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KEYENCE

96175A

Ultra High-Speed, Flexible Machine Vision System

XG-7000 Series

User's Manual

Read this manual before use.
Keep this manual in a safe place for future reference.



Multi Camera System 16

A.C.E.II COLOR

Introduction

The XG-7000 Series uses a 2-way approach (either on the controller or on a PC) to build inspection programs. The controller can be used to carry out adjustments in the field, add vision units and perform product changeovers. A PC can be used to establish inspection methods and build new programs with original operation menus and other essential GUI elements. The available PC programs are the XG VisionEditor development environment and the XG VisionTerminal log data collection program.

Notations used in this manual

Symbols

The following warning symbols are used to ensure safety and to prevent human injury and/or damage to property when using the system.

⚠ DANGER
Indicates that the operator is at risk of death or serious physical injury if the system is improperly operated or this precaution is not followed.

⚠ Warning
Indicates that the operator is at risk of physical injury if the system is improperly operated or this precaution is not followed.

⚠ Caution
Indicates that property could be damaged (product malfunction, etc.) if the system is improperly operated or this precaution is not followed.

► Note
Indicates important operating procedures that could be easily overlooked.

Reference
Indicates items to enhance system understanding and other useful information.

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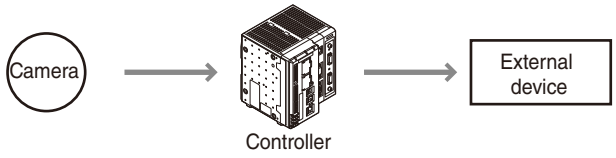
This manual and related manuals

This manual describes the basic operating methods for the XG-7000 Series (hereafter in this manual referred to as "the controller"). Read this manual thoroughly in order to understand how the controller works and to maximize performance of the controller.
Always keep this manual in a safe place for future reference.
Please ensure that the manual is passed to the end user of the software.

Applicable Manuals

Initial Installation

XG-7000 Series system connections, installation and product specifications



XG-7000 Series Setup Manual

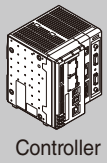
Inspection program development

Inspection program development/Support functions for Inspection program development



Program development and controller setting using XG Vision Editor.

XG VisionEditor Reference Manual (Programming Edition)



Program development and controller setting using the built-in GUI interface on the controller.

XG-7000 Series User's Manual (this manual)

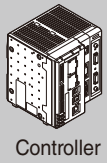
Support tool for operation

Creating GUI/Tool simulation



Operation methods of tools by XG VisionEditor

XG VisionEditor Reference Manual (Utility)

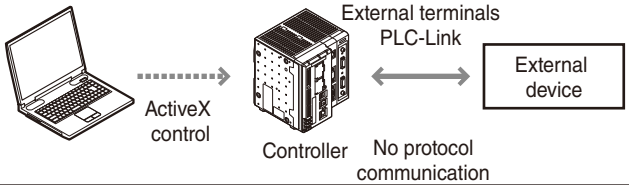


Operation methods of tools by functions built into the controller

XG-7000 Series User's Manual (this manual)

Communication control/external monitoring

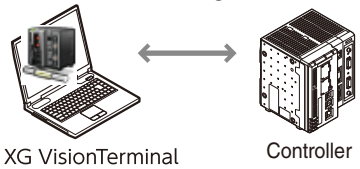
Communication and control with external equipment



XG-7000 Series Communications Control Manual

ActiveX control for XG Reference Manual

Remote monitoring and data/image collection



XG VisionTerminal User's Manual

96175A

Safety Information for XG-7000 Series

General Precautions

- Before starting or operating the system, check to make sure all system functions are working properly.
- If any Keyence product fails, take all safety precautions to prevent damage before using the system again.
- If the system is operated beyond its published specifications or if the system is modified, its functions and performance cannot be guaranteed.
- Please note that when the system is used in combination with other devices, its functions and performance may be negatively affected.
- Do not use this product for the purpose to protect a human body or a part of human body.
- This product is not intended for use as explosion-proof product. Do not use this product in a hazardous location and/or potentially explosive atmosphere.
- Do not subject the controller or connected devices to a sudden change in temperature. There is the risk of condensation occurring.

Warning

General

- Do not use with any power voltage other than 24 V DC. Doing so may cause fire, electric shock, or product malfunction.
- Do not disassemble or modify the unit. Doing so may cause fire or electric shock.

Operating environment and conditions

- For safe and proper use of the controller, avoid installing it in the following locations: Doing so may cause fire, electric shock, or product malfunction.
  - Locations that contain moisture or dust, or that are poorly ventilated.
  - Locations where the controller is exposed to direct sunlight or temperature increases.
  - Locations where there are flammable or corrosive gases.
  - Locations where the controller may be subjected to vibration or shock.
  - Locations where water, oil or chemicals may splash onto the controller.
  - Locations where static electricity is present or electric discharge may occur.
- Keep the controller and cables away from high voltage cables or power lines. Otherwise, noise interference may cause malfunction or accidents.
- Bundle cables with a protective spiral tubing material. Direct bundling will concentrate the cable load on the bindings, which can result in cable damage or short circuit.
- The controller and optional devices are precision components. To maintain performance do not subject them to vibration or shock.

Measures to be taken during abnormal performance

In the following cases, turn the power OFF immediately. Using the system in a defective condition may cause fire, electric shock, or product malfunction. Contact your local Keyence office for repair.

- If water or debris enters the system
- If the system is dropped or the case is damaged
- If smoke or a burning smell is emitted from the system

Caution

Usage

- Before connecting or disconnecting cables or expansion units, be sure to turn off the controller and other connected devices. Failure to do so may result in malfunction of the controller or connected devices.
- Do not turn the power off while you are programming. Otherwise, all or part of the program settings may be lost.
- Do not block the ventilation holes. Otherwise, the inside temperature may rise and malfunction may occur.
- Do not allow an excessive amount of sunlight or other bright light to enter the camera for a long period of time. Doing so may cause damage to the CCD inside the camera.

Note

Maintenance

Do not clean with benzene, thinner, or alcohol.
Doing so may cause discoloration or deform the controller. If the controller has been contaminated in anyway, use a cloth moistened with a mild detergent to wash off, then wipe dry with a dry cloth.

Precautions on Regulations and Standards

CE Marking

Keyence Corporation has confirmed that this product complies with the essential requirements of the applicable EC Directive, based on the following specifications. Be sure to consider the following specifications when using this product in the Member State of European Union.

EMC Directive (2004/108/EC)

- Applicable standard EMI: EN61326-1, Class A
  EMS: EN61326-1
- The length of cables connected to the controller and its external devices must be less than or equal to 30m.
- When using a CC-Link unit CA-NCL10E, attach a ferrite core (OP-84364) to the CC-Link dedicated cable at a position within 300 mm from the CA-NCL10E.
- When using RS-422, attach the provided ferrite core (ZCAT2035-0930A) to the RS-422 cable at a position within 300mm from the controller.

Remarks:
These specifications do not give any guarantee that the end-product with this product incorporated complies with the essential requirements of EMC Directive. The manufacturer of the end-product is solely responsible for the compliance on the end-product itself according to EMC Directive.

Differences in the XG-7000 Series (7702/7502/7002)

This manual covers the XG-7000 Series Ver. 4.1, which includes the XG-7702/XG-7502/XG-7002/XG-7002A models. All references, unless otherwise stated, pertain to the XG-7502. Additionally, all screen images in this manual are taken from the XG-7502.

The differences between each model are listed below.

- The image processor used in the XG-7702/XG-7502/XG-7002A is approximately 30% faster than that of the XG-7002. Processing speed should be evaluated by uploading the program to the actual model to be used.
- The XG-7702 has approximately 3 times the image memory and processing memory of other controller models.
- For more details on differences between the models, refer to the XG-7000 Series Setup Manual.

			XG-7702	XG-7502	XG-7002	XG-7702A	XG-7502A
Number of connectable cameras	Digital Color Area Cameras	XG-035C	2(4)[*1]	2(4)[*1]	2(4)[*1]	2(4)[*1]	2(4)[*1]
		XG-S035C	2(4)[*1]	2(4)[*1]	2(4)[*1]	2(4)[*1]	2(4)[*1]
		XG-H035C	2(4)[*1]	2(4)[*1]	2(4)[*1]	2(4)[*1]	2(4)[*1]
		XG-H100C	2(4)[*1*2]	2(4)[*1*2]	×	2(4)[*1*2]	2(4)[*1*2]
		XG-200C	2(4)[*1*2]	2(4)[*1*2]	×	2(4)[*1*2]	2(4)[*1*2]
		XG-S200C	2(4)[*1*2]	2(4)[*1*2]	×	2(4)[*1*2]	2(4)[*1*2]
		XG-H200C	2(4)[*1*2]	2(4)[*1*2]	×	2(4)[*1*2]	2(4)[*1*2]
		XG-H500C	2(4)[*1*2]	×	×	2(4)[*1*2]	×
	Digital Monochrome Area Cameras	XG-035M	2(4)[*1]	2(4)[*1]	2(4)[*1]	2(4)[*1]	2(4)[*1]
		XG-S035M	2(4)[*1]	2(4)[*1]	2(4)[*1]	2(4)[*1]	2(4)[*1]
		XG-H035M	2(4)[*1]	2(4)[*1]	2(4)[*1]	2(4)[*1]	2(4)[*1]
		XG-H100M	2(4)[*1*2]	2(4)[*1*2]	×	2(4)[*1*2]	2(4)[*1*2]
		XG-200M	2(4)[*1*2]	2(4)[*1*2]	×	2(4)[*1*2]	2(4)[*1*2]
		XG-S200M	2(4)[*1*2]	2(4)[*1*2]	×	2(4)[*1*2]	2(4)[*1*2]
		XG-H200M	2(4)[*1*2]	2(4)[*1*2]	×	2(4)[*1*2]	2(4)[*1*2]
		XG-H500M	2(4)[*1*2]	×	×	2(4)[*1*2]	×
	Line Scan Cameras	XG-HL02M	×	×	×	1(2)[*3]	1(2)[*3]
		XG-HL04M	×	×	×	1(2)[*3]	×
		XG-HL08M	×	×	×	1(2)[*3]	×

[*1] Up to 4 area type cameras can be connected and used simultaneously by using the camera expansion unit (XG-E800 with XG-EC80).

[*2] In addition to the 240,000 and 310,000 pixel standard cameras, the XG-7702/XG-7502 is also capable of processing 1 and 2 megapixel images from 1 or 2 megapixel cameras. Furthermore, the XG-7702 also supports 5 megapixel cameras.

[*3] Up to 2 line scan type cameras can be connected and used simultaneously by using the camera expansion unit (XG-E800 with XG-EC80L).

Compatibility of Inspection Program Files

Notes concerning the uploading of programs configured for a camera not connected to the controller

- Program files created in Ver. 2.1 or earlier that use a camera not connected to the controller will not run. A camera setting error will occur when the controller is put in Run mode.
- Before uploading or copying a program file make sure the cameras set in the program match the camera models actually connected to the controller.

Program file compatibility between different model controllers

Program files created for one XG Series controller are compatible with other XG Series controller models. If the program specifies a camera the controller does not support, or if the camera is not connected, a camera connection error will occur and the program will not run.
Programs may also fail to load on controllers due to insufficient processing and internal image memory. This can occur when loading a program created on the workspace of a different controller.

Reference

For details on workspaces and controller models, refer to the XG VisionEditor Reference Manual (Programming Edition).

Changes to XG-7002 Ver. 4.1 and Earlier Versions

This manual covers the XG-7702 and Ver. 4.1 of the XG-7502, XG-7002, and XG-7002A.

Reference

- The firmware on the controller can be checked by clicking "System Information" on the System Configuration menu (Page 7-53).
- While some exceptions apply, dedicated software is required to use the functions described in this manual.

Major controller changes between Ver. 4.0 and Ver. 4.1

Additional and modified functions

The following functions have been added or modified.

- Keyence touch panel (CA-MP120T) support.
  - KEYENCE CA-MP120T Touch panel connectivity added for full menu operation and image display re-sizing and movement.
- In the Variables menu, language selection support for setting item names, group names, and menu names.
- System Configuration
  - FTP added to [Communications & I/O].
  - [Port] setting added to [RS-232C] to allow for selection of I/O & Data Control or Touch Panel Connectivity.
  - VNC Server support added.
  - [CA-Series Touch Panel Calibration] was added to [Custom Functionality].
- Addition of compatible PLC-Link connections
  - Support for SYSMAC CP1 Series of Omron Corporation PLC.

Additional and modified functions

The following functions have been added or modified.

- Capture Unit
  - Settings for HDR capture have been added to the image capture settings (Compliant with Ver. 4.1.0010 or later).
- Blob Unit
  - Support for displaying the current value measured from the displayed image was added to the filter settings.
- Defect Unit
  - Support for displaying the current value measured from the displayed image was added to the filter and group settings.
  - "Data expansion" added to the detection conditions. When enabled, the major axis angle, feret diameter X/Y, perimeter, major axis, minor axis, axes ratio, distributed oval major axis, distributed oval minor axis, aspect ratio, and circumscribed rectangle top-left/bottom-left/top-right/bottom-right positions are available to be output as results data.
- Image Enhance
  - A [Direction] parameter has been added to the shading correction expand filter, shrink, and image extraction filters.
- Register Image
  - Support for extracting and registering only a designated region of the image.

Changes in communication commands

The following commands have been modified:

- BS (register image): Support for registering a portion of an image as a registered image.

Major controller changes between 3.0 and Ver. 4.0

Additional and modified functions

The following functions have been added or modified.

- Image strip, retest function
  - Retest mode added to support retesting using images stored in the controller's memory, SD card, or FTP server.
  - Image strip display showing thumbnails of images that can be retested, allowing for images to be individually retested.
  - Online retesting and batch testing functions.
  - Statistical functions for batch test results.
- Additional support for screen editing on the controller.
  - Functions for loading and saving screen displays.
  - Support for the alignment, distribution, and top/bottom ordering movement of screen parts.
- EtherNet/IP communication support.
- Built-in menu
  - Added Update Variables Menu, Variable Update Settings Menu, and Retest Mode.
  - Changed [FTP Settings] to [FTP Setup].
- Function Menu
  - Added Update Variables Menu and Retest Mode.
- System Configuration
  - Language supports for simplified Chinese and traditional Chinese.
  - It is now possible to change the EtherNet/IP settings, the OCR Encryption, and Custom Instruction Settings in Offline mode.
  - Ethernet BOOTP support.
  - CC-Link CSP file creation support.
  - The Terminal Block & Parallel Port settings support a setting that disables handshake timeout.
  - Save/Load System Settings supports master OK/NG reference images for retesting.
  - MAC address display is supported in the System Information and Ethernet settings.
- The Change Program menu design was changed.
- The Unit Properties top menu design was changed.
- Master OK/NG reference images are supported for copying, saving, and loading in the New/Edit/Del Programs menu.
- Master OK/NG reference images are supported in the Copy/Delete Programs menu.
- Master OK/NG reference images are supported in the Save/Load System Settings menu.
- Compatible PLC link connections
  - Supports for YASKAWA Electric PLC's MP series.
  - For PLC-Link (Ethernet), KEYENCE PLC KV-LE20 series notation changed to KV series.
- [Resources] and [Add to Update List] added to the Edit menu.
- Layout of the software keyboard when English is used changed to QWERTY layout.

Additional and modified functions

The following functions have been added or modified:

- **2D Code Reader Unit**: 2D Decoding vision tool added capable of reading up to 512 characters of a 2D code (QR Code: Model 1, Model 2, Micro QR, DataMatrice, Rectangle DataMatrix (ECC2200)) and supports for up to 16 registered patterns.
- **Pattern search unit**: [Highest+(4)] added to sensitivity settings.
- **Capture Unit**: EtherNet/IP added to trigger options.
- **Calibration unit**: [Use Axis Settings] parameter added to the Setup Axis/Origin.
- **Terminal I/O Delay Units**, **Variable Delay Units**: Added [Update Display While Waiting] parameter.
- **Branch Unit**: Function added to force branch during retesting.
- **On-screen Graphics unit**: [OCR] changed to [Decimal to ASCII].
- **Data Output Unit**: EtherNet/IP destination added.
- **Image Output Unit**, **Image Archive**, **Image Archive Output**
  - The upper limit for the number of folder divisions increased from 10,000 to 50,000.
  - The default result of the image archive condition is changed to [OFF].
  - Setting items relating to the number of data points for retest mode added to [Statistics].
- **Calculation Unit**:
  - Unit processing time on the controller was improved.
  - " (double quotation marks) added to the software keyboard.
- **Command Unit**: " (double quotation marks) added to the software keyboard.
- **Plugin Unit**: "int get ContrllerId(void)" method added for acquiring the controller ID.
- **Screen Properties**:
  - In the menu template properties, changed [Update screen when changes are applied] to [Update screen when value changes].
  - [Update screen when value changes] setting added to Screen Display templates.
- Addition of the following system variables.
  - %Cam1Status through to %Cam4Status: Display the status of the image capture buffer.
  - %Cam1Num through %Cam4Num: Display the number of images in the image capture buffer.
  - %RetestStatus: Indicates whether or not Retest Mode is being used.
- Removed the forced mode change key operation by simultaneously pressing the No.1 button, No.7 button, and No.8 button on the handheld controller.

Additions and changes to communication commands

The following functions have been added or modified

- **OPW (Change Output Folder)**: Command added for changing the output folder for outputting from the Data Output unit, Image Output unit, and Image Archive.
- **OPW (Read Output Folder)**: Command added for reading the output folder for outputting from the Data Output unit, Image Output unit, and Image Archive.
- **AT (Auto Tune)**: Command added for auto tuning the selected 2D Code Reader unit using the current or registered image.
- **OW (Change File Naming Rule Fixed Name)**: Support for changing the fixed name of the file naming rules for Image Archive output.
- **OR (Read File Naming Rule Fixed Name)**: Support for reading the fixed name of the file naming rules for Image Archive output.
- **CW (REG Write)**: Support for changing 2D Code unit reference patterns.
- **CW (REG Read)**: Support for reading 2D Code unit reference patterns.

Reference

Refer to the XG VisionEditor Reference Manual (Control/Data Edition) for more details on the communications commands.

Major controller changes between Ver. 2.1 and Ver. 3.0

Additional and modified functions

The following functions have been added or modified.

- Flowchart display/editing functions:
  - Ability to display flowcharts; add, delete, and copy units; group settings; change unit names and comments; renumber unit IDs.
  - Ability to hide/show flowcharts from the function menu; switch between the run and edit flowchart views.
- Edit Unit menu:
  - Ability to edit other units (all units except for C plugins) in addition to measurement units. Ability to edit display options such as the frame color for each unit.
  - Ability to change the maximum count; toggle high speed modes ON/OFF; toggle image areas ON/OFF; add new subtraction filters; add new expanded custom filters.
- Addition of built-in menus: Camera Selection; Resources; New / Edit / Delete Programs; Variables; Setup Total Status; Setup Total Error; Setup Scale Factor; Image Capture Buffer Settings; Setup Statistics; Setup Image Archive; FTP Settings.
- Options for System Configuration: Language; Register Image File Type; Overall Menu Opacity; Startup Mode; Input/Output terminal assignments; PLC-Link settings; CC-Link settings.
- English on the controller in the language selection option.
- Group lock function: Groups can be locked to prevent viewing or editing of units in the group on the flowchart and in editor views.
- Limit on externally executed BU, DO, FV, and ES commands: Addition of support to limit access to the Edit Unit menu, Show Flowchart, and Edit Flowchart views invoked by external commands.
- Password-protected programs supported on the controller: Password-protected programs are enforced on the remote console operations in the unit properties, flowchart display, and edit flowchart.
- Models supported in PLC-Link mode: Added support for MELSEC L series PLCs manufactured by Mitsubishi Electric Corporation.

Addition and modification of processing and image enhancement features

The following functions have been added or modified.

Reference

For more details on processing and image enhancement features, refer to "Image Enhancement Filters" (Page 10-11) and the XG VisionEditor Reference Manual (Programming Edition).

- Calibration unit: This calculation unit corrects far-near distortion caused by lens distortion and camera placement.
- C Plug In unit: Provides pixel-level access to image variables using C language, and allows numerical calculations of various variables.
- Background capture feature: Background buffering is used to allow the capture of images and flowchart execution to run asynchronously.
- Addition of capture priority support to the capture unit: Capture units can be completed based on individually specified triggers.
- Addition of FTP support for archive output: FTP can now be selected as an output location for the archive function.
- Addition of unit results to blob units to calculate the vertexes of: Box Width, Box Height, Aspect Ratio, Major Axis, Minor Axis, Axes Ratio, and Minimum bounding box.
- Addition of blob filters to image enhancement: Blob filters are now available during image enhancement for vision tool processing units.
- Expansion in the range of filtering that can be applied by the grouping function in defect units: Roundness, Box Width, Aspect Ratio, Major Axis, and Axes Ratio filters have been added to the unit settings for filtering grouping results.
- Expansion of the maximum character limit for mathematical expressions in calculation units to 5,000 characters.

- Addition of eight geometric functions: Functions performed on two-dimensional vectors (AddVector: addition, SubVector: subtraction, InnerProd: inner product, OuterProd: outer product); function to calculate the center of rotation (RotCenter); functions to convert between world and pixel coordinates (ConvPixToWld, ConvWldToPix); and a function to calibrate mutiple points (MultiPtCalib).
- Added trapezoidal correction to conversion processing in an image operation unit: Trapezoidal correction can be applied to a rectangle formed by four user-specified points, or a user-specified square.
- The use of registered images to update reference position information: Registered images can now be used to update reference position information when editing a position adjustment unit or position reference unit, and when registering an image.
- The use of image variables to reference registered images in search units: Registered images can now be referenced from image variables when using Pattern search.
- Accuracy options for Pattern searches: Options were added for very fine (3) and very coarse (-3).
- Unit execution support: The execution option for a unit can now be set on the controller.
- Output options for %JAHold: In addition to Latching, options were added for Sync with STO and One shot output.
- Skip unexecuted outputs: An option was added to automatically skip terminal output and result outputs if the unit was not executed.
- Change in the decimal place for scaling: The scaling accuracy was expanded from 3 to 6 digits after the decimal.

Specification changes to supported devices

- Changes to the SD card capacity of C drive on the XG-7502, XG-7002, and XG-7002A: The standard equipped SD card in the C drive has been changed from OP-84232 (256 MB) to OP-87133 (512 MB).

Major controller changes between Ver. 2.0 and Ver. 2.1

Additional and modified functions

The following functions have been added or modified.

- Edit Unit menu (Page 4-8): A dedicated menu [Edit Unit menu] was added for changing the unit settings.
- Statistics (Page 5-11): Tolerance values can now be modified from the [Statistics] screen even if variables have not been assigned to the tolerance settings.
- Models supported in PLC-Link mode (Page 8-15): Added support for PLC systems from Mitsubishi Electric Corporation and Omron Corporation. Also added PLC-Link support via the Ethernet port on selected controller models.

Major controller changes between Ver. 1.0 and Ver. 2.0

Addition of supported devices

The following controllers, cameras, and illumination expansion units are now supported.

- Controller: 5 megapixel camera compatible high-end controller XG-7702
- Cameras:
  - High-speed 5 megapixel camera XG-H500C (color) / XG-H500M (monochrome)
  - High-speed 2 megapixel camera XG-H200C (color) / XG-H200M (monochrome) Illumination expansion unit:
- Illumination expansion unit: CA-DC20E (Note: up to 4 units can be connected)

► Note

- XG-H500C / H500M can only be used with the XG-7702.
- XG-H200C / H200M cannot be used with the XG-7002.
- CA-DC20E can be used with all controllers.
- 200The XG-H500C/H500M is not guaranteed to operate with the camera expansion unit XG-E700, shipped prior to January 14, 2009.

Addition and modification of processing and image enhancement features

The following functions have been added or modified:

Reference

For more details on processing and image enhancement features, refer to "Image Enhancement Filters" (Page 10-11) and the XG VisionEditor Reference Manual (Programming Edition).

- **Profile Defect**: This vision tool detects defects on the outline of the inspection target (protrusions and indentations) from the edge detected by the profile position.
- **Image Operation**: This function stores images in user-specified variables used for processing. The images can be the result of a calculation performed on multiple user-specified source images, or the result of an image created by pixel value conversion performed on a single source image.
- **Fine Color Defect**: [Fine Color] was added as a color extraction setting in the defect unit. Defect inspections make direct use of the HSB information (hue, saturation, and brightness) for easy and stable defect detection.
- **Real-time shading correction**: This correction maintains uniform contrast at all times by correcting the active shading inside the inspection region in real-time.
- **Blur**: This filter softens the image within the inspection region in the X, Y, or XY direction.
- **Custom (Advance)**: Supports up to 21 x 21 convolutions, expansion, and shrink filters.
- **RGB gray**: The gray image can be generated from the average intensity of RGB pixel values when a color camera is connected.

Other additional and modified functions

The following functions have been added or modified:

- **OCR date and time encryption function**: The OCR unit now supports a calendar tolerance setting for encrypted characters, such as best-before dates.
- **640 x 480 imaging area** (Page 7-13): In addition to the conventional 512 x 480 pixels, 640 x 480 pixels can be selected as the imaging area for a standard digital camera in a capture unit.
- **Trigger Delay** (Page 7-9): This feature places a delay between the trigger input and the start of processing.
- **Rename, copy, delete programs** (4-362, Page 4-363): The function menu now supports rename, copy, and delete functions for user-specified programs.
- **Built-in menu for library files** (Page 4-250): A built-in menu was added for registering libraries for use with an OCR unit.
- **Unit ID selection supported for built-in menus for inspection regions and color extraction** (Page 3-20, Page 10-2): This feature supports global changes across multiple units using a single menu.
- **Specifying a reference unit in the Register Image built-in menu** (Page 3-28): An image can be registered from a specified position adjustment unit after the image has been corrected.
- **Region selection in the Inspection Region built-in menu** (Page 3-20): The "Target region" for search region and pattern region can be selected in the Inspection Region built-in menu.

Upgrading V-Works for XG (XG-H7NE)

The controller requires the separately sold V-Works for XG Ver. 4.1 for full operation.
Visit the XG-7000 Users Support page (http://www.visionsystem.com/XGSUPPORT) to download and upgrade to the latest version free of charge.

► Note

- XG VisionEditor which is included with V-Works for XG Ver. 4.0 or earlier versions does not support the Ver. 4.1 controller. Note, V-Works for XG Ver. 4.1 has forward compatibility with previous versions.
- The XG VisionTerminal included with V-Works for XG Ver. 4.0 and earlier versions can communicate with controllers up to Ver. 4.1 However the new functions added to each version (for example the mouse support added to Ver. 4.0) can be used only with supporting versions of XG VisionTerminal.
- XG VisionEditor included with V-Works for XG Ver. 4.1 does not have to be registered if an earlier registered version already exists on the same PC.

Reference

For further details on upgrading the software included with V-Works for XG Ver. 4.1, refer to the separate manuals and online help supplied with each application.

Changes in specifications

The power consumption has changed for XG-7000 Series Ver. 2.0 or later.

- XG-7002 (2 cameras at maximum load/4 cameras at maximum load)
  - Ver. 1.0: 2.1A/2.8A
  - Ver. 2.0: 2.2A/2.8A
- XG-7502 (2 cameras at maximum load/4 cameras at maximum load)
  - Ver. 1.0: 2.3A/3.0A
  - Ver. 2.0: 2.4A/3.2A

Compatibility of program data

- Due to functional enhancements in Ver. 4.1, the program data (inspection settings, global variable settings, and system settings) are now in Ver. 4.1 format. (Program files for Ver. 1.0, 2.0, 2.1, and 3.0 are in Ver. 1.0, 2.0, 2.1, and 3.0 formats, respectively).
  Ver. 4.1 has backward compatibility and can read programs created in earlier versions. A complied bin file is required if using the C Plug In unit in version 4.0 and later due to the retest mode capability. Refer to the XG VisionEditor Reference Manual (Control/Data Edition) for more details on the Plugin units.
- Upward compatibility has not been provided. Therefore, programs in Ver. 4.1 format cannot be used on Ver. 1.0 controllers (registered images, library settings, and logo files can be used though).
- Earlier version program files can be upgraded using XG VisionEditor Ver. 4.1. Programs that meet certain conditions can be converted from a later version to an earlier version. For more details, refer to the XG VisionEditor Reference Manual (Programming Edition).
- The XG-7000 Series Ver. 4.0 and earlier controllers can be upgraded to Ver. 4.1 by downloading the firmware upgrade. Visit the XG-7000 Users Support page (http://www.visionsystem.com/XGSUPPORT) for more details on upgrading the firmware. This page is for registered users (V-Works for XG serial number is required). Note, depending on the date of manufacture, some Ver. 1.0 controllers cannot be upgraded to Ver. 3.0. Please contact your local sales representative for details.

  *Controllers shipped before January 2009 that do not have the letter D after the # symbol in their serial numbers cannot be upgraded. On controllers that have been upgraded to Ver. 2.1.0001, the controller cannot be upgraded for hardware version 1.0. You can find this version in the [System Information] screen under System Configuration.

Reference

The serial number of the controller can be confirmed by the sticker on the left side of the controller, or by clicking System Configuration then System Information (Page 7-53).

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Chapter 1

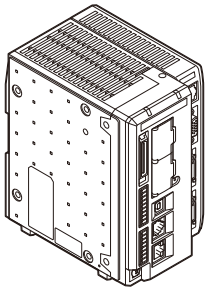
Function

Package Contents

The equipment and accessories listed below are included in the package when shipped. Check that you have received all of the equipment and accessories.

Standard Package

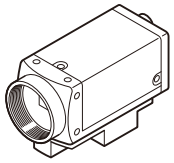
- Controller Unit XG-7702/XG-7502/XG-7002/XG-7002A, x 1



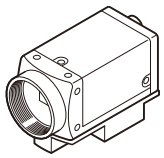
- SD memory card (OP-87133 (512 MB): XG-7502/7002/7002A, CA-SD1G (1 GB): XG-7702) x 1 (Installed in controller SD card slot 1.)
- Controller instruction manual x 1
- Set of terminal block labels x 1

Options

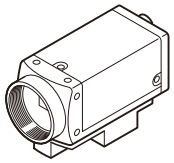
- XG-200C
  (2 megapixel color camera)
- XG-200M
  (2 megapixel monochrome camera)



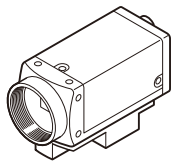
- XG-035C
  (320,000 pixel double speed color camera)
- XG-035M
  (320,000 pixel double speed monochrome camera)



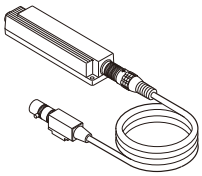
- XG-H100C
  (1 megapixel 7x-speed color camera)
- XG-H100M
  (1 megapixel 7x-speed monochrome camera)
- XG-H200C
  (2 megapixel 7x-speed color camera)
- XG-H200M
  (2 megapixel 7x-speed monochrome camera)
- XG-H500C
  (5 megapixel 11x-speed color camera)
- XG-H500M
  (5 megapixel 11-speed monochrome camera)



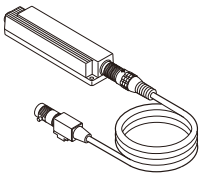
- XG-H035C
  (310,000 pixel 7x-speed color camera)
- XG-H035M
  (310,000 pixel 7x-speed monochrome camera)



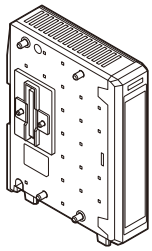
- XG-S035C
  (320,000 pixel ultra small double speed color camera)
- XG-S035M
  (320,000 pixel ultra small double speed monochrome camera)



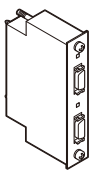
- XG-S200C
  (2 megapixel ultra small color camera)
- XG-S200M
  (2 megapixel ultra small monochrome camera)



- XG-E800
  (Camera expansion unit)



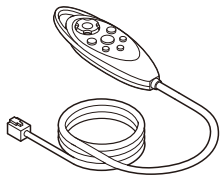
- XG-EC80
  (Area camera input unit)



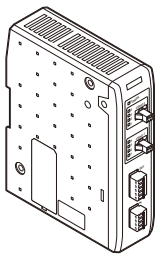
- OP-84231
  (Handheld controller)

Reference

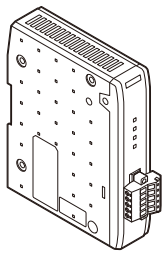
OP-84236 (blank) is also available.



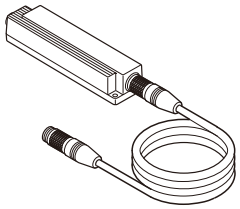
- CA-DC21E
  (Illumination expansion unit)



- CA-NCL10E
  (CC-Link unit)



- CA-CNX10U/CHX10U
  (Camera cable extension repeater)



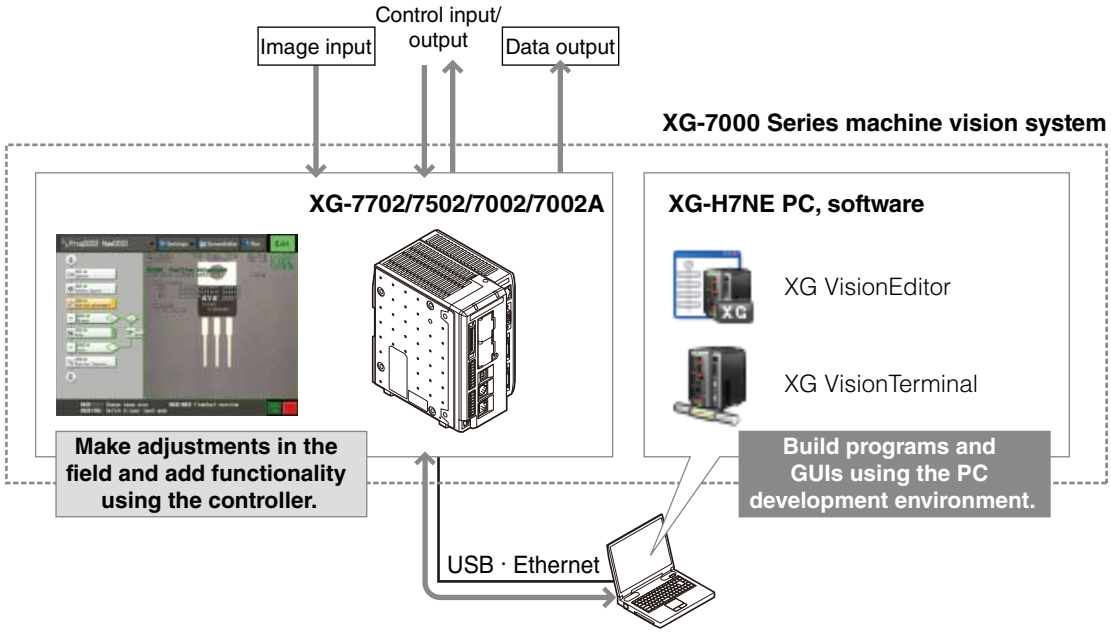
- XG-H8NE (dedicated software V-Works for XG)
  - XG Vision Editor
  - XG Vision Terminal

► Note

Refer to "Options" (Page 9-34) for more details about the options which can be used with this controller.

Overview of the XG-7000 Series Machine Vision System

The XG-7000 Series uses a 2-way process (either on the controller or on a PC) to build inspection programs. The controller can be used to carry out adjustments in the field, addition of units and product changeovers. A PC can be used to establish inspection methods and build new programs with original operation menus and other essential GUI elements. The provided PC programs are the XG VisionEditor development environment and the XG VisionTerminal log data collection program.



XG-7000 Series (controller) (this product)

This is a platform mounting a multi-core DSP. In addition to running user-developed inspection programs, the handheld controller can be used to check and edit inspection flowcharts and display screen setting. This allows for instant adjustments and program changes as they become necessary.

XG VisionEditor

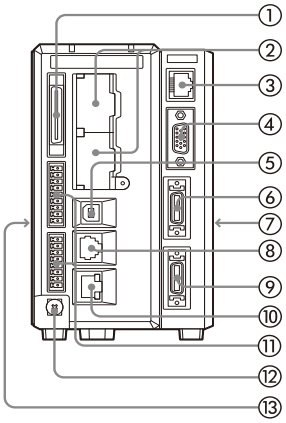
XG VisionEditor is integrated development software for the ultra high-speed, high-capacity multi-camera XG-7000 Series machine vision system. It provides all the inspection program development functions and utilities required for complete processing of the XG-7000 Series. Here you can create inspection programs that include original dialogs and display screens.

XG VisionTerminal

XG VisionTerminal is dedicated software for the ultra high-speed, high-capacity multi-camera XG-7000 Series machine vision system. XG VisionTerminal uses a remote desktop function allowing the user to view the monitor output from the XG-7000 Series on a PC, as well to issue commands for remote control and interaction. (Mouse operation is also supported.)
The XG VisionTerminal also allows for data logging directly from the XG-7000 controller.

Connections

Controller



(1) Parallel I/O connector

Use for signal input and output (Page 8-21).

(2) SD2 slot (upper), SD1 slot (lower)

Insert an SD card (Page 2-37).
The provided SD card (512 MB or 1 GB) is inserted into the lower slot (SD1) as SD card 1.

► Note

SD Card 1 must be inserted to operate the controller.

(3) Modular connector

Connect the optional handheld controller (OP-84231/84236) (Page 2-22).

(4) RGB output terminal

Use to connect to an external monitor (Page 2-22).

(5) USB connector

Use to connect a USB cable (Page 8-8).

(6) Camera 2 connector

Use to connect camera 2 (Page 2-22).

(7) Expansion unit connector 1 (right side)

Use to connect the camera expansion unit (XG-E700/E700A).

(8) RS-232C connector

Use to connect an optional RS-232C communications cable (OP-26487: 2.5 m) or optional touch panel RS-232C modular cable (OP-87264: 3 m / OP-87265: 10 m) (Page 8-2).

Reference

When connecting a touch panel, it is necessary to change the RS-232C port settings on the controller (Page 7-28).

(9) Camera 1 connector

Use to connect camera 1 (Page 2-22).

(10) Ethernet connector

Use to connect an Ethernet cable (Page 8-4).

(11) Terminal block

Use to connect power (24 V DC) and input/output signals (2-22).

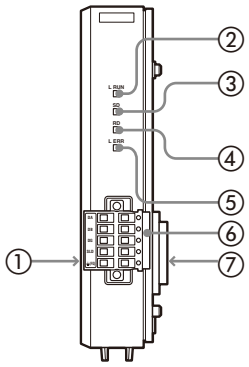
(12) Grounding terminal

Use to frame ground the unit (Page 2-25).

(13) Expansion unit connector 2 (left side)

Use when connecting light controller CA-DC21E and CC-Link unit CA-NCL10E (Page 2-5).

CC-Link Module (option)



(1) Connector on expansion unit side

Use when connecting light controller CA-DC21E (Page 2-6).

(2) Operation status indicator light (L RUN)

- **ON**: Master station and self station are updating the data correctly (green light lit).
- **OFF**: Data communication timed out (light will turn on when data is being received correctly).

(3) Data indicator (SD)

- **ON**: Data is being transmitted.

(4) Data indicator (RD)

- **ON**: Data is being received.

(5) Error indicator lamp (L ERR)

- **ON**: : Communication error (red light lit).
- **Flashing at constant intervals**: Station number or communication speed setting was changed during data transfer.
- **Flashing irregularly**: Terminator is not installed properly and or the unit or CC-Link cable is being affected by electrical noise.
- **OFF**: No communication errors

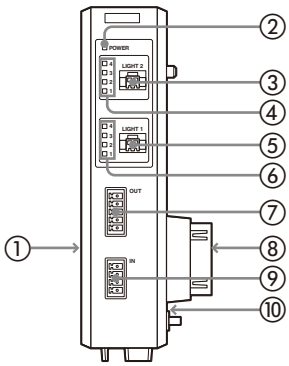
(6) Terminal block

See the wiring diagram (Page 8-19).

(7) Connector on controller side

Connect to the controller.

Illumination Expansion Module (Option)



(1) Connector on expansion unit side

Use when connecting two or more illumination expansion units.

(2) Power supply LED

Lit when the power is supplied to the illumination expansion unit.

(3) Light 2 output connector

Use to connect LED light No.2.

(4) Light 2 intensity LED

Indicates the intensity of Light 2 in four steps.

(5) Light 1 output connector

Use to connect LED light No.1.

(6) Light 1 intensity LED

Indicates the intensity of light 1 in four steps.

(7) OUT Connector Terminal Block

Use when connecting lights directly to the terminal block.

(8) Connector on controller side

Connect to the controller.

► Note

Make sure to connect to the controller side connector when connecting directly to the CC-Link unit CA-NCL10E.

(9) IN Connector Terminal Block

Use this to supply power to the illumination expansion unit, and to control the force light off input.

(10) DIP switch for output voltage change

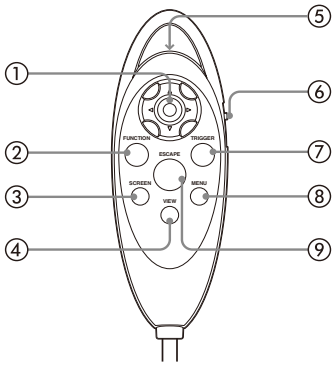
Use to select the output voltage on the output connector (Page 2-30).

Handheld Controller

This section explains the common operations and functions of the handheld controller (OP-84231).

Reference

- Text in parentheses indicates the labeling on OP-84231. A blank console without labels (OP-84236) is also available in consideration of original button assignments.
- Functions can be assigned to each button and to key combinations. The accessible operations on the handheld controller can be changed for different user accounts. The operations described here assume the handheld controller is being used with the default assignments by a user with administrator privileges. The actual operation may differ for your console. For more details, see "Controller Global Settings" in the XG VisionEditor Reference Manual.



(1) No.0/8-way thumbpad

Press the outer cursor button up, down, right or left to move the selected item on the screen.
Press the button in the center to confirm the setting on the screen.

(2) No.1 button (FUNCTION)

Press the button to toggle the function menu on/off.
It is also setup by default as a combination button.

(3) No.4 button (SCREEN)

This button cycles the screen through different display types (raw image 1, filtered, etc.).

(4) No.5 button (VIEW)

Press to display the View Toolbar, zoom in or out on the screen, or to switch between options such as result values or display templates.

(5) No.7 Back button

This button calls up the function menu, just like the No.1 (FUNCTION) button. It is also used to toggle the flowchart area on screen between normal and enlarged. Pressing and holding the button displays the entire flowchart.
Some of the button combinations differ from the No.1 (FUNCTION) button.

(6) No.8 selector switch (RUN/STOP)

Flicking this switch toggles between edit and run modes. Flick this switch to show/hide the Flow Editor.

Reference

It is also possible to forcibly change from Remote capture mode to Run mode.

(7) No.3 button (TRIGGER)

Press this button to issue a trigger for all cameras. Press and hold the No.3 button in the flowchart view to issue a continuous trigger (only when trigger input is enabled). Press the No.3 button (TRIGGER) again to stop triggering.

(8) No.6 button (MENU)

This button displays the image bar and performs operations related to Retesting mode.

(9) No.2 button (ESCAPE)

Press this button to return to the previous screen or to resume the previous operation.

Special Functions assigned to Buttons and Multiple Key Combinations

The buttons on the handheld controller perform special functions when pressed under certain conditions. Various other functions can be performed using key combinations (pressing two or more buttons simultaneously). Note, the functions available will differ depending on the controller operating state, and the functions assigned to the key combinations on the handheld controller.

1. Operation when turning on the power (special button function)

Operation	Buttons to use
Re-Initialize the controller and format the contents of SD Card 1	No.2 button + power ON
Start and display the initial startup screen (Page 2-32)	No.1 button + power ON
Forcibly start the controller in Offline mode	No.1 button + 8-way touchpad UP + power ON
Acquire network settings by BOOTP protocol	No.6 button + power ON

► Note

- Never turn off the power while initialization of the controller is in progress. Doing so may cause errors in the internal data
- Initializing the contents of SD Card 1 in the controller will erase all files, including inspection setting files and the global settings file which contains settings for terminal assignments, etc. When the controller is started immediately after it was initialized, settings are automatically created for the language and resolution that were selected on the initial startup screen.

2. Operation when the power is on (combination keys: default settings)

Operation	Buttons to use
Saving the current image on the screen to SD Card 2 (Screen capture)	No.1 button (FUNCTION) + No.5 button (VIEW) Or No.7 Back button + No.5 button (VIEW)
Send a reset signal to the controller during Run mode	No.1 button (FUNCTION) + No.2 button (ESCAPE) Or No.7 Back button + No.2 button (ESCAPE)
Changing screens	No.1 button (FUNCTION) + No.4 button (SCREEN) Or No.7 Back button + No.4 button (SCREEN)
Change the level of intensity for the dialog menus	No.1 button (FUNCTION) + No.6 button (MENU) Or No.7 Back button + No.6 button (MENU)

Reference

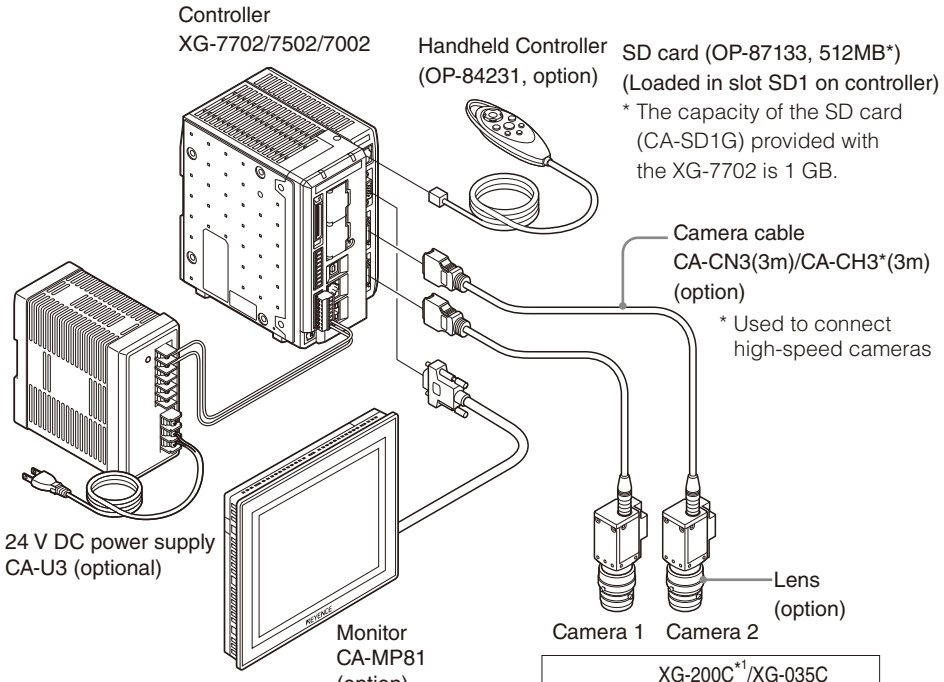
In addition to the above, there are also key operations which can only be used from the Flow Editor and Screen Editor. For more details, see the XG-7000 Series User's Manual.

Chapter 2

Installation and Connection

Standard System Configuration

Example of a standard system setup with two cameras



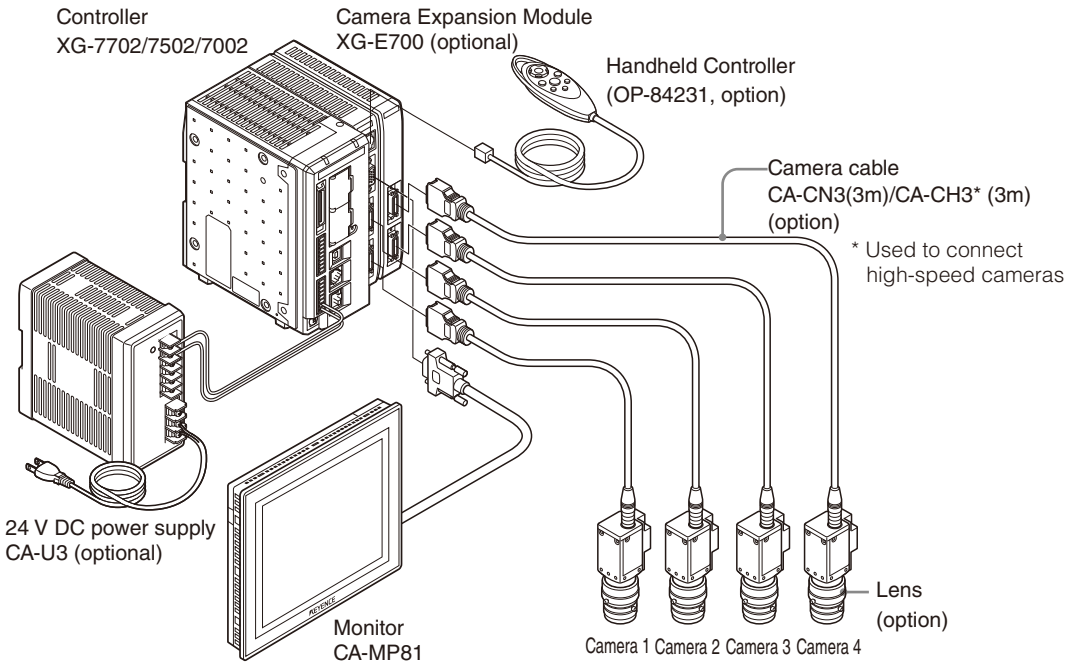
Compatible cameras (option)	XG-200C*1/XG-035C XG-S200C*1/XG-S035C XG-200M*1/XG-035M XG-S200M*1/XG-S035M XG-H100C*1/XG-H035C XG-H100M*1/XG-H035M XG-H500C*2/XG-H200C*1 XG-H500M*2/XG-H200M*1

*1 Only XG-7702/7502 can be connected.
*2 Only XG-7702 can be connected.

Reference

- Products that can be used with the analog camera-compatible controller XG-7002A will have different model numbers than those shown above as they require a dedicated analog camera and camera cable.
- For more information on connecting cables to cameras, please refer to "Camera Cable (Digital Cameras)" (Page 9-27) and "Camera Cable (Analog Cameras)".

Example of a standard system setup with four cameras



Compatible cameras (option)	XG-200C*1/XG-035C XG-S200C*1/XG-S035C XG-200M*1/XG-035M XG-S200M*1/XG-S035M XG-H100C*1/XG-H035C XG-H100M*1/XG-H035M XG-H500C*2/XG-H200C*1 XG-H500M*2/XG-H200M*1

*1 XG-7702/7502 only.
*2 XG-7702 only.

Reference

- Products that can be used with the analog camera-compatible controller XG-7002A will have different model numbers than those shown above as they require a dedicated analog camera and camera cable.
- For more information on connecting cables to cameras, please refer to "Camera Cable (Digital Cameras)" (Page 9-27) and "Camera Cable (Analog Cameras)".

Installing the Controller

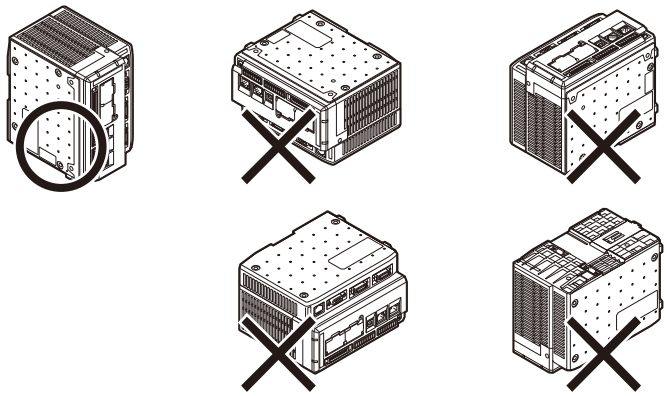
Secure the controller to DIN rail, or use the holes on the bottom of the controller to fix it to a base with screws.

► Note

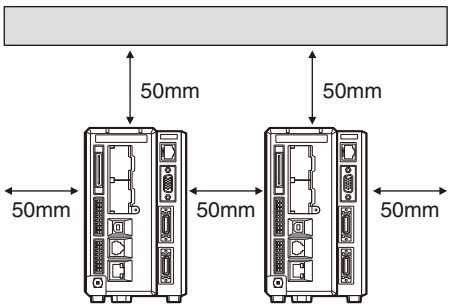
Do not install the controller in a location with lots of dust or water vapor. The controller does not have a mechanism to protect it from dust or water. Dust or water entering the controller can cause damage to the controller.

Correct Controller Mounting

- Install the controller in the correct orientation as indicated by the circle shown below. Do not install the controller in any other orientation.



- For ventilation, ensure a minimum of 50 mm of space above the controller unit and 50 mm of space on either side.
  So that the cables can be safely connected, ensure a minimum of 90 mm of space in front of the controller connector panel.
- When two or more controllers are installed side by side, ensure a minimum of 50 mm of space between the controllers, and 50 mm above both controllers.



► Note

- Do not block the ventilation openings on the top and bottom of the controller. If the vents are blocked, heat will accumulate inside the controller and can cause system failure.
- If the temperature inside the control panel (temperature at the bottom of the controller) exceeds the recommended specification, use forced air-cooling or increase the free space around the controller to improve ventilation until the operating ambient temperature drops below the recommended specification.

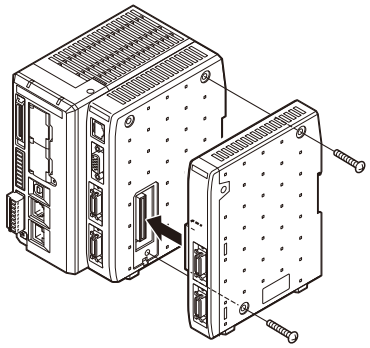
Installing Expansion Modules

► Note

- Turn off the controller when connecting or removing an expansion unit. Connecting or removing the camera expansion unit while connected to a power source may damage the controller or peripheral devices.
- When an expansion unit is not connected, keep the connector protection cover on the controller. Using the controller with the connector exposed may cause damage to the controller.

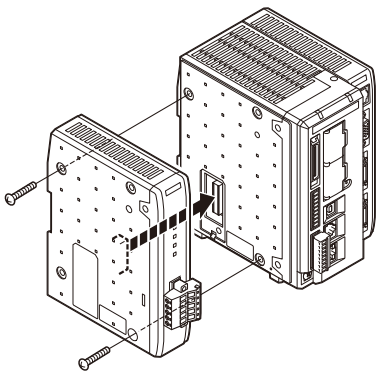
Installing the Camera Expansion Module

Use optional camera expansion module XG-E700 (for the XG-7702/7502/7002) or the analog camera expansion module XG-E700A (for the XG-7002A) to connect three or more cameras.
Remove the protective cover from connector 1 on the right side of the controller and install the camera expansion unit as shown below.



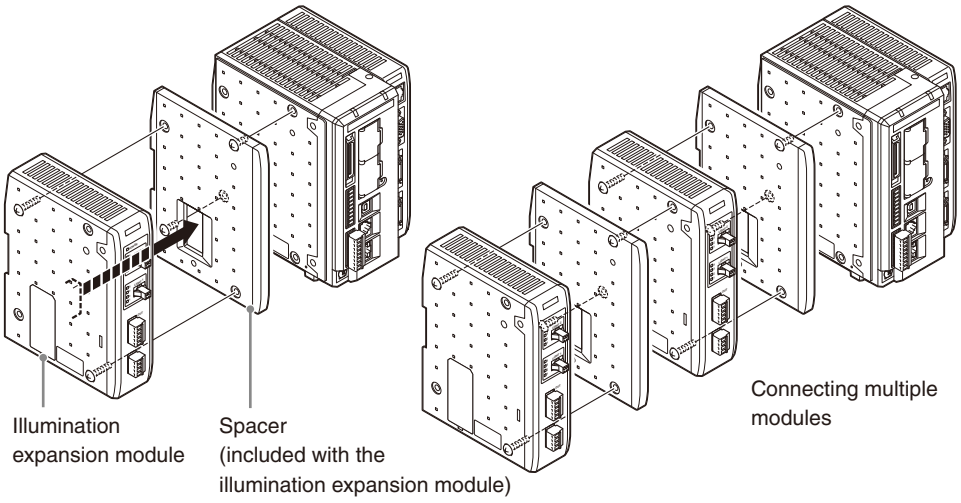
Installing the Communication Expansion Module

The optional CC-Link module CA-NCL10E can be used when for communicating via CC-Link (Page 8-19).
Remove the protective cover from connector 2 on the left side of the controller and install the CC-Link unit as shown below.



Installing the Illumination Expansion Module

Up to 4 CA-DC21E illumination expansion modules can be connected for the control of up to 8 individual lights. Remove the protective cover from connector 2 on the left side of the controller and install the illumination expansion unit as shown below.

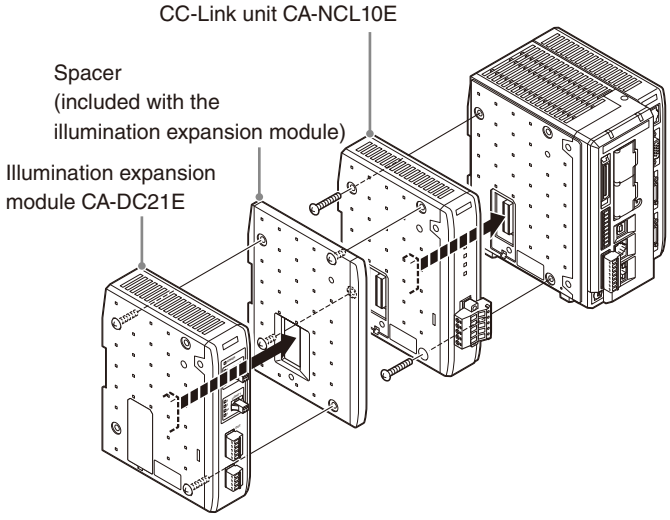


► Note

- It is necessary to mount the supplied spacers before mounting the illumination expansion unit.
- Turn off the controller when connecting or removing an illumination expansion unit. Connecting or removing the illumination expansion unit while connected to a power source may damage the controller or peripheral devices.
- When an illumination expansion unit is not connected, keep the connector protection cover on the controller. Using the controller with the connector exposed may cause damage to the controller.

Using the Illumination Expansion Module and CC-Link Module Together

Mount the CC-Link module CA-NCL10E directly to the controller first, then mount the illumination expansion module to the left side of the CC-Link unit.



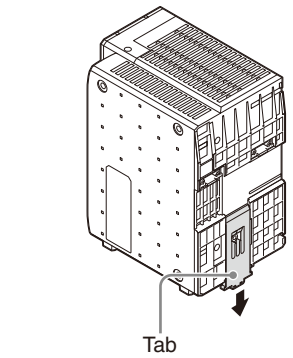
► Note

The CC-Link module cannot be mounted to the left side of the illumination expansion unit. If connected by mistake, it may damage the controller itself or the peripherals.

Installing the Controller

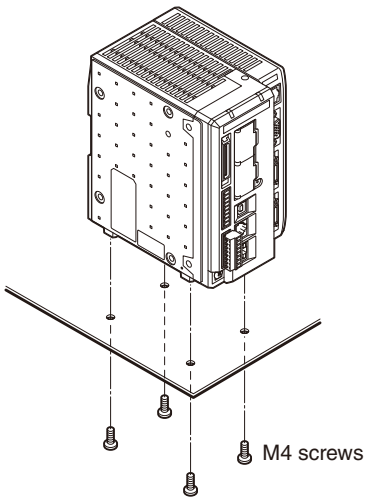
Installing the Controller on a DIN Rail

The controller and the expansion unit are designed to be mounted on a DIN rail.



Pull the tab on the bottom in the direction of the arrow to mount or dismount the controller.

Mounting to the Bottom of the Controller



► Note

Mount the controller in a stable location that is free from vibration.

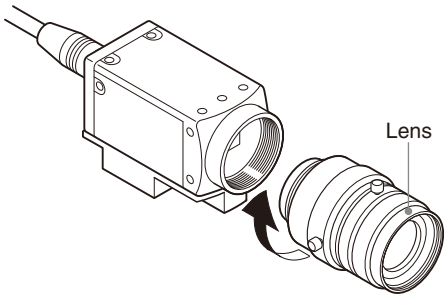
Installing the Camera

⚠ Notes on Electrical Insulation

- The camera case acts as the ground for the camera circuit. If the installation bracket or mount has any electrical potential or noise, it may cause internal damage and malfunction. For secure insulation, be sure to use the plastic mounting bracket and screws that are supplied with the controller when installing the camera.
- If the supplied plastic mounting parts are not used in the installation, take care to insulate adequately.

1 Install the lens on the camera.

Select an appropriate lens according to the size of the object or distance between the object and the camera (Page 2-10).



► Note

- Do not touch the inside of the camera when installing the lens.
- Take care to ensure dust and/or foreign material does not enter into the camera.

2 Install the camera using the screw holes provided on the plastic mount.

There are three types of screw holes. Use the standard camera connection and appropriate screw holes suitable for the mounting setup.

► Note

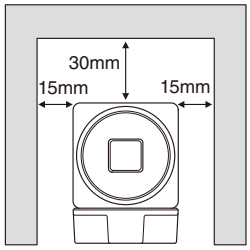
- When installing the camera, use a tightening torque of 0.5 Nm and a maximum tension of 30 N.
- Leave enough space around the lens to ensure easy adjustment of the focus and aperture (Page 2-36).
- If the camera is mounted where there is vibration, the lens mount or the lock screw for the lens may loosen. Use of a locking bond adhesive is recommended in such a case.
- Mounting the provided plastic mount on a side other than the bottom of the camera can cause gaps between the mount and the camera. If the installation needs to be very precise, try to fix the mount to the bottom of the camera.

Reference

To allow for future adjustment of the camera, an optional XY stage is available (CA-S2040). Using slot holes for the mounting screws of the camera will allow for similar adjustments to be made.

Camera ventilation

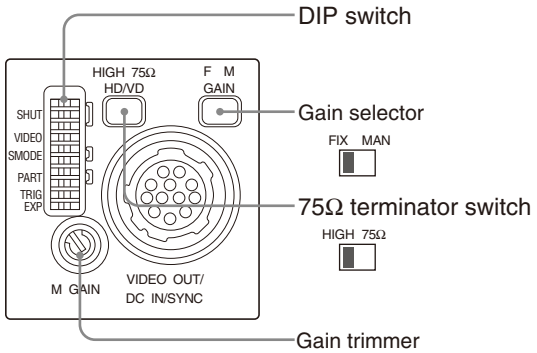
When installing the camera, maintain 30 mm or more of space above the camera and 15 mm or more on both sides.



Changing the DIP switches on an analog camera

When connecting an analog camera to the analog camera-compatible controller XG-7002A, the DIP switches on the camera must be configured correctly according to the inspection settings. Consult your sales representative for instructions on how to set the camera model being used and the inspection settings.

This example shows the settings for a Keyence analog camera CA-CM20



- The factory settings of the DIP switch positions are indicated by ■.

OFF	ON	Settings
	■	Bits 1 to 3 Electronic shutter (1/200)
■		
■		
■		Bit 4 Image sensing OFF: Progressive, ON: Interlaced
■		Bits 5 to 6 Shutter control (no VD)
	■	
■		Bits 7 to 8 Partial capture
■		
■		Bit 9 Trigger polarity (positive)
	■	Bit 0 Shutter speed (pulse width)

- Set bits 7 and 8 as shown below.

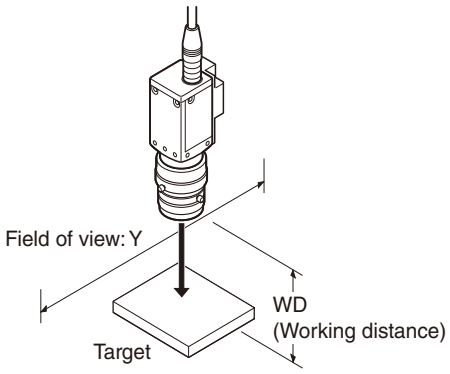
Scanning method	Capture range	Bit 7	Bit 8
Progressive	640 x 480	OFF	OFF
	640 x 210	OFF	ON
	640 x 70	ON	ON
Interlaced	640 x 480	OFF	OFF
	640 x 140	OFF	ON
	640 x 50	ON	ON

► Note

Do not change the non-grey background DIP switches (bits 1 to 3, 5 to 6, 9, and 0) from their factory preset condition. Otherwise, the camera may not operate properly.

Selecting a Lens

Select the lens according to the size of the target (FOV (Field of view): Y) and the distance between the camera and the target (working distance). Select a suitable lens referencing the FOV chart.



Working Distance and FOV Lens Chart

- The numbers in the FOV chart represent the thickness required for the close-up ring. Install the close-up ring between the lens and the camera when required.
- The asterisk (*) symbol in the FOV chart indicates the type of lens.

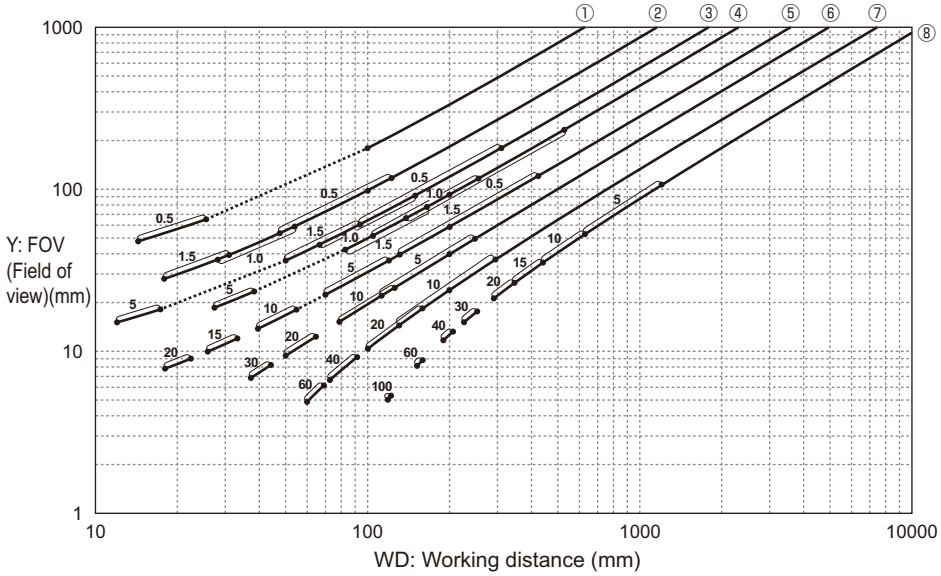
► Note

The numerical numbers shown in the FOV chart are typical values.

Using a 5 Megapixel Camera (XG-H500C/XG-H500M)

When using the CA-LH16 on the XG-H500C with a required field of view of 50 mm, the chart shows that the working distance should be set to 100 mm and the 1.5 mm close-up ring should be used.

Using a low distortion lens (CA-LH*): 2432 x 2050 pixels (5 megapixel mode)

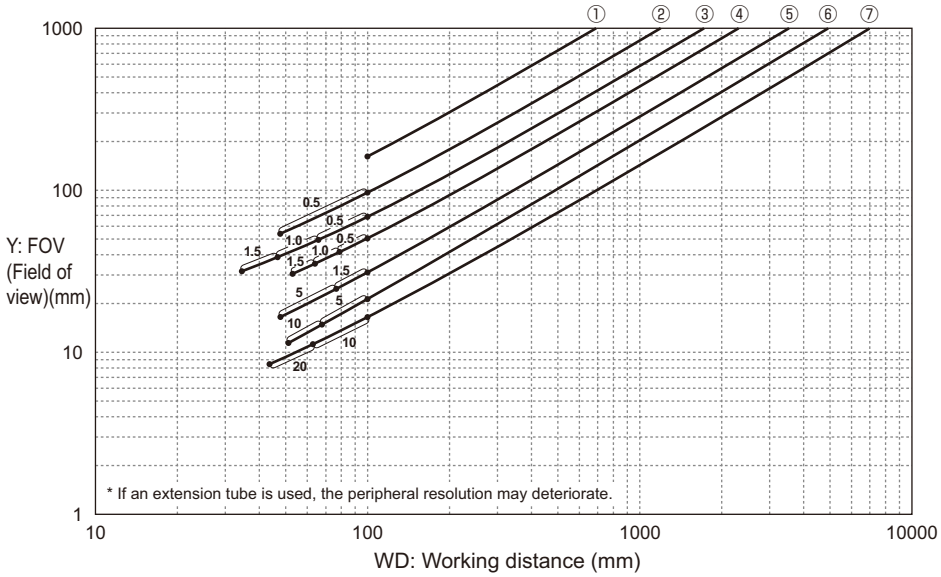


① CA-LH4 ② CA-LH8 ③ CA-LH12 ④ CA-LH16 ⑤ CA-LH25 ⑥ CA-LH35 ⑦ CA-LH50 ⑧ CA-LH75

► Note

The standard CV-L lens cannot be used with XG-H500C/H500M high-speed 5 megapixel cameras due to vignetting.

Using a low distortion lens (CA-LHR*): 2432 x 2050 pixels

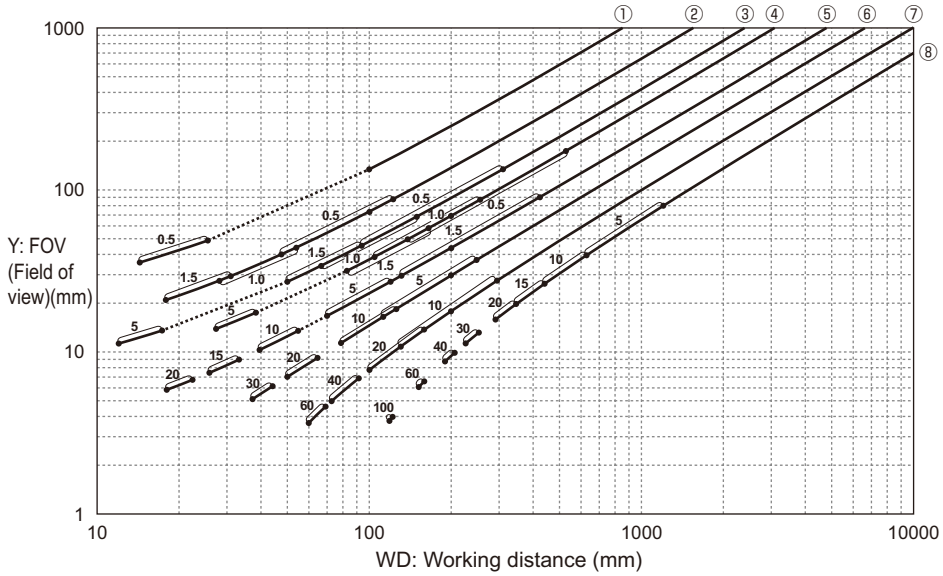


① CA-LHR5 ② CA-LHR8 ③ CA-LHR12 ④ CA-LHR16 ⑤ CA-LHR25 ⑥ CA-LHR35 ⑦ CA-LHR50

Using a 2 Megapixel Camera (XG-200C/XG-200M) or a High-speed 2 Megapixel Camera (XG-H200C/XG-H200M)

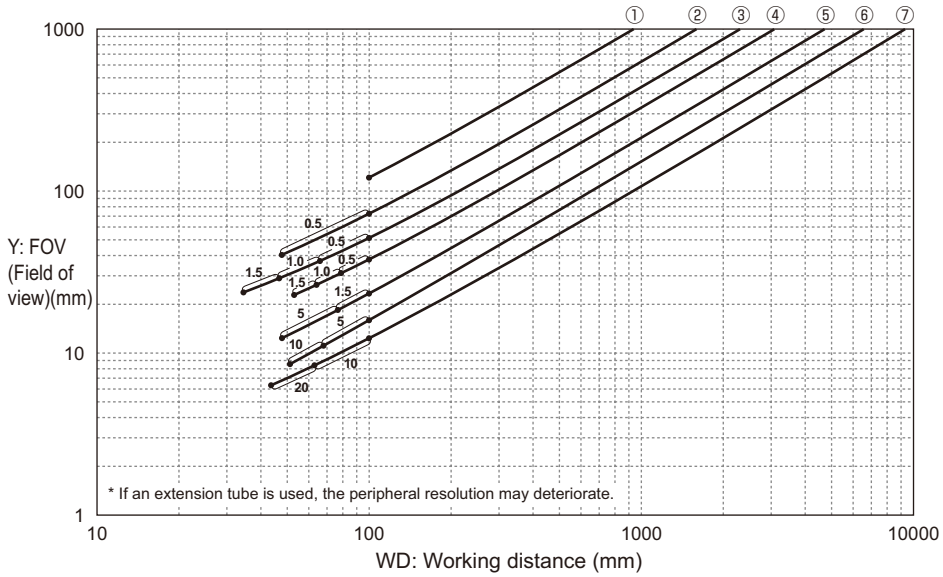
When using the CA-LH16 on the XG-200C in 2 megapixel mode with a required FOV of 40 mm, the chart shows that the working distance should be set to 100 mm and the 1.5 mm close-up ring should be used.

Using a low distortion lens (CA-LH*): 1600 x 1200 pixels (2 megapixel mode)



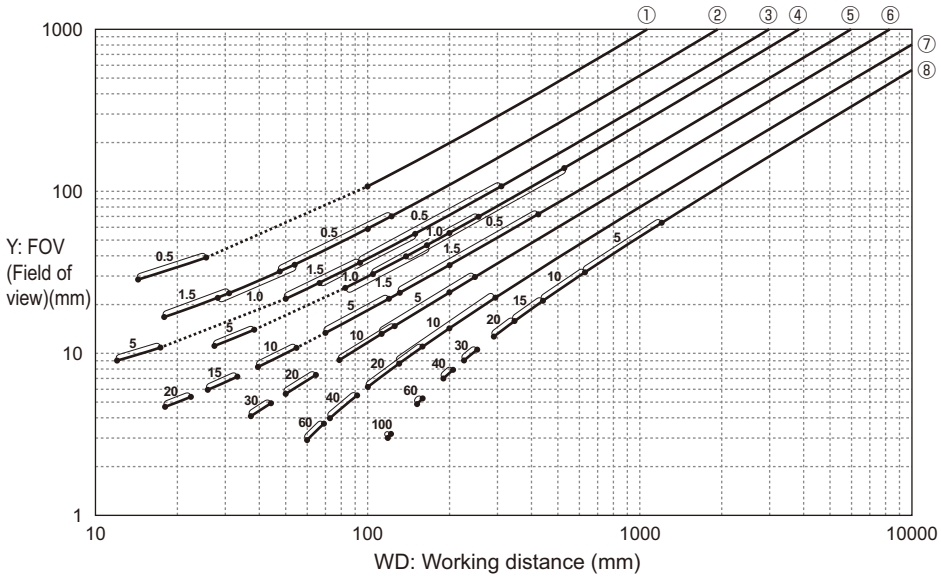
① CA-LH4 ② CA-LH8 ③ CA-LH12 ④ CA-LH16 ⑤ CA-LH25 ⑥ CA-LH35 ⑦ CA-LH50 ⑧ CA-LH75

Using a low distortion lens (CA-LH*): 1600 x 1200 pixels (2 megapixel mode)



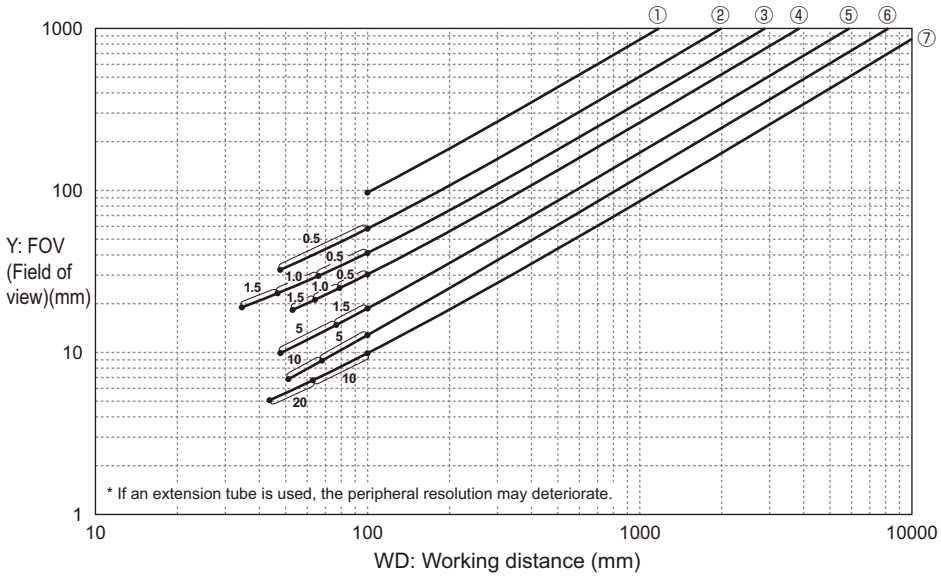
① CA-LHR5 ② CA-LHR8 ③ CA-LHR12 ④ CA-LHR16 ⑤ CA-LHR25 ⑥ CA-LHR35 ⑦ CA-LHR50

Using a low distortion lens (CA-LH*): 1024 x 960 pixels (1 megapixel mode)



① CA-LH4 ② CA-LH8 ③ CA-LH12 ④ CA-LH16 ⑤ CA-LH25 ⑥ CA-LH35 ⑦ CA-LH50 ⑧ CA-LH75

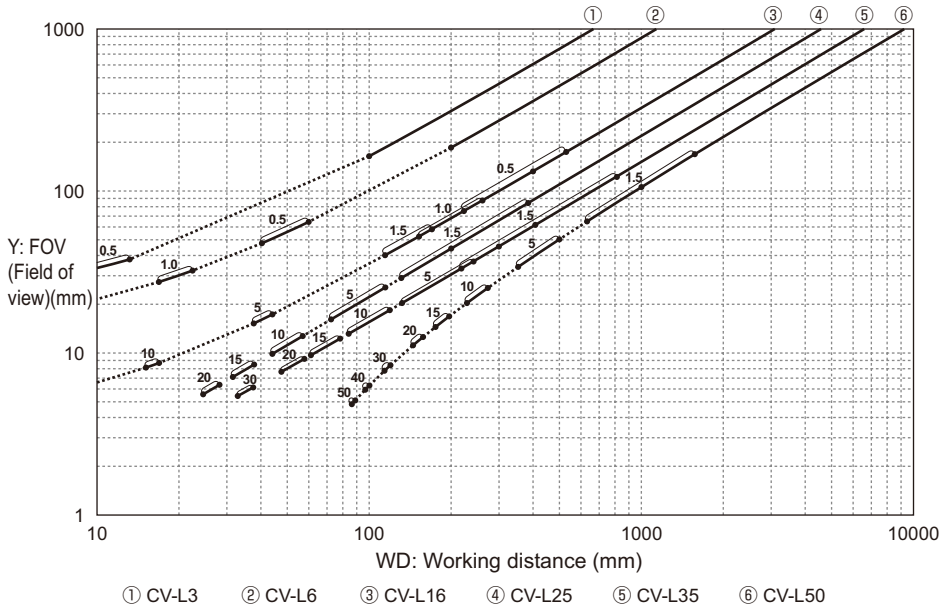
Using a low distortion lens (CA-LHR*): 1024 x 960 pixels (1 megapixel mode)



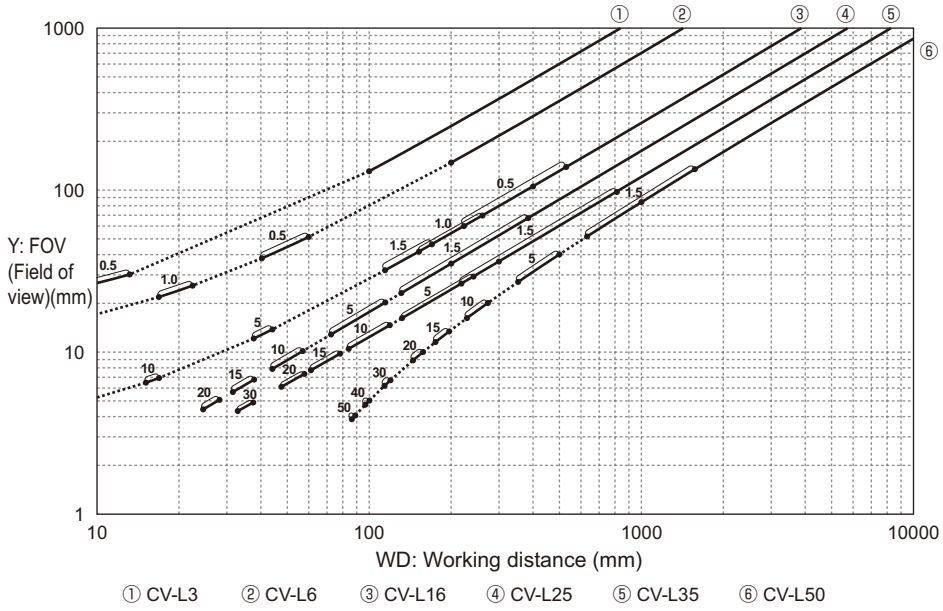
① CA-LHR5 ② CA-LHR8 ③ CA-LHR12 ④ CA-LHR16 ⑤ CA-LHR25 ⑥ CA-LHR35 ⑦ CA-LHR50

The following graph shows the performance when using a standard lens.

Using a standard lens (CV-L*): 1600 x 1200 pixels (2 megapixel mode)

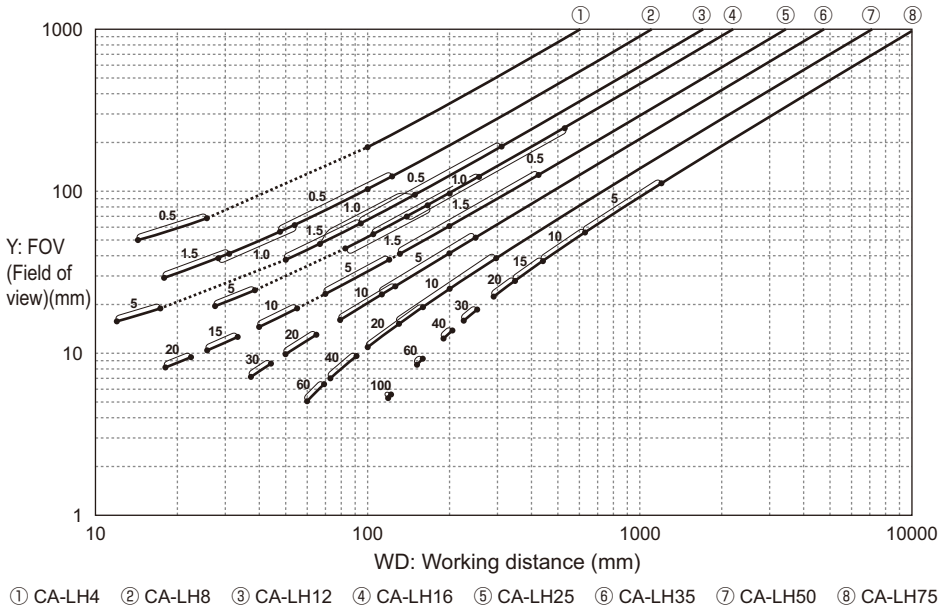


Using a standard lens (CV-L*): 1024 x 960 pixels (1 megapixel mode)



Using a High-Speed 1 Megapixel Camera (XG-H100C/XG-H100M)

Using a low distortion lens (CA-LH*): 1000 x 1000 pixels (1 megapixel mode)



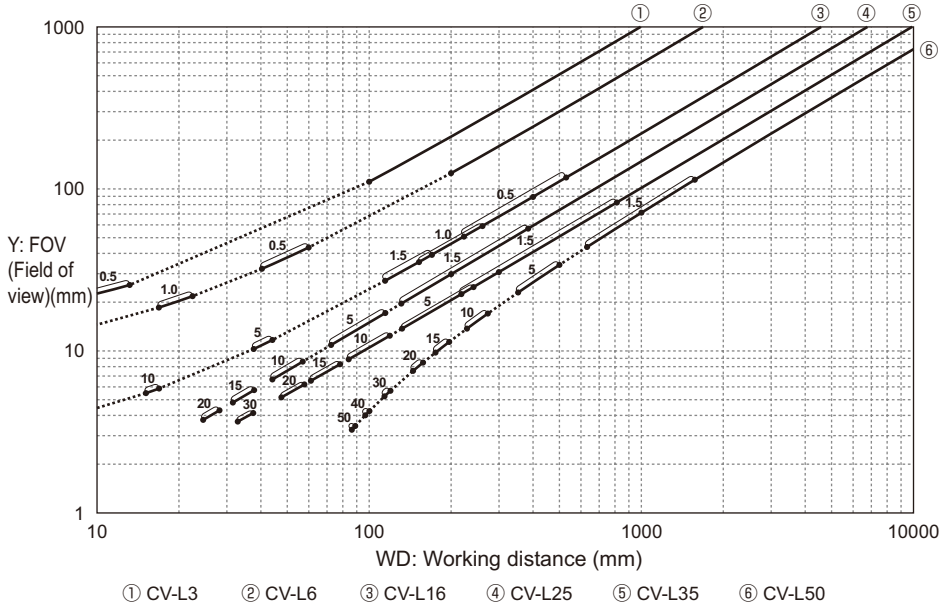
① CA-LH4 ② CA-LH8 ③ CA-LH12 ④ CA-LH16 ⑤ CA-LH25 ⑥ CA-LH35 ⑦ CA-LH50 ⑧ CA-LH75

► Note

The standard CV-L lens cannot be used with XG-H100C/XG-H100M high-speed 1 megapixel cameras due to vignetting.

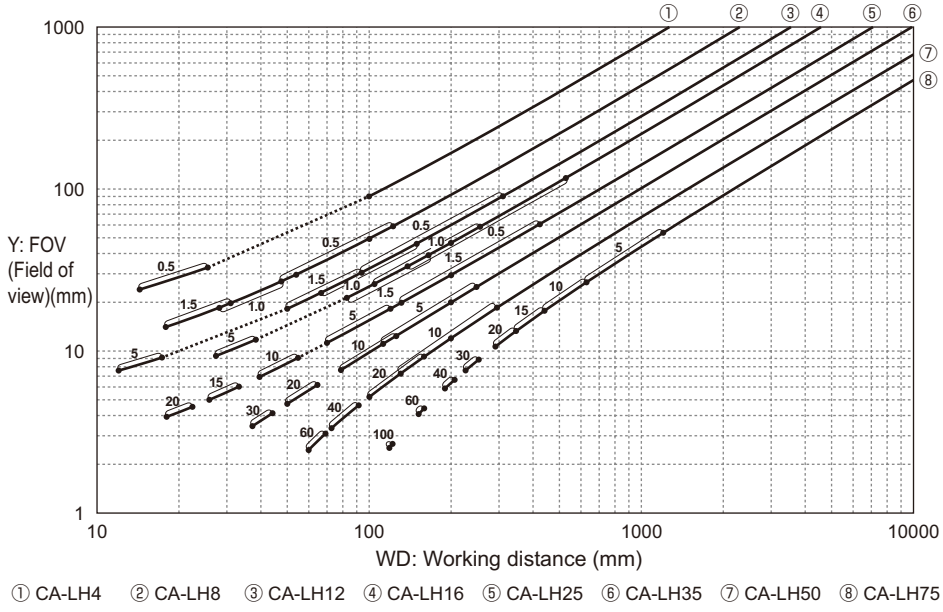
Using a Double Speed Camera (XG-035C/XG-035M) or a 7x-speed Camera (XG-H035C/XG-H035M)

Using the standard lens (CV-L*)



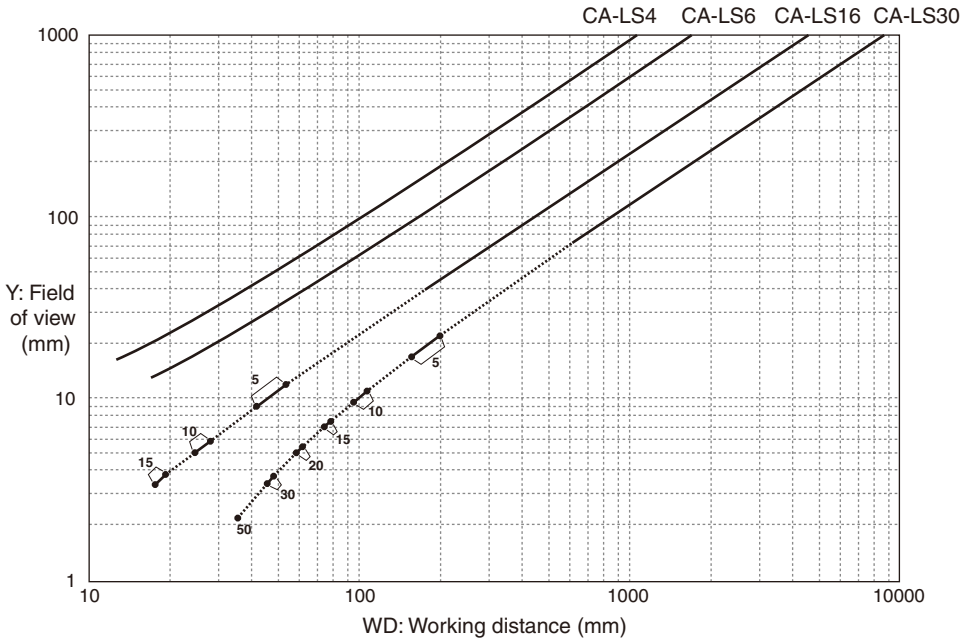
① CV-L3 ② CV-L6 ③ CV-L16 ④ CV-L25 ⑤ CV-L35 ⑥ CV-L50

Using a high accuracy, low distortion lens (CA-LH*)



① CA-LH4 ② CA-LH8 ③ CA-LH12 ④ CA-LH16 ⑤ CA-LH25 ⑥ CA-LH35 ⑦ CA-LH50 ⑧ CA-LH75

Using an Ultra Small Double Speed Camera (XG-S035C/XG-S035M)

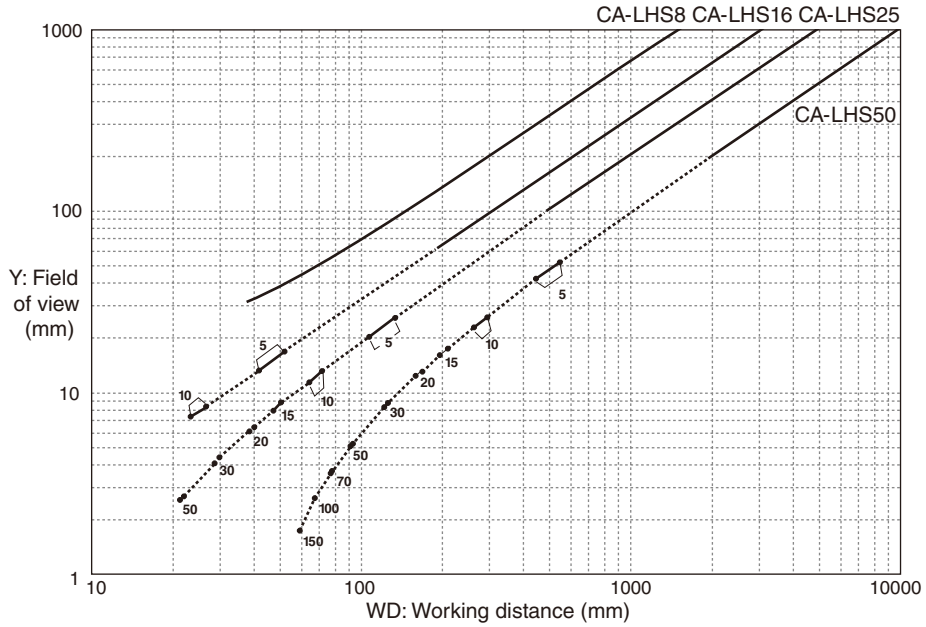


► Note

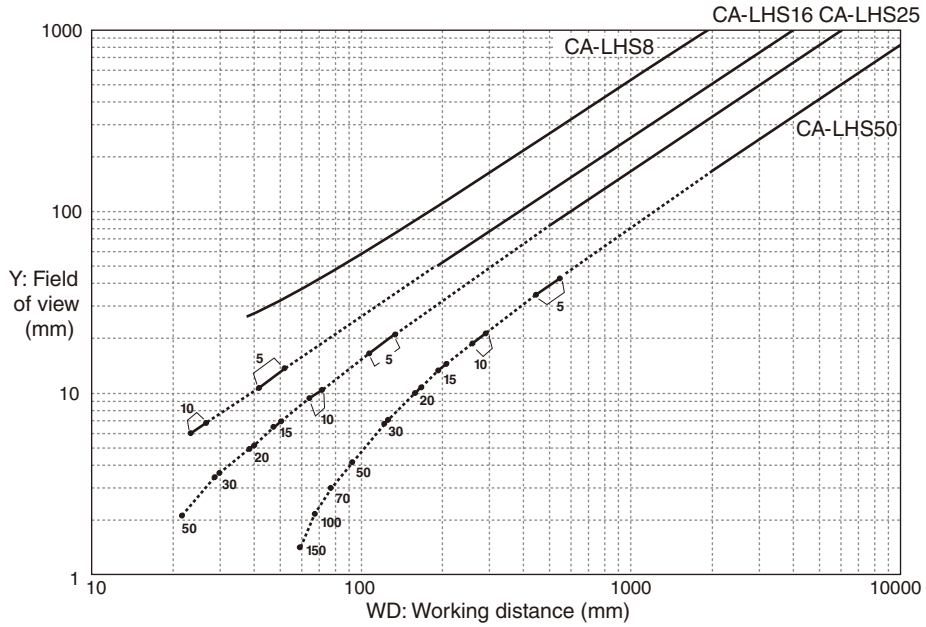
- The numerical numbers shown in the FOV chart are typical values. Adjust the settings as required when installing the camera.
- For more information on installing and adjusting ultra small cameras, refer to the instruction manual provided with the camera.
- When attaching the side view attachment OP-51503, subtract the internal optical length of 15.3 mm from the working distance.

Using an Ultra Small 2 Megapixel Camera (XG-S200C/XG-S200M)

Using 1600 x 1200 pixels (2 megapixel mode)



Using 1024 x 960 pixels (1 megapixel mode)



► Note

- The numerical numbers shown in the FOV chart are typical values. Adjust the settings as required when installing the camera.
- For more information on installing and adjusting ultra small cameras, refer to the instruction manual provided with the camera.
- When attaching the side view attachment OP-66833, subtract the internal optical length of 25.8 mm from the working distance.

Information on Optional Lenses

Contact your local Keyence office if you require lenses not shown here.

XG-200C/200M/H200C/H200M/035C/035M/H035C/H035M

Standard Lenses

Model	Focal Distance	Aperture	Filter attachment size
CV-L3	3.5 mm	F1.6	43.0 mm P0.75
CV-L6	6 mm	F1.4	30.5 mm P0.5
CV-L16	16 mm	F1.6	27.0 mm P0.5
CV-LC16	16 mm	F1.4	27.0 mm P0.5
CV-L25	25 mm	F1.6	27.0 mm P0.5
CV-L35	35 mm	F1.6	30.5 mm P0.5
CV-L50	50 mm	F1.8	30.5 mm P0.5

XG-H500C/H500M/200C/200M/H200C/H200M/H100C/H100M/035C/035M/ H035C/H035M

Low Distortion Lenses

Model	Focal Distance	Aperture	Filter attachment size
CA-LH4	4.4 mm	F1.6	43.0 mm P0.75
CA-LH8	8 mm	F1.4	27.0 mm P0.5
CA-LH12	12 mm	F1.4	27.0 mm P0.5
CA-LH16	16 mm	F1.4	25.5 mm P0.5
CA-LH25	25 mm	F1.4	27.0 mm P0.5
CA-LH35	35 mm	F2.0	27.0 mm P0.5
CA-LH50	50 mm	F2.8	27.0 mm P0.5
CA-LH75	75 mm	F2.5	34.0 mm P0.5

High-resolution, low distortion lenses

Model	Focal Distance	Aperture	Filter attachment size
CA-LHR5	5 mm	F1.8	46.0 mm P0.75
CA-LHR8	8.5 mm	F1.8	34.0 mm P0.5
CA-LHR12	12 mm	F1.8	25.5 mm P0.5
CA-LHR16	16 mm	F1.8	25.5 mm P0.5
CA-LHR25	25 mm	F1.8	25.5 mm P0.5
CA-LHR35	35 mm	F2.0	34.0 mm P0.5
CA-LHR50	50 mm	F2.8	30.5 mm P0.5

For XG-S035C/S035M

Standard Lenses

Model	Focal Distance	Aperture
CA-LS4	4 mm	F2.0
CA-LS6	6 mm	F2.0
CA-LS16	16 mm	F2.0
CA-LS30	30 mm	F3.4

For XG-S200C/S200M

Low Distortion Lenses

Model	Focal Distance	Aperture
CA-LHS8	8 mm	F2.0
CA-LHS16	16 mm	F2.0
CA-LHS25	25 mm	F2.0
CA-LHS50	50 mm	F3.8

Macro lenses (for all cameras, excluding the XG-S **** series)

Model	Shape	Optical magnification	WD (Standard magnification)
CA-LM0510	Straight	x0.5 to x1	111 mm (x0.5) - 78 mm (x1.0)
CA-LM1	Straight	x1	67.0 mm
CA-LM2	Straight	x2	66.9 mm
CA-LM4	Straight	x4	70.3 mm
CA-LM6	Straight	x6	64.4 mm
CA-LM8	Straight	x8	64.5 mm
CA-LMA1	Coaxial	x1	67.0 mm
CA-LMA2	Coaxial	x2	66.9 mm
CA-LMA4	Coaxial	x4	70.3 mm

► Note

The area around the captured image might darken if the processing area is positioned at the edge of the CCD while using the macro lens.

Reference

- Use the formula below when calculating the macro lens field of view.
  Field of view (mm) = CCD size (Y) / Optical magnification
  Example: When CA-LM2 is used with XG-035M, 3.6 (CCD size) / 2 (optical magnification) = 1.8 mm
- The size of the CCD in the Y direction for each type of camera is shown below. Note that the numbers in parentheses are the values used in 1 megapixel mode.

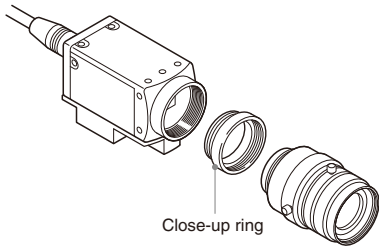
XG-H200C/XG-H200M/XG-200C/XG-200M	5.3 mm (4.2 mm)
XG-035C/XG-035M/XG-H035C/XG-H035M	3.6 mm
XG-H100C/XG-H100M	7.4 mm
XG-H500C/XG-H500M	7.1 mm

- The optical magnification is based on the optical design value. Individual variability will occur depending on installation.

Using the Close-up Rings

The close-up ring is installed between the camera and the lens.
Close-up rings are available in a set of five different sizes of 0.5 mm, 1.0 mm, 5 mm, 10 mm, and 22 mm (OP-51612).

- Use the 5 mm (OP-51500) or 10 mm (OP-51501) close-up ring when using the XG-S035C/S035M.
- Use the 5 mm (OP-66830) or 10 mm (OP-66831) close-up ring when using the XG-S200C/S200M.



If a single ring does not provide the required thickness, combine multiple rings.

► Note

If you use the 0.5 mm or 1.0 mm close-up rings with other close-up rings, the lens may become loose through vibrations due to insufficient tightening with the camera. Use of a locking bond adhesive is recommended in such a case.

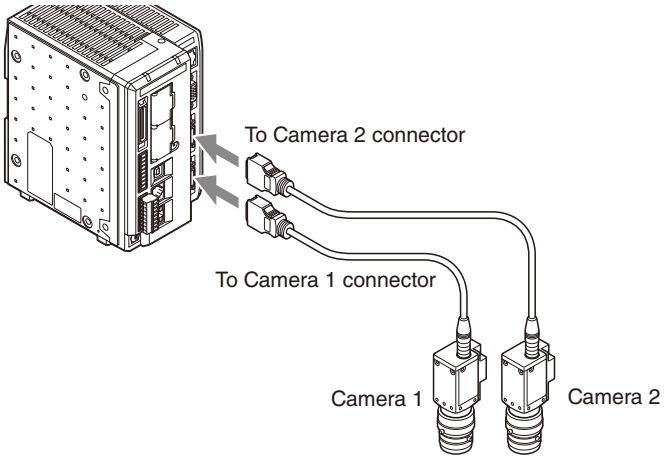
Connecting Cables

Notes when connecting cables

- Make sure that there is no power to the controller before connecting cables. Connecting cables while the power is turned on may cause damage to the camera or peripherals.
- Bundle cables with a spiral tubing like protective material. Direct bundling will concentrate the cable load on the bindings, which can result in cable damage or short circuit.
- In the absence of other specifications, the minimum cable flexibility (R) should be 3 times the external diameter (5 times is recommended). Additionally, repeated flexing and twisting should be avoided. The minimum bend radius is the same, even when using high-flex cable. Unless otherwise stated, use the R100 or greater.

1 Connect the camera to the camera connector of the controller using one of the optional camera cables.

If connecting only a single camera, attach it to the camera 1 connector.

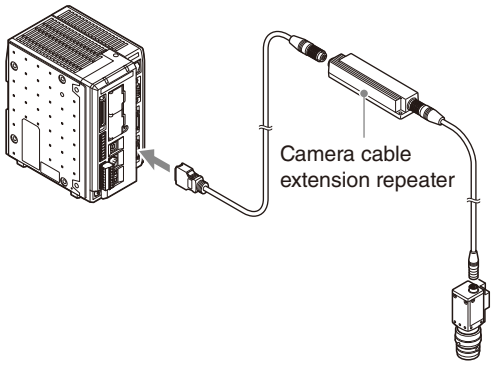


► Note

- Camera cables CA-CN17, CA-CN17L, and CA-CN17R can only be used to connect the XG-035C and XG-035M.
- With a XG-H**** high speed camera, only CA-CH* camera cables can be connected.
- Do not connect the CA-CH cable to other cameras. Doing so may result in malfunction. When using the analog camera-compatible controller XG-7002A, be sure to use an analog camera and camera cable that is supported by this controller.
- For more information on connecting cables to cameras, please refer to "Camera Cable (Digital Cameras)" (Page 9-27) and "Camera Cables (for High-speed Cameras XG-H****)" (Page 9-29).
- For more details on analog camera models that are supported by this controller, refer to "Main Specifications" (Page 9-2).

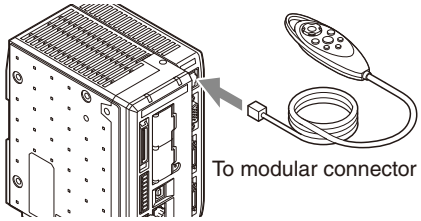
Using the camera cable extension repeater

Camera cables can be extended by using the camera cable extension repeater (Page 9-32).

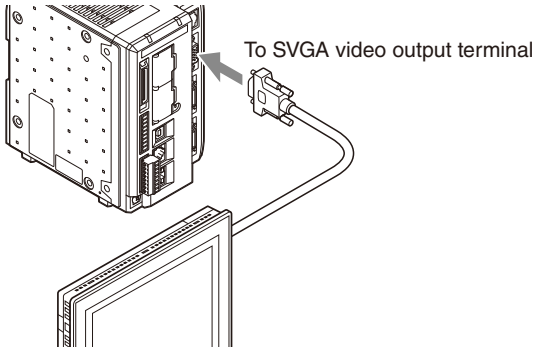


For more information on connection, read the instructions provided with the camera extension repeater.

2 Connect the optional handheld controller (OP-84231 or OP-84236) to the modular connector on the controller.



3 Connect the monitor to the video output terminal of the controller.



Reference

When inputting the touch panel signal output from the touch panel LCD monitor CA-MP120T, connect the touch panel modular RS-232 cable OP-87265 (3 m) or OP-87264 (10 m) to the controller RS-232C connector. To use the RS-232C connector of the controller for touch panel signal, it is necessary to change the port function on the controller. Refer to "RS-232 Network Settings" (Page 7-28) for more details.

► Note

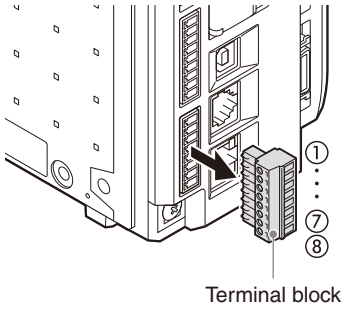
- When using a commercial RGB analog monitor that is not SVGA (800 x 600 pixels) or XGA (1024 x 768 pixels) in size, the displayed image quality may degrade and the screen may not appear correctly depending on the specifications of the monitor. (Recommended monitor: CA-MP81)
- When connecting the controller via Keyence touch panel VT3 and VT3-VD4, use the special RGB cable (3 m) OP-66842 or RGB cable (10 m) OP-87055. If a commercial RGB cable is used, the screen may not be displayed correctly.

4 Connect DC 24 V power to terminals No. 7 and 8 on the terminal block.

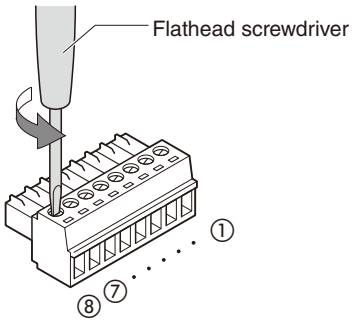
► Note

- Use a flat head screwdriver to connect the power supply to the input terminals.
- Use a torque of 0.25 Nm or less to tighten the screws.
- Use electrical wiring AWG14 to AWG22.
- Make sure to connect the frame ground terminal for the DC 24 V power source to a Class D ground.
- Do not supply power until the installation is completed.

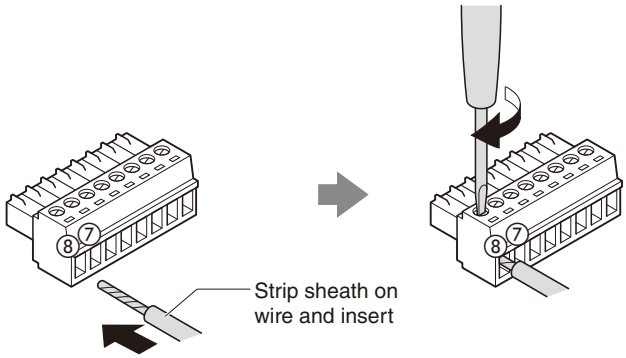
(1) Remove the terminal block from the controller.



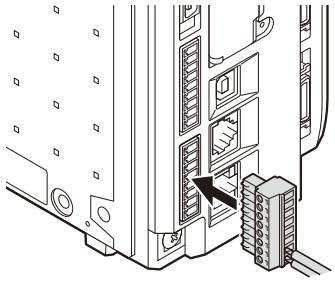
(2) Loosen the screws on the terminals with the flat head screwdriver.



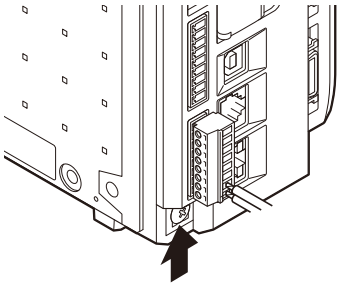
(3) After stripping the insulating sheath 7 mm, insert the wires to terminal No. 7 (24 V DC) and No. 8 (0 V), and then tighten the screws.



(4) After connecting all the necessary cables or wires, securely insert the I/O terminal block into the I/O connector as far as it will go.



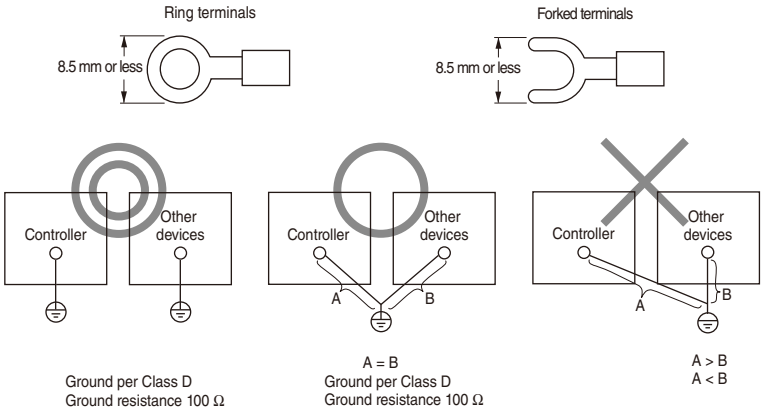
(5) Connect the ground wire to the grounding terminal.



Connect ground wire here.

► Note

- Ground each device separately.
- Use a Class D ground.
- Keep ground resistance under 100Ω.
- Keep the ground wire as short as possible.
- If it is not possible to ground each device separately, ground them together. However, make sure that the electrical cables are the same length.
- The solderless terminal sizes are noted below, use a size which fits M4 screws.
- Tighten the screws securely to a torque of 0.8 [Nm].



Selection and Installation of LED Lighting

Reference

Up to 8 LED lights can be controlled using the optional illumination expansion unit CA-DC21E. See "Using the Illumination Expansion Unit" (Page 2-28) for more details.

Selecting the Correct Lighting System

Use the correct lighting system to ensure stable inspection

Inspecting in one of the following locations may lead to unstable detection. Relocate the inspection or use a dedicated lighting system.

- Locations where the inspection is exposed to direct sunlight
- Locations where the outside light varies greatly depending on the time of day
- Locations where the amount of light changes due to the movement of machines and people

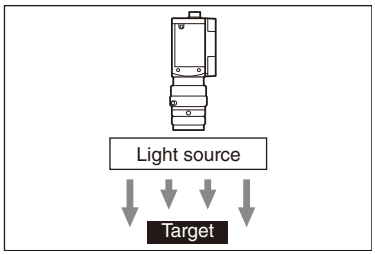
Ask your KEYENCE sales representative for details.

