judgment list, unit list)</td>
</tr>
<tr>
<td><strong>Menus</strong></td>
<td>Menu settings</td>
</tr>
<tr>
<td>Allows for the creation of up to 900 user defined menus per program with support for external control and display. Menus can be used to interact with settings via variables and support numerous command functions as well as other menus display operation.</td>
<td></td>
</tr>
<tr>
<td>Menu elements</td>
<td>Text, numerical input box, drop-down menu, normal button, confirmation button</td>
</tr>
<tr>
<td><strong>Variables</strong></td>
<td>Local Variable</td>
</tr>
<tr>
<td>Define up to 10000 variables (numerical, positional, line and circle based) per program each being able to be set as an array (up to 10000 elements) and having support for comments and value retention during program changes.</td>
<td></td>
</tr>
<tr>
<td>Global Variable</td>
<td>Define up to 1024 variables (numerical, positional, line and circle based) per controller (dependent on controller menu) each being able to be set as an array and having support for comments and value retention during program changes.</td>
</tr>
<tr>
<td>Image Variable</td>
<td>Define up to 512 variables (image) per program each being able to be set as an array (up to 512 elements) and having support for comments and image operation processing.</td>
</tr>
<tr>
<td><strong>Simulation</strong></td>
<td>Offline Simulation Mode</td>
</tr>
<tr>
<td>Enables offline simulation of BMP, JPEG images (256 maximum) that have either been stored on a PC or loaded in through a connected controller.</td>
<td></td>
</tr>
<tr>
<td>Online Simulation Mode</td>
<td>Enables online simulation based on live images being obtained from a connected controller via Ethernet or USB. Also supports external trigger synchronization and image archive.</td>
</tr>
<tr>
<td>Simulator+</td>
<td>Enables reproduction of inspections based on image archive images (BMP, JPEG, 256 maximum) and result data that has been previously recorded.</td>
</tr>
<tr>
<td><strong>Development Functions</strong></td>
<td>Creation</td>
</tr>
<tr>
<td>Flowchart/Program</td>
<td>Creation, editing and deletion of all components used in image processing in a flowchart format. Supports split view, zoom, multiple unit movement, multi region alignment, grouping of units (including locking), repeated pasting, delete/paste, unit ID renumbering, breakpoint setting, stop control, group viewing, editing and control directly on the controller.</td>
</tr>
<tr>
<td>Processing View</td>
<td>Enables online simulation on a PC, working with the GUI of the XG controller operating through the XG Vision Editor software, allowing the testing of up to 50000 images and processing of statistical data. Supports mouse operation.</td>
</tr>
<tr>
<td>Screen Management</td>
<td>Management of screens, elements and menu interfaces available on the controller in a hierarchical format. Supports the verification of user group screens, the editing of screens and menus, and the displaying of result components sorting.</td>
</tr>
<tr>
<td>Screen Editor</td>
<td>Allows for elements and menus to be used and dragged while creating the GUI. Supports writing/reading display patterns, frames and elements allowing for screen parts to be freely moved, positioned, sized and layered accordingly. Grid or free formatting can be used for aligning elements correctly.</td>
</tr>
<tr>
<td>Parts List</td>
<td>Provides a list of all the available parts (units, functions, commands, buttons, etc.) that can be copied during the development of a solution.</td>
</tr>
<tr>
<td><strong>Image Archive Settings</strong></td>
<td>Specify up to 8 image archives for storing images and data from inspections. Each archive has the ability to be customized to save a set number of images based on a particular condition. Image archives support series image and data accumulation, preceding image and data accumulation and replay modes on both controllers and in XG Vision Editor. Images and results can also be output to SD cards, PC applications and FTP servers for storage and retesting.</td>
</tr>
<tr>
<td><strong>System Settings</strong></td>
<td>Ability to edit controller system settings including: controller naming, controller language settings, registered image format, menu opacity, controller unit processing, operational settings on the flow display screen, default camera settings, I/O (including terminal assignment), %AHold signal customization (oneshot, latching, synchronization with STG), output file name, processing errors, busy conditions, customized commands, handheld controller operation, accounts, operation logs, and OOD data/time encryption.</td>
</tr>
<tr>
<td><strong>Password Protection and Security</strong></td>
<td>Password protection of program files allowing program editing via XG Vision Editor only. Cross referencing of individual unique controller ID's for copyright protection.</td>
</tr>
</tbody>
</table>
## SPECIFICATIONS (SOFTWARE/CONTROLLER)

### Development Functions

**Testing and Debugging**
- **Unit Results**: Verify unit parameters, results, local and global variable initial and current values from processing during simulation. Also supports the changing of variables.
- **Watch**: Combine multiple data into 1 of 4 views for verification of multiple parts of the process during simulation.
- **Log**: Continual log of unit results and errors or units processed during simulation.

**Variable Reference List**
- Verification of variable referencing throughout the image processing flowchart.

**Check**
- Verification of version, settings and finding of errors in the image processing flowchart and screen. Displays error location and details for easy quick debugging.

**Find**
- Search for unit references, variables, setting parameters and result data used in the image processing flowchart. Summarized results display of find function for referencing and locating of results.

**Unit List**
- Summarized list of unit settings from units used in the image processing flowchart with support for parameters.

**Statistical Analysis**
- Show statistical results from simulation including summary data (maximum, minimum, standard deviation, 3σ, 95%NS frequency, yield), trend graphs (supporting the simultaneous comparison display of 4 items) and histograms for up to 1000 data points. Support for the changing of upper and lower limits of any monitored data.

**User Processing View**
- Up to 16 views for displaying differing image types based on user selection including live images, single unit processing, multi unit processing, color extraction (color camera), image enhance filters and contrast display.

**Status bar**
- Displays % resources used of each memory (program memory, image memory, processing memory) based upon current program settings.
- Displays the mouse position, HSV and RGB values when over an image and image processing buffer parameters.

**Layout**
- Customization of 8 different XG Vision Editor screen layouts each with the ability to be reset.

### File Transfer/ System/ Program Management

**System View**
- Upload/download various program data and other files to the controller via Ethernet or USB connection. Management of multiple workspaces and programs stored on the PC. Support for the importing and exporting of single settings and the transferring of files between programs.

**Copy to Clipboard**
- Gives the ability to create supporting documentation by copying various settings to the Windows clipboard for pasting into another Windows program.

**Version Control**
- Control and upgrading of program and other file versions.

**Remote Connection**
- Remote control and operation (via keyboard or mouse) of a connected controller (via Ethernet or USB) using the XG GUI.

**Image Archive**
- Verification and management of image archive and result data of a connected controller (via Ethernet or USB).

**Trace log viewer**
- Enables you to save the inspection settings, tool, unit, commands, collection of terminal operation conditions and log data of the controller connected via Ethernet or USB.

**Variable Re-Write**
- Capability for rewriting local, global and system variables in online mode for a connected controller (via Ethernet or USB).

**Mode Changing**
- Verifies and switch modes (online mode/offline mode/remote capture mode) of a controller connected (via Ethernet or USB).

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

**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 using of parameters for displaying unit edit menus.

### Operating Systems

PC
- **Microsoft Windows 2000 Professional SP4 or later**
- **Microsoft Windows XP Home Edition/Professional SP2 or later**
- **Microsoft Windows Vista Home Basic, Home Premium, Business, Ultimate, Enterprise**
- **Microsoft Windows 7 Home Premium, Professional, Ultimate, Enterprise**
- **64-bit operating systems are not supported.**

SQL Vision Terminal
- License free remote support, data logging (image and data output), and file management PC software for use with up to 8 connected controllers (via Ethernet or USB).

XG Vision Editor
- USB driver (license free) specifically for connecting an XG-7000 controller via USB to either the XG Vision Editor, XG Vision Terminal or XG Simulator+ software. Supplied with XG Vision Editor, XG Vision Terminal and Simulator+.

**USB Driver**
- License free remote support, data logging (image and data output), and file management PC software for use with up to 8 connected controllers (via Ethernet or USB).