Reflected illumination

Illuminates broadly and evenly using a lighting system such as a ring light. This type of lighting is suitable for general surface inspection.

LED Illumination System

- Direct-ring lights (CA-DR)
- Multi-angle light (CA-DR*M/DQ*M)

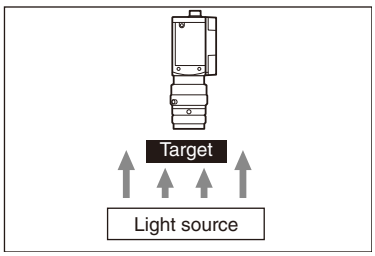


Backlight illumination

Illuminates from behind the target.
This type of lighting is suitable for measuring the shape, size, and position of a thin target.

LED Illumination System

Back lights (CA-DS)

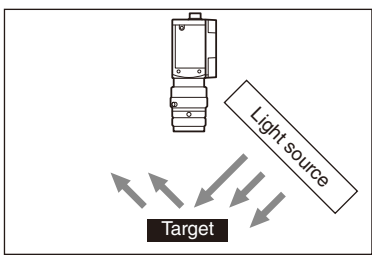


Indirect illumination

Illuminates the target from an angle.
This type of lighting is suitable for surface inspection when you want to reduce the effects of glare or specular reflection.

LED Illumination System

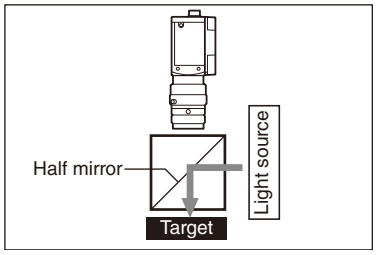
Bar lights (CA-DB/DZ)



Coaxial Illumination

Illuminates along the same axis as the lens.
This type of lighting makes flat glossy surfaces on the target appear brighter. This is suitable for surface inspection or position and size measurement of a flat surface.

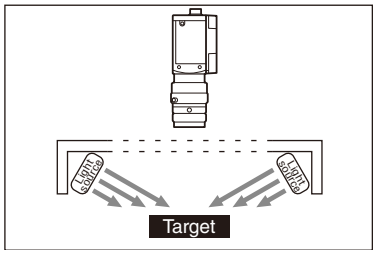
LED Illumination System
Coaxial lights (CA-DX)



Low-angle Illumination

Illuminates the target from a very low angle.
This type of lighting is suitable for detecting minute defects such as surface flaws (raised and reduced) and chipped edges.

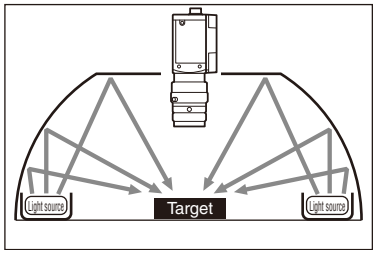
LED Illumination System
- Low-angle lights (CA-DL)
- Multi-angle light (CA-DRM/DQM)
- Square lights (CA-DQ)



Dome Illumination

Illuminates evenly around a target. Dome lighting is more effective when used as close as possible to the target.
This type of lighting reduces shadows and hot spots because it evenly distributes the light over the targets surface.

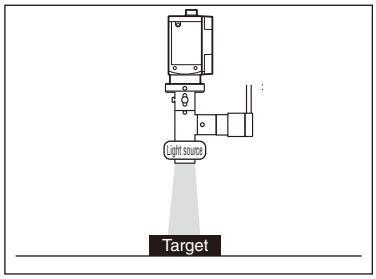
LED Illumination System
Dome lights (CA-DD)



Spot Illumination

Used with a coaxial macro lens.
This type of lighting provides high contrast, even illumination for images captured under high magnification.

LED Illumination System
Spot lights (CA-DP)



Using the Illumination Expansion Unit

Precautions and wiring when using the optional illumination expansion unit CA-DC21E are explained here.

Usage Precautions

► Note

- For more details on general precautions for the illumination expansion unit, see "Safety Information for XG-7000 Series" (Page 4).
- For more details on cautions and warnings in the installation and handling of the unit, see the operation manuals of the illumination expansion unit and LED light that are being used.

Power supply

⚠ **WARNING**

Do not use with any power voltage other than DC 24 V. Doing so may cause fire, electric shock, or damage to the unit.

► Note

- Always connect the frame ground terminal or ground terminal when a switching regulator is used.
- A separate, dedicated power supply is recommended.

Handling

⚠ **WARNING**

- Illumination units may reach very high temperatures while in operation. Avoid direct contact. Doing so may cause burns.
- Do not disassemble or modify the unit. Doing so may cause fire, electric shock, or damage to the unit.
- Do not stare into the LED light source for prolonged periods of time. This may cause damage to the eyes.
- The illumination units are classified as Class 1M or Class 2 LED Products (IEC60825-1). Read the "Precautions of Use" accompanied with the illumination units carefully before use.

Terminal Block Interface

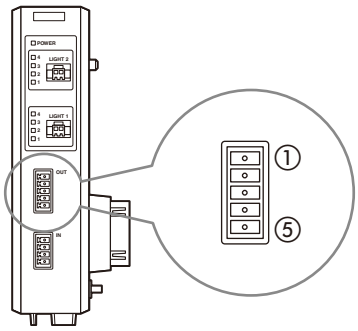
The following section details the terminal block specifications for the illumination expansion unit (CA-DC21E).

► Note

Tightening above the specified torque may cause damage to the terminal block

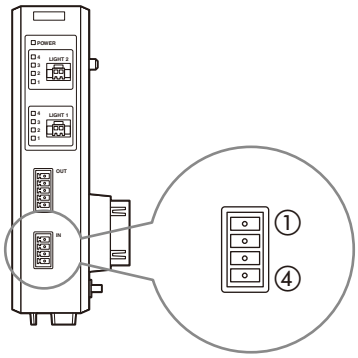
OUTPUT connector

- Terminal block: MC1.5/5-ST-3.5BK (Phoenix Contact)
- Compatible wires: AWG14 to 22
- Terminal block screw torque: 0.25 Nm or less



INPUT connector

- Terminal block: MC1.5/4-ST-3.5BK (Phoenix Contact)
- Compatible wires: AWG14 to 22
- Terminal block screw torque: 0.25 Nm or less



Connector Specifications

- OUT Connector Terminal Block

No.	Signal (terminal block display)	Signal Description	Function
1	LIGHT2+ (L2+)	+ ve terminal for Light 2	Connect the + ve side of light 2.
2	LIGHT2- (L2-)	- ve terminal for Light 2	Connect the - ve side of light 2.
3	NC (NC)	Not used	Not used
4	LIGHT1+ (L1+)	+ ve terminal for Light 1	Connect the + ve side of light 1.
5	LIGHT1- (L1-)	- ve terminal for Light 1	Connect the - ve side of light 1.

⚠ WARNING

- Connecting a 12 V DC illumination unit to an output terminal at 24 V DC may cause fire, electric shock, or damage to the controller and user operating the unit.
- Ensure that the DIP switch located on the right side of the CA-DC20E is configured correctly for the illumination being connected.

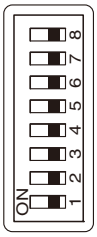
- IN Connector Terminal Block

No.	Signal (terminal block display)	Signal Description	Function
1	COMIN (COMIN)	Common for terminal block inputs	Dedicated common input for the IN connector terminal.
2	LIGHT_OFF (LOFF)	Forced light off input	Used to force the emission of LED illumination units to off.
3	24VDC (24V)	+ ve power supply input (24 V DC)	Supplies a 24 V power source for the illumination expansion unit.
4	0 V (0 V)	- power supply (0 V) input	Supplies a 0 V power source for the illumination expansion unit.

The power source 0V and COMIN1 are all isolated.

DIP Switch Settings

Output voltages for Light 1 and Light 2 can be changed individually by configuring the DIP switches as indicated below. The factory settings of the DIP switch positions are indicated by ■.



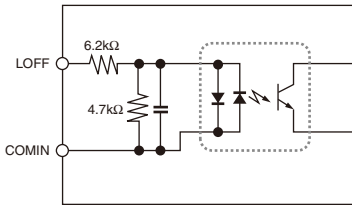
Bit								Output voltage
1	2	3	4	5	6	7	8	
OFF	OFF	OFF	OFF	—	—	—	—	Light 1: 12 V
ON	ON	ON	OFF	—	—	—	—	Light 1: 24 V
—	—	—	—	OFF	OFF	OFF	OFF	Light 2: 12 V
—	—	—	—	ON	ON	ON	OFF	Light 2: 24 V

⚠ WARNING

Setting the output voltage incorrectly may cause fire, electric shock, or product malfunction. Under normal conditions, use the factory setting of 12 V.

Input Circuit Diagram

- Max. applied voltage: 26.4 V
- ON voltage: 10.8 V or greater
- ON current: 2 mA or greater
- OFF voltage: 3 V or less
- OFF current: 0.3 mA or less



Connecting Cables

After mounting the illumination expansion unit to the controller (Page 2-6), use the following procedures to connect the cables and wiring.

1 Connect the LED light to the output connector of the illumination expansion unit.

⚠ WARNING

- Connecting a 12 V DC illumination unit to an output terminal at 24 V DC may cause fire, electric shock, or other damage to the controller and user operating the unit.
- Ensure that the DIP switch located on the right side of the CA-DC20E is configured correctly for the illumination being connected.

Reference

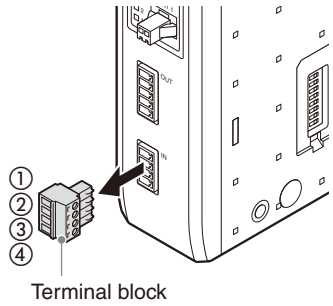
24 V lights, with different output connector configurations can be connected directly to the terminal block. See "Connector Specifications" (Page 2-29) for more details.

2 Supply a 24 V DC power source to terminal number 3 and 4 of the IN connector terminal block.

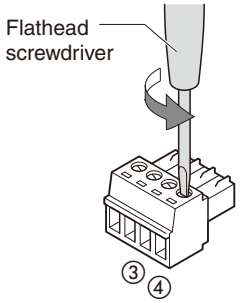
► Note

- Use a flat head screwdriver to connect the power supply to the input terminals.
- Use a torque of 0.25 Nm or less to tighten the screws.
- Use electrical wiring AWG14 to AWG22.
- Make sure to connect the frame ground terminal for the DC 24 V power source to a Class D ground.
- Do not supply power until the installation is completed.

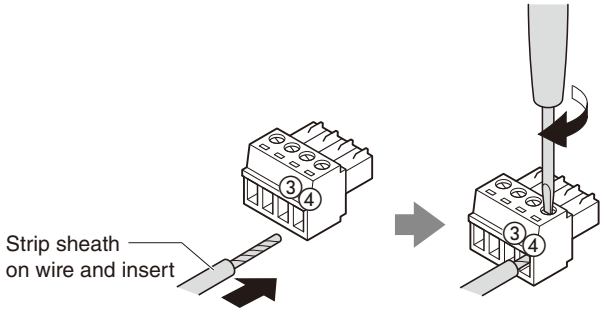
(1) Remove the IN connector terminal block from the illumination expansion unit.



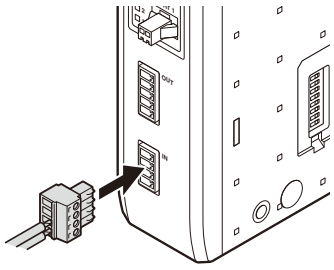
(2) Loosen the screw of the IN connector terminal block using a flat head screwdriver.



(3) After stripping the insulating sheath by about 7 mm, insert the wires to terminal No.3 (24 V DC) and No.4 (0 V), and then tighten the screws.



(4) After connecting all the necessary cables or wires, securely insert the IN connector terminal block into the I/O connector as far as it will go.



Adjustments

This section explains how to adjust the controller from its purchased condition to capture images properly.

► Note

The handheld controller (OP-84231 or OP-84236) is required to adjust the controller.

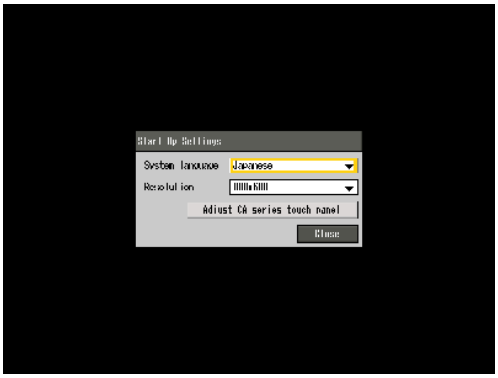
Reference

The software may not operate as described below if the inspection settings have already been uploaded.

Check that a Screen is Displayed on the Monitor

1 **Confirm that the cables are connected correctly, and then turn on the power.**

After the opening screen is displayed, the initial startup screen appears.



If nothing appears on the monitor

Check the following:

- Are the power input terminals connected correctly?
  - Is 24 V DC (2 A) being used for the power supply?
  - Have the power input terminals (+24 V) and (0 V) been connected in reverse polarity by mistake?
- Is the monitor cable connected correctly?
- Is the monitor turned on?
- Does the monitor support SVGA (800 x 600 pixel) resolution or XGA (1024 x 768 pixel) resolution, and 60 Hz vertical frequency?

2 **In the [System Language] box, select the language to use.**

- **Japanese**
- **English**
- **Traditional Chinese**
- **Simplified Chinese**

3 **In the [Resolution] box, select the resolution at the time the settings are created.**

When new settings are created with the controller, the resolution selected here will be applied to the created inspection settings.

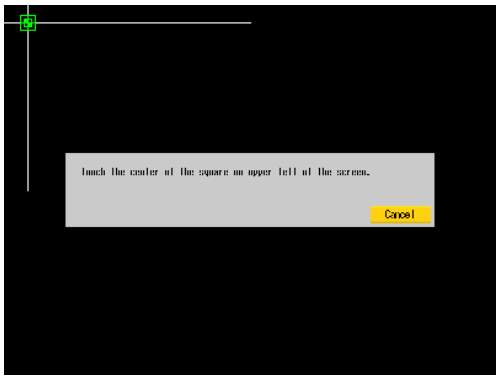
- **800 x 600:** SVGA
- **1024 x 768:** XGA

4 **If no touch panel is used, click [Close]. If a touch panel will be used, click [Adjust CA series touch panel].**

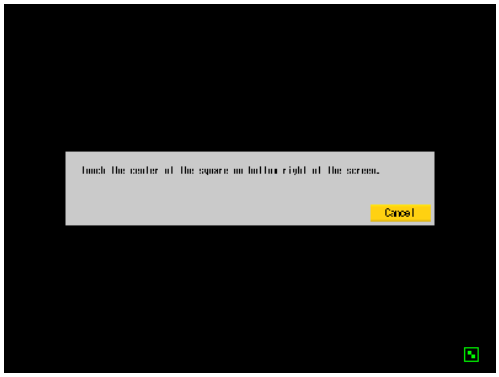
If no touch panel is used, proceed to Step 6.

5 Perform touch panel FOV (field of view) correction.

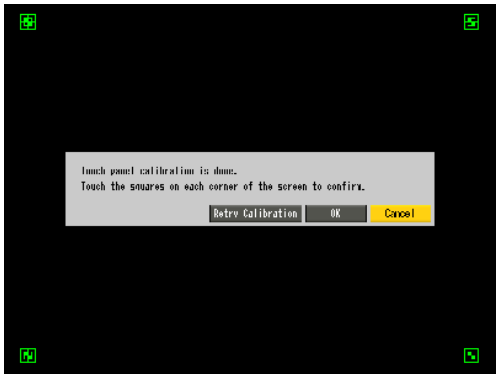
(1) Touch the at the top left of the screen.



(2) Touch the at the bottom right of the screen.



(3) Touch the at the four corners of the screen, and verify that the touched locations were each selected correctly.



If one was not selected correctly, the at the touched location turns red.

► Note

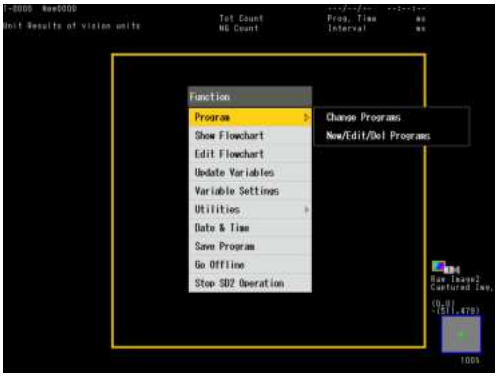
If FOV correction is not correct, or to perform correction again, click [Retry Calibration] and perform correction again.

(4) Click [OK].

(5) Click [Close].

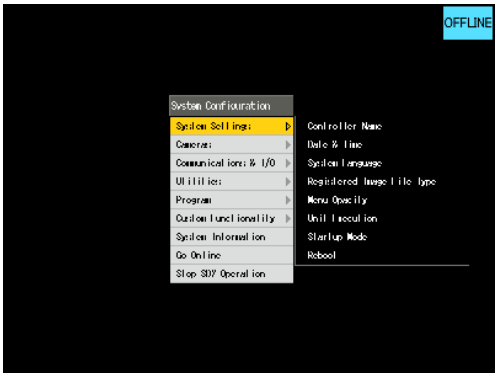
6 **Press the No.1 (FUNCTION) button on the handheld controller.**

The [Function] menu appears.



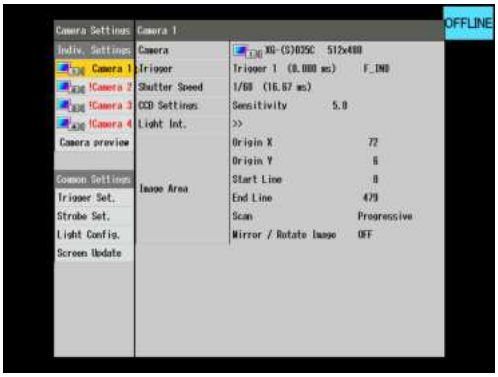
7 **Select [Go Offline].**

The [System Configuration] menu appears.



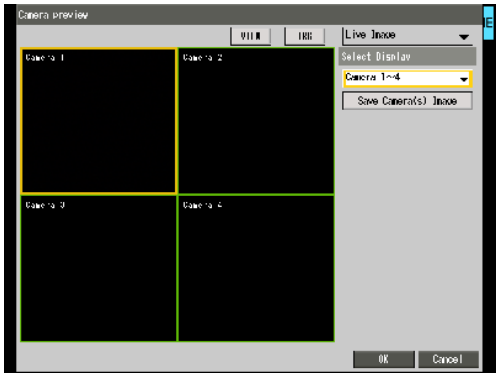
8 **From the System Configuration, select [Cameras] - [Camera Settings].**

The [Camera Settings] screen appears.



9 Select the [Camera preview] under Individual Settings and make sure the active screen from the camera connected to the controller appears.

The active screen displays the image from the connected cameras.



Reference

- You can display the feed on the entire screen by selecting the desired camera under [Select Display].
- When set for trigger, you can press and hold the No.3 button (TRIGGER) on the handheld controller to continuously refresh the data and image on the screen. Press the No.3 button (TRIGGER) once more and the screen refresh will stop.

If the active screen is not displayed

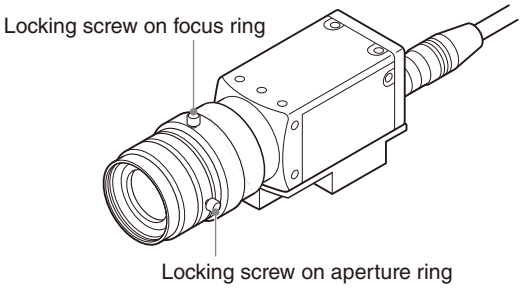
Check the following:

- Are the cameras connected correctly?
- Are the lens caps removed from the cameras?
- Is the aperture ring of the lens closed?

Adjusting the Aperture and Focus

XG-H500C/H500M/H200C/H200M/200C/200M/H100C/H100M/035C/035M/ H035C/H035M

While viewing the monitor, turn the aperture ring and the focus ring to adjust the aperture and focus.

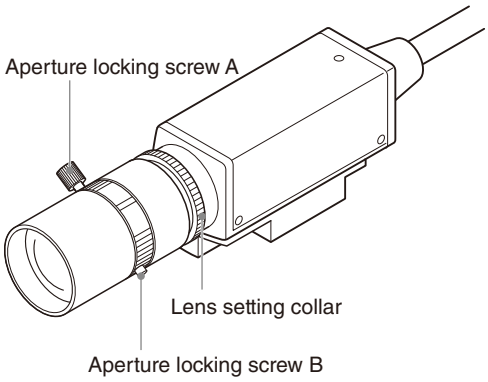


- Adjusting the aperture: Loosen the locking screw on the aperture ring to make the target and the surroundings brighter / darker.
- Adjusting the focus: Loosen the locking screw on the focus ring to sharpen the outline of the target image.

When the aperture and focus adjustments are complete, tighten the locking screws so that the aperture ring and the focus ring do not move.

For XG-S035C/S035M/S200C/S200M

While viewing the monitor, turn the aperture locking screws A and B and the lens setting collar to adjust the aperture and focus.



1 **Screw the lens setting collar on the thread completely.**
At the same time, install the lens as far on the thread as it will go.

2 **Adjust the distance between the camera and the target, then loosen the lens until the image is focused.**

3 **Fix the lens with the lens setting collar at the position where the image is in focus.**

4 **Loosen the aperture locking screws A and B to adjust for the best possible brightness of the image.**
The image becomes brighter when turned towards the OPEN side, and darker when turned towards the CLOSE side.

5 **After brightness is adjusted, fix the aperture with the aperture locking screws A and B.**

Loading and Removing an SD Card

Users can save the program settings or captured images on an SD card.

► Note

- The flash memory used as the storage element on the SD card has a read/write lifespan that, when reached, may result in an eventual loss of data. It is therefore strongly recommended that data stored on an SD card be backed up regularly to other media.
- SD Card 1 contains the global settings and other data necessary for the controller to operate. Make sure it is inserted at startup and when powering up.
- Data that must be loaded by swapping SD cards should be stored on SD card 2.

Supported SD Card Models

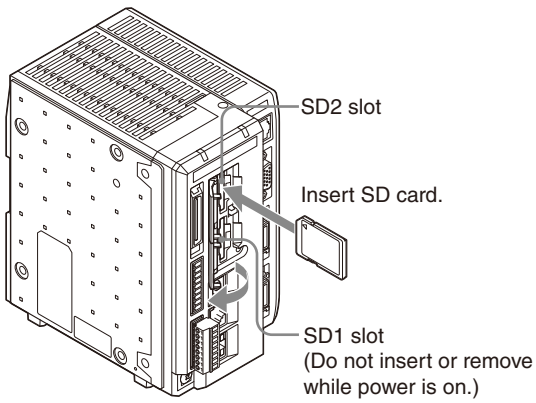
Use the optional Keyence OP-87133 (512 MB), optional CA-SD1G (1 GB), or optional CA-SD4G (4 GB). Note that the controller ships with OP-87133 (CA-SD1G for XG-7702) inserted in the SD1 slot.

► Note

- SDHC formats are supported on the controller.
- When loading data saved on the CA-SD4G into a PC, use a card reader that supports SDHC.
- SD cards other than the models mentioned above may not operate normally and are exempt from the warranty of this equipment.
- For details about file management on SD cards and card initialization (formatting), refer to the XG-7000 Series User's Manual.

Inserting an SD Card

Insert the SD card into the SD1 or SD2 slot so that the triangle inscription is on the top of the card.



► Note

- Be sure the card is oriented correctly when inserting it. Inserting the card in the wrong direction may damage the data and SD card.
- The access drive light illuminates while there is an SD card in the drive.
  - Green: An SD card is inserted and accessible.
  - Red: The SD card is being accessed.
  - Not lit: The SD card is not active. (The SD card can be removed from the slot.)
- When inserting the SD card into the SD1 slot, turn off the controller. Keep SD Card 1 inserted at startup and while the power is ON.

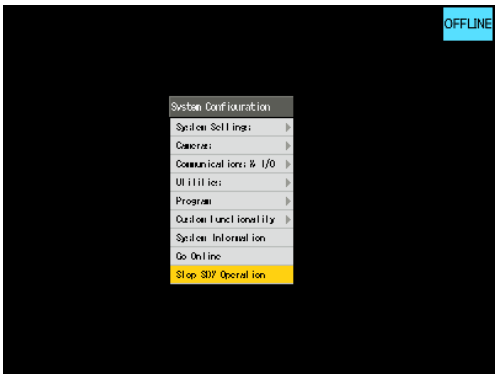
Removing an SD Card

Choose [Stop SD2] operation, then press the SD card in the SD2 slot inward to release and remove the card.

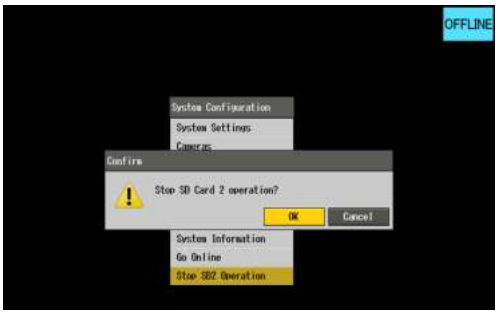
► Note

- Take the following steps to protect the SD card and the data it contains.
- If you remove the SD card using a procedure other than that specified, or if power is turned off when the card is being accessed, any writing task will stop resulting in a possible loss of data or damage to the SD card.
- SD Card 1 should not be removed while the controller is turned on. Turn off the controller before removing SD Card 1.

1 On the Function menu or System Configuration menu, select [Stop SD2 Operation].



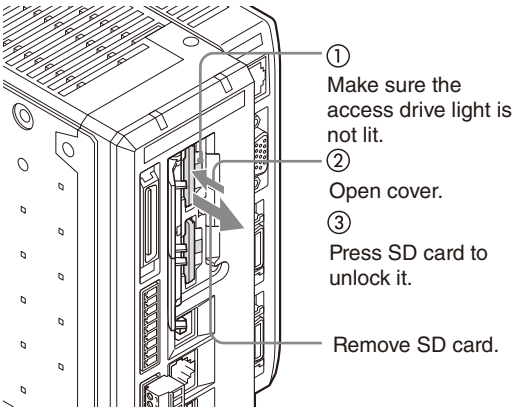
A confirmation screen appears.



2 Click [OK].

The LED indicator turns off, indicating that SD Card 2 can now be removed.

3 Remove the SD card from the SD2 slot on the controller.



► Note

The cover on the SD1 slot is screwed in place using (M2 L5) screws when the controller is shipped. This cover should be left on to prevent accidental removal while the controller is turned on.

Using Dedicated Software to Access the Controller

This section explains the information necessary to connect the controller to and use it with the dedicated PC software XG VisionEditor and XG VisionTerminal.

Reference

In addition to the dedicated software, these methods can also be used to connect and communicate with the controller: no-protocol mode using RS-232C (Page 8-2) or Ethernet (Page 8-4), PLC Link (Page 8-10), CC-Link (Page 8-19), EtherNet/IP, FTP client function (Page 4-359), and the VNC server function (page XX). For more details on how to setup these modes, see the XG VisionEditor Reference Manual.

Supported Software

The controller supports connection to XG dedicated software XG VisionEditor and XG VisionTerminal. Both applications are supplied with the optional V-Works for XG Ver. 4.1 (XG-H8N). See the separate manuals supplied with each application for details on their operation.

► Note

- The controller supports applications using the dedicated ActiveX control. Otherwise, Keyence does not support the use of third-party applications.
- Some communication features are not supported when using Ver. 1.0 software with Ver. 2.0 and later controllers. See "Upgrading V-Works for XG (XG-H7NE)" (Page 9) for more details on compatibility.
- For the XG-7000 Series settings, XG VisionEditor Ver.4.* of the same version as the controller firmware that is used is recommended. Although XG VisionEditor Ver. 5.0 and later versions for use with the XG-8000 Series can also be connected, there will be some limitations on the XG-7000 Series settings. For more details, refer to the XG VisionEditor Reference Manual.

Integrated Vision Editing Software "XG VisionEditor"

XG VisionEditor is programming software that provides access to all functions on the controller.
XG VisionEditor can be used to create all the program files that are used in the controller.



Main features of the XG VisionEditor

- Create image processing programs / flowcharts.
- Create display screens.
- Create custom dialog menus to change settings.
- Configure data logging for saving inspection result images and results history on the controller.
- Configure the statistics analysis.
- Use the remote capture feature to acquire image data necessary for programming.
- Provide various simulation environments to check the operation of the controller on the PC.

Remote Control Software "XG VisionTerminal"



XG VisionTerminal is operating software designed to acquire data from the controller, and operate it by remote control via communication.

Main features of the XG VisionTerminal

- Save measurement results and image data output from the controller to the PC.
- Allow remote operation of the controller (remote desktop) by means of the handheld controller view or mouse while viewing images acquired via communication on the display screen.
- Acquire files from the controller SD Card 1 and SD Card 2.

Reference

In addition to the above, XG VisionTerminal also supports binary data communication and command control communication using the dedicated ActiveX control.
Ask your local sales office for further information about the dedicated ActiveX control.

Preparing to Connect with the Controller

These two methods may be used to connect the dedicated XG software.

► Note

The RS-232C and CC-Link interfaces do not support connection using the dedicated XG software.

Ethernet Connection

Connecting

The following methods are supported.

- 1:1 connection using a cross cable (OP-66843 1Gbps cable is recommended).
- 1:n or n:1 connection via a hub and commercial straight cable (category 5e or higher).

See "Ethernet" (Page 8-4) for more details about the Ethernet interface.

Settings

- Configure the IP address, subnet mask, and default gateway on the controller (Page 7-25).
- See the dedicated XG software manual for instructions on connecting to the controller.

USB Connection

Connecting

The USB port supports a 1:1 connection using a USB 2.0 cable (OP-66844 is recommended).

► Note

1:n and n:1 connections are not supported.

See "USB Interface" (Page 8-8) for detailed specifications of the USB interface.

Settings

- There are no settings to make on the controller.
- When connecting to the controller via USB, the dedicated USB driver included with XG-H7NE must also be installed in addition to the dedicated software (Page 8-9).
- See the dedicated XG software manual for instructions on connecting to the controller.

Connecting to the Controller

The dedicated XG software can connect to the controller in any operating mode.

Reference

All connections are initiated by the dedicated XG software. See each software manual for details on connections.

	XG VisionEditor	XG VisionTerminal
Run mode	○	○
Offline mode	○	○
Remote capture mode	○	○
Retesting mode	○	○

► Note

- When the dedicated XG software is connected to the controller, display updates may slow down and inspections may stop executing. The connection may also be denied depending on the state the controller is in.
- Refer to each software manual for more details on controller behavior during connections.

Chapter 3

Run

Controller Operation Flow

This section explains the flow of operations required to execute measurement using the controller, and the basic common operations which are required to operate the controller.

- Controller Operation Flow (Page 3-1)
  - Operations Necessary for Measurement (Page 3-2)
  - Controller Operation Modes (Page 3-4)
- Interface (Page 3-5)
- Basic System Operation
  - Selecting Items (Page 3-7)
  - Entering Values (Page 3-7)
  - Entering Characters (Page 3-8)
- Changing the Screen Display (VIEW Toolbar)
  - Using the View toolbar (Page 3-10)
  - Zooming in/out of the displayed image (Page 3-10)
  - Scrolling the image (Page 3-11)
  - Change units / pages (Page 3-12)
  - Changing the displayed image type (Page 3-13)
  - Switching between displayed images (Page 3-13)
  - Switching between displayed images (Page 3-13)
  - Changing the Opacity of Menus (Page 3-14)
- Operating Using the Touch Panel
  - Basic Touch Panel Operations (Page 3-15)
  - Zooming in/out of the displayed image (Page 3-15)
  - Operating from the Touch Menu (Page 3-16)
- Inspection Region Menu (Page 3-20)
- Registering Images (Page 3-28)

► Note

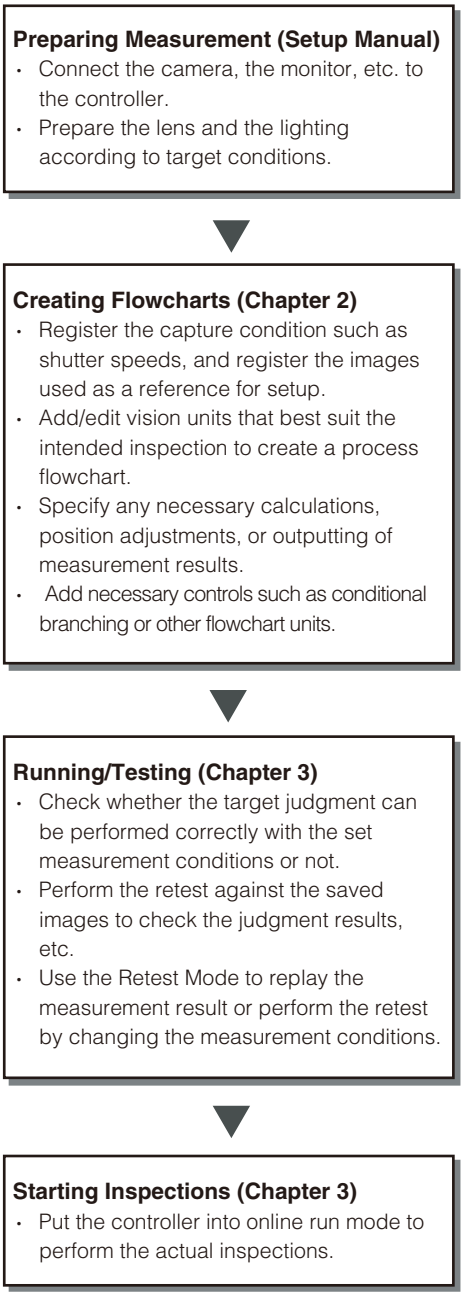
- The optional handheld controller (OP-84231 or OP-84236) is required to operate and edit directly on the controller.
- The functions available and operations possible vary depending on the version of the program and the system setting files.

Reference

- Some operations may be restricted depending on the user account settings (Page 5-43).
- If the default functions assigned to the handheld controller have been modified, some options may be disabled or perform differently from the explanations outlined in this manual. For more details on programmable function buttons, refer to "Controller System Settings" in the XG VisionEditor Reference Manual (Programming Edition) .

Operations Necessary for Measurement

The standard setting operations for inspection/ measurement using the controller is as shown in the diagram below.



Reference

- Reduce time when setting of image capture settings by changing the controller system settings (Chapter 5) and using the provided functions (Chapter 3) for operation as necessary.
- Also refer to the XG-7000 Series Setup Manual, XG VisionEditor Reference Manual (Programming Edition), and XG-7000 Series Communications Control Manual.

Direct light control using the CA-DC21E

When performing LED light illumination and intensity control via the integrated lighting controller, the following operations, in addition to the standard settings, are necessary.

1 **Attach the optional illumination expansion unit (CA-DC21E) to the controller.**

2 **Change the illumination expansion unit settings on the controller settings screen to control the lights.**

- When changing the illumination expansion unit settings, refer to "Lighting Configuration" (Page 7-19).
- When adjusting the light intensity, refer to "Light intensity" (Page 4-28).

Using the controller connected to a PC by RS-232C / Connecting to PLC via no protocol mode

In addition to the standard settings, the following operations are required.

1 **Set the desired RS-232C port settings and output data unit on the controller.**

2 **Connect the controller to the PC or PLC via the RS-232C port.**

3 **Execute communications.**
Communication takes place in no protocol mode. For more details, see the XG-7000 Series Communication Control Manual.

Control/output using PLC Link

When performing control/output using PLC-Link, the following setup, in addition to the standard settings, is required.

1 **Verify that the PLC to be used is supported by the controller.**

2 **Complete the necessary wiring.**

3 **Change the controller PLC-Link settings to perform control/output.**
For more details, see the XG-7000 Series Communication Control Manual.

Control/output using CC-Link

When performing control/output using CC-Link, the following setup, in addition to the standard settings, is required.

1 **Attach the optional CC-Link unit (CA-NCL10E) to the controller.**

2 **Complete the necessary wiring.**

3 **Change the controller CC-Link settings to perform control/output.**
For more details, see the XG-7000 Series Communication Control Manual.

Control/output using EtherNet/IP

When performing control/output using EtherNet/IP, the following sertup, in addition to the standard settings, is required.

1 **Connect the controller Ethernet port to the host network.**

2 **Change the controller EtherNet/IP settings to perform control/output.**
For more details, refer to the XG-7000 Series Communication Control Manual.

Using the controller connected to a PC by Ethernet (TCP/IP)

The following operations, in addition to the standard settings, are required.

1 **Change the controller Ethernet communications settings (Page 7-25).**

2 **Connect to the PC.**

3 **Execute communications.**
Communication takes place in no protocol mode (TCP/IP).
For more details, see the XG-7000 Series Communication Control Manual.

Using the controller connected to a PC by USB

The following operations, in addition to the standard settings, are required.

► Note

For more details about the OS that are supported, refer to the XG-7000 Series Communication Control Manual.

1 Change the controller USB communications settings.

2 Connect to the PC (with USB driver installed).

3 Execute communications.

Communication takes place in no protocol mode.
For more details, see the XG-7000 Series Communication Control Manual.

Control/output using I/O output (external terminals)

Perform control/output using the parallel I/O interface or terminal block interface. The following operations, in addition to the standard settings, are required.

1 Change the controller external terminal settings (Page 7-25).

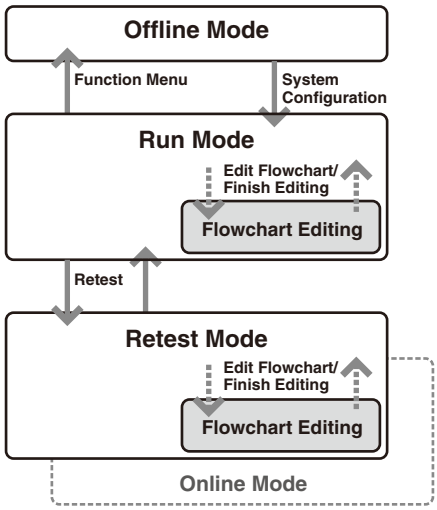
2 Connect to the external device.

3 Execute communications.

Communication takes place by energizing/monitoring the necessary inputs/outputs.
For more details, see the XG-7000 Series Communication Control Manual.

Controller Operation Modes

The controller operation modes consist of Run mode for performing/editing inspections, Retest mode for executing repeated measurement of archived images, Offline mode for stopping inspection and changing the controller system settings, and Remote Capture mode specifically for communication with XG VisionEditor/XG Simulator+ software.



Run mode (Page 5-2)
Run mode is typically used for changing programs (flowchart editing) and running vision-based inspections.

Retest mode (Page 5-26)
Retesting mode is used for changing measurement conditions and executing repeated measurement of previous measurement results (archived images). Tolerances and other measurement conditions can be changed and retesting is executed so that the measurement conditions can be correctly adjusted. It is also possible to execute retest mode while the controller remains online with the actual measurement being executed (Retest Mode: Online).

Offline mode (Page 7-1)
This mode is used to make changes to the system settings (RS-232C, TCP/IP, Date & Time etc.) Actual inspection is stopped while in offline mode.

Remote capture mode
This mode is only used via the XG Vision Editor/Simulator+ software. For more details on the Remote capture mode, refer to the XG VisionEditor Reference Manual.

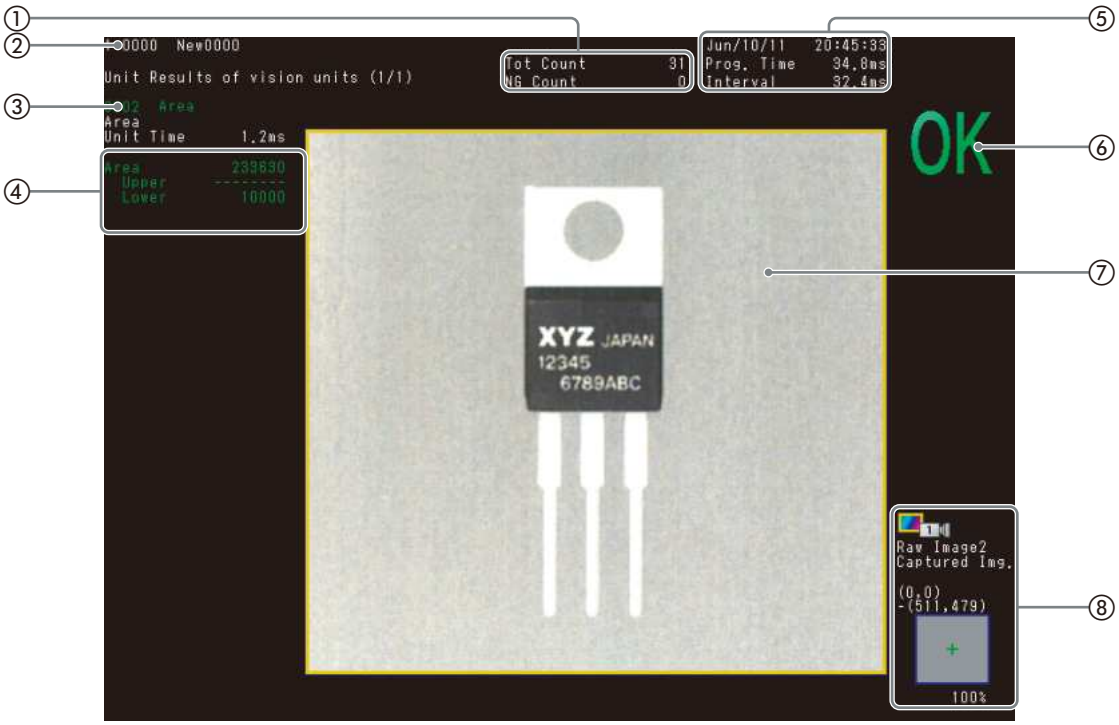
Interface

Standard Run Mode Screen

Following is an example of a standard Run mode screen.

Reference

Depending on the settings of the Screen Editor (Page 6-1) and the user account (Page 5-43) which is logged in, some functions may not be displayed.



(1) Total count / NG count display

This displays the total measurement count in Run mode, and the number of total status NG judgments. The measurement and judgment results are not applied in Settings mode. The maximum total count is 1,000,000,000. Subsequently the count returns to 1.

(2) Program No. display

This displays the program number which is currently being processed.

(3) Unit

This displays the ID and name of the unit which is currently displayed.

(4) Inspection result display

This displays the measurement results and judgments of the unit which is currently displayed.

(5) Date/time, program time, trigger interval display

- **Date/time**: Displays the capture start time for the capture unit which was executed first in the flowchart that was most recently executed.
- **Program time**: Displays the program processing time (time from trigger input until image processing is completed) of the currently running program that was most recently executed.
- **Trigger interval**: Displays the calculation of the shortest possible trigger interval that can be input according to the result of the most recent execution of the current program. (This is valid only when [Trigger] is selected for [Run screen update mode].)

► Note

- Because some processes are not applied in Edit mode, it is necessary to switch to Run mode in order to obtain a reliable program time and trigger interval.
- The displayed value is a reference value calculated by assuming normal settings and operating status. The value may vary depending on the inspection settings and operating status.

(6) Judgment result display

Displays the total status judgment result of the current program.

(7) Camera image

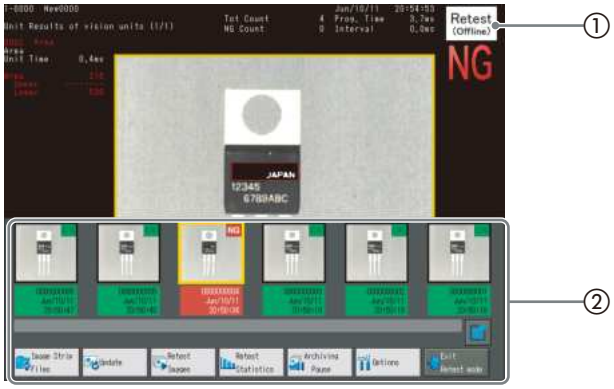
Displays the image which was input from the camera.

(8) Information

Displays information such as the camera which is connected to the controller, the display type, the displayed image, and the displayed position.

Retest Mode Screen

Following is an example of a screen showing the image strip display in Retest (Page 5-26) mode.



(1) Operation mode

Displays "Retesting Retest".

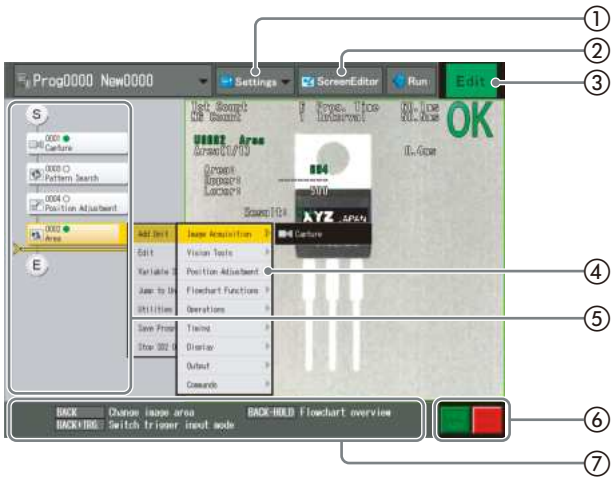
If [System Processing] is set to ON, "Retest (Online)" is displayed.

(2) Image Strip

Functions related to retest mode can be used from this toolbar. Refer to "Using Inspection Results for Retesting (Retest Mode)" (Page 5-26) for more details.

Flowchart Editing Screen

Following is an example of a screen during flowchart editing (Page 4-1).



(1) Settings

Allows variable settings, scaling, camera selection, image capture/archive buffers and other settings to be changed. Refer to "Program Settings" (Page 4-347) for more details.

(2) Screen Editor

Allows the display templates to be edited. For more details, refer to Chapter 6 Creating Controller Display Screens (Screen Editor) (Page 6-1).

(3) Operation mode display

[Edit] is display while editing the flowchart. If Retest Mode is activated, [Retest (Offine/Online)] will be displayed.

(4) Function Menu

The menu options available depend on the current screen or the item selected. Refer to "Function menu items displayed during flowchart editing" (Page 4-3) for more details.

(5) Flowchart

When [Edit Flowchart] is selected from the function menu (Page 4-3), the current flowchart is displayed and can be edited. Refer to "What is a "Flowchart"" (Page 4-1) for more details.

(6) Trigger/output status display

Displays the trigger and output status (ON/OFF) while in Edit mode. Refer to "Disable Functionality" (Page 4-347) for more details.

Reference

If the controller is in Retest Mode (Online)

(7) Help Bar

Displays a guide for handheld controller operations.

Basic System Operation

It is possible to select the displayed items on the controller screen and enter the necessary setting values for the primary controller operations.

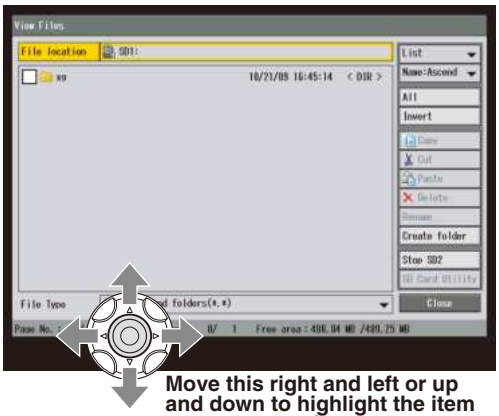
Selecting Items

The following section describes how to select, enter settings and interface with options using the handheld controller.

Reference

This manual describes the process of selecting and confirming items as "Select, Choose or Click (item name)".

1 **Move the 8-way key on the handheld controller right and left or up and down to highlight the item.**



2 **Press the No.0 (ENTER) button.**

This selects the item highlighted from Step 1.



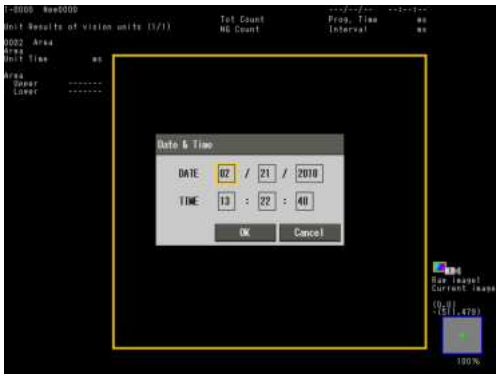
To cancel the operation

Press the No.2 (ESCAPE) button on the handheld controller to cancel the previously selected option.

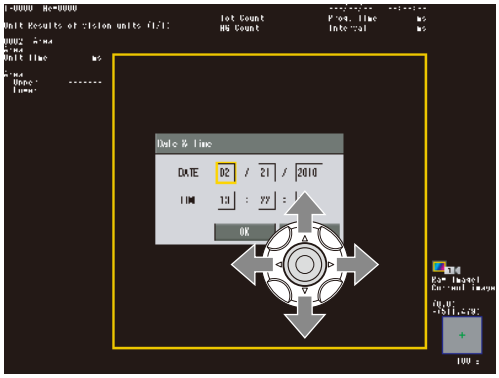
Entering Values

To enter values and other settings use the procedure described below.

1 **Highlight and select the item using the No.0 (ENTER) button.**



2 **Move the 8-way key up and down to specify the value.**



Reference

The digit (highlighted) to be modified can also be changed by moving the 8-way key left or right.

3 **After specifying the value, press the No.0 (ENTER) button.**

This confirms and enters the specified value.

To cancel the change

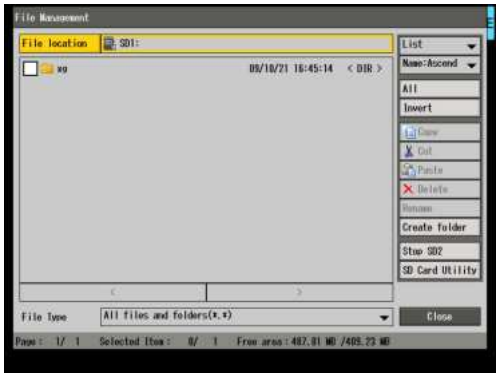
Press the No.2 (ESCAPE) button before pressing the No.0 (ENTER) button in Step 3.

Entering Characters

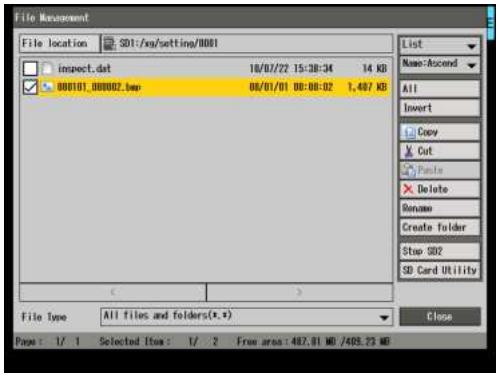
To input text for file names and other settings use the procedure described below. As an example, this procedure explains how to change the file name in the File Management screen (Page 5-35).

1 From the Function menu (Page 5-4) or System Configuration menu (Page 7-1) select [Utility] - [File Management].

The [File Management] menu appears.

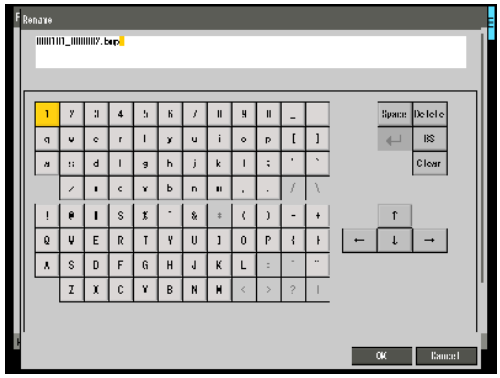


2 Highlight the file to rename and place a check in the check box.



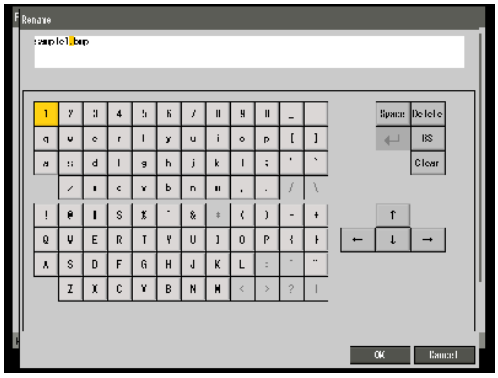
3 Click [Rename].

The [Rename] menu appears.



In this example, Sample1.bmp is the new filename.

4 Input "Sample1.bmp" one character at a time.



To input characters

Move the cursor over the character to input and press the No.0 (ENTER) button.

Reference

Because the kanji are displayed in order of the JIS First Level Character Codes, some kanji are displayed with their kun (Japanese) reading.

Entering symbols

Select the symbol from the list displayed with the alphanumeric characters.

Inputting a space

Select [Space] on the right hand side of the character input screen.

Selecting and deleting characters

Use the [↑], [↓], [←], [→] buttons on the right hand side of the character input screen to select characters. Choosing [Delete] deletes the selected character or [BS] deletes the character before the selected one.

Deleting all characters

Select [Clear] on the right hand side of the character input screen.

Reference

To move the cursor within the text, press and hold the No.1 (FUNCTION) button while moving the 8-way key. (The No.7 button can also be used in place of the No.1 button.)

- To move the cursor left and right within the text, hold the No.1 (FUNCTION) button while moving the 8-way key left and right.
- To move the cursor to the beginning of the text, hold the No.1 (FUNCTION) button while moving the 8-way key up.
- To move the cursor to the end of the text, hold the No.1 (FUNCTION) button while moving the 8-way key down.

5 **After entering the text, select [OK].**

The file selected in step 3 has been renamed to "Sample1.bmp".

► Note

It is not possible to enter Chinese from the controller software keyboard even if Chinese (Simplified or Traditional) is selected for [Language] (Page 7-4) in the system settings.

Changing the Screen Display (View Toolbar)

The View toolbar allows the displayed screen to be changed as described below.

- Zooming in/out of the displayed image (Page 3-10)
- Scrolling the image (Page 3-11)
- Changing units / pages (Page 3-12)
- Changing the displayed image type (Page 3-13)
- Switching between displayed images (Page 3-13)
- Changing screens (Page 3-13)
- Changing the transparency of menus (Page 3-14)

► Note

Some features on the View toolbar may be unavailable or different from explanations in this manual, depending on program file settings and the controller state. For more details, refer to "Controller Global Settings" and "Screen Editor" in the XG VisionEditor Reference Manual (Programming Edition).

Reference

- Using the View toolbar during operation does not affect the inspection being performed.
- On the Options menu (Page 6-7) of the Screen Editor, it is possible to set whether or not the results of changes to the display template screen made using the View toolbar will be stored as settings (Page 5-46) and used again the next time the power is turned on.

Using the View toolbar

1 Press the No.5 (VIEW) button on the handheld controller.

The View toolbar appears on the screen.

2 Select the desired item and change the display options.

Reference

If multiple screens are and image displays are available the focus can be chosen (Page 3-13) before changes are made.

3 To close the View Toolbar press the No.5 (VIEW) button on the handheld controller.

The View toolbar closes.

Reference

The View toolbar can also be closed by pressing the No.2 (ESCAPE) button.

Zooming In/Out on the Displayed Image

The image displayed can be enlarged or shrunk as desired.

The zoom ratio can be set from x $^{1}/_{100}$ (1%) to x25 (2500%).

If using multiple image displays each display has its own zoom settings.

Zooming can be especially useful when drawing regions around small targets or locating defects for parameter setting.

Reference

- The View toolbar can be used to zoom in or out while running inspections.
- The program can be configured to hold the zoom at a fixed ratio, and provide auto tracking to the center of a detected point or region. For more details, refer to "Screen Editor" in the XG VisionEditor Reference Manual (Programming Edition).

1 Select (zoom in/out) on the View toolbar.

appears on the screen.

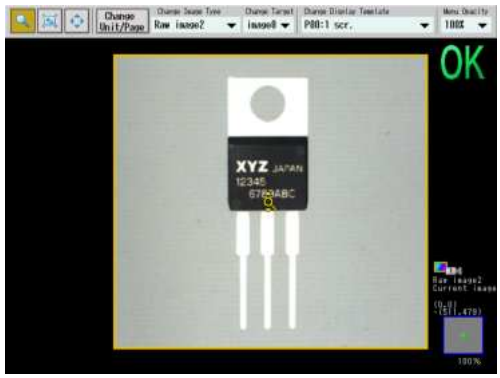
Reference

If multiple image displays are available, select the display to use after selecting zoom.

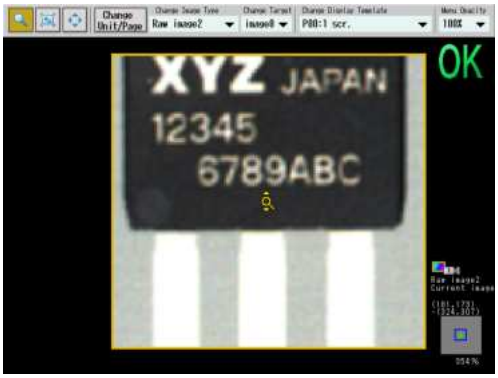
2 Place the over the center of the area to zoom in on.

3 Press the No.0 (ENTER) button.

When the symbol changes to , then it is possible to zoom in or out on the displayed image.



4 **Move the 8-way key up and down to zoom in or out on the image.**
Moving the 8-way key up zooms in, while moving down zooms out.



5 **Press the No.2 [ESCAPE] button on the handheld controller to keep the current zoom settings.**

6 **Press the No.2 [ESCAPE] button once more to exit the zoom function.**

► Note
Other settings cannot be made while the symbol is displayed. Use the No.2 [ESCAPE] button to exit the zoom function and or close the View toolbar.

To return to normal display (100% magnification)
Click (Fit) on the View toolbar .

To close the VIEW toolbar
Press the No.5 (VIEW) button on the handheld controller.

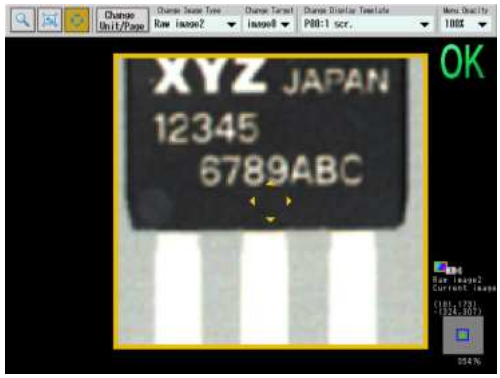
Scrolling the Image

If using a high resolution camera or displaying a magnified image, the entire image cannot be displayed on the screen. To see areas of the image currently not displayed scroll the image using the procedure below.

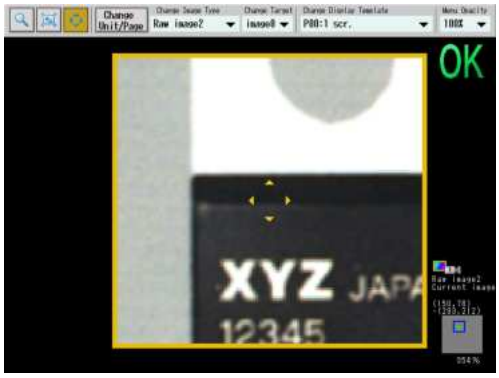
Reference
Using the View toolbar during operation does not affect the inspection being performed.

1 **Select (Scroll) on the View toolbar.**
When the symbol appears on screen, the displayed image can be scrolled.

Reference
If multiple screens are and image displays are available the focus can be chosen (Page 3-13) before changes are made.



2 **Move the 8-way key up, down, left and or right to scroll around the image.**



3 **Press the No.2 (ESCAPE) button on the handheld controller to stop scrolling.**

► Note
Other settings cannot be made while the symbol is displayed. Use the No.2 (ESCAPE) button to exit the scrolling function and or close the View toolbar.

To return to normal display (100% magnification)
Click (Fit) on the View toolbar .

To close the VIEW toolbar
Press the No.5 (VIEW) button on the handheld controller.

Change Units/Pages

This function changes the displayed unit and results page on the screen. This is useful if the results displayed need to be changed yet the handheld controller is being used to interact with an on-screen menu.

1 Click [Change Unit/Page] on the View toolbar.

2 Use the 8-way key to switch the unit or page to display.

- Up/down: changes the displayed unit results.
- Left/right: changes the page results on the screen.

Reference

If multiple screens are and image displays are available the focus can be chosen (Page 3-13) before changes are made.

3 Use the No.2 (ESCAPE) button on the handheld controller to exit the function.

Reference

If no menus are open units and pages can be toggled through using the 8-way key on the handheld controller without displaying the View toolbar.

Changing the Displayed Image Type

This function can be used to change the type of image displayed on the screen.

Select the image type from the drop down menu [Change Image Type].

- **Raw image 1:** Displays the raw image as it is without any regions or processing.
- **Raw image 2:** Displays the raw image as it is with the inspection region shown.
- **Grayed image:** Displays the image showing the effects of color extraction in the inspection region for the selected unit.
- **Filtered image:** displays the image showing the effects of processing in the region (or full image based on settings) for the unit.
- **Filtered image 2** (only available when showing or editing the flowchart)**:** Displays the image showing the effects of processing in the region (or full image based on settings) for the unit along with displaying other regions using the same image variable.
- **Contrast image:** Displays a color representation of the distribution of the defect level for defect detection or contast level for grayscale blob. If the currently selected unit is not defect or grayscale blob, the type displayed is [Filtered image].

The screen display changes to the selected display type.

Reference

- If multiple screens and image displays are available, the focus can be chosen (Page 3-13) before changes are made.
- The image type can also be changed by pressing the No.4 (SCREEN) button on the handheld controller.

Switching between Displayed Images

When multiple images are available, this function specifies the target for the View toolbar operations, if the target is set to a display showing an image from the image archive that includes data, the results displayed will be the ones associated with the image archive data.

Select the image display from the drop down menu [Change Target].

The target frame will move to the selected image display, indicating that display is the target for the View toolbar.

Reference

The target can also be set by pressing and holding the No.1 (FUNCTION) button or No.7 Back button while moving the 8-way key up or down.

Changing Screens

This function changes the screen being display. Up to 100 screens can be created, from P00 to P99. Each screen is assigned with its own image displays, values, text, graphics and menus.

Select the screen from the drop down menu [Change Display Template].

The screen changes to the selected screen.

Reference

To cycle through screens, press and hold the No.7 Back button while pressing the No.4 (SCREEN) button on the handheld controller.

Changing the Transparency of Menus

This function can be used to change the transparency of menus and screens so that what is going on in the background (behind the menu) can be seen. Menus are opaque at 100% and become more transparent as the number decreases (90%, 75%, 50%, 25%).

Select the opacity from the drop down menu [Menu Opacity].

The menu will be displayed using the selected opacity.

► Note

Image displays cannot be made transparent.

Reference

The menu transparency can be changed by holding down the No. (FUNCTION) button or No.7 Back button on the hand-held controller while pressing the No.6 (MENU) button.

Operating Using the Touch Panel

The Keyence CA-MP120T touch panel can optionally be used to operate and program the controller instead of using the hand held controller.

Reference

When connecting a touch panel, it is necessary to change the RS-232C port settings on the controller. See "RS-232 Network Settings" (Page 7-28) for more details.

Basic Touch Panel Operations

Selecting Items

Instead of pressing the 8-way key to select an item and then pressing the No.0 (ENTER) button, directly touch the item which you want to select on the touch panel screen.

Displaying the touch menu

The touch menu is used for touch panel operation of the functions that are frequently used in Run mode (Page 3-16).

To display the touch menu, tap a location on the screen where there is no button, or else tap  (display touch menu) at the top right of each screen.

Displaying the function menu

Tap  (function menu) on the touch menu or else tap  (function menu) at the top right of each screen.

Closing the displayed screen and returning to the previous screen

Instead of pressing the No.2 (ESCAPE) button on the handheld controller, tap  (cancel) on the screen you want to close.

Zooming IN/OUT of the Displayed Image

The displayed image can be zoomed in and out by pinching in or out on the touch panel screen. The zoom ratio can be set from 1% (0.1x) to 2500% (25x). When multiple image displays are being used, each screen has its own zoom ratio setting.

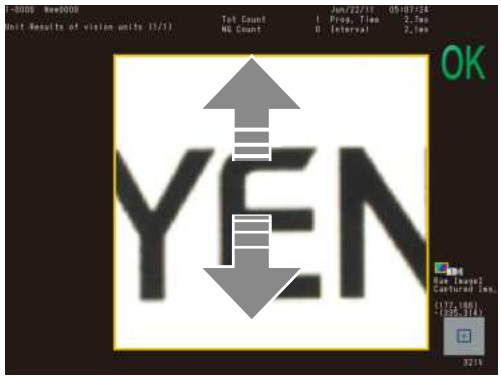
Zooming can be especially useful when drawing regions around small targets or locating defects for parameter setting. To move the displayed image area, simply touch and drag on the image on the touch screen to the desired location.

Reference

- If multiple image displays are present, select the display to operate before zooming in or out.
- The program can be configured to hold the zoom at a fixed ratio, and provide auto tracking to the center of a detected point or region. For more details, refer to "Screen Editor" in the XG VisionEditor Reference Manual (Programming Edition).

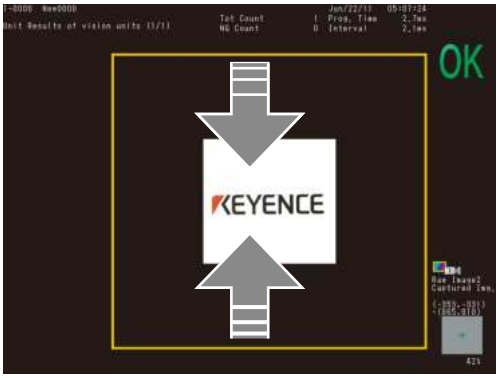
Zooming In on the Image Display

Tap the screen with two fingers close together, then spread your fingers apart to zoom in on the display. (This is referred to as "pinching out".)



Zooming Out on the Image Display

Tap the screen with two fingers at separate locations, then bring your fingers towards each other to zoom out. (This is referred to as "pinching in".)



Auto-fit the Full Image to the Image Display

Press and hold the image display to automatically fit the full image to the size of the image display.



Operating from the Touch Menu

You can use the touch menu that appears when the screen is tapped in Run mode in order to perform basic controller operations.

► Note

The touch menu cannot be called if the system settings version is 4.0 or earlier, or if the logged in user does not have permission to operate the touch menu.

Displaying the touch menu

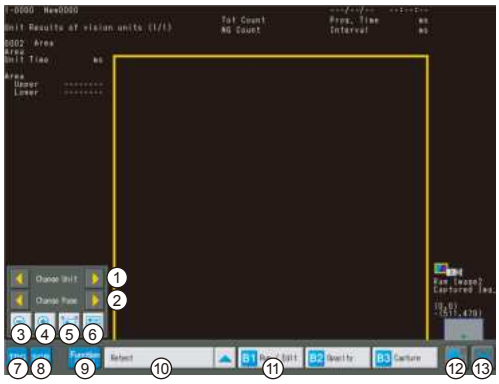
During Run mode, touch any location on the screen where there is no button or menu.



The touch menu has two modes: normal mode and handheld controller mode. Tap  on the touch menu to toggle between the modes.

Using the Touch Menu (Normal Mode)

The touch menu (normal mode) is used for touch operation of the functions that are frequently used in Run mode. The functions of the buttons displayed on the touch menu (normal mode) are as shown below.



(1) Change the displayed unit
Switches the display to the unit results before or after the currently displayed unit (Page 3-12).

(2) Change the displayed page
Switches the displayed page to the page before or after the currently displayed page (Page 3-12).

(3) Display zoom out
Zooms out on the currently selected camera image display (Page 3-16).

(4) Display zoom in
Zooms in on the currently selected camera image display (Page 3-15).

(5) Display auto-fit
Automatically fits the currently selected camera image to fill the size of the image display window (Page 3-16).

(6) Change the display screen template
Changes to the next screen template that is after the one currently being displayed.

(7) Trigger input
Inputs a trigger signal.

(8) Change the image type
Changes the displayed image type (Page 3-13).

(9) Display the function menu
Displays the function menu (Page 5-4).

(10)Display the utility menu
Used to call up the utility menu functions.
Tapping ▲ displays the utility list. Tap the desired utility function and then it will automatically be launched & displayed.

► Note
Utility functions that are disabled in the account settings for the current user group will not be displayed.

(11)Touch menu buttons B1 - B3
These execute the functions that are allocated to them using XG VisionEditor. For more details, refer to "Controller System Settings" in the XG VisionEditor Reference Manual.

► Note
Default assignment B1: Run/Edit; B2: Opacity; B3: Capture.

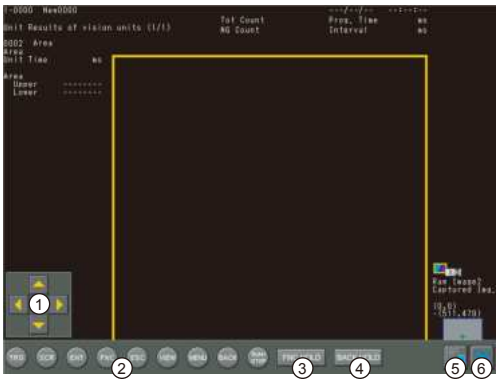
(12)Handheld controller mode
Changes the touch menu to handheld controller mode (Page 3-18).

(13)Exit touch menu
Closes the touch menu.

Reference
In Replay mode, the [Exit Replay] and [Change Count] buttons are displayed at the top of the touch menu.

Using the Touch Menu (Handheld Controller Mode)

The touch menu (handheld controller mode) is used to perform handheld controller input by touch operations. The functions of the buttons displayed on the touch menu (handheld controller mode) are as shown below.



(1) Cursor keys
Executes the same function as the Up/Down/Left/Right on the handheld controller to select desired items on the screen.

(2) Handheld controller command input keys
Executes the same commands as the buttons used on the handheld controller.

(3) FNC HOLD (Button No.1)
Tap to select this button when inputting a command that requires holding down the No.1 button while pressing another button on the handheld controller. Tap the button again to deselect it and return to normal button input.

(4) BACK HOLD (Button No.7)
Tap to select this button when inputting a command that requires holding down the No.7 button while pressing another button on the handheld controller. Tap the button again to deselect it and return to normal button input.

(5) Normal mode
This changes the touch menu to normal mode (Page 3-17).

(6) Exit touch menu
Closes the touch menu.

Editing a Flowchart with the Touch Panel

This section explains the special operations and menus used to perform flowchart editing (Page 4-1) from the touch panel.

Editing units on the Flow Editor

Tap any location on the desired unit other than the tool icon to display the edit icons. When any part of the flowchart other than the units is tapped, arrow buttons appear in order to change the displayed flowchart location.

► Note
The edit icons are grayed out if the user does not have permission to edit flowcharts.



(1) Edit unit
Enters the unit edit menu of the currently selected unit.

Reference
You can also enter the unit edit menu by double-tapping the unit or tapping the unit tool icon.

(2) Add unit
The screen status is the same as when [Add Unit] > [Vision Tools] has been opened from the Flow Editor menu.

(3) Cut
Cuts the selected unit.

(4) Delete
Deletes the selected unit.

(5) Flow Editor menu display
Displays the flowchart edit menu.

(6) Copy
Copies the selected unit.

(7) Paste
Pastes the copied (or cut) unit.

(8) Variables

Opens the Variables Settings menu (Page 4-348).

Operating the help display buttons

Tap the help display buttons at the bottom of the screen to execute the help function shortcuts. See "Handheld controller operation on the Flowchart" (Page 4-3) for more details.

Reference

The [TRG] and [SCR] button displayed in the help display are not displayed when operating with the handheld controller. They will be displayed when an operation is performed from the touch panel.

Assigning variables to parameters

When assigning a variable to a parameter, tap the parameter to edit then cancel once.
After canceling, either call the function menu from the touch menu or else tap FNC (function menu) and select [Reference Variable].

Operation when setting regions

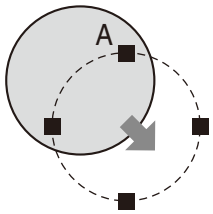
Select the region type on the Inspection Region menu, then tap [Edit] to enable region drawing.

Reference

Values can be entered directly in the Edit menu by tapping the desired number.

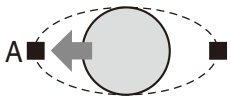
Changing the location of a region

Tap inside the region, then slide it to the desired location on the screen.



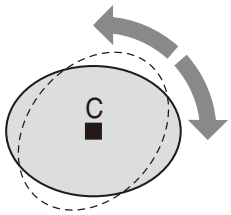
Changing the size

Tap the location (green node) to change, then slide it to change the size.



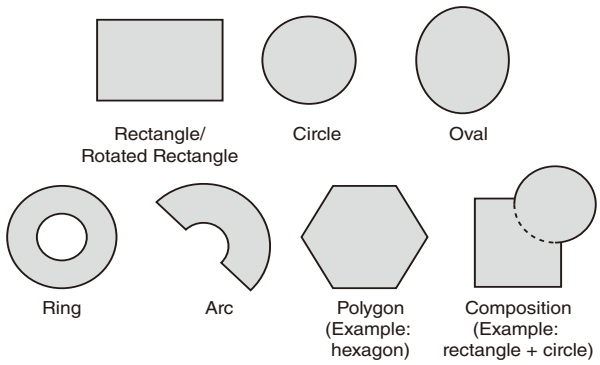
Changing the angle

Tap the center of the region (green node), then slide it up or down to change the angle.



Inspection Region Menu

This menu is used to edit the size and position of the regions used in a unit. This includes inspection, mask, search, pattern, calibration, and trapezoid correction regions.
The following regions shapes are supported by the XG-7000 Series.



► Note

Depending on the content of the program, it may not be possible to change all or some of the region settings.

Some functions in the Inspection Region Menu and the sub menu [Inspection Region] of the Edit Unit Menu work and behave differently. Refer to "Difference between sub menus of the Edit Unit menu and other built-in menus" (Page 4-10) for further details.

Selecting the Inspection Region

Open the Inspection Region Menu, then select the display image and regions to work on.

Unit (only displayed in the Inspection Region Menu)
Select the unit with the region to be adjusted.

Region (Only displayed in the Inspection Region Menu)
Select the type of region to be adjusted. The type of region will differ depending on the selected unit and the menu settings.

Display Image

- **Captured Image**: Displays the latest captured image from the set measurement unit.
- **Registered Image**: Displays the registered image from the set measurement unit.
- **Archived Img.**: Displays an image from the image archive. This is only displayed in the Inspection Region Menu when activated. Toggle through the image archive by using the No.1 (FUNCTION) or No.7 (BACK) button and left or right.

Areas (Only displayed in the Inspection Region Menu)

- **Single**: Displays only the selected inspection region.
- **All**: Displays all the regions of units that reference the same image variable or registered image if [Display Image] is set to [Regist. Image].

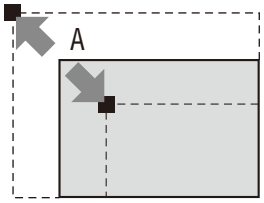
► Note

- Inspection regions can only be added, deleted or have their shape changed through the Inspection Region sub menu when editing a unit.
- The region cannot be adjusted via the Inspection Region Menu unless variables are assigned to the nodes of the inspection region.
- When all or part of the inspection region is outside the imaging region (Page 7-13), the part of the region outside the imaging region is always removed from the process area.

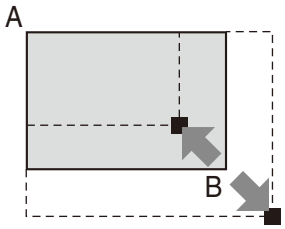
Drawing a Rectangle

1 **Click [Edit] under [Inspection Region].**
This allows the region to be drawn on the image.

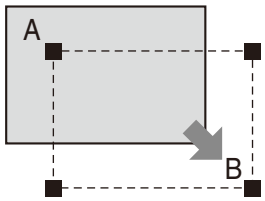
2 **Set the upper left node of the rectangle.**
Use the 8-way key to set point A, then press the No.0 (ENTER) button.



3 **Set the lower right node of the rectangle.**
Use the 8-way key to set point B, then press the No.0 (ENTER) button.



4 **Position the rectangle.**
Use the 8-way key to move the entire rectangle, then press the No.0 (ENTER) button. Each press of the No. (ENTER) button will cycle through steps 2 to 4.



5 **To finish editing, press the No.2 (ESCAPE) button.**

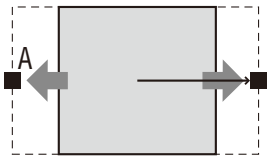
Reference

The positions of the nodes can also be input as values. For more details, refer to "Drawing Regions by Using Values" (Page 3-26).

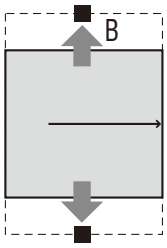
Drawing a Rotated Rectangle

1 **Click [Edit] under [Inspection Region].**
This allows the region to be drawn on the image.

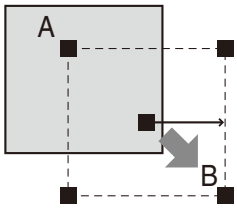
2 **Set the width of the rotated rectangle.**
Move the 8-way key up and down to adjust the width, then press the No.0 (ENTER) button.



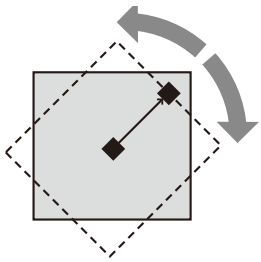
3 **Set the height of the rotated rectangle.**
Move the 8-way key up and down to adjust the height, then press the No.0 (ENTER) button.



4 **Position the rotated rectangle.**
Use the 8-way key to move the entire rotated rectangle, then press the No.0 (ENTER) button.



5 **Set the angle of the rotated rectangle.**
Move the 8-way key up and down to adjust the angle, then press the No.0 (ENTER) button.
Each press of the No.(ENTER) button will cycle through steps 2 to 5.



6 **To finish editing, press the No.2 (ESCAPE) button.**

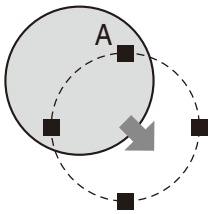
Reference

The height, width, and angle can also be input as values. For more details, refer to "Drawing Regions by Using Values" (Page 3-26).

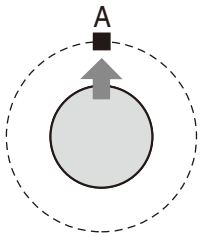
Drawing a Circle

1 **Click [Edit] under [Inspection Region].**
This allows the region to be drawn on the image.

2 **Position the circle.**
Use the 8-way key to move the entire circle, then press the No.0 (ENTER) button.



3 **Set the size of the circle.**
Move the 8-way key up and down to set the size of the circle then press the No.0 (ENTER) button. Each press of the No. (ENTER) button will cycle through steps 2 and 3.



4 **To finish editing, press the No.2 (ESCAPE) button.**

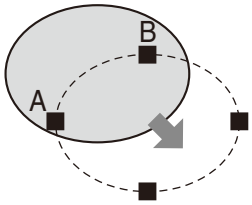
Reference

The position of the center of the circle and the radius of the circle can also be input as values. For more details, refer to "Drawing Regions by Using Values" (Page 3-26).

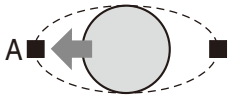
Drawing an Oval

1 **Click [Edit] under [Inspection Region].**
This allows the region to be drawn on the image.

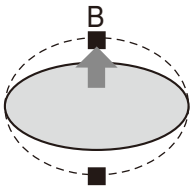
2 **Position the oval.**
Use the 8-way key to move the entire oval, then press the No.0 (ENTER) button.



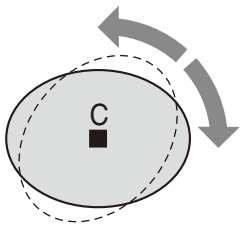
3 **Set the horizontal size of the oval.**
Move the 8-way key up and down to set the size of the oval then press the No.0 (ENTER) button.



4 **Set the vertical size of the oval.**
Move the 8-way key up and down to set the size of the circle and press the No.0 (ENTER) button.



5 **Set the angle of the oval.**
Move the 8-way key up and down to adjust the angle, then press the No.0 (ENTER) button.
Each press of the No. (ENTER) button will cycle through steps 2 through 5.



6 **To finish editing, press the No.2 (ESCAPE) button.**

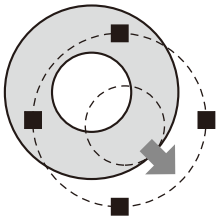
Reference

The position of the center, rotation angle, and the radius (in X and Y) can also be input as numeric values. For more details, refer to "Drawing Regions by Using Values" (Page 3-26).

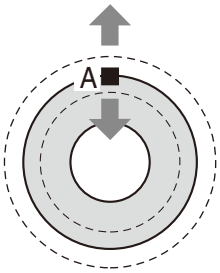
Drawing a Ring

1 **Click [Edit] under [Inspection Region].**
This allows the region to be drawn on the image.

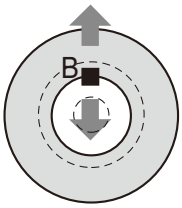
2 **Position the ring.**
Use the 8-way key to move the entire ring, then press the No.0 (ENTER) button.



3 **Set the size of the outer circle of the ring.**
Move the 8-way key up and down to set the size of the circle and press the No.0 (ENTER) button.



4 **Set the size of the inner circle of the ring.**
Move the 8-way key up and down to set the size of the circle and press the No.0 (ENTER) button. Each press of the No. (ENTER) button will cycle through steps 2, 3 and 4.



5 **To finish editing, press the No.2 (ESCAPE) button.**

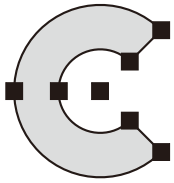
Reference

The position of the center and the radius of the inner and outer circles can also be input as values. For more details, refer to "Drawing Regions by Using Values" (Page 3-26).

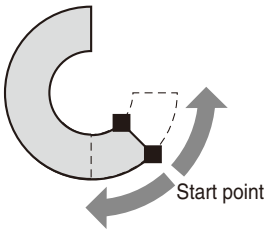
Drawing an Arc

1 **Click [Edit] under [Inspection Region].**
This allows the region to be drawn on the image.

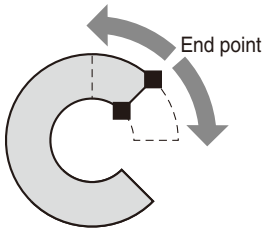
2 **Position the arc.**
Use the 8-way key to move the entire arc, then press the No.0 (ENTER) button.



3 **Set the starting point of the arc.**
Move the 8-way key up and down to set the starting point, then press the No.0 (ENTER) button.



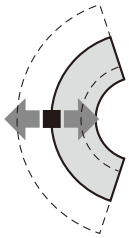
4 **Set the ending point of the arc.**
Move the 8-way key up and down to set the ending point, then press the No.0 (ENTER) button.



5 **Set the curvature of the arc.**
Move the 8-way key up and down to set the curvature, then press the No.0 (ENTER) button.

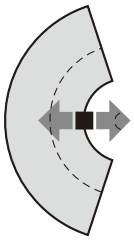


6 **Set the size of the outer arc.**
Move the 8-way key up and down to set the size of the outer arc, then press the No.0 (ENTER) button.



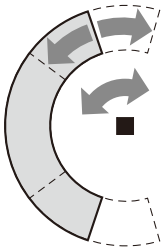
7 **Set the size of the inner arc.**

Move the 8-way key up and down to set the size of the inner arc, then press the No.0 (ENTER) button.



8 **Adjust the angle of the arc.**

Move the 8-way key up and down to adjust the angle, then press the No.0 (ENTER) button. Each press of the No. (ENTER) button will cycle through steps 2 to 8.



9 **To finish editing, press the No.2 (ESCAPE) button.**

Reference

The position of the center, starting and ending angles, and the radius of the inner and outer arc can also be input as values. For more details, refer to "Drawing Regions by Using Values" (Page 3-26).

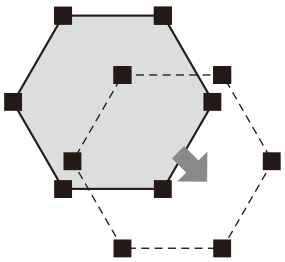
Drawing a Polygon

1 **Click [Edit] under [Inspection Region].**

This allows the region to be drawn on the image.

2 **Position the polygon.**

Use the 8-way key to move the entire polygon, then press the No.0 (ENTER) button. Each time the No.0 (ENTER) button is pressed, the function alternates between adjusting points or moving the polygon.



3 **Set the position of a node of the polygon.**

Use the 8-way key to set a point, then press the No.0 (ENTER) button.

Repeat this step until all the required nodes are set.

4 **To finish editing, press the No.2 (ESCAPE) button.**

Reference

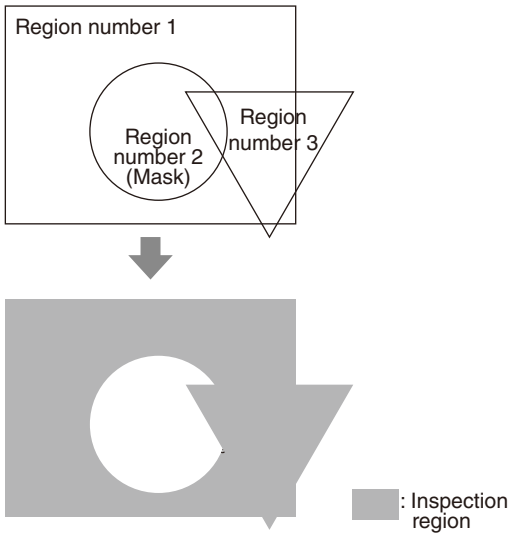
- The center of the polygon and the position of each node can also be input as values. For more details, refer to "Drawing Regions by Using Values" (Page 3-26).
- Nodes can only be added or deleted via the Inspection Region sub menu when editing a unit.
- A four point polygon can be used for the regions in a calibration unit and [Trapezoid Correction] in Image Operations (Page 4-293).
- If using [Trapezoid Correction] (Page 4-293) an arrow indicates the order of specifying points.

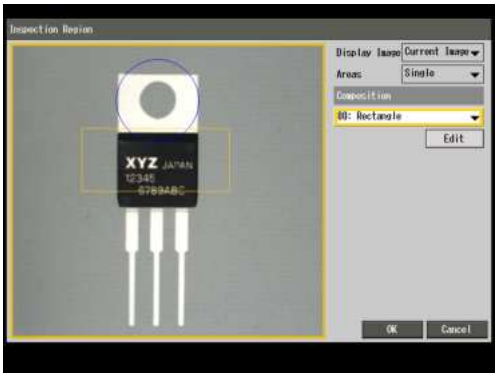
Drawing a Composition Region

A maximum of 32 regions and masks of differing shapes can be combined to form a complex region.

Reference

If the regions overlap, the region with the higher number takes precedence.





1 **Choose the region from the list to edit and click [Edit].**

The [Edit] menu appears.

2 **Edit the selected region.**

Refer to the editing instructions for each region shape.

3 **Repeat steps 1 and 2 until all the necessary regions have been edited.**

4 **Putting a check mark in the [Enable Mask] check box defines the region as a mask.**

► Note

The mask option can only be edited via the Inspection Region sub menu when editing a unit.

5 **To finish editing, press the No.2 (ESCAPE) button.**

Reference

The positions and sizes of each region can also be input as values. For more details, refer to "Drawing Regions by Using Values" (Page 3-26).

► Note

Regions can only be added, deleted or have their shape changed via the Inspection Region sub menu when editing a unit.

Drawing Regions by Using Values

The position and size of a region can also be set by specifying values.

► Note

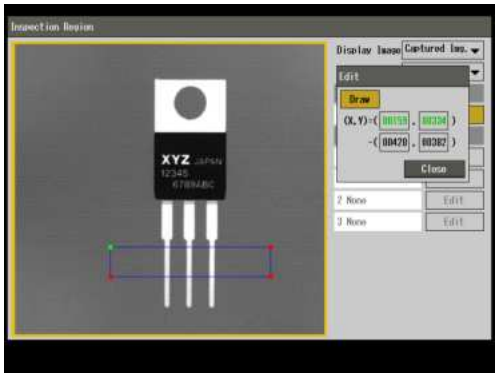
Values that can be entered differ depending on the region shape.

1 **While drawing regions, press the No.2 (ESCAPE) button.**

The [Edit] menu appears.

2 **Select the value of the item to change.**

The part of the region associated to the selected value is highlighted.



3 **Specify the value.**

The region position, size and shape changes as the value changes.

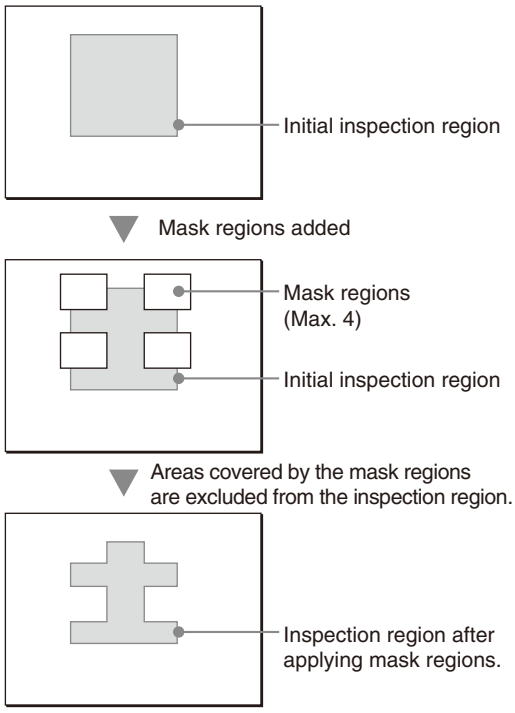
4 **To finish editing, click [Close].**

Reference

From the [Edit] menu, select [Draw] to draw the region on the image.

Excluding Part of the Region

A region can have up to four mask regions (or up to 31 for composition regions) for excluding areas. This is useful when the target has a complicated shape or when an area needs to be excluded from the inspection.



1 **Click [Edit] next to the mask to use.**

The mask region drawing menu appears. Draw the mask region as desired.

2 **Click [Close].**

► Note

- Mask regions can only be added, deleted or have their shape changed via the Inspection Region sub menu when editing a unit.
- The regions cannot be adjusted via the Inspection Region menu unless variables are assigned to the region coordinates.

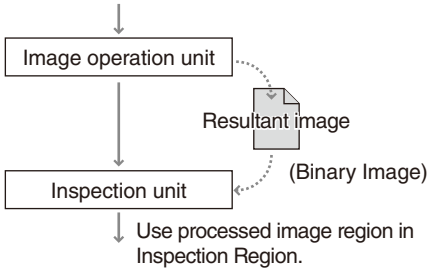
Reference

The position and size of each mask region can also be input as values. For more details, refer to "Drawing Regions by Using Values" (Page 3-26).

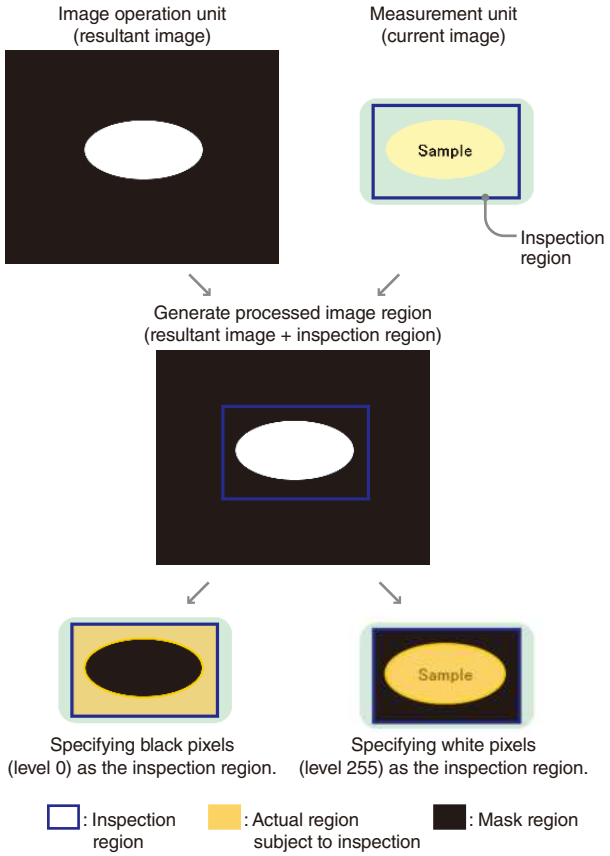
Generating a Region from an Image

The white (grayscale value 255) or black (grayscale value 0) area of a binary image created from the image operation unit (Page 4-286) can be used to define a region. This function is very useful for automatically creating an inspection region for complicated shapes based on a grouping of pixels.

How to set the Image Region



Processing image



Using Processed Image Region

► Note

The setting for whether or not to use an image region cannot be changed from the Inspection Region menu.

1 In the [Inspection region] field, select a shape to use as the processing region.

► Note

Regions can only be added, deleted or have their shape changed via the Inspection Region sub menu when editing a unit.

2 Draw a region large enough to cover the entire inspection area.

3 In the [Detect] field, choose the area to be used as the inspection region.

- **White**: Sets areas with "white" (grayscale value 255) as the inspection region.
- **Black**: Sets areas with "black" (grayscale value 0) as the inspection region.

4 Use preview to confirm the region.

5 To finish settings, click [OK].

Registering Images

An image can be saved to the controller to be used as a template for measurements and settings. The environment should be optimized and stable before registering an image to reduce problems when used as part of an inspection.

► Note

Images cannot be registered in Retesting mode (nonstop ON).

Some features in the Register Image Menu and the sub menu [Register] of the Edit Unit Menu work and behave differently. Refer to "Difference between sub menus of the Edit Unit menu and other built-in menus" (Page 4-10) for further details.

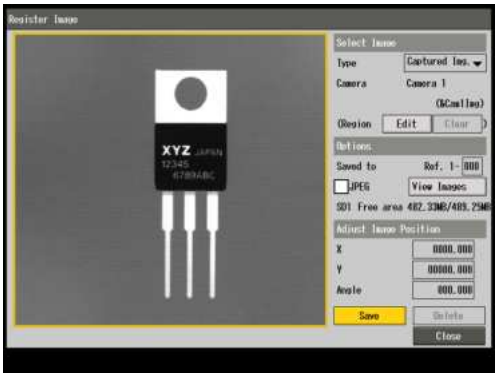
1 Select the image display and camera to be used as a reference.

2 Choose the image type in [Select Image].

- **Captured image**: Displays the latest captured image from the specified camera (image variable).
- **Image**: Displays the registered image specified under [Image Selection Select Image].
- **Archived Img.**: Displays an image from the image archive for the specified camera (image variable). This is only used in the Registered Image Menu when activated. Toggle through the image archive by using the No.1 (FUNCTION) or No.7 (BACK) button and left or right.

Reference

Current and archive images will be adjusted if the [Position Adjustment] option is enabled for the Register Image menu and the unit selected uses position adjustment. For more information on the [Position Adjustment] setting of the Register Image Menu, refer to the XG VisionEditor Reference Manual (Programming Edition).



3 Press the No.3 (TRIGGER) button on the handheld controller.

The image from the specified camera (image variable) will be captured and displayed.

4 Specify the image number filename to save to in [Options].

Reference

Select [View All] to view current registered images.

5 If necessary put a check mark next to [JPEG].

The registered image will be compressed using the JPEG format when saved to memory.

► Note

Using image compression may result in some image deterioration, thus results from a compressed image may differ to those when using non compressed images.

6 If necessary adjust the position of the image to be registered.

- **X**: Adjusts image in the X (horizontal) direction.
- **Y**: Adjusts image in the Y (vertical) direction.
- **Angle**: Adjusts the angle (rotation) of the image.

► Note

- Re-adjusting images that have already been adjusted may result in the loss of image data and blank areas around the perimeter.
- If position adjustment has been disabled or refers to the adjustment used by units the X, Y and Angle cannot be changed.

7 Click [Save] to register the image.

The displayed image is saved and registered to the controller.

Registering multiple images

Up to 1000 images can be registered for a single program in the controller. However the actual number available may be less depending on the available memory.

To register multiple images, repeat steps 4, 5, 6, and 7, and specify the registered image number (000 - 999) in step 4 before selecting [Register].

Registering part of an image (partial registration)

By selecting a region, it is possible to register only a part of an image as a registered image. By using partial registration, it is possible to reduce the memory required by the registered images and shorten the time required for settings changes.

1 **In the Register Image menu select [Edit.] from [Select Image] - Region.**
The [Edit] menu appears.

2 **Select the range of the image to register.**
A rectangle appears. Move the rectangle and change its size so that it encloses the part of the image to be registered.

Reference

The values of the region can be manually entered by selecting the item and changing the value.

3 **To finish editing, click [Close].**

4 **The Edit menu closes and the image can be registered.**
Click [Save] to registered the part of the image that is within the region.

To cancel partial registration
Select [Clear] under [Options] on the Image Registration menu, then select [OK] on the confirmation screen.

Deleting registered images

1 **In the Register Image Menu select [Registered Img.] from the [Type] drop down menu.**

2 **Specify the number of the image to delete in [Options].**
The specified registered image is displayed.

3 **Click [Delete].**
A confirmation screen appears.

4 **Click [OK].**
The registered image is deleted from the controller.

Chapter 4

Flowchart Editing - Setting the Inspection and Measurement Conditions

Creating and Editing Flowcharts

What is a "Flowchart"

The XG-7000 Series manages the series of operations from capturing an image, processing its information through to generating data and results as a "flowchart."

- A flowchart is created by combining the required "units", which are used to represent inspection, calculation, control, and other processes.
- An inspection will be performed according to the created flowchart.

Example of a flowchart



- Each process executed in the flowchart is shown as a unit.
- Units are connected automatically with lines, indicating they will be processed one by one from the top to the bottom of the flowchart.
- The ● mark of each unit shows the execution result of that unit.
  - Green: Execution result is OK (successful).
  - Red: Execution result is NG (failed).
  - Yellow: Calculation error (Error occurred with the calculation data).
  - White: Not executed
- Units where those properties are set to [Never Execute] are shown in gray (when [Unit Execution] (Page 7-6) is set to [PC & XG Controller]).

► Note

When the [Execute] for each unit is set to [Data Reference], the unit is not shown in gray.

Showing/hiding a flowchart

A flowchart is not shown by default in run mode. To display a flowchart, select [Show Flowchart] from the function menu (Page 4-3).

To hide a flowchart:

Select [Hide Flowchart] from the function menu.

Reference

You can also use [Startup Mode] on the System Configuration menu (Page 7-7) to show a flowchart by default.

Operation Flow

A flowchart is edited using the procedures below.

1 **Choose to change the flowchart program of the current inspection or add a new inspection (Page 4-5).**

2 **Enable editing of a flowchart (Page 4-6).**

3 **Addition of unit(s) to a flowchart (Page 4-7).**
Various functions are also available such as deleting/copying/cutting/pasting a unit, grouping units, jumping to a specified unit, and renumbering unit IDs (Page 4-11).

4 **Changing a unit settings (Page 4-8).**
In the Edit Unit menu, configure the settings for each unit.

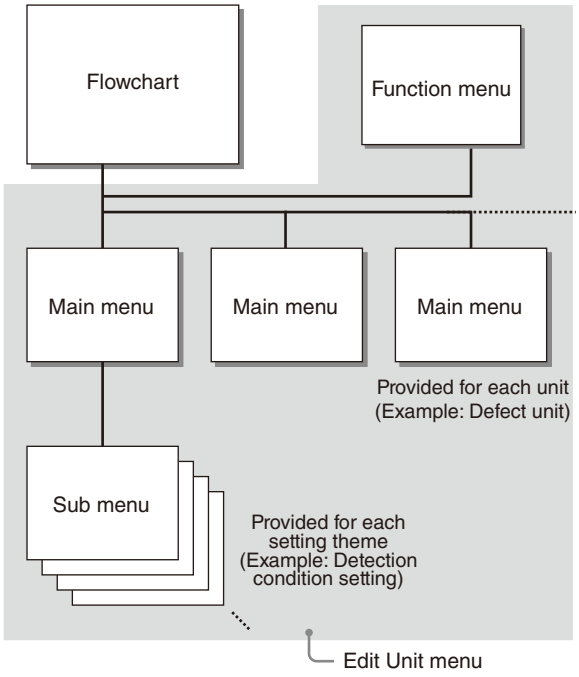
5 **Changing of other settings as required.**
From [Settings], you can change various settings associated with the flowchart.

- Changing the operation during flowchart editing (Page 4-347)
- Changing the variable settings (Page 4-348)
- Specifying the unit(s) to be used for total status output (Page 4-355)
- Specifying the unit(s) to be used for total error output (Page 4-356)
- Setting the scale factor of each camera (Page 4-356)
- Specifying the type of connected camera (Page 4-357)
- Changing the settings of image buffer for images captured when processing (Page 4-358)
- Specifying items to be used for statistical analysis (Page 5-11)
- Setting the conditions to archive images used for inspection and result data (Page 5-20)
- Specifying the FTP server to which archived data will be output (Page 4-359)
- Specify the variables which can be easily updated during run mode (Page 5-8).
- Specify classification and output conditions from detected targets, defects and blobs.
- Universal updating of image information used for registered images (Page 4-359)
- Universal updating of the positioning information for the position adjustment units in the inspection settings (Page 4-360)
- Locking/unlocking groups (Page 4-360)

6 **Save the setting.**

Editing the Flowchart

The flowchart is configured using related Edit Unit menus selectable from the flowchart editor menu.



Main menu

This menu is used to access the edit menu (sub menus) for each unit. When you select the setting you want to change in the top menu, the corresponding sub menu opens.

Sub menu

This menu is used to change the individual setting parameters of a unit such as [Inspect Region] or [Condition].

► Note

- Depending on the unit, top menus may not exist.
- See "Editing a Programmed Unit (Unit Properties Menu)" (Page 10-9) for more details on the launcher menu.

Handheld controller operation on the Flowchart

You can use the buttons of the handheld controller, indicated in the help display at the bottom of the menu.

- No.7 button: Switches between the normal display and an enlarged display of the flowchart.
- Holding down the No.7 button, or No.1 button + No.7 button: Displays the overview of the flowchart. This is useful to edit a flowchart that contains many units.
- No.1 or No.7 button + No.3 button: Switches the enabling or disabling of trigger inputs.
- No.1 or No.7 button + No.4 button (when zoomed in on a flowchart): Switches between the current image display and registered image display.
- No.1 or No.7 button + No.0 button (when a setting parameter is selected): Displays the [Data Reference] menu.
- Holding down the No.3 button (only when trigger inputs are enabled), gives a continuous trigger to the system. The trigger input stops when the No.3 button is pressed again.

Function menu items displayed during flowchart editing

The following three types of function menus are displayed when the No.1 (FUNCTION) button of the handheld controller is pressed during flowchart editing. The menu displayed will depend on the situation.

► Note

- The selectable menu items may vary depending on the account settings.
- The user account cannot be changed during flowchart editing.

When a unit is selected in a flowchart

The [Flowchart edit menu] is displayed.



Adding, cutting, copying, pasting units etc.

When an Edit Unit menu (top menu, sub menu) is displayed

The [Edit Menu] is displayed.



Editing and assigning data references and variables.

- **Reference Variables**: Reference a variable to the selected unit parameter.
- **Variable Settings**: Edit and or create variables. Refer to "Variable Settings (Variables)" (Page 4-348) for more details.
- **Stop SD2 Operation**: Stop SD card 2 operation so that the SD card can be removed.
- **Add to Update List**: If the parameter is linked to a variable then the variable can be added to the update variable list available in run mode (Page 5-8).
- **Update View Mode**: Sets the timing for updating the display. If [Manual] is selected, then the display is updated when the No.7 button + No.5 button on the handheld controller are pressed (or the UPDATE button when the touch panel is used). In cases when the processed image is large, this will allow smoother handheld controller operation.
- **Resources**: Allows the user to check the amount of memory currently being used.

► Note

- For those parameters which cannot reference variables or result data, the [Data Reference] is grayed out.
- The [Update View Mode] setting cannot be saved. (When the handheld controller is used, this setting is set to [Auto].)

Normal operation

The ordinary function menu (Page 5-4) is displayed. From this screen programs can be changed and utilities setup.

Cautions on flowchart editing

The influence of flowchart editing on current operations

When you edit a flowchart during continuous operation, the ongoing image processing may be interrupted, delayed, or the measurement result may be affected, depending on the edit operation.

Timing when %Trg1 - 8Ready status changes

The state of the triggers (%Trg1Ready, %Trg2Ready, etc) can change between ON/OFF when changes are applied to certain functions such as the image capture buffer. If the trigger setting is disabled, these triggers will always be OFF when editing the flowchart.

Changing settings based on variable references

- A setting value with a variable reference is shown with a light blue or gray background. Since the setting value with a gray background references a system variable, setting data, or the result data of a unit, that value cannot be changed.
- The setting value shown in red letters has a link error due to an absence of a referenced variable or for another reason. Consequently, that value cannot be changed.
- Settings that are linked to variables will lose their link if the setting is cleared or if a setting change causes a link to be cleared.
- If the [Update Variables] option is disabled for a user account, only a direct value input via an external device or command is allowed. Clearing values (initializing), making changes, and setting new references is also not allowed.

Setting items affected by the user account settings

Depending on the user account setup the following items can be set to not be changed:

- Flowchart Editing
- Variables and data reference settings
- Image display
- Trigger input disabling
- Output disabling
- Reference position adjustment updating
- Maximum count value
- Target Classification settings
- Touch Menu access

Behavior when [Cancel] is selected in the menu

- When [Cancel] is selected after a setting is changed in the sub menu, the value returns to the previous value immediately when the sub menu is opened (When the variable reference is canceled, the reference will return to its previous state).
- When [Cancel] is selected in the top menu, all settings changed in the sub menu return to the previous values immediately after the top menu opens.
- When program data is changed in the Edit Unit menu on the controller, the archived result data recorded before the change may not conform to the changed inspection result, preventing proper replay of the archived result.

► Note

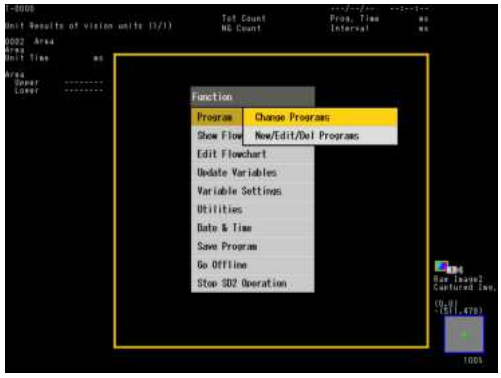
The [CCD Imaging Region], [Select Camera], [Trigger Options], and [Trigger Common Settings] settings of a capture unit, and the [Target] setting of a position adjustment unit, do not return to their original settings even after [Cancel] is selected.

1. Changing Programs and Editing the Flowchart

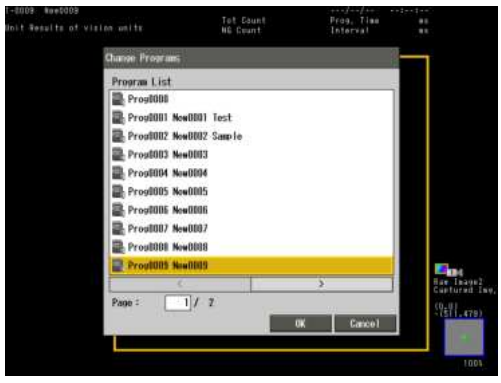
Choose to change the flowchart program of the current inspection or add a new inspection.

Changing programs

1 From the Function menu (Page 4-3) select [Program] - [Change Programs].



The [Change Programs] window appears.

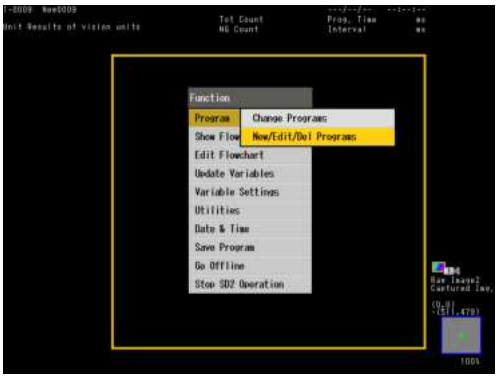


2 Select the inspection program to edit, then select [OK].

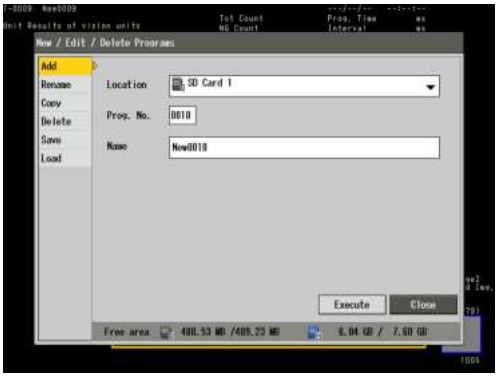
This changes the inspection program.

Adding a new program

1 **From the Function menu (Page 4-3) select [Program] - [New/Edit/Del Programs].**



The [New/Edit/Delete Programs] menu appears.



2 **Select [New].**

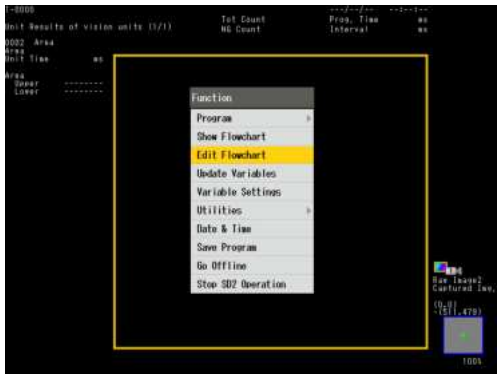
3 **Specify the save location, inspection program No., and inspection program name.**
See "Adding a New Program" (Page 4-361) for more details.

4 **Click [Execute].**
A new program is created and the system changes to the new program.

2. Editing and Running the Flowchart

By default the system starts by running the flowchart. Change the mode by using the function menu.

1 **From the function menu (Page 4-3), select [Edit Flowchart].**



A confirmation screen appears.

2 **Click [OK].**
You can now edit the flowchart and units.

Ending the flowchart editing process

From the function menu (Page 4-3), either select [End to Edit Program] or select [Run] at the top right of the Flow Editor screen.
The flowchart editing process ends.

When using the No.2 button (ESCAPE) to end the flowchart editing process
Select [OK] in the displayed confirmation screen to end the flowchart editing process.

When attempting to end the flowchart editing process without saving the flowchart
A confirmation screen appears.
Select [OK] to save the current setting, or select [Cancel] to end the process without saving the setting.

3. Adding a Unit to a Flowchart

In the default state of the program, a flowchart shows the start unit (Unit ID: U0000), capture unit (U0001) and end unit (U0999). Add necessary units to create a flowchart.

► Note

- Up to 1000 units can be added to a flowchart, including the start and end units. When you exceed 1000 units in a flowchart, no more units are able to be added.
- Even with 999 units in a flowchart, a branch unit and loop unit cannot be added because they are considered a pair.
- If there is not enough memory, a unit cannot be added even when the number of units is 999 or less.

1 **Place the cursor on the unit below where you want to add a unit, and then display the flowchart edit menu (Page 4-3) by pressing the button No.1 (Function).**



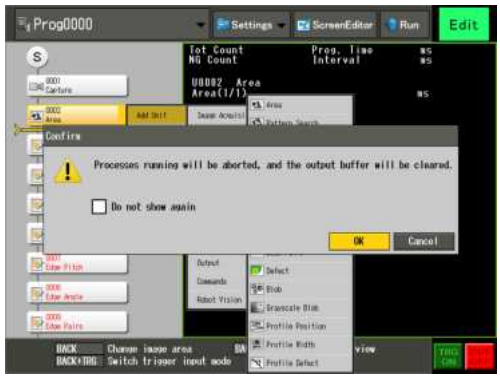
2 **Select [Add].**

The position where a unit will be added is highlighted.



3 **Select the type of unit to be added.**

A confirmation screen appears.



4 **Click [OK].**

The selected unit is added to the flowchart.



5 **Configure the necessary settings for the unit.**

See the explanation of each unit for more details.

Reference

The added unit is automatically assigned with the smallest available unit ID.

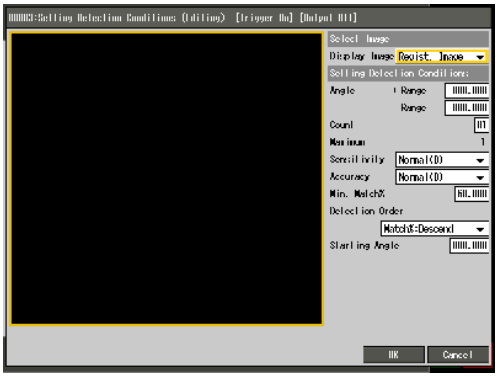
Other flowchart edit functions

Various functions are available such as deleting/copying/cutting/pasting a unit, grouping units, jumping to a specified unit, renumbering unit IDs, and viewing information. See "Other Flowchart Edit Menu Functions" (Page 4-11) for more details.

4. Changing the Settings of a Unit (Edit Unit Menu)

What is the Edit Unit menu?

The Edit Unit menu is a GUI intended for changing the setting parameters of a unit which has been added to a flowchart on the controller. In this menu, you can edit various settings of a unit such as changing the setting value or assigning a variable to the setting value (Page 4-354).



► Note

- Changing the settings via the Edit Unit menu during inspection may greatly affect the inspection result. It is recommended that the inspection is stopped before changes are made.
- As the XG-7000 Series allows for the restriction of operations and functions accessible via the unit menus some or all of the functions described here may not be available or their operation and behavior may differ from these descriptions.

Reference

- Depending on the program, this Edit Unit menu can be launched from [Edit Unit] in the function menu, or from the retesting results Statistics menu. The following sections describe the overview and operational procedures of the Edit Unit menu.
- For more details on the operation using [Edit Unit], see "Editing a Programmed Unit (Unit Properties Menu)" (Page 10-9).

Editable units

You can use the Edit Unit menu to change the settings of the following units.

► Note

- Some restrictions are imposed on changing the settings on the controller side. See the explanation of each unit for more details.
- The settings for a C Plugin unit, Start unit, End unit, Break unit, Loop End unit, and Join unit cannot be changed from the controller side. See the XG VisionEditor Reference Manual (Programming Edition) for more details.

Image acquisition

- Capture (Page 4-17)

Vision Tools

- Area (Page 4-31)
- Pattern Search (Page 4-40)
- Edge Position (Page 4-52)
- Edge Width (Page 4-64)
- Edge Pitch (Page 4-77)
- Edge Angle (Page 4-90)
- Edge Pairs (Page 4-101)
- Defect (Page 4-115)
- Blob (Page 4-132)
- Grayscale Blob (Page 4-146)
- Profile Position (Page 4-163)
- Profile Width (Page 4-179)
- Profile Defect (Page 4-195)
- Intensity (Page 4-213)
- Color (Page 4-222)
- OCR (Page 4-231)
- 2D Code Reader (Page 4-255)

Position Adjustment

- Position adjustment (Page 4-274)

Flowchart Functions

- Branch / Join (Page 4-278)
- Loop Function / Loop End (Page 4-281)
- Break (Page 4-282)
- End (Page 4-282)

Operations
- Calculation (Page 4-283)
- Image Operation (Page 4-286)
- Calibration (Page 4-299)

Timing
- Pause (Page 4-311)
- Timer Start (Page 4-311)
- Timer End (Page 4-312)
- Terminal I/O Delay (Page 4-313)
- Variable Delay (Page 4-315)
- User Menu (Page 4-317)

Display
- On-screen Graphics (Page 4-318)

Output
- Parallel Terminal Output (Page 4-333)
- Data Output (Page 4-336)
- Image Output (Page 4-341)

Commands
- Command Execution (Page 4-345)

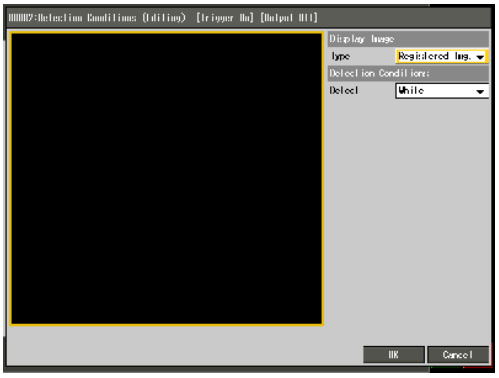
Operation with the Edit Unit menu

1 **Select a unit whose setting you want to change.**
The top menu for the selected unit appears.



Reference
- A confirmation screen may appear depending on the type of selected unit. Be sure to read the message before selecting [OK].
- When there are many units in a flowchart, it is useful to use the jump function (Page 4-16) which allows easy selection of the unit to be edited.

2 **Change appropriate settings of the unit.**



See the explanation of each unit for more details.

Reference
If a unit has parameters which support variable referencing, a variable can be assigned to control or change the parameters externally, or to tie multiple settings to one central point. See "Assigning variables to Parameters" (Page 4-354) for more details.

3 **Click [OK].**

Saving settings

Selecting [Save] saves the changes to settings made so far in a program file.

► Note

Any changes in the settings that were not saved prior to turning off the controller will be lost.

Key operations on the edit unit menu

On the Edit Unit menu, the following combinations have are available with the handheld controller

Dialogs	Combination keys	Operation
Main menu, Limits menu	No.1 or No.7 button + Right/left movement of No.0 button	Switch pages
Main menu, Limits menu	Combination assigned to [Screen change] for [Handheld controller assignment] in the system settings of the XG VisionEditor (Default: No.4 + No.7 buttons)	Switch screens
Each menu (when a parameter that allows data reference is selected)	No.1 button or No.7 button + No.0 button	Display the data reference menu
Image enhancement menu	No.1 or No.7 button + Up/down movement of No.0 button	Change the order of image enhancement filters.
Inspection region menu (when composition regions are set)	No.1 or No.7 button + Up/down movement of No.0 button	Change the order of composite regions.
Inspection region menu (when a polygon is set)	No.1 or No.7 button + Up/down movement of No.0 button	Change the order of the nodes of a polygon
Conversion menu (image operation unit)	No.1 or No.7 button + Up/down movement of No.0 button	Change the order of conversions.
Block set menu (OCR unit)	No.1 or No.7 button + Up/down movement of No.0 button	Change the order of block regions
Data output menu (data output unit)	No.1 or No.7 button + Up/down movement of No.0 button	Change the order of output data Nos..
Setup graphics (on-screen graphics unit)	No.1 or No.7 button + Up/down movement of No.0 button	Change the drawing order of graphics settings.
Branch menu (Branch unit)	No.1 or No.7 button + Up/down movement of No.0 button	Change the order of branch Nos.
Multi Reference Pattern List (2D code reader unit)	No.1 button or No.7 button + Up/down key	Change the order of reference patterns
Unit Properties menu	No.1 button or No.7 button + No.3 button	Change trigger enabled/disabled status.
All screens except for main menu	No.7 button + No.5 button	Updates the screen (when update view mode is set to [Manual].

Difference between sub menus of the Edit Unit menu and other built-in menus

Although the following menus have basically the same functionality, take care to note that some operations and behaviors are different.

- Inspection region menu (Page 3-20) and the [Inspection Region] (sub menu) of the Edit Unit menu.
- Register menu (Page 3-28) and the [Register] (sub menu) of the Edit Unit menu.
- Color menu (Page 10-2) and the [Color] (sub menu) of the Edit Unit menu.
- Library Setting menu (Page 4-250) and the [Library Settings] (sub menu) of the Edit Unit menu (OCR only)

How to differentiate sub menus from the other built-in menus

The sub menu of the Edit Unit menu shows the unit ID at the upper left of the menu.



Other Flowchart Edit Menu Functions

Selecting two or more units on a flowchart simultaneously

This function is useful when you want to copy/cut/delete two or more units in one operation.

1 From the flowchart edit menu (Page 4-3), select [Edit Unit] - [Multi Select].



2 On the flowchart, select the first unit of the selection.

3 On the flowchart, select the last unit of the selection.



The units between the first and last unit selected in steps 2 and 3 respectively are selected.

Deleting a unit from a flowchart

▶ Note

- When you select a group and delete it, all units in the group are deleted.
- When a locked group is included in the selection, the deletion is disabled.
- When a branch of a branch unit is deleted, all units of the deleted branch No. are deleted.
- The start unit and the end unit at the end of a flowchart cannot be deleted.
- When the branch / join units or loop / loop end units are selected individually, all units between the branch / join units or between the loop / loop end units are selected. Take care to note that if you choose delete unit, all selected units will be deleted.

1 Place the cursor on the units you want to delete or select such units, and then display the flowchart edit menu (Page 4-3).



2 Select [Edit Unit] - [Delete].

A confirmation screen appears.



3 **Click [OK].**
The specified unit(s) are deleted from the flowchart.



Reference
Even when a unit(s) is deleted, the unit IDs assigned to the other units will not change.

Copying/cutting a unit

You can cut, copy and paste single / multiple units already used in a flowchart.

1 **Place the cursor on the unit you want to cut / copy or select multiple units, and then display the flowchart edit menu (Page 4-3).**

2 **Select [Edit Unit] - [Copy].**
To cut the unit, select [Edit Unit] - [Cut].
The selected unit(s) are cut / copied.
If [Cut] was selected, the unit is cut.

► Note
Copying/cutting is disabled when a locked group is included in the selection.

Pasting a cut / copied unit(s)

1 **Place the cursor on the unit directly below where you want to paste, and then display the flowchart edit menu (Page 4-3).**

2 **Select [Paste].**
The position where a unit will be added is highlighted.
A confirmation screen appears.

3 **Click [OK].**
The cut / copied unit(s) are pasted into the flowchart.

► Note
It is also possible to paste a unit which was copied from a different inspection program No. However this may not be possible in some cases depending on the data size of the copied unit.

Grouping multiple units

A series of related units in a flowchart can be shown as a group. Such grouped units can be collapsed in the view. Grouping logically related units allows for easy understanding of the overall structure of the flowchart.

► Note

- The start unit, end unit at the bottom of a flowchart, and discrete units (units which are not directly connected with lines) cannot be grouped.
- Up to 128 groups can be created in a flowchart. When there are already 128 groups in a flowchart, no more grouping is possible.

1 Place the cursor on a unit you want to include in a group, or select multiple units, and then display the flowchart edit menu (Page 4-3).

2 Select [Edit Unit] - [Group] - [Grouping].

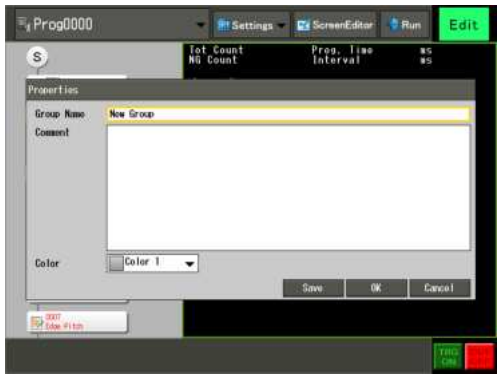
The unit(s) selected in step 1 are grouped as [New Group] and shown in the flowchart as a group icon.



Selecting [−] next to the group icon collapses the units in the group, and selecting [+] expands the units.

3 Select the created group.

The [Properties] menu appears.



4 In the [Group Name] field, enter the name of the group.

Comments for reference purposes can be allocated to the group (creation purpose, operation) in the [Comment] field as necessary.

Reference

In the [Color] field, it is possible to select from 10 colors for displaying the group in the flowchart. This allows easy differentiation of the groups in the flowchart.

5 Click [OK].

6 Add or move units into the group as necessary.

To move other units into a group, cut the unit first and then paste it in the group. See "Copying/cutting a unit" (Page 4-12) for more details.

Reference

You can also group units which have already been grouped (nested grouping). However, nested grouping is only possible when one group completely contains the other group.

Resetting groups

► Note

When a group is locked (Page 4-360), the group cannot be removed.

1 Place the cursor on the group that you want to ungroup, and then display the flowchart edit menu (Page 4-3).

2 Select [Edit Unit] - [Group] - [Ungrouping].

The group is removed.

Editing (adding / deleting) branches

Branches which have been set in the flow chart can also be edited. For more details, see "Adding additional branches" (Page 4-279) and "Removing part of a branch" (Page 4-279) of the Branch/Join units.

Renumbering Units

During program refinement unit IDs can fall out of sequence with no relation to the processing order of the flowchart, making unit management difficult. Unit IDs can be automatically re-numbered according to the processing order of the flowchart.

► Note

When you renumber the unit IDs, the inspection and global settings are saved and this operation cannot be reversed.

Reference

- The unit IDs are renumbered based on the following principles:
  - **Units other than branch / join units**: Unit IDs are renumbered one by one from the top of the flowchart.
  - **Branch/Join units**: After the unit ID of the branch unit is renumbered, the unit IDs under the branch are renumbered one by one starting from the top of the left branch. After unit IDs for all units in the left branch are renumbered, unit IDs are renumbered from the top of the branch on the immediate right and so on. Lastly, the unit IDs of the join units are numbered.
- To avoid inconsistency in the referencing relationships between unit IDs after renumbering, unit IDs are also automatically updated for these functions:
  - Flowchart unit ID references
  - Command units
  - Calculation units
  - Output units
  - Parallel Terminal Output unit ID references
  - Position Adjustment Unit
  - Branch Unit
  - Position adjustment units used in other units
  - Screen editor (unit references)
  - Custom commands
  - Statistics function
  - Image Archive
  - Trace logs (targets, event settings)

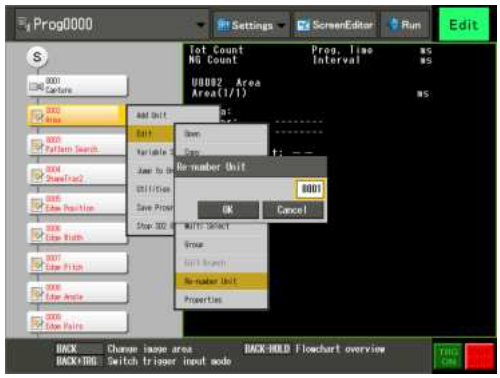
► Note

The changes in targets and the event settings of the trace logs caused by the unit ID renumbering do not affect the conditions of any on-going logging.

1 Select the unit to start renumbering ID's for and open the function menu (Page 4-3).

2 Select [Edit Unit] - [Renumber unit ID].

The Renumber Unit ID menu appears.



3 Enter the start unit ID and then select [OK]. A confirmation screen appears.

4 Click [OK].

Unit IDs in the flowchart are renumbered from the specified start unit ID.

► Note

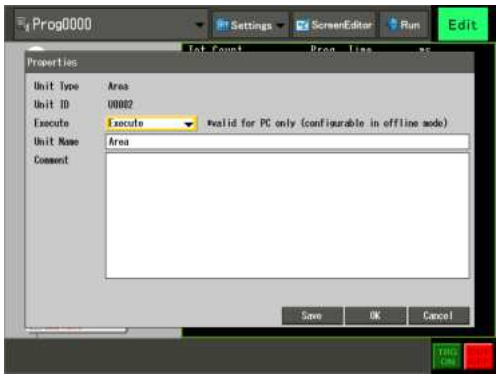
If the unit ID renumbering causes an overflow for those units with maximum character limitations (such as calculation units or command units), the unit IDs for the parameters in those functions may not be updated. Consequently, there may be some inconsistency in the unit ID referencing relationship.

Viewing/editing information of a unit in a flowchart

You can view or edit the setting parameters of a specific unit or grouped units.

1 **Place the cursor on the unit you want to view information for, and then display the flowchart edit menu (Page 4-3).**

2 **Select [Edit Unit] - [Properties].**
The [Properties] menu appears.



3 **Change the settings as required.**

Unit Type
The type of the selected unit is displayed.

Unit ID
The ID of the selected unit is displayed.

Execute
Select whether to execute the selected unit or not.
- Always execute (default): Process the unit.
- Never execute: Do not process the unit.

► Note
You can enable / disable processing on the controller by setting [Unit Execution] in the System Configuration menu (Page 7-6). When [Unit Execution] is set to [PC (XG VisionEditor) only], the unit will be executed even when [Execute] is set to [Never Execute] in the [Properties] menu.

Unit Name
The name of the selected unit is displayed.
Any name (up to 50 characters, 100 single byte characters) can be entered for easy, intuitive referencing.

Comment
Any associated comments for the selected unit are displayed. Up to 256 characters (512 single-byte characters) can be entered. Comments are useful for entering in information for later reference, such as circumstances or remarks concerning the unit settings and operations.

Color settings (Branch, Loop and Group units only)
Select the color to use for displaying the unit/group in the flowchart from the 10 available colors.

4 **Click [OK].**

► Note
You cannot display the properties menu for two or more units simultaneously.

Finding and displaying units based on their ID (Jump)

To find and go directly to a unit you want to edit, you can specify its ID or name to jump directly to it.

1 **Display the flowchart edit menu (Page 4-3).**

2 **Select [Jump].**

Fields that specify the unit to jump to are displayed at the bottom of the screen.



3 **Select the unit you want to jump to.**

First, select the method for finding a unit.

- **Unit ID**: Specify the ID of the unit to jump to.
- **Select Group**: Specify the name of the group to jump to.
- **Select Unit**: Select the unit to jump from a list.

4 **Select [Jump].**

The flowchart scrolls to the position of the specified unit and the unit is highlighted.

Reference

If the specified unit is in a collapsed group, between branch / join units, or in a loop, the view is automatically expanded to show that unit. If the specified unit is in a locked group, the group is not expanded.

Capture

The capture unit is used for configuring cameras and lighting options for capturing an image for inspection. When the CA-DC21E illumination expansion unit is installed, settings (intensity, pattern and strobe options) for connected lights can be configured as part of the flowchart program.

Image Capture Setup

In the capture unit, an image is captured by using one of up to four cameras connected to the controller. The image data is sent from the camera to the controller and assigned to a specified image variable.

► Note

If the cameras used in a capture unit are different from the cameras actually connected to the controller, a camera setting error will occur. No image capturing and subsequent image processing units will be processed. In such cases, set the camera correctly, or turn off the controller and connect the correct camera.

Reference

- The model and other information for the camera settings in a capture unit can be viewed in the [Camera Settings] menu (Page 4-23).
- The cameras for a capture unit are displayed in the [Camera Selection] menu when [Select Cameras] is selected in the [Camera Settings] menu. The cameras can be individually selected or set to the system settings based on the System Configuration menu (Page 7-8).

Main Menu

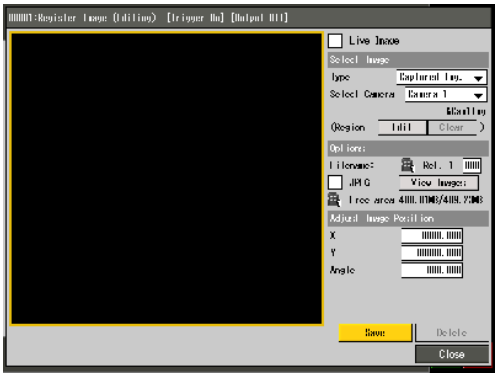
The capture unit menu has the following options. Change the settings as required.



Register Image (Page 4-18)	Register an image to be used as a template for settings.
Capture Opt. (Page 4-19)	Image capture options and settings.
Camera Set. (Page 4-23)	Camera(s) and settings used in image capture.
Trigger Settings (Page 4-25)	Trigger settings used in image capture.
Flash Settings (Page 4-27)	Light strobe settings used in image capture.
Light Intensity (Page 4-28)	Light intensity control when the CA-DC21E illumination expansion module is connected.
Light Config. (Page 4-29)	CA-DC21E illumination expansion module configuration.
Save (Page 4-30)	Save unit settings.

Register Image

An image can be saved to the controller to be used as a template for measurements and settings. It is recommended to adjust and fix lighting and other external influences before registering an image.



Live Image

Check this box to display live images through a continuous feed.

► Note

- A live feed is only available while the unit is being edited.
- This setting cannot be changed when the screen update mode is set to [Continuous] in the trigger settings (Page 4-25).
- If the capture on trigger input is disabled in the trigger settings (Page 4-25), this check box is always unchecked and the setting cannot be changed.
- When Live image is selected for a moving object, take care when registering as there will be a time lag between the external trigger input and the actual image capture.
- In principle, Live-image is only used when the capture unit being edited is being executed (waiting for a trigger input). When the image capture buffer is set to custom and the capture unit which was most recently executed is being edited, the images collected in the buffer will still be displayed even if the capture unit is not presently capturing images.
- Continuous update cannot be used when HDR capture (Page 4-21) is enabled or when a line scan camera is being used.
- When the HDR capture (Page 4-21) is enabled, the Multi-image cannot be used.

Select Image

Type

Select an image to register.

- **Captured Img.**: Displays the latest image from the specified camera (image variable).
- **Registered Img.**: The registered image specified in [Options] is displayed.

Select Camera

Select the number of the camera used for registration. Choose from Camera1 - Camera4, and select only the camera number used for the capture unit being edited.

Specifying a region

To register only part of an image, select [Edit] then specify the region to register. To cancel the selected region, select [Clear].

Save Image

Filename

Specify the registered image number used for image registration in the form "(Camera No.)-(User-specified No.)".

Reference

The name of the saved file is "ref (Camera No.)_(Specified No.)" (for full screen image registration) or "ref (Camera No.)_(Specified No.)_XXX_YYY" (for partial image registration).

JPEG

Check this box to save the image in JPEG format. When this box is not checked, the image will be saved in BMP format as either a 24-bit color bitmap image (when a color camera is used) or an 8-bit grayscale bitmap image (when a monochrome camera is used).

► Note

Using image compression may result in some image deterioration, thus results from a compressed image may differ to those when using non compressed images.

View All

View all registered images in a list.

Adjust Image Position

Adjust the position of the image being captured.

X

-Adjust the movement in the X (horizontal) direction between -8191.000 and 8191.000 pixels.

Y

-Adjust the movement in the Y (vertical) direction between -16383.000 and 16383.000 pixels.

Angle

Adjust the position angle (rotation) around the center of the image between -999.999° and 999.999°.

► Note

Position adjustment may cause missing peripheries (black areas) due to image movement or jagged edges (jaggies) due to rotation in the registered image.

Save

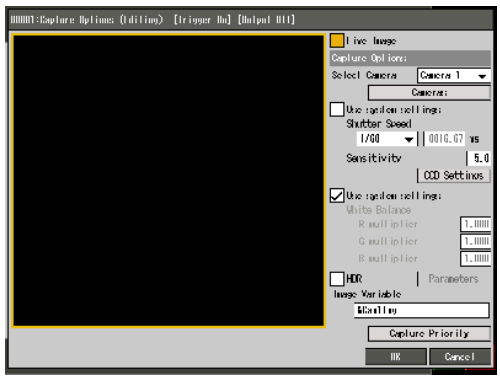
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Registered Img.] is selected for [Type], you can delete the registered image specified in [Options].

Capture Options

Specify the options for image capture.



The capture options unit allows for the adjustment image the quality by changing the cameras sensitivity and gain-adjustment. This functionality is useful when needing to optimize an images brightness and black / white saturation.

► Note

If the capture options are changed after color extraction the color extraction result for the current image may be different. Make sure to check and change the color settings if the capture options are changed.

Reference

The gain adjustment can be set separately for each camera as well as being set via the contrast conversion filter (Page 10-14) for each vision tool unit.

Live Image

Check this box to display live images through a continuous feed.

► Note

- A live feed is only available while the unit is being edited.
- This setting cannot be changed when the screen update mode is set to [Continuous] in the trigger settings (Page 4-25).
- If the capture on trigger input is disabled in the trigger settings (Page 4-25), this check box is always unchecked and the setting cannot be changed.
- When Live image is selected for a moving object, take care when registering as there will be a time lag between the external trigger input and the actual image capture.
- In principle, Live-image is only used when the capture unit being edited is being executed (waiting for a trigger input). When the image capture buffer is set to custom and the capture unit which was most recently executed is being edited, the images collected in the buffer will still be displayed even if the capture unit is not presently capturing images.
- Continuous update cannot be used when HDR capture (Page 4-21) is enabled or when a line scan camera is being used.
- When the HDR capture (Page 4-21) is enabled, the Multi-image cannot be used.

Capture Options

Select Camera

Select the camera used for setting the capture options.

Cameras

Specify a camera to be configured in this unit.

► Note

- Enabling a camera consumes image and processing memory.
- When this setting is changed, the processing of other operations will stop.

Use system settings

Use the values set in the system settings ([Camera Settings] of the System Configuration menu (Page 7-8)).

Shutter speed

Select or enter the shutter speed for the camera specified in [Select Camera]. Select the shutter speed according to the target movement speed and lighting conditions. Before using a fast shutter speed, make sure there is sufficient light to produce the desired image.

- Area camera: 0.05 - 9000 (ms)
- Line scan camera: 2 - 20000 (μs)

► Note

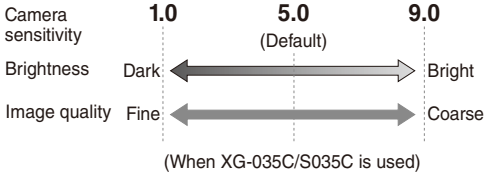
When using a fast shutter speed with a high intensity light, a smear effect (vertical streaks on the image) may occur. Allowing intense light to enter with the aperture wide open may also cause a smear affect.

Camera sensitivity

The sensitivity to light for the camera specified in [Select Camera] can be adjusted. Typically to adjust the brightness of an image the lens aperture, lighting and shutter speed are all adjusted accordingly. However, if none of these improve the brightness of the image the camera's sensitivity can be changed as well.

Reference

As the sensitivity is increased the overall brightness of the image increases, however noise elements in the image become more visible and the image appears coarser. When the cameras sensitivity is decreased the overall image darkens, the noise elements lessen and the image appears smoother.



► Note

If using a high-speed camera (XG-H035C/H035M/H100C/H100M/H200C/H200M/H500C/H500M), with the camera sensitivity set higher than default, a vertical line may appear on the screen. This phenomenon is a feature of the cameras design and not an error. If this occurs, set the camera sensitivity lower and adjust the external lighting.

Reference

The range of sensitivity adjustment for each camera type is different.

- XG-H035C/H035M/H100C/H100M/S200C/S200M/H200C/H200M/H500C/H500M/HL02M/HL04M/HL08M: 1.0 - 7.0
- Cameras other than the above: 1.0 - 9.0

CCD Settings

To adjust high or low intensity regions (gain adjustment) for the displayed image of the camera specified in [Select Camera], select [CCD Settings]. This option allows adjustment of the shift (offset) and span (range) for the CCD. For color cameras, these parameters can be set for RGB components individually.

Reference

The gain adjustment can be set for each vision unit through the [Contrast Conversion] filter ([Image Enhance]) (The shift and span for RGB are adjusted together and cannot be adjusted individually). To adjust the gain for each vision unit, select the [Contrast Conversion] filter in [Image Enhance], and then select [Detail].

1 **Select [CCD Settings].**

The [(Camera No.) CCD Settings] menu appears.

2 **When setting RGB individually, select [SEL], and then select the color (R, G, or B).**

The graph on the screen will be displayed for the selected color.

► Note

This setting cannot be changed when the [Use system settings] is checked.

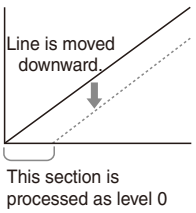
Reference

To adjust all RGB elements together, select [ALL]. When the selection state is set to [ALL], any previous individual settings are set to the same as the setting values for the R component.

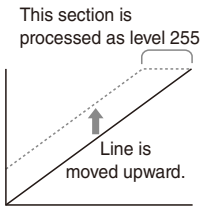
3 **Select [Shift], and then specify the shift (offset) level for the entire digital signal.**

The range of values that can be specified are -255 to +255 (default: 0).

- **To darken the image:** Use a negative value to move the entire line downward. The range below the minimum value on the Y-axis is processed as 0 (black).



- **To lighten the image:** Use a positive value to move the entire line upward. The range above the maximum value on the Y-axis is processed as 255 (white).

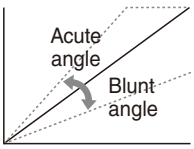


Reference

Shift can also be used to set all bright or dark parts above/below certain values to either 255 or 0.

4 **Specify a value for [Span (All)], and then specify the degree of adjustment for the contrast level.**

The setting range is from 0.0 to 7.9 (default 1.0).



- **To increase the contrast in an image**: Increase the value so there is a greater rate of change.
- **To decrease the contrast in an image**: Decrease the value so there is a lesser rate of change.

► Note

- This setting cannot be changed when the [Use system settings] is checked.
- In the same way as shift [Shift] in step 3, the range below the minimum value on the Y-axis is processed as 0 (black), and the range above the maximum value is processed as 255 (white).

5 **To finish settings, click [OK].**

Reference

If [Divide Graph] is checked, it is possible to set an individual contrast span for each of the 16 shades of the graph. Select a level of shading at [Span (Division)] and specify the span value.

White balance

Adjustment of the white balance of the camera specified in [Select Camera]. When a color camera is used, you can adjust the color balance to reproduce an exact white by correlating the illumination of the environment to a reference.

- **R multiplier**: Specify the correction multiplier for the R component.
- **G multiplier**: Specify the correction multiplier for the G component.
- **B multiplier**: Specify the correction multiplier for the B component.

► Note

- This setting cannot be changed when the [Use system settings] is checked.
- The color extraction result may change due to changes in the white balance setting. Be sure to verify the operation after changing the white balance setting.

HDR capture

This allows an image with a broader dynamic range to be captured by capturing multiple images with exposure and other settings changed (HDR capture). Check the box to use HDR capture. The use of HDR capture can provide an image which is suitable for processing even when there is uneven glare, mixed bright and dark spots, or other issues with the target.

When [Parameters] is selected, the HDR settings menu appears, and the HDR capture settings can be changed.

- **Disabling HDR temporarily**: HDR capture is disabled and ordinary capture is performed when this box is checked.
- **White Saturation Correction Level**: Set the level of whiteout prevention for HDF capture. A higher level increases the number of captures.
- **Black Saturation Correction Level**: Set the level of black saturation prevention for HDF capture. A higher level increases the number of captures.
- **Captures**: Select the number of captures in order to prioritize either image quality or speed.
  - **Auto (Speed Priority)**: The number of captures is set to prioritize speed.
  - **Auto (Quality Priority)**: The number of captures is set to prioritize image quality.
- **Brightness**: Adjust the brightness within the range of 0 (dark) to 100 (bright) (default 50).
- **Contrast**: Adjust the brightness within the range of 0 (low) to 100 (high) (default 50).

► Note

- Because HDR capture performs multiple captures, it will not be possible to capture images correctly if the target is moving.
- HDR capture cannot be used at the same time as the image capture buffer.
- HDR capture cannot be used at the same time as multiple cameras.
- HDR caputure set here can be used with the XG VisionEditor and controllers for the XG-7000 Series version 4.1.0010 or later and XG-8000 Series version 5.0.0010 or later. It is disabled when used with earlier versions. When the setting file is overwritten with the XG VisionEditor and controllers for the earlier version of XG-8000 Series version 5.0.0010, the settings for HDR capture are cleared.

Capture to an image variable used for processing

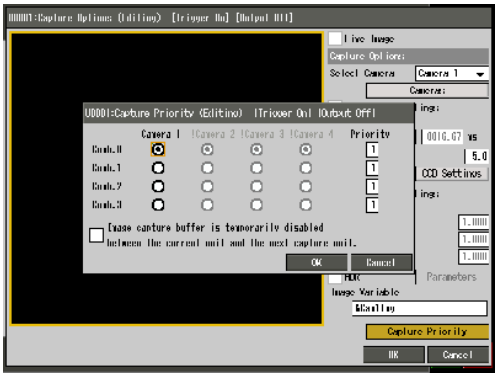
Specify an image variable which will contain the image captured with the camera selected in [Select Camera].

► Note

- The image variable may need to be added in advance in the [Variables] menu (Page 4-348).
- When this setting is changed, the processing of other operations will stop. All image variables, archived data, the output buffer, and defect type results are cleared.

Capture Priority

This option controls the priority of the capture unit completion based on when a camera is triggered. Normally, the capture unit is complete when the trigger inputs for all effective cameras are received. It is possible to move to the next unit when the trigger input(s) of the specified camera(s) combination is received.



Comb 0 to 3

Set up to 4 combinations to complete the capture unit. When all trigger inputs for the specified cameras are received, the process moves to the next unit.

Reference

- You can only specify the combination for set cameras enabled in [Cameras] (Page 4-20).
- The combination for which the unit is completed is stored as 0 to 3 in unit result data [Status] (RSLT.STAT).

Priority

Specify the priority (from 1 to 4) for when more than one condition is met simultaneously. When the same priority is assigned, the condition met earliest is processed.

Disabling the image capture buffer between capture units

When the image capture buffer is set to custom (Page 4-358), checking this option disables all image capture buffer operations until the next capture unit is started. Use this option when there are several capture units with different settings in the flowchart and you want to start image capture after change in conditions for the next unit have been completed.

► Note

When this setting is changed, the processing of other operations will stop temporarily.

Reference

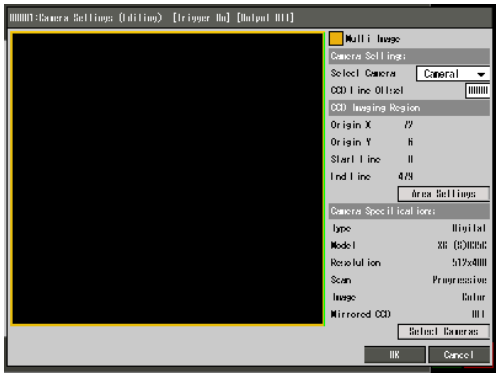
[Camera Settings] and [Trigger Setting] are displayed only when a line scan camera is used (when trigger 1 or trigger 2 is set for the line scan camera). For details about the setting of each item, see "CCD Imaging Region" (Page 4-23) and "Trigger Settings" (Page 7-17).

Camera Settings

Specify the settings of the camera used for image capture.

► Note

The settings in [Camera Settings] other than [CCD Line Offset] are applied to all capture units in the same program.



Live Image

Check this box to display live images through a continuous feed.

► Note

- A live feed is only available while the unit is being edited.
- This setting cannot be changed when the screen update mode is set to [Continuous] in the trigger settings (Page 4-25).
- If the capture on trigger input is disabled in the trigger settings (Page 4-25), this check box is always unchecked and the setting cannot be changed.
- When Live image is selected for a moving object, take care when registering as there will be a time lag between the external trigger input and the actual image capture.
- In principle, Live-image is only used when the capture unit being edited is being executed (waiting for a trigger input). When the image capture buffer is set to custom and the capture unit which was most recently executed is being edited, the images collected in the buffer will still be displayed even if the capture unit is not presently capturing images.
- Continuous update cannot be used when HDR capture (Page 4-21) is enabled or when a line scan camera is being used.
- When the HDR capture (Page 4-21) is enabled, the Multi-image cannot be used.

Camera Settings

Select Camera

Select the camera to change the settings for.

CCD Line Offset (area cameras only)

Set the offset for the pixel row / CCD line in the CCD imaging region. The range of values available are from 0 (default) to (Maximum pixel row / CCD line of the camera - specified end line).

Reference

When the pixel row / CCD line offset is set, the pixel row / line positions following the offset are shown in blue next to the [Start Line] and [End Line].

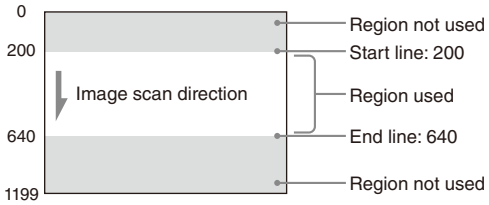
► Note

When the offset value is changed, the processing time for the capture unit is extended due to the changes being applied.

CCD Imaging Region

The current CCD imaging region for the camera is displayed.

Example: CCD imaging region is set to "Start Line: 200, End Line: 640" when an area camera is used



CCD Imaging Region

Set the CCD imaging region.

- **Origin X**: Specify the X coordinate of the origin (upper left) of the region.
- **Origin Y**: Specify the Y coordinate of the origin (upper left) of the region.
- **Start Line**: Specify the start line of the region.
- **End Line**: Specify the end line of the region.
- **Number of Lines** (line scan cameras only): Set the number of lines for an image.
- **Overlapping Lines** (line scan cameras only) (when continuous capture is selected): Set the number of lines to overlap. [Number of Lines] must be an exact multiple of the [Number of Overlapping Lines].

► Note

- When a CCD imaging region is set, ordinary capture is performed even if HDR capture is enabled.
- While a CCD imaging region is being set, ordinary capture is performed even if HDR is enabled.
- Image processing will not occur for units whose regions do not lie between the start and end lines.
- The area around the edge of the captured image may appear dark when a lens with an image size smaller than the CCD is used.
- The CCD setting is common for all capture units.
- While the CCD imaging region is being set, the processing of other operations stops, and all image variables, archived data, and the output buffer are cleared.
- Only cameras which support interlaced scanning can capture even lines.

Mirror image

Select whether to perform mirror inversion or rotation of the image for the camera selected in [Select Camera].

- **OFF** (default): Do not mirror the image.
- **Horizontal**: Mirror the image horizontially.
- **Vertical**: Mirror the image vertically.
- **180°Rotate**: Rotate the image by 180°.

► Note

[Vertical] and [180° Rotate] cannot be selected with a line scan camera.

System Settings

Obtain the CCD imaging region and mirrored CCD settings from the system settings.

Camera Specifications

Information for the camera being used is displayed.

Model

Select the model of the camera. If [Auto] is selected, [Type] and [Number of Pixels] are set automatically.

► Note

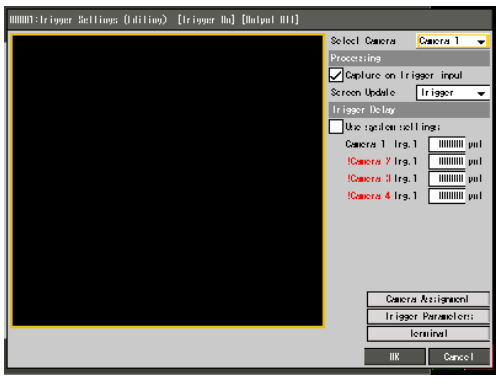
- If the cameras used in a capture unit are different from the cameras actually connected to the controller, a camera setting error will occur. No image capturing and subsequent image processing units will be processed. In such cases, set the camera correctly, or turn off the controller and connect the correct camera.
- For details on the CCD types used in your camera, refer to the instruction manual provided with the camera.
- When the model or resolution is changed, operation stops, and all image variables, archived data, the output buffer, and defect type results are cleared.
- When a XG-HL02M/HL04M/HL08M is connected, [Fixed] or [Continuous] can be selected.

Reference

When set to [Continuous], measurement data can adjusted based on encoder values via the EC (encoder calculation) parameter.

Trigger setting

Specify the settings for the image capture trigger operations.



Select Camera

Select the camera to change the settings for.

Trigger setting

Capture on trigger input

Select whether to wait for a trigger signal input for the capture unit. When the checkmark is removed, all preset cameras will capture images according to the capture unit operation, regardless of their independent trigger signals. This is the case when the image capture buffer is set to custom (Page 4-358) and the buffer is empty when the capture unit execution starts. But if there are any images in the buffer which satisfy the image capture settings, the capture unit will process and the next unit is executed regardless of this setting.

► Note

When this setting is changed, the processing of other operations will stop temporarily.

Screen Update

Select whether to update the screen image continuously while waiting for a trigger signal.

- **Trigger**: Update the image only when a trigger input is received.
- **Continuous**: Always display the latest image while waiting for a trigger signal.

► Note

- When [Continuous] is selected, there will be a time lag of up to "Shutter speed + Image capture time" between the trigger input and the actual image capture.
- When [Continuous] is selected, the image will not update if the flowchart operation is in an alternative state other than waiting for trigger signals.
- When the HDR capture (Page 4-21) is enabled, the Multi-image cannot be used.

Trigger Delay

To set a time delay between the selected trigger input and capturing of an image, specify a trigger delay time. The trigger delay can be set from 0 - 999 ms for each camera.

► Note

- This setting cannot be changed when the [Use system settings] is checked.
- If the trigger delay is set to a value other than 0 ms, the variance in time between the trigger input and image capture may vary from 0 to 200µs of the expected capture time. Refer to the XG VisionEditor Reference Manual (Control/Data Edition) for more details.

Use system settings

Use the values set in the system settings ([Camera Settings] of the System Configuration menu (Page 7-8)).

Terminal

The trigger information assigned to the capture unit is displayed.

Camera Assignment

Select the trigger input to be used for Camera 1 to 4 individually.

► Note

When this setting is changed, the processing of other operations will stop temporarily.

Trigger Options

Select the type of trigger to be used.

- **External** (default): Capture images in response to trigger inputs from the handheld controller or trigger signals sent from an external device. The capture is performed only once for each trigger input.
  To use an external trigger, select and check the type of trigger to be used for image capture.
  - **Terminal**: Trigger input through the external terminal input assigned with %Trg1 through to 4
  - **Handheld Controller**: Trigger input provided by the No. 3 (TRIGGER) button on the handheld controller
  - **RS-232C**: Trigger input though the commands from RS232C
  - **Ethernet**: Trigger input though the commands from the Ethernet
  - **PLC-Link**: Trigger input though the commands from RS232C or the Ethernet PLC Link
  - **CC-Link**: Trigger input through the bit devices or commands from the CC-Link
  - **EtherNet/IP**: Trigger input though the cyclic communication, message communication, or commands from the EtherNet/IP
  - **PC Program**: Trigger input through the control method from ActiveX
- **Internal**: Capture images in response to trigger signals that are generated periodically at specified intervals. By generating internal trigger signals during operation, it is possible to capture images repeatedly without receiving trigger inputs. To use the internal trigger, set the trigger interval time between 1 and 999 ms.

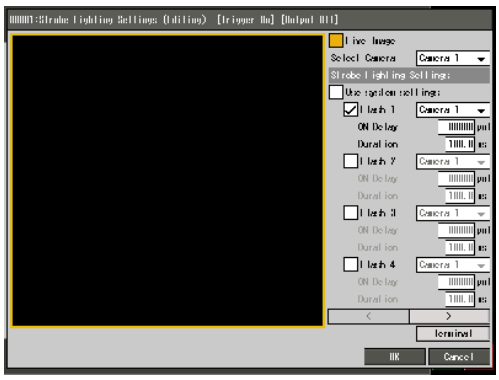
Reference

When the internal trigger is selected, trigger signals are continuously generated during Run mode operation. To stop the trigger signal generation temporarily from an external device, disable trigger acceptance by using any of the following methods. When trigger acceptance is disabled, the output of the result data up to that period continues.

- Disable acceptance by using a terminal block input (EXT terminal) (Page 8-23)
- Sending the communication command (TE,0 command): See XG VisionEditor Reference Manual (Control/Data Edition) for more details.
- When this setting is changed, the processing of other operations will stop temporarily.
- These setting items are the same for all capture units in the flowchart.

Strobe Settings

Specify the settings for strobe control of lights for image capture.



When the CA-DC21E illumination expansion unit is connected, the specified settings are applied to the illumination expansion unit through the FLASH (strobe) signals.

Live Image

Check this box to display live images through a continuous feed.

► Note

- A live feed is only available while the unit is being edited.
- This setting cannot be changed when the screen update mode is set to [Continuous] in the trigger settings (Page 4-25).
- If the capture on trigger input is disabled in the trigger settings (Page 4-25), this check box is always unchecked and the setting cannot be changed.
- When Live image is selected for a moving object, take care when registering as there will be a time lag between the external trigger input and the actual image capture.
- In principle, Live-image is only used when the capture unit being edited is being executed (waiting for a trigger input). When the image capture buffer is set to custom and the capture unit which was most recently executed is being edited, the images collected in the buffer will still be displayed even if the capture unit is not presently capturing images.
- Continuous update cannot be used when HDR capture (Page 4-21) is enabled or when a line scan camera is being used.
- When the HDR capture (Page 4-21) is enabled, the Multi-image cannot be used.

Select Camera

Select the camera to change the settings for.

Lighting Settings

Use system settings

Use the values set in the system settings ([Camera Settings] of the System Configuration menu (Page 7-8)).

Flash1

Check this box and then select the camera associated with the Flash 1 signal, specifying the ON-delay and duration.

- **ON-Delay**: Set the Flash 1 signal output start duration in the range from -500 to 500 (µs), based on the image capture start time being 0 (default value: 0 µs = Same time as image capture start). (If [Encoder] is set for [Method], the range is -32767 to 32767 pulses.) If a negative value is specified, output starts before the CCD opens. If a positive value is specified, output starts after the CCD opens.
- **Duration**: Set the Flash 1 signal output time within the range 0.1 to 999.9 (ms).

Flash 2 through 8

Specify the settings for Flash 2 through Flash 8 in the same way as those for Flash 1.

► Note

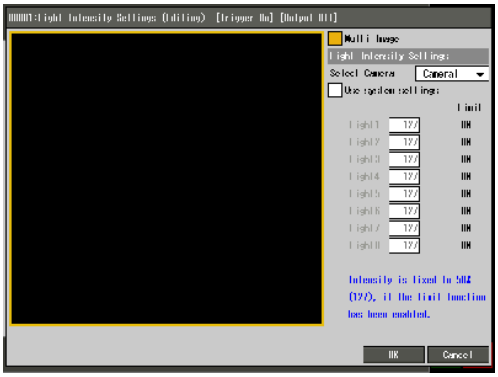
- This setting cannot be changed when the [Use system settings] is checked.
- To assign multiple flash terminals (strobe lights) to a single camera, specify the settings so that the delay in the output start points between the terminals is 500 µs or less.

Terminal

Selecting [Terminal] displays the assignment of the Flash output terminals.

Light intensity

Set the illumination light intensity settings when the optional CA-DC21E illumination expansion module is connected to the controller.



Use this in conjunction with the shutter speed setting to correctly illuminate images.

Live Image

Check this box to display live images through a continuous feed.

► Note

- A live feed is only available while the unit is being edited.
- This setting cannot be changed when the screen update mode is set to [Continuous] in the trigger settings (Page 4-25).
- If the capture on trigger input is disabled in the trigger settings (Page 4-25), this check box is always unchecked and the setting cannot be changed.
- When Live image is selected for a moving object, take care when registering as there will be a time lag between the external trigger input and the actual image capture.
- In principle, Live-image is only used when the capture unit being edited is being executed (waiting for a trigger input). When the image capture buffer is set to custom and the capture unit which was most recently executed is being edited, the images collected in the buffer will still be displayed even if the capture unit is not presently capturing images.
- Continuous update cannot be used when HDR capture (Page 4-21) is enabled or when a line scan camera is being used.
- When the HDR capture (Page 4-21) is enabled, the Multi-image cannot be used.

Light Intensity Settings

Select Camera

Select the connected camera (1 - 4) to change the settings for.

Use system settings

Use the values set in the system settings ([Camera Settings] of the System Configuration menu (Page 7-8)).

Light1 to 8

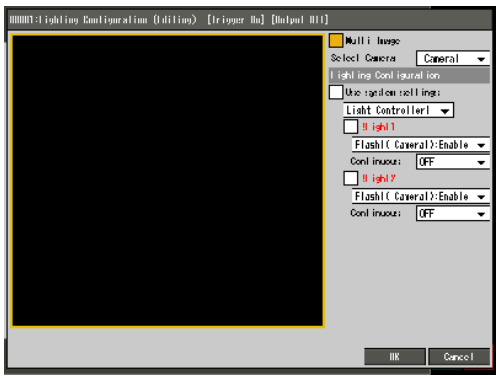
The intensity of each light can be set in the range 0 to 255 (default 127). The light numbers correspond to the connection order of the lighting controllers CA-DC21E's.

► Note

- This setting cannot be changed when the [Use system settings] is checked.
- The intensity can only be changed for lights which have been enabled in the [Light Configuration] menu (Page 4-29).
- The intensity of continuous lighting can be changed regardless of the camera selection. If a flash terminal output has been assigned to the light, the intensity can only be changed when the selected camera is the camera that is used with the flash terminal output.
- When the output limit is [ON], the upper limit is set to 127. (Even when 128 or a higher value is entered the intensity remains at 127.)
- When the output limit is [OFF] and the intensity is set to 128 or higher, be careful not to damage the terminal through excessive heat generation.

Light Configuration

Adjust the configuration for each light when the optional CA-DC21E illumination expansion unit is connected to the controller.



Change settings and assignments of flash terminals for controlling the lights connected to the lighting controllers. The FLASH system variables enable the control of lighting without the need for external wiring.

Live Image

Check this box to display live images through a continuous feed.

► Note

- A live feed is only available while the unit is being edited.
- This setting cannot be changed when the screen update mode is set to [Continuous] in the trigger settings (Page 4-25).
- If the capture on trigger input is disabled in the trigger settings (Page 4-25), this check box is always unchecked and the setting cannot be changed.
- When Live image is selected for a moving object, take care when registering as there will be a time lag between the external trigger input and the actual image capture.
- In principle, Live-image is only used when the capture unit being edited is being executed (waiting for a trigger input). When the image capture buffer is set to custom and the capture unit which was most recently executed is being edited, the images collected in the buffer will still be displayed even if the capture unit is not presently capturing images.
- Continuous update cannot be used when HDR capture (Page 4-21) is enabled or when a line scan camera is being used.
- When the HDR capture (Page 4-21) is enabled, the Multi-image cannot be used.

Select Camera

Select the camera to change the settings for.

Lighting Configuration

Choose the light controller module connected to the controller with the lights needing to be configured.

Reference

- When multiple lighting controllers are connected, they will be numbered 1 through 4, with 1 being the unit closest to the controller.
- When the illumination expansion module is invalid, such as when it is turned off, the corresponding number is shown in red.

Use system settings

Use the values set in the system settings ([Camera Settings] of the System Configuration menu (Page 7-8)).

Light 1

Check the box next to the light 1 to enable its operation and configure its flash terminal settings

- **Flash 1 to 8**: Specify the flash signal used for controlling light 1 from Flash 1 through 8. The light will illuminate according to the output status of the assigned Flash signal associated with the camera set in the strobe settings.
- **Continuous**: Set to [ON] to keep the light illuminated regardless of the flash terminal output.

► Note

- This setting cannot be changed when the [Use system settings] is checked.
- Flash signals are disabled and the light will not illuminate if the %Flash1 to 8 that is selected as the flash signal is not assigned to an output terminal in the system configuration options or the terminal is not checked in [Strobe Settings] when none of %Flash1-8 are assigned to an output terminal, the flash signal will still be enabled even if %Flash* is not assigned to an output terminal.
- Flash assignments cannot be configured when continuous lighting is set to [ON].

Light 2 to 8

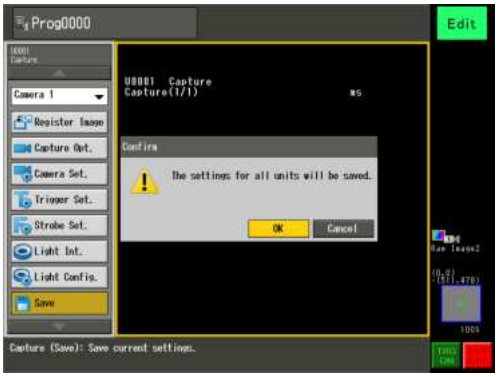
Specify the settings of Light 2 through 8 in the same way as those for Light 1.

Save

Save the current unit changes the program file.

► Note

- If the device is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the system power while you are saving the settings. Doing so may cause errors in the internal data



Save

The settings for the unit are saved in the current program file in SD Card 1 or SD Card 2.

► Note

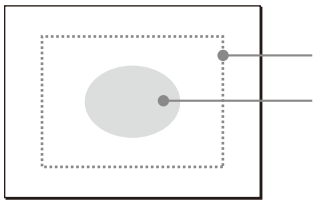
Items specified not to be saved in XG VisionEditor are excluded from the saving operation.
For example, variable values changed in the current program or the default display, and display parts, can be excluded when saving.

Area

Area Tool

Converts the captured image into binary data (black-and-white pixels) and measures (counts the number of pixels) of either the white or black area.

Image processing



Processing results

The standard results and data returned by the area tool are as follows:

Area	Outputs the number of pixels. Tolerance inspection target
Unit judgment value	Outputs the binary result of the unit based on the measured value and the specified tolerance range (upper / lower limits). The unit is judged as [NG] (binary 1) when outside the tolerance range and [OK] (binary 0) when inside.

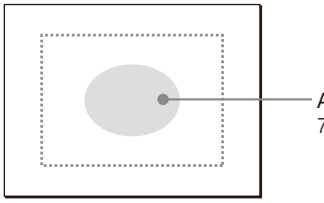
Reference

For the lists of available measurement output values and setting parameters, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

Example

Example showing the results of an area inspection performed under the following conditions:

- Detect color: Black



Main Menu

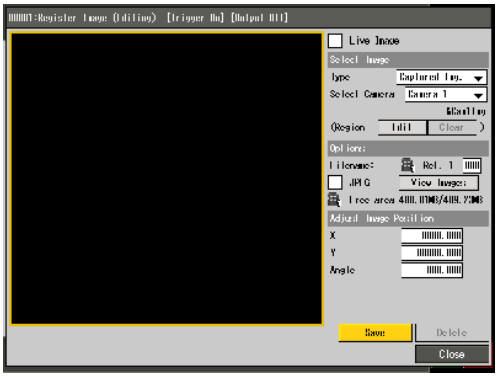
The main menu of the area tool consists of the following options. Configure settings under each option as required for the inspection.



Register Image (Page 4-32)	Register an image to be used as a template for settings.
Select Image (Page 4-33)	Specify the image to be used for unit processing.
Inspect Region (Page 4-34)	Define the region to be used for unit processing.
Color (Page 4-35)	Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).
Image Enhance (Page 4-36)	Settings for pre-processing image filters.
Condition (Page 4-36)	Specific conditions for processing an area inspection.
Parameters (Page 4-37)	Additional optional parameters.
Limits (Page 4-38)	Unit pass / fail tolerances.
Display Options (Page 4-38)	Unit processing display settings.
Save (Page 4-39)	Save unit settings.

Register Image

An image can be saved to the controller to be used as a template for measurements and settings. It is recommended to adjust and fix lighting and other external influences before registering an image.



Live Image

Check this box to display live images through a continuous feed.

► Note

- A live feed is only available while the unit is being edited.
- This setting cannot be changed when the screen update mode is set to [Continuous] in the trigger settings (Page 4-25).
- If the capture on trigger input is disabled in the trigger settings (Page 4-25), this check box is always unchecked and the setting cannot be changed.
- When Live image is selected for a moving object, take care when registering as there will be a time lag between the external trigger input and the actual image capture.
- In principle, Live-image is only used when the capture unit being edited is being executed (waiting for a trigger input). When the image capture buffer is set to custom and the capture unit which was most recently executed is being edited, the images collected in the buffer will still be displayed even if the capture unit is not presently capturing images.
- Continuous update cannot be used when HDR capture (Page 4-21) is enabled or when a line scan camera is being used.
- When the HDR capture (Page 4-21) is enabled, the Multi-image cannot be used.

Select Image

Type

Select an image to register.

- **Captured Img.**: Displays the latest image from the specified camera (image variable).
- **Registered Img.**: The registered image specified in [Options] is displayed.

Select Camera

Select the number of the camera used for registration. Choose from Camera1 - Camera4, and select only the camera number used for the capture unit being edited.

Specifying a region

To register only part of an image, select [Edit] then specify the region to register. To cancel the selected region, select [Clear].

Save Image

Filename

Specify the registered image number used for image registration in the form "(Camera No.)-(User-specified No.)".

Reference

The name of the saved file is "ref (Camera No.)_(Specified No.)" (for full screen image registration) or "ref (Camera No.)_(Specified No.)_XXX_YYY" (for partial image registration).

JPEG

Check this box to save the image in JPEG format. When this box is not checked, the image will be saved in BMP format as either a 24-bit color bitmap image (when a color camera is used) or an 8-bit grayscale bitmap image (when a monochrome camera is used).

► Note

Using image compression may result in some image deterioration, thus results from a compressed image may differ to those when using non compressed images.

View All

View all registered images in a list.

Adjust Image Position

Adjust the position of the image being captured.

X

-Adjust the movement in the X (horizontal) direction between -8191.000 and 8191.000 pixels.

Y

-Adjust the movement in the Y (vertical) direction between -16383.000 and 16383.000 pixels.

Angle

Adjust the position angle (rotation) around the center of the image between -999.999° and 999.999°.

► Note

Position adjustment may cause missing peripheries (black areas) due to image movement or jagged edges (jaggies) due to rotation in the registered image.

Save

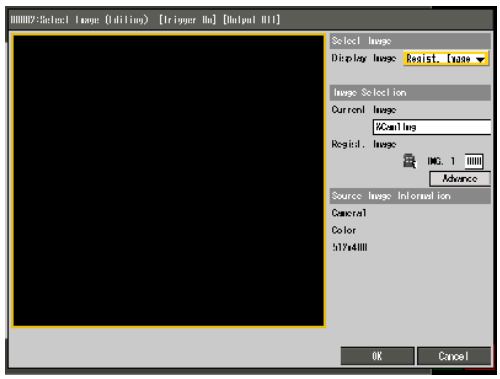
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Registered Img.] is selected for [Type], you can delete the registered image specified in [Options].

Select Image

Specify the image variable and associated registered image to be used for configuring the vision tool.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured Image**: Displays the latest image from the specified camera (image variable).
- **Registered Image**: The registered image specified under [Image Selection] is displayed.

Select image

Captured Img.

Set an image variable to be used as a current image for the unit.

Registered Img.

Specify the registered image No. for the registered image to be used.

- The registered images are managed as "Image (Camera No.) - (Registered image No.0 to 999)".
- The "Camera No" is fixed to the number of the camera associated to the image variable specified for the current image.

Advance

Set advance options for the switching of registered images as necessary.

- **Use numerical variable for registered image number**: To use a variable for the registered image No., check this box and assign a numerical or numerical array variable reference. By using a variable for the registered image No. and then issuing a variable reference value apply command (NU), the image is switched to the specified registered image in the variable and the reference image information is updated. For more details, see the XG-7000 Series Communication Control Manual.
- **Process variable when changing programs**: Use this option to switch to the registered image based on the initial value of the variable referenced when the program is changed or the controller is next turned on.

► Note

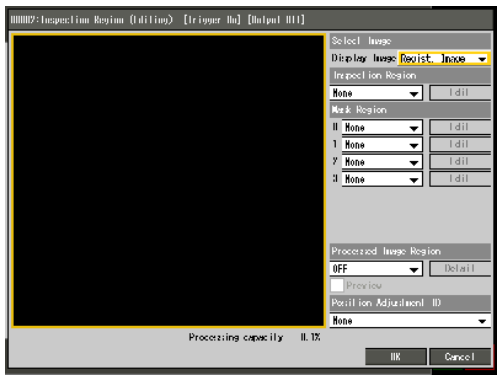
Note that the registered image No. does not switch in accordance with a change in the variable.

Source Image Information

The camera No., type (color / monochrome), and resolution of the camera associated to the image variable specified is displayed.

Inspection Region

Outline the region on the captured image to be used for inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured Image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Inspection region

Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Inspection Region Menu" (Page 3-20) for more details.

Mask region

A mask region is an area which can be defined in the inspection region and will be excluded from the inspection. Up to four mask regions can be set per inspection region. A mask region is typically used for hiding an area that does not require inspection.

Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Excluding Part of the Region" (Page 3-26) for more details.

Reference

If a complex region needs to be defined and cannot be achieved with a single inspection region and masks, draw an inspection region as a composition region (Page 3-25).

Processed image region

Use processed image region to generate a region for inspection based on an image. (Page 4-295), select [ON] and then select [Detail] for configuration.

Reference

Refer to "Generating a Region from an Image" (Page 3-27) for more details on processed image region.

Image

Specify the image variable to be used for generating the region.

Area

Specify the area and border color for the region based on the image specified in the image variable. Select either [Black] (Level 0) or [White] (Level 255, default).

Preview

Use this checkbox to display the specified image. When the checkmark is removed, the display returns to its normal state.

Position Adjustment ID

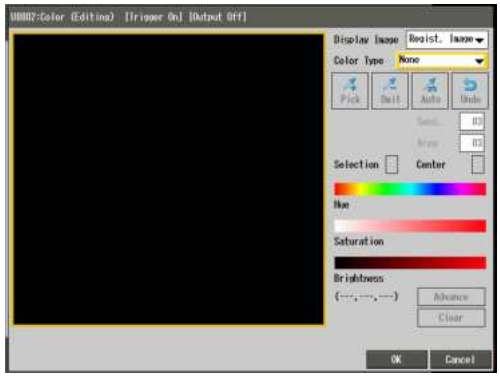
To use position adjustment for the region, select the position adjustment unit to be referenced.

Reference

The position adjustment is applied to all inspection, mask, and image regions.

Color

When working with a color camera, convert the captured color image into a binary (black and white) or a grayscale converted image by extracting the desired color.



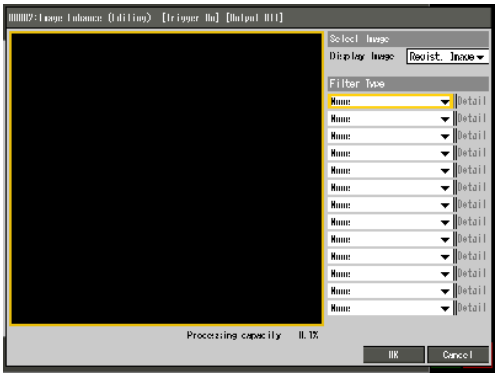
Note

This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-295) is referenced as the current image.

Refer to "Working with Color Images (Color Extraction)" (Page 10-2) for concepts involving color extraction and its operation.

Image Enhance

Specify the filter processing to apply to the image.
When a color camera is used, the filter is applied to the images converted using color extraction.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Filter type

Select the [Filter Type] field and then select the filter to apply. To perform area measurement using a method other than color to binary, you must select the [Binary] filter as the last filter. See "Image Enhancement Filters" (Page 10-11) for more details of each filter processing.

► Note

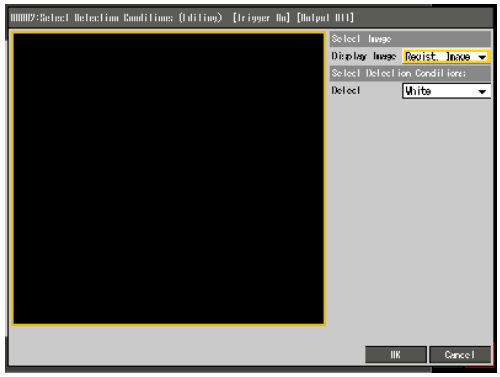
- For the area tool, [Binary] must be selected unless color to binary is used in the color extraction settings.
- If the binary filter is not selected or another filter is applied after the binary filter, the measurement result may not be correct.
- The binary, subtract and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 13 types of filters can be stacked according to application requirements. When multiple filters are set, they are processed one by one from the top.
- The order of the filters can be changed by selecting a filter in one of the [Filter Type] fields, holding down the No.1 (FUNCTION) button of the handheld controller, and then moving the 8-way key up or down.

Conditions

Specify the conditions for performing an area measurement.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Detection Conditions

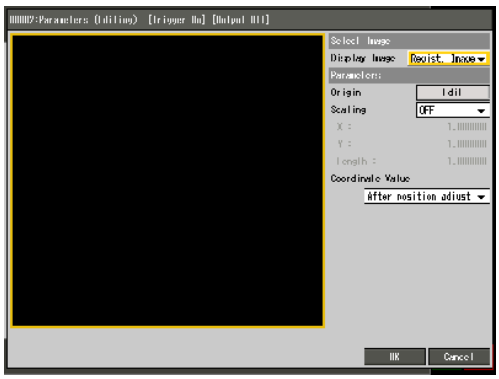
Detect

Specify the color of pixels (black/white) to be detected in the binary (monochrome) image.

- **White**: The number of white pixels are counted.
- **Black**: The number of black pixels are counted.

Parameters

Specify additional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Parameters

Origin

By default, the origin is set to the top left corner of the camera but its location can be moved as required. To specify the origin, select [Edit] and then specify the coordinates.

Reference

The origin can be set outside the process region. The available range for the origin is -9600 to 9600 (X), -7200 to 7200 (Y).

Scaling

The controller processes image data in pixels, The result data and setting parameters used for display, judgement and calculations can be converted and scaled to real life values and dimensions by using the pre-set scaling factor option.

- **OFF**: Do not use scaling.
- **ON**: Use scaling.

Reference

- The scaling factor can be changed from the [Option] menu of the Flowchart (Page 4-356).
- For a summary list of the result data for which scaling can be used, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

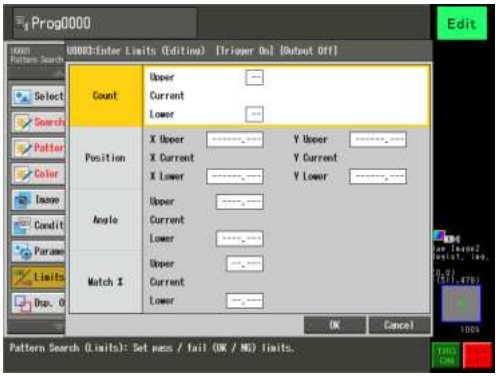
Coordinate value

Select the coordinate system to be used after position adjustment. If position adjustment is not used, this setting will have no effect on the measurement.

- **After position adjust**: The inspection uses the adjusted coordinate axes determined after position adjustment.
- **Before position adjust**: The distance from the position specified for the [Origin] of the inspection is used.

Limits

Set Pass / fail tolerances (upper and lower limits) for the inspection.
If the result is outside of the specified tolerance range, it is judged as [NG] (binary 1). If the result is within the tolerance range, it is judged as [OK] (binary 0).



Use [Direct Input] to enter a value and set the tolerance.

Reference

- [-----] indicates an empty state where no tolerance is set. In this state, no judgment will be performed on the measurement.
- To reset the tolerance setting to an empty state, select [Clear].

Area

Specify the tolerance for the inspected area.
The unit of measurement is the [Number of Pixels] of the measurement area (0 to 99999999).

Display Options

The display color of the units visual indicators can be changed based on the judgment result for that unit. The visual indicator can also be made transparent by selecting [Setting] - [Select Color] - [None].



Inspection region

Specify the line width and display color of the inspection region.

Mask region

Specify the line width and display color of the mask region.

Processing Priority

Specify the processing priority when displaying large processed images during Run mode.
When a line scan camera is used with the XG-7502A, it is not possible to display the processed image if the image size exceeds 25 MB (26214400 pixels). In such a case it is possible to display the filtered image and contrast image by using a display image variable.

Filtered image

Select whether or not to use a display image variable for the filtered image display.

- **Unit Processing**: Processes the filtered image without using the display image variable.
- **Image Display**: Processes the filtered image using a display image variable.

Reference

- When processing images 25 MB or less, or when using the XG-7702A, it is not necessary to select [Image Display].
- When processing an image larger than 25 MB, if the area displayed is 8 MB (8388608 pixels) or less, the filtered image will be automatically displayed when [Unit Priority] is selected. (However the following processes are excluded.)
  - Image enhancement: Shading correction, blob filter
  - Conversion (image operation): Rotate/translate, zoom, trapezoid correction, blob filter
  - Defect, Grayscale Blob: Contrast display

► Note

When [Image Display] is selected for [Filtered Image], the following restrictions on operation occur.

- Processing time increases.
- The background outside the inspection region becomes a black image.
- Displaying of multiple units is not possible.
- For display of registered images outside of unit edit, the filtered image cannot be displayed and the display is the same as when [Unit Processing] is set.
- When an archived image is displayed, it ix not possible to display the processed image unless the display image variable and results are also stored in the archive.

Image variable

Specify a display image variable for displaying the filtered image.

Reset

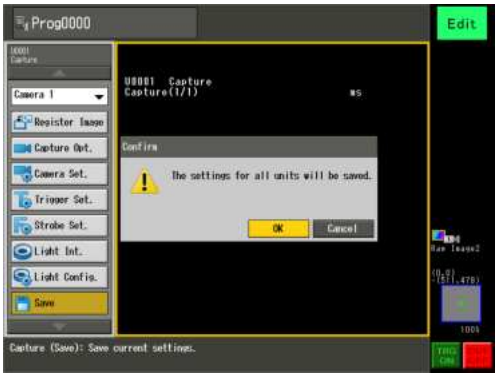
Returns the display options to their defaults.

Save

Save the current unit changes the program file.

► Note

- If the device is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the system power while you are saving the settings. Doing so may cause errors in the internal data



Save

The settings for the unit are saved in the current program file in SD Card 1 or SD Card 2.

► Note

Items specified not to be saved in XG VisionEditor are excluded from the saving operation.
For example, variable values changed in the current program or the default display, and display parts, can be excluded when saving.

Pattern search

Pattern Search Tool

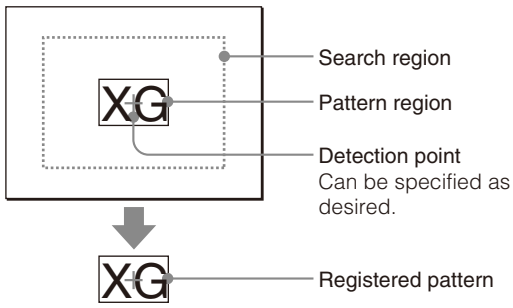
A particular shape or pattern from a registered image can be stored and compared to the current image. From this comparison, the position, angle, and correlation value can be calculated and output.

► Note

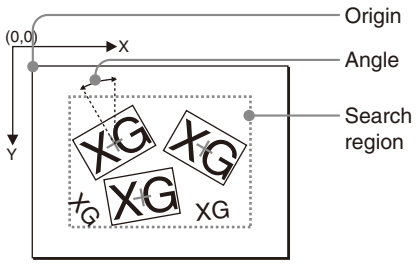
The size of the pattern region may be limited by the remaining program memory. The program memory is shared by all units in one program. When processing multiple units which use the program memory, you need to limit the total memory usage to less than that of the program memory. In the pattern search, the pattern region consumes the majority of program memory. Once [Processing capacity] (displayed during region setting) has reached 100%, no more pattern regions can be set.

Image processing

Teaching a pattern



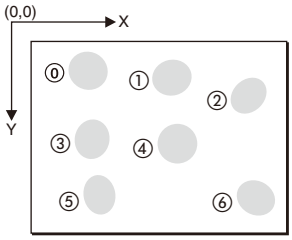
During operation



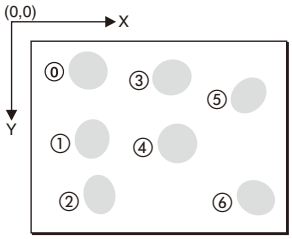
Ordering detected patterns

There are 10 ways the patterns can be ordered.

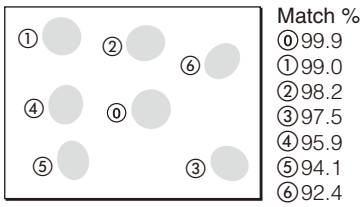
- Y>X: Ascend (ordered in rows)



- X>Y: Ascend (ordered in columns)



- X: Ascend
- X: Descend
- Y: Ascend
- Y: Descend
- Match%: Ascend
- Match%: Descend



- Clockwise
- Counter CW

Reference

To select a different order, see "Detection Order" (Page 4-48).

Processing results

The standard results and data returned by the pattern search tool are as follows:

Count	Outputs the number of detected patterns. Tolerance inspection target
Detected point (X, Y) [ ]	Outputs the coordinates of all detected patterns in pixels. Tolerance inspection target Label specification target
Detected angle [ ]	Outputs the difference in angles between the registered pattern and each detected pattern. The angle difference in a clockwise direction is calculated with a positive (+) sign. The angle difference in a counter-clockwise direction is calculated with a negative (-) sign. Tolerance inspection target Label specification target
Correlation Value % [ ]	Outputs the percentage match (0 to 99.999) between the registered pattern and the detected patterns in the search region. Tolerance inspection target Label specification target
Unit judgment value	Outputs the binary result of the unit based on the measured value and the specified tolerance range (upper / lower limits). The unit is judged as [NG] (binary 1) when outside the tolerance range and [OK] (binary 0) when inside.

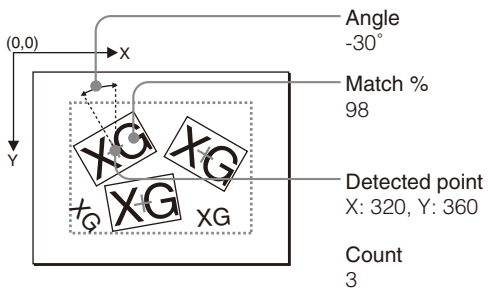
Reference

For the lists of available measurement output values and setting parameters, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

Example

Example showing the results of a pattern search inspection performed under the following conditions:

- Detection Order: X>Y: Ascend
- Primary Target: 0



Main Menu

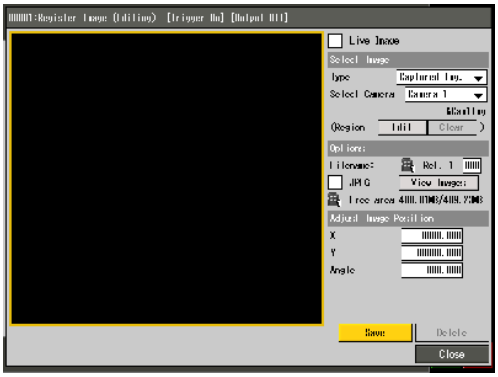
The main menu of the pattern search tool consists of the following options. Configure settings under each option as required for the inspection.



Register Image (Page 4-42)	Register an image to be used as a template for settings.
Select Image (Page 4-43)	Specify the image to be used for unit processing.
Search Region (Page 4-44)	Outline the region on the captured image to be used for searching.
Pattern Region (Page 4-45)	Outline the region on the captured image to record the pattern.
Color (Page 4-46)	Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).
Image Enhance (Page 4-46)	Settings for pre-processing image filters.
Condition (Page 4-47)	Specific conditions for processing a pattern search inspection.
Parameters (Page 4-48)	Additional optional parameters.
Limits (Page 4-50)	Unit pass / fail tolerances.
Display Options (Page 4-50)	Unit processing display settings.
Save (Page 4-51)	Save unit settings.

Register Image

An image can be saved to the controller to be used as a template for measurements and settings. It is recommended to adjust and fix lighting and other external influences before registering an image.



Live Image

Check this box to display live images through a continuous feed.

► Note

- A live feed is only available while the unit is being edited.
- This setting cannot be changed when the screen update mode is set to [Continuous] in the trigger settings (Page 4-25).
- If the capture on trigger input is disabled in the trigger settings (Page 4-25), this check box is always unchecked and the setting cannot be changed.
- When Live image is selected for a moving object, take care when registering as there will be a time lag between the external trigger input and the actual image capture.
- In principle, Live-image is only used when the capture unit being edited is being executed (waiting for a trigger input). When the image capture buffer is set to custom and the capture unit which was most recently executed is being edited, the images collected in the buffer will still be displayed even if the capture unit is not presently capturing images.
- Continuous update cannot be used when HDR capture (Page 4-21) is enabled or when a line scan camera is being used.
- When the HDR capture (Page 4-21) is enabled, the Multi-image cannot be used.

Select Image

Type

Select an image to register.

- **Captured Img.**: Displays the latest image from the specified camera (image variable).
- **Registered Img.**: The registered image specified in [Options] is displayed.

Select Camera

Select the number of the camera used for registration. Choose from Camera1 - Camera4, and select only the camera number used for the capture unit being edited.

Specifying a region

To register only part of an image, select [Edit] then specify the region to register. To cancel the selected region, select [Clear].

Save Image

Filename

Specify the registered image number used for image registration in the form "(Camera No.)-(User-specified No.)".

Reference

The name of the saved file is "ref (Camera No.)_(Specified No.)" (for full screen image registration) or "ref (Camera No.)_(Specified No.)_XXX_YYY" (for partial image registration).

JPEG

Check this box to save the image in JPEG format. When this box is not checked, the image will be saved in BMP format as either a 24-bit color bitmap image (when a color camera is used) or an 8-bit grayscale bitmap image (when a monochrome camera is used).

► Note

Using image compression may result in some image deterioration, thus results from a compressed image may differ to those when using non compressed images.

View All

View all registered images in a list.

Adjust Image Position

Adjust the position of the image being captured.

X

-Adjust the movement in the X (horizontal) direction between -8191.000 and 8191.000 pixels.

Y

-Adjust the movement in the Y (vertical) direction between -16383.000 and 16383.000 pixels.

Angle

Adjust the position angle (rotation) around the center of the image between -999.999° and 999.999°.

► Note

Position adjustment may cause missing peripheries (black areas) due to image movement or jagged edges (jaggies) due to rotation in the registered image.

Save

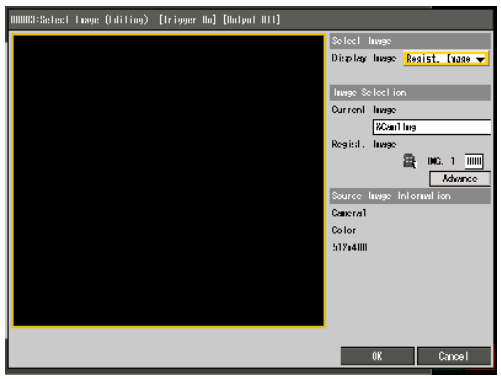
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Registered Img.] is selected for [Type], you can delete the registered image specified in [Options].

Select Image

Specify the image variable and associated registered image to be used for configuring the vision tool.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured Image**: Displays the latest image from the specified camera (image variable).
- **Registered Image**: The registered image specified under [Image Selection] is displayed.

Select image

Captured Img.

Set an image variable to be used as a current image for the unit.

Registered Img.

Specify the registered image No. for the registered image to be used.

- The registered images are managed as "Image (Camera No.) - (Registered image No.0 to 999)".
- The "Camera No" is fixed to the number of the camera associated to the image variable specified for the current image.

Advance

Set advance options for the switching of registered images as necessary.

- **Use numerical variable for registered image number**: To use a variable for the registered image No., check this box and assign a numerical or numerical array variable reference. By using a variable for the registered image No. and then issuing a variable reference value apply command (NU), the image is switched to the specified registered image in the variable and the reference image information is updated. For more details, see the XG-7000 Series Communication Control Manual.
- **Process variable when changing programs**: Use this option to switch to the registered image based on the initial value of the variable referenced when the program is changed or the controller is next turned on.
- **Use image variable for registered image**: To directly reference an image variable as a registered image, use this option and assign an image variable to be referenced.

► Note

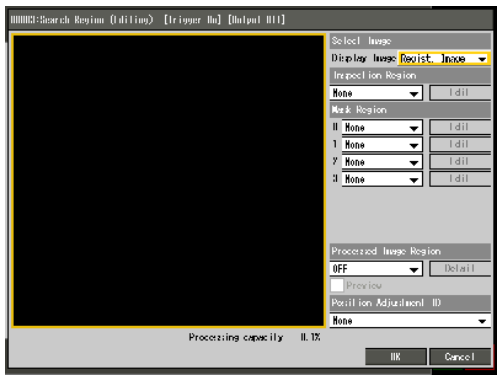
- Note that the registered image No. does not switch in accordance with a change in the variable.
- Only an image variable set to [use for processing] to [Use image variable for registered image].
- When [Use image variable for registered image] is enabled while [Registered Image] (Page 4-49) has been set to [Fixed (fast)], the [Registered Image] setting is automatically changed to [Updated each process (slow)]. This option can still set it to [User updated (fast)] in the [Parameters] menu.
- When [Assign variable to registered image No.] is enabled, [Use image variable for image registration] cannot be used.
- The resultant image variable assigned to [Use image variable for image registration] must use the same camera type as the current image.
- When the registered image is referenced with an image variable and while [Referenced Image] is set to [Update by user (fast)], the process uses the resultant image variable at the time the reference image information is updated. To update the reference image information immediately, update reference image information or issue the RU command.

Source Image Information

The camera No., type (color / monochrome), and resolution of the camera associated to the image variable specified is displayed.

Search Region

Outline the region on the captured image to search within (Page 4-45).



Reference

The smaller the search region, the shorter the processing time.

Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Inspection region

Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Inspection Region Menu" (Page 3-20) for more details.

Mask region

A mask region is an area which can be defined in the inspection region and will be excluded from the inspection. Up to four mask regions can be set per inspection region. A mask region is typically used for hiding an area that does not require inspection.

Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Excluding Part of the Region" (Page 3-26) for more details.

Reference

If you want to define a region which can not be set through the available masks, draw an inspection region as a composition region (Page 3-25).

Processed image region

Use processed image region to generate a region for inspection based on an image. (Page 4-295), select [ON] and then select [Detail] for configuration.

Reference

Refer to "Generating a Region from an Image" (Page 3-27) for more details on processed image region.

Image

Specify the image variable to be used for generating the region.

Area

Specify the area and border color for the region based on the image specified in the image variable. Select either [Black] (Level 0) or [White] (Level 255, default).

Preview

Use this checkbox to display the specified image. When the checkmark is removed, the display returns to its normal state.

Position Adjustment ID

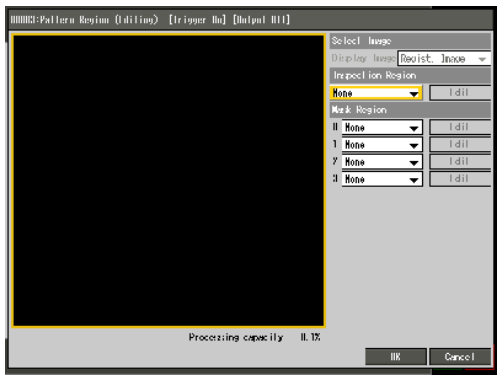
To use position adjustment for the region, select the position adjustment unit to be referenced.

Reference

The position adjustment is applied to all inspection, mask, and image regions.

Pattern region settings

Outline the region on the captured image to determine the pattern.



Reference

If the pattern region is a complicated shape, mask regions can be used to exclude unwanted parts.

► Note

It is necessary to set when the region size is more than 2432 pixels in width or more than 2050 pixels in height. However, it is not possible to set a large pattern region which exceeds height 8192.

Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Region

Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Inspection Region Menu" (Page 3-20) for more details.

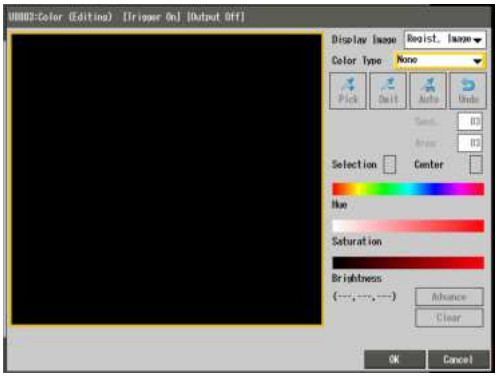
Mask region

A mask region is an area which can be defined in the inspection region and will be excluded from the inspection. Up to four mask regions can be set per inspection region. A mask region is typically used for hiding an area that does not require inspection.

Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Excluding Part of the Region" (Page 3-26) for more details.

Color

When working with a color camera, convert the captured color image into a binary (black and white) or a grayscale converted image by extracting the desired color.



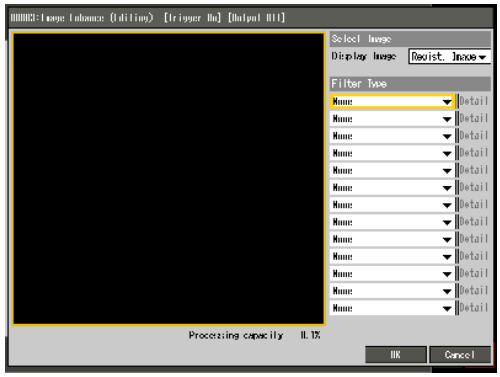
► Note

This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-295) is referenced as the current image.

Refer to "Working with Color Images (Color Extraction)" (Page 10-2) for concepts involving color extraction and its operation.

Image Enhance

Specify the filter processing to apply to the image. When a color camera is used, the filter is applied to the images converted using color extraction.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Filter type

Select the [Filter Type] field and then select the filter to apply. To perform area measurement using a method other than color to binary, you must select the [Binary] filter as the last filter. See "Image Enhancement Filters" (Page 10-11) for more details of each filter processing.

► Note

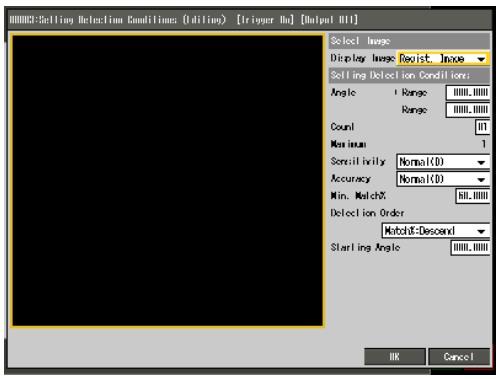
- For the area tool, [Binary] must be selected unless color to binary is used in the color extraction settings.
- If the binary filter is not selected or another filter is applied after the binary filter, the measurement result may not be correct.
- The binary, subtract and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 13 types of filters can be stacked according to application requirements. When multiple filters are set, they are processed one by one from the top.
- The order of the filters can be changed by selecting a filter in one of the [Filter Type] fields, holding down the No.1 (FUNCTION) button of the handheld controller, and then moving the 8-way key up or down.

Conditions

Specify the conditions for performing a pattern search.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Select Detection Conditions

Angle

When a pattern is rotated, specify the angle to be measured in the range between-179.999° and 180.000°.

- Select [+ Range] (clockwise rotation) and set the maximum allowable angle range for detection.
- Select [- Range] (counter-clockwise rotation) and set the maximum allowable angle range.

Count

Specify the maximum number of patterns to be detected in the pattern search. When [3] is specified, the process searches for up to 3 pattern positions.

► Note

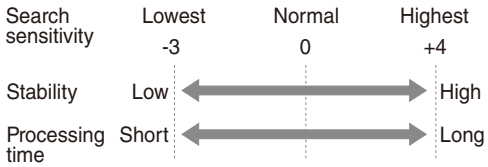
- The maximum number of patterns available for detection can change based on other settings.
- Based on specific settings, the number of patterns is fixed and cannot be changed.

Reference

- Even if there is only one pattern in the search region, setting a higher count can improve the search process and make the result more stable.
- The [Count] value can be set higher than the [Maximum Count] value (Maximum: 99) depending on the account setting. The increase in the [Maximum Count] value, will result in additional consumption of program memory.

Search sensitivity

Configure the search sensitivity. When detection is unstable, increase the level of sensitivity.

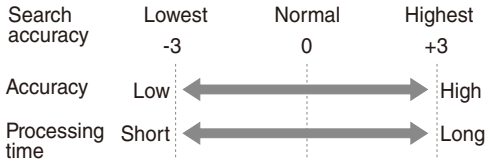


► Note

Increasing the level of search sensitivity may improve the stability of detection, but the processing time may become longer.

Search accuracy

Configure the search accuracy. To measure with a high level of accuracy, set the search accuracy higher.



► Note

Increasing the level of search accuracy may improve the accuracy of detection, but the processing time may become longer.

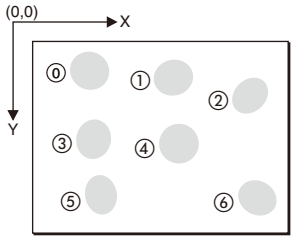
Minimum match %

Specify the minimum correlation value for detected patterns to prevent false detection. Example:
When the [Min. Match%] is set to 80%, only those patterns having a correlation value of 80% or more are actually processed.

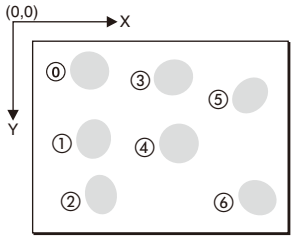
Detection order

Specify the identification order of the detected patterns.

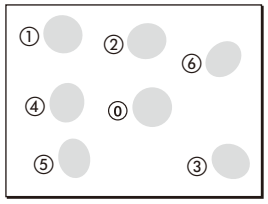
- Y>X: Ascend:



- X>Y: Ascend:



- X:Ascend
- X:Descend
- Y:Ascend
- Y:Descend
- Match%: Ascend
- Match%:Descend:



Match %
⓪99.9
①99.0
②98.2
③97.5
④95.9
⑤94.1
⑥92.4

- Clockwise
- Counter CW

Starting angle

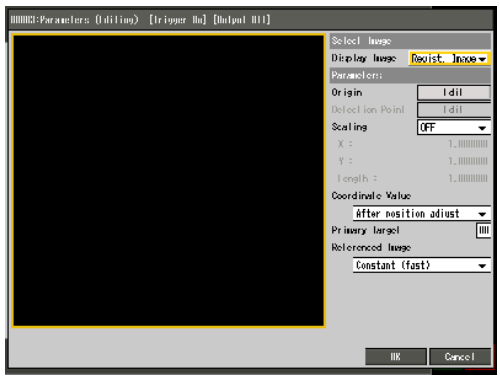
Specify the angle to start numbering when the [Detection Order] setting is [Clockwise] or [Counter CW].

► Note

This setting is not used if the [Detection Order] is not [Clockwise] or [Counter CW].

Parameters

Specify additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Parameters

Origin

By default, the origin is set to the top left corner of the camera but its location can be moved as required. To specify the origin, select [Edit] and then specify the coordinates.

Reference

The origin can be set outside the process region. The available range for the origin is -9600 to 9600 (X), -7200 to 7200 (Y).

Detection Point

To offset (shift) the detection point, select [Edit] and then specify the offset value.

Reference

The origin of the offset is the center of the pattern region.

► Note

The detection point cannot be offset if the pattern region is not set.

Scaling

The controller processes image data in pixels, The result data and setting parameters used for display, judgement and calculations can be converted and scaled to real life values and dimensions by using the pre-set scaling factor option.

- **OFF**: Do not use scaling.
- **ON**: Use scaling.

Reference

- The scaling factor can be changed from the [Option] menu of the Flowchart (Page 4-356).
- For a summary list of the result data for which scaling can be used, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

Coordinate value

Select the coordinate system to be used after position adjustment. If position adjustment is not used, this setting will have no effect on the measurement.

- **After position adjust**: The inspection uses the adjusted coordinate axes determined after position adjustment.
- **Before position adjust**: The distance from the position specified for the [Origin] of the inspection is used.

Primary target

Specify the pattern (0 through 98) to be used as the primary target for judgment from the detected patterns. Use [0] for normal operation.

► Note

Only the data from the primary target (excluding count) is used for judgment.

High speed mode

Select the operation for determining the speed of the pattern search.

- **Fixed (fast)** (default): Uses the processing memory to speed up processing. In this mode, variables cannot be assigned for pattern region settings, color extraction, or image enhancement.
- **Updated each process (slow)**: Variables for pattern region settings, color extraction, or image enhancement can be used yet the processing time increases as image memory has to be used to recalculate the reference image information for each inspection.
- **User updated (fast)**: This option uses both program memory and image memory to allow variable referencing but is faster when compared with the [Updated every process (slow)] setting. Changes in parameters from referenced variables are applied when the update reference image information command (RU) is used. For more details see the XG-700 Series Communication Control Manual.

Reference

- Parameters relating to the registered image information include pattern region, color extraction, image enhancement and detection conditions (angle range, search sensitivity, search accuracy).
- If [User updated (fast)] is selected, when settings are applied in Re-test mode (online) before exiting, or when changes are made via the Inspection Region menu (Page 3-20), Color menu (Page 10-2) and Edit Unit menu, the changes are applied without the need to execute the recalculation (RU) command. (The recalculation of the registered image information is done immediately when using the Edit Unit menu, and when [OK] is used with other menus.)

► Note

- If there is not enough memory for each operation, a setting error occurs.
- The [Registered Image] cannot be set to [Fixed (fast)] when a variable is assigned to the pattern region setting, color extraction or image enhancement. In such cases, remove the referenced variable and change the setting.
- If the captured image size from any camera exceeds 26214400 pixels, it is not possible to use [User updated (fast)] for high speed mode.

Large area search

Specify which mode to use for processing large pattern regions.

- **OFF** (default): Large Area Search mode is not used.
- **Mode 1**: Use this mode when the region size is 2432 pixels or more in width or 2050 pixels or more in height.
- **Mode 2**: Use this mode when the region size is 4096 pixels or more in width or 4096 pixels or more in height.

Reference

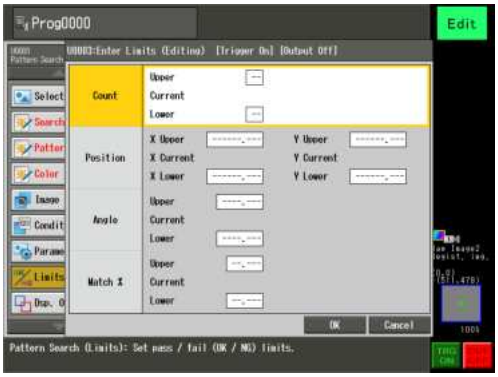
This option is only available when a line scan camera is used.

► Note

- It is not possible to set a large pattern region which exceeds 8192 pixels in height.
- If the Large Area Search is enabled, regardless of a small pattern area, the inspection accuracy may be diminished.

Limits

Set pass / fail tolerances (upper and lower limits) for the inspection.
If the result is outside of the specified tolerance range, it is judged as [NG] (binary 1). If the result is within the tolerance range, it is judged as [OK] (binary 0).



Use [Direct Input] to enter a value and set the tolerance.

Reference

- [-----] indicates an empty state where no tolerance is set. In this state, no judgment will be performed on the measurement.
- To reset the tolerance setting to an empty state, select [Clear].

Count

Specify the tolerance for the pattern count.
The measurement value is the number of detected patterns.

Position

Specify the tolerance for the coordinates of the primary detected pattern.
The measurement value is the number of pixels indicating position.

Angle

Specify the tolerance for the angle of the pattern.
The measurement value is an angle in degrees.

Match %

Specify the tolerance for the correlation value of the pattern.
The measurement value is a numerical value in the range of 0 to 99.999%.

Display Options

The display color of the units visual indicators can be changed based on the judgment result for that unit. The visual indicator can also be made transparent by selecting [Setting] - [Select Color] - [None].



Search region

Specify the line width and display color of the inspection region.

Mask region

Specify the line width and display color of the mask region.

Pattern ref. region

Specify the line width and display color of the pattern region.

Detected Point

Primary target

Specify the width and display color of the detected pattern region and reference point (center of the pattern region).

Reference

When the detection point offset (Page 4-48) has been set, the detected point shifts according to the offset value.

Other target

For the detected patterns, other than the primary target (Page 4-49), specify the width and display color of the detected pattern region and reference point (center of the pattern region).

Reference

When the detection point offset (Page 4-48) has been set, the detected point shifts according to the offset value.

Processing Priority

Specify the processing priority when displaying large processed images during Run mode.
When a line scan camera is used with the XG-7502A, it is not possible to display the processed image if the image size exceeds 25 MB (26214400 pixels). In such a case it is possible to display the filtered image and contrast image by using a display image variable.

Filtered image

Select whether or not to use a display image variable for the filtered image display.

- **Unit Processing**: Processes the filtered image without using the display image variable.
- **Image Display**: Processes the filtered image using a display image variable.

Reference

- When processing images 25 MB or less, or when using the XG-7702A, it is not necessary to select [Image Display].
- When processing an image larger than 25 MB, if the area displayed is 8 MB (8388608 pixels) or less, the filtered image will be automatically displayed when [Unit Priority] is selected. (However the following processes are excluded.)
  - Image enhancement: Shading correction, blob filter
  - Conversion (image operation): Rotate/translate, zoom, trapezoid correction, blob filter
  - Defect, Grayscale Blob: Contrast display

► Note

When [Image Display] is selected for [Filtered Image], the following restrictions on operation occur.

- Processing time increases.
- The background outside the inspection region becomes a black image.
- Displaying of multiple units is not possible.
- For display of registered images outside of unit edit, the filtered image cannot be displayed and the display is the same as when [Unit Processing] is set.
- When an archived image is displayed, it ix not possible to display the processed image unless the display image variable and results are also stored in the archive.

Image variable

Specify a display image variable for displaying the filtered image.

Reset

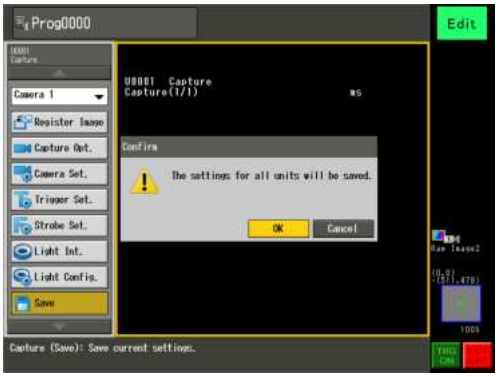
Returns the display options to their defaults.

Save

Save the current unit changes the program file.

► Note

- If the device is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the system power while you are saving the settings. Doing so may cause errors in the internal data



Save

The settings for the unit are saved in the current program file in SD Card 1 or SD Card 2.

► Note

Items specified not to be saved in XG VisionEditor are excluded from the saving operation.
For example, variable values changed in the current program or the default display, and display parts, can be excluded when saving.

Edge position

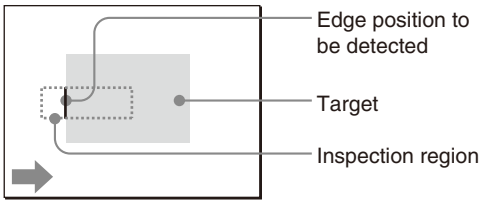
Edge Position Tool

The edge pitch tool scans across a target in a user specified direction within a specified region detecting contrast changes. Based on these contrast changes (edge positions) the tool measures the position of a user specified edge.
Because edge detection is based on the transition from bright to dark (or dark to bright), not on absolute intensity values, it is less affected by changes in illumination during image capturing.

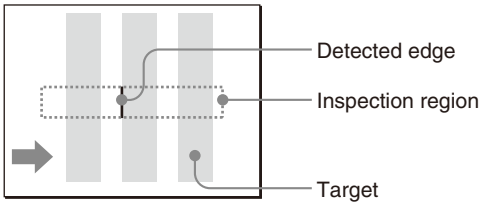
Image processing

Example showing the results of an edge position inspection performed under the following conditions:

- Primary Target: 0
- Scan Direction: →
- Edge Direction: Light to Dark



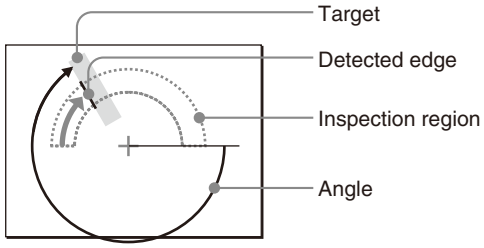
- Primary Target: 1
- Scan Direction: →
- Edge Direction: Light to Dark



When the inspection region is an arc

Example showing the results of an edge position inspection performed under the following conditions:

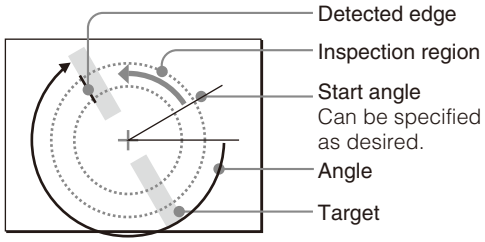
- Primary Target: 0
- Scan Direction: (Clockwise)
- Edge Direction: Light to Dark



When the inspection region is a ring

Example showing the results of an edge position inspection performed under the following conditions:

- Primary Target: 0
- Scan Direction: (Counter CW)
- Edge Direction: Dark to Light



Processing results

The standard results and data returned by the edge position tool are as follows:

Reference

Processing results may vary depending on the shape of the inspection region. The result for an item which is not processed is always 0.

When the inspection region is not a ring or an arc

Number of edges	Outputs the number of detected edges. Tolerance inspection target
Edge position coordinates (X, Y) [ ]	Outputs the position coordinates of all detected edges in pixels. Tolerance inspection target Label specification target
Distance [ ]	Outputs the distances from the start of the inspection region to the position coordinates of all edges in pixels. Label specification target
Intensity [ ]	Outputs the intensity differential of all detected edges. Label specification target
Unit judgment value	Outputs the binary result of the unit based on the measured value and the specified tolerance range (upper / lower limits). The unit is judged as [NG] (binary 1) when outside the tolerance range and [OK] (binary 0) when inside.

When the inspection region is a ring or an arc

Number of edges	Outputs the number of detected edges. Tolerance inspection target
Edge position coordinates (X, Y) [ ]	Outputs the position coordinates of all the intersection points between the projected lines (radial) of the detected edges and the center line (circular) of the inspection region. Label specification target
Angle [ ]	Outputs the angles of all detected edges. Tolerance inspection target Label specification target
Distance [ ]	Outputs the angles from the start of the inspection region to the positions of all edges. Label specification target
Intensity [ ]	Outputs the maximum edge intensity differential of all detected edges. Label specification target
Unit judgment value	Outputs the binary result of the unit based on the measured value and the specified tolerance range (upper / lower limits). The unit is judged as [NG] (binary 1) when outside the tolerance range and [OK] (binary 0) when inside.

Reference

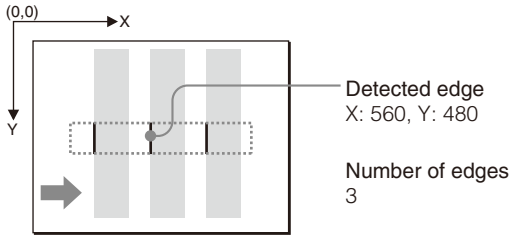
For the lists of available measurement output values and setting parameters, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

Example

When the inspection region is a rectangle

Example showing the results of an edge position inspection performed under the following conditions:

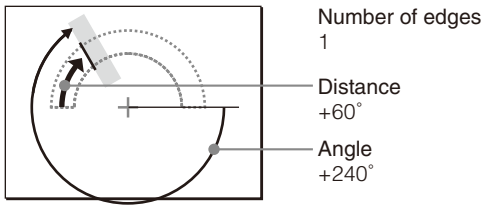
- Primary Target: 1
- Scan Direction: →
- Edge Direction: Light to Dark



When the inspection region is an arc

Example showing the results of an edge position inspection performed under the following conditions:

- Primary Target: 0
- Scan Direction: (Clockwise)
- Edge Direction: Light to Dark



Main Menu

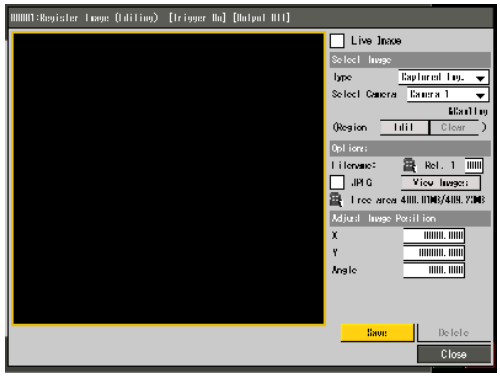
The main menu of the edge position tool consists of the following options. Configure settings under each option as required for the inspection.



Register Image (Page 4-54)	Register an image to be used as a template for settings.
Select Image (Page 4-56)	Specify the image to be used for unit processing.
Inspect Region (Page 4-57)	Define the region to be used for unit processing.
Color (Page 4-58)	Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).
Image Enhance (Page 4-58)	Settings for pre-processing image filters.
Edge Detection (Page 4-59)	Specific conditions for processing an edge position inspection.
Parameters (Page 4-60)	Additional optional parameters.
Limits (Page 4-61)	Unit pass / fail tolerances.
Display Options (Page 4-62)	Unit processing display settings.
Save (Page 4-63)	Save unit settings.

Register Image

An image can be saved to the controller to be used as a template for measurements and settings. It is recommended to adjust and fix lighting and other external influences before registering an image.



Live Image

Check this box to display live images through a continuous feed.

► Note

- A live feed is only available while the unit is being edited.
- This setting cannot be changed when the screen update mode is set to [Continuous] in the trigger settings (Page 4-25).
- If the capture on trigger input is disabled in the trigger settings (Page 4-25), this check box is always unchecked and the setting cannot be changed.
- When Live image is selected for a moving object, take care when registering as there will be a time lag between the external trigger input and the actual image capture.
- In principle, Live-image is only used when the capture unit being edited is being executed (waiting for a trigger input). When the image capture buffer is set to custom and the capture unit which was most recently executed is being edited, the images collected in the buffer will still be displayed even if the capture unit is not presently capturing images.
- Continuous update cannot be used when HDR capture (Page 4-21) is enabled or when a line scan camera is being used.
- When the HDR capture (Page 4-21) is enabled, the Multi-image cannot be used.

Select Image

Type

Select an image to register.

- **Captured Img.**: Displays the latest image from the specified camera (image variable).
- **Registered Img.**: The registered image specified in [Options] is displayed.

Select Camera

Select the number of the camera used for registration. Choose from Camera1 - Camera4, and select only the camera number used for the capture unit being edited.

Specifying a region

To register only part of an image, select [Edit] then specify the region to register. To cancel the selected region, select [Clear].

Save Image

Filename

Specify the registered image number used for image registration in the form "(Camera No.)-(User-specified No.)".

Reference

The name of the saved file is "ref (Camera No.)_(Specified No.)" (for full screen image registration) or "ref (Camera No.)_(Specified No.)_XXX_YYY" (for partial image registration).

JPEG

Check this box to save the image in JPEG format. When this box is not checked, the image will be saved in BMP format as either a 24-bit color bitmap image (when a color camera is used) or an 8-bit grayscale bitmap image (when a monochrome camera is used).

► Note

Using image compression may result in some image deterioration, thus results from a compressed image may differ to those when using non compressed images.

View All

View all registered images in a list.

Adjust Image Position

Adjust the position of the image being captured.

X

-Adjust the movement in the X (horizontal) direction between -8191.000 and 8191.000 pixels.

Y

-Adjust the movement in the Y (vertical) direction between -16383.000 and 16383.000 pixels.

Angle

Adjust the position angle (rotation) around the center of the image between -999.999° and 999.999°.

► Note

Position adjustment may cause missing peripheries (black areas) due to image movement or jagged edges (jaggies) due to rotation in the registered image.

Save

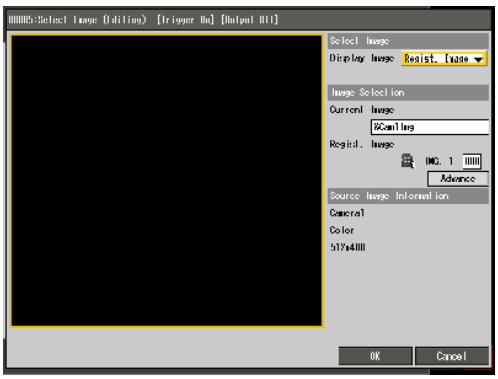
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Registered Img.] is selected for [Type], you can delete the registered image specified in [Options].