**Version Control**
- Control of program and other file versions.

**Remote Connection**
- Remote control and operation (via keyboard or mouse) of a connected controller (via Ethernet or USB) using the XG GUI.

**Variable Re-Write**
- Capability for rewriting local, global and system variables in online mode for a connected controller (via Ethernet or USB).

**Mode Changing**
- Verifies and switch modes (online mode/offline mode/remote capture mode) of a controller connected (via Ethernet or USB).

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

**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 using of parameters for displaying unit edit menus.

### Controller (XG-7702/7502/7002/7002A)

<table>
<thead>
<tr>
<th>Model</th>
<th>UNIT RESULTS</th>
<th>XG-7502</th>
<th>XG-7002</th>
<th>XG-7002A</th>
</tr>
</thead>
<tbody>
<tr>
<td>XG-7502P</td>
<td>8-camera simultaneous capture/individual capture can be selected (when XG-700 is not connected, images from up to two cameras can be captured at the same time)</td>
<td>400(H) x 480(V), approx. 310,000 pixels</td>
<td>approx. 240,000 pixels</td>
<td>approx. 310,000 pixels</td>
</tr>
<tr>
<td>XG-7002P</td>
<td>4-camera simultaneous capture/individual capture can be selected (when XG-700 is not connected, images from up to two cameras can be captured at the same time)</td>
<td>4-camera simultaneous capture/individual capture can be selected (when XG-700 is not connected, images from up to two cameras can be captured at the same time)</td>
<td>4-camera simultaneous capture/individual capture can be selected (when XG-700 is not connected, images from up to two cameras can be captured at the same time)</td>
<td>4-camera simultaneous capture/individual capture can be selected (when XG-700 is not connected, images from up to two cameras can be captured at the same time)</td>
</tr>
</tbody>
</table>

**Additional Software**
- USB Driver (license free) specifically for connecting an XG-7000 controller via USB to either the XG Vision Editor, XG Vision Terminal or XG Simulator+ software. Supplied with XG Vision Editor, XG Vision Terminal and Simulator+.

**The number of possible settings amongst all listed items depends on the main unit memory capacity.**

### PC Specifications

**Operating Systems**
- **Microsoft Windows 2000 Professional SP4 or later**
- **Microsoft Windows XP Home Edition/Professional SP2 or later**
- **Microsoft Windows Vista Home Basic, Home Premium, Business, Ultimate, Enterprise**
- **Microsoft Windows 7 Home Premium, Professional, Ultimate, Enterprise**
- **64-bit operating systems are not supported.**

**License**
- License required for full activation. Information for receiving a license activation code includes: company details, user ID and CD serial number.

**Additional Software**
- USB Driver (license free) specifically for connecting an XG-7000 controller via USB to either the XG Vision Editor, XG Vision Terminal or XG Simulator+ software. Supplied with XG Vision Editor, XG Vision Terminal and Simulator+.

*For PNP output type, contact your local KEYENCE office.*
SPECFICATIONS (CONTROLLER)

**Model**
- NPN XG-7702
- XG-7502
- XG-7002
- XG-7002A
- XG-7702P
- XG-7502P
- XG-7002P

**Editing**
Supports the creation, deletion, copying and renaming of programs in edit mode, adding/editing units to a database (file formats: XG-7100/7000 series).

**System Settings**
Supports the editing of system settings during offline mode, general (controller name, input and output settings, language settings, etc.).

**Retest**
Supports retests that use historical image data, selected image, and other settings, and the display of captured images.

**SD Card Specifications**
- *2 SD card slots (SDHC/SDXC compatible)
- *2 SD-C Card slots (SDHC compatible)
- *2 SD Card slots (SDHC compatible)

**Image Processing Area**
- Specify a 980,000-pixel area (1024 x 960 pixels) in any position as the image processing area.
- Specify a 240,000-pixel area (512 x 480 pixels) in any position as the processing area within 320,000 pixels.