Select Image

Specify the image variable and associated registered image to be used for configuring the vision tool.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured Image**: Displays the latest image from the specified camera (image variable).
- **Registered Image**: The registered image specified under [Image Selection] is displayed.

Select image

Captured Img.

Set an image variable to be used as a current image for the unit.

Registered Img.

Specify the registered image No. for the registered image to be used.

- The registered images are managed as "Image (Camera No.) - (Registered image No.0 to 999)".
- The "Camera No" is fixed to the number of the camera associated to the image variable specified for the current image.

Advance

Set advance options for the switching of registered images as necessary.

- **Use numerical variable for registered image number**: To use a variable for the registered image No., check this box and assign a numerical or numerical array variable reference. By using a variable for the registered image No. and then issuing a variable reference value apply command (NU), the image is switched to the specified registered image in the variable and the reference image information is updated. For more details, see the XG-7000 Series Communication Control Manual.
- **Process variable when changing programs**: Use this option to switch to the registered image based on the initial value of the variable referenced when the program is changed or the controller is next turned on.

► Note

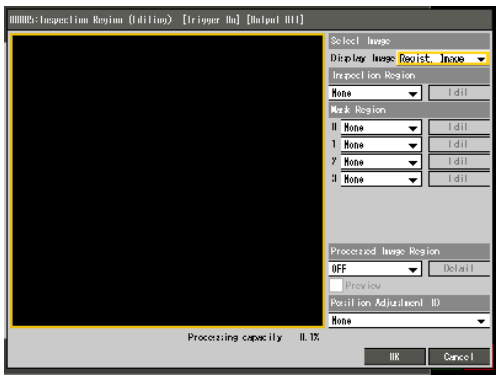
Note that the registered image No. does not switch in accordance with a change in the variable.

Source Image Information

The camera No., type (color / monochrome), and resolution of the camera associated to the image variable specified is displayed.

Inspection Region

Outline the region on the captured image to be used for inspection.



► Note

Changing the shape of the region will initialize or clear some of the settings in the [Edge Detection] and [Limits] menus.

Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Region

Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Inspection Region Menu" (Page 3-20) for more details.

Mask region

A mask region is an area which can be defined in the inspection region and will be excluded from the inspection. Up to four mask regions can be set per inspection region. A mask region is typically used for hiding an area that does not require inspection.
Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Excluding Part of the Region" (Page 3-26) for more details.

Processed image region

Use processed image region to generate a region for inspection based on an image. (Page 4-295), select [ON] and then select [Detail] for configuration.

Reference

Refer to "Generating a Region from an Image" (Page 3-27) for more details on processed image region.

Image

Specify the image variable to be used for generating the region.

Area

Specify the area and border color for the region based on the image specified in the image variable. Select either [Black] (Level 0) or [White] (Level 255, default).

Preview

Use this checkbox to display the specified image. When the checkmark is removed, the display returns to its normal state.

Position Adjustment ID

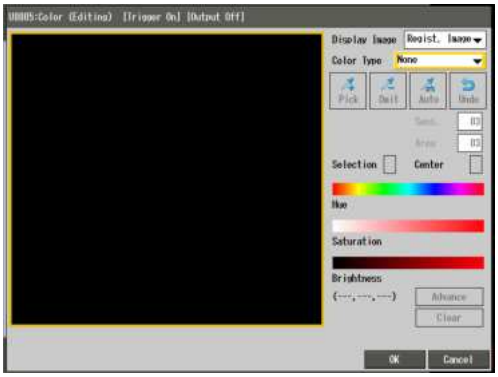
To use position adjustment for the region, select the position adjustment unit to be referenced.

Reference

The position adjustment is applied to all inspection, mask, and image regions.

Color

When working with a color camera, convert the captured color image into a binary (black and white) or a grayscale converted image by extracting the desired color.



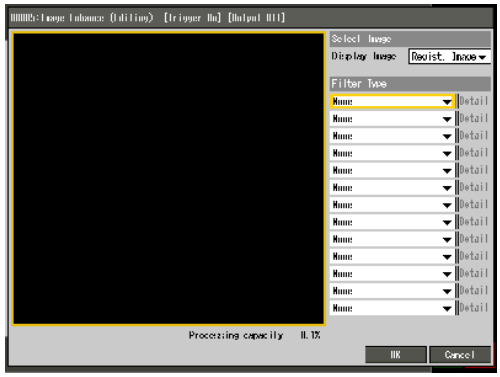
► Note

This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-295) is referenced as the current image.

Refer to "Working with Color Images (Color Extraction)" (Page 10-2) for concepts involving color extraction and its operation.

Image Enhance

Specify the filter processing to apply to the image. When a color camera is used, the filter is applied to the images converted using color extraction.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Filter type

Select the [Filter Type] field and then select the filter to apply. To perform area measurement using a method other than color to binary, you must select the [Binary] filter as the last filter. See "Image Enhancement Filters" (Page 10-11) for more details of each filter processing.

► Note

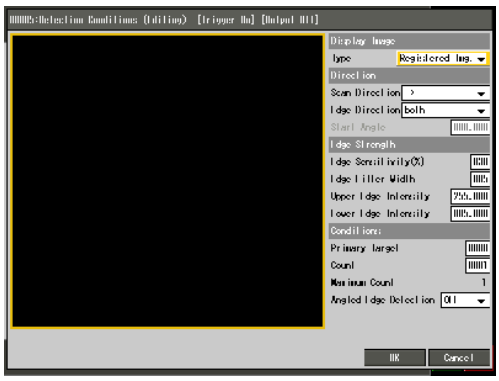
- For the area tool, [Binary] must be selected unless color to binary is used in the color extraction settings.
- If the binary filter is not selected or another filter is applied after the binary filter, the measurement result may not be correct.
- The binary, subtract and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 13 types of filters can be stacked according to application requirements. When multiple filters are set, they are processed one by one from the top.
- The order of the filters can be changed by selecting a filter in one of the [Filter Type] fields, holding down the No.1 (FUNCTION) button of the handheld controller, and then moving the 8-way key up or down.

Edge Detection

Specify the conditions for locating an edge position.



Reference

See "What is an Edge?" (Page 10-25) for the technical description on edge detection.

Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Direction

Scan Direction

Select the scan direction to detect an edge.

- **When the inspection region is a rectangle, circle, oval, polygon or composition**: →, ←, ↑, ↓
- **When the inspection region is a rotated rectangle**: Forward or reverse with respect to the horizontal axis (X axis) of the region Since the scan direction depends on the rotation angle of the inspection region, this should be taken into consideration when selecting this option.
- **When the inspection region is a ring or an arc**: Clockwise, Counter CW

Edge Direction

Select the change in contrast for detecting an edge.

- **Light to Dark**: Detect edges in a transition that changes from a bright area to a dark area.
- **Dark to Light**: Detect edges in a transition that changes from a dark area to a bright area.
- **Both** (default): Detect edges in a transition that can change either from a bright area to a dark area or from a dark area to a bright area.

Start angle

When [Ring] is selected for the inspection region, specify a position to start the edge scan. The setting range is 0° to 359.999°.

Reference

If the start angle is changed, the detection angle will be calculated with reference to the 3 o'clock position being 0°.

Edge Strength

Edge Sensitivity (%)

Set the percentage threshold (0% to 100%) for detecting edges.

Edge Filter Width

Set the width (0 to 100 pixels) of the smoothing filter applied to the differential graph for detecting edges.

Edge Intensity

- **Upper Edge Intensity**: Specify the upper limit (0.000 to 255.000) of edge intensity for detecting edges.
- **Lower Edge Intensity**: Specify the lower limit (0.000 to 255.000) of edge intensity for detecting edges.

Reference

Unwanted edges can be excluded from detection by adjusting the upper and lower edge intensity values referring the highest edge intensity in the region (shown on the left of the edge graph). See "What is an Edge?" (Page 10-25) for more details.

Conditions

Primary Target

Specify the edge number (0 through 3599) to be used as the primary target for judgment from the detected patterns. Edge numbers are assigned in order based on the scan direction. (If the primary target is not found the detected point position defaults to 0).

Count

Specify the maximum number of edges (1 to 3600) to be detected. The edge count cannot exceed the [Maximum Count] value.

► Note

- The maximum number of edges available for detection can change based on other settings.
- Based on specific settings, the maximum number of edges is fixed and cannot be changed.

Reference

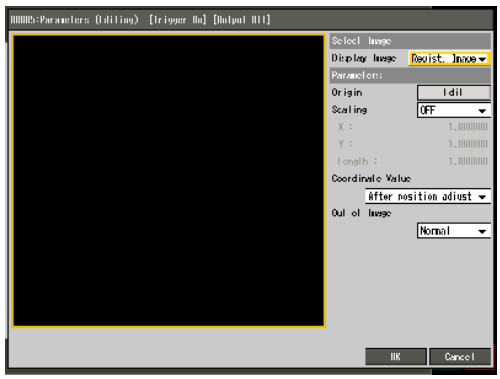
The [Count] value can be set higher than the [Maximum Count] value (Maximum: 3600) depending on the account setting. Note, this also increases the [Maximum Count] value, resulting in additional consumption of program memory.

Angled Edge Detection

Set to [ON] to stabilize the detection of slanted edges in the inspection region. Using this option may affect the edge X, Y position accuracy.

Parameters

Specify additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Parameters

Origin

By default, the origin is set to the top left corner of the camera but its location can be moved as required. To specify the origin, select [Edit] and then specify the coordinates.

Reference

The origin can be set outside the process region. The available range for the origin is -9600 to 9600 (X), -7200 to 7200 (Y).

Scaling

The controller processes image data in pixels, The result data and setting parameters used for display, judgement and calculations can be converted and scaled to real life values and dimensions by using the pre-set scaling factor option.

- **OFF**: Do not use scaling.
- **ON**: Use scaling.

Reference

- The scaling factor can be changed from the [Option] menu of the Flowchart (Page 4-356).
- For a summary list of the result data for which scaling can be used, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

Coordinate value

Select the coordinate system to be used after position adjustment. If position adjustment is not used, this setting will have no effect on the measurement.

- **After position adjust**: The inspection uses the adjusted coordinate axes determined after position adjustment.
- **Before position adjust**: The distance from the position specified for the [Origin] of the inspection is used.

Out of Image

Specify whether to incorporate data that falls outside of the inspection region. This maybe required when position adjustment is used.

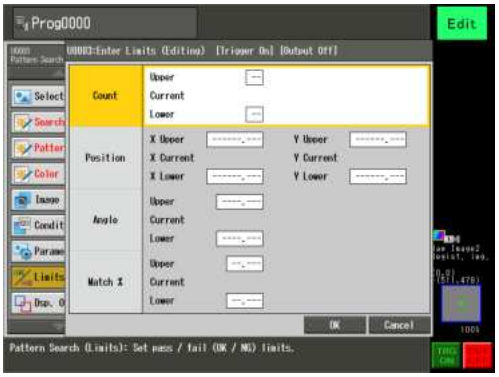
- **Normal (default)**: Edge detection outside of the region is disabled as the image data outside of the region is masked. Since masking requires time to process, the inspection time may vary depending on the quantity image data outside the region. Processing will take longer when the inspection region is a ring or an arc.
- **Fast**: The image data outside of the region is not masked, allowing for faster processing. As the image data outside the region has not been masked so there is an increased chance of detecting an edge outside the region. Select [Normal] to avoid incorrect edge detection.

Reference

Image data which is already located outside of the region during the inspection region setting will always be masked regardless of the [Out of Image] setting.

Limits

Set pass / fail tolerances (upper and lower limits) for the inspection.
If the result is outside of the specified tolerance range, it is judged as [NG] (binary 1). If the result is within the tolerance range, it is judged as [OK] (binary 0).



Use [Direct Input] to enter a value and set the tolerance.

Reference

- [-----] indicates an empty state where no tolerance is set. In this state, no judgment will be performed on the measurement.
- To reset the tolerance setting to an empty state, select [Clear].

Count

Specify the tolerance for the detected edge count.
The unit of measurement is the "number of edges" detected.

Position

Specify the tolerance for the position of the detected edge (primary target) (When the inspection region is not a ring or an arc).
The unit of measurement is the "number of pixels" indicating the Y coordinate of the edge position.

Angle

Specify the tolerance of the angle for the angle of the detected edge (primary target) when the inspection region is a ring or an arc).
The unit of measurement is the "angle" of the detected edge.

Display Options

The display color of the units visual indicators can be changed based on the judgment result for that unit. The visual indicator can also be made transparent by selecting [Setting] - [Select Color] - [None].



Inspection region

Specify the line width and display color of the inspection region.

Mask region

Specify the line width and display color of the mask region.

Detected Point

Primary target
Specify the width and display color of the line indicating the detected edge.

Other target
Specify the width and display color of the line indicating the detected edge other than the one specified as the primary target (Page 4-60).

Edge Graph

Edge Graph
Select whether to display the edge graph.

- **ON**: Show the edge graph.
- **OFF**: Hide the edge graph.

Wave
Specify the width and display color of the edge graph waveform.

Frame
Specify the width and display color of the edge graph frame.

Sensitivity
Specify the width and display color of the line representing the edge sensitivity threshold.

► Note

Setting [Edge graph] to [ON] consumes additional program memory. Check the amount of remaining program memory before enabling.

Processing Priority

Specify the processing priority when displaying large processed images during Run mode.
When a line scan camera is used with the XG-7502A, it is not possible to display the processed image if the image size exceeds 25 MB (26214400 pixels). In such a case it is possible to display the filtered image and contrast image by using a display image variable.

Filtered image

Select whether or not to use a display image variable for the filtered image display.

- **Unit Processing**: Processes the filtered image without using the display image variable.
- **Image Display**: Processes the filtered image using a display image variable.

Reference

- When processing images 25 MB or less, or when using the XG-7702A, it is not necessary to select [Image Display].
- When processing an image larger than 25 MB, if the area displayed is 8 MB (8388608 pixels) or less, the filtered image will be automatically displayed when [Unit Priority] is selected. (However the following processes are excluded.)
  - Image enhancement: Shading correction, blob filter
  - Conversion (image operation): Rotate/translate, zoom, trapezoid correction, blob filter
  - Defect, Grayscale Blob: Contrast display

► Note

When [Image Display] is selected for [Filtered Image], the following restrictions on operation occur.

- Processing time increases.
- The background outside the inspection region becomes a black image.
- Displaying of multiple units is not possible.
- For display of registered images outside of unit edit, the filtered image cannot be displayed and the display is the same as when [Unit Processing] is set.
- When an archived image is displayed, it ix not possible to display the processed image unless the display image variable and results are also stored in the archive.

Image variable

Specify a display image variable for displaying the filtered image.

Reset

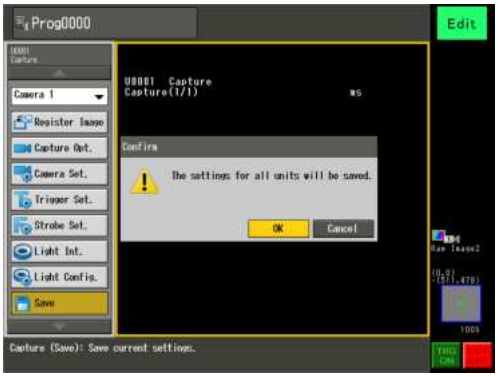
Returns the display options to their defaults.

Save

Save the current unit changes the program file.

► Note

- If the device is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the system power while you are saving the settings. Doing so may cause errors in the internal data



Save

The settings for the unit are saved in the current program file in SD Card 1 or SD Card 2.

► Note

Items specified not to be saved in XG VisionEditor are excluded from the saving operation.
For example, variable values changed in the current program or the default display, and display parts, can be excluded when saving.

Edge width

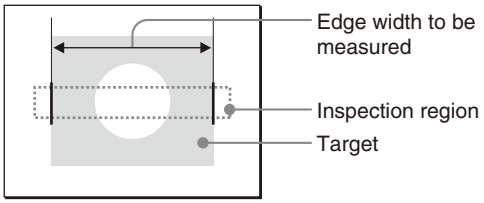
Edge Width Tool

The edge width tool scans across a target in a user specified direction within a specified region detecting contrast changes. Based on these contrast changes the width between two user specified points can be measured. Because edge detection is based on the transition from bright to dark (or dark to bright), not on absolute intensity values, it is less affected by illumination fluctuations during image capturing.

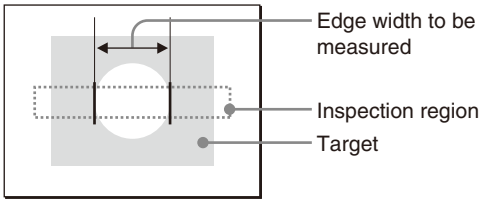
Image processing

When the inspection region is a rectangle or a rotated rectangle

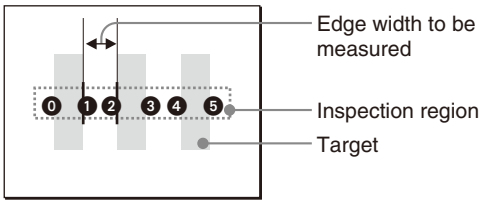
- When [Outer Gap] is the selected measurement mode



- When [Inner Gap] is the selected measurement mode

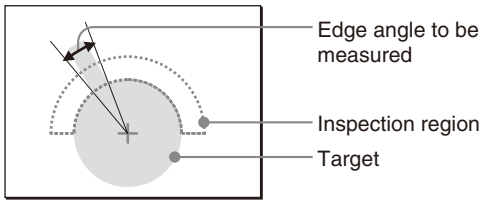


- When [Specified Edges] is the selected measurement mode (example: 1→2)

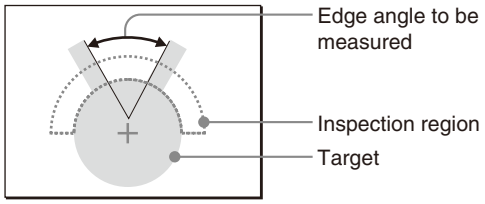


When the inspection region is a ring or an arc

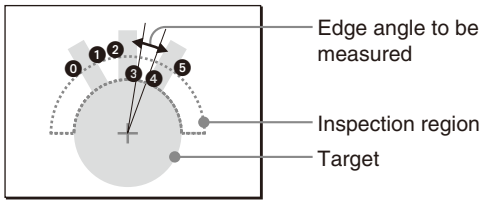
- When [Outer Gap] is the selected measurement mode



- When [Inner Gap] is the selected measurement mode



- When [Specified Edges] is the selected measurement mode (example: 3→4)



Processing results

The standard results and data returned by the edge width tool are as follows:

Reference

Processing results may vary depending on the shape of the inspection region. The result for an item which is not processed is always 0.

When the inspection region is not a ring or an arc

Edge width	Outputs the average width in pixels. Tolerance inspection target
Number of pairs	Outputs (1) if a pair is detected (0) if not.
Edge position 1 (X, Y)	Outputs the position coordinates for the first identified edge (typically the one nearest the start of the inspection region) of the edge width pair in pixels.
Distance 1	Outputs the distance from the start of the inspection region to the edge identified in segment 1 in pixels.
Intensity 1	Outputs the intensity differential for the identified edge in segment 1.
Edge position 2 (X, Y)	Outputs the position coordinates for the second identified edge (typically the one nearest the end of the inspection region) of the edge width pair in pixels.
Distance 2	Outputs the distance from the start of the inspection region to the second identified edge (typically the one nearest the end of the inspection region) of the edge with pair in pixels.
Intensity 2	Outputs the intensity differential of the edge at edge position 2.
Unit judgment value	Outputs the binary result of the unit based on the measured value and the specified tolerance range (upper / lower limits). The unit is judged as [NG] (binary 1) when outside the tolerance range and [OK] (binary 0) when inside.

When the inspection region is a ring or an arc

Edge width	Outputs the average width as an angle. Tolerance inspection target
Number of pairs	Outputs (1) if a pair is detected (0) if not.
Edge position 1 (X, Y)	Outputs the position coordinates of the intersection point between the projected line (radial) of the first identified edge (typically the one nearest the start of the inspection region) and the center line (circular) of the inspection region.
Angle 1	Outputs the first identified edge of the edge width pair as an angle.
Distance 1	Outputs the distance from the start of the inspection region to the first identified edge (typically the one nearest the start of the inspection region) of the edge width pair as an angle.
Intensity 1	Outputs the intensity differential for the identified edge in segment 1.
Edge position 2 (X, Y)	Outputs the position coordinates of the intersection point between the projected line (radial) of the second identified edge (typically the one nearest the end of the inspection region) and the center line (circular) of the inspection region.
Angle 2	Outputs the second identified edge (typically the one nearest the end of the inspection region) of the edge width pair as an angle.
Distance 2	Outputs the distance from the start of the inspection region to the second identified edge (typically the one nearest the end of the inspection region) of the edge width pair as an angle.
Intensity 2	Outputs the intensity differential of the edge at edge position 2.
Unit judgment value	Outputs the binary result of the unit based on the measured value and the specified tolerance range (upper / lower limits). The unit is judged as [NG] (binary 1) when outside the tolerance range and [OK] (binary 0) when inside.

Reference

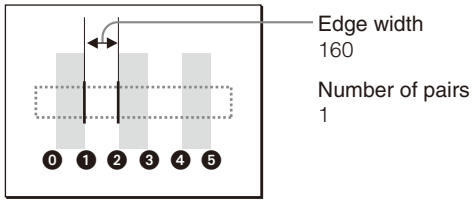
For the lists of available measurement output values and setting parameters, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

Example

When the inspection region is a rectangle

Example showing the results of an edge width inspection performed under the following conditions:

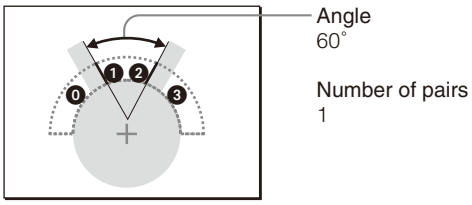
- Scan Direction: →
- Edge Direction: Both
- Specified Edge 1: 1
- Specified Edge 2: 2



When the inspection region is an arc

Example showing the results of an edge width inspection performed under the following conditions:

- Scan Direction: (Clockwise)
- Edge Direction: Both
- Specified Edge 1: 1
- Specified Edge 2: 2



Main Menu

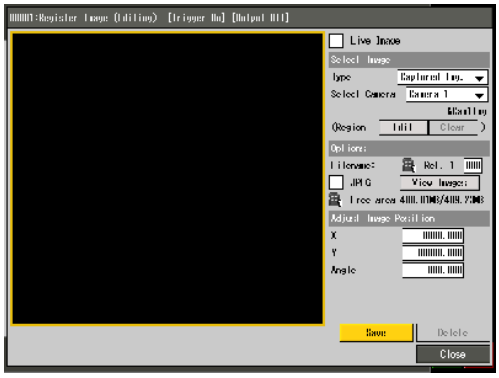
The main menu of the edge width tool consists of the following options. Configure settings under each option as required for the inspection.



Register Image (Page 4-67)	Register an image to be used as a template for settings.
Select Image (Page 4-68)	Specify the image to be used for unit processing.
Inspect Region (Page 4-69)	Define the region to be used for unit processing.
Color (Page 4-70)	Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).
Image Enhance (Page 4-71)	Settings for pre-processing image filters.
Edge Detection (Page 4-71)	Specific conditions for processing an edge width inspection.
Parameters (Page 4-73)	Additional optional parameters.
Limits (Page 4-74)	Unit pass / fail tolerances.
Display Options (Page 4-75)	Unit processing display settings.
Save (Page 4-76)	Save unit settings.

Register Image

An image can be saved to the controller to be used as a template for measurements and settings. It is recommended to adjust and fix lighting and other external influences before registering an image.



Live Image

Check this box to display live images through a continuous feed.

► Note

- A live feed is only available while the unit is being edited.
- This setting cannot be changed when the screen update mode is set to [Continuous] in the trigger settings (Page 4-25).
- If the capture on trigger input is disabled in the trigger settings (Page 4-25), this check box is always unchecked and the setting cannot be changed.
- When Live image is selected for a moving object, take care when registering as there will be a time lag between the external trigger input and the actual image capture.
- In principle, Live-image is only used when the capture unit being edited is being executed (waiting for a trigger input). When the image capture buffer is set to custom and the capture unit which was most recently executed is being edited, the images collected in the buffer will still be displayed even if the capture unit is not presently capturing images.
- Continuous update cannot be used when HDR capture (Page 4-21) is enabled or when a line scan camera is being used.
- When the HDR capture (Page 4-21) is enabled, the Multi-image cannot be used.

Select Image

Type

Select an image to register.

- **Captured Img.**: Displays the latest image from the specified camera (image variable).
- **Registered Img.**: The registered image specified in [Options] is displayed.

Select Camera

Select the number of the camera used for registration. Choose from Camera1 - Camera4, and select only the camera number used for the capture unit being edited.

Specifying a region

To register only part of an image, select [Edit] then specify the region to register. To cancel the selected region, select [Clear].

Save Image

Filename

Specify the registered image number used for image registration in the form "(Camera No.)-(User-specified No.)".

Reference

The name of the saved file is "ref (Camera No.)_(Specified No.)" (for full screen image registration) or "ref (Camera No.)_(Specified No.)_XXX_YYY" (for partial image registration).

JPEG

Check this box to save the image in JPEG format. When this box is not checked, the image will be saved in BMP format as either a 24-bit color bitmap image (when a color camera is used) or an 8-bit grayscale bitmap image (when a monochrome camera is used).

► Note

Using image compression may result in some image deterioration, thus results from a compressed image may differ to those when using non compressed images.

View All

View all registered images in a list.

Adjust Image Position

Adjust the position of the image being captured.

X

-Adjust the movement in the X (horizontal) direction between -8191.000 and 8191.000 pixels.

Y

-Adjust the movement in the Y (vertical) direction between -16383.000 and 16383.000 pixels.

Angle

Adjust the position angle (rotation) around the center of the image between -999.999° and 999.999°.

► Note

Position adjustment may cause missing peripheries (black areas) due to image movement or jagged edges (jaggies) due to rotation in the registered image.

Save

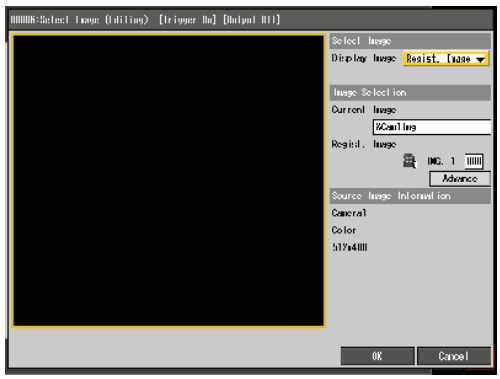
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Registered Img.] is selected for [Type], you can delete the registered image specified in [Options].

Select Image

Specify the image variable and associated registered image to be used for configuring the vision tool.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured Image**: Displays the latest image from the specified camera (image variable).
- **Registered Image**: The registered image specified under [Image Selection] is displayed.

Select image

Captured Img.

Set an image variable to be used as a current image for the unit.

Registered Img.

Specify the registered image No. for the registered image to be used.

- The registered images are managed as "Image (Camera No.) - (Registered image No.0 to 999)".
- The "Camera No" is fixed to the number of the camera associated to the image variable specified for the current image.

Advance

Set advance options for the switching of registered images as necessary.

- **Use numerical variable for registered image number**: To use a variable for the registered image No., check this box and assign a numerical or numerical array variable reference. By using a variable for the registered image No. and then issuing a variable reference value apply command (NU), the image is switched to the specified registered image in the variable and the reference image information is updated. For more details, see the XG-7000 Series Communication Control Manual.
- **Process variable when changing programs**: Use this option to switch to the registered image based on the initial value of the variable referenced when the program is changed or the controller is next turned on.

► Note

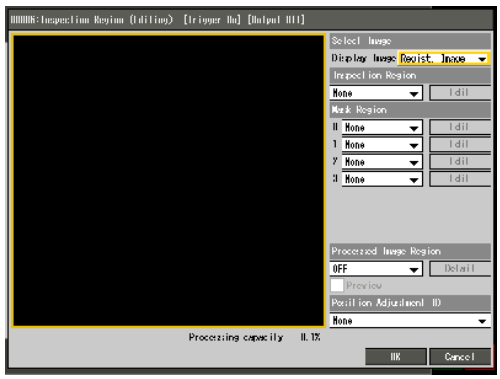
Note that the registered image No. does not switch in accordance with a change in the variable.

Source Image Information

The camera No., type (color / monochrome), and resolution of the camera associated to the image variable specified is displayed.

Inspection Region

Outline the region on the captured image to be used for inspection.



► Note

Changing the shape of the region will initialize or clear some of the settings in the [Edge Direction] menu.

Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Region

Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Inspection Region Menu" (Page 3-20) for more details.

Mask region

A mask region is an area which can be defined in the inspection region and will be excluded from the inspection. Up to four mask regions can be set per inspection region. A mask region is typically used for hiding an area that does not require inspection.

Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Excluding Part of the Region" (Page 3-26) for more details.

Processed image region

Use processed image region to generate a region for inspection based on an image. (Page 4-295), select [ON] and then select [Detail] for configuration.

Reference

Refer to "Generating a Region from an Image" (Page 3-27) for more details on processed image region.

Image

Specify the image variable to be used for generating the region.

Area

Specify the area and border color for the region based on the image specified in the image variable. Select either [Black] (Level 0) or [White] (Level 255, default).

Preview

Use this checkbox to display the specified image. When the checkmark is removed, the display returns to its normal state.

Position Adjustment ID

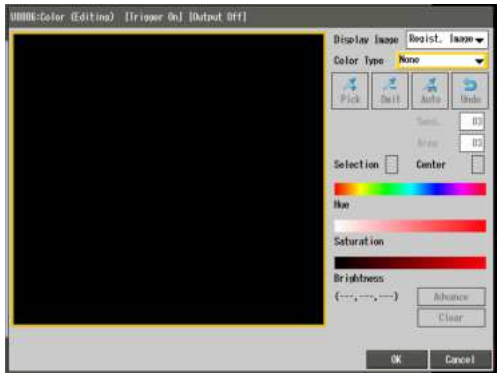
To use position adjustment for the region, select the position adjustment unit to be referenced.

Reference

The position adjustment is applied to all inspection, mask, and image regions.

Color

When working with a color camera, convert the captured color image into a binary (black and white) or a grayscale converted image by extracting the desired color.



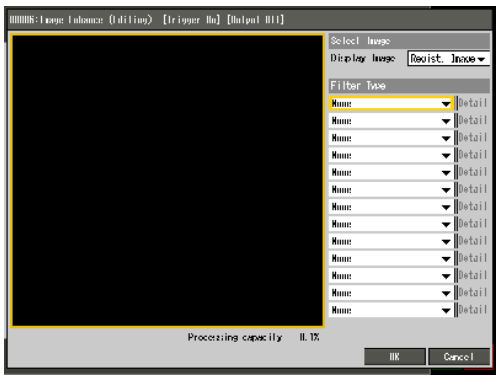
► Note

This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-295) is referenced as the current image.

Refer to "Working with Color Images (Color Extraction)" (Page 10-2) for concepts involving color extraction and its operation.

Image Enhance

Specify the filter processing to apply to the image.
When a color camera is used, the filter is applied to the images converted using color extraction.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Filter type

Select the [Filter Type] field and then select the filter to apply. To perform area measurement using a method other than color to binary, you must select the [Binary] filter as the last filter. See "Image Enhancement Filters" (Page 10-11) for more details of each filter processing.

► Note

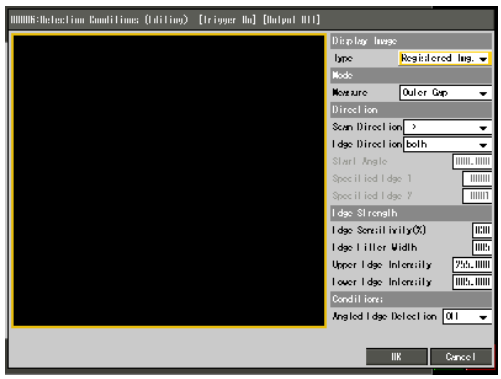
- For the area tool, [Binary] must be selected unless color to binary is used in the color extraction settings.
- If the binary filter is not selected or another filter is applied after the binary filter, the measurement result may not be correct.
- The binary, subtract and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 13 types of filters can be stacked according to application requirements. When multiple filters are set, they are processed one by one from the top.
- The order of the filters can be changed by selecting a filter in one of the [Filter Type] fields, holding down the No.1 (FUNCTION) button of the handheld controller, and then moving the 8-way key up or down.

Edge Detection

Specify the conditions for measuring the distance between 2 edges.



Reference

See "What is an Edge?" (Page 10-25) for the technical description on edge detection.

Select Image

Display Image

Switch the image displayed on the screen.

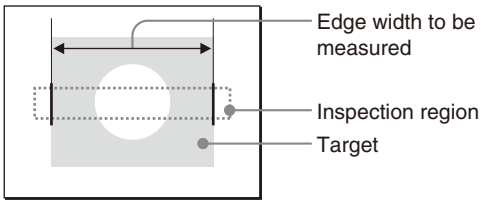
- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Mode

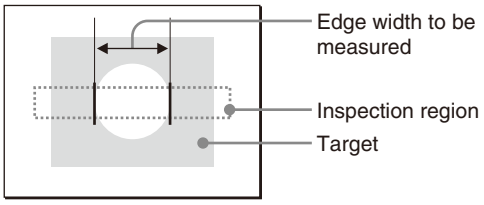
Measure

Select the type of edge width measurement.

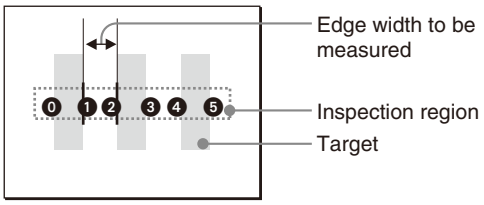
- **Outer Gap**: Measure the distance between the two outermost edges in the inspection region.



- **Inner Gap**: Measure the distance between the two innermost edges in the inspection region.



- **Specified Edges**: Measure the width between specified edges in the inspection region.



► Note

When the mode is changed from [Specified Edges] to [Inner Gap] or [Outer Gap], the settings for [Specified Edge 1] and [Specified Edge 2] are reset. (If a variable is referenced for any parameter, the reference will be cleared as well.)

Direction

Scan direction

Select the scan direction to detect an edge.

- **When the inspection region is a rectangle, circle, oval, polygon or composition**: →, ←, ↑, ↓
- **When the inspection region is a rotated rectangle**: Forward or reverse with respect to the horizontal axis (X axis) of the region Since the scan direction depends on the rotation angle of the inspection region, this should be taken into consideration when selecting this option.
- **When the inspection region is a ring or an arc**: Clockwise, Counter CW

Edge direction

Select the change in contrast for detecting an edge.

- **Light to Dark**: Detect edges in a transition that changes from a bright area to a dark area.
- **Dark to Light**: Detect edges in a transition that changes from a dark area to a bright area.
- **Both** (default): Detect edges in a transition that can change either from a bright area to a dark area or from a dark area to a bright area.

Start angle

When [Ring] is selected for the inspection region, specify a starting angle (0° to 359.999°) for the edge scan.

Reference

If the start angle is changed, the detection angle will be calculated with reference to the 3 o'clock position being 0°.

Specified Edge 1 / Specified Edge 2

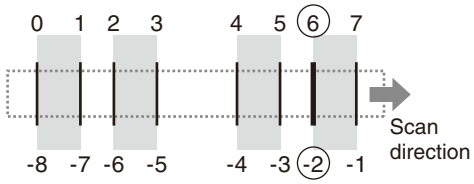
When using [Specified Edge] for [Measure], select [Specified Edge 1] and specify the edge number for the start of the width to measure. Use [Specified Edge 2] to specify the edge number for the end of the width to measure.

Reference

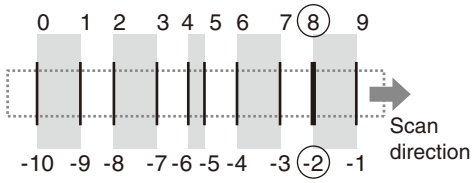
Negative values can be used for [Specified Edge 1] and or [Specified Edge 2] to specify the edge number in the opposite scan direction. This technique is useful when the number of edges is always changing.

Example: When the scan direction is set to [→], when "-2" is set for [Specified Edge 2], then the second edge from the right is used as the edge for the end of the width. In this case if more edges are detected due to noise or part changes inside of the two edges specified the proper edges are still detected

Normal case



When a noisy edge exists



If [Specified Edge 2] is set to "6", false measurement occurs from extra edges. Using "-2" prevents false detection.

Edge Strength

Edge Sensitivity (%)

Set the percentage threshold (0% to 100%) for detecting edges.

Edge filter width

Set the width (0 to 100 pixels) of the smoothing filter applied to the differential graph for detecting edges.

Edge Intensity

- **Upper Edge Intensity**: Specify the upper limit (0.000 to 255.000) of edge intensity for detecting edges.
- **Lower Edge Intensity**: Specify the lower limit (0.000 to 255.000) of edge intensity for detecting edges.

Reference

Unwanted edges can be excluded from detection by adjusting the upper and lower edge intensity values referring the highest edge intensity in the region (shown on the left of the edge graph). See "What is an Edge?" (Page 10-25) for more details.

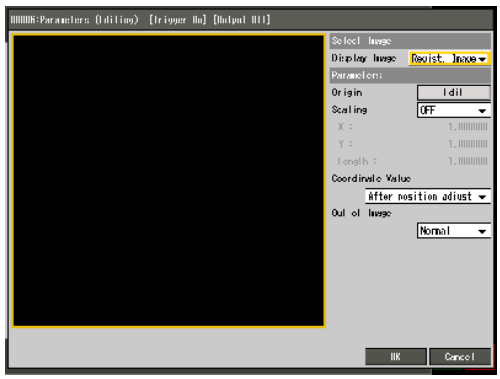
Conditions

Angled edge detection

Set to [ON] to stabilize the detection of slanted edges in the inspection region. Using this option may affect the edge X, Y position accuracy.

Parameters

Specify additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Parameters

Origin

By default, the origin is set to the top left corner of the camera but its location can be moved as required. To specify the origin, select [Edit] and then specify the coordinates.

Reference

The origin can be set outside the process region. The available range for the origin is -9600 to 9600 (X), -7200 to 7200 (Y).

Scaling

The controller processes image data in pixels, The result data and setting parameters used for display, judgement and calculations can be converted and scaled to real life values and dimensions by using the pre-set scaling factor option.

- **OFF**: Do not use scaling.
- **ON**: Use scaling.

Reference

- The scaling factor can be changed from the [Option] menu of the Flowchart (Page 4-356).
- For a summary list of the result data for which scaling can be used, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

Coordinate value

Select the coordinate system to be used after position adjustment. If position adjustment is not used, this setting will have no effect on the measurement.

- **After position adjust**: The inspection uses the adjusted coordinate axes determined after position adjustment.
- **Before position adjust**: The distance from the position specified for the [Origin] of the inspection is used.

Out of Image

Specify whether to incorporate data that falls outside of the inspection region. This maybe required when position adjustment is used.

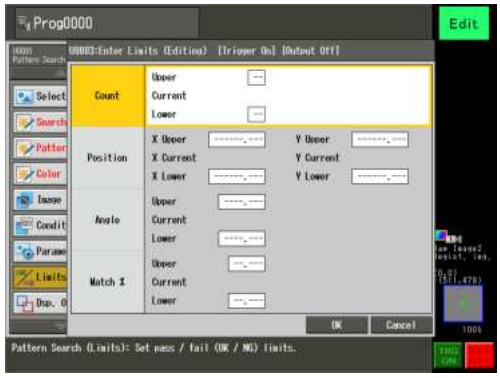
- **Normal (default)**: Edge detection outside of the region is disabled as the image data outside of the region is masked. Since masking requires time to process, the inspection time may vary depending on the quantity image data outside the region. Processing will take longer when the inspection region is a ring or an arc.
- **Fast**: The image data outside of the region is not masked, allowing for faster processing. As the image data outside the region has not been masked so there is an increased chance of detecting an edge outside the region. Select [Normal] to avoid incorrect edge detection.

Reference

Image data which is already located outside of the region during the inspection region setting will always be masked regardless of the [Out of Image] setting.

Limits

Set pass / fail tolerances (upper and lower limits) for the inspection.
If the result is outside of the specified tolerance range, it is judged as [NG] (binary 1). If the result is within the tolerance range, it is judged as [OK] (binary 0).



Use [Direct Input] to enter a value and set the tolerance.

Reference

- [-----] indicates an empty state where no tolerance is set. In this state, no judgment will be performed on the measurement.
- To reset the tolerance setting to an empty state, select [Clear].

Width

Specify the tolerance for the edge width (When the inspection region is not a ring or an arc).
The unit of measurement is the "number of pixels" indicating the width.

Angle width

Specify the tolerance for the edge width (When the inspection range is a ring or an arc).
The unit of measurement is the "angle" indicating the width.

Display Options

The display color of the units visual indicators can be changed based on the judgment result for that unit. The visual indicator can also be made transparent by selecting [Setting] - [Select Color] - [None].



Inspection region

Specify the line width and display color of the inspection region.

Mask region

Specify the line width and display color of the mask region.

Detected point

Specify the width and display color of the line indicating the detected edge.

Edge Graph

Edge Graph

Select whether to display the edge graph.

- **ON**: Show the edge graph.
- **OFF**: Hide the edge graph.

Wave

Specify the width and display color of the edge graph waveform.

Frame

Specify the width and display color of the edge graph frame.

Sensitivity

Specify the width and display color of the line representing the edge sensitivity threshold.

► Note

Setting [Edge graph] to [ON] consumes additional program memory. Check the amount of remaining program memory before enabling.

Processing Priority

Specify the processing priority when displaying large processed images during Run mode.
When a line scan camera is used with the XG-7502A, it is not possible to display the processed image if the image size exceeds 25 MB (26214400 pixels). In such a case it is possible to display the filtered image and contrast image by using a display image variable.

Filtered image

Select whether or not to use a display image variable for the filtered image display.

- **Unit Processing**: Processes the filtered image without using the display image variable.
- **Image Display**: Processes the filtered image using a display image variable.

Reference

- When processing images 25 MB or less, or when using the XG-7702A, it is not necessary to select [Image Display].
- When processing an image larger than 25 MB, if the area displayed is 8 MB (8388608 pixels) or less, the filtered image will be automatically displayed when [Unit Priority] is selected. (However the following processes are excluded.)
  - Image enhancement: Shading correction, blob filter
  - Conversion (image operation): Rotate/translate, zoom, trapezoid correction, blob filter
  - Defect, Grayscale Blob: Contrast display

► Note

When [Image Display] is selected for [Filtered Image], the following restrictions on operation occur.

- Processing time increases.
- The background outside the inspection region becomes a black image.
- Displaying of multiple units is not possible.
- For display of registered images outside of unit edit, the filtered image cannot be displayed and the display is the same as when [Unit Processing] is set.
- When an archived image is displayed, it ix not possible to display the processed image unless the display image variable and results are also stored in the archive.

Image variable

Specify a display image variable for displaying the filtered image.

Reset

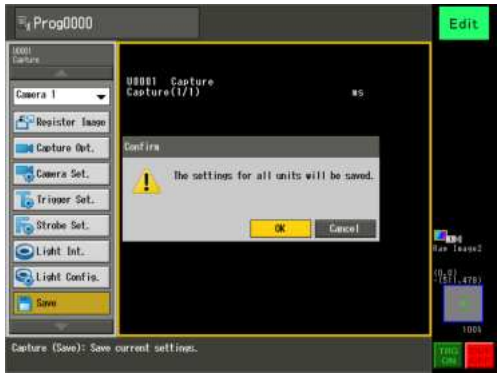
Returns the display options to their defaults.

Save

Save the current unit changes the program file.

► Note

- If the device is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the system power while you are saving the settings. Doing so may cause errors in the internal data



Save

The settings for the unit are saved in the current program file in SD Card 1 or SD Card 2.

► Note

Items specified not to be saved in XG VisionEditor are excluded from the saving operation.
For example, variable values changed in the current program or the default display, and display parts, can be excluded when saving.

Edge pitch

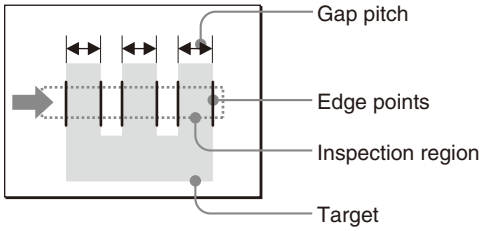
Edge Pitch Tool

The edge pitch tool scans across a target in a user specified direction within a specified region detecting contrast changes. Based on these contrast changes the maximum, minimum and average center pitch or gap pitch between edges can be measured.
Because edge detection is based on the transition from bright to dark (or dark to bright), not on absolute intensity values, it is less affected by illumination fluctuations during image capturing.

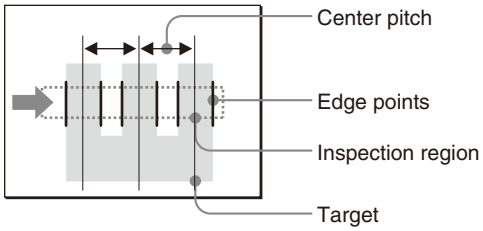
Image processing

When the inspection region is a rectangle

- Example of measuring the gap pitch

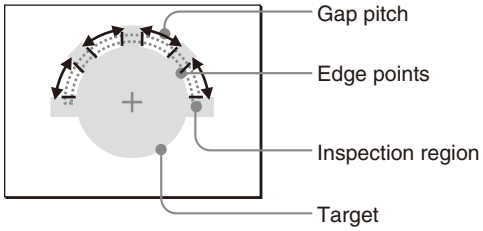


- Example of measuring the center pitch

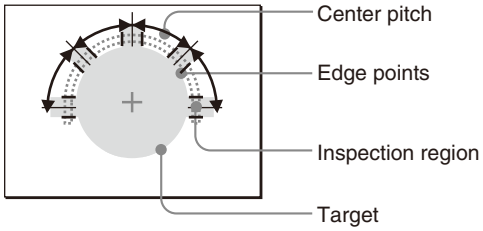


When the inspection region is a ring or an arc

- Example of measuring the gap pitch



- Example of measuring the center pitch



Processing results

The standard results and data returned by the edge pitch tool are as follows:

Reference

Processing results may vary depending on the shape of the inspection region. The result for an item which is not processed is always 0.

When the inspection region is not a ring or an arc

Number of pitches	Outputs the number of detected pitches. Tolerance inspection target
Maximum edge pitch	Outputs the maximum width in pixels. Tolerance inspection target
Minimum edge pitch	Outputs the minimum width in pixels. Tolerance inspection target
Average edge pitch	Outputs the average width in pixels.
Pitches [ ]	Outputs all detected pitches in pixels. Label specification target
Edge position 1 (X, Y) [ ]	Outputs the position coordinates for all the first identified edges (typically the ones nearest the start of the inspection region) of each edge pitch in pixels. Label specification target
Distance 1 [ ]	Outputs the distances from the start of the inspection region to all the first identified edges (typically the ones nearest the start of the inspection region) of each edge pitch in pixels. Label specification target
Intensity 1 [ ]	Outputs the intensity differential for all the first identified edges (typically the ones nearest the start of the inspection region) of each edge pitch. Label specification target
Edge position 2 (X, Y) [ ]	Outputs the position coordinates for all the second identified edges (typically the ones nearest the end of the inspection region) of each edge pitch in pixels. Label specification target
Distance 2 [ ]	Outputs the distances from the start of the inspection region to all the second identified edges (typically the one nearest the end of the inspection region) of each edge pitch in pixels. Label specification target
Intensity 2 [ ]	Outputs the intensity differential for all the second identified edges (typically the ones nearest the end of the inspection region) of each edge pitch. Label specification target
Unit judgment value	Outputs the binary result of the unit based on the measured value and the specified tolerance range (upper / lower limits). The unit is judged as [NG] (binary 1) when outside the tolerance range and [OK] (binary 0) when inside.

When the inspection region is a ring or an arc

Number of pitches	Outputs the number of detected pitches. Tolerance inspection target
Maximum edge pitch	Outputs the maximum width as an angle. Tolerance inspection target
Minimum edge pitch	Outputs the minimum width as an angle. Tolerance inspection target
Average edge pitch	Outputs the average width as an angle.
Pitches [ ]	Outputs all detected pitches as angles. Label specification target
Edge position 1 (X, Y) [ ]	Outputs the position coordinates of all the intersection points between the projected lines (radial) of the first identified edges (typically the one nearest the start of the inspection region) and the center line (circular) of the inspection region. Label specification target
Angle 1 [ ]	Outputs the first identified edge of the edge width pair as an angle. Label specification target
Distance1 [ ]	Outputs the distances from the start of the inspection region to all the first identified edges (typically the ones nearest the start of the inspection region) of each edge pitch in pixels. Label specification target
Intensity1 [ ]	Outputs the intensity differential for all the first identified edges (typically the ones nearest the start of the inspection region) of each edge pitch. Label specification target
Edge position 2 (X, Y) [ ]	Outputs the position coordinates of all the intersection points between the projected lines (radial) of the second identified edges (typically the one nearest the end of the inspection region) and the center line (circular) of the inspection region. Label specification target
Angle 2 [ ]	Outputs the second identified edge (typically the one nearest the end of the inspection region) of the edge width pair as an angle. Label specification target
Distance 2 [ ]	Outputs the distances from the start of the inspection region to all the second identified edges (typically the one nearest the end of the inspection region) of each edge pitch in pixels. Label specification target
Intensity 2 [ ]	Outputs the intensity differential for all the first identified edges (typically the ones nearest the end of the inspection region) of each edge pitch. Label specification target
Unit judgment value	Outputs the binary result of the unit based on the measured value and the specified tolerance range (upper / lower limits). The unit is judged as [NG] (binary 1) when outside the tolerance range and [OK] (binary 0) when inside.

Reference

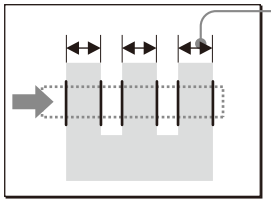
- For the edge pitch judgment, the upper tolerance limit is applied to the value of the maximum edge pitch, and the lower tolerance limit is applied to the value of the minimum edge pitch.
- For the lists of available measurement output values and setting parameters, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

Example

When the inspection region is a rectangle or a rotated rectangle

Example showing the results of an edge pitch inspection performed under the following conditions:

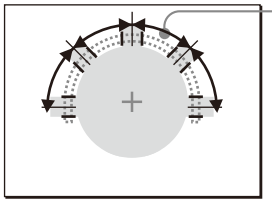
- Measure: Gap pitch
- Scan Direction: →
- Edge Direction: Both



When the inspection region is a ring or an arc

Example showing the results of an edge pitch inspection performed under the following conditions:

- Measure: Center pitch
- Scan Direction: (Counter CW)
- Edge Direction: Both



Main Menu

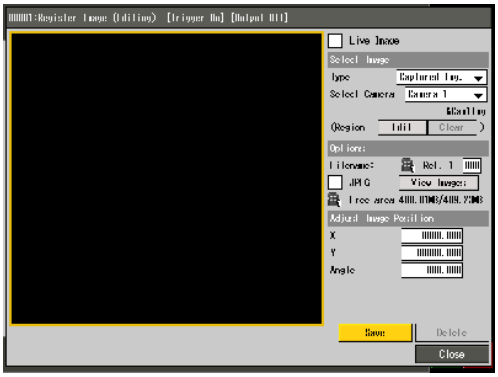
The main menu of the edge pitch tool consists of the following options. Configure settings under each option as required for the inspection.



Register Image (Page 4-79)	Register an image to be used as a template for settings.
Select Image (Page 4-81)	Specify the image to be used for unit processing.
Inspect Region (Page 4-82)	Define the region to be used for unit processing.
Color (Page 4-83)	Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).
Image Enhance (Page 4-83)	Settings for pre-processing image filters.
Edge Detection (Page 4-84)	Specific conditions for processing an edge pitch inspection.
Parameters (Page 4-86)	Additional optional parameters.
Limits (Page 4-87)	Unit pass / fail tolerances.
Display Options (Page 4-87)	Unit processing display settings.
Save (Page 4-89)	Save unit settings.

Register Image

An image can be saved to the controller to be used as a template for measurements and settings. It is recommended to adjust and fix lighting and other external influences before registering an image.



Live Image

Check this box to display live images through a continuous feed.

► Note

- A live feed is only available while the unit is being edited.
- This setting cannot be changed when the screen update mode is set to [Continuous] in the trigger settings (Page 4-25).
- If the capture on trigger input is disabled in the trigger settings (Page 4-25), this check box is always unchecked and the setting cannot be changed.
- When Live image is selected for a moving object, take care when registering as there will be a time lag between the external trigger input and the actual image capture.
- In principle, Live-image is only used when the capture unit being edited is being executed (waiting for a trigger input). When the image capture buffer is set to custom and the capture unit which was most recently executed is being edited, the images collected in the buffer will still be displayed even if the capture unit is not presently capturing images.
- Continuous update cannot be used when HDR capture (Page 4-21) is enabled or when a line scan camera is being used.
- When the HDR capture (Page 4-21) is enabled, the Multi-image cannot be used.

Select Image

Type

Select an image to register.

- **Captured Img.**: Displays the latest image from the specified camera (image variable).
- **Registered Img.**: The registered image specified in [Options] is displayed.

Select Camera

Select the number of the camera used for registration. Choose from Camera1 - Camera4, and select only the camera number used for the capture unit being edited.

Specifying a region

To register only part of an image, select [Edit] then specify the region to register. To cancel the selected region, select [Clear].

Save Image

Filename

Specify the registered image number used for image registration in the form "(Camera No.)-(User-specified No.)".

Reference

The name of the saved file is "ref (Camera No.)_(Specified No.)" (for full screen image registration) or "ref (Camera No.)_(Specified No.)_XXX_YYY" (for partial image registration).

JPEG

Check this box to save the image in JPEG format. When this box is not checked, the image will be saved in BMP format as either a 24-bit color bitmap image (when a color camera is used) or an 8-bit grayscale bitmap image (when a monochrome camera is used).

► Note

Using image compression may result in some image deterioration, thus results from a compressed image may differ to those when using non compressed images.

View All

View all registered images in a list.

Adjust Image Position

Adjust the position of the image being captured.

X

-Adjust the movement in the X (horizontal) direction between -8191.000 and 8191.000 pixels.

Y

-Adjust the movement in the Y (vertical) direction between -16383.000 and 16383.000 pixels.

Angle

Adjust the position angle (rotation) around the center of the image between -999.999° and 999.999°.

► Note

Position adjustment may cause missing peripheries (black areas) due to image movement or jagged edges (jaggies) due to rotation in the registered image.

Save

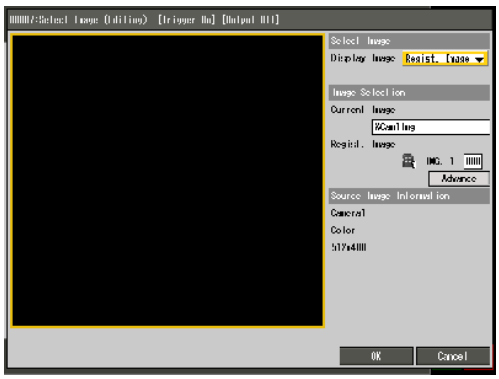
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Registered Img.] is selected for [Type], you can delete the registered image specified in [Options].

Select Image

Specify the image variable and associated registered image to be used for configuring the vision tool.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured Image**: Displays the latest image from the specified camera (image variable).
- **Registered Image**: The registered image specified under [Image Selection] is displayed.

Select image

Captured Img.

Set an image variable to be used as a current image for the unit.

Registered Img.

Specify the registered image No. for the registered image to be used.

- The registered images are managed as "Image (Camera No.) - (Registered image No.0 to 999)".
- The "Camera No" is fixed to the number of the camera associated to the image variable specified for the current image.

Advance

Set advance options for the switching of registered images as necessary.

- **Use numerical variable for registered image number**: To use a variable for the registered image No., check this box and assign a numerical or numerical array variable reference. By using a variable for the registered image No. and then issuing a variable reference value apply command (NU), the image is switched to the specified registered image in the variable and the reference image information is updated. For more details, see the XG-7000 Series Communication Control Manual.
- **Process variable when changing programs**: Use this option to switch to the registered image based on the initial value of the variable referenced when the program is changed or the controller is next turned on.

► Note

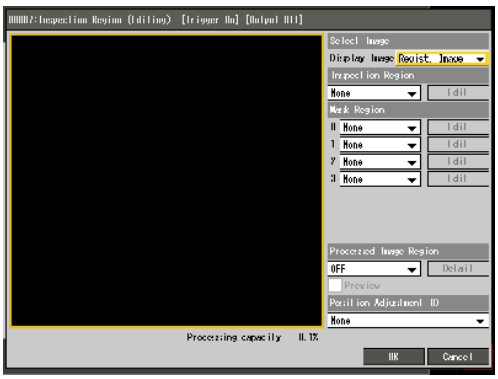
Note that the registered image No. does not switch in accordance with a change in the variable.

Source Image Information

The camera No., type (color / monochrome), and resolution of the camera associated to the image variable specified is displayed.

Inspection Region

Outline the region on the captured image to be used for inspection.



► Note

Changing the shape of the region will initialize or clear some of the settings in the [Edge Detection] menu.

Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Region

Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Inspection Region Menu" (Page 3-20) for more details.

Mask region

A mask region is an area which can be defined in the inspection region and will be excluded from the inspection. Up to four mask regions can be set per inspection region. A mask region is typically used for hiding an area that does not require inspection.
Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Excluding Part of the Region" (Page 3-26) for more details.

Processed image region

Use processed image region to generate a region for inspection based on an image. (Page 4-295), select [ON] and then select [Detail] for configuration.

Reference

Refer to "Generating a Region from an Image" (Page 3-27) for more details on processed image region.

Image

Specify the image variable to be used for generating the region.

Area

Specify the area and border color for the region based on the image specified in the image variable. Select either [Black] (Level 0) or [White] (Level 255, default).

Preview

Use this checkbox to display the specified image. When the checkmark is removed, the display returns to its normal state.

Position Adjustment ID

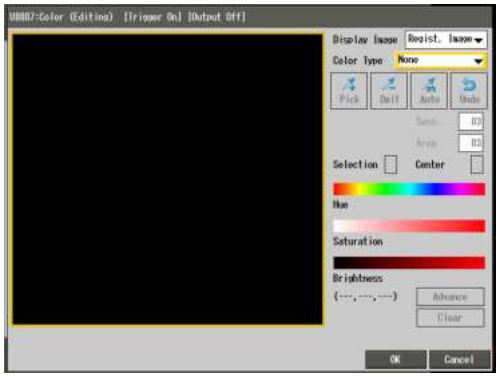
To use position adjustment for the region, select the position adjustment unit to be referenced.

Reference

The position adjustment is applied to all inspection, mask, and image regions.

Color

When working with a color camera, convert the captured color image into a binary (black and white) or a grayscale converted image by extracting the desired color.



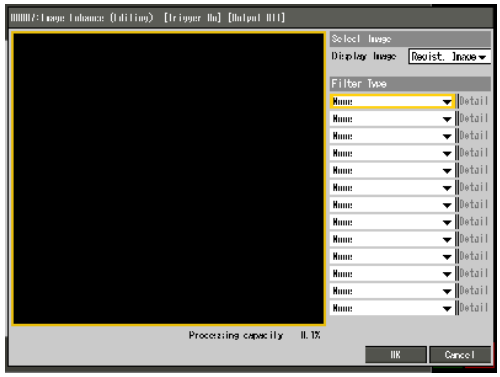
► Note

This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-295) is referenced as the current image.

Refer to "Working with Color Images (Color Extraction)" (Page 10-2) for concepts involving color extraction and its operation.

Image Enhance

Specify the filter processing to apply to the image. When a color camera is used, the filter is applied to the images converted using color extraction.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Filter type

Select the [Filter Type] field and then select the filter to apply. To perform area measurement using a method other than color to binary, you must select the [Binary] filter as the last filter. See "Image Enhancement Filters" (Page 10-11) for more details of each filter processing.

► Note

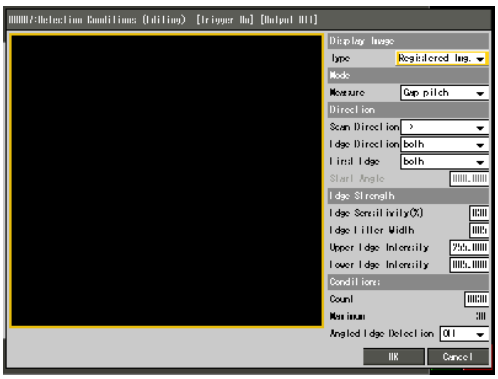
- For the area tool, [Binary] must be selected unless color to binary is used in the color extraction settings.
- If the binary filter is not selected or another filter is applied after the binary filter, the measurement result may not be correct.
- The binary, subtract and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 13 types of filters can be stacked according to application requirements. When multiple filters are set, they are processed one by one from the top.
- The order of the filters can be changed by selecting a filter in one of the [Filter Type] fields, holding down the No.1 (FUNCTION) button of the handheld controller, and then moving the 8-way key up or down.

Edge Detection

Specify the conditions for measuring the distance between a series of edges.



Reference

See "What is an Edge?" (Page 10-25) for the technical description on edge detection.

Select Image

Display Image

Switch the image displayed on the screen.

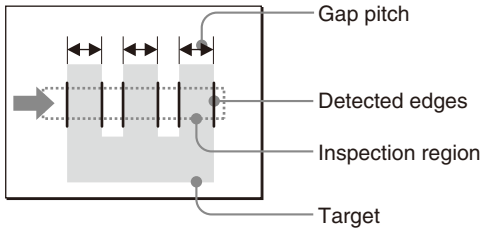
- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Mode

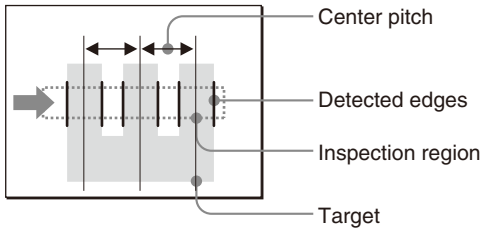
Measure

Select the type of edge pitch measurement.

- **Gap pitch**: Detect edges in the specified scan direction and measure the maximum, minimum, and average distance between odd and even edges.



- **Center pitch**: Measure the maximum, minimum, and average distance between the center points of pairs of edges.



Direction

Scan direction

Select the scan direction to detect an edge.

- **When the inspection region is a rectangle, circle, oval, polygon or composition**: →, ←, ↑, ↓
- **When the inspection region is a rotated rectangle**: Forward or reverse with respect to the horizontal axis (X axis) of the region Since the scan direction depends on the rotation angle of the inspection region, this should be taken into consideration when selecting this option.
- **When the inspection region is a ring or an arc**: Clockwise, Counter CW

Edge direction

Select the change in contrast for detecting an edge.

- **Light to Dark**: Detect edges in a transition that changes from a bright area to a dark area.
- **Dark to Light**: Detect edges in a transition that changes from a dark area to a bright area.
- **Both** (default): Detect edges in a transition that can change either from a bright area to a dark area or from a dark area to a bright area.

First edge

Specify the type of transition for starting the edge pitch measurement (only when [Edge Direction] is set to [both]).

- **Both (default)**: Start measurement edges in a transition that changes either from a bright area to a dark area or from a dark area to a bright area.
- **Light to Dark**: Start measurement edges in a transition that changes from a bright area to a dark area.
- **Dark to Light**: Start measurement edges in a transition that changes from a dark area to a bright area.

► Note

When the edge direction is set to either [Light to Dark] or [Dark to Light] and the first edge is set to the opposite transition, edge pitch measurements are not possible.

Start angle

When [Ring] is selected for the inspection region, specify a starting angle (0° to 359.999°) for detecting edges.

Reference

If the start angle is changed, the detection angle will be calculated with reference to the 3 o'clock position being 0°.

Edge Strength

Edge Sensitivity (%)

Set the percentage threshold (0% to 100%) for detecting edges.

Edge filter width

Set the width (0 to 100 pixels) of the smoothing filter applied to the differential graph for detecting edges.

Edge Intensity

- **Upper Edge Intensity**: Specify the upper limit (0.000 to 255.000) of edge intensity for detecting edges.
- **Lower Edge Intensity**: Specify the lower limit (0.000 to 255.000) of edge intensity for detecting edges.

Reference

Unwanted edges can be excluded from detection by adjusting the upper and lower edge intensity values referring the highest edge intensity in the region (shown on the left of the edge graph). See "What is an Edge?" (Page 10-25) for more details.

Conditions

Count

Specify the maximum number of pitches (1 to 3600) to be measured. The pitch count cannot exceed the [Maximum Count] value.

► Note

- The maximum number of pitches that can actually be detected changes depending on the settings.
- With some settings, the maximum number of pitches cannot be changed.

Reference

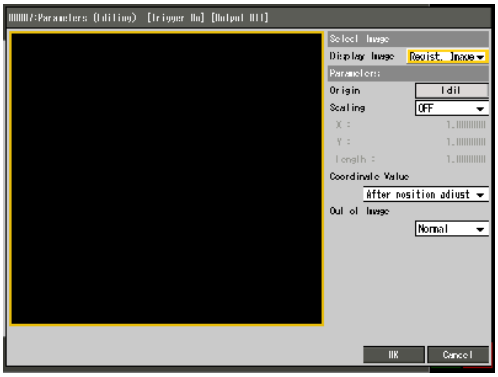
It may be possible to specify the [Count] value exceeding the [Maximum] value (Maximum: 1800) depending on the account setting. Note, however, that this also increases the [Maximum] value, resulting in more consumption of the program memory.

Angled edge detection

Set to [ON] to stabilize the detection of slanted edges in the inspection region. Using this option may affect the edge X, Y position accuracy.

Parameters

Specify additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Parameters

Origin

By default, the origin is set to the top left corner of the camera but its location can be moved as required. To specify the origin, select [Edit] and then specify the coordinates.

Reference

The origin can be set outside the process region. The available range for the origin is -9600 to 9600 (X), -7200 to 7200 (Y).

Scaling

The controller processes image data in pixels, The result data and setting parameters used for display, judgement and calculations can be converted and scaled to real life values and dimensions by using the pre-set scaling factor option.

- **OFF**: Do not use scaling.
- **ON**: Use scaling.

Reference

- The scaling factor can be changed from the [Option] menu of the Flowchart (Page 4-356).
- For a summary list of the result data for which scaling can be used, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

Coordinate value

Select the coordinate system to be used after position adjustment. If position adjustment is not used, this setting will have no effect on the measurement.

- **After position adjust**: The inspection uses the adjusted coordinate axes determined after position adjustment.
- **Before position adjust**: The distance from the position specified for the [Origin] of the inspection is used.

Out of Image

Specify whether to incorporate data that falls outside of the inspection region. This maybe required when position adjustment is used.

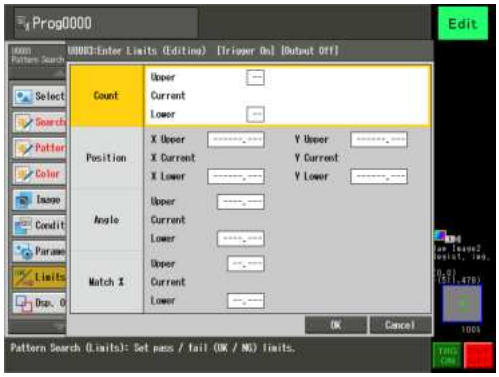
- **Normal (default)**: Edge detection outside of the region is disabled as the image data outside of the region is masked. Since masking requires time to process, the inspection time may vary depending on the quantity image data outside the region. Processing will take longer when the inspection region is a ring or an arc.
- **Fast**: The image data outside of the region is not masked, allowing for faster processing. As the image data outside the region has not been masked so there is an increased chance of detecting an edge outside the region. Select [Normal] to avoid incorrect edge detection.

Reference

Image data which is already located outside of the region during the inspection region setting will always be masked regardless of the [Out of Image] setting.

Limits

Set pass / fail tolerances (upper and lower limits) for the inspection.
If the result is outside of the specified tolerance range, it is judged as [NG] (binary 1). If the result is within the tolerance range, it is judged as [OK] (binary 0).



Use [Direct Input] to enter a value and set the tolerance.

Reference

- [-----] indicates an empty state where no tolerance is set. In this state, no judgment will be performed on the measurement.
- To reset the tolerance setting to an empty state, select [Clear].

Count

Specify the tolerance for the detected edge pitch.
The unit of measurement is the "number of edge pitches" detected.

Pitch

Specify the tolerance for the width of the detected edge pitches. The unit of measurement is the "number of pixels" (when the inspection region is not a ring or an arc) or "angle" (only when the inspection region is a ring or an arc) of the pitches.

Reference

For the edge pitch judgment, the upper tolerance limit is applied to the value of the maximum edge pitch, and the lower tolerance limit is applied to the value of the minimum edge pitch.

Display Options

The display color of the units visual indicators can be changed based on the judgment result for that unit. The visual indicator can also be made transparent by selecting [Setting] - [Select Color] - [None].



Inspection region

Specify the line width and display color of the inspection region.

Mask region

Specify the line width and display color of the mask region.

Detected point

Specify the width and display color of the line indicating the detected edge.

Edge Graph

Edge Graph
Select whether to display the edge graph.
- **ON**: Show the edge graph.
- **OFF**: Hide the edge graph.

Wave
Specify the width and display color of the edge graph waveform.

Frame
Specify the width and display color of the edge graph frame.

Sensitivity
Specify the width and display color of the line representing the edge sensitivity threshold.

► Note

Setting [Edge graph] to [ON] consumes additional program memory. Check the amount of remaining program memory before enabling.

Processing Priority

Specify the processing priority when displaying large processed images during Run mode.
When a line scan camera is used with the XG-7502A, it is not possible to display the processed image if the image size exceeds 25 MB (26214400 pixels). In such a case it is possible to display the filtered image and contrast image by using a display image variable.

Filtered image
Select whether or not to use a display image variable for the filtered image display.
- **Unit Processing**: Processes the filtered image without using the display image variable.
- **Image Display**: Processes the filtered image using a display image variable.

Reference
- When processing images 25 MB or less, or when using the XG-7702A, it is not necessary to select [Image Display].
- When processing an image larger than 25 MB, if the area displayed is 8 MB (8388608 pixels) or less, the filtered image will be automatically displayed when [Unit Priority] is selected. (However the following processes are excluded.)
  - Image enhancement: Shading correction, blob filter
  - Conversion (image operation): Rotate/translate, zoom, trapezoid correction, blob filter
  - Defect, Grayscale Blob: Contrast display

► Note

When [Image Display] is selected for [Filtered Image], the following restrictions on operation occur.
- Processing time increases.
- The background outside the inspection region becomes a black image.
- Displaying of multiple units is not possible.
- For display of registered images outside of unit edit, the filtered image cannot be displayed and the display is the same as when [Unit Processing] is set.
- When an archived image is displayed, it ix not possible to display the processed image unless the display image variable and results are also stored in the archive.

Image variable
Specify a display image variable for displaying the filtered image.

Reset

Returns the display options to their defaults.

Save

Save the current unit changes the program file.

► Note

- If the device is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the system power while you are saving the settings. Doing so may cause errors in the internal data



Save

The settings for the unit are saved in the current program file in SD Card 1 or SD Card 2.

► Note

Items specified not to be saved in XG VisionEditor are excluded from the saving operation.
For example, variable values changed in the current program or the default display, and display parts, can be excluded when saving.

Edge angle

Edge Angle Tool

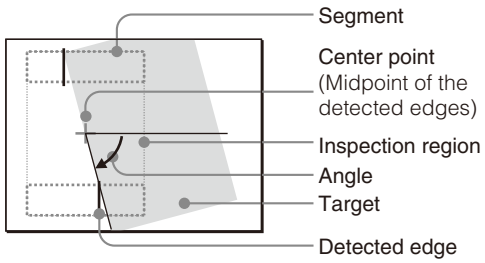
The edge angle tool scans across a target in a user specified direction within two segments of a specified region detecting contrast changes. Based on these contrast changes two edges can be specified and the angle between the two can be measured. Based on a horizontal reference line and the edge scanning direction the edge angle can be negative (-0.001 to -179.999) when measured counterclockwise and positive (0.000 to 180.000) when measured clockwise.
Because edge detection is based on the transition from bright to dark (or dark to bright), not on absolute intensity values, it is less affected by illumination fluctuations during image capturing.

Reference

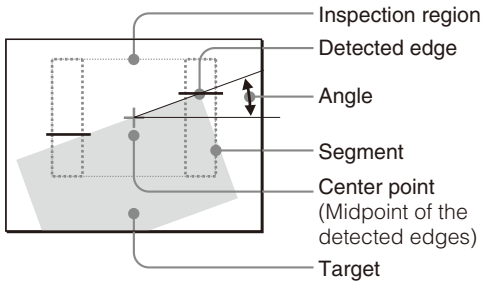
You can specify the edge detection options, such as a scan direction or edge direction, for each segment individually. This makes it easier to detect the tilt angle of a target in a single unit even when target with a complicated shape is measured.

Image processing

When the edge angle is "+75°"



When the edge angle is "-20°"



Processing results

The standard results and data returned by the edge angle tool are as follows:

Reference

Processing results may vary depending on the shape of the inspection region. The result for an item which is not processed is always 0.

Angle	Outputs the angle of the target by detecting two edge positions (-179.999° to 180.000°). Tolerance inspection target
Center (X, Y)	Outputs the position coordinates of the midpoint between the two identified edges from the two segments in pixels.
Edge position 1 (X, Y)	Outputs the position coordinates of the identified edge detected in the 1st area (The edge detected in the upper segment when the rotation angle is 0°) in pixels.
Distance 1	Outputs the distance from the start of the inspection region to the edge identified in segment 1 in pixels.
Intensity 1	Outputs the intensity differential for the identified edge in segment 1.
Edge position 2 (X, Y)	Outputs the position coordinates of the identified edge detected in the 2nd area (The edge detected in the lower segment when the rotation angle is 0°) in pixels.
Distance 2	Outputs the distance from the start of the inspection region to the edge identified in segment 2 in pixels.
Intensity 2	Outputs the intensity differential for the identified edge in segment 2.
Unit judgment value	Outputs the binary result of the unit based on the measured value and the specified tolerance range (upper / lower limits). The unit is judged as [NG] (binary 1) when outside the tolerance range and [OK] (binary 0) when inside.

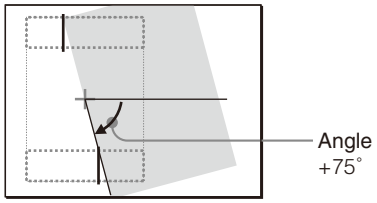
Reference

For the lists of available measurement output values and setting parameters, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

Example

Example showing the results of an edge angle inspection performed under the following conditions:

- Edge Direction: Both



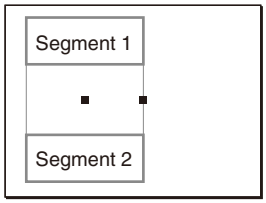
Reference

The edge angle measurement value is the angle between the horizontal and the straight line connecting the two identified edges in the two segments.

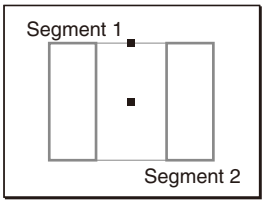
Definition of edge position 1 and edge position 2

This system labels an edge found in segment 1 as edge position 1 and the edge found in segment 2 as edge position 2. When the rotation angle of the region is 0° (default), the upper rectangle is segment 1 and the lower rectangle is segment 2. When the rotation angle is 180° the segment order is changed. If the edge scanning direction is also changed angle measurement values will be reversed. Negative angles will become positive and positive angles will become negative.

When the rotation angle is 0°



When the rotation angle is 270°



Main Menu

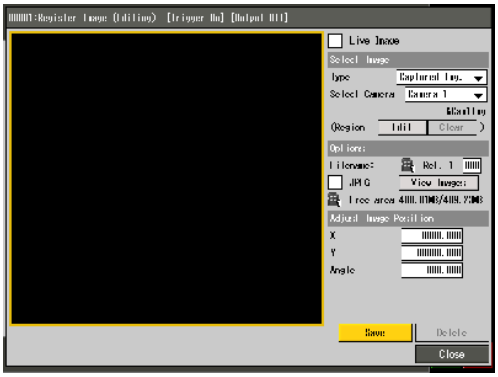
The main menu of the edge angle tool consists of the following options. Configure settings under each option as required for the inspection.



Register Image (Page 4-92)	Register an image to be used as a template for settings.
Select Image (Page 4-93)	Specify the image to be used for unit processing.
Inspect Region (Page 4-94)	Define the region to be used for unit processing.
Color (Page 4-95)	Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).
Image Enhance (Page 4-95)	Settings for pre-processing image filters.
Edge Detection (Page 4-96)	Specific conditions for processing an edge angle inspection.
Parameters (Page 4-97)	Additional optional parameters.
Limits (Page 4-98)	Unit pass / fail tolerances.
Display Options (Page 4-98)	Unit processing display settings.
Save (Page 4-100)	Save unit settings.

Register Image

An image can be saved to the controller to be used as a template for measurements and settings. It is recommended to adjust and fix lighting and other external influences before registering an image.



Live Image

Check this box to display live images through a continuous feed.

► Note

- A live feed is only available while the unit is being edited.
- This setting cannot be changed when the screen update mode is set to [Continuous] in the trigger settings (Page 4-25).
- If the capture on trigger input is disabled in the trigger settings (Page 4-25), this check box is always unchecked and the setting cannot be changed.
- When Live image is selected for a moving object, take care when registering as there will be a time lag between the external trigger input and the actual image capture.
- In principle, Live-image is only used when the capture unit being edited is being executed (waiting for a trigger input). When the image capture buffer is set to custom and the capture unit which was most recently executed is being edited, the images collected in the buffer will still be displayed even if the capture unit is not presently capturing images.
- Continuous update cannot be used when HDR capture (Page 4-21) is enabled or when a line scan camera is being used.
- When the HDR capture (Page 4-21) is enabled, the Multi-image cannot be used.

Select Image

Type

Select an image to register.

- **Captured Img.**: Displays the latest image from the specified camera (image variable).
- **Registered Img.**: The registered image specified in [Options] is displayed.

Select Camera

Select the number of the camera used for registration. Choose from Camera1 - Camera4, and select only the camera number used for the capture unit being edited.

Specifying a region

To register only part of an image, select [Edit] then specify the region to register. To cancel the selected region, select [Clear].

Save Image

Filename

Specify the registered image number used for image registration in the form "(Camera No.)-(User-specified No.)".

Reference

The name of the saved file is "ref (Camera No.)_(Specified No.)" (for full screen image registration) or "ref (Camera No.)_(Specified No.)_XXX_YYY" (for partial image registration).

JPEG

Check this box to save the image in JPEG format. When this box is not checked, the image will be saved in BMP format as either a 24-bit color bitmap image (when a color camera is used) or an 8-bit grayscale bitmap image (when a monochrome camera is used).

► Note

Using image compression may result in some image deterioration, thus results from a compressed image may differ to those when using non compressed images.

View All

View all registered images in a list.

Adjust Image Position

Adjust the position of the image being captured.

X

-Adjust the movement in the X (horizontal) direction between -8191.000 and 8191.000 pixels.

Y

-Adjust the movement in the Y (vertical) direction between -16383.000 and 16383.000 pixels.

Angle

Adjust the position angle (rotation) around the center of the image between -999.999° and 999.999°.

► Note

Position adjustment may cause missing peripheries (black areas) due to image movement or jagged edges (jaggies) due to rotation in the registered image.

Save

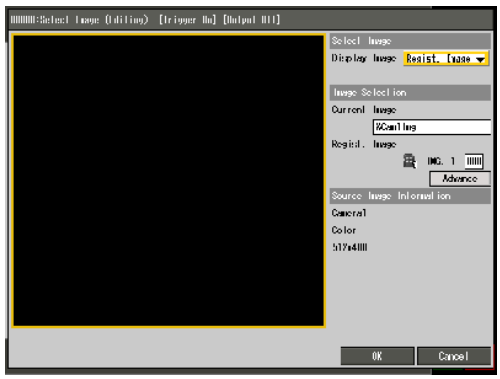
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Registered Img.] is selected for [Type], you can delete the registered image specified in [Options].

Select Image

Specify the image variable and associated registered image to be used for configuring the vision tool.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured Image**: Displays the latest image from the specified camera (image variable).
- **Registered Image**: The registered image specified under [Image Selection] is displayed.

Select image

Captured Img.

Set an image variable to be used as a current image for the unit.

Registered Img.

Specify the registered image No. for the registered image to be used.

- The registered images are managed as "Image (Camera No.) - (Registered image No.0 to 999)".
- The "Camera No" is fixed to the number of the camera associated to the image variable specified for the current image.

Advance

Set advance options for the switching of registered images as necessary.

- **Use numerical variable for registered image number**: To use a variable for the registered image No., check this box and assign a numerical or numerical array variable reference. By using a variable for the registered image No. and then issuing a variable reference value apply command (NU), the image is switched to the specified registered image in the variable and the reference image information is updated. For more details, see the XG-7000 Series Communication Control Manual.
- **Process variable when changing programs**: Use this option to switch to the registered image based on the initial value of the variable referenced when the program is changed or the controller is next turned on.

► Note

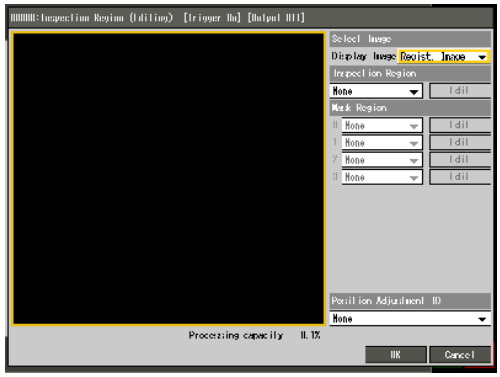
Note that the registered image No. does not switch in accordance with a change in the variable.

Source Image Information

The camera No., type (color / monochrome), and resolution of the camera associated to the image variable specified is displayed.

Inspection Region

Outline the region on the captured image to be used for inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Inspection region

Select [Rotated Rect] and then draw the region, or select [Edit] and specify the region with numerical values. See "Inspection Region Menu" (Page 3-20) for more details.

► Note

- You can use only rotated rectangles for the inspection region for the edge angle measurement.
- The sizes of the two segments cannot be different.
- Mask regions cannot be used for the edge angle measurement.

Position Adjustment ID

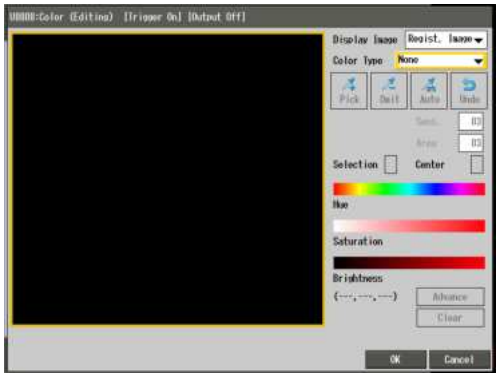
To apply position adjustment to the region, select the position adjustment unit to be referenced.

Reference

The position adjustment is applied to all inspection, mask, and image regions.

Color

When working with a color camera, convert the captured color image into a binary (black and white) or a grayscale converted image by extracting the desired color.



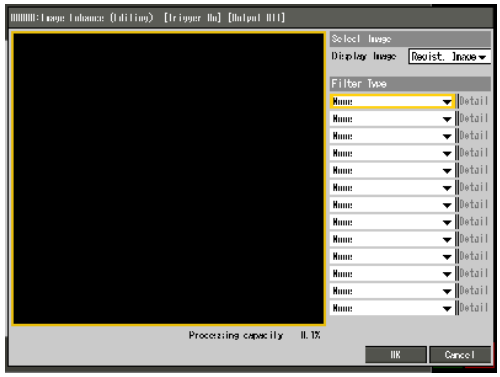
► Note

This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-295) is referenced as the current image.

Refer to "Working with Color Images (Color Extraction)" (Page 10-2) for concepts involving color extraction and its operation.

Image Enhance

Specify the filter processing to apply to the image.
When a color camera is used, the filter is applied to the images converted using color extraction.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Filter type

Select the [Filter Type] field and then select the filter to apply. To perform area measurement using a method other than color to binary, you must select the [Binary] filter as the last filter. See "Image Enhancement Filters" (Page 10-11) for more details of each filter processing.

► Note

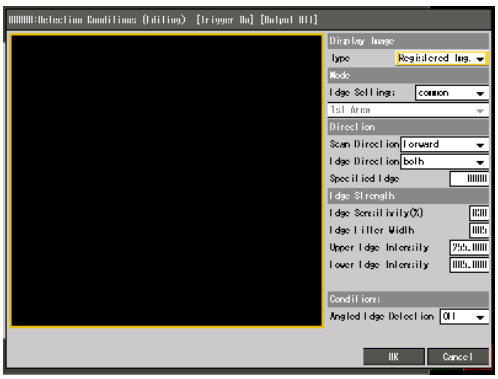
- For the area tool, [Binary] must be selected unless color to binary is used in the color extraction settings.
- If the binary filter is not selected or another filter is applied after the binary filter, the measurement result may not be correct.
- The binary, subtract and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 13 types of filters can be stacked according to application requirements. When multiple filters are set, they are processed one by one from the top.
- The order of the filters can be changed by selecting a filter in one of the [Filter Type] fields, holding down the No.1 (FUNCTION) button of the handheld controller, and then moving the 8-way key up or down.

Edge Detection

Specify the conditions for measuring the angle between two edges.



Reference

See "What is an Edge?" (Page 10-25) for the technical description on edge detection.

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Image**: Displays the registered image specified under [Image Selection].

Edge setting

Select [individual] to specify the edge detection conditions of each segment individually, or select [common] to use the same conditions for both segments.

Use [Individual] when working with a complex shaped target or differing contrasts within the two segments. As each segment has individual edge detection parameters stable detection can be maintained.

If using [Individual], select [1st Area] and set the parameters for the first segment, then select [2nd Area] and set the parameters for the second segment.

Direction

Scan direction

Select the scan direction to detect an edge.

- **Forward**: Scan in the direction of the rotation of the inspection region.
- **Reverse**: Scan in the opposite direction of the rotation of the inspection region.

Edge direction

Select the change in contrast for detecting an edge.

- **Light to Dark**: Detect edges in a transition that changes from a bright area to a dark area.
- **Dark to Light**: Detect edges in a transition that changes from a dark area to a bright area.
- **Both** (default): Detect edges in a transition that can change either from a bright area to a dark area or from a dark area to a bright area.

Specified edge

Specify the edge used when multiple edges are detected. Edge numbers are assigned in order based on the scan direction. When a negative value is specified, the edge numbers will be assigned in the opposite direction.
This setting can be omitted when not required.

Edge Strength

Edge Sensitivity (%)

Set the percentage threshold (0% to 100%) for detecting edges.

Edge filter width

Set the width (0 to 100 pixels) of the smoothing filter applied to the differential graph for detecting edges.

Edge Intensity

- **Upper Edge Intensity**: Specify the upper limit (0.000 to 255.000) of edge intensity for detecting edges.
- **Lower Edge Intensity**: Specify the lower limit (0.000 to 255.000) of edge intensity for detecting edges.

Reference

Unwanted edges can be excluded from detection by adjusting the upper and lower edge intensity values referring the highest edge intensity in the region (shown on the left of the edge graph). See "What is an Edge?" (Page 10-25) for more details.

Conditions

Angled edge detection

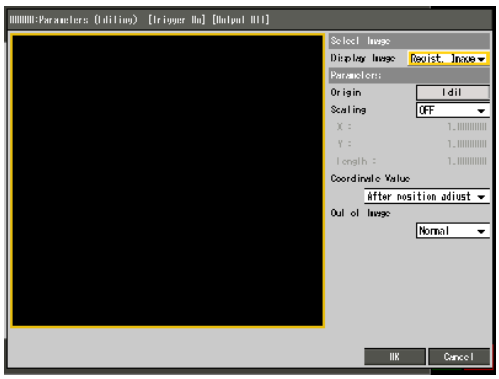
Set to [ON] to stabilize the detection of slanted edges in the inspection region. Using this option may affect the edge X, Y position accuracy.

Reference

The [Counting Options] parameters are applied to the both the 1st and 2nd segments.

Parameters

Specify additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Parameters

Origin

By default, the origin is set to the top left corner of the camera but its location can be moved as required. To specify the origin, select [Edit] and then specify the coordinates.

Reference

The origin can be set outside the process region. The available range for the origin is -9600 to 9600 (X), -7200 to 7200 (Y).

Scaling

The controller processes image data in pixels, The result data and setting parameters used for display, judgement and calculations can be converted and scaled to real life values and dimensions by using the pre-set scaling factor option.

- **OFF**: Do not use scaling.
- **ON**: Use scaling.

Reference

- The scaling factor can be changed from the [Option] menu of the Flowchart (Page 4-356).
- For a summary list of the result data for which scaling can be used, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

Coordinate value

Select the coordinate system to be used after position adjustment. If position adjustment is not used, this setting will have no effect on the measurement.

- **After position adjust**: The inspection uses the adjusted coordinate axes determined after position adjustment.
- **Before position adjust**: The distance from the position specified for the [Origin] of the inspection is used.

Out of Image

Specify whether to incorporate data that falls outside of the inspection region. This maybe required when position adjustment is used.

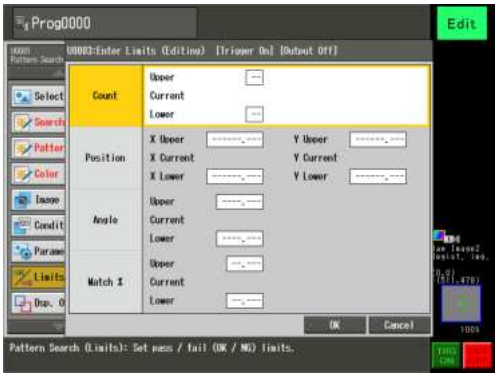
- **Normal (default)**: Edge detection outside of the region is disabled as the image data outside of the region is masked. Since masking requires time to process, the inspection time may vary depending on the quantity image data outside the region. Processing will take longer when the inspection region is a ring or an arc.
- **Fast**: The image data outside of the region is not masked, allowing for faster processing. As the image data outside the region has not been masked so there is an increased chance of detecting an edge outside the region. Select [Normal] to avoid incorrect edge detection.

Reference

Image data which is already located outside of the region during the inspection region setting will always be masked regardless of the [Out of Image] setting.

Limits

Set pass / fail tolerances (upper and lower limits) for the inspection.
If the result is outside of the specified tolerance range, it is judged as [NG] (binary 1). If the result is within the tolerance range, it is judged as [OK] (binary 0).



Use [Direct Input] to enter a value and set the tolerance.

Reference

- [-----] indicates an empty state where no tolerance is set. In this state, no judgment will be performed on the measurement.
- To reset the tolerance setting to an empty state, select [Clear].

Angle

Specify the tolerance for the angle from the two detected edges.
The unit of measurement is the angle in degrees.

Display Options

The display color of the units visual indicators can be changed based on the judgment result for that unit. The visual indicator can also be made transparent by selecting [Setting] - [Select Color] - [None].



Inspection region

Specify the line width and display color of the inspection region.

Mask region

Specify the line width and display color of the mask region.

Line

Specify the width and display color of the straight line connecting the two detected edges.

Edge Graph

Edge Graph

Select whether to display the edge graph.

- **ON**: Show the edge graph.
- **OFF**: Hide the edge graph.

Wave

Specify the width and display color of the edge graph waveform.

Frame

Specify the width and display color of the edge graph frame.

Sensitivity

Specify the width and display color of the line representing the edge sensitivity threshold.

► Note

Setting [Edge graph] to [ON] consumes additional program memory. Check the amount of remaining program memory before enabling.

Processing Priority

Specify the processing priority when displaying large processed images during Run mode.
When a line scan camera is used with the XG-7502A, it is not possible to display the processed image if the image size exceeds 25 MB (26214400 pixels). In such a case it is possible to display the filtered image and contrast image by using a display image variable.

Filtered image

Select whether or not to use a display image variable for the filtered image display.

- **Unit Processing**: Processes the filtered image without using the display image variable.
- **Image Display**: Processes the filtered image using a display image variable.

Reference

- When processing images 25 MB or less, or when using the XG-7702A, it is not necessary to select [Image Display].
- When processing an image larger than 25 MB, if the area displayed is 8 MB (8388608 pixels) or less, the filtered image will be automatically displayed when [Unit Priority] is selected. (However the following processes are excluded.)
  - Image enhancement: Shading correction, blob filter
  - Conversion (image operation): Rotate/translate, zoom, trapezoid correction, blob filter
  - Defect, Grayscale Blob: Contrast display

► Note

When [Image Display] is selected for [Filtered Image], the following restrictions on operation occur.

- Processing time increases.
- The background outside the inspection region becomes a black image.
- Displaying of multiple units is not possible.
- For display of registered images outside of unit edit, the filtered image cannot be displayed and the display is the same as when [Unit Processing] is set.
- When an archived image is displayed, it ix not possible to display the processed image unless the display image variable and results are also stored in the archive.

Image variable

Specify a display image variable for displaying the filtered image.

Reset

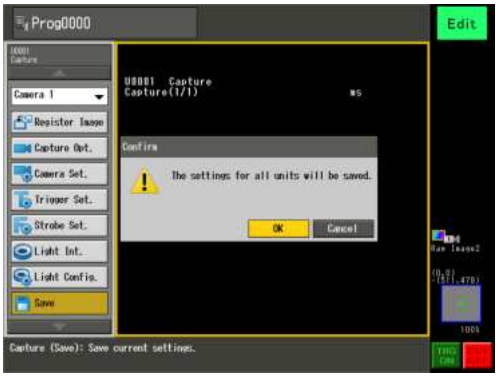
Returns the display options to their defaults.

Save

Save the current unit changes the program file.

► Note

- If the device is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the system power while you are saving the settings. Doing so may cause errors in the internal data



Save

The settings for the unit are saved in the current program file in SD Card 1 or SD Card 2.

► Note

Items specified not to be saved in XG VisionEditor are excluded from the saving operation.
For example, variable values changed in the current program or the default display, and display parts, can be excluded when saving.

Edge Pairs

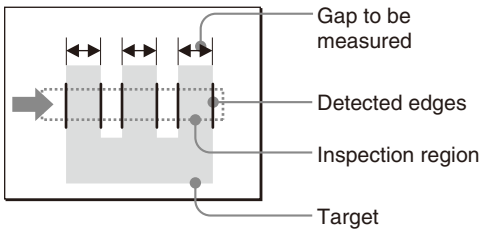
Edge Pairs Tool

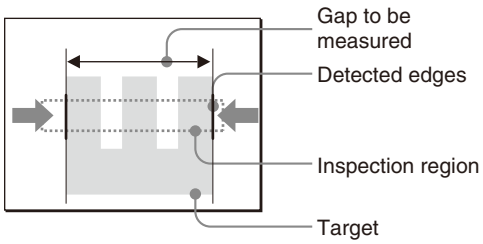
The edge pairs tool scans across a target twice in a user specified direction within a specified region detecting contrast changes. Based on these contrast changes (edges) gaps and widths can be measured. Due to the double scan method the edge detection criteria can be specified individually for a more stable inspection than a standard edge tool.
Because edge detection is based on the transition from bright to dark (or dark to bright), not on absolute intensity values, it is less affected by illumination fluctuations during image capturing.

Image processing

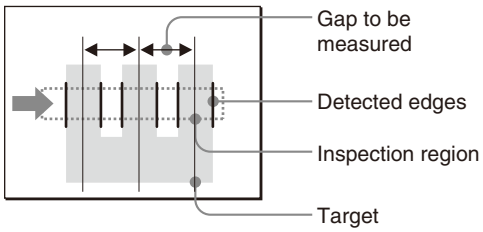
When the inspection region is a rectangle or a rotated rectangle

- Example of measuring the gap pitch



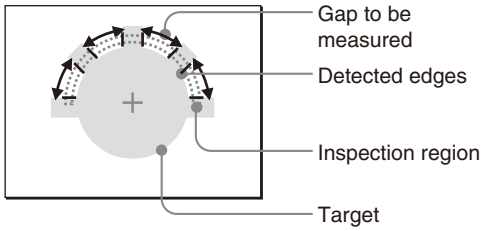


- Example of measuring the center pitch

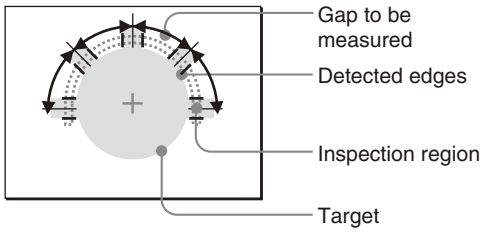


When the inspection region is a ring or an arc

- Example of measuring the gap pitch



- Example of measuring the center pitch



Processing results

The standard results and data returned by the edge pairs tool are as follows:

Reference

Processing results may vary depending on the shape of the inspection region. The result for an item which is not processed is always 0.

When the inspection region is not a ring or an arc

Number of pairs	Outputs the number of detected pairs. Tolerance inspection target
Maximum width	Outputs the maximum width in pixels. Tolerance inspection target
Minimum width	Outputs the average width in pixels. Tolerance inspection target
Average width	Outputs the minimum width in pixels.
Width [ ]	Outputs the widths of all detected pairs in pixels. Tolerance inspection target Label specification target
Edge position 1 (X, Y) [ ]	Outputs the position coordinates for the first identified edge (typically the one nearest the start of the inspection region) of the edge width pair in pixels. Label specification target
Distance 1 [ ]	Outputs the distance from the start of the inspection region to the first identified edge (typically the one nearest the start of the inspection region) of the edge width pair in pixels. Label specification target
Intensity 1 [ ]	Outputs the intensity differential for all the first identified edges (typically the ones nearest the start of the inspection region) of each edge pitch. Label specification target
Edge position 2 (X, Y) [ ]	Outputs the position coordinates for the second identified edge (typically the one nearest the end of the inspection region) of the edge width pair in pixels. Label specification target
Distance 2 [ ]	Outputs the distances from the start of the inspection region to all the second identified edges (typically the one nearest the end of the inspection region) of each edge pitch in pixels. Label specification target
Intensity 2 [ ]	Outputs the intensity differential for all the first identified edges (typically the ones nearest the end of the inspection region) of each edge pitch. Label specification target
Unit judgment value	Outputs the binary result of the unit based on the measured value and the specified tolerance range (upper / lower limits). The unit is judged as [NG] (binary 1) when outside the tolerance range and [OK] (binary 0) when inside.

When the inspection region is a ring or an arc

Number of pairs	Outputs the number of detected pairs. Tolerance inspection target
Maximum width	Outputs the maximum width as an angle. Tolerance inspection target
Minimum width	Outputs the minimum width as an angle. Tolerance inspection target
Average width	Outputs the average width as an angle.
Width [ ]	Outputs the widths of all detected pairs as angles. Tolerance inspection target Label specification target
Edge position 1 (X, Y) [ ]	Outputs the position coordinates of the intersection points between the projected lines (radial) of the first identified edges (typically the one nearest the start of the inspection region) and the center line (circular) of the inspection region. Label specification target
Angle 1 [ ]	Outputs the first identified edge of the edge width pair as an angle. Label specification target
Distance 1 [ ]	Outputs the distances from the start of the inspection region to all the first identified edges (typically the ones nearest the start of the inspection region) of each edge pitch in pixels. Label specification target
Intensity 1 [ ]	Outputs the intensity differential for all the first identified edges (typically the ones nearest the start of the inspection region) of each edge pitch. Label specification target
Edge position 2 (X, Y) [ ]	Outputs the position coordinates of the intersection points between the projected lines (radial) of the second identified edge (typically the one nearest the end of the inspection region) and the center line (circular) of the inspection region. Label specification target
Angle 2 [ ]	Outputs the second identified edge (typically the one nearest the end of the inspection region) of the edge width pair as an angle. Label specification target
Distance 2 [ ]	Outputs the distances from the start of the inspection region to all the second identified edges (typically the one nearest the end of the inspection region) of each edge pitch in pixels. Label specification target
Intensity 2 [ ]	Outputs the intensity differential for all the first identified edges (typically the ones nearest the end of the inspection region) of each edge pitch. Label specification target
Unit judgment value	Outputs the binary result of the unit based on the measured value and the specified tolerance range (upper / lower limits). The unit is judged as [NG] (binary 1) when outside the tolerance range and [OK] (binary 0) when inside.

Reference

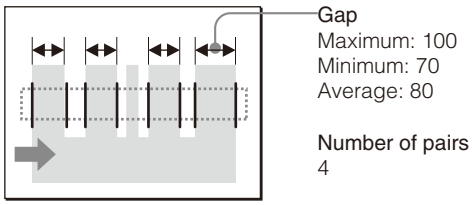
- When primary target (Page 4-110) is set to [All] (Default), the maximum pair width is used as the upper limit and the minimum pair width is used as the lower limit.
- For the lists of available measurement output values and setting parameters, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

Example

When the inspection region is a rectangle or a rotated rectangle

Example 1: Example showing the results of a gap pitch inspection performed under the following conditions

- Measure: Gap pitch
- Scan direction (1st scan): →
- Scan direction (2nd scan): →
- Edge direction (1st scan): Light to Dark
- Edge direction (2nd scan): Dark to Light
- Maximum edge gap: 99999.999
- Minimum edge gap: 0050.000

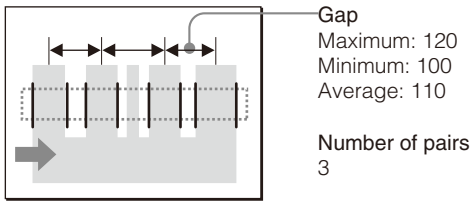


Reference

The central pin is below the minimum edge gap and is therefore excluded from the search.

Example 2: Example showing the results of a center pitch inspection performed under the following conditions

- Measure: Center pitch
- Scan direction (1st scan): →
- Scan direction (2nd scan): →
- Edge direction (1st scan): Light to Dark
- Edge direction (2nd scan): Dark to Light
- Maximum edge gap: 99999.999
- Minimum edge gap: 0050.000



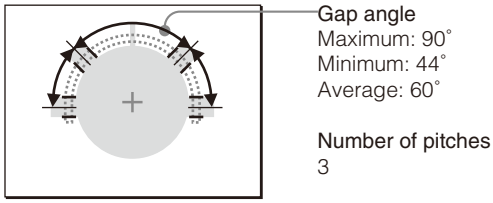
Reference

The central pin is below the minimum edge gap and is therefore excluded from the search.

When the inspection region is a ring or an arc

Example showing the results of a center pitch inspection performed under the following conditions:

- Measure: Center pitch
- Scan direction (1st scan): Clockwise
- Scan direction (2nd scan): Clockwise
- Edge direction (1st scan): Light to Dark
- Edge direction (2nd scan): Dark to Light
- Maximum edge gap: 99999.999
- Minimum edge gap: 0005.000



Reference

The third pin is below the minimum edge gap and is therefore excluded from the search.

Main Menu

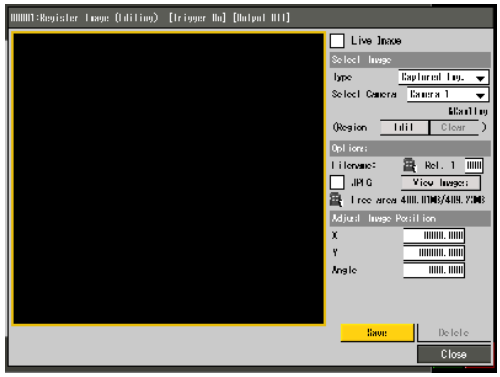
The main menu of the edge pairs tool consists of the following options. Configure settings under each option as required for the inspection.



Register Image (Page 4-104)	Register an image to be used as a template for settings.
Select Image (Page 4-106)	Specify the image to be used for unit processing.
Inspect Region (Page 4-107)	Define the region to be used for unit processing.
Color (Page 4-108)	Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).
Image Enhance (Page 4-108)	Settings for pre-processing image filters.
Edge Detection (Page 4-109)	Specific conditions for processing an edge pairs inspection.
Parameters (Page 4-111)	Additional optional parameters.
Limits (Page 4-112)	Unit pass / fail tolerances.
Display Options (Page 4-112)	Unit processing display settings.
Save (Page 4-114)	Save unit settings.

Register Image

An image can be saved to the controller to be used as a template for measurements and settings. It is recommended to adjust and fix lighting and other external influences before registering an image.



Live Image

Check this box to display live images through a continuous feed.

► Note

- A live feed is only available while the unit is being edited.
- This setting cannot be changed when the screen update mode is set to [Continuous] in the trigger settings (Page 4-25).
- If the capture on trigger input is disabled in the trigger settings (Page 4-25), this check box is always unchecked and the setting cannot be changed.
- When Live image is selected for a moving object, take care when registering as there will be a time lag between the external trigger input and the actual image capture.
- In principle, Live-image is only used when the capture unit being edited is being executed (waiting for a trigger input). When the image capture buffer is set to custom and the capture unit which was most recently executed is being edited, the images collected in the buffer will still be displayed even if the capture unit is not presently capturing images.
- Continuous update cannot be used when HDR capture (Page 4-21) is enabled or when a line scan camera is being used.
- When the HDR capture (Page 4-21) is enabled, the Multi-image cannot be used.

Select Image

Type

Select an image to register.

- **Captured Img.**: Displays the latest image from the specified camera (image variable).
- **Registered Img.**: The registered image specified in [Options] is displayed.

Select Camera

Select the number of the camera used for registration. Choose from Camera1 - Camera4, and select only the camera number used for the capture unit being edited.

Specifying a region

To register only part of an image, select [Edit] then specify the region to register. To cancel the selected region, select [Clear].

Save Image

Filename

Specify the registered image number used for image registration in the form "(Camera No.)-(User-specified No.)".

Reference

The name of the saved file is "ref (Camera No.)_(Specified No.)" (for full screen image registration) or "ref (Camera No.)_(Specified No.)_XXX_YYY" (for partial image registration).

JPEG

Check this box to save the image in JPEG format. When this box is not checked, the image will be saved in BMP format as either a 24-bit color bitmap image (when a color camera is used) or an 8-bit grayscale bitmap image (when a monochrome camera is used).

► Note

Using image compression may result in some image deterioration, thus results from a compressed image may differ to those when using non compressed images.

View All

View all registered images in a list.

Adjust Image Position

Adjust the position of the image being captured.

X

-Adjust the movement in the X (horizontal) direction between -8191.000 and 8191.000 pixels.

Y

-Adjust the movement in the Y (vertical) direction between -16383.000 and 16383.000 pixels.

Angle

Adjust the position angle (rotation) around the center of the image between -999.999° and 999.999°.

► Note

Position adjustment may cause missing peripheries (black areas) due to image movement or jagged edges (jaggies) due to rotation in the registered image.

Save

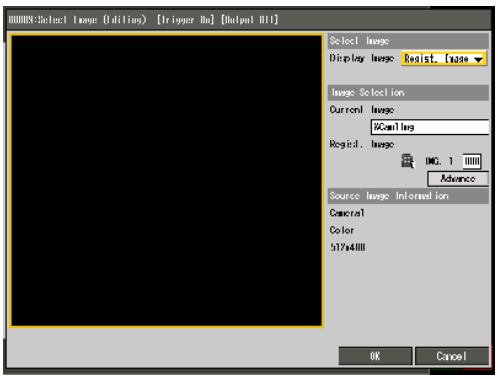
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Registered Img.] is selected for [Type], you can delete the registered image specified in [Options].

Select Image

Specify the image variable and associated registered image to be used for configuring the vision tool.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured Image**: Displays the latest image from the specified camera (image variable).
- **Registered Image**: The registered image specified under [Image Selection] is displayed.

Select image

Captured Img.

Set an image variable to be used as a current image for the unit.

Registered Img.

Specify the registered image No. for the registered image to be used.

- The registered images are managed as "Image (Camera No.) - (Registered image No.0 to 999)".
- The "Camera No" is fixed to the number of the camera associated to the image variable specified for the current image.

Advance

Set advance options for the switching of registered images as necessary.

- **Use numerical variable for registered image number**: To use a variable for the registered image No., check this box and assign a numerical or numerical array variable reference. By using a variable for the registered image No. and then issuing a variable reference value apply command (NU), the image is switched to the specified registered image in the variable and the reference image information is updated. For more details, see the XG-7000 Series Communication Control Manual.
- **Process variable when changing programs**: Use this option to switch to the registered image based on the initial value of the variable referenced when the program is changed or the controller is next turned on.

► Note

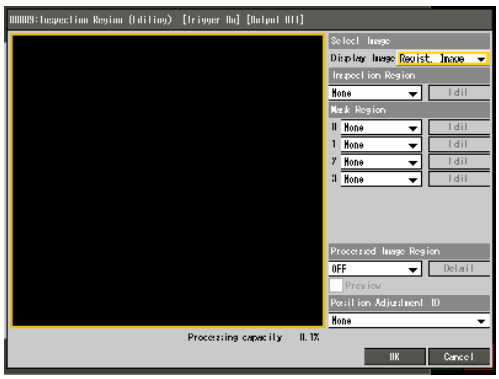
Note that the registered image No. does not switch in accordance with a change in the variable.

Source Image Information

The camera No., type (color / monochrome), and resolution of the camera associated to the image variable specified is displayed.

Inspection Region

Outline the region on the captured image to be used for inspection.



► Note

Changing the shape of the region will initialize or clear some of the settings in the [Edge Detection] menu.

Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Region

Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Inspection Region Menu" (Page 3-20) for more details.

Mask region

A mask region is an area which can be defined in the inspection region and will be excluded from the inspection. Up to four mask regions can be set per inspection region. A mask region is typically used for hiding an area that does not require inspection.

Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Excluding Part of the Region" (Page 3-26) for more details.

Processed image region

Use processed image region to generate a region for inspection based on an image. (Page 4-295), select [ON] and then select [Detail] for configuration.

Reference

Refer to "Generating a Region from an Image" (Page 3-27) for more details on processed image region.

Image

Specify the image variable to be used for generating the region.

Area

Specify the area and border color for the region based on the image specified in the image variable. Select either [Black] (Level 0) or [White] (Level 255, default).

Preview

Use this checkbox to display the specified image. When the checkmark is removed, the display returns to its normal state.

Position Adjustment ID

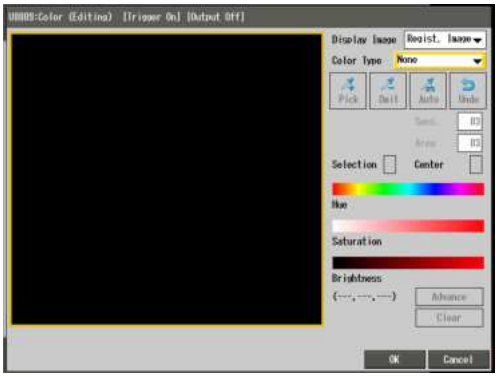
To use position adjustment for the region, select the position adjustment unit to be referenced.

Reference

The position adjustment is applied to all inspection, mask, and image regions.

Color

When working with a color camera, convert the captured color image into a binary (black and white) or a grayscale converted image by extracting the desired color.



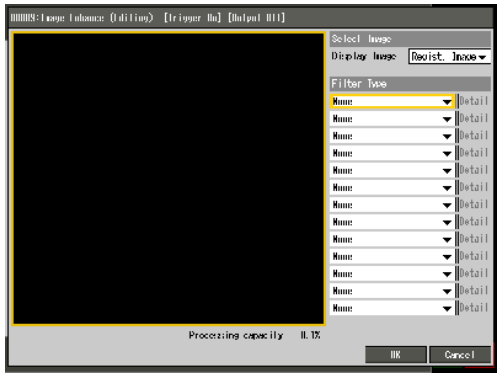
► Note

This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-295) is referenced as the current image.

Refer to "Working with Color Images (Color Extraction)" (Page 10-2) for concepts involving color extraction and its operation.

Image Enhance

Specify the filter processing to apply to the image. When a color camera is used, the filter is applied to the images converted using color extraction.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Filter type

Select the [Filter Type] field and then select the filter to apply. To perform area measurement using a method other than color to binary, you must select the [Binary] filter as the last filter. See "Image Enhancement Filters" (Page 10-11) for more details of each filter processing.

► Note

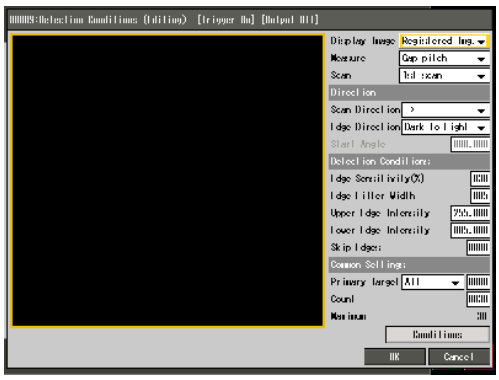
- For the area tool, [Binary] must be selected unless color to binary is used in the color extraction settings.
- If the binary filter is not selected or another filter is applied after the binary filter, the measurement result may not be correct.
- The binary, subtract and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 13 types of filters can be stacked according to application requirements. When multiple filters are set, they are processed one by one from the top.
- The order of the filters can be changed by selecting a filter in one of the [Filter Type] fields, holding down the No.1 (FUNCTION) button of the handheld controller, and then moving the 8-way key up or down.

Edge Detection

Specify the conditions for measuring the distance between a series of edges allocated into pairs.



Reference

See "What is an Edge?" (Page 10-25) for the technical description on edge detection.

Display Image

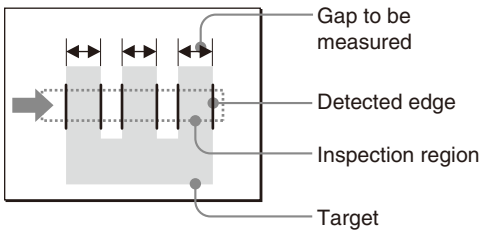
Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Image**: Displays the registered image specified under [Image Selection].

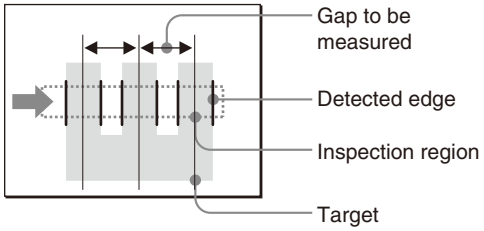
Measure

Select the type of edge gap measurement.

- **Gap pitch**: Detect edges in the specified scan direction and measure the maximum, minimum, and average gap values between each pair of odd and even edges.



- **Center pitch**: Measure the maximum, minimum, and average values between the center points of the pairs of odd and even edges.



Scan

Select [1st scan] and set the parameters for the first scan, and then select [2nd scan] and set the parameters for the second scan.

Direction

Scan direction

Select the scan direction to detect an edge.

- **When the inspection region is a rectangle, circle, oval, polygon or composition**: →, ←, ↑, ↓
- **When the inspection region is a rotated rectangle**: Forward or reverse with respect to the horizontal axis (X axis) of the region Since the scan direction depends on the rotation angle of the inspection region, this should be taken into consideration when selecting this option.
- **When the inspection region is a ring or an arc**: Clockwise, Counter CW

Edge direction

Select the change in contrast for detecting an edge.

- **Light to Dark**: Detect edges in a transition that changes from a bright area to a dark area.
- **Dark to Light**: Detect edges in a transition that changes from a dark area to a bright area.
- **Both** (default): Detect edges in a transition that can change either from a bright area to a dark area or from a dark area to a bright area.

Start angle

When [Ring] is selected for the inspection region, specify a starting angle (0° to 359.999°) for detecting edges.

Reference

If the start angle is changed, the detection angle will be calculated with reference to the 3 o'clock position being 0°.

Detection Conditions

Edge Sensitivity (%)
Set the percentage threshold (0% to 100%) for detecting edges.

Edge filter width
Set the width (0 to 100 pixels) of the smoothing filter applied to the differential graph for detecting edges.

Edge Intensity
- **Upper Edge Intensity**: Specify the upper limit (0.000 to 255.000) of edge intensity for detecting edges.
- **Lower Edge Intensity**: Specify the lower limit (0.000 to 255.000) of edge intensity for detecting edges.

Reference

Unwanted edges can be excluded from detection by adjusting the upper and lower edge intensity values referring the highest edge intensity in the region (shown on the left of the edge graph). See "What is an Edge?" (Page 10-25) for more details.

Skip Edges
Specify the number of edges to be excluded before the first desired edge.

Common Settings

Primary target
Use [All] to scan for all pairs and measure the maximum and minimum gap / pitch. To measure a single pair gap / pitch, select [Specified] and then specify the edge pair number. The pair that is specified here provides the measurement data for judgment in the unit.

Count
Specify the maximum number of edge pairs (0 to 3600) to be measured.

► Note

- The edge pair count cannot exceed the value set for [Maximum].
- The maximum number of edge pairs available for detection can change based on other settings.

Reference

Based on specific settings, the maximum number of edge pairs is fixed and cannot be changed. The [Count] value can be set higher than the [Maximum] value (Maximum: 3600) depending on the account setting. Note, this also increases the [Maximum] value, resulting in additional consumption of program memory.

Conditions

By selecting [Counting Options], you can change the following settings:

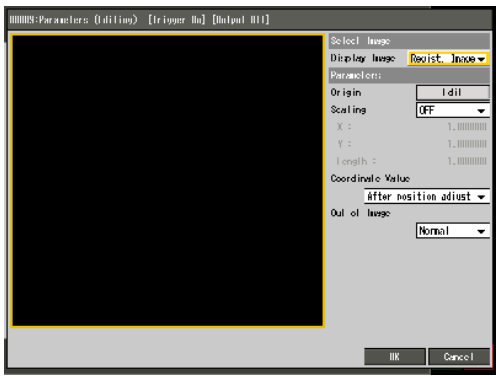
- **Gap pitch**
  - **Max Edge Gap**: Specify the maximum distance between edges in a pair. Edge pairs that exceed the maximum distance will not be returned as pairs.
  - **Min Edge Gap**: Specify the minimum distance between edges in a pair. Edge pairs with a pitch below the minimum distance will not be returned as pairs.
- **Angled Edge Detection:** Set to [ON] to stabilize the detection of slanted edges in the inspection region. Using this option may affect the edge X, Y position accuracy.

Reference

The maximum and minimum distances specified in the [Gap pitch] will be applied to the results before the scaling operation, even if [Scaling] (Page 4-111) is set to [ON].

Parameters

Specify additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Parameters

Origin

By default, the origin is set to the top left corner of the camera but its location can be moved as required. To specify the origin, select [Edit] and then specify the coordinates.

Reference

The origin can be set outside the process region. The available range for the origin is -9600 to 9600 (X), -7200 to 7200 (Y).

Scaling

The controller processes image data in pixels, The result data and setting parameters used for display, judgement and calculations can be converted and scaled to real life values and dimensions by using the pre-set scaling factor option.

- **OFF**: Do not use scaling.
- **ON**: Use scaling.

Reference

- The scaling factor can be changed from the [Option] menu of the Flowchart (Page 4-356).
- For a summary list of the result data for which scaling can be used, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

Coordinate value

Select the coordinate system to be used after position adjustment. If position adjustment is not used, this setting will have no effect on the measurement.

- **After position adjust**: The inspection uses the adjusted coordinate axes determined after position adjustment.
- **Before position adjust**: The distance from the position specified for the [Origin] of the inspection is used.

Out of Image

Specify whether to incorporate data that falls outside of the inspection region. This maybe required when position adjustment is used.

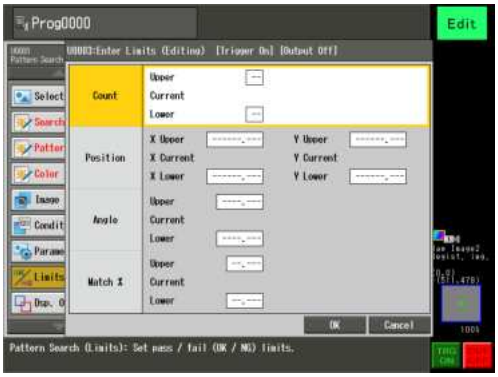
- **Normal (default)**: Edge detection outside of the region is disabled as the image data outside of the region is masked. Since masking requires time to process, the inspection time may vary depending on the quantity image data outside the region. Processing will take longer when the inspection region is a ring or an arc.
- **Fast**: The image data outside of the region is not masked, allowing for faster processing. As the image data outside the region has not been masked so there is an increased chance of detecting an edge outside the region. Select [Normal] to avoid incorrect edge detection.

Reference

Image data which is already located outside of the region during the inspection region setting will always be masked regardless of the [Out of Image] setting.

Limits

Set pass / fail tolerances (upper and lower limits) for the inspection.
If the result is outside of the specified tolerance range, it is judged as [NG] (binary 1). If the result is within the tolerance range, it is judged as [OK] (binary 0).



Use [Direct Input] to enter a value and set the tolerance.

Reference

- [-----] indicates an empty state where no tolerance is set. In this state, no judgment will be performed on the measurement.
- To reset the tolerance setting to an empty state, select [Clear].

Count

Specify the tolerance for the edge pairs detection count.
The unit of measurement is the "number of pairs" detected.

Pair width

Specify the tolerance for the width for the detected edge pairs.
The unit of measurement is the "number of pixels" (when the inspection region is not a ring or an arc) or "angle" (only when the inspection region is a ring or an arc) of the width between the pairs of edges.

Display Options

The display color of the units visual indicators can be changed based on the judgment result for that unit. The visual indicator can also be made transparent by selecting [Setting] - [Select Color] - [None].



Inspection region

Specify the line width and display color of the inspection region.

Mask region

Specify the line width and display color of the mask region.

Detected point

Primary target
Specify the width and display color of the line indicating the detected edge.

Other target
Specify the width and display color of the line indicating the detected edge other than the one specified as the primary target (Page 4-110).

Edge Graph

Edge Graph
Select whether to display the edge graph.
- **ON**: Show the edge graph.
- **OFF**: Hide the edge graph.

Wave
Specify the width and display color of the edge graph waveform.

Frame
Specify the width and display color of the edge graph frame.

Sensitivity
Specify the width and display color of the line representing the edge sensitivity threshold.

► Note
Setting [Edge graph] to [ON] consumes additional program memory. Check the amount of remaining program memory before enabling.

Processing Priority

Specify the processing priority when displaying large processed images during Run mode.
When a line scan camera is used with the XG-7502A, it is not possible to display the processed image if the image size exceeds 25 MB (26214400 pixels). In such a case it is possible to display the filtered image and contrast image by using a display image variable.

Filtered image
Select whether or not to use a display image variable for the filtered image display.
- **Unit Processing**: Processes the filtered image without using the display image variable.
- **Image Display**: Processes the filtered image using a display image variable.

Reference
- When processing images 25 MB or less, or when using the XG-7702A, it is not necessary to select [Image Display].
- When processing an image larger than 25 MB, if the area displayed is 8 MB (8388608 pixels) or less, the filtered image will be automatically displayed when [Unit Priority] is selected. (However the following processes are excluded.)
  - Image enhancement: Shading correction, blob filter
  - Conversion (image operation): Rotate/translate, zoom, trapezoid correction, blob filter
  - Defect, Grayscale Blob: Contrast display

► Note
When [Image Display] is selected for [Filtered Image], the following restrictions on operation occur.
- Processing time increases.
- The background outside the inspection region becomes a black image.
- Displaying of multiple units is not possible.
- For display of registered images outside of unit edit, the filtered image cannot be displayed and the display is the same as when [Unit Processing] is set.
- When an archived image is displayed, it ix not possible to display the processed image unless the display image variable and results are also stored in the archive.

Image variable
Specify a display image variable for displaying the filtered image.

Reset

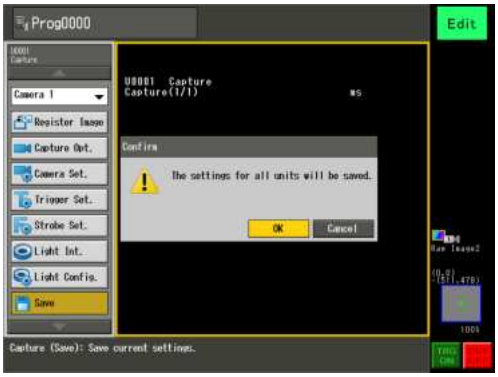
Returns the display options to their defaults.

Save

Save the current unit changes the program file.

► Note

- If the device is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the system power while you are saving the settings. Doing so may cause errors in the internal data



Save

The settings for the unit are saved in the current program file in SD Card 1 or SD Card 2.

► Note

Items specified not to be saved in XG VisionEditor are excluded from the saving operation.
For example, variable values changed in the current program or the default display, and display parts, can be excluded when saving.

Defect

Defect Tool

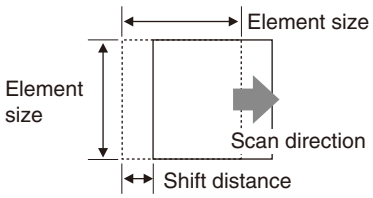
The defect tool is convenient when precise detection is required for detecting flaws on targets. With the inspection region a small group of pixels (element) is defined and the average intensity calculated. Nearby elements are compared with each other to check average intensity differences.
Elements that have an intensity difference greater than the threshold specified when compared are identified as defects. Adjacent defects can be grouped together for blob based processing and subtraction image enhancement filters (Page 10-15) can also be used for detecting flaws on complex images.

Reference

- Because defect detection is based on the transition from bright to dark (or dark to bright), not on absolute intensity values, it is less affected by illumination fluctuations during image capturing.
- The [Fine Color] (defect tool specific function) can be used to detect defects based on color and not intensity. Making the defect tool capable of detecting color defects only and ignoring intensity changes caused by lighting or changes in target reflectivity.

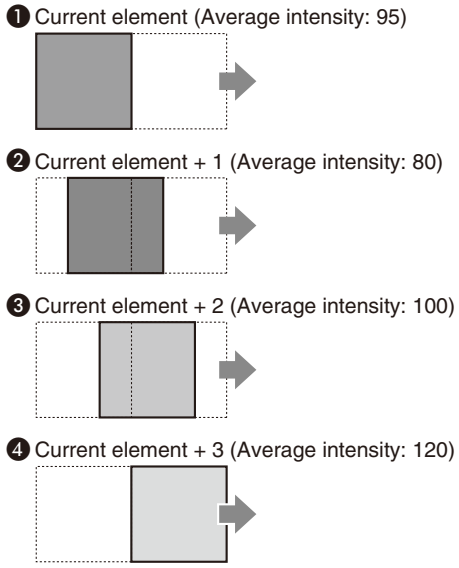
Image processing

The defect tool indexes the element by the shift distance in the specified scan direction within the inspection region measuring the average intensity of each element.



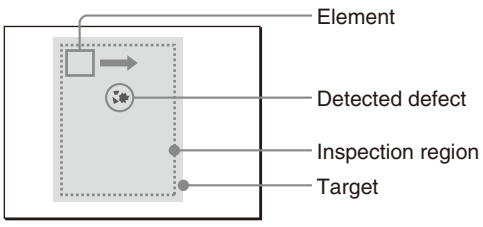
Difference between defect level and defect area

The [Defect Level] is the difference between the maximum and minimum intensities across the last 4 elements, including the current element.
In the following example, the defect level is obtained as follows: [Maximum intensity of 120] (Intensity of the segment at position number 4) - [Minimum intensity of 80] (Intensity of the segment at position number 2) = 40 (Defect level).

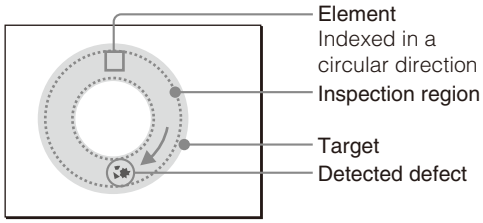


If the threshold set in the [Defect Level] is exceeded, the current element is judged to be a defect and is added to the [Defect Area] ([Defect Area] is the number of elements that exceed the defect level).

Example when the detection direction is either X or Y or XY



Example when the detection direction is circular

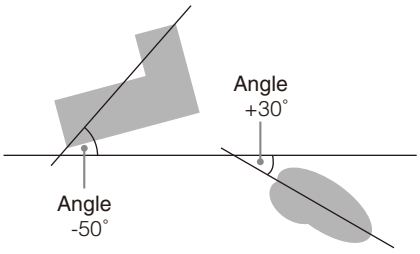
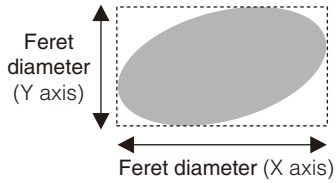
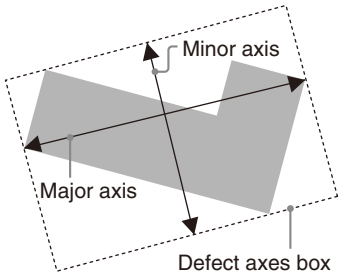


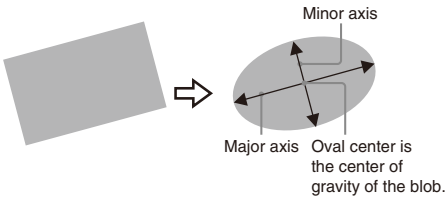
Processing results

The standard results and data returned by the defect tool are as follows:

Reference

Processing results may vary depending on the shape of the inspection region. The result for an item which is not processed is always 0.

Detected defect level	Outputs the intensity difference from the element with the highest defect level.
Total defect area	Outputs the total number of elements with defect levels exceeding the defect level threshold in the inspection region. Tolerance inspection target
Position (X, Y)	Outputs the position coordinates of the element with the highest defect level.
Number of groups	Outputs the number of groups detected by the defect grouping function (when the defect grouping function is ON). Tolerance inspection target
Defect Area [ ]	Outputs the total number of elements for each group which have defect levels exceeding the defect level threshold (when the defect grouping function is ON). Tolerance inspection target Label specification target
Position (X, Y) [ ]	Outputs the coordinates of the centers of all groups in pixels. The general location of a defect can be measured. If the defect tool is being used for position adjustment (Page 4-274), this is result that needs to be used for stable processing. Tolerance inspection target Label specification target
Angle (T) [ ]	Outputs angles relative to the horizontal (X axis) for all detected defects (only when [Additional Group Result] in [Group Setting] is enabled). Label specification target 
Area [ ]	Outputs the surface area as a number of pixels for all defects (only when the defect grouping function is ON). Label specification target
Feret Diameter (X, Y) [ ]	Outputs the feret diameter (length and width calculated from the circumscribed rectangle created with parallel horizontal (X axis) and vertical (Y axis) boundaries) of all detected blobs after filtering in pixels (only when [Additional Group Result] in [Group Setting] is enabled]. Label specification target 
Perimeter [ ]	Outputs the perimeters as a number of pixels for all detected defects (only when [Additional Group Result] in [Group Setting] is enabled). Label specification target
Roundness	Outputs the degree of similarity (1.000 to 0.000) to a perfect circle of all defects. (only when [Additional Group Result] in [Group Setting] is enabled). A perfect circle is considered as a value of 1.000. and the value will reduce to 0.000 as the similarity decreases. Label specification target 
Major Axis [ ]	Outputs the major axis' as a number of pixels (only when [Additional Group Result] in [Group Setting] is enabled.) Label specification target
Minor Axis [ ]	Outputs the minor axis' as a number of pixels (only when [Additional Group Result] in [Group Setting] is enabled.) Label specification target
Axes Ratio [ ]	Outputs the ratio of the major and minor axes as a number of pixels (only when [Additional Group Result] in [Group Setting] is enabled) The axes ratio is a value of the "Major axis/Minor axis," and a larger value represents a thinner shape. Label specification target 
Distributed Oval Major Axis [ ]	Outputs the major axis' of an equivalent distributed oval as a number of pixels (only when [Additional Group Result] in [Group Setting] is enabled). Label specification target

Distributed Oval Minor Axis [ ]	Outputs the minor axis' of an equivalent distributed oval as a number of pixels (only when [Additional Group Result] in [Group Setting] is enabled). Label specification target
Aspect Ratio [ ]	Outputs the ratio of the major and minor axes of an equivalent distributed oval (only when [Additional Group Result] in [Group Setting] is enabled). A larger value represents a thinner shape.) Label specification target  The equivalent oval of a defect is an approximate oval obtained from the shape of the defect and is useful for stable measurement of shapes that have spikes or strands that skew major/minor axis measurements.
Defect axes box position (Upper left, lower left, upper right, lower right) [ ]	Outputs the coordinates for the circumscribed rectangle based on the major and minor axis for all detected defects ([Additional Group Result] in [Group Setting] is enabled). Label specification target
Distributed Oval Position X,Y XY (Upper left, lower left, upper right, lower right) [ ]	Outputs the coordinates for the major and minor axis points for the equivalent distributed oval for all detected defects ([Additional Group Result] in [Group Setting] is enabled) The position relationship (up/down/right/left) is based on the angle of the major axis. Label specification target
Unit judgment value	Outputs the binary result of the unit based on the measured value and the specified tolerance range (upper / lower limits). The unit is judged as [NG] (binary 1) when outside the tolerance range and [OK] (binary 0) when inside.

Reference

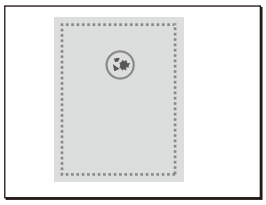
- When the result is within the tolerance range, it is judged as [OK] (binary 0).
- When target classification is ON, the results are also output for each classification type No. (in the format !U[****].RSLT.CLS[*1].****, *1 is) For more details, see "List of Setting Parameters / Result Data" in the XG-7000 Series Communication Control Manual.
- For the lists of available measurement output values and setting parameters, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.
- If the region is a [Rotated Rectangle], all [Bounding Box] values are 0.

Example

Example showing the results of a defect inspection performed under the following conditions.

When a defect on the surface of a target is detected

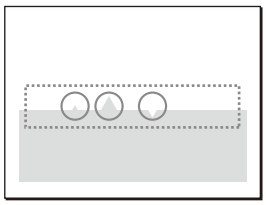
- Direction: XY



Total area
20

When a crack or burr on the surface of a target is detected

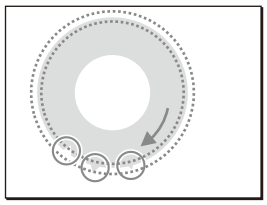
- Direction: X



Total area
55

When a crack or burr on the round surface of a target is detected

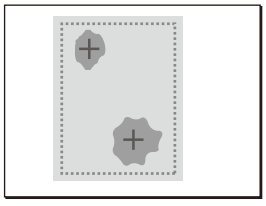
- Direction: Circular



Total area
35

When the position of a defect on the surface of a target is detected

- Direction: XY
- Defect Grouping Function: ON
- Detection count: 2
- Label order: X>Y: Ascend



Result of the first defect
Defect area: 70
Center:
X100, Y100

Result of the second defect
Defect area: 100
Center:
X200, Y400

Main Menu

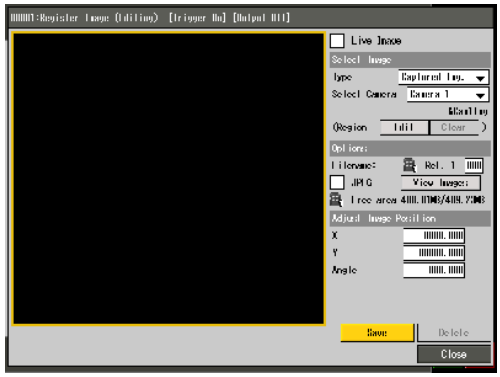
The main menu of the defect tool consists of the following options. Configure settings under each option as required for the inspection.



Register Image (Page 4-118)	Register an image to be used as a template for settings.
Select Image (Page 4-120)	Specify the image to be used for unit processing.
Inspect Region (Page 4-121)	Define the region to be used for unit processing.
Color (Page 4-122)	Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).
Image Enhance (Page 4-122)	Settings for pre-processing image filters.
Condition (Page 4-123)	Specific conditions for processing a defect inspection.
Parameters (Page 4-127)	Additional optional parameters.
Limits (Page 4-128)	Unit pass / fail tolerances.
Display Options (Page 4-129)	Unit processing display settings.
Save (Page 4-130)	Save unit settings.

Register Image

An image can be saved to the controller to be used as a template for measurements and settings. It is recommended to adjust and fix lighting and other external influences before registering an image.



Live Image

Check this box to display live images through a continuous feed.

► Note

- A live feed is only available while the unit is being edited.
- This setting cannot be changed when the screen update mode is set to [Continuous] in the trigger settings (Page 4-25).
- If the capture on trigger input is disabled in the trigger settings (Page 4-25), this check box is always unchecked and the setting cannot be changed.
- When Live image is selected for a moving object, take care when registering as there will be a time lag between the external trigger input and the actual image capture.
- In principle, Live-image is only used when the capture unit being edited is being executed (waiting for a trigger input). When the image capture buffer is set to custom and the capture unit which was most recently executed is being edited, the images collected in the buffer will still be displayed even if the capture unit is not presently capturing images.
- Continuous update cannot be used when HDR capture (Page 4-21) is enabled or when a line scan camera is being used.
- When the HDR capture (Page 4-21) is enabled, the Multi-image cannot be used.

Select Image

Type

Select an image to register.

- **Captured Img.**: Displays the latest image from the specified camera (image variable).
- **Registered Img.**: The registered image specified in [Options] is displayed.

Select Camera

Select the number of the camera used for registration. Choose from Camera1 - Camera4, and select only the camera number used for the capture unit being edited.

Specifying a region

To register only part of an image, select [Edit] then specify the region to register. To cancel the selected region, select [Clear].

Save Image

Filename

Specify the registered image number used for image registration in the form "(Camera No.)-(User-specified No.)".

Reference

The name of the saved file is "ref (Camera No.)_(Specified No.)" (for full screen image registration) or "ref (Camera No.)_(Specified No.)_XXX_YYY" (for partial image registration).

JPEG

Check this box to save the image in JPEG format. When this box is not checked, the image will be saved in BMP format as either a 24-bit color bitmap image (when a color camera is used) or an 8-bit grayscale bitmap image (when a monochrome camera is used).

► Note

Using image compression may result in some image deterioration, thus results from a compressed image may differ to those when using non compressed images.

View All

View all registered images in a list.

Adjust Image Position

Adjust the position of the image being captured.

X

-Adjust the movement in the X (horizontal) direction between -8191.000 and 8191.000 pixels.

Y

-Adjust the movement in the Y (vertical) direction between -16383.000 and 16383.000 pixels.

Angle

Adjust the position angle (rotation) around the center of the image between -999.999° and 999.999°.

► Note

Position adjustment may cause missing peripheries (black areas) due to image movement or jagged edges (jaggies) due to rotation in the registered image.

Save

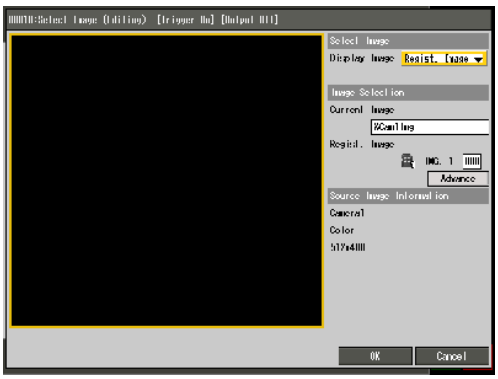
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Registered Img.] is selected for [Type], you can delete the registered image specified in [Options].

Select Image

Specify the image variable and associated registered image to be used for configuring the vision tool.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured Image**: Displays the latest image from the specified camera (image variable).
- **Registered Image**: The registered image specified under [Image Selection] is displayed.

Select image

Captured Img.

Set an image variable to be used as a current image for the unit.

Registered Img.

Specify the registered image No. for the registered image to be used.

- The registered images are managed as "Image (Camera No.) - (Registered image No.0 to 999)".
- The "Camera No" is fixed to the number of the camera associated to the image variable specified for the current image.

Advance

Set advance options for the switching of registered images as necessary.

- **Use numerical variable for registered image number**: To use a variable for the registered image No., check this box and assign a numerical or numerical array variable reference. By using a variable for the registered image No. and then issuing a variable reference value apply command (NU), the image is switched to the specified registered image in the variable and the reference image information is updated. For more details, see the XG-7000 Series Communication Control Manual.
- **Process variable when changing programs**: Use this option to switch to the registered image based on the initial value of the variable referenced when the program is changed or the controller is next turned on.

► Note

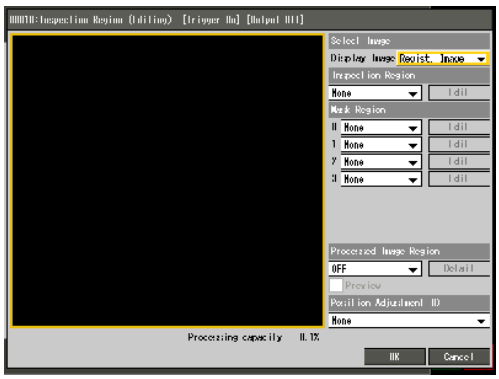
Note that the registered image No. does not switch in accordance with a change in the variable.

Source Image Information

The camera No., type (color / monochrome), and resolution of the camera associated to the image variable specified is displayed.

Inspection Region

Outline the region on the captured image to be used for inspection.



► Note

Changing the shape of the region will initialize or clear some of the settings in the [Condition] menu.

Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Region

Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Inspection Region Menu" (Page 3-20) for more details.

Mask region

A mask region is an area which can be defined in the inspection region and will be excluded from the inspection. Up to four mask regions can be set per inspection region. A mask region is typically used for hiding an area that does not require inspection.
Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Excluding Part of the Region" (Page 3-26) for more details.

Processed image region

Use processed image region to generate a region for inspection based on an image. (Page 4-295), select [ON] and then select [Detail] for configuration.

Reference

Refer to "Generating a Region from an Image" (Page 3-27) for more details on processed image region.

Image

Specify the image variable to be used for generating the region.

Area

Specify the area and border color for the region based on the image specified in the image variable. Select either [Black] (Level 0) or [White] (Level 255, default).

Preview

Use this checkbox to display the specified image. When the checkmark is removed, the display returns to its normal state.

Position Adjustment ID

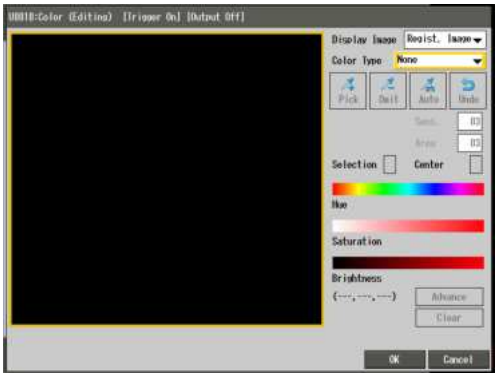
To use position adjustment for the region, select the position adjustment unit to be referenced.

Reference

The position adjustment is applied to all inspection, mask, and image regions.

Color

When working with a color camera, convert the captured color image into a binary (black and white) or a grayscale converted image by extracting the desired color.



► Note

This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-295) is referenced as the current image.

Refer to "Working with Color Images (Color Extraction)" (Page 10-2) for concepts involving color extraction and its operation.

Operation when [Fine Color] is selected for color extraction (color defect mode)

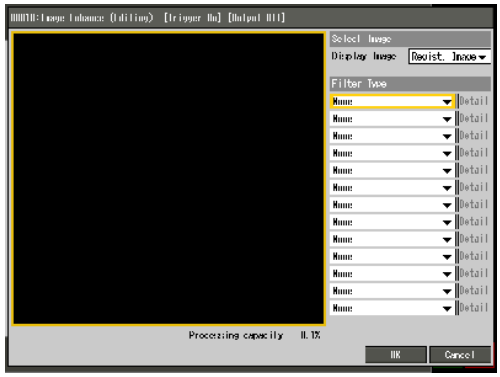
Selecting [Fine Color] will cause changes in color to be detected as defects, rather than specific colors.

- As in the case where [Gray] or [RGB Gray] is selected, selecting [Fine Color] initializes the color extraction settings and no further settings are possible.
- Filter processing cannot be optimized in color defect mode.
- In color defect mode, the [Ignore Intensity] setting can be used in the [Select Detection Conditions] menu (Page 4-124).

See "What is Fine Color Mode?" (Page 10-27) for more details.

Image Enhance

Specify the filter processing to apply to the image.
When a color camera is used, the filter is applied to the images converted using color extraction.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Filter type

Select the [Filter Type] field and then select the filter to apply. To perform area measurement using a method other than color to binary, you must select the [Binary] filter as the last filter. See "Image Enhancement Filters" (Page 10-11) for more details of each filter processing.

► Note

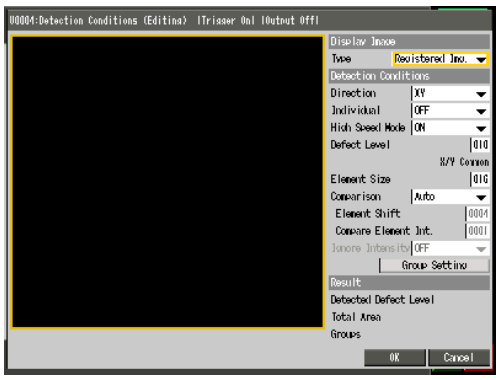
- For the area tool, [Binary] must be selected unless color to binary is used in the color extraction settings.
- If the binary filter is not selected or another filter is applied after the binary filter, the measurement result may not be correct.
- The binary, subtract and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 13 types of filters can be stacked according to application requirements. When multiple filters are set, they are processed one by one from the top.
- The order of the filters can be changed by selecting a filter in one of the [Filter Type] fields, holding down the No.1 (FUNCTION) button of the handheld controller, and then moving the 8-way key up or down.

Conditions

Specify the conditions for detecting a "defect" defect on a target.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Detection Conditions

Direction

Select the direction to search for defects.

- **XY**: Detect intensity differences together in both the X-direction and Y-directions.
- **X**: Detect intensity differences only in the X-direction.
- **Y**: Detect intensity differences only in the Y-direction.
- **Cir.**: Detect intensity differences only in a circular direction.
- **Rad.**: Detect intensity differences radially from the inside of a ring/arc outward.

► Note

- Circular and radial directions are only available when the inspection region is a ring or an arc.
- If the search region is a ring and the search direction is circular or radial, the defect grouping function and results data expansion are not available.
- When the inspection region is a rotated rectangle, the XY coordinates move according to the rotation of the region.
- If the search direction is specified circular or radial, no filter can be applied to the defect grouping.
- If the search region is a ring and the search direction is circular or radial, additional group results are not available.

Individual

Select [ON] to set element parameters individually for each search direction.

- **OFF**: Use the same segment parameters for different search directions.
- **ON**: Set segment parameters individually for each search direction.

This allows the independent setting of the segment size and shift in the X and Y directions (or in the circular and radial directions when the inspection region is a ring or an arc).

High speed mode

Use High speed mode to decrease unit processing time or enable fine detection.

- **ON** (default): High speed processing.
- **OFF**: Fine detection.

When the high speed mode is set to [ON], the segment size and shift can be set in multiples of 4 only. (If a variable is referenced the value is rounded off to the nearest integer and then rounded up to the nearest multiple of 4.)
If the inspection region extends off the screen, a measurement error (Total defect area: 99999999) will result and the contrast view within the inspection region will be cancelled.

Defect level

Set the deviation from the average change in intensity for identifying a defect.
Defects that deviate from the average by less than this parameter will not be considered defects. The defect level can be specified within the range 0 to 254.

Element Size

Set the element (pixel group) size (1 to 256 pixels) which moves inside the inspection region in the X (horizontal) and Y (vertical) directions respectively.

► Note

If the element size is larger than the inspection region, the measurement is disabled and the total defect area is shown as "99999999".

Reference

- When [Cir.] or [Rad.] is selected for [Direction], the settings are changed to [Rad.] or [Cir.].
- To specify different sizes in the direction of X/Y and Radial/Circular individually, set [Individual] to [ON].

Comparison

To record gradual changes in intensity as a greater amount of defect, select [Manual] and then make the necessary settings.

The defect measurement is initially set to detect sharp changes in contrast within the inspection region. This is because it calculates the difference in intensity between 2 neighboring segment scans, and by default those neighboring scans are only a few pixels apart. However, there may be instances where it is necessary to detect gradual changes in contrast, such as when trying to detect color irregularities on a target surface.

In such a case, large defects can be detected by changing the settings of [Element Shift] or [Compare Segment] to allow detection of intensity differences across long distances.

Element Shift

Specify the number of pixels within the range 1 to 2432 as the distance to shift the element for calculating the next average intensity value. When [Auto] is selected, this is automatically set to 1/4 of the element size. If the high speed mode is [ON], this value must be a multiple of 4.

► Note

If the value of [Element Shift] is larger than [Element Size], some parts of the inspection region will not be reflected in the intensity average. To detect defects smaller than the segment size, use [Auto] or specify an element shift smaller than the element size.

Compare Element

Specify the number of elements within the range 1 to 2432 as the interval distance when comparing the difference in intensity between elements. When [Auto] is selected, this is always set to [1].

► Note

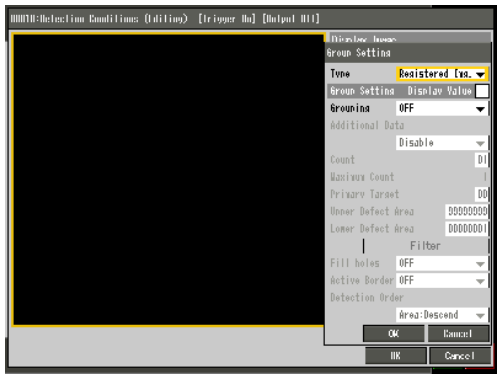
Increasing the [Compare Element] value increases the risk of a single defect being detected more than once. When using the grouping function (Page 4-124) to process defects as blobs, lower the value of [Compare Element].

Ignore intensity

Detect only changes in the pure color information (hue and saturation) as defects, and exclude any brightness / intensity information.

- **OFF**: Changes in intensity are processed as part of the defect level measurement.
- **ON**: Hue and saturation are only used for the defect level measurement.

Group Setting



Display Value

Use this function to display the defect area value for the displayed image next to the [Lower defect] field.

Grouping

If turned [ON], adjacent defects are grouped together so that the center point, area and size aspects of each group can be processed.

- **ON**: Group defects.
- **OFF**: Do not group defects.

► Note

- Grouping is disabled when the inspection region is an arc or ring and [Direction] (Page 4-123) is set to [Cir.] or [Rad.].
- If the grouping is set to [OFF], all group-related functions are disabled.
- If grouping is changed from [ON] to [OFF], previous group-related settings associated limits are reset.
- If grouping is changed from [ON] to [OFF], the detection count is initialized to 1. If changes to the count value are prohibited, the detection count cannot be changed and will remain 1 when grouping is returned from [OFF] to [ON].

Additional group result

This option enables additional result data to be obtained through group processing.

See "Processing results" (Page 4-116) for details about the individual items.

► Note

If the search region is a ring and the search direction is circular or radial, additional group result data is not available.

Count

Specify the maximum number of groups (1 to 99) to be detected. When [Grouping] is [OFF], this setting is disabled.

► Note

- The maximum number of groups available for detection can change based on other settings.
- Based on specific settings, the number of groups is fixed and cannot be changed.

Reference

The [Count] value can be set higher than the [Maximum Count] value (Maximum: 99) depending on the account setting. Note this also increases the [Maximum Count] value, resulting in additional consumption of program memory.

Primary target

Specify the group data (0 to 98) to be used for judgment, set to [0] for normal operation.

Reference

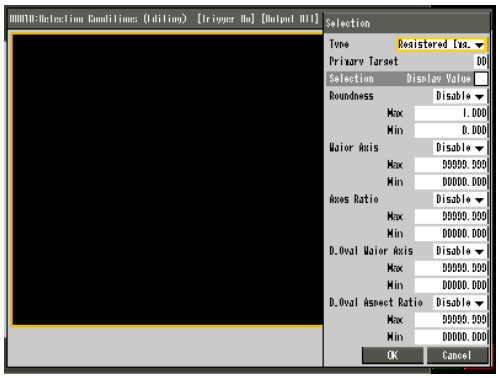
When the primary target is changed, it is possible to change the defect area value shown in the current value display to the value of any group.

Defect area

- **Upper Defect**: Specify the maximum area for a defect to be detected as a group. Groups with an area higher than this value are not detected as groups. When [Grouping] is [OFF], this setting is disabled.
- **Lower Defect**: Specify the minimum area for a defect to be detected as a group. Groups with an area lower than this value are not detected as groups. When [Grouping] is [OFF], this setting is disabled.

Selection

Specify the maximum / minimum range for each selection parameter used to identify a group.



- **Display Image**: Switch the image displayed on the screen.
  - **Captured image**: Displays the latest image from the specified camera (image variable).
  - **Registered Image**: The registered image specified under [Image Selection] is displayed.
- **Primary Target**: Specify the group data (0 to 98) to be used for judgment, set to [0] for normal operation.
- **Display value**: Use this function to display the values of each parameter for the displayed image in blue.
- **Selection**: Choose to enable / disable each filter and set the maximum and minimum range.
  - **Roundness**: Groups that have their roundness values higher than the specified maximum value (0.000 to 1.000, where 1.000 is a perfect circle) or groups that have roundness values lower than the specified minimum value are not detected as defect groups.
  - **Major Axis**: Groups that have their major axis values higher than the specified maximum value or groups that have major axis values lower than the specified minimum value are not detected as defect groups.
  - **Axes Ratio**: Groups that have their axes ratios (major axis / minor axis) higher than the specified maximum value (thinner groups) or groups that have axes ratios lower than the specified minimum value (proportionally correct groups) are not detected as defect groups.
  - **Distributed Oval Major Axis**: Groups that have their distributed oval major axis value of the group higher than the specified maximum value or groups that have their distributed oval major axis value of the group lower than the specified minimum value are not detected as defect groups.
  - **Distributed Oval Aspect Ratio**: Groups that have their aspect ratio (distributed oval major axis / minor axis) of the group higher than the specified maximum value (thinner groups) or groups that have their aspect ratio (distributed oval major axis / minor axis) of the group lower than the specified minimum value (proportionally correct groups) are not detected as defect groups.

► Note

- The filter functions cannot be used when [Cir.] or [Rad.] is selected for [Direction] (Page 4-123).
- When [Additional group result] in the group settings is OFF, current values are shown as [0] even when the [Selection Current Value Display] box is checked.

Reference

When the primary target is changed, it is possible to also change the defect area value shown in the current value display to the value of any group.

Fill holes

Select whether to fill the holes inside a group to include them as part of a detected defect.

Fill holes: OFF

Fill holes: ON

- **OFF**: Do not fill the holes.
- **ON**: Fill the holes.

► Note

The results of fill holes are not reflected in [Total Area] or [Contrast view].

Active Border

Specify whether to separate groups with mutual borders.

- **OFF**: Merge groups that have the same border.
- **ON**: Separate groups that have the same border.

► Note

The active border ON/OFF can only be specified when the inspection region is a rectangle, rotated rectangle, arc ([Direction] is [Cir.] or [Rad.]), or when no mask and image regions have been set. If any other type of inspection region is selected, the active border is always set to OFF.

Detection order

Select the identification order of the detected groups. When [Grouping] is [OFF], this setting is disabled.

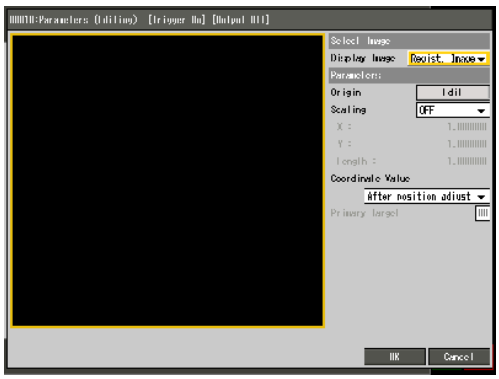
- If the inspection region is not set to [Ring] and the detection direction is not [Cir.] or [Rad.], select the conditions for ordering groups from the following 8 methods.
  - **Y>X: Ascend**: Sort groups in ascending Y order. If Y values are the same, then sort the groups in ascending X order.
  - **X>Y: Ascend**: Sort groups in ascending X order. If X values are the same, then sort the groups in ascending Y order.
  - **X:** Ascend: Sort groups in ascending X order.
  - **X: Descend**: Sort groups in descending X order.
  - **Y: Ascend**: Sort groups in ascending Y order.
  - **Y: Descend**: Sort groups in descending Y order.
  - **Area: Ascend**: Sort groups from the lowest defect area to highest.
  - **Area: Descend (default)**: Sort groups from the highest defect area to lowest.
- If the inspection region is set to [arc] and the detection direction is either [Cir.] or [Rad.], select the conditions for ordering groups from the following 6 methods.
  - **Clockwise**: Sort groups based on angle, clockwise from the start of inspection region.
  - **Counter CW**: Sort groups based on angle, counterclockwise from the start of inspection region.
  - **Out → Center**: Sort groups based on the distance from the center of the inspection region, starting with the longest.
  - **Center → Out**: Sort groups based on the distance from the center of the inspection region, starting with the shortest.
  - **Area: Ascend**: Sort groups from the lowest defect area to highest.
  - **Area: Descend (default)**: Sort groups from the highest defect area to lowest.

► Note

When the inspection region is a rotated rectangle, the XY coordinates move according to the rotation of the region.

Parameters

Specify additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Parameters

Origin

By default, the origin is set to the top left corner of the camera but its location can be moved as required. To specify the origin, select [Edit] and then specify the coordinates.

Reference

The origin can be set outside the process region. The available range for the origin is -9600 to 9600 (X), -7200 to 7200 (Y).

Scaling

The controller processes image data in pixels, The result data and setting parameters used for display, judgement and calculations can be converted and scaled to real life values and dimensions by using the pre-set scaling factor option.

- **OFF**: Do not use scaling.
- **ON**: Use scaling.

Reference

- The scaling factor can be changed from the [Option] menu of the Flowchart (Page 4-356).
- For a summary list of the result data for which scaling can be used, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

Coordinate value

Select the coordinate system to be used after position adjustment. If position adjustment is not used, this setting will have no effect on the measurement.

- **After position adjust**: The inspection uses the adjusted coordinate axes determined after position adjustment.
- **Before position adjust**: The distance from the position specified for the [Origin] of the inspection is used.

Primary target

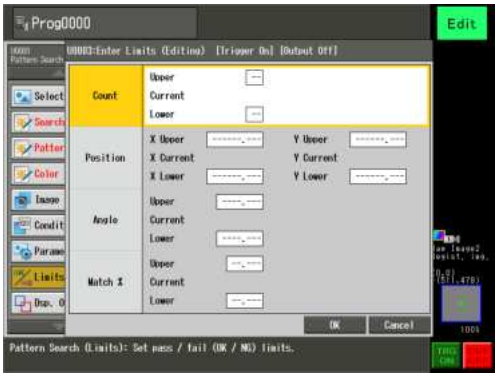
Specify the group data (0 to 98) to be used for judgment, set to [0] for normal operation.
When [Grouping] is [OFF], this setting is disabled.

► Note

Only the data from the primary target will be used for judgment (excluding the total defect area and group count).

Limits

Set pass / fail tolerances (upper and lower limits) for the inspection.
If the result is outside of the specified tolerance range, it is judged as [NG] (binary 1). If the result is within the tolerance range, it is judged as [OK] (binary 0).



Use [Direct Input] to enter a value and set the tolerance.

Reference

- [-----] indicates an empty state where no tolerance is set. In this state, no judgment will be performed on the measurement.
- To reset the tolerance setting to an empty state, select [Clear].

Total area

Specify the tolerance for the total defect area in the inspection region.
The unit of measurement is the "defect area", denoting is the number of elements of the detected defect.

Groups

Specify the tolerance for the defect group count.
The unit of measurement is the "number of groups".

► Note

This limit is disabled when [Grouping] (Page 4-124) is set to [OFF].

Defect area

Specify the tolerance for the defect area of the group.
The unit of measurement is the "defect area", denoting the number of elements of the detected defect.

► Note

This limit is disabled when [Grouping] (Page 4-124) is set to [OFF].

Group center

Specify the tolerance for the center co-ordinate of the group.
The unit of tolerance is the "number of pixels" indicating the center co-ordinates.

► Note

This limit is disabled when [Grouping] (Page 4-124) is set to [OFF].

Display Options

The display color of the units visual indicators can be changed based on the judgment result for that unit. The visual indicator can also be made transparent by selecting [Setting] - [Select Color] - [None].



Inspection region

Specify the line width and display color of the inspection region.

Mask region

Specify the line width and display color of the mask region.

Detected Point

Primary target

Specify the width or display color of the detected point (center) of the detected defect.

Other target

Specify the width and display color of the detected point (center) of the detected defect other than the one specified as the primary target (Page 4-127).

Processing Priority

Specify the processing priority when displaying large processed images during Run mode.
When a line scan camera is used with the XG-7502A, it is not possible to display the processed image if the image size exceeds 25 MB (26214400 pixels). In such a case it is possible to display the filtered image and contrast image by using a display image variable.

Filtered image

Select whether or not to use a display image variable for the filtered image display.

- **Unit Processing**: Processes the filtered image without using the display image variable.
- **Image Display**: Processes the filtered image using a display image variable.

Reference

- When processing images 25 MB or less, or when using the XG-7702A, it is not necessary to select [Image Display].
- When processing an image larger than 25 MB, if the area displayed is 8 MB (8388608 pixels) or less, the filtered image will be automatically displayed when [Unit Priority] is selected. (However the following processes are excluded.)
  - Image enhancement: Shading correction, blob filter
  - Conversion (image operation): Rotate/translate, zoom, trapezoid correction, blob filter
  - Defect, Grayscale Blob: Contrast display

► Note

When [Image Display] is selected for [Filtered Image], the following restrictions on operation occur.

- Processing time increases.
- The background outside the inspection region becomes a black image.
- Displaying of multiple units is not possible.
- For display of registered images outside of unit edit, the filtered image cannot be displayed and the display is the same as when [Unit Processing] is set.
- When an archived image is displayed, it ix not possible to display the processed image unless the display image variable and results are also stored in the archive.

Image variable

Specify a display image variable for displaying the filtered image.

Contrast image

Select whether or not to use a display image variable for the contrast image display.

- **Unit Processing**: Processes the filtered image without using the display image variable.
- **Image Display**: Processes the filtered image using a display image variable.

Reference

- When processing images 25 MB or less, or when using the XG-7702A, it is not necessary to select [Image Display].
- When processing an image larger than 25 MB, if the area displayed is 8 MB (8388608 pixels) or less, the filtered image will be automatically displayed when [Unit Priority] is selected. (However the following processes are excluded.)
  - Image enhancement: Shading correction, blob filter
  - Conversion (image operation): Rotate/translate, zoom, trapezoid correction, blob filter
  - Defect, Grayscale Blob: Contrast display

► Note

When [Image Display] is selected for [Filtered Image], the following restrictions on operation occur.

- Processing time increases.
- The background outside the inspection region becomes a black image.
- Displaying of multiple units is not possible.
- For display of registered images outside of unit edit, the filtered image cannot be displayed and the display is the same as when [Unit Processing] is set.
- When an archived image is displayed, it ix not possible to display the processed image unless the display image variable and results are also stored in the archive.

Image variable

Specify a display image variable for displaying the filtered image.

Reset

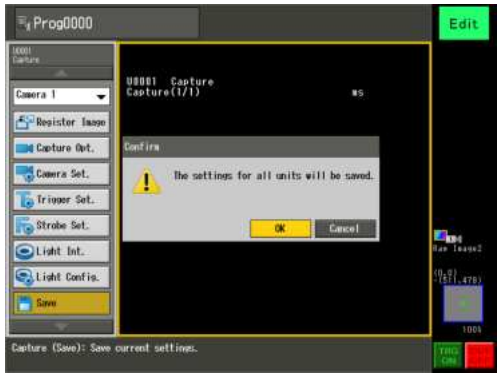
Returns the display options to their defaults.

Save

Save the current unit changes the program file.

► Note

- If the device is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the system power while you are saving the settings. Doing so may cause errors in the internal data



Save

The settings for the unit are saved in the current program file in SD Card 1 or SD Card 2.

► Note

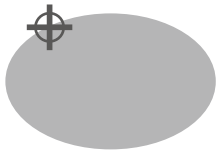
Items specified not to be saved in XG VisionEditor are excluded from the saving operation.
For example, variable values changed in the current program or the default display, and display parts, can be excluded when saving.

What is the Defect Grouping Function

The defect grouping function in the defect unit (Page 4-115) allows successive small areas that have been detected as a defect to be grouped together.
A normal defect inspection identifies the segment with the maximum intensity difference (defect level) among multiple segments. The defect area represents the total number of segments (defects) that exceed the threshold (defect level) in the inspection region. The defect grouping function treats successive segments that exceed the defect level threshold value as a group for processing.
The grouping function is useful for finding the position of flaws and defects larger than the segment size, and for features (defects, etc.) that are larger in area than their intensity difference.

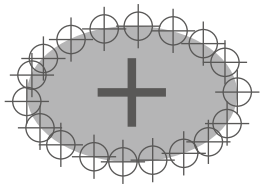
Detecting positions

Defect grouping function [OFF]



The position of the element that has the maximum intensity difference is detected.

Defect grouping function [ON]



The center of gravity from the grouping of several elements is used for the position.

Reference

The detection element in the illustration is a conceptual image and may differ from actual inspection. Check the defect detection in the [Contrast img.] to setup defect grouping correctly.

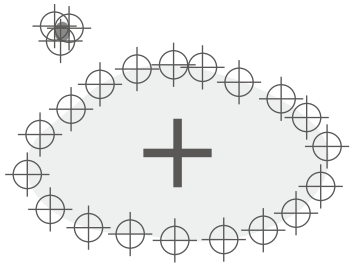
Detecting large flaws

Defect grouping function [OFF]



The element that has the maximum intensity difference is detected.

Defect grouping function [ON]



The group that has the larger number of elements (amount of defects) that exceed the defect level (a subtle defect, in the example above) can be detected.

Reference

The detection element in the illustration is a conceptual image and may differ from actual inspection. Check the defect detection in the [Contrast img.] to setup defect grouping correctly.

► Note

- When [Ring] is selected for the inspection region and [Ring direction] or [Radial direction] is selected for the scan direction, the defect grouping function is disabled.
- When [Arc] is selected for the inspection region and [Ring direction] or [Radial direction] is selected for the scan direction, the defect grouping function is disabled.

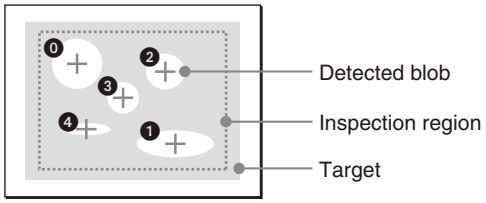
Blob

Blob Tool

The blob tool identifies a continuous group of pixels that have the same grayscale intensity binary conversion range (0 to 255) as a blob. The blob tool identifies and counts all the blobs in the inspection region and for each blob calculates its area, center of gravity, angle and length of major / minor axis, feret diameter, perimeter, and roundness.

Image processing

Blobs are measured, filtered and identified based on numerous criteria. When identified they can be ordered based on size or detection direction.

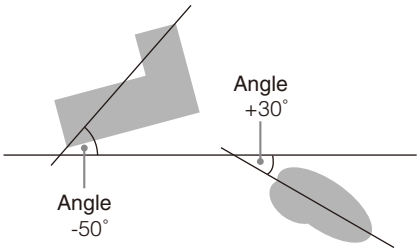
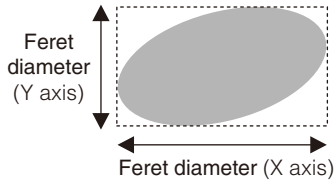


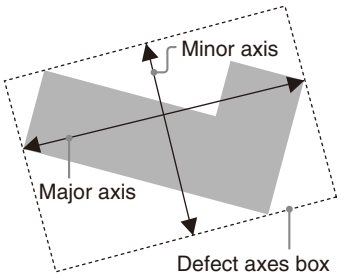
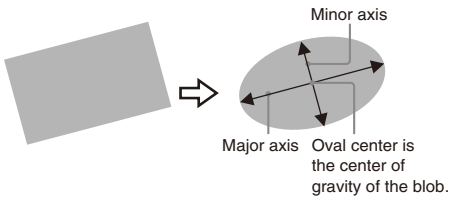
Processing results

The standard results and data returned by the blob measurement are as follows:

Reference

Processing results may vary depending on the shape of the inspection region. The result for an item which is not processed is always 0.

Number of blobs	Outputs the number of detected blobs after filtering. Tolerance inspection target
Position (X, Y) [ ]	Outputs the center of gravity position coordinates for all detected blobs after filtering. Tolerance inspection target Label specification target
Position (X, Y) (max, min)	Outputs the maximum and minimum center of gravity position coordinates in pixels from the range of detected blobs after filtering. Tolerance inspection target
Angle (T) [ ]	Outputs the major axis angle (with reference to the horizontal X axis) of all detected blobs after filtering. Tolerance inspection target Label specification target 
Angle (T) (max, min)	Outputs the maximum and minimum angle of the major axis from the range of detected blobs after filtering. Tolerance inspection target
Area [ ]	Outputs the areas of all detected blobs after filtering in pixels. Tolerance inspection target Label specification target
Area (max, min)	Outputs the maximum and minimum areas in pixels from the range of detected blobs after filtering. Tolerance inspection target
Feret Diameter (X, Y) [ ]	Outputs the feret diameter (length and width calculated from the circumscribed rectangle created with parallel horizontal (X axis) and vertical (Y axis) boundaries) of all detected blobs after filtering in pixels. Tolerance inspection target Label specification target 
Feret Diameter (X, Y) (max, min)	Outputs the maximum and minimum feret diameters in pixels from the range of detected blobs after filtering. Tolerance inspection target
Perimeter [ ]	Outputs the perimeters of all detected blobs after filtering in pixels . Tolerance inspection target Label specification target
Perimeter (max, min)	Outputs the maximum and minimum peripheries in pixels from the range of detected blobs after filtering. Tolerance inspection target
Roundness	Outputs the degree of similarity (1.000 to 0.000) to a perfect circle of all blobs after filtering. A perfect circle is output as a value of 1.000. The number will close in on 0.000 as the similarity to a perfect circle decreases. Tolerance inspection target Label specification target  Similar to a perfect circle Roundness: 0.950 Less similar to a perfect circle Roundness: 0.345
Roundness (max, min)	Outputs the maximum and minimum roundness values from the range of detected blobs after filtering. Tolerance inspection target
Major Axis [ ]	Outputs the major axis' in pixels when [Major / Minor Axis] in [Target Data] is enabled. Tolerance inspection target Label specification target
Major Axis (max, min)	the maximum and minimum major axis' in pixels when [Major / Minor Axis] in [Target Data] is enabled. Tolerance inspection target
Minor Axis [ ]	Outputs the minor axis' in pixels when [Major / Minor Axis] in [Target Data] is enabled. Tolerance inspection target Label specification target
Minor Axis (max, min)	the maximum and minimum minor axis' in pixels when [Major / Minor Axis] in [Target Data] is enabled. Tolerance inspection target

Axes Ratio [ ]	Outputs the ratio of the major and minor axes in pixels when [Major / Minor Axis] in [Target Data] is enabled. The axes ratio is a value of the "Major axis/Minor axis," and a larger value represents a thinner shape. Tolerance inspection target (Label specification target) 
Axes ratio (max, min)	Outputs the maximum and minimum ratio of the major and minor axes in pixels when [Major / Minor Axis] in [Target Data] is enabled. The aspect ratio is a value of the "Major axis/Minor axis," and a larger value represents a thinner shape. Tolerance inspection target
Distributed oval Major Axis [ ]	Outputs the major axis' of an equivalent distributed oval in pixels when [Distributed Oval] in [Target Data] is enabled. Tolerance inspection target (Label specification target)
Distributed Oval Major axis (max, min)	Outputs the maximum and minimum major axis of an equivalent distributed oval in pixels when [Distributed Oval] in [Target Data] is enabled. Tolerance inspection target
Distributed Oval Minor Axis [ ]	Outputs the minor axis' of an equivalent distributed oval in pixels when [Distributed Oval] in [Target Data] is enabled. Tolerance inspection target (Label specification target)
Distributed Oval Minor Axis (max, min)	Outputs the maximum and minimum minor axis of an equivalent distributed oval in pixels when [Distributed Oval] in [Target Data] is enabled. Tolerance inspection target
Aspect Ratio [ ]	Outputs the ratio of the major and minor axes of an equivalent distributed oval in pixels when [Distributed Oval] in [Target Data] is enabled. Tolerance inspection target (Label specification target)  The equivalent oval of a blob is an approximate oval obtained from the shape of the blob and is useful for stable measurement of shapes that have spikes or strands that skew major/minor axis measurements.
Aspect Ratio (max, min)	Outputs the maximum and minimum ratio of the major and minor axes of an equivalent distributed oval in pixels when [Distributed Oval] in [Target Data] is enabled. Tolerance inspection target
Blob Axes position (Upper left, lower left, upper right, lower right) [ ]	Outputs coordinates for the circumscribed rectanglee of all blobs based on the major and minor axis when [Distributed Oval] in [Target Data] is enabled. (Label specification target)
Distributed Oval Position X,Y XY [ ]	Outputs coordinates for the major and minor axis points for the equivalent distributed oval. The position relationship (up/down/right/left) is based on the angle of the major axis. (Label specification target)
Unit judgment value	Outputs the binary result of the unit based on the measured value and the specified tolerance range (upper / lower limits). The unit is judged as [NG] (binary 1) when outside the tolerance range and [OK] (binary 0) when inside.

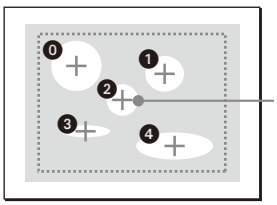
Reference

- The blob used for tolerance judgment is specified by the [Primary target] (Default: 0) except for the blob count. If the primary target is set to [All], the tolerance for each item becomes the maximum and minimum for that item.
- When target classification is ON, the results are also output for each classification type No. (in the format !U[****].RSLT.CLS[*1].****, *1) For more details, see "List of Setting Parameters / Result Data" in the XG-7000 Series Communication Control Manual.
- For the lists of available measurement output values and setting parameters, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

Example

Example showing the results of a BLOB inspection performed under the following conditions:

- Detect. Order: Y X: Ascend
- Primary Target: 2



No. of blobs
5

Target blob
Center of gravity: X: 600, Y: 460
Area: 20,000
Roundness: 0.85

Main Menu

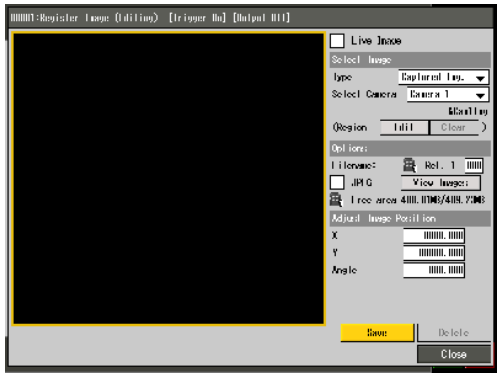
The main menu of the blob tool consists of the following options. Configure settings under each option as required for the inspection.



Register Image (Page 4-134)	Register an image to be used as a template for settings.
Select Image (Page 4-136)	Specify the image to be used for unit processing.
Inspect Region (Page 4-137)	Define the region to be used for unit processing.
Color (Page 4-138)	Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).
Image Enhance (Page 4-138)	Settings for pre-processing image filters.
Condition (Page 4-139)	Specific conditions for processing a blob inspection.
Parameters (Page 4-141)	Additional optional parameters.
Limits (Page 4-142)	Unit pass / fail tolerances.
Display Options (Page 4-144)	Unit processing display settings.
Save (Page 4-145)	Save unit settings.

Register Image

An image can be saved to the controller to be used as a template for measurements and settings. It is recommended to adjust and fix lighting and other external influences before registering an image.



Live Image

Check this box to display live images through a continuous feed.

► Note

- A live feed is only available while the unit is being edited.
- This setting cannot be changed when the screen update mode is set to [Continuous] in the trigger settings (Page 4-25).
- If the capture on trigger input is disabled in the trigger settings (Page 4-25), this check box is always unchecked and the setting cannot be changed.
- When Live image is selected for a moving object, take care when registering as there will be a time lag between the external trigger input and the actual image capture.
- In principle, Live-image is only used when the capture unit being edited is being executed (waiting for a trigger input). When the image capture buffer is set to custom and the capture unit which was most recently executed is being edited, the images collected in the buffer will still be displayed even if the capture unit is not presently capturing images.
- Continuous update cannot be used when HDR capture (Page 4-21) is enabled or when a line scan camera is being used.
- When the HDR capture (Page 4-21) is enabled, the Multi-image cannot be used.

Select Image

Type

Select an image to register.

- **Captured Img.**: Displays the latest image from the specified camera (image variable).
- **Registered Img.**: The registered image specified in [Options] is displayed.

Select Camera

Select the number of the camera used for registration. Choose from Camera1 - Camera4, and select only the camera number used for the capture unit being edited.

Specifying a region

To register only part of an image, select [Edit] then specify the region to register. To cancel the selected region, select [Clear].

Save Image

Filename

Specify the registered image number used for image registration in the form "(Camera No.)-(User-specified No.)".

Reference

The name of the saved file is "ref (Camera No.)_(Specified No.)" (for full screen image registration) or "ref (Camera No.)_(Specified No.)_XXX_YYY" (for partial image registration).

JPEG

Check this box to save the image in JPEG format. When this box is not checked, the image will be saved in BMP format as either a 24-bit color bitmap image (when a color camera is used) or an 8-bit grayscale bitmap image (when a monochrome camera is used).

► Note

Using image compression may result in some image deterioration, thus results from a compressed image may differ to those when using non compressed images.

View All

View all registered images in a list.

Adjust Image Position

Adjust the position of the image being captured.

X

-Adjust the movement in the X (horizontal) direction between -8191.000 and 8191.000 pixels.

Y

-Adjust the movement in the Y (vertical) direction between -16383.000 and 16383.000 pixels.

Angle

Adjust the position angle (rotation) around the center of the image between -999.999° and 999.999°.

► Note

Position adjustment may cause missing peripheries (black areas) due to image movement or jagged edges (jaggies) due to rotation in the registered image.

Save

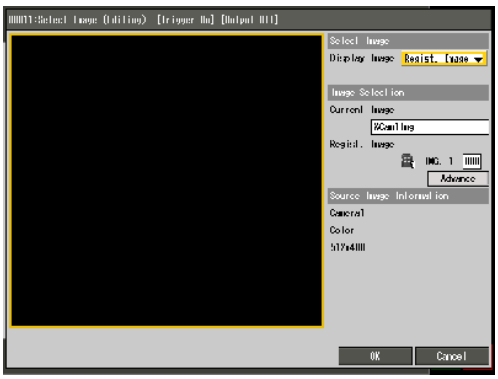
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Registered Img.] is selected for [Type], you can delete the registered image specified in [Options].

Select Image

Specify the image variable and associated registered image to be used for configuring the vision tool.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured Image**: Displays the latest image from the specified camera (image variable).
- **Registered Image**: The registered image specified under [Image Selection] is displayed.

Select image

Captured Img.

Set an image variable to be used as a current image for the unit.

Registered Img.

Specify the registered image No. for the registered image to be used.

- The registered images are managed as "Image (Camera No.) - (Registered image No.0 to 999)".
- The "Camera No" is fixed to the number of the camera associated to the image variable specified for the current image.

Advance

Set advance options for the switching of registered images as necessary.

- **Use numerical variable for registered image number**: To use a variable for the registered image No., check this box and assign a numerical or numerical array variable reference. By using a variable for the registered image No. and then issuing a variable reference value apply command (NU), the image is switched to the specified registered image in the variable and the reference image information is updated. For more details, see the XG-7000 Series Communication Control Manual.
- **Process variable when changing programs**: Use this option to switch to the registered image based on the initial value of the variable referenced when the program is changed or the controller is next turned on.

► Note

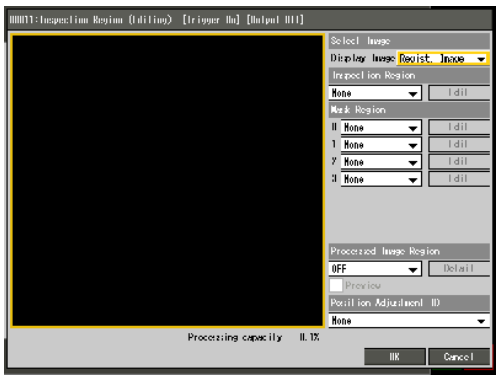
Note that the registered image No. does not switch in accordance with a change in the variable.

Source Image Information

The camera No., type (color / monochrome), and resolution of the camera associated to the image variable specified is displayed.

Inspection Region

Outline the region on the captured image to be used for inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Region

Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Inspection Region Menu" (Page 3-20) for more details.

Mask region

A mask region is an area which can be defined in the inspection region and will be excluded from the inspection. Up to four mask regions can be set per inspection region. A mask region is typically used for hiding an area that does not require inspection.
Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Excluding Part of the Region" (Page 3-26) for more details.

Processed image region

Use processed image region to generate a region for inspection based on an image. (Page 4-295), select [ON] and then select [Detail] for configuration.

Reference

Refer to "Generating a Region from an Image" (Page 3-27) for more details on processed image region.

Image

Specify the image variable to be used for generating the region.

Area

Specify the area and border color for the region based on the image specified in the image variable. Select either [Black] (Level 0) or [White] (Level 255, default).

Preview

Use this checkbox to display the specified image. When the checkmark is removed, the display returns to its normal state.

Position Adjustment ID

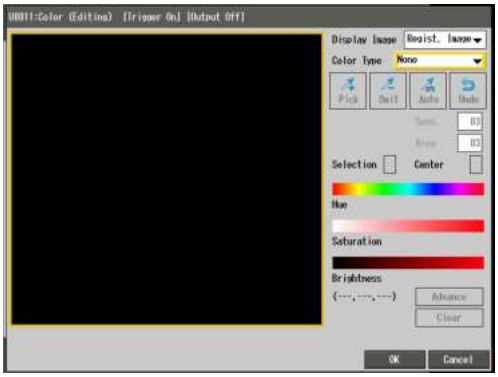
To use position adjustment for the region, select the position adjustment unit to be referenced.

Reference

The position adjustment is applied to all inspection, mask, and image regions.

Color

When working with a color camera, convert the captured color image into a binary (black and white) or a grayscale converted image by extracting the desired color.



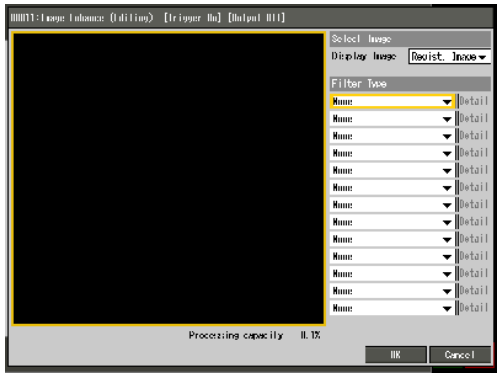
► Note

This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-295) is referenced as the current image.

Refer to "Working with Color Images (Color Extraction)" (Page 10-2) for concepts involving color extraction and its operation.

Image Enhance

Specify the filter processing to apply to the image. When a color camera is used, the filter is applied to the images converted using color extraction.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Filter type

Select the [Filter Type] field and then select the filter to apply. To perform area measurement using a method other than color to binary, you must select the [Binary] filter as the last filter. See "Image Enhancement Filters" (Page 10-11) for more details of each filter processing.

► Note

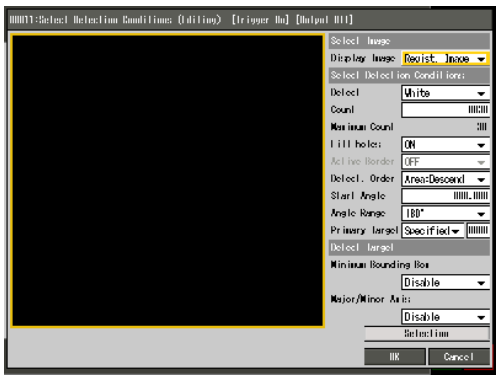
- For the area tool, [Binary] must be selected unless color to binary is used in the color extraction settings.
- If the binary filter is not selected or another filter is applied after the binary filter, the measurement result may not be correct.
- The binary, subtract and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 13 types of filters can be stacked according to application requirements. When multiple filters are set, they are processed one by one from the top.
- The order of the filters can be changed by selecting a filter in one of the [Filter Type] fields, holding down the No.1 (FUNCTION) button of the handheld controller, and then moving the 8-way key up or down.

Conditions

Specify the conditions for detecting blobs.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Detection Conditions

Detect

Specify the color of pixels (black/white) to be detected in the binary (monochrome) image.

- **White**: Set white blobs to be the target of measurement.
- **Black**: Set black blobs to be the target of measurement.

Count

Specify the maximum number of blobs (1 to 9999) to be detected. The number of blobs cannot exceed the [Maximum Count] value.

► Note

- The maximum number of blobs available for detection can change based on other settings.
- Based on specific settings, the number of blobs is fixed and cannot be changed.

Reference

It may be possible to set a [Count] value that is higher than the [Maximum Count] value (Maximum: 9), depending on the account setting. Note this also increases the [Maximum Count] value, resulting in additional consumption of program memory.

Fill holes

Specify whether to fill the inside of blobs with the color specified in [Detect].

If the inside of a blob contains an area with a different color than the [Detect] color, the area, center of gravity, major axis angle, and roundness measurements could be affected. In order to prevent this, the inside of blobs can be filled using the [Detect] color as follows.

Fill holes: OFF　　Fill holes: ON

- **OFF**: Do not fill the inside of blobs.
- **ON**: Fill the inside of blobs.

► Note

The result of fill holes is not reflected on the processing screen.

Active Border

Specify whether to separate groups with mutual borders.

- **OFF**: Merge blobs that have the same border.
- **ON**: Separate blobs that have the same border.

► Note

The active border ON/OFF setting can only be specified if the inspection region is a rectangle and no mask or image regions have been set. If any other inspection region is selected, the active border will be processed as if set to OFF.

Detection order

Select the identification order of the detected blobs.

- **Y>X: Ascend**: Sort groups in ascending Y order. When Y values are the same, reorders in ascending X order.
- **X>Y: Ascend**: Sort groups in ascending X order. When X values are the same, reorders in ascending Y order.
- **X:** Ascend: Sort groups in ascending X order.
- **X: Descend**: Sort groups in descending X order.
- **Y: Ascend**: Sort groups in ascending Y order.
- **Y: Descend**: Sort groups in descending Y order.
- **Area: Ascend**: Sorts blobs from smallest area to largest.
- **Area: Descend**: Sorts blobs from largest area to smallest.
- **Round.: Asc.**: Sort blobs from the lowest roundness value (0.000 to 1.000, where 1.000 is a perfect circle) to the highest.
- **Round.: Desc.**: Sort blobs from the highest roundness value (0.000 to 1.000, where 1.000 is a perfect circle) to the lowest.
- **Clockwise**: Sort groups based on angle, clockwise from the start angle.

- **Counter CW**: Sort groups based on angle, counterclockwise from the start angle.

Starting angle

Specify a starting angle for order identification when [Detect. Order] is [Clockwise] or [Counter CW]

► Note

This setting is ignored when [Detect. Order] is not [Clockwise] or [Counter CW].

Angle range

Specify the angle range of the major axis.

- **180**°: Process angles in the range -89.999° to 90.000°.
- **360**°: Process angles in the range -179.999° to 180.000°.
- **OFF**: Angle is not processed (major axis angle value is defaulted to 0°).

► Note

Processing may become unstable with symmetrical shapes detected as blobs when [360°] has been set for the angle range.

Primary target

Select the blob to be used for OK / NG judgment.

- **All**: Use the maximum and minimum values measured from all blobs for the OK/NG judgment.
- **Specified**: Select [Specified] for [Primary Target] and then specify the No. of the blob used in judgment (0 to 9998). Only the blob that is specified here becomes the target of judgment.

Target Data

Major / Minor Axis

- **Enable**: Enable the [Major Axis], [Minor Axis], and [Axes Ratio] parameters for the blob measurement, OK / NG judgment, and filter settings.
- **Disable** (Default): Disable the [Major Axis], [Minor Axis], and [Axes Ratio] parameters for the blob measurement, OK / NG judgment, and filter settings.

Distributed Oval

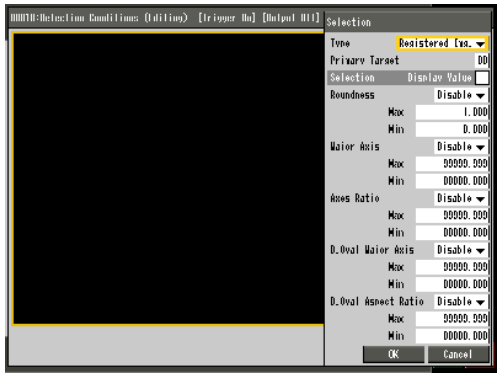
- **Enable**: Enable the [Distributed Oval Major Axis], [Distributed Oval Minor Axis], and [Aspect Ratio] parameters for the blob measurement, OK / NG judgment, and filter settings.
- **Disable** (Default): Disable the [Distributed Oval Major Axis], [Distributed Oval Minor Axis], and [Aspect Ratio] parameters for the blob measurement, OK / NG judgment conditions, and filter settings.

► Note

The result data of [Major / Minor Axis] and [Distributed Oval] are defaulted to 0. Enabling [Major / Minor Axis] and [Distributed Oval] increases the consumption of program memory slowing down the processing time.

Selection

Specify the maximum / minimum range for each selection parameter used to identify a group.



- **Display Image**: Switch the image displayed on the screen.
  - **Captured image**: Displays the latest image from the specified camera (image variable).
  - **Registered Image**: The registered image specified under [Image Selection] is displayed.
- **Primary Target**: Specify the group data (0 to 98) to be used for judgment, set to [0] for normal operation.
- **Display value**: Use this function to display the values of each parameter for the displayed image in blue.
- **Selection**: Choose to enable / disable each filter and set the maximum and minimum range.

- **Roundness**: Groups that have their roundness values higher than the specified maximum value (0.000 to 1.000, where 1.000 is a perfect circle) or groups that have roundness values lower than the specified minimum value are not detected as defect groups.
- **Major Axis**: Groups that have their major axis values higher than the specified maximum value or groups that have major axis values lower than the specified minimum value are not detected as defect groups.
- **Axes Ratio**: Groups that have their axes ratios (major axis / minor axis) higher than the specified maximum value (thinner groups) or groups that have axes ratios lower than the specified minimum value (proportionally correct groups) are not detected as defect groups.
- **Distributed Oval Major Axis**: Groups that have their distributed oval major axis value of the group higher than the specified maximum value or groups that have their distributed oval major axis value of the group lower than the specified minimum value are not detected as defect groups.
- **Distributed Oval Aspect Ratio**: Groups that have their aspect ratio (distributed oval major axis / minor axis) of the group higher than the specified maximum value (thinner groups) or groups that have their aspect ratio (distributed oval major axis / minor axis) of the group lower than the specified minimum value (proportionally correct groups) are not detected as defect groups.

► Note

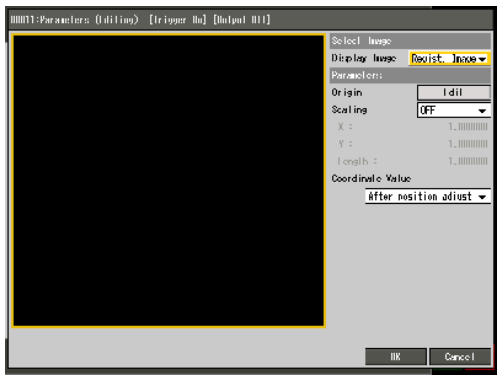
- The filter functions cannot be used when [Cir.] or [Rad.] is selected for [Direction] (Page 4-123).
- When [Additional group result] in the group settings is OFF, current values are shown as [0] even when the [Selection Current Value Display] box is checked.

Reference

When the primary target is changed, it is possible to also change the defect area value shown in the current value display to the value of any group.

Parameters

Specify additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Parameters

Origin

By default, the origin is set to the top left corner of the camera but its location can be moved as required. To specify the origin, select [Edit] and then specify the coordinates.

Reference

The origin can be set outside the process region. The available range for the origin is -9600 to 9600 (X), -7200 to 7200 (Y).

Scaling

The controller processes image data in pixels, The result data and setting parameters used for display, judgement and calculations can be converted and scaled to real life values and dimensions by using the pre-set scaling factor option.

- **OFF**: Do not use scaling.
- **ON**: Use scaling.

Reference

- The scaling factor can be changed from the [Option] menu of the Flowchart (Page 4-356).
- For a summary list of the result data for which scaling can be used, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

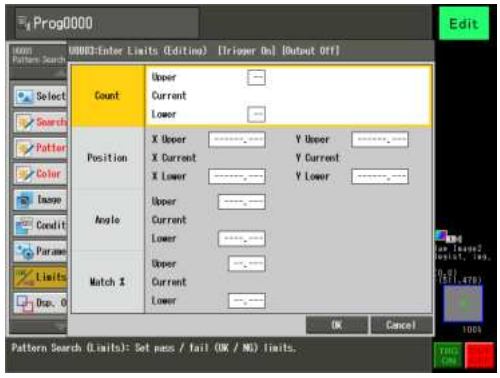
Coordinate value

Select the coordinate system to be used after position adjustment. If position adjustment is not used, this setting will have no effect on the measurement.

- **After position adjust**: The inspection uses the adjusted coordinate axes determined after position adjustment.
- **Before position adjust**: The distance from the position specified for the [Origin] of the inspection is used.

Limits

Set Pass / fail tolerances (upper and lower limits) for the inspection.
If the result is outside of the specified tolerance range, it is judged as [NG] (binary 1). If the result is within the tolerance range, it is judged as [OK] (binary 0).



Use [Direct Input] to enter a value and set the tolerance.

Reference

- [-----] indicates an empty state where no tolerance is set. In this state, no judgment will be performed on the measurement.
- To reset the tolerance setting to an empty state, select [Clear].

► Note

- [Major Axis], [Minor Axis], and [Axes Ratio] cannot be set when [Major / Minor Axis] is disabled.
- [Distrubted Oval Major Axis], [Distributed Oval Minor Axis], and [Aspect Ratio] cannot be set when [Distributed Oval] is disabled.

Count

Specify the tolerance for the number of blobs detected.
The unit of measurement is the "number of blobs" detected.

Position

Specify the tolerance for the position of the blob.
The unit of measurement is the "number of pixels" indicating the center of gravity coordinates.

Angle

Specify the tolerance for the angle of the blob.
The unit of measurement is the "angle" of the major axis.

Area

Specify the tolerance for the area of the blob.
The unit of measurement is the [Number of Pixels] of the measurement area (0 to 99999999).

Feret

Specify the tolerance for the feret diameter of the blob.
The unit of measurement is the "number of pixels" indicating the feret diameter.

Perimeter

Specify the tolerance for the perimeter of the blob.
The unit of measurement is the "number of pixels" indicating the perimeter.

Roundness

Specify the tolerance for the roundness of the blob.
The unit of measurement is the "roundness correlation" indicating the roundness (0.000 to 1.000, where 1.000 is a perfect circle).

Major Axis

Specify the tolerance for the major axis of the blob.
The unit of measurementa is the "number of pixels" indicating the major axis length.

Minor Axis

Specify the tolerance for the minor the blob.
The unit of measurement is the "number of pixels" indicating the major axis length.

Major / Minor Axes Ratio

Specify the tolerance for the axes ratio (Major axis / Minor axis) of the blob.
The unit of measurement is the "ratio" indicating the axes ratio (0.000 to 99999.999).

Distributed Oval Major axis

Specify the tolerance for the distributed oval major axis of the blob.
The unit of measurement is the "number of pixels" indicating the major axis length.

Distributed Oval Minor axis

Specify the tolerance for the distributed oval minor axis of the blob.
The unit of measurement is the "number of pixels" indicating the minor axis length.

Distributed Oval Aspect ratio

Specify the tolerance for the distributed oval aspect ration (Major Axis / Minor Axis) of the blob.
The unit of measurement is the "ratio" indicating the aspect ratio (0.000 to 99999.999).

Display Options

The display color of the units visual indicators can be changed based on the judgment result for that unit. The visual indicator can also be made transparent by selecting [Setting] - [Select Color] - [None].



Inspection region

Specify the line width and display color of the inspection region.

Mask region

Specify the line width and display color of the mask region.

Detected Point

Primary target

Specify the width and display color for the center of gravity position of a blob.

Other target

Specify the width and display color of the center of gravity positions for the blobs other than the one specified as the primary target (Page 4-140).

Display Target

Specify the blob(s) for which the center of gravity position is displayed.

- **All**: Display the detection position for all blobs.
- **Primary Target**: Display the detection position only for the blob specified as the primary target.

Processing Priority

Specify the processing priority when displaying large processed images during Run mode.
When a line scan camera is used with the XG-7502A, it is not possible to display the processed image if the image size exceeds 25 MB (26214400 pixels). In such a case it is possible to display the filtered image and contrast image by using a display image variable.

Filtered image

Select whether or not to use a display image variable for the filtered image display.

- **Unit Processing**: Processes the filtered image without using the display image variable.
- **Image Display**: Processes the filtered image using a display image variable.

Reference

- When processing images 25 MB or less, or when using the XG-7702A, it is not necessary to select [Image Display].
- When processing an image larger than 25 MB, if the area displayed is 8 MB (8388608 pixels) or less, the filtered image will be automatically displayed when [Unit Priority] is selected. (However the following processes are excluded.)
  - Image enhancement: Shading correction, blob filter
  - Conversion (image operation): Rotate/translate, zoom, trapezoid correction, blob filter
  - Defect, Grayscale Blob: Contrast display

► Note

When [Image Display] is selected for [Filtered Image], the following restrictions on operation occur.

- Processing time increases.
- The background outside the inspection region becomes a black image.
- Displaying of multiple units is not possible.
- For display of registered images outside of unit edit, the filtered image cannot be displayed and the display is the same as when [Unit Processing] is set.
- When an archived image is displayed, it ix not possible to display the processed image unless the display image variable and results are also stored in the archive.

Image variable

Specify a display image variable for displaying the filtered image.

Reset

Returns the display options to their defaults.

Save

Save the current unit changes the program file.

► Note

- If the device is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the system power while you are saving the settings. Doing so may cause errors in the internal data



Save

The settings for the unit are saved in the current program file in SD Card 1 or SD Card 2.

► Note

Items specified not to be saved in XG VisionEditor are excluded from the saving operation.
For example, variable values changed in the current program or the default display, and display parts, can be excluded when saving.

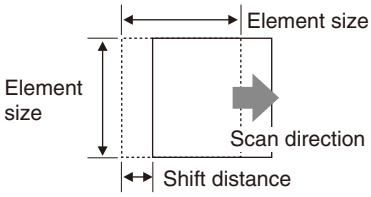
Grayscale Blob

Grayscale Blob Tool

The grayscale blob tool identifies a continuous group of pixels that exceed a threshold level from a base grayscale intensity as a target. The tool characterizes the detected targets defining properties such as area, volume, center of gravity, angle and length of major / minor axis, feret diameter, perimeter, and roundness.

Image processing

The grayscale blob tool indexes the element by the shift distance in the specified scan direction within the inspection region measuring the average intensity of each element.



The difference between the intensity of each element and the base intensity is called the "intensity level", and a collection of elements with intensity levels that exceed the threshold value are detected as a target.

► Note

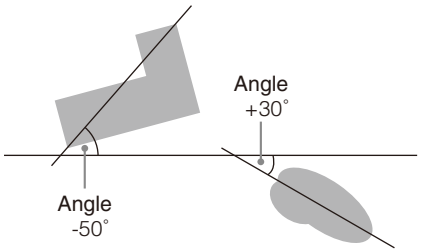
If a group of elements that exceed the threshold value are in contact with other bright or dark elements that exceed the threshold, all the elements will be grouped together as a single target. To separate the targets either specify [Bright & Dark] for the detection method and perform detection individually, or set a higher threshold value to prevent mis-detection.

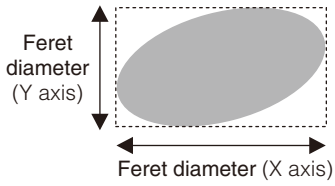
Processing results

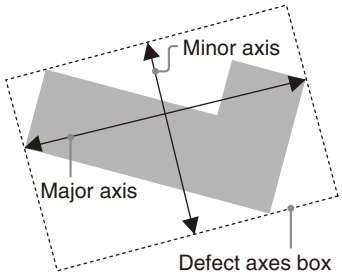
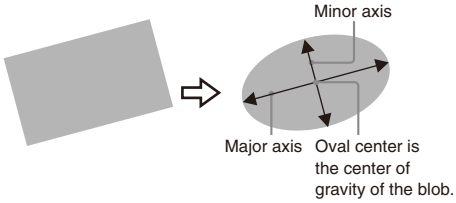
The standard results and data returned by the grayscale blob measurement are as follows:

Reference

Processing results may vary depending on the shape of the inspection region. The result for an item which is not processed is always 0.

Intensity level	Outputs the intensity level value.
Base intensity	Outputs the reference intensity level.
Total area	Outputs the total surface area of the detected targets in pixels. Tolerance inspection target
Number of targets	Outputs the number of detected targets after filtering. Tolerance inspection target
Position (X, Y) [ ]	Outputs the center of gravity position coordinates for all detected targets after filtering. Tolerance inspection target Label specification target
Position (X, Y) (max, min)	Outputs the maximum and minimum center of gravity position coordinates in pixels from the range of detected targets after filtering. Tolerance inspection target
Angle (T) [ ]	Outputs the major axis angle (with reference to the horizontal X axis) for all detected targets (only available when [Angle Range] is set to [180°] or [360°]). Tolerance inspection target Label specification target 
Angle (T) (max, min)	Outputs the maximum and minimum major axis angle from the range of detected targets (only available when [Angle Range] is set to [180°] or [360°]). Tolerance inspection target
Area [ ]	Outputs the areas for all detected targets after filtering in pixels. Tolerance inspection target Label specification target
Area (max, min)	Outputs the maximum and minimum area from the range of detected targets after filtering in pixels. Tolerance inspection target
Volume[ ]	Outputs the volume of the target (integral sum of the intensity levels) for all detected targets (only available when the [Target Data] option [Volume] is enabled). Tolerance inspection target Label specification target
Volume (max, min)	Outputs the maximum and minimum volume (integral sum of the intensity levels) from the range of detected targets (only available when the [Target Data] option [Volume] is enabled). Tolerance inspection target

Bright & Dark[ ]	Outputs whether the detected target is bright (1) or dark (-1). Label specification target
Average Intensity Level [ ]	Outputs the average value for all intensity level for all detected targets. Tolerance inspection target Label specification target
Average Intensity Level (max, min)	Outputs the maximum and minimum average intensity levels from the range of detected targets. Tolerance inspection target
Maximum Intensity Level [ ]	Outputs the maximum value of the intensity level for all detected targets. Tolerance inspection target Label specification target
Maximum Intensity Level (max, min)	Outputs the maximum and minimum maximum intensity levels from the range of detected targets. Tolerance inspection target
Feret diameter (X, Y) [ ]	Outputs the feret diameter (length and width calculated from the circumscribed rectangle created with parallel horizontal (X axis) and vertical (Y axis) boundaries) for all detected targets after filtering in pixels. Tolerance inspection target Label specification target 
Feret diameter (X, Y) (max, min)	Outputs the maximum and minimum feret diameters in pixels from the range of detected targets after filtering. Tolerance inspection target
Perimeter [ ]	Outputs the perimeters for all detected targets after filtering in pixels. Tolerance inspection target Label specification target
Perimeter (max, min)	Outputs the maximum and minimum perimeters in pixels from the range of detected targets after filtering. Tolerance inspection target
Roundness	Outputs the degree of similarity (1.000 to 0.000) to a perfect circle for all targets after filtering. A perfect circle is considered as a value of 1.000. and the value will reduce to 0.000 as the similarity decreases. Tolerance inspection target Label specification target 
Roundness (max, min)	Outputs the maximum and minimum roundness values from the range of detected targets after filtering. Tolerance inspection target
Major Axis [ ]	Outputs the major axis' for all detected targets (when[Major / Minor Axis] in [Target Data] is enabled). Tolerance inspection target Label specification target
Major Axis (max, min)	Outputs the maximum and minimum major axis from the range of detected targets (when[Major / Minor Axis] in [Target Data] is enabled). Tolerance inspection target

Minor Axis [ ]	Outputs the minor axis' for all detected targets (when[Major / Minor Axis] in [Target Data] is enabled). Tolerance inspection target Label specification target
Minor Axis (max, min)	Outputs minor axis from the range of detected targets (when[Major / Minor Axis] in [Target Data] is enabled). Tolerance inspection target
Axes Ratio [ ]	Outputs the major minor axis ratio for all detected targets (when[Major / Minor Axis] in [Target Data] is enabled). The axes ratio is a value of the "Major axis/Minor axis," and a larger value represents a thinner shape. Tolerance inspection target Label specification target 
Axes ratio (max, min)	Outputs the maximum and minimum axes ratio from the range of detected targets (when [Major / Minor Axis] in [Target Data] is enabled). The axes ratio is a value of the "Major axis/Minor axis," and a larger value represents a thinner shape. Tolerance inspection target
Distributed Oval Major Axis [ ]	Outputs the major axis' of an equivalent distributed oval for all detected targets (when [Distributed Oval] in [Target Data] is enabled). Tolerance inspection target Label specification target
195Distributed Oval Major axis (max, min)	Outputs the maximum and minimum major axis' of an equivalent distributed oval from the range of detected targets (when [Distributed Oval] in [Target Data] is enabled). Tolerance inspection target
Distributed Oval Minor Axis [ ]	Outputs the minor axis' of an equivalent distributed oval for all detected targets (when [Distributed Oval] in [Target Data] is enabled). Tolerance inspection target Label specification target
Distributed Oval Minor axis (max, min)	Outputs the maximum and minimum minor axis' of an equivalent distributed oval from the range of detected targets (when [Distributed Oval] in [Target Data] is enabled). Tolerance inspection target
Aspect Ratio [ ]	Outputs the ratio of the major and minor axes of an equivalent distributed oval for all detected targets (when [Distributed Oval] in [Target Data] is enabled). A larger value represents a thinner shape. Tolerance inspection target Label specification target  The equivalent oval of a blob is an approximate oval obtained from the shape of the blob and is useful for stable measurement of shapes that have spikes or strands that skew major/minor axis measurements.

Aspect Ratio (max, min)	Outputs the maximum and minimum ratio of the major and minor axes of an equivalent distributed oval from the range of detected targets (when [Distributed Oval] in [Target Data] is enabled). Tolerance inspection target
Target axes box position (Upper left, lower left, upper right, lower right) [ ]	Outputs maximum and minimum ratio of the major and minor axes of an equivalent distributed oval from the range of detected targets (when [Distributed Oval] in [Target Data] is enabled). Label specification target
Distributed Oval Position X,Y XY [ ]	Outputs the coordinates for the major and minor axis points for the equivalent distributed oval for all detected targets. Label specification target
Unit judgment value	Outputs the binary result of the unit based on the measured value and the specified tolerance range (upper / lower limits). The unit is judged as [NG] (binary 1) when outside the tolerance range and [OK] (binary 0) when inside.

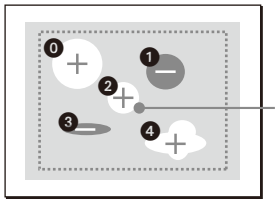
Reference

- The target used for tolerance judgment is specified by the [Primary target] (Default: 0) except for the target count. If the primary target is set to [All], the tolerance for each item becomes the maximum and minimum for that item.
- When target classification is ON, the results are also output for each classification type No. (in the format !U[****].RSLT.CLS[*1].****, *1) For more details, see "List of Setting Parameters / Result Data" in the XG-7000 Series Communication Control Manual.
- For the lists of available measurement output values and setting parameters, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

Example

Example showing the results of an grayscale blob inspection performed under the following conditions:

- Detect. Order: Y X: Ascend
- Primary Target: 2



Bright target:❶, ❷, ❹
Dark target:❶, ❸
No. of target: 5
Primary target
Center of gravity: X: 600, Y: 460
Area: 20,000
Roundness: 0.85,

Main Menu

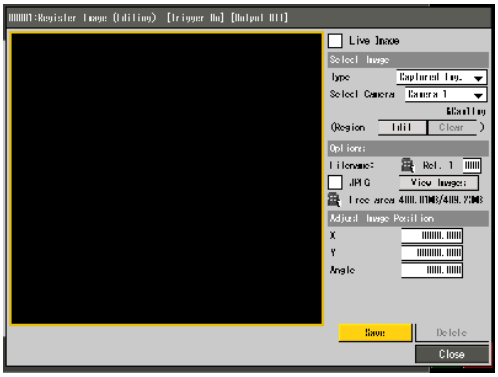
The main menu of the grayscale blob tool consists of the following options. Configure settings under each option as required for the inspection.



Register Image (Page 4-149)	Register an image to be used as a template for settings.
Select Image (Page 4-151)	Specify the image to be used for unit processing.
Inspect Region (Page 4-152)	Define the region to be used for unit processing.
Color (Page 4-153)	Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).
Image Enhance (Page 4-153)	Settings for pre-processing image filters.
Condition (Page 4-154)	Specific conditions for processing a grayscale blob inspection.
Parameters (Page 4-159)	Additional optional parameters.
Limits (Page 4-160)	Unit pass / fail tolerances.
Display Options (Page 4-161)	Unit processing display settings.
Save (Page 4-162)	Save unit settings.

Register Image

An image can be saved to the controller to be used as a template for measurements and settings. It is recommended to adjust and fix lighting and other external influences before registering an image.



Live Image

Check this box to display live images through a continuous feed.

► Note

- A live feed is only available while the unit is being edited.
- This setting cannot be changed when the screen update mode is set to [Continuous] in the trigger settings (Page 4-25).
- If the capture on trigger input is disabled in the trigger settings (Page 4-25), this check box is always unchecked and the setting cannot be changed.
- When Live image is selected for a moving object, take care when registering as there will be a time lag between the external trigger input and the actual image capture.
- In principle, Live-image is only used when the capture unit being edited is being executed (waiting for a trigger input). When the image capture buffer is set to custom and the capture unit which was most recently executed is being edited, the images collected in the buffer will still be displayed even if the capture unit is not presently capturing images.
- Continuous update cannot be used when HDR capture (Page 4-21) is enabled or when a line scan camera is being used.

Select Image

Type

Select an image to register.

- **Captured Img.**: Displays the latest image from the specified camera (image variable).
- **Registered Img.**: The registered image specified in [Options] is displayed.

Select Camera

Select the number of the camera used for registration. Choose from Camera1 - Camera4, and select only the camera number used for the capture unit being edited.

Specifying a region

To register only part of an image, select [Edit] then specify the region to register. To cancel the selected region, select [Clear].

Save Image

Filename

Specify the registered image number used for image registration in the form "(Camera No.)-(User-specified No.)".

Reference

The name of the saved file is "ref (Camera No.)_(Specified No.)" (for full screen image registration) or "ref (Camera No.)_(Specified No.)_XXX_YYY" (for partial image registration).

JPEG

Check this box to save the image in JPEG format. When this box is not checked, the image will be saved in BMP format as either a 24-bit color bitmap image (when a color camera is used) or an 8-bit grayscale bitmap image (when a monochrome camera is used).

► Note

Using image compression may result in some image deterioration, thus results from a compressed image may differ to those when using non compressed images.

View All

View all registered images in a list.

Adjust Image Position

Adjust the position of the image being captured.

X

-Adjust the movement in the X (horizontal) direction between -8191.000 and 8191.000 pixels.

Y

-Adjust the movement in the Y (vertical) direction between -16383.000 and 16383.000 pixels.

Angle

Adjust the position angle (rotation) around the center of the image between -999.999° and 999.999°.

► Note

Position adjustment may cause missing peripheries (black areas) due to image movement or jagged edges (jaggies) due to rotation in the registered image.

Save

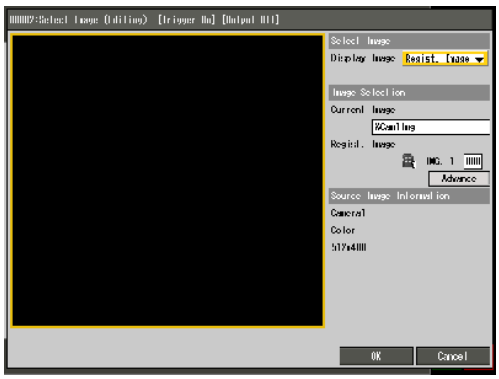
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Registered Img.] is selected for [Type], you can delete the registered image specified in [Options].

Select Image

Specify the image variable and associated registered image to be used for configuring the vision tool.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured Image**: Displays the latest image from the specified camera (image variable).
- **Registered Image**: The registered image specified under [Image Selection] is displayed.

Select image

Captured Img.

Set an image variable to be used as a current image for the unit.

Registered Img.

Specify the registered image No. for the registered image to be used.

- The registered images are managed as "Image (Camera No.) - (Registered image No.0 to 999)".
- The "Camera No" is fixed to the number of the camera associated to the image variable specified for the current image.

Advance

Set advance options for the switching of registered images as necessary.

- **Use numerical variable for registered image number**: To use a variable for the registered image No., check this box and assign a numerical or numerical array variable reference. By using a variable for the registered image No. and then issuing a variable reference value apply command (NU), the image is switched to the specified registered image in the variable and the reference image information is updated. For more details, see the XG-7000 Series Communication Control Manual.
- **Process variable when changing programs**: Use this option to switch to the registered image based on the initial value of the variable referenced when the program is changed or the controller is next turned on.

► Note

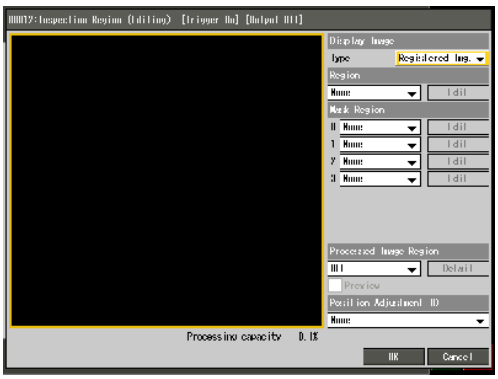
Note that the registered image No. does not switch in accordance with a change in the variable.

Source Image Information

The camera No., type (color / monochrome), and resolution of the camera associated to the image variable specified is displayed.

Inspection Region

Outline the region on the captured image to be used for inspection.



► Note

Changing the shape of the region will initialize or clear some of the settings in the [Condition] menu.

Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Region

Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Inspection Region Menu" (Page 3-20) for more details.

Mask region

A mask region is an area which can be defined in the inspection region and will be excluded from the inspection. Up to four mask regions can be set per inspection region. A mask region is typically used for hiding an area that does not require inspection.
Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Excluding Part of the Region" (Page 3-26) for more details.

Processed image region

Use processed image region to generate a region for inspection based on an image. (Page 4-295), select [ON] and then select [Detail] for configuration.

Reference

Refer to "Generating a Region from an Image" (Page 3-27) for more details on processed image region.

Image

Specify the image variable to be used for generating the region.

Area

Specify the area and border color for the region based on the image specified in the image variable. Select either [Black] (Level 0) or [White] (Level 255, default).

Preview

Use this checkbox to display the specified image. When the checkmark is removed, the display returns to its normal state.

Position Adjustment ID

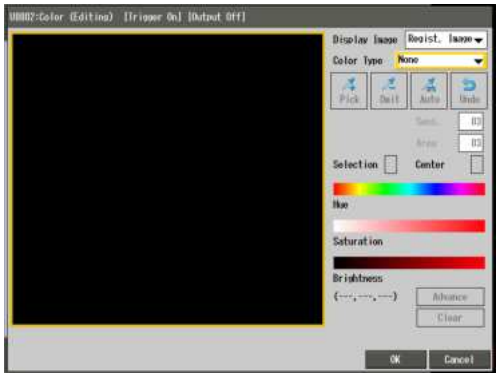
To use position adjustment for the region, select the position adjustment unit to be referenced.

Reference

The position adjustment is applied to all inspection, mask, and image regions.

Color

When working with a color camera, convert the captured color image into a binary (black and white) or a grayscale converted image by extracting the desired color.



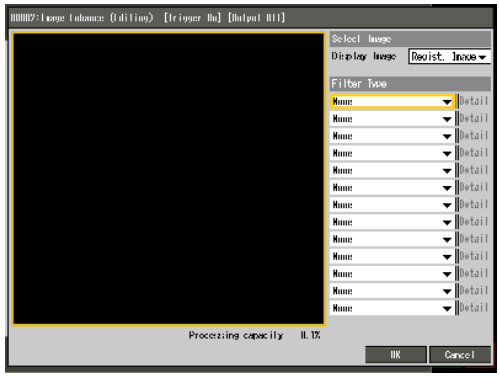
► Note

This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-295) is referenced as the current image.

Refer to "Working with Color Images (Color Extraction)" (Page 10-2) for concepts involving color extraction and its operation.

Image Enhance

Specify the filter processing to apply to the image. When a color camera is used, the filter is applied to the images converted using color extraction.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Filter type

Select the [Filter Type] field and then select the filter to apply. To perform area measurement using a method other than color to binary, you must select the [Binary] filter as the last filter. See "Image Enhancement Filters" (Page 10-11) for more details of each filter processing.

► Note

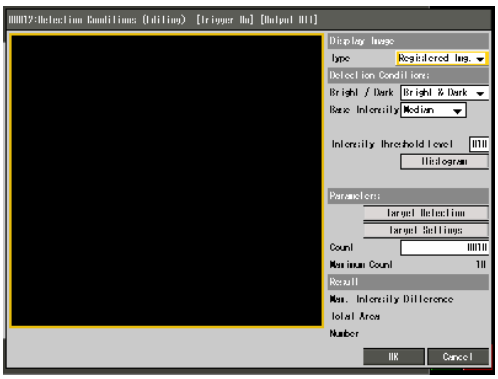
- For the area tool, [Binary] must be selected unless color to binary is used in the color extraction settings.
- If the binary filter is not selected or another filter is applied after the binary filter, the measurement result may not be correct.
- The binary, subtract and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 13 types of filters can be stacked according to application requirements. When multiple filters are set, they are processed one by one from the top.
- The order of the filters can be changed by selecting a filter in one of the [Filter Type] fields, holding down the No.1 (FUNCTION) button of the handheld controller, and then moving the 8-way key up or down.

Conditions

Specify the conditions for detecting targets.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Detection Conditions

Bright / Dark

Choose the method for detecting targets.