**Image Capture Settings**
- Progressive/Interface
- Progressive/Interface

**Image start/end function**
Enables the choosing of the start/stop line within the image capture range.

**Camera gain adjustment**
- Enables the choosing of the start/stop line within the image capture range.

**White balance adjustment (color only)**
Manual setting with white target

**Image Inversion**
Supports inverting the image to the left or right.

**Scaling**
- Allows setting and application of individual scaling values for X, Y and height.

**Statistics**
- Maximum of 100,000 points per item, maximum of 256 items.

**Image Archive**
- Supports the editing of system settings during offline mode, general (controller name, input and output settings, language settings, etc.).
- Supports the editing of system settings during offline mode, general (controller name, input and output settings, language settings, etc.).

**Screen**
- Enables the verification/changing of selected local variables, global variables, and system variables values (only verification for system variables).

**Programming Assistance**
- Enables the display of the display differential waveform graph and associated data during operation.

**Stability Display**
- Enables the display of the stability display (steady state) contrast window during operation.

**Profile Display**
- Enables the display of the profile display for trend edge (trend edge) during operation.

**Edge Waveform Display**
- Enables the display of the edge differential waveform graph and associated data during operation.

**Viewing the Display**
- Enables the display of the display position of the display pattern via external controls depending on the commands issued.

**Image Archive**
- Enables the display of the defect level waveform for trend edge defects during operation.

**Data Save Functionality**
Supports the direct saving of data files captured images (compression possible).

**Assigning Input**
- Input rating 26.4V or lower, 2mA or greater (3mA or greater for high speed input terminal)

**Assigning Output**
- Numerical data output and control input/output enabled via the RS-232C port or Ethernet port (Cannot be used with CC-Link or EtherNet/IP).

**Ethernet**
- Supports the interlocking function with statistics through batch test.

**PLC Interface**
- Compatible with PLCs supported via link unit: *4

**Power Supply**
- Power supply voltage: 24 VDC and regulated to ±10%

**Power Consumption**
- 3.2 A (4 cameras at maximum load)
- 4.6 A (4 cameras at maximum load)
- 5.6 A (4 cameras at maximum load)

**Ambient Temperature**
- For four cameras connected: 0 to 50°C (32 to 122°F)
- For four cameras connected: 40°C to 113°F
- For four cameras connected: 0 to 45°C (32 to 113°F)
- For four cameras connected: 0 to 50°C (32 to 122°F)
- For four cameras connected: 40°C to 113°F

**Ambient Operating Humidity**
- 35 to 85% RH (no condensation)
- Approx. 1300 g

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*1 When connecting XG-H035C/H035M, so 640 (H) x 480 (V) cannot be selected.
*2 In regard to the PNP output type, please contact KEYENCE.
*4 Models that install the Ethernet port to the CPU unit support Ethernet port direct connection.

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* NPN XG-H035C/H035M, so 640 (H) x 480 (V) cannot be selected.
* In regard to the PNP output type, please contact KEYENCE.
* Models that install the Ethernet port to the CPU unit support Ethernet port direct connection.
**SPECIFICATIONS (CAMERA)**