- **Bright**: Extract only features that are brighter than the base intensity.
- **Dark**: Extract only features that are darker than the base intensity.
- **Bright & Dark (default)**: Extract both light and dark features.
- **Individual**: Specify individual extraction lvels for bright and dark features.

Base intensity

Specify the method for determining the base intensity.

- **Average**: Use the average grayscale value across the region as the base intensity.
- **Median** (default): Median grayscale value across the region as the base intensity.
- **Mode**: Use the mode (most common) grayscale value across the region as the base intensity.
- **Specified**: Specify a grayscale value (0-255) for the base intensity.

► Note

The base intensity when calculated is derived from the segmented image.

Intensity

Displays the reference intensity value.
When [Specified] is selected for the reference intensity, enter the intensity value 0 to 255 (default 128).

Intensity Threshold Level

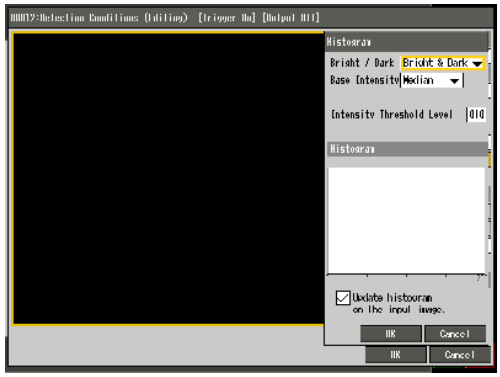
Set the lower intensity threshold level for detecting targets within the range of 0 to 254 (default: 10). A group of elements at an intensity level above this value will be detected as a target.

Histogram

Displays the intensity distribution within the region.
The base intensity is indicated as [BASE], the bright threshold value as [UP], and the dark threshold value as [LO].

► Note

As the displayed intensity distribution is based on the element size and shift setting, it may not exactly match the intensity distribution of the filtered image.

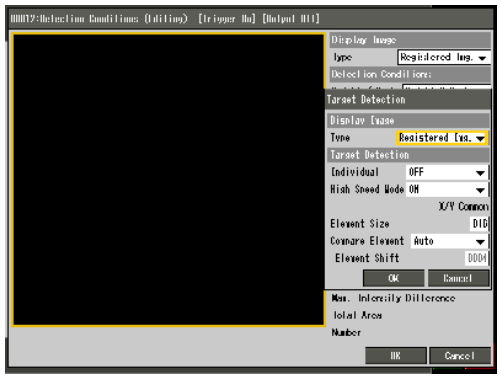


- **Bright / Dark**: Uses the same setting as the [Bright / Dark] setting on the [Detect Conditions] tab. If the settings under the [Histogram] menu are changed, the same changes will be applied to the [Bright / Dark] setting in the [Detect Conditions] tab.
- **Reference Intensity**: Uses the same setting as the [Reference Intensity] setting on the [Detect Conditions] tab. If the settings under the [Histogram] menu are changed, the same changes will be applied to the [Reference Intensity] setting on the [Detect Conditions] tab.
- **Base Intensity**: Uses the same setting as the [Base Intensity] setting on the [Detect Conditions] tab. If the settings under the [Histogram] menu are changed, the same changes will be applied to the [Base Intensity] setting on the [Detect Conditions] tab.

- **Intensity Threshold Level**: Uses the same setting as the [Intensity Threshold Level] setting on the [Detect Conditions] tab. If the settings under the [Histogram] menu are changed, the same changes will be applied to the [Intensity Threshold Level] setting on the [Detect Conditions] tab.
- **Update histogram on the input image**: Use this option to update the histogram display to match the captured image.

Target detection

Specify the detection direction and element size for finding targets.



Individual

Use [ON] to set element parameters individually for the XY directions.

- **OFF** (default): Do not set elements individually for the XY directions.
- **ON**: Set element parameters individually for the XY directions.

Using this option makes possible to set a different element size, shift, and other settings for X and Y.

High speed mode

Use High speed mode to decrease unit processing time or enable fine detection.

- **ON** (default): High speed processing.
- **OFF**: Fine detection.

When the high speed mode is set to [ON], the segment size and shift can be set in multiples of 4 only. (If a variable is referenced the value is rounded off to the nearest integer and then rounded up to the nearest multiple of 4.)
If the inspection region extends off the screen, a measurement error (Total defect area: 99999999) will result and the contrast view within the inspection region will be cancelled.

Element Size

Specify the element (pixel group) size (1 to 256 pixels) which moves inside the inspection region in the X (horizontal) and Y (vertical) directions respectively (default 16).

Reference

To specify different sizes in the direction of X/Y individually, set [Individual] to [ON].

Compare element

Select [Manual] and increase the shift in order to reduce processing time and perform a coarser search. Increasing the compare element will result in a decrease in detection accuracy.

Element Shift

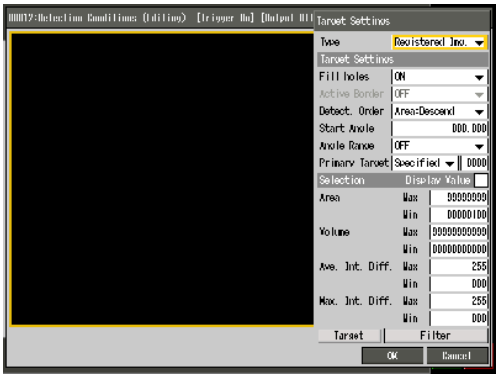
Specify the number of pixels within the range 1 to 2432 as the distance to shift the element for calculating the next average intensity value. When [Auto] is selected, this is automatically set to 1/4 of the element size. If high speed mode is [ON], this value must be a multiple of 4.

► Note

If the value of [Element Shift] is larger than [Element Size], some parts of the inspection region will not be reflected in the intensity average. To detect defects smaller than the element size, use [Auto] or specify an element shift smaller than the element size.

Target settings

Specify the conditions for processing targets.



Fill holes

Select whether to fill the holes inside a group to include them as part of a detected defect.

Fill holes: OFF

Fill holes: ON

- **OFF**: Do not fill the holes.
- **ON**: Fill the holes.

► Note

- The result of fill holes is not reflected on the processing screen.
- When fill holes used the area includes the holes, however the volume, average intensity level, and maximum intensity level are calculated only from the parts which exceeded the threshold value in the filled target.

Active Border

Specify whether to separate targets with mutual borders.

- **OFF**: Merge targets that have the same border.
- **ON**: Separate targets that have the same border.

► Note

The active border ON/OFF can only be specified when the inspection region is a rectangle, rotated rectangle, arc ([Direction] is [Cir.] or [Rad.]), or when no mask and image regions have been set. If any other type of inspection region is selected, the active border is always set to OFF.

Detection order

Select the identification order of the detected targets.

- **Volume: Ascend**: Sorts targets from smallest volume to largest.
- **Volume: Descend**: Sorts targets from largest volume to smallest.
- **Average Intensity Difference: Asc.**: Sort targets from lowest average intensity level to highest.
- **Average Intensity Difference: Des.**: Sort targets from highest average intensity level to lowest.
- **Max Intensity Difference:Asc.**: Sort targets from lowest maximum intensity level to highest.
- **Max Intensity Difference:Des.**: Sort targets from highest maximum intensity level to lowest.
- **Y>X: Ascend**: Sort groups in ascending Y order. When Y values are the same, reorders in ascending X order.
- **X>Y: Ascend**: Sort groups in ascending X order. When X values are the same, reorders in ascending Y order.
- **X:** Ascend: Sort groups in ascending X order.
- **X: Descend**: Sort groups in descending X order.
- **Y: Ascend**: Sort groups in ascending Y order.
- **Y: Descend**: Sort groups in descending Y order.
- **Area: Ascend**: Sorts blobs from smallest area to largest.
- **Area: Descend**: Sorts blobs from largest area to smallest.
- **Round.: Asc.**: Sort blobs from the lowest roundness value (0.000 to 1.000, where 1.000 is a perfect circle) to the highest.
- **Round.: Desc.**: Sort blobs from the highest roundness value (0.000 to 1.000, where 1.000 is a perfect circle) to the lowest.
- **Clockwise**: Sort groups based on angle, clockwise from the start angle.
- **Counter CW**: Sort groups based on angle, counterclockwise from the start angle.

Starting angle

Specify a starting angle for order identification when [Detect. Order] is [Clockwise] or [Counter CW]

► Note

This setting is ignored when [Detect. Order] is not [Clockwise] or [Counter CW].

Angle range

Specify the angle range of the major axis.

- **180**°: Process angles in the range -89.999° to 90.000°.
- **360**°: Process angles in the range -179.999° to 180.000°.
- **OFF**: Angle is not processed (major axis angle value is defaulted to 0°).

► Note

Processing may become unstable with symmetrical shapes detected as blobs when [360°] has been set for the angle range.

Primary target

Select the target to be used for OK / NG judgment.

- **All**: Use the maximum and minimum values measured from all targets for the OK/NG judgment.
- **Specified**: Select [Specified] for [Primary Target] and then specify the No. of the target used in judgment (0 to 9998). Only the target that is specified here becomes the target of judgment.

Selection

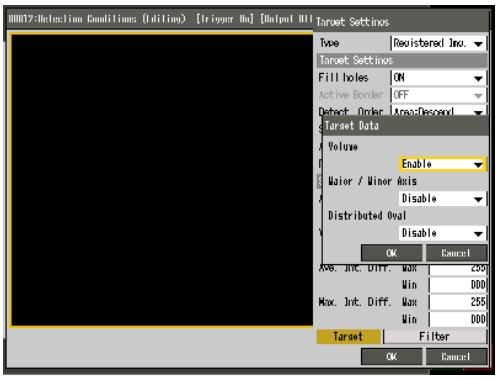
Choose to enable / disable each filter and set the maximum and minimum range.

- **Display Value**: Use this function to display the values of each parameter for the displayed image in blue.
- **Area**: Targets that are larger than the specified maximum value or smaller than the specified minimum value are not detected as targets (Area filter).
- **Volume**: Targets that have a larger volume than the specified maximum volume or smaller than the specified minimum volume are not detected as targets (Volume filter).
- **Average Intensity Difference**: Targets that have a larger average intensity differential than the specified average intensity differential level or smaller than the specified differential level are not detected as targets (Average intensity difference filter).
- **Maximum Intensity Difference**: Targets that have a larger maximum intensity differential than the specified maximum intensity differential level or smaller than the specified maximum differential level are not detected as targets (Maximum intensity difference filter).

Reference

When the primary target is changed, it is possible to also change the value shown in the current value display to the value of any target.

Target data

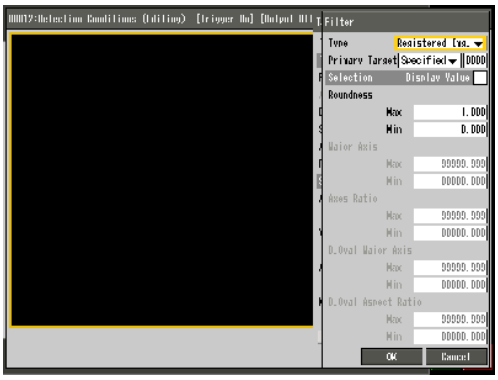


- **Volume**:
  - **Enable** (default): Enables the measurement data and OK/NG judgment for [Volume], [Average Intensity Difference], [Maximum Intensity Difference], and [Bright & Dark] definition.
  - **Disable**: Disables the measurement data and OK/NG judgment for [Volume], [Average Intensity Difference], [Maximum Intensity Difference], and [Bright & Dark] definition. As a result any data is defaulted to 0.
- **Major / Minor Axis**:
  - **Enable**: Enables the [Major Axis], [Minor Axis] and [Axes Ratio] measurement, OK/NG judgment and filtering for targets.
  - **Disable** (Default): Disables the [Major Axis], [Minor Axis] and [Axes Ratio] measurement, OK/NG judgment and filtering for targets. As a result any data is defaulted to 0.
- **Distributed Oval**:
  - **Enable**: Enables the [Distributed Oval Major Axis], [Distributed Oval Minor Axis] and [Aspect Ratio] measurement, OK/NG judgment and filtering for targets.
  - **Disable** (Default): Disables the [Distributed Oval Major Axis], [Distributed Oval Minor Axis] and [Aspect Ratio] measurement, OK/NG judgment and filtering for targets. As a result any data is defaulted as 0.

► Note

- Enabling [Major / Minor Axis], [Distributed Oval], and [Volume] increases the consumption of program memory, slowing down the processing time.
- If Volume is disabled when Volume: Ascend, Volume: Descend, Average Intensity Difference: Ascend, Average Intensity Difference: Descend, Maximum Intensity Difference: Ascend, or Maximum Intensity Difference: Descend is selected as the detection order, the detection order is initialized to Area: Descend.

Filter



- **Display Image**: Switch the image displayed on the screen.
  - **Captured image**: Displays the latest image from the specified camera (image variable).
  - **Registered Image**: The registered image specified under [Image Selection] is displayed.
- **Primary Target**: Specify the group data (0 to 98) to be used for judgment, set to [0] for normal operation.
- **Display value**: Use this function to display the values of each parameter for the displayed image in blue.
- **Selection**: Choose to enable / disable each filter and set the maximum and minimum range.
  - **Roundness**: Targets that have their roundness values higher than the specified maximum value (0.000 to 1.000, where 1.000 is a perfect circle) or targets that have roundness values lower than the specified minimum value are not detected as defect targets.
  - **Major Axis**: Targets that have their major axis values higher than the specified maximum value or targets that have major axis values lower than the specified minimum value are not detected as defect targets.
  - **Axes Ratio**: Targets that have their axes ratios (major axis / minor axis) higher than the specified maximum value (thinner targets) or targets that have axes ratios lower than the specified minimum value (proportionally correct targets) are not detected as defect targets.
  - **Distributed Oval Major Axis**: Targets that have their distributed oval major axis value of the group higher than the specified maximum value or targets that have their distributed oval major axis value of the group lower than the specified minimum value are not detected as defect targets.
  - **Distributed Oval Aspect Ratio**: Targets that have their aspect ratio (distributed oval major axis / minor axis) of the group higher than the specified maximum value (thinner targets) or targets that have their aspect ratio (distributed oval major axis / minor axis) of the group lower than the specified minimum value (proportionally correct targets) are not detected as defect targets.

► Note

- [Major Axis] and [Axes Ratio] cannot be set if [Major / Minor Axis] has been disabled.
- [Distributed Oval Major Axis] and [Aspect Ratio] cannot be set if [Distributed Oval] has been disabled.
- If [Volume] is disabled, [Volume], [Average Intensity Difference], and [Maximum Intensity Difference] cannot be set.

Reference

When the primary target is changed, it is possible to also change the value shown in the current value display to the value of any target.

Parameters

Count

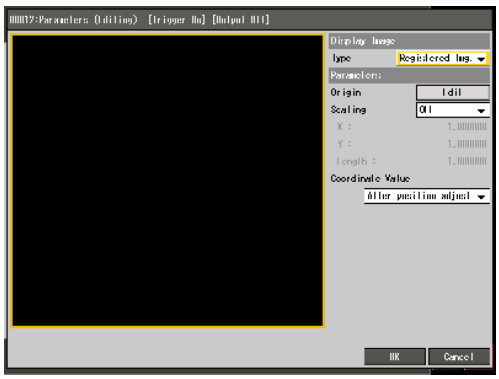
Specify the maximum number of targ (1 to 9999) to be detected. The number of targets cannot exceed the [Maximum Count] value.

► Note

- The maximum number of targets available for detection can change based on other settings.
- Based on specific settings, the number of targets is fixed and cannot be changed.
- A [Count] value that is higher than the [Maximum Count] value (Maximum: 9999) can be set, depending on the account setting. Note this also increases the [Maximum Count] value, resulting in additional consumption of program memory.

Parameters

Specify additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Parameters

Origin

By default, the origin is set to the top left corner of the camera but its location can be moved as required. To specify the origin, select [Edit] and then specify the coordinates.

Reference

The origin can be set outside the process region. The available range for the origin is -9600 to 9600 (X), -7200 to 7200 (Y).

Scaling

The controller processes image data in pixels, The result data and setting parameters used for display, judgement and calculations can be converted and scaled to real life values and dimensions by using the pre-set scaling factor option.

- **OFF**: Do not use scaling.
- **ON**: Use scaling.

Reference

- The scaling factor can be changed from the [Option] menu of the Flowchart (Page 4-356).
- For a summary list of the result data for which scaling can be used, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

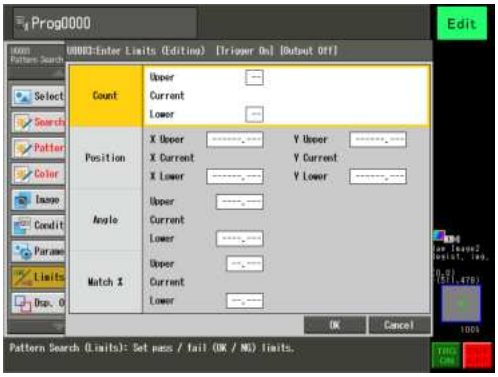
Coordinate value

Select the coordinate system to be used after position adjustment. If position adjustment is not used, this setting will have no effect on the measurement.

- **After position adjust**: The inspection uses the adjusted coordinate axes determined after position adjustment.
- **Before position adjust**: The distance from the position specified for the [Origin] of the inspection is used.

Limits

Set pass / fail tolerances (upper and lower limits) for the inspection.
If the result is outside of the specified tolerance range, it is judged as [NG] (binary 1). If the result is within the tolerance range, it is judged as [OK] (binary 0).



Use [Direct Input] to enter a value and set the tolerance.

Reference

- [-----] indicates an empty state where no tolerance is set. In this state, no judgment will be performed on the measurement.
- To reset the tolerance setting to an empty state, select [Clear].

► Note

- [Major Axis] and [Axes Ratio] cannot be set if [Major / Minor Axis] has been disabled.
- [Distributed Oval Major Axis] and [Aspect Ratio] cannot be set if [Distributed Oval] has been disabled.
- If [Volume] is disabled, [Volume], [Average Intensity Difference], and [Maximum Intensity Difference] cannot be set.

Total area

Specify the tolerance for the total area for the detected targets.
The unit of measurement is the [Number of Pixels] of the measurement area (0 to 99999999).

Count

Specify the tolerance for the number of targets detected.
The unit of measurement is the "number of blobs" detected.

Position

Specify the tolerance for the position of the target.
The unit of measurement is the "number of pixels" indicating the center of gravity coordinates.

Major axis angle

Specify the tolerance for the major axis angle of the target.
The unit of measurement is the "angle" of the major axis.

Area

Specify the tolerance for the area of the target.
The unit of measurement is the [Number of Pixels] of the measurement area (0 to 99999999).

Average intensity difference

Specify the tolerance for the average intensity difference of the target compared to the base intensity.
The unit of measurement is the [Grayscale Level] indicating the average intensity (0 to 255).

Maximum intensity difference

Specify the tolerance for the maximum intensity difference of the target compared to the base intensity.
The unit of measurement is the [Grayscale Level] indicating the maximum intensity (0 to 255).

Volume

Specify the tolerance for the volume of the target.
The unit of measurement is the "integral sum of the intensity difference" indicating the measured volume (0 to 99999999999).

Feret

Specify the tolerance for the feret diameter of the target.
The unit of measurement is the "number of pixels" indicating the feret diameter.

Perimeter

Specify the tolerance for the perimeter of the target.
The unit of measurement is the "number of pixels" indicating the perimeter.

Roundness

Specify the tolerance for the roundness of the target.
The unit of measurement is the "roundness correlation" indicating the roundness (0.000 to 1.000, where 1.000 is a perfect circle).

Major axis

Specify the tolerance for the major axis of the target.
The unit of measurement is the "number of pixels" indicating the major axis length.

Minor axis

Specify the tolerance for the minor axis of the target.
The unit of measurement is the "number of pixels" indicating the minor axis length.

Axes Ratio

Specify the tolerance for the axes ratio (Major / Minor axis) of the target.
The unit of measurement is the "ratio" indicating the axes ratio (0.000 to 99999.999).

Distributed Oval Major axis

Specify the tolerance for the distributed oval major axis of the target.
The unit of measurement is the "number of pixels" indicating the major axis length.

Distributed Oval Minor axis

Specify the tolerance for the distributed oval minor axis of the target.
The unit of measurement is the "number of pixels" indicating the minor axis length.

Aspect ratio

Specify the tolerance for the distributed oval aspect ratio (Major / Minor axis) of the target.
The unit of measurement is the "ratio" indicating the aspect ratio (0.000 to 99999.999).

Display Options

The display color of the units visual indicators can be changed based on the judgment result for that unit. The visual indicator can also be made transparent by selecting [Setting] - [Select Color] - [None].



Inspection region

Specify the line width and display color of the inspection region.

Mask region

Specify the line width and display color of the mask region.

Detected Point

Primary target
Specify the width and display color for the center of gravity position of a target.

Other target
Specify the width and display color of the center of gravity positions for the targets other than the one specified as the primary target (Page 4-140).

Display Target

Specify the target(s) for which the center of gravity position is displayed.

- **All**: Display the detection position for all targets.
- **Primary Target**: Display the detection position only for the target specified as the primary target.

Processing Priority

Specify the processing priority when displaying large processed images during Run mode.
When a line scan camera is used with the XG-7502A, it is not possible to display the processed image if the image size exceeds 25 MB (26214400 pixels). In such a case it is possible to display the filtered image and contrast image by using a display image variable.

Filtered image

Select whether or not to use a display image variable for the filtered image display.

- **Unit Processing**: Processes the filtered image without using the display image variable.
- **Image Display**: Processes the filtered image using a display image variable.

Reference

- When processing images 25 MB or less, or when using the XG-7702A, it is not necessary to select [Image Display].
- When processing an image larger than 25 MB, if the area displayed is 8 MB (8388608 pixels) or less, the filtered image will be automatically displayed when [Unit Priority] is selected. (However the following processes are excluded.)
  - Image enhancement: Shading correction, blob filter
  - Conversion (image operation): Rotate/translate, zoom, trapezoid correction, blob filter
  - Defect, Grayscale Blob: Contrast display

► Note

When [Image Display] is selected for [Filtered Image], the following restrictions on operation occur.

- Processing time increases.
- The background outside the inspection region becomes a black image.
- Displaying of multiple units is not possible.
- For display of registered images outside of unit edit, the filtered image cannot be displayed and the display is the same as when [Unit Processing] is set.
- When an archived image is displayed, it ix not possible to display the processed image unless the display image variable and results are also stored in the archive.

Image variable

Specify a display image variable for displaying the filtered image.

Reset

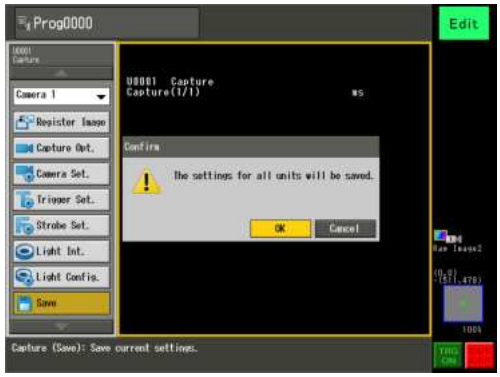
Returns the display options to their defaults.

Save

Save the current unit changes the program file.

► Note

- If the device is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the system power while you are saving the settings. Doing so may cause errors in the internal data



Save

The settings for the unit are saved in the current program file in SD Card 1 or SD Card 2.

► Note

Items specified not to be saved in XG VisionEditor are excluded from the saving operation.
For example, variable values changed in the current program or the default display, and display parts, can be excluded when saving.

Profile Position

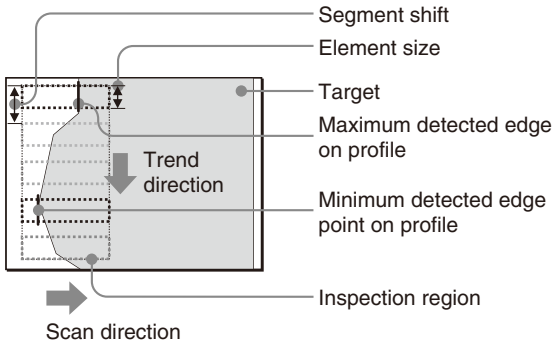
Profile PositionTool

The profile position tool takes a segment of a specified size and indexes it through the inspection region along the trend direction. With each shift of the segment the tool scans in the opposing direction detecting contrast changes to identify an edge point. By identifying all the edge points along the profile the maximum, minimum and average edge position of the target profile can be measured.

Image processing

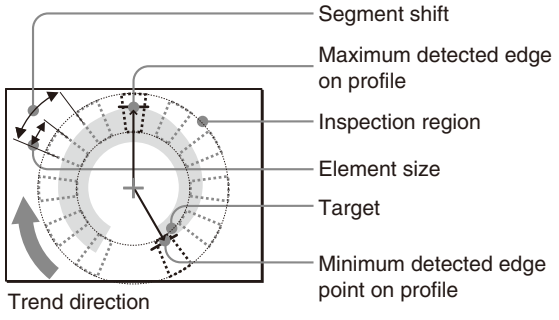
When the inspection region is a rectangle or a rotated rectangle

In the instance the scan direction is [→] and trend direction is [↓]



When the inspection region is a ring or an arc

When the trend direction is [Clockwise]



Processing results

The standard results and data returned by the profile position tool are as follows:

Reference

Processing results may vary depending on the shape of the inspection region. The result for an item which is not processed is always 0.

When the inspection region is a rectangle or a rotated rectangle

Number of segments	Outputs the number of set segments.
Number of detected segments	Outputs the number of segments where contrast changes were detected and edges identified. Tolerance inspection target
Number of edges	Outputs the number edges in all segments. Label specification target
Number (max)	Outputs the number of edges in the segment with the maximum edge position.
Number (min)	Outputs the number of edges in the segment with the minimum edge position.
Position X [ ]	Outputs the X position coordinate of all the edge positions in pixels. Tolerance inspection target (only when the inspection region is a rectangle and the trend direction is ↓) Label specification target
Position X (Max)	Outputs the X position coordinate of the maximum edge position in pixels. Tolerance inspection target (only when the inspection region is a rectangle and the trend direction is ↓)
Position X (Min)	Outputs the X position coordinate of the minimum edge position in pixels. Tolerance inspection target (only when the inspection region is a rectangle and the trend direction is ↓)
Position X (Ave)	Outputs the average X position coordinate from all the edge positions in pixels.
Position Y [ ]	Outputs the Y position coordinate of all the edge positions in pixels. Tolerance inspection target (only when the inspection region is a rectangle and the trend direction is →) Label specification target
Position Y (Max)	Outputs the Y position coordinate of the maximum edge position in pixels. Tolerance inspection target (only when the inspection region is a rectangle and the trend direction is →)
Position Y (Min)	Outputs the Y position coordinate of the minimum edge position in pixels. Tolerance inspection target (only when the inspection region is a rectangle and the trend direction is →)
Position Y (Ave)	Outputs the average Y position coordinate from all the edge positions in pixels.

Angle [ ]	Outputs the angle of rotation of the inspection region when the region is a rotated rectangle (always 0 when the inspection region is a rectangle). (Label specification target)
Angle (Max)	Outputs the maximum angle of rotation of the inspection region when the region is a rotated rectangle (always 0 when the inspection region is a rectangle).
Angle (Min)	Outputs the minimum angle of rotation of the inspection region when the region is a rotated rectangle (always 0 when the inspection region is a rectangle).
Position XY [ ]	Outputs the position coordinates of all the edge positions in pixels. (Label specification target)
Position XY (Max)	Outputs the position coordinates of the maximum edge position in pixels.
Position XY (Min)	Outputs the position coordinates of the minimum edge position in pixels.
Position XY (Ave)	Outputs the average position coordinates from all the edge positions in pixels.
Distance [ ]	Outputs the distances from the start of each segment of the inspection region to the position coordinate of the edge position in the segment in pixels. (Tolerance inspection target) (only when the inspection region is a rotated rectangle) (Label specification target)
Distance (Max)	Outputs the distance from the start of the segment with the maximum edge position to the position coordinate of the maximum edge position in pixels. (Tolerance inspection target) (only when the inspection region is a rotated rectangle)
Distance (Min)	Outputs the distance from the start of the segment with the minimum edge position to the position coordinate of the minimum edge position in pixels. (Tolerance inspection target) (only when the inspection region is a rotated rectangle)
Distance (Ave)	Outputs the average distance from the start of the segments to the coordinate of the edge positions in pixels.
Intensity [ ]	Outputs the intensity differential of the edge at all the edge positions. (Label specification target)
Intensity (Max)	Outputs the intensity differential of the edge at the maximum edge position.
Intensity (Min)	Outputs the intensity differential of the edge at the minimum edge position.
Circle radius	Outputs the radius of the best fit circle in pixels. (when [Best Fit Circle/Line] is [Circle])
Circle center X	Outputs the X position coordinate at the center of the best fit circle in pixels. (when [Best Fit Circle/Line] is [Circle])
Circle center Y	Outputs the Y position coordinate at the center of the best fit circle in pixels. (when [Best Fit Circle/Line] is [Circle])
Circle center XY	Outputs the position coordinates at the center of the best fit circle in pixels. (when [Circle Best Fit Circle/Line] is [Circle])
Line X1	Outputs the X position coordinate of the intersection between the best fit line and the top side of the inspection region (or left side when the trend direction is →). (when [Best Fit Circle/Line] is [Line])
Line Y1	Outputs the Y position coordinate of the intersection between the best fit line and the top side of the inspection region (or left side when the trend direction is →). (when [Best Fit Circle/Line] is [Line])
Line XY1	Outputs the position coordinates of the intersection between the best fit line and the top side of the inspection region (or left side when the trend direction is →). (when [Best Fit Circle/Line] is [Line])
Line X2	Outputs the X position coordinate of the intersection between the best fit line and the bottom side of the inspection region (or right side when the trend direction is →). (when [Best Fit Circle/Line] is [Line])
Line Y2	Outputs the Y position coordinate of the intersection between the best fit line and the bottom side of the inspection region (or right side when the trend direction is →). (when [Best Fit Circle/Line] is [Line])
Line XY2	Outputs the position coordinates of the intersection between the best fit line and the bottom side of the inspection region (or right side when the trend direction is →). (when [Best Fit Circle/Line] is [Line])
Line center X	Outputs the X position coordinate of the midpoint between the Line XY1 and Line XY2 positions. (when [Best Fit Circle/Line] is [Line])
Line center Y	Outputs the Y position coordinate of the midpoint between the Line XY1 and Line XY2 positions. (when [Best Fit Circle/Line] is [Line])
Line center XY	Outputs the position coordinates of the midpoint between the Line XY1 and Line XY2 positions. (when [Best Fit Circle/Line] is [Line])
Line angle	Outputs the angle of Line XY2 in reference to Line XY1. (0° to 359.999°) (when [Best Fit Circle/Line] is [Line])
Maximum segment No.	Outputs the segment No. of the segment with the maximum edge position.
Minimum segment No.	Outputs the segment No. of the segment with the minimum edge position.
Unit judgment value	Outputs the binary result of the unit based on the measured value and the specified tolerance range (upper / lower limits). The unit is judged as [NG] (binary 1) when outside the tolerance range and [OK] (binary 0) when inside.

When the measurement area is a ring or an arc

Number of segments	Outputs the number of set segments.
Number of detected segments	Outputs the number of segments where contrast changes were detected and edges identified. Tolerance inspection target
Number	Outputs the number edges in all segments. Label specification target
Number (max)	Outputs the number of edges in the segment with the maximum radius.
Number (min)	Outputs the number of edges in the segment with the minimum radius.
Position X [ ]	Outputs the X position coordinate of all the edge positions in pixels. Label specification target
Position X (Max)	Outputs the X position coordinate of the maximum radius.
Position X (Min)	Outputs the X position coordinate of the minimum radius.
Position X (Ave)	Outputs the average X position coordinate from all the edge positions in pixels.
Position Y[ ]	Outputs the Y position coordinate of all the edge positions in pixels. Label specification target
Position Y (Max)	Outputs the Y position coordinate of the maximum radius.
Position Y (Min)	Outputs the Y position coordinate of the minimum radius.
Position Y (Ave)	Outputs the average Y position coordinate from all the edge positions in pixels.
Angle [ ]	Outputs the angle of a measured segment. Label specification target
Angle (Max)	Outputs the angle of the segment with the maximum radius.
Angle (Min)	Outputs the angle of the segment with the minimum radius.
Position XY [ ]	Outputs the position coordinates of all the edge positions in pixels. Label specification target
Position XY (Max)	Outputs the position coordinates of the maximum radius.
Position XY (Min)	Outputs the position coordinates of the minimum radius.
Position XY (Ave)	Outputs the average position coordinates from all the edge positions in pixels.
Distance [ ]	Outputs the distances from the start of each segment of the inspection region to the position coordinate of the edge position in the segment in pixels. Label specification target
Distance (Max)	Outputs the distance from the start of the segment with the maximum radius to the position coordinate of the maximum radius in pixels.
Distance (Min)	Outputs the distance from the start of the segment with the minimum radius to the position coordinate of the minimum radius in pixels.
Distance (Ave)	Outputs the average distance from the start of the segments to the coordinate of the edge positions in pixels.
Radius [ ]	Outputs the radius of all edge positions in pixels. Tolerance inspection target Label specification target
Radius (Max)	Outputs the radius of the edge position with the maximum radius. Tolerance inspection target
Radius (Min)	Outputs the radius of the edge position with the minimum radius. Tolerance inspection target
Radius (Ave)	Outputs the average radius of all edge positions in pixels.
Intensity [ ]	Outputs the intensity differential of the edge at all the edge positions. Label specification target
Intensity (Max)	Outputs the intensity differential of the edge at the maximum radius.
Intensity (Min)	Outputs the intensity differential of the edge at the minimum radius.
Circle radius	Outputs the radius of the best fit circle in pixels. (when [Best Fit Circle/Line] is [Circle])
Circle center X	Outputs the X position coordinate at the center of the best fit circle in pixels. (when [Best Fit Circle/Line] is [Circle])
Circle center Y	Outputs the Y position coordinate at the center of the best fit circle in pixels. (when [Best Fit Circle/Line] is [Circle])
Circle center XY	Outputs the position coordinates at the center of the best fit circle in pixels. (when [Best Fit Circle/Line] is [Circle])
Maximum segment No.	Outputs the segment No. of the segment with the maximum edge position.
Minimum segment No.	Outputs the segment No. of the segment with the minimum edge position.
Unit judgment value	Outputs the binary result of the unit based on the measured value and the specified tolerance range (upper / lower limits). The unit is judged as [NG] (binary 1) when outside the tolerance range and [OK] (binary 0) when inside.

Reference

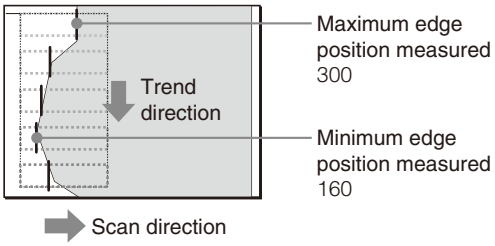
For the lists of available measurement output values and setting parameters, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

Example

When the inspection region is a rectangle or a rotated rectangle

Example showing the results of a profile position inspection performed under the following conditions:

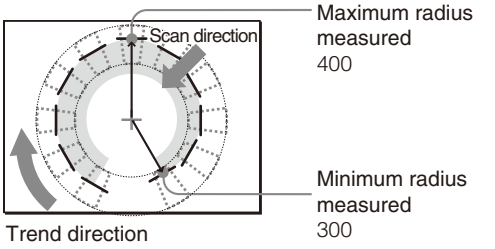
- Trend direction: ↓
- Scan Direction: →
- Edge Direction: Both



When the inspection region is a ring or an arc

Example showing the results of a profile position inspection performed under the following conditions:

- Trend direction: Clockwise
- Scan Direction: Out → Center
- Edge Direction: Both



Main Menu

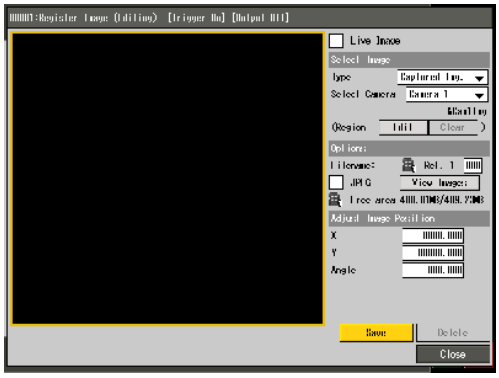
The main menu of the profile position tool consists of the following options. Configure settings under each option as required for the inspection.



Register Image (Page 4-167)	Register an image to be used as a template for settings.
Select Image (Page 4-168)	Specify the image to be used for unit processing.
Inspect Region (Page 4-169)	Define the region to be used for unit processing.
Color (Page 4-170)	Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).
Image Enhance (Page 4-171)	Settings for pre-processing image filters.
Edge Detection (Page 4-171)	Specific conditions for processing a profile position inspection.
Parameters (Page 4-174)	Additional optional parameters.
Limits (Page 4-175)	Unit pass / fail tolerances.
Display Options (Page 4-176)	Unit processing display settings.
Save (Page 4-178)	Save unit settings.

Register Image

An image can be saved to the controller to be used as a template for measurements and settings. It is recommended to adjust and fix lighting and other external influences before registering an image.



Live Image

Check this box to display live images through a continuous feed.

► Note

- A live feed is only available while the unit is being edited.
- This setting cannot be changed when the screen update mode is set to [Continuous] in the trigger settings (Page 4-25).
- If the capture on trigger input is disabled in the trigger settings (Page 4-25), this check box is always unchecked and the setting cannot be changed.
- When Live image is selected for a moving object, take care when registering as there will be a time lag between the external trigger input and the actual image capture.
- In principle, Live-image is only used when the capture unit being edited is being executed (waiting for a trigger input). When the image capture buffer is set to custom and the capture unit which was most recently executed is being edited, the images collected in the buffer will still be displayed even if the capture unit is not presently capturing images.
- Continuous update cannot be used when HDR capture (Page 4-21) is enabled or when a line scan camera is being used.
- When the HDR capture (Page 4-21) is enabled, the Multi-image cannot be used.

Select Image

Type

Select an image to register.

- **Captured Img.**: Displays the latest image from the specified camera (image variable).
- **Registered Img.**: The registered image specified in [Options] is displayed.

Select Camera

Select the number of the camera used for registration. Choose from Camera1 - Camera4, and select only the camera number used for the capture unit being edited.

Specifying a region

To register only part of an image, select [Edit] then specify the region to register. To cancel the selected region, select [Clear].

Save Image

Filename

Specify the registered image number used for image registration in the form "(Camera No.)-(User-specified No.)".

Reference

The name of the saved file is "ref (Camera No.)_(Specified No.)" (for full screen image registration) or "ref (Camera No.)_(Specified No.)_XXX_YYY" (for partial image registration).

JPEG

Check this box to save the image in JPEG format. When this box is not checked, the image will be saved in BMP format as either a 24-bit color bitmap image (when a color camera is used) or an 8-bit grayscale bitmap image (when a monochrome camera is used).

► Note

Using image compression may result in some image deterioration, thus results from a compressed image may differ to those when using non compressed images.

View All

View all registered images in a list.

Adjust Image Position

Adjust the position of the image being captured.

X

-Adjust the movement in the X (horizontal) direction between -8191.000 and 8191.000 pixels.

Y

-Adjust the movement in the Y (vertical) direction between -16383.000 and 16383.000 pixels.

Angle

Adjust the position angle (rotation) around the center of the image between -999.999° and 999.999°.

► Note

Position adjustment may cause missing peripheries (black areas) due to image movement or jagged edges (jaggies) due to rotation in the registered image.

Save

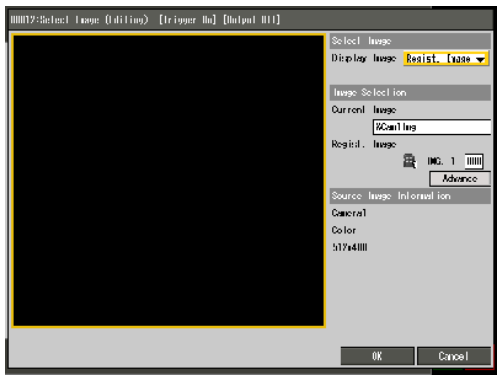
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Registered Img.] is selected for [Type], you can delete the registered image specified in [Options].

Select Image

Specify the image variable and associated registered image to be used for configuring the vision tool.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured Image**: Displays the latest image from the specified camera (image variable).
- **Registered Image**: The registered image specified under [Image Selection] is displayed.

Select image

Captured Img.

Set an image variable to be used as a current image for the unit.

Registered Img.

Specify the registered image No. for the registered image to be used.

- The registered images are managed as "Image (Camera No.) - (Registered image No.0 to 999)".
- The "Camera No" is fixed to the number of the camera associated to the image variable specified for the current image.

Advance

Set advance options for the switching of registered images as necessary.

- **Use numerical variable for registered image number**: To use a variable for the registered image No., check this box and assign a numerical or numerical array variable reference. By using a variable for the registered image No. and then issuing a variable reference value apply command (NU), the image is switched to the specified registered image in the variable and the reference image information is updated. For more details, see the XG-7000 Series Communication Control Manual.
- **Process variable when changing programs**: Use this option to switch to the registered image based on the initial value of the variable referenced when the program is changed or the controller is next turned on.

► Note

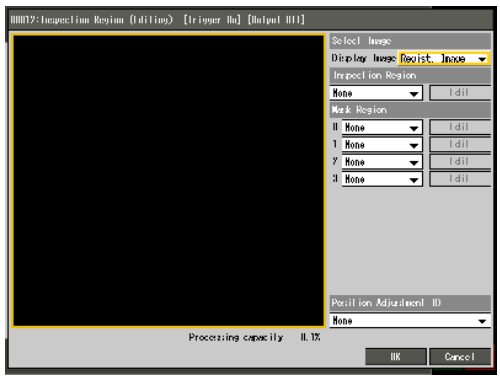
Note that the registered image No. does not switch in accordance with a change in the variable.

Source Image Information

The camera No., type (color / monochrome), and resolution of the camera associated to the image variable specified is displayed.

Inspection Region

Outline the region on the captured image to be used for inspection.



► Note

Changing the shape of the region will initialize or clear some of the settings in the [Edge Detection] and [Limits] menus.

Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Region

Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Inspection Region Menu" (Page 3-20) for more details.

► Note

- The inspection regions available for the trend edge measurement window are rectangle, rotated rectangle, ring, and arc.
- The available functions and measurement items vary depending on the shape of the inspection region.

Mask region

A mask region is an area which can be defined in the inspection region and will be excluded from the inspection. Up to four mask regions can be set per inspection region. A mask region is typically used for hiding an area that does not require inspection.
Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Excluding Part of the Region" (Page 3-26) for more details.

Position Adjustment ID

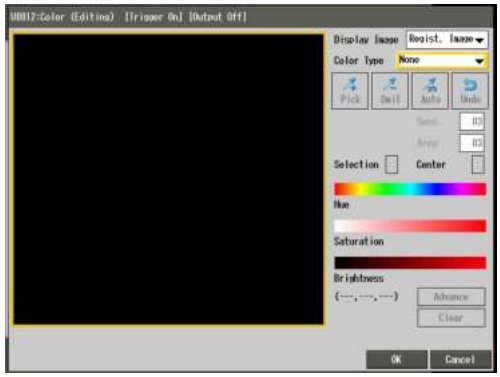
To apply position adjustment to the region, select the position adjustment unit to be referenced.

Reference

The position adjustment is applied to all inspection, mask, and image regions.

Color

When working with a color camera, convert the captured color image into a binary (black and white) or a grayscale converted image by extracting the desired color.



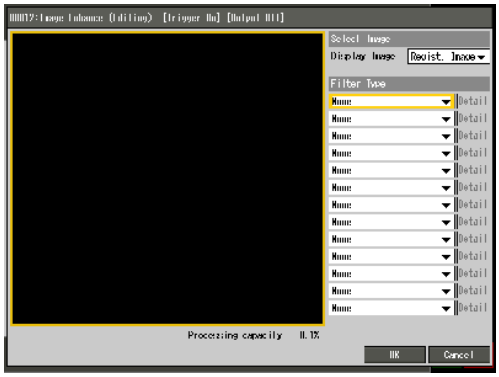
► Note

This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-295) is referenced as the current image.

Refer to "Working with Color Images (Color Extraction)" (Page 10-2) for concepts involving color extraction and its operation.

Image Enhance

Specify the filter processing to apply to the image.
When a color camera is used, the filter is applied to the images converted using color extraction.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Filter type

Select the [Filter Type] field and then select the filter to apply. To perform area measurement using a method other than color to binary, you must select the [Binary] filter as the last filter. See "Image Enhancement Filters" (Page 10-11) for more details of each filter processing.

► Note

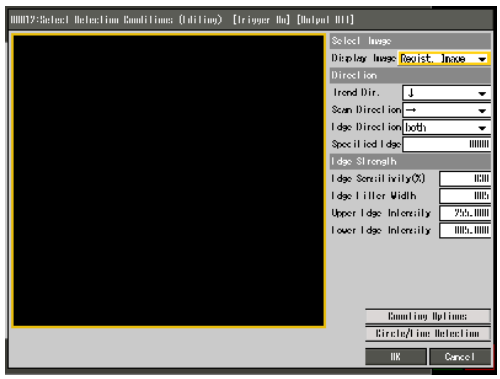
- For the area tool, [Binary] must be selected unless color to binary is used in the color extraction settings.
- If the binary filter is not selected or another filter is applied after the binary filter, the measurement result may not be correct.
- The binary, subtract and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 13 types of filters can be stacked according to application requirements. When multiple filters are set, they are processed one by one from the top.
- The order of the filters can be changed by selecting a filter in one of the [Filter Type] fields, holding down the No.1 (FUNCTION) button of the handheld controller, and then moving the 8-way key up or down.

Edge Detection

Specify the conditions for detecting multiple edge positions to make up a trend.



Reference

See "What is an Edge?" (Page 10-25) for the technical description on edge detection.

Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Direction

Trend direction

Select the edge segment movement direction.

- **When the inspection region is a rectangle**: → or ↓
- **If the inspection region is a rotated rectangle**: ↓ (top to bottom) only.
- **When the inspection region is a ring or an arc**: only clockwise is available.

Reference

If variable referencing is used for the scan direction, the reference setting may be canceled if there is a change in the trend direction.

Scan direction

Select the scan direction to detect an edge.

- **When the inspection region is a rectangle**: ↓ or ↑ (when the trend direction is →), → or ← (when the trend direction is ↓)
- **When the inspection region is a rotated rectangle**: Forward (from left to right), Reverse (from right to left)
- **When the inspection region is a ring or an arc**: Center → Out, Out → Center

Edge direction

Select the change in contrast for detecting an edge.

- **Both** (default): Detect edges in a transition that can change either from a bright area to a dark area or from a dark area to a bright area.
- **Light to Dark**: Detect edges in a transition that changes from a bright area to a dark area.
- **Dark to Light**: Detect edges in a transition that changes from a dark area to a bright area.

Specified edge

Specify the edge No. (-3600 to 3599) used for the measurement within the segment.
If a value of 0 or higher is specified, the edge No. is counted in the order of detection in the scan direction. If a negative value is specified, the edge No. is counted in the order opposite to that of the scan direction.
If the specified edge number is not found, the result of that segment is 0.

Edge Strength

Edge Sensitivity (%)

Set the percentage threshold (0% to 100%) for detecting edges.

Edge filter width

Set the width (0 to 100 pixels) of the smoothing filter applied to the differential graph for detecting edges.

Edge Intensity

- **Upper Edge Intensity**: Specify the upper limit (0.000 to 255.000) of edge intensity for detecting edges.
- **Lower Edge Intensity**: Specify the lower limit (0.000 to 255.000) of edge intensity for detecting edges.

Reference

It may be possible to exclude noisy edges in the segment by adjusting the upper and lower edge intensity values based on the highest edge intensity in the segment, shown on the left of the edge graph. See "What is an Edge?" (Page 10-25) for more details.

Segment Options

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered Img.**: Displays the registered image specified under [Image Selection].

Segment Size

Specify the size of the segment in the inspection region.

- When the inspection region is a rectangle or a rotated rectangle: Specify a value between 1 and 9999 pixels. If the segment size is larger than the size of the inspection region, a measurement error will occur.
- When the inspection region is a ring or an arc: Specify a value between 0.01 and 359.99°. If the segment size is larger than the inspection region, a measurement error will occur.

Segment Shift

Specify the shifting distance of the segment along the trend.

- When the inspection region is a rectangle or a rotated rectangle: Specify a value between 0.01 and 9999.99 pixels.
- When the inspection region is a ring or an arc: Specify a value between 0.01 and 359.99°.

Segment Offset

Specify the offset (distance or angle) of the first segment in the inspection region. If an error occurs due to no edge points near the beginning of the inspection region, offset the segment to a better location.

- When the inspection region is a rectangle or a rotated rectangle: Specify a value between 0 and 9999 pixels.
- When the inspection region is a ring or an arc: Specify a value between 0.00 and 359.99°.

Primary target

Select the measurement type from [Max.], [Min.] or [Specified] to be used for the OK / NG judgment. When selecting [Specified], specify the segment No. (0 to 4999) of the segment.

► Note

The number of segments set in the current inspection region is updated automatically according to the change in the segment size and shift. The maximum number of segments is 5000, but the actual number of segments that can be set may be lower depending on other settings.

Reference

During operation, the screen displays the position, edge graph, edge intensity value, and measurement results of the segment specified as the primary target. Changing the primary target is useful for checking the detection status of specific segments.

Angled edge detection

Set to [ON] to stabilize the detection of slanted edges in the inspection region. Using this option may affect the edge X, Y position accuracy.

Segment count

Specify the maximum number of segments (1 to 5000) which can be used. The segment count cannot exceed the [Maximum Segment Count] value.

► Note

- The maximum number of segments available for detection can vary based on other settings.
- Based on specific settings, the maximum number of segments is fixed and cannot be changed.

Reference

The [Segment Count] value can be set higher than the [Maximum Segment Count] value (Maximum: 5000) depending on the account settings. Note this also increases the [Maximum Segment Count] value, resulting in additional consumption of program memory.

Best Fit Circle/Line

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered Img.**: Displays the registered image specified under [Image Selection].

Circle/line detection

Select whether to project a best fit circle or line based on the detected edge information.

- **OFF**: No best fit line
- **Circle**: Calculate a best fit circle using the least square method on the range of edge points detected.
- **Line**: Calculate a best fit a line using the least square method on the range of edge points detected (only available when the inspection region is a rectangle or a rotated rectangle).

► Note

- Detection is not possible if there are fewer than 3 segments inside the inspection region for a circle or less than 2 for a line.
- The best fit circle is not possible when the calculation result exceeds either the center coordinates by ±16000 pixels or its radius exceeds 16000 pixels.
- If a best fit [Circle] or [Line] is used the data used for position adjustment will be changed to the information from the best fit circle or line.
- If variables are used for [Correction], [Abnormal Gap Size], or [Abnormal Sensitivity], the reference setting may be reset depending on the change in the [Best Fit Circle/Line] setting.

Correction

Correct any false detection for the best fit [Circle / Line] caused by noise.

When [Circle/Line Detection] is selected, noise in the edge information may greatly affect the result. Turn correction [ON] to remove incomplete edges from the best fit calculation and thus reduce the effects of noise.

► Note

If too few edge points are detected, turning the correction [ON] in [Circle/Line Detection] may increase the occurrence of errors in circle or line detection.

Abnormal Gap Size

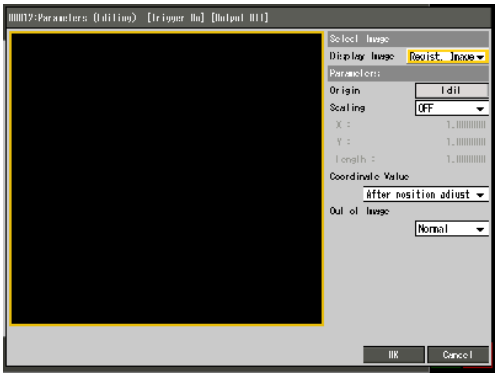
When [Best Fit Circle/Line] and [Correction] are selected, specify the allowable range of deviation (distance) between adjacent segments to remove abnormal detected edge points.

Abnormal Sensitivity

When [Best Fit Circle/Line] and [Correction] are selected, specify the upper edge sensitivity limit (%) for the abnormal detected points, in the segments.

Parameters

Specify additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Parameters

Origin

By default, the origin is set to the top left corner of the camera but its location can be moved as required. To specify the origin, select [Edit] and then specify the coordinates.

Reference

The origin can be set outside the process region. The available range for the origin is -9600 to 9600 (X), -7200 to 7200 (Y).

Scaling

The controller processes image data in pixels, The result data and setting parameters used for display, judgement and calculations can be converted and scaled to real life values and dimensions by using the pre-set scaling factor option.

- **OFF**: Do not use scaling.
- **ON**: Use scaling.

Reference

- The scaling factor can be changed from the [Option] menu of the Flowchart (Page 4-356).
- For a summary list of the result data for which scaling can be used, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

Coordinate value

Select the coordinate system to be used after position adjustment. If position adjustment is not used, this setting will have no effect on the measurement.

- **After position adjust**: The inspection uses the adjusted coordinate axes determined after position adjustment.
- **Before position adjust**: The distance from the position specified for the [Origin] of the inspection is used.

Out of Image

Specify whether to incorporate data that falls outside of the inspection region. This maybe required when position adjustment is used.

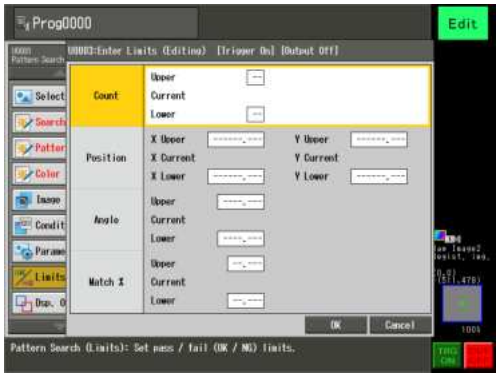
- **Normal (default)**: Edge detection outside of the region is disabled as the image data outside of the region is masked. Since masking requires time to process, the inspection time may vary depending on the quantity image data outside the region. Processing will take longer when the inspection region is a ring or an arc.
- **Fast**: The image data outside of the region is not masked, allowing for faster processing. As the image data outside the region has not been masked so there is an increased chance of detecting an edge outside the region. Select [Normal] to avoid incorrect edge detection.

Reference

Image data which is already located outside of the region during the inspection region setting will always be masked regardless of the [Out of Image] setting.

Limits

Set pass / fail tolerances (upper and lower limits) for the inspection.
If the result is outside of the specified tolerance range, it is judged as [NG] (binary 1). If the result is within the tolerance range, it is judged as [OK] (binary 0).



Use [Direct Input] to enter a value and set the tolerance.

Reference

- [-----] indicates an empty state where no tolerance is set. In this state, no judgment will be performed on the measurement.
- To reset the tolerance setting to an empty state, select [Clear].

Detected segments

Specify the tolerance for the segment detection count.
The unit of measurement is the "number of segments" detected.

Position X (Max)

Specify the tolerance for the maximum value of the detected X position (when the inspection region is a [Rectangle] and the trend direction is ↓).
The unit of measurement is the "number of pixels" indicating the X coordinate of the edge position.

Position X (Min)

Specify the tolerance for the minimum value of the detected X position (when the inspection region is a [Rectangle] and the trend direction is ↓).
The unit of measurement is the "number of pixels" indicating the X coordinate of the edge position.

Position X

Specify the tolerance for the X edge position (when the inspection region is a [Rectangle] and the trend direction is ↓).
The unit of measurement is the "number of pixels" indicating the X coordinate of the edge position.

Position Y (Max)

Specify the tolerance for the maximum value of the detected Y position (when the inspection region is a [Rectangle] and the trend direction is →).
The unit of measurement is the "number of pixels" indicating the Y coordinate of the edge position.

Position Y (Min)

Specify the tolerance for the minimum value of the detected Y position (when the inspection region is a [Rectangle] and the trend direction is →).
The unit of measurement is the "number of pixels" indicating the Y coordinate of the edge position.

Position Y

Specify the tolerance for the Y position edge (when the inspection region is a [Rectangle] and the trend direction is →).
The unit of measurement is the "number of pixels" indicating the Y coordinate of the edge position.

Distance (Max)

Specify the tolerance for the maximum detected distance (when the inspection region is a [Rotated Rectangle]).
The unit of measurement is the "number of pixels" indicating the distance.

Distance (Min)

Specify the tolerance for the minimum detected distance (when the inspection region is a [Rotated Rectangle]).
The unit of measurement is the "number of pixels" indicating the distance.

Distance

Specify the tolerance for the detected distance (when the inspection region is a [Rotated Rectangle]).
The unit of measurement is the "number of pixels" indicating the distance.

Radius (Max)

Specify the tolerance for the maximum detected radius (when the inspection region is a [Ring/Arc]).
The unit of measurement is the "number of pixels" indicating the radius.

Radius (Min)

Specify the tolerance for the minimum detected radius (when the inspection region is a [Ring/Arc]).
The unit of measurement is the "number of pixels" indicating the radius.

Radius

Specify the tolerance for the detected radius (when the inspection region is a [Ring/Arc]).
The unit of measurement is the "number of pixels" indicating the radius.

Display Options

The display color of the units visual indicators can be changed based on the judgment result for that unit. The visual indicator can also be made transparent by selecting [Setting] - [Select Color] - [None].



Inspection region

Specify the line width and display color of the inspection region.

Mask region

Specify the line width and display color of the mask region.

Detected point

Display Target

Specify how to display the detected points.

- **OFF:** Hide the detected points.
- **Primary Target** (default)**:** Show the detected points for the primary target.
- **Primary Target, Max/Min**: Show the detected points for the primary target, maximum and minimum measured values.

Primary target

Specify the width and display color of the line indicating the detected edge.

Other target

Specify the width and display color of the line indicating the detected edge other than the one specified as the primary target (Page 4-172).

Edge Graph

Edge Graph

Select whether to display the edge graph.

- **OFF** (default): Hide the edge graph.
- **Primary Target**: Display a graph of the primary target segment.
- **Maximum**: Display a graph of the largest segment.
- **Minimum**: Display a graph of the smallest segment.

Wave

Specify the width and display color of the edge graph waveform.

Frame

Specify the width and display color of the edge graph frame.

Sensitivity

Specify the width and display color of the line representing the edge sensitivity threshold.

► Note

Setting [Edge graph] to [OFF] consumes additional program memory. Check the amount of remaining program memory before enabling.

Edge point

Profile

Specify the thickness and display color of the line connecting the detection point in the segment and the edge detection point.

► Note

This setting is not applied to the display when [Image Type] is set to [Raw image2].

Segments

Specify the line thickness and display color of the segments.

► Note

- This setting is not applied to the display when [Image Type] is set to [Raw image2].
- If the segment size is larger than the segment shift, the segments will not be displayed.

Circle/Line

Specify the width and display color of the best fit line or circle determined from the detected points.

Processing Priority

Specify the processing priority when displaying large processed images during Run mode.
When a line scan camera is used with the XG-7502A, it is not possible to display the processed image if the image size exceeds 25 MB (26214400 pixels). In such a case it is possible to display the filtered image and contrast image by using a display image variable.

Filtered image

Select whether or not to use a display image variable for the filtered image display.

- **Unit Processing**: Processes the filtered image without using the display image variable.
- **Image Display**: Processes the filtered image using a display image variable.

Reference

- When processing images 25 MB or less, or when using the XG-7702A, it is not necessary to select [Image Display].
- When processing an image larger than 25 MB, if the area displayed is 8 MB (8388608 pixels) or less, the filtered image will be automatically displayed when [Unit Priority] is selected. (However the following processes are excluded.)
  - Image enhancement: Shading correction, blob filter
  - Conversion (image operation): Rotate/translate, zoom, trapezoid correction, blob filter
  - Defect, Grayscale Blob: Contrast display

► Note

When [Image Display] is selected for [Filtered Image], the following restrictions on operation occur.

- Processing time increases.
- The background outside the inspection region becomes a black image.
- Displaying of multiple units is not possible.
- For display of registered images outside of unit edit, the filtered image cannot be displayed and the display is the same as when [Unit Processing] is set.
- When an archived image is displayed, it ix not possible to display the processed image unless the display image variable and results are also stored in the archive.

Image variable

Specify a display image variable for displaying the filtered image.

Reset

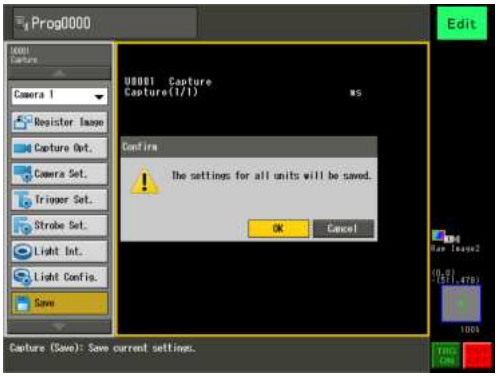
Returns the display options to their defaults.

Save

Save the current unit changes the program file.

► Note

- If the device is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the system power while you are saving the settings. Doing so may cause errors in the internal data



Save

The settings for the unit are saved in the current program file in SD Card 1 or SD Card 2.

► Note

Items specified not to be saved in XG VisionEditor are excluded from the saving operation.
For example, variable values changed in the current program or the default display, and display parts, can be excluded when saving.

Profile Width

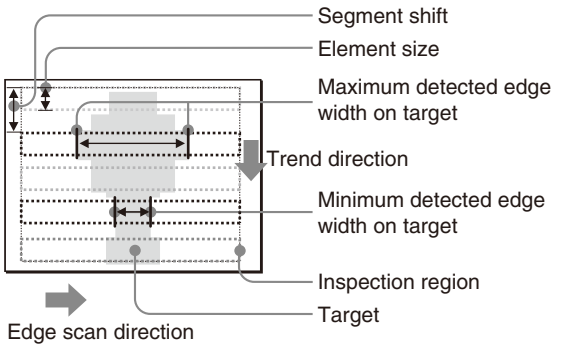
Profile Width Tool

The profile width tool takes a segment of a specified size and indexes it through the inspection region along the trend direction. With each shift of the segment the tool scans in the opposing direction detecting contrast changes to identify edge points. By identifying all the edge points along the two sides of a target the maximum, minimum and average edge width of the target profile can be measured.

Image processing

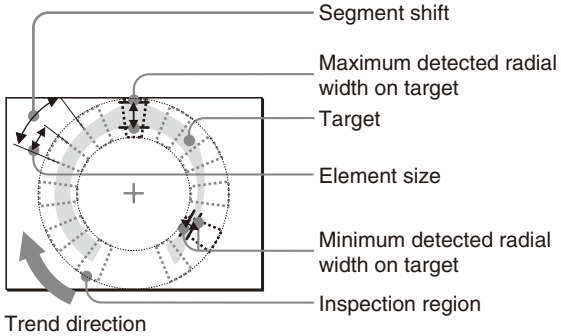
When the inspection region is a rectangle or a rotated rectangle

- In the instance the scan direction is [→] and trend direction is [↓]

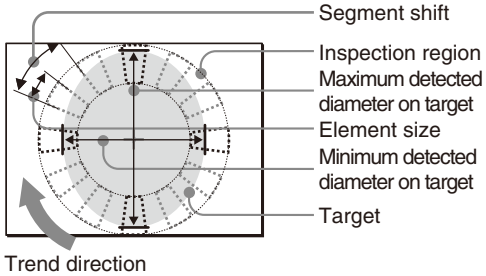


When the inspection region is a ring or an arc

- In the instance the trend direction is [Clockwise] and [Measure] is [Outer Gap]



- In the instance the trend direction is [Clockwise] and [Measure] is [Outer Diameter]



Processing results

The standard results and data returned by the profile width tool are as follows:

Reference

Processing results may vary depending on the shape of the inspection region. The result for an item which is not processed is always 0.

When the inspection region is a rectangle or a rotated rectangle

Number of segments	Outputs the number of set segments.
Number of detected segments	Outputs the number of segments where contrast changes were detected and edges identified. Tolerance inspection target
Number [ ]	Outputs (1) if a pair is detected and (0) if a pair is not detected for all segments. (Label specification target)
Number (max)	Outputs (1) if a pair is detected and (0) if a pair is not detected for the segment with the maximum edge width.
Number (min)	Outputs (1) if a pair is detected and (0) if a pair is not detected for the segment with the minimum edge width.
Width [ ]	Outputs the width (diameter/radial width) of all the edge width pairs in pixels. Tolerance inspection target (Label specification target)
Width (Max)	Outputs the maximum edge width (diameter / radial width) from all the edge width pairs in pixels. Tolerance inspection target
Width (Min)	Outputs the minimum edge width (diameter / radial width) from all the edge width pairs in pixels. Tolerance inspection target
Width (Ave)	Outputs the average edge width from all the edge width pairs in pixels.
Position 1 (X/Y/XY) [ ]	Outputs position coordinates for the first identified edge (typically the one nearest the start of the segment) of all edge width pairs in pixel. (Label specification target)
Position 1 (X/Y/XY) (max)	Outputs position coordinates for the first identified edge (typically the one nearest the start of the segment) of the maximum edge width pair in pixels.
Position 1 (X/Y/XY) (min)	Outputs position coordinates for the first identified edge (typically the one nearest the start of the segment) of the minimum edge width pair in pixels.
Angle 1 [ ]	Outputs the angle of rotation of the inspection region when the region is a rotated rectangle (always 0 when the inspection region is a rectangle). (Label specification target)

Angle 1(max)	Outputs the maximum angle of rotation of the inspection region when the region is a rotated rectangle (always 0 when the inspection region is a rectangle).
Angle 1(min)	Outputs the minimum angle of rotation of the inspection region when the region is a rotated rectangle (always 0 when the inspection region is a rectangle).
Distance 1 [ ]	Outputs the distance from the start of each segment of the inspection region to the position coordinate of the first identified edge (typically the one nearest the start of the segment) of the edge width pair in pixels. Label specification target
Distance 1(max)	Outputs the distance from the start of the segment with the maximum edge width pair to the position coordinate of the first identified edge (typically the one nearest the start of the segment) of the maximum edge width pair in pixels.
Distance 1(min)	Outputs the distance from the start of the segment with the minimum edge width pair to the position coordinate of the first identified edge (typically the one nearest the start of the segment) of the minimum edge width pair in pixels.
Intensity 1 [ ]	Outputs the intensity differential of the first identified edge (typically the one nearest the start of the segment) of all the edge width pairs. Label specification target
Intensity 1(max)	Outputs the intensity differential of the first identified edge (typically the one nearest the start of the segment) of the maximum edge width pair.
Intensity 1(min)	Outputs the intensity differential of the first identified edge (typically the one nearest the start of the segment) of the minimum edge width pair.
Position 2 (X/Y/XY) [ ]	Outputs position coordinates for the second identified edge (typically the one nearest the end of the segment) of all edge width pairs in pixels. Label specification target
Position 2 (X/Y/XY) (max)	Outputs position coordinates for the second identified edge (typically the one nearest the end of the segment) of the maximum edge width pair in pixels.
Position 2 (X/Y/XY) (min)	Outputs position coordinates for the second identified edge (typically the one nearest the end of the segment) of the minimum edge width pair in pixels.
Angle 2 [ ]	Outputs the angle of rotation of the inspection region when the region is a rotated rectangle (always 0 when the inspection region is a rectangle). Label specification target

Angle 2 (Max)	Outputs the maximum angle of rotation of the inspection region when the region is a rotated rectangle (always 0 when the inspection region is a rectangle).
Angle 2 (Min)	Outputs the minimum angle of rotation of the inspection region when the region is a rotated rectangle (always 0 when the inspection region is a rectangle).
Distance 2 [ ]	Outputs the distance from the start of each segment of the inspection region to the position coordinate of the second identified edge (typically the one nearest the end of the segment) of the edge width pair in pixels. Label specification target
Distance 2 (Max)	Outputs the distance from the start of the segment with the maximum edge width pair to the position coordinate of the second identified edge (typically the one nearest the end of the segment) of the maximum edge width pair in pixels.
Distance 2 (Min)	Outputs the distance from the start of the segment with the minimum edge width pair to the position coordinate of the second identified edge (typically the one nearest the end of the segment) of the minimum edge width pair in pixels.
Intensity 2 [ ]	Outputs the intensity differential of the second identified edge (typically the one nearest the end of the segment) of all the edge width pairs. Label specification target
Intensity 2 (Max)	Outputs the intensity differential of the second identified edge (typically the one nearest the end of the segment) of the maximum edge width pair.
Intensity 2 (Min)	Outputs the intensity differential of the second identified edge (typically the one nearest the end of the segment) of the minimum edge width pair.
Maximum segment No.	Outputs the segment No. of the segment with the maximum edge position.
Minimum segment No.	Outputs the segment No. of the segment with the minimum edge position.
Unit judgment value	Outputs the binary result of the unit based on the measured value and the specified tolerance range (upper / lower limits). The unit is judged as [NG] (binary 1) when outside the tolerance range and [OK] (binary 0) when inside.

When the inspection region is a ring or an arc

Number of segments	Outputs the number of set segments.
Number of detected segments	Outputs the number of segments where contrast changes were detected and edges identified. Tolerance inspection target
Number [ ]	Outputs (1) if a pair is detected and (0) if a pair is not detected for all segments. Label specification target
Number (Max)	Outputs (1) if a pair is detected and (0) if a pair is not detected for the segment with the maximum edge width.
Number (Min)	Outputs (1) if a pair is detected and (0) if a pair is not detected for the segment with the minimum edge width.
Width [ ]	Outputs the width (diameter/radial width) of all the edge width pairs in pixels. Tolerance inspection target Label specification target
Width (Max)	Outputs the maximum edge width (diameter / radial width) from all the edge width pairs in pixels. Tolerance inspection target
Width (Min)	Outputs the minimum edge width (diameter / radial width) from all the edge width pairs in pixels. Tolerance inspection target
Width (Ave)	Outputs the average edge width (diameter / radial width) from all the edge width pairs in pixels.
Position 1 (X/Y/XY) [ ]	Outputs position coordinates for the first identified edge (typically the one nearest the start of the segment) of all edge width pairs in pixel. Label specification target
Position 1 (X/Y/XY) (max)	Outputs position coordinates for the first identified edge (typically the one nearest the start of the segment) of the maximum edge width pair in pixels.
Position 1 (X/Y/XY) (min)	Outputs position coordinates for the first identified edge (typically the one nearest the start of the segment) of the minimum edge width pair in pixels.
Angle 1 [ ]	Outputs angle for the second identified edge (typically the one nearest the end of the segment) of all edge width pairs. Label specification target
Angle 1(max)	Outputs the angle for the second identified edge (typically the one nearest the end of the segment) of the maximum edge width pair.
Angle 1(min)	Outputs the angle for the second identified edge (typically the one nearest the end of the segment) of the minimum edge width pair.
Distance 1 [ ]	Outputs the distance from the start of each segment of the inspection region to the position coordinate of the first identified edge (typically the one nearest the start of the segment) of the edge width pair in pixels. Label specification target
Distance 1(max)	Outputs the distance from the start of the segment with the maximum edge width pair to the position coordinate of the first identified edge (typically the one nearest the start of the segment) of the maximum edge width pair in pixels.
Distance 1(min)	Outputs the distance from the start of the segment with the minimum edge width pair to the position coordinate of the first identified edge (typically the one nearest the start of the segment) of the minimum edge width pair in pixels.
Intensity 1 [ ]	Outputs the intensity differential of the first identified edge (typically the one nearest the start of the segment) of all the edge width pairs. Label specification target
Intensity 1(max)	Outputs the intensity differential of the first identified edge (typically the one nearest the start of the segment) of the maximum edge width pair.
Intensity 1(min)	Outputs the intensity differential of the first identified edge (typically the one nearest the start of the segment) of the minimum edge width pair.
Position 2 (X/Y/XY) [ ]	Outputs position coordinates for the second identified edge (typically the one nearest the end of the segment) of all edge width pairs in pixels. Label specification target
Position 2 (X/Y/XY) (max)	Outputs position coordinates for the second identified edge (typically the one nearest the end of the segment) of the maximum edge width pair in pixels.
Position 2 (X/Y/XY) (min)	Outputs position coordinates for the second identified edge (typically the one nearest the end of the segment) of the minimum edge width pair in pixels.
Angle 2 [ ]	Outputs angle for the second identified edge (typically the one nearest the end of the segment) of all edge width pairs. (For outer gap and inner gap, the value is the same as for Angle 1. For outer diameter and inner diameter, the value is Angle 1 + 180°.) Label specification target
Angle 2 (Max)	Outputs the angle for the second identified edge (typically the one nearest the end of the segment) of the maximum edge width pair. (For outer gap and inner gap, the value is the same as for Angle 1. For outer diameter and inner diameter, the value is Angle 1 + 180°.)

Angle 2 (Min)	Outputs the angle for the second identified edge (typically the one nearest the end of the segment) of the minimum edge width pair. (For outer gap and inner gap, the value is the same as for Angle 1. For outer diameter and inner diameter, the value is Angle 1 + 180°.)
Distance 2 [ ]	Outputs the distance from the start of each segment of the inspection region to the position coordinate of the second identified edge (typically the one nearest the end of the segment) of the edge width pair in pixels. Label specification target
Distance 2 (Max)	Outputs he distance from the start of the segment with the maximum edge width pair to the position coordinate of the second identified edge (typically the one nearest the end of the segment) of the maximum edge width pair in pixels.
Distance 2 (Min)	Outputs the distance from the start of the segment with the minimum edge width pair to the position coordinate of the second identified edge (typically the one nearest the end of the segment) of the minimum edge width pair in pixels.
Intensity 2 [ ]	Outputs the intensity differential of the second identified edge (typically the one nearest the end of the segment) of all the edge width pairs. Label specification target
Intensity 2 (Max)	Outputs the intensity differential of the second identified edge (typically the one nearest the end of the segment) of the maximum edge width pair.
Intensity 2 (Min)	Outputs the intensity differential of the second identified edge (typically the one nearest the end of the segment) of the minimum edge width pair.
Maximum segment No.	Outputs the segment No. of the segment with the maximum edge position.
Minimum segment No.	Outputs the segment No. of the segment with the minimum edge position.
Unit judgment value	Outputs the binary result of the unit based on the measured value and the specified tolerance range (upper / lower limits). The unit is judged as [NG] (binary 1) when outside the tolerance range and [OK] (binary 0) when inside.

Reference

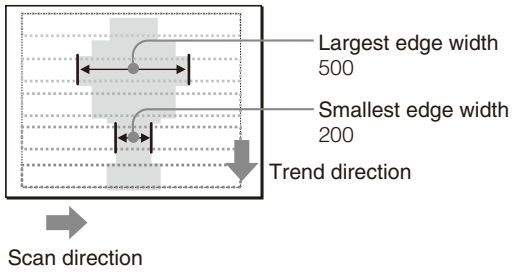
For the lists of available measurement output values and setting parameters, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

Example

When the inspection region is a rectangle or a rotated rectangle

Example showing the results of a profile width inspection performed under the following conditions:

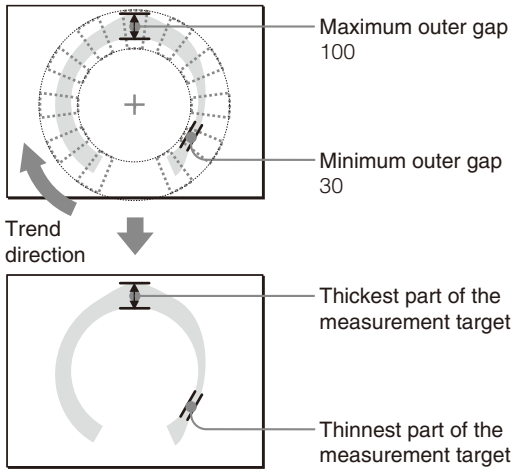
- Measure: Outer Gap
- Trend direction: ↓
- Scan Direction: →
- Edge Direction: Both



When the inspection region is a ring or an arc (1)

Example showing the results of a profile width inspection performed under the following conditions:

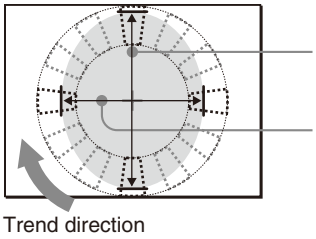
- Measure: Outer Gap
- Trend direction: Clockwise
- Scan Direction: Center → Out
- Edge Direction: Both



When the inspection region is a ring or an arc (2)

Example showing the results of a profile width inspection performed under the following conditions:

- Measure: Diameter Outside
- Trend direction: Clockwise
- Scan Direction: Center → Out
- Edge Direction: Both



Main Menu

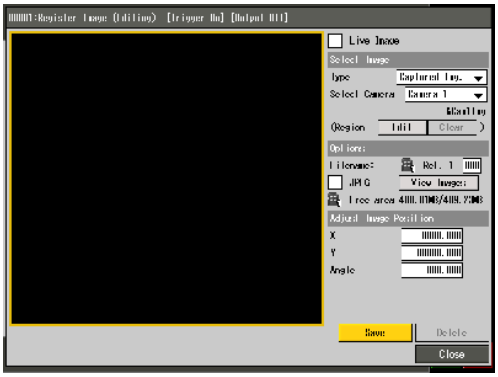
The main menu of the profile width tool consists of the following options. Configure settings under each option as required for the inspection.



Register Image (Page 4-184)	Register an image to be used as a template for settings.
Select Image (Page 4-185)	Specify the image to be used for unit processing.
Inspect Region (Page 4-186)	Define the region to be used for unit processing.
Color (Page 4-187)	Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).
Image Enhance (Page 4-188)	Settings for pre-processing image filters.
Edge Detection (Page 4-188)	Specific conditions for processing a profile width inspection.
Parameters (Page 4-191)	Additional optional parameters.
Limits (Page 4-192)	Unit pass / fail tolerances.
Display Options (Page 4-193)	Unit processing display settings.
Save (Page 4-194)	Save unit settings.

Register Image

An image can be saved to the controller to be used as a template for measurements and settings. It is recommended to adjust and fix lighting and other external influences before registering an image.



Live Image

Check this box to display live images through a continuous feed.

► Note

- A live feed is only available while the unit is being edited.
- This setting cannot be changed when the screen update mode is set to [Continuous] in the trigger settings (Page 4-25).
- If the capture on trigger input is disabled in the trigger settings (Page 4-25), this check box is always unchecked and the setting cannot be changed.
- When Live image is selected for a moving object, take care when registering as there will be a time lag between the external trigger input and the actual image capture.
- In principle, Live-image is only used when the capture unit being edited is being executed (waiting for a trigger input). When the image capture buffer is set to custom and the capture unit which was most recently executed is being edited, the images collected in the buffer will still be displayed even if the capture unit is not presently capturing images.
- Continuous update cannot be used when HDR capture (Page 4-21) is enabled or when a line scan camera is being used.
- When the HDR capture (Page 4-21) is enabled, the Multi-image cannot be used.

Select Image

Type

Select an image to register.

- **Captured Img.**: Displays the latest image from the specified camera (image variable).
- **Registered Img.**: The registered image specified in [Options] is displayed.

Select Camera

Select the number of the camera used for registration. Choose from Camera1 - Camera4, and select only the camera number used for the capture unit being edited.

Specifying a region

To register only part of an image, select [Edit] then specify the region to register. To cancel the selected region, select [Clear].

Save Image

Filename

Specify the registered image number used for image registration in the form "(Camera No.)-(User-specified No.)".

Reference

The name of the saved file is "ref (Camera No.)_(Specified No.)" (for full screen image registration) or "ref (Camera No.)_(Specified No.)_XXX_YYY" (for partial image registration).

JPEG

Check this box to save the image in JPEG format. When this box is not checked, the image will be saved in BMP format as either a 24-bit color bitmap image (when a color camera is used) or an 8-bit grayscale bitmap image (when a monochrome camera is used).

► Note

Using image compression may result in some image deterioration, thus results from a compressed image may differ to those when using non compressed images.

View All

View all registered images in a list.

Adjust Image Position

Adjust the position of the image being captured.

X

-Adjust the movement in the X (horizontal) direction between -8191.000 and 8191.000 pixels.

Y

-Adjust the movement in the Y (vertical) direction between -16383.000 and 16383.000 pixels.

Angle

Adjust the position angle (rotation) around the center of the image between -999.999° and 999.999°.

► Note

Position adjustment may cause missing peripheries (black areas) due to image movement or jagged edges (jaggies) due to rotation in the registered image.

Save

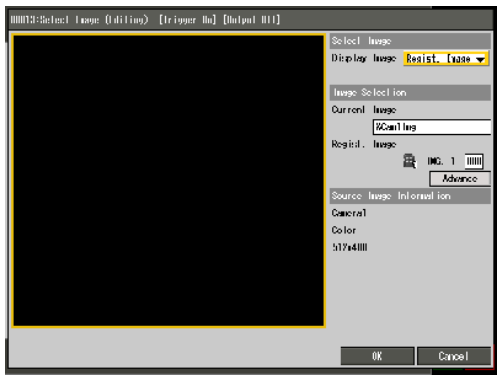
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Registered Img.] is selected for [Type], you can delete the registered image specified in [Options].

Select Image

Specify the image variable and associated registered image to be used for configuring the vision tool.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured Image**: Displays the latest image from the specified camera (image variable).
- **Registered Image**: The registered image specified under [Image Selection] is displayed.

Select image

Captured Img.

Set an image variable to be used as a current image for the unit.

Registered Img.

Specify the registered image No. for the registered image to be used.

- The registered images are managed as "Image (Camera No.) - (Registered image No.0 to 999)".
- The "Camera No" is fixed to the number of the camera associated to the image variable specified for the current image.

Advance

Set advance options for the switching of registered images as necessary.

- **Use numerical variable for registered image number**: To use a variable for the registered image No., check this box and assign a numerical or numerical array variable reference. By using a variable for the registered image No. and then issuing a variable reference value apply command (NU), the image is switched to the specified registered image in the variable and the reference image information is updated. For more details, see the XG-7000 Series Communication Control Manual.
- **Process variable when changing programs**: Use this option to switch to the registered image based on the initial value of the variable referenced when the program is changed or the controller is next turned on.

► Note

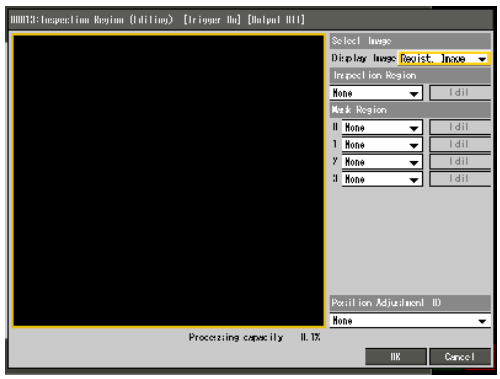
Note that the registered image No. does not switch in accordance with a change in the variable.

Source Image Information

The camera No., type (color / monochrome), and resolution of the camera associated to the image variable specified is displayed.

Inspection Region

Outline the region on the captured image to be used for inspection.



► Note

Changing the shape of the region will initialize or clear some of the settings in the [Edge Detection] menu.

Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Region

Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Inspection Region Menu" (Page 3-20) for more details.

► Note

- The inspection regions available for the profile width measurement window are a rectangle, rotated rectangle, ring, and arc.
- The available functions and measurement items vary depending on the shape of the inspection region.

Mask region

A mask region is an area which can be defined in the inspection region and will be excluded from the inspection. Up to four mask regions can be set per inspection region. A mask region is typically used for hiding an area that does not require inspection.
Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Excluding Part of the Region" (Page 3-26) for more details.

Position Adjustment ID

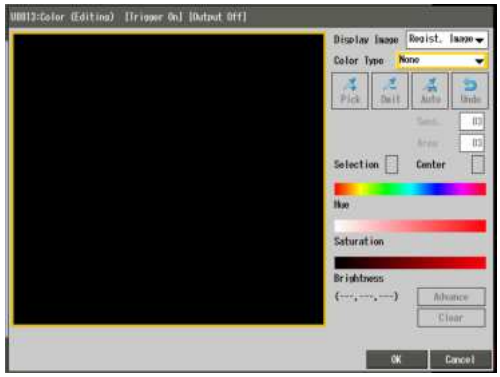
To apply position adjustment to the region, select the position adjustment unit to be referenced.

Reference

The position adjustment is applied to all inspection, mask, and image regions.

Color

When working with a color camera, convert the captured color image into a binary (black and white) or a grayscale converted image by extracting the desired color.



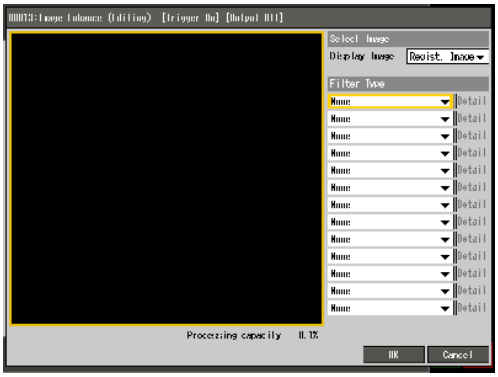
► Note

This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-295) is referenced as the current image.

Refer to "Working with Color Images (Color Extraction)" (Page 10-2) for concepts involving color extraction and its operation.

Image Enhance

Specify the filter processing to apply to the image.
When a color camera is used, the filter is applied to the images converted using color extraction.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Filter type

Select the [Filter Type] field and then select the filter to apply. To perform area measurement using a method other than color to binary, you must select the [Binary] filter as the last filter. See "Image Enhancement Filters" (Page 10-11) for more details of each filter processing.

► Note

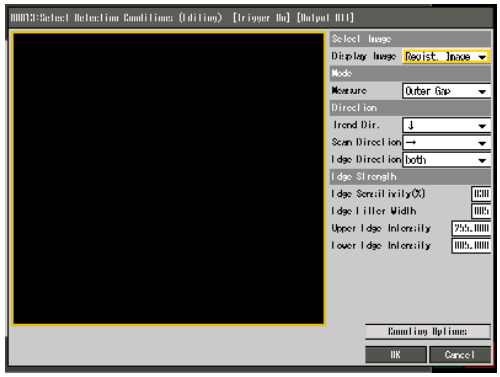
- For the area tool, [Binary] must be selected unless color to binary is used in the color extraction settings.
- If the binary filter is not selected or another filter is applied after the binary filter, the measurement result may not be correct.
- The binary, subtract and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 13 types of filters can be stacked according to application requirements. When multiple filters are set, they are processed one by one from the top.
- The order of the filters can be changed by selecting a filter in one of the [Filter Type] fields, holding down the No.1 (FUNCTION) button of the handheld controller, and then moving the 8-way key up or down.

Edge Detection

Specify the conditions for detecting multiple edge widths to make up a trend.



Reference

See "What is an Edge?" (Page 10-25) for the technical description on edge detection.

Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

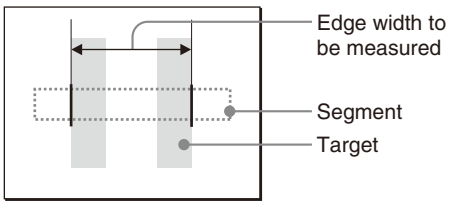
Mode

Measure

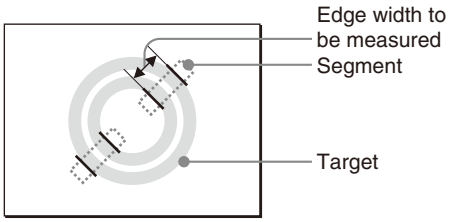
Select the type of edge width measurement.

- **Outer Gap:** Measure the distance between the two outermost edges in the inspection region.

  When the inspection region is a rectangle or a rotated rectangle:

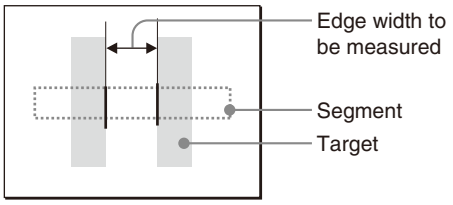


  When the inspection region is a ring or an arc:

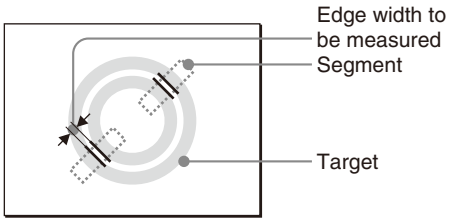


- **Inner Gap:** Measure the distance between the two innermost edges in the inspection region.

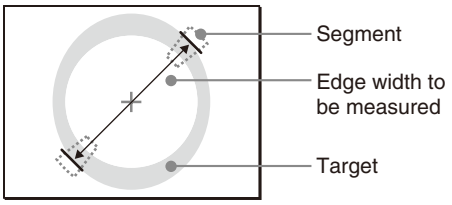
  When the inspection region is a rectangle or a rotated rectangle:



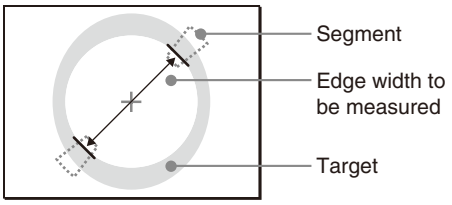
  When the inspection region is a ring or an arc:



- **Outer Diameter** (Ring only)**:** Measure the outer diameter of the edges detected by two opposing segments in a ring inspection region.



- **Inner Diameter** (Ring only)**:** Measure the inner diameter of the edges detected by two opposing segments in a ring inspection region.



► Note

If variable referencing is used for the scan direction, the reference setting may be canceled if there is a change in the trend direction.

Direction

Trend direction

Select the edge segment movement direction.

- **When the inspection region is a rectangle**: → or ↓
- **If the inspection region is a rotated rectangle**: ↓ (top to bottom) only.
- **When the inspection region is a ring or an arc**: only clockwise is available.

Scan direction

Select the scan direction to detect an edge.

- **When the inspection region is a rectangle**: ↓ or ↑ (when the trend direction is →), → or ← (when the trend direction is ↓)
- **When the inspection region is a rotated rectangle**: Forward (from left to right), Reverse (from right to left)
- **When the inspection region is a ring or an arc**: Center → Out, Out → Center

Edge direction

Select the change in contrast for detecting an edge.

- **Both** (default): Detect edges in a transition that can change either from a bright area to a dark area or from a dark area to a bright area.
- **Light to Dark**: Detect edges in a transition that changes from a bright area to a dark area.
- **Dark to Light**: Detect edges in a transition that changes from a dark area to a bright area.

Edge Strength

Edge Sensitivity (%)

Set the percentage threshold (0% to 100%) for detecting edges.

Edge filter width

Set the width (0 to 100 pixels) of the smoothing filter applied to the differential graph for detecting edges.

Edge Intensity

- **Upper Edge Intensity**: Specify the upper limit (0.000 to 255.000) of edge intensity for detecting edges.
- **Lower Edge Intensity**: Specify the lower limit (0.000 to 255.000) of edge intensity for detecting edges.

Reference

It may be possible to exclude noisy edges in the segment by adjusting the upper and lower edge intensity values based on the highest edge intensity in the segment, shown on the left of the edge graph. See "What is an Edge?" (Page 10-25) for more details.

Segment Options

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered Img.**: Displays the registered image specified under [Image Selection].

Edge width

- **Upper**: Specify the upper limit of the detected edge width (0 - 99999.999 pixels).
- **Lower** : Specify the lower limit of the detected edge width (0 - 99999.999 pixels).

Reference

The maximum and minimum distances specified in the [Edge Width] will apply to the results before the scaling operation, even if [Scaling] (Page 4-191) is set to [ON].

Segment Size

Specify the size of the segment in the inspection region.

- When the inspection region is a rectangle or a rotated rectangle: Specify a value between 1 and 9999 pixels. If the segment size is larger than the size of the inspection region, a measurement error will occur.
- When the inspection region is a ring or an arc: Specify a value between 0.01 and 359.99°. If the segment size is larger than the inspection region, a measurement error will occur.

Segment Shift

Specify the shifting distance of the segment along the trend.

- When the inspection region is a rectangle or a rotated rectangle: Specify a value between 0.01 and 9999.99 pixels.
- When the inspection region is a ring or an arc: Specify a value between 0.01 and 359.99°.

Segment Offset

Specify the offset (distance or angle) of the first segment in the inspection region. If an error occurs due to no edge points near the beginning of the inspection region, offset the segment to a better location.

- When the inspection region is a rectangle or a rotated rectangle: Specify a value between 0 and 9999 pixels.
- When the inspection region is a ring or an arc: Specify a value between 0.00 and 359.99°.

Primary target

Select the measurement type from [Max.], [Min.] or [Specified] to be used as a OK / NG judgment (0 to 4999).

► Note

The number of segments set in the current inspection region is updated automatically according to the change in the segment size and shift. The maximum number of segments is 5000, but the actual number of segments that can be set may be lower depending on other settings.

Reference

During operation, the screen displays the position, edge graph, edge intensity value, and measurement results of the segment specified as the primary target. Changing the primary target is useful for checking the detection status of specific segments.

Angled edge detection

Set to [ON] to stabilize the detection of slanted edges in the inspection region. Using this option may affect the edge X, Y position accuracy.

Segment count

Specify the maximum number of segments (1 to 5000) which can be used. The segment count cannot exceed the [Maximum Segment Count] value.

► Note

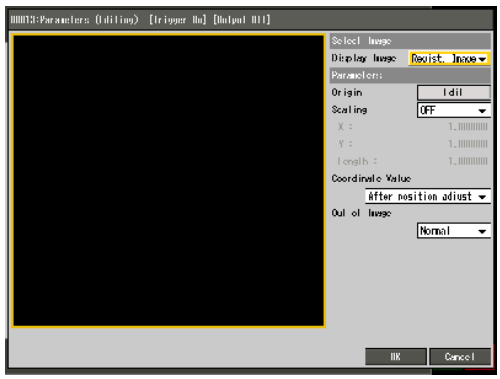
- The maximum number of segments available for detection can vary based on other settings.
- Based on specific settings, the maximum number of segments is fixed and cannot be changed.

Reference

The [Segment Count] value can be set higher than the [Maximum Segment Count] value (Maximum: 5000) depending on the account settings. Note this also increases the [Maximum Segment Count] value, resulting in additional consumption of program memory.

Parameters

Specify additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Parameters

Origin

By default, the origin is set to the top left corner of the camera but its location can be moved as required. To specify the origin, select [Edit] and then specify the coordinates.

Reference

The origin can be set outside the process region. The available range for the origin is -9600 to 9600 (X), -7200 to 7200 (Y).

Scaling

The controller processes image data in pixels, The result data and setting parameters used for display, judgement and calculations can be converted and scaled to real life values and dimensions by using the pre-set scaling factor option.

- **OFF**: Do not use scaling.
- **ON**: Use scaling.

Reference

- The scaling factor can be changed from the [Option] menu of the Flowchart (Page 4-356).
- For a summary list of the result data for which scaling can be used, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

Coordinate value

Select the coordinate system to be used after position adjustment. If position adjustment is not used, this setting will have no effect on the measurement.

- **After position adjust**: The inspection uses the adjusted coordinate axes determined after position adjustment.
- **Before position adjust**: The distance from the position specified for the [Origin] of the inspection is used.

Out of Image

Specify whether to incorporate data that falls outside of the inspection region. This maybe required when position adjustment is used.

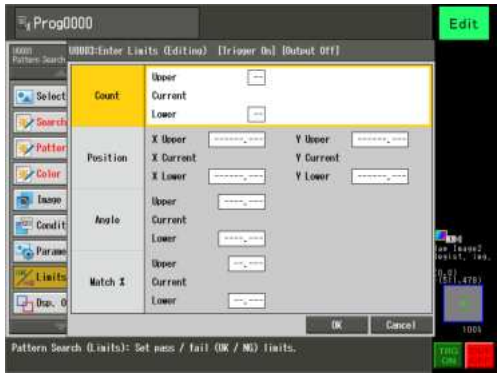
- **Normal (default)**: Edge detection outside of the region is disabled as the image data outside of the region is masked. Since masking requires time to process, the inspection time may vary depending on the quantity image data outside the region. Processing will take longer when the inspection region is a ring or an arc.
- **Fast**: The image data outside of the region is not masked, allowing for faster processing. As the image data outside the region has not been masked so there is an increased chance of detecting an edge outside the region. Select [Normal] to avoid incorrect edge detection.

Reference

Image data which is already located outside of the region during the inspection region setting will always be masked regardless of the [Out of Image] setting.

Limits

Set pass / fail tolerances (upper and lower limits) for the inspection.
If the result is outside of the specified tolerance range, it is judged as [NG] (binary 1). If the result is within the tolerance range, it is judged as [OK] (binary 0).



Use [Direct Input] to enter a value and set the tolerance.

Reference

- [-----] indicates an empty state where no tolerance is set. In this state, no judgment will be performed on the measurement.
- To reset the tolerance setting to an empty state, select [Clear].

Detected Segments

Specify the tolerance for the segment detection count.
The unit of measurement is the "number of segments" detected.

Width (Max)

Specify the tolerance for the maximum value of the detected width.
The unit of measurement is the "number of pixels" indicating the minimum width.

Width (Min)

Specify the tolerance for the minimum value of the detected width.
The unit of measurement is the "number of pixels" indicating the minimum width.

Width

Specify the tolerance for the detected width.
The unit of measurement is the "number of pixels" indicating the minimum width.

Display Options

The display color of the units visual indicators can be changed based on the judgment result for that unit. The visual indicator can also be made transparent by selecting [Setting] - [Select Color] - [None].



Inspection region

Specify the line width and display color of the inspection region.

Mask region

Specify the line width and display color of the mask region.

Detected Point

Display Target

Specify how to display the detected points.

- **OFF:** Hide the detected points.
- **Primary Target** (default)**:** Show the detected points for the primary target.
- **Primary Target, Max/Min**: Show the detected points for the primary target, maximum and minimum measured values.

Primary target

Specify the width and display color of the line indicating the detected edge.

Other target

Specify the width and display color of the line indicating the detected edge other than the one specified as the primary target (Page 4-190).

Edge Graph

Edge Graph

Select whether to display the edge graph.

- **OFF** (default): Hide the edge graph.
- **Primary Target**: Display a graph of the primary target segment.
- **Maximum**: Display a graph of the largest segment.
- **Minimum**: Display a graph of the smallest segment.

Wave

Specify the width and display color of the edge graph waveform.

Frame

Specify the width and display color of the edge graph frame.

Sensitivity

Specify the width and display color of the line representing the edge sensitivity threshold.

► Note

Setting [Edge graph] to [OFF] consumes additional program memory. Check the amount of remaining program memory before enabling.

Edge point

Profile

Specify the thickness and display color of the line connecting the detection point in the segment and the edge detection point.

► Note

This setting is not applied to the display when [Image Type] is set to [Raw image2].

Segments

Specify the line thickness and display color of the segments.

► Note

- This setting is not applied to the display when [Image Type] is set to [Raw image2].
- If the segment size is larger than the segment shift, the segments will not be displayed.

Processing Priority

Specify the processing priority when displaying large processed images during Run mode.
When a line scan camera is used with the XG-7502A, it is not possible to display the processed image if the image size exceeds 25 MB (26214400 pixels). In such a case it is possible to display the filtered image and contrast image by using a display image variable.

Filtered image

Select whether or not to use a display image variable for the filtered image display.

- **Unit Processing**: Processes the filtered image without using the display image variable.
- **Image Display**: Processes the filtered image using a display image variable.

Reference

- When processing images 25 MB or less, or when using the XG-7702A, it is not necessary to select [Image Display].
- When processing an image larger than 25 MB, if the area displayed is 8 MB (8388608 pixels) or less, the filtered image will be automatically displayed when [Unit Priority] is selected. (However the following processes are excluded.)
  - Image enhancement: Shading correction, blob filter
  - Conversion (image operation): Rotate/translate, zoom, trapezoid correction, blob filter
  - Defect, Grayscale Blob: Contrast display

► Note

When [Image Display] is selected for [Filtered Image], the following restrictions on operation occur.

- Processing time increases.
- The background outside the inspection region becomes a black image.
- Displaying of multiple units is not possible.
- For display of registered images outside of unit edit, the filtered image cannot be displayed and the display is the same as when [Unit Processing] is set.
- When an archived image is displayed, it ix not possible to display the processed image unless the display image variable and results are also stored in the archive.

Image variable

Specify a display image variable for displaying the filtered image.

Reset

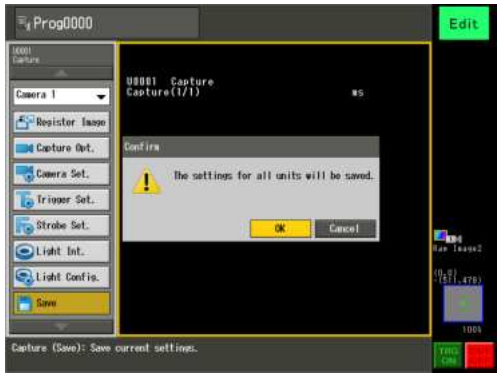
Returns the display options to their defaults.

Save

Save the current unit changes the program file.

► Note

- If the device is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the system power while you are saving the settings. Doing so may cause errors in the internal data



Save

The settings for the unit are saved in the current program file in SD Card 1 or SD Card 2.

► Note

Items specified not to be saved in XG VisionEditor are excluded from the saving operation.
For example, variable values changed in the current program or the default display, and display parts, can be excluded when saving.

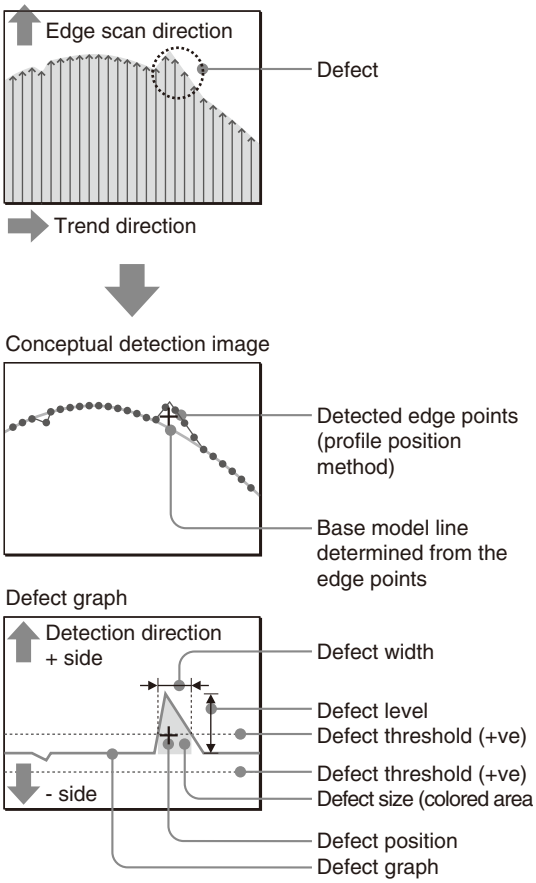
Profile Defect

Profile Defect Tool

The profile defect tool takes a targets edge points (similar to profile position) (Page 4-163) and compares them to a smoothed base model line (straight line, circle, oval or free curve) to determine if there are any individual or small groups of edge points that are outside of the normal target profile. Detected deviations from the norm which are greater than the threshold value are determined as defects and their position, level (height or depth), width and size (area) can all be measured.

Image processing

Example of an inspection region with a curved base model line

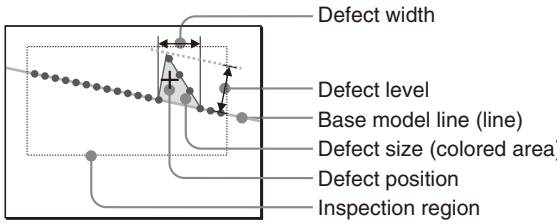


- **Detection direction**: The defect detection direction is based on the edge scan direction. If the edge direction is from inside outwards then positive defects are considered protrusions, where as negative defects are depressions.
- **Defect level**: The maximum difference in distance between the base model line and the detected edge points which make up the defect by exceeding the detection threshold.
- **Defect width**: The number of continuous edge points (segments) that exceed the detection threshold and thus make up the defect.
- **Defect size**: The sum of the differences between the base model line and all edge points of the defect (defect levels) or the differences between the detection threshold value and all edge points of the defect. (The selection is available in [Defect Size Calculation Method] in the [Parameters] menu.)
- **Defect position**: The center of gravity of the defect. Defined by the base model line and the defect edge points.

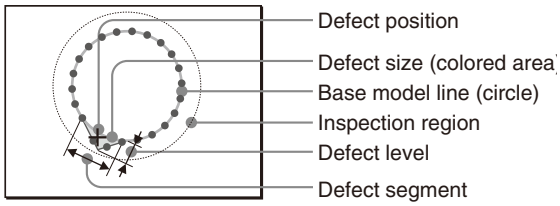
► Note

The measured results may differ depending on the segment size and shift specified in the [Edge Detection] menu. For example, even if the physical size is the same, increasing the segment size or shift may affect the defect segment count and measured defect size. If the inspection region is a ring or an arc, such changes may affect defect detection close to the border of the region.

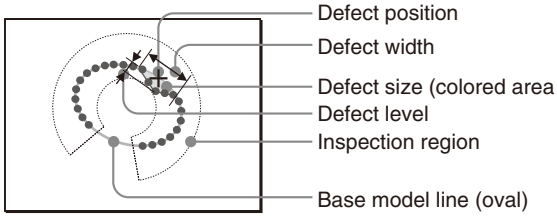
Example with a rectangle or rotated rectangle inspection region and a straight base model line



Example of a ring inspection region and a circle base model line



Example of an arc inspection region and an oval base model line



Processing results

The standard results and data returned by the profile defect measurement are as follows:

Number of segments	Outputs the number of set segments.
Number of detected segments	Outputs the number of segments where contrast changes were detected and edges identified. Tolerance inspection target
Defect count	Outputs the number of defects detected in the inspection region. Tolerance inspection target
Total defect size	Outputs the total size of all defects detected in the inspection region. Tolerance inspection target
Defect Size [ ]	Outputs the defect sizes (areas) of all individual defects detected in the inspection region. Tolerance inspection target Label specification target
Defect size (Max)	Outputs the maximum defect size (area) detected in the inspection region. Tolerance inspection target
Defect size (Min)	Outputs the minimum defect (area) size detected in the inspection region. Tolerance inspection target
Defect Position X [ ]	Outputs the X position coordinate of all defects in pixels. Tolerance inspection target Label specification target
Defect position X (Max)	Outputs the maximum X position coordinate from the range of detected defects in the inspection region in pixels. Tolerance inspection target
Defect position X (Min)	Outputs the minimum X position coordinate from the range of detected defects in the inspection region in pixels. Tolerance inspection target
Defect Position Y [ ]	Outputs the Y position coordinate of all defects in pixels. Tolerance inspection target Label specification target
Defect position Y (Max)	Outputs the maximum Y position coordinate from the range of detected defects in the inspection region in pixels. Tolerance inspection target
Defect position Y (Min)	Outputs the minimum Y position coordinate from the range of detected defects in the inspection region in pixels. Tolerance inspection target
Defect Position XY [ ]	Outputs the XY position coordinates of all defects in pixels. Label specification target
Defect Angle [ ]	Outputs the angles of all defects in reference to the following position coordinates (Circle and oval base model lines: Angle from the center of the base circle or oval. Other base model lines: Angle from the center of the inspection region when the inspection region is a ring or an arc, or the angle of a rotated rectangle when the inspection region is a rectangle or a rotated rectangle). Label specification target
Defect Level [ ]	Outputs the defect levels (height / depth) of all individual defects detected in the inspection region. Label specification target
Defect level (Max)	Outputs the maximum defect level (height / depth) detected in the inspection region.
Defect level (Min)	Outputs the minimum defect level (height / depth) detected in the inspection region.
Total defect level	Outputs the sum of the maximum positive and negative (protrusions and depressions) defect level detected in the inspection region.
Total defect width	Outputs the total number of edge points of all detected defects in the inspection region.
Defect Width [ ]	Outputs the number of edge points for all individual defects detected in the inspection region defect. Label specification target
Defect width (Max)	Outputs the number of edge points for the maximum defect width detected in the inspection region
Defect width (Min)	Outputs the number of edge points for the minimum defect width detected in the inspection region.
Defect Top Position X [ ]	Outputs the X position coordinate of the top of the defect (the edge point with the maximum defect level in the defect) for all defects in pixels. Label specification target
Defect Top Position Y [ ]	Outputs the Y position coordinate of the top of the defect (the edge point with the maximum defect level in the defect) for all defects in pixels. Label specification target
Defect Top Position XY [ ]	Outputs the XY position coordinates of the top of the defect (the edge point with the maximum defect level in the defect) for all defects in pixels. Label specification target
Defect Edge Position X1 [ ]	Outputs the X position coordinate of the edge point located immediately before a defect begins (if the inspection region is a ring or an arc, the position before a defect in the clockwise direction) for all detected defects in the inspection region in pixels. Label specification target
Defect Edge Position Y1 [ ]	Outputs the Y position coordinate of the edge point located immediately before a defect begins (if the inspection region is a ring or an arc, the position before a defect in the clockwise direction) for all detected defects in the inspection region in pixels. Label specification target
Defect Edge Position XY1 [ ]	Outputs the XY position coordinates of the edge point located immediately before a defect begins (if the inspection region is a ring or an arc, the position before a defect in the clockwise direction) for all detected defects in the inspection region in pixels. Label specification target
Defect Edge Position X2 [ ]	Outputs the X position coordinate of the edge point located immediately after a defect ends (if the inspection region is a ring or an arc, the position after a defect in the clockwise direction) for all detected defects in the inspection region in pixels. Label specification target
Defect Edge Position Y2 [ ]	Outputs the X position coordinate of the edge point located immediately after a defect ends (if the inspection region is a ring or an arc, the position after a defect in the clockwise direction) for all detected defects in the inspection region in pixels. Label specification target

Defect Edge Position XY 2 [ ]	Outputs the XY position coordinates of the edge point located immediately after a defect ends (if the inspection region is a ring or an arc, the position after a defect in the clockwise direction) for all detected defects in the inspection region in pixels. (Label specification target)
Base line	Outputs (1) if the creation of the base model line is successful (0) if not
Base line X1	Outputs the X position coordinate of the intersection between the base model line and the top side (or left side when the trend direction is →) of the inspection region in pixels (when the base model line is [Line]).
Base line Y1	Outputs the Y position coordinate of the intersection between the base model line and the top side (or left side when the trend direction is →) of the inspection region in pixels (when the base model line is [Line]).
Base line XY1	Outputs the XY position coordinates of the intersection between the base model line and the top side (or left side when the trend direction is →) of the inspection region in pixels (when the base model line is [Line]).
Base line X2	Outputs the X position coordinate of the intersection between the base model line and the bottom side (or right side when the trend direction is →) of the inspection region in pixels (when the base model line is [Line]).
Base line Y2	Outputs the Y position coordinate of the intersection between the base model line and the bottom side (or right side when the trend direction is →) of the inspection region in pixels (when the base model line is [Line]).
Base line XY2	Outputs the XY position coordinates of the intersection between the base model line and the bottom side (or right side when the trend direction is →) of the inspection region in pixels (when the base model line is [Line]).
Base line center X	Outputs the X position coordinate of the center of the line between the base model line XY1 and XY2 positions in pixels (when the base model line is [Line]).
Base line center Y	Outputs the Y position coordinate of the center of the line between the base model line XY1 and XY2 positions in pixels (when the base model line is [Line]).
Base line center XY	Outputs the XY position coordinates of the center of the line between the base model line XY1 and XY2 positions in pixels (when the base model line is [Line]).
Base line angle	Outputs the angle (0° to 359.999°) of Base Line XY2 in reference to Base Line XY1 (base model line and inspection region) (when the base model line is [Line]).
Base circle radius	Outputs the radius of the circle from the base model line (when the base model line is [Circle]).
Base circle center X	Outputs the X position coordinate at the center of the circle from the base model line in pixels (when the base model line is [Circle]).
Base circle center Y	Outputs the Y position coordinate at the center of the circle from the base model line in pixels (when the base model line is [Circle]).
Base circle center XY	Outputs the XY position coordinates at the center of the circle from the base model line in pixels (when the base model line is [Circle]).
Base oval radius 1	Outputs the horizontal radius of the oval from the base model line in pixels (when the base model line is [Oval]).
Base oval radius 2	Outputs the vertical radius of the oval from the base model line in pixels (when the base model line is [Oval]).
Base oval center X	Outputs the X position coordinate at the center of the oval from the base model line in pixels (when the base model line is [Oval]).
Base oval center Y	Outputs the Y position coordinate at the center of the oval from the base model line in pixels (when the base model line is [Oval]).
Base oval center XY	Outputs the XY position coordinates at the center of the oval from the base model line in pixels (when the base model line is [Oval]).
Base oval angle	Outputs the major axis angle (0° to 359.999°) of the detected oval (when the base model line is [Oval]).
Defect Start Segment	Outputs the start segment No. of all detected defects in the inspection region. (Label specification target)
Defect Top Segment	Outputs the segment No. of the segment showing the top of the defect (the edge point with the maximum defect level in the defect) for all detected defects in the inspection region. (Label specification target)
Defect End Segment	Outputs the end segment No. of all detected defects in the inspection region. (Label specification target)
Base Free Curve X [ ]	Outputs the X position coordinate of all edge points that make up the detected free curve in the inspection region in pixels (when the base model line is [Free Curve]). (Label specification target)
Base Free Curve Y [ ]	Outputs the Y position coordinate of all edge points that make up the detected free curve in the inspection region in pixels (when the base model line is [Free Curve]). (Label specification target)
Base Free Curve XY [ ]	Outputs the XY position coordinates of all edge points that make up the detected free curve in the inspection region in pixels (when the base model line is [Free Curve]). (Label specification target)
Difference [ ]	Outputs the difference between the base model line and the edge point in all the segments in pixels. (Label specification target)
Edge Count[]	Outputs the number edges in all segments. (Label specification target)
Edge Position X [ ]	Outputs the X position coordinate of all the edge positions in pixels. (Label specification target)

Edge Position Y [ ]	Outputs the Y position coordinate of all the edge positions in pixels. (Label specification target)
Edge Position XY [ ]	Outputs the XY position coordinates of all the edge positions in pixels. (Label specification target)
Edge Angle [ ]	Outputs the angles of all edge points (or the angle of the rotated rectangle when the inspection region is a rectangle or a rotated rectangle). (Label specification target)
Unit judgment value	Outputs the binary result of the unit based on the measured value and the specified tolerance range (upper / lower limits). The unit is judged as [NG] (binary 1) when outside the tolerance range and [OK] (binary 0) when inside.

Reference

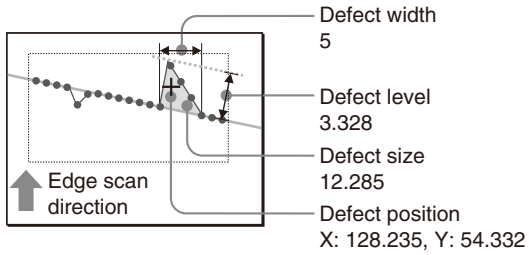
For the lists of available measurement output values and setting parameters, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

Example

Example of a rectangle or rotated rectangle inspection region and a straight base model line

Example showing results of a profile defect inspection performed under the following conditions:

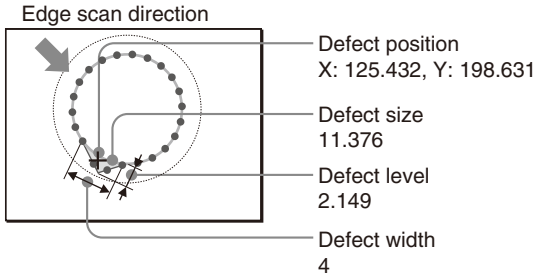
- Base model: Line
- Edge scan direction: ↑
- Defect detection direction: +



Example of a ring inspection region and a circle base model line

Example showing results of a profile defect inspection performed under the following conditions:

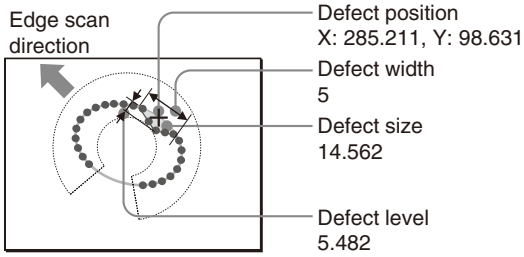
- Base model: Line
- Edge scan direction: Out to Center
- Defect detection direction: ±



Example of an arc inspection region and an oval base model line

Example showing results of a profile defect inspection performed under the following conditions:

- Base model: Oval
- Edge scan direction: Center to Out
- Defect detection direction: -



Main Menu

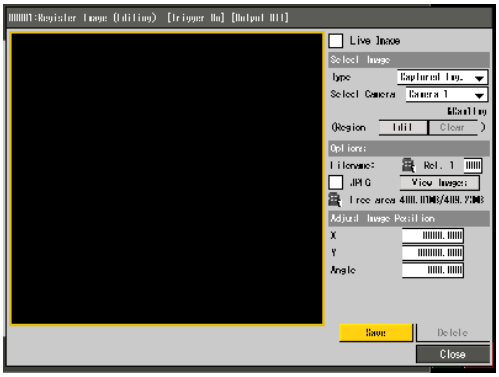
The main menu of the profile defect tool consists of the following options. Configure settings under each option as required for the inspection.



Register Image (Page 4-199)	Register an image to be used as a template for settings.
Select Image (Page 4-201)	Specify the image to be used for unit processing.
Inspect Region (Page 4-202)	Define the region to be used for unit processing.
Color (Page 4-203)	Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).
Image Enhance (Page 4-203)	Settings for pre-processing image filters.
Edge Detection (Page 4-204)	Settings for detecting and filtering edges to build a profile and model of the target outline.
Defect Detection (Page 4-206)	Specific conditions for processing a profile defect inspection.
Parameters (Page 4-207)	Additional optional parameters.
Limits (Page 4-209)	Unit pass / fail tolerances.
Display Options (Page 4-210)	Unit processing display settings.
Save (Page 4-212)	Save unit settings.

Register Image

An image can be saved to the controller to be used as a template for measurements and settings. It is recommended to adjust and fix lighting and other external influences before registering an image.



Live Image

Check this box to display live images through a continuous feed.

► Note

- A live feed is only available while the unit is being edited.
- This setting cannot be changed when the screen update mode is set to [Continuous] in the trigger settings (Page 4-25).
- If the capture on trigger input is disabled in the trigger settings (Page 4-25), this check box is always unchecked and the setting cannot be changed.
- When Live image is selected for a moving object, take care when registering as there will be a time lag between the external trigger input and the actual image capture.
- In principle, Live-image is only used when the capture unit being edited is being executed (waiting for a trigger input). When the image capture buffer is set to custom and the capture unit which was most recently executed is being edited, the images collected in the buffer will still be displayed even if the capture unit is not presently capturing images.
- Continuous update cannot be used when HDR capture (Page 4-21) is enabled or when a line scan camera is being used.
- When the HDR capture (Page 4-21) is enabled, the Multi-image cannot be used.

Select Image

Type

Select an image to register.

- **Captured Img.**: Displays the latest image from the specified camera (image variable).
- **Registered Img.**: The registered image specified in [Options] is displayed.

Select Camera

Select the number of the camera used for registration. Choose from Camera1 - Camera4, and select only the camera number used for the capture unit being edited.

Specifying a region

To register only part of an image, select [Edit] then specify the region to register. To cancel the selected region, select [Clear].

Save Image

Filename

Specify the registered image number used for image registration in the form "(Camera No.)-(User-specified No.)".

Reference

The name of the saved file is "ref (Camera No.)_(Specified No.)" (for full screen image registration) or "ref (Camera No.)_(Specified No.)_XXX_YYY" (for partial image registration).

JPEG

Check this box to save the image in JPEG format. When this box is not checked, the image will be saved in BMP format as either a 24-bit color bitmap image (when a color camera is used) or an 8-bit grayscale bitmap image (when a monochrome camera is used).

► Note

Using image compression may result in some image deterioration, thus results from a compressed image may differ to those when using non compressed images.

View All

View all registered images in a list.

Adjust Image Position

Adjust the position of the image being captured.

X

-Adjust the movement in the X (horizontal) direction between -8191.000 and 8191.000 pixels.

Y

-Adjust the movement in the Y (vertical) direction between -16383.000 and 16383.000 pixels.

Angle

Adjust the position angle (rotation) around the center of the image between -999.999° and 999.999°.

► Note

Position adjustment may cause missing peripheries (black areas) due to image movement or jagged edges (jaggies) due to rotation in the registered image.

Save

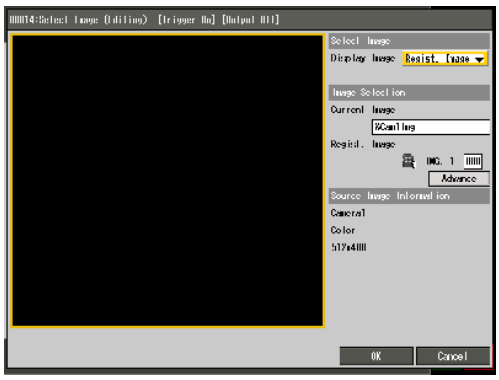
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Registered Img.] is selected for [Type], you can delete the registered image specified in [Options].

Select Image

Specify the image variable and associated registered image to be used for configuring the vision tool.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured Image**: Displays the latest image from the specified camera (image variable).
- **Registered Image**: The registered image specified under [Image Selection] is displayed.

Select image

Captured Img.

Set an image variable to be used as a current image for the unit.

Registered Img.

Specify the registered image No. for the registered image to be used.

- The registered images are managed as "Image (Camera No.) - (Registered image No.0 to 999)".
- The "Camera No" is fixed to the number of the camera associated to the image variable specified for the current image.

Advance

Set advance options for the switching of registered images as necessary.

- **Use numerical variable for registered image number**: To use a variable for the registered image No., check this box and assign a numerical or numerical array variable reference. By using a variable for the registered image No. and then issuing a variable reference value apply command (NU), the image is switched to the specified registered image in the variable and the reference image information is updated. For more details, see the XG-7000 Series Communication Control Manual.
- **Process variable when changing programs**: Use this option to switch to the registered image based on the initial value of the variable referenced when the program is changed or the controller is next turned on.

► Note

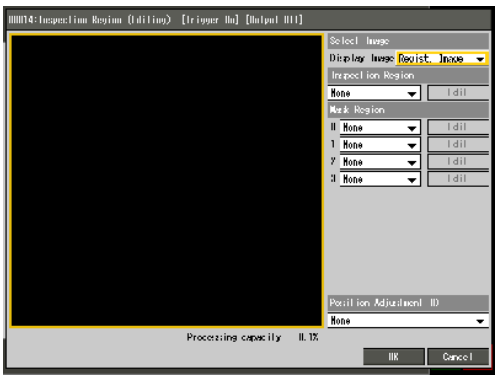
Note that the registered image No. does not switch in accordance with a change in the variable.

Source Image Information

The camera No., type (color / monochrome), and resolution of the camera associated to the image variable specified is displayed.

Inspection Region

Outline the region on the captured image to be used for inspection.



► Note

Changing the shape of the region will initialize or clear some of the settings in the [Edit Detection] and [Condition] menus.

Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Region

Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Inspection Region Menu" (Page 3-20) for more details.

► Note

- The inspection regions available for the profile defect measurement tool are rectangle, rotated rectangle, ring, and arc.
- The available functions and measurement items vary depending on the shape of the inspection region.

Mask region

A mask region is an area which can be defined in the inspection region and will be excluded from the inspection. Up to four mask regions can be set per inspection region. A mask region is typically used for hiding an area that does not require inspection.

Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Excluding Part of the Region" (Page 3-26) for more details.

Position Adjustment ID

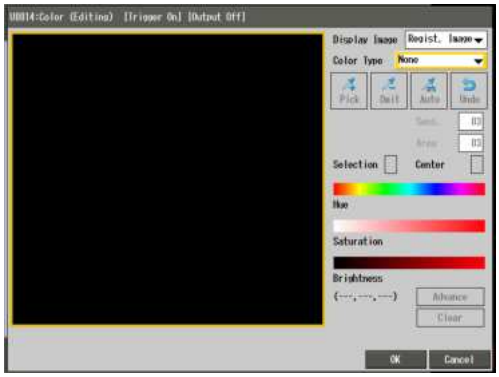
To apply position adjustment to the region, select the position adjustment unit to be referenced.

Reference

The position adjustment is applied to all inspection, mask, and image regions.

Color

When working with a color camera, convert the captured color image into a binary (black and white) or a grayscale converted image by extracting the desired color.



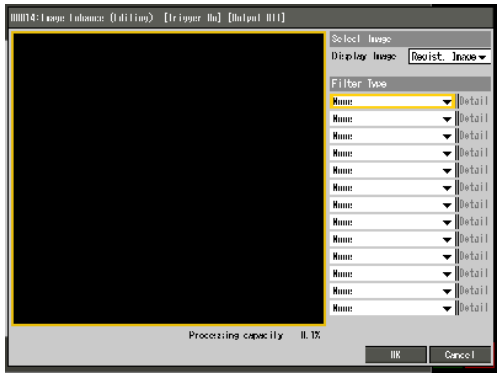
► Note

This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-295) is referenced as the current image.

Refer to "Working with Color Images (Color Extraction)" (Page 10-2) for concepts involving color extraction and its operation.

Image Enhance

Specify the filter processing to apply to the image.
When a color camera is used, the filter is applied to the images converted using color extraction.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Filter type

Select the [Filter Type] field and then select the filter to apply. To perform area measurement using a method other than color to binary, you must select the [Binary] filter as the last filter. See "Image Enhancement Filters" (Page 10-11) for more details of each filter processing.

► Note

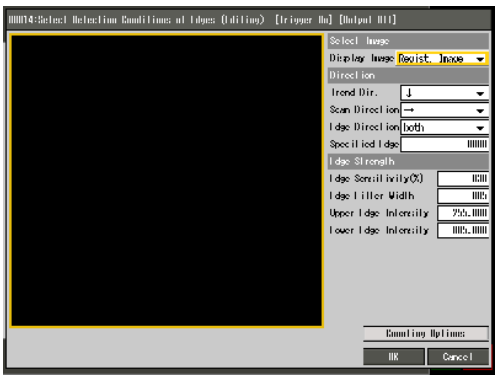
- For the area tool, [Binary] must be selected unless color to binary is used in the color extraction settings.
- If the binary filter is not selected or another filter is applied after the binary filter, the measurement result may not be correct.
- The binary, subtract and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 13 types of filters can be stacked according to application requirements. When multiple filters are set, they are processed one by one from the top.
- The order of the filters can be changed by selecting a filter in one of the [Filter Type] fields, holding down the No.1 (FUNCTION) button of the handheld controller, and then moving the 8-way key up or down.

Edge Detection

Specify settings for detecting edges on the target to build up the profile and mode base line from.



Reference

See "What is an Edge?" (Page 10-25) for the technical description on edge detection.

Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Direction

Trend direction

Select the edge segment movement direction.

- **When the inspection region is a rectangle**: → or ↓
- **If the inspection region is a rotated rectangle**: ↓ (top to bottom) only.
- **When the inspection region is a ring or an arc**: only clockwise is available.

► Note

If variable referencing is used for the scan direction, the reference setting may be canceled if there is a change in the trend direction.

Scan direction

Select the scan direction to detect an edge.

- **When the inspection region is a rectangle**: ↓ or ↑ (when the trend direction is →), → or ← (when the trend direction is ↓)
- **When the inspection region is a rotated rectangle**: Forward (from left to right), Reverse (from right to left)
- **When the inspection region is a ring or an arc**: Center → Out, Out → Center

Edge direction

Select the change in contrast for detecting an edge.

- **Both** (default): Detect edges in a transition that can change either from a bright area to a dark area or from a dark area to a bright area.
- **Light to Dark**: Detect edges in a transition that changes from a bright area to a dark area.
- **Dark to Light**: Detect edges in a transition that changes from a dark area to a bright area.

Specified edge

Specify the edge No. (-3600 to 3599) to be used within the segments.

- If a negative value is specified, the edge No. is counted in the order opposite to that of the scan direction.
- If the specified edge number is not found, the result of that segment is 0. If the specified edge number is not found, the result of that segment is 0. However, note that when [Undetected Point] in the [Parameters] menu is set to an option other than [Ignore], the result will be output according to that setting.

Edge Strength

Edge Sensitivity (%)

Set the percentage threshold (0% to 100%) for detecting edges.

Edge filter width

Set the width (0 to 100 pixels) of the smoothing filter applied to the differential graph for detecting edges.

Edge Intensity

- **Upper Edge Intensity**: Specify the upper limit (0.000 to 255.000) of edge intensity for detecting edges.
- **Lower Edge Intensity**: Specify the lower limit (0.000 to 255.000) of edge intensity for detecting edges.

Reference

It may be possible to exclude noisy edges in the segment by adjusting the upper and lower edge intensity values based on the highest edge intensity in the segment, shown on the left of the edge graph. See "What is an Edge?" (Page 10-25) for more details.

Segment Options

Display Image

Switch the image displayed on the screen.

- **Captured Img.**: Displays the latest image from the specified camera (image variable).
- **Registered Img.**: Displays the registered image specified under [Image Selection].

Segment Size

Specify the size of the segment in the inspection region.

- When the inspection region is a rectangle or a rotated rectangle: Specify a value between 1 and 9999 pixels. If the segment size is larger than the size of the inspection region, a measurement error will occur.
- When the inspection region is a ring or an arc: Specify a value between 0.01 and 359.99°. If the segment size is larger than the inspection region, a measurement error will occur.

Segment Shift

Specify the shifting distance of the segment along the trend.

- When the inspection region is a rectangle or a rotated rectangle: Specify a value between 0.01 and 9999.99 pixels.
- When the inspection region is a ring or an arc: Specify a value between 0.01 and 359.99°.

Segment Offset

Specify the offset (distance or angle) of the first segment in the inspection region. If an error occurs due to no edge points near the beginning of the inspection region, offset the segment to a better location.

- When the inspection region is a rectangle or a rotated rectangle: Specify a value between 0 and 9999 pixels.
- When the inspection region is a ring or an arc: Specify a value between 0.00 and 359.99°.

Segment No.

Specify the segment No. (0 to 4999) to be shown on the edge graph.

► Note

The number of segments set in the current inspection region is updated automatically according to the change in the segment size and shift. The maximum number of segments is 5000, but the actual number of segments that can be set may be lower depending on other settings.

Reference

During operation, the screen displays the position, edge graph, edge intensity value, and measurement results of the segment specified as the primary target. Changing the primary target is useful for checking the detection status of specific segments.

Angled edge detection

Set to [ON] to stabilize the detection of slanted edges in the inspection region. Using this option may affect the edge X, Y position accuracy.

Segment count

Specify the maximum number of segments (1 to 5000) which can be used. The segment count cannot exceed the [Maximum Segment Count] value.

► Note

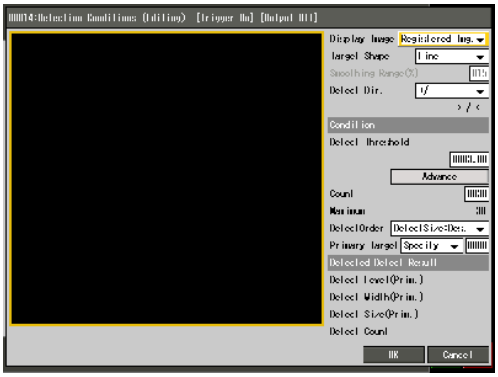
- The maximum number of segments available for detection can vary based on other settings.
- Based on specific settings, the maximum number of segments is fixed and cannot be changed.

Reference

The [Segment Count] value can be set higher than the [Maximum Segment Count] value (Maximum: 5000) depending on the account settings. Note this also increases the [Maximum Segment Count] value, resulting in additional consumption of program memory.

Defect Detection

Specify the conditions for detecting multiple edge positions that make up a profile and identification of deviations to the profile.



Display Image

Switch the image displayed on the screen.

- **Captured Img.**: Displays the latest image from the specified camera (image variable).
- **Registered Img.**: Displays the registered image specified under [Image Selection].

Target shape

Select the model line similar to that of the target shape to be used as a reference for the profile.

- **Line**: Use a straight line as the reference model line (when the inspection region is a rectangle or a rotated rectangle).
- **Circle**: Use a circle as the reference model line.
- **Oval:** Use an oval as the reference model line (when the inspection region is a ring or an arc).
- **Free Curve:** Use a free curve as the reference model line.

Smoothing Range (%)

When [Free Curve] is selected as the [Target Shape], specify the percentage (with respect to all segments) of smoothing for the curve. Increase the smoothing range to make the reference model line smoother, or reduce it for a finer sharp change.

Detection direction

Select the direction to search for a defect.

- **+**: Detect changes in the + direction only.
- **-**: Detect changes in the - direction only.
- **+/-**: Detect changes in both the + and - directions.
- **+/- (Indiv.)**: Detect changes in both the + and - directions. This option enables the detection thresholds for defects in the + and - directions to be set individually.

Reference

A reference is shown on screen to indicate the scan direction based on the shape of the inspection region. The + sign indicates the direction is the same as the scan direction while the - sign indicates the direction is opposite to the scan direction.

Condition

Detection threshold

Set the threshold value for the defect level (0to 9999.99) as the threshold level (defect level) for identifying defects.

Advance

Use this option to specify the detection conditions in detail. Using the [Advance] menu options can help filter out falsely detected defects.

- **Display Image**: Switch the image displayed on the screen.
  - **Captured Img.**: Displays the latest image from the specified camera (image variable).
  - **Registered Img.**: Displays the registered image specified under [Image Selection].
- **Defect Level Filter:**
  - **Upper**: Specify the upper limit of the defect level to detect defects (0.00 to 9999.99).
  - **Lower**: Specify the lower limit of the defect level to detect defects (0.00 to 9999.99).
- **Defect Width Filter:**
  - **Upper**: Specify the upper limit of the defect width to detect defects (0 to 9999).
  - **Lower**: Specify the lower limit of the defect width to detect defects (0 to 9999).
- **Defect Size Filter:**
  - **Upper**: Specify the upper limit of the defect size to detect defects (0.00 to 9999999.99).
  - **Lower**: Specify the lower limit of the defect size to detect defects (0.00 to 9999999.99).

Count

Specify the maximum number of defects (1 to 9999) to be detected. When [3] is specified, the process searches for up to 3 defects.

► Note

- The maximum number of defects available for detection can change based on other settings.
- Based on specific settings, the number of defects is fixed and cannot be changed.

Reference

The [Count] value can be set higher than the [Maximum Count] value (Maximum: 5000) depending on the account setting. Note this also increases the [Maximum Count] value, resulting in additional consumption of program memory.

Detection order

Select the identification order of the defects. From the 12 options below.

- **Seg.: Ascend**: Sort defects based on smallest segment No. to largest.
- **Seg.: Descend**: Sort defects based on largest segment No. to smallest.
- **X**: Ascend: Sort groups in ascending X order.
- **X: Descend**: Sort groups in descending X order.
- **Y: Ascend**: Sort groups in ascending Y order.
- **Y: Descend**: Sort groups in descending Y order.
- **DefectLevel:Asc.**: Sort defects from lowest defect level to highest.
- **DefectLevel:Des.**: Sort defects from highest defect level to lowest.
- **DefectWidth:Asc.**: Sort defects from lowest defect width to highest.
- **DefectWidth:Des.**: Sort defects from highest defect width to lowest.
- **Defect Size: Asc.**: Sort defects from lowest defect size to highest.
- **Defect Size: Des.**: Sort defects from highest defect size to lowest.

Primary target

Set the defect to be used for OK / NG judgment.

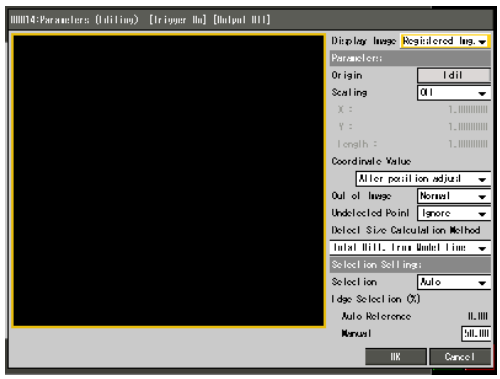
- **All**: Use the minimum and maximum values measured from all defects for the judgment.
- **Specify**: To judge only a particular defect, specify the No. of the defect used in judgment (0 to 4999). The measurement from the defect specified here is used for judgment.

Reference

- During operation, the defect graph, position and defect level of the defect segment specified as the primary target are displayed. Changing the defect segment is useful for checking the detection status of a specific defect.
- If [Primary Target] is set to [All], all the defect edge points will be displayed in green.

Parameters

Specify additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Parameters

Origin

By default, the origin is set to the top left corner of the camera but its location can be moved as required. To specify the origin, select [Edit] and then specify the coordinates.

Reference

The origin can be set outside the process region. The available range for the origin is -9600 to 9600 (X), -7200 to 7200 (Y).

Scaling

The controller processes image data in pixels, The result data and setting parameters used for display, judgement and calculations can be converted and scaled to real life values and dimensions by using the pre-set scaling factor option.

- **OFF**: Do not use scaling.
- **ON**: Use scaling.

Reference

- The scaling factor can be changed from the [Option] menu of the Flowchart (Page 4-356).
- For a summary list of the result data for which scaling can be used, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

Coordinate value

Select the coordinate system to be used after position adjustment. If position adjustment is not used, this setting will have no effect on the measurement.

- **After position adjust**: The inspection uses the adjusted coordinate axes determined after position adjustment.
- **Before position adjust**: The distance from the position specified for the [Origin] of the inspection is used.

Out of Image

Specify whether to incorporate data that falls outside of the inspection region. This maybe required when position adjustment is used.

- **Normal (default)**: Edge detection outside of the region is disabled as the image data outside of the region is masked. Since masking requires time to process, the inspection time may vary depending on the quantity image data outside the region. Processing will take longer when the inspection region is a ring or an arc.
- **Fast**: The image data outside of the region is not masked, allowing for faster processing. As the image data outside the region has not been masked so there is an increased chance of detecting an edge outside the region. Select [Normal] to avoid incorrect edge detection.

Reference

Image data which is already located outside of the region during the inspection region setting will always be masked regardless of the [Out of Image] setting.

Undetected point

Use this setting for handling the defect level for where no edge points are detected.

- **Ignore**: Undetected points are treated as having a defect level of 0.
- **Maximize**: Undetected points are treated as having the maximum value in the edge scan direction.
- **Minimize**: Undetected points are treated as having the minimum value in the edge scan direction.
- **Fill**: The defect level of undetected points is determined from the surrounding area.

► Note

Selecting [Fill] increases processing time.

Defect size calculation method

Select a defect size calculation method.

- **Total Diff. From Model Line**: The total difference from the base model line is used as the defect size.
- **Total Diff. From Threshold**: The total difference from the [Detect Threshold] value set in the [Select Detection Conditions] menu is used as the defect size.

Selection Rate Settings

- **Selection Rate**: Select the culling rate of detection data to create a model line. To increase (for a more precise baseline) or decrease (for faster processing) the number of detection points used to create the base model line, select [Manual] and then specify the cull rate.
  - **Auto**: Set the culling rate automatically.
  - **Manual**: Set the desired culling rate.

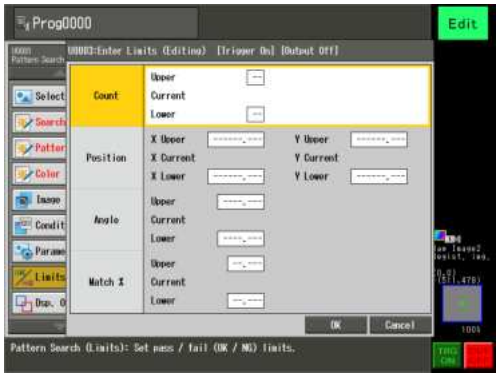
► Note

Setting the cull rate too high will make the base model line undetectable.

- **Edge selection rate(%)**: When [Manual] is selected for the [Selection Rate], specify the culling rate between 0 and 99.99%.

Limits

Set pass / fail tolerances (upper and lower limits) for the inspection.
If the result is outside of the specified tolerance range, it is judged as [NG] (binary 1). If the result is within the tolerance range, it is judged as [OK] (binary 0).



Use [Direct Input] to enter a value and set the tolerance.

Reference

- [-----] indicates an empty state where no tolerance is set. In this state, no judgment will be performed on the measurement.
- To reset the tolerance setting to an empty state, select [Clear].

Detected Segments

Specify the tolerance for the segment detection count.
The unit of measurement is the "number of segments" detected.

Defect count

Specify the tolerance for the detected defect count.
The unit of measurement is the "number of defects" detected.

Total size

Specify the tolerance for the total size of all defects.
The unit of measurement is the "number of pixels".

Defect size

Specify the tolerance of the defect size.
The unit of measurement is the "number of pixels".

Defect Position

Specify the tolerance for the center of gravity of the defect.
The unit of measurement is the "number of pixels" indicating the center of gravity coordinates.

Display Options

The display color of the units visual indicators can be changed based on the judgment result for that unit. The visual indicator can also be made transparent by selecting [Setting] - [Select Color] - [None].



Inspection region

Specify the line width and display color of the inspection region.

Mask region

Specify the line width and display color of the mask region.

Detected Point

Display Target

Specify how to display the detected defect points.

- **OFF:** Hide the detected points.
- **Primary target:** Show the detected defect points for the primary target.
- **All** (default)**:** Show the detected points for all the defect defects.

Primary target

Specify the width and display color of the line indicating the detected defect.

Other target

Specify the width and display color of the line indicating the detected defect other than the one specified as the primary target (Page 4-207).

Defect Graph

Defect graph display

Specify whether to display the defect graph or not.

- **ON**: Display the defect graph.
- **OFF** (default): Hide the defect graph.

► Note

Selecting [ON] will increase the processing time.

Wave

Specify the width and display color of the defect graph waveform.

Frame

Specify the width and display color of the defect graph frame.

Detect threshold

Specify the width and display color of the line representing the detection threshold.

Filter lower limits

Specify the width and display color for the line representing the lower limit of the defect level filter.

► Note

Setting [Defect graph] to [ON] consumes additional program memory. Check the amount of remaining program memory before enabling.

Edge Graph

Edge Graph

Select whether to display the edge graph.

- **OFF** (default): Hide the edge graph.
- **Primary Target**: Display the edge graph of the segment specified at [Primary Target] which has the maximum defect level.

Wave

Specify the width and display color of the edge graph waveform.

Frame

Specify the width and display color of the edge graph frame.

Sensitivity

Specify the width and display color of the line representing the edge sensitivity threshold.

► Note

Setting [Edge Graph] to [Primary Target] consumes additional program memory. Check the amount of remaining program memory before enabling.

Edge point

Edge point

Specify how to display the edge point detected during operation.

- **OFF** (default)**:** Hide the edge detection point display.
- **Primary target:** Display the detected edge point of the segment specified at [Primary Target] which has the maximum defect level.
- **Primary target, Max/Min:** Display the detected edge points of the three segments: The segment specified at [Primary Target] and those with maximum defect levels on the + and - sides respectively.

Profile

Specify whether to display the line connecting the detection point in the segment and the edge detection point.

- **OFF:** Hide the profile.
- **ON** (default)**:** Display the profile.

Segments

Select whether to display the segments.

- **OFF** (default)**:** Hide the segments.
- **ON:** Show the segments.

► Note

If the segment size is larger than the segment shift, the segments will not be displayed. When the edge graph is set to be displayed, the segment of the corresponding edge will be shown even if [Segments] is set to [OFF].

Model line

Specify the line width and display color of the base model line.

Processing Priority

Specify the processing priority when displaying large processed images during Run mode.
When a line scan camera is used with the XG-7502A, it is not possible to display the processed image if the image size exceeds 25 MB (26214400 pixels). In such a case it is possible to display the filtered image and contrast image by using a display image variable.

Filtered image

Select whether or not to use a display image variable for the filtered image display.

- **Unit Processing**: Processes the filtered image without using the display image variable.
- **Image Display**: Processes the filtered image using a display image variable.

Reference

- When processing images 25 MB or less, or when using the XG-7702A, it is not necessary to select [Image Display].
- When processing an image larger than 25 MB, if the area displayed is 8 MB (8388608 pixels) or less, the filtered image will be automatically displayed when [Unit Priority] is selected. (However the following processes are excluded.)
  - Image enhancement: Shading correction, blob filter
  - Conversion (image operation): Rotate/translate, zoom, trapezoid correction, blob filter
  - Defect, Grayscale Blob: Contrast display

► Note

When [Image Display] is selected for [Filtered Image], the following restrictions on operation occur.

- Processing time increases.
- The background outside the inspection region becomes a black image.
- Displaying of multiple units is not possible.
- For display of registered images outside of unit edit, the filtered image cannot be displayed and the display is the same as when [Unit Processing] is set.
- When an archived image is displayed, it ix not possible to display the processed image unless the display image variable and results are also stored in the archive.

Image variable

Specify a display image variable for displaying the filtered image.

Reset

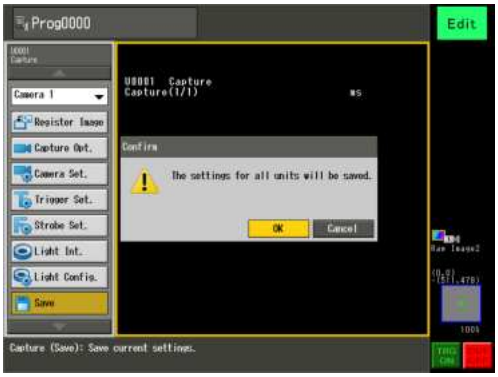
Returns the display options to their defaults.

Save

Save the current unit changes the program file.

► Note

- If the device is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the system power while you are saving the settings. Doing so may cause errors in the internal data



Save

The settings for the unit are saved in the current program file in SD Card 1 or SD Card 2.

► Note

Items specified not to be saved in XG VisionEditor are excluded from the saving operation.
For example, variable values changed in the current program or the default display, and display parts, can be excluded when saving.

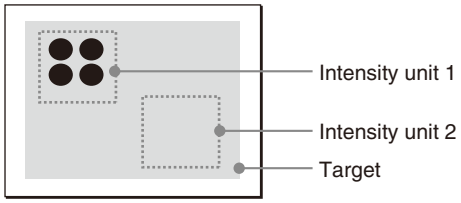
Intensity

Intensity Tool

The intensity tool measures the maximum, minimum, average, and deviation of the grayscale intensity (brightness) within the inspection region.
This tool can be used for checking the presence/absence of parts based on the difference of intensity values between the target and background.

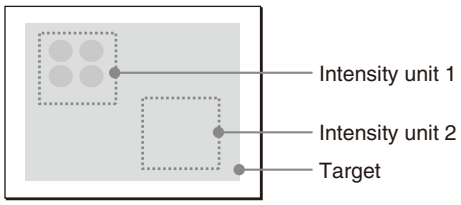
Image processing

When the intensity difference is large



- Average intensity of intensity unit 1: 50
- Average intensity of intensity unit 2: 200
- Intensity difference: 150

When the intensity difference is small



- Average intensity of intensity unit 1: 150
- Average intensity of intensity unit 2: 200
- Intensity difference: 50

Processing results

The standard results and data returned by the intensity tool are as follows:

Average intensity	Outputs the average intensity in the inspection region on a scale of 0 to 255 (levels). Tolerance inspection target
Maximum intensity	Outputs the maximum intensity (the brightest part) in the inspection region. Tolerance inspection target
Minimum intensity	Outputs the minimum intensity (the darkest part) in the inspection region. Tolerance inspection target
Deviation	Outputs the intensity deviation in the inspection region. This deviation represents the variation level (standard deviation) calculated from the intensity of each pixel in the inspection region. Tolerance inspection target
Unit judgment value	Outputs the binary result of the unit based on the measured value and the specified tolerance range (upper / lower limits). The unit is judged as [NG] (binary 1) when outside the tolerance range and [OK] (binary 0) when inside.

Reference

- When [Color to Binary] or [Color to Gray] extraction is used, the black-and-white image after the color extraction process is used for the intensity measurement.
- For the lists of available measurement output values and setting parameters, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

Main Menu

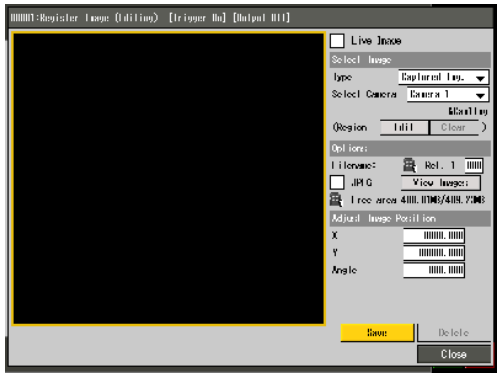
The main menu of the intensity tool consists of the following options. Configure settings under each option as required for the inspection.



Register Image (Page 4-214)	Register an image to be used as a template for settings.
Select Image (Page 4-216)	Specify the image to be used for unit processing.
Inspect Region (Page 4-217)	Define the region to be used for unit processing.
Color (Page 4-218)	Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).
Image Enhance (Page 4-218)	Settings for pre-processing image filters.
Parameters (Page 4-219)	Additional optional parameters.
Limits (Page 4-220)	Unit pass / fail tolerances.
Display Options (Page 4-220)	Unit processing display settings.
Save (Page 4-221)	Save unit settings.

Register Image

An image can be saved to the controller to be used as a template for measurements and settings. It is recommended to adjust and fix lighting and other external influences before registering an image.



Live Image

Check this box to display live images through a continuous feed.

► Note

- A live feed is only available while the unit is being edited.
- This setting cannot be changed when the screen update mode is set to [Continuous] in the trigger settings (Page 4-25).
- If the capture on trigger input is disabled in the trigger settings (Page 4-25), this check box is always unchecked and the setting cannot be changed.
- When Live image is selected for a moving object, take care when registering as there will be a time lag between the external trigger input and the actual image capture.
- In principle, Live-image is only used when the capture unit being edited is being executed (waiting for a trigger input). When the image capture buffer is set to custom and the capture unit which was most recently executed is being edited, the images collected in the buffer will still be displayed even if the capture unit is not presently capturing images.
- Continuous update cannot be used when HDR capture (Page 4-21) is enabled or when a line scan camera is being used.
- When the HDR capture (Page 4-21) is enabled, the Multi-image cannot be used.

Select Image

Type

Select an image to register.

- **Captured Img.**: Displays the latest image from the specified camera (image variable).
- **Registered Img.**: The registered image specified in [Options] is displayed.

Select Camera

Select the number of the camera used for registration. Choose from Camera1 - Camera4, and select only the camera number used for the capture unit being edited.

Specifying a region

To register only part of an image, select [Edit] then specify the region to register. To cancel the selected region, select [Clear].

Save Image

Filename

Specify the registered image number used for image registration in the form "(Camera No.)-(User-specified No.)".

Reference

The name of the saved file is "ref (Camera No.)_(Specified No.)" (for full screen image registration) or "ref (Camera No.)_(Specified No.)_XXX_YYY" (for partial image registration).

JPEG

Check this box to save the image in JPEG format. When this box is not checked, the image will be saved in BMP format as either a 24-bit color bitmap image (when a color camera is used) or an 8-bit grayscale bitmap image (when a monochrome camera is used).

► Note

Using image compression may result in some image deterioration, thus results from a compressed image may differ to those when using non compressed images.

View All

View all registered images in a list.

Adjust Image Position

Adjust the position of the image being captured.

X

-Adjust the movement in the X (horizontal) direction between -8191.000 and 8191.000 pixels.

Y

-Adjust the movement in the Y (vertical) direction between -16383.000 and 16383.000 pixels.

Angle

Adjust the position angle (rotation) around the center of the image between -999.999° and 999.999°.

► Note

Position adjustment may cause missing peripheries (black areas) due to image movement or jagged edges (jaggies) due to rotation in the registered image.

Save

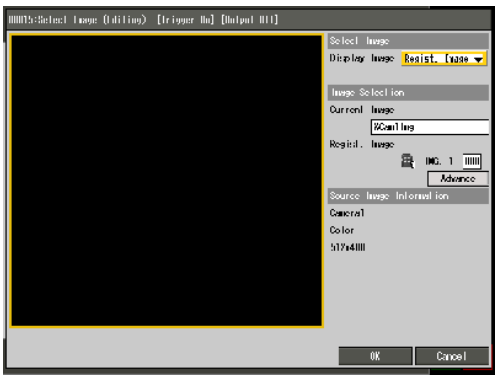
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Registered Img.] is selected for [Type], you can delete the registered image specified in [Options].

Select Image

Specify the image variable and associated registered image to be used for configuring the vision tool.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured Image**: Displays the latest image from the specified camera (image variable).
- **Registered Image**: The registered image specified under [Image Selection] is displayed.

Select image

Captured Img.

Set an image variable to be used as a current image for the unit.

Registered Img.

Specify the registered image No. for the registered image to be used.

- The registered images are managed as "Image (Camera No.) - (Registered image No.0 to 999)".
- The "Camera No" is fixed to the number of the camera associated to the image variable specified for the current image.

Advance

Set advance options for the switching of registered images as necessary.

- **Use numerical variable for registered image number**: To use a variable for the registered image No., check this box and assign a numerical or numerical array variable reference. By using a variable for the registered image No. and then issuing a variable reference value apply command (NU), the image is switched to the specified registered image in the variable and the reference image information is updated. For more details, see the XG-7000 Series Communication Control Manual.
- **Process variable when changing programs**: Use this option to switch to the registered image based on the initial value of the variable referenced when the program is changed or the controller is next turned on.

► Note

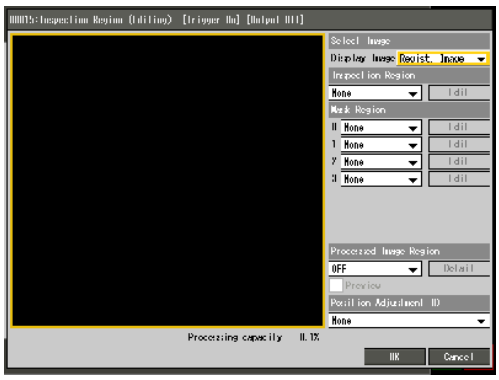
Note that the registered image No. does not switch in accordance with a change in the variable.

Source Image Information

The camera No., type (color / monochrome), and resolution of the camera associated to the image variable specified is displayed.

Inspection Region

Outline the region on the captured image to be used for inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Region

Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Inspection Region Menu" (Page 3-20) for more details.

Mask region

A mask region is an area which can be defined in the inspection region and will be excluded from the inspection. Up to four mask regions can be set per inspection region. A mask region is typically used for hiding an area that does not require inspection.
Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Excluding Part of the Region" (Page 3-26) for more details.

Processed image region

Use processed image region to generate a region for inspection based on an image. (Page 4-295), select [ON] and then select [Detail] for configuration.

Reference

Refer to "Generating a Region from an Image" (Page 3-27) for more details on processed image region.

Image

Specify the image variable to be used for generating the region.

Area

Specify the area and border color for the region based on the image specified in the image variable. Select either [Black] (Level 0) or [White] (Level 255, default).

Preview

Use this checkbox to display the specified image. When the checkmark is removed, the display returns to its normal state.

Position Adjustment ID

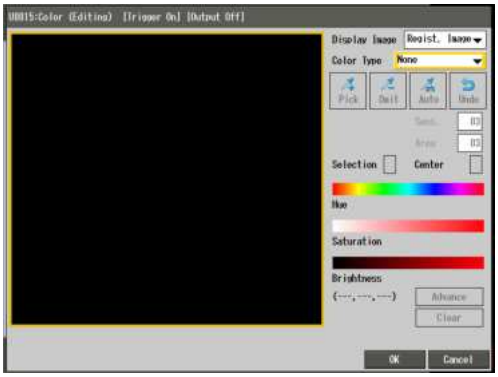
To use position adjustment for the region, select the position adjustment unit to be referenced.

Reference

The position adjustment is applied to all inspection, mask, and image regions.

Color

When working with a color camera, convert the captured color image into a binary (black and white) or a grayscale converted image by extracting the desired color.



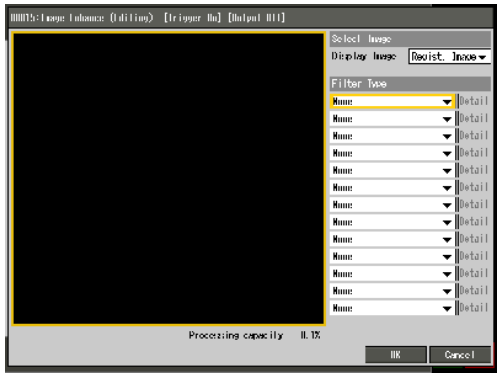
► Note

This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-295) is referenced as the current image.

Refer to "Working with Color Images (Color Extraction)" (Page 10-2) for concepts involving color extraction and its operation.

Image Enhance

Specify the filter processing to apply to the image. When a color camera is used, the filter is applied to the images converted using color extraction.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Filter type

Select the [Filter Type] field and then select the filter to apply. To perform area measurement using a method other than color to binary, you must select the [Binary] filter as the last filter. See "Image Enhancement Filters" (Page 10-11) for more details of each filter processing.

► Note

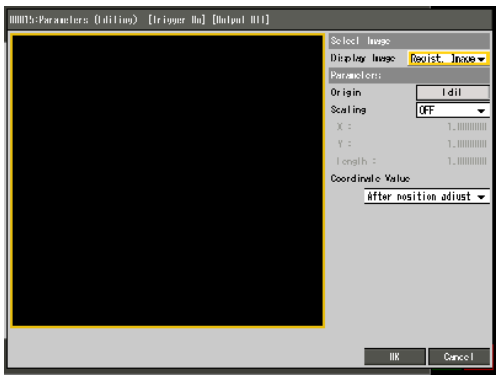
- For the area tool, [Binary] must be selected unless color to binary is used in the color extraction settings.
- If the binary filter is not selected or another filter is applied after the binary filter, the measurement result may not be correct.
- The binary, subtract and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 13 types of filters can be stacked according to application requirements. When multiple filters are set, they are processed one by one from the top.
- The order of the filters can be changed by selecting a filter in one of the [Filter Type] fields, holding down the No.1 (FUNCTION) button of the handheld controller, and then moving the 8-way key up or down.

Parameters

Specify additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Parameters

Origin

By default, the origin is set to the top left corner of the camera but its location can be moved as required. To specify the origin, select [Edit] and then specify the coordinates.

Reference

The origin can be set outside the process region. The available range for the origin is -9600 to 9600 (X), -7200 to 7200 (Y).

Scaling

The controller processes image data in pixels, The result data and setting parameters used for display, judgement and calculations can be converted and scaled to real life values and dimensions by using the pre-set scaling factor option.

- **OFF**: Do not use scaling.
- **ON**: Use scaling.

Reference

- The scaling factor can be changed from the [Option] menu of the Flowchart (Page 4-356).
- For a summary list of the result data for which scaling can be used, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

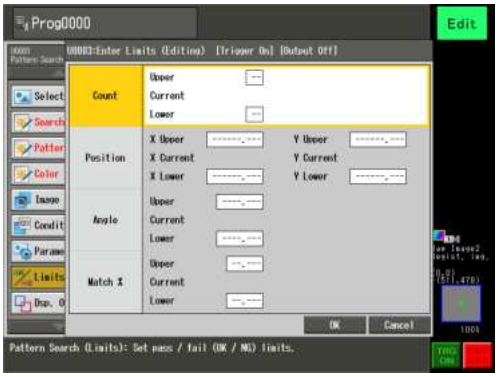
Coordinate value

Select the coordinate system to be used after position adjustment. If position adjustment is not used, this setting will have no effect on the measurement.

- **After position adjust**: The inspection uses the adjusted coordinate axes determined after position adjustment.
- **Before position adjust**: The distance from the position specified for the [Origin] of the inspection is used.

Limits

Set pass / fail tolerances (upper and lower limits) for the inspection.
If the result is outside of the specified tolerance range, it is judged as [NG] (binary 1). If the result is within the tolerance range, it is judged as [OK] (binary 0).



Use [Direct Input] to enter a value and set the tolerance.

Reference

- [-----] indicates an empty state where no tolerance is set. In this state, no judgment will be performed on the measurement.
- To reset the tolerance setting to an empty state, select [Clear].

Average

Specify the tolerance for the detected average intensity.
The unit of measurement is the "grayscale level" indicating the average intensity (0 to 255).

Deviation

Specify the tolerance for the deviation of the detected intensity.
The unit of measurement is the "grayscale level" indicating the deviation.

Intensity

Specify the tolerance for the maximum and minimum values of the detected intensity.
The unit of measurement is the "grayscale level" indicating the intensity (0 to 255).

Display Options

The display color of the units visual indicators can be changed based on the judgment result for that unit. The visual indicator can also be made transparent by selecting [Setting] - [Select Color] - [None].



Inspection region

Specify the line width and display color of the inspection region.

Mask region

Specify the line width and display color of the mask region.

Processing Priority

Specify the processing priority when displaying large processed images during Run mode.
When a line scan camera is used with the XG-7502A, it is not possible to display the processed image if the image size exceeds 25 MB (26214400 pixels). In such a case it is possible to display the filtered image and contrast image by using a display image variable.

Filtered image

Select whether or not to use a display image variable for the filtered image display.

- **Unit Processing**: Processes the filtered image without using the display image variable.
- **Image Display**: Processes the filtered image using a display image variable.

Reference

- When processing images 25 MB or less, or when using the XG-7702A, it is not necessary to select [Image Display].
- When processing an image larger than 25 MB, if the area displayed is 8 MB (8388608 pixels) or less, the filtered image will be automatically displayed when [Unit Priority] is selected. (However the following processes are excluded.)
  - Image enhancement: Shading correction, blob filter
  - Conversion (image operation): Rotate/translate, zoom, trapezoid correction, blob filter
  - Defect, Grayscale Blob: Contrast display

► Note

When [Image Display] is selected for [Filtered Image], the following restrictions on operation occur.

- Processing time increases.
- The background outside the inspection region becomes a black image.
- Displaying of multiple units is not possible.
- For display of registered images outside of unit edit, the filtered image cannot be displayed and the display is the same as when [Unit Processing] is set.
- When an archived image is displayed, it ix not possible to display the processed image unless the display image variable and results are also stored in the archive.

Image variable

Specify a display image variable for displaying the filtered image.

Reset

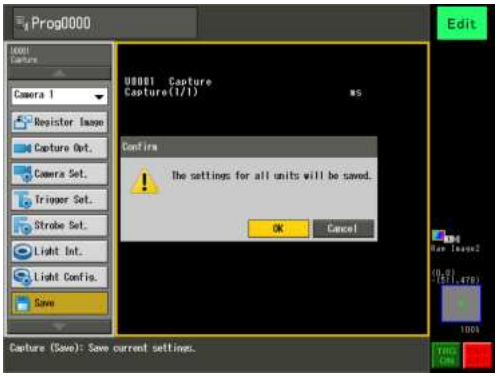
Returns the display options to their defaults.

Save

Save the current unit changes the program file.

► Note

- If the device is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the system power while you are saving the settings. Doing so may cause errors in the internal data



Save

The settings for the unit are saved in the current program file in SD Card 1 or SD Card 2.

► Note

Items specified not to be saved in XG VisionEditor are excluded from the saving operation.
For example, variable values changed in the current program or the default display, and display parts, can be excluded when saving.

Color

Color Tool

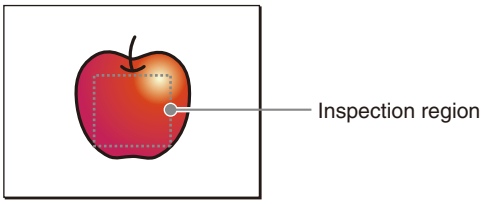
The color tool measures the average, deviation and intensity of the color information within the inspection region. The measurement can be based on Red/Green/Blue or Hue/Saturation/Brightness values. Acquiring the color information allows for the differentiation of targets and conditions through detailed, fine inspection of specific color elements.

► Note

The results of the color tool will vary based on changes in the surrounding environment, CCD differences between cameras, controller chipsets, and the white balance settings. Due to the measurement principle, false measurements may become greater when inspecting achromatic and or dark colors, or in environments with insufficient ambient light. Be sure to confirm settings and results for the actual inspection after there have been changes to the camera, measurement target, or surrounding environment.

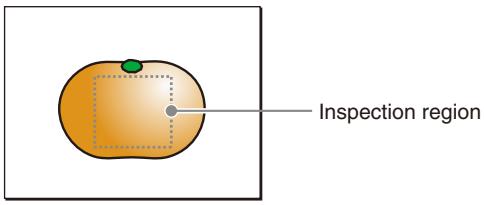
Image processing

Example of measuring a red object



- R-Ave: 200
- G-Ave: 50
- B-Ave: 50

Example of measuring an orange object



- R-Ave: 250
- G-Ave: 200
- B-Ave: 40

Processing results

The standard results and data returned by the color tool are as follows:

Average intensity	Outputs the average RGB or HSB intensity in the inspection region on a scale of 0 to 255 (levels). Tolerance inspection target
Deviation	Outputs the RGB or HSB intensity deviation in the inspection region. Tolerance inspection target
Maximum intensity	Outputs the RGB or HSB maximum intensity in the inspection region. Tolerance inspection target
Minimum intensity	Outputs the RGB or HSB minimum intensity in the inspection region. Tolerance inspection target
Unit judgment value	Outputs the binary result of the unit based on the measured value and the specified tolerance range (upper / lower limits). The unit is judged as [NG] (binary 1) when outside the tolerance range and [OK] (binary 0) when inside.

Reference

- See "The HSB Color System" (Page 10-8) for color information parameters for the HSB mode.
- For the lists of available measurement output values and setting parameters, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

► Note

The maximum and minimum intensity values of H in HSB mode are be fixed to 0 as hue is measured on a circular scale.

Main Menu

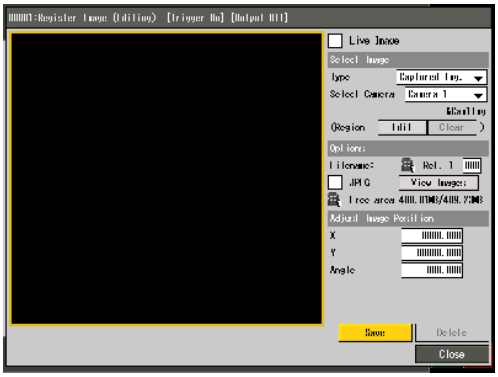
The main menu of the color tool consists of the following options. Configure settings under each option as required for the inspection.



Register Image (Page 4-223)	Register an image to be used as a template for settings.
Select Image (Page 4-225)	Specify the image to be used for unit processing.
Inspect Region (Page 4-226)	Define the region to be used for unit processing.
Condition (Page 4-227)	Specific conditions for processing a color inspection.
Parameters (Page 4-227)	Additional optional parameters.
Limits (Page 4-228)	Unit pass / fail tolerances.
Display Options (Page 4-229)	Unit processing display settings.
Save (Page 4-230)	Save unit settings.

Register Image

An image can be saved to the controller to be used as a template for measurements and settings. It is recommended to adjust and fix lighting and other external influences before registering an image.



Live Image

Check this box to display live images through a continuous feed.

► Note

- A live feed is only available while the unit is being edited.
- This setting cannot be changed when the screen update mode is set to [Continuous] in the trigger settings (Page 4-25).
- If the capture on trigger input is disabled in the trigger settings (Page 4-25), this check box is always unchecked and the setting cannot be changed.
- When Live image is selected for a moving object, take care when registering as there will be a time lag between the external trigger input and the actual image capture.
- In principle, Live-image is only used when the capture unit being edited is being executed (waiting for a trigger input). When the image capture buffer is set to custom and the capture unit which was most recently executed is being edited, the images collected in the buffer will still be displayed even if the capture unit is not presently capturing images.
- Continuous update cannot be used when HDR capture (Page 4-21) is enabled or when a line scan camera is being used.
- When the HDR capture (Page 4-21) is enabled, the Multi-image cannot be used.

Select Image

Type

Select an image to register.

- **Captured Img.**: Displays the latest image from the specified camera (image variable).
- **Registered Img.**: The registered image specified in [Options] is displayed.

Select Camera

Select the number of the camera used for registration. Choose from Camera1 - Camera4, and select only the camera number used for the capture unit being edited.

Specifying a region

To register only part of an image, select [Edit] then specify the region to register. To cancel the selected region, select [Clear].

Save Image

Filename

Specify the registered image number used for image registration in the form "(Camera No.)-(User-specified No.)".

Reference

The name of the saved file is "ref (Camera No.)_(Specified No.)" (for full screen image registration) or "ref (Camera No.)_(Specified No.)_XXX_YYY" (for partial image registration).

JPEG

Check this box to save the image in JPEG format. When this box is not checked, the image will be saved in BMP format as either a 24-bit color bitmap image (when a color camera is used) or an 8-bit grayscale bitmap image (when a monochrome camera is used).

► Note

Using image compression may result in some image deterioration, thus results from a compressed image may differ to those when using non compressed images.

View All

View all registered images in a list.

Adjust Image Position

Adjust the position of the image being captured.

X

-Adjust the movement in the X (horizontal) direction between -8191.000 and 8191.000 pixels.

Y

-Adjust the movement in the Y (vertical) direction between -16383.000 and 16383.000 pixels.

Angle

Adjust the position angle (rotation) around the center of the image between -999.999° and 999.999°.

► Note

Position adjustment may cause missing peripheries (black areas) due to image movement or jagged edges (jaggies) due to rotation in the registered image.

Save

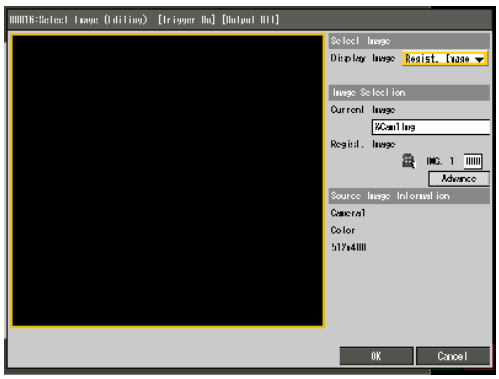
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Registered Img.] is selected for [Type], you can delete the registered image specified in [Options].

Select Image

Specify the image variable and associated registered image to be used for configuring the vision tool.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured Image**: Displays the latest image from the specified camera (image variable).
- **Registered Image**: The registered image specified under [Image Selection] is displayed.

Select image

Captured Img.

Set an image variable to be used as a current image for the unit.

Registered Img.

Specify the registered image No. for the registered image to be used.

- The registered images are managed as "Image (Camera No.) - (Registered image No.0 to 999)".
- The "Camera No" is fixed to the number of the camera associated to the image variable specified for the current image.

Advance

Set advance options for the switching of registered images as necessary.

- **Use numerical variable for registered image number**: To use a variable for the registered image No., check this box and assign a numerical or numerical array variable reference. By using a variable for the registered image No. and then issuing a variable reference value apply command (NU), the image is switched to the specified registered image in the variable and the reference image information is updated. For more details, see the XG-7000 Series Communication Control Manual.
- **Process variable when changing programs**: Use this option to switch to the registered image based on the initial value of the variable referenced when the program is changed or the controller is next turned on.

► Note

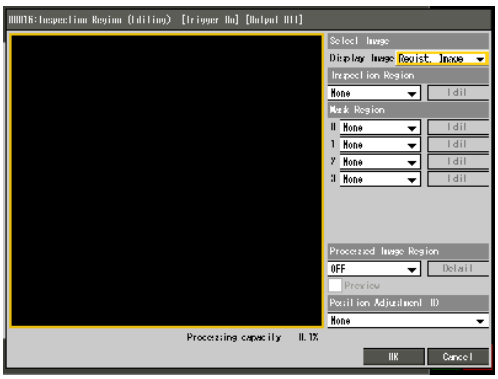
Note that the registered image No. does not switch in accordance with a change in the variable.

Source Image Information

The camera No., type (color / monochrome), and resolution of the camera associated to the image variable specified is displayed.

Inspection Region

Outline the region on the captured image to be used for inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

RegionRegion

Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Inspection Region Menu" (Page 3-20) for more details.

Mask region

A mask region is an area which can be defined in the inspection region and will be excluded from the inspection. Up to four mask regions can be set per inspection region. A mask region is typically used for hiding an area that does not require inspection.
Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Excluding Part of the Region" (Page 3-26) for more details.

Processed image region

Use processed image region to generate a region for inspection based on an image. (Page 4-295), select [ON] and then select [Detail] for configuration.

Reference

Refer to "Generating a Region from an Image" (Page 3-27) for more details on processed image region.

Image

Specify the image variable to be used for generating the region.

Area

Specify the area and border color for the region based on the image specified in the image variable. Select either [Black] (Level 0) or [White] (Level 255, default).

Preview

Use this checkbox to display the specified image. When the checkmark is removed, the display returns to its normal state.

Position Adjustment ID

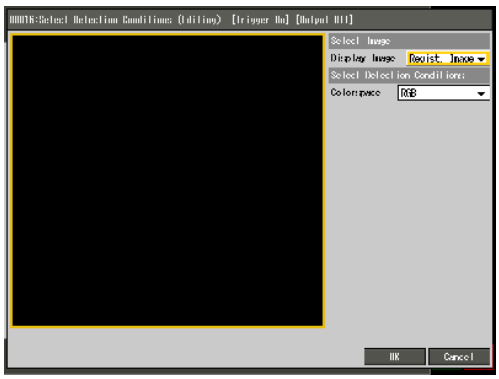
To use position adjustment for the region, select the position adjustment unit to be referenced.

Reference

The position adjustment is applied to all inspection, mask, and image regions.

Conditions

Specify the conditions for detecting the color of a target.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Detection Conditions

Colorspace

Select the colorspace type for the inspection.

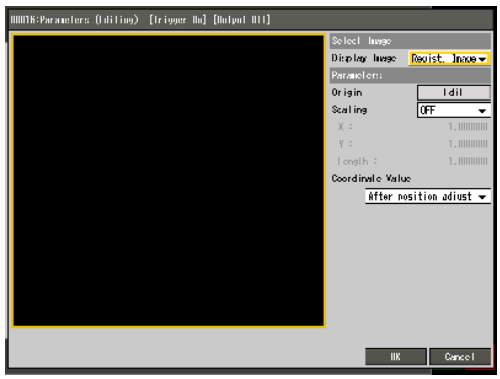
- **RGB** (default)**:** Measure colors in RGB (Red Green and Blue) terms.
- **HSB:** Measure colors in HSB (Hue, Saturation and Brightness) terms.

► Note

- The RGB and HSB parameters cannot be used simultaneously for measurement in the same unit.
- When [HSB] is selected, the maximum and minimum intensity value of H (Hue) are fixed to 0 as hue is measured on a circular scale.
- When an achromatic target is measured in [HSB] mode, the measured value of H (Hue) may be unstable due to the calculation principle.

Parameters

Specify additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Parameters

Origin

By default, the origin is set to the top left corner of the camera but its location can be moved as required. To specify the origin, select [Edit] and then specify the coordinates.

Reference

The origin can be set outside the process region. The available range for the origin is -9600 to 9600 (X), -7200 to 7200 (Y).

Scaling

The controller processes image data in pixels, The result data and setting parameters used for display, judgement and calculations can be converted and scaled to real life values and dimensions by using the pre-set scaling factor option.

- **OFF**: Do not use scaling.
- **ON**: Use scaling.

Reference

- The scaling factor can be changed from the [Option] menu of the Flowchart (Page 4-356).
- For a summary list of the result data for which scaling can be used, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

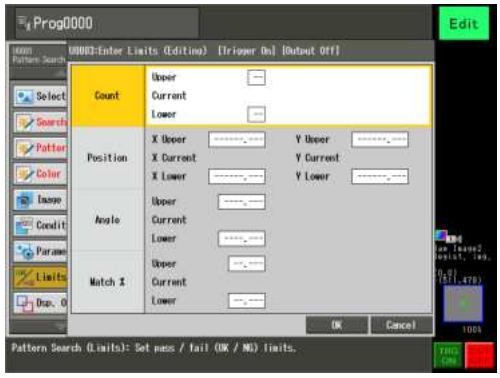
Coordinate value

Select the coordinate system to be used after position adjustment. If position adjustment is not used, this setting will have no effect on the measurement.

- **After position adjust**: The inspection uses the adjusted coordinate axes determined after position adjustment.
- **Before position adjust**: The distance from the position specified for the [Origin] of the inspection is used.

Limits

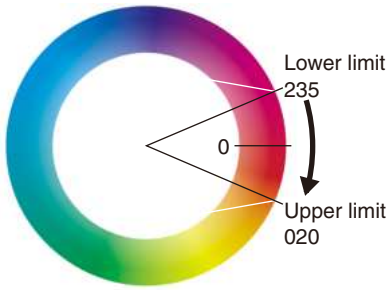
Set pass / fail tolerances (upper and lower limits) for the inspection.
If the result is outside of the specified tolerance range, it is judged as [NG] (binary 1). If the result is within the tolerance range, it is judged as [OK] (binary 0).



Use [Direct Input] to enter a value and set the tolerance.

Reference

- [-----] indicates an empty state where no tolerance is set. In this state, no judgment will be performed on the measurement.
- To reset the tolerance setting to an empty state, select [Clear].
- The upper intensity limit will be applied to the maximum intensity value, and the lower intensity limit will be applied to the minimum intensity value.
- When [HSB] is selected for [Colorspace], H (hue) is output as 0 to 255 in a looped fashion. This means that the lower limit can have a higher value than the upper limit.
  Example: When the range around R (hue value: 0) is judged OK



For more details about hue, see "The HSB Color System" (Page 10-8).

Average

Specify the tolerance for the average detected intensity. The unit of measurement is the [Color Level] indicating the average intensity (0 to 255).

Deviation

Specify the tolerance for the deviation of the detected intensity.
The unit of measurement is the "color level" indicating the deviation.

Intensity

Specify the tolerance for the maximum and minimum values of the detected intensity.
The unit of measurment is the [Color Level] indicating the intensity (0 to 255).

Display Options

The display color of the units visual indicators can be changed based on the judgment result for that unit. The visual indicator can also be made transparent by selecting [Setting] - [Select Color] - [None].



Inspection region

Specify the line width and display color of the inspection region.

Mask region

Specify the line width and display color of the mask region.

Reset

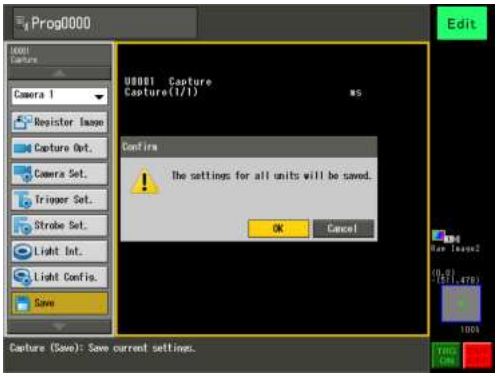
Returns the display options to their defaults.

Save

Save the current unit changes the program file.

► Note

- If the device is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the system power while you are saving the settings. Doing so may cause errors in the internal data



Save

The settings for the unit are saved in the current program file in SD Card 1 or SD Card 2.

► Note

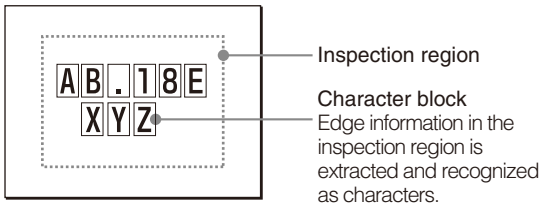
Items specified not to be saved in XG VisionEditor are excluded from the saving operation.
For example, variable values changed in the current program or the default display, and display parts, can be excluded when saving.

OCR

OCR Tool

A string of characters in the inspection region can be recognized, extracted and verified against a series of libraries and character variations stored in the program. The recognized string can be directly output to an external device or the string, along with its correlation and stability data can be compared against pre-set, encoded and offset criteria.
Allowing the OCR tool to verify and judge the quality of the string as well as capabilities for performing date, time, shift and serial code checks.

Image processing



Processing results

The standard results and data returned by the OCR tool are as follows:

Line 1 string	Outputs the character string recognized on the first line. Tolerance inspection target
Line 2 string	Outputs the character string recognized on the second line. Tolerance inspection target
Line 1 registered string	Outputs the registered character string that is used as judgment criteria for the first line.
Line 2 registered string	Outputs the registered character string that is used as judgment criteria for the second line.
Detected Character [ ]	Outputs all detected characters. Tolerance inspection target Label specification target
Registered Character [ ]	Outputs all registered characters which can be used for judgment. Label specification target
1st Candidate Character [ ]	Outputs all characters selected as first candidates from the recognition process. Label specification target
2nd Candidate Character [ ]	Outputs all characters selected as second candidates from the recognition process. Label specification target
1st Candidate Correlation [ ]	Outputs the correlation level (0 to 99%) of all first candidate characters from the recognition process based on the library data. Label specification target
2nd Candidate Correlation [ ]	Outputs the correlation level (0 to 99%) of all second candidate characters from the recognition process based on the library data. Label specification target
Stability [ ]	Outputs the correlation level (0 to 99%) difference between the first and second candidates for all the characters detected by the recognition process. Label specification target
Character Contrast [ ]	Outputs the character contrast level (0 to 99%) for all the extracted regions. Label specification target
Number of lines	Outputs the number of lines of characters.
Line 1 Number of Characters	Outputs the number of characters on the first line which have been detected by the recognition process.
Line 2 Number of Characters	Outputs the number of characters on the second line which have been detected by the recognition process.
Line 1 Correlation (max)	Outputs the maximum correlation value from the characters detected by the recognition process on the first line.
L1 Correlation (min)	Outputs the minimum correlation value from the characters detected by the recognition process on the first line. Tolerance inspection target

Line 1 Stability (max)	Outputs the maximum stability value from the characters detected by the recognition process on the first line.
L1 Stability (min)	Outputs the minimum stability value from the characters detected by the recognition process on the first line. Tolerance inspection target
Line 2 Correlation (max)	Outputs the maximum correlation value from the characters detected by the recognition process on the second line.
Line 2 Correlation (min)	Outputs the minimum correlation value from the characters detected by the recognition process on the second line. Tolerance inspection target
Line 2 Stability (max)	Outputs the maximum stability value from the characters detected by the recognition process on the second line.
Line 2 Stability (min)	Outputs the minimum stability value from the characters detected by the recognition process on the second line. Tolerance inspection target
Block position [ ]	Outputs the positions of all extraction blocks. Label specification target
Inspection region position	Outputs the position of the inspection region in pixels. (Available only for calculation referencing)
Unit judgment value	Outputs the binary result of the unit based on the measured value and the specified tolerance range (upper / lower limits). The unit is judged as [NG] (binary 1) when outside the tolerance range and [OK] (binary 0) when inside.

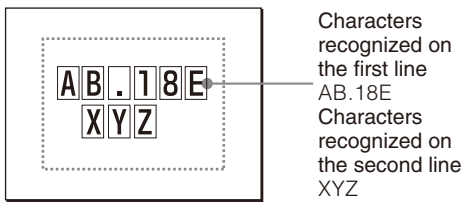
Reference

For the lists of available measurement output values and setting parameters, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

Example

Example showing the results of an OCR inspection performed under the following conditions:

- Number of lines: 2
- Number of characters on the first line: 6
- Number of characters on the second line: 3



Main Menu

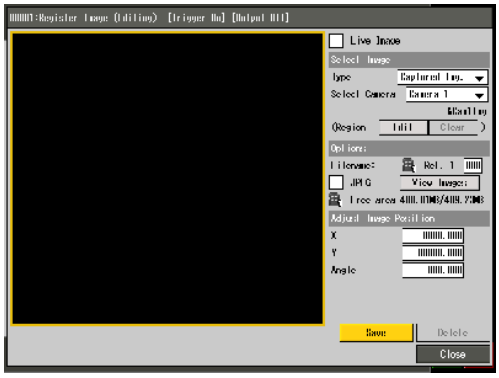
The main menu of the OCR tool consists of the following options. Configure settings under each option as required for the inspection.



Register Image (Page 4-233)	Register an image to be used as a template for settings.
Select Image (Page 4-234)	Specify the image to be used for unit processing.
Inspect Region (Page 4-235)	Define the region to be used for unit processing.
Color (Page 4-236)	Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).
Image Enhance (Page 4-237)	Settings for pre-processing image filters.
Block Set (Page 4-237)	Select the mode used for identifying and extracting individual characters from the inspection region.
Library (Page 4-239)	Register, add, delete and update the libraries of characters used for recognition .
Setup Calendar (Page 4-240)	Specify the allowable date / time (year, month, day, hour, minute, second) offset and error to the actual date / time of the controller.
Parameters (Page 4-241)	Additional optional parameters.
Limits (Page 4-242)	Unit pass / fail tolerances.
Display Options (Page 4-244)	Unit processing display settings.
Save (Page 4-246)	Save unit settings.

Register Image

An image can be saved to the controller to be used as a template for measurements and settings. It is recommended to adjust and fix lighting and other external influences before registering an image.



Live Image

Check this box to display live images through a continuous feed.

► Note

- A live feed is only available while the unit is being edited.
- This setting cannot be changed when the screen update mode is set to [Continuous] in the trigger settings (Page 4-25).
- If the capture on trigger input is disabled in the trigger settings (Page 4-25), this check box is always unchecked and the setting cannot be changed.
- When Live image is selected for a moving object, take care when registering as there will be a time lag between the external trigger input and the actual image capture.
- In principle, Live-image is only used when the capture unit being edited is being executed (waiting for a trigger input). When the image capture buffer is set to custom and the capture unit which was most recently executed is being edited, the images collected in the buffer will still be displayed even if the capture unit is not presently capturing images.
- Continuous update cannot be used when HDR capture (Page 4-21) is enabled or when a line scan camera is being used.
- When the HDR capture (Page 4-21) is enabled, the Multi-image cannot be used.

Select Image

Type

Select an image to register.

- **Captured Img.**: Displays the latest image from the specified camera (image variable).
- **Registered Img.**: The registered image specified in [Options] is displayed.

Select Camera

Select the number of the camera used for registration. Choose from Camera1 - Camera4, and select only the camera number used for the capture unit being edited.

Specifying a region

To register only part of an image, select [Edit] then specify the region to register. To cancel the selected region, select [Clear].

Save Image

Filename

Specify the registered image number used for image registration in the form "(Camera No.)-(User-specified No.)".

Reference

The name of the saved file is "ref (Camera No.)_(Specified No.)" (for full screen image registration) or "ref (Camera No.)_(Specified No.)_XXX_YYY" (for partial image registration).

JPEG

Check this box to save the image in JPEG format. When this box is not checked, the image will be saved in BMP format as either a 24-bit color bitmap image (when a color camera is used) or an 8-bit grayscale bitmap image (when a monochrome camera is used).

► Note

Using image compression may result in some image deterioration, thus results from a compressed image may differ to those when using non compressed images.

View All

View all registered images in a list.

Adjust Image Position

Adjust the position of the image being captured.

X

-Adjust the movement in the X (horizontal) direction between -8191.000 and 8191.000 pixels.

Y

-Adjust the movement in the Y (vertical) direction between -16383.000 and 16383.000 pixels.

Angle

Adjust the position angle (rotation) around the center of the image between -999.999° and 999.999°.

► Note

Position adjustment may cause missing peripheries (black areas) due to image movement or jagged edges (jaggies) due to rotation in the registered image.

Save

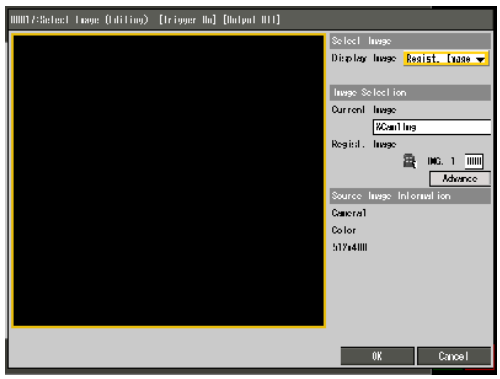
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Registered Img.] is selected for [Type], you can delete the registered image specified in [Options].

Select Image

Specify the image variable and associated registered image to be used for configuring the vision tool.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured Image**: Displays the latest image from the specified camera (image variable).
- **Registered Image**: The registered image specified under [Image Selection] is displayed.

Select image

Captured Img.

Set an image variable to be used as a current image for the unit.

Registered Img.

Specify the registered image No. for the registered image to be used.

- The registered images are managed as "Image (Camera No.) - (Registered image No.0 to 999)".
- The "Camera No" is fixed to the number of the camera associated to the image variable specified for the current image.

Advance

Set advance options for the switching of registered images as necessary.

- **Use numerical variable for registered image number**: To use a variable for the registered image No., check this box and assign a numerical or numerical array variable reference. By using a variable for the registered image No. and then issuing a variable reference value apply command (NU), the image is switched to the specified registered image in the variable and the reference image information is updated. For more details, see the XG-7000 Series Communication Control Manual.
- **Process variable when changing programs**: Use this option to switch to the registered image based on the initial value of the variable referenced when the program is changed or the controller is next turned on.

► Note

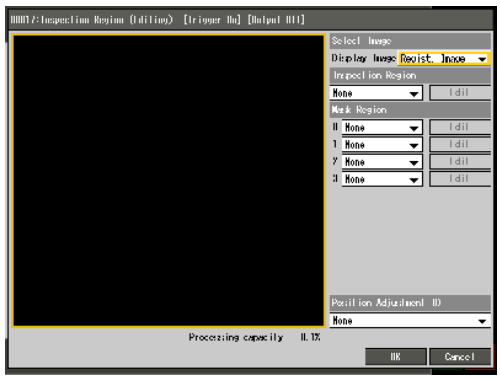
Note that the registered image No. does not switch in accordance with a change in the variable.

Source Image Information

The camera No., type (color / monochrome), and resolution of the camera associated to the image variable specified is displayed.

Inspection Region

Outline the region on the captured image to be used for inspection.



Reference

- The smaller the inspection region, the shorter the processing time.
- The extraction may not execute properly if the character background is included in the inspection region. Set the inspection region as small as possible to enclose just the characters.

Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Region

Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Inspection Region Menu" (Page 3-20) for more details.

► Note

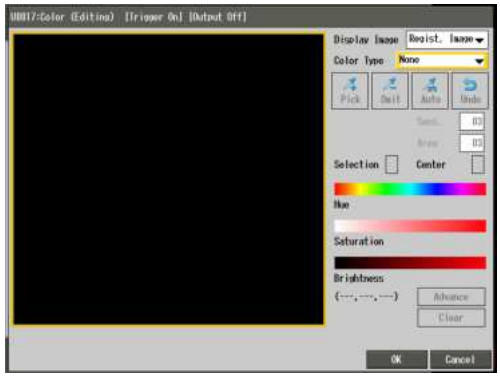
- You can only use a rectangle as an inspection region for an OCR inspection.
- Processed image regions cannot be used.
- The region size in the captured image cannot be set to higher than 2432 pixels in width or 2050 pixels in height.

Mask regionMask region

A mask region is an area which can be defined in the inspection region and will be excluded from the inspection. Up to four mask regions can be set per inspection region. A mask region is typically used for hiding an area that does not require inspection.
Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Excluding Part of the Region" (Page 3-26) for more details.

Color

When working with a color camera, convert the captured color image into a binary (black and white) or a grayscale converted image by extracting the desired color.



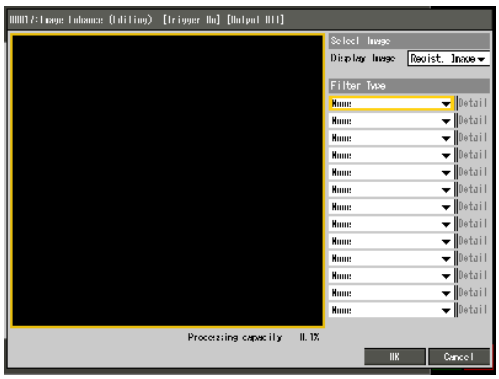
► Note

This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-295) is referenced as the current image.

Refer to "Working with Color Images (Color Extraction)" (Page 10-2) for concepts involving color extraction and its operation.

Image Enhance

Specify the filter processing to apply to the image.
When a color camera is used, the filter is applied to the images converted using color extraction.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Filter type

Select the [Filter Type] field and then select the filter to apply. To perform area measurement using a method other than color to binary, you must select the [Binary] filter as the last filter. See "Image Enhancement Filters" (Page 10-11) for more details of each filter processing.

► Note

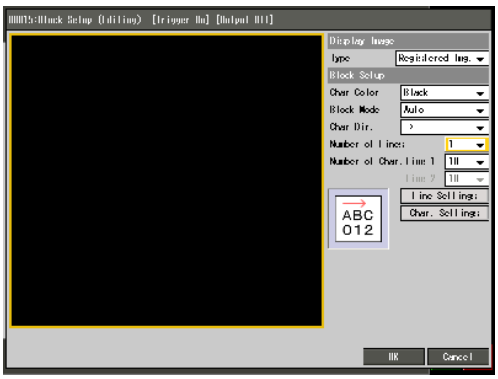
- For the area tool, [Binary] must be selected unless color to binary is used in the color extraction settings.
- If the binary filter is not selected or another filter is applied after the binary filter, the measurement result may not be correct.
- The binary, subtract and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 13 types of filters can be stacked according to application requirements. When multiple filters are set, they are processed one by one from the top.
- The order of the filters can be changed by selecting a filter in one of the [Filter Type] fields, holding down the No.1 (FUNCTION) button of the handheld controller, and then moving the 8-way key up or down.

Block Setup

Specify the mode and parameters used for identifying and extracting individual characters in the inspection region.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Block setup

Character color

Select the color of characters to differentiate them from the background.

- **Black** (default): Recognize targets darker than the background as characters.
- **White**: Recognize targets lighter than the background as characters.

Block mode

"Extraction" is the process that separates the character information in the inspection region into individual characters. A proper extraction process is necessary for correctly recognizing characters for a stable OCR inspection.
Select the block mode to extract individual characters properly.

- **Auto** (default): Automatically extracts up to two lines (maximum of 20 characters per line) from one inspection region. The differential edge waveform from the automatic extraction for each character is displayed on the screen.
- **Fixed**: Extract a single line (a maximum of 20 characters) by manually setting a region for each character.

► Note

- When [Fixed] is selected, all extracted characters are brought together into the first line.
- Changing the block mode resets various settings in the [Block Setup] menu.

[Auto] Block Mode Settings

Reference

If characters are not properly extracted with [Auto], configure the detailed [Auto] settings by changing [Line Settings] and [Char. Settings] or change the block mode to [Fixed] (Page 4-238). See "Stabilizing Character Recognition" (Page 4-246) for more details.

Character Direction

If the string is rotated 90° or more, change the character reading direction in 90-degree increments with reference to the horizontal axis of the image. A reference is displayed in the menu showing the character appearance and read direction.

- → (Default): Read characters from left to right on the image (normal direction).
- ←: Read characters from right to left on the image (180° rotation).
- ↑: Read characters from bottom to top on the image (90° counterclockwise rotation).
- ↓: Read characters from top to bottom on the image (90° clockwise rotation).

Reference

If rotation of the target string is less than 90°, use the position adjustment unit to adjust the inspection region.

Number of Lines

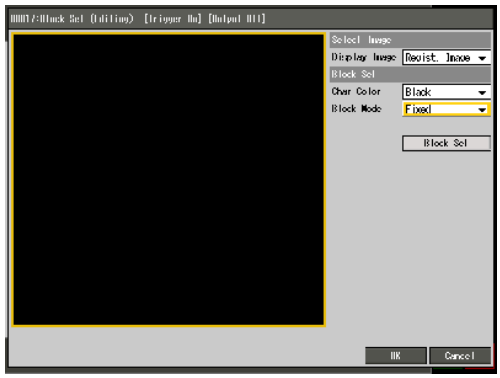
Specify the number of lines (1 or 2) of characters to be extracted from the inspection region.

Number of characters

Specify the number of characters (1 to 20) to be extracted from each line (default 10)

[Fixed] Block Mode Settings

When the characters cannot be extracted properly with the Auto extraction mode, set the block region manually for each character (up to 20 characters).



► Note

In the fixed extraction mode, only one line can be extracted in one region.

Block setup

Select [Block Setup] and [Add], to add a new block. Configure the block region so that it encloses a single character.

Reference

- Refer to "Inspection Region Menu" (Page 3-20) for more details on drawing a region.
- The shape of the block is fixed to a rotated rectangle.
- When position adjustment is used for the fixed extraction mode, the adjustment will be applied to all blocks in the unit.
- When you select a block from the list, the value setting menu for [Rotated Rectangle] is displayed, allowing you to edit the region by specifying numerical values.
- To change the order of the blocks select a block in the list, holding down the No.1 (FUNCTION) button of the handheld controller, and then moving the 8-way button up or down.

► Note

- Make sure that only one character is included in a block region. Proper recognition cannot be achieved if two or more characters are present in the block.
- Make sure that the region does not go outside of the inspection region. Any part drawn outside the inspection region will not be included and correct extraction may not be possible.

Delete

Deletes the selected block from the list.

Fine adjustment

Use fine adjustment to adjust to the character size in the individual block region.

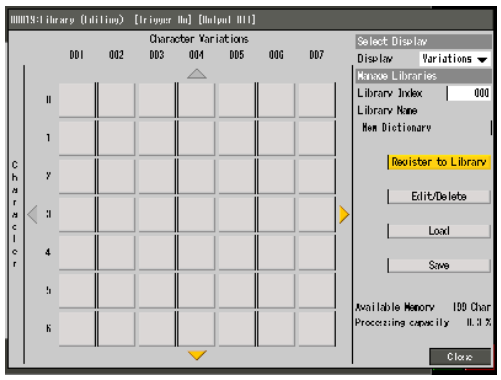
- **ON** (Default): Adjust to the actual character size in the region to allow for changing character sizes and a stable comparison.
- **OFF**: Extract characters in the region of a specified fixed size.

Reference

The [Fine Adjustment] setting is applied to all blocks in the inspection region.

Library

Select the library where the character patterns used for character recognition are registered. New and existing libraries can also be created and updated through this option. In addition to alphanumeric characters (0-9, A-Z) and symbols (dash, period, colon and forward slash), up to 20 user-defined characters can be registered in a single library.



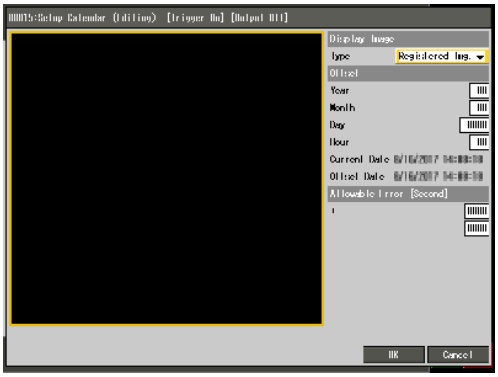
Refer to "Registering Characters for Optical Character Recognition (Library Menu)" (Page 4-250) for more details about the library setting.

Reference

To create a conversion table for decrypting OCR data when encrypted date, time or shift codes are printed on a target, refer to "OCR Encryption" (Page 7-45).

Setup Calendar

Specify the allowable date / time (year, month, day, hour, minute, second) offset and error to the actual date / time of the controller.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Set Date & Time Offset

Add an offset to the value or encoded value of the calendar OK / NG tolerance (Page 4-243). The current and offset date and time is displayed at [Offset Date] in the [Setup Calendar] menu. The setting ranges are: ±10 for [Year], ±12 for [Month], ±1999 for [Day], and ±24 for [Hour].

Allowable Error [Second]

Specify the allowable difference between the controllers internal date & time and the inspected targets marked date & time based on the current process or operation. The specified values (±0 to 3599 seconds) can used as an additional offset to the value or encoded value of the calendar OK / NG tolerance (Page 4-243).

Example: Judgment results when the allowable error is set to ±60 seconds at the turn of the day

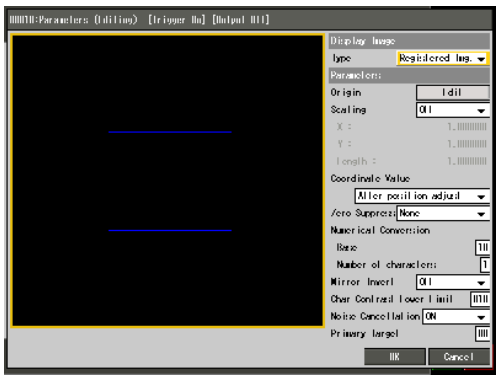
Current internal calendar time	2007.12.31		2008.1.1	
	~23:58:59	23:59:00 ~23:59:59	0:00:00 ~0:01:00	0:01:01~
Printing 2007/12/31	OK		OK	NG
Printing 2008/1/1	NG	OK	OK	

Allowable error -60 seconds

Allowable error +60 seconds

Parameters

Specify additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Parameters

Origin

By default, the origin is set to the top left corner of the camera but its location can be moved as required. To specify the origin, select [Edit] and then specify the coordinates.

Reference

The origin can be set outside the process region. The available range for the origin is -9600 to 9600 (X), -7200 to 7200 (Y).

Scaling

The controller processes image data in pixels, The result data and setting parameters used for display, judgement and calculations can be converted and scaled to real life values and dimensions by using the pre-set scaling factor option.

- **OFF**: Do not use scaling.
- **ON**: Use scaling.

Reference

- The scaling factor can be changed from the [Option] menu of the Flowchart (Page 4-356).
- For a summary list of the result data for which scaling can be used, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

Coordinate value

Select the coordinate system to be used after position adjustment. If position adjustment is not used, this setting will have no effect on the measurement.

- **After position adjust**: The inspection uses the adjusted coordinate axes determined after position adjustment.
- **Before position adjust**: The distance from the position specified for the [Origin] of the inspection is used.

Zero Suppress

Remove zeros from the calendar or string used in the limit settings.

- **None** (default): Include zeros
- **Space forward**: Replace leading zeros with a space.
- **Space backward**: Replace trailing zeros with spaces.
- **Remove zeros**: Remove all zeros.

► Note

- Zeros in the first digit (and second digit of the year) are exempt from zero suppression regardless of the setting.
- As a space is recognized when using [Fixed] or [Auto (Ratio)], use [Space forward] or [Space backward]. If [Auto (Waveform)] is used, the space will not be extracted and [Remove zeros] needs to be used.

Example: Conversion result of the registered character strings using zero suppression

Zero suppression setting	Date & time tolerances	Calculation tolerance	Note
OFF	08/08/25	00350	
Space forward	08/_8/25	_ _350	Use either of these two options when [Fixed] or [Auto (Ratio)] is used.
Space backward	08/8_/26	350_ _	
Remove zeros	08/8/25	350	

Underscore "_" is considered as a space.

Calc Result Converted

Specify the number base and number of recognized characters used for conversion of numerical variables used in the limit settings.

- **Base**: Set the number base (10 to 36) (Default: 10).
  Example: Numerical conversion when N-adic is set to base 36

Calculation result	0	to	9	10	to	35
Calculation tolerance	0	to	9	A	to	Z

- **Number of Char.**: Specify the number of characters to use after conversion of the numerical limit (1 to 6, default: 1).

► Note

Converted numerical values that result in the number of characters being exceeded are excluded. Example: Number of Char. 2 and converted numerical value 350 results in the limit being 50.

Mirror Invert

Use mirror invert to properly recognize and process inverted characters for images that are captured with a mirror or through a prism.

- **OFF** (default): Do not recognize mirrored characters.
- **ON**: Recognize mirrored characters.

Reference

The reading direction in the block extraction mode will also change as a result of mirror inversion. The reading direction is shown by the icon in the [Block Setup] menu (Page 4-237).

► Note

If [Mirrored CCD] is used in the capture unit (Page 4-17), this mirror inversion is applied to the mirrored image resulting in a normalized image.

Character contrast lower limit

Specify the lower limit of character contrast deviation (0 to 255) for detecting characters and blank spaces. If the noise elements in the background are being recognized as characters, increase the lower limit. If the contrast between the character and its background are low and the character being recognized as a space, decrease the lower limit.

Noise cancellation

Exclude noise on the border of the block that can cause the fine adjustment function (Page 4-239) to work incorrectly.

- **ON** (Default): Exclude noises on the border during fine adjustment.
- **OFF**: Include noise on the border during fine adjustment.

Primary target

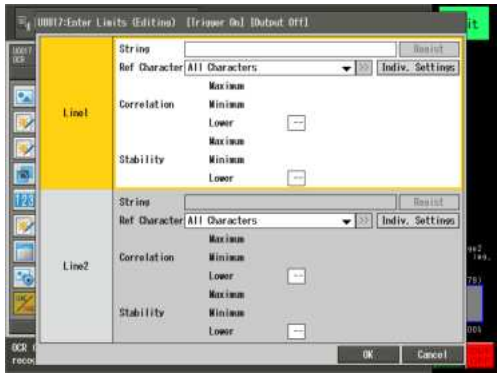
Specify the primary target to be used for judgment result processing from all the characters detected in the recognition processed based on thier sequence (0 (default) through 39).

Reference

The primary target reference numbering starts on the first line at the first character, and correlates to the sequence that the characters are detected on the two lines.

Limits

Specify pass / fail strings and tolerances (lower limit) settings for the OCR inspection.
If the detected string does not match the registered string, or the detected value for correlation or stability is below the lower limit, the inspection result will be "NG". If the detected string matches the registered string and the detected value for correlation and stability is equal to or above the lower limit, the inspection result will be "OK". By changing the [Ref. Character] setting the available characters used for comparison can be limited as required for controlled comparison.



Select the desired tolerance and then enter a value.

- If no limits or tolerances are set the unit will result in a pass (OK).
- The unit of tolerance varies depending on the limit parameter.

► Note

When a character is judged as "?" (recognition impossible), the result will be NG even if [String] is blank.

String

Register a string for judgment against the characters detected by the extraction process. Select [String] and enter up to 20 characters or symbols as a fixed string.

- Fixed characters can be combined with live tolerances that automatically change such as date and time.
- REG (registered string) can only be used by itself.

Library Registered Characters and Wildcards

Use the following special options for judgment against the characters detected by the extraction process.

- **SPACE**: Indicates a space.
- *: Any character except ones not stored in the library.
- **#**: Any character including ones not stored in the library.

Differences in results when using "*" versus "#"

Recognition result		Text	
		ABC*	ABC#
ABCD	→	OK	OK
ABC8	→	OK	OK
ABC?	→	NG	OK

The results are different when the correlation or stability of the forth character goes below the lower limit, and cannot be recognized.

- **REG** (registered string): A specific set of characters are set as the string based on the registered or captured image. Selecting [Regist] registers the detected characters from the current display image.

► Note

- The registered string cannot be used in combination with other fixed characters or other tolerance types.
- When the captured image is selected for the display image and there is no previous results, SPACE (blank) is used for REG.

Date & time tolerances

The following date and time functions from the internal calendar and clock can be used in the string judgment.

- **Year4**: Four digit calendar year
- **Year2**: Two digit calendar year
- **Month**: Two digit month
- **Day**: Two digit day
- **Hour**: Two digit hour

Example: Verifying the year/month/day (January 1, 2008) using the internal calendar tolerances.

Text		Registered string
Year4/Month/Day	→	2008/01/01

This example uses both calendar tolerance and a fixed character "/".

Reference

- A user specified offset and allowable error can be set for the date time functions of the internal calendar. See "Allowable Error [Second]" (Page 4-240) for more details.
- Zero suppression (Page 4-241) can be set for the Month, Day, and Hour.

Encrypted date, time and shift tolerances

The text mapped against the date, time and shift pattern in the encryption table can be used for string judgment. The number used in parentheses represent the encryption table.

- **eYear ()**: Correlates to the year in the encryption table.
- **eMonth ()**: Correlates to the month in the encryption table.
- **eDay ()**: Correlates to the day in the encryption table.
- **eHour ()**: Correlates to the hour in the encryption table.
- **eMinute ()**: Correlates to the minute in the encryption table.
- **Shift ()**: Correlates to the shift in the encryption table.

Reference

A user specified offset and allowable error can be set for the encrypted date time functions of the internal calendar. See "Allowable Error [Second]" (Page 4-240) for more details.

► Note

This function was added in version 4.0.

Calculation tolerance (Variable reference)

Convert the scalar type variable to the numerical variable. The conversion method is determined by the calculation result conversion (Page 4-241) setting.

- **Variable**: Specify the scalar variable to register in the registered character string. Example: For a 7-character string composed of text ("TEST") plus a 3-digit serial number to which 1 is added at each inspection (#Count01) (Set calculation result conversion: Base / 3 digits, zero suppression: OFF.)

Text		Registered string
TEST#Count01	→	TEST000 - 999 (Next to 999, it goes back to 000.)

► Note

Only scalar variable can be specified.

Ref Character

Typically, all the characters stored in the library are used for judgment, however the range of characters used can be limited. Limiting the characters used can help resolve false rejects and mis-detection for similar characters such as an "E" and a "F" while also increasing processing speed.

- **All Characters**: Use all the characters stored in the library for judgment.
- **Character Groups**: Use only the types of characters in the string for recognition. The type relates to either an alphabetical, numerical, symbol or special character. For example, the recognition of character "A" uses only the library data for alphabetical characters A to Z.
- **Specified Order**: Use only the characters in the string for judgment.
- **Specified Char**: Use only selected characters for judgment.

Reference

The limiting of character types can also be applied to each individual character by selecting [Indiv. Settings]. This is also useful when the registered string includes multiple character types.

► Note

When REG (registered tolerance) is used for the string, do not change the reference character setting from [All Characters]. Selecting other options may result in improper character recognition.

Correlation

Enter the lower limit for the minimum correlation % match of all recognized characters. If the stability value is below the lower limit after cross referencing with the library, "?" is output to indicate that the character is unstable and the inspection result is NG.

Stability

Enter the lower limit for the minimum stability of all recognized characters. If the stability value is below the lower limit after cross referencing with the library, "?" is output to indicate that the character is unstable and the inspection result is NG.

Display Options

The display color of the units visual indicators can be changed based on the judgment result for that unit. The visual indicator can also be made transparent by selecting [Setting] - [Select Color] - [None].



Inspection Region

Specify the line width and display color of the inspection region.

Mask Region

Specify the line width and display color of the mask region.

Block & Char. Region (when fixed extraction is used)

Fixed block region

Specify the line width and display color of the block region.

Fixed block region (fine adjusted)

Specify the line width and display color of the adjusted block region when [Fine Adjustment] (Page 4-239) is set to [ON].

Block & Char. Region (when auto extraction is used)

Line / Block

Specify the line width and display color of the block region.

Character

Specify the line width and display color of the character region.

Block Extraction

Waveform
Select whether to display the character extraction waveform.
- **ON** (default): Show the character extraction waveform.
- **OFF**: Hide the character extraction waveform.

Wave
Specify the width and display color of the character extraction waveform.

Frame
Specify the width and display color of the frame.

Threshold
Specify the width and display color of the line representing the threshold.

Minimum wave height
Specify the width and display color of the line representing the minimum wave height.

► Note
Setting [Waveform] to [ON] consumes additional program memory. Check the amount of remaining program memory before enabling.

Processing Priority

Specify the processing priority when displaying large processed images during Run mode.
When a line scan camera is used with the XG-7502A, it is not possible to display the processed image if the image size exceeds 25 MB (26214400 pixels). In such a case it is possible to display the filtered image and contrast image by using a display image variable.

Filtered image
Select whether or not to use a display image variable for the filtered image display.
- **Unit Processing**: Processes the filtered image without using the display image variable.
- **Image Display**: Processes the filtered image using a display image variable.

Reference
- When processing images 25 MB or less, or when using the XG-7702A, it is not necessary to select [Image Display].
- When processing an image larger than 25 MB, if the area displayed is 8 MB (8388608 pixels) or less, the filtered image will be automatically displayed when [Unit Priority] is selected. (However the following processes are excluded.)
  - Image enhancement: Shading correction, blob filter
  - Conversion (image operation): Rotate/translate, zoom, trapezoid correction, blob filter
  - Defect, Grayscale Blob: Contrast display

► Note
When [Image Display] is selected for [Filtered Image], the following restrictions on operation occur.
- Processing time increases.
- The background outside the inspection region becomes a black image.
- Displaying of multiple units is not possible.
- For display of registered images outside of unit edit, the filtered image cannot be displayed and the display is the same as when [Unit Processing] is set.
- When an archived image is displayed, it ix not possible to display the processed image unless the display image variable and results are also stored in the archive.

Image variable
Specify a display image variable for displaying the filtered image.

Reset

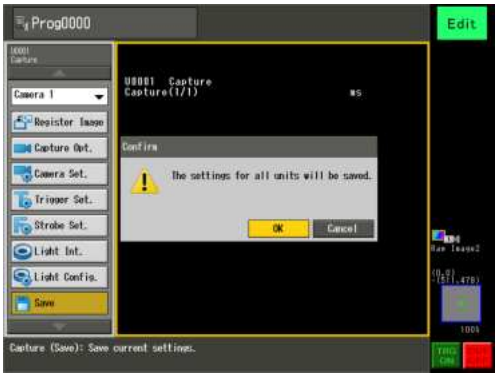
Returns the display options to their defaults.

Save

Save the current unit changes the program file.

► Note

- If the device is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the system power while you are saving the settings. Doing so may cause errors in the internal data



Save

The settings for the unit are saved in the current program file in SD Card 1 or SD Card 2.

► Note

Items specified not to be saved in XG VisionEditor are excluded from the saving operation.
For example, variable values changed in the current program or the default display, and display parts, can be excluded when saving.

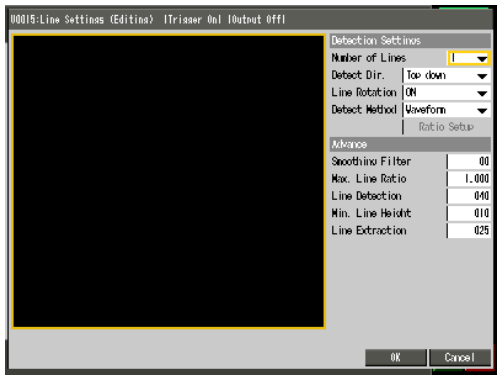
Stabilizing Character Recognition

The auto extraction mode extracts characters by detecting the space between characters (lines) from the character extraction waveform. If the spaces are too narrow or the characters are slanted, the waveform line may not show any spaces between characters.
To make character extraction possible and stable, the extraction method can be set to [Fixed] or the detailed auto extraction settings can be adjusted in [Block Setup].

Changing the [Line Settings]

Adjustments can be made to the methods used for line extraction.

1 Select [Line Settings] in the [Block Setup] menu.
The [Line Settings] menu appears.



2 For [Number Of Lines], specify the number of lines (1 or 2) to extract from the inspection region.

3 For [Detect Dir.], select the extraction direction.
Changing this option may help when character extraction fails due to background noise.

- **Top down**: Extract the specified number of lines from the top with reference to the reading direction.
- **Bottom up**: Extract the specified number of lines from the bottom with reference to the reading direction.
- **Size**: Extract the specified number of lines in descending order of line height regardless of the reading direction.

4 If the line varies due to the string being at angle to the inspection region switch [Line Rotation] on for rotation correction.

- **ON**: Line rotation correction.
- **OFF**: No rotation correction

► Note

The rotation correction is suitable for approximately ±15° of rotation. If the angle of the line to the inspection region is greater use position adjustment.

Reference

If rotation correction is used the rotation will be reflected in the character block region as well.

5 If the line extraction is unstable (due to the space between lines being narrow, etc.), choose the appropriate extraction method in [Detect Method].

- **Waveform**: Extract a line by detecting spaces based on changes in the line extraction waveform.
- **Ratio**: Extracts the line at a specified ratio to the projected waveform width of the entire line. This is effective when the ratio of the line height is constant even when the line space is small.

► Note

When the number of lines changes, do not select [Ratio]. Ratio specification forcibly extracts the number of lines regardless of the actual number of lines in the region.

Specifying the ratio

When [Ratio] is selected [Ratio Setup] allows the setting of the line ratio.

- **Start**: Specify the start position of line extraction as a percentage ratio of the overall line extraction waveform (000.00 to 100.00).
- **Line Separation** (only when the [Number Of Lines] is set to 2): Specify the separation distance of line 1 and line 2 as a percentage of the overall line extraction waveform (000.00 to 100.00).
- **End**: Specify the end position of line extraction as a percentage ratio of the overall line extraction waveform (000.00 to 100.00).

► Note

The specified ratio returns to the default value if the [Number Of Lines] setting is changed.

6 Change detailed waveform generation and character extraction settings.

Typically the character extraction waveform generation method does not need to be changed, however adjusting the generation method may improve the character extraction result.

Smoothing filter

To aid proper character extraction of dot based characters the smoothing filter can be changed from (0 to 99). Increasing the smoothing filter increases the number of rows of pixels used in the generation of the line extraction waveform. This can subsequently lower the detection sensitivity for narrow gaps.

Max. Line Ratio

f two lines are being accidently extracted as one due to a narrow line spacing, setting the [Max. Line Ratio] (0.100 to 1) enables the system to analyze the line extraction waveform and force the line height to be equal to the ratio of the inspection region or less ensuring separation of the two lines.

Reference

The equivalent line height is displayed as a green (orange when the item is selected) bracket next to the line extraction waveform.

Line Detection

Specify the lower limit line detection threshold (0 to 255) to remove unwanted noise from the generated waveform used for line extraction.
Lowering the threshold increases the extraction sensitivity, but may increase the influence of noise.

Reference

This setting is displayed as a straight green line across the line extraction waveform.

Min. Line Height

Specify the lower limit of the line height, equivalent to the width (0 to 255) used for line extraction from the generated waveform.
Setting the [Min. Line Height] eliminates noise and spikes in the character extraction waveform.

Reference

This setting is displayed as an orange bracket next to the line extraction waveform.

Line Extraction

Specify the threshold increase (0 to 255) from the line detection threshold for line extraction from the generated waveform, based on the normalized contrast across the inspection region.

Reference

This setting is displayed as a straight yellow line across the line extraction waveform.

7 **Click [OK].**

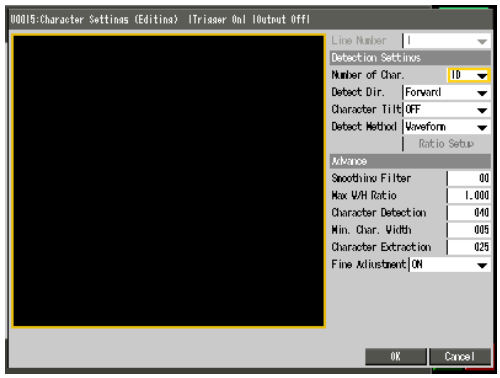
The [Block Setup] menu reappears.

Changing the [Char. Settings]

Adjustments can be made to the methods used for character extraction.

1 **Select [Char. Settings] in the [Block Setup] menu.**

The [Char. Settings] menu appears.



2 **Select the line number (1 or 2) in [Number of Lines] to change the character settings for.**

► Note

This option cannot be selected when [Number Of Lines] is set to 1.