### Camera (XG-H500C/XG-H500M/XG-H200C/XG-H200M)

<table>
<thead>
<tr>
<th>Model</th>
<th>Camera (XG-H500C/XG-H500M)</th>
<th>Camera (XG-H200C/XG-H200M)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CCD</strong></td>
<td>1/3-inch color CCD image receiving element, 2x high-speed reading using square-pixel, 2,010,000 pixels (XG-H500C)/1/3-inch monochrome CCD image receiving element, 2x high-speed reading using square-pixel, 2,010,000 pixels (XG-H500M)/Unit cell size 7.4 µm x 7.4 µm (29 x 29 Mil)</td>
<td>1/3-inch color CCD image receiving element, 2x high-speed reading using square-pixel, 2,010,000 pixels (XG-H200C)/1/3-inch monochrome CCD image receiving element, 2x high-speed reading using square-pixel, 2,010,000 pixels (XG-H200M)/Unit cell size 4.4 µm x 4.4 µm (14 x 14 Mil)</td>
</tr>
<tr>
<td><strong>Resolution</strong></td>
<td>4,990,000 pixels (4K x 2K)</td>
<td>1,800,000 pixels (1080 x 1920)</td>
</tr>
<tr>
<td><strong>Scanning system</strong></td>
<td>Progressive (16.0 ms) Interface: XG-H500M only (8.8 ms)</td>
<td>Progressive (16.0 ms) Interface: XG-H200M only (8.8 ms)</td>
</tr>
<tr>
<td><strong>Pixel transfer frequency</strong></td>
<td>25 MHz (55 kHz x 2 ch)</td>
<td>8 MHz (40 MHz x 2 ch)</td>
</tr>
<tr>
<td><strong>Digital serial transfer</strong></td>
<td>Digital serial transfer</td>
<td>Digital serial transfer</td>
</tr>
<tr>
<td><strong>Lens mount</strong></td>
<td>C mount</td>
<td>Special mount (M15.5 P0.5 male)</td>
</tr>
<tr>
<td><strong>Environmental resistance</strong></td>
<td>Ambient temperature: 0 to 40°C (94 °F) Relative humidity: 35 to 85%RH (No condensation)</td>
<td>Ambient temperature: 0 to 40°C (94 °F) Relative humidity: 35 to 85%RH (No condensation)</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>Approx. 112 g (not including the lens)</td>
<td>Approx. 110 g (not including the lens)</td>
</tr>
</tbody>
</table>

* Only the high-speed camera cable can be used (CA-CHxx).

### Camera (XG-H035C/XG-H035M)

<table>
<thead>
<tr>
<th>Model</th>
<th>Camera (XG-H035C/XG-H035M)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CCD</strong></td>
<td>1/3-inch color CCD image receiving element, 7x high-speed reading using square-pixel, 2,010,000 pixels (XG-H035C)/1/3-inch monochrome CCD image receiving element, 7x high-speed reading using square-pixel, 2,010,000 pixels (XG-H035M)/Unit cell size 7.4 µm x 7.4 µm (29 x 29 Mil)</td>
</tr>
<tr>
<td><strong>Resolution</strong></td>
<td>4,990,000 pixels (4K x 2K) (XG-H035C)/3,930,000 pixels (XG-H035M)</td>
</tr>
<tr>
<td><strong>Scanning system</strong></td>
<td>Progressive (4.7 ms) XG-H035M only (2.5 ms)</td>
</tr>
<tr>
<td><strong>Pixel transfer frequency</strong></td>
<td>40 MHz</td>
</tr>
<tr>
<td><strong>Lens mount</strong></td>
<td>C mount</td>
</tr>
<tr>
<td><strong>Environmental resistance</strong></td>
<td>Ambient temperature: 0 to 40°C (94 °F) Relative humidity: 35 to 85%RH (No condensation)</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>Approx. 112 g (not including the lens)</td>
</tr>
</tbody>
</table>

* Only the high-speed camera cable can be used (CA-CHxx).