3 **Specify the number of characters (1 to 20) in [Number Of Char.] to extract from the selected line.**

4 **Using [Detect Dir.], select the extraction direction.**

Changing this option may help when character extraction fails due to background noise.

- **Forward**: Extract the specified number of characters from left to right with reference to the general reading direction.
- **Reverse**: Extract the specified number of characters from right to left (typically reverse reading) with reference to the general reading direction.
- **Size**: Extract the specified number of characters in the descending order of character width regardless of the general reading direction.

5 **If the characters are deformed or offset at an angle (such as italics) set [Character Tilt] to on.**

- **OFF**: No character tilt correction
- **ON**: Character tilt correction

► Note

The tilt correction can correct up to about ±20° of character tilit but does not correct for rotated characters.

6 If the character extraction is unstable (due to narrow character spacing, etc.), choose the appropriate extraction method in [Detect Method].

- **Waveform**: Extract a character by detecting spaces based on changes in the character extraction waveform.
- **Ratio**: Extracts the character at a specified ratio to the projected waveform width of the entire character. This is effective when the ratio of the number of characters and the character width is constant even when the character space is small.

► Note

When the number of characters changes, do not use [Ratio]. As it forces the OCR tool to extract a specified number of characters.

Specifying the ratio

When [Ratio] is selected [Ratio Setup] allows the setting of the character ratio.

- **Start**: Specify the start position of character extraction as a percentage ratio of the overall character extraction waveform (000.00 to 100.00).
- **n-n+1**: Specify the separation distance of the "n" character and the "n+1" character as a percentage of the overall character extraction waveform (000.00 to 100.00).
- **End**: Specify the end position of character extraction as a percentage ratio of the overall character extraction waveform (000.00 to 100.00).

► Note

The specified ratio returns to the default value if the [Number of Char.] setting is changed.

7 Change detailed waveform generation and character extraction settings.

Typically the character extraction waveform generation method does not need to be changed, however adjusting the generation method may improve the character extraction result.

Smoothing Filter

To aid proper character extraction of dot based characters the smoothing filter can be changed from (0 to 99). Increasing the smoothing filter increases the number of columns of pixels used in the generation of the character extraction waveform. This can subsequently lower the detection sensitivity for narrow character gaps.

Max. W/H Ratio

If multiple characters are being accidently extracted together due to narrow character spacing, setting the [Max W/H Ratio] (0.100 to 9.999) enables the system to analyze the character extraction waveform and force the character width to be equal to the ratio of the character height or less ensuring character separation.

Reference

The equivalent character width is displayed as a green (orange when the item is selected) bracket next to the character extraction waveform.

Character Detection

Specify the lower limit character detection threshold (0 to 255) to remove unwanted noise from the generated waveform used for character extraction.
Lowering the threshold increases the extraction sensitivity, but may increase the influence of noise.

Reference

This setting is displayed as a straight green line across the character extraction waveform.

Min. Char. Width

Specify the lower limit of the character width, equivalent to the width (0 to 255) used for character extraction from the generated waveform.
Setting the [Min. Char. Width] eliminates noise and spikes in the character extraction waveform.

Reference

This setting is displayed as an orange bracket next to the character extraction waveform.

Character Extraction

Specify the threshold increase (0 to 255) from the character detection threshold for character extraction from the generated waveform, based on the normalized contrast across the inspection region.

Reference

This setting is displayed as a straight yellow line across the character extraction waveform.

Fine adjustment

Uses the block defined by the line extraction and character extraction waveforms as the boundaries for extracting each character individually, enabling stable recognition and correlation when individual character sizes change.

- **ON**: Extract the character based on the block region
- **OFF**: Do not use fine adjustment

8 Click [OK].

The [Block Setup] menu reappears.

Registering Characters for Optical Character Recognition (Library Menu)

Image based characters can be registered to the library for use in optical character recognition. In addition to alphanumeric characters (A-Z, 0-9) and symbols (dash, period, colon, forward slash) up to 20 user defined characters can be registered in a single library.

Some functions in the Library menu and the sub-menu [Library] of the Edit Unit Menu work and behave differently. Refer to "Difference between sub menus of the Edit Unit menu and other built-in menus" (Page 4-10) for further details.

► Note

The following operations are carried out after the current unit has been processed. Processing resumes after the operation has been completed.

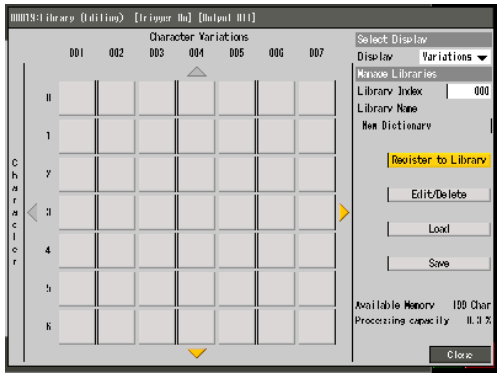
- Opening and closing the Library menu
- Register Individually/Register All
- Library index changes
- Library name changes
- Library deletion
- Loading and saving the library

Reference

- Foreign characters, pictogram, or custom pattern can also be registered as characters.
- User defined characters are displayed and managed by ID number (1 to 20).

1 Select the destination library (0 to 999) to register characters to.

The [Library] menu appears.



► Note

- The Library menu cannot be used to:
  - A new library file cannot be created. Only library files that already exist in the program can be used.
  - register a character in a library not referenced by any OCR unit.
- To use the OCR tool, character data must be registered in a library. If all character data has been removed from the selected library, the OCR tool will not work properly and return "????" as the result.

Changing the list format

The display format can be changed using [Display Form].

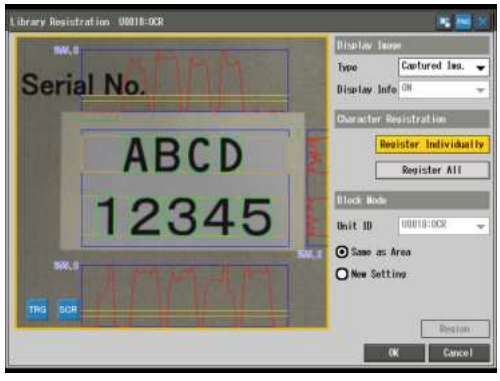
- **Char List** (default): Displays the list of the registered characters in matrix format.
- **Var List**: Displays the registration status of each character.

Changing the library name

Select [Library Name], and then enter the desired name (up to 60 characters).

2 Select [Register to Library].

The [Library Registration] menu appears.



3 Choose the image to extract characters from.

- **Registered Img**: Displays the OCR unit registered image that was specified in [Extraction Method].
- **Captured Image**: Displays the OCR unit current image that was specified in [Extraction Method].
- **Archived Img.**: Displays an image from the image archive (only displayed in the Library menu). When there are multiple images registered in the image archive, toggle through the images by holding down the No.1 (FUNCTION) while moving the 8-way key left or right.
  If [Display Info] is set to [ON] when an archived image selected, the total count, inspection date and time, and inspection result (string, correction level, and extraction waveform) will be displayed.

► Note

This information is archived as part of the image archive data. If the [Same as Area] is used and [Display Image] is set to [Regist. Image] the character extraction is not displayed. To register individual characters use [New Setting] and specify a fixed extraction area.

4 Choose the character registration and extraction method.

The following two methods can be used for character registration along with the extraction method.

Character Registration:

- **Register Individually**: Allows extracted characters to be registered one by one.
- **Register All**: Allows registration of all the extracted characters together as a string.

Reference

Up to 200 characters can be registered in one library, but is dependent on the processing memory available.

Block mode

- Only available in the Library menu:
  - **Same as Area (default)**: Uses the same extraction settings as the referenced unit.
  - **New Setting**: Allows the manual placement of a fixed extraction region. Use this option if its not practical to use the extraction settings initially set in the unit. See "Specifying a fixed extraction block" (Page 4-254) for more details.
- In the [Library] sub menu (Page 4-207) of the OCR unit only the extraction settings used in [Block Setup] can be used.

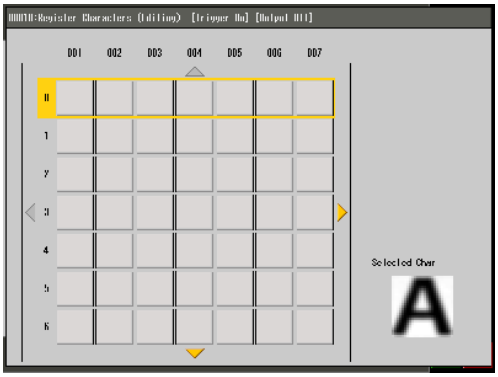
Reference

For more information about character extraction, refer to the XG VisionEditor Reference Manual (Programming Edition).

5 Choose the extraction method, then register the extracted character.

When [Register Individually] is selected

Select the character to be registered. The [Register Characters] menu appears. Choose a row to register the character to and press the No.0 (ENTER) button. Repeat until all the required characters are registered.



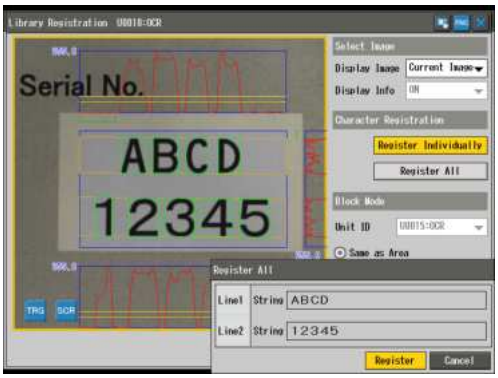
Reference

If multiple character registrations are made for one character type, the additional characters are automatically registered as character variations. Registering several variations of a character allows more stable recognition when there are changes in the character, by finding the closest matching character from the registered variations.

When [Register All] is selected

The [Register All] menu appears.

Choose the appropriate line number and manually enter the string that is currently extracted.



Reference

- Exclude any undesired characters from the string by using an asterisk "*".
- If more than one of the same character exists in the extracted string, the repeated characters will be registered as character variations. To avoid repeated characters being registered use an asterisk "*" in their place.

6 **To complete the registration, click [OK].**

The screen reverts to the [Library] menu.

► Note

If the same image is registered to several different character types in the library, the character with the smallest ASCII code is output as the result. To avoid such mis-matches do not register the same image to different character types.

Reference

If the OCR unit recognizes a character registered as a user character, (1) to (20) is displayed on screen, and the lower case ("a" to "t") are used for output and decimal conversion.

7 **Click [Close].**

Editing and deleting registered characters

Characters in the library can be edited or deleted using the procedure below.

► Note

Deleted characters cannot be restored.

1 **Click [Edit/Delete] on the [Library] menu.**

The [Edit/Delete] menu appears.

2 **Make changes as necessary.**

Enable/Disable

Temporarily enables or disables the selected character. An X is used to show the character has been disabled.

Delete Character

Deletes the selected character.

Delete Variation

Deletes all the variations for a character.

Delete All

Deletes all the characters from the selected library.

► Note

If the library is saved after deleting all the characters, any OCR units that reference the library will return "????" as the recognition result and potentially lead to incorrect inspections.

3 **Click [Close].**

Loading library data from an SD card

To load library data saved on an SD card use the procedure below.

► Note

The loaded data is added to the library currently selected. If the library to be loaded is to be used on its own setup a new library to load the data into.

Reference

Library data created from different resolutions of cameras can be loaded into the library. Due to differences in resolution check that the loaded data can be recognized correctly before inspection.

1 **Click [Load] on the [Library] menu.**
The [Load] menu appears.

2 **Select the folder that contains the library data.**

3 **Click [Execute].**
The library data is loaded from the SD card, into the current library.

► Note

Execute is disabled in Step 2 unless the library file (xgdic.dat) is in the selected folder.

Saving library data to an SD card

To save the registered library to an SD card for use by other programs or controllers follow the procedure below.

1 **Click [Save] on the [Library] menu.**
The [Save] menu appears.

2 **Select the save destination.**

3 **Click [Execute].**
The library data is saved to the specified folder on the SD card.

Reference

The library data is saved to the specified folder with the file name "xgdic.dat".

► Note

Do not change the file name "xgdic.dat". If the library filename is changed from xgdic.dat it will not be recognized by the controller.

Specifying a fixed extraction block

This function allows the specifying of up to 20 individual blocks for character extraction.

► Note

If the [Block Mode] is set to [Fixed], only one line can be extracted from a single region.

1 **Select [Region].**

The [Block Set] menu appears.



2 **Click [Add] under [Block Region].**

The block can be manually drawn around the desired character.

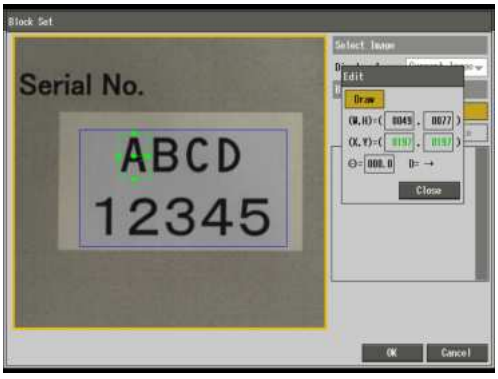
Reference

- The shape of the block is fixed to a rotated rectangle.
- Additional blocks are initially set to the same size and are automatically placed next to the previous block.
- To delete a block click [Delete] and choose the block to delete.

3 **Draw a block area.**

Draw a block around the outside of the desired character.

Refer to "Drawing a Rotated Rectangle" (Page 3-21) for more details.



► Note

- Make sure that only one character is included in a block region. The OCR tool will not function correctly if two or more characters are present in the block.
- Make sure that the region does not go outside of the inspection region. Any part drawn outside the inspection region will not be included and correct extraction may not be possible.

4 **To finish drawing the block, press the No.2 (ESCAPE) button on the handheld controller.**

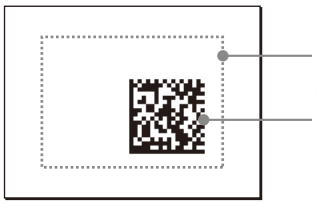
5 **Click [Close].**

2D Code Reader

2D Code Reader

The 2D code reader detects a 2D code in the inspection region, decodes the information contained in the 2D code and outputs the data as a string.
In addition to decoding and outputting the code the tool can also verify, split and judge the data against a pre-registered string. Multiple judgment strings can also be registered so that the tool can be used for sorting based applications.

Image processing



Supported codes

Codes in the following formats are supported.

QR

Model1 and Model 2 support



► Note

Linking functions are not supported.

Micro QR



► Note

Linking functions are not supported.

DataMatrix

ECC200 support



► Note

- ECC000 - ECC140 are not supported.
- Linking functions are not supported.

Rectangle DataMatrix



► Note

Linking functions are not supported.

Processing results

The standard results and data returned by 2D code reader measurement are as follows.

Code Length	Outputs the length (number of characters) of the decoded 2D code. Tolerance inspection target
Readout	Outputs the decoded data as a string. Tolerance inspection target
Position X	Outputs the center X coordinate (pixels) of the detected 2D code. Tolerance inspection target
Position Y	Outputs the center Y coordinate (pixels) of the detected 2D code. Tolerance inspection target
Position XY	Outputs the center XY coordinates (pixels) of the detected 2D code.
Detection angle	Outputs the difference of the detected 2D code from the base angle. Tolerance inspection target
Position XY / Detected Angle	Outputs the center XY coordinates (pixels and angle) of the detected 2D code.
Split Data Length [ ]	Outputs the length (number of characters) of the split data.
Split Data Readout [ ]	Outputs the split data as a string. Tolerance inspection target
Cell size	Outputs the code resolution as the number of pixels per cell.
Unused error correction	Outputs the available (unused) error correction of the detected 2D code as a percentage (0 - 100%).
Number of rows	Outputs the number of cells of the detected 2D code in the horizontial direction.
No. of cell rows	Outputs the number of cells of the detected 2D code in the vertical direction.
Number of columns	Outputs the printed color of the detected 2D code. (0: Not detected, 1: Black on white, 2: White on black)
Mirror Invert	Outputs mirrored code information. (0: Not used, 1: No mirror inversion, 2: Mirror inversion)
Code angle	Outputs the detection angle of the detected 2D code, using the base angle as 0°.
Code data length	Outputs the full length of the detected 2D code.
Read error	Outputs whether or not a reading error occurred. (0: Reading successful, 1: Reading failed)
Read error cause	Outputs the cause of a reading error. (0: Reading successful, 1: Code detection failed, 2: Decoding failed, 3: Timeout)
Match number	Outputs the lowest number of the multi reference pattern that was matched.
Multi Matching Pattern [ ]	Outputs the strings of multi reference patterns No.1 to No.16.
Matching Result	Outputs the total judgment result based on all matching criteria.
Multi Matching Result 1-16	Outputs the matching result of patterns 1 to 16 (-1: Matching impossible, 0: Matched, 1 or higher: Number assigned to the unmatched digit).
2D Code Area: Position 1 X	Outputs the region information (first coordinate X) (pixels) of the detected 2D code.
2D Code Area: Position 1 Y	Outputs the region information (first coordinate Y) (pixels) of the detected 2D code.
2D Code Area: Position 1 XY	Outputs the region information (first coordinate XY) (pixels) of the detected 2D code.
2D Code Area: Position 2 X	Outputs the region information (second coordinate X) (pixels) of the detected 2D code.
2D Code Area: Position 2 Y	Outputs the region information (second coordinate Y) (pixels) of the detected 2D code.
2D Code Area: Position 2 XY	Outputs the region information (second coordinate XY) (pixels) of the detected 2D code.
2D Code Area: Position 3 X	Outputs the region information (third coordinate X) (pixels) of the detected 2D code.
2D Code Area: Position 3 Y	Outputs the region information (third coordinate Y) (pixels) of the detected 2D code.
2D Code Area: Position 3 XY	Outputs the region information (third coordinate XY) (pixels) of the detected 2D code.
2D Code Area: Position 4 X	Outputs the region information (fourth coordinate X) (pixels) of the detected 2D code.
2D Code Area: Position 4 Y	Outputs the region information (fourth coordinate Y) (pixels) of the detected 2D code.
2D Code Area: Position 4 XY	Outputs the region information (fourth coordinate XY) (pixels) of the detected 2D code.
Unit judgment value	Outputs the binary result of the unit based on the measured value and the specified tolerance range (upper / lower limits). The unit is judged as [NG] (binary 1) when outside the tolerance range and [OK] (binary 0) when inside.

Reference

- For the processing results where a character string is output (Readout, Split Data [ ], Multi Matching Pattern [ ]), the character string result is acquired when no array element is specified (example: ID_DATA[]), and the numeric value result is acquired when an array element is specified (example: ID_DATA[0]).
- For the lists of available measurement output values and setting parameters, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

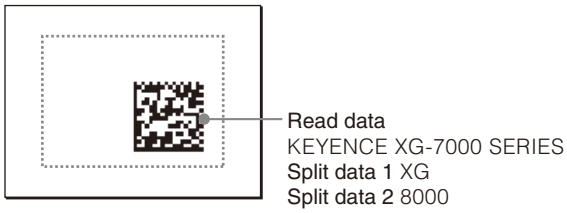
► Note

- If [PC Program] is set as the destination for results output, processing results where a character string is output (Readout, Split Data [ ], Multi Matching Pattern [ ]), the maximum number of characters which can be output for 1 item is limited to 80. Use "Data Split" (Page 4-266) as necessary to increase the number of characters.
- When handling binary data, numeric data following 0 (null) is not displayed and cannot be referenced.

Example

Example showing the results of a 2D code reading inspection performed under the following conditions:

- Code Type: DataMatrix
- Start Digit: 1
- Data Length: 100
- Data Split: ON
  - DATA1: Start Digit 9, Data Length 2
  - DATA2: Start Digit 12, Data Length 4



Main Menu

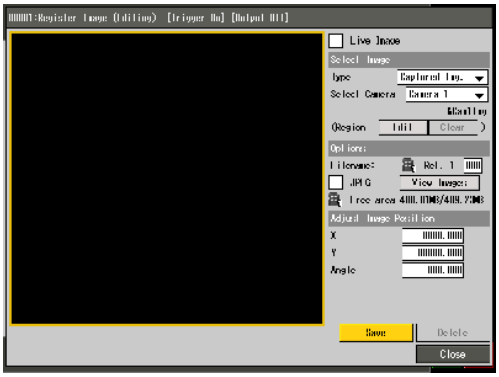
The main menu of the 2D code reader tool consists of the following options. Configure settings under each option as required for the inspection.



Register Image (Page 4-223)	Register an image to be used as a template for settings.
Select Image (Page 4-225)	Specify the image to be used for unit processing.
Inspect Region (Page 4-226)	Define the region to be used for unit processing.
Color (Page 4-236)	Color extraction and conversion settings for a color image to gray-scale or binary (only available for color cameras).
Image Enhance (Page 4-237)	Settings for pre-processing image filters.
Condition (Page 4-227)	Specific conditions for processing a 2D Code.
Parameters (Page 4-227)	Additional optional parameters.
Limits (Page 4-228)	Unit pass / fail tolerances.
Display Options (Page 4-229)	Unit processing display settings.
Save (Page 4-230)	Save unit settings.

Register Image

An image can be saved to the controller to be used as a template for measurements and settings. It is recommended to adjust and fix lighting and other external influences before registering an image.



Live Image

Check this box to display live images through a continuous feed.

► Note

- A live feed is only available while the unit is being edited.
- This setting cannot be changed when the screen update mode is set to [Continuous] in the trigger settings (Page 4-25).
- If the capture on trigger input is disabled in the trigger settings (Page 4-25), this check box is always unchecked and the setting cannot be changed.
- When Live image is selected for a moving object, take care when registering as there will be a time lag between the external trigger input and the actual image capture.
- In principle, Live-image is only used when the capture unit being edited is being executed (waiting for a trigger input). When the image capture buffer is set to custom and the capture unit which was most recently executed is being edited, the images collected in the buffer will still be displayed even if the capture unit is not presently capturing images.
- Continuous update cannot be used when HDR capture (Page 4-21) is enabled or when a line scan camera is being used.
- When the HDR capture (Page 4-21) is enabled, the Multi-image cannot be used.

Select Image

Type

Select an image to register.

- **Captured Img.**: Displays the latest image from the specified camera (image variable).
- **Registered Img.**: The registered image specified in [Options] is displayed.

Select Camera

Select the number of the camera used for registration. Choose from Camera1 - Camera4, and select only the camera number used for the capture unit being edited.

Specifying a region

To register only part of an image, select [Edit] then specify the region to register. To cancel the selected region, select [Clear].

Save Image

Filename

Specify the registered image number used for image registration in the form "(Camera No.)-(User-specified No.)".

Reference

The name of the saved file is "ref (Camera No.)_(Specified No.)" (for full screen image registration) or "ref (Camera No.)_(Specified No.)_XXX_YYY" (for partial image registration).

JPEG

Check this box to save the image in JPEG format. When this box is not checked, the image will be saved in BMP format as either a 24-bit color bitmap image (when a color camera is used) or an 8-bit grayscale bitmap image (when a monochrome camera is used).

► Note

Using image compression may result in some image deterioration, thus results from a compressed image may differ to those when using non compressed images.

View All

View all registered images in a list.

Adjust Image Position

Adjust the position of the image being captured.

X

-Adjust the movement in the X (horizontal) direction between -8191.000 and 8191.000 pixels.

Y

-Adjust the movement in the Y (vertical) direction between -16383.000 and 16383.000 pixels.

Angle

Adjust the position angle (rotation) around the center of the image between -999.999° and 999.999°.

► Note

Position adjustment may cause missing peripheries (black areas) due to image movement or jagged edges (jaggies) due to rotation in the registered image.

Save

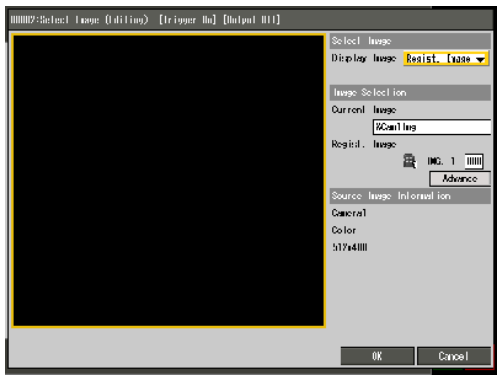
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Registered Img.] is selected for [Type], you can delete the registered image specified in [Options].

Select Image

Specify the image variable and associated registered image to be used for configuring the vision tool.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured Image**: Displays the latest image from the specified camera (image variable).
- **Registered Image**: The registered image specified under [Image Selection] is displayed.

Select image

Captured Img.

Set an image variable to be used as a current image for the unit.

Registered Img.

Specify the registered image No. for the registered image to be used.

- The registered images are managed as "Image (Camera No.) - (Registered image No.0 to 999)".
- The "Camera No" is fixed to the number of the camera associated to the image variable specified for the current image.

Advance

Set advance options for the switching of registered images as necessary.

- **Use numerical variable for registered image number**: To use a variable for the registered image No., check this box and assign a numerical or numerical array variable reference. By using a variable for the registered image No. and then issuing a variable reference value apply command (NU), the image is switched to the specified registered image in the variable and the reference image information is updated. For more details, see the XG-7000 Series Communication Control Manual.
- **Process variable when changing programs**: Use this option to switch to the registered image based on the initial value of the variable referenced when the program is changed or the controller is next turned on.

► Note

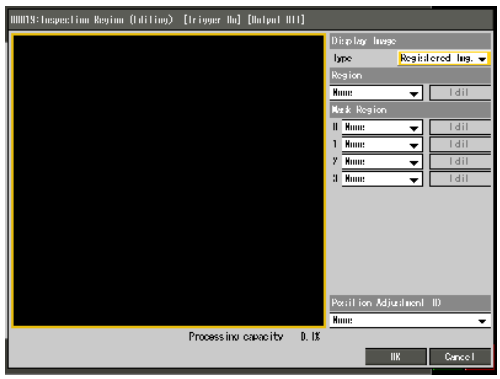
Note that the registered image No. does not switch in accordance with a change in the variable.

Source Image Information

The camera No., type (color / monochrome), and resolution of the camera associated to the image variable specified is displayed.

Inspection Region

Outline the region on the captured image to be used for inspection.



Reference

- The smaller the inspection region, the shorter the processing time.
- When there is a background other than the 2D code in the inspection region, there may be a large increase in the processing time and automatic tuning time. Set the region as necessary.

► Note

It is not possible to specify which code to detect when there are 2 or more codes in the inspection region that match the detection conditions.

Region

Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Inspection Region Menu" (Page 3-20) for more details.

► Note

- Only a rectangle can be used as an inspection region for the 2D code reader.
- Processed image regions cannot be used cannot be used.
- The region size in the captured image cannot be set to higher than 2432 pixels in width or 2050 pixels in height.

Mask region

A mask region is an area which can be defined in the inspection region and will be excluded from the inspection. Up to four mask regions can be set per inspection region. A mask region is typically used for hiding an area that does not require inspection.
Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Excluding Part of the Region" (Page 3-26) for more details.

Position Adjustment ID

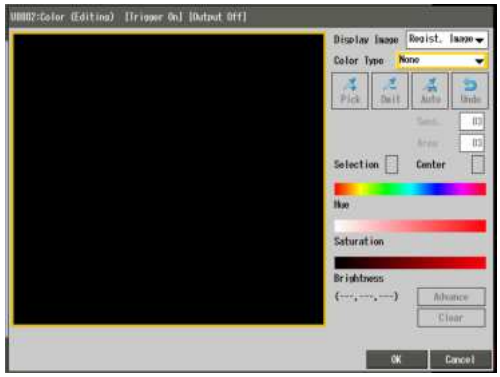
To use position adjustment for the region, select the position adjustment unit to be referenced.

Reference

The position adjustment is applied to all inspection, mask, and image regions.

Color

When working with a color camera, convert the captured color image into a binary (black and white) or a grayscale converted image by extracting the desired color.



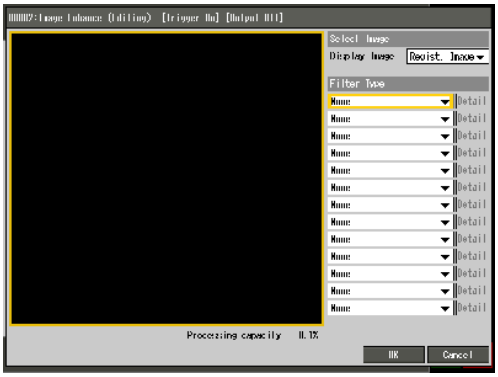
► Note

This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-295) is referenced as the current image.

Refer to "Working with Color Images (Color Extraction)" (Page 10-2) for concepts involving color extraction and its operation.

Image Enhance

Specify the filter processing to apply to the image.
When a color camera is used, the filter is applied to the images converted using color extraction.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Filter type

Select the [Filter Type] field and then select the filter to apply. To perform area measurement using a method other than color to binary, you must select the [Binary] filter as the last filter. See "Image Enhancement Filters" (Page 10-11) for more details of each filter processing.

► Note

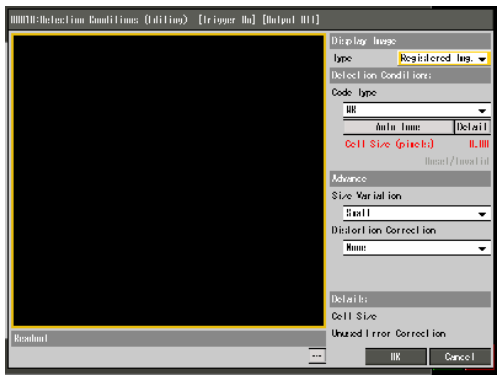
- For the area tool, [Binary] must be selected unless color to binary is used in the color extraction settings.
- If the binary filter is not selected or another filter is applied after the binary filter, the measurement result may not be correct.
- The binary, subtract and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 13 types of filters can be stacked according to application requirements. When multiple filters are set, they are processed one by one from the top.
- The order of the filters can be changed by selecting a filter in one of the [Filter Type] fields, holding down the No.1 (FUNCTION) button of the handheld controller, and then moving the 8-way key up or down.

Conditions

Specify the conditions for detecting and decoding 2D codes.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Code type

Select the type of 2D code to detect and decode.

- **QR** (default): Detect and decode QR codes.
- **Micro QR**: Detect and decode Micro QR codes.
- **DataMatrix**: Detect and decode DataMatrix codes.
- **RectangleDataMatrix**: Detect and decode Rectangle DataMatrix codes.

► Note

Some screen settings are initialized when the code type is changed.

Auto Tune

Use automatic tuning to automatically adjust settings best suited for the detection of the code.

Reference

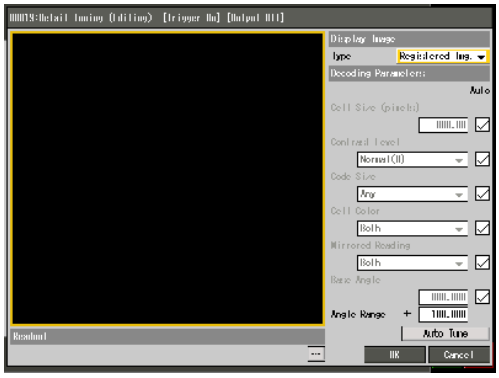
The AT command can be used in order to execute automatic tuning from an external device or menu.

► Note

- Automatic tuning will fail when a settings error is present and normal detection is not successful (timeout, angle range setting is too small, etc.).
- If the inspection region is large, the effects of background noise may cause automatic tuning to fail or may increase the amount of time required for automatic tuning. Adjust the size of the inspection region as necessary.
- It is not possible to specify which code to detect when there are 2 or more codes in the inspection region.

Detail

When the optimal settings cannot be acquired by automatic tuning, or to change the settings that were created by automatic tuning, select [Detail] and manually specify the detection parameters.



For items to be set by automatic tuning, place a check next to [Auto]. If the check is removed, change the setting for each item accordingly based on the code.

Cell size (pixels)

Specify the resolution (number of pixels per cell) that is the standard for the 2D code which will be read (default 0.00). Setting a value that is closer to the 2D code specification allow for faster and more stable detection.

Reference

A cell size of 4.0 pixels or higher is recommended.

Contrast level

Select the contrast level which will be used as a reference when extracting code features from the following: Highest (2) / High (1) / Normal (0) / Low (-1) / Lowest (-2) (default: Normal (0)).

Setting a lower value will increase the possibility of detecting the code even when the contrast is poor, however if the value is set too low the detection will be susceptible to the effects of noise and detection may become unstable. When automatic tuning is used, a value slightly lower than the maximum detectable value is used based on the image used during the tuning.

Code Size

Specify the 2D code size (based on number of horizontal and vertical cells). The available settings are.

- QR: 21 × 21 to 177 × 177
- Micro QR: 11 × 11 to 17 × 17
- DataMatrix: 10 × 10 to 144 × 144
- Rectangle DataMatrix: 8 × 18 to 16 × 48

When automatic tuning is used, the numbers of cells in the detected 2D code is set to the default [Any]. When [Any] is selected, code detection is possible regardless of the numbers of cells, however the processing time is longer than if the correct code size is selected.

If a number of cells has been selected, 2D codes with different numbers of cells are not detected.

Cell color

Select the color of the code relative to the background to be detected.

- **Both** (default): Detection of both black codes on white backgrounds and white codes on black backgrounds. However the processing time will be longer than when [Black] or [White] is selected.
- **Black**: Detection of black codes on white backgrounds.
- **White**: Detection of white codes on black backgrounds.

Mirrored Reading

Changes the internal processing in order to read mirror-image codes when images are captured through a mirror, a prism, from the reverse side of a transparent sheet, or other similar circumstances.

- **Both** (default): Both normal codes and mirror-image codes are detected. However processing time will be longer than when [Standard Only] or [Mirrored Only] is selected.
- **Standard Only**: Only normal codes are detected (mirrored codes cannot be detected).
- **Mirrored Only**: Only mirrored codes are detected (normal codes cannot be detected).

► Note

When the capture unit is used to mirror the image horizontally, vertically or rotated 180°, the mirror inversion process is applied to the mirrored or rotated image.

Base angle

Specify the angle used as reference for code detection (default 0.000).

Reference

When the base angle for each code is 0°, the conditions are as listed for the codes in "Supported codes" (Page 4-255).

Angle Range

Specify the code angle detection range relative to the base angle (default 180,000). Limiting the angle range can result in faster and more stable detection.

Reference

The value set for [Base Angle] is used as the reference angle for the detection range set with [Angle Range].

Auto Tune

To tune the parameters designated for auto tune in the [Detail] menu, select [Auto Tune] to start the tuning process.

Advance

Size Variation

Specify the level of variation in detecting codes of different size. The smaller the variation the shorter the processing time and less chance for false detection.

- **Small** (default): Detects codes with a ±10% size variation.
- **Medium**: Detects codes with a ±20% size variation.
- **Large**: Detects codes with a ±30% size variation.
- **Unlimited**: Allows detection of all size variations.

Reference

When [Unlimited] is selected, operation is still possible even when cell size (pixels) has not been set. Specifying a value that is close to the 2D code size will allow for faster and more stable detection.

Distortion Correction

Use this setting for distorted codes.

- **None** (default): Distortion correction is not performed.
- **Linear**: Additional processing is performed to correct for linear distortion (due to camera mounting angle) up to 30 30°.

Fine Search (only when DataMatrix or Rectangle DataMatrix is selected)

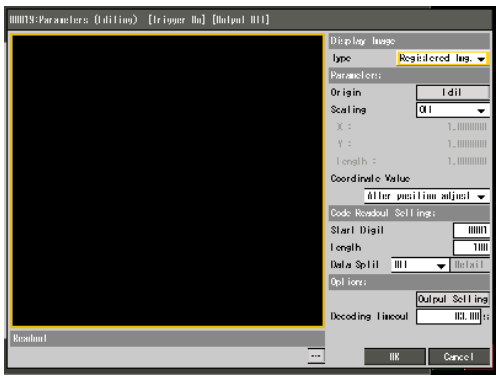
- **OFF** (default): Code detection is tried several times in a short period of time. If no code is detected an error is returned.
- **ON**: Code detection is tried multiple times increasing the detection capability and processing time especially if detection results in a failure.

Readout

Displays the decoded 2D data based on the current settings.

Parameters

Specify additional optional parameters for the inspection.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured image**: Displays the latest image from the specified camera (image variable).
- **Registered image**: Displays the registered image specified under [Image Selection].

Parameters

Origin

By default, the origin is set to the top left corner of the camera but its location can be moved as required. To specify the origin, select [Edit] and then specify the coordinates.

Reference

The origin can be set outside the process region. The available range for the origin is -9600 to 9600 (X), -7200 to 7200 (Y).

Scaling

The controller processes image data in pixels, The result data and setting parameters used for display, judgement and calculations can be converted and scaled to real life values and dimensions by using the pre-set scaling factor option.

- **OFF**: Do not use scaling.
- **ON**: Use scaling.

Reference

- The scaling factor can be changed from the [Option] menu of the Flowchart (Page 4-356).
- For a summary list of the result data for which scaling can be used, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

Coordinate value

Select the coordinate system to be used after position adjustment. If position adjustment is not used, this setting will have no effect on the measurement.

- **After position adjust**: The inspection uses the adjusted coordinate axes determined after position adjustment.
- **Before position adjust**: The distance from the position specified for the [Origin] of the inspection is used.

Code Readout Settings

Start digit

Specify the digit (1 to 9999) to use as the start point for data from the detected code.

Length

Specify the number of characters (1 to 512) to read beginning at the the start digit.

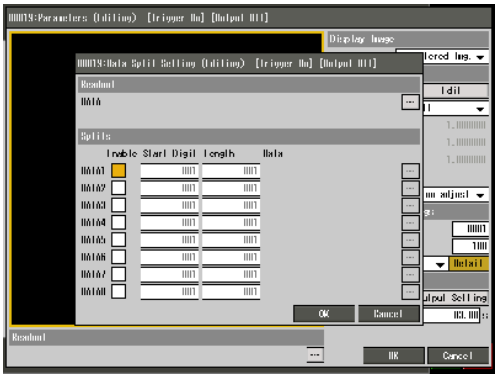
► Note

As this function forcibly divides the data at the designated points, if the start or end digit is in the middle of a kanji, kana, or other 2-byte character, the character may become garbled.

Data Split

Select whether or not to split the data into segments. Segmented data, can be individually used and compared to multiple reference patterns.

- **OFF** (default): The decoded data is not divided.
- **ON**: The decoded data is split into a maximum of 8 segments for output and judgment. When [Detail] is selected: the [Data Split Setting menu] appears. Choose whether or not to enable/disable each data split and specify the starting digit and data length.



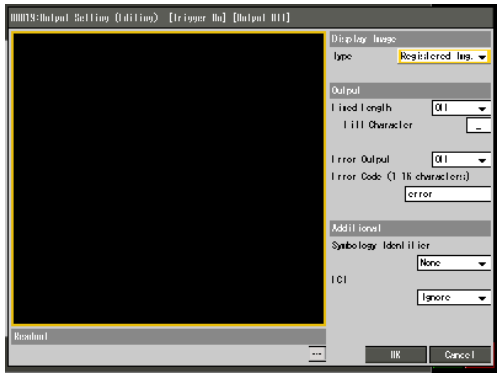
► Note

As this function forcibly divides the data at the designated points, if the start or end digit is in the middle of a kanji, kana, or other 2-byte character, the character may become garbled.

Options

Output Setting

Use the [Output Setting] menu to configure how data is output.



- **Fixed Length**: Select whether or not to fix the length of the data output.
  - **OFF** (default): Output successfully decoded characters up to the number specified in [Data length]. (The data output length varies depending on the number of decoded characters.)
  - **ON**: Output only the data for the predetermined number of characters set in [Data Length]. If the number of decoded characters is less than this number, the character specified in [Fill Character)] is added.
- **Fill Character**: Specify the supplementary character to add to the data when [Fixed Length] is set to [ON] and the number of read characters is insufficient (default: "_" (underscore)).
- **Error Output**: Output a specified string when an error occurs.
  - **OFF** (default): No output.
  - **ON**: Output a specified string.
- **Error Code (1 - 16 characters)**: Specify the character string (maximum 16 characters) which is output when [Error Output] is set to [ON] and an error occurs (default "error").
- **Symbol Identifier**: Select whether or not to add the 2D code symbol identifier (3 characters: 3 bytes) to the decoded data readout.
  - **None** (default): Do not add a symbol identifier.
  - **Output**: Add the symbol identifier (3 bytes) that is defined in JIS X 0530 "Data carrier identifiers (including symbology identifiers)" to the start of the read data.

Reference

The symbol identifiers that are added by [Symbol Identifier] are shown in the table below.

Code type	Added data	Condition
QR Code (including Micro QR)	] Q0	Model 1 (or Micro QR)
	] Q1	Model 2 (not including ECI)
	] Q2	Model 2 (including ECI)
	] Q3	Model 2 (not including ECI, FNC1: exists in No.1 position)
	] Q4	Model 2 (including ECI, FNC1: exists in No.1 position)
	] Q5	Model 2 (not including ECI, FNC1: exists in No.2 position)
	] Q6	Model 2 (including ECI, FNC1: exists in No.2 position)
DataMatrix (including Rectangle DataMatrix)	] d1	ECC 200 (not including ECI)
	] d2	ECC 200 (not including ECI, FNC1: exists in No.1 or No.5 position)
	] d3	ECC 200 (not including ECI, FNC1: exists in No.2 or No.6 position)
	] d4	ECC 200 (including ECI)
	] d5	ECC 200 (including ECI, FNC1: exists in No.1 or No.5 position)
	] d6	ECC 200 (including ECI, FNC1: exists in No.2 or No.6 position)

- **ECI**: Select the handling of codes which contain ECI (Extended channel interpretation)

► Note

This does not affect the reading of codes which do not contain ECI.

- **Ignore** (default): ECI data is not output.
- **Output**: ECI data is output

Timeout

For time sensitive processing, a time-out can be used to specify a time (0.1 to 600.0 s) to wait for the conditions to be satisfied (default: 60.0).

- **ON**: Wait for conditions to be satisfied in the specified period of time. If the time-out time is reached continue to process the rest of the flowchart regardless of the state of the monitored terminals.
- **OFF** (Default): No time-out function, continued processing of the flowchart will only occur when the conditions are satisfied.

► Note

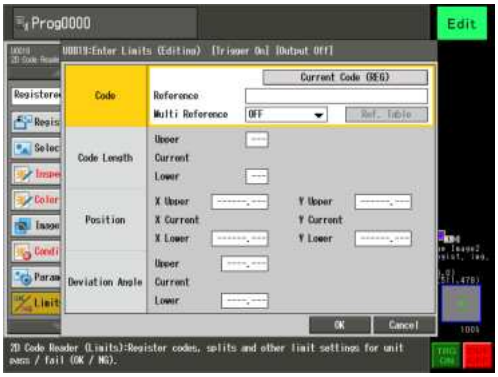
Depending on the processing load of the controller the timeout value maybe longer than specified.

Readout

Displays the decoded 2D data based on the current settings.

Limits

Set the matching pattern to be compared with the read code data and the tolerances (upper and lower limits) for the detected value. When the code reading result does not match the criteria or when the measurement value is outside of the specified tolerance range, it is judged as "NG". When the result matches the criteria and the measurement value is within the tolerance range, it is judged as "OK".



Select the desired tolerance and then enter a value.

- If no limits or tolerances are set the unit will result in a pass (OK).
- The unit of tolerance varies depending on the limit parameter.

Code

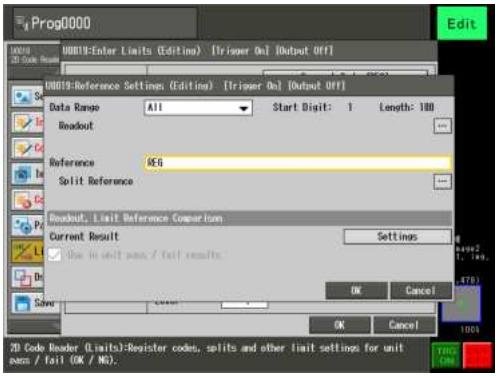
Current Code (REG)

Register up to 512 characters (512 bytes) from the data that was read with the current settings as a REG reference pattern.

- If the registration pattern is blank and the [Multi Reference] setting (Page 4-270) is [OFF], REG is input automatically and the read results from the currently displayed image are registered.
- See "REG (registered string)" (Page 4-268) for details concerning REG.

Reference Settings

When [Reference] is selected, the Reference Settings menu appears where a matching pattern, a matching method, or other matching criteria can be specified.



► Note

- When the [Multi Reference] (Page 4-270) is [ON], [Reference] cannot be selected.
- In order to set multiple reference limits, select [Ref. Table] (Page 4-270) and select [Edit] to display the menu for the desired reference setting.

- **Data Range**: Select the data range to check against the reference pattern (default [All]). If [Data Split] (Page 4-266) in the parameters menu is set to [ON], the split (1 through 8) can be specified.

► Note

If [Data Split] in the parmaeters menu is not [ON], this option is fixed to [All].

- **Readout**: Displays the decoded 2D data based on the current settings.
- **Reference**: Click the reference field and a software keyboard is displayed. Enter up to 32 characters and symbols (32 bytes) as a matching pattern.
  - It is possible to combine a fixed character with other tolerances that vary according to external information such as calendar data, or variable data.
  - Readout: Specify the current decoded data as the reference pattern.
  - Special: The following wildcards can be used in the reference pattern.
    * and #: Used to check only the presence of one character (1 byte) of data and skip matching.
    !: Used to skip matching of zero or more characters.
    Example: Differences in results when using "*" ("#") versus "!"

Decoding results		Matching pattern	
		AB* (AB#)	AB!
AB	→	NG	OK
ABC	→	OK	OK
ABC**D**	→	NG	OK

- **REG** (registered pattern): A specific set of characters are set as the pattern based on the registered or captured image. Selecting [Regist] registers the detected characters from the current display image.

  Reference

  The CW command can be used to rewrite the REG data on the controller. For more details, see the XG-7000 Series Communication Control Manual.

  ► Note

  - The special character "!" cannot be used twice or more in a matching pattern. If two or more "!'s" are used in a pattern matching will fail.
  - The REG (registered string) cannot be used in combination with other fixed characters, multiple reference patterns or other tolerance types.
  - When the captured image is selected as the display image and there is no previous data, REG is will be blank. Be sure that a code has been detected before registering the reading results.

Date & time tolerances

The following date and time functions from the internal calendar and clock can be used in the pattern judgment.

- **Year4**: Four digit calendar year
- **Year2**: Two digit calendar year
- **Month**: Two digit month
- **Day**: Two digit day
- **Hour**: Two digit hour

  Example: Verifying the year/month/day (January 1, 2008) using the internal calendar tolerances.

Text		Registered pattern
Year4/Month/Day	→	2008/01/01

This example uses both calendar tolerance and a fixed character "/".

Reference

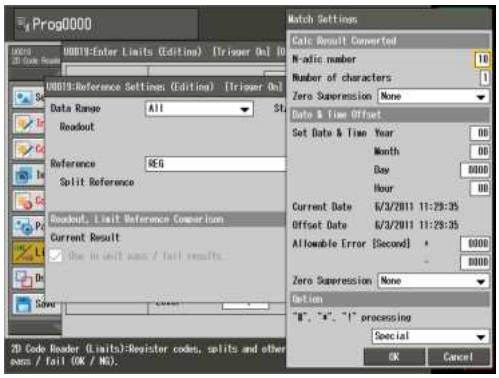
- A user specified offset and allowable error can be set for the date time functions of the internal calendar. See "Allowable Error [Second]" (Page 4-240) for more details.
- Zero suppression (Page 4-241) can be set for the Month, Day, and Hour.

- **Variable**: Convert the value of a variable into characters. The conversion method is determined by the settings in the [Calc Result Converted] series of options.

  Example: For a 7-character 2D code made up of text "TEST" plus a 3-digit serial number (to which 1 is added to each time) use fixed characters (TEST) and the variable #Count01 together as the reference pattern. Set the calculation result conversion: N-adic number: 3 digits, zero suppression: OFF.

Reference Pattern		2D Decode
TEST#Count01	→	TEST000 to 999 (After 999, the count returns to 000.)

- **Settings**: Use this option to specify the parameters for the reference pattern.



Calc Result Converted

Specify the number base and number of recognized characters used for conversion of numerical variables used in the limit settings.

- **N-adic number**: Set the number base (10 to 36) (Default: 10).
  Example: Numerical conversion when N-adic is set to base 36

Calculation result	0	to	9	10	to	35
Calculation tolerance	0	to	9	A	to	Z

- **Number of Char.**: Specify the number of characters to use after conversion of the numerical limit (1 to 6, default: 1).

► Note

Converted numerical values that result in the number of characters being exceeded are excluded. Example: Number of Char. 2 and converted numerical value 350 results in the limit being 50.

Zero Suppress

Remove zeros from the calendar or string used in the limit settings.

- **None** (default): Include zeros
- **Space forward**: Replace leading zeros with a space.
- **Space backward**: Replace trailing zeros with spaces.
- **Remove zeros**: Remove all zeros.

► Note

- Zeros in the first digit (and second digit of the year) are exempt from zero suppression regardless of the setting.

Example: Conversion result of the registered character strings using zero suppression

Zero suppression setting	Date & time tolerances	Calculation tolerance
OFF	08/08/25	00350
Space forward	08/_8/25	_350
Space backward	08/8_/26	350_
Remove zeros	08/8/25	350

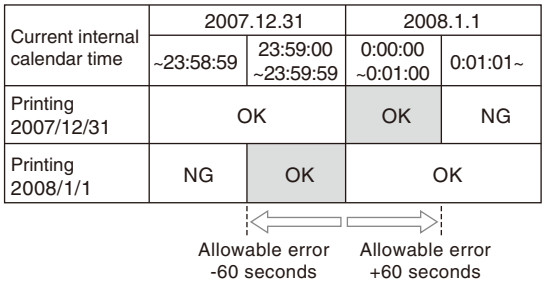
Underscore "_" is considered as a space.

- **Date & Time Offset**
  Set Date & Time Offset: Adds an offset to the date and time that is used in the reference pattern. The current and offset date and time are displayed below. The range of offset values that can be specified are: Year: ±10, Month: ±12, Day: ±1999, Hour: ±24 (By default, all of the offset values are set to 0).

Allowable Error [Second]

Specify the allowable difference between the controllers internal date & time and the inspected targets marked date & time based on the current process or operation. The specified values (±0 to 3599 seconds) can used as an additional offset to the value or encoded value of the calendar OK / NG tolerance (Page 4-243).

Example: Judgment results when the allowable error is set to ±60 seconds at the turn of the day



Zero Suppress

Remove zeros from the calendar or string used in the limit settings.

- **None** (default): Include zeros
- **Space forward**: Replace leading zeros with a space.
- **Space backward**: Replace trailing zeros with spaces.
- **Remove zeros**: Remove all zeros.

► Note

- Zeros in the first digit (and second digit of the year) are exempt from zero suppression regardless of the setting.

Example: Conversion result of the registered character strings using zero suppression

Zero suppression setting	Date & time tolerances	Calculation tolerance
OFF	08/08/25	00350
Space forward	08/_8/25	_350
Space backward	08/8_/26	350_
Remove zeros	08/8/25	350

Underscore "_" is considered as a space.

- **"#", "*", and "!" processing**: Select whether to use "#", "*", "!" as wildcard characters for reference pattern judgment, or to handle them as ordinary "#", "*", and "!" characters.

- **Use in unit pass / fail results**: Check this box to use the matching result for unit judgment (Default: Checked). Remove the check mark to use multiple matching criteria and perform matching without affecting the unit judgment.

► Note

If [Multi Reference] is set to [OFF] this option is fixed on.

Multi Reference

Use this option to to set multiple reference patterns (default [OFF]).

► Note

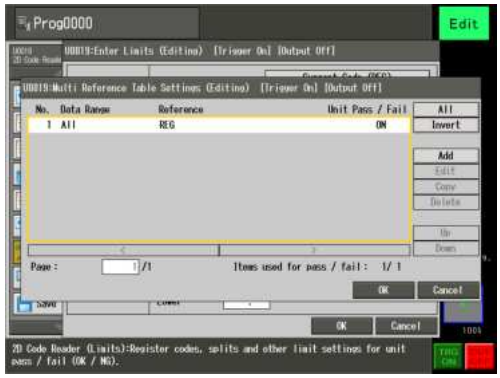
When this setting is changed from [ON] to [OFF], the second and later reference settings are cleared.

Ref. Table

Multiple reference patterns can be added, modified and deleted in the table display.

► Note

The [Ref. Table] cannot be selected when [OFF] is selected for [Multi Reference].



- **All**: Select all reference patterns in the table.
- **Invert**: Invert the current selection.
- **Add**: Add a new reference pattern (maximum 16). The [Reference Settings] menu (Page 4-267) allows for the setting of the reference pattern, reference method and other settings associated with the reference pattern.
- **Copy**: Copies the currently selected reference pattern.
- **Delete**: Deletes the currently selected reference pattern.
- **Move Up / Move Down**: Change the order No. of the currently selected reference pattern.

Reference

- A maximum of 16 reference patterns can be added.
- When multiple reference patterns are made, it is possible to reference a combination of ranges from the read data, and to perform sorting based on the results data according to which of the reference patterns are matched.
- When using the 2D code reader tool for sorting remove the check from [Use in unit pass/fail results] in the [Reference Settings menu] (default enabled) to avoid mismatching results affecting the unit judgment.

Code length

Specify the tolerance for the number of decoded characters in the code.
The measurement value is the number of characters (byte units) decoded at inspection.

► Note

- The number of characters applies to the data length that is set in the [Parameters] menu.
- Alphanumeric and other half-size characters are handled as 1 byte per character, while kanji, kana, and other full-size characters are handled as 2 bytes per character.

Position

Specify the tolerance for the coordinates of the code detection position.
The measurement value is the number of pixels indicating position.

Detection angle

Specify the tolerance for the angle of the code.
The measurement value is an angle in degrees.

► Note

The detected angle is the difference from the [Base Angle] specified on the [Detection Conditions] menu.

Display Options

The display color of the units visual indicators can be changed based on the judgment result for that unit. The visual indicator can also be made transparent by selecting [Setting] - [Select Color] - [None].



Inspection region

Specify the line width and display color of the inspection region.

Mask region

Specify the line width and display color of the mask region.

Primary target

Specify the detected code region, the width and display color of the detected point (code center).

Processing Priority

Specify the processing priority when displaying large processed images during Run mode.
When a line scan camera is used with the XG-7502A, it is not possible to display the processed image if the image size exceeds 25 MB (26214400 pixels). In such a case it is possible to display the filtered image and contrast image by using a display image variable.

Filtered image

Select whether or not to use a display image variable for the filtered image display.

- **Unit Processing**: Processes the filtered image without using the display image variable.
- **Image Display**: Processes the filtered image using a display image variable.

Reference

- When processing images 25 MB or less, or when using the XG-7702A, it is not necessary to select [Image Display].
- When processing an image larger than 25 MB, if the area displayed is 8 MB (8388608 pixels) or less, the filtered image will be automatically displayed when [Unit Priority] is selected. (However the following processes are excluded.)
  - Image enhancement: Shading correction, blob filter
  - Conversion (image operation): Rotate/translate, zoom, trapezoid correction, blob filter
  - Defect, Grayscale Blob: Contrast display

► Note

When [Image Display] is selected for [Filtered Image], the following restrictions on operation occur.

- Processing time increases.
- The background outside the inspection region becomes a black image.
- Displaying of multiple units is not possible.
- For display of registered images outside of unit edit, the filtered image cannot be displayed and the display is the same as when [Unit Processing] is set.
- When an archived image is displayed, it ix not possible to display the processed image unless the display image variable and results are also stored in the archive.

Image variable

Specify a display image variable for displaying the filtered image.

Reset

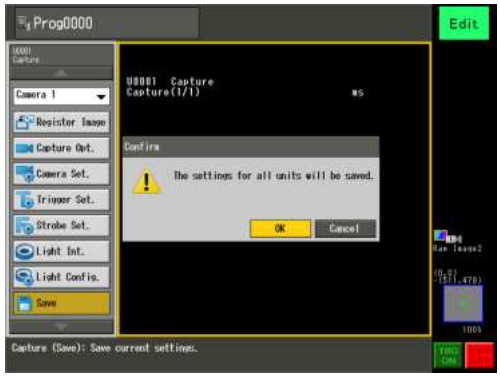
Returns the display options to their defaults.

Save

Save the current unit changes the program file.

► Note

- If the device is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the system power while you are saving the settings. Doing so may cause errors in the internal data



Save

The settings for the unit are saved in the current program file in SD Card 1 or SD Card 2.

► Note

Items specified not to be saved in XG VisionEditor are excluded from the saving operation.
For example, variable values changed in the current program or the default display, and display parts, can be excluded when saving.

When Codes Cannot be Read Correctly

If code tuning and reading is not possible, check whether any of the following problems exists.

Low resolution

Increase the CCD area for the 2D code as much as possible by adjusting the lens or using a higher resolution camera using 4 pixels per cell as a minimum guideline.

Poor contrast

Use contrast conversion or other image enhancement filter (Page 4-262) to improve the contrast.
If [Gray] is selected for color extraction (Page 4-261) with a color camera, using [RGB Gray] may also improve the contrast.

Out of focus

Check the lens focus adjustment and camera shutter speed.

Distorted or bad print quality

Check the code printing / marking conditions.

Gaps between cells or holes in cells

Use a combination of enlarge, shrink, and other image enhancement filters (Page 4-262) and try to connect the cells and or fill the holes.

Small quiet zone (less than 2 cells)

Check that there is sufficient blank space (minimum space equivalent to the size of 2 cells) around the code within the inspection region. If the code position is displaced toward the edge of the inspection region, consider position adjustment using the Position Adjustment unit (Page 4-274).

Code moving out of region / position

Make sure the position adjustment unit is referenced in the inspection region menu of the 2D code reader unit. (Page 4-274).

Code not detected

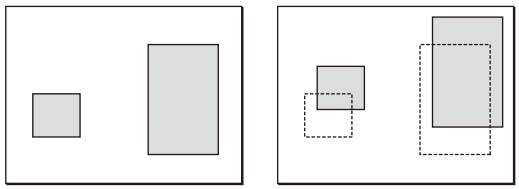
Try setting [Linear] for [Distortion Correction] and setting [Fine Search] (DataMatrix only) to [ON] to increase the probability of detecting the code.

Position Adjustment

The position adjustment unit allows the configuration and allocation of settings relating to part tracking and region movement for correct inspection of a target that could be misaligned or is not repeatable when presented to the camera.

Position Adjustment

For situations where regions are fixed and target misalignment occurs correct measurements and inspection results cannot be guaranteed.



Example:
Reference position setting

Example:
Misaligned target
v. fixed region

The position adjustment unit is used to specify a reference position and have the deviation information automatically reflected to other units for proper measurement and inspection.

Processing results

The standard results and data returned by the position adjustment unit are as follows:

Offset (X, Y)	Outputs the X and Y deviation in pixels between the registered base position and the current base position.
Rot. Center (X, Y)	Outputs the X Y center co-ordinates used for rotation angle deviation results.
Rotation angle	Outputs the rotation angle deviation between the registered reference angle and the current reference angle.
Base (X, Y) 1/2	Outputs the registered XY reference position coordinates pixels. In the 2-point position adjustment mode the coordinates of position 1 and 2 are output individually.
Base Position Angle 1	Outputs the registered reference angle.

Reference

For the lists of available measurement output values, refer to "List of Result Data" in the XG-7000 Series Communications Control Manual.

Selectable reference units

The list below details the unit type and result data that can be used as the reference position in the position adjustment unit.

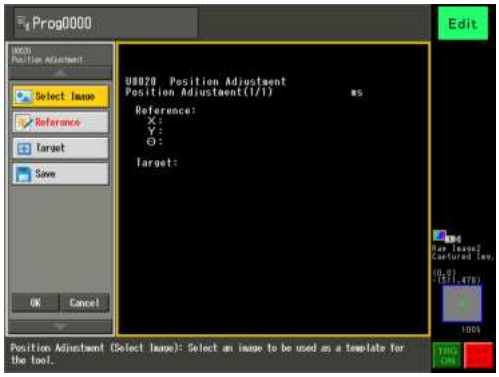
Unit type		Result data (item)
Pattern Search		Position, angle
Edge Position		Position, angle
Edge Angle		Center, angle
Defect	Grouping OFF	Position
	Grouping ON	Center of gravity
Blob		Center of gravity, major axis angle
Grayscale Blob		Center of gravity, major axis angle
Profile Position	best fit Circle/Line OFF	Position, angle
	best fit Circle ON	Circle center
	best fit Line ON	Line Center, line angle
Profile Defect		Defect position, defect angle
2D Code Reader		Position, code angle
Calculation		Calculation result (ANS)

Reference

The calculation unit can only be specified through the Edit Unit menu, and the only data that is available is the result (ANS) data.

Main Menu

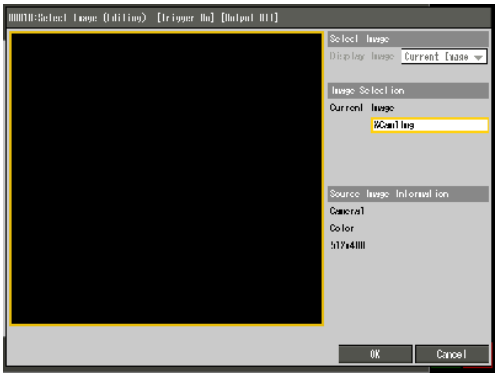
The main menu of the position adjustment function consists of the following options. Configure settings under each option as required for the inspection.



Select Image (Page 4-275)	Specify the image to be used for unit processing.
Reference (Page 4-276)	Select the reference information (such as unit X Y position) for the position adjustment deviation information to be taken from.
Target (Page 4-276)	Specify the units for which the position adjustment will be reflected to.
Save (Page 4-277)	Save unit settings.

Select Image

Specify the image variable and associated registered image to be used for configuring the vision tool.



Select Image

Display Image

Switch the image displayed on the screen.

- **Captured Image**: Displays the latest image from the specified camera (image variable).
- **Registered Image**: The registered image specified under [Image Selection] is displayed.

Select image

Captured Img.

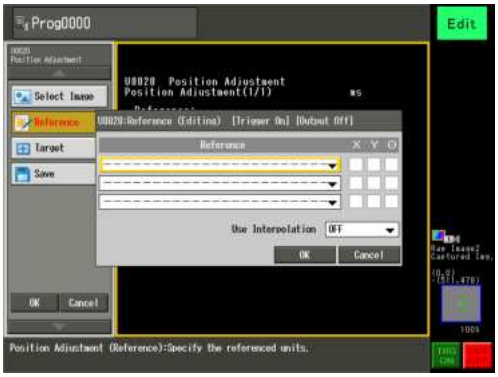
Set an image variable to be used as a current image for the unit.

Source Image Information

The camera No., type (color / monochrome), and resolution of the camera associated to the image variable specified is displayed.

Reference

Specify the reference information (such as unit result X Y position) for the position adjustment deviation information to be taken from.



► Note

- Changes made here will only be reflected when OK is selected.
- Based on the items used in the reference menu the position adjustment information may be based on registered images when [OK] is selected.
- Variables and specific unit result data can not be directly specified in the reference menu. Nor can any variables or unit result data that have been specified elsewhere be displayed or edited either.

Reference

Select a unit containing X Y coordinates or angle information to be used as a reference for the position adjustment, and then specify the appropriate item (X, Y, or θ) individually.

Reference

- Units with different image variables can also be selected.
- Refer to "Selectable reference units" (Page 4-274) for more information on units and items which can be selected for the position adjustment reference.

Use interpolation

Use interpolation on the target image.

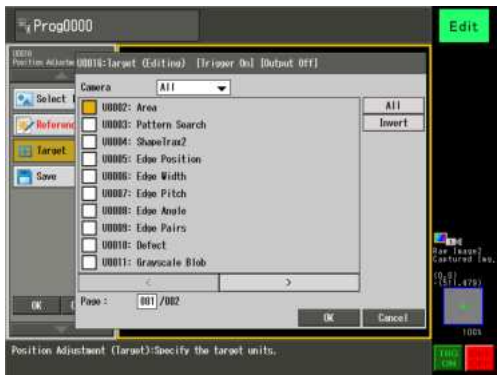
- **ON**: Use interpolation.
- **OFF** (default): Do not use interpolation.

► Note

This setting is only valid when a monochrome image variable is used. Interpolation is disabled for a color image variable regardless of this setting.

Target

Specify the units for which the position adjustment will be reflected to.



► Note

Changes made here will only be reflected when OK is selected.

Target

Select units for which the position adjustment will be applied to.

Reference

Units with different image variables can be filtered.

Save

Save the current unit changes the program file.

► Note

- If the device is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the system power while you are saving the settings. Doing so may cause errors in the internal data



Save

The settings for the unit are saved in the current program file in SD Card 1 or SD Card 2.

► Note

Items specified not to be saved in XG VisionEditor are excluded from the saving operation.
For example, variable values changed in the current program or the default display, and display parts, can be excluded when saving.

Program Branch

The flowchart can be branched off into different processes based on a specified condition. A branch can be used to control the processing flow based on the result of a vision unit, a calculation, a variable or external I/O.

Processing results

The standard results and data returned by the branch unit are as follows:

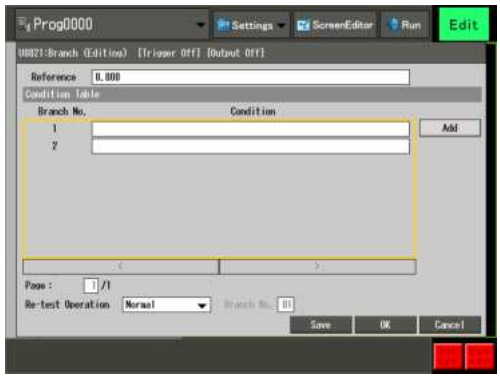
Reference value	The assigned reference value used in the evaluation of the branch processing.
Destination branch	The branch number that the process follows based on the evaluation of the reference and conditions. If no conditions are satisfied then 0 is returned.

Reference

- The join unit has no specific result data.
- The join unit cannot be edited.

Branch

Specify the parameters for branching the process.



Reference

Specify a numerical value, result data, variable or I/O to be used for evaluation.

► Note

A mathematical expression cannot be used here.

Branch No.

The available branches (1 to 64) in the branch unit are shown in a list indicating the order of comparison that occurs between the reference and condition values. Comparison starts at No.1 and carries on until the reference value equals the condition value unless ELSE is specified as one of the conditions. The unit then branches to that No..

Condition table

Specify a numerical value, result data, variable or I/O to be compared to the reference value. [ELSE] can also be used as a condition value for instances where no condition values are satisfied.

► Note

A mathematical expression cannot be used here.

Reference

- The order of the branch Nos. can be changed by holding down the No.1 (FUNCTION) button or No.7 (BACK) button while moving up or down.
- If the reference value does not equal any of the condition values and [ELSE] is not set as a condition value, units in the branch area skipped and processing moves to the join unit.

Add

Specify the number of branches to be added. The specified number of branches are added below the current set of branches.

Re-test Operation

When [Single Branch] is selected and a branch No. is specified, the process is forced down this branch number during Retest mode (default Normal).
This function is useful when needing to force operation from an external source.

Save

The settings for the unit are saved in the current program file in SD Card 1 or SD Card 2.

► Note

Items specified not to be saved in XG VisionEditor are excluded from the saving operation.
For example, variable values changed in the current program or the default display, and display parts, can be excluded when saving.

Other Operations

Adding additional branches

Additional branches can be added on to an existing branch from the flowchart. The number of branches that can be used in a branch unit is minimum 2 and maximum 64.

1 **On the flowchart select the branch to add a branch to, and display the Flow Editor menu (Page 4-3).**

2 **Select [Edit] - [Edit Branch] - [Add Branch].**
A branch is added.

3 **From the branch menu set the condition value for the new branch.**

Removing part of a branch

Selected branches can be removed from a branch without deleting the whole branch / joint unit.

► Note

- If other units exist under the branch being removed then they will be deleted when the branch is removed. Deleted units can not be restored.
- If the selected only has 2 branches the branch cannot be removed.
- To re-organize branches before moving branches expand and edit the branch unit.

1 **On the flowchart, select the branch to remove, and display the edit menu (Page 4-3).**

2 **Select [Edit] - [Edit Branch] - [Remove Branch].**
The branch is removed.

Moving branches

Branches can be moved left or right in the flowchart.

► Note

To re-organize branches before moving branches expand and edit the branch unit.

1 On the flowchart select the branch to move, and display the edit menu (Page 4-3).

2 Select [Edit] - [Edit Branch] - [Move Branch Right] or [Move Branch Left].

The branch is moved accordingly.

Loop Function

The loop function causes the units in between the loop function and loop end unit to be processed in order a set number of times.

► Note

- When the loop function unit is added to the flowchart, the loop end unit is automatically added. When the loop function unit is deleted from the flowchart, the corresponding loop end unit is automatically deleted.
- When the loop function unit and loop end unit are deleted from the flowchart, all other units between the pair are also deleted.

Processing results

The standard results and data returned by the loop function/end units are as follows:

No. of loops	The current loop number being processed by the loop function. This value is 0 when the flowchart starts and increases by +1 when the process returns to the loop function unit after reaching the loop end unit.

Reference

- The loop end unit has no specific result data.
- The loop end unit cannot be edited.

Loop function

Specify the number of times to loop and process the units contained in the loop.



No. loops

Specify the number of times (0 to 9999999, default: 1) to process units between the Loop Function unit and Loop End unit.

Reference

When [No. Loops] is set to [0], the units between the loop function unit and loop end unit are not executed, and the process moves to the unit immediately after the loop end unit.

Save

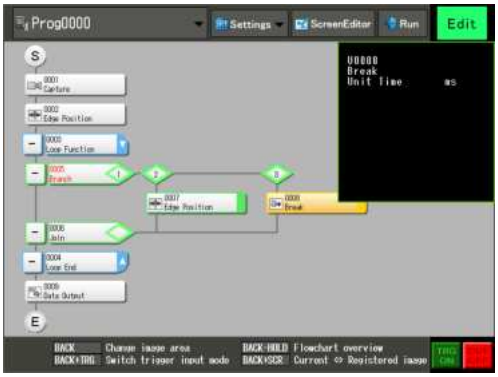
The settings for the unit are saved in the current program file in SD Card 1 or SD Card 2.

► Note

Items specified not to be saved in XG VisionEditor are excluded from the saving operation.
For example, variable values changed in the current program or the default display, and display parts, can be excluded when saving.

Break

The break unit is placed between the loop function and loop end unit to force the loop operation to cancel.
This unit can be used in conjunction with a the branch unit (Page 4-278) to force the process to go out of the loop when a specific condition is satisfied.



In the example above, the loop operation is canceled and the process moves to the data output unit.

► Note

- A break unit can only be used in-between the loop function and loop end units.
- The break unit cannot be edited.

End

The end unit terminates the flowcharts operation.
An end unit is automatically inserted at the bottom of the flowchart when a new program is created. Additional end units can also be placed at other points in the flowchart allowing for other circumstances to cause the flowchart to end.

Calculation

The calculation unit is used for processing multiple functions in as a calculation string with the results being used directly as the output of the calculation unit or for populating user specified variables. While complex mathematical calculations and scripts can be constructed and processed, upper and lower limits can also be set to act as pass / fail criteria for the units function in the rest of the program.

Processing results

The standard results and data returned by the calculation unit are as follows:

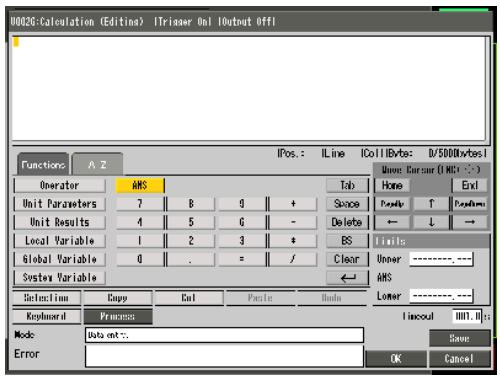
Calculation result	The result of the calculation (default 0) if ANS is used as the result for a function processed in the script. Tolerance inspection target
Error Code	The reference error code (default 0) used when an error occurs in the processing of the script in the unit. ► Note The default value is used for other errors in the unit (such as judgment limits).
Error line	The line number of the error found in the calculation unit. Reference These error codes and lines numbers are not displayed for setting errors.

Reference

For the lists of available measurement output values and setting parameters, refer to "List of Setting Parameters/Result Data" in the XG-7000 Series Communications Control Manual.

Calculation setting

Specify the functions, parameters and results to generate a calculation script along with associated pass/ fail limits.



Operator

Select a function to be used in the calculation unit from the XG-7000 Series list of functions. Up to 5000 characters can be used to write a function in a single calculation unit (including comments). Note that a line feed is counted as two characters, and a tab is counted as one character.
For more information about operators and functions available for an arithmetic expression, see "Operator and Function List" (Page 10-28).

► Note

- If the number of characters exceed the upper limit due to changes in unit ID number (Page 4-14) and or variable name length the function will not be processed.
- The script in the calculation unit has to be less than 1000 characters per line and less than 2000 lines long.

Reference

- To use two or more functions in the calculation separate them with a blank line.
- To specify comments in the function precede the comment with '.
- English and Japanese characters can be used in the comments.

Unit parameter

Use this option to select parameters from units already configured in the program.
When the [Unit Parameters] menu is displayed, select the appropriate unit and tab to the right to drill down to the desired parameter.

Unit results

Use this option to select result data from units already configured in the program.
When the [Unit Results] menu is displayed, select the appropriate unit and tab to the right to drill down to the desired result.

Local Variable

Use this option to select from a list of local variables defined in the program.
When the [Local Variable] menu is displayed, select the variable and tab to the right to drill down to the desired option or variable value to be used.

Global Variable

Use this option to select from a list of global variables defined in the program.
When the [Global Variable] menu is displayed, select the variable and tab to drill down to the desired option or variable value to be used.

System Variable

Use this option to select from a list of system variables.
When the [System Variable] menu is displayed, select the variable to be used.

Selection

Highlight characters to be edited by selecting the first and last characters.

Copy

Copy selected characters.

Cut

Cut selected characters.

Paste

Paste selected characters.

Undo

Undo the last operation.

Text Input

[Hiragana], [Katakana], [Alphanumeric Characters], and [Kanji] can be entered.

Process

Calculate the entered script.
If an error is found in the calculation script, that error is displayed.

► Note

If variables are used in the calculation script, updating such variables may affect their values during operation.

Errors

If an error occurs in the calculation script, the line, column and description of the error are displayed.

- If a syntax error is found, the cursor jumps to the location of the error.
- The [Error] field shows the line, column and description of the error.
- If several errors exist, the first error from the beginning of the script is displayed.
- When a calculation processing error occurs (such as dividing by 0), a unit error (UERR) is output as result data for the calculation unit together with the calculation error code (ERRC) and error line (ERRL). For the error codes, see the XG-7000 Series Communication Control Manual.

Limits

To generate pass / fail results from the calculation unit upper and lower limits need to be set as judgment criteria for ANS.

- The calculation result ANS represents result data from the calculation unit and can be populated with a value directly in the calculation script.
- By associating ANS with a variable (which is processed in another calculation script) tolerances can be set for a variable and the calculation unit result can be used for processing in the rest of the program.
- Example of using ANS with a variable:
  Using a calculation unit to judge the variable #Areacount which contains a processed value.
  ANS=#Area_count

► Note

ANS is reset to 0 every time before the calculation unit is processed.

Upper

To set upper pass / fail criteria, input the upper limit. When the ANS value exceeds the specified upper limit, the unit is judged as NG.

Lower

To set lower pass / fail, input the lower limit. When the ANS value is below the specified lower limit, the unit is judged as NG.

Reference

- The current value of the calculation result ANS is shown next to [ANS] between the upper and lower limit values.
- Pass / fail judgment is performed regardless of the unit error or timeout.
- If a calculation unit is specified as a position adjustment reference ANS will be the value referenced.

Timeout

For time sensitive processing, a time-out can be used to specify a time (0.1 to 600.0 s) to wait for the conditions to be satisfied (default: 60.0).

- **ON**: Wait for conditions to be satisfied in the specified period of time. If the time-out time is reached continue to process the rest of the flowchart regardless of the state of the monitored terminals.
- **OFF** (Default): No time-out function, continued processing of the flowchart will only occur when the conditions are satisfied.

► Note

Depending on the processing load of the controller the timeout value maybe longer than specified.

Save

The settings for the unit are saved in the current program file in SD Card 1 or SD Card 2.

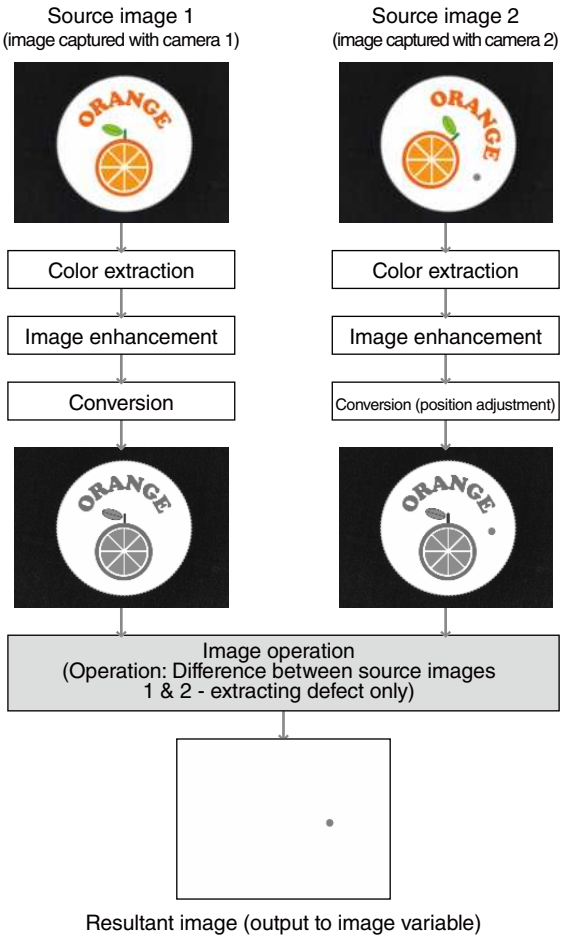
► Note

Items specified not to be saved in XG VisionEditor are excluded from the saving operation.
For example, variable values changed in the current program or the default display, and display parts, can be excluded when saving.

Image operation

Image operation gives the ability to create and store new images in a user specified image variable. This image is the result of a process or a conversion being performed on a single multiple source images.

Image Operation Flow



Resultant image (output to image variable)

Reference

- Registered and captured images can be specified as either source image.
- If a color image is specified as the source image, the resultant image will always be a grayscale image due to the grayscale conversion performed by the color extraction process.

Main Menu

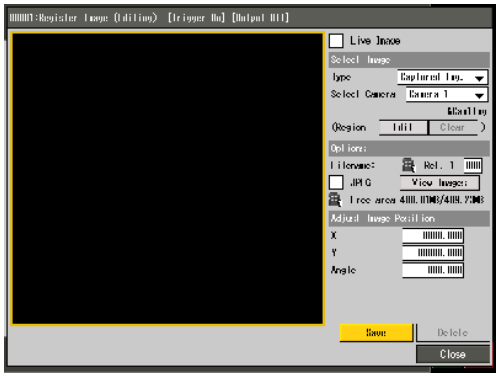
The main menu of the image operation function consists of the following options. Configure settings under each option as required for the inspection.



Register Image (Page 4-287)	Register an image to be used as a template for settings.
Operation (Page 4-288)	Outline the operation to be performed using source images 1 and 2 after individual image processing.
Source 1 (Page 4-290)	Selection and processing of image 1 used in the operation.
Source 2 (Page 4-294)	Selection and processing of image 2 used in the operation.
Inspect Region (Page 4-295)	Define the region to be used for unit processing.
Result Image (Page 4-295)	Outline the settings for the result image.
Display Options (Page 4-297)	Unit processing display settings.
Save (Page 4-298)	Save unit settings.

Register Image

An image can be saved to the controller to be used as a template for measurements and settings. It is recommended to adjust and fix lighting and other external influences before registering an image.



Live Image

Check this box to display live images through a continuous feed.

► Note

- A live feed is only available while the unit is being edited.
- This setting cannot be changed when the screen update mode is set to [Continuous] in the trigger settings (Page 4-25).
- If the capture on trigger input is disabled in the trigger settings (Page 4-25), this check box is always unchecked and the setting cannot be changed.
- When Live image is selected for a moving object, take care when registering as there will be a time lag between the external trigger input and the actual image capture.
- In principle, Live-image is only used when the capture unit being edited is being executed (waiting for a trigger input). When the image capture buffer is set to custom and the capture unit which was most recently executed is being edited, the images collected in the buffer will still be displayed even if the capture unit is not presently capturing images.
- Continuous update cannot be used when HDR capture (Page 4-21) is enabled or when a line scan camera is being used.
- When the HDR capture (Page 4-21) is enabled, the Multi-image cannot be used.

Select Image

Type

Select an image to register.

- **Captured Img.**: Displays the latest image from the specified camera (image variable).
- **Registered Img.**: The registered image specified in [Options] is displayed.

Select Camera

Select the number of the camera used for registration. Choose from Camera1 - Camera4, and select only the camera number used for the capture unit being edited.

Specifying a region

To register only part of an image, select [Edit] then specify the region to register. To cancel the selected region, select [Clear].

Save Image

Filename

Specify the registered image number used for image registration in the form "(Camera No.)-(User-specified No.)".

Reference

The name of the saved file is "ref (Camera No.)_(Specified No.)" (for full screen image registration) or "ref (Camera No.)_(Specified No.)_XXX_YYY" (for partial image registration).

JPEG

Check this box to save the image in JPEG format. When this box is not checked, the image will be saved in BMP format as either a 24-bit color bitmap image (when a color camera is used) or an 8-bit grayscale bitmap image (when a monochrome camera is used).

► Note

Using image compression may result in some image deterioration, thus results from a compressed image may differ to those when using non compressed images.

View All

View all registered images in a list.

Adjust Image Position

Adjust the position of the image being captured.

X

-Adjust the movement in the X (horizontal) direction between -8191.000 and 8191.000 pixels.

Y

-Adjust the movement in the Y (vertical) direction between -16383.000 and 16383.000 pixels.

Angle

Adjust the position angle (rotation) around the center of the image between -999.999° and 999.999°.

► Note

Position adjustment may cause missing peripheries (black areas) due to image movement or jagged edges (jaggies) due to rotation in the registered image.

Save

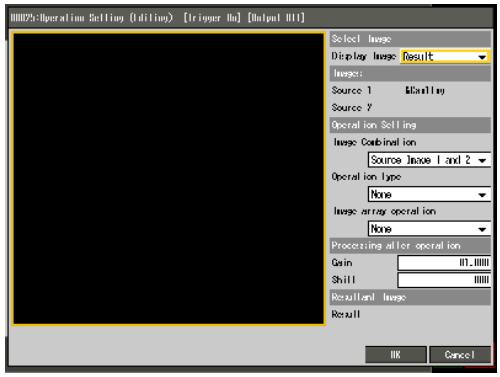
Save the displayed image as a registered image under the conditions specified in the [Register Image] menu.

Delete

When [Registered Img.] is selected for [Type], you can delete the registered image specified in [Options].

Operation setting

Outline the operation to be performed using source images 1 and 2 after individual processing.



In this option the processing combination of the source images 1 and 2 can be set. See "Image Operation" (Page 10-58) for more details.

Display Image

Type

- **Source 1**: Display source image 1.
- **Source 2**: Display source image 2.
- **Result**: Display the resultant image.
- **Source 1 4 scr.**: Display a split screen showing the raw image, filtered image, converted image, and resultant image of source image 1.
- **Source 2 4 scr.**: Display a split screen showing the raw image, filtered image, converted image, and resultant image of source image 2.

Images

Source 1

The captured image or registered image specified for operation in [Image Selection] under [Source 1] is displayed. If the image operation is set so that [Source 1] is not used, nothing is displayed.

Source 2

The captured image or registered image specified for operation in [Image Selection] under [Source 2] is displayed. If the image operation is set so that [Source 2] is not used, nothing is displayed.

Operation setting

Image Combination

Select the combination of images used for operation.

- **Source Image 1 and 2** (default): Perform image operation using source images 1 and 2.
- **Source Image 1**: Perform image operation using source image 1 only (Source image 2 is not be used.).

Operation type

Specify the type of operation for combining source images.

Refer to "Functional Explanation of Operations" (Page 10-67) for more details on individual operations.

- **None** (default): No image operation.
- **Add**: Create an image by adding the specified images together.
- **Subtract**: Create an image by subtracting the specified images from each other.
- **AbsoluteDifference**: Create an image using the absolute difference between the specified images.
- **Average**: Create an image from the average across the specified images.
- **Multiply(Normalized)**: Create an image by multiplying the specified images together and then scaling across 0-255.
- **Multiply**: Create an image by multiplying the specified images together.
- **Max**: Create an image by using the maximum value from the specified images.
- **Min**: Create an image by using the minimum value from the specified images.
- **AND**: Create an image by using the logical product (AND) function between the specified images.
- **OR**: Create an image by using the logical sum (OR) function between the specified images.
- **XOR**: Create an image by using the logical exclusive sum (XOR) function between the specified images.
- **NAND**: Create an image by using the negative of the logical product (NAND) function between the specified images.
- **NOR**: Create an image by using the negative of the logical sum (OR) function between the specified images.
- **XNOR**: Create an image by using the negative of the logical exclusive sum (XNOR) function between the specified images.

Reference

Normalizing is the dividing of the result by 256 to scale the result in accordance with the 0-255 processing range to avoid saturation.

► Note

- [None] can only be selected if source image 1 is the only image used.
- The operation type is limited to [Subtract] or [AbsoluteDifference], when [Source Image 1 and 2] is selected for [Image Combination] with the current image variable being specified as an array and [Use Image Array] option checked.
- If [Source Image 1] is selected for [Image Combination] and [Use Image Array] is not selected, no operation can be specified.

Image array operation

Specify the method to process a source image array when either source image 1 or 2 has [Use Image Array] selected, after which the image operation is applied.

This option is only available enabled when [Subtract] or [AbsoluteDifference] is selected in [Operation type], and an array based image variable is set for the current image and [Use Image Array] is selected in [Image] under [Source 1]. Refer to "Functional Explanation of Operations" (Page 10-67) for more details on individual operations.

- **None** (default): No image operation.
- **Add**: Create an image by adding the pixels of the target images together.
- **Average**: Create an image by averaging the pixels of the target images together.
- **Multiply(Normalized)**: Create an image by multiplying the pixel of the target images together, normalizing the result on a 0 to 255 scale.
- **Multiply**: Create an image by multiplying the pixel of the target images together.
- **Max**: Create an image by comparing the pixel of the target images and using the maximum pixel value.
- **Min**: Create an image by comparing the pixel of the target images and using the minimum pixel values.
- **AND**: Obtain the logical (AND) product of the pixels of the target images.
- **OR**: Obtain the logical (OR) sum for the pixels of the target images.
- **XOR**: Obtain the exclusive logical (XOR) sum of the pixels of the target images.
- **NAND**: Obtain the negative logical (NAND) product of the pixels of the target images.
- **NOR**: Obtain the negative logical (NOR) sum of the pixel of the target images.
- **XNOR**: Obtain the negative exclusive logical (XNOR) sum of the pixel of the target images.

Reference

Normalizing is the dividing of the result by 256 to scale the result in accordance with the 0-255 processing range to avoid saturation.

Processing after operation

The grayscale levels of the resultant image can be adjusted after the operation has been performed.

Gain

Multiplies the pixel value in the resultant image by a specified factor (0.000 to 64.000). This option can be used to remap and adjust the overall balance and distribution of the high or low contrast areas.

Shift

Offsets the pixel value of the resultant image by adding a specified level value (-510 to 510). This option can be used to increase or decrease the overall brightness of the image.

Resultant Image

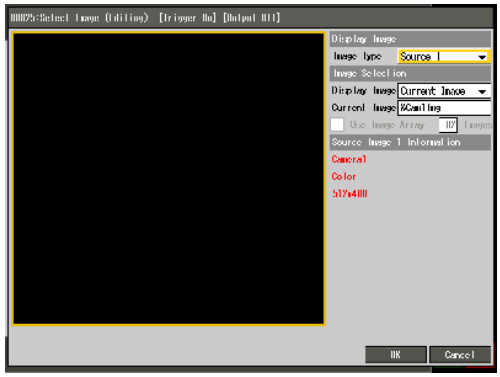
Specify the image variable and specifications for the resultant image.

Source 1

Source image 1 settings and processing parameters.

Image

Selection of the current or registered image to be used for source 1.



Note

The images used in source image 1 and source image 1 must be of the same resolution.

Display image

- **Source 1**: Display source image 1.
- **Source 2**: Display source image 2.
- **Source 1 4 scr.**: Display a split screen showing the raw image, filtered image, converted image, and resultant image of source image 1.
- **Source 2 4 scr.**: Display a split screen showing the raw image, filtered image, converted image, and resultant image of source image 2.

Note

When [Source Image 1] is selected for [Image Combination], [Source Image 2] and [Source 2 4 scr.] cannot be selected.

Select Image

Choose whether to use the captured image or a registered image for source 1.

Captured Image

Select this option and specify the image variable to use the captured image for source image 1.

- Use Image Array: If the image variable referenced is an image array specify the number of images to be used. This setting is unavailable when an image array variable is not specified.

Note

If the captured image size from any camera exceeds 26214400 pixels, it is not possible to use [Use Image Array].

Registered Image

Select this option to use a registered image for source image 1.

Specify the registered image No.

- **Advance**: Set advance options for the switching of registered images as necessary.
- **Use numerical variable for registered image number**: To use a variable for the registered image No., check this box and assign a numerical or numerical array variable reference. By using a variable for the registered image No. and then issuing a variable reference value apply command (NU), the image is switched to the specified registered image in the variable and the reference image information is updated. For more details, see the XG-7000 Series Communication Control Manual.
- **Process variable when changing programs**: Use this option to switch to the registered image based on the initial value of the variable referenced when the program is changed or the controller is next turned on.

► Note

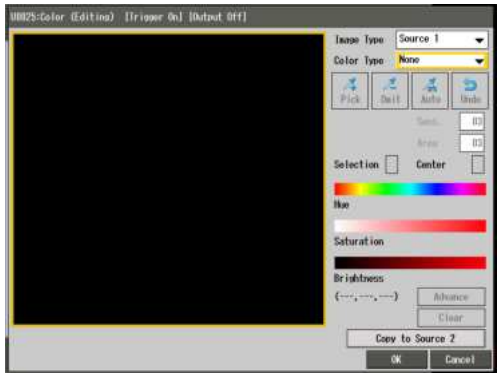
Note that the registered image No. does not switch in accordance with a change in the variable.

Reference

The camera No., number of colors, and number of pixels for the camera applicable to the image variable specified in the [Captured Image] or [Registered Img.] field are displayed in [Source Image 1 Information].

Color

When working with a color camera, convert the captured color image into a binary (black and white) or a grayscale converted image by extracting the desired color.



► Note

This setting is disabled when a monochrome camera is used or when a resultant image variable (Page 4-295) is referenced as the current image.

Refer to "Working with Color Images (Color Extraction)" (Page 10-2) for concepts involving color extraction and its operation.

Image type

- **Source 1**: Display source image 1.
- **Source 2**: Display source image 2.

Copy to Source 2

Copy the color extraction settings from source image 1 to source image 2.

Select [OK] on the confirmation message.

► Note

- When [Source Image 1 Only] is selected in [Image Combination], [Source 2] cannot be selected.
- When source image 2 is monochrome data or when [Source Image 1 Only] is selected in [Image Combination], [Copy to Source 2] cannot be selected.
- When a variable has been assigned to the parameter to be copied and the user does not have an account with privileges to change the variable settings, the current value for the variable will be copied. (The variable itself will not be copied.)

Image Enhance

Specify the filter processing to apply to the image.
When a color camera is used, the filter is applied to the images converted using color extraction.

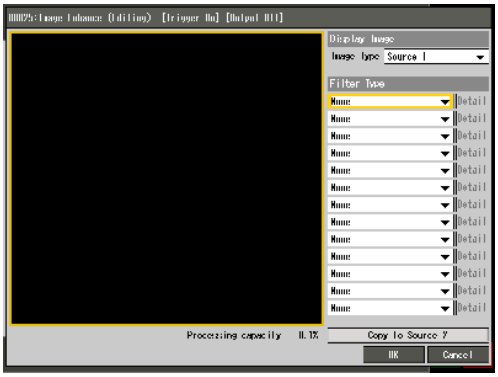


Image type

- **Source 1**: Display source image 1.
- **Source 2**: Display source image 2.
- **Source 1 4 scr.**: Display a split screen showing the raw image, filtered image, converted image, and resultant image of source image 1.
- **Source 2 4 scr.**: Display a split screen showing the raw image, filtered image, converted image, and resultant image of source image 2.

► Note

When [Source Image 1] is selected for [Image Combination], [Source Image 2] and [Source 2 4 scr.] cannot be selected.

Filter type

Select the [Filter Type] field and then select the filter to apply. To perform area measurement using a method other than color to binary, you must select the [Binary] filter as the last filter. See "Image Enhancement Filters" (Page 10-11) for more details of each filter processing.

► Note

- For the area tool, [Binary] must be selected unless color to binary is used in the color extraction settings.
- If the binary filter is not selected or another filter is applied after the binary filter, the measurement result may not be correct.
- The binary, subtract and blob filters cannot be used more than once in the same unit.

Reference

- Use [Detail] to apply more detailed filter settings.
- Up to 13 types of filters can be stacked according to application requirements. When multiple filters are set, they are processed one by one from the top.
- The order of the filters can be changed by selecting a filter in one of the [Filter Type] fields, holding down the No.1 (FUNCTION) button of the handheld controller, and then moving the 8-way key up or down.

Copy to Source 2

Copy the image enhancement settings from source image 1 to source image 2.
Select [OK] on the confirmation message.

► Note

- When [Source Image 1 Only] is selected in [Image Combination], [Copy to Source 2] cannot be selected.
- When a variable has been assigned to the parameter to be copied and the user does not have an account with privileges to change the variable settings, the current value for the variable will be copied. (The variable itself will not be copied.)
- The setting of an expanded custom filter cannot be copied when the user does not have an account with privileges to change variable settings.

Conversion

After the image has been through color extraction and image enhancement filtering, further conversion image processing can be applied.

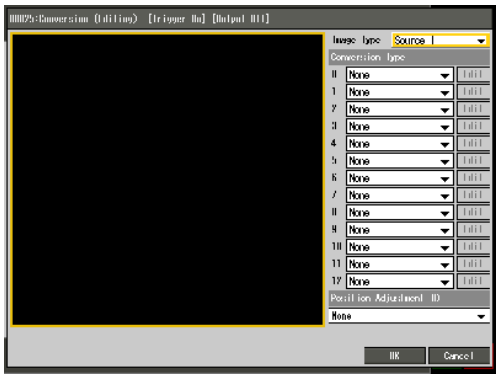


Image type

- **Source 1**: Display source image 1.
- **Source 2**: Display source image 2.
- **Source 1 4 scr.**: Display a split screen showing the raw image, filtered image, converted image, and resultant image of source image 1.
- **Source 2 4 scr.**: Display a split screen showing the raw image, filtered image, converted image, and resultant image of source image 2.

► Note

When [Source Image 1] is selected for [Image Combination], [Source Image 2] and [Source 2 4 scr.] cannot be selected.

Conversion type

Up to 13 types of conversions can be set according to application requirements. When multiple conversions are set, they are processed one by one from the top.
See "Functional Explanation of Conversions" (Page 10-59) for more details on the individual conversion types.

- **None**: No conversion.
- **Add**: Add a specified value to the pixel.
- **Subtract**: Subtract a specified value from the pixel.
- **AbsoluteDifference**: Obtain the absolute difference of the pixel and a specified value.
- **Multiply**: Multiply the pixels in the image by a specified value.
- **Rotate / Translate**: Rotate and or translate the image.
- **Zoom**: Enlarge or reduce the image.
- **Trapezoid Correct**: Transform the image so that four specified user points are re-mapped to four different specified points.
- **Pixel Val. Conv.**: Convert pixels in the image falling into a specified range into a single value.
- **Blob**: Apply blob filtering to the image for hole filling or border exclusion.
- **NOT**: Reverse the black and white pixels in the image.
- **AND**: Obtain the logical product (AND) of the pixel and a specified value.
- **OR**: Obtain the logical sum (OR) of the pixel and a specified value.
- **XOR**: Obtain the exclusive logical sum (XOR) of the pixel and a specified parameter value.
- **NAND**: Obtain the negative logical product (NAND) of the pixel and a specified parameter value.
- **NOR**: Obtain the negative logical sum (NOR) of the pixel and a specified parameter value.
- **XNOR**: Obtain the negative exclusive logical sum (XNOR) of the pixel and a specified parameter value.
- **Right Bit Shift**: Shift the 8 bit binary of the pixel value to the right by a specified quantity.
- **Left Bit Shift**: Shift the 8 bit binary of the pixel value to the left by a specified quantity.

► Note

The blob filter cannot be used more than once on the same source image.

Edit

Display the menu for detailed setting of each conversion function.
See "Functional Explanation of Conversions" (Page 10-59) for more details.

Reference

The order of conversions can be changed by selecting a conversion in one of the [Conversion Type] fields, holding down the No.1 (FUNCTION) button of the handheld controller, and then moving the 8-way key up or down.

Position Adjustment ID

To apply position adjustment to source image 1, select the position adjustment unit to be referenced.

Source 2

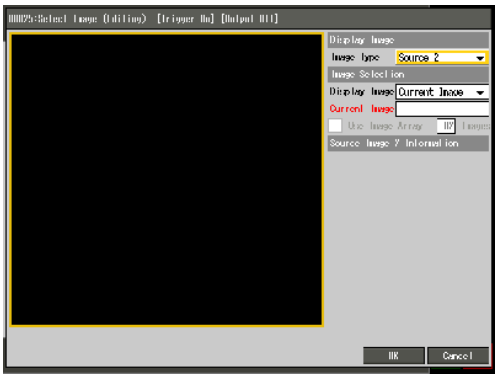
Source image 2 settings and processing parameters.

► Note

- When [Source Image 1 Only] is selected in [Image Combination], [Source 2] can not be selected.
- The images used in source image 1 and source image 2 must be of the same resolution.

Image

The setting options for [Source 2] are the same as [Source 1].

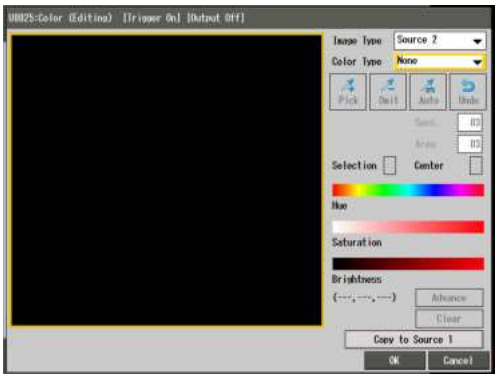


Reference

The camera No., number of colors, and number of pixels for the camera applicable to the image variable specified in the [Current Image] or [Regist. Image] field are displayed in [Source Image 2 Information].

Color

The setting options for [Source 2] are the same as [Source 1].



Reference

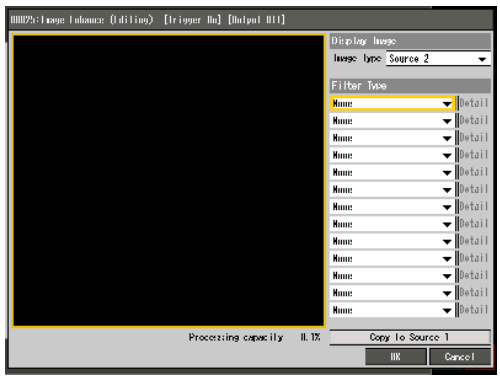
Selecting [Copy to Source 1] applies the specified color extraction information to the color extraction setting of [Source 1].

► Note

- When source image 1 is monochrome data, [Copy to Source 1] cannot be selected.
- When a variable has been assigned to the parameter to be copied and the user does not have an account with privileges to change the variable settings, the current value for the variable will be copied. (The variable itself will not be copied.)

Image Enhance

The setting options for [Source 2] are the same as [Source 1].



Reference

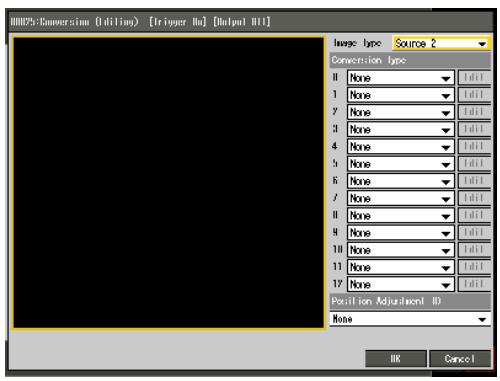
Selecting [Copy to Source 1] applies the specified image enhancement information to the image enhancement setting of [Source 1].

► Note

- When a variable has been assigned to the parameter to be copied and the user does not have an account with privileges to change the variable settings, the current value for the variable will be copied. (The variable itself will not be copied.)
- The binary and blob filters cannot be used more than once in the same source image.
- The setting of an expanded custom filter cannot be copied when the user does not have an account with privileges to change variable settings.

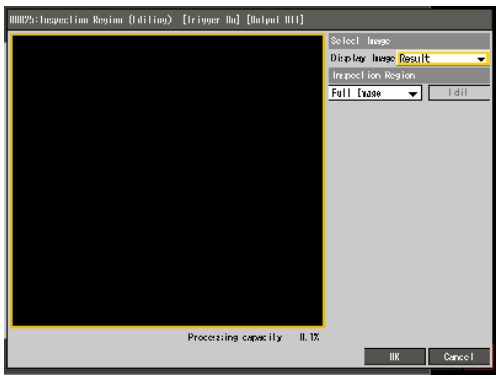
Conversion

The setting options for [Source 2] are the same as [Source 1].



Inspection Region

Define a specific rectangular region to be used as the processing area. The default setting for this option results in the full image being processed.



Display Image

Type

- **Source 1**: Display source image 1.
- **Source 2**: Display source image 2.
- **Result**: Display the resultant image.

Region

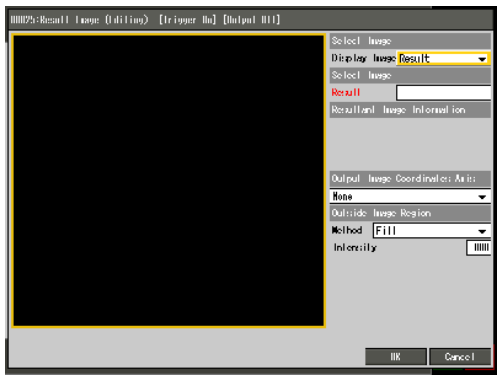
Select a shape and then draw the region, or select [Edit] and specify the region with numerical values. See "Inspection Region Menu" (Page 3-20) for more details.

Reference

- You can only use a rectangle shape as the region for image operation.
- You cannot set a mask region or an image region.
- The areas outside the region are output to the resultant image variable as black (level 0).

Result Image

Result image settings and processing parameters.



Display Image

Type

- **Source 1**: Display source image 1.
- **Source 2**: Display source image 2.
- **Result**: Display the resultant image.
- **Source 1 4 scr.**: Display a split screen showing the raw image, filtered image, converted image, and resultant image of source image 1.
- **Source 2 4 scr.**: Display a split screen showing the raw image, filtered image, converted image, and resultant image of source image 2.

Select image

Result

Specify image variable for the result.

► Note

The resultant image resolution must be the same as source images 1 and 2.

Resultant Image Information

The camera information of the resultant image variable specified at [Result] is displayed. The information includes the following items.

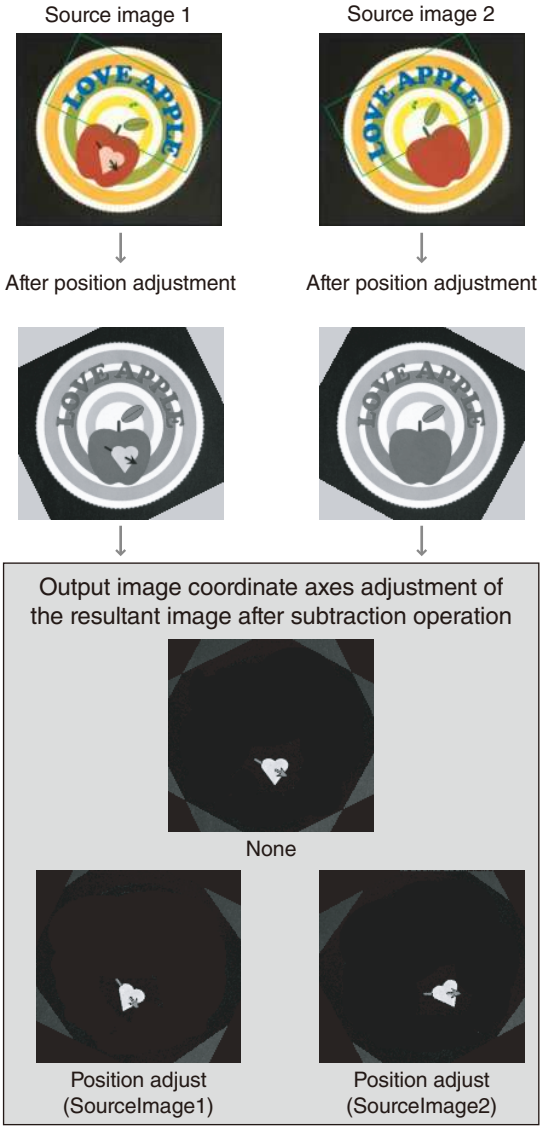
- Camera No.
- Color
- Image size

Position Adjustment

When position adjustment is used for conversion of the source images specify which position adjustment information the resultant image should use.

- **None** (default): Output the exact result after image operation.
- **Position adjust (SourceImage1)**: Re-adjust the resultant image based on the original position of source image 1.
- **Position adjust (SourceImage2)**: Re-adjust the resultant image based on the original position of source image 2.

Example for [Position Adjustment] setting



Outside Converted Region

Use this option for handling any areas in the resultant image region which are formulated from outside of the source images area due to position adjustment or other processing functions.

Method

- **Fill** (Default): Convert all pixel values in the missing information area to a specified intensity value.
- **Extended Image**: Replace the pixel values in the missing information area by extending the pixel values at the border known image.

Intensity

When [Fill] is selected in [Method], set the pixel value used to fill the area (from 0 (black) to 255 (white) (default 0))

Display Options

Image operation display settings.



Region

Specify the line width and display color of the region.

Display image variable

Set the order of priority for image display on the Run screen.
When a line scan camera is used with the XG-7502A, it will not be possible to display the processed image if the image size exceeds 25 MB (26214400 pixels). However in this case, it is still possible to use the filtered image and converted image by setting the display image variable.

Display image variable (source image 1)
Set the order of priority for image display of source image 1.

- **Filtered Image**:
  - **Unit Processing** (default): Displays the filtered image without using the display image variable.
  - **Image Display**: Displays the filtered image using the display image variable.
- **Image Variable**: Specify the resultant image variable to use as the display image variable when displaying a filtered image.
- **Converted Image**:
  - **Unit Processing** (default): Displays the converted image without using the display image variable.
  - **Image Display**: Displays the converted image using the display image variable.
- **Image Variable**: Specify the resultant image variable to use as the display image variable when displaying a converted image.

Reference

- When processing images of size 25 MB or less, or when using the XG-7702A, it is not necessary to select [Image Display].
- Even when processing an image larger than 25 MB, if the area displayed in the camera image is 8 BM (8388608 pixels) or less, the processed Image will be automatically displayed when [Processing Priority] is selected. (However the following processes are excluded.)
  - Image enhancement: Shading correction, blob filter
  - Conversion (image operation): Rotate/translate, zoom, trapezoid correction, blob filter
  - Defect, Grayscale Blob: Contrast display

► Note

When [Image Display] is selected for [Filtered image] and [Converted Image], the following restrictions on operation occur.

- Processing time increases.
- The background outside the inspection region becomes a black image.
- Multiple unit display is not possible.
- For display of registered images outside of unit edit, the filtered image cannot be displayed and the display is the same as when [Processing Priority] is set.
- When an archived image is displayed, it will not be possible to display the processed image unless the resultant image variable and results are also stored in the archive.

Processing priority (source image 2)
Specify the processing priority when displaying large processed images for source 2 during Run mode.
The setting items are the same as for source image 1.

Reset

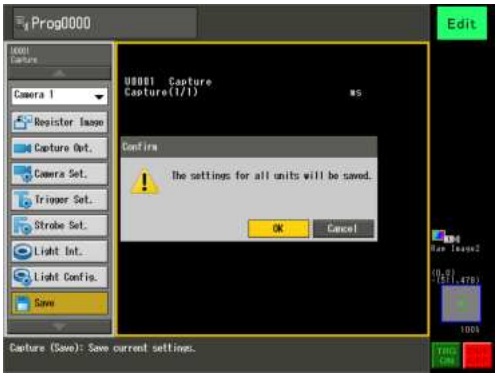
Returns the display options to their defaults.

Save

Save the current unit changes the program file.

► Note

- If the device is turned off before any settings are saved, all of those changes will be deleted.
- Do not turn off the system power while you are saving the settings. Doing so may cause errors in the internal data



Save

The settings for the unit are saved in the current program file in SD Card 1 or SD Card 2.

► Note

Items specified not to be saved in XG VisionEditor are excluded from the saving operation.
For example, variable values changed in the current program or the default display, and display parts, can be excluded when saving.

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