### Camera (XG-200C/XG-200M/XG-S200C/XG-S200M)

<table>
<thead>
<tr>
<th>Model</th>
<th>Camera (XG-200C/XG-200M)</th>
<th>Camera (XG-S200C/XG-S200M)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CCD</strong></td>
<td>1/3.8-inch color CCD image receiving element, square-pixel (all-pixel reading), 2,010,000 pixels (XG-200C)/1/3.8-inch monochrome CCD image receiving element, square-pixel (all-pixel reading), 2,010,000 pixels (XG-200M)/Unit cell size 4.4 µm x 4.4 µm (14 x 14 Mil)</td>
<td>1/3.8-inch color CCD image receiving element, square-pixel (all-pixel reading), 2,010,000 pixels (XG-200C)/1/3.8-inch monochrome CCD image receiving element, square-pixel (all-pixel reading), 2,010,000 pixels (XG-200M)/Unit cell size 4.4 µm x 4.4 µm (14 x 14 Mil)</td>
</tr>
<tr>
<td><strong>Resolution</strong></td>
<td>5,610,000 pixels (1080 x 1920)</td>
<td>5,610,000 pixels (1080 x 1920)</td>
</tr>
<tr>
<td><strong>Scanning system</strong></td>
<td>Progressive (31.6 ms) Interface: XG-200M only (16.2 ms)</td>
<td>Progressive (8.3 ms) Interface: XG-200M only (8.3 ms)</td>
</tr>
<tr>
<td><strong>Pixel transfer frequency</strong></td>
<td>30 MHz (15 MHz x 2 ch)</td>
<td>8 MHz (40 MHz x 2 ch)</td>
</tr>
<tr>
<td><strong>Lens mount</strong></td>
<td>C mount</td>
<td>Special mount (M15.5 P0.5 male)</td>
</tr>
<tr>
<td><strong>Environmental resistance</strong></td>
<td>Ambient temperature: 0 to 40°C (94 °F) Relative humidity: 35 to 85%RH (No condensation)</td>
<td>Ambient temperature: 0 to 40°C (94 °F) Relative humidity: 35 to 85%RH (No condensation)</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>Approx. 110 g (not including the lens)</td>
<td>Head: Approx. 210 g (excluding the cable, not the lens) relay unit: Approx. 70 g</td>
</tr>
</tbody>
</table>

* The camera cable CA-CN17/L/R (17m) and repeater cable CA-CN 17X/17LX/RX (17m) cannot be used.

### Camera (XG-035C/XG-035M/XG-S035C/XG-S035M)

<table>
<thead>
<tr>
<th>Model</th>
<th>Camera (XG-035C/XG-035M)</th>
<th>Camera (XG-S035C/XG-S035M)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CCD</strong></td>
<td>1/3-inch color CCD image receiving element, 2x high-speed reading using square-pixel, 3,930,000 pixels (XG-035C)/1/3-inch monochrome CCD image receiving element, 2x high-speed reading using square-pixel, 3,930,000 pixels (XG-035M)/Unit cell size 7.4 µm x 7.4 µm (29 x 29 Mil)</td>
<td>1/3-inch color CCD image receiving element, 2x high-speed reading using square-pixel, 3,930,000 pixels (XG-035C)/1/3-inch monochrome CCD image receiving element, 2x high-speed reading using square-pixel, 3,930,000 pixels (XG-035M)/Unit cell size 4.4 µm x 4.4 µm (14 x 14 Mil)</td>
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<tr>
<td><strong>Resolution</strong></td>
<td>3,930,000 pixels (1080 x 1920)</td>
<td>3,930,000 pixels (1080 x 1920)</td>
</tr>
<tr>
<td><strong>Scanning system</strong></td>
<td>Progressive (16.2 ms) Interface: XG-035M only (8.8 ms)</td>
<td>Progressive (8.3 ms) Interface: XG-035M only (8.8 ms)</td>
</tr>
<tr>
<td><strong>Pixel transfer frequency</strong></td>
<td>25 MHz (6 MHz x 2 ch)</td>
<td>8 MHz (40 MHz x 2 ch)</td>
</tr>
<tr>
<td><strong>Lens mount</strong></td>
<td>C mount</td>
<td>Special mount (M11.5 P0.5 male)</td>
</tr>
<tr>
<td><strong>Environmental resistance</strong></td>
<td>Ambient temperature: 0 to 40°C (94 °F) Relative humidity: 35 to 85%RH (No condensation)</td>
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</tr>
<tr>
<td><strong>Weight</strong></td>
<td>Approx. 110 g (not including the lens)</td>
<td>Head: Approx. 160 g (excluding the cable, not the lens) relay unit: Approx. 70 g</td>
</tr>
</tbody>
</table>

* The camera cable CA-CN17/L/R (17m) and repeater cable CA-CN 17X/17LX/RX (17m) cannot be used.

### Light control expansion module CA-DC20E

<table>
<thead>
<tr>
<th>Output</th>
<th>Light control method</th>
<th>Intensity range</th>
<th>Number of connection points</th>
<th>Voltage</th>
<th>Capacity</th>
<th>Synchronization</th>
<th>Response speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/1.8-inch color CCD image receiving element, 2x high-speed reading using square-pixel, 3,930,000 pixels (XG-035C)/1/3-inch monochrome CCD image receiving element, 2x high-speed reading using square-pixel, 3,930,000 pixels (XG-035M)</td>
<td>(1) Constant voltage control method (direct current light)</td>
<td>253-level digital</td>
<td>2 CH (relay output, LED connector connection and terminal block connection)</td>
<td>DC, 12/24 V (0.5 A switch contact)</td>
<td>Maximum 40 W (header: 20 W)</td>
<td>100 kHz (controller setting conversion)</td>
<td>(1) Constant voltage control Under 10 ms During 12 V output Under 20 ms During 24 V output</td>
</tr>
<tr>
<td>2/3-inch color CCD image receiving element, 2x high-speed reading using square-pixel, 5,050,000 pixels (XG-H500C)/2/3-inch monochrome CCD image receiving element, 2x high-speed reading using square-pixel, 5,050,000 pixels (XG-H500M)</td>
<td>(2) Pulse width modulation method (emission frequency 100 kHz)</td>
<td>0 to 1024 levels</td>
<td>2 CH (Enables LED connector connection and terminal block connection)</td>
<td>DC, 12/24 V (0.5 A switch contact)</td>
<td>Maximum 100 W (header: 50 W)</td>
<td>100 kHz (controller setting conversion)</td>
<td>(2) Pulse width modulation method Under 1 ms During 12/24 V output</td>
</tr>
</tbody>
</table>

* The environmental resistance of the LED lighting is ambient temperature of 9 to 40°C 33 to 104 °F, relative humidity 35 to 65% (no condensation).

* You will be restricted by the ambient temperature tolerance of the connected controller.

* Each company name, system name, and product name in the catalog is generally a registered mark or a trademark of each company. Neither (tm) nor (R) is indicated in the texts or in the charts in the catalog.
DIMENSIONS

Please refer to the "Vision System Peripheral Equipment catalog" in regards to any dimensional diagrams of additional devices that have not been included here.
Additional KEYENCE Vision Systems

CV-5000 Series

**INDUSTRY LEADING SYSTEM**

- Multiple vision processing and image enhancement tools
- High performance 3+1 processing architecture
- Sophisticated blur and shading correction filters

**Expandable Architecture**

Eliminate the need for wiring and complex PLC programs with KEYENCE’s unique expandable controller design. Giving you the ability to control lighting and I/O all in one system and program.

**11x Ultra High Speed 5 Megapixel Camera**

Full support for 4x ultra high speed 5 Megapixel cameras for unsurpassed high accuracy image processing.

Conventional (310,000 pixel) camera: The defect cannot be recognized

5 Megapixel camera: The break in the pattern is clearly visible

**Trend Edge Defect Detection**

Packaged with the industries original “Trend Edge Defect” detection for easy detection of chips and burrs.

Burr/chip detection of a plastic mold

Outline trace image

The target profile is automatically detected and the true curve model line calculated according (shown in green).

Detection of the burr section

The burrs section deviates from the model line, and is therefore detected as a flaw.

Detection of the chipped section

Even very moderate chips that were conventionally difficult to detect can now be reliably detected.

CV-3000 SO Series

**LOADED WITH FUNCTIONALITY AND UTILITIES PERFECTED FROM THE CV-5000 AND CV-3000 SERIES**

**Statistical Functions**

Verify inspections and adjust limits based on statistical data.

**Real-time Limit Adjustment**

During inspection, and without affecting processing/timer, tolerances can be selected and adjusted.

**Image Archive**

Store, evaluate, re-test and adjust settings based on archived images.
After Sales Support

Here at KEYENCE we pride ourselves on the quality of our after sales support on all our products and the XG-7000 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.

**Example programs**

Example programs can be downloaded with easy to use instructions enabling you to benefit from and gain experience on all the XG-7000 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-7000 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.

